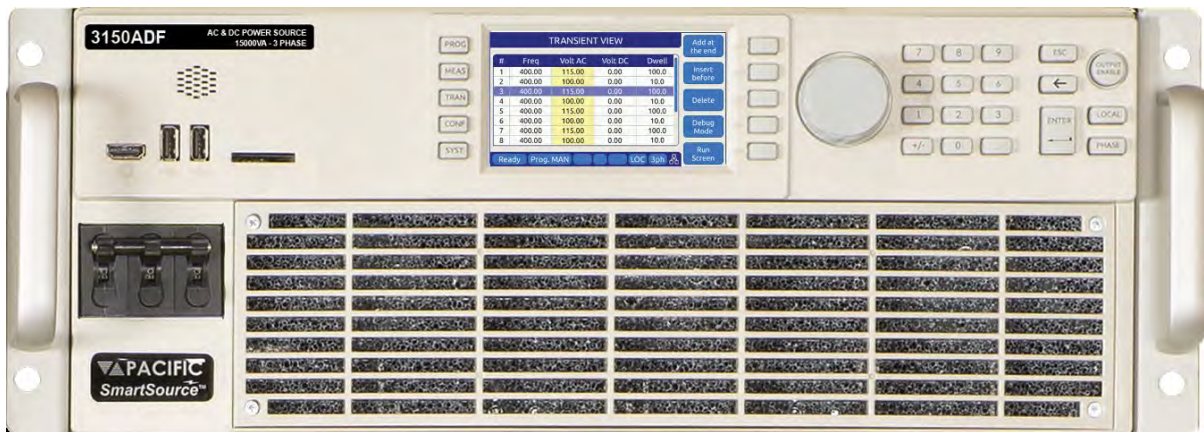


Operation Manual

ADF Series™ – Rev 1.2.2

P/N 160670-10

ADF Series® Programmable AC Power Source



LXI
LAN eXtensions for Instrumentation

PACIFIC® **PACIFIC POWER SOURCE**
Worldwide Supplier of Precision Programmable Power

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2 Safety & Warranty Information

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2.2 Safety Information

This chapter contains important information you should read BEFORE attempting to install and power-up PPS Equipment. The information in this chapter is provided for use by experienced operators. Experienced operators understand the necessity of becoming familiar with, and then observing, life-critical safety and installation issues. Topics in this chapter include:

- Safety Notices
- Warnings
- Cautions
- Preparation for Installation
- Installation Instructions

Make sure to familiarize yourself with the **SAFETY SYMBOLS** shown on the next page. These symbols are used throughout this manual and relate to important safety information and issues affecting the end user or operator.

SAFETY SYMBOLS**Direct current (DC)****Alternating current (AC)****Both direct and alternating current****Three-phase alternating current****Protective Earth (ground) terminal****On (Supply)****Off (Supply)****Fuse****Caution: Always consult this manual when you see this warning symbol marking in order to familiarize yourself with the nature of the potential hazard and actions to be taken to avoid them.****Caution, risk of electric shock**

2.3 Safety Notices

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Pacific Power Source assumes no liability for the customer's failure to comply with these requirements.



WARNING: CLASS 1 INSTRUMENT

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.



AVERTISSEMENT: APPAREIL CLASSE 1

Cet produit est un appareil Classe 1 (avec terre de protection). Les dispositifs de sécurité de ce produit peuvent être altérés si le produit est utilisé d'une manière non spécifiée dans le manuel d'utilisation.



WARNING: ENVIRONMENTAL CONDITIONS

This instrument is intended for indoor use in an installation category II, pollution degree 2 environments only. It is designed to operate at a maximum relative humidity of 80% for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.



AVERTISSEMENT: CONDITIONS ENVIRONNEMENTALES

Cet appareil est destiné à une utilisation intérieure dans une installation de catégorie II, degré de pollution 2. Il est conçu pour fonctionner sous humidité relative maximale de 80%, pour des températures allant jusqu'à 31°C, diminuant linéairement jusqu'à 50% d'humidité relative à 40°C et à des altitudes allant jusqu'à 2000 m. Se reporter aux tableaux de spécifications pour les exigences en terme de tension secteur et plage de température ambiante de fonctionnement.

**CAUTION: BEFORE APPLYING POWER**

Verify that the product AC input specifications noted on the model tag matches the available utility line voltage and frequency.

**ATTENTION: AVANT DE METTRE SOUS TENSION**

Vérifier que les spécifications de tension d'alimentation de l'équipement notées sur l'étiquette sont bien compatibles avec la tension et fréquence secteur disponibles.

**SAFETY NOTICE: GROUNDING**

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis or cabinet must be connected to an electrical safety ground. The instrument must be connected to the AC power supply mains through a properly rated three phase power cable with protective earth (L1-L2-L3-E). Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be properly grounded to minimize electric shock hazard. Operation at line voltages or frequencies in excess of those stated on the model type plate may cause leakage currents in excess of 5.0 mA peak.

**REGLE DE SECURITE: MISE A LA TERRE**

Ce produit est un équipement de Classe 1 (muni d'une borne de mise à la terre). Pour minimiser le risque de choc électrique, le châssis de l'appareil ou de l'armoire/rack doit impérativement être relié à une terre de sécurité électrique. L'appareil doit être branché sur le secteur d'alimentation électrique à courant alternatif par un câble d'alimentation triphasé approprié avec terre de protection (L1-L2-L3-PE). Toute interruption de la mise à la terre de protection ou de déconnexion de la borne de terre causera un risque de choc électrique qui pourrait entraîner des blessures.

Cet appareil peut être équipé d'un filtre secteur pour réduire les interférences électromagnétiques et doit être correctement mis à la terre afin de minimiser le risque de choc électrique. Le fonctionnement sous tensions et fréquences supérieures à celles indiquées sur l'étiquette peut provoquer des courants de fuite de plus de 5,0 mA peak.

**WARNING: DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE**

Do not operate the instrument in the presence of flammable gases or fumes.

**AVERTISSEMENT: NE PAS UTILISER SOUS ATMOSPHERE
EXPLOSIVE**

Ne pas faire fonctionner l'appareil en présence de gaz ou vapeurs inflammables.

**WARNING: KEEP AWAY FROM LIVE CIRCUITS**

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. This includes the AC Input terminals which may have residual voltage due to internal charged capacitors that have no discharge path. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

After disconnecting grid power, ALWAYS wait at least 1 minute, then use a Digital Voltmeter (DMM) in VDC Mode to check for any residual DC voltage from each Line terminal to the Chassis ground stud to check for safe voltage levels (< 5 Vdc) before touching the unit or any terminal blocks or pins.

**AVERTISSEMENT: TENIR A L'ECART DE CIRCUITS SOUS TENSION**

Les utilisateurs ne doivent pas retirer les capots de l'appareil. Le remplacement des composants et les ajustements internes doivent être et ne peuvent être effectués que par un personnel qualifié. Ne pas remplacer les composants avec câble d'alimentation connecté sur le secteur. Sous certaines conditions, des tensions dangereuses peuvent exister même avec le câble d'alimentation retiré. Ceci inclut les bornes d'entrée CA qui peuvent avoir une tension résiduelle due aux condensateurs chargés internes. Pour éviter les blessures, toujours débrancher le câble d'alimentation, décharger les circuits électriques et débrancher les sources de tension externes avant de toucher les composants.

Après avoir débranché l'alimentation du réseau, attendez TOUJOURS au moins 1 minute, puis utilisez un voltmètre numérique (DMM) en mode VDC pour vérifier toute tension CC résiduelle de chaque borne de ligne sur le plot de masse du châssis pour vérifier les niveaux de tension sécurisés (<5 Vcc) avant de toucher l'unité ou des borniers ou des broches.

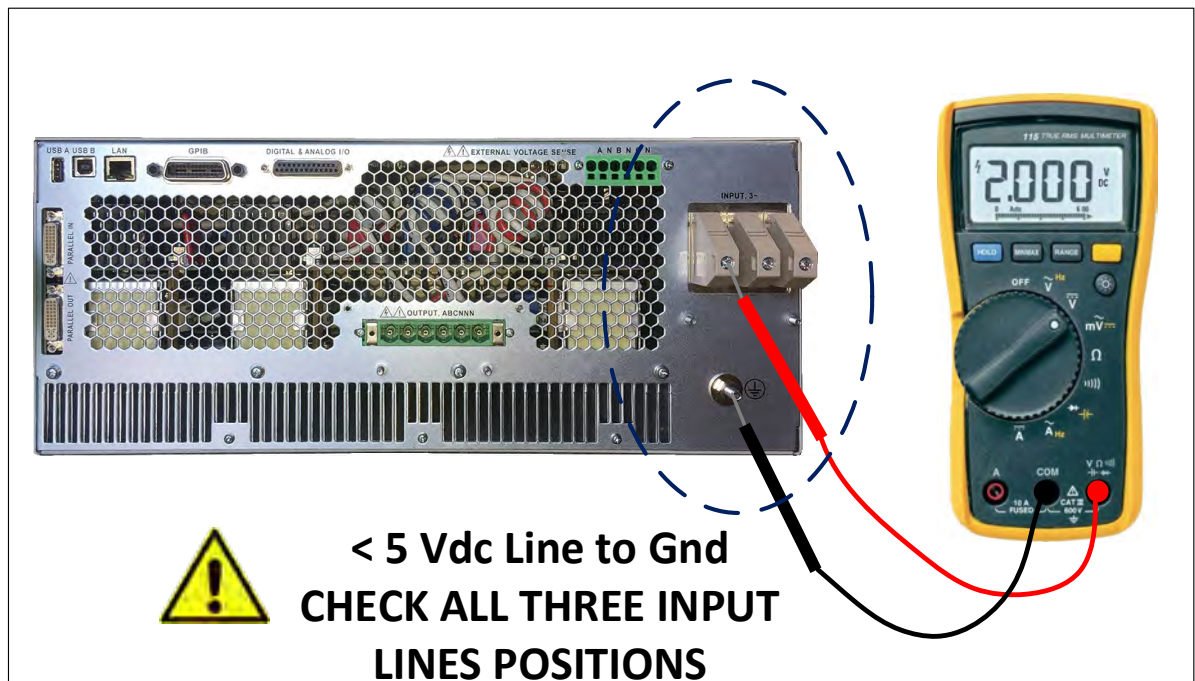


Figure 2-1: EMI AC Input Filter Residual Voltage Check after disconnecting AC Mains power

**WARNING: DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT**

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Pacific Power Source Sales and Service Office for service and repair to ensure that safety features are maintained.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

**AVERTISSEMENT: NE PAS REMPLACER DE PIÈCES ET DE COMPOSANTS – NE PAS MODIFIER L'ÉQUIPEMENT**

En raison d'introduction de dangers supplémentaires, ne pas installer des pièces de rechange et ne pas effectuer de modification de l'équipement non autorisés. Retourner l'appareil à un bureau de ventes et services Pacific Power Source pour le service et la réparation afin d'assurer le maintien des caractéristiques de sécurité. Les appareils qui semblent endommagés ou défectueux doivent être rendus inopérants et protégés contre le fonctionnement involontaire jusqu'à ce qu'ils puissent être réparés par un personnel qualifié.

**CAUTION: INSTRUMENT LOCATION**

Do not position this instrument in such a way as to block easy access to any mains disconnect device or in any way that makes it difficult to operate the mains disconnect device.

**ATTENTION: EMPLACEMENT DE L'APPAREIL**

Ne pas placer cet appareil de manière à bloquer l'accès facile à tout débranchement du réseau électrique ou d'une façon qui rende difficile l'opération de débranchement du réseau électrique.

3 Product Overview

This chapter provides an overview of the PPS ADF Series® programmable power sources. It introduces the reader to general operating characteristics of these power supplies.

3.1 General Description

The Pacific Power Source (PPS) ADF Series® power source is designed to provide accurate, stable and clean AC power to a unit under test. The PPS ADF Series® power supply can be operated from the front panel (manual mode) or using RS232, USB, LAN (Ethernet) or GPIB remote control.

The performance of the ADF Series® power source models is detailed in section 4, “Technical Specifications”. Maximum voltage, current and power capability depends on the specific model. This manual covers standard ADF Series® models. Modified units are generally shipped with a manual addendum as a supplement to this manual. The manual addendum covers specific modifications from the standard model(s).

3.2 Product Features

The following key characteristics apply to all ADF Series® models;

- Programmable electronic power source.
- AC output mode
- Single or Three / Split phase output models available.
- Fully remote control of all settings and metering read back.
- Constant power mode single-voltage range eliminates the need to switch between high and low voltage ranges.
- Over voltage, over current and over power protection.
- External voltage sense.
- Auxiliary I/O – Analog and Digital.
- Digital Interfaces for Remote Control

3.3 Block Diagram

The block diagram of the fully digital power source is shown in Figure 3-1 below. It shows the key functional blocks for the three phase 3150ADF models. The 1150ADF uses a similar architecture but has a single higher power DC/AC inverter output stage.

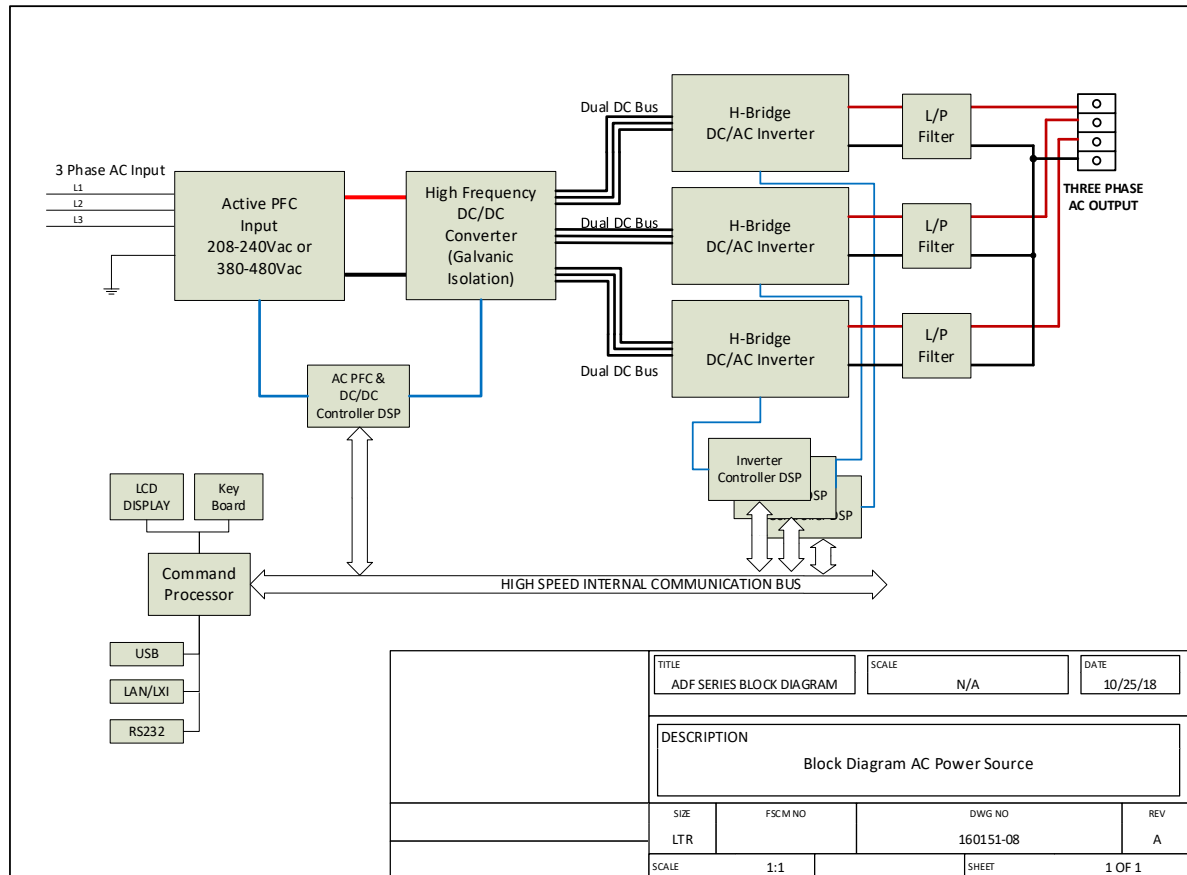


Figure 3-1: ADF Series® Basic Block Diagram

3.4 Controller Description

The ADF Series® power supplies use an advanced command processor that communicates with the internal power stages using several high speed communication buses and with the outside world through a variety of interfaces. One of these interfaces is the front panel keyboard and LCD display which supports manual operation of the AC power source.

The command processor handles all user inputs as well as any analog or digital input provided to the unit. All power stages are operated autonomously and take input from the main command processor. For larger power configurations consisting for multiple chassis, the master unit command processor communicates to all chassis that are connected on the master/auxiliary interconnect bus.

3.5 Measurement Read-back

The voltage, frequency and current limit settings of the AC power source can be set from the front panel or over any of the available digital remote control interfaces. During operation, the AC source output voltage, frequency, current and power can be read back for each of the available output phases.

3.6 Accessories Included (Ship Kit)

The following accessories are included with each ADF Series® AC power source. If one or more of these is missing upon incoming inspection of the product, please contact Pacific Power Source customer service.

Item	Quantity
Operation Manual in PDF Format	Available from PPS website
Mating Output Connector	1 per unit
Certificate of Conformance	1
Output Shorting Adaptor (Single Phase ADF units only)	1 per unit

Table 3-1: Included Accessories

3.7 Remote Control Interfaces

Following remote control interfaces are supported.

Remote Control Interfaces	
USB Interface	Standard
RS-232 Interface	Standard
LAN Interface	Standard
AUX I/O	Standard
GPIB	Standard

Table 3-2: Remote Control Interfaces

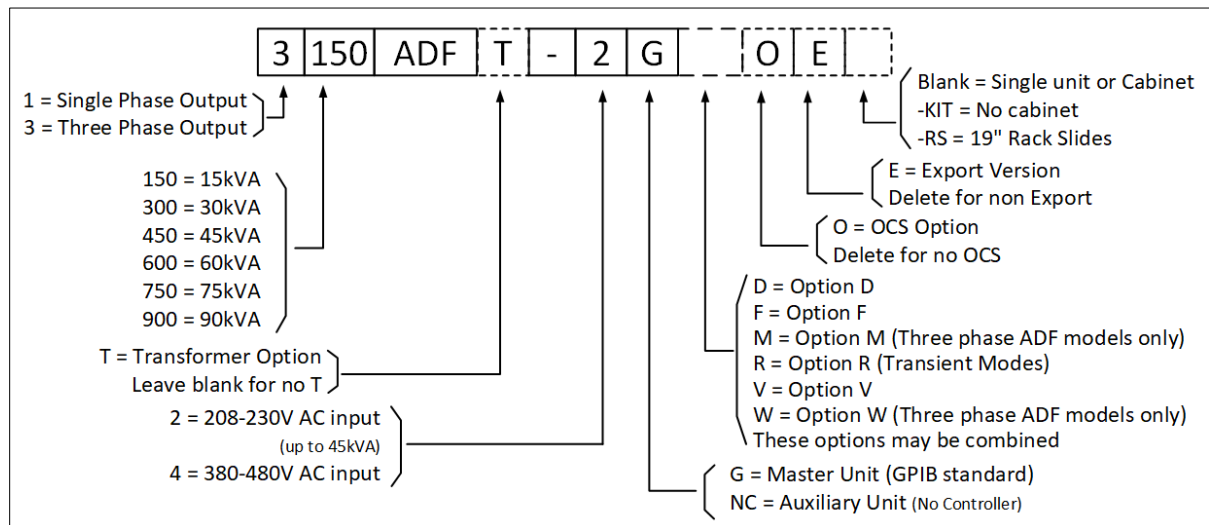
3.8 Available Options

The following options can be ordered at the time of original purchase to the ADF Series Power Sources.

Option Designation	Description	Notes
D	DC Output Mode Option	
F	Extended Frequency Range Option	
M	Single Phase Output Mode Shorting adaptor for A,B,C phases P/N 160086 available.	Requires 3 Phase ADF (3150ADF)
O	Output Control Switch	
R	Transient Programming Mode (List, Step, Pulse)	
T	Output Transformer for 400Vac Range	External Chassis
V	Extended AC Voltage Range	
W	Provides isolation output Neutrals for each phase to support Modes 4 through 6.	Available on 3 Phase ADF models only.

Table 3-3: Available ADF Options

ADF Model Number Encoder:



Note: For field upgrades of certain options, contact factory for details. This may require returning your unit to an authorized service center for retrofit. Some options may not be retrofittable.

4 Technical Specifications

Technical specifications shown here apply at an ambient temperature of 25° C ± 5° C.

4.1 Single Chassis Models

Single Phase Models

MODEL	No. Outputs	Rated Power	Voltage Range AC	Current	No. Chassis
190ADF¹	1 Phase	9 kW	300 V rms	75.0 A rms	1
1150ADF	1 Phase	15 kW	300 V rms	125.0 A rms	1

Note 1: 9KVA models not available in all markets

Three Phase Models

MODEL	No. Outputs	Rated Power	Voltage Range AC	Current / Phs	No. Chassis
390ADF¹	3 Phase, Split Phase	9 kW	300 V rms	25 A rms	1
3150ADF	3 Phase, Split Phase	15 kW	300 V rms	41.7 A rms	1

Note 1: 9KVA models not available in all markets

4.2 Multiple Chassis Models

Multi chassis model configurations consist of a single master unit and one or more slave units connected through a high-speed parallel bus. Each unit requires its own three-phase AC input and must be turned on at the front panel using its individual circuit breaker. This avoids massive inrush current at power up of the system as each unit can be turned on one at a time. Multi chassis systems are installed in a suitable 19" cabinet from the factory with a common AC input terminal block and a single phase or three phase common output terminal block. The same model is also available as a kit (-KIT post-fix) for installation into an end-user provided cabinet. No input or output wiring is provided with these kits.

Single Phase Models

MODEL	No. Outputs	Rated Power	Voltage Range AC	Current	No. Chassis
1300ADF (-KIT)	1 Phase	30 kW	300 V rms	250 A rms	2
1450ADF (-KIT)	1 Phase	45 kW	300 V rms	375 A rms	2

Three Phase Models

MODEL	No. Outputs	Rated Power	Voltage Range AC	Current / Phs	No. Chassis
3300ADF (-KIT)	3 Phase, Split Phase	30 kW	300 V rms	83.3 A rms	2
3450ADF (-KIT)	3 Phase, Split Phase	45 kW	300 V rms	125.0 A rms	3
3600ADF (-KIT)	3 Phase, Split Phase	60 kW	300 V rms	166.7 A rms	4
3750ADF (-KIT)	3 Phase, Split Phase	75 kW	300 V rms	208.3 A rms	5
3900ADF (-KIT)	3 Phase, Split Phase	90 kW	300 V rms	250.0 A rms	6

4.3 AC Output Mode

AC OUTPUT	
Voltage	
AC Range	0 - 300 V L-N rms / 0 - 520V L-L rms
Extended Voltage Range ¹ (Option V)	0 - 333 V L-N rms / 0 - 576 V L-L rms, see Note 1
Programming Resolution	0.01 V
Accuracy	± 0.25% F.S.
Waveform	Sine wave
DC Offset	< 20 mV
Harmonic Distortion ² (Vthd) (Full, Resistive Load)	< 100 Hz < 0.3% 100 Hz to 500Hz < 0.5% Option F: 500 to 1000 Hz < 1.0% > 1000 Hz < 1.5% See V THD Chart at bottom of next page
Output Noise (DC – 300 kHz)	< 150 mV rms
Load Regulation	± 0.02% (CSC Mode on)
Line Regulation	± 0.1% for 10% Line Change
External Voltage Sense	External Sense, max. voltage drop 5% FS.
Voltage Slew Rate	At least 1.0 V/us
Isolation	550 Vrms
Frequency	
Range	45.00 – 500.0 Hz
Extended Frequency Range (Option F)	15.00 – 1200.0 Hz
Programming Resolution ³	0.01 Hz
Accuracy	± 0.01%
Current Limit	
Range ⁴	See model tables, Figure 4-3 and Figure 4-4. Values shown are supported for any period of time.
Current Overload	Available 30% Current overload for up to 2.0 seconds when enabled. See Figure 4-2.
Crest Factor	2.5:1 @ 41.67 to 6.3:1 @ 16.67 (104Apk / phase for 3150ADF, 312Apk for 1150ADF)
Programming Resolution	0.01 A rms
Accuracy	± 0.5% F.S.
Modes	Constant Current Mode or Output Trip
Phase Angles (3 Phase Models)	
Phase Offsets ⁵	A = 0°, B = 240°, C = 120
Accuracy	± 0.35°

Note 1: Extended operation to 333V L-N / 576V L-L supported in Three and Split Phase mode up to 3.3kVA per phase for frequency range 45Hz ~ 800Hz with Option F. Some specifications exceptions apply. Requires Option V.

Note 2: Refer to Figure 4-1, "Output Voltage distortion into full R Load as a function of Frequency" on next page.

AC OUTPUT
Note 4: FREQUENCY PROGRAM RESOLUTION FOR EXPORT MODELS WITH OPTION E (-4GE, -2GE):

Per U.S.A. Bureau of Industry and Security, ECCN 3A225, frequency control is limited to no better than 0.2% at frequencies of 600 Hz. or more for unrestricted export products. To meet that requirement, frequency programming in all -2GE and -4GE ADF models has three resolution ranges, which round the frequency to the nearest increment, as defined in the table below.

Frequency Resolution for Export Models

<u>Range</u>	<u>Resolution</u>
1.00 - 99.99 Hz	0.01 Hz
100-599.9 Hz	0.1 Hz
600 - 999 Hz	2.0 Hz
1000 - 1200 Hz	10.0 Hz

Note 5: Refer to Voltage / Current ratings tables.

Note 6: Actual output phase angles may be slightly different from programmed values for highly unbalanced three phase load conditions, in particular at high frequency due to amplifier phase shift differences.

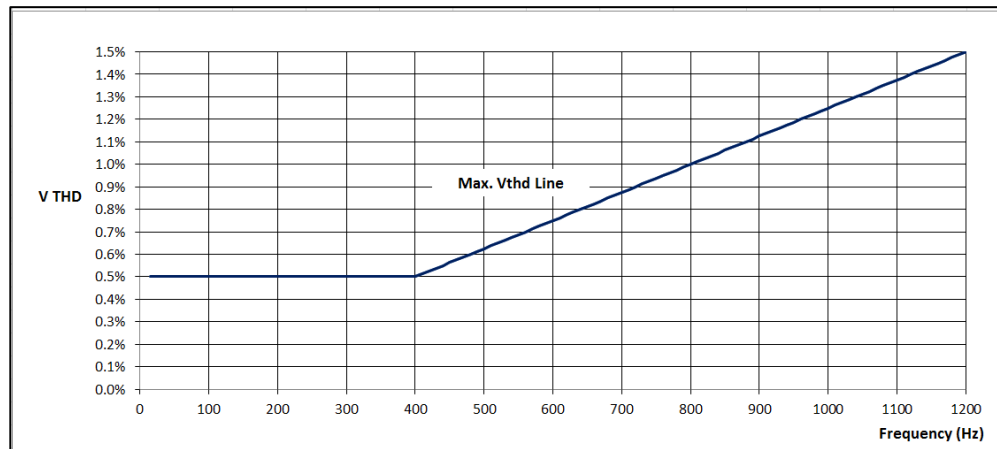
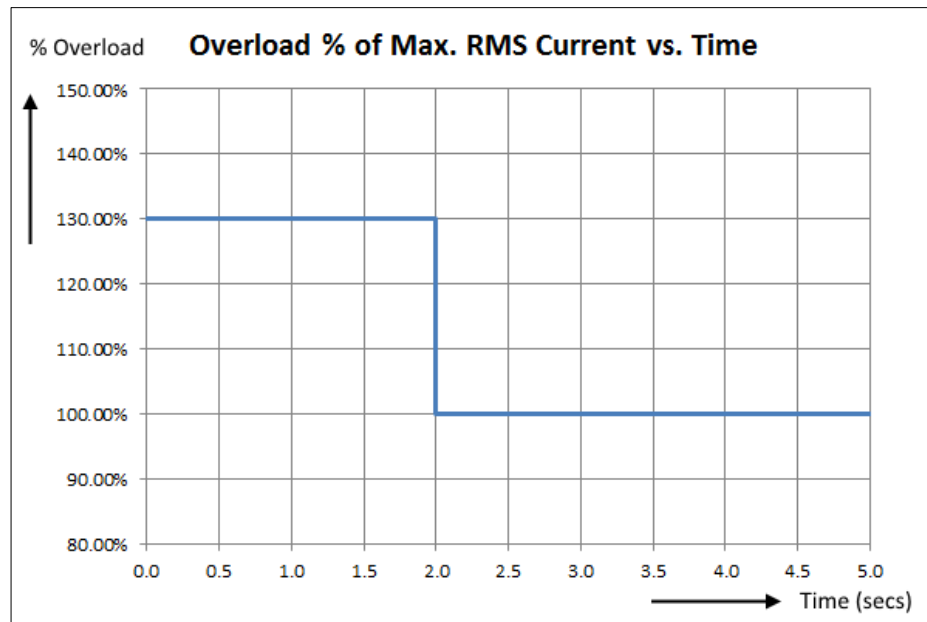


Figure 4-1: Output Voltage distortion into full R Load as a function of Frequency

4.3.1 Temporary Current Overload



4.3.2 AC Voltage and Current Output Charts

AC VOLTAGE RANGES

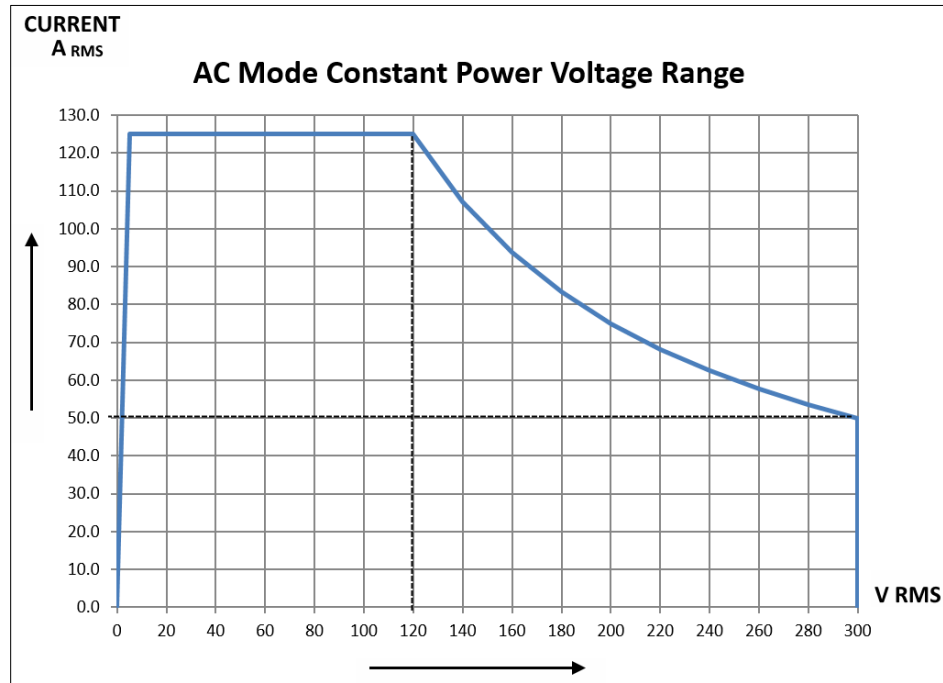


Figure 4-3: AC Mode Voltage/Current range, 1150ADF Model

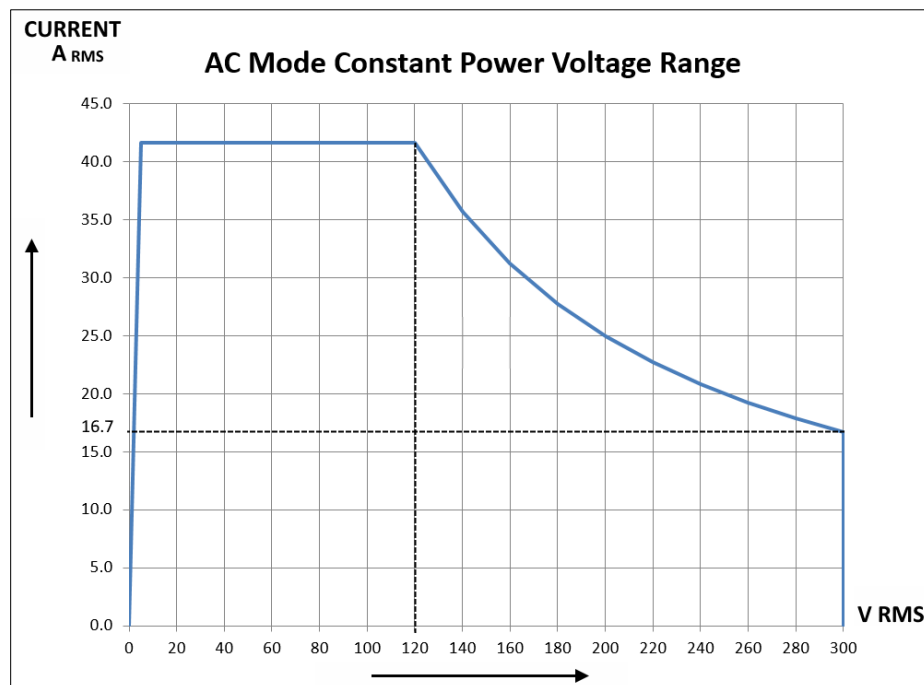


Figure 4-4: AC Mode Voltage/Current range, 3150ADF Model per Phase

4.3.3 Option V - Extended AC Voltage Ranges – Supplemental specs

The ADF-2V / ADF-4V provides three extended voltage ranges, 0 through 2. The maximum programmable Vrms AC limits for each of these extended ranges are:

- Range 0 312V_{LN}
- Range 1 320 V_{LN}
- Range 2 333 V_{LN}

Range 0 is activated by setting the AC voltage user limit to a value between 300 and 312. More details on extended range 0 are provided in section 6.4.11, page 97.

Range 1 and 2 must be enabled using a bus command before they can be activated in a similar way. Refer to

Note: For voltage limits higher than 312V L-N, this mode must be enabled first. See “[SOURCE:]VOLTage:EXTend” command in section 8.7.2 on page 241.

The following specification adjustments apply for each extended range mode.

Range 0: up to 312V

- Standard THD specs apply only from 45-100Hz
- Only supported in three phase mode
- Maximum output power is 3kW per phase

Range 1: up to 320V

- Max. current limited to 35Arms/phase
- Limits maximum frequency set point to 800Hz
- Does not guarantee THD specification but designed to have THD < 1.0% at Pout<9kW

Range 2: up to 333V

- Max. current limited to 35Arms/phase
- Limits maximum frequency set point to 800Hz
- Does not guarantee THD. Control loop may saturate at V > 320, giving a THD of 2-3% at 333V/9kW

These power and current restrictions are reflected in the charts below for reference.

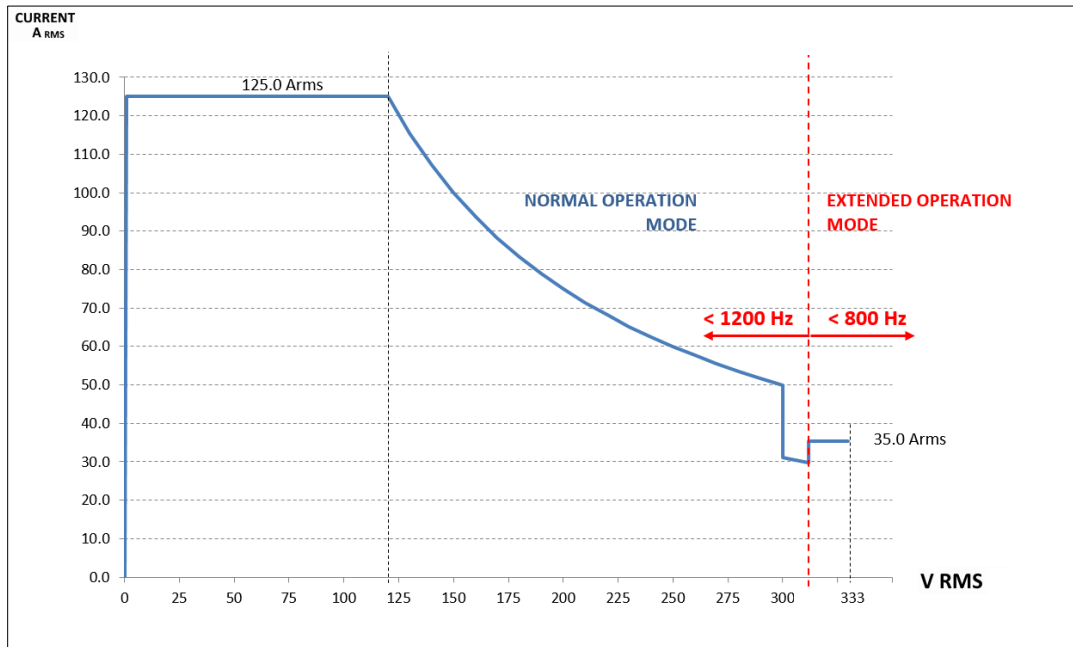


Figure 4-5: Extended AC Voltage/Current Range, 1150ADF Model

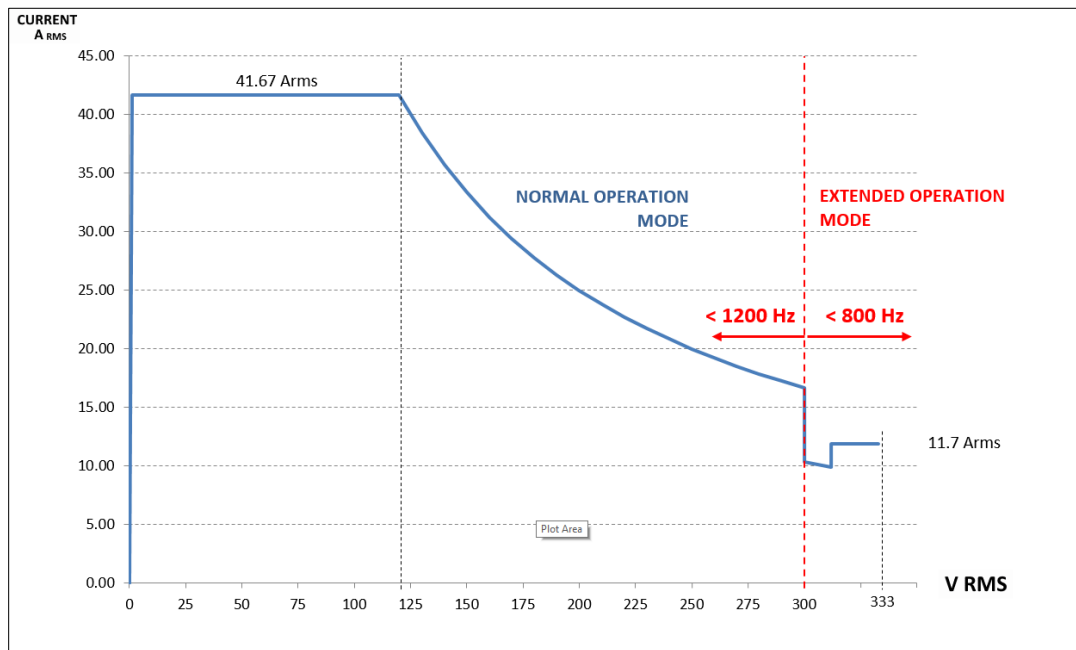


Figure 4-6: Extended AC Voltage/Current Range, 3150ADF Model per phase

4.4 DC Output Mode (Requires Option D)

DC OUTPUT	
Voltage	
Range	0 – 425 Vdc
Programming Resolution	0.01 V
Accuracy	± 0.25% F.S.
Noise & Ripple	< 150 mV rms
Load Regulation	± 0.02%
Line Regulation	± 0.1% for 10% Line Change
External Voltage Sense	External Sense, max. voltage drop 5% FS.
Voltage Slew Rate	At least 3.0 V/us (DC Mode)
Current Limit	
Programming Resolution	0.01 Adc
Accuracy	± 0.5 Adc
Modes	Constant Current Mode or Output Trip

MODEL	Phase Mode	Rated Power	DC Voltage Range	Max. DC Current 3/2 Phase Mode	Max. DC Current 1 Phase Mode	Form Factor
1150ADF-xGD	1 Phase	15 kVA	0 ~ ±425 Vdc	n/a	62.5 Adc	4U Chassis, Rackmount
3150ADF- xGD	3 / 2 Phase	15 / 10 kVA		21.0 Adc	n/a	
1300ADF- xGD	1 Phase	30 kVA		n/a	125.0 Adc	Fully wired 28U Cabinet power system
3300ADF- xGD	3 / 2 Phase	30 / 20 kVA		41.7 Adc	n/a	
1450ADF- xGD	1 Phase	45 kVA		n/a	187.5 Adc	
3450ADF- xGD	3 / 2 Phase	45 / 30 kVA		62.5 Adc	n/a	Fully wired 36U Cabinet power system
3600ADF- xGD	3 / 2 Phase	60 / 45 kVA		83.5 Adc	n/a	

4.5 Protection Modes

PROTECTION	
Protection Modes	Over Current fold-back or trip
	Progr. Peak Current Limit
	Power fold-back or trip
	Apparent Power fold-back or trip
	Over Voltage trip
	Over Temperature
OVP Range	0 - 105% Vmax
AC Input Voltage	Over and Under Voltage

4.6 Metering

MEASUREMENTS		
Voltage AC ⁽¹⁾		
Range	L-N: 0 – 350 V rms; L-L: 0 – 600 V rms	
Resolution	0.01 V	
Accuracy	± 0.25% F.S.	
Frequency (AC Mode Only)		
Range	15 – 1200Hz	
Resolution	0.01 Hz	
Accuracy	± 0.1% Reading	
Current AC ⁽²⁾		
Range	See model table in section 4.1 or 0	
Resolution	0.01 A	
Accuracy	± 0.5% F.S.	
Peak Current		
Range	4 x RMS current	
Resolution	0.01 A	
Accuracy	± 1.5% F.S.	
Crest Factor		
Range	1.00 – 5.00	
Resolution	0.01	
Accuracy	± 2.0% F.S.	
True Power ^(2,)		
Range	See model table in section 4.1 or 0	
Resolution	0.01 W	
Accuracy	± 1.5% F.S.	
Apparent Power ⁽²⁾		
Range	See model table in section 4.1 or 0	
Resolution	0.01 VA	
Accuracy	± 1.5% F.S.	
Power Factor ⁽³⁾		
Range	0.00 – 1.00	
Resolution	0.01	
Accuracy	± 0.5% F.S.	
Voltage DC (Requires Option D)		
Range	0- 440 Vdc	
Resolution	0.1 V	
Accuracy	± 0.25% F.S.	
Current DC (Requires Option D)		
Range	See model table in section 4.1 or 0	
Resolution	0.01 A	
Accuracy	± 0.5% F.S.	

Note 1: AC Voltage measurement accuracy shown for Line to Neutral measurements. Line to Line voltage measurements are calculated based on VLN and phase angles and are < 0.5% F.S. and valid only for sinusoidal voltage waveforms with low levels of distortion and under balanced three phase load conditions.

Note 2: Measurement Accuracies for Current and Power apply for load currents of 2.0 A or more.

Note 3: For Power level above 100 W

4.7 Transients (Requires Option R)

Transients	
Programming	
No. of Entries	200 Steps, 400 Segments
Parameters	Voltage, Frequency, Phase B & C, Ramp Time, Dwell Time
Dwell Time Range	0.0 – 10,000,000 msec
Ramp Time Range	0.2 – 10,000,000 msec
Time Resolution	0.1 msec
Edit Modes	Add at End, Insert Before, Delete
Execution	
Run Control	Run from Step # to Step # Run, Step, Restart, Stop
Program Storage	
Non-Volatile	100, Programs + Transients

4.8 AC Input

AC INPUT		9kVA	15kVA
Frequency Range			
AC Input Frequency		47 - 63 Hz	
Connection		4 Wire, (L1, L2, L3 and PE)	
-208 Input Version (-2)			
Input Voltage Range		208 Vac – 240 Vac ± 10%	
Nominal Phase Current @ 208V 3ø		33 A rms	51 A rms
Max. Rated Phase Current, 3ø		37 A rms	55 A rms
Peak Inrush Current ¹		< 1.5 x I _{rms}	
Input Power Factor		> 0.9	
Efficiency		> 85 %	
Internal Line Fuses -2		NOT USER SERVICEABLE	
Type		FUSE, SEMICONDUCTOR,22X58MM	
Rating		80A,600VAC	
-400 / -480 Input Version (-4)			
Input Voltage Range		380 Vac – 480 Vac ± 10%	
Nominal Phase Current @ 380V 3ø		18 A rms	27 A rms
Max. Rated Phase Current		20 A rms	30 A rms
Nominal Phase Current @ 480V 3ø		14 A rms	23 A rms
Max. Rated Phase Current		16 A rms	28 A rms
Peak Inrush Current ²		< 1.5 x I _{rms}	
Input Power Factor		> 0.9	
Efficiency		> 85 %	
Internal Line Fuses -4		NOT USER SERVICEABLE	
Type		FUSE, SEMICONDUCTOR,22X58MM	
Rating		63A,600VAC	

NOTE: For models consisting of multiple chassis, power input ratings apply to each chassis.

¹ For nominal line input voltage

² For nominal line input voltage

4.9 Dimensions & Weight

DIMENSIONS & WEIGHT		9 kVA	15 kVA
Dimensions			
	Height	7.0" / 178 mm / 4U	
	Width	17.0" / 432 mm – w/o rack handles 19.0" / 483 mm - with attached rack handles	
	Depth	25.0" / 635 mm	
Weight			
	Net	111.2lbs. / 50.4 kg	
	Shipping	130 lbs. / 59 kg	

NOTE: For models consisting of multiple chassis, multiply weight and height by the number of chassis.

See dimension drawing. 3D Step Models Available on request.

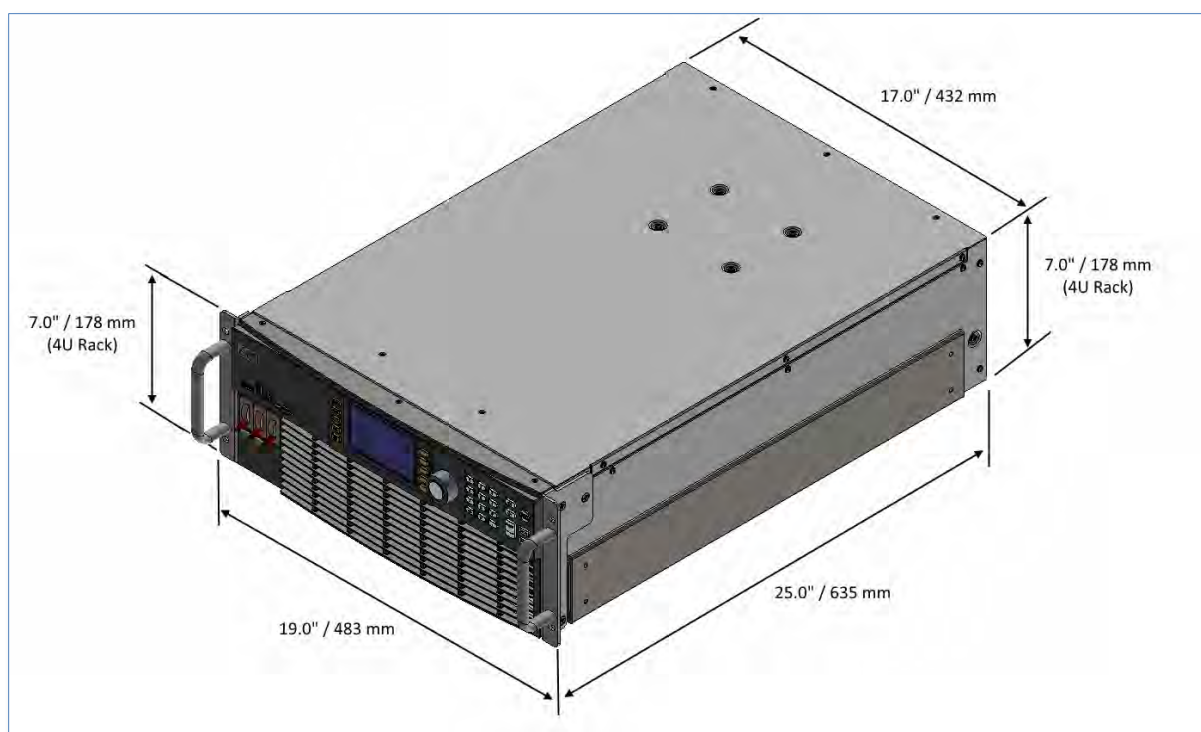


Figure 4-7: Dimension Drawing ADF Series® 15KW Model

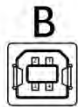
4.10 Environmental

ENVIRONMENTAL	
Cooling	Fan Cooled
Audible Noise (at 1 meter)	Standby: 46 dBA Full power: 85 dBA typical
Operating Temperature	0 to 40 °C / 32 to 104 °F
Storage Temperature	-20 to 70 °C / -4 to 158 °F
Humidity	< 80%, non-condensing for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C
Altitude (max.)	2000 m / 6500 feet

4.11 Safety & Regulatory

SAFETY & REGULATORY	
Safety Standard	EN 61010-1;2010 (Edition 3)
EMC Emissions	EN 55011:2009+A1:2010
EMC Immunity	EN 6100-4-2, -3, -4, -5, -6, -8, -11
Product Category	EN61326-1:2010 (Measurement, Laboratory and Control Equipment)
Approvals	CE Mark, NTRL Nemko US/Canada

4.12 Digital Interfaces

USB	
USB Standard	USB 2
USB Class	
Front Panel	Type A USB Host (2)
Connector	Type A, standard
Rear Panel	Type A USB Host (1) Type B USB Device (1)
Connector Types	A  B 

RS232	
Baud rate:	9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O = Odd = uneven parity E = Even = even parity N = None = no parity bit
Number of data bits:	7 or 8
Number of stop bits:	1 or 2
Handshake:	Xon/Xoff
Signal Levels:	
Inputs (RxD)	Maximum input voltage: ± 25 V Input Impedance: 5 k Ω typical Switching thresholds: $V_H < -3$ V, $V_L > +3$ V
Outputs (TxD)	Output voltage (at $R_{LOAD} > 3$ k Ω): min ± 5 V, typical ± 5.4 V Output Impedance: $< 300\Omega$ min., 10 M Ω typical in power off state Short circuit current: Typ. ± 35 mA typical

Ethernet	
Protocol	Ethernet TCP/IP, 100Mb/1000Mb
Connector	RJ45
Webserver	Built-in
LXI Compliance	Core, version 1.4

GPIB	
IEEE Standard	IEEE488.1, IEEE488.2 (2003 incl., NI HS488) IEC 60488-1, IEC 60488-2 (2004)
IEEE Functions Supported	SH1, AH1, T6, L3, SR1, RL1, DC1, DT1
Connector	Amphenol 24 pin, Micro ribbon connector. Rear Panel Set screws: M3.5x0.6 metric threads.

4.13 Auxiliary I/O

The Auxiliary I/O functions are only available on all ADF Series power source models.

The following technical specifications apply to the Auxiliary I/O functions.

AUX I/O SIGNAL SPECIFICATIONS	
Digital Inputs	
Input Signals	Remote Inhibit, External Trigger Input, Phase Sync, User Inputs (3)
Voltage Levels	Logic low: $V_{in} < 0.4\text{ V}$ Logic High: $V_{in} > 2.0\text{ V}$
Input Impedance	10 k Ω
Absolute max. voltage	12V
Digital Outputs	
Output Signals	<i>Open Collector (0.5A max. protection):</i> FORM Relay Control, Transformer Relay Control Note: DO1 and DO2 are TTL outputs with 5.2V output and 200Ω output impedance. Into a 5kΩ load, the output voltage is ~5V. Note: DO3 and DO4 are open-drain outputs with internal pull-up of 1k to 5.5V with a diode protection. At no load, these outputs will measure 5.5V. With a 5kΩ impedance, these outputs will measure ~4.6V. <i>TTL Level:</i> Relay State/Function Strobe / Trigger Out Phase Reference (sync output) User programmable outputs (2)
Voltage Levels @ 0.4 mA	Logic low: $V_{in} < 0.4\text{ V}$ Logic High: $V_{in} > 4.6\text{ V}$
Output impedance	200 Ω
Analog Inputs	
Signals	Analog Inputs (4) - AI #1, #2, #3, #4, user defined setpoint programming, not real time (50 to 500ms).
Voltage Range	-10V to +10V
Accuracy	$\pm 0.1\%$ F.S.
Sampling Rate	10 Hz or 10 times/sec
Open Circuit Level	2 ~ 3 % of F.S. if analog input is left floating (no connection)
Input Impedance	5 k Ω
Absolute max. voltage	12V
Analog Outputs	
Signals	Analog Outputs (4) - user defined monitor (RMS and average measurements, 100ms)
Voltage Range	0V – 5V
Accuracy	$\pm 0.1\%$ F.S. (with 5 k Ω load or higher)
Update Rate	10 Hz or 10 times/sec
Output Impedance	< 10 Ω
Power	
Output	12.0 Vdc
Accuracy	$\pm 0.1\%$ Vdc
Max. Current	0.5 Adc
RS232	
Signals	Tx, Rx
Handshake	Xon/ Xoff
Baud rates	9600 – 460800 bps

Auxiliary I/O Signal Protection Information and Recommendations

- All the signals on the auxiliary I/O DB25 port have double insulation with respect to high voltage. They are safe to touch (SELV) and safe to connect to any other equipment.
- These signals are referenced to earth, so any data acquisition card or equipment used to control the power source should be referenced to the same earth as the power source. For the power source unit, earth is its chassis.
- If the controlling computer connected to the power source is connected to an earth with different potential - this can happen when using different outlets or AC utility circuits - , that voltage difference can damage low-signal circuits.
- Analog outputs cannot be negative and cannot be higher than 5V. Any DAQ card or instrument used to monitor/read these outputs must have a sufficient input voltage range.
- In general, it is recommended to limit signal input voltages with series resistors and clamping diodes in case the “source” can generate a voltage higher than the maximum allowed by the analog inputs of the power source. See relevant specification on the previous page.

4.14 Transformer Output Voltage Range (T Option)

If more than 332Vac L-N is required in three-phase mode, the 400V Transformer option may be added to an ADF power source. This option provides an additional 400Vac L-N AC only voltage range. The standard 300Vac L-N voltage range remains available as the output transformer for this option is bypassed when not in use.

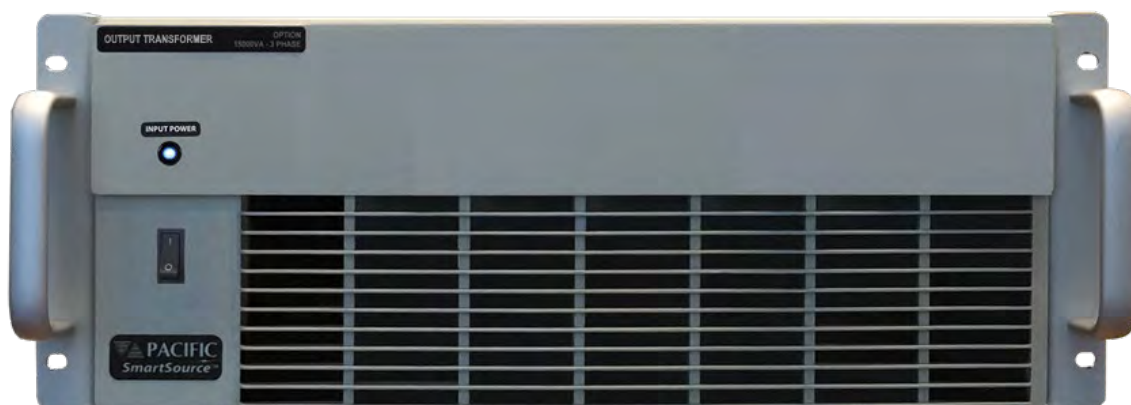


Figure 4-8: Rack Mount Chassis for 15kVA Transformer Option

4.14.1 Available T Option Rating Versions

The Transformer option is available in several power levels to match the power source configuration. The following transformer option ratings are available. Note that ADF models configured for a Transformer option are designated by an “ADFT” model designation.

ADFT Models	Transformer Rating
3150ADFT	Rack Mount 19" Chassis, 4U (7") height. Rated for 15kVA max, 0 -400Vac _{LN} / 0 – 692Vac _{LL}
3300ADFT	Transformers are installed in 19" Cabinet Systems along with ADF power sources Rated to 30kVA max, 0 -400Vac _{LN} / 0 – 692Vac _{LL}
3450ADFT	Transformers are installed in 19" Cabinet Systems along with ADF power sources Rated to 45kVA max, 0 -400Vac _{LN} / 0 – 692Vac _{LL}
3600ADFT	Transformers are installed in 19" Cabinet Systems along with ADF power sources Rated to 60kVA max, 0 -400Vac _{LN} / 0 – 692Vac _{LL}
For higher power configurations, contact factory	

4.14.2 Technical Specifications 400V Range

AC OUTPUT											
Voltage											
AC Only Range	0 - 400 V L-N rms / 0 - 692V L-L rms										
Programming Resolution	0.01 V										
Accuracy	$\pm (0.25\% + 0.25 * f \text{ (kHz)}) \text{ F.S.}$										
Constant Power Range	From 40% to 100% of Voltage Range: 160Vac L-N to 400Vac L-N										
External Voltage Sense	Automatically scaled for 400Vac Range										
Frequency											
Range	45.00 – 1000.0 Hz For models with –F Option: - Linear voltage derating from 45Hz to 15Hz - Linear current derating from 1000Hz to 1200Hz.										
Programming Resolution ¹	0.01 Hz										
Accuracy	$\pm 0.01\%$										
Current²											
Range	Available RMS Current per phase is scaled by transformer ratio. E.g. for 3150ADF, max current at 400Vac L-N is $(41.7 * \frac{1}{4}) = 31.27\text{Arms}$ in 3 Phase mode										
Current Overload	Available 30% Current overload for up to 2.0 seconds when enabled.										
Note 1: FREQUENCY PROGRAM RESOLUTION FOR EXPORT MODELS (-4FE, -2FE): <i>Per U.S.A. Bureau of Industry and Security, ECCN 3A225, frequency control is limited to no better than 0.2% at frequencies of 600 Hz. or more for unrestricted export products. To meet that requirement, frequency programming in all ADF-xFE models has three resolution ranges, which round the frequency to the nearest increment, as defined in the table below.</i> Frequency Resolution for Export Models <table> <tr> <th>Range</th><th>Resolution</th></tr> <tr> <td>15.00 - 99.99 Hz</td><td>0.01 Hz</td></tr> <tr> <td>100-599.9 Hz</td><td>0.1 Hz</td></tr> <tr> <td>600 - 999 Hz</td><td>2.0 Hz</td></tr> <tr> <td>1000 - 1200 Hz</td><td>5.0 Hz</td></tr> </table>		Range	Resolution	15.00 - 99.99 Hz	0.01 Hz	100-599.9 Hz	0.1 Hz	600 - 999 Hz	2.0 Hz	1000 - 1200 Hz	5.0 Hz
Range	Resolution										
15.00 - 99.99 Hz	0.01 Hz										
100-599.9 Hz	0.1 Hz										
600 - 999 Hz	2.0 Hz										
1000 - 1200 Hz	5.0 Hz										
Note 2: Refer to AC Mode Voltage / Current rating charts Error! Reference source not found. and Error! Reference source not found. on following pages.											

MODEL	Phase Mode	Rated Power	T Voltage Range Vac L-N	Max. AC Current 3 Phase Mode	Max. AC Current 1 Phase Mode	Form Factor
1150ADFT	1 Phase	15 kVA	0-400 V	n/a	93.8 Arms	2x 4U Chassis, Rackmount
3150ADFT	3 Phase	15 kVA		31.3 Arms	n/a	
1300ADFT	1 Phase	30 kVA		n/a	187.6 Arms	Fully wired 28U Cabinet power system
3300ADFT	3 Phase	30 kVA		62.5 Arms	n/a	
1450ADFT	1 Phase	45 kVA		n/a	281 Arms	
3450ADFT	3 Phase	45 kVA		93.8 Arms	n/a	
3600ADFT	3 Phase	60 kVA		125.0 Arms	n/a	Fully wired 36U Cabinet power system

5 Unpacking and Installation

5.1 Inspection

The ADF Series® of AC power sources are carefully inspected before shipment. If instrument damage has occurred during transport, please inform Pacific Power Source' nearest sales and service office or representative.

All ADF models require three-phase AC input and are furnished with a compression terminal block for AC input. A suitable line cord and power disconnect is required (but not included) to connect these power supplies to the mains.

Refer to "check line voltage" to check the line voltage selection and fuse type.

Note: For input and output connections to ADF cabinet systems, refer to Section 5.15, "Cabinet Systems" starting on page 66.

5.2 Lifting and Carrying Instructions



WARNING

THIS UNIT IS HEAVY. Two persons are required to lift or carry this unit. DO NOT attempt to lift alone. DO NOT use the front panel rack handles alone to lift this unit. The unit must be supported in front and back when carrying.



AVERTISSEMENT

CET EQUIPEMENT EST LOURD. Deux personnes sont requises pour transporter ou soulever cet équipement. NE PAS tenter de soulever ou déplacer seul. NE PAS utiliser les poignées en face avant pour soulever l'appareil. L'équipement doit être pris en charge à l'avant et à l'arrière pour le transport.

This equipment weighs over 100 lbs. / 50 Kg and requires two persons to lift or carry. To remove the equipment from its packaging, use the provided handgrip openings on either side of the unit to lift the unit from its packaging and place it on a suitable surface that is rated to support the weight of the unit. Two persons are required to remove the ADF unit from its packaging, one on each long side of the box. Refer to Figure 5-2 for reference.

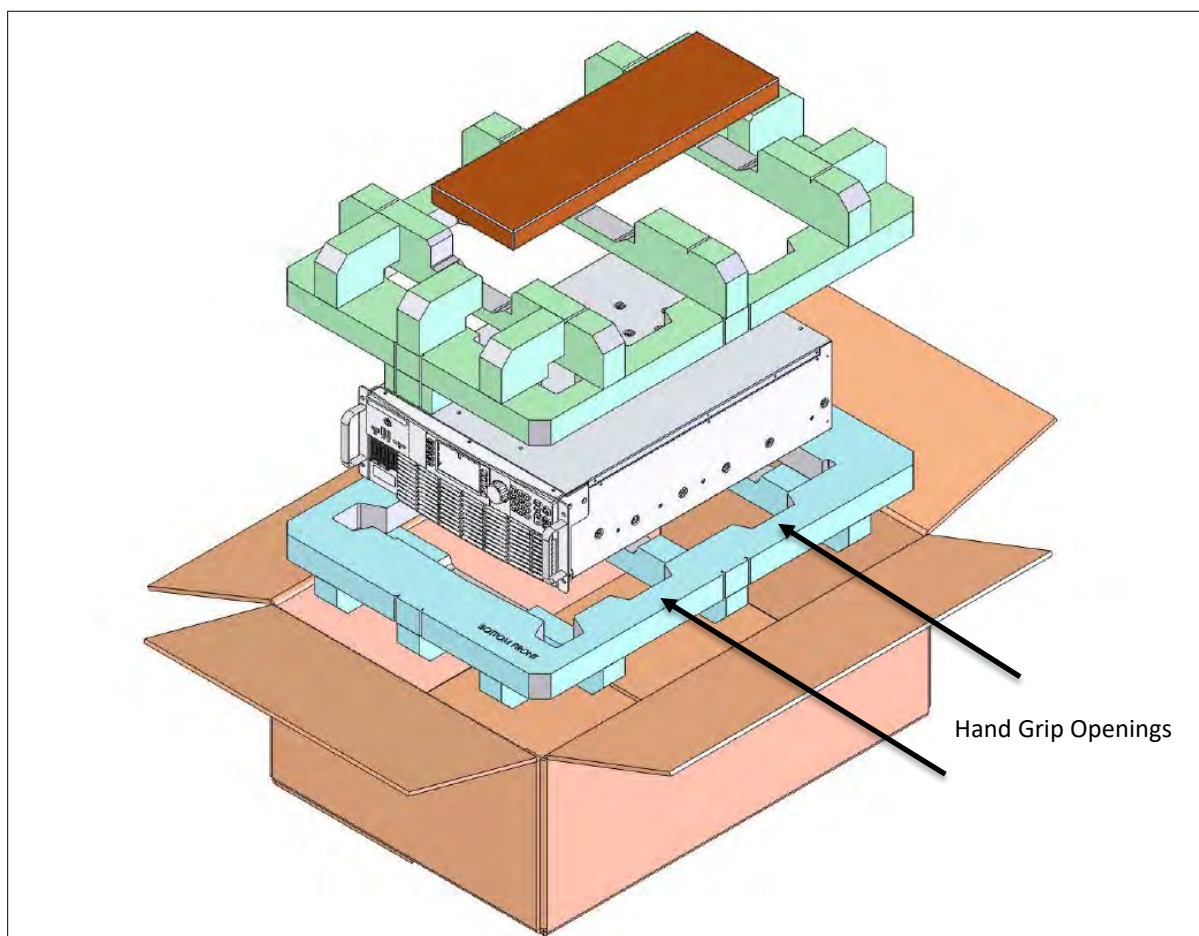


Figure 5-2: Exploded view of ADF unit packaging

If the unit is to be installed in an instrument rack, the straps may be removed. In that case, a suitable lift must be used to position the unit at the desired rack height and pushed in place using either rack slides or L-brackets (not included with the unit). The front panel handles may be used to pull or push the unit in or out of a rack space only.

Note: The front panel handles are not designed to carry the entire unit. It must be supported on front and back or both sides by two persons when being handled.

5.3 Verify Correct AC Input Line Voltage

The ADF Series® power supply can be ordered with a range of 3 phase AC input voltage configurations. Prior to connecting the AC power source to the local mains, it is important to check the type label on the unit to verify that its AC input configuration matches the local utility power.

Do not connect the power supply to the mains if the AC input voltage, phasing and frequency does not match.



WARNING

DO NOT CONNECT A 208 – 240 V AC INPUT ADF MODEL TO A 380V, 400V OR 480V OR HIGHER THREE PHASE UTILITY LINE VOLTAGE AS DAMAGE TO THE UNIT MAY OCCUR.

DO NOT CONNECT A 380 – 480 V AC INPUT ADF MODEL TO A 208V TO 240V THREE PHASE UTILITY LINE VOLTAGE AS THE UNIT WILL NOT OPERATE.



AVERTISSEMENT

NE PAS CONNECTER UNE 208-240 V AC ENTRÉE ADF MODÈLE À UN 380V, 400V OU 480V OU PLUS DE TROIS PHASES UTILITAIRE TENSION EN PANNE QUI PEUT SE PRODUIRE.

NE PAS CONNECTER UNE 380 - 480 V AC ENTRÉE ADF MODÈLE À UN 208V TO 240V TRIPHASE UTILITAIRE TENSION QUE L'APPAREIL NE FONCTIONNE PAS.

5.4 AC Input Connections



WARNING

The AC input connections must include a disconnect device (an external switch or circuit-breaker) as part of the installation. The disconnect device must be suitably located and easily reached and must be marked as the disconnecting device for the equipment. The disconnect device must disconnect all line conductors simultaneously.

An external overcurrent protection device must be provided (by, e.g., fuses or circuit breaker). The breaking capacity of the overcurrent protection device should be compatible with the current rating of the installation.

A minimum of basic insulation is required between mains-connected parts of opposite polarity on the supply side of the overcurrent protection device.

Overcurrent protection devices shall not be fitted in the protective conductor. Fuses or single pole circuit-breakers shall not be fitted in the neutral conductor of multi-phase equipment.

Installation should be in accordance with ANSI/NFPA 70, NEC.

After disconnecting grid power, ALWAYS wait at least 1 minute, then use a Digital Voltmeter (DMM) in VDC Mode to check for any residual DC voltage from each Line terminal to the Chassis ground stud to check for safe voltage levels (< 5 Vdc) before touching the unit or any terminal blocks or pins.



AVERTISSEMENT

Les connexions d'entrée AC doivent inclure un dispositif de déconnexion (un commutateur externe ou disjoncteur) dans le cadre de l'installation. Le dispositif de déconnexion doit être convenablement situé et facilement accessible et doit être marqué comme le dispositif de déconnexion de l'équipement. Le dispositif de déconnexion doit déconnecter tous les conducteurs de ligne simultanément.

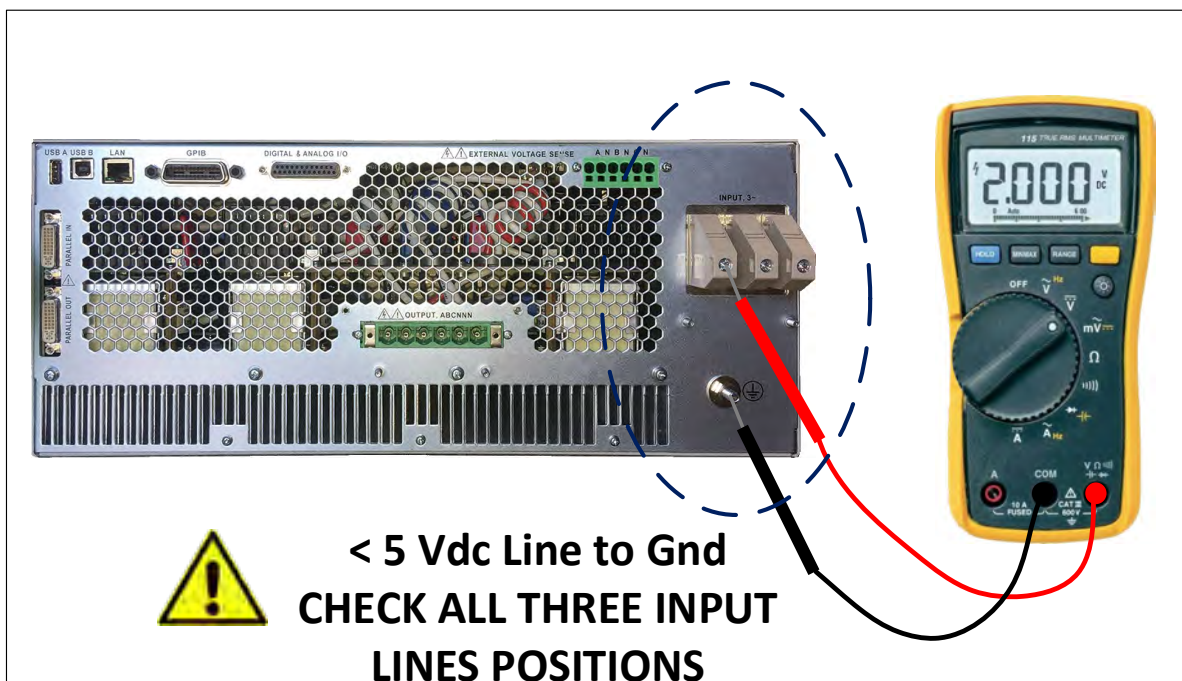
Un dispositif de protection de surintensité externe doit être fourni (par exemple, par des fusibles ou coupe-circuit). Le pouvoir de coupure du dispositif de protection contre les surintensités doit être compatible avec le courant nominal de l'installation.

Un minimum d'isolation de base est nécessaire entre les parties de réseau connecté de polarité opposée sur le côté d'alimentation du dispositif de protection contre les surintensités.

Les dispositifs de protection contre les surintensités ne doivent pas être installés dans le conducteur de protection. Fusibles ou simples disjoncteurs ne doivent pas être installés dans le conducteur neutre des équipements multi-phasés.

L'installation doit être conforme à la norme ANSI / NFPA 70, NEC.

Après avoir débranché l'alimentation du réseau, attendez TOUJOURS au moins 1 minute, puis utilisez un voltmètre numérique (DMM) en mode VDC pour vérifier toute tension CC résiduelle de chaque borne de ligne sur le plot de masse du châssis pour vérifier les niveaux de tension sécurisés (<5 Vcc) avant de toucher l'unité ou des borniers ou des broches.



Consult the table below for recommended wire size by model number and AC input rating.

MODEL	INPUT VOLTAGE	INPUT CURRENT	RECOMMENDED INPUT SERVICE	MINIMUM COPPER WIRE SIZE, 75°C RATED
190ADF-2	208 V ac, 3~	37 A rms, max	40 A rms	10 mm ² (AWG 8)
1150ADF-2	208 V ac, 3~	55 A rms, max	60 A rms	21 mm ² (AWG 4)
3150ADF-2	208 V ac, 3~	55 A rms, max	60 A rms	21 mm ² (AWG 4)
190ADF-4	380/400 V ac, 3~ 480 V ac, 3~	20 A rms, max 16 A rms, max	25 A rms 20 A rms	6 mm ² (AWG 10) 4 mm ² (AWG 12)
1150ADF-4	380/400 V ac, 3~ 480 V ac, 3~	30 A rms, max 24 A rms, max	35 A rms 30 A rms	10 mm ² (AWG 8) 6 mm ² (AWG 10)
3150ADF-4	380/400 V ac, 3~ 480 V ac, 3~	30 A rms, max 24 A rms, max	35 A rms 30 A rms	10 mm ² (AWG 8) 6 mm ² (AWG 10)

Table 5-1: AC Input Wire Size Table

Note: Maximum wire size that will fit the AC Input terminal block is AWG 4.

AWG	Diameter		Turns of wire, without insulation		Area	
	(in)	(mm)	(per in)	(per cm)	(kcmil)	(mm ²)
4	0.2043	5.189	4.89	1.93	41.7	21.2

The AC input connections must be made at the rear panel AC terminal block. This input block has a removable safety cover that must be installed when the instrument is used on a bench or is otherwise accessible at the rear. If mounted in a cabinet with a locked door or screen, the AC input safety cover may be omitted if needed.



Figure 5-3: Rear Panel Layout

EARTH GROUND

The AC input terminal phasing is marked on the rear panel and shown in the illustration below. A four wire mains connection is required. (L1, L2, L3 and Earth Ground). Ground connection is located directly below the AC Line input terminal block as shown in Figure 5-3 above.

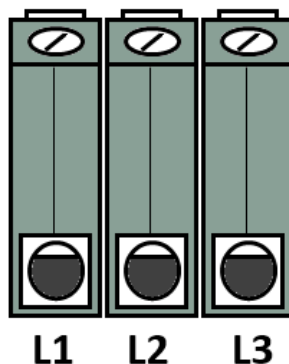


Figure 5-4: AC Input Terminal Block - Rear Panel

5.4.1 AC Input Cover & Strain Relief Option

For bench use or installation other than a 19" rack with rear safety screen, an optional safety cover with wire strain relief is available. P/N 128081-001 for 208V AC input models or P/N 128081-002 for 400~480V AC input models. This cover is pictured below.

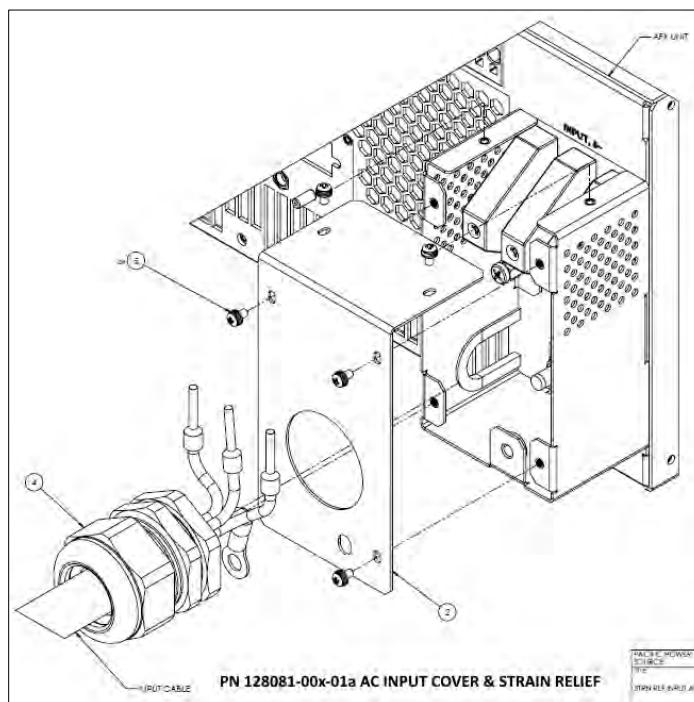


Figure 5-5: AC Input Safety Cover & Strain Relief Option

5.5 Grounding Requirements

5.5.1 Chassis Ground Connection Required



WARNING

SHOCK HAZARD: Equipment must be grounded.



AVERTISSEMENT

RISQUE DE CHOC: l'équipement doit être mis à la terre.

The unit **MUST** be grounded via the AC Input. A line cord with proper Earth Ground must be used at all times. Correct grounding of your electrical system infrastructure according to applicable national standards must also be observed.

5.5.2 Output Neutral Grounding

The output neutral terminals of the power source are **NOT** connected to earth ground but rather floating. This allows the output of the power source to float with respect to ground. Some loads will have their neutral input grounded, which will result in the power source neutral being grounded through the load. Alternatively, the user may ground the output neutral terminals himself by running a suitable wire size from one of the output neutral terminals to the ground stud on the rear panel of the power source as shown in Figure 5-5.

Grounding the output neutral can help reduce common mode noise at the output of the power source.

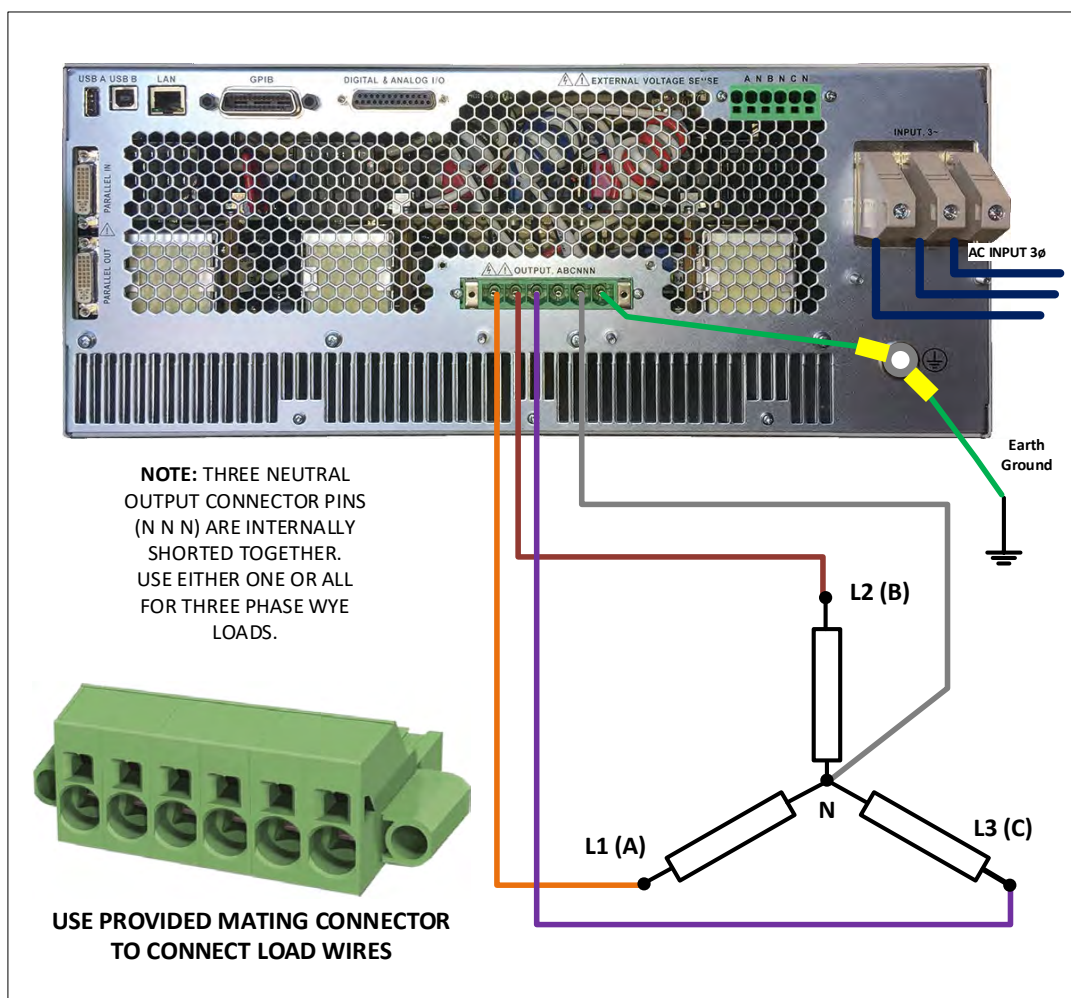


Figure 5-6: Grounding Floating Neutral Output

5.6 AC Input Circuit Breaker

This product is fitted with a mains input circuit breaker on the left hand side of the front panel. The power off position of the circuit breaker handle is marked "O". The power on position of the circuit breaker is marked "I".

5.7 Bench Use



CAUTION

When placing this instrument on a workbench or table, ensure the maximum weight rating of the bench/table exceeds the actual weight of the unit.



ATTENTION

Lorsque l'appareil est placé sur un banc de travail ou une table, s'assurer que la capacité de charge maximale du banc / table dépasse le poids réel de l'appareil.

The ADF Series® chassis is not equipped with surface protection feet as it is intended primarily for 19" rack mount use. When used on a bench, use care not to damage bench surface by sliding ADF unit.

5.8 Rack Mounting

The ADF Series® chassis is designed to be rack mounted in a standard 19-inch rack for system applications. Zero stacking with other units or test equipment is possible. The weight of the unit **MUST** be supported properly. Either use rack slides or L brackets of sufficient weight rating that are compatible with the dimensions of the cabinet used.

ADF Series® models with an output power rating above 15KVA are available as factory installed 19" instrument cabinet systems including input and output wiring to connection terminal blocks at the bottom rear of the cabinet.

Customers (i.e. System Integrators) preferring to install one or more ADF units in their own cabinet systems can order Master and multiple Auxiliary parallel systems as a **KIT** with no 19" cabinet or wiring included.

5.9 Airflow

The ADF Series® of AC power sources are cooled by drawing in air through the front and out at the back of each unit. Do not ADF units install in a manner that blocks the free flow of air such as in a cabinet with a solid rear door. Allow a minimum of 6" (15 cm) free of obstructions behind the unit to prevent overheating.

5.10 Sound Levels



WARNING

Sound pressure level from power source may exceed 85 dBA.

Sound pressure level should be measured both at the operator's position in normal use and at whatever point 1 meter from the power source enclosure that has the highest sound pressure level.

The installer shall provide measures to reduce the sound pressure level at the operator's point of use to a safe level. These measures may include the fitting of noise-reducing baffles or hoods or provision of protective earpieces.



AVERTISSEMENT

Le niveau sonore de l'appareil peut dépasser 85 dBA.

Le niveau sonore doit être mesuré à la fois à la position de l'opérateur en utilisation normale et quelque soit le point à 1 mètre de l'enceinte de l'appareil qui a le niveau sonore le plus élevé.

L'installateur doit prendre des mesures visant à réduire le niveau sonore au point d'utilisation de l'opérateur. Ces mesures peuvent inclure la mise en place de hottes antibruit, ou la fourniture d'oreillettes de protection.



When the equipment is operated at or near full rated output power, fan speed will be at its highest and corresponding noise levels will be higher. Operators should wear ear protection while exposed to these levels of sound.

5.11 Cleaning



CAUTION

BEFORE you clean the unit, switch the unit off at the front panel breaker AND remove all mains power using the mains disconnect.

- Please do NOT use any organic solvent capable of changing the nature of the plastic such as benzene or acetone.
- Please ensure that no liquid is allowed to penetrate this product.



ATTENTION

AVANT de nettoyer l'appareil, mettez l'appareil hors tension au niveau du disjoncteur de face avant ET retirez tout câble d'alimentation secteur.

- Ne pas utiliser **de** solvant organique capable de changer la nature de la matière plastique tel que le benzène ou l'acétone.
- Veiller à ce qu'aucun liquide ne pénètre à l'intérieur de l'appareil

To clean this product, use a soft or slightly damp cloth.

5.12 Air Intake Filter Removal and Cleaning

Units equipped with a removable air intake filter must have their filter material cleaned on a regular basis. A six-month cleaning interval is recommended. For units deployed in particularly dirty environments, this cleaning interval should be shortened to three months or less to prevent the air filter from clogging up with dirt. This applies to both Master units and Auxiliary units.



Figure 5-7: Air Intake Filter Removal

5.12.1 Air Filter Removal

To remove the air filter, proceed as follows:

1. Turn the unit off first. Using a small Philips screwdriver
2. Remove the four M3 Philips screws from each corner of the filter panel on the front of the unit.
3. Pull the filter panel toward you carefully and remove the filter material.

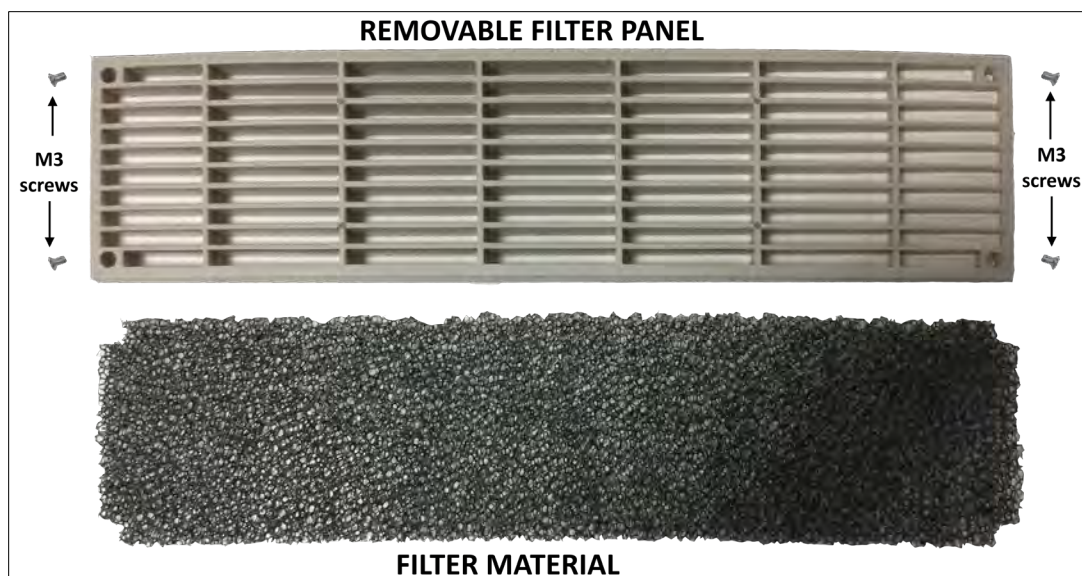


Figure 5-8: Air Intake Filter and Filter Panel

5.12.2 Filter Cleaning

Use warm water and some mild detergent to rinse all dirt out of the filter material. Allow the filter to dry for 2 hours or more till fully dry before re-installing. If the filter material is too dirty to clean, replace with a new filter. Contact customer service for replacement filters.

5.12.3 Air Filter Installation

To reinstall the filter material, proceed as follows:

1. Place the cleaned filter material against the lower part of the unit's front panel.
2. Line up the filter material so the corner cut-outs align with the four corners
3. Install the removable filter panel using the four M3 Philips screws.

5.13 Liquids

The ADF Series® of AC power sources are not protected against liquid spills. Do not install where chemicals are used or where liquids could be spilled into the unit.

5.14 Load Connections



WARNING

HAZARDOUS OUTPUT: The power source output may be set to hazardous voltage levels. It provides basic isolation from the AC input mains. Therefore, the output must always be considered hazardous. Connections must be inaccessible to the operator in all situations when AC input mains voltage is applied.

Always disconnect power supply from the mains before connecting or disconnecting to the hazardous output terminals.



AVERTISSEMENT

SORTIE DANGEREUSE: La sortie de l'appareil peut être réglée à des niveaux de tension dangereux. L'appareil fournit une isolation de base du réseau d'entrée AC. Par conséquent, la sortie doit toujours être considérée comme dangereuse. Les connexions doivent être inaccessibles à l'opérateur dans toutes les situations où la tension d'entrée secteur est appliquée.

Toujours débrancher l'alimentation secteur avant de connecter ou déconnecter les bornes de sortie dangereuses.

The AC power source can be configured for either single-phase output or three-phase output.

Note: The External Voltage Sense connector always has three phase and three neutral connections but in single-phase mode of operation, only the A phase and one neutral connection are required.

5.14.1 Output Wiring and Recommended Wire Sizing

Connections from the AC source output terminal to the load should be made using the provided mating output connector. This connector is safety rated and does not require an output cover. It **MUST** be used when connecting load wires.

Load current is a function of the load so care must be taken by the end user to select appropriately sized output wires in accordance with local electrical codes.

Maximum output voltage and current ratings of the available power source models are shown in section 4, "Technical Specifications" and should be consulted when determining correct wire size. Also consider the voltage insulation rating of the load wires and External voltage sense wires used.

5.14.2 Three Phase Wye or Split Phase Load Output Connection – 3150ADF

Connection of a three-phase load requires the mating connector provided in the 3150ADF ship kit. This six-pole connector uses a spring loaded wire attachment system. To unlock a position, use a small screwdriver or pin to push down in the square hole located directly above each connection. Once you push in, you will feel to spring unlatch. Now push the stripped wire end into the connector and pull out the small screwdriver or pin. This will release the spring locking down the wire. Use a pull test to make sure the wire is clamped down securely.



Note: The output terminal diameter is 16 mm² so largest wire gauge that can be used is AWG6.

AWG	Diameter		Turns of wire, without insulation		Area	
	(in)	(mm)	(per in)	(per cm)	(kcmil)	(mm ²)
6	0.1620	4.115	6.17	2.43	26.3	13.3

Repeat for the three (3 Phase load) or two phase (Split phase load) wires and the neutral wire. Note that the three neutral positions on the rear panel output power connector are all shorted together inside the ADF. Thus, there is only one neutral, which is common for all output phases. For balanced three phase Wye loads, only one of these three neutral output positions has to be connected to the load's neutral position.

For split phase load applications, the A and B phases are connected to the load. The C phase load and C phase Voltage sense connections are not used.

For bench use or setups where the rear panel is accessible, an optional output safety cover and wire strain relief is available as P/N 128080 pictured here.

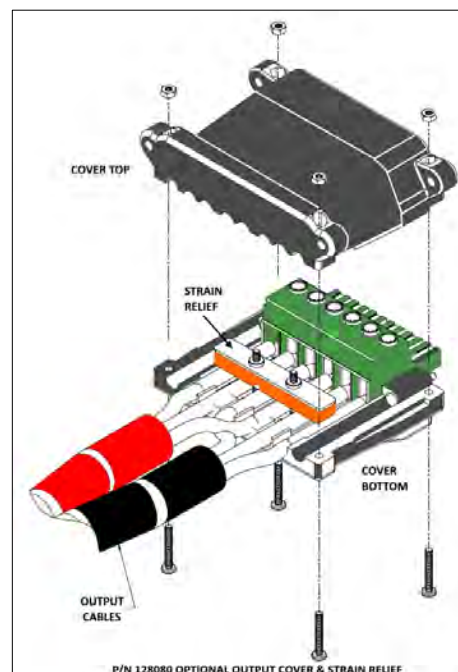


Figure 5-9: Output Cover
Option P/N 128080

The requisite WYE load output wiring is shown in Figure 5-8 using internal voltage sense and Figure 5-9 when using external voltage sense.

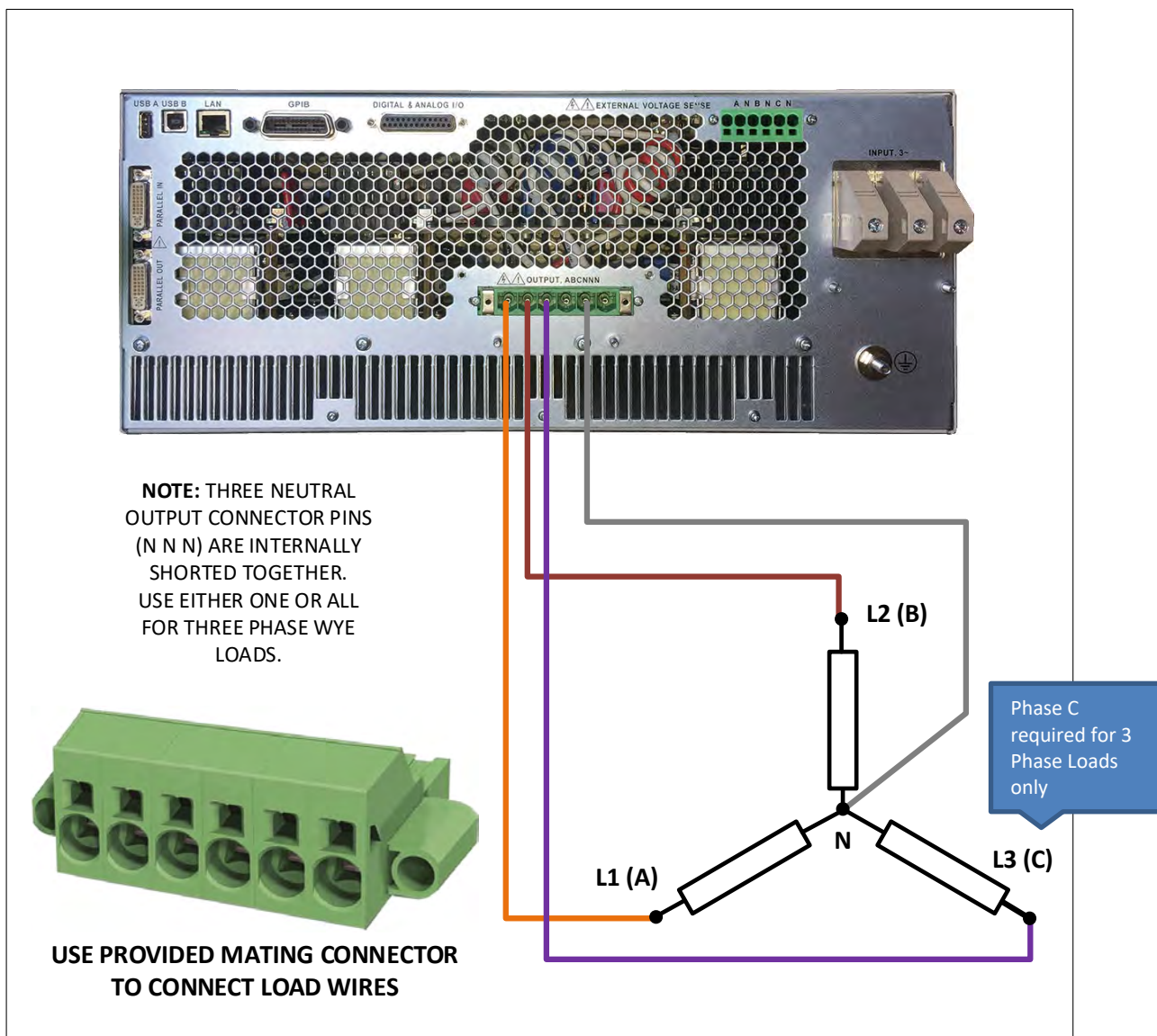


Figure 5-10: Three phase Wye or Split phase Load Output Connections – Internal Voltage Sense

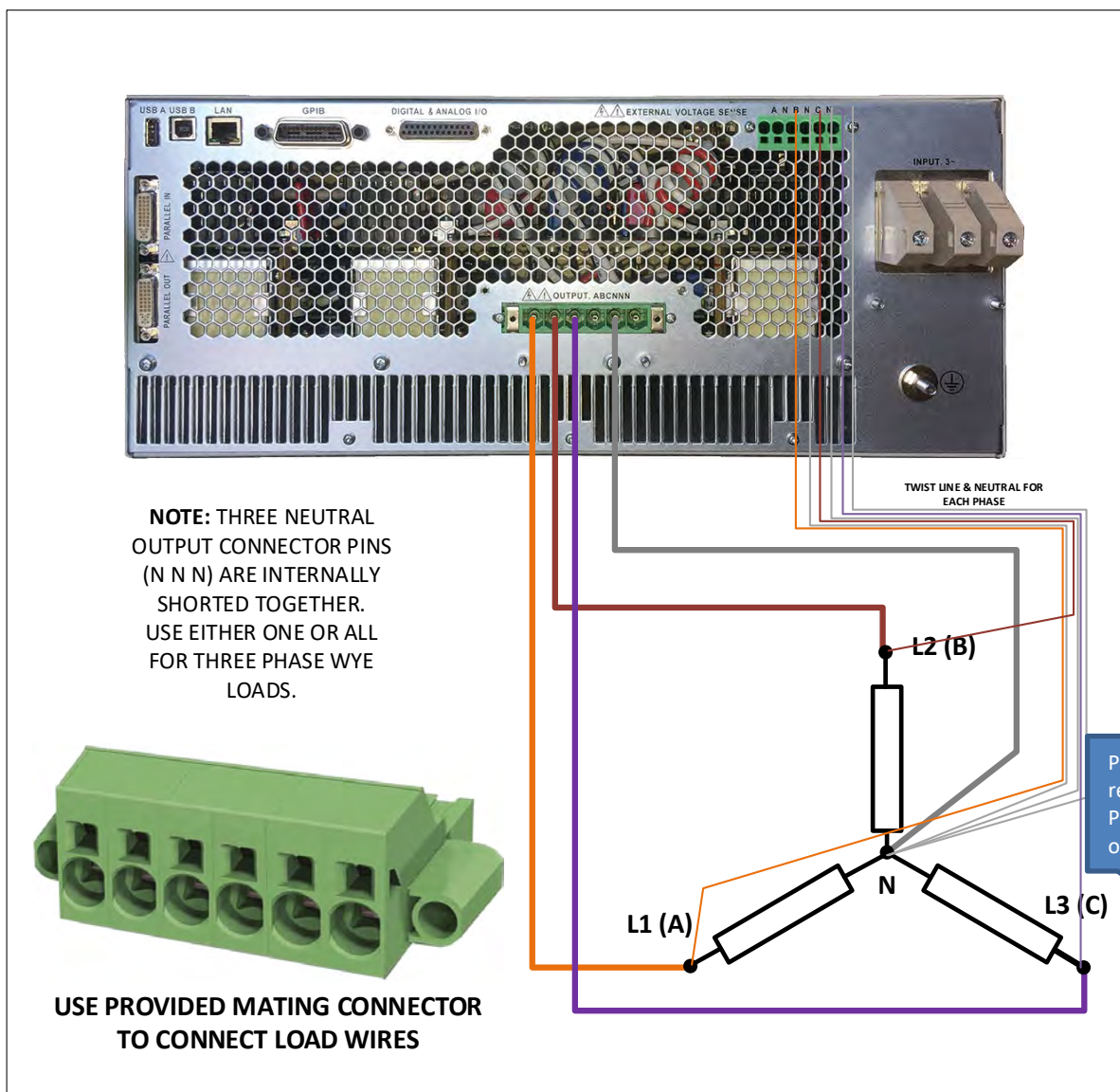


Figure 5-11: Three phase Wye or Split phase Load Output Connections – External Voltage Sense

5.14.3 Three Phase Delta Load Output Connection – 3150ADF Only

Connection of a three-phase load requires the mating connector provided in the ADF Series® ship kit. This six-pole connector uses a spring loaded wire attachment system. To unlock a position, use a small screwdriver or pin to push down in the square hole located directly above each connection. Once you push in, you will feel to spring unlatch. Now push the stripped wire end into the connector and pull out the small screwdriver or pin. This will release the spring locking down the wire. Use a pull test to make sure the wire is clamped down securely.



Repeat for the three phase wires. For Delta loads, there is no neutral connection.

Note: The output terminal diameter is 16 mm² so largest wire gauge that can be used is AWG6.

AWG	Diameter		Turns of wire, without insulation		Area	
	(in)	(mm)	(per in)	(per cm)	(kcmil)	(mm ²)
6	0.1620	4.115	6.17	2.43	26.3	13.3

Repeat for the three phase wires. For Delta loads, there is no neutral connection.

The requisite DELTA load output wiring is shown in Figure 5-10 using internal voltage sense and Figure 5-11 when using external voltage sense.

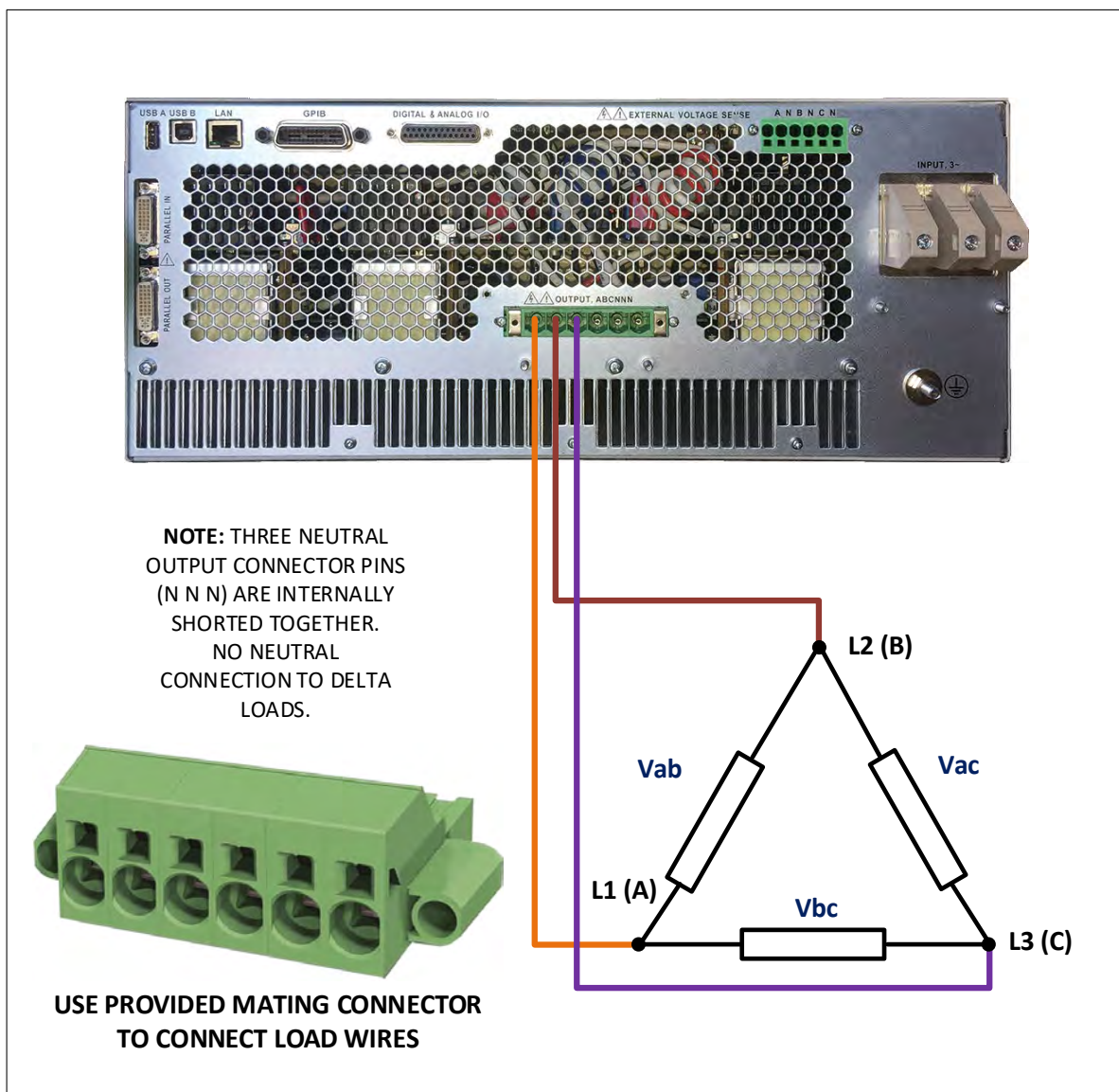


Figure 5-12: Three phase Delta Load Output Connections – Internal Voltage Sense

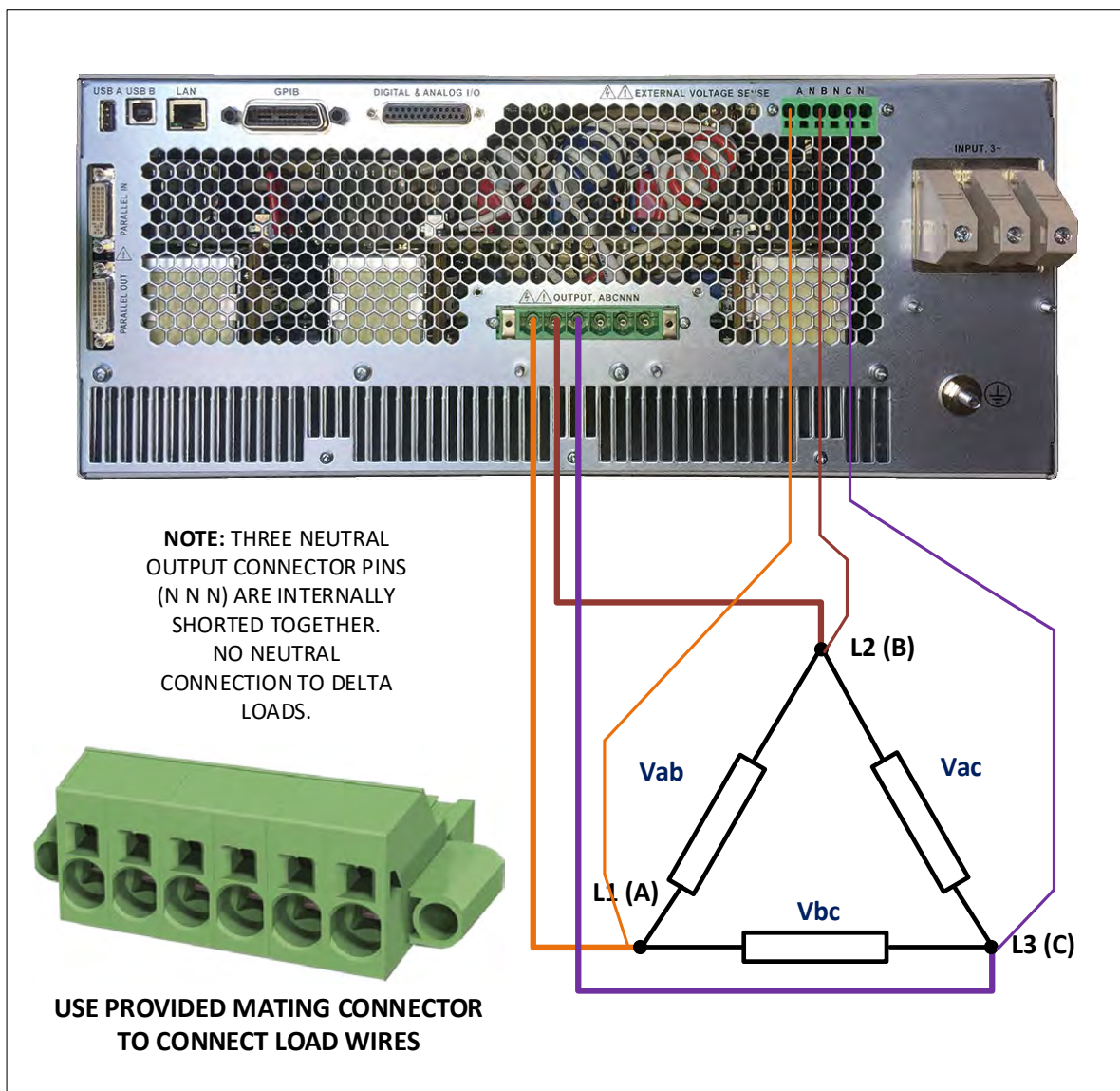


Figure 5-13: Three phase Delta Load Output Connections – External Voltage Sense

5.14.4 Single Phase Load Output Connection

Connection of a single phase load can be accomplished by using the single phase shorting connector . (Part number 160086) provided in the 1150ADF ship kit. This requires shorting of the three phase outputs. This adaptor is also available for 3150ADF units configured with the Single phase mode option (-M).



Figure 5-14: 1150ADF or 3150ADF-M Single Phase Shorting Adaptor assembly

Connect phase A output to the Line connection of the AC load. Connect the neutral output to the Neutral connection of the AC load. Refer to Figure 5-13 for single-phase load connection diagram.

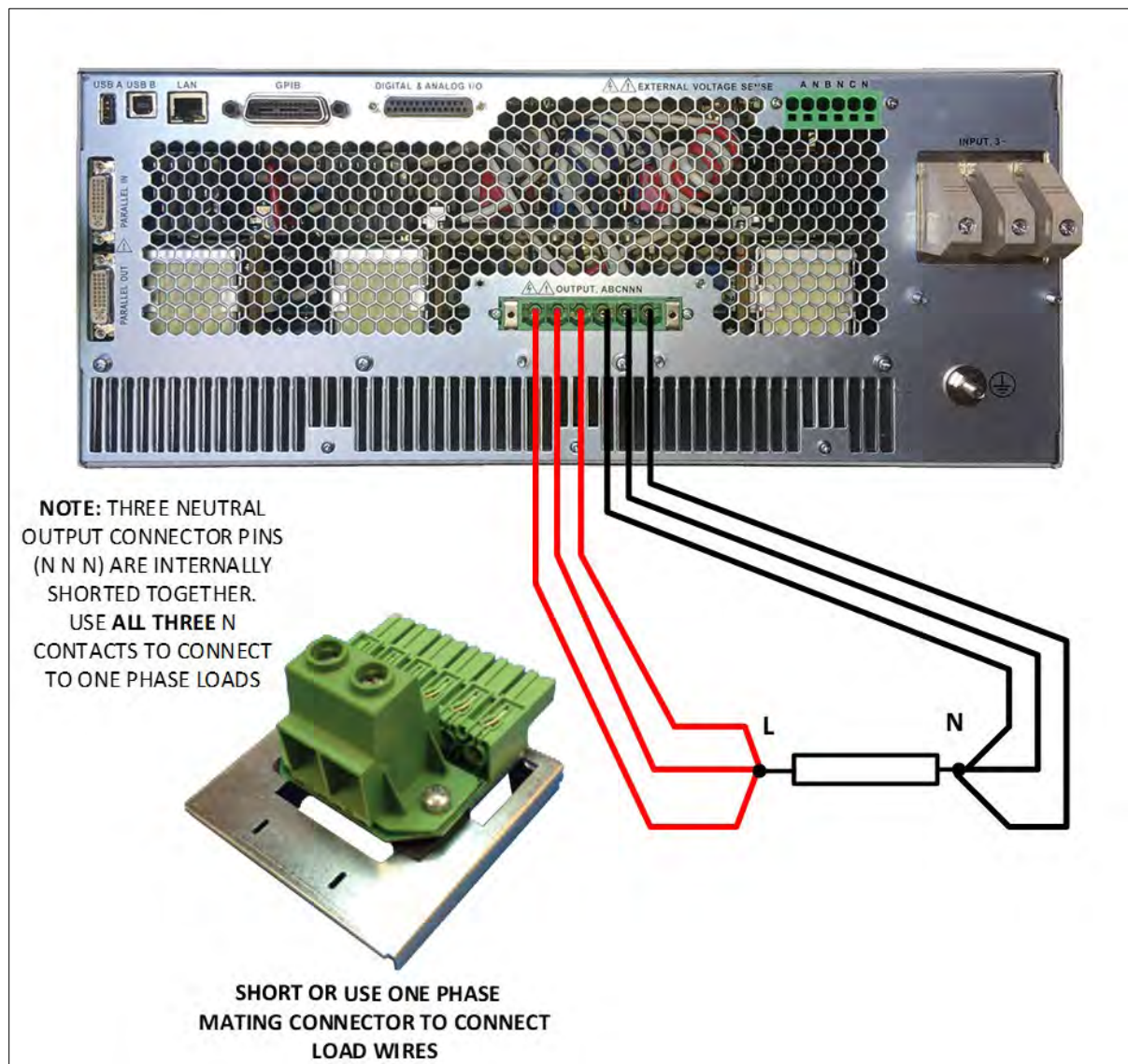


Figure 5-15: Single phase Load Output Connections

5.14.5 External Voltage Sense Connections



WARNING

HAZARDOUS OUTPUT: The power source output may be set to hazardous voltage levels. It provides basic isolation from the ac input mains. Therefore, the external voltage sense must also always be considered hazardous. Connections must be inaccessible to operator in all situations when ac input mains voltage is applied.

Always disconnect power supply from the mains before connecting or disconnecting to the hazardous external voltage sense terminals.



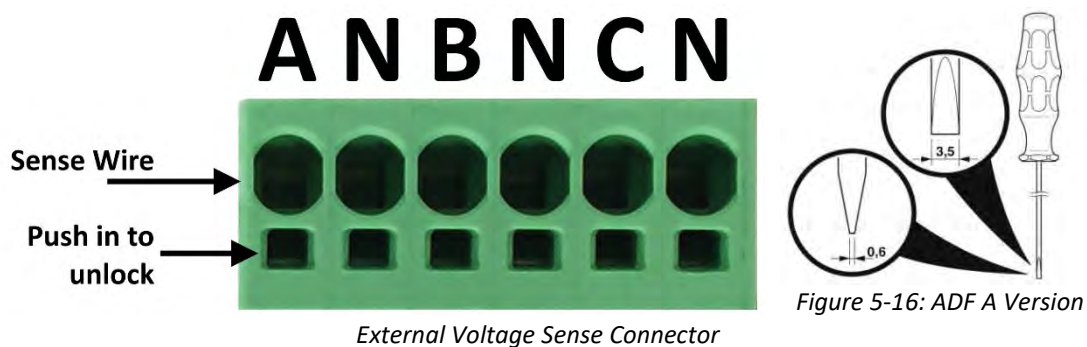
AVERTISSEMENT

SORTIE DANGEREUSE: La sortie de l'appareil peut être réglée à des niveaux de tension dangereux. L'appareil fournit une isolation de base du réseau d'entrée AC. Par conséquent, les connexions de sense externes doivent toujours être considérées comme dangereuses. Les connexions doivent être inaccessibles à l'opérateur dans toutes les situations où la tension d'entrée secteur est appliquée.

Toujours débrancher l'alimentation secteur avant de connecter ou déconnecter les bornes de connexions de sense externes.

When using external voltage sense, sense wires must be connected between the rear panel External voltage sense terminal and the load. These wires do not carry any load current so can be sized accordingly.

Note: ADF-2 and ADF-4 Model units use a Push-in spring connection type external voltage sense terminal that requires no mating connector. Use a small screwdriver³ to push in the locking mechanism, push in the stripped sense wire ends and pull out the screwdriver to lock the wire in place. See for reference.



Note: For three-phase sense connection wiring (model 3150ADF), refer to Figure 5-9 for 3 phase WYE load connections and Figure 5-11 for three phase DELTA load connections.

Note: For single-phase sense connection wiring (model 1150ADF), only A and Neutral sense positions have to be connected.

³ Actuation tool, bladed screwdriver, size: 0.6 x 3.5 x 100 mm

5.14.6 Isolated Output Neutrals (Option W)

Three phase ADF models equipped with the “W” option have three isolated Neutral terminals on the output terminal block – NA, NB & NC - instead of three common (shorted) Neutral connections. This output configuration allows each phase output to be at a different neutral level from the other output phases.

Note: The “W” option must be specified at time of order. It cannot be installed in the field.

The difference between a standard ADF unit’s output terminal and an ADF with Option W output connector pin assignments is shown here. **Note the different positions of the Neutral outputs on the ADF-W version compared to a standard ADF unit.**



Figure 5-17: Standard ADF model vs ADF-W Model Output Connector pins

The isolated neutral all each output to be used to drive a separate EUT so up to three different single phase EUTs can be powered at the same time using different Vac and Frequency settings by used MODE5 or MODE6. These additional phase modes are illustrated below.

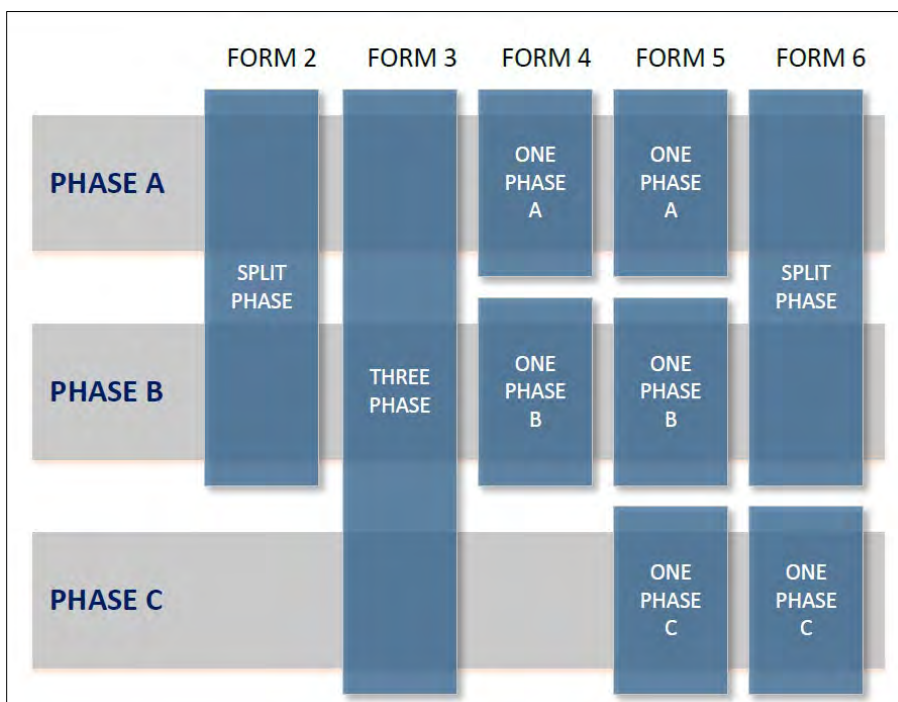
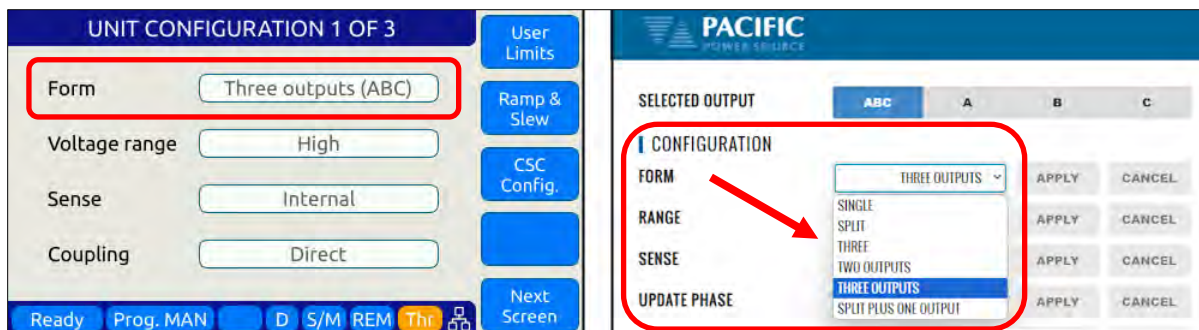


Figure 5-18: Available Output Phase modes with Option W

The desired form can be selected from the CONF menu, UNIT CONFIGURATION 1 OF 3 screen from the front panel or from the Configuration menu when using the SmartSource Suite web browser interface under CONFIGURATION -> UNIT SETTINGS.



FORM4 allow supports two independent loads to be powered.

FORM4 allow supports two independent loads to be powered.

FORM6 is a combination of a split phase output and a separate single phase output. Not that for this application, the neutrals of Phase A (NA) and Phase B (NB) must be shorted together at the back of the power sources are at the load connection to allow split phase.

5.14.7 Powering Up

The following procedure should be followed before applying mains power:

1. Check that the front panel circuit breaker is in the OFF (O) position.
2. Verify that the model nameplate AC input specification match the local utility power.
3. Make sure that nothing is connected to any of the OUTPUT terminals on the rear panel.
4. Connect the correct AC mains line to the ADF Series® AC input terminal using a suitable three phase AC mains disconnect switch.
5. Close the AC mains disconnect to apply utility power.
6. Turn on the front panel circuit breaker by pulling the lever upward to the "I" position.
Note: Allow about 3 to 5 seconds for the ADF unit to fully initialize.
7. If the instrument does not turn on for some reason, turn OFF the front panel circuit breaker and verify the presence of the correct AC line input voltage using appropriate safety measures.

Note: For information on turning on ADF cabinet systems, refer to Section 5.16, "ADF Cabinet Systems Turn ON and turn OFF Procedures" instead.

5.14.8 In Case of Malfunction

In the unlikely event of an instrument malfunction or if the instrument does not turn on despite the presence of the correct AC line voltage, please attach a warning tag to the instrument to identify the owner and indicate that service or repair is required. Contact Pacific Power Source or its authorized representative to arrange for service.

5.15 Cabinet Systems Installation

ADF Series® power sources above 15kVA output are available pre-installed and pre-wired in a 19-inch cabinet. These cabinet systems include all internal AC input and AC output wiring. Several options can be added to these ADF cabinet systems as well.

5.15.1 Standard Cabinet Sizes

All standard ADF cabinet systems feature the same depth and width but height may vary by power level to accommodate more or less ADF units.

The following two sizes are offered:

- 18U For power levels of 30kVA or 45kVA
- 28U For power levels of 60kVA to 90kVA
- 36U For power levels higher than 90kVA

Note that alternative cabinet sizes and power levels may be supported for special requirements so this information applies to catalog models only.

Refer to cabinet dimension drawings shown below for the two available cabinet dimensions.

5.15.2 Tools Required

Installing AC Input and AC Output cable connections to the terminal blocks furnished with ADF cabinet systems requires the use of a Phillips screwdriver to remove the rear panel screen and some Allen (Hex) wrenches for the terminal blocks.



#2 x 6 Phillips Screw driver. Not included in ADF Cabinet ship kit.

5.15.3 Dimensions

Cab Size	Height incl. Casters	Width	Depth
18U	1036 mm	600 mm	900 mm
	40.8	23.6"	35.4"
28U	1480 mm	600 mm	900 mm
	58.3"	23.6"	35.4"
36U	1836 mm	600 mm	900 mm
	73.5"	23.6"	35.4"

Figure 5-19: ADF Cabinet Dimensions

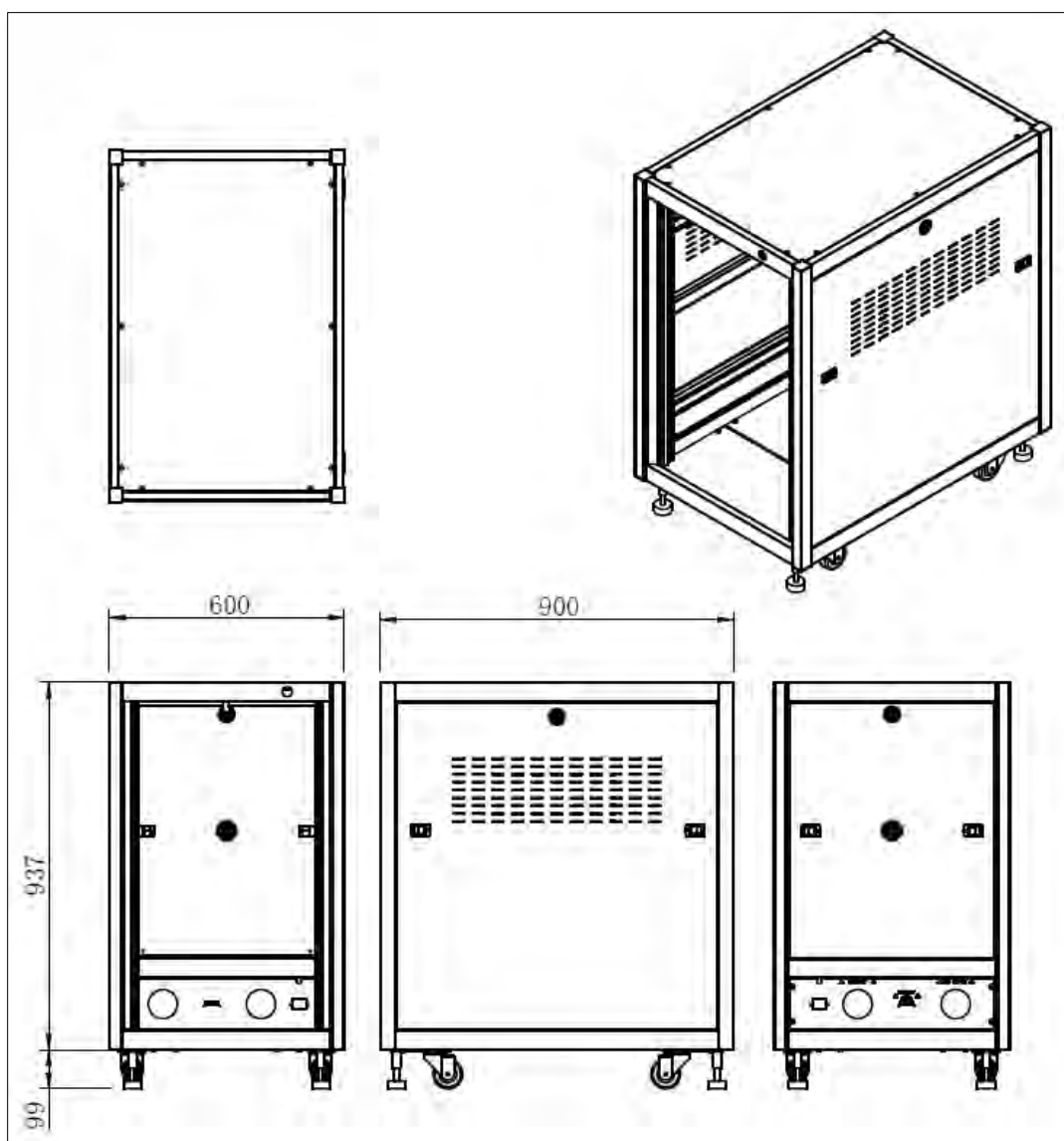


Figure 5-20: Dimension Drawing 18 U Cabinet

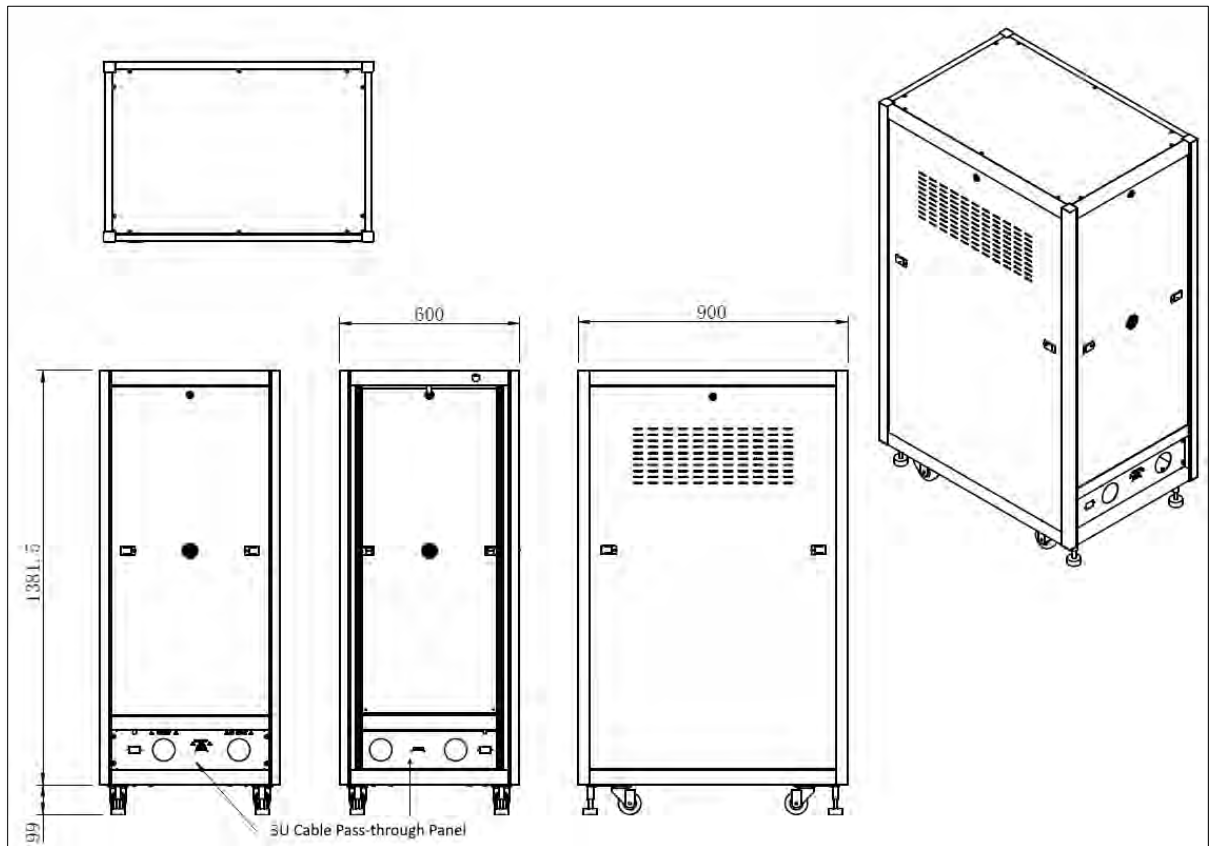


Figure 5-21: Dimension Drawing 28 U Cabinet

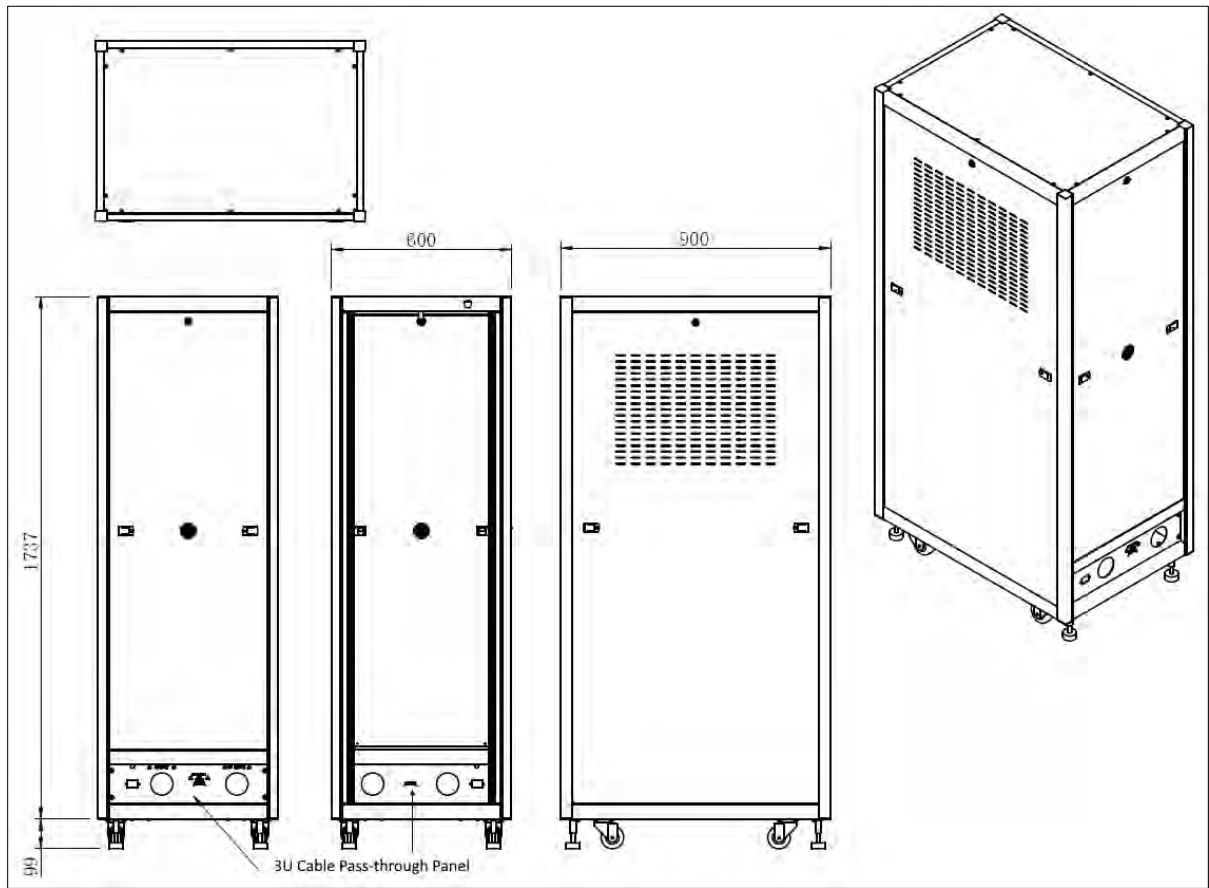


Figure 5-22: Dimension Drawing 36 U Cabinet

5.15.4 Cabinet System AC Input Connections

All input and output connections are located at the lower rear of the back of the cabinet. To access the internal terminal blocks, the rear panel grid must be removed temporarily by removing the screws that hold it to the cabinet's rear. Strain reliefs for both input and output cables are provided on the lower rear filler panel.

Note: Input and /or Output cables for grid power and load connections are NOT included with ADF cabinets.

AC input ratings for Cabinet systems are the same as for individual ADF units. The AC input rating is listed on the cabinet serial tag, which is located on the side of the cabinet. As sample ADF Cabinet System label is shown below. Maximum AC input current rating is shown per phase for the entire cabinet at low line conditions.

Note: The grid panel **MUST** be re-installed after all input and output wiring is installed.

INPUT VOLTAGE RATING ON SYSTEM LABEL

ADF SERIES CABINET SYSTEM DATA				AC INPUT VOLTAGE	
MODEL	3450ADF-4	P/N		VOLTAGE	380 Vac-480 Vac, 3~
S/N		CABINET	1 OF 1	AMPS MAX	90 A
IWA		W/O		FREQ	47 - 63 Hz
MOD		CAB SIZE	28U		
ITEMS	MODEL	TYPE	S/N		
1	3150ADF-4E	MASTER		 PATENTED   PACIFIC POWER SOURCE, INC., CA	
2	3150ADF-4NC	AUX			
3	3150ADF-4NC	AUX			
4					



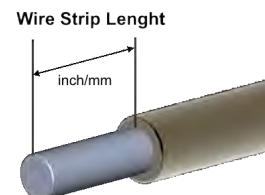
CAUTION: GRID DISCONNECT REQUIRED

Note that a suitable grid power disconnect switch must be provided between the grid connection and the ADF Cabinet AC input terminal block. Consult an electrician to ensure proper local electrical codes are used at all times.

5.15.5 Recommended AC Input Wire Strip Lengths

The following wire strip lengths are required for the AC input wires listed.

L1, L2, L3 Wires:	11/16", 17 mm
Neutral, Ground Wires:	3/4", 19 mm



Connect AC input power three phase with correct Voltage to terminal block TB1 as shown in the figure below.

The AC i phase terminals are oriented as shown below when facing the back of the cabinet.



CAUTION: Connect the Chassis Ground Stud to earth ground to ground the cabinet. Cabinet must be grounded for safety purposes at all times.

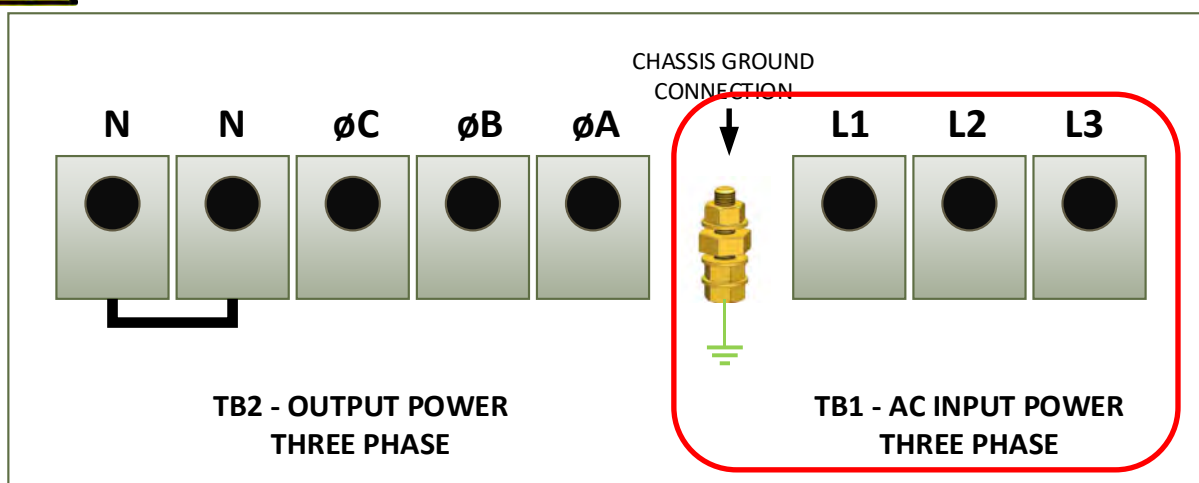


Figure 5-23: ADF Cabinet AC Input Connection Terminal Block TB1

5.15.6 Cabinet System AC Input Neutral

The ADF power sources DO NOT require a neutral connection as they operate from a Delta AC input of either 208V L-L or 380 to 480V L-L. However, some available cabinet options may operate from Line to Neutral input voltage only. If so, a neutral connection will be present at the AC input side of the cabinet and this Neutral must be brought into the cabinet (Wye). Refer to Section 5.17, "Cabinet System Options" for more details.

5.15.7 Cabinet System Grounding

All ADF cabinet systems **MUST** be properly grounded using the provided GROUND terminal on the AC Input terminal block located inside the cabinet.



SAFETY NOTICE: GROUNDING

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis or cabinet must be connected to an electrical safety ground. The instrument must be connected to the AC power supply mains through a properly rated three-phase power cable with protective earth (L1-L2-L3-E). Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be properly grounded to minimize electric shock hazard. Operation at line voltages or frequencies in excess of those stated on the model type plate may cause leakage currents in excess of 5.0 mA peak.



REGLE DE SECURITE: MISE A LA TERRE

Ce produit est un équipement de Classe 1 (muni d'une borne de mise à la terre). Pour minimiser le risque de choc électrique, le châssis de l'appareil ou de l'armoire/rack doit impérativement être relié à une terre de sécurité électrique. L'appareil doit être branché sur le secteur d'alimentation électrique à courant alternatif par un câble d'alimentation triphasé approprié avec terre de protection (L1-L2-L3-PE). Toute interruption de la mise à la terre de protection ou de déconnexion de la borne de terre causera un risque de choc électrique qui pourrait entraîner des blessures.

Cet appareil peut être équipé d'un filtre secteur pour réduire les interférences électromagnétiques et doit être correctement mis à la terre afin de minimiser le risque de choc électrique. Le fonctionnement sous tensions et fréquences supérieures à celles indiquées sur l'étiquette peut provoquer des courants de fuite de plus de 5,0 mA peak.

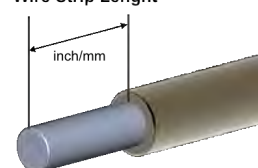
5.15.8 Recommended AC Output Wire Strip Lengths

The following wire strip lengths are required for the output wires listed.

Phase A, B & C Wires:	11/16", 17 mm
Neutral Wire:	1 9/16", 40 mm

Note that there are two Neutral terminals on TB2 to support Single phase mode operation. Both Neutral terminals are shorted together.

Wire Strip Length





NOTE: When operating in single phase mode, the user is responsible for shorting the A, B and C output terminal together.

5.16 Cabinet System Options

The following cabinet option is available. If your cabinet was not furnished with this option, you can skip to Section 5.18, “Interface Options”.

5.16.1 -OCS: Output Control Switch Option

The output control switch option adds an output control selector switch on a 1U filler panel located directly above the master ADF unit of the cabinet. It also provides a terminal block located in the rear of the ADF cabinet that allows the user to wire in one or more series SPST switches as part of a text fixture safety interlock. Opening the front panel mounted switch will disable the output of the power source. The ON and OFF position of the OCS switch is silkscreened on the panel.



With this option installed, the Remote Inhibit function of the ADF master unit is permanently set to **REMOTE INHIBIT**. (Refer to Section 5.18.3).

5.17 Interface Options

All ADF Series® models support four different remote control interface options; USB, LAN, RS232 and GPIB. All remote control interface connectors are located at the rear panel as shown in the illustration below.



WARNING



Do NOT connect the RJ45 LAN (Ethernet) connector of the power source to a PoE (Power over Ethernet) port, as the DC voltage will damage the LAN interface.

5.17.1 Rear Panel Connector Locations

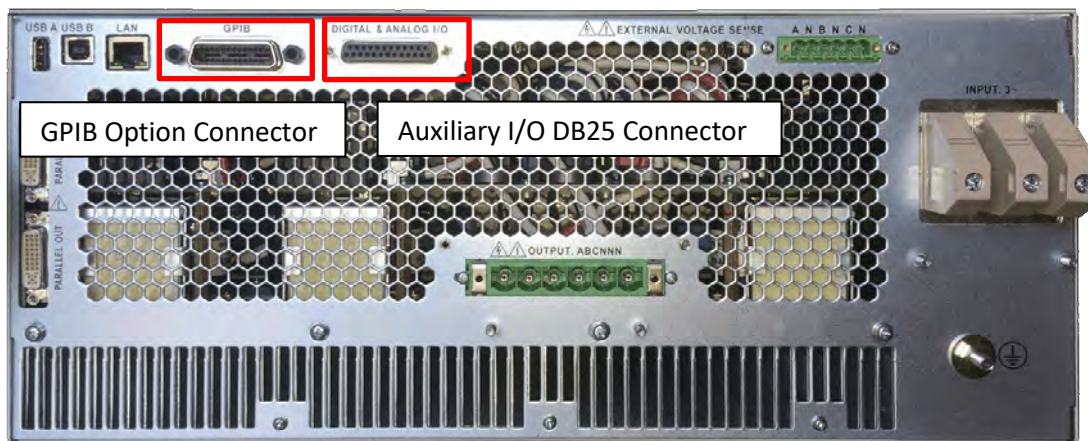


Table 5-2: Remote Control Interface Connector Locations on Rear Panel (A Versions w GPIB)

5.17.2 USB Device Interface

The USB DEVICE interface (USB Type B connector on the rear panel) provides a virtual COM port for the PC. Via this port, the unit can be controlled as a normal RS232 interface, e. g. with a terminal program or user application program. Refer to the section 9, “USB Driver Installation” for further setup and configuration information.

Refer to the section 9, “USB Driver Installation” for further setup and configuration information.

5.17.3 GPIB Device Interface

The GPIB interface uses the IEEE488.1 standard 24-pin D-Shell Amphenol micro ribbon connector. Using a standard GPIB cable, the cable will break out to the left of the unit when facing the rear. This will typically obstruct USB and LAN interface connector access. Reverse GPIB cables are available but using these will obstruct the Auxiliary I/O connector.

The GPIB pin assignments are per the IEEE488.1 standard and listed in the table below.

PIN	Signal	Description
Pin 1	DIO1	Data input/output bit.
Pin 2	DIO2	Data input/output bit.
Pin 3	DIO3	Data input/output bit.
Pin 4	DIO4	Data input/output bit.
Pin 5	EOI	End-of-identify.
Pin 6	DAV	Data valid.
Pin 7	NRFD	Not ready for data.
Pin 8	NDAC	Not data accepted.
Pin 9	IFC	Interface clear.
Pin 10	SRQ	Service request.
Pin 11	ATN	Attention.
Pin 12	SHIELD	

PIN	Signal	Description
Pin 13	DIO5	Data input/output bit.
Pin 14	DIO6	Data input/output bit.
Pin 15	DIO7	Data input/output bit.
Pin 16	DIO8	Data input/output bit.
Pin 17	REN	Remote enable.
Pin 18	GND	(wire twisted with DAV)
Pin 19	GND	(wire twisted with NRFD)
Pin 20	GND	(wire twisted with NDAC)
Pin 21	GND	(wire twisted with IFC)
Pin 22	GND	(wire twisted with SRQ)
Pin 23	GND	(wire twisted with ATN)
Pin 24	Logic ground	

Table 5-3: GPIB Interface Connector Pin Assignments

5.17.4 LAN Interface

The LAN interface connector is installed on the rear panel. The MAC address of the unit can be found near the LAN connector.



WARNING



Do NOT connect the RJ45 LAN (Ethernet) connector of the power source to a PoE (Power over Ethernet) port as the DC voltage will damage the LAN interface.

No special device drivers are required to use the LAN interface as it uses TCP/IP protocol but the IP address needs to be configured to operate on the user's local area network or private network.



MAC Address

Figure 5-24: ADF Series® Rear Panel Layout

5.17.5 System Interface Bus Connectors



WARNING

SHOCK HAZARD: DO NOT remove safety covers from the two System Interface DVI Connectors.



AVERTISSEMENT

RISQUE DE CHOC: NE PAS retirer les capots de sécurité des deux connecteurs d'interface DVI

The system interface bus is not user-accessible. It consists of two Digital Visual Interface (DVI-I dual link) connectors that are covered by a protective cover. There are no user accessible signals on the system interface bus. It is used for system configuration cabinet systems only.

5.18 Multi-Unit Parallel Operation

Two or more ADF units can be configured as a parallel system to create a high power system. This requires at least one Master ADF unit and one or more Auxiliary units or Master units that will be used as Auxiliaries to the first Master.

Note: Auxiliary units or Master units used in an auxiliary position must be of the same power output as the Master unit so each unit delivers the same amount of current /power into the load.

5.18.1 Load Connections on Parallel Systems

Paralleling two or more units requires that their outputs are tied together using equal length load cables from each unit to the load. A common coupling terminal block may be used to combine outputs in combination with larger size load wires to the load. Make sure the appropriate size wiring is used for the higher current levels obtained by paralleling two or more units.

5.18.2 Parallel System Bus Connection

For both units to operate correctly, the system bus connections between the master and auxiliary units **MUST** be made. This is done by daisy chaining the master to the first auxiliary and that auxiliary to the next one.

The system interface connectors are located on the left hand side of the rear panel and marked as follows:

- PARALLEL IN** On the MASTER unit, this connector is NOT CONNECTED. This causes the unit to become a master for other parallel units at power on. On an AUX unit, this connector is connected to a MASTER unit or an AUX unit that precedes this unit in the parallel chain.,
- PARALLEL OUT** On the MASTER unit, this connector is connected to the first AUX unit. On the last AUX unit in the parallel chain, this connector is NOT CONNECTED signifying the end of the parallel chain.

The system bus uses a DVI-I Dual Link Male to Male interconnect cable with noise suppression ferrite beads. Cable length for paralleling units that are stacked in a 19" cabinet with no more than 1U space between units is 1 foot (0.3 m). Use of longer cables than 1 foot /30 cm is not recommended. If units cannot be installed in a cabinet, a longer DVI cable up to 3 feet in length may be used as an exception.

An example of the interconnect between one MASTER and one AUX is shown in the figure below.

Note: Any unused Parallel bus connector must be covered by the included safety covers.

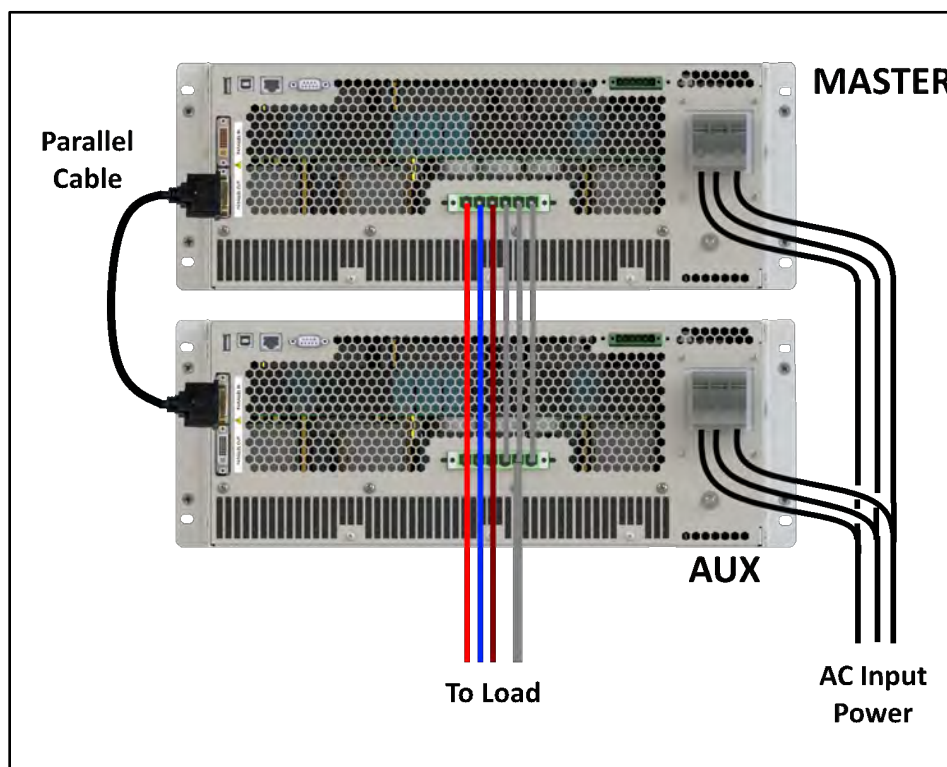


Figure 5-25: Parallel Mode Bus Connections using parallel bus cable

5.18.3 Master / Master Paralleling

Two or more masters can be paralleled as well. This allows ADF units to be used separately or as part of a larger power source system. This operation is the same and when paralleling using auxiliary units but only the first Master on the system bus will have an active front panel. All other Masters will display the fact that they are operating in Auxiliary mode with an inactive front panel. No re-configuration is of a Master unit used in an auxiliary position is required.

5.19 Multi-Cabinet Parallel Operation Guidelines

Please adhere to the following guidelines when paralleling two or more ADF Cabinet Systems. Unless these guidelines are following, optimal current sharing between cabinets cannot be guaranteed.

5.19.1 Output Wiring

1. All output wires (Neutral, Phase A, Phase B and Phase C) from each cabinet must be paralleled. Each individual output wire from each Cabinet to the output load connection **MUST BE THE SAME LENGTH AND WIRE SIZE**.
2. **DO NOT** connect any power wiring between the cabinets. The output wiring from each cabinet must be brought to a common load termination point.
3. Keep all power connections between the ADF cabinet and the load termination point as short as possible.

See diagram on next page for three phase output configuration parallel cabinets.

5.19.2 System Grounding

1. All ADF Cabinet systems **MUST** be properly grounded to the local facility ground using the provided GROUND terminal on the AC input terminal block located inside the cabinet.
2. In addition to individual facility ground connections, Multi-Cabinet units must be grounded to each other. This may be accomplished by connecting a ground cable to the rear of the cabinet rack on the designated Master Cabinet, passing the cable through the Input / Output power strain reliefs, and terminating the cable on the rear of the cabinet rack of the designated Auxiliary cabinet.

Refer to diagram above for suggested ground wire routing between two cabinets.

NOTE: Each cabinet should still be ground to facility ground.

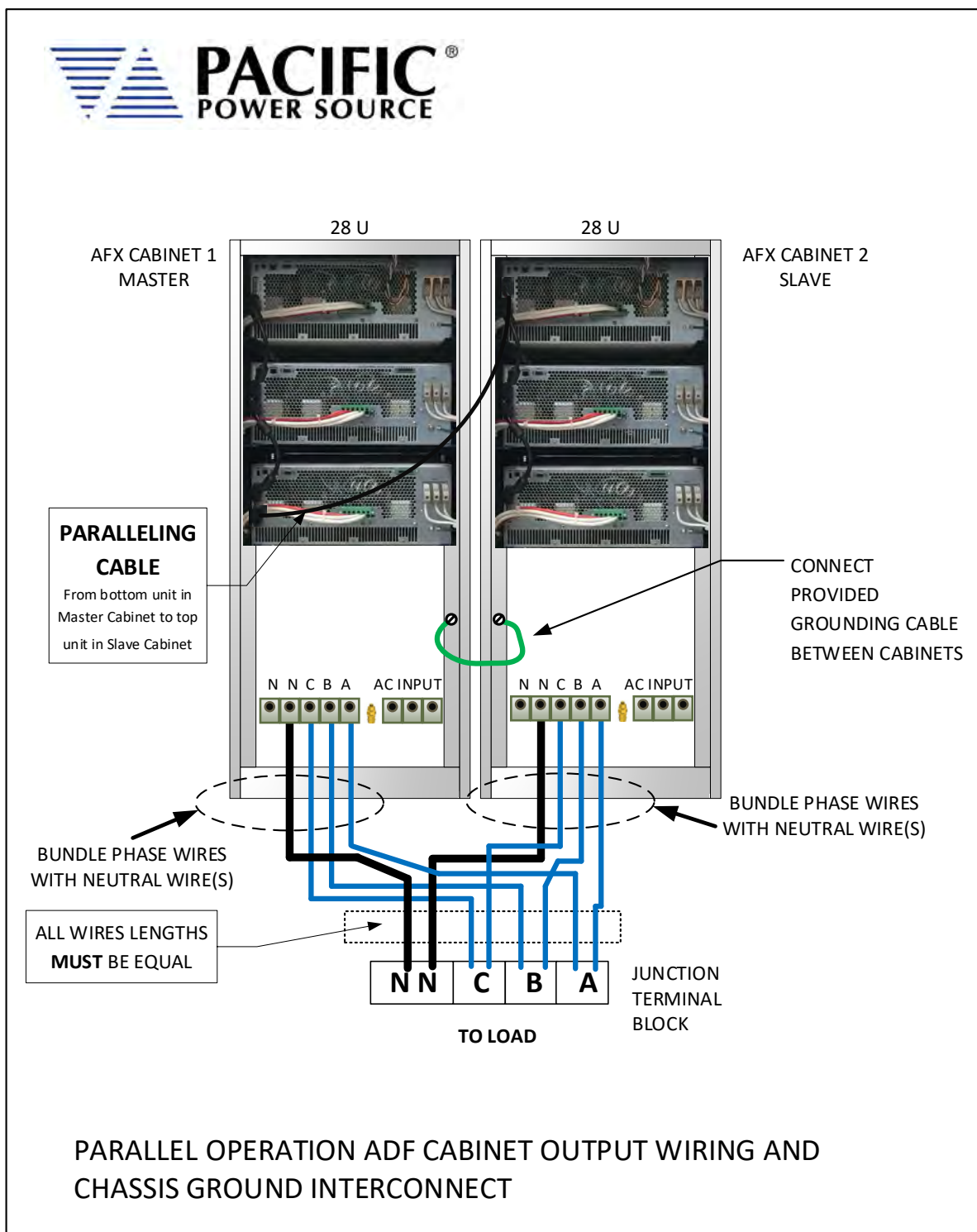


Figure 5-26: Multi-Cabinet Parallel Configuration Output Wiring - 3 Phase

6 Front Panel Operation

This Chapter provides an overview of front panel operation for the ADF Series® AC power sources. For remote control operation, refer to Section 8 “Remote Control Programming” of this manual for an overview of available programming commands.

6.1 Front Panel Layout

The front panel layout is shown in Figure 6-1 below. The number of buttons is kept to a minimum to ensure simple front panel operation for casual and experienced users alike. The shuttle knob is used to slew parameter values and move through menus to make selections.

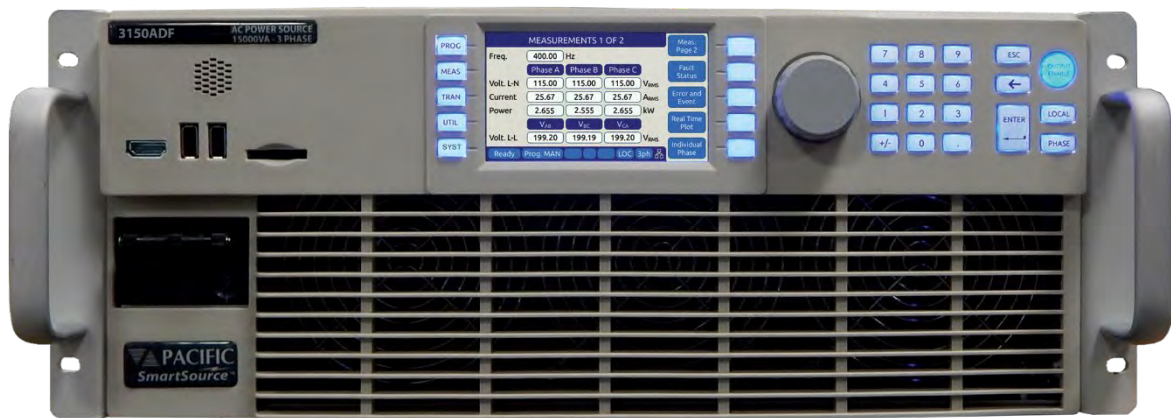
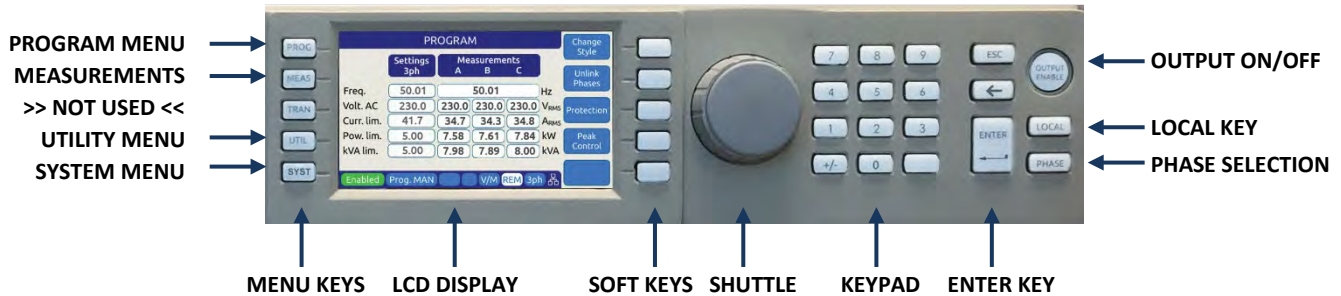


Figure 6-1: ADF Series® Front Panel View

A large backlit LCD display is located in the center. Most user controls are located directly to the right of the display. The power ON/OFF circuit breaker is located in the lower left corner of the front panel.

6.1.1 Keyboard Buttons

There are several groupings of push buttons that make up the front panel. They are grouped as follows:



Group	Function
Menu Selection Keys	These keys select the available top-level menus. Sub menus may be accessible using any of the available soft keys within each top-level menu.
Soft Keys	Soft keys change function as indicated by the decal directly to the left of the soft key on the LCD display.
Shuttle	See next section for details on shuttle operation.
Decimal Key Pad	The decimal key pad is used to enter parameter values directly. Values may also be set using any available soft key or the shuttle.
ENTER Key	The ENTER key confirms a selection or setting made with the decimal key pad. Until confirmed by pressing the ENTER key, selections and values will be shown grayed out on the LCD display to indicate they have been edited/changed but have not yet taken effect. This allows multiple parameters in the same screen to be edited with all new setting values taking effect at once when the ENTER or UPDATE ALL soft key is pressed.
ESC Key	The escape key backs out of a menu or selection and returns to a previous level.
Back Space Key (←)	This key backs up one position erasing the last digit value entered.
OUTPUT ENABLE	The OUTPUT ENABLE key is used to toggle the output on or off. If the output is ON, this key will be lit.
LOCAL	Returns the instrument to local control mode allowing front panel operation. This key may be disabled over one of the remote control interfaces. While in REMOTE, the keyboard is locked out. The LOCAL key can also be used to capture and LCD Image and store it as an .png image file in internal memory. To do so press and hold the LOCAL key, then press the 1 key. Screen images are saved in folder "internal/screenshots".
PHASE	The PHASE key is used to select a specific phase on three phase 3150ADF —models. On single phase 1150ADF models, the selected phase is always A and this key has no function.

6.1.2 Shuttle Knob

The shuttle knob or rotary digital encoder is used to navigate (scroll) through menus and select fields to modify settings. The shuttle knob also includes a SELECT push button function. Pushing in the shuttle knob (SELECT) while on a data field will allow the value to be slewed up or down.

NOTE: Unlike when using the decimal keypad to enter a value, the SELECT shuttle mode will cause the output to change immediately. This allows slewing of the actual output value.

Once the final value is reached, pressing the shuttle again will take it out of slew mode and back into scroll mode.

6.1.3 PC Monitor Output

A PC monitor output connector is located on the front panel's left side. This connector is marked with a monitor icon as shown here. This allows connection of a computer monitor. When connected, the monitor will display the information otherwise shown on the front panel LCD screen and the LCD screen itself will be off.



This feature allows for the connection of a touch enabled LCD monitor to the Video Output the front panel as well. When detected by the ADF, a message will pop-up asking the operator to change to the external screen. If accepted, the front panel LCD will turn off and the ADF screen will be display on the monitor along with a touch panel to operate the unit. The actual front panel keypad will remain active as well. This feature is useful for operator training or in control rooms where being able to read the measurement screen from across the room is required. A USB connection to one of the ADF USB ports is required to use the monitor's touch feature.

To return the display to the LCD screen, unplug the monitor.

6.1.4 USB Host Ports

Two USB host ports are located on the left hand side of the front panel. These ports will accept a USB memory device or a USB peripheral such as a mouse or keyboard. These USB ports are marked with the standard USB symbol as shown here.



6.1.5 SD Card Memory Slot

A SD Card memory device slot is located on the left hand side of the front panel. This slot will accept a standard SD memory card. The SD Card slot is marked with the symbol shown to the right here.



6.2 OUTPUT ENABLE Button

The circular Output Enable (On/Off) button is located on the right hand side of the front panel keypad. Its unique circular shape makes it easy to find so the output can be turned off quickly if needed.

6.2.1 OUTPUT State Indication

The state of the output is indicated by the back light color of the Output On/Off button. A blue color indicates the output is OFF, a green color indicates the output is ON.

6.2.2 Energy Savings Modes

The ADF Series® was designed to conserve energy when powered on but not in actual use to power a load. This situation is common as adjustments are being made to the setup or the load before any power is applied. This mode is controlled by the state of the Output. If the output is off, the ADF will enter one of two energy savings modes:

1. **SLEEP MODE** In sleep mode, all three inverter stages are switched off. If the internal heatsink is sufficiently cool, all fans are turned off as well. This essentially means the power source draws almost no power at all yet the front panel controls, displays and all digital control interfaces remain operational so any required program changes can be made.
2. **STANDBY MODE** In standby mode, only the output inverter stage for each phase is turned off. This means the first two stages remain on while the output is off. This means the fan will run at its lowest speed setting for quieter operation. This mode is considered a fast startup mode.

The desired energy savings mode can be selected from the front panel or via one of the remote control interfaces using the OUTP:FAST command (See section 8.7.1.).

6.2.3 Output On Response Times

Turning the output ON means that any power stage that was disabled for energy conservation purposes will be started and allowed to settle. This includes the output inverters. Once all power stages are up and running, the output relays are closed and whatever programmed output mode, voltage and frequency will be applied to the load. If all stages were off – power source in sleep mode – this process can take up to 2.2 seconds. If the output control mode is set to FAST mode however, only the inverters are ever turned off and output can be applied within 200 msec, which is typical for older design power source with no energy saving features or sleep mode capability.

6.3 Menu Keys

The various menus and settings available to the user from the front panel are detailed in this section of the manual.

All available menus can be accessed using the Menu keys to the left of the LCD display. The following five keys are available.

MENU KEY	MENU SCREEN	Description
PROG	PROGRAM	Programming of output parameters and Measurements read back
MEAS	MEASUREMENTS	Measurements
TRAN	TRANSIENTS	Only available if the R Option is installed.
CONF	CONFIGURATION	Configuration Screens
SYST	SYSTEM	System Settings, Interface Configuration and Calibration

Table 6-1: Available Menu Keys

Following sections cover each aspect of the front panel screen and parameters in more detail.

6.4 PROG – PROGRAM & MEASUREMENTS Screen



All output parameters can be set from the PROGRAM & MEASUREMENT screen. This screen has a list of available parameters on the main PROGRAM screen. Each parameter can be changed by highlighting the field and either slewing the value using the shuttle knob or entering a value using the numeric key pad. The difference between these two data entry modes is that slewing causes the output to change as the knob is turned while using the keypad allows one or more parameters to be preset to a new value which won't become active until the "Apply All" soft key or the ENTER key is pressed.

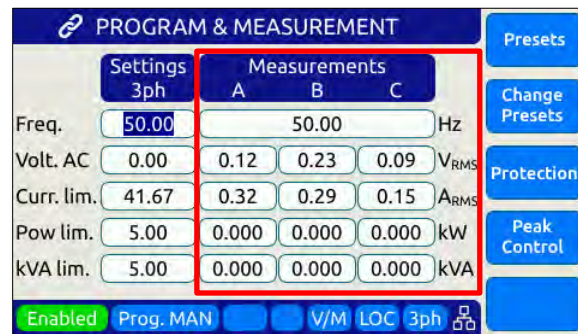
Thus to slew a value, proceed as follows:

1. Use shuttle to move the active field to the parameter you want to slew.
2. Press the shuttle once to enter the slew mode. The selected field will be highlighted.



3. Use the shuttle to increment (*clockwise*) or decrement (*counterclockwise*) the selected parameter. Note that these changes take effect immediately resulting in the active output slewing up or down.
4. To set commonly used standard AC voltage values, the preset value soft keys shown in the screen above may be used as well to directly set a pre-defined value. The settings for these pre-set soft keys can be changed from factory defaults shown here as needed.

Note: This assumes the output is ON. If the output is OFF, the new value will be in effect and apply at the output as soon as the output is turned ON.



Measurements can be seen on same screen so any changes made to output settings will be reflecting in the measurement read-back portion of this screen.

To change one or more values but not change the actual output till all parameters are preset, proceed as follows:

1. Use shuttle to move the selected field to the parameter you want to change.
2. With the parameter field selected, enter a new value using the numeric keypad.
Note that all fields are now shown with a gray background (Edit mode active)
3. Once satisfied with the new value, move to the next parameter you want to change.
4. Once all values are set to the new desired set value, press the ENTER key or the "Apply All" soft key.

6.4.1 Power On Settings

The ADF Series will normally power up with the last settings in effect at turn-off.

This behavior is determined by the the "SOURce:INITial" command. This feature is active by default. This makes the ADF "remember" all the settings after cycling power.

This mode can be disabled by using the remote control command:

SOURce:INITial 0

This setting is retained in non-volatile (FLASH) memory. For set points affected, refer to Section 8.7.1, "Source Configuration Programming Commands" on page 237.

6.4.2 PROGRAM Output Parameters

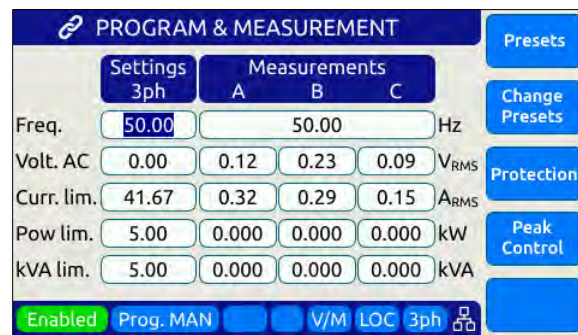


Figure 6-2: PROGRAM Screen

The two data entry methods described apply to the parameters on the PROGRAM & MEASUREMENTS screen. This includes those shown in the table below.

PARAMETER	Range	Unit	Description
Frequency	45 - 500 ¹	Hz	Output frequency
Voltage AC	0 – 300 ²	V rms	AC output
Voltage DC	0 – 425 ³	V dc	DC output (Option D)
Current limit	0 to Max	A rms	RMS Current Limit
Power limit	0 to Max	W	True Power Limit
kVA limit	0 to Max	VA	Apparent Power Limit

Table 6-2: Available Output Parameters on PROGRAM screen

Note 1: On ADF Series models with Option F, frequency setting range is 15 -1200 Hz

Note 2: On ADF Series models with Option V, max voltage setting can be higher than 300V

Note 3: On ADF Series models with Option D, max voltage setting is 425Vdc

Each screen has up to five soft keys on the right hand side of the display. These may change as the selected parameter changes. To move between parameter fields in any screen, use the shuttle knob. To change a parameter, press the shuttle knob and then adjust the value by turning the shuttle. When done, press the shuttle to exit edit mode.

Negative AC RMS set values: Depending on the firmware revision, the unit may accept negative RMS set values. A negative value setting means the AC waveform will be inverted. This feature is also available in Transient modes (Requires Option R).

6.4.3 Three Phase Models – Phase Linked or Unlinked Data Entry

On three phase ADF models, the user can choose to enter voltage, current limit or power limit values that are the same for all phases (**LINKED** mode) or set different values for each phase (**UNLINKED** mode). The mode can be selected using the **PHASE** key on the front panel located in the lower right corner of the front panel below the LOCAL key.

A chain link symbol  will be displayed in the upper left corner of the LCD display when in LINKED mode. In LINKED mode, data set for phase A is automatically applied to phases B and C (Except for phase angle settings which are never linked).

In UNLINKED mode, the user needs to set each phase setting separately allowing different values to be set for each phase.

Sample PROGRAM screens using UNLINKED versus UNLINK mode are shown below.



6.4.4 Phase Rotation / Phase Sequence

Phase rotation(aka sequence) in three-phase mode is fixed. The default phase rotation of the ADF is the same as that of legacy PPS UPC controllers.

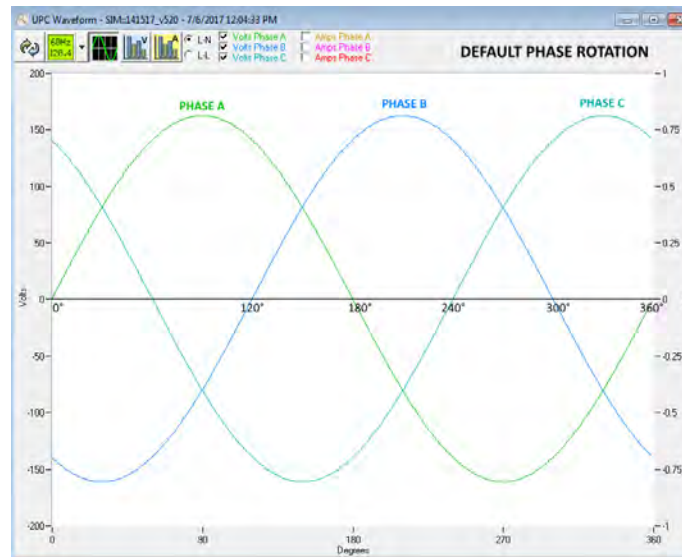


Figure 6-3: Three Phase AC mode Default Phase Rotation

Phase rotation in three-phase mode can be reversed if needed by swapping output connection wires B and C to the load.

The reversed phase rotation is shown in the figure below for reference.

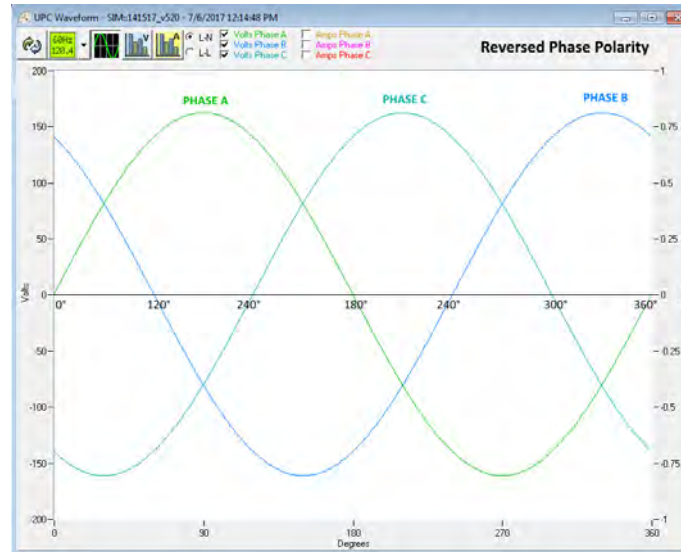


Figure 6-4: Three Phase AC mode Reversed Phase Rotation

6.4.5 Direct Data Entry - Presets

Values for Frequency, Voltage, Current, Phase and Power can be entered directly using the numeric keypad. Position the flashing cursor on the field for which you want to enter a new setting value. Once a field is selected, press the first key of the value you want.

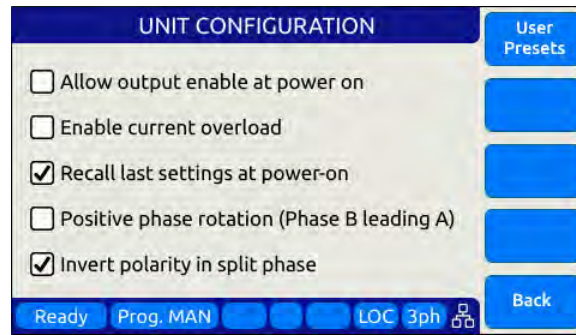
As soon as you enter the first digit, the soft keys will display commonly used values for the parameter you are changing. For example, if you are on the Frequency fields, presets for 50 Hz, 60 Hz and 400 Hz will appear. On ADF Series models with Option F, an additional 800 Hz preset soft key will be available.

If you are on the Voltage AC field, voltage presets for single phase (on single phase ADF models) or LN and LL voltage preset soft keys will appear. A Low Voltage Range selection will be offered as well allowing you to lock in the virtual low range, which limits AC voltage entry to no more than 150 Vac. This is illustrated on the image below.



6.4.6 Customizing Output Programming Preset Soft Key Values

The power source allows the user to set up his own preferred or often used output programming values in place of the factory default selections. This can be done from the SYST menu by selecting the UNIT CONFIGURATION 2 OF 2 screen and pressing the “User Presets” soft key.



For details on change any available pre-set soft key value, refer to Section 6.7.6, “USER PRESETS Screen” on page 132.

6.4.7 Changing Shuttle Programming Resolution

Once entering EDIT mode on any programmable field – by double clicking the shuttle knob – the parameter value can be slewed by turning the knob. The setting resolution can be changed as needed. If a large value change is needed, a lower resolution will result in a faster change, e.g. changing voltage 10V per click or 1V per click. For a very small change, a 0.1V or 0.01V change per click may be more appropriate.

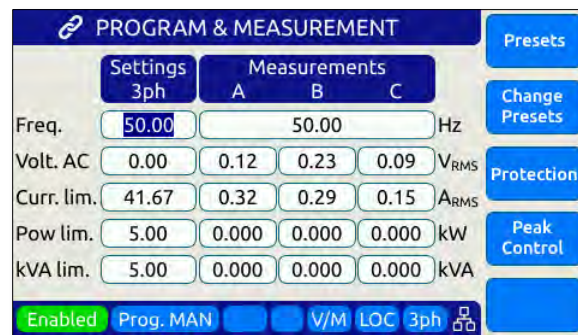
The selected resolution is reflected by the blinking character when in edit slew mode. To change the position and thus resolution, use the keypad numeric keys. The lowest number keys will select the smallest increment/decrement setting. The higher number keys will select a larger increment/decrement setting.

The table bellows maps the keypad keys to the resolution setting.

Key Pad Key #	Position	Resolution
1 or 2		0.01
3		0.1
4		1
5		10
6, 7, 8 or 9		100
7, 8, 9		1000

Table 6-3: Changing Programming Resolution

6.4.8 PROGRAM & MEASUREMENTS Soft Keys



The following five soft keys are available on the main PROGRAM screen.

SOFT KEY	Description										
Presets (SK1)	Changes all soft keys to up to five preset values that may be used to change the selected parameter to any of the preset values shown on the soft key labels. This provides a quick way to set commonly used values. It is also possible to reprogram these presets to user specific values. Refer to Section 6.4.5, “Customizing Output Programming Preset Soft Key Values” on page 91 for details. The following presets are offered for the parameters listed: <table> <tr> <td>Frequency</td><td>50Hz, 60Hz, 400Hz (800Hz, 1200Hz with Option F)</td></tr> <tr> <td>Voltage AC</td><td>115V, 230V, 300V</td></tr> <tr> <td>Current limit</td><td>MAX, 15A, 4A, PEAK CURRENT</td></tr> <tr> <td>Power limit</td><td>MAX, 4kW, 2kW, 1kW</td></tr> <tr> <td>kVA limit</td><td>MAX, 4kVA, 2kVA, 1kVA</td></tr> </table>	Frequency	50Hz, 60Hz, 400Hz (800Hz, 1200Hz with Option F)	Voltage AC	115V, 230V, 300V	Current limit	MAX, 15A, 4A, PEAK CURRENT	Power limit	MAX, 4kW, 2kW, 1kW	kVA limit	MAX, 4kVA, 2kVA, 1kVA
Frequency	50Hz, 60Hz, 400Hz (800Hz, 1200Hz with Option F)										
Voltage AC	115V, 230V, 300V										
Current limit	MAX, 15A, 4A, PEAK CURRENT										
Power limit	MAX, 4kW, 2kW, 1kW										
kVA limit	MAX, 4kVA, 2kVA, 1kVA										
Change Preset (SK2)	Access UNIT CONFIGURATION screen to change preset values.										

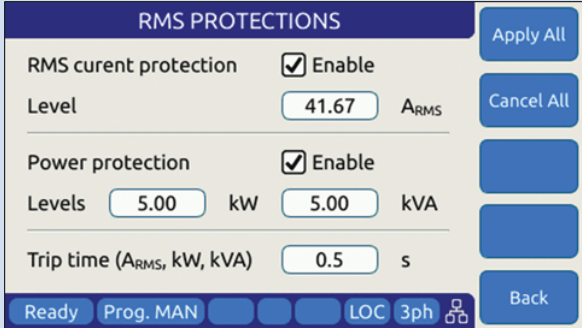
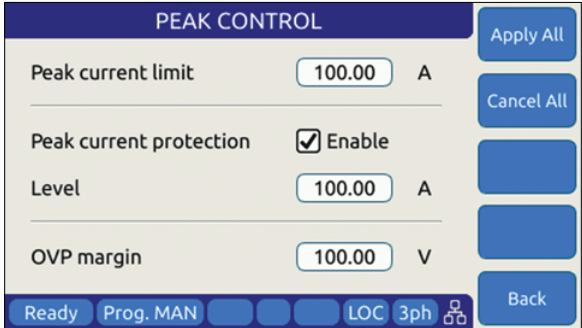
SOFT KEY	Description
Protection (SK3)	Displays the POWER AND CURRENT PROTECTIONS screen shown below.  There are two check box options and one data field on this screen that can be set as needed: Enable RMS current protection Activates the programmable current limit function at the value set in the main program screen Enable power protection Activates power protection at W and kVA set points. Trip time: Determines how long the power source will allow the power level setting to be exceeded before tripping off.
Peak Current (SK4)	Displays the Peak Current protection screen. This protection function is separate from the RMS current limit function. By setting the peak current protection mode, the maximum peak current is limited by the power source to the programmed level. This is done on a cycle by cycle basis. Note that a minimum setting applies as described in section 6.4.8, next page.  The level can be set using the shuttle or key pad. To enable or disable this function, scroll to the “Enable peak current protection” check box and press the shuttle to toggle on or off.

Table 6-4: PROGRAM screen soft keys

6.4.9 Peak Current Protection Minimum Setting

The programmable peak current protection feature allows the user to limit the peak current that is applied to the EUT. In order to do this, the power source has to clamp the output voltage. The power source will do so when the set limit is exceeded on a switching cycle by switching cycle bases. There are some practical considerations to take into account as some of the current delivered by the power source can be absorbed by the internal output filters.

If the peak current limit value is set too low, it may prevent the power source from delivering the programmed output voltage at higher frequencies. Even if no load is connected to the power source, some reactive power is required to generate the output voltage. This reactive current will be limited by the peak protection level set point so a minimum value applies. The formula that determines the minimum set value for peak current protection is:

$$I_{pk} > 1 \text{ A} + V_{ac_setpoint} * 0.09 * Freq_setpoint \text{ (in kHz)}.$$

This formula applies in three phase mode for ADF models of 15kVA and below. For example, with an output AC voltage setting of 230Vac and a frequency setting of 1000 Hz, the minimum set value would be:

$$I_{pk} \text{ min} = 1 + 230 * 0.09 * 1 = 21.7 \text{ A}_{peak}$$

If the set value is below this level, the following two conditions will occur:

A) The voltage measured at the output will be less than desired.

Example 1:

- Frequency 400Hz.
- Voltage 120Vac.
- Peak current limit 1A.
- The voltage measured at the output will be limited to 25.6Vrms

Example 2:

- Frequency 400Hz.
- Voltage 120Vac.
- Peak current limit 2A.
- The voltage measured at the output will be 54.6Vrms

Example 3:

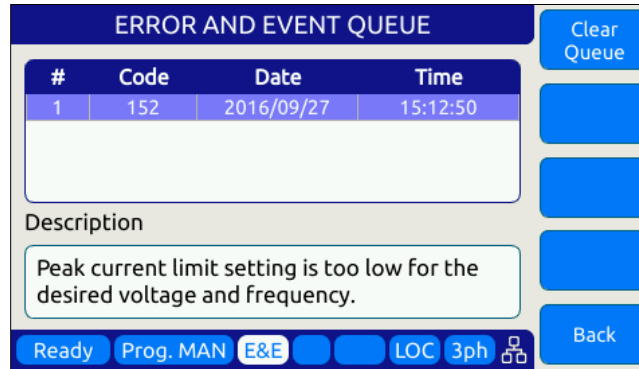
- Frequency 400Hz.
- Voltage 120Vac.
- Peak current limit 3A.
- The voltage measured at the output will be 83.22Vrms

The higher the frequency and the AC voltage set points are, the lower the measured voltage at the output will be unless the peak current protection level is set high enough to prevent this condition.

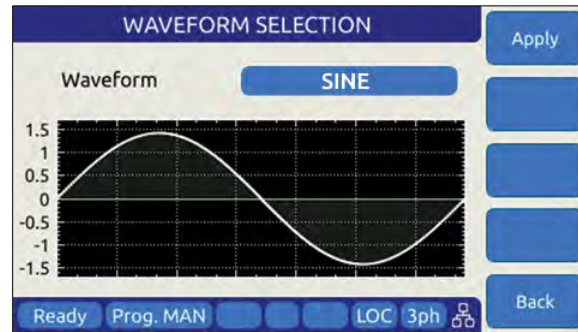
- B) An Error event will be triggered in the error and event queue in order to notify the user.
The error message is:

"Peak current limit setting is too low for the desired voltage and frequency."

as shown in the screen capture below.



6.4.10 Sine Waveform



The ADF Series® support only sinewave output.waveforms. Preview of the sinewave is shown on the LCD screen.

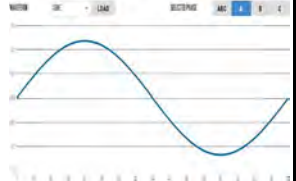
Name	Description	Image	Notes
1	SINE		Standard sine wave.

Table 6-5: ADF Series® Sine Waveform

6.4.11 AUTO RMS Function – Steady State

The AUTO RMS mode, if enabled, causes the AC voltage output value to be calculated as a true RMS voltage of the waveform selected. This means the output RMS voltage will remain at the programmed level regardless of a change in waveform shape. This may or may not be what the user intends. For example, adding a transient spike on a sine wave as part of a user defined waveform will cause the overall RMS value to increase so the sinewave portion of this user defined waveform will be attenuated somewhat when used.

When AUTO RMS is disabled, RMS calculation of substituted waveforms does not occur so the output RMS voltage may change from the set value if the waveform selected for output is not a sine wave. This mode is preferred if switching to a user waveform that has a different mathematical RMS value from a sine wave should NOT result in the output voltage amplitude being adjusted to maintain the same RMS level as with a sine wave. As in the previous example, adding a spike or a dip in part of the sinewave will not affect the output amplitude of the sinewave portion.

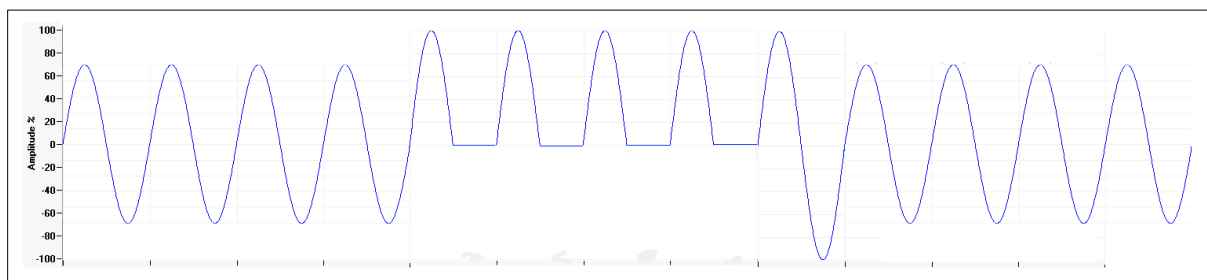
Note: The setting of the AUTO RMS mode is important when CSC mode is used as CSC mode uses the measured output RMS voltage to adjust the output to maintain voltage regulation.

This mode can be set by sending the **[SOURCE:]WAVEFORM:AUTORMS** command over one of the Digital control interfaces.

The following examples illustrate the different behaviors between AUTO RMS mode ON and OFF.

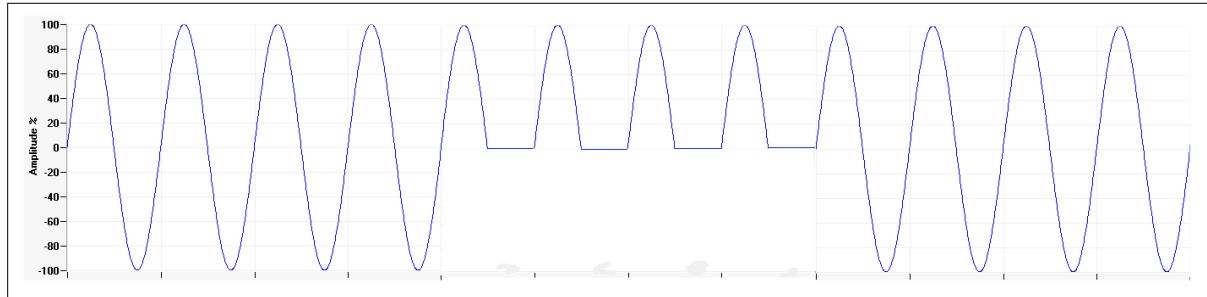
6.4.11.1 AUTO RMS ON Mode:

In the example below a, 100Vrms sine wave is swapped for a half wave rectified ac waveform. The RMS value of this non-sinusoidal waveform is 1.414x that of a sine wave so the peak value is increased to maintain a 100Vrms output voltage with this wave shape. Not that there is a considerable amount of DC offset present as well due to this non-symmetrical waveform.



6.4.11.2 AUTO RMS OFF Mode:

Same waveform example but this time with AUTO RMS mode OFF results in no change to output peak voltage but the actual RMS voltage during these four cycles is only 70.7Vrms instead of the 100Vrms programmed setting.



Note: In UPC Compatibility mode, this mode is always enabled.

6.4.12 Option V - Extended AC Voltage Range Operation

The standard AC voltage range maximum setting for line-to-neutral voltage programming is 300Vac rms. This setting is equivalent to 520V line-to-line in three-phase mode.

For ADF Series models configured with the V Option (Option V), extended voltage operation to 320V or even 333V is supported with some restrictions. These restrictions are determined by the maximum voltage setting programmed:

6.4.12.1 300 – 305 V - Max Voltage 305VL-N / 528VL-L

This setting reflects a 10% over voltage for 277V_{L-N} / 480V_{L-N} nominal voltage applications.

Restrictions

- **Frequency Range:** 45.00 – 100.00 Hz.
- **Phase Mode:** Available in single, split and three phase modes.
- **Output Power:**
 - Three phase – Full power (no restriction).
 - Single and Split phase – Maximum power 3kVA/kW per phase per ADF unit.

6.4.12.2 305 – 312 V - Max Voltage 312V_{L-N} / 540V_{L-L}

This setting reflects a 30% over voltage for 240V_{L-N} / 415V_{L-N} nominal voltage applications.

Restrictions

- **Frequency Range:** 45.00 – 100.00 Hz.
- **Phase Mode:** Available in three-phase mode only.
- **Output Power:**
 - Three phase – Maximum power 3kVA/kW per phase per ADF unit.
 - Single and Split phase – Not available.

6.4.12.3 Higher Voltage Settings (Requires Option V)

For applications requiring more than 312V L-N, refer to the “SOURce:VOLTage:EXTend” command in the programming section of this manual. Only available if Option V has been installed.

6.4.12.4 Extended Voltage Range Power Limit Setting

Applicable output power restrictions as stated above will result in adjustment of the programmed kW and kVA power limits in the PROGRAM screen. This occurs automatically when programming an AC voltage value higher than 300 and is based on the value set and the standard available max. power level of the ADF model used. An Event Message is generated to notify the user of this restriction.

6.4.12.5 Accessing Extended Voltage Ranges

To enable higher voltage operation, the user must first set the MAX USER LIMIT for Vac to more than 300.00V. Values from 300.00 to 312.00 will be accepted.



Figure 6-5: Enable Vac extended operating range to 312Vac

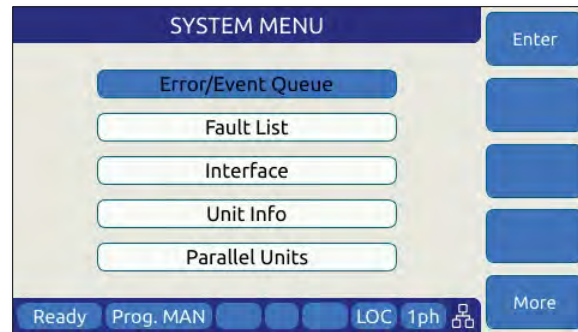
Once the Voltage AC MAX user limit has been set to a higher value, the PROGRAM screen will accept a Volt AC setting up to this new value.

When a value above 300 is entered in any of the available Vac setting fields, an Error & Event (E&E) message will be generated in the Error and Event Queue. The E&E field in the bottom status bar will blink to indicate a message is available. Note that the power limit fields will automatically update as needed to indicate the power limit.

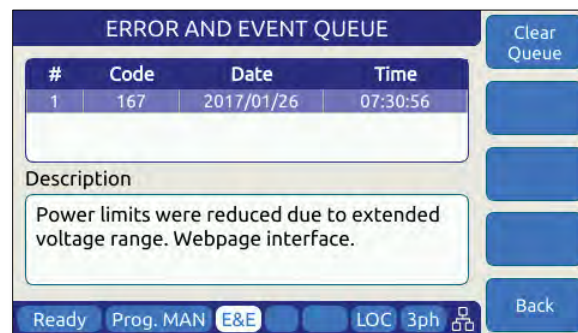
For applications requiring more than 312V L-N, refer to the “SOURce:VOLTage:EXTend” command in the programming section of this manual.

6.4.12.6 Power Limit Adjustment Notification Messages

The message queue is accessible from the SYSTEM MENU.



A sample of the relevant Event Message is shown below. The “Webpage interface” indicates the setting change was triggered from a browser connection. Alternative sources are “Front Panel Interface” or “Remote Interface”.



Note: Disable extended AC voltage range access, set the voltage AC MAX user limit setting back to 300.00 in the USER LIMITS screen.

6.5 MEAS – MEASUREMENTS Screens

The MEAS menu key displays the first of two measurement screens. Measurement screens are used to display measurement values taken at the output of the AC power source.

The measurements screen layouts differ between single phase and multiphase mode. If the power source is configured for single-phase mode operation, only the single phase measurement screens are available. When in three phase mode, the user can change screens between all three phases or one phase at a time using the PHASE key located below the Output ON/OFF key or by pressing the “Individual Phase” soft key (SK5).

6.5.1 Measurements Screen by Phase

The different measurement screen layouts are shown below.

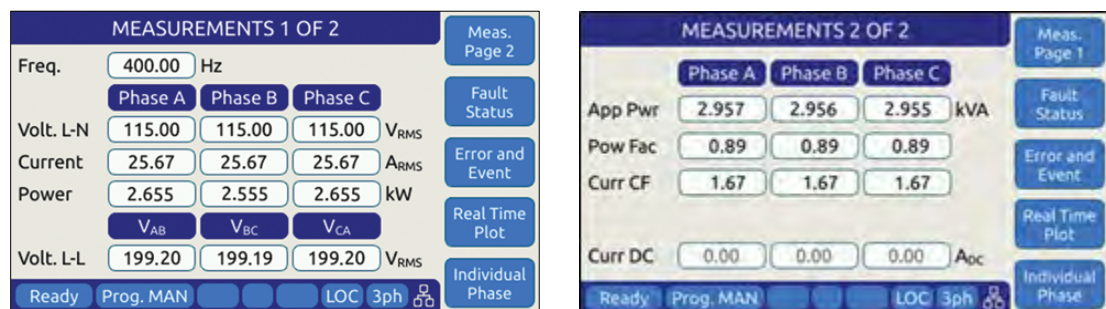


Figure 6-6: Three Phase Measurement Screens

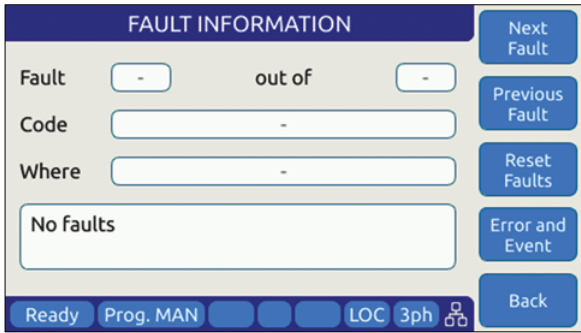


Figure 6-7: Single Phase Measurement Screens for Phase A and B

Note: The individual phase display screens contain all measurement parameters on one screen so there is one screen for each phase.

6.5.2 Three Phase Measurement Screen Soft Keys

The following five soft keys are available on the three-phase measurement screen.

SOFT KEY	Description								
Meas. Page 2 (SK1)	The first soft key allows toggling between the two available measurement screens. The same can be accomplished by pressing the MEAS button on the left hand side of the LCD display.								
Fault Status (SK2)	Pressing this soft key displays the Fault Status screen. The fault status shows a history list of possible error or fault messages that have been recorded by the power source.  The following soft keys are available to review or clear fault messages: <table> <tr> <td>Next Fault</td><td>Scrolls to the next available fault message if any.</td></tr> <tr> <td>Previous Fault</td><td>Scrolls to the previous fault message if any.</td></tr> <tr> <td>Reset Faults</td><td>Clear Fault Buffer</td></tr> <tr> <td>Clean and Refresh</td><td>Clears displayed faults and updates</td></tr> </table>	Next Fault	Scrolls to the next available fault message if any.	Previous Fault	Scrolls to the previous fault message if any.	Reset Faults	Clear Fault Buffer	Clean and Refresh	Clears displayed faults and updates
Next Fault	Scrolls to the next available fault message if any.								
Previous Fault	Scrolls to the previous fault message if any.								
Reset Faults	Clear Fault Buffer								
Clean and Refresh	Clears displayed faults and updates								
(SK 4)-	N/A								

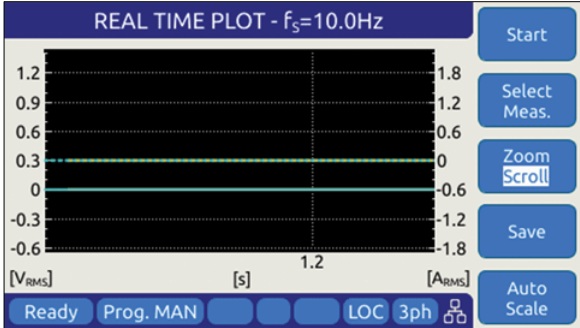
SOFT KEY	Description										
Real Time Plot (SK3)	Display strip chart of voltage, current or both against time. This provides a trend plot of any available measured parameter.  The following soft keys are available to control the time plot: <table> <tr> <td>Start</td><td>Starts time plot.</td></tr> <tr> <td>Select Meas.</td><td>Select parameters to display</td></tr> <tr> <td>Zoom Y</td><td>Zoom both X and Y axis</td></tr> <tr> <td>Save</td><td>Saves plot data to memory device</td></tr> <tr> <td>Clean and Refresh</td><td>Auto-scaled Y axis</td></tr> </table>	Start	Starts time plot.	Select Meas.	Select parameters to display	Zoom Y	Zoom both X and Y axis	Save	Saves plot data to memory device	Clean and Refresh	Auto-scaled Y axis
Start	Starts time plot.										
Select Meas.	Select parameters to display										
Zoom Y	Zoom both X and Y axis										
Save	Saves plot data to memory device										
Clean and Refresh	Auto-scaled Y axis										
Individual Phase (SK5)	Displays the individual phase measurement screen for Phase A. To select other screens, use the PHASE key on the front panel or the first three soft keys on the measurement screen.										

Table 6-6: Three Phase Measurement Screen Soft Keys

6.5.3 Individual Phase Measurement Screen Soft Keys

The following five soft keys are available on the individual phase measurement screens.

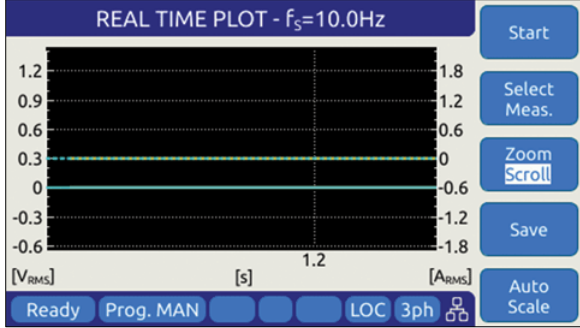
SOFT KEY	Description										
Phase A (SK1)	Displays individual phase measurement screen for phase A if not already displayed.										
Phase B (SK2)	Displays individual phase measurement screen for phase B if not already displayed.										
Phase C (SK3)	Displays individual phase measurement screen for phase C if not already displayed.										
Real Time Plot (SK4)	Display strip chart of voltage, current or both against time. This provides a trend plot of any available measured parameter.  The following soft keys are available to control the time plot: <table> <tr> <td>Start</td><td>Starts time plot.</td></tr> <tr> <td>Select Meas.</td><td>Select parameters to display</td></tr> <tr> <td>Zoom Y</td><td>Zoom both X and Z axis</td></tr> <tr> <td>Save</td><td>Save plot data to memory device</td></tr> <tr> <td>Clean and Refresh</td><td>Auto-scaled Y axis</td></tr> </table>	Start	Starts time plot.	Select Meas.	Select parameters to display	Zoom Y	Zoom both X and Z axis	Save	Save plot data to memory device	Clean and Refresh	Auto-scaled Y axis
Start	Starts time plot.										
Select Meas.	Select parameters to display										
Zoom Y	Zoom both X and Z axis										
Save	Save plot data to memory device										
Clean and Refresh	Auto-scaled Y axis										
Phase ABC (SK5)	Displays the three-phase measurement screen.										

Table 6-7: Individual Phase Measurement Screen Soft Keys

6.5.4 Measurement Screen Soft Keys

The following five soft keys are available on the two three-phase measurement screens.

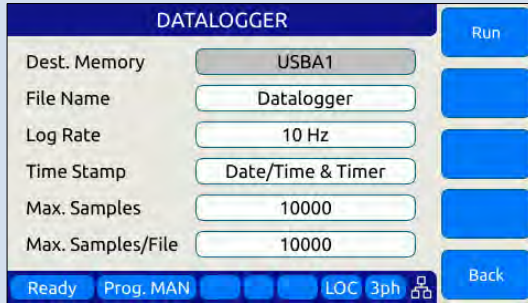
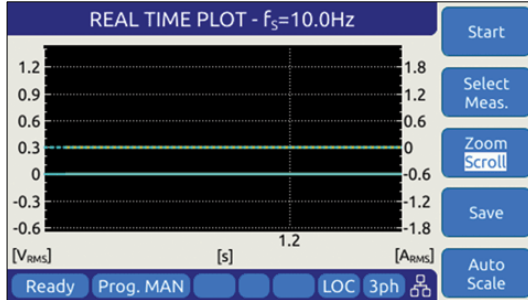
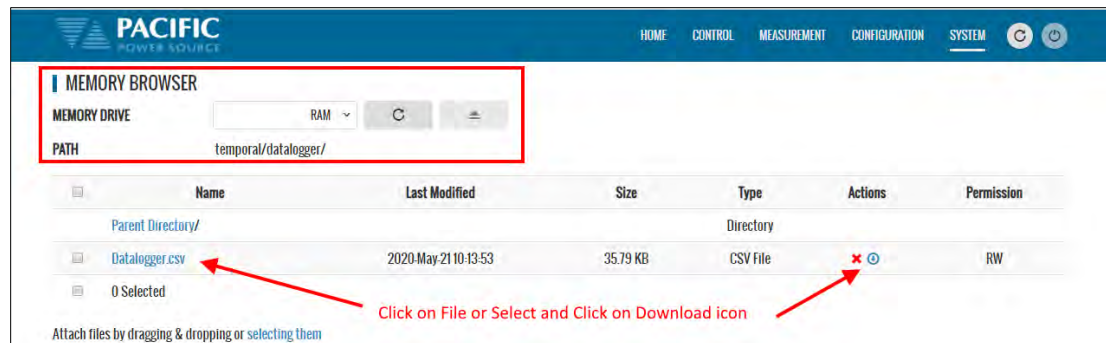
SOFT KEY	Description										
Datalogger (SK1)	The Datalogger soft key allows setting the measurement data logging memory type to be selected, sample rate and no. of samples to be logged to memory. To use a usb memory stick (32GB max), insert it in one of the two USB ports on the front panel and select either USBA1 or USBA2. Only memory devices found will be selectable in addition to the default internal RAM (volatile) memory. 										
Real Time Plot (SK2)	Display strip chart of voltage, current or both against time. This provides a trend plot of any available measured parameter.  The following soft keys are available to control the time plot: <table> <tr> <td>Start</td><td>Starts time plot.</td></tr> <tr> <td>Select Meas.</td><td>Select parameters to display</td></tr> <tr> <td>Zoom or Scroll</td><td>Zoom both X and Y axis</td></tr> <tr> <td>Save</td><td>Saves plot data to memory device</td></tr> <tr> <td>Auto Scale</td><td>Auto-scale the Y axis (Amplitude)</td></tr> </table>	Start	Starts time plot.	Select Meas.	Select parameters to display	Zoom or Scroll	Zoom both X and Y axis	Save	Saves plot data to memory device	Auto Scale	Auto-scale the Y axis (Amplitude)
Start	Starts time plot.										
Select Meas.	Select parameters to display										
Zoom or Scroll	Zoom both X and Y axis										
Save	Saves plot data to memory device										
Auto Scale	Auto-scale the Y axis (Amplitude)										
Next Screen (SK5)	This soft key allows toggling between the two available measurement screens. The same can be accomplished by pressing the MEAS button on the left hand side of the LCD display.										

Table 6-8: Measurement Screen Soft Keys

6.5.5 Measurement Data Logging

Logging measurement data is easy to do using the Datalogging function. Files are saved in a comma separated value text file which is easily imported into MS Excel or other programs for analyzer and / or display purposes.

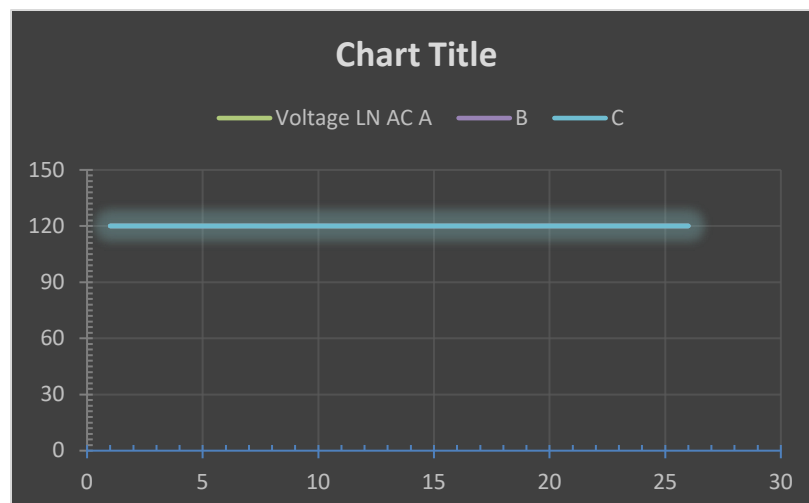
Destination memory defaults to internal RAM allowing log files to be downloaded to browsers or local drives using the web server SYSTEM -> MEMORY BROWSER menu entry.



A small datalogging file sample is shown here for reference.

Date & Time,Timer, Frequency, Voltage VLL ACDC A-B,B-C,C-A,Voltage VLL AC A-B,B-C,C-A,Voltage VLL DC A-B,B-C,C-A,Voltage LN ACDC A,B,C,Voltage LN AC A,B,C,Voltage LN DC A,B,C,Current RMS A,B,C,Current DC A,B,C,Power A,B,C,App. Power A,B,C,Power Factor A,B,C,Peak Current A,B,C,Crest Factor A,B,C,
21/4/2020 10:13:17.647,0,207.846,207.846,207.845,207.846,207.846,207.846,207.845,207.846,0.0015717,0.000892723,0.000678978,120,120,120,120,120,120,5.74293e-05,0.00162913,0.000736408,0.0961562,0.0658469,0.0389105,0.0091741,0.00100751,-0.00516246,0.00012973,0.000672549,0.00066903,0.0115388,0.00790161,0.00466924,0,0,0,0.249016,0.199247,0.126655,0,0,0,
21/4/2020 10:13:17.748,0.01,60,207.845,207.846,207.847,207.845,207.846,207.846,0.000484911,0.000716525,0.000231614,120,119.999,120.001,120,119.999,120.001,0.000291418,-0.000193493,0.000523032,0.0963041,0.0606505,0.0392375,0.00873799,0.000840356,-0.0050669,0.000142419,0.000692023,0.000528912,0.0115565,0.0079262,0.00470855,0,0,0,0.245361,0.199247,0.126651,0,0,0,
21/4/2020 10:13:17.847,0.200,60,207.845,207.847,207.844,207.845,207.847,207.844,0.00195489,0.000834307,0.0027892,120,119.999,119.998,120,119.999,119.998,0.00201776,6.2867e-05,-0.00077144,0.0957361,0.0658142,0.0392642,0.00805068,0.00024351,-0.00582215,0.000124226,0.00072046,0.000534704,0.000789763,0.00471161,0,0,0,0.249,0.195608,0.128863,0,0,0,
21/4/2020 10:13:17.947,0.300,60,207.844,207.847,207.846,207.844,207.847,207.846,7.05616e-05,0.00486062,0.000556624,119.998,119.999,120.002,119.998,119.999,120.002,0.004956289,0.000425727,-0.0335151,0.05,0.0967671,0.0652786,0.0393575,0.00906719,0.000913487,-0.0051749,0.000184154,0.00060259,0.00057676,0.0116118,0.00783339,0.00472296,0,0,0,0.252638,0.192,0.126645,0,0,0,

Using Excel to select several measurement columns allows for easy plotting of trends. For example VLN for A, B and C (Y-axis) against no of samples (X-axis) as shown below.



6.6 TRAN- TRANSIENTS Screens (Option R)

These functions are only available if Option R is configured. Transient sequences allow precise time-controlled changes to be made to voltage (AC and DC mode) and frequency (AC mode only) under program control. A transient sequence consists of one or more list entries (or segments) that are executed in sequence.

There are three types of Transients modes:

- **LIST Mode**
- **STEP and RAMP Mode**
- **PULSE Mode**

Note that Step and Pulse transients can be accomplished using LIST mode as well but STEP and PULSE data entry is more intuitive.



Transients are created or edited in EDIT mode and can be saved to non-volatile memory as part of an instrument setup. They are executed in Execution mode.

The following sections cover all available transient modes.

6.6.1 LIST Mode

List mode is the most versatile transient data entry mode as it allows any of the other Transients types to be created as well. However, entering a long ramp or step transient consisting of many discrete steps in List mode is time consuming and tedious. It is also easier to make a mistake in LIST mode than using the STEP or RAMP mode. Same is true for PULSE transients which can be created with a short transient list as well.

LIST transients can be created from the front panel, using the LXI web server and a web browser or with Pacific's PPCS Manager Windows software.

An example Transient LIST created from the front panel is shown below.

TRANSIENT VIEW					Add at the end
#	Freq	Volt AC	Volt DC	Dwell	
1	400.00	115.00	0.00	100.0	Insert before
2	400.00	100.00	0.00	10.0	
3	400.00	115.00	0.00	100.0	Delete
4	400.00	100.00	0.00	10.0	
5	400.00	115.00	0.00	100.0	Debug Mode
6	400.00	100.00	0.00	10.0	
7	400.00	115.00	0.00	100.0	Run Screen
8	400.00	100.00	0.00	10.0	

6.6.2 LIST Parameters

The following parameters are available in each list transient list step.

PARAMETER	Range	Unit	Description
#	1 - 199	-	Displays the row number in the transient table. These numbers are generated automatically.
Ramp	0.2 - 9999	msec.	Ramp time to slew from existing set point to new set point value. Applies to both Frequency and Voltage. If previous set value is the same as new value, the value is not slewed but rather stays at the same value for the duration of the ramp time.
Frequency	16 – 1200	Hz	New frequency value
Voltage AC	0 – 320	V rms	New AC voltage value
Voltage DC	0 – 450	V dc	New DC voltage value
Dwell	0.2 - 9999	msec.	Dwell time. At the end of the ramp time, the new set values remain in effect during the dwell period. At the end of the dwell time, the next list entry (if any) will be executed.

Table 6-9: Available LIST Transient Parameters

Voltage LIST Transient Example 1

The table and associated figure below illustrates the operation of a transient. The blue line represents the RMS value of the phase A output voltage.

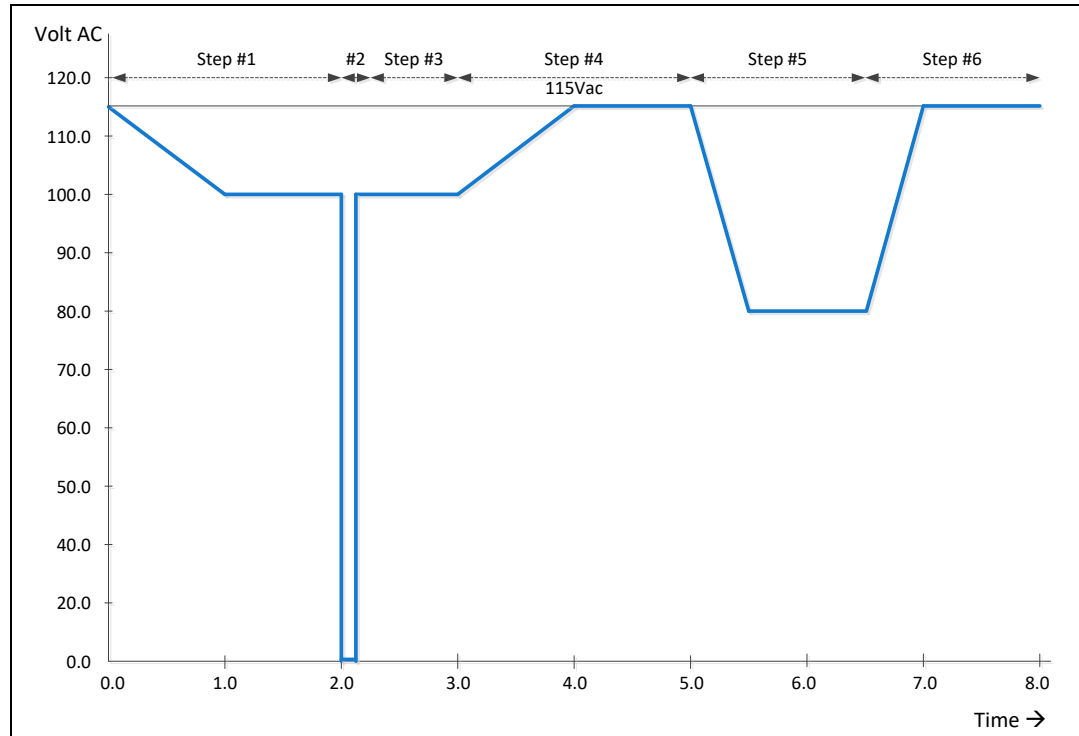


Figure 6-8: Voltage Transient Example 1

To generate this voltage versus time output sequence, the following transient list entries are required. (Ramp and dwell times shown in milliseconds using STEP mode.)

#	Ramp	Freq	Volt	Dwell
1	1000	400	100.00	1000
2	0.2	400	0.00	100
3	0.2	400	100.00	900
4	1000	400	115.00	1000
5	500	400	80.00	1000
6	0.5	400	115.00	1.00

Table 6-10: Voltage Transient List for Example 1

Voltage and Frequency LIST Transient Example 2

This example is based on an actual avionics test requirement from RTCA/DO160 Section 16 test number 16.5.2.1d. This is a single-phase abnormal voltage and frequency limit test for airborne equipment operated from 400Hz AC power.

The requirement from the test standard is shown in the table below:

TEST	VOLTAGE (V rms)	FREQUENCY (Hz)
1	122	430
2	100	430
3	122	370
4	100	370

Table 6-11: RTCA/DO160 Section 16 test number 16.5.2.1d

There are four tests, each runs for at least 5 minutes or 300 seconds. Each test step has a different voltage and frequency deviation from the nominal 115V and 400Hz. This is graphically illustrated by the image below.

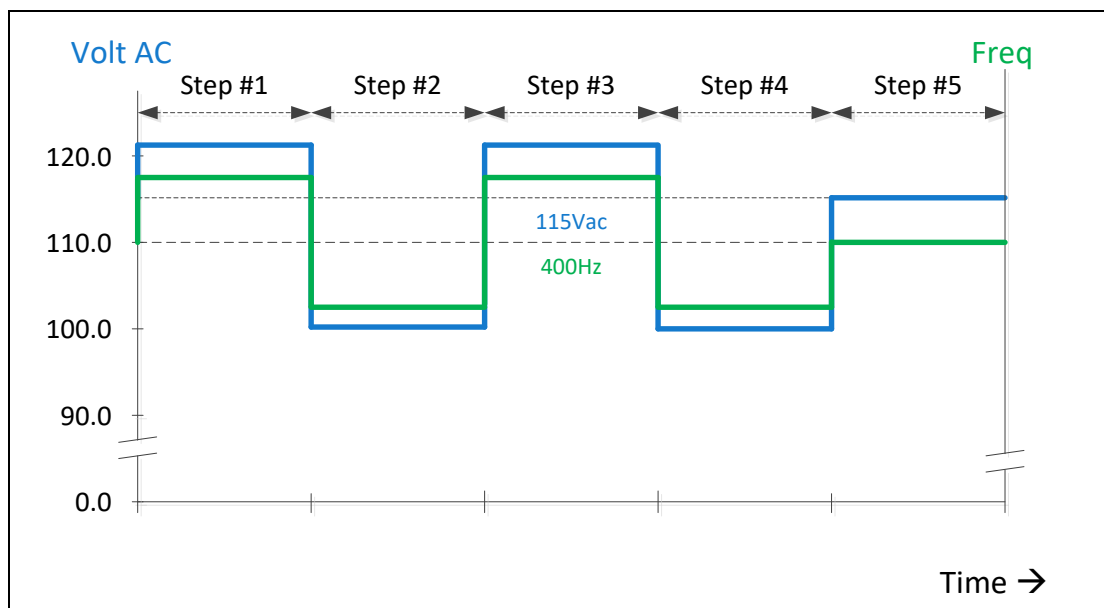


Figure 6-9: RTCA/DO160 Section 16 test number 16.5.2.1d

To generate this DO160 test sequence, the following transient list entries are required. Times shown in milliseconds.

#	Ramp	Freq	Volt	Dwell
1	0.2	430	122.00	300000
2	0.2	370	100.00	300000
3	0.2	430	122.00	300000
4	0.2	370	100.00	300000
5	1000	400	115.00	300000

Table 6-12: Voltage Transient List for Example 1

6.6.3 LIST Transient Edit Mode

To create a new transient program, press the **TRAN** key to select the Transient screen and then select the preferred data entry mode, LIST, STEP/RAMP or PULSE. If no transients have been entered or recalled, the initial screen will be blank.

Figure 6-10: Blank TRANSIENT PROGRAM screen

The only available soft key is the “Create” key (SK1). Press the “Create” soft key to enter the Transient Edit mode. This will display the TRANSIENT VIEW screen.

#	Freq	Volt AC	Volt DC	Dwell
1	400.00	115.00	0.00	100.0
2	400.00	100.00	0.00	10.0
3	400.00	115.00	0.00	100.0
4	400.00	100.00	0.00	10.0
5	400.00	115.00	0.00	100.0
6	400.00	100.00	0.00	10.0
7	400.00	115.00	0.00	100.0
8	400.00	100.00	0.00	10.0

Figure 6-11: TRANSIENT VIEW Edit Mode

In Edit mode, a number of soft keys are available to aid in editing new or existing transient lists. They are defined in the following table.

SOFT KEY	Description
Add at the end (SK1)	Adds a new row entry at the bottom of the transient list table. If there are no table entries yet (new), pressing this key will add the first line of a new transient table.
Insert before (SK2)	Insert a new table row before the current selected row. The selected row and any rows below that are all pushed down one position.
Delete (SK3)	Deletes the current selected row. Any rows below the selected row are pushed up one position. Note: This action cannot be undone.

SOFT KEY	Description
Debug Mode (SK4)	Displays the Debug Execution mode screen. See section 6.6.4
Run Screen (SK5)	Returns to the regular TRANSIENT PROGRAM screen used for transient execution mode. See section 6.6.4.

Table 6-13: Available TRANSIENT EDIT screen soft keys

Once created, a transient sequence can be saved as part of the instrument setup. Refer to Section 6.7.4 for information on saving and recalling setups.

6.6.4 LIST Transient Execution Modes

Transients can be executed as soon as they have been entered. To execute a transient, the output **must be ON**. Sometimes it is best to debug a new transient sequence to make sure it performs the intended test and all values were entered correctly. To do so, the DEBUG mode is provided.

DEBUG MODE

The debug mode can be selected from the TRANSIENT VIEW screen by pressing the “Debug Mode” soft key (SK4). This changes the TRANSIENT VIEW screen from EDIT to DEBUG mode and displays a different set of soft keys to control execution.

TRANSIENT VIEW				
#	Freq	Volt AC	Volt DC	Dwell
1	400.00	115.00	0.00	100.0
2	400.00	100.00	0.00	10.0
3	400.00	115.00	0.00	100.0
4	400.00	100.00	0.00	10.0
5	400.00	115.00	0.00	100.0
6	400.00	100.00	0.00	10.0
7	400.00	115.00	0.00	100.0
8	400.00	100.00	0.00	10.0

Ready Prog. MAN LOC 3ph

Figure 6-12: TRANSIENT Debug mode screen

The following execution control soft keys are available.

SOFT KEY	Description
Run (SK1)	Starts the transient from the currently selected row number
Step (SK2)	Single steps one row at a time
Step Mode (SK3)	Executes one step at a time
Edit Mode (SK4)	Stops execution and reverts to Edit mode
Run Screen (SK5)	Returns to the regular TRANSIENT PROGRAM screen used for transient execution mode. See section 6.6.4.

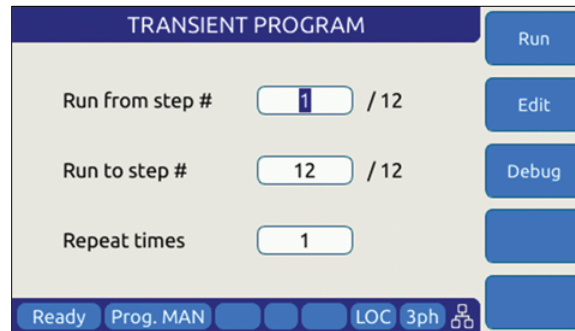
Table 6-14: Available TRANSIENT DEBUG screen soft keys

Note: The progress of the transient is indicated by the “Program” status bar at the bottom of the screen.

NORMAL EXECUTION MODE

Transient execution is controlled from the TRANSIENT PROGRAM screen. If no transient data has been entered, no run mode soft key will be visible. In that case, you must use the “Create” soft key to create a new transient sequence table.

The TRANSIENT PROGRAM screen for LIST mode is shown below.



There are three user settable parameters that control execution of the transient sequence. They are:

1. Run from step #
2. Run to step #
3. Repeat times

Transients will be executed when the “Run” soft key (SK1) is pressed. If the output is **OFF** however, a message will appear indicating the output must be turned **ON** first.

The transient execution will start at the step # set and run until the Run to step value is reached. In the example above, from step #1 through step #6 inclusive.

The “Repeat times” field determines how many times the same sequence will be repeated. To run a sequence indefinitely or until manually stopped, use the shuttle to scroll down to zero or enter zero in this field using the keypad. This will set the repeat field to “indefinitely”.

The following soft keys are available on the TRANSIENT PROGRAM screen.

SOFT KEY	Description
Run (SK1)	Starts the transient from the “Run from step#” row number
Edit (SK2)	Displays the TRANSIENT VIEW edit mode screen. See section 6.6.3
Debug (SK3)	Displays the TRANSIENT VIEW debug mode screen.
Stop (SK4)	Only appears if “Repeat time” value is set to “indefinitely”. Press to stop execution manually

Table 6-15: Available TRANSIENT PROGRAM screen soft keys

6.6.5 LIST Transient Entry Modes

The AFX Series® supports two types of transient entry modes:

- LIST STEP Entry
- LIST SEGMENT Entry

Step mode is commonly used on AC and DC power sources that support the SCPI command language as the SCPI standard defines a LIST, STEP and PULSE command syntax.

Segment mode is used on all Pacific Power sources with UPC controllers such as ASX and AMX Series. Both modes support the same capabilities however.

Note that in STEP mode, two segment entries are combined so each STEP mode entry requires two SEGMENT entries. The two transient examples below represent the same transient display in either mode.

TRANSIENT EXECUTION

▶ RUN STOP H STEP H RESTART

STATE: STOPPED

PROGRESS: 0%

REPEAT TIMES COUNTER: 0

CONFIGURATION: SETTINGS

RUN FROM STEP #: 1

RUN TO STEP #: 2

REPEAT TIMES: Infinite

✓ APPLY ✕ CANCEL

TRANSIENT TABLE

MODE: STEP SEGMENT

EDIT MODE: CYCLE BASED TIME BASED

#	RAMP [ms]	DWELL [ms]	FREQ [Hz]	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C
> 1	100.0	2000.0	61.00	120.00/110.00/120.00	0.00	1/2/3	120.00/240.00
> 2	200.0	1500.0	59.00	120.00	0.00	4/5/6	120.00/240.00

Figure 6-13: Transient shown in STEP Entry Mode

TRANSIENT EXECUTION

▶ RUN STOP H STEP H RESTART

STATE: STOPPED

PROGRESS: 0%

REPEAT TIMES COUNTER: 0

CONFIGURATION: SETTINGS

RUN FROM STEP #: 1

RUN TO STEP #: 4

REPEAT TIMES: Infinite

✓ APPLY ✕ CANCEL

TRANSIENT TABLE

MODE: STEP SEGMENT

EDIT MODE: CYCLE BASED TIME BASED

#	TIME [ms]	FREQ [Hz]	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C
> 1	100.0	61.00	120.00/110.00/120.00	0.00	1/2/3	120.00/240.00
> 2	2000.0	61.00	120.00/110.00/120.00	0.00	1/2/3	120.00/240.00
> 3	200.0	59.00	120.00	0.00	4/5/6	120.00/240.00
> 4	1500.0	59.00	120.00	0.00	4/5/6	120.00/240.00

Figure 6-14: Transient shown in SEGMENT Entry Mode

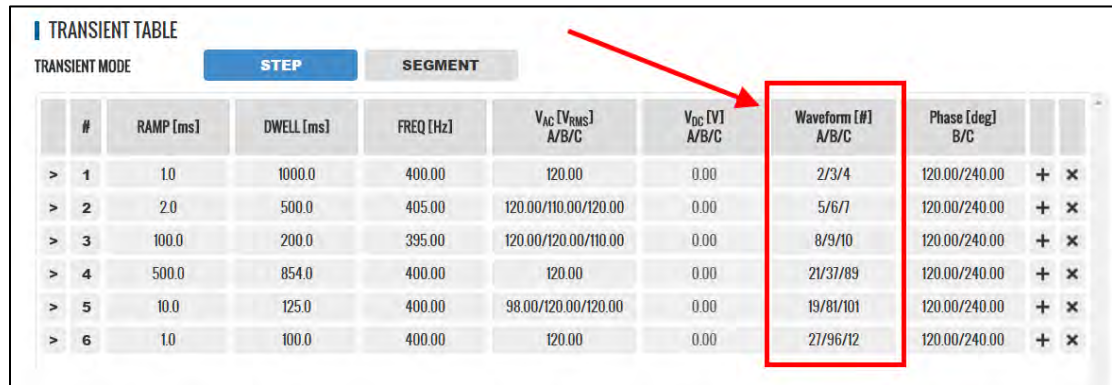
6.6.6 Multiple User Waveforms in LIST Transients

Transient programs are very useful to deliver precisely controlled transitions between different waveforms to a unit under test. This means transitions from a normal AC sine wave to a non-sinusoidal or distorted waveform can be accomplished by using different waveform at different segment or step entries.

Waveforms are numbered from 1 through 200 with 1 being a fixed sine wave. All other waveform registers are user defined arbitrary waveforms.

When in AC mode, transient segments or steps can called out different waveform numbers on each of up to three phases⁴. For each segment, up to six different waveforms can be selected. The same waveform can be repeated as of often as needed within the same transient program.

In three or split phase mode, each phase in a transient program can use its own set of up to six user-defined waveform. Thus, up to 18 different waveforms are available when in three-phase mode.



TRANSIENT TABLE									
TRANSIENT MODE									
STEP									
SEGMENT									
#	RAMP [ms]	DWELL [ms]	FREQ [Hz]	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C		
> 1	1.0	1000.0	400.00	120.00	0.00	2/3/4	120.00/240.00	+	×
> 2	2.0	500.0	405.00	120.00/110.00/120.00	0.00	5/6/7	120.00/240.00	+	×
> 3	100.0	200.0	395.00	120.00/120.00/110.00	0.00	8/9/10	120.00/240.00	+	×
> 4	500.0	854.0	400.00	120.00	0.00	21/37/89	120.00/240.00	+	×
> 5	10.0	125.0	400.00	98.00/120.00/120.00	0.00	19/81/101	120.00/240.00	+	×
> 6	1.0	100.0	400.00	120.00	0.00	27/96/12	120.00/240.00	+	×

Figure 6-15: Available User Waveforms in Transients

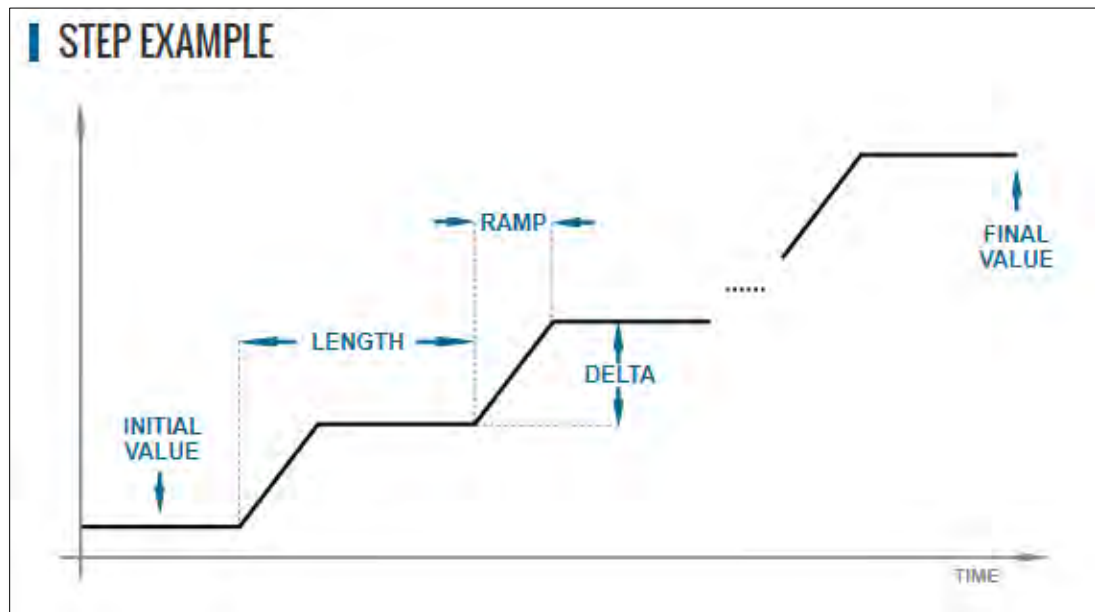
⁴ Requires Front Panel Firmware revision 1.3.3.

6.6.7 STEP or RAMP Modes

STEP and RAMP transients are very similar except in RAMP data entry mode, each step duration is set to the minimum available time interval of 0.2 msec to obtain the smoothest possible ramp result.

In STEP mode, the user sets each increment/decrement and step dwell time.

Step transients are useful for testing over or under voltage protection circuits on AC or DC input supplies. They allow Voltage (AC or DC), Frequency and phase B or C to be steps at discrete intervals and times. An example STEP transient is shown in the screen capture below. It shows the relationship between the RAMP Parameters.



The LENGTH is the dwell time for each step level, including any ramp time. The first step starts from the INITIAL VALUE. The DELTA is the increment or decrement value for each step. The FINAL VALUE determines how many steps will be required to reach it.

Thus, the step COUNT will be:

$$\text{COUNT} = (\text{FINAL VALUE} - \text{INITIAL VALUE}) / \text{DELTA}$$

The total duration to complete the STEP transient depends on the repeat setting, length and if the Insert Initial Value check box is ON or OFF:

If Insert Initial Value = ON (default):

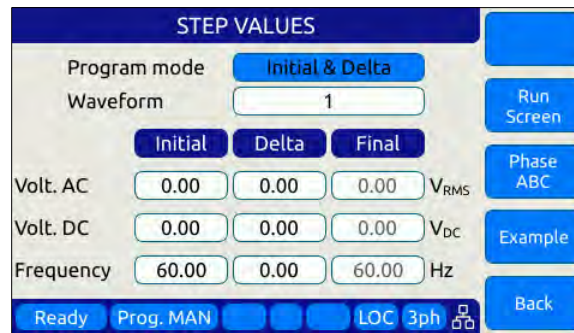
$$\text{DURATION} = \text{REPEAT TIMES} * (\text{COUNT} + 1) * \text{LENGTH}$$

If Insert Initial Value = OFF:

$$\text{DURATION} = \text{REPEAT TIMES} * \text{COUNT} * \text{LENGTH}$$

Step Transients can be programmed from the front panel or the LXI webserver.

6.6.8 STEP or RAMP Parameters



Step transients can be used to create discrete stair step like voltage and/or frequency changes or smooth ramps. The default ramp time is 0.2 msec.

Ramps can be programmed in three modes:

- INIDEL (0): Initial & Delta: Programmed by initial and delta values
- FINDEL (1): Final & Delta: Programmed by final and delta values
- INIFIN (2): Initial & Final: Programmed by initial and final values

Step transients can be used to step frequency, voltage AC, voltage DC, and phases.

The HOLD is ON, the last step values will be set as steady-state when the step execution ends. Duration of each step is determined by: $\text{LENGTH} = \text{WIDTH} + \text{RAMP TIME}$

The following parameters are available in a STEP VALUES screen.

PARAMETER	Range	Unit	Description
Program Mode	Initial & Delta Final & Delta Initial & Final	-	Program Entry Modes
Waveform	1 ~ 200		Waveform number
Voltage AC	0 ~ 320	Vrms	AC Voltage
Voltage DC	-450 ~ + 450	Vdc	DC Voltage
Frequency	15 ~ 1200	Hz	Frequency

Table 6-16: Available STEP Transient Parameters

The following soft keys are available on the STEP PROGRAM screen.

SOFT KEY	Description
(SK1)	
Run Screen(SK2)	Displays the STEP EXECUTION screen.
Phase ABC (SK3)	Toggles between phase A, B, C or Coupled ABC
Example (SK4)	Displays a graphical representation of the STEP parameters
Back (SK5)	Returns to previous screen

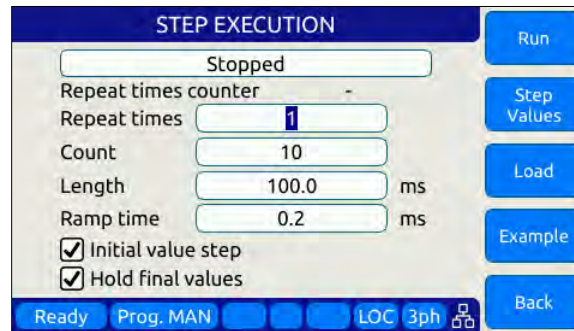
Table 6-17: Available STEP PROGRAM screen soft keys

6.6.9 STEP or RAMP Transient Execution Modes

STEP Transients can be executed as soon as they have been entered. To execute a transient, the output **must be ON**.

STEP or RAMP Transient execution is controlled from the STEP EXECUTION screen. If no STEP or RAMP transient data has been entered, no run mode soft key will be visible. In that case, you must back up to the STEP VALUES screen.

The STEP EXECUTION screen is shown below.



For STEP transients, Count and Length as well as Ramp time are available to be set. The “Hold final values” checkbox determines if the final state after the ramp completes remains at the final ramp values or returns the to settings before the ramp was executed.

Transients will be executed when the “Run” soft key (SK1) is pressed. If the output is **OFF** however, a message will appear indicating the output must be turned **ON** first.

The “Repeat times” field determines how many times the same STEPS or RAMPS will be repeated. To run a sequence indefinitely or until manually stopped, use the shuttle to scroll down to zero or enter zero in this field using the keypad. This will set the repeat field to “indefinitely”.

The “Count” field specifies how many steps will be taken and

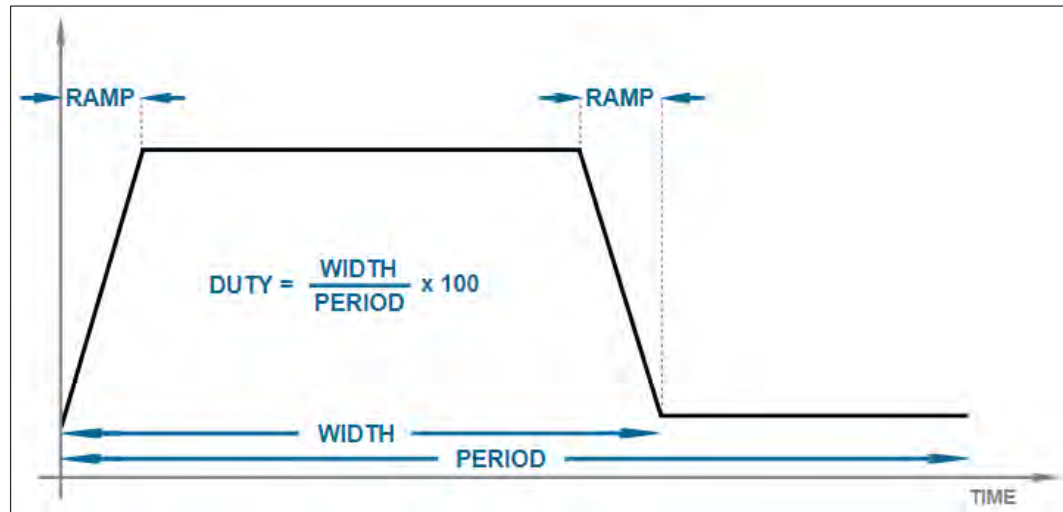
The following soft keys are available on the STEP PROGRAM screen.

SOFT KEY	Description
Run (SK1)	Starts the transient from the “Run from step#” row number
Step Values (SK2)	Displays the STEP VIEW edit mode screen.
Load (SK3)	Converts STEP transient definition to standard transient segments
Example (SK4)	Displays a graphical representation of the STEP parameters
Back (SK5)	Returns to previous screen

Table 6-18: Available STEP EXECUTION screen soft keys

6.6.10 PULSE Mode

PULSE transient mode provides a quick and easy way to enter repetitive pulsed output events. This applies to AC voltage, DC voltage and or Frequency. A sample of a PULSE transient definition is shown in the screen capture below.



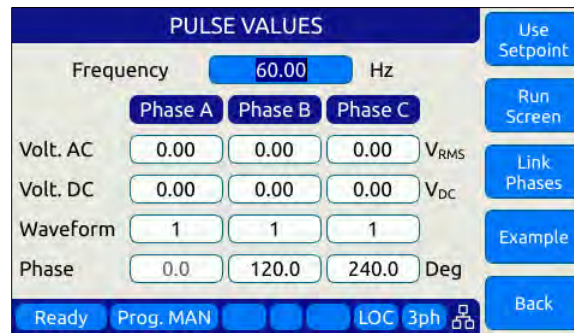
The parameters that define a PULSE transient are dependent of each other so changing one may force another to change. The semantics used for setting PULSE transients is as follows:

Parameter	Description
RAMP	Up or down ramp time
WIDTH	Duration of pulse including rising and failing ramp times
PERIOD	Total time duration for a single pulse
DUTY	Duty cycle of the pulse

The DUTY cycle is determined by the other three parameters as in:

$$DUTY = WIDTH \times 100 / PERIOD$$

6.6.11 PULSE Parameters



Pulse transients can be used to create repetitive events for endurance testing of AC and DC powered products.

The following parameters are available in a PULSE VALUES screen.

PARAMETER	Range	Unit	Description
Frequency	15 ~ 1200	Hz	Frequency
Voltage AC	0 ~ 320	Vrms	AC Voltage
Voltage DC	-450 ~ + 450	Vdc	DC Voltage
Waveform	1 ~ 200		Waveform number
Phase	0.0 ~ 359.9	Deg	Phase angle for phases B & C

Table 6-19: Available STEP Transient Parameters

The following soft keys are available on the PULSE VALUES screen.

SOFT KEY	Description
Use Setpoint (SK1)	Starts the transient from the “Run from step#” row number
Run Screen(SK2)	Displays the PULSE EXECUTION screen.
Link Phases (SK3)	Toggles between phase A, B, C or Coupled ABC
Example (SK4)	Displays a graphical representation of the STEP parameters
Back (SK5)	Returns to previous screen

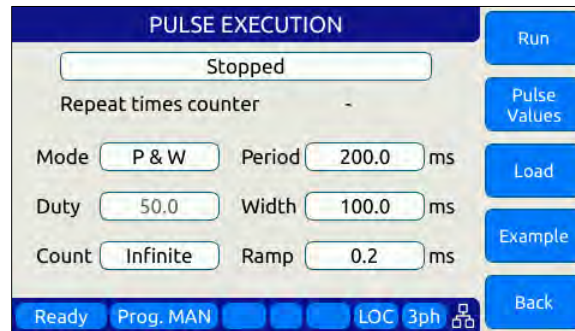
Table 6-20: Available STEP PROGRAM screen soft keys

6.6.12 PULSE Transient Execution Modes

PULSE Transients can be executed as soon as they have been entered. To execute a transient, the output **must be ON**.

PULSE transient execution is controlled from the PULSE EXECUTION screen. If no PULSE transient data has been entered, no run mode soft key will be visible. In that case, you must back up to the PULSE VALUES screen.

The PULSE EXECUTION screen is shown below.



For PULSE transients, there are three user settable parameters that control execution of the transient sequence. They are:

- P&W (0): Programmed by Period & Width
- P&D (1): Programmed by Period & Duty Cycle
- W&D (2): Programmed by Width & Duty Cycle

Depending on the data entry mode selected, one of the data entry fields will be disabled and calculated based on the other parameter settings.

Transients will be executed when the “Run” soft key (SK1) is pressed. If the output is **OFF** however, a message will appear indicating the output must be turned **ON** first.

The “Count” field determines how many pulses will be run. To run a sequence indefinitely or until manually stopped, use the shuttle to scroll down to zero or enter zero in this field using the keypad. This will set the repeat field to “Infinite”.

The following soft keys are available on the PULSE PROGRAM screen.

SOFT KEY	Description
Run (SK1)	Starts the transient from the “Run from step#” row number
Pulse Values (SK2)	Displays the PULSE edit mode screen.
Load (SK3)	Converts PULSE transient definition to transient segments
Example (SK4)	Displays a graphical representation of the PULSE parameters
Back (SK5)	Returns to previous screen

Table 6-21: Available STEP PROGRAM screen soft keys

6.6.13 AUTO RMS Function – Transients

The AUTO RMS mode⁵, if enabled, causes all transient voltages to be calculated as true RMS voltage of the waveforms used in any Segment of the Transient. This means the output voltage RMS level will remain the same, regardless of the wave shape.

When disabled, RMS calculation of substituted waveforms does not occur. Disabling AUTO RMS facilitates constant amplitude transients such as partial cycle dropouts or sub-cycle spike transients.

This mode is set by sending the **PROGram:TRANSient:AUTORMS** command over one of the Digital control interfaces.

Note: In UPC Compatibility mode, this mode is always enabled but applies to steady state only.

⁵ Requires Front Panel Firmware revision 1.3.3.

6.7 CONF – CONFIGURATION Screens

The CONFIGURATION screens 1 & 2 allow setting of secondary parameters functions. These include the following operation aspects:

- Configuration

Pressing the **CONF** key will display the CONFIGURATION screen as shown on the left below.



UNIT CONFIGURATION 1 OF 2

Form: Three (ABC)
Voltage range: High
Mode: AC
Update phase: 0.00 Deg
Coupling: XFMR (400V)

User Limits
Ramp & Slew
Program Memory
CSC Config.
Next Screen

Ready Prog. MAN LOC 3ph

USER LIMITS

MIN MAX
Voltage AC: 0.00 600.00 Vrms
Frequency: 15.00 1200.00 Hz

Apply
Cancel
Back

Ready Prog. MAN LOC 1ph

RAMP TIME & SLEW RATE

Ramp time: Disabled ms
Slew rate control is active.
Voltage AC: 10.00 Vrms/ms
Frequency: 5.00 Hz/ms

Apply Alt
Cancel Alt
Enable Ramp T.
Enable Slew R.
Back

Ready Prog. MAN LOC 3ph

PROGRAM MEMORY

Current program register #: MANUAL
Manual
Recall from register #: 1
Save setup to register #: 1
Power-on recall register #: Disabled

Browse
Recall
Save
Set
Refresh

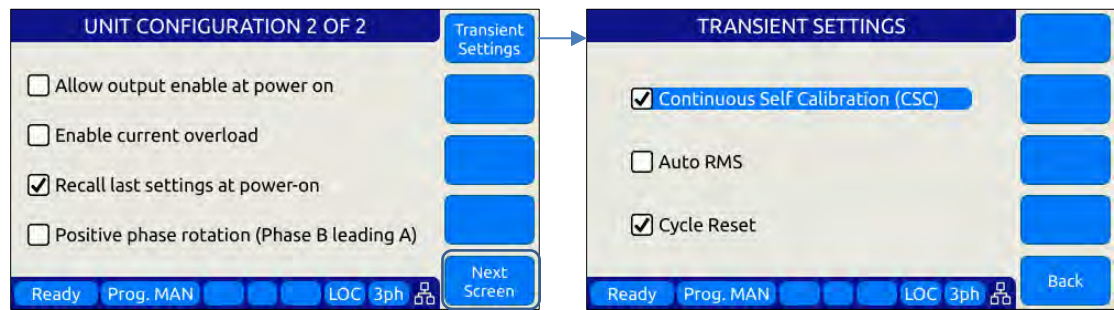
Ready Prog. MAN LOC 3ph

CSC CONFIGURATION

☒ Continuous self calibration
☐ Fault on saturation
Max CSC gain: 1.15

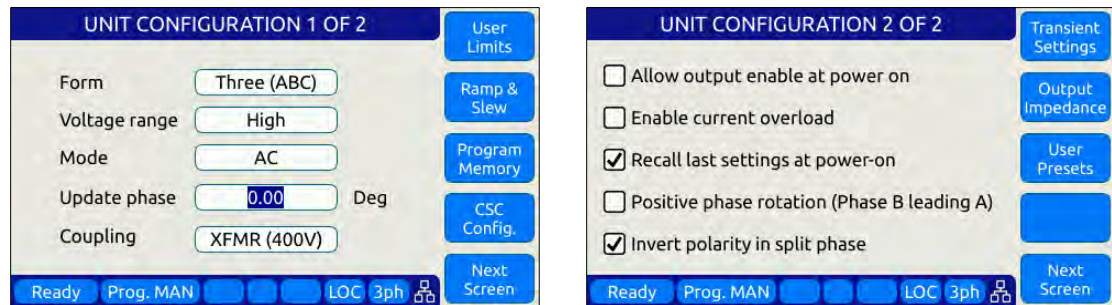
Back

Ready Prog. MAN LOC 3ph



All other system related screens can be accessed using the SYST menu key. (Refer to Section 6.7.6).

6.7.1 UNIT CONFIGURATION Screens



The following settings can be changed from the UNIT CONFIGURATION screens:

UNIT CONFIGURATION 1 OF 2-----

Form	This field displays the phase mode of operation. On 3150ADF models this is always “Three (ABC)”. On 1150ADF models this is always “Single (A)”
Voltage Range	Although the power source uses a constant power mode voltage range to allow operation using a single 300Vac voltage range only, the end user can simulate a low voltage range by setting this field to Low. Doing so limits programming of any output voltage to no more than 150Vac or half the available voltage range of the power source. If operation to 300Vac is desired, this field should be set to High. This effectively simulates a conventional dual voltage range model.
Mode	Displays the output mode (AC).
Update Phase	Sets the phase angle at which output voltage and frequency changes will take place on phase A. This setting applies to both steady state output changes and to the start of a transient program execution. It also applies to the OUTPUT ENABLE and DISABLE function key on the front panel. Changes on phases B and C will take place at the same moment in time but at phase angles that are shifted from phase A by the phase angles programmed for phase B and C.
Coupling	This field selects the output coupling mode of the power source. Unless an optional output transformer is installed with the power source (T Option), this field is always fixed to DIRECT. If the optional transformer is installed, the ADF model number will show “ADFT” to indicate the presence of the output transformer. To use the output transformer coupled range, selected XFMR (xxxV) in this field. The voltage indication may vary based on the transformer ration

of the installed output transformers.

Note: In either coupled mode, only **AC** voltage programming is possible.

Access to other utility screens is available from the UNIT CONFIGURATION screen through the soft keys. The table below lists the available soft keys on the UNIT CONFIGURATION screen.

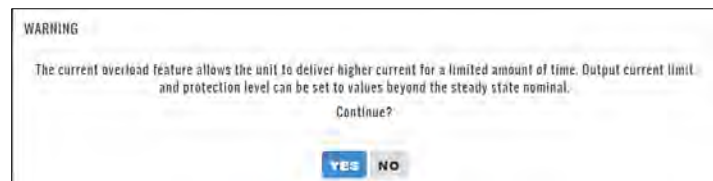
SOFT KEY	Description
User Limits (SK1)	Displays SETUP MENU screen. Refer to section 6.7.2
Ramp & Slew (SK3)	Displays SLEW RATE MENU screen. Refer to section 6.7.3
Program Memory (SK2)	Displays PROGRAM MEMORY screen. Refer to section 6.7.4
CSC Config. (SK4)	Display CSC setting screen
Next Screen (SK5)	Toggle to alternate UNIT CONFIGURATION screen

Table 6-22: Available UNIT CONFIGURATION 1 screen soft keys

UNIT CONFIGURATION 2 OF 2 -----

Allow Output Enable at Power On This mode if set, causes the output to turn on at power up.

Enable Current Overload Current Overload mode allows the power source to provide more than the nominal max. RMS current (around 30 percent more) for a short period (up to 2 seconds). When enabled, the user can set the CURR:LIM 30% higher than what this mode off. For example in a stand-alone 3150ADF unit in three phase mode (FORM 3), RMS output current can be up to 55A when the continuous output limit is 41.7A. A warning message will be display notifying the user this mode is being enabled.



Recall last settings at power-on When checked, this mode will cause the last settings that were in effect when the power source was last turned off to be recalled at power on. This allows a user to resume operation without having to set up again between power on/off events.

Positive phase rotation When checked, the phase rotation in three phase mode will be set to A -> C -> B corresponding to positive phase rotation for three phase AC motors. To select negative phase rotation, uncheck this option.

Access to other utility screens is available from the UNIT CONFIGURATION screen through the soft keys. The table below lists the available soft keys on the UNIT CONFIGURATION screen.

SOFT KEY	Description
Transient Settings (SK1)	Display Transient Configuration Settings
Output Impedance (SK2)	Program Output Impedance R and L values.
User Presets (SK3)	Access to user defined preset value settings for output programming soft keys
Next Screen (SK5)	Toggle to alternate UNIT CONFIGURATION screen

Table 6-23: Available UNIT CONFIGURATION 2 screen soft keys

6.7.2 USER LIMITS SETTINGS Screen

This screen allows programming user defined voltage and frequency upper and lower limits to prevent an operator from accidentally programming output settings that could be damaging to a unit under test.

For example, when testing a 50 Hz transformer, a lower frequency limit setting of 47 would prevent output frequency programming of values that could cause the transformer to saturate.

This applies to voltage where a high voltage value could damage a unit under test that was not designed to handle high AC input voltage.



Figure 6-16: USER LIMIT SETTINGS Screen

The following parameters can be set from this screen:

Voltage AC Lower and Upper Vrms set limits for AC programming.

Frequency Lower and Upper limits for Frequency programming.

The soft keys on the USER LIMITS SETTINGS screen provide access to additional functionality as listed in the table below.

SOFT KEY	Description
Apply (SK1)	Accepts new settings and returns to previous screen.
Cancel (SK2)	Returns to the previous screen.
-	
-	
Back (SK5)	Returns to the previous screen.

Table 6-24: Available USER LIMITS SETTINGS screen soft keys

6.7.3 RAMP TIME & SLEW RATE SETTINGS Screen

This screen allows programming of the update ramp time or individual voltage and frequency slew rates, which are applied when changing output settings. Ramp time and slew rate settings are mutually exclusive so Ramp time must be disabled in order to program individual voltage, frequency and phase update rates. Setting a slew rate other than the maximum value allows voltage and frequency changes to occur at a controlled rate of change. The Ramp time when enabled applies to any setting change equally.



Figure 6-17: RAMP TIME & SLEW RATE SETTINGS Screen

The following parameters can be set from this screen:

- | | |
|-------------------|---|
| Ramp time | Sets the time (in msec) over which output changes will take place. For the time set, output changes will ramp from their previous set value to the new set value. When DISABLED , changes will occur at the programmed slew rate settings in the SLEW RATE SETTING screen, as both cannot be in effect at the same time. Settings Slew Rate settings provide control over individual parameters whereas the RAMP TIME setting applies to all parameters (F, Vac, Vdc and Phase) changes equally. |
| Voltage AC | AC Voltage slew rate in Vrms per msec. Available range is 0.01 Vrms/ms through 300 Vrms/ms. |
| Frequency | Frequency slew rate in Hz per msec. Available range is 0.01 Hz/ms through 1200 Hz/ms. |

NOTE: Programmed Slew Rate settings will only take effect when the RAMP TIME setting is **DISABLED**.

The soft keys on the SLEW RATE SETTINGS screen provide access to additional functionality as listed in the table below.

SOFT KEY	Description
Apply All (SK1)	Applies all changes made (highlighted in grey) and returns to previous screen.

SOFT KEY	Description
Cancel All (SK2)	Cancels all changes (highlighted in grey), sets slew rates back to prior settings and returns to previous screen.
Enable Ramp T.	Enables Ramp time, disables Slew rate settings
Enable Slew R.	Enable Slew Rate settings, disables Ramp time
Back (SK5)	Returns to the previous screen.

Table 6-25: Available RAMP TIME & SLEW RATE SETTINGS screen soft keys

6.7.4 PROGRAM MEMORY Screen

The Program Memory menu allows saving and recalling of instrument setups in non-volatile memory registers. Setups include all steady state parameters, limits, operating modes and transient list if programmed.

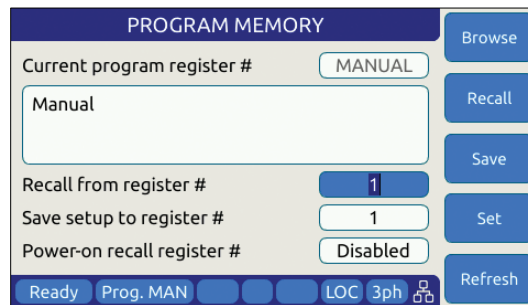


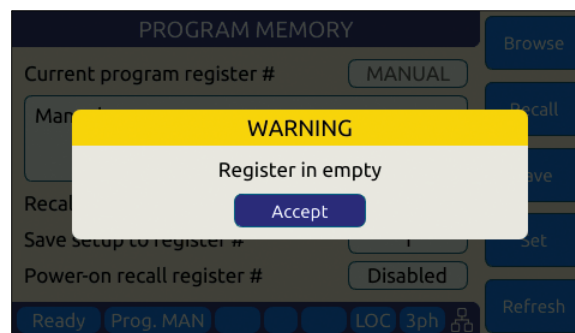
Figure 6-18: PROGRAM MEMORY screen

There are 10 setup registers numbered from 1 through 10. Use the shuttle to select either the Recall or Save field and press the shuttle to enter edit mode. Once the correct number is selected, press ENTER to confirm.

Recall from register

Recalls setup from selected register. If register is empty, an error message will be displayed and no setting will be recalled.

Note: If a register location is empty, an error message will be displayed.



Save setup to register

Saves setup in effect to selected register number. If this register already contained a saved setup, it will be over-written.

Power recall register

Determines which register number setup is recalled at power-up. Using this feature, the user can determine the power-on default settings of the power source.

The soft keys on the PROGRAM MEMORY screen provide access to additional functionality as listed in the table below.

SOFT KEY	Description
Browse(SK1)	Allows browsing for a particular register's content.
Recall (SK2)	Recalls selected Register setup content
Save (SK3)	Saves setup to selected Register
Set (SK4)	Sets output to selected Register content
Refresh (SK5)	Return to previous screen

Table 6-26: Available SLEW RATE SETTINGS screen soft keys

6.7.5 CSC CONFIGURATION Screen

The CSC CONFIGURATION menu allows the Continuous Self Calibration mode to be enabled. This feature is used to improve load regulation of the power source by continuous measurement of the output phase voltage(s) and adjusting the internal set points as needed to maintain close to zero load regulation. This feature is based on RMS measurements taken using 100ms windows resulting in a response time of around 500ms.

If the CSC is unable to get the output to the set point, an error will be generated. This error can be disabled by unchecking the "Fault on saturation" check box.

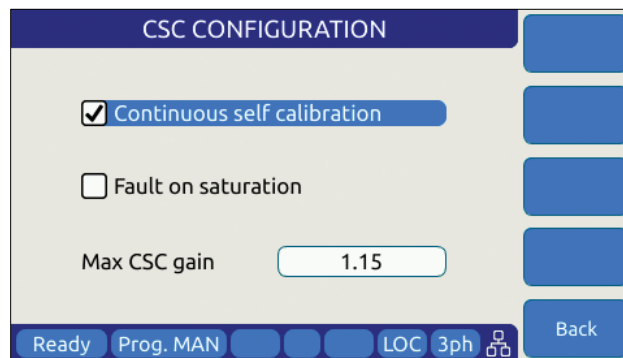


Figure 6-19: CSC CONFIGURATION screen

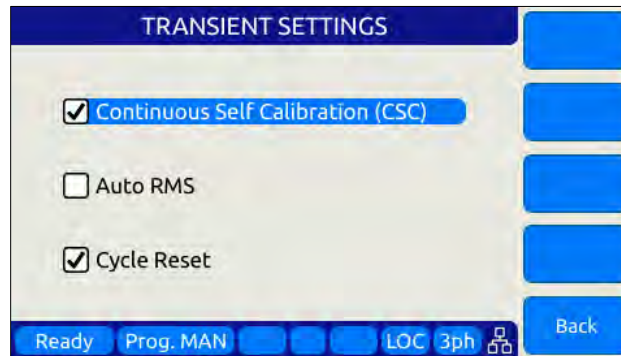
The soft keys on the CSC CONFIGURATION screen are listed in the table below

SOFT KEY	Description
-	
-	
-	
-	
Back (SK5)	Return to previous screen

Table 6-27: Available CSC CONFIGURATION screen soft keys

6.7.6 TRANSIENT SETTINGS Screen

The TRANSIENT SETTINGS screen defines operation of transient execution.



Available settings are:

- | | |
|------------------------------------|---|
| Continuous Self Calibration | This CSC mode is similar to the CSC mode for steady state operation but applies to transient mode. |
| Auto RMS | This field allows enabling or disabling of the Auto RMS mode for transient mode operation. Refer to section 6.6.13, “AUTO RMS Function – Transients” for further details. |
| Cycle Reset | When enabled, the CYCLE RESET mode will cause repeated executions of the transient as determined by the repeat count or the continuous execution setting to re-sync to the start phase angle set for the start of each transient. When disabled, repeats of the transients start immediately after the previous execution completes with no resync. With Cycle Reset on, there may be up to one period of the AC frequency of delay added between successive runs.
Note: In UPC Compatibility mode, Cycle Reset is default on. |

The soft keys on the TRANSIENT SETTINGS screen are listed in the table below

SOFT KEY	Description
-	
-	
-	
-	
Back (SK5)	Return to previous screen

Table 6-28: Available TRANSIENT SETTINGS screen soft keys

6.7.7 USER PRESETS Screen

The USER PRESETS screen allows the soft key set values for output programming that appear in the PROGRAM screen to be changed to setting values preferred by the user.

Presets can be defined for the following output settings:

- VOLTage[:AC]
- FREQuency
- CURRent:LIMit
- POWer:LIMit
- KVA:LIMit

6.7.7.1 AC Voltage Soft keys



6.7.7.2 Frequency Soft keys



Note: Preset value higher than 500.00 Hz are only available on ADF Models with Option F.

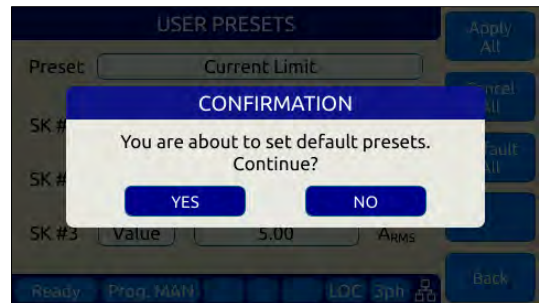
6.7.7.3 Current Limit Soft keys



6.7.7.4 Power and VA Limit Soft keys




For each parameter, the user will be prompted to confirm soft key value setting changes. See dialog to the right. ►



SOFT KEY	Description
Apply All (SK1)	Applies values entered by user.
Cancel All (SK2)	Cancel all changes made.
Default All (SK3)	Sets all soft key settings for selected parameter to factory defaults.
-	
Back (SK5)	Refreshes screen

6.8 SYST – SYSTEM Screens

The System screens allow setting of secondary system level functions that are used less often than the first four screens. This generally involves setting system level operation modes and parameters to tailor the instruments operation to the user's specific requirements and operating environment. These include the following areas:

- Remote Control Interfaces
- System level settings, logs and firmware updates
- Calibration
- Parallel Operation
- Options if any

Pressing the **SYST** key will display the first of two CONFIGURATION screens as shown below.

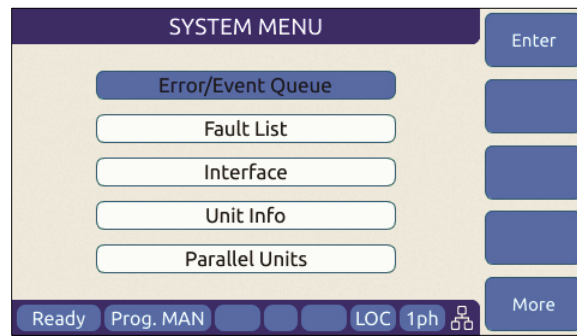


Figure 6-20: SYSTEM MAIN MENU 1

The **More** soft key will allow moving back and forth between the two main SYSTEM screens.

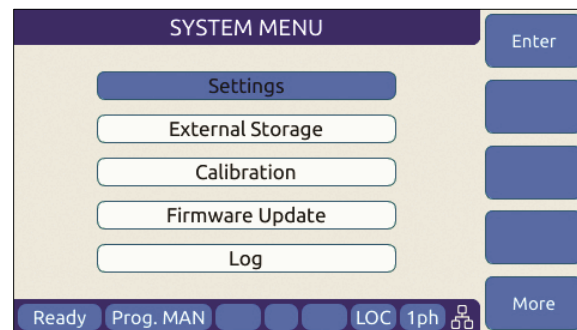


Figure 6-21: SYSTEM MAIN MENU 2

Selections on each screen are made by scrolling through the available entries using the shuttle knob. Pressing the **Enter** soft key, ENTER key or shuttle will display the selected highlighted entry screen.

6.8.1 SYSTEM MENU 1

The first SYSTEM MENU allows for selection of the following functions:

- Error/Event Queue Screen
- Fault Information Screen
- Interface Settings Screen
- Unit Information Screen
- Connected Units Screen
- SCPI Console

Each screen is covered in subsequent sections.



6.8.2 SYSTEM MENU 2

The second SYSTEM MENU allows for selection of the following functions:

- System Settings Screen
- Memory Management Screen
- Calibration Screen
- Firmware Update Screen
- Remote Support Screen

Each screen is covered in subsequent sections.



6.8.3 ERROR / EVENT QUEUE Screen

The Error and Event queue shows the history of any errors or events that have occurred since the last time the error queue was cleared.

The error queue can be cleared using a SCPI command over any of the remote control interfaces or by pressing the “Clear Queue” soft key while on this screen.

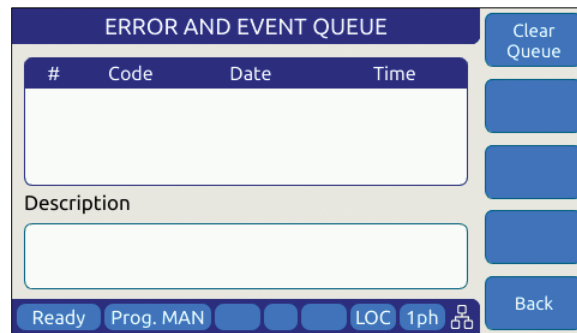


Figure 6-22: ERROR & EVENT QUEUE Screen

6.8.4 FAULT INFORMATION Screen

The fault list shows any logged internal operation faults. This information may be useful when trouble shooting any issues with the power source. In that even, customer service may request this information from the end user or request access to the instrument through the LAN interface for further diagnostics.

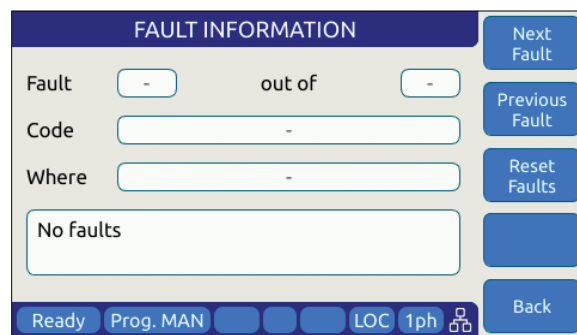


Figure 6-23: FAULT INFORMATION screen

6.8.5 INTERFACE Screen

The INTERFACE SETUP screen allows access to the setup parameter of any of the available remote control interfaces.

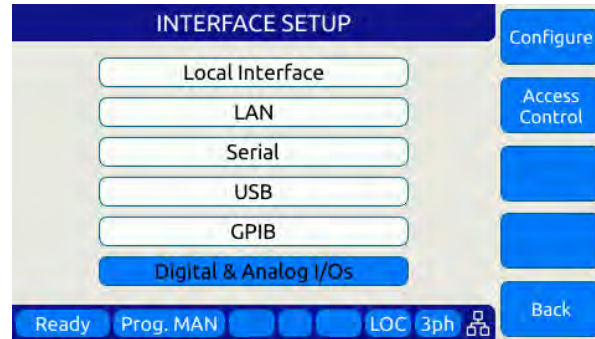


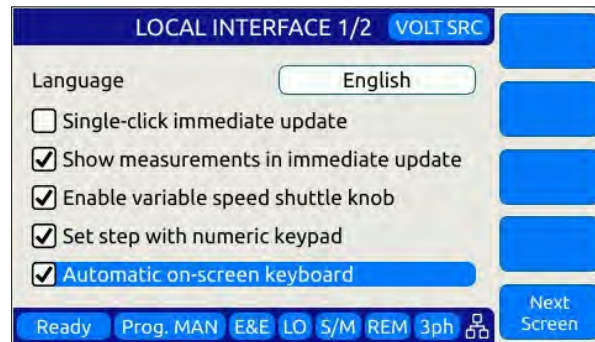
Figure 6-24: INTERFACE SETUP Screen

Available selections are:

- Local Interface (Relates to front panel operation)
- LAN – Ethernet Interface Setup
- Serial – RS232 Serial Interface Setup
- USB – USB Interface Setup
- GPIB – GPIB Interface Setup
- Digital & Analog I/O Setup

Each section is covered in subsequent sections.

6.8.5.1 LOCAL INTERFACE 1 OF 2



Several aspects of front panel operation can be configured by the user from this screen. This relates primarily to the language selection and operation of the shuttle knob, which has three distinct functions:

1. Scrolling values up or down
2. Single Click push function
3. Double Click push function

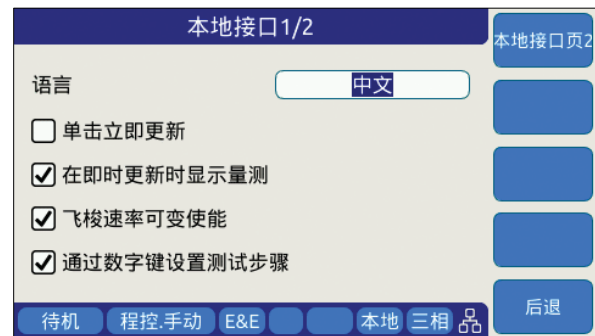
Parameters available to set are as follows:

Language

Available language selections are:

- English (default factory setting)
- Chinese.

Language can be switched by pressing the shuttle while on the language field and scrolling between available selections. Press ENTER to confirm selection.



Single-Click Immediate Mode

Enters Immediate Mode upon single depression of shuttle knob. Immediate mode means value changes occur immediately on the output of the power source. When unchecked, a double click of the shuttle knob is required to enter this mode.

Show Measurements in Immediate Mode	When checked, entering immediate mode will result in the Measurement screen being display with the changing parameter showing in the title bar. This allows monitoring of all output measurements while slewing voltage, current of frequency.
Enable variable speed shuttle knob	When selected, the speed of rotating the shuttle knob will increase the step size of the parameter being changed. If unchecked, changes occur at a fixed step size (resolution).
Set step with numeric keypad	When set, the numeric keypad can be used to increment or decrement the step size of the shuttle knob. Digits 9 to 1 our use to change from largest step size (9) to smallest step size (1) and any step size in between.
Automatic on-screen keyboard	This selection enables the on-screen Qwerty keyboard pop-up when the scroll knob is pressed once. When turned OFF, it is still available but requires double clicking the knob. This touch keyboard allows entering of alpha numeric parameters and also supports number value entries. See next section for details.

The following soft keys are available from the LOCAL INTERFACE setup screen:

SOFT KEY	Description
Local Inter. Page 2. (SK1)	Toggle to LOCAL INTERFACE 2 OF 2 screen
-	
-	
-	
Back (SK5)	Returns to previous screen

Table 6-29: Available USER INTERFACE screen soft keys

6.8.5.2 TOUCHSCREEN KEYBOARD

The on-screen Touchscreen Keyboard features allow entry of alpha numeric values such as names in text entry fields from the front panel. It pops up when the scroll knob is pressed once is set to on or double clicked when set to off in the LOCAL INTERFACE 1 OF 2 Screen.

It is mainly intended for use in text entry fields as the numeric keypad is always available for numeric entries. These are several keyboards available and the default type depends on the data entry field the cursor is on when the shuttle knob is pressed. The number of text characters in each keyboard is limited by the field type.

Key Descriptions

The following keys are supported:



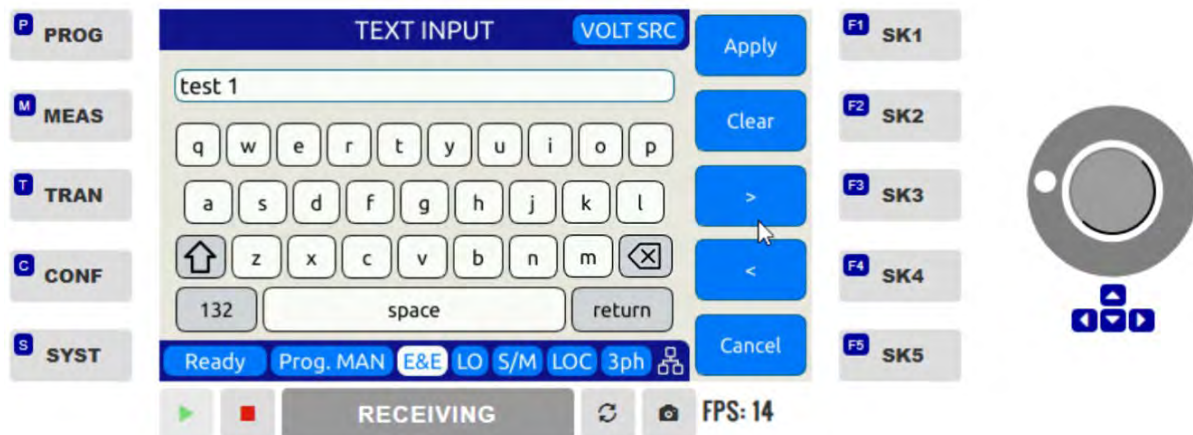
1. Shift: Allows switching between lowercase and uppercase letters, numbers and symbols.
2. 123/ABC: Allows switching from letters to numbers and symbols or vice versa.
3. Return: Places the cursor at the end of the text.
4. Backspace: Deletes the previous character depending on the cursor position
5. Apply: Closes the keyboard and apply text to the field.
6. Clear: Clears all text.
7. Arrows: Allows moving through the text.
8. Cancel: Discards text and close the keyboard

Available Qwerty keyboard Types:

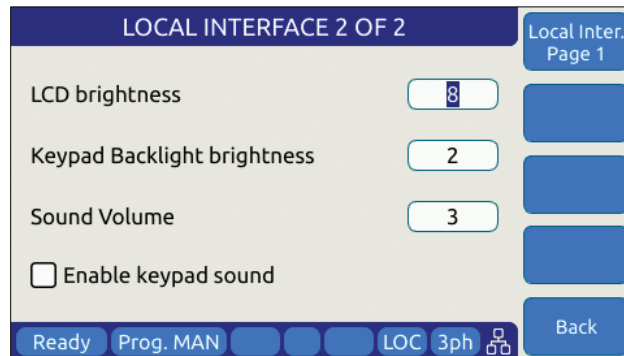


Web Browser Front Panel Mode.

The same on-screen keyboard functions are available from the Web browser interface via LAN or USB as shown below.



6.8.5.3 LOCAL INTERFACE 2 OF 2



Several aspects of front panel operation can be configured by the user from this screen. These setting relate primarily to visual and audible user interface aspects:

1. LCD brightness
2. Keyboard Backlight
3. Sound Levels

Parameters available to set are as follows:

LCD brightness	Adjusts the LCD display backlight brightness. Range is 0-9.
Keypad Backlight brightness	Adjusts the keyboard backlight brightness. Range is 0-9.
Sound Volume	Adjusts the loudness of the keyboard and message beeps.
Enable keypad sound	Enables or Disables audible beeps when operating the keyboard.

The following soft keys are available from the LOCAL INTERFACE setup screen:

SOFT KEY	Description
Local Inter. Page 1. (SK1)	Toggle to LOCAL INTERFACE 1 OF 2 screen
-	
-	
-	
Back (SK5)	Returns to previous screen

Table 6-30: Available USER INTERFACE screen soft keys

6.8.5.4 LAN (ETHERNET) INTERFACE SETUP Screen

The LAN INTERFACE SETUP screen allows configuring the Ethernet interface for use with your local area network (LAN) and is accessed from the INTERFACE SETUP screen.



WARNING



Do NOT connect the RJ45 LAN (Ethernet) connector of the power source to a PoE (Power over Ethernet) port as the DC voltage will damage the LAN interface.

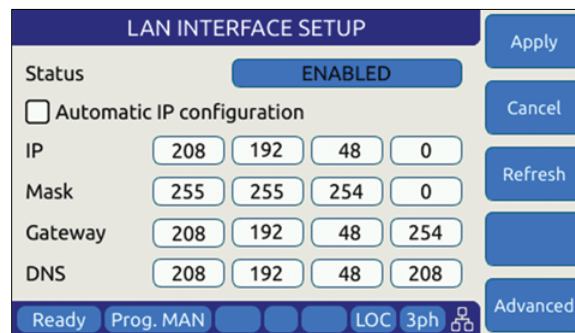


Figure 6-25: ETHERNET INTERFACE SETUP Screen

This screen is used to configure the Ethernet interface for your local area network.

Note: You may need to consult your network administrator to set up this interface correctly.

The following parameters can be set on this screen:

Automatic IP Configuration	Select this mode if your network has a domain name server running. An IP address will be assigned by the DNS each time the power source is turned on.
IP	IP address setting. This address must be unique to your network segment. Consult your network administrator if you are not sure about this setting.
Mask	IP mask setting. This mask must be correct for your network. Consult your network administrator if you are not sure about this setting.
Gateway	Gateway address setting. Consult your network administrator if you are not sure about this setting.
DNS	Domain Name Server address setting. Consult your network administrator if you are not sure about this setting.
Port	Port socket address. For message based instruments like this power source, this setting is typically 5025.

The following soft keys are available from the ETHERNET INTERFACE SETUP screen:

SOFT KEY	Description
Apply (SK1)	Accepts new settings and returns to previous screen.
Cancel (SK2)	Returns to the previous screen.
Refresh (SK3)	
-	
Advanced (SK5)	Access detailed LAN Interface Setting screen

Table 6-31: Available ETHERNET INTERFACE SETUP screen soft keys

6.8.5.5 SERIAL INTERFACE SETUP Screen

The SERIAL INTERFACE SETUP screen allows configuring the RS232 serial interface and is accessed from the “INTERFACE SETUP” screen.

SERIAL INTERFACE SETUP		Apply
Status	ENABLED	Cancel
Bits per second	9600	
Data bits	8	
Parity	None	
Stop bits	1	
Flow control	None	
Ready Prog. MAN LOC 3ph		Back

Figure 6-26: SERIAL INTERFCSE SETUP Screen

The following parameters can be set on this screen:

- Bits per second** Sets the baud rate. Available settings are 9600, 14400, 19200, 38400, 57600 or 115200.
- Data bits** Sets the number of bits per frame. Available settings are 7 or 8 bits
- Parity** Sets parity check to either odd, even or none.
- Stop bits** Sets the number of stop bits as either 1 or 2.
- Flow control** Sets handshake mode to None or Xon/Xoff

The following soft keys are available from the SERIAL INTERFACE SETUP screen:

SOFT KEY	Description
Apply (SK1)	Accepts new settings and returns to previous screen.
Cancel (SK2)	Returns to the previous screen.
-	
-	
Back (SK5)	Returns to the previous screen.

Table 6-32: Available SERIAL INTERFACE SETUP screen soft keys

6.8.5.6 USB INTERFACE SETUP Screen

The USB INTERFACE SETUP screen allows configuring the USB interface and is accessed from the INTERFACE SETUP screen.

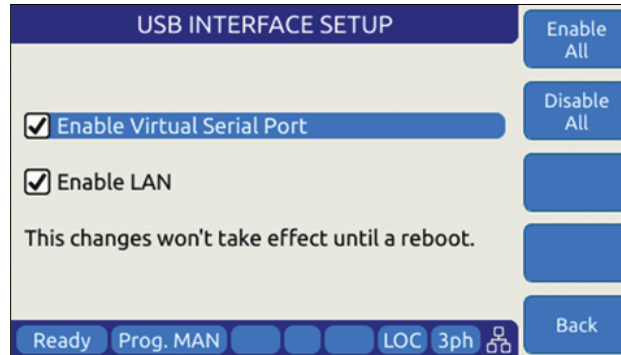


Figure 6-27: USB INTERFACE SETUP Screen

The following settings can be configured on this screen:

- Enable Virtual Serial Port** Enables or disables PC control using a virtual serial port driver.
- Enable LAN** Enables or disables the LAN (Ethernet) Interface IP emulation mode, which supports use of the embedded LXI web server. The virtual IP address of the USB-LAN emulation mode is fixed at 192.168.123.1.

Note: Any changes made to this screen will NOT take effect until the power source has been completely powered off and back on. (Re-boot).

The following soft keys are available from the USB INTERFACE SETUP screen:

SOFT KEY	Description
Enable All (SK1)	Set all check boxes
Disable All (SK2)	Clear all check boxes
-	
-	
Back (SK5)	Returns to the previous screen.

Table 6-33: Available USB INTERFACE SETUP screen soft keys

6.8.5.7 GPIB INTERFACE SETUP Screen

The GPIB INTERFACE SETUP screen allows configuring the GPIB interface and is accessed from the INTERFACE SETUP screen.

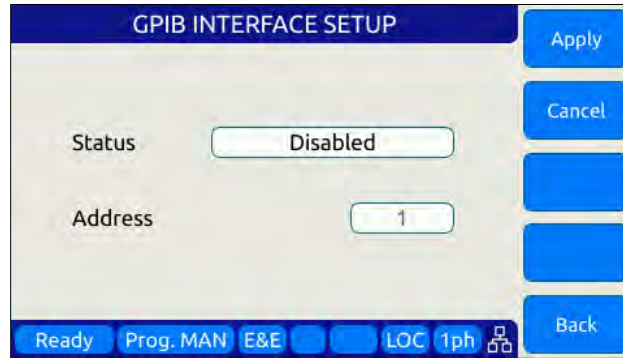


Figure 6-28: USB INTERFACE SETUP Screen

The following settings can be configured on this screen:

- Status** Enables or disables the GPIB interface. Disable when not in use to avoid erroneous interrupts.
- Address** Sets GPIB bus address. Available range is from 1 through 30. Default factory setting is address 1.

The following soft keys are available from the GPIB INTERFACE SETUP screen:

SOFT KEY	Description
Apply (SK1)	Accepts new settings and returns to previous screen.
Cancel (SK2)	Returns to the previous screen.
-	
-	
Back (SK5)	Returns to the previous screen.

Table 6-34: Available GPIB INTERFACE SETUP screen soft keys

6.8.5.8 DIGITAL & ANALOG I/Os SETUP Screen

The Digital & Analog IOs SETUP screen allows configuring the auxiliary I/O interfaces and is accessed from the INTERFACE SETUP screen.

For further details, refer to Section 7.3, “Auxiliary I/O” on page 168.

6.8.5.9 REMOTE INHIBIT SETUP Screen

The REMOTE INHIBIT SETUP screen allows configuring the remote output control input for various modes of operation. Once set, this setting is retained in non-volatile memory so the selection persists between input power cycles.

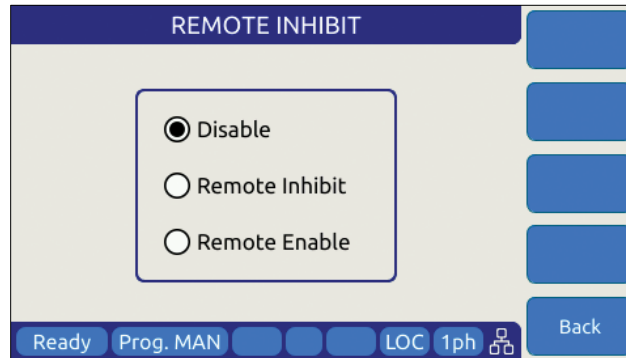


Figure 6-29: REMOTE INHIBIT Setup Screen

There are three modes of operation for this input: remote inhibit and remote enable.

1. **Disable mode:** In this mode, the Remote Inhibit inputs are not active so this function is turned off. No short between the RI pins is required to enable the output in this mode.
2. **Remote Inhibit mode:** The two pins have to be shorted for the output to be enabled from the front panel or remote command. This is a necessary but not a sufficient condition to enable the output. If the output is enabled and the remote inhibit connection is open, a fault is generated. This mode is recommended for interlock safety applications such as safety cages and test fixture interlocks.
3. **Remote Enable mode:** The output can be enabled by shorting these two pins, regardless of the output enable command/button. It is a sufficient condition to enable the output.

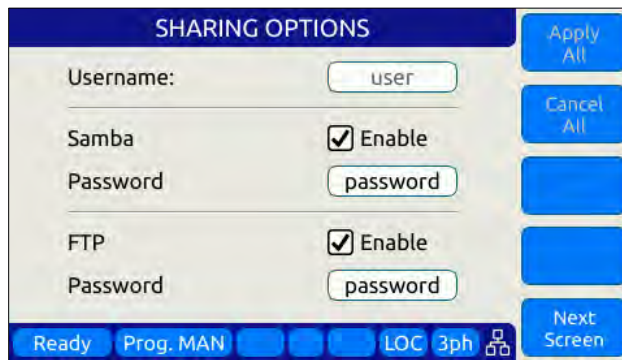
6.8.5.10 REMOTE SHARING

Remote sharing of the power source is provided using one of two protocols:

Samba: Samba is a free software re-implementation of the SMB networking protocol. Server Message Block (SMB), also known as Common Internet File System (CIFS) operates as an application-layer network protocol for providing shared access to resources miscellaneous communications between nodes on a network.

FTP: File Transfer Protocol. FTP is built on a client-server model architecture using separate control and data connections between the client and the server.

Note: Either one or both may be chosen. It is strongly recommended to set a custom password to prevent unauthorized access to the power source.



SHARING OPTIONS	
Username:	user
Samba	☒ Enable
Password	password
FTP	☒ Enable
Password	password

Buttons: Ready, Prog. MAN, LOC, 3ph, Next Screen

6.8.6 UNIT INFORMATION Screen

The UNIT INFORMATION screen is an information only screen that contains information about the power source and is accessed from the SYSTEM SETTINGS screen using the “Unit info” soft key (SK3).

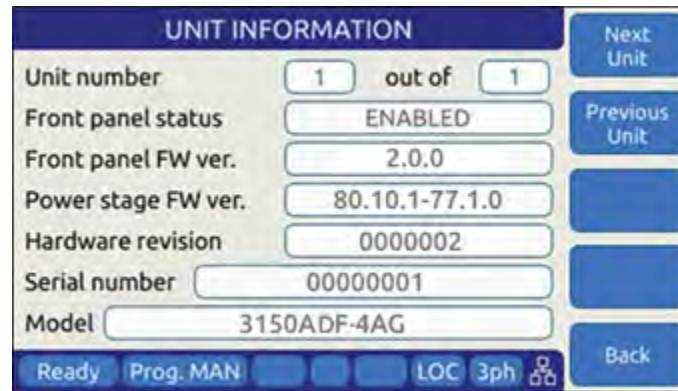


Figure 6-30: UNIT INFORMATION Screen

The following information is provided on this screen:

Unit Number	Shows the position of this unit in a string of paralleled power sources. For a stand-alone power source, the display will show 1 of 1.
Front panel status	Shows the status of the front panel. Only the MASTER unit in a multi-unit system will have its front panel enabled.
Front panel FW ver.	Firmware revision of the front panel control processor.
Power stage FW ver.	Firmware revision of the power stage processors.
Hardware revision	Hardware build revision.
Serial number	Unit Serial number.
Model	Model number, typically 1xxxADX or 3xxxADX where xxx = power rating.

Note: This information is for information purposes only and cannot be changed by the operator.

The following soft keys are available from the UNIT INFORMATION screen:

SOFT KEY	Description
Next Unit (SK1)	If this unit is part of a parallel system, information on the next unit in the chain will be displayed.
Previous Unit (SK2)	If this unit is part of a parallel system, information on the previous unit in the chain will be displayed.
-	
-	
Back (SK5)	Returns to the previous screen.

Table 6-35: Available UNIT INFORMATION screen soft keys

6.8.7 CONNECTED UNITS Screen

The CONNECTED UNITS screen controls the behavior of this power source in a multi-unit parallel or series system where two or more power sources are either paralleled or in series (AFXS models) to provide higher power level systems.

This screen is accessed from the SYSTEM SETTINGS screen using the “Connected Units” entry.

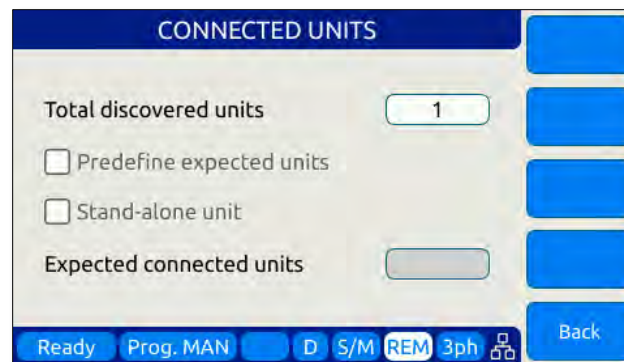


Figure 6-31: PARALLEL UNITS Screen

The first field shows the number of units found at power up on the system bus. A value of 1 means this is a stand-alone unit (not part of a larger system).

The following settings can be configured on this screen:

- Predefine expected units** Tells the power source how many total units to expect to find on the system interface bus at power up. If the number found is less than the number expected as set by the user, one or more units may not be powered up or missing. Leaving this check box off means the system will operate with the number of units found, regardless.
- Stand-alone unit** Set this check box if you want the power supply to operate as a stand-alone unit, even if it is connected to the system interface bus. To do so, you must make sure the outputs of this power source are not connected to any other units' outputs.
- Expected parallel units** Use this field to enter the number of expected units only if the “Predefine expected units” option is checked.

The following soft keys are available from the PARALLEL UNITS screen:

SOFT KEY	Description
Discover units (SK1)	Re-scan the system interface bus to determine how many units are on the bus. This also happens at power on.
Back (SK5)	Returns to the previous screen.

Table 6-36: Available PARALLEL UNITS screen soft keys

6.8.8 SCPI CONSOLE

The SCIP Console screen allows entry of remote control SPCI command directly from the front panel instead of one of the available remote-control interfaces. This feature is similar to the command line available at the bottom of the Web browser interface Home page.



The following softkeys are available to operate this feature:

Query / Write	Sends the SCPI command shown in the command line on top. The default command is the *IDN? Query which returns the make and mode of the power source. This field will also retain the last command entered by the user.
Clear	Clears the test in the command line and the response area below it.
Scroll Up/Down	Allows scrolling of the text in the response area.
Back	Returns to the System Menu page.

6.8.9 SYSTEM SETTINGS Screen

This screen allows system level settings such date and time to be changed. It also controls the UPC Compatibility mode setting.

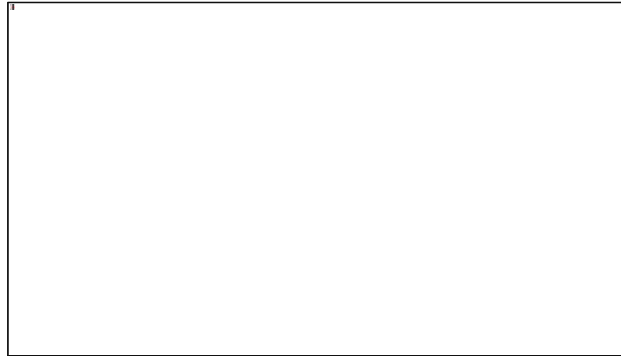


Figure 6-32: SYSTEM SETTINGS Screen

The following parameters can be set from this screen:

Date	Sets the date for the real-time clock.
Time	Sets the time for the real-time clock.
Use Network Time Protocol	When set, the time and date will be adjusted based on the NTP protocol. This requires the unit to be connected to a local area network.
Time zone UTC offset	This parameter sets the number of time zone from UTC where the unit is located to reflect local time. Coordinated Universal Time (UTC) is the primary time standard by which the world regulates clocks and time. It does not observe daylight saving time.
Consider Leap Seconds	When enabled, the time setting incorporated any lead seconds for the current year in the time setting.
UPC compatible mode	When enabled, the controller operates in UPC compatibility mode for back ward compatibility with legacy PPS UPC controllers.

The soft keys on the SYSTEM SETTINGS screen provide access to additional functionality as listed in the table below.

SOFT KEY	Description
Apply All (SK1)	Applies all changes made to this screen.
Cancel All (SK2)	Cancels any changes made and returns to previous screen
Sanitize	Erases all user settings from the unit and returns it to its factory default state.
Reboot	Reboot front panel controller without cycling AC input power.

SOFT KEY	Description
Back (SK5)	Returns to the previous screen.

Table 6-37: Available SYSTEM SETTINGS screen soft keys

6.8.10 MEMORY MANAGEMENT Screen

The ADF Series® is able to use a wide variety of external storage devices such USB memory sticks and SD-Cards in addition to its internal storage memory. These devices may be used to store or load data, programs (setup + transient) etc.

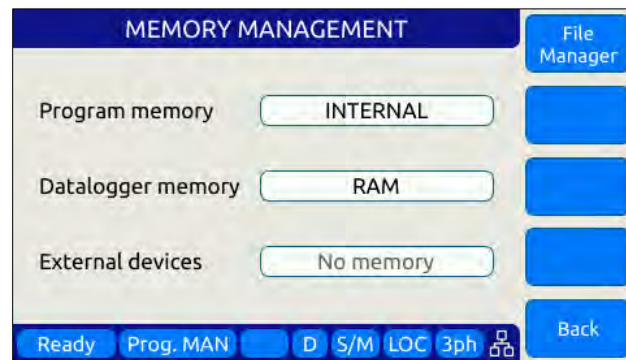


Figure 6-33: MEMORY MANAGMENT Screen

Program storage memory defaults to INTERNAL but can be changed to any available (inserted and mounted) external memory device if needed. The first parameter field is used to make this selection.

If any external memory devices are inserted, they will appear in the “External memories” field at the bottom of this screen.

Note: Maximum supported external memory device storage size is 32 GBytes.

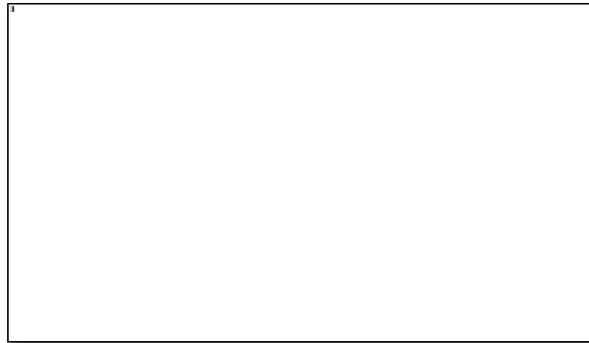
The following files types can be located in each of these directories.

Subdirectory	File type and naming convention
plot	Measurement plots
sequences	Test sequences
screenshots	PNG image files captured from the LCD screen with filename convention screenshot_YYYY-MM-DD_HH-MM-SS.png where YYYY-MM-DD_HH-MM-SS is the time stamp.
waveforms	CSV comma separated waveform data files with filename convention X.csv where X is a number form 2 through 200.
program	Steady state + transient segment files using filename convention program_xx.xml where xx = 00 through 99 indicated program memory location #.

6.8.10.1 Loading Programs from a USB Drive.

Programs stored on a USB drive using the directory structure shown in the previous section can be loaded using the Browser interface – see section **Error! Reference source not found.** on page **Error! Bookmark not defined.** – or from the front panel.

To load from the front panel USB ports, store the program_xx.xml file in the program subdirectory and insert in one of the two USB A ports on the front panel. After a short period of time, the drive will mount and will be visible in the CONF -> PROGRAM BROWSER screen.



Select the USB A1 drive in the upper right corner Memory field to see the available program files on the USB drive. Scroll down with the shuttle to select the desired program file to load.

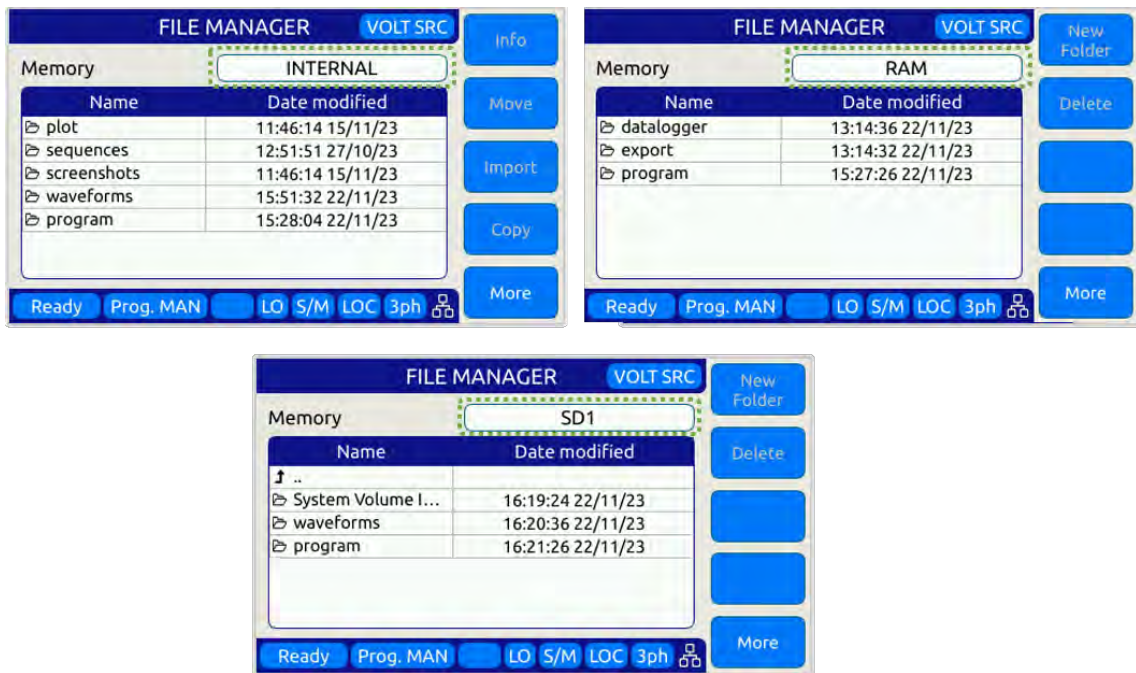
Then use the **Recall** Softkey to load the selected program file. The program will now be available in the assigned program memory location as determined by the XML file name.



Note: program_xx.xml files must have a Steady State section to be valid. The Transient section may be empty in which case no transient will be loaded.

6.8.10.2 File Manger Operation

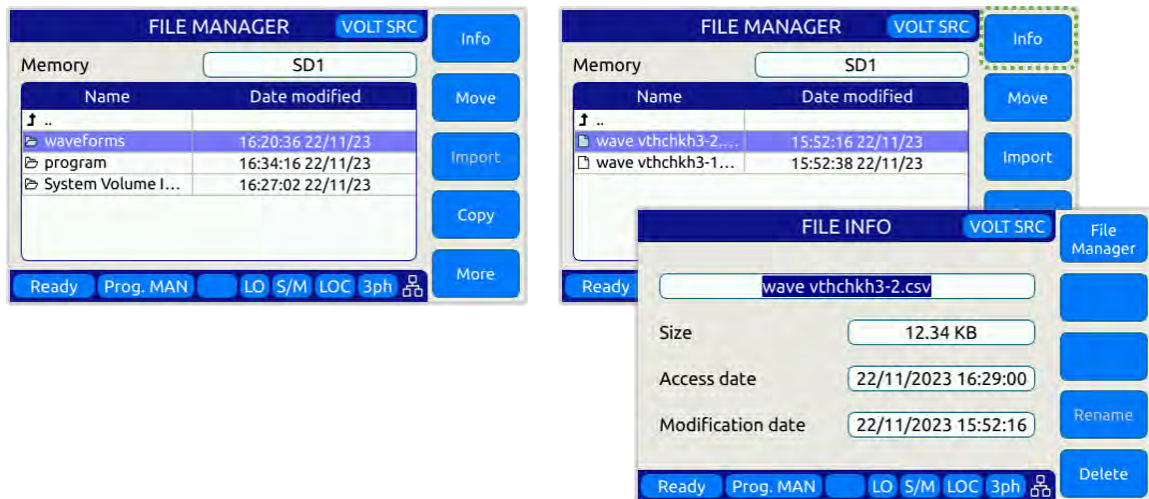
To access the File Manager functions, Press “**SYST**” -> **Memory management**” –(**Sk1**) **File Manager**”. The File Manager allows the user to browse through the directories and files stored on the selected memory type, INTERNAL, RAM or External media. Select the relevant memory type before entering this screen. See sample screens below.



This screen contains file info such as date/time, and supports the following functions:

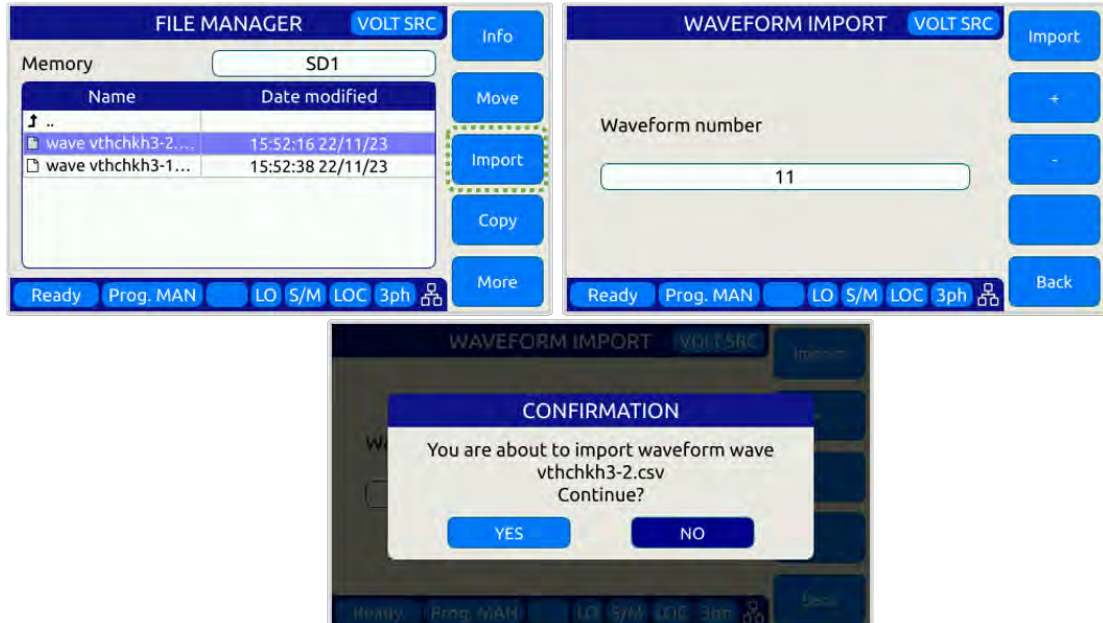
1. Move, Copy and Delete files.
2. Create new folders.
3. Import Waveforms.
4. Import Programs.

To navigate between files and folders, use the shuttle knob to select a folder and press to enter.



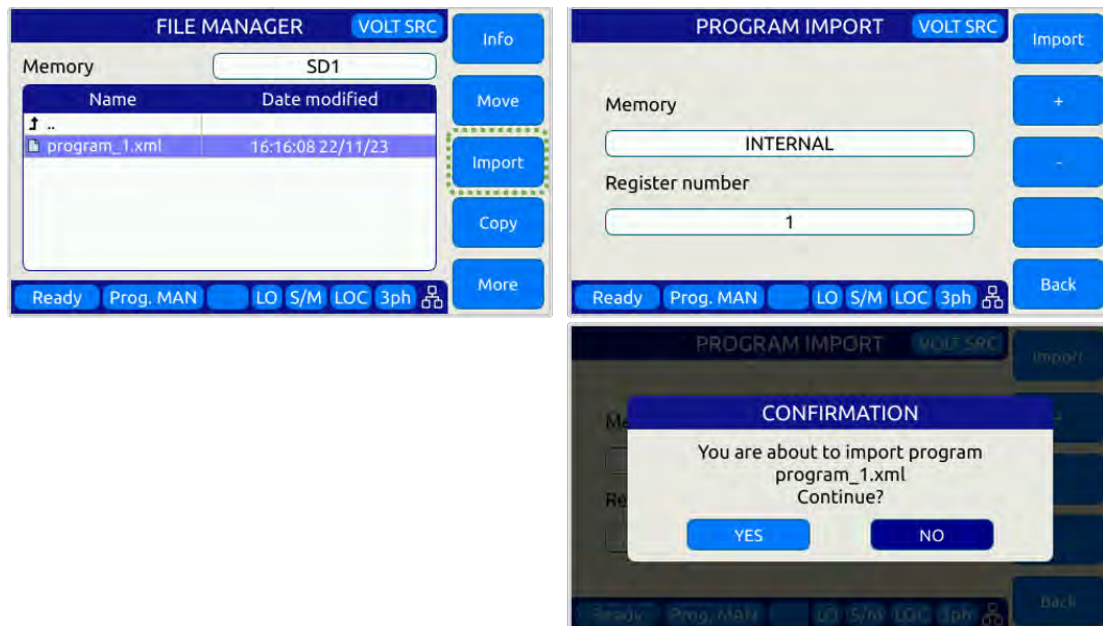
Importing Waveforms

The Import softkey allows importing of CSV format waveforms. Select the location to import the content of the waveform from. Use the +/- softkeys or the shuttle knob to scroll the waveform number. Press the Import (Sk1) softkey and YES to confirm when prompted.

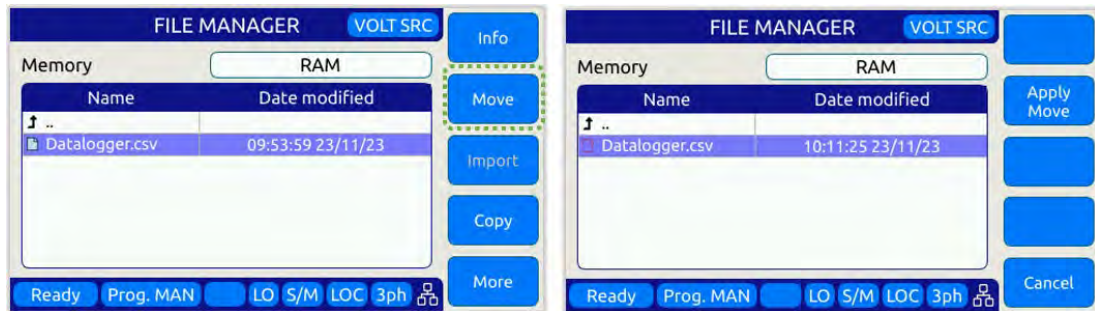


Importing Programs

Importing xml format program files uses a similar process except they are stored in a register location by number. Select the desired program file, select the memory type and register number and press Import (Sk1), the confirm when prompted.



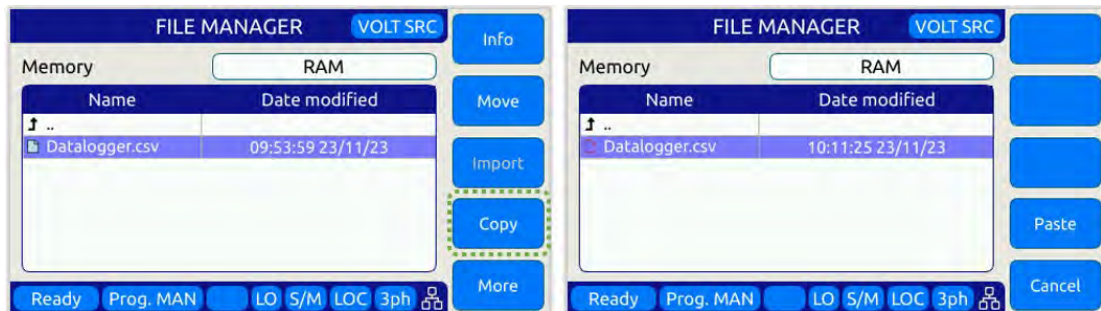
Moving Files



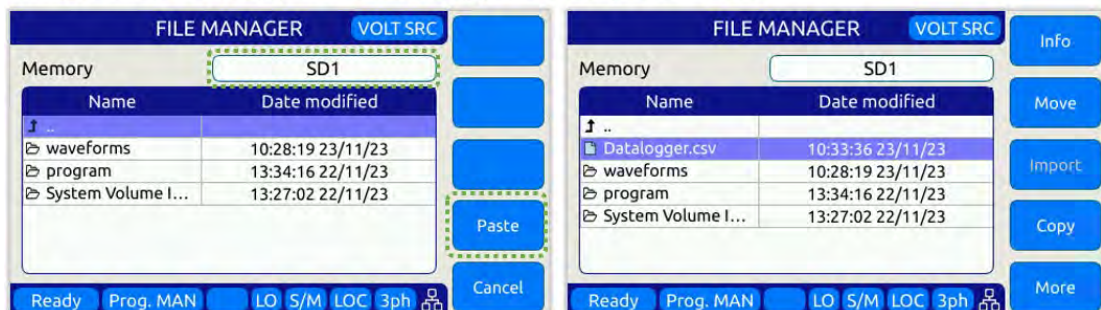
- Changes the directory and then press **“Apply Move”**



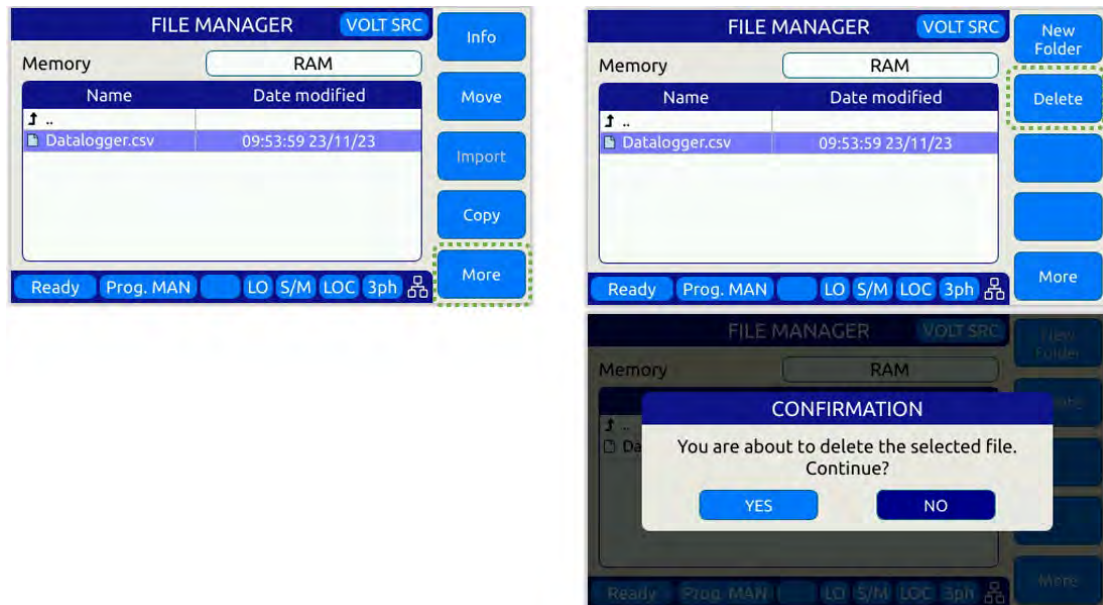
Copy and Pasting Files



Changes the directory (and/or Memory) and then press **“Paste”**



Deleting Files



6.8.11 CALIBRATION MENU Screen

All power sources are shipped with a Certificate of Compliance to NIST traceable standards ("CoC") from the factory. Output and Measurements are calibrated to an external reference DMM at the same time. A suitable current shunt or current transformer and a load will be required to perform calibration.

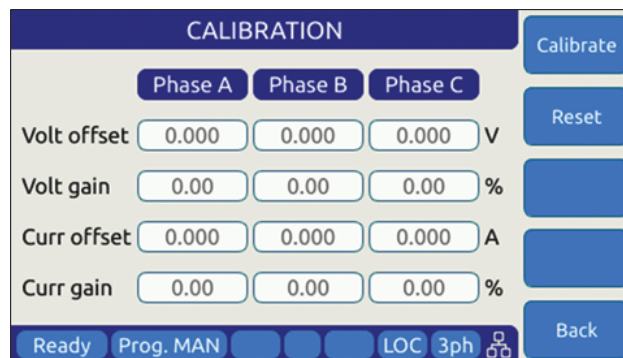


Figure 6-34: CALIBRATION MENU Screen

The following soft keys are available from the CALIBRATION MENU:

SOFT KEY	Description
Calibrate (SK1)	Enters calibration state
Reset (SK2)	Resets all calibration coefficients' previous values.
-	
-	

SOFT KEY	Description
Back (SK5)	Returns to previous screen

Table 6-38: Available CALIBRATION MENU screen soft keys

For details on calibration requirements and procedures, refer to the Calibration section towards the end of this manual. (Section 11, “Calibration”).

6.8.12 FIRMWARE UPDATE Screen

Firmware updates may be distributed via different media such as SD-Card, USB memory stick or on-line through Pacific’s FTP site. The FIRMWARE UPDATE screen provides the means for the end user to perform a firmware update.

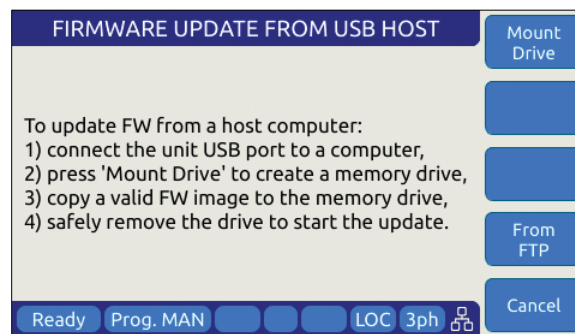


Figure 6-35: FIRMWARE UPDATE Screen

The following soft keys are available from the FIRMWARE UPDATE screen:

SOFT KEY	Description
Mount Drive (SK1)	Mount media that contains new firmware revision.
-	
-	
From FTP (SK4)	Install latest firmware from Pacific Power Sources’ FTP server.
Cancel (SK5)	Exit firmware update screen

Table 6-39: Available FIRMWARE UPDATE screen soft keys

6.8.13 REMOTE SUPPORT Screen

The REMOTE SUPPORT feature can be used to send information to customer support in case the user experiences an issue with the unit. It also provides a means to allow Pacific's technical support team to access the unit remotely assuming it is connected to a network with Internet access.

Figure 6-36: REMOTE SUPPORT Screen

The Report soft keys will cause a detailed report to be generated and sent to Pacific Power Source customer support so we can assist in resolving any technical support issues.

Figure 6-37: Remote Support REPORT Screen

The following soft keys are available from the LOGGING TOOL screen:

SOFT KEY	Description
Connect (SK1)	Connect to Pacific Power Support site
Disconnect (SK2)	Disconnect from Pacific Power Support site
Report (SK3)	Generates a report for Customer Support Department
Log (SK4)	Start Logging
Back (SK5)	Returns to the previous screen.

Table 6-40: Available LOGGING TOOL screen soft keys

7 Rear Panel, Connectors and Protection

This section describes the rear panel layout of the ADF Series® AC power source.

7.1 OUTPUT Terminals



WARNING

HAZARDOUS OUTPUT: The power source output may be set to hazardous voltage levels. It provides basic isolation from the AC input mains. Therefore, the output must always be considered hazardous. Connections must be inaccessible to the operator in all situations when AC input mains voltage is applied.

Always disconnect power supply from the mains before connecting or disconnecting to the hazardous output terminals.



AVERTISSEMENT

SORTIE DANGEREUSE: La sortie de l'appareil peut être réglée à des niveaux de tension dangereux. L'appareil fournit une isolation de base du réseau d'entrée AC. Par conséquent, la sortie doit toujours être considérée comme dangereuse. Les connexions doivent être inaccessibles à l'opérateur dans toutes les situations où la tension d'entrée secteur est appliquée.

Toujours débrancher l'alimentation secteur avant de connecter ou déconnecter les bornes de sortie dangereuses.

The output terminal block for load connections is located near the center of the rear panel.

Note: Always refer to Section 0 “The General Terms & Conditions document defines payment terms, shipping charges, title passage, packaging, indemnification, warranty terms as well as Pacific’s Service & Spare Parts Limited Warranty. We encourage you to read these terms and conditions very carefully at <https://pacificpower.com/support/> Any additional or different terms or conditions in any form presented by you (“the customer”) outside of the Pacific Power Source, Inc. General Terms & Conditions are hereby deemed to be material modifications and notice of disapproval to them and rejection of them is hereby delivered.

Safety Information” before making any load connections.

7.1.1 Output Power Connector Rating and Isolation

Maximum rated output voltage:	300V rms AC, 425Vdc
Maximum Current Rating:	60A
Connector Type:	Phoenix Contact SPC 16/ 6-STF-10, 16 - 1711417
Designated Use:	AC Load Connection

Isolation Rating:	600V
Wire Stripping Length:	18 mm
Nominal Contact Cross Section	16 mm ²

7.1.2 Wire Size

A major consideration in making load connections is the wire size. The minimum wire size is required to prevent overheating and to maintain good regulation. It is recommended that the wires are sized large enough to limit the voltage drop at the maximum current rating of the AC power source to less than 0.5V per lead.

Wire size also depends on ambient temperature and total wires in the cable bundle. For example, for the full 41.7 amp current capability of a single output, at an ambient temperature of 30 °C, in a bundle of not more than three 75 °C rated wires, common electrical codes would recommend AWG 8 size (~10 mm²). However, maximum supported Wire Size for the output connector is AWG 6.

AWG	Diameter		Turns of wire, without insulation		Area	
	(in)	(mm)	(per in)	(per cm)	(kcmil)	(mm ²)
6	0.1620	4.115	6.17	2.43	26.3	13.3

7.1.3 Connecting a UUT

When setting up for a new test and connecting any equipment to the AC power source, proceed as follows:

1. Always make sure the AC power source is turned OFF at the POWER switch when making any wire connections.
2. Check that the output of the equipment under test is **OFF**.
Note: Some power equipment's output may still be energized even if the equipment has been turned off or its output is turned off. This is especially true for AC power sources.

Note: When working with batteries, it is recommended to provide a suitable disconnect relay or switch so the AC power source can be physically disconnected from the battery for handling purposes.

3. Connect one end of the load wires to the output terminals on the rear panel.
4. Check the polarity of the connections and connect the other end of the load wires to the input terminals of the equipment under test.

7.2 External Voltage Sense Input Terminals



WARNING

HAZARDOUS OUTPUT: The power source output may be set to hazardous voltage levels. It provides basic isolation from the ac input mains. Therefore, the external voltage sense must also always be considered hazardous. Connections must be inaccessible to operator in all situations when ac input mains voltage is applied.

Always disconnect power supply from the mains before connecting or disconnecting to the hazardous external voltage sense terminals.



AVERTISSEMENT

SORTIE DANGEREUSE: La sortie de l'appareil peut être réglée à des niveaux de tension dangereux. L'appareil fournit une isolation de base du réseau d'entrée AC. Par conséquent, la sortie doit toujours être considérée comme dangereuse. Les connexions doivent être inaccessibles à l'opérateur dans toutes les situations où la tension d'entrée secteur est appliquée.

Toujours débrancher l'alimentation secteur avant de connecter ou déconnecter les bornes de sortie dangereuses.

This section covers external voltage sensing. This feature improves voltage accuracy at the point of load when used correctly.

Note: External Voltage sense is sometimes referred to as Remote Voltage sense and Internal Voltage sense is sometimes referred to as Local Voltage sense. Both definitions are used in the industry. For consistency, External Voltage Sense and Internal Voltage Sense are used in this manual.

7.2.1 External Voltage Sense Connector Rating and Isolation

Maximum rated voltage:	400V rms AC, 425Vdc
Maximum Current Rating:	1A
Connector Type:	ADF A Version: Phoenix Contact P/N SPT 5 / 6-H-7,5-ZB - 1719231
Designated Use:	AC Load Connection
Isolation Rating:	600V
Wire Stripping Length:	10 mm

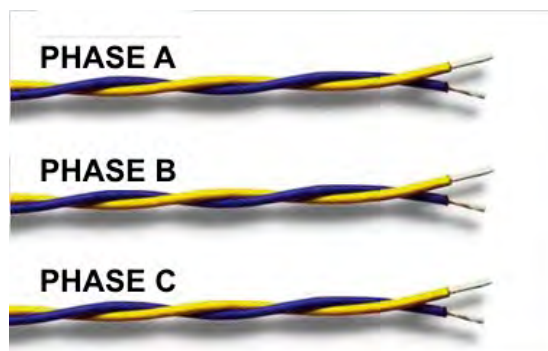
7.2.2 Load Connection without External Voltage Sense

ADF Series® power sources can be operated with internal voltage sense. For higher current loads, the voltage at the load will drop due to the load cable impedance. Using the proper wire gauge for the rated current of the AC source is required to minimize load cable impedance.

7.2.3 Load Connection with External Voltage Sense.

The following points must be considered, when existing sense cables are connected directly to the load or to the central load distribution point:

1. Minimize the distance between the AC power source and the load as much as possible to keep load wire length to a minimum.
2. Directly connect **A, B, C** and **N** with **correct phasing** to the load distribution point
3. Twist each phase sense wire with a neutral sense wire to minimize cross talk. Three neutral connection points are provided for this purpose.



4. Avoid overload of power wires

Note: External voltage sense connections are at the programmed output voltage when the output is on so DO NOT connect or disconnect the external voltage sense lines while the AC power source is in use.

ADF L Version units are shipped with the mating sense connector installed but no wires to prevent contact with the sense connections. ADF A Version units don't require a mating connector.

7.3 Auxiliary I/O

The Auxiliary I/O functions are available on all ADF Series power source models.

7.3.1 Auxiliary I/O Functions

The Auxiliary I/O board when added to an ADF Series power source adds the following functions and features:

- Digital Inputs for trigger functions and control.
- Digital Outputs for status indication and relay control.
- Analog Inputs for control of power source parameters.
- Analog Outputs for measurement monitoring.
- A 12Vdc power output to power external circuits.
- RS232 Serial Interface.
- Optional embedded GPIB Control Interface

The analog, digital and RS232 ports are accessible on a female DB25 connector located on the rear panel of the ADF master unit. This connector is mounted upside down so pin 1 is located in the lower right-hand corner when facing the back of the ADF master unit.

The USB, LAN and optional GPIB connectors are located to the left of the AUX I/O connector on the rear panel when facing the power source from behind.



Figure 7-1: Rear Panel AUX I/O DB25 Connector Location

7.3.2 DB25 Connector AUX I/O Pin locations

The pin locations for the various I/O signals on the DB25 connectors are shown in Figure 7-2 below. Note that the connector is installed “Upside” down due to mounting constraints.

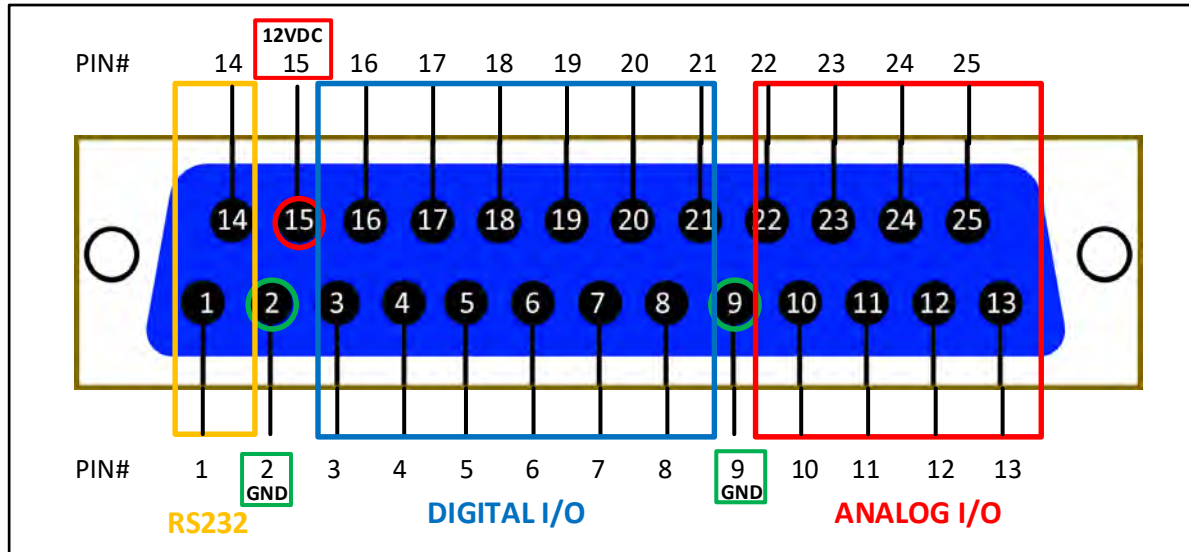


Figure 7-2: DB25 Connector AUX I/O Pin Locations

Functional grouping of pins by I/O function is done as shown in the figure above. The left hand side groups all **Analog I/O** signals on top on bottom row. The middle section is reserved for all **Digital I/O** pins. The **RS232** Transmit (Tx) and Receive (Rx) signals are located on the far right.

7.3.3 I/O Signal Table by pin number

Pin assignments in order of pin number are shown in the table below.

Pin #	Name	Primary Function	Alternate Use / Comment	Type	Direction
1	RxD	RS232 Receive Data (Rx)		RS232	Input
2	GND	Chassis Ground		Ground	n/a
3	DI1	General Purpose Digital Input #1	Programmable	Digital	Input
4	DI2	General Purpose Digital Input #2	Programmable	Digital	Input
5	DI3	General Purpose Digital Input #3	Programmable	Digital	Input
6	RI	Remote Inhibit	Short to +12Vdc Pin 15	Digital	Input
7	TT	Transient Trigger Input		Digital	Input
8	Sync In	Phase Sync Input		Digital	Input
9	GND	Chassis Ground		Ground	n/a
10	AI1	Analog Input – Volt RMS Phase A	Any set point	Analog	Input
11	AI2	Analog Input – Volt RMS Phase B	Any set point	Analog	Input
12	AI3	Analog Input – Volt RMS Phase C	Any set point	Analog	Input
13	AI4	Analog Input – Current Limit RMS all phases	Any set point	Analog	Input
14	TxD	RS232 Transmit Data (Tx)		RS232	Output
15	12V	Output, 12Vdc	0.5 A max, current protected	Power	Output
16	DO3 /RC1	Relay Control #1 – FORM	Programmable, Open Collector, Current protected	Digital	Output
17	DO4 /RC2	Relay Control #2 - TRANSFORMER	Programmable, Open Collector, Current protected	Digital	Output
18	FS	Trigger Output / Function Strobe		Digital	Output
19	Sync Out	Phase Sync Output		Digital	Output
20	DO1	General Purpose Digital Output #1	Programmable	Digital	Output
21	DO2	General Purpose Digital Output #2	Programmable	Digital	Output
22	AO1	Analog output #1 – Volt RMS Measurements Phase A	Any other measurement	Analog	Output
23	AO2	Analog output #2 – Volt RMS Measurements Phase B	Any other measurement	Analog	Output
24	AO3	Analog output #3 – Volt RMS Measurements Phase C	Any other measurement	Analog	Output
25	AO4	Analog output #4 – Total Power (all phases combined)	Any other measurement	Analog	Output

Table 7-1: Auxiliary I/O DB25 Connector Pin numbers and Signals by DB25 pin number

7.3.4 I/O Signal Table by Function

Pin assignments in order of pin number are shown in the table below.

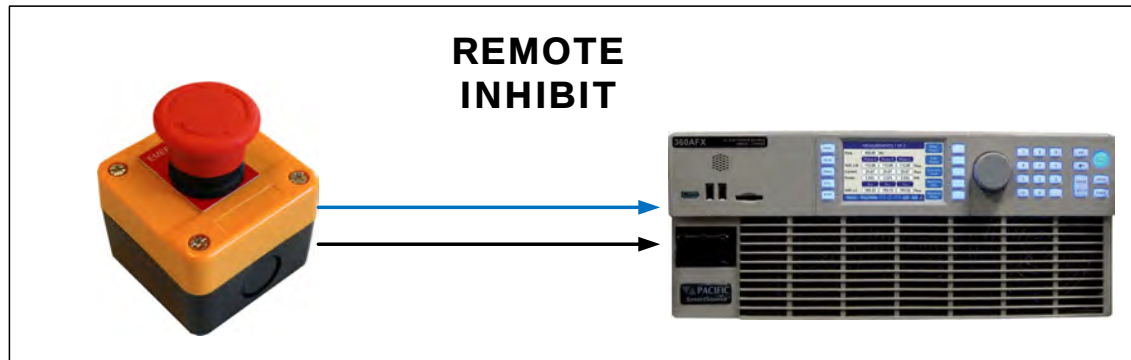
Pin #	Name	Primary Function	Alternate Use / Comment	Type	Direction
10	AI1	Analog Input – Volt RMS Phase A	Any set point	Analog	Input
11	AI2	Analog Input – Volt RMS Phase B	Any set point	Analog	Input
12	AI3	Analog Input – Volt RMS Phase C	Any set point	Analog	Input
13	AI4	Analog Input – Current Limit RMS all phases	Any set point	Analog	Input
22	AO1	Analog output #1 – Volt RMS Measurements Phase A	Any other measurement	Analog	Output
23	AO2	Analog output #2 – Volt RMS Measurements Phase B	Any other measurement	Analog	Output
24	AO3	Analog output #3 – Volt RMS Measurements Phase C	Any other measurement	Analog	Output
25	AO4	Analog output #4 – Total Power (all phases combined)	Any other measurement	Analog	Output
3	DI1	General Purpose Digital Input #1	Programmable	Digital	Input
4	DI2	General Purpose Digital Input #2	Programmable	Digital	Input
5	DI3	General Purpose Digital Input #3	Programmable	Digital	Input
20	DO1	General Purpose Digital Output #1	Programmable	Digital	Output
21	DO2	General Purpose Digital Output #2	Programmable	Digital	Output
18	FS	Trigger Output / Function Strobe		Digital	Output
16	DO3 /RC1	Relay Control #1 – FORM	Programmable, Open Collector, Current protected	Digital	Output
17	DO4 /RC2	Relay Control #2 - TRANSFORMER	Programmable, Open Collector, Current protected	Digital	Output
6	RI	Remote Inhibit	Short to +12Vdc Pin 15	Digital	Input
8	Sync In	Phase Sync Input		Digital	Input
19	Sync Out	Phase Sync Output		Digital	Output
7	TT	Transient Trigger Input		Digital	Input
15	12V	Output, 12Vdc	0.5 A max, current protected	Power	Output
2	GND	Chassis Ground		Ground	n/a
9	GND	Chassis Ground		Ground	n/a
1	RxD	RS232 Receive Data (Rx)		RS232	Input
14	TxD	RS232 Transmit Data (Tx)		RS232	Output

Table 7-2: Auxiliary I/O DB25 Connector Pin numbers and Signals by Signal Name

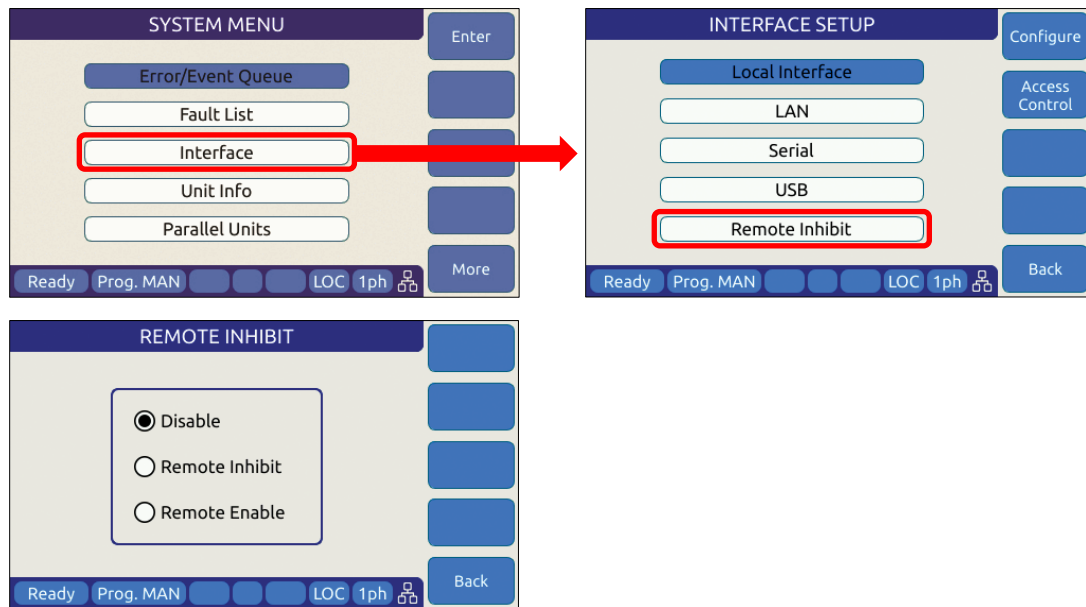
7.3.5 Dedicated Function Digital Inputs

- Remote Inhibit
- External Trigger Input
- External Phase Sync Input

7.3.5.1 Remote Inhibit



The mode can be selected from the SYST (SYSTEM) menu screen using the Interfaces, Remote Inhibit selection as shown below.



There are three modes of operation for this input:

1. **Disable mode:** In this mode, the Remote Inhibit inputs are not active so this function is turned off. No short between the RI pins is required to enable the output in this mode.

2. **Remote Inhibit mode:** The Remote Input pins 6 and 15 on the rear panel DB25 AUX I/O have to be shorted for the output to be enabled from the front panel or remote command. This is a necessary but not a sufficient condition to enable the output. If the output is enabled and the remote inhibit connection is open, a fault is generated. This mode is recommended for interlock safety applications such safety cages and test fixture interlocks.

Command: SYSTem:DIO:REMOte:INHibit 0 | 1

3. **Remote Enable mode:** The output can be enabled by shorting pins 6 & 15 on the rear panel DB25 AUX I/O connector, regardless of the output enable command/button. It is a sufficient condition to enable the output.

Command: SYSTem:DIO:REMOte:ENABle 0 | 1

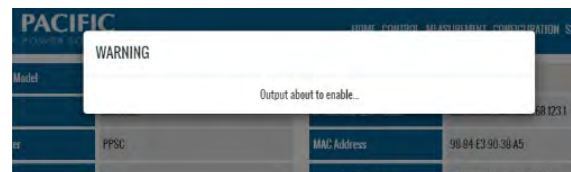
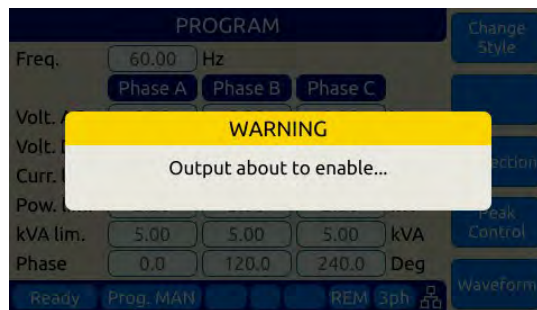
This function can be enabled or disabled at power on using

Command⁶: SYSTem:DIO:REMOte:ENABle:AUTO 0 | 1 (default = 1)

When AUTO is set to 1, output is enabled immediately after power up if the remote enable input is 1. When Auto is set to 0, output is enabled only when a 0 to 1 input level change is detected and disabled on a 1 to 0 level change.

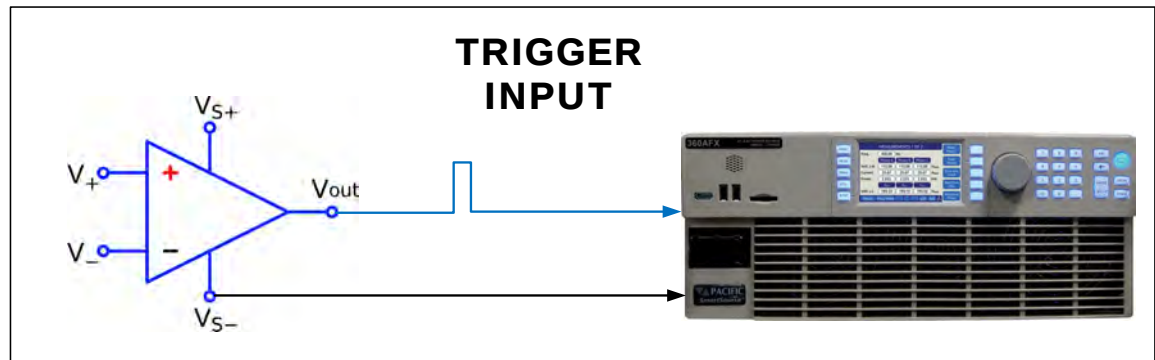
Both settings can be changed by the user. Sending a sanitize command returns both back to 1 and 0 respectively.

Countdown beeping warning before enabling output, like a time boom. The warning pop-ups messages below are shown on LCD and webpage before enabling the output.



4. Transient Trigger Input

⁶ This command is supported with firmware revision 2.2.48 or higher only.



The external trigger input can be programmed to trigger the start of a transient program. This allows the power source output sequence to be initialized by an external sync signal.

In order to use the trigger input, the mode has to be active (from any of the graphical interfaces or using the SCPI command `PROG:TRANsient:TRIGger:INput`), and the transient program has to be executed first. The transient will wait and start execution when a rising edge is detected on this digital input.

The graphical interfaces (front panel and webpage) will show the state “Running” but with a progress of 0% until the transient program is actually started.

The following specifications apply to the external trigger input:

Input Voltage	Logic Low $V_{in} < 0.4 \text{ V}$ Logic High $V_{in} > 2.0 \text{ V}$
Impedance	10 k Ω
Edge Triggered	Rising edge

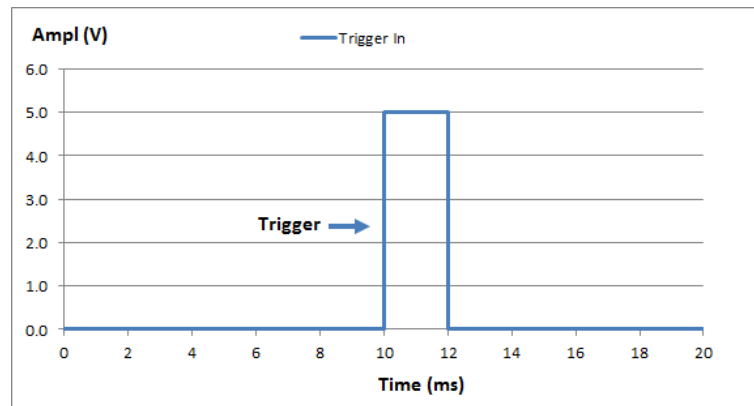
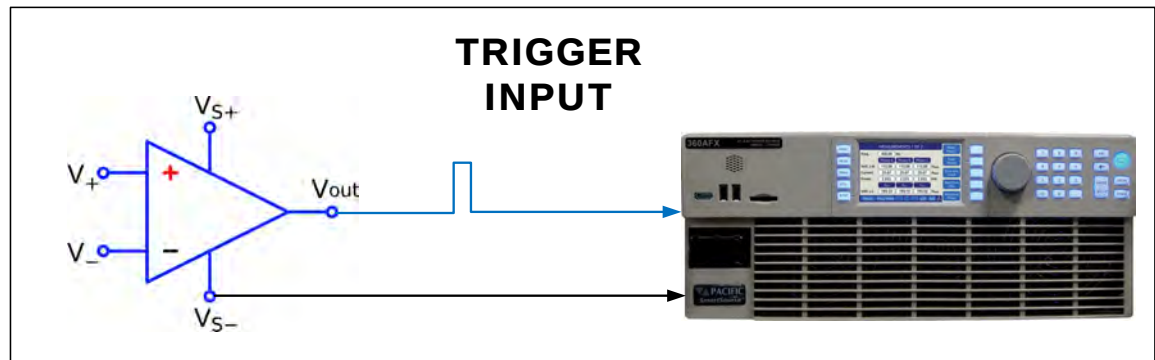


Figure 7-3: External Trigger Input Timing

7.3.6 Transient Trigger Input



The external trigger input can be programmed to trigger the start of a transient program. This allows the power source output sequence to be initialized by an external sync signal.

In order to use the trigger input, the mode has to be active (from any of the graphical interfaces or using the SCPI command `PROgram:TRANsient:TRIGger:INput`), and the transient program has to be executed first. The transient will wait and start execution when a rising edge is detected on this digital input.

The graphical interfaces (front panel and webpage) will show the state “Running” but with a progress of 0% until the transient program is actually started.

The following specifications apply to the external trigger input:

Input Voltage	Logic Low $V_{in} < 0.4 \text{ V}$ Logic High $V_{in} > 2.0 \text{ V}$
Impedance	10 k Ω
Edge Triggered	Rising edge

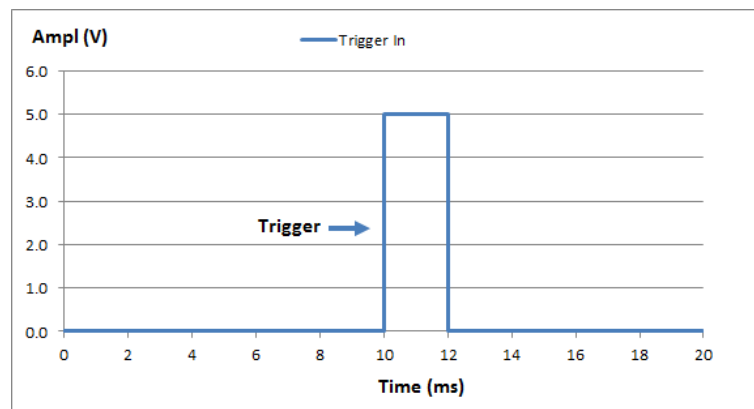
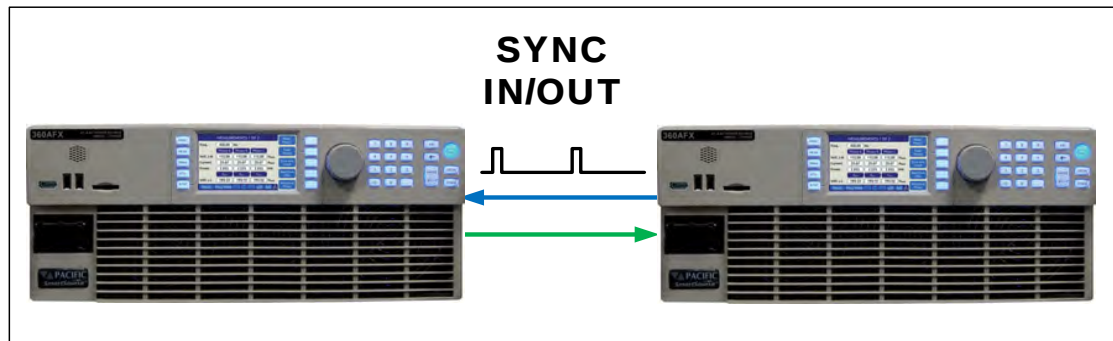


Figure 7-4: External Trigger Input Timing

7.3.7 External or Line Sync Input



The phase sync input can be used to synchronize in frequency and phase the internal waveform generation of the ADF to an external sync reference or to the AC mains. The reference must be within the specified frequency range of the power source and zero phase offset calibration for phase A may be required to compensate for any phase shifts. Note that Phase B and C are still phase related to A as programmed by B and C phase angles.

7.3.7.1 Principle of Operation

In AC Line sync mode, the ADF uses the L-L AC input voltage to generate the internal sync signal. The goal of the phase sync is to provide precise frequency synchronization, and consistent phase at a given operating point, but the phase shift between AC input and AC output is not automatically zero. A phase adjustment for Phase A must be made by the user to time-align the power source's phase A output voltage to the L1 leg of the actual three phase Grid voltage powering the ADF.

A couple of factors affect the phase shift:

- The internal AC sync circuits have some inherent delays. If more accuracy is required then the TTL input mode can be used instead using an external line sync circuit.
- Even if TTL input is used, there can be a phase shift that depends on the output load because of the finite bandwidth of the output inverter stages. This is particularly visible at higher frequencies. At 50Hz or 60Hz, the phase shift will be pretty small.

Note: When the sync input is enabled, the ADF frequency set point **must** be set to a value similar to the external sync signal. This minimizes the synchronization time and improves the stability of the generated frequency.

After the sync input is activated, or the external signal frequency/phase is changed, the Sync circuit's Phase Lock Loop (PLL) requires a short time to "lock" to the external source. The ADF reports the status of the PLL in the external interfaces (front panel and webpage) by showing a "Synced" or "Unsynced" message in the status bars. (See section 0 for details).

The status can also be queried with the SCPI command "SOURce:SYNChronize:STATe?".

The sync circuit is able to synchronize to any signal with a frequency if $F_{\text{SETPOINT}} \pm F_{\text{RANGE}}$, where F_{SETPOINT} is the normal frequency set point and F_{RANGE} is a configurable value (default is 10Hz)

The following specifications apply to the phase sync input at the DB25 port:

Input Voltage	Logic Low Vin < 0.4 V Log High Vin > 2.0 V
Impedance	10 kΩ
Frequency Range	15 Hz – 1200 Hz
Edge Triggered	Rising edge

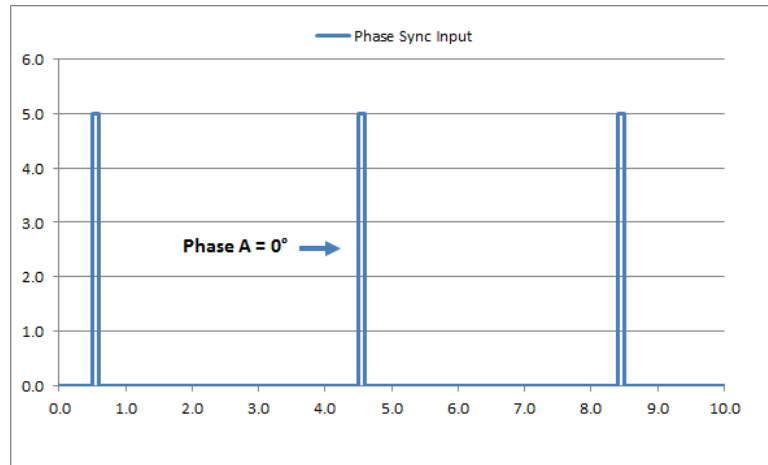


Figure 7-5: External Sync Input Pulses

The SYNC setting screens are available under INTERFACXE SETUP -> Digital & Analog I/Os -> External sync in the SYSTEM menu. This screen set/clears both SYNC output (Check box at the bottom) and SYNC input enable, source, phase shift, sync speed and sync frequency width (Range).

EXTERNAL SYNC

Status	-	Apply All
External sync	Disabled	Cancel All
Sync source	AC Line	Enable
Phase shift	0.00 Deg	[]
Speed	2.50 x	[]
Range	10.00 Hz	[]
☒ Enable sync output signal		

Fault
Prog. MAN
E&E
S/M
LOC
3ph
[Icon]
Back

7.3.7.2 SYNC Status Display

A “Synced” status field will be displayed in **Green** in the lower left corner of the LCD display. This field will toggle with the regular “Ready/Enabled/Fault” status field also shown in this location. The “Synced” status will be shown every 3 seconds for 1 second in place of the “Ready/Enabled/Fault” field. When the PLL is not locked to the external source, the unit will display an “Unsynced” status in **Orange**.

It is not recommended to enable the unit when it has not locked or synchronized to the external source because the frequency may be unknown.

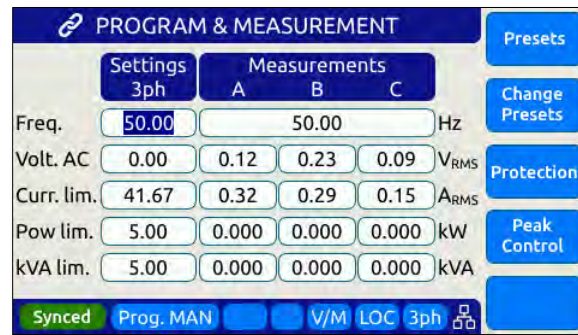


Figure 7-6: External Sync Input Sync Status Indication



Figure 7-7: External Sync Input Sync Lost Status Indication

7.3.7.3 Sync Operation Settings

The ADF allows precise configuration of the synchronization parameters to optimize performance for each application. The parameters are:

- 1 **Phase shift:** Defines a fixed phase shift between phase A waveform generation and the external sync source. Used to calibrate any phase difference between the sync signal and the power source output on phase A.
Command: SOURce:SYNChronize:PHASEshift
- 2 **Speed:** Allows accelerating the speed of the internal synchronization engine (PLL) in case the external sync source is not constant and presents periodic or continuous changes. A slower speed improves the stability of the waveform frequency, so it is

recommended to use the smallest possible speed values.

Command: SOURce:SYNChronize:SPEed

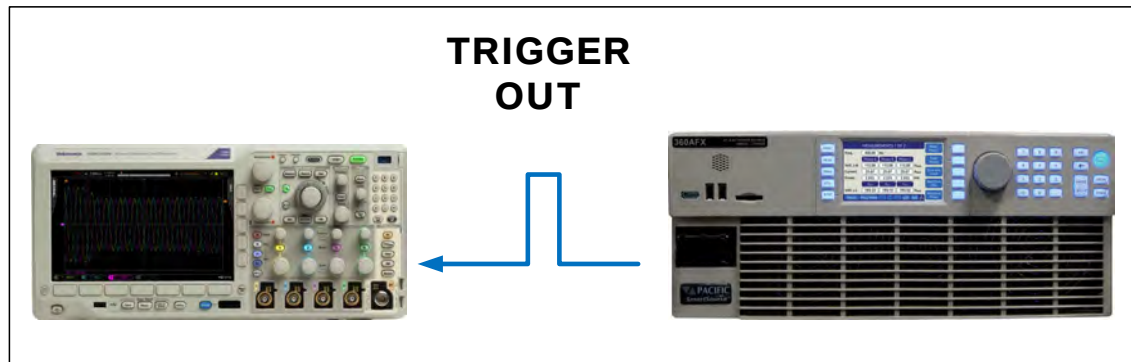
- 3 **Range:** Allows configuration of how much the synchronization engine is able to deviate from the ADF programmed frequency. This helps to keep the waveform frequency under control, even if the external source is not present all the time. The synchronization engine is limited to frequencies of FSETPOINT +/- FRANGE.

Command: SOURce:SYNChronize:RANGe

7.3.8 Digital Output control signals

- External Relay Control #1 - FORM
- External Relay Control #2 - TRANSFORMER
- Trigger Output / Function Strobe
- Phase Sync Output

7.3.8.1 Function Strobe / Trigger Out



The external trigger output can be programmed to generate an output pulse on the following events:

- a. The start of a transient program (Transient Trigger)
- b. Output Replay State Change
- c. Any parameter change. Parameter changes that generate an output function strobe pulse are:
 - i. Voltage on any phase
 - ii. Frequency
 - iii. Waveform on any phase
 - iv. Phase angle

The mode can be set from the front panel or by using the following SCPI commands:

Transient start mode: SYSTEM:DIO:STROBE:TRANSient 0/1
 PROGRAM:TRANSient:TRIGger:OUTput 0/1 (alias)

Output Relay mode: SYSTEM:DIO:STROBE:OUTPutstate 0/1

Program Change mode: SYSTEM:DIO:STROBE:SOURce 0/1

The following specifications apply to the external trigger output:

Output Voltage @ 0.4 mA	Logic Low Vout < 0.4 V	
	Log High Vout > 4.6 V	
Max. Current	± 10 mA	
Output Impedance	100 Ω	
Pulse Width	190 us ± 10 us	For Transient Trigger mode
	2.0 msec ± 10 μs	For OUTPutstate & SOURce modes

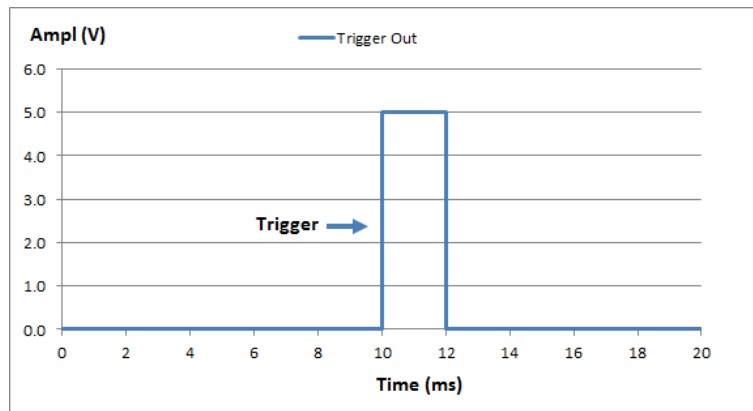


Figure 7-8: Transient Trigger Output Pulse

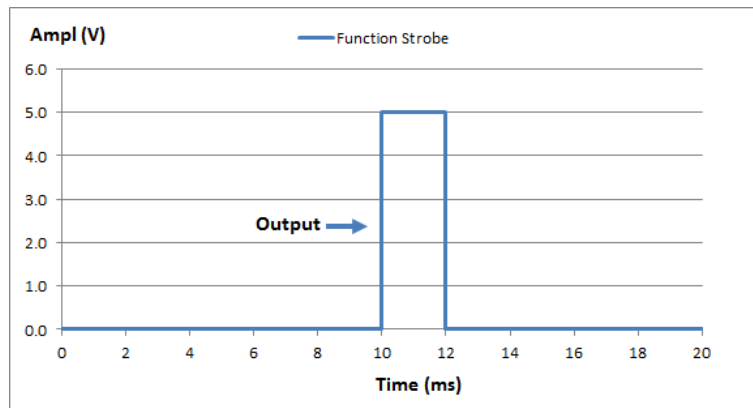
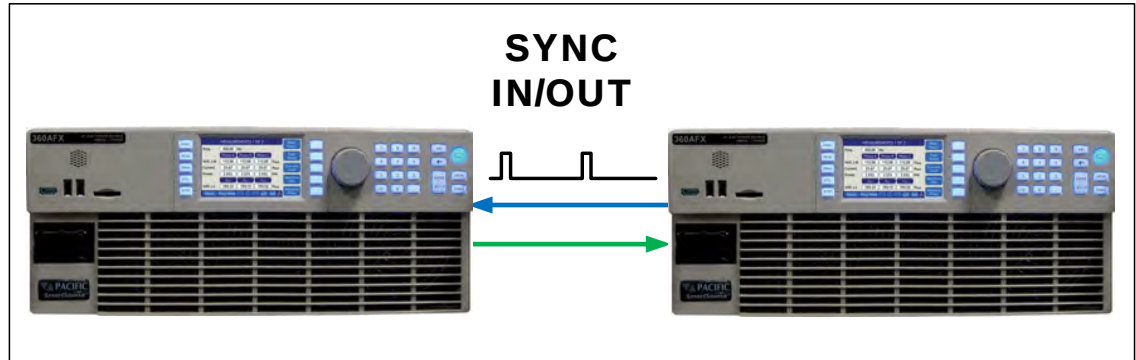


Figure 7-9: Function Strobe Output Pulse

7.3.8.2 Phase Sync Output



The phase sync output signal can be programmed to generate an output pulse at each zero crossing of the phase A voltage. This indicates the 0° phase angle output on Phase A.

The mode can be set from the front panel or by using the following SCPI commands:

The following specifications apply to the external trigger output:

Output Voltage @ 0.4 mA	Logic Low Vout < 0.4 V
	Logic High Vout > 4.6 V
Max. Current	± 10 mA
Output Impedance	100 Ω
Pulse Width	100 us ± 10 us

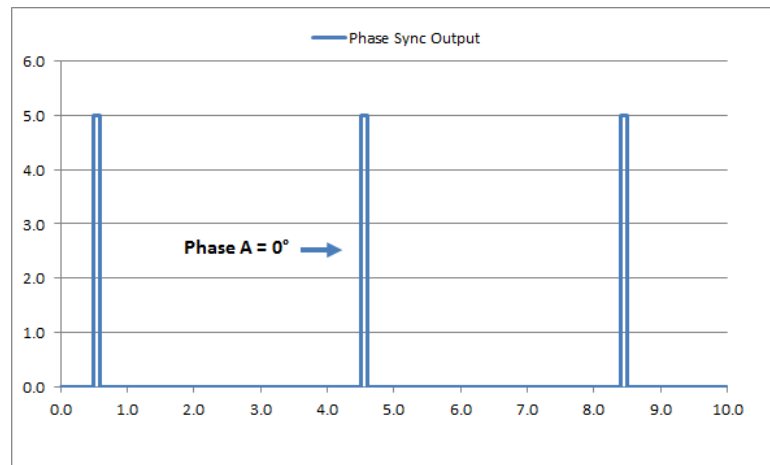
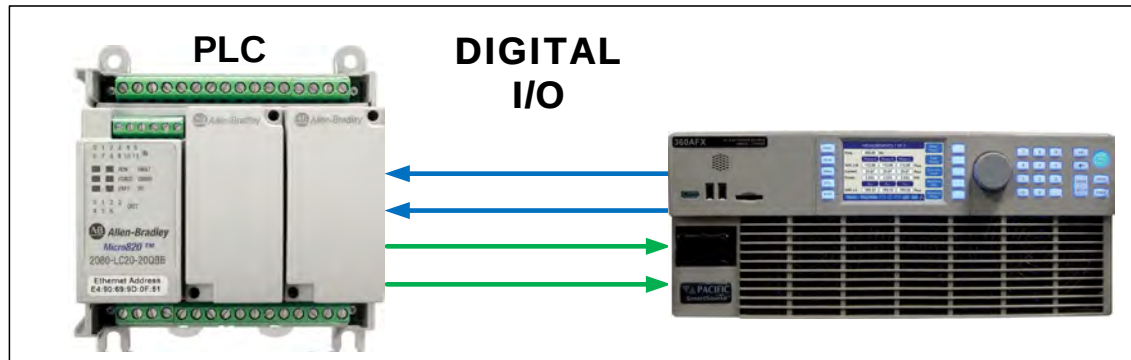


Figure 7-10: Phase A Zero Phase Sync Output Pulse

7.3.9 User Programmable Digital signals

Available user defined digital input and outputs are provided as part of the I/O feature. These signals may be assigned different purposes under software control.



User Programmable Digital Input signals functions are:

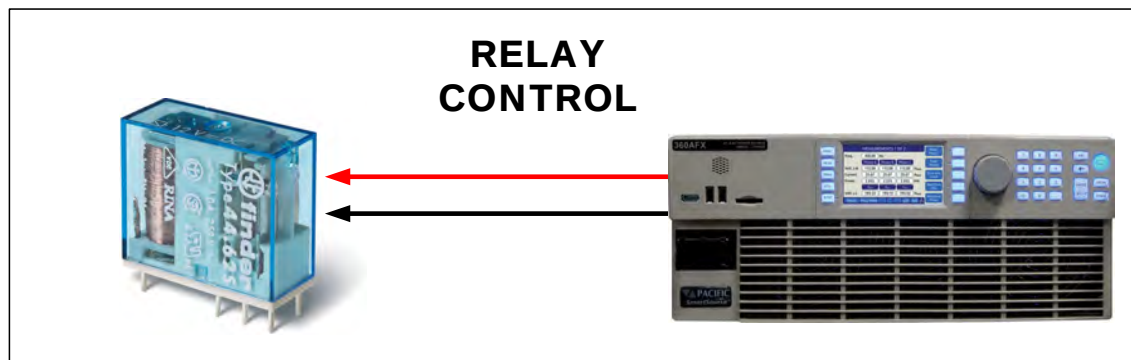
- DIO:INput1 - Digital Input #1
- DIO:INput2 - Digital Input #2
- DIO:INput3 - Digital Input #3

User Programmable Digital Output control signals are:

- DIO:OUTput1 - Digital Output – TTL level
- DIO:OUTput2 - Digital Output – TTL level
- DIO:OUTput3 - Digital Output – Open drain
- DIO:OUTput4 - Digital Output – Open drain

Digital outputs 3 and 4 are open drain with internal +5Vdc pull-ups.

7.3.9.1 Relay Control Outputs



The external relay control output signals DO3 and DO4 can be used to control external relays. These control lines are user programmable for difference functions such as FORM relay control and Transformer Option control.

These relays are used to either short all outputs together for single-phase output mode or to connect and disconnect and external transformer for a higher voltage AC output range.

- Relay signal #3 is normally used for the FORM (Mode Change) Relay option on ADF cabinet systems.
- Relay signal #4 is normally used for the Transformer Option.
- A 12V dc output is provided as well to drive a small signal relay to operate a large contactor.

7.3.9.2 Digital User Inputs

The digital inputs allow any action to be executed at the rising and/or falling edge of the signal, by simply assigning a SCPI command for execution to that event.

For example, a digital input can be configured to enable the output at the rising edge and disable it at the falling edge of the signal. Alternatively, it can be configured to change any set point and either of those 2 events.

A total of three digital inputs are available. These following input characteristics can be programmed for each digital input (1, 2 and 3):

- **Command** to execute (a SCPI command string) at each edge. Rising and falling edges can have different commands.
- **Filter** Setting, to reduce sensitivity to short pulses that can be caused by electrical noise or some mechanical switches.

See SCPI command section 8.10.1.3 for commands that configure and read digital inputs.

7.3.9.3 Digital User Outputs

There are four programmable digital outputs (1 to 4), which can be configured to change state based on different conditions:

- 1=ON, 0=OFF it is used as general-purpose digital output, with the value set with a SCPI command.
- OUTPUT_STATE indicates output enabled (1) or disabled (0).
- FORM indicates single (1) or split/three (0).
- FAULT indicates fault (1) or no fault (0).
- TRANSIENT indicates when a transient is running/paused/stepping (1) or stopped (0).
- PROGRAM indicates when a program is in execution at steady state level (1) or manual mode (0).
- REMOTE indicates remote (1) or local (0).
- XFMR_COUPLING indicates direct (0) or transformer (1) coupling. This output is relevant only when an output transformer option is installed and configured.

Note: Each output can be also configured to invert its logic.

User defined digital inputs can be queried using the SYSTEM:DIO:OUTput# command.

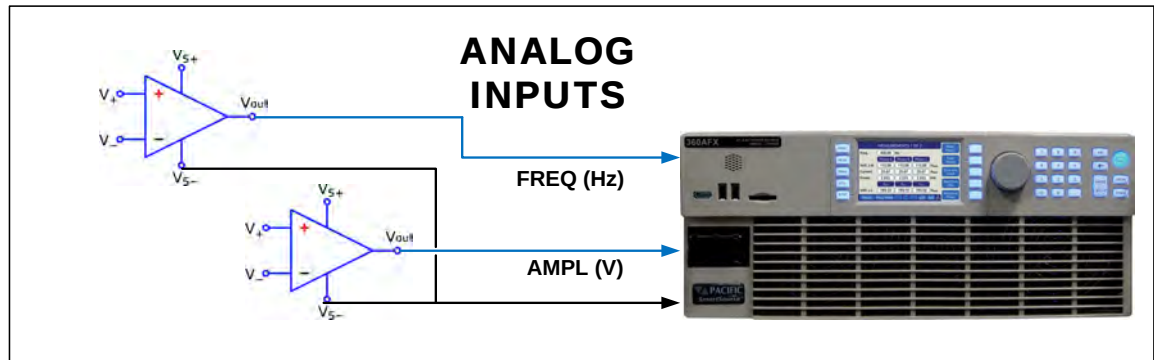
Digital outputs 1 and 2 are TTL level signals (0 to 5V), and digital outputs 3 and 4 are open-drain type outputs (with an internal pull-up) that can be used to drive external relays. Each open-drain output has a current protection of 0.5A and internal clamping diode prepared to drive a relay coil.

See section 8.10.1.4 for commands that configure and read digital outputs.

7.3.10 Analog I/O Descriptions

Both analog inputs and outputs are available on the AUX I/O feature. Analog inputs are used to change output parameters such as voltage or frequency. Analog outputs are provided to allow monitoring the ADF measurements using external equipment.

7.3.10.1 Analog Inputs



There are 4 analog inputs that accept DC signals up to 10Vdc and may be used to program the ADF output parameters such as voltage, frequency, current and power limits.

These inputs are sampled 20 times per second so updates of the assigned parameters occur at this rate. The full-scale range of the analog inputs can be programmed to be 5V, 10V or any value between 1 and 10V.

Note: Once enabled, make sure the input is not left floating or a small offset of about 2 to 3 % of full scale may be present affecting the programmed parameter. For example, when programmed to control AC voltage, no input on the analog input assigned will result in an output voltage of about 0.02 to $0.03 \times 300 = 6$ to 9 Vac.

The full-scale value for voltage programming depends on the selected operating mode. A 10V input represents 300Vac RMS.

For frequency programming, 0V represents 15Hz while 10V represents 1200Hz.

These analog inputs are all disabled by default. In order to use this feature, each analog input has to be assigned to an ADF parameter and phase, for example AC voltage of phase A.

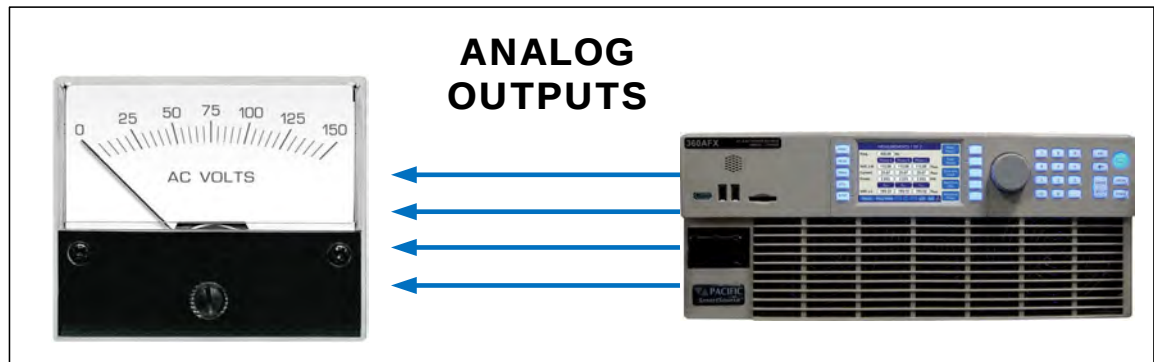
7.3.10.2 Programming Analog Inputs

The range of the analog inputs can be changed with two parameters for each input, gain and offset. For example if an input is assigned to AC voltage programming the default gain is 300V and the offset is 0V. This means that 10V at the analog input port represents a programmed voltage of 300Vrms and 0V represents 0Vrms.

Different gain and offset combinations can be used to customize the range of the analog programming input, being the “gain” the programmed value that represents the maximum input at the analog port, and “offset” the value at 0V. For example, a gain of 150V and offset of 50V produce an output of 50V to 200V for analog programming signals of 0V to 10V.

Note: Different ADF parameters have different units (Volts, Amperes, Watts, Hertz, etc.), so when an analog input parameter is changed, the gain and offset are reset to default values (zero for offset and max full-scale values for gain).

7.3.10.3 Analog Outputs



Analog outputs are available to monitor output values for voltage, current or power using external measurement equipment. A total of four analog outputs are provided, with an output voltage range of 0 to 5V. Output scaling is fully programmable for each measurement with an offset and gain.

For example, for RMS voltage measurements the default gain is 300V and offset is 0V. This means that measurements of 0 to 300V generate monitoring voltages of 0 to 5V. An offset of 50V and a gain of 150V will mean that measurements in the range of 50 to 200V will be mapped to the analog output range of 0 to 5V.

Analog outputs are available to monitor output values for voltage, current or power using external measurement equipment. A total of four analog outputs are provided. Output scaling is from 0 to 10V for zero to full scale.

Pin #	Signal	Programs
22	AO1	Volt RMS Measurements Phase A
23	AO2	Volt RMS Measurements Phase B
24	AO3	Volt RMS Measurements Phase C
25	AO4	Total Power (all phases combined)

Table 7-3: Default Analog Output Functions

7.3.11 12 DC Power Supply

A pin in the DB25 port provides a current limited, regulated 12V supply. The maximum current capability is 0.5Adc.

There are no menus or commands associated with this output, as it is always active.

7.3.12 RS232 Description

The Tx and Rx signal on the AUX I/O connector may be used to connect to a serial port. Only Xon/Xoff handshake mode is supported on this RS232 port. For most situations, it is recommended to use the USB Device port for remote serial control applications.

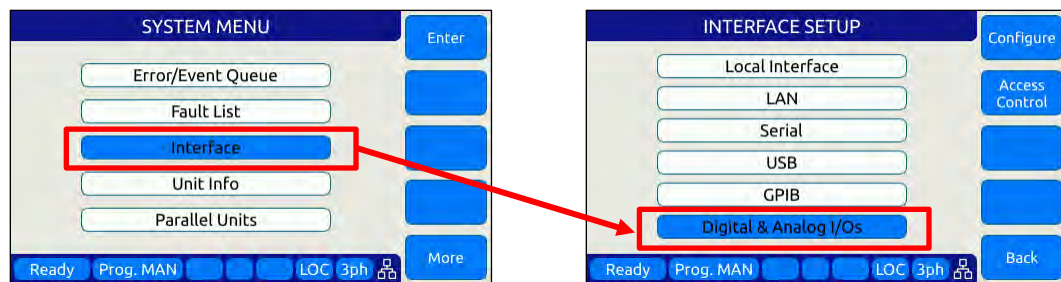
7.3.13 Front Panel Operation of AUX I/O Functions

The auxiliary I/O functions can be configured and programmed from the front panel using the SYSTEM menu (Press SYST key to left of the LCD screen). This section describes the available AUX I/O program screens and parameters for each function.

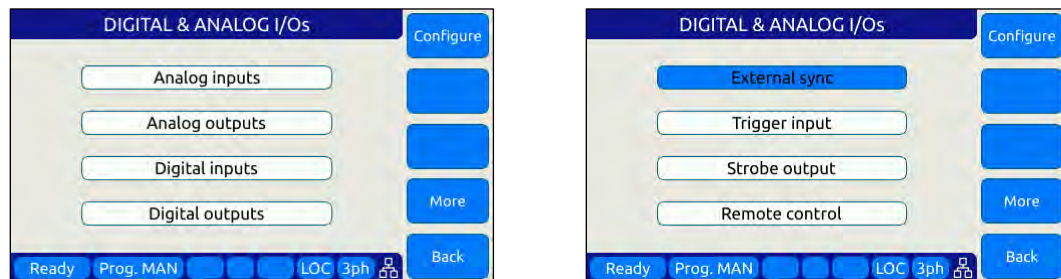
7.3.13.1 Accessing AUX I/O Screens.

From the SYSTEM MENU, scroll to the INTERFACE entry and press the shuttle or ENTER key as indicated below. If the Interface selection is not visible, press the “More” soft key to display the second System Menu screen.

Next, scroll to the “Digital & Analog I/Os” entry at the bottom of the INTERFACE SETUP screen.



This will display a list of available Auxiliary I/O functions and features. To display the second of two DIGITAL & ANALOG I/Os screens, use the “More” soft key.



To select the desired function, use the knob to scroll up or down. Once selected, press the Shuttle knob or ENTER key to open the relevant I/O control screen.

Each screen is covered in the following sections in more detail.

7.3.13.2 Analog Inputs

Analog inputs allow parameters settings to be controlled using DC input signals. The parameter to be controller by each of four available analog inputs can be assigned from the front panel.

Available settings or read-outs and parameter ranges are:

- CHANNEL [1 | 2 | 3 | 4]
- INPUT VOLTAGE Displays read back voltage
- COMMAND Select command from dropdown list or OFF for none. See table below
- RANGE 0.0000 to 10.000 V
- GAIN Gain
- OFFSET Offset value

The **Command** parameter allows the user to assign the selected analog input to the parameter that will be controlled by it. The list of available setting commands for these inputs is shown below.

Analog Input Command Values					
VOLT:AC	n/a	CURR:LIM	FREQ	KVA:LIM	POW:LIM
VOLT:AC1	n/a	CURR:LIM1	PHAS2	KVA:LIM1	POW:LIM1
VOLT:AC2	n/a	CURR:LIM2	PHAS3	KVA:LIM2	POW:LIM2
VOLT:AC3	n/a	CURR:LIM3	OFF	KVA:LIM3	POW:LIM3

Table 7-4: AUX I/O Analog Input assignable Commands

The Gain and Offset parameters can be used to scale and shift the input value to the desired range for min. and max. output.

7.3.13.3 Analog Outputs

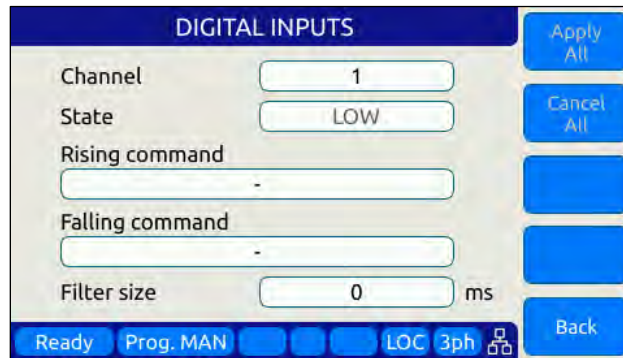
ANALOG OUTPUTS		Apply All
Channel	1	Cancel All
Output Voltage	0.00 V	
Measurement	None	
Range	5.000 V	
Gain	5.00000 V	
Offset	0.000000 V	
Ready Prog. MAN LOC 3ph		Back

Analog outputs allow external equipment to monitor power source output values using an analog DC output signal. The assignment of measurement functions to each of four available outputs can be configured from the front panel.

Available settings are:

- CHANNEL [1 | 2 | 3 | 4]
- OUTPUT VOLTAGE Output setting
- MEASUREMENT Select measurement to be assigned to output
- RANGE 0.0000 to 5.000 V
- GAIN 0.000 to 1000
- OFFSET – 1000 to +1000

7.3.13.4 Digital Inputs

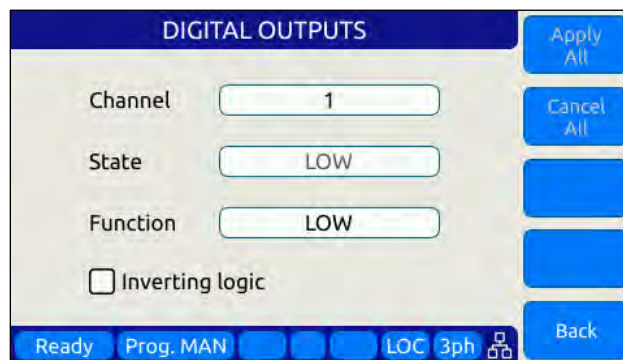


Digital Inputs allow external equipment such as PLCs. to control the power source operation. The assignment functions to each available input can be configured from the front panel.

Available settings are:

- CHANNEL [1 | 2 | 3]
- STATE Displays input state
- RISING CMD Set command string to execute on rising edge
- FALLING CMD Set command string to execute on falling edge
- FILTER SIZE 0 to 10,000,000 msec

7.3.13.5 Digital Outputs



Digital Outputs can be used to trigger or control external equipment. The events assignable to each digital output can be selected using the **Function** field.

Available settings are:

- CHANNEL [1 | 2 | 3 | 4]
- STATE Displays current state
- FUNCTION Assigns state to selected channel. Available states are:
- INV. LOGIC [ON | OFF] Reverses polarity

Events that can be assigned to digital outputs are listed in the table below and can be set using the **Function** field.

Digital Output Assignable Events		
EVENT	Description	Indication
FAULT	Output goes high on fault event	1 = Fault occurred, 0 = No Fault
FORM	Output FORM state	1 = SINGLE, 0 = SPLIT/THREE
HIGH	Fixed Output high	1 = ON
LOW	Fixed Output low	0 = OFF
OUTPUT STATE	Output Relay State	1 = ON (enabled), 0 = OFF (disabled)
PROGRAM	Output goes high when Program is selected	1 = Steady State Program, 0 = Manual mode
REMOTE	Output goes high when unit is in REMOTE state	1 = REMOTE state, 0 = LOCAL state
TRANSIENT	Output goes high when transient is running	1 = Running/Paused/Stepping, 0 = Stopped
XFMR_COUPLING	Indicates output coupling mode	1 = Transformer Coupled, 0 = Direct Coupled

Table 7-5: AUX I/O Digital Output assignable Events or Conditions

7.3.13.6 Polarity Selection for DO3 and DO4 vs DO1 and DO2

The two open drain outputs DO3 and DO4 have internal 1 kΩ pull-up resistors to +5.5V. These outputs can be used as regular digital outputs (open-drain type) if needed. However, the logic will be inverted because a “direct” logic for the relay drive means an “inverted” logic for the open drain output. The FET being on means the relay coil active, but with a pull-up the output goes to low.

DO3 and DO4 use direct logic for the relay drive, which means that if the inverting logic is not active and there is a “1” written to the digital output, an internal FET will be activated causing a “low” in the open drain output.

Each digital output can be configured to have separate inverting logic, so the user can configure these 2 to be inverting and have the normal direct logic when used as open-drain outputs.

7.3.13.7 External Sync

The screenshot shows the 'EXTERNAL SYNC' menu with the following settings:

- Status: -
- External sync: Disabled
- Sync source: Line
- Phase shift: 0.00 Deg
- Speed: 2.50 x
- Range: 10.00 Hz
- ☒ Enable sync output signal

Buttons on the right: Apply All, Cancel All, Enable, Back. Bottom status bar: Ready, Prog. MAN, LOC 3ph.

External sync is used to synchronize the power source's phase A output to an external frequency.

Available settings are:

- STATUS Display SYNC Status
- EXTERNAL SYNC [ON | OFF]
- SYNC SOURCE Select Sync source
- Available sync sources are:
 - External sync input on I/O connector
 - LINE (AC input to power source)
- PHASE SHIFT Offset Phase A angle
- SPEED 1.00 to 10.00
- RANGE 0.10 to 500 Hz
- EXTERNAL SYNC [ON | OFF]

7.3.13.8 Trigger Input

The screenshot shows the 'TRIGGER INPUT' menu with the following settings:

- Status: Disabled
- Immediate: Disabled
- Autorun: Disabled

Buttons on the right: Back. Bottom status bar: Ready, Prog. MAN, LOC 3ph.

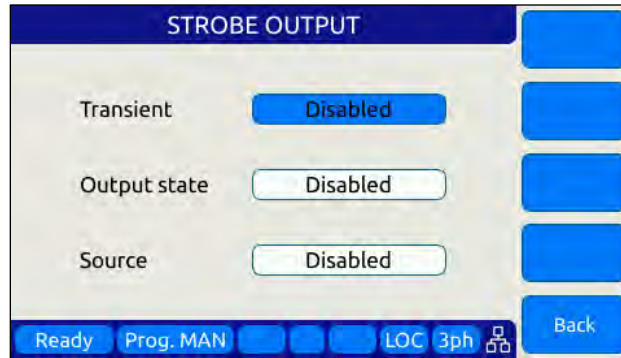
The External Trigger Input can be used to synchronize the power source's transient execution to external equipment. This

Available settings are:

- STATUS [ON | OFF] Enabled or disabled

- IMMEDIATE [ON | OFF] Ignore phase update setting if ON
- AUTORUN [ON | OFF] No RUN command required if ON

7.3.13.9 Strobe Output

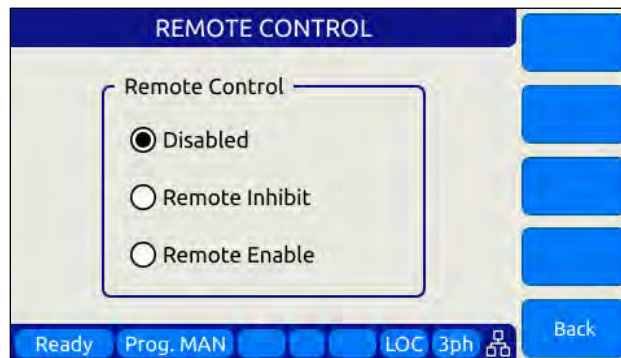


The Strobe Output is used to synchronize or trigger external equipment to an event occurring on the AC power source.

Available settings are:

- TRANSIENT ON = Strobe output on transient start
- OUTPUT STATE ON = Strobe output on relay close
- SOURCE ON = Strobe output on any program parameter change

7.3.13.10 Remote Control



The remote control input is used to control operation of the output relay.

Available settings are:

- DISABLED No remote output control
- REMOTE INHIBIT Contact closure needed to close output relay
- REMOTE ENABLE Contact closure or front panel can control output relay

See Section 6.8.5.7.

7.4 System Interface Bus Connectors



WARNING

SHOCK HAZARD: DO NOT remove safety covers from the two System Interface DVI Connectors.



AVERTISSEMENT

RISQUE DE CHOC: NE PAS retirer les capots de sécurité des deux connecteurs d'interface DVI

The system interface bus is not user-accessible. It consists of two Digital Visual Interface (DVI-I dual link) connectors that are covered by a protective cover. There are no user accessible signals on the system interface bus. It is used for system configuration cabinet systems only.

8 Remote Control Programming

8.1 Overview

If your unit is fitted with a computer interface option then RS232, USB or LAN connector will be present on the rear panel based on the order configuration. The interface allows the power source settings to be configured remotely and measurement data to be retrieved for analysis and test report generation.

The front panel LOCAL key allows the user to restore LOCAL CONTROL unless the Bus controller has sent a LOCAL LOCKOUT (LLO) message. The Bus Controller may restore LOCAL CONTROL by sending a GOTO LOCAL (GTL) message.

8.1.1 Programming Conventions and Notations

The following conventions and notations are used in this section of the manual:

1. COMMANDS are shown in the left hand column in BOLD with NO underline.
2. Command DESCRIPTIONS appear in the right hand column.
3. SCPI is "Standard Commands for Programmable Instruments -1992". Refer to the SCPI 1992 standard for more information. The full standard publication is available from the IVI Foundation at <http://www.ivifoundation.org/>
4. Some SCPI keywords are optional, and are ignored by the device. Optional keywords are enclosed in [] brackets.
5. Lowercase letters of commands shown are also optional.
6. The SCPI standard requires uppercase text in all SCPI commands (start with :), however, the command parser is not case sensitive and will accept commands sent in lower case. It is recommended that programming formats follow the SCPI standard.
7. Some SCPI commands have query command counterparts as noted. A query command consists of the command with a question mark (?) appended at the end. Parameters cannot be sent with a query. IEEE-488.2 commands do not have query counterparts unless explicitly shown with a question mark appended.
8. IEEE488.2 common commands start with an asterisk (*) and are not case sensitive.
9. All required Functional Elements for devices are implemented.
10. All numerical values are ASCII encoded decimal strings consisting of 1 or more ASCII digits. 8 and 16 bit register values are binary weighted values represented by an ASCII string of 1 or more decimal digits. One exception, the Serial Poll byte, is an 8 bit hexadecimal byte.
11. Multiple Commands and Queries may be sent in one Program Message but each must be separated by a semicolon (;). The term 'Program Message' refers to one or more

commands and/or queries sent to the controller as one continuous string and is not to be confused with Stored Programs (1-99) within the controller.

12. Multiple data parameter names and values must be separated by commas.
 13. Voltage and Waveform parameter names without a channel number suffix (1,2,3) may be used to set all 3 channels (phases) simultaneously, as an alternative to setting each separately to the same value.
 14. Multiple keyword messages may be sent without duplicating the first level SCPI keyword i.e., **SOURce**).
e.g., **:SOURce:VOLTage1,120; FREQuency,60**
A keyword is a single word beginning with a colon (:).
 15. Program Messages **MUST** be terminated with a LINE FEED (0Ahex, 10dec) or END (EOI) signal. This is referred to as an end-of-string <eos>. A Carriage Return character (0Dhex, 13dec) is converted to a LINE FEED by the power source. Further SCPI commands shall begin with a first level keyword (i.e., **:SOURce:**).
 16. All values shown in angle brackets <> are examples of real values used with commands but labels are sometimes used to indicate a variable which is not known until actual time of use. e.g., <AMPS meter range> might actually be <50>.
Units such as AAC, Hz. or % shown after the angle bracketed value are not to be included inside the value, but are shown as a reference to the units. The angle brackets are not part of the value.
 17. The controller data input buffer is 8k bytes, as is its data output buffer. No program message may exceed this length.
 18. All **:SOURce:** commands also support queries. An alternate method of writing or reading the presently active **:SOURce:FORM**, **COUPLing**, **VOLTage**, **FREQuency**, and **CURRent:LIMit** values is to use **PROGram 0** (see examples). **PROGram 0** contains the **MANUAL MODE** parameters.
- NOTE:** Sending any **:SOURce:** command invokes **MANUAL MODE** and **REMOTE CONTROL**.
19. Command strings may contain spaces.
 20. The controller interface accepts IEEE-488.2 <nr1>, <nr2> and <nr3> numeric formats. Most query responses are <nr1> or <nr2> types. i.e., <nr1>=120, <nr2>=120.0, <nr3>=1.2E+02.
 21. Follow any command (in the same Program Message) with ***OPC** to detect completion of the command or termination of a Transient event. An SRQ occurs when the command or Transient is complete (if ESB bit is set in SRE and OPC bit is set in ESE).
***OPC?** may be used in the same manner.

8.1.2 Command Terminators

Allowable terminator characters are:

Character	ASCII	Dec value	Hex value
Carriage Return	<CR>	13	0x0d
Line Feed	<LF>	10	0x0a

8.2 Remote Control Command Descriptions by Subsystem

This section covers detailed description of the available commands by category. The following command categories are defined.

Command Subsystem	Description
CALIBRATE	These commands perform calibration functions
MEASURE	These commands are used to measure voltage, current, power and any other measurement parameters from the instrument.
OUTPUT	These command control the power source output
PROGRAM	These commands control programmed settings and transient segments
SENSE	These commands control the voltage sense modes
SOURCE	These commands are used to set instrument settings
STATUS	These commands are used to control or query status and error messages.
SYSTEM	These commands are used to control system level setting such as interfaces, special operating modes or other special instrument specific functions.

Table 8-1: Available SCPI Command Subsystems

8.3 Calibration Commands

Calibration commands allow for fully automated calibration of the power source.

Note: It is not recommended for the end user to use these command unless calibration must be automated. Any errors in using these commands could invalidate user calibration data. Pacific Power Source recommends the use of a competent and authorized calibration lab to perform routine calibration.

The following calibration commands are supported. Commands marked “UPC” are provided for backward compatibility with UPC controller based PPS power sources.

8.3.1 ADF Calibration Commands

Command Syntax	CALibrate:COEFFicients:OFFSET:VOLTage
Description	Calibrates output DC voltage offset to lowest possible level.
Parameters	None
Parameter Format	n/a
Example	CAL:OFFSET:VOLT
Command Syntax	CALibrate:COEFFicients:OFFSET:CURREnt
Description	Calibrates output DC current offset to lowest possible level
Parameters	None
Parameter Format	n/a
Example	CAL:OFFSET:CURREnt
Command Syntax	CALibrate:COEFFicients:NOISE:VOLTage
Description	Calibrates output voltage noise to lowest possible level.
Parameters	None
Parameter Format	n/a
Example	n/a
Command Syntax	CALibrate:COEFFicients:NOISE:CURREnt
Description	Calibrates output current noise to lowest possible level.
Parameters	None
Parameter Format	n/a
Example	n/a

Command Syntax	CALibrate:COEFFicients:GAIN:VOLTage[:AC] <cr>
Description	Loads values measured with an external DVM for calibration of AC voltage output and metering. The first 3 values are Voltages measured at the output relay of the power source for each phase. The second set of 3 values are Voltages measured at the external voltage sense points (at the load) for each phase.
Parameters	External reference voltage readings for each phase
Parameter Format	n/a
Example	n/a
Command Syntax	CALibrate:COEFFicients:GAIN:CURREnt[:AC] <cr>
Description	Loads values measured with an external shunt and DVM for calibration of AC current metering. The first 3 values are currents measured at the output of the power source for each phase.
Parameters	External reference current reading
Parameter Format	n/a
Example	n/a
Query Format	No
Returned Data Format	n/a
Query Example	n/a
Command Syntax	CALibrate:RESET
Description	Clears all calibration coefficients. Sending this command resets all calibration factors to defaults. After sending this command, programming and metering remains functional and will still meet spec.
Parameters	None
Parameter Format	n/a
Example	CAL:RESET
Query Format	CALibrate:COEFFicients:ALL?
Description	Returns all eighteen calibration factors as a comma delimited list.
Returned Data Format	<nr1>,...,<nr1>
Query Example	CAL:FACT:ALL? 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Command Syntax	CALibrate:UPDATE
Description	Transfers cal factors from XML Calibration file to NVM. Required only if calibration.xml has been modified. Alternatively, the unit can be power cycled.
Parameters	None
Parameter Format	n/a
Example	n/a

8.3.2 UPC Specific commands.

Following commands are included for UPC compatibility mode only and don't perform any function other than providing query responses for use with legacy software programs.

Query Format	CALibrate:VALue:XFMRRatio?
Query Format	CALibrate:VALue:AMPLIFIERS?
Command Syntax	CALibrate:KFACTORS <k_int_Va, k_int_Vb, k_int_Vc, k_ext_Va, k_ext_Vb, k_ext_Vc, k_la, k_lb, k_lc, k_oscA, k_oscB, k_oscC>
Query Format	CALibrate:KFACTors:ALL?

8.3.3 AUX I/O Interface Calibration Commands

For a list of AUX I/O calibration commands, see Section 8.10.4, "AUX I/O Calibration Command" on page 349.

8.4 Measurement Commands

Measurement commands are typically queries only and return power source measurement data values. This section is broken down into the commands for each measurement parameter.

The following measurement commands are supported.

8.4.1 Voltage Measurement Commands

Query Format	MEASure:VOLTage[:ACDC]#?
Description	Returns the measured RMS voltage for the selected phase #. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:VOLT:ACDC2? 230.0000
Query Format	MEASure:VOLTage:AC#?
Description	Returns the measured RMS voltage for the selected phase #. If no phase number is specified, returns the reading for the last selected phase. This command is equivalent to “MEASure:VOLTage[:ACDC]#?” and is provided for backward compatibility with the UPC controllers.
Returned Data Format	<nr2>
Query Example	MEAS:VOLT:AC3? 230.0000
Query Format	MEASure:VLL#?
Description	Returns the measured RMS Line-to-Line voltage ¹ for the selected phase #. If no phase number is specified, returns the reading for the last selected phase. Phase reference applies as follows: # = 1 V _{AB} , # = 2 V _{AC} , # = 3 V _{BC}
Returned Data Format	
Query Example	MEAS:VLL2? 398.3780

Note 1: Line to Line voltage measurements are calculated based on VLN and phase angles and are valid only for sinusoidal voltage waveforms with low levels of distortion and under balanced three phase load conditions.

Commands available only with Option D:

Query Format	MEASure:VOLTage:DC#?
Description	Returns the measured DC voltage for the selected phase #. If no phase number is specified, returns the reading for all phases.
Returned Data Format	<nr2>
Query Example	MEAS:VOLT:DC1? 2.2500

8.4.2 Frequency Measurement Commands

Query Format	MEASure:FREQuency#?
Description	Returns the fundamental frequency for the selected phase #. If no phase number is specified, returns the reading for the last selected phase. For frequency measurements, the phase reference is irrelevant as all phase are at the same frequency.
Returned Data Format	<nr2>
Query Example	MEAS:FREQ? 50.0000

8.4.3 Current Measurement Commands

Query Format	MEASure:CURRent[:ACDC]#?
Description	Returns the measured RMS current for the selected phase #. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:CURR:ACDC1? 21.1587
Query Format	MEASure:CURRent:PEAK#?
Description	Returns the measured peak current for the selected phase #. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:CURR:PEAK1? 45.5845
Query Format	MEASure:CURRent:CREST#?
Description	Returns the measured current crest factor for the selected phase #. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:CURR:CREST1? 2.1544
Query Format	MEASure:CURRent:AC#?"
Description	Returns the measured RMS current for the selected phase #. If no phase number is specified, returns the reading for the last selected phase. This command is equivalent to "MEASure:CURRent[:ACDC]#?" and is provided for backward compatibility with the UPC controllers.
Returned Data Format	<nr2>
Query Example	MEAS:CURR:AC1? 21.1587

Commands available only with Option D:

Query Format	MEASure:CURRent:DC#?
Description	Returns the measured DC current for the selected phase #. If no phase number is specified, returns the reading for all phases.
Returned Data Format	<nr2>
Query Example	MEAS:CURR:DC1? 0.0000

8.4.4 Power Measurement Commands

Query Format	MEASure:POWer#?
Description	Returns the true power for the selected phase # in kW. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:POWer1? 4.4203

Query Format	MEASure:POWer:MAXimum:HOLD?
Description	Returns the highest total power reading obtained for all phases. The reset this track and hold value, use the MEASure:POWer:RESET command.
Returned Data Format	<nr2>, <nr2>, <nr2>
Query Example	MEAS:POW:MAX:HOLD? 4800.0000, 4780.0000, 4687.0000

Query Format	MEASure:POWer:MINimum:HOLD?
Description	Returns the lowest total power reading obtained for all phases. If this command returns a negative value, then power has been fed back into the power source. For non-regenerative power sources, the ability to absorb energy from the load is very limited and the unit may FAULT. The reset this track and hold value, use the MEASure:POWer:RESET command.
Returned Data Format	<nr2>, <nr2>, <nr2>
Query Example	MEAS:POW:MIN:HOLD? 200.0000, -190.0000, 230.0000

Command Syntax	MEASure:POWer:RESET
Description	Clear the track and hold MINimum and MAXimum power hold readings.
Returned Data Format	<nr2>
Query Example	MEAS:POWer1? 4.4203

Query Format	MEASure:KVA#?
Description	Returns the true apparent for the selected phase # in kVA. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:KVA1? 4.8665
Query Format	MEASure:PF#?
Description	Returns the true apparent for the selected phase # in kVA. If no phase number is specified, returns the reading for the last selected phase.
Returned Data Format	<nr2>
Query Example	MEAS:PF1? 0.9083

8.4.5 Other Measurement Commands

Query Format **MEASure:TEMPerature:AMBient?**
Description Returns the ambient temperature of the power source in degrees celcius.
Returned Data Format <nr1>
Query Example MEAS:TEMP:AMB?
24

Query Format **MEASure:ALL#?**
Description Returns 14 parametric measurements for the selected phase # as a comma delimited string. The # is used to specify phase A, B or C using 1, 2 or 3 respectively. If phase reference is omitted, measurement data for all three phases is returned. Value order for each phase is:

All Firmware Revisions	
1. Frequency (repeats for each phase)	2. VLL AC+DC
3. VLL AC RMS	4. VLL DC
5. VLN AC+DC	6. VLN AC
7. VLN DC	8. I AC
9. I DC	10. POWER
11. APP POWER	12. I PEAK
13. PF	14. CF
FW Rev 2.0.0 ~ 2.2.15	
15. PEAK CURRENT	16. KWH
17. Elapsed Time for KWH	

Thus, each phase data set consists of 14 values. For all phases, a total of 42 comma separated values are returned.

Returned Data Format <nr2>,<nr2>,...,<nr2>,<nr2>
Query Example MEAS:ALL1?
1200.0000,519.5981,519.5981,0.0028,299.9990,299.9989,-
0.0007,0.1711,-0.0016,0.0000,0.0513,0.4849,0.0000,0.0000

Query Format **MEASure:ALL:CATALOG?**
Description Returns a comma-separated human-readable list of available measurements in the same order as the command returns it. See MEASure:ALL#? Command for parameter list as a function of Firmware revision.
Note: Available in FW Revisions 2.2.16 / 3.3.13 or higher.

Query Format	MEASure:ALL#? <OPTIONAL: List of measurements to return>
Description	Same as MEASure:ALL#? Command with optional user specified parameters list. Query command returns measurement parameters as included in list in the order they are specified by the list.
	Note: Available in FW Revisions 2.2.16 / 3.3.13 or higher.

8.4.6 Measurement Data Logging Commands

Command Syntax	MEASure:LOGger:START
Description	Starts the logging of measurements process. The process consists of taking measurements and saving them in a file. The log file can be found in the “datalogger” folder and is a comma separated value format (.csv) file. Measurements will be taken while the output is enabled only.
Parameters	None
Parameter Format	n/a
Example	MEAS:LOG:START
Query Format	None
Command Syntax	MEASure:LOGger:STOP
Description	Stops the logging process that was started with MEASure:LOGger:START.
Parameters	None
Parameter Format	n/a
Example	MEAS:LOG:STOP
Query Format	None
Query Format	MEASure:LOGger:STATe?
Description	Returns the state of the measurement data logging process as a number as follows: 0 – Stopped 1 – Running 2 – Paused
Returned Data Format	<nr1>
Query Example	MEAS:LOG:STAT? 1

Command Syntax Description	MEASure:LOGger:LIMit <cr> Sets the number of samples to get. Once the logging process reach this limit it will stop.If the limit is set as OFF or 0 it will not stop unless MEAS:LOG:STOP is executed. The limit can be specified as a number of samples or in seconds if a character "S" is added to the number. If the limit is passed as seconds, the command will compute the number of samples based on the logging rate. The formula is: number of samples = seconds / rate. The rate can be set with: MEASure:LOGger:RATE <nr1> or queried with: MEASure:LOGger:RATE?.
Parameters	< OFF 0 > XS where X is a time limit in seconds X where X is the limit in number of samples
Parameter Format Examples	<cr> MEAS:LOG:LIM OFF MEAS:LOG:LIM 20S MEAS:LOG:LIM 100
Query Format	MEASure:LOGger:LIMit?
Returned Data Format	0
Query Example	MEAS:LOG:LIM? 10000
Command Syntax Description	MEASure:LOGger:FILELimit <nr1> Sets the limit of samples to save in the file. If the limit is reached and the logging process continues, a new file will be created.
Parameters	Limit in number of samples.
Parameter Format	<nr1>
Example	MEAS:LOG:FILEL 100
Query Format	MEASure:LOGger:FILELimit?
Returned Data Format	<nr1>
Query Example	MEAS:LOG:FILEL? 10000
Command Syntax Description	MEASure:LOGger:FILENAME <cr> Sets the data logging file name
Parameters	Filename between double quotes
Parameter Format	<cr>
Example	MEAS:LOG:FILEN "Measurement-AC"
Query Format	MEASure:LOGger:FILENAME?
Returned Data Format	<cr>
Query Example	MEAS:LOG:FILEN? Measurement-AC

Command Syntax	MEASure:LOGger:MEMory <cr>
Description	Select the memory where the logging files will be saved. By default it is RAM unless a memory stick or USB drive was inserted and selected with this command: MEAS:LOG:MEM:CAT? can be used to get the available memories. Memory name between double quotes.
Parameters	<cr>
Parameter Format	MEAS:LOG:MEM "USBA"
Example	MEASure:LOGger:MEMory?
Query Format	<cr>
Returned Data Format	MEAS:LOG:MEM?
Query Example	USBA
Query Format	MEASure:LOGger:MEMory:CATalog?
Description	Returns the catalog of available memory names.
Returned Data Format	<cr>
Query Example	MEAS:LOG:MEM:CAT? RAM, USBA
Command Syntax	MEASure:LOGger:RATE
Description	Sets the frequency at which the logging process will take measurements.
Parameters	Frequency in Hz. Range is 1 Hz through 10 Hz.
Parameter Format	<nr1>
Example	MEAS:LOG:RATE 5
Query Format	MEASure:LOGger:RATE?
Returned Data Format	<nr1>
Query Example	MEAS:LOG:RATE? 5
Command Syntax	MEASure:LOGger:TIMEstamp <cr>
Description	Sets the time stamp format that will be attached to every measurement record in the measurement log file.
Parameters	< DATE 0 TIME 1 ALL 2 >
Parameter Format	<cr>
Example	MEAS:LOG:TIME ALL
Query Format	MEASure:LOGger:TIMEstamp?
Returned Data Format	<nr1>
Query Example	MEAS:LOG:TIME? 2

8.4.7 Measurement Resolution Setting Commands

All SCPI measurement commands return measurement data in a format with a specific resolution, i.e. a certain number of digits after the decimal point. The default resolution (number of positions after the decimal point) for each parameter is chosen based on the dimension (VA or KVA) and measurement accuracy of that specific parameter.

The user can increase or decrease the number of digits for each measurement parameter if so desired by using the RESolution commands listed in this section⁷.

Note: Increasing the resolution of a measurement for any parameter does NOT improve the specified measurement's accuracy specification. As such, digits added for to any measurement may not represent meaningful information.

The generic format for this command is:

MEASure:MMMnnn:RESolution <RESOLUTION>

MEASure:MMMnnn:RESolution?

Where MMMnnn is the measurement command syntax of the measurement for which the resolution is to be set. The Query command can be used to query a command's active resolution setting.

<RESOLUTION> is a formatted number that specifies the number of digits to include in the query response. For example:

0.1	Only one digit behind the decimal point
0.0001	4 digits behind the decimal point
0.00001	6 digits behind the decimal point

Example:

MEASure:POWer:RESolution 0.00001

This changes the number of digits for True Power measurements from the default 4 to 5. Since Power measurements are reported in KW, this is equivalent to changing the measurement resolution from 0.1 W / 10mW to 0.01W / 10mW. All these settings are independent of each other so only the specified measurement command's resolution will be changed. To change multiple commands, send this command for each one.

Note: Changing the resolution for any measurement command does NOT affect the displayed resolution of measurements in any of the power sources' front panel display screen. This command only affects remote control bus measurement queries.

Note: Once a command's resolution has been changed using the MEASure:MMMnnn:RESolution <RESOLUTION> command, the new resolution format is persistent, i.e. it remains in effect between power on/off cycles. To change it back, a new RESolution command must be sent.

⁷ Requires Firmware Revision 2.2.11 or higher

The following table shows the available RESolution commands.

Measurement Resolution Command	Query Format
MEASure:VOLTage:RESolution <RESOLUTION>	MEASure:VOLTage:RESolution?
MEASure:VLL:RESolution <RESOLUTION>	MEASure:VLL:RESolution?
MEASure:FREQuency:RESolution <RESOLUTION>	MEASure:FREQuency:RESolution?
MEASure:CURRent:RESolution <RESOLUTION>	MEASure:CURRent:RESolution?
MEASure:CURRent:CREST:RESolution <RESOLUTION>	MEASure:CURRent:CREST:RESolution?
MEASure:POWer:RESolution <RESOLUTION>	MEASure:POWer:RESolution?
MEASure:KVA:RESolution <RESOLUTION>	MEASure:KVA:RESolution?
MEASure:PF:RESolution <RESOLUTION>	MEASure:PF:RESolution?
MEASure:TEMPerature:RESolution <RESOLUTION>	MEASure:TEMPerature:RESolution?

8.5 Output Control Commands

The output command subsystem is used to control the output state of the power source. The following measurement commands are supported.

Command Syntax	OUTPut:FAST
Description	Enable or disable fast energy savings startup mode (STANDBY mode) when output is closed. This mode does not completely shut down all inverters for energy savings while the output is off. This allows near immediate application of output to the load when the output command is received. When disabled, there is delay of 2.2 seconds to allow all power stages to start up and settle in.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	OUTP:FAST ON
Query Format	OUTPut:FAST?
Returned Data Format	
Query Example	OUTP:FAST?
	1

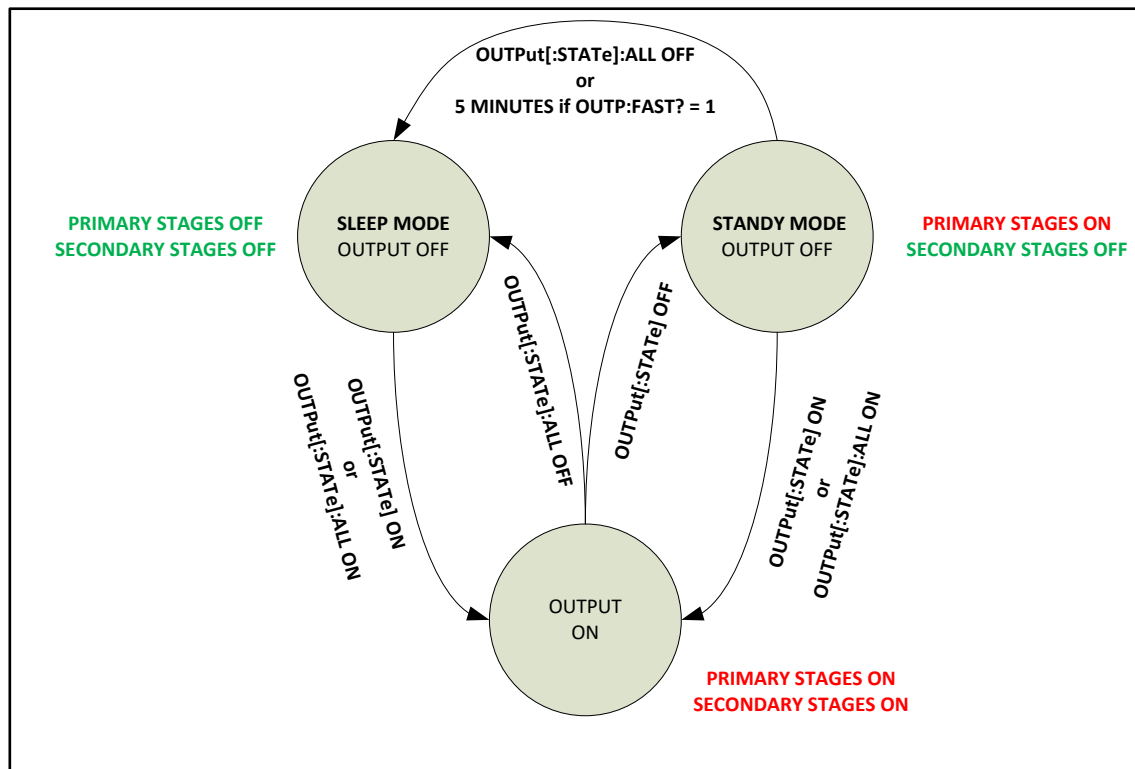


Figure 8-1: Energy Saving Modes and Output Commands State Diagram

Command Syntax
Description
OUTPut[:STATe]

Enables or Disables power output. When enabled, all output relays are closed. When disabled, all output relays are open. The time it takes for the output to turn on is determined by the status of the OUTP:FAST setting.

If the power source is in sleep mode (all power stages are off), it will take about 2.2 seconds before the output relays are closed. This is required to let all stages settle. If the power source is in standby mode, it will only take 200 msec to close the output relay as only the second (inverter) stage needs to settle.

Note: Sending the OUTP OFF command will only cause the second stage to be turned off. The primary stages remain on and thus the AC source will be in standby mode. If OUTP:FAST = 0, the primary stages will turn off after 5 minutes of non-use and the AC source will enter sleep mode.

Refer to section 6.2.2, “Energy Savings Modes” for more details.

< 0 | OFF | 1 | ON >

OUTP ON

OUTPut[:STATe]?

OUTP?

1

Parameters
Parameter Format
Example
Query Format
Returned Data Format
Query Example
Command Syntax
Description
OUTPut[:STATe]:ALL

This command enables or disables the output and is similar to the OUTPut[:STATe] command but always turns off all power stages, regardless of the energy savings mode set with the OUTP:FAST command. Thus, the OUTP:ALL OFF command will turn off all power stages and put the AC source in sleep mode.

Note: The OUTP:ALL ON command has the same effect as the OUTP ON command.

< 0 | OFF | 1 | ON >

OUTP:ALL OFF

Parameters
Parameter Format
Example

Command Syntax	OUTPut[:STATe]:AUTO
Description	This commands determines the state of the OUTPUT when the power source is turned on (powered on). Enables the output automatically when the unit is energized, depending on the state of the OUTPut:STATe:AUTO:FORCE setting: OUTPut:STATe:AUTO:FORCE = 0: enables output only if the output was enabled when the unit was shut down. OUTPut:STATe:AUTO:FORCE = 1: always enables output, even if the output was disabled when the unit was shut down.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	OUTP:AUTO ON
Query Format	OUTPut[:STATe]:AUTO?
Returned Data Format	
Query Example	OUTP:AUTO? 1
Command Syntax	OUTPut[:STATe]:AUTO:FORCE
Description	This command allows the auto-enable function to enable the output automatically in all cases, even when the output was disabled at the moment the unit was shut down.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	OUTP:AUTO:FORCE 1
Query Format	OUTPut[:STATe]:AUTO:FORCE?
Returned Data Format	
Query Example	OUTP:AUTO:FORCE? 1
Command Syntax	OUTPut:DISABLEPHase
Description	This command sets the disable phase angle. This is the phase angle on phase A at which the power source output will be disabled. Available range is 0 ~ 360. Also allows a negative number that indicates a RANDOM phase angle/ Note: Available in units with Firmware revision 1.6.6 or higher. Refer also to the OUTPut:ZEROprogram command.
Parameters	0.0 ~ 360.0 or negative number
Parameter Format	<nr2>
Example	OUTPDISABLEPH 90.0 OUTPDISABLEPH -1
Query Format	OUTPut:DISABLEPHase?
Returned Data Format	<nr2>
Query Example	OUTP:DISABLEPH? 90.000

Query Syntax	OUTPut:DISABLEPHase:MINimum OUTPut:DISABLEPHase:MAXimum OUTPut:DISABLEPHase:DEFault
Description	These query commands return minimum, maximum and default Output Disable Phase values respectively. Available range is -0.01 (Random) through 360.0. Note: Available in units with Firmware revision 1.6.6 or higher.
Returned Data Format	<nr2>
Query Example	OUTP:DISABLEPH:MIN? -0.010 OUTP:DISABLEPH:MAX? 360.000 OUTP:DISABLEPH:DEF? 0.000
Command Syntax	OUTPut:ZEROprogram
Description	This command sets the programmed output voltage to zero before opening the output relay when the OUTP OFF 0 command is sent. This feature is disabled by default but can be enabled by sending OUTP:ZERO ON 1. In this mode, the output of the power source goes to a low impedance state before disconnecting the load. Note: Available in units with Firmware revision 1.6.6 or higher. Refer also to the OUTPut:DISABLEPHase command.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	OUTP:ZERO 1
Query Format	OUTPut:ZEROprogram?
Returned Data Format	
Query Example	OUTP:ZERO? 1
Command Syntax	OUTPut:ZEROprogram:RAMP <nr1>
Description	This command sets the voltage ramp down to zero time before opening the output relay when the OUTP OFF 0 command is sent. See Figure for reference. Default value is 0 msec. This command is intended for uses with XFMR units but configurable for both couplings. XFMR and direct parameters are independent. For direct coupling delay is 100ms and ramp 0ms by default but can be changed to any value. The ramp allows the voltage to reduce slowly, useful for reducing the magnetization of the transformer so at the next turn on, there is no excessive peak current due to remaining magnetization. Note: Available in units with Firmware revision 2.2.12 or higher.
Parameters	Time in msecs.
Parameter Format	<nr1>
Example	OUTP:ZERO:RAMP? 50
Query Format	OUTPut:ZEROprogram:RAMP?

Returned Data Format	<nr1>
Query Example	OUTP:ZERO:RAMP? 50
Command Syntax	OUTPut:ZEROpogram:DWELL <nr1>
Description	This command sets the voltage dwell time before opening the output relay when the OUTP OFF 0 command is sent. See Figure for reference. Default value is 100 msec. Note: Available in units with Firmware revision 2.2.12 or higher.
Parameters	Time in msec.
Parameter Format	<nr1>
Example	OUTP:ZERO:DWELL? 20
Query Format	OUTPut:ZEROpogram:DWELL?
Returned Data Format	<nr1>
Query Example	OUTP:ZERO:DWELL? 20

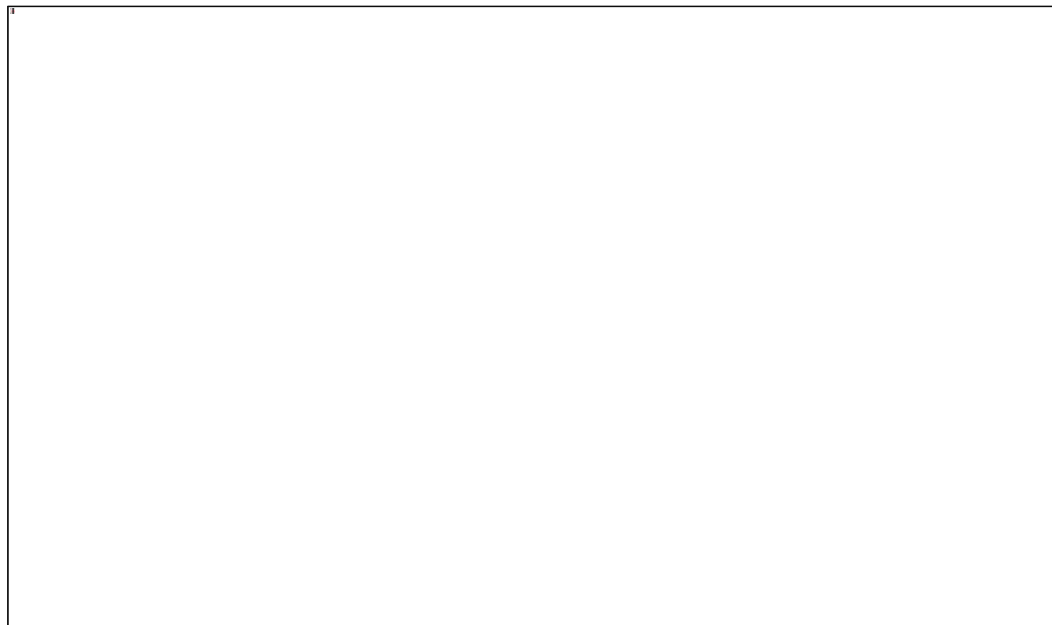


Figure 8-2: OUTP:ZERO Command Ramp and Dwell settings

8.6 Program Commands

Program commands allow management and programming of stored program segments for steady state. These commands are grouped by the following subsystems.

- Program Control Commands
- Execution Commands
- Transient Segment Commands (Option R Required)
- Memory Management Commands

The Program commands are similar to those found on the Pacific Power UPC controllers used for other PPS AC power source models.

8.6.1 Program Control Commands

The following commands allow recall of stored programs and transient segments. Programs are selected and recalled using their memory location reference ranging from 1 through 99. Program location zero (0) is reserved for the Manual Mode setup. Optionally, a memory source may be specified. If none is provided, INTERNAL memory is used as a default.

Command Syntax	PROG ram:NAME [<nr1>,<cr>] [<cr>,<cr>] <cr>
Description	This command selects program <nr1> for execution deletion or copying.
Parameters	Option: PROGRAM, NUMBER [<cr>] or [<cr>,<nr1>] - 0 through 99 Option: MEMORY [<cr>] – Available are: INTERNAL RAM USB Parameter list define string <cr>,<cr>,<cr>,<cr>,<cr>
Parameter Format	<nr1> [<cr>]
Example	PROG:NAME 4, USB
Query Format	PROG ram:NAME?
Description	The query format of this command returns the value of last program selected. Returned value range is 0 through 99.
Returned Data Format	<nr1>
Query Example	PROG:NAME? 4

Command Syntax		
Description	This command programs all values stored in the selected program number. Both steady-state and transient segment parameter names and values may be sent. Program parameters are defined in the following sections.	
Parameters	NOTE: Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values within a single command message. Option: PROGRAM, NUMBER [,<cr>} or [,<nrl>] Option: MEMORY [,<cr>] – Available are: INTERNAL RAM USB Parameter list define string <cr>,<cr>,....,<cr>	
	Steady State list	FORM,<n> COUPLing,<s> XFMRRATIO,<n.nn> FREQuency,<n> VOLTage,<n> see Convention #13. VOLTage1,<n> VOLTage2,<n> VOLTage3,<n> CURRent:LIMit,<n> CURRent:PROTect:LEVel,<n> CURRent:PROTect:TOUT,<n> PHASe2,<n> PHASe3,<n> WAVEFORM,<n> see Convention #13. WAVEFORM1,<n> WAVEFORM2,<n> WAVEFORM3,<n> EVENTS,<n> AUTORMS,<n> NSEGS, <n>
Parameter Format	<cr>,<cr>,....,<cr>,<cr>	
Optional Transient SEGment list Tags	SEGment,<n> FSEG,<n> VSEG,<n> VSEG1,<n> VSEG2,<n> VSEG3,<n> VSEGDC, <n> VSEGDC1, <n> VSEGDC2, <n> VSEGDC3, <n> PSEG1, <n> PSEG2, <n> PSEG3, <n> WFSEG,<n> WFSEG1,<n> WFSEG2,<n> WFSEG3,<n> TSEG,<n> LAST	Multiple segments per Program Message may be sent, see Convention 17. AC Voltage, see Convention #13. DC Voltage, see Convention #13. Cmd available for FW 3.6.x or higher only see Convention #13. Sent only if this is the LAST segment.

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Segment Example Program Strings:**PROG:DEFine**

FORM,3,COUPL,DIRECT,VOLT:MODE,2,CONFIG,0,RANG,0,FREQ,60.000,VOLT1,0.000,VOLT2,0.000,VOLT3,0.000,VOLT:ALC:STAT,1,CURR:OV,0,CURR:LIM1,130.000,CURR:LIM2,130.000,CURR:LIM3,130.000,IPTOT:STAT,0,CURR:PROT:LEV,130.000,IPEAK:LIM,360.000,PHAS1,0.000,PHAS2,120.000,PHAS3,240.000,WAVEFORM1,1,WAVEFORM2,1,WAVEFORM3,1,VOLT:DC1,0.000,VOLT:DC2,0.000,VOLT:DC3,0.000,POW:LIM1,17.2500,POW:LIM2,17.2500,POW:LIM3,17.2500,KVA:LIM1,17.2500,KVA:LIM2,17.2500,KVA:LIM3,17.2500,PPROT:STAT,0,POW:PROT:LEV,17.2500,KVA:PROT:LEV,17.2500,PROT:TDELAY,5,FREQ:SLEW,5.000,VOLT:SLEW,10.000,VOLT:DC:SLEW,10.000,UPDATEPH,0.000,RAMP,0.0002,VPEAK:MARG,100.000,EVENTS,0,AUTORMS,1,SEG,1,FSEG,60.00,VSEG1,0.00,VSEG2,0.00,VSEG3,0.00,VDCSEG1,0.00,VDCSEG2,0.00,VDCSEG3,0.00,PSEG2,120.00,PSEG3,240.00,WFSEG1,1,WFSEG2,1,WFSEG3,1,TSEG,0.1000,SEG,2,FSEG,60.00,VSEG1,0.00,VSEG2,0.00,VSEG3,0.00,VDCSEG1,0.00,VDCSEG2,0.00,VDCSEG3,0.00,PSEG2,120.00,PSEG3,240.00,WFSEG1,1,WFSEG2,1,WFSEG3,1,TSEG,0.1000,LAST (Note I removed NSEGS,2 PSEG1,0.00)

PROG:DEFine:ALL?

FORM,3,COUPL,DIRECT,VOLT:MODE,2,CONFIG,0,RANG,0,FREQ,60.000,VOLT1,0.000,VOLT2,0.000,VOLT3,0.000,VOLT:ALC:STAT,1,CURR:OV,0,CURR:LIM1,130.000,CURR:LIM2,130.000,CURR:LIM3,130.000,IPTOT:STAT,0,CURR:PROT:LEV,130.000,IPEAK:LIM,360.000,PHAS1,0.000,PHAS2,120.000,PHAS3,240.000,WAVEFORM1,1,WAVEFORM2,1,WAVEFORM3,1,VOLT:DC1,0.000,VOLT:DC2,0.000,VOLT:DC3,0.000,POW:LIM1,17.2500,POW:LIM2,17.2500,POW:LIM3,17.2500,KVA:LIM1,17.2500,KVA:LIM2,17.2500,KVA:LIM3,17.2500,PPROT:STAT,0,POW:PROT:LEV,17.2500,KVA:PROT:LEV,17.2500,PROT:TDELAY,5,FREQ:SLEW,5.000,VOLT:SLEW,10.000,VOLT:DC:SLEW,10.000,UPDATEPH,0.000,RAMP,0.0002,VPEAK:MARG,100.000,EVENTS,0,AUTORMS,1,NSEGS,2,SEG,1,FSEG,60.00,VSEG1,0.00,VSEG2,0.00,VSEG3,0.00,VDCSEG1,0.00,VDCSEG2,0.00,VDCSEG3,0.00,PSEG1,0.00,PSEG2,120.00,PSEG3,240.00,WFSEG1,1,WFSEG2,1,WFSEG3,1,TSEG,0.1000,SEG,2,FSEG,60.00,VSEG1,0.00,VSEG2,0.00,VSEG3,0.00,VDCSEG1,0.00,VDCSEG2,0.00,VDCSEG3,0.00,PSEG1,0.00,PSEG2,120.00,PSEG3,240.00,WFSEG1,1,WFSEG2,1,WFSEG3,1,TSEG,0.1000,LAST

Step Example Program Strings:

PROGram:DEFine

```
FORM,3,COUPL,DIRECT,VOLT:MODE,2,CONFIG,0,RANG,0,FREQ,60.000,VOLT1,0.000,VOLT2,0.000,VOLT3,0.000,VOLT:ALC:STAT,1,CURR:OV,0,CURR:LIM1,130.000,CURR:LIM2,130.000,CURR:LIM3,130.000,IPROT:STAT,0,CURR:PROT:LEV,130.000,IPEAK:LIM,360.000,PHAS1,0.000,PHAS2,120.000,PHAS3,240.000,WAVEFORM1,1,WAVEFORM2,1,WAVEFORM3,1,VOLT:DC1,0.000,VOLT:DC2,0.000,VOLT:DC3,0.000,POW:LIM1,17.2500,POW:LIM2,17.2500,POW:LIM3,17.2500,KVA:LIM1,17.2500,KVA:LIM2,17.2500,KVA:LIM3,17.2500,PPROT:STAT,0,POW:PROT:LEV,17.2500,KVA:PROT:LEV,17.2500,PROT:TDELAY,5,FREQ:SLEW,5.000,VOLT:SLEW,10.000,VOLT:DC:SLEW,10.000,UPDATEPH,0.000,RAMP,0.0002,VPEAK:MARG,100.000,EVENTS,0,AUTORMS,1,STEP,1,FSTEP,60.00,VSTEP1,0.00,VSTEP2,0.00,VSTEP3,0.00,VDCSTEP1,0.00,VDCSTEP2,0.00,VDCSTEP3,0.00,PSTEP2,120.00,PSTEP3,240.00,WFSTEP1,1,WFSTEP2,1,WFSTEP3,1,RTSTEP,0.1000,DTSTEP,0.1000,LAST
```

Note: NSTEPS,1, PSTEP1,0.00 not included in program command.

PROGram:DEFine:ALL?

```
FORM,3,COUPL,DIRECT,VOLT:MODE,2,CONFIG,0,RANG,0,FREQ,60.000,VOLT1,0.000,VOLT2,0.000,VOLT3,0.000,VOLT:ALC:STAT,1,CURR:OV,0,CURR:LIM1,130.000,CURR:LIM2,130.000,CURR:LIM3,130.000,IPROT:STAT,0,CURR:PROT:LEV,130.000,IPEAK:LIM,360.000,PHAS1,0.000,PHAS2,120.000,PHAS3,240.000,WAVEFORM1,1,WAVEFORM2,1,WAVEFORM3,1,VOLT:DC1,0.000,VOLT:DC2,0.000,VOLT:DC3,0.000,POW:LIM1,17.2500,POW:LIM2,17.2500,POW:LIM3,17.2500,KVA:LIM1,17.2500,KVA:LIM2,17.2500,KVA:LIM3,17.2500,PPROT:STAT,0,POW:PROT:LEV,17.2500,KVA:PROT:LEV,17.2500,PROT:TDELAY,5,FREQ:SLEW,5.000,VOLT:SLEW,10.000,VOLT:DC:SLEW,10.000,UPDATEPH,0.000,RAMP,0.0002,VPEAK:MARG,100.000,EVENTS,0,AUTORMS,1,NSTEPS,1,STEP,1,FSTEP,60.00,VSTEP1,0.00,VSTEP2,0.00,VSTEP3,0.00,VDCSTEP1,0.00,VDCSTEP2,0.00,VDCSTEP3,0.00,PSTEP1,0.00,PSTEP2,120.00,PSTEP3,240.00,WFSTEP1,1,WFSTEP2,1,WFSTEP3,1,RTSTEP,0.1000,DTSTEP,0.1000,LAST
```

8.6.1.1 Steady State Output Parameter List Table

The following table details the available parameters for the steady state program definitions.

Parameter	Description
FORM,<n>	sets Output Power Form of selected program n = <1>Single Φ , <2>Split Φ , or <3>Three Φ
COUPLing,<s>	sets Output coupling of selected program s = <DIRECT> <0> or <XFMR> <1>
XFMRRatio,<n.nn>	sets Output XFMR ratio (n.nn:1) of selected program n.nn = <0.0100> to <5.1111>
FREQuency,<n>	sets Output Frequency of selected program n = <:SOUR:FREQ:LIM:MIN> to <:SOUR:FREQ:LIM:MAX> Hz
VOLTage,<n>	sets Output VOLTAGE Φ A,B,C of selected program n = <0> to <300 x XFMRRatio> Volts
VOLTage1,<n>	sets Output VOLTAGE Φ A of selected program n = <0> to <300 x XFMRRatio> Volts
VOLTage2,<n>	sets Output VOLTAGE Φ B of selected program n = <0> to <300 x XFMRRatio> Volts
VOLTage3,<n>	sets Output VOLTAGE Φ C of selected program n = <0> to <300 x XFMRRatio> Volts
CURRent:LIMit,<n>	sets Output Current Limit of selected program n = <0> to <AMPS meter range> Amps
CURRent:PROTect:LEVel,<n>	sets Output Current level that triggers Current Protect mode n = <0> to <AMPS meter range> Amps
CURRent:PROTect:TOUT,<n>	sets time that the Output Current must exceed the Current Protect level before Current Protect disables the power source output. n = <1> to <65535>, 1 = 100mSec.
PHASe2,120	sets Output Phase Angle B of selected program n = 120 degrees
PHASe3,240	sets Output Phase Angle C of selected program n = 240 degrees
WAVEFORM,1	sets Output Waveform Φ A, Φ B, Φ C of selected program n = 1
WAVEFORM1,1	sets Output Waveform Φ A of selected program n = 1
WAVEFORM2,1	sets Output Waveform Φ B of selected program n = 1
WAVEFORM3,1	sets Output Waveform Φ C of selected program n = 1
AUTORMS,<n>	program Transient Waveform Auto RMS mode (4.5.2) n = 0, use program steady-state waveform RMS factor n = 1, calculate RMS factor based on transient waveform
NSEGS,<n>	Command: Specifies the number of Transient segments (all parameters) to return in a subsequent :PROG:DEFine? query. If NSEGS is not specified, 1 segment is returned by :PROG:DEFine? EXAMPLE: :PROG:DEF SEG,3,NSEGS,4;PROG:DEF? will return 4 transient segments, starting with Segment 3. NOTE: The value will revert back to 1 after each query. Query: The NSEGS parameter of a :PROG:DEF? query returns total number of Transient segments defined in the selected program

8.6.1.2 Transient Segment Output Parameter List Table

The following table details the available parameters for the transient segment program definitions.

Parameters	Description
SEGment,<n>	Transient segment n of the selected program to be edited. Also the starting segment when querying multiple segments (see NSEGS) n = <1> to <100>
FSEG,<n>	sets objective Frequency of selected segment n = <:SOUR:FREQ:LIM:MIN> to <:SOUR:FREQ:LIM:MAX> Hz
VSEG,<n>	sets objective voltage ΦA , ΦB , ΦC of selected segment n = <0> to <320 x XFMRRTATIO> Volts
VSEG1,<n>	sets objective voltage ΦA of selected segment n = <0> to <320 x XFMRRTATIO> Volts
VSEG2,<n>	sets objective voltage ΦB of selected segment n = <0> to <320 x XFMRRTATIO> Volts
VSEG3,<n>	sets objective voltage ΦC of selected segment n = <0> to <320 x XFMRRTATIO> Volts
WFSEG,<n>	sets Waveform ΦA , ΦB , ΦC of selected segment n = <1> to <16>
WFSEG1,<n>	sets Waveform ΦA of selected segment n = <1> to <16>
WFSEG2,<n>	sets Waveform ΦB of selected segment n = <1> to <16>
WFSEG3,<n>	sets Waveform ΦC of selected segment n = <1> to <16>
TSEG,<n>	sets execution time (to reach objective Voltage and Frequency) of selected segment n = <0> or <0.0002> to <300> seconds. Setting n to a negative value such as -5 selects cycle-based transient operation, i.e., each segment time is equal to the period of 5 cycles (1 cycle = 1/FREQ secs)
LAST	sets selected segment to be the last segment of selected transient

Command Syntax	PROG:EXECuted:DEFine <cr>
Description	This command programs all values stored in the selected program number. Both steady-state and transient segment parameter names and values may be sent. Program parameters are defined in the following sections. NOTE: Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values within a single command message.
Parameters	Refer to PROG:SElected:DEFine command
Parameter Format	<cr>,<cr>,...,<cr>,<cr>
Example	
Query Format	PROG:EXECuted:DEFine?
Returned Data Format	<cr>,<cr>,...,<cr>,<cr>
Query Example	PROG:EXEC:DEF? -> parameter list

Transient Format Example:

```

<TRANSIENT>
  <OUTPUT_A>
    <EVENTS>0</EVENTS>
    <AUTORMS>1</AUTORMS>
    <STEP NUMBER="1">
      <FSTEP>60.00</FSTEP>
      <ACSTEP>10.00</ACSTEP>
      <DCSTEP>0.00</DCSTEP>
      <PSTEP>0.00</PSTEP>
      <WFSTEP>1</WFSTEP>
      <RTSTEP>0.1000</RTSTEP>
      <DTSTEP>2.0000</DTSTEP>
    </STEP>
    <STEP NUMBER="2">
      <FSTEP>60.00</FSTEP>
      <ACSTEP>15.00</ACSTEP>
      <DCSTEP>0.00</DCSTEP>
      <PSTEP>0.00</PSTEP>
      <WFSTEP>1</WFSTEP>
      <RTSTEP>0.1000</RTSTEP>
      <DTSTEP>2.0000</DTSTEP>
    </STEP>
  </OUTPUT_A>
  <OUTPUT_B>
    ---
    ---
  </OUTPUT_B>
  <OUTPUT_C>
    ---
    ---
  </OUTPUT_C>
</TRANSIENT>

```

Query Format	PROGram[:SElected]:DEFine:ALL?
Description	This query returns the parameter list for the selected program number or name.
Parameters	Option: PROGRAM, NUMBER [,<cr>} or [,<nr1>] Option: MEMORY [,<cr>}– Available are: INTERNAL RAM USB Parameter list define string <cr>,<cr>,...,<cr>
Query Example	PROG:DEF:ALL? -> parameter list
Query Format	PROGram:EXECuted:DEFine:ALL?
Description	This query returns the parameter list for the executing program number or name.
Parameters	Option: PROGRAM, NUMBER [,<cr>} or [,<nr1>] Option: MEMORY [,<cr>} Parameter list define string <cr>,<cr>,...,<cr>
Query Example	PROG:EXEC:DEF:ALL? 3 -> parameter list
Command Syntax	PROGram[:SElected]:INFORmation <cr> [,<nr1>] [,<cr>]
Description	This command assigns program information data to the selected program.
Parameters	Information string <cr> Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>}– Available are: INTERNAL RAM USB
Parameter Format	<cr> [,<nr1>] [,<cr>]
Example	PROG:INFO 3, INTERNAL, SAMPLE TEST
Query Format	PROGram[:SElected]:INFORmation? [<nr1>] [,<cr>]
Returned Data Format	<cr>
Query Example	PROG:INFO? 2, USB -> Program info string
Command Syntax	PROGram:EXECuted:INFORmation <cr> [,<nr1>] [,<cr>]
Description	This command assigns program information data to the executing program.
Parameters	Information string <cr> Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>}– Available are: INTERNAL RAM USB
Parameter Format	<cr> [,<nr1>] [,<cr>]
Example	PROG:EXEC:INFO 3, INTERNAL, SAMPLE TEST
Query Format	PROGram:EXECuted:INFORmation? [,<nr1>] [,<cr>]
Returned Data Format	<cr>
Query Example	PROG:EXEC:INFO? 2, USB -> Program info string

Command Syntax	PROGram[:SElected]:ALIAS <cr> [,<nr1>] [,<cr>]
Description	This command assigns a user provided alias string name to the selected program. Program number and memory type are optional parameters.
Parameters	Alias String <cr> Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB
Parameter Format	<cr> [,<nr1>] [,<cr>]
Example	PROG:ALIAS TEST1
Query Format	PROGram[:SElected]:ALIAS? [,<nr1>] [,<cr>]
Returned Data Format	<cr>
Query Example	PROG:ALIAS? TEST1
Command Syntax	PROGram:EXECuted:ALIAS <cr> [,<nr1>] [,<cr>]
Description	This command assigns a user provided alias string name to the executing program. Program number and memory type are optional parameters.
Parameters	Alias String <cr> Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB
Parameter Format	<cr> [,<nr1>] [,<cr>]
Example	PROG:EXEC:ALIAS TEST2
Query Format	PROGram:EXECuted:ALIAS? [,<nr1>] [,<cr>]
Returned Data Format	<cr>
Query Example	PROG:EXEC:ALIAS? TEST2
Query Format	PROGram[:SElected]:SST? [,<nr1>] [,<cr>]
Description	This command returns the Steady State Table settings of the selected program only. The transient table data is not returned.
Parameters	Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB
Returned Data Format	<cr>
Query Example	PROG:SST? 2, USB -> steady state table program data
Query Format	PROGram:EXECuted:SST? [,<nr1>] [,<cr>]
Description	This command returns the Steady State Table settings of the executing program only. The transient table data is not returned.
Parameters	Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB
Returned Data Format	<cr>
Query Example	PROG:EXEC:SST? -> steady state table program data

Query Format	PROG:SELEcted:TT? [,<nr1>] [,<cr>]
Description	This command returns the Transient Table settings of the selected program only. The steady state table data is not returned.
Parameters	Option: STYLE [,<nr1> 0 = Human readable Style A (default if omitted) 1 = Human readable Style B 2 = Binary Data Format. Can be more useful to search for differences between programs. See PROG:TT? Command for formats Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB <cr>
Returned Data Format	PROG:TT? 1
Query Example	-> transient table program data
Query Format	PROG:SELEcted:CHECK? [,<nr1>] [,<cr>]
Description	This command performs a check on the selected program steady state tables looking for the following conditions: • Hardware Limit violations • User Limit violations • Saturation limits. If no violations are present, this command returns OK and the program can be executed without generating any errors. If the selected program cannot be run due to one or more issues with its content, one or more errors detailing the issues will be returned. For example, if the upper voltage user limit is set to 100V and the program contains a setting of 300V, a “Cannot load program, Run PROGRAM:CHECK?” error will be generated when attempting to execute this program. When sending the PROG:CHECK? Query, the response will be “VOLT1 AC voltage set point cannot change due to user limit”.
Parameters	Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB <cr>
Returned Data Format	PROG:CHECK?
Query Example	VOLT1 AC voltage set point cannot change due to user limit
Query Format	PROG:EXECuted:CHECK? [,<nr1>] [,<cr>]
Description	This command serves the same purpose as the PROG:CHECK? Command but applies to a program that is executing.
Parameters	Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB <cr>
Returned Data Format	PROG:EXEC:CHECK?
Query Example	VOLT1 AC voltage set point cannot change due to user limit

Command Syntax	PROGram[:SElected]:DELeTe
Description	This command deletes the selected program. Attempting to DELeTe an EXECuting Program will result in an Error.
Parameters	Program number
Parameter Format	<nr1>
Example	PROG:DEL 9
Query Format	PROGram[:SElected]:CHANges? <nr1>, <cr>
Description	This command compares the program that is executing with another program stored in the memory type and location passed as parameters. The results of the comparison is returned as a decimal number ranging from 0 to 15 representing a four bit binary value. This result can be decoded as shown below.
Parameters	Option: PROGRAM NUMBER [, <nr1>] Option: MEMORY [, <cr>]– Available are: INTERNAL RAM USB
Returned Data Format	<nr>1
Decoding	Bit 0: If set to 1, there are differences in the steady state table (SST) Bit 1: If set to 1, there are differences in the transient table (TT) Bit 2: If set to 1, there are differences in the ALIAS of the program Bit 3: If set to 1, there are differences in INfOrmation of the program
Query Example	PROG:CHAN? 16
Example	If the query returns zero (0), the program executing is identical to the stored program referenced. If the command returns three (3), the program executing has differences with the referenced program in both the steady state table and the transient table.
Command Syntax	PROGram[:SElected]:COPY <nr1> [, <cr>]
Description	This command copies the selected program as previously specified by the PROG:NAME <nr1> command to destination program number. NOTE: The destination Program specified cannot be currently executing.
Parameters	DESTINATION PROGRAM NUMBER <nr1> Option: MEMORY [, <cr>]– Available are: INTERNAL RAM USB
Parameter Format	<nr1>, [, <cr>]
Example	PROG:COPY 2, USB
Command Syntax	PROGram:EXECuted:COPY <nr1> [, <cr>]
Description	This command copies the executed program to destination program number.
Parameters	DESTINATION PROGRAM NUMBER <nr1> Option: MEMORY [, <cr>]– Available are: INTERNAL RAM USB
Parameter Format	<nr1>, [, <cr>]
Example	PROG:EXEC:COPY 2, USB

8.6.2 Execution Commands

The following commands may be used to control stored program executions.

Command Syntax	PROGram[:SElected]:EXECute [<nr1> [,<cr>]
Description	This command executes the selected program (default) or the program number passed as the first parameter.
Parameters	Option: PROGRAM NUMBER [,<nr1>] Option: MEMORY [,<cr>]– Available are: INTERNAL RAM USB
Parameter Format	[<nr1> [,<cr>]
Example	PROG:EXEC 2
Query Format	PROGram[:SElected]:EXECute ?
Description	The query format returns the number of the program that is in effect.
Parameter Format	<nr1>
Example	PROG:EXEC? 23

8.6.3 Transient Segments Commands

The following commands may be used to control stored transient program executions.

Command Syntax	PROG:TRANSient
Description	This command controls transient execution
Parameters	RUN STOP PAUSE STEP REStart
Parameter Format	<cr>
Example	PROG:TRAN RUN
Query Format	PROG:TRANSient?
Description	Query format returns the transient execution state as either RUN, STOP, PAUS, STEP or REST
Returned Data Format	<cr>
Query Example	PROG:TRAN? RUN
Command Syntax	PROG:TRANSient:AUTORMS <BOOLEAN>
Description	If enabled, the value of any waveform used in a transient segment is normalized in order to match the RMS set point. If disabled, the waveform is reproduced without any normalization. This function is useful for waveform substitution at the steady state level. Note: This function is related to the AUTORMS function in the steady state segment.
Parameters	[0 OFF 1 ON]
Parameter Format	
Example	PROG:TRAN:AUTORMS 1
Query Format	PROG:TRANSient:AUTORMS?
Returned Data Format	
Query Example	PROG:TRAN:AUTORMS? 1
Command Syntax	PROG:TRANSient:CR <BOOLEAN>
Description	This command enables or disables the Cycle Reset mode during transient execution. When on, Cycle Reset will resync each transient run in repeat mode to the start phase angle.
Parameters	[0 OFF 1 ON]
Parameter Format	
Example	PROG:TRAN:CR 1
Query Format	PROG:TRANSient:CR?
Returned Data Format	<nr1>
Query Example	PROG:TRAN:CR? 0

Command Syntax Description	PROG:TRANSient:HOLD <ON OFF> This commands turns the Transient HOLD mode on or off. If ON, the power source holds the last segment values at steady state after the transient ends. If OFF, the output of the power source returns to the steady state settings in effect before the transient segment ran.
Parameters	[0 OFF 1 ON]
Parameter Format	<cr>
Example	PROG:TRAN:HOLD ON
Query Format	PROG:TRANSient:HOLD?
Returned Data Format	
Query Example	PROG:TRAN:MODE? 1
Command Syntax Description	PROG:TRANSient:MODE This commands selected between legacy UPC controller mode SEGMENT transient mode or STEP mode. Segment mode is backward compatible with PPS UPC controllers and use a steady state table and a transient table for each segment. A total of 99 segments can be programmed. STEP mode uses the conventional SCPI LIST system of a list of transient steps executed sequentially.
Parameters	[0 SEGMENT 1 STEP]
Parameter Format	<cr>
Example	PROG:TRAN:MODE STEP
Query Format	PROG:TRANSient:MODE?
Returned Data Format	<nr1>
Query Example	PROG:TRAN:MODE? 1
Query Format Description	PROG:TRANSient:PROGress? This command returns the progress status of a running transient. The response data content depends on the selected transient mode, SEGMENT or STEP. (Refer to the “PROG:TRANSient:MODE” command) The following information is returned in the order shown below. Values are separated by a “/” character:
Return Data Format	A. Progress as a percent of the total between 0 to 100. B. Current element progress. A percent between 0 and 100 of the element executing. C. Active step or segment in execution. D. Active step or segment time. In multiples of 0.2 ms. E. Total time. In multiples of 0.2 ms. F. Total number of steps or segments.
Returned Data Format	<nr1> / <nr1> / <nr1> / <nr1> / <nr1> / <nr1>
Query Example	PROG:TRAN:PROG? 57/31/3/1554/20000/4
<i>Continues next page</i>	

TRANSIENT TABLE						
TRANSIENT MODE						
STEP						
SEGMENT						
	#	TIME (ms)	FREQ (Hz)	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Phase [deg B/C
>	1	1000.0	60.00	0.00	0.00	120.00/240.0
>	2	1000.0	60.00	0.00	0.00	120.00/240.0
>	3	1000.0	60.00	0.00	0.00	120.00/240.0
>	4	1000.0	60.00	0.00	0.00	120.00/240.0

Example Return data for transient table shown above in STEP mode would be

57/31/3/1554/20000/4

- A. Progress = 57% of total time or $0.57 * 4000 \text{ ms} = 2280 \text{ ms}$
- B. Current element progress = 31% or $0.31 * 1000 \text{ ms} = 310 \text{ ms}$
- C. Active step = 3
- D. Active step time = $1554 * 0.2 \text{ ms} = 310.8 \text{ ms}$
- E. Total time = $20000 * 0.2 \text{ ms} = 4000 \text{ ms}$
- F. Total number of steps = 4.

Relationship between data fields

$A = (((\text{Summing of the element times between 1 and C-1}) / 0.2 + D) / E) * 100$

For the example $A = ((1000+1000)/0.2+1554)/20000 = 57\%$

$B = (D / (\text{Time of the element C} / 0.2)) * 100$

For the example $B = (1554/(1000/0.2))*100 = 31\%$

Query Format
Description

PROG:TRANSient:EIE?

This query command returns the active Element In Execution. An element is either a STEP when in transient STEP mode or a SEGMENT when in transient SEGMENT mode.

Note: the data returned on this query is the same as the "C" data returned by the "PROG:TRANSient:PROGress?" command.

Returned Data Format
Query Example

```
<nr1>
PROG:TRAN:EIE?
3
```

Query Format
Description

PROG:TRANSient:ETE?

This query command returns the active Element To Execute. An element is either a STEP when in transient STEP mode or a SEGMENT when in transient SEGMENT mode.

The ETE query is useful when a transient execution has been PAUSED by the "PROG:TRANSient PAUSE" command. For example, if the execution is paused in the middle of an element (step or segment) execution for element "n", the ETE value will be "n". If it is paused at the end of element "n", the ETE value will be "n+1".

Returned Data Format
Query Example

```
<nr1>
PROG:TRAN:ETE?
4
```

Command Syntax
Description

PROG:TRANSient:MODE

This commands selected between legacy UPC controller mode SEGMENT transient mode or STEP mode. Segment mode is backward compatible with PPS UPC controllers and use a steady state table and a transient table for each segment. A total of 99 segments can be programmed. STEP mode uses the conventional SCPI LIST system of a list of transient steps executed sequentially.

Parameters

< 0 | SEGMENT | 1 | STEP >

Parameter Format

<cr>

Example

PROG:TRAN:MODE STEP

Query Format

PROG:TRANSient:MODE?

Returned Data Format

<cr>

Query Example

PROG:TRAN:MODE?

1

Command Syntax
Description

PROG:TRANSient:CSC

This command turns the CSC Mode during transient execution on (1) or off (0). This allows load regulation adjustment during transient execution. However, keep in mind that CSC adjustments are based on RMS voltage measurement, which take several cycles to run so turning on CSC on fast changing voltage transients is not recommended as the CSC may interfere with the programmed transient voltages.

Note 1: In UPC compatibility mode, the CSC is always off during transient execution regardless of this setting to match the UPC controller operation.

Note 2: This command is available on units with firmware revision 1.3.0 or higher.

Parameters

< 0 | OFF | 1 | ON >

Parameter Format

<cr>

Example

PROG:TRAN:CSC ON

Query Format

PROG:TRANSient:CSC?

Returned Data Format

<cr>

Query Example

PROG:TRAN:CSC?

1

Command Syntax	PROG:TRANsient:FROM
Description	This command sets the first transient step number at which step mode execution is to begin. The step specified must exist or an error message will be generated.
Parameters	STEP number from 1 ~ 99
Parameter Format	<nr1>
Example	PROG:TRAN:FROM 5
Query Format	PROG:TRANsient:FROM?
Returned Data Format	<nr1>
Query Example	PROG:TRAN:FROM? 5
Command Syntax	PROG:TRANsient:TO
Description	This command sets the transient step number at which step mode execution is to end. The step specified must exist or an error message will be generated.
Parameters	STEP number from 1 ~ 99
Parameter Format	<nr1>
Example	PROG:TRAN:TO 25
Query Format	PROG:TRANsient:TO?
Returned Data Format	<nr1>
Query Example	PROG:TRAN:TO? 25
Command Syntax	PROG:TRANsient:EVENTs <nr1>
Description	This command sets the number of repetitions for executing the selected transient. A zero value is equivalent to infinite execution until aborted by "PROG:TRAN STOP" command.
Parameters	Repetition, range is 0 ~ 99999
Parameter Format	<nr1>
Example	PROG:TRAN:EVEN 5
Query Format	PROG:TRANsient:EVENTs?
Returned Data Format	<nr1>
Query Example	PROG:TRAN:EVEN? 5
Command Syntax	PROG:TRANsient:GOTO <nr1>
Description	This command forces transient execution to move to the element argument passed (STEP in STEP mode or SEGMENT in segment mode).
Parameters	ELEMENT
Parameter Format	<nr1>
Example	PROG:TRAN:GOTO 3

8.6.4 Memory Management Commands

The Program memory subsystem commands allow management of Program memory contents.

Command Syntax	PROG:MEMory <cr>
Description	This command selects the specific program memory type for storing and retrieving programs. Default is INTERNAL memory. Alternatives are RAM and USB devices. The memory type can also be specified as an optional parameter with several PROG:MEM commands where indicated in this manual.
Parameters	Memory types: INTERNAL RAM USB. For a complete list of available memory types, use the "PROG:MEMory:CATalog?" Command.
Parameter Format	<cr>
Example	PROG:MEM USB
Query Format	PROG:MEMory?
Returned Data Format	<cr>
Query Example	PROG:MEM? USB
Query Format	PROG:MEMory:CATalog?
Description	This query command returns a comma separated list of available memory types that can be selected for storage of steady state and transient table information.
Returned Data Format	INTERNAL, RAM, SD1, SD2, SD3, USB
Memory Types	INTERNAL = Internal Flash Memory. (Default selection) RAM = Internal RAM. Content will be lost when power source is turned off. USB[X][Y] = USB memory stick devices. X = port number, Y = partition number SD[Y] = SC Card, Y = partition number X = symbolizes different memory sticks connected to various available USB ports. Y = symbolizes different logical partitions on a USB memory stick or SD card. INTERNAL and RAM are always available. INTERNAL is default selection. Use the "PROG:MEMory <cr>" command to select active memory selection.
Query Example	PROG:MEM:CAT? INTERNAL,RAM,USBA1

Query Format Description	PROGram:EXECuted:MEMory? This command selects the specific program memory type for storing and retrieving programs. Default is INTERNAL memory. Alternatives are RAM and USB devices. The memory type can also be specified as an optional parameter with several PROGram commands where indicated in this manual.
Parameters	Memory types: INTERNAL RAM USB
Parameter Format	<cr>
Example	PROG:EXEC:MEM USB
Query Format	PROGram:EXECuted:MEMory?
Returned Data Format	<cr>
Query Example	PROG:EXEC:MEM? USB
Command Syntax Description	PROGram:POWOn <nr1> Returns the number of the stored program that will be recalled at power on.
Parameters	Program number
Parameter Format	<nr1>
Example	PROG:POWO 1
Query Format	PROGram:POWOn?
Returned Data Format	<nr1>
Query Example	PROG:POWO? 1
Command Syntax Description	PROGram:DELeTe:ALL <cr> This command deletes all programs, waveforms and setup values, performs device RESET, loads Program #1 with *RST default values, executes MANUAL MODE with *RST values. Waveforms (1-16) are re-loaded from internal Flash memory. Attempting to DELeTe an EXECuting Program will result in an error message.
Parameters	Optional: Memory type: INTERNAL RAM USB
Parameter Format	<cr>
Example	PROG:DEL:ALL USB
Query Format Description	PROGram:CATalog? <cr> This query returns a comma separated list of <nr1> values representing stored programs (e.g. 1,2,7...). If the MANUAL MODE program setup exists, the list will include 0. If no programs are stored at all, this query returns a 1
Parameters	Optional: Memory type: INTERNAL RAM USB
Parameter Format	<cr>
Returned Data Format	<nr1>,<nr1>,...,<nr1>,<nr1>
Query Example	PROG:CAT? 0,1,2,9,12 PROG:CAT? INTERNAL 0

Query Format	PROG:CR? <cr>
Description	This query command calculates and returns the checksum value of the selected program. This CRC may be used to verify the program data integrity is intact. This command is provided for UPC compatibility mode and not recommended for new programs.
Parameters	Optional: Memory type: INTERNAL RAM USB
Parameter Format	<cr>
Returned Data Format	<nr1>
Query Example	PROG:CR? RAM 08ad55
Query Format	PROG:BROW?
Description	This command returns the list of available programs stored in the memory selected or passed as a parameter.
Parameters	Optional: Memory type: INTERNAL RAM USB
Parameter Format	<cr>
Returned Data Format	<nr1>, <nr1>, ..., <nr1>
Query Example	PROG:BROW? 1,8,9,23

8.7 Source Commands

Source commands control the settings of the power source. This includes all operating modes, voltages, frequency, current and power limits and phase angles as well as transient operation. Since the SOURCE subsystem is the primary system, the SOURce portion of these commands is optional. The following status commands are supported broken down by SOURCE sub groups.

8.7.1 Source Configuration Programming Commands

Command Syntax	[SOURce:]CONFIG
Description	Selects alternative loop compensation mode for improved transient response. The effect of this command depends on the selected output mode as follows:
Parameters	AC Mode: Changes the AC loop compensation.
Parameter Format	< 0 1 > (0 = Normal loop, 1 = Faster Loop)
Example	
Query Format	SOUR:CONFIG 1
Returned Data Format	[SOURce:]CONFIG?
Query Example	
	CONFIG?
	0
Command Syntax	[SOURce:]CONFIG:AC
Description	Selects alternative AC loop compensation mode for improved AC transient response.
	The effect of this command depends on the selected output mode as follows:
Parameters	AC Mode: Changes the AC loop compensation
Parameter Format	< 0 1 > (0 = Normal loop, 1 = Faster Loop)
Example	
Query Format	SOUR:CONFIG:AC 1
Returned Data Format	[SOURce:]CONFIG:AC?
Query Example	
	CONFIG:AC?
	0

Command Syntax	[SOURce:]CONFIG:HFreq
Description	This command enables high-frequency output current protection extension mode. In this mode, the protection for high frequency content at the output of the power source is held off for up to 2 seconds to allow short time events to ride through without tripping the normal protection mode. Note: Available in units with Firmware revision 1.6.6 or higher.
Parameters	< 0 OFF 1 ON > (0 = Off, 1 = On)
Parameter Format	
Example	SOUR:CONFIG:HF 1
Query Format	[SOURce:]CONFIG:HFreq?
Returned Data Format	
Query Example	CONFIG:HF? 1

Command Syntax	[SOURce:]INITial <n>
Description	Sets source output settings initialization mode. This command in combination with the "OUTPut[:STATe]:AUTO" command allows the unattended resumption of a test station after a power failure. Note: This condition is potentially hazardous and should be used with caution.
[SOURce:]INITial? = ON	Set points of the unit at power on will be the last set after power off. The set points affected by this command are: - Frequency - Voltage AC1 - Voltage AC2 - Voltage AC3 - 0 - 0 - 0 - Form (THREE , SPLIT or SINGLE) - Range (High or Low) - Compatibility Mode (UPC or NORMAL)
[SOURce:]INITial? = OFF	Set points of the unit at power on will have a default value of: - Frequency = 60Hz - Voltage AC1 = 0V - Voltage AC2 = 0V - Voltage AC3 = 0V - 0 - 0 - 0 - Form = THREE - Range = HIGH - Compatibility = NORMAL
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	:INIT ON
Query Format	[SOURce:]INITial?
Returned Data Format	
Query Example	INIT? 0

Command Syntax Description	[SOURce:]RANGe Selects high or low voltage range. Although the ADF Series® has only a single voltage range, this commands allows simulation of a dual range AC voltage source which is more familiar to some users. Despite this virtual low range capability, no actual physical range change takes places so the output is never interrupted. Note: When switching from HIGH to LOW range, the output voltage may be reduced to the highest available voltage on the low range.
Parameters	< 0 LOW 1 HIGH >
Parameter Format	
Example	RANG HIGH
Query Format	[SOURce:]RANGe?
Returned Data Format	
Query Example	RANG? 1
Command Syntax Description	[SOURce:]RAMP# Sets voltage slew rate for selected phase number or for all phases if no phase number is specified.
Parameters	Slew rate
Parameter Format	<nr2>
Example	SOUR:RAMP3 10.5
Query Format	[SOURce:]RAMP#?
Description	Returns voltage slew rate setting for specified phase (1, 2 or 3) or for phase 1 (A) if no phase number is specified.
Returned Data Format	
Query Example	SOUR:RAMP3? 10.5000
Command Syntax Description	[SOURce:]UPDATEPHase Set the phase angle at which programmed voltage changes on phase A will take place. This applies to output on and off phase angle placement as well. Available range is from 0° through 360.0° inclusive. Values higher than 360.0° will be truncated to 360.0000° automatically.
Parameters	< 0.0000 - 360.0000 >
Parameter Format	<nr2>
Example	UPDATEPH 90.00
Query Format	[SOURce:]UPDATEPHase?
Returned Data Format	<nr2>
Query Example	SOURce:UPDATEPH? 90.0000

8.7.2 Voltage Programming Commands

Note that most of the voltage programming commands are phase specific so in three or split phase mode, each phase voltage can be individually programmed. This is done by appending 1, 2 or 3 for the “#” symbol shown in the syntax below. If the “#” value is omitted, all available phase (1, 2 or 3 in single, split or three phase mode respectively) will be set to the same amplitude. This allows the same program code to be used for any phase mode as long as the phase amplitudes need to be balanced.

The following command sets each phase to a different amplitude when in three phase mode.

SOUR:VOLT:AC1 15;;SOUR:VOLT:AC2 30;;SOURCE:VOLT:AC3 45

This command sets all phases to the same amplitude, regardless of phase mode:

SOUR:VOLT:AC 100

The query format for these phase specific commands will return the value for the phase number appended to the command. If the phase number reference is omitted, the setting for phase 1 (A) is returned.

Command Syntax	[SOURce:]VOLTage:CSC[:STATE#] [SOURce:]CSC:STATE#
Description	Turns the Continuous Source Calibration (CSC) mode on or off.
Parameters	<0 OFF 1 ON>
Parameter Format	
Example	VOLT:CSC ON
Query Format	[SOURce:]VOLTage:CSC[:STATE]?
Returned Data Format	<nr1>
Query Example	VOLT:CSC? 1
Command Syntax	[SOURce:]VOLTage[:AC]#
Description	Sets AC voltage for phase #. If # is omitted, sets all available phases to value specified.
Parameters	Range 0.0000 - 300.0000
Parameter Format	<nr2>
Example	VOLT:AC1 100.00
Query Format	[SOURce:]VOLTage[:AC]#?
Description	Returns voltage setting for specified phase. If phase is omitted, returns voltage setting for phase A.
Returned Data Format	<nr2>
Query Example	VOLT:AC1? 100.0000

Command Syntax	[SOURce:]VOLTage[:AC]#:SLEW
Description	Sets AC voltage slew rate for phase # in Volts per msec. If # is omitted, sets phase A slew rate to value specified.
Parameters	Range 0.01 – 300.0
Parameter Format	<nr2> and <nr3>
Example	VOLT:AC1:SLEW 300.00
Query Format	[SOURce:]VOLTage[:AC]#:SLEW?
Description	Returns voltage slew rate setting for specified phase. If phase is omitted, returns voltage setting for phase A.
Returned Data Format	<nr2>
Query Example	VOLT:AC1:SLEW? 300.0000
Command Syntax	[SOURce:]VOLTage[:AC]:LIMit:MINimum
Description	Sets low user limit for AC voltage programming. User limits must fall within actual hardware limits of the power source. Also, MIN limit must be less than MAX limit.
Parameters	0.000 – 300.000
Parameter Format	<nr2>
Example	VOLT:LIM:MIN 20.0
Query Format	[SOURce:]VOLTage[:AC]#:LIMit:MINimum?
Returned Data Format	<nr2>
Query Example	VOLT:LIM:MIN? 20.0000
Command Syntax	[SOURce:]VOLTage[:AC]:LIMit:MAXimum
Description	Sets high user limit for AC voltage programming. User limits must fall within actual hardware limits of the power source. Also, MAX limit must be greater than MIN limit.
Parameters	0.000 – 300.000
Parameter Format	<nr2>
Example	VOLT:LIM:MAX 240.0
Query Format	[SOURce:]VOLTage[:AC]#:LIMit:MAXimum?
Returned Data Format	<nr2>
Query Example	VOLT:LIM:MAX? 240.0000
Query Format	[SOURce:]VOLTage[:AC]#:LIMit:RANGe?
Description	Returns available AC voltage range low and high limits.
Returned Data Format	<nr2>,<nr2>
Query Example	VOLT:AC1:LIM:RANG? 0.0000,300.0000

Query Format	[SOURce:]VOLTage[:AC]#:LIMIT:SATuration:RANGe?
Description	Returns the upper and lower limit sine wave RMS voltage at which saturation of the output inverter will occur. Saturation limits are determined in the maximum peak voltage capability of the AC components at the output of the power source. For the ADF Series®, these limits are -425Vp and +425Vp. The VOLT:AC1:LIM:SAT:RANG? returns the min and max. RMS of a sine wave that may be programmed. Maximum allowable values are: Maximum positive peak voltage: $V_{peak_max} = V_{AC_peak_max}$ Minimum negative peak voltage: $V_{peak_min} = V_{AC_peak_min}$ For a sinusoidal AC waveform, these limits are: $V_{rms_sat} = (425 - V_{dc}) / 1.4142$ $V_{rms_sat} = (-425 + V_{dc}) / 1.4142$ 425 = 1.41 * 300 (V_AC_rms_sat = 300)
Examples	
Returned Data Format	<nr2>
Query Example	VOLT:AC3:LIM:SAT:RANG? 300.5204
Query Format	[SOURce:]VOLTage[:AC]#:LIMIT:SATuration:MAXimum?
Description	Returns maximum sine wave RMS voltage at which saturation of the output inverter will occur. See [SOURce:]VOLTage[:AC]#:LIMIT:SATuration:RANGe? for details.
Returned Data Format	<nr2>
Query Example	VOLT:AC3:LIM:SAT:MAX? 301.154
Query Format	[SOURce:]VOLTage[:AC]#:LIMIT:SATuration:MINimum?
Description	Returns minimum sine wave RMS voltage at which saturation of the output inverter will occur. See [SOURce:]VOLTage[:AC]#:LIMIT:SATuration:RANGe? for details.
Returned Data Format	<nr2>
Query Example	VOLT:AC3:LIM:SAT:MIN? 0.000

Command Syntax	[SOURce:]VOLTage[:AC]:INITial
Description	This command is equivalent to the “[SOURce:]INITial <n>” command but applies only to the AC1, AC2 and AC3 parameters.
VOLT:INIT? = ON	Set points of the unit at power on will be the last set after power off. The set points affected by this command are: - Voltage AC1 - Voltage AC2 - Voltage AC3
VOLT:INIT? = OFF	Set points of the unit at power on will have a default value of: - Voltage AC1 = 0V - Voltage AC2 = 0V - Voltage AC3 = 0V
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	VOLT:AC:INIT OFF
Query Format	[SOURce:]VOLTage[:AC]:INITial?
Returned Data Format	
Query Example	VOLT:AC:INIT? 0

Command Syntax	[SOURce:]VOLTage:EXTend
Description	Available only on ADF models with Option V. This command grants access to a higher voltage range extension mode. When enabled, AC voltage settings up to 333V L-N are supported.
Parameters	[0 OFF 1 2] 0 = Off, 312Vac max. 1 = 320Vac max 2 = 333Vac max
Parameter Format	<bool>
Example	VOLT:EXT 1
Query Format	[SOURce:]VOLTage:EXTend?
Returned Data Format	<nr1>
Query Example	VOLT:EXT? 1

Commands available only with Option D:

Command Syntax	[SOURce:]VOLTage:DC#
Description	Sets DC voltage for phase #. If # is omitted, sets all available phases to value specified. Note: Source must be in DC or AC+DC mode and UPC compatibility mode must be disabled.
Parameters	Range 0.0000 - 425.0000
Parameter Format	<nr2>
Example	VOLT:DC1 375.0
Query Format	[SOURce:]VOLTage:DC#?
Returned Data Format	<nr2>
Query Example	VOLT:DC1? 375.0000

Command Syntax	[SOURce:]VOLTage:DC#:SLEW
Description	Sets DC voltage slew rate for phase #. If # is omitted, sets all available phases to value specified. Note: Source must be in DC or AC+DC mode and UPC compatibility mode must be disabled.
Parameters	Range 0.01- 850.00
Parameter Format	<nr2> and <nr3>
Example	VOLT:DC1:SLEW 850.00
Query Format	[SOURce:]VOLTage:DC#:SLEW?
Returned Data Format	<nr2>
Query Example	VOLT:DC1:SLEW? 850.0000
Command Syntax	[SOURce:]VOLTage:DC#:LIMit:MINimum
Description	Sets low user limit for DC voltage programming for phase #. If # is omitted, sets all available phases to value specified. User limits must fall within actual hardware limits of the power source. Also, MIN limit must be less than MAX limit.
Parameters	-425.0 – 425.0
Parameter Format	<nr2>
Example	VOLT:LIM:DC1:MIN 20.0
Query Format	[SOURce:]VOLTage:DC#:LIMit:MINimum?
Returned Data Format	<nr2>
Query Example	VOLT:DC1:LIM:MIN? -425.000
Command Syntax	[SOURce:]VOLTage:DC#:LIMit:MAXimum
Description	Sets upper user limit for DC voltage programming for phase #. If # is omitted, sets all available phases to value specified. User limits must fall within actual hardware limits of the power source. Also, MIN limit must be less than MAX limit.
Parameters	-425.0 – 425.0
Parameter Format	<nr2>
Example	VOLT:LIM:DC1:MAX 270.0
Query Format	[SOURce:]VOLTage:DC#:LIMit:MAXimum?
Returned Data Format	<nr2>
Query Example	VOLT:DC1:LIM:MAX? -425.000
Query Format	[SOURce:]VOLTage:DC#:LIMit:RANGe?
Description	This query returns both upper and lower user limits for DC voltage programming.
Returned Data Format	<nr2>,<nr2>
Query Example	VOLT:DC1:LIM:RANG? -425.0000,425.0000

Query Format	[SOURce:]VOLTage:DC#:LIMit:SATuration:RANGe?
Description	Returns maximum DC voltage at which saturation of the output inverter will occur. Saturation limits are determined in the maximum peak voltage capability of the AC+DC components at the output of the power source. For the ADF Series®, these limits are -425 and +425V. The VOLT:DC1:SAT? returns the max. DC level that may be programmed based on the programmed AC wave shape and RMS level. Maximum allowable values are: Maximum positive peak voltage: $V_DC = V_peak_max - V_AC_peak_max$ Minimum negative peak voltage: $V_DC = V_peak_min + V_AC_peak_min$
Examples	$V_AC = 300V_{rms}$ sine wave $V_DC = 425 - 1.41 * 300$ (V_DC_sat = 0) $V_AC = 120V_{rms}$ sine wave $V_DC = 425 - 1.41 * 120$ (V_DC_sat = 255) $V_AC = 0V_{rms}$ $V_DC = 425 - 0$ (V_DC_sat = 425)
Returned Data Format	<nr2>
Query Example	VOLT:DC1:LIM:SAT:RANG? -225, + 225
Query Format	[SOURce:]VOLTage:DC#:LIMit:SATuration:MAXimum?
Description	Returns maximum sine wave RMS voltage at which saturation of the output inverter will occur. See [SOURce:]VOLTage:DC#:LIMIT:SATuration:RANGe? for details.
Returned Data Format	<nr2>
Query Example	VOLT:DC3:LIM:SAT:MAX? 254.946
Query Format	[SOURce:]VOLTage:DC#:LIMit:SATuration:MINimum?
Description	Returns minimum sine wave RMS voltage at which saturation of the output inverter will occur. See [SOURce:]VOLTage:DC#:LIMIT:SATuration:RANGe? for details.
Returned Data Format	<nr2>
Query Example	VOLT:DC3:LIM:SAT:MIN? -254.946

Commands available only with Option V:

Command Syntax	[SOURce:]VOLTage:EXTend
Description	This command grants access to a higher voltage range extension mode. When enabled, AC voltage settings up to 333V L-N are supported.
Parameters	[0 OFF 1 2] 0 = Off, 312Vac max. 1 = 320Vac max 2 = 333Vac max
Parameter Format	<bool>
Example	VOLT:EXT 1
Query Format	[SOURce:]VOLTage:EXTend?
Returned Data Format	<nr1>
Query Example	VOLT:EXT? 1

8.7.3 Frequency Programming Commands

Command Syntax	[SOURce:]FREQuency
Description	Sets output frequency for all phases.
Parameters	45.00 – 500.0 For ADF models with Option F. 15.00 – 1200.0
Parameter Format	<nr2>
Example	FREQ 400.0
Query Format	[SOURce:]FREQuency?
Returned Data Format	<nr2>
Query Example	FREQ? 400.0000
Command Syntax	[SOURce:]FREQuency:LIMit:MINimum
Description	Sets the lower user limit for frequency programming. Note that the lower limit set value must be less than the upper limit set value or an error will be generated and no change to the set value will take place. The lower limit set value must fall within the source specified frequency range capability.
Parameters	45.00 – 500.0 For ADF models with Option F. 15.00 – 1200.0
Parameter Format	<nr2>
Example	FREQ:LIM:MIN 47.0
Query Format	[SOURce:]FREQuency:LIMit:MINimum?
Returned Data Format	<nr2>
Query Example	FREQ:LIM:MIN? 47.0000
Command Syntax	[SOURce:]FREQuency:LIMit:MAXimum
Description	Sets the upper user limit for frequency programming. Note that the upper limit set value must be greater than the lower limit set value or an error will be generated and no change to the set value will take place. The upper limit set value must fall within the source specified frequency range capability.
Parameters	45.00 – 500.0 For ADF models with Option F. 15.00 – 1200.0
Parameter Format	<nr2>
Example	FREQ:LIM:MAX 63.0
Query Format	[SOURce:]FREQuency:LIMit:MAXimum?
Returned Data Format	<nr2>
Query Example	FREQ:LIM:MAX? 63.0000

Query Format	[SOURce:]FREQuency:LIMit:RANGe?
Description	This command returns the lower and upper frequency user limit set values
Returned Data Format	<nr2>, <nr2>
Query Example	FREQ:LIM:RANG? 53.0000,63.0000
Command Syntax	[SOURce:]FREQuency:SLEW
Description	Sets the frequency slew rate in Hz/msec.
Parameters	0.01 – 1200.00
Parameter Format	<nr2>
Example	FREQ:SLEW 100.0
Query Format	[SOURce:]FREQuency:SLEW?
Returned Data Format	<nr2>
Query Example	FREQ:SLEW? 100.0000
Query Format	[SOURce:]FREQuency:SPAN?
Description	This command is provided to support backward compatibility with Pacific Power UPC controllers. Refer also to the “ SYSTem:COMPAtible ” command. For ADF Series®, this query always returns 1200.0000
Returned Data Format	<nr2>
Query Example	FREQ:SPAN? 1200.0000

8.7.4 Current Programming Commands

Command Syntax	[SOURce:]CURRent:LIMit#
Description	This command sets the programmable current level for the selected phase #. If # is omitted, sets all phases to current level specified. The value set cannot exceed the maximum current capability of the power source as returned by the “[SOURce:]CURRent:LIMit#:MAX?” command. If the load current exceeds the current limit set point, the source will go into constant current mode to maintain the load current at the set limit level.
Parameters	0.00 – MAX
Parameter Format	<nr2>
Example	CURR:LIM 20.5
Query Format	[SOURce:]CURRent:LIMit#?
Returned Data Format	<nr2>
Query Example	CURR:LIM? 41.667,41.667,41.667

Query Format	[SOURce:]CURRent:LIMit#:MAX?
Description	This command returns the maximum available programmable current limit setting. Note that the returned value is a function of the “ SYSTem:COMPAtible ” setting
UPC	If UPC mode is enabled, this command always returns 2000.0000 to emulate the UPC controllers
DISABLED	With UPC mode disabled, this command returns the max. available current output per phase. This value is a function of the ADF model and the number of units that are connected in parallel.
Returned Data Format	<nr2>
Query Example	CURR:LIM:MAX? 41.6667
Query Format	[SOURce:]CURRent:LIMit#:DEFault?
Description	This command returns the default current limit setting at power up for the referenced phase.
Returned Data Format	<nr2>
Query Example	CURR:LIM1:DEF? 41.67
Query Format	[SOURce:]CURRent:LIMit#:MAXimum?
Description	This command returns the maximum current limit setting available for the referenced phase.
Returned Data Format	<nr2>
Query Example	CURR:LIM:MAX1? 41.67
Query Format	[SOURce:]CURRent:LIMit#:MINimum?
Description	This command returns the minimum current limit setting available for the referenced phase.
Returned Data Format	<nr2>
Query Example	CURR:LIM:MIN1? 0.000

Command Syntax
Description

[SOURce:]CURRent:LIMit:AUTO

This commands enables or disables the Auto Current Limit function. This function automatically adjusts the programmed current limit level as a function of programmed voltage along the constant power curve of the voltage range.

For example: On a 3150ADF model in three phase mode, if VOLT = 0 and CURR:LIM = 41.67 and voltage is changed to V = 300, the CURR:LIM will change to: 5000 VA / 300 Vac = 16.0.

If CURR:LIM:AUTO = OFF then the CURR:LIM setting will remain at 41.67A and the power source will power limit at 5000VA instead if the load draws more than 16Aac.

Parameters

< 0 | OFF | 1 | ON >

Parameter Format

Example

CURR:LIM:AUTO ON

Query Format

[SOURce:]CURRent:LIMit:AUTO?

Returned Data Format

Query Example

CURR:LIM:AUTO?

1

Command Syntax

[SOURce:]CURRent:OVerload

Description

This command turns the overload current mode on or off

Parameters

[0 | OFF | 1 | ON]

Parameter Format

Example

SOUR:CURR:OV ON

Query Format

[SOURce:]CURRent:OVerload?

Returned Data Format

Query Example

CURR:OV?

1

8.7.5 Phase Programming Commands

Command Syntax	[SOURce:]PHASe:ROTation
Description	This command sets default phase rotation at power on. Available settings are POSITIVE (1) or NEGATIVE (0). This setting effectively swaps phases B and C and may be used to set the required phase rotation for AC motors.
Parameters	[0 NEGative 1 POSitive] 0 = NEGATIVE 1 = POSITIVE
Parameter Format	
Example	PHAS:ROT POS
Query Format	[SOURce:]PHASe:ROTation?
Returned Data Format	
Query Example	PHAS:ROT? 1
Command Syntax	[SOURce:]PHASe:SPLIT
Description	This command sets the split phase mirroring mode. This mode allows non-symmetrical AC arbitrary waveforms to be used when in split phase mode. Default state is on.
Parameters	[0 OFF 1 ON] 0 = OFF 1 = ON
Parameter Format	
Example	PHAS:SPLIT ON
Query Format	[SOURce:]PHASe:SPLIT?
Returned Data Format	
Query Example	PHAS:SPLIT? 1

8.7.6 Voltage Protection Programming Commands

Note: For all protection commands, # = Phase 1, 2 or 3 select or omit for all phases.

Command Syntax	[SOURce:]PROTect:PEAK:VOLTage#:STATe
Description	This command enables or disables the peak voltage protection.
Parameters	< 0 OFF 1 } ON >
Parameter Format	
Example	PROT:PEAK:VOLT1:STAT 1
Query Format	[SOURce:]PROTect:PEAK:VOLTage#:STATe?
Returned Data Format	<nr1>
Query Example	PROT:PEAK:VOLT1:STAT? 1
Command Syntax	[SOURce:]PROTect:PEAK:VOLTage:MODE <MARGin LEVel BOTH>
Description	This command sets the maximum voltage peak margin. If the output voltage peak exceeds the programmed peak level by more than this amount, an error is tripped.
Parameters	<MARGin 0 LEVel 1 BOTH 2 > Encoding: MARGin 0 Relative level LEVel 1 Absolute level BOTH 2 Both
Parameter Format	<cr> <nr1>
Example	PROT:PEAK:VOLT:MODE BOTH
Query Format	[SOURce:]PROTect:PEAK:VOLTage:MODE?
Returned Data Format	<nr2>
Query Example	PROT:PEAK:VOLT:MODE? 2
Command Syntax	[SOURce:]PROTect:PEAK:VOLTage:MARGin <VOLTAGE MARGIN>
Description	This command sets the maximum voltage peak margin. If the output voltage peak exceeds the programmed peak margin by more than this amount, an error is tripped.
Parameters	<VOLTAGE MARGIN>
Parameter Format	<nr2>
Example	PROT:PEAK:VOLT:MARG 120.0
Query Format	[SOURce:]PROTect:PEAK:VOLTage:MARGIN?
Returned Data Format	<nr2>
Query Example	PROT:PEAK:VOLT:MARG? 120.000
Query Syntax	[SOURce:]PROTect:PEAK:VOLTage:MARGin:MINimum?
Description	This command returns the minimum voltage peak margin setting.
Query Example	PROT:PEAK:VOLT:MARG:MIN? 0.000

Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:MARGin:MAXimum?
Description	This command returns the maximum voltage peak margin setting
Query Example	PROT:PEAK:VOLT:MARG:MAX? 500.000
Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:MARGin:DEFault?
Description	This command returns the default voltage peak margin setting
Query Example	PROT:PEAK:VOLT:MARG:DEF? 100.000
Command Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:LEVel <VOLTAGE LEVEL>
Description	This command sets the maximum voltage peak level. If the output voltage peak exceeds the programmed peak level by more than this amount, an error is tripped.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	PROT:PEAK:VOLT:LEV 120.0
Query Format	[SOURCE:]PROTECT:PEAK:VOLTage:LEVel?
Returned Data Format	<nr2>
Query Example	PROT:PEAK:VOLT:LEV? 500.000
Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:LEVel:MINimum?
Description	This command returns the minimum voltage peak level setting.
Query Example	PROT:PEAK:VOLT:LEV:MIN? 0.000
Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:LEVel:MAXimum?
Description	This command returns the maximum voltage peak level setting
Query Example	PROT:PEAK:VOLT:LEV:MAX? 500.000
Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:LEVel:DEFault?
Description	This command returns the default voltage peak level setting
Query Example	PROT:PEAK:VOLT:LEV:DEF? 500.000
Query Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:TRIPped?
Description	This command returns 1 if the voltage peak protection has been tripped or 0 if no trip occurred.
Query Example	PROT:PEAK:VOLT:TRIP? 0.000
Command Syntax	[SOURCE:]PROTECT:PEAK:VOLTage:TRIPped:CLEar

Description	This command clears the peak voltage protection trip status. Once cleared, the power source output can be re-enabled.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	PROT:PEAK:VOLT:TRIP:CLE
Command Syntax	[SOURCE:]PROTect:RMS:OV#:LEVel <VOLTAGE LEVEL>
Description	This command sets the over-voltage level. If the output voltage exceeds the programmed level, an error is tripped.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	PROT:RMS:OV1:LEV 120.0
Query Format	[SOURCE:]PROTect:RMS:OV#:LEVel?
Returned Data Format	<nr2>
Query Example	PROT:RMS:OV:LEV? 500.000
Command Syntax	[SOURCE:]PROTect:RMS:OV#:STATe
Description	This command enables or disables the over-voltage level protection.
Parameters	< 1 } 0 >
Parameter Format	
Example	PROT:RMS:OV1:LEV 120.0
Query Format	[SOURCE:]PROTect:RMS:OV#:VOLTage#:STATe?
Returned Data Format	<nr2>
Query Example	PROT:RMS:OV:STAT? 500.000
Command Syntax	[SOURCE:]PROTect:RMS:UV#:LEVel <VOLTAGE LEVEL>
Description	This command sets the under-voltage level. If the output voltage drops below the programmed level, an error is tripped.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	PROT:RMS:UV1:LEV 120.0
Query Format	[SOURCE:]PROTect:RMS:UV#:LEVel?
Returned Data Format	<nr2>
Query Example	PROT:RMS:UV:LEV? 500.000

Command Syntax	[SOURCE:]PROTECT:RMS:UV#:STATe
Description	This command enables or disables the under-voltage level protection.
Parameters	< 1 } 0 >
Parameter Format	
Example	PROT:RMS:UV1:LEV 120.0
Query Format	[SOURCE:]PROTECT:RMS:UV#:VOLTage#:STATe?
Returned Data Format	<nr2>
Query Example	PROT:RMS:UV:STAT?
	1

8.7.7 Voltage Sense Protection Commands

The **SENSE:FAULT** is a fault based on the difference between the RMS voltage measurement and the RMS voltage setpoint programmed.

If the **ABS(VOLTAGE_SETPOINT_RMS – VOLTAGE_MEASUREMENT_RMS) > MAX(SENSe:FAULT:LEVel:PERCentage * VOLTAGE_SETPOINT_RMS, SENSe:FAULT:LEVel:MIN)** the fault trips and turns the output of the unit off.

The trip time is programmed with **PROT:TDELAY X** where X is in 100 milliseconds unit, so 1 means 100ms, 2 means 200ms, and so on. It can be queried with **PROT:TDELAY?**

As this is a RMS protection it will take at least 100ms to trip, it is not faster than that.

- **SENSe:FAULT:LEVel:MIN** establishes the minimum difference it will compare in RMS voltage terms.
- **SENSe:FAULT:LEVel:PERCentage** establishes the difference in terms of a percentage of the programmed RMS setpoint.

The maximum is used to compare, this gives the possibility to program in percentage terms absolute terms, or both.

For example, at 108Vrms programmed, the **ABS(VOLTAGE_SETPOINT_RMS – VOLTAGE_MEASUREMENT_RMS)** should exceed 108Vrms to trip.

For faster voltage protection use **peak voltage protection** which is based on instantaneous values instead of RMS.

Command Syntax	SENSe:FAULT:LEVel:MIN <nr2>
Description	This command sets the minimum sense voltage at which a voltage sense fault will trip the output. The protection trips if the following condition is fulfilled during a time equal to the protection trip time: $ABS(VOLTAGE_SETPOINT_RMS - VOLTAGE_MEASUREMENT_RMS) > MAX(SENSe:FAULT:LEVel:PERCentage * VOLTAGE_SETPOINT_RMS, SENSe:FAULT:LEVel:MIN)$ By default SENSe:FAULT:LEVel:PERCentage is 10% and SENSe:FAULT:LEVel:MIN is 25 volts.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	SENS:FAULT:LEV:MIN 120.0
Query Format	SENSe:FAULT:LEVel:MIN?
Returned Data Format	<nr2>
Query Example	SENS:FAULT:LEV:MIN? 25.000
Command Syntax	SENSe:FAULT:LEVel:PERCentage <nr2>
Description	This command sets the sense voltage delta between programmed and actual senses voltage in percent of voltage range at which a voltage sense fault will trip the output. The protection trips if the following condition is fulfilled during a time equal to the protection trip time: $ABS(VOLTAGE_SETPOINT_RMS - VOLTAGE_MEASUREMENT_RMS) > MAX(SENSe:FAULT:LEVel:PERCentage * VOLTAGE_SETPOINT_RMS, SENSe:FAULT:LEVel:MIN)$ By default SENSe:FAULT:LEVel:PERCentage is 10% and SENSe:FAULT:LEVel:MIN is 25 volts.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	SENS:FAULT:LEV:PERC 10.0
Query Format	SENSe:FAULT:LEVel:PERC?
Returned Data Format	<nr2>
Query Example	SENS:FAULT:LEV:PERC? 10.000
Command Syntax	SENSe:FAULT:STATe
Description	This command enables or disables the send fault error. Default is on (1). It can be disabled by setting the state to off (0).
Parameters	< 0 1 >
Parameter Format	
Example	SENS:FAULT:STAT 1
Query Format	SENSe:FAULT:STATe?
Returned Data Format	
Query Example	SENS:FAULT:STAT? 1

Command Syntax	SENSe:PATH
Description	This command selects the source for metering and CSC mode as either internal (0) or external (1).
Parameters	< 0 1 >
Parameter Format	
Example	SENS:PATH 1
Query Format	SENSe:PATH?
Returned Data Format	
Query Example	SENS:PATH? 1

8.7.8 Current Protection Programming Commands

Note: For all protection commands, # = Phase 1, 2 or 3 select or omit for all phases.

Command Syntax	[SOURce:]PROTeCt[:RMS]:CURRent[:STATe] <ON OFF>
Description	This command enables or disables the rms current protection. If the protection is tripped the power source output is disabled.
Parameters	< ON 1 OFF 0 >
Parameter Format	<nr1> <cr>
Example	PROTeCt:CURRent ON
Query Format	[SOURce:]PROTeCt[:RMS]:CURRent[:STATe]?
Returned Data Format	<nr2>
Query Example	PROTeCt:CURRent? 1

Command Syntax	[SOURce:]PROTeCt[:RMS]:CURRent:LEVel <LEVEL>
Description	This command sets the rms current protection level.
Parameters	< LEVEL >
Parameter Format	<nr2>
Example	PROT:CURR:LEVel 40.0
Query Format	[SOURce:]PROTeCt[:RMS]:CURRent:LEVel?
Returned Data Format	<nr2>
Query Example	PROT:CURR:LEV? 40.000

Query Syntax	[SOURce:]PROTeCt[:RMS]:CURRent:LEVel:MINimum?
Description	This command returns the minimum rms current protection level setting.
Query Example	PROT:CURR:LEV:MIN? 0.000

Query Syntax	[SOURce:]PROTeCt[:RMS]:CURRent:LEVel:MAXimum?
Description	This command returns the maximum rms current protection level setting.
Query Example	PROT:CURR:LEV:MAX? 41.667

Query Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:LEVEL:DEFAULT?
Description	This command returns the default rms current protection level setting. This value will be a function of the power source model.
Query Example	PROT:CURR:LEV:DEF? 41.667
Command Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY <DELAY>
Description	This command sets the rms current protection trip delay in 100 msecs increments, i.e. as setting of 5 means 500 msec.
Parameters	< DELAY >
Parameter Format	<nr1>
Example	PROTECT:CURR:TDELAY 5
Query Format	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY?
Returned Data Format	<nr1>
Query Example	PROT:CURR:LEV? 5
Query Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY:MINIMUM?
Description	This command returns the minimum rms current protection trip delay setting.
Query Example	PROT:CURR:TDELAY:MIN? 0
Query Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY:MAXIMUM?
Description	This command returns the maximum rms current protection trip delay setting.
Query Example	PROT:CURR:TDELAY:MAX? 3000
Query Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY:DEFAULT?
Description	This command returns the default rms current protection trip delay setting.
Query Example	[SOURCE:]PROTECT[:RMS]:CURRENT:TDELAY:DEFAULT? 41.667
Query Syntax	[SOURCE:]PROTECT[:RMS]:CURRENT:TRIPPED?
Description	This command returns rms current protection trip status. Returns 1 if tripped or 0 if not.
Query Example	PROT:CURR:TRIP? 41.667

Command Syntax	[SOURce:]PROTect[:RMS]:CURRent:TRIPped:CLEar
Description	This command clears the rms current protection trip status. Once cleared, the power source output can be enabled.
Parameters	None
Parameter Format	n/a
Example	PROT:CURR:TRIP:CLE

8.7.9 Power Protection Programming Commands

Command Syntax	[SOURce:]POWER:LIMit#
Description	This command sets the programmable true power limit level in kW for phase #. If # is omitted, all available phases are set to the value specified. The max available power for a phase can be obtained using the [SOURce:]POWER:LIMit#:MAX? query command.
Parameters	Limit value in kW
Parameter Format	<nr2>
Example	POW:LIM 2.5
Query Format	[SOURce:]POWER:LIMit#?
Returned Data Format	<nr2>
Query Example	POW:LIM1? 2.5000
Query Format	[SOURce:]POWER:LIMit#:MAX?
Description	Returns maximum available true power capability for the specified phase # in kW. If # is omitted, returns maximum available power level for last phase selected. Typically, this value will be the same for all phases.
Returned Data Format	<nr2>
Query Example	POW:LIM1:MAX? 5.0000
Command Syntax	[SOURce:]POWER:PROTect:LEVel
Description	This command sets the power protection trip level in kW for all available phases. If the true power of any phase exceeds this trip level, the power source will shut off the output to protect the load.
Parameters	True power trip limit level in kW
Parameter Format	<nr2>
Example	POW:PROT:LEV 2.7555
Query Format	[SOURce:]POWER:PROTect:LEVel?
Returned Data Format	<nr2>
Query Example	POW:PROT:LEV? 2.7555

Command Syntax	[SOURce:]KVA:LIMit#
Description	This command sets the programmable apparent power limit level in kVA for phase #. If # is omitted, all available phases are set to the value specified. The max available apparent power for a phase can be obtained using the [SOURce:]KVA:LIMit#:MAX? query command.
Parameters	Limit value in kVA
Parameter Format	<nr2>
Example	KVA:LIM 2.5
Query Format	[SOURce:]KVA:LIMit#?
Returned Data Format	<nr2>
Query Example	POW:LIM1? 2.5000
Query Format	[SOURce:]KVA:LIMit#:MAX?
Description	Returns maximum available apparent power capability for the specified phase # in kVA. If # is omitted, returns maximum available apparent power level for last phase selected. Typically, this value will be the same for all phases.
Returned Data Format	<nr2>
Query Example	KVA:LIM1:MAX? 5.0000
Query Format	[SOURce:]MODE#?
Description	Returns protection mode for the selected phase # (# = 1, 2, or 3). If # is omitted, returns protection mode for all phases in comma separated format. Note: When the phase suffix is 1, 2 or 3 the possible return categories are from 0 to 4. With suffix is omitted, this command will return MIXED(5) if modes for each phase are not the same. For example, if in split phase mode phase A (suffix 1) is in VOLTAGE mode but phase B (suffix 2) is in CURRENT mode, the query SOUR:MODE? you will return MIXED: SOUR:MODE1? = VOLTAGE and SOUR:MODE2? = CURRENT -> SOUR:MODE? = MIXED If both or phases are set to the same mode, the actual mode will be returned: SOUR:MODE1? = VOLTAGE and SOUR:MODE2? = VOLTAGE -> SOUR:MODE? = VOLTAGE
Returned Data Format	<cr> Available protection modes: 0 = NONE 1 = VOLTAGE 2 = CURRENT 3 = POWER 4 = KVA 5 = MIXED
Query Example	SOUR:MODE? VOLTAGE, VOLTAGE, VOLTAGE

Command Syntax	[SOURCE:]PROTECT[:RMS]:POWER#[:STATE] <ON OFF>
Description	This command turns the true power protection on or off.
Parameters	< 0 OFF 1 ON >
Parameter Format	 <cr>
Example	PROT:POW ON
Query Format	[SOURCE:]PROTECT[:RMS]:POWER#[:STATE]?
Returned Data Format	
Query Example	PROT:POW? 1
Command Syntax	[SOURCE:]PROTECT[:RMS]:POWER#:LEVEL <LEVEL>
Description	This command sets the true power protection trip level. Setting is in KW.
Parameters	< LEVEL >
Parameter Format	<nr2>
Example	PROT:POW:LEV 5
Query Format	[SOURCE:]PROTECT[:RMS]:POWER#:LEVEL?
Returned Data Format	
Query Example	PROT:POW:LEV? 5.000
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:LEVEL:MINimum?
Description	This command returns the minimum true power protection level setting.
Query Example	PROT:POW:LEV:MIN? 0.000
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:LEVEL:MAXimum?
Description	This command returns the maximum true power protection level setting.
Query Example	PROT:POW:LEV:MAX? 41.667
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:LEVEL:DEFAULT?
Description	This command returns the default true power protection level setting. This value will be a function of the power source model.
Query Example	PROT:POW:LEV:DEF? 41.667

Command Syntax	[SOURCE:]PROTECT[:RMS]:POWER#:TDELAY <DELAY>
Description	This command sets the true power protection trip delay time. Setting is in multiples of 100 msec so 5 equals 500 msec.
Parameters	< LEVEL >
Parameter Format	<nr2>
Example	PROT:POW:LEV 5
Query Format	[SOURCE:]PROTECT[:RMS]:POWER#:TDELAY?
Returned Data Format	
Query Example	PROT:POW:TDELAY? 5.000
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:TDELAY:MINimum?
Description	This command returns the minimum true power protection trip delay time setting.
Query Example	PROT:POW: TDELAY:MIN? 0
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:TDELAY:MAXimum?
Description	This command returns the maximum true power protection trip delay time setting.
Query Example	PROT:POW: TDELAY:MAX? 3000
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER:TDELAY:DEFault?
Description	This command returns the default true power protection trip delay time setting.
Query Example	PROT:POW:TDELAY:DEF? 5
Query Syntax	[SOURCE:]PROTECT[:RMS]:POWER#:TRIPped?
Description	This command returns the true power protection trip status. Returns 1 if tripped or 0 if not.
Query Example	PROT:POW:TRIP? 41.667
Command Syntax	[SOURCE:]PROTECT[:RMS]:POWER#:TRIPped:CLEar
Description	This command clears the true power protection trip status. Once cleared, the power source output can be enabled.
Parameters	None
Parameter Format	n/a
Example	PROT:POW:TRIP:CLE

Command Syntax	[SOURce:]PROTect[:RMS]:KVA#[:STATe] <ON OFF>
Description	This command turns the apparent power protection on or off.
Parameters	< 0 OFF 1 ON >
Parameter Format	 <cr>
Example	PROT:POW ON
Query Format	[SOURce:]PROTect[:RMS]:KVA#[:STATe]?
Returned Data Format	
Query Example	PROT:KVA? 1
Command Syntax	[SOURce:]PROTect[:RMS]:KVA#:LEVel <LEVEL>
Description	This command sets the apparent power protection trip level. Setting is in KW.
Parameters	< LEVEL >
Parameter Format	<nr2>
Example	PROT:POW:LEV 5
Query Format	[SOURce:]PROTect[:RMS]:KVA#:LEVel?
Returned Data Format	
Query Example	PROT:KVA:LEV? 5.000
Query Syntax	[SOURce:]PROTect[:RMS]:KVA:LEVel:MINimum?
Description	This command returns the minimum apparent power protection level setting.
Query Example	PROT:KVA:LEV:MIN? 0.000
Query Syntax	[SOURce:]PROTect[:RMS]:KVA:LEVel:MAXimum?
Description	This command returns the maximum apparent power protection level setting.
Query Example	PROT:KVA:LEV:MAX? 41.667
Query Syntax	[SOURce:]PROTect[:RMS]:KVA:LEVel:DEFault?
Description	This command returns the default apparent power protection level setting. This value will be a function of the power source model.
Query Example	PROT:KVA:LEV:DEF? 41.667

Command Syntax	[SOURCE:]PROTECT[:RMS]:KVA#:TDELAY <DELAY>
Description	This command sets the apparent power protection trip delay time. Setting is in multiples of 100 msec so 5 equals 500 msec.
Parameters	< LEVEL >
Parameter Format	<nr2>
Example	PROT:KVA:LEV 5
Query Format	[SOURCE:]PROTECT[:RMS]:KVA#:TDELAY?
Returned Data Format	
Query Example	PROT:KVA:TDELAY? 5.000
Query Syntax	[SOURCE:]PROTECT[:RMS]:KVA:TDELAY:MINimum?
Description	This command returns the minimum apparent power protection trip delay time setting.
Query Example	PROT:KVA: TDELAY:MIN? 0
Query Syntax	[SOURCE:]PROTECT[:RMS]:KVA:TDELAY:MAXimum?
Description	This command returns the maximum apparent power protection trip delay time setting.
Query Example	PROT:KVA: TDELAY:MAX? 3000
Query Syntax	[SOURCE:]PROTECT[:RMS]:KVA:TDELAY:DEFault?
Description	This command returns the default apparent power protection trip delay time setting.
Query Example	PROT:KVA:TDELAY:DEF? 5
Query Syntax	[SOURCE:]PROTECT[:RMS]:KVA#:TRIPped?
Description	This command returns the apparent power protection trip status. Returns 1 if tripped or 0 if not.
Query Example	PROT:KVA:TRIP? 41.667
Command Syntax	[SOURCE:]PROTECT[:RMS]:KVA#:TRIPped:CLEar
Description	This command clears the apparent power protection trip status. Once cleared, the power source output can be enabled.
Parameters	None
Parameter Format	n/a
Example	PROT:KVA:TRIP:CLE

8.7.10 Frequency Protection Programming Commands

Command Syntax	[SOURce:]PROTect:RMS:UF#:LEVel <FREQ LEVEL>
Description	This command sets the under-frequency level. If the output frequency drops below the programmed level, an error is tripped.
Parameters	<VOLTAGE LEVEL>
Parameter Format	<nr2>
Example	PROT:RMS:UF1:LEV 45.0
Query Format	[SOURce:]PROTect:RMS:UF#:LEVel?
Returned Data Format	<nr2>
Query Example	PROT:RMSUV:LEV? 45.000
Command Syntax	[SOURce:]PROTect:RMS:UF#:STATe
Description	This command sets the under frequency level. If the output frequency drops below the programmed level, an error is tripped.
Parameters	< 0 1 >
Parameter Format	
Example	PROT:RMS:UV1:STAT 1
Query Format	[SOURce:]PROTect:RMS:UF#:STATe?
Returned Data Format	<nr1>
Query Example	PROT:RMS:UV1:STAT? 1

8.7.11 STEP Transient Commands

The command in this section control STEP transients. Some of these commands have the option to specify NORMAL or SATurate.

- SATurate mode:** If a dwell time setting is out of limits, the dwell time will saturate to the limit min/max and it will not trip an error.
- NORMAL mode:** If a dwell time setting is out of limits, an error will be generated and the dwell time setting will not be modified.

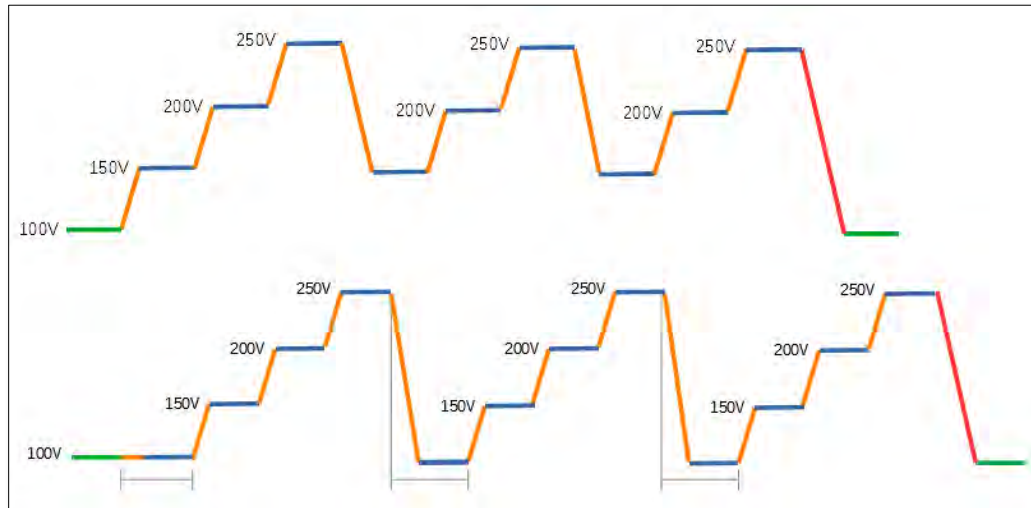
Command Syntax	[SOURCE:]STEP:MODE < INIDEL 0 FINDEL 1 INIFIN 2 >
Description	This command sets the programming mode for a STEP Transient. 0 INIDEL Allows programming the step by initial and delta values 1 FINDEL Allows programming the step by final and delta values 2 INIFIN Allows programming the step by initial and final values
Parameters	< INIDEL 0 FINDEL 1 INIFIN 2 >
Parameter Format	<cr> or <nr1>
Example	STEP:MODE 1
Query Format	[SOURCE:]STEP:MODE?
Returned Data Format	<nr1>
Query Example	STEP:MODE? 1

Query Syntax	[SOURCE:]STEP:MODE:CATalog?
Description	This command returns the available mode settings for a STEP Transient. 0 INIDEL Allows programming the step by initial and delta values 1 FINDEL Allows programming the step by final and delta values 2 INIFIN Allows programming the step by initial and final values
Returned Data Format	<nr1>
Query Example	STEP:MODE:CAT? 0,Initial and delta,1,Final and delta,2,Initial and final

Command Syntax	[SOURCE:]STEP:INITialvalue <OFF 0 ON 1>
Description	This command determines if an initial value step is inserted at the beginning of each repeat of a step transient. 0 ON Allows programming the step by initial and delta values 1 OFF Allows programming the step by final and delta values
Parameters	< OFF 0 ON 1 >
Parameter Format	<cr> or <nr1>
Example	STEP:INIT ON
Query Format	[SOURCE:]STEP:INITialvalue?
Returned Data Format	
Query Example	STEP:INIT? 1

The impact of inserting the initial value (ON) or not (OFF) is illustrated in the figure below.

- The top sequence shows a STEP transient repeated 3 times with STEP:INIT set to OFF. The output will not return to the initial output setting between repetitions.
- The bottom sequence is the same STEP transient with STEP:INIT set to ON. Each repeat will start from the initial set value so each repetition produces the same output levels.



Command Syntax
Description

Parameters

Parameter Format
Example

Query Format
Returned Data Format
Query Example

[SOURCE:]STEP:DWELL <time>, <opt>

This command sets the dwell time of the step in seconds
Minimum time set value allowed is 0.0002 sec. (0.2 msec)
Time in seconds, Option: < NORMal | SATurate >
Default is NORMal if optional second parameter is omitted.

<nr2>, <cr>

STEP:MODE:DWELL 10, SAT

[SOURCE:]STEP:MODE?

<nr2>

STEP:MODE:DWELL?

10.0000, SAT

Query Syntax
Description

Returned Data Format
Query Example

[SOURCE:]STEP:DWELL:MINimum?

This command returns lowest permissible set value for the STEP dwell time setting.

<nr2>

STEP:DWELL:MIN?

Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Query Syntax Description	[SOURCE:]STEP:DWELL:MAXimum? This command returns highest permissible set value for the STEP dwell time setting.
Returned Data Format Query Example	<nr2> STEP:DWELL:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax Description	[SOURCE:]STEP:DWELL:DEFault? This command returns default set value for the STEP dwell time setting.
Returned Data Format Query Example	<nr2> STEP:DWELL:DEF? 0.0998
Command Syntax Description	[SOURCE:]STEP:RAMP <time>, <opt> This command sets the ramp time of the step in seconds Minimum time set value allowed is 0.0002 sec. (0.2 msec)
Parameters	Time in seconds, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format Example	<nr2>, <cr> STEP:MODE:RAMP 5, SAT
Query Format Returned Data Format Query Example	[SOURCE:]STEP:RAMP? <nr2> STEP:RAMP? 5.0000, SAT
Query Syntax Description	[SOURCE:]STEP:RAMP:MINimum? This command returns lowest permissible set value for the STEP ramp time setting.
Returned Data Format Query Example	<nr2> STEP:RAMP:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax Description	[SOURCE:]STEP:RAMP:MAXimum? This command returns highest permissible set value for the STEP ramp time setting.
Returned Data Format Query Example	<nr2> STEP:RAMP:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Query Syntax	[SOURCE:]STEP:RAMP:DEfault?
Description	This command returns default set value for the STEP ramp time setting.
Returned Data Format	<nr2>
Query Example	STEP:RAMP:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]STEP:LENGth <time>, <opt>
Description	This command sets the ramp time of the step in seconds Minimum time set value allowed is 0.0002 sec. (0.2 msec)
Parameters	Time in seconds, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:MODE:LENG 5, SAT
Query Format	[SOURCE:]STEP:LENGth?
Returned Data Format	<nr2>
Query Example	STEP:LENG? 5.0000, SAT
Query Syntax	[SOURCE:]STEP:LENGth:MINimum?
Description	This command returns lowest permissible set value for the STEP length time setting.
Returned Data Format	<nr2>
Query Example	STEP:LENG:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:LENGth:MAXimum?
Description	This command returns highest permissible set value for the STEP length time setting.
Returned Data Format	<nr2>
Query Example	STEP:LENG:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP: LENGth:DEfault?
Description	This command returns default set value for the STEP length time setting.
Returned Data Format	<nr2>
Query Example	STEP:LENG:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:REPeat <no, opt>
Description	This command sets the number of repeat times for the ramp of the step
Parameters	No of repeats, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	STEP:MODE:REP 100
Query Format	[SOURCE:]STEP:REP?
Returned Data Format	<nr2>
Query Example	STEP:REP? 100, NOR
Query Syntax	[SOURCE:]STEP:REPeat:MINimum?
Description	This command returns lowest permissible set value for the STEP length time setting.
Returned Data Format	<nr1>
Query Example	STEP:REP:MIN? 0
Query Syntax	[SOURCE:]STEP:REPeat:MAXimum?
Description	This command returns highest permissible set value for the STEP length time setting.
Returned Data Format	<nr1>
Query Example	STEP:REP:MAX? 65535
Query Syntax	[SOURCE:]STEP:REPeat:DEFault?
Description	This command returns default set value for the STEP length time setting.
Returned Data Format	<nr2>
Query Example	STEP:REP:DEF? 1
Command Syntax	[SOURCE:]STEP:COUNT <no, opt>
Description	This command sets the number of steps count.
Parameters	No of step count, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	STEP:MODE:REP 12
Query Format	[SOURCE:]STEP:COUNT?
Returned Data Format	<nr2>
Query Example	STEP:REP? 12, NOR

Query Syntax	[SOURCE:]STEP:COUNT:MINimum?
Description	This command returns lowest permissible set value for the STEP count setting.
Returned Data Format	<nr1>
Query Example	STEP:COUNT:MIN? 1
Query Syntax	[SOURCE:]STEP:COUNT:MAXimum?
Description	This command returns highest permissible set value for the STEP count setting.
Returned Data Format	<nr1>
Query Example	STEP:COUNT:MAX? 200
Query Syntax	[SOURCE:]STEP:COUNT:DEFault?
Description	This command returns default set value for the STEP count setting.
Returned Data Format	<nr2>
Query Example	STEP:COUNT:DEF? 10
Command Syntax	[SOURCE:]STEP:HOLD < 0 OFF 1 ON >
Description	This command determines what happens to the source output after the step transient finishes. If ON, the last step value will be set as the steady state output when the step execution ends. If OFF, the output will revert to the original steady state setting in effect before the step transient execution.
Parameters	< 0 OFF 1 ON >
Parameter Format	<cr>
Example	STEP:HOLD ON
Query Format	[SOURCE:]STEP:HOLD?
Returned Data Format	
Query Example	STEP:HOLD? 1

Command Syntax	[SOURce:]STEP:VOLTage[:AC][:INITial]# < nr2 >, <cr> [SOURce:]STEP:VOLTage[:AC][:INITial]#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the initial STEP voltage for selected phase # or for all phases if phase reference is omitted. Note: If you get the following error, check the STEP:MODE setting as the parameter you are trying to program is the depending one. Execution error: Not allowed command with the current configuration. Either set one of the othe STEP parameters or change the MODE. Note: If you get this error, check the min or max range for this parameter. Parameter above maximum unit scope.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT1 230.00, SAT
Query Format	[SOURce:]STEP:VOLTage[:AC][:INITial]#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT1? 230.0000
Query Syntax	[SOURce:]STEP:VOLTage[:AC][:INITial]#:MINimum?
Description	This command returns the minimum permissible set value for the initial STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:VOLTage[:AC][:INITial]#:MAXimum?
Description	This command returns the maximum permissible set value for the initial STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:VOLTage[:AC][:INITial]#:DEFault?
Description	This command returns the default set value for the initial STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURce:]STEP:VOLTage[:AC]:FINal# < nr2 >, <cr> [SOURce:]STEP:VOLTage[:AC]:FINal#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the final STEP voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT:FIN 180.00, SAT
Query Format	[SOURce:]STEP:VOLTage[:AC]:FINal#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT:FIN? 180.000,180.000,180.000
Query Syntax	[SOURce:]STEP:VOLTage[:AC]:FINal#:MINimum?
Description	This command returns the minimum permissible set value for the final STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:FIN1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:VOLTage[:AC]:FINal#:MAXimum?
Description	This command returns the maximum permissible set value for the final STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:FIN1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:VOLTage[:AC]:FINal#:DEFault?
Description	This command returns the default set value for the final STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:FIN1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:VOLTage[:AC]:DELTA# < nr2 >, <cr> [SOURCE:]STEP:VOLTage[:AC]:DELTA#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the delta STEP voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMAL SATurate > Default is NORMAL if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT:DELT1 10.00, SAT
Query Format	[SOURCE:]STEP:VOLTage[:AC]:DELTA#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT:DELT? 10.000,10.000,10.000
Query Syntax	[SOURCE:]STEP:VOLTage[:AC]:DELTA#:MINimum?
Description	This command returns the minimum permissible set value for the delta STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DELT1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage[:AC]:DELTA#:MAXimum?
Description	This command returns the maximum permissible set value for the delta STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DELT1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage[:AC]:DELTA#:DEFault?
Description	This command returns the default set value for the delta STEP voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DELT1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:VOLTage:DC[:INITial]# < nr2 >, <cr> [SOURCE:]STEP:VOLTage:DC[:INITial]#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the initial STEP DC voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT:DC1 230.00, SAT
Query Format	[SOURCE:]STEP:VOLTage:DC[:INITial]#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT:DC? 0.000,0.000,0.000
Query Syntax	[SOURCE:]STEP:VOLTage:DC[:INITial]#:MINimum?
Description	This command returns the minimum permissible set value for the initial STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC[:INITial]#:MAXimum?
Description	This command returns the maximum permissible set value for the initial STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC[:INITial]#:DEFault?
Description	This command returns the default set value for the initial STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:VOLTage:DC:FINal# < nr2 >, <cr> [SOURCE:]STEP:VOLTage:DC:FINal#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the final STEP DC voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT:DC:FIN 187.00, SAT
Query Format	[SOURCE:]STEP:VOLTage:DC:FINal#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT:DC:FIN? 187.000,187.000,187.000
Query Syntax	[SOURCE:]STEP:VOLTage:DC:FINal#:MINimum?
Description	This command returns the minimum permissible set value for the final STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:FIN1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC:FINal#:MAXimum?
Description	This command returns the maximum permissible set value for the final STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:FIN1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC:FINal#:DEFault?
Description	This command returns the default set value for the final STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:FIN1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:VOLTage:DC:DELTA# < nr2 >, <cr> [SOURCE:]STEP:VOLTage:DC:DELTA#
Description	Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT This command sets the delta STEP DC voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:VOLT:DC:DELT1 10.00, SAT
Query Format	[SOURCE:]STEP:VOLTage:DC:DELTA#?
Returned Data Format	<nr2> <nr2>,<nr2>,<nr2>
Query Example	STEP:VOLT:DC:DELT? 10.0000
Query Syntax	[SOURCE:]STEP:VOLTage:DC:DELTA#:MINimum?
Description	This command returns the minimum permissible set value for the delta STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:DELT1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC:DELTA#:MAXimum?
Description	This command returns the maximum permissible set value for the delta STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:DELT1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:VOLTage:DC:DELTA#:DEFault?
Description	This command returns the default set value for the delta STEP DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	STEP:VOLT:DC:DELT1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Command Syntax	[SOURCE:]STEP:FREQUENCY[:INITIAL] <nr2 >, <cr>
Description	This command sets the initial STEP frequency.
Parameters	Frequency, < NORMAL SATurate > Default is NORMAL if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:FREQ 50.0, SAT
Query Format	[SOURCE:]STEP:FREQUENCY[:INITIAL]?
Returned Data Format	<nr2>
Query Example	STEP:FREQ? 50.0000
Query Syntax	[SOURCE:]STEP:FREQUENCY[:INITIAL]:MINimum?
Description	This command returns the minimum permissible set value for the initial STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:MIN? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:FREQUENCY[:INITIAL]:MAXimum?
Description	This command returns the maximum permissible set value for the initial STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:MAX? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:FREQUENCY[:INITIAL]:DEFAULT?
Description	This command returns the default set value for the initial STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:DEF? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]STEP:FREQUENCY:FINal <nr2 >, <cr>
Description	This command sets the final STEP frequency.
Parameters	Frequency, < NORMAL SATurate > Default is NORMAL if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:FREQ:FIN 55.0, SAT
Query Format	[SOURCE:]STEP:FREQUENCY:FINal?
Returned Data Format	<nr2>
Query Example	STEP:FREQ:FIN? 55.0000

Query Syntax	[SOURCE:]STEP:FREQuency:FINal:MINimum?
Description	This command returns the minimum permissible set value for the final STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:FIN:MIN? 15.0000
Query Syntax	[SOURCE:]STEP:FREQuency:FINal:MAXimum?
Description	This command returns the maximum permissible set value for the final STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:FIN:MAX? 1200.0000
Query Syntax	[SOURCE:]STEP:FREQuency:FINal:DEFault?
Description	This command returns the default set value for the final STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:FIN:DEF? 60.0000
Command Syntax	[SOURCE:]STEP:FREQuency:DELTA <nr2 >, <cr>
Description	This command sets the delta frequency.
Parameters	Frequency, < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:FREQ:DELT 5.0, SAT
Query Format	[SOURCE:]STEP:FREQuency:DELTA?
Returned Data Format	<nr2>
Query Example	STEP:FREQ:DELT? 5.0000
Query Syntax	[SOURCE:]STEP:FREQuency:DELTA:MINimum?
Description	This command returns the minimum permissible set value for the delta STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:DELT:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Query Syntax	[SOURCE:]STEP:FREQuency:DELTA:MAXimum?
Description	This command returns the maximum permissible set value for the delta STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:DELTA:MAX? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:FREQuency:DELTA:DEFAULT?
Description	This command returns the default set value for the delta STEP frequency.
Returned Data Format	<nr2>
Query Example	STEP:FREQ:DELTA:DEF? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]STEP:WAVEFORM# <nr1 >
Description	This command sets the selected waveform using the waveform number.
Parameters	Waveform number
Parameter Format	<nr1>, <cr>
Example	STEP:WAVEFORM 1
Query Format	[SOURCE:]STEP:WAVEFORM#?
Returned Data Format	<nr1>
Query Example	STEP:WAVEFORM#? 1.0000
Query Syntax	[SOURCE:]STEP:WAVEFORM#:MINimum?
Description	This command returns the minimum permissible set value for the STEP waveform.
Returned Data Format	<nr1>
Query Example	STEP:WAVEFORM#:MIN? 1
Query Syntax	[SOURCE:]STEP:WAVEFORM#:MAXimum?
Description	This command returns the maximum permissible set value for the STEP waveform.
Returned Data Format	<nr1>
Query Example	STEP:WAVEFORM#:MAX? 200
Query Syntax	[SOURCE:]STEP:WAVEFORM:DEFAULT?
Description	This command returns the default set value for the STEP waveform.
Returned Data Format	<nr1>
Query Example	STEP:WAVEFORM:DEF? 1

Command Syntax	[SOURce:]STEP:PHASe[:INITial]# < nr2 >, <cr>
Description	This command sets the initial STEP phase angle for selected phase # number. Only phase 1 (B) and 2 (C) are allowed.
Parameters	Phase No., < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	STEP:PHAS1 245.0
Query Format	[SOURce:]STEP:PHASe[:INITial]#?
Returned Data Format	<nr1>, <cr>
Query Example	STEP:PHAS1? 245.0000
Query Syntax	[SOURce:]STEP:PHASe[:INITial]#:MINimum?
Description	This command returns the minimum permissible set value of the initial STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:PHASe[:INITial]#:MAXimum?
Description	This command returns the maximum permissible set value of the initial STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURce:]STEP:PHASe[:INITial]#:DEF?
Description	This command returns the default set value of the initial STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURce:]STEP:PHASe:FINal# < nr2 >, <cr>
Description	This command sets the final STEP phase angle for selected phase # number. Only phase 1 (B) and 2 (C) are allowed.
Parameters	Phase No., < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	STEP:PHAS:FIN1 240.0
Query Format	[SOURce:]STEP:PHASe:FINal#?
Returned Data Format	<nr2>
Query Example	STEP:PHAS:FIN1? 240.0000

Query Syntax	[SOURCE:]STEP:PHASE:FINal#:MINimum?
Description	This command returns the minimum permissible set value of the final STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS:FIN1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:PHASE:FINal#:MAXimum?
Description	This command returns the maximum permissible set value of the final STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS:FIN1:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:PHASE:FINal#:DEF?
Description	This command returns the default set value of the final STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS:FIN1:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]STEP:PHASE:DELTA# < nr2 >, <cr>
Description	This command sets the delta STEP phase angle for selected phase # number. Only phase 1 (B) and 2 (C) are allowed.
Parameters	Phase No., < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	STEP:PHAS:DELT1 240.0
Query Format	[SOURCE:]STEP:PHASE:DELTA#?
Returned Data Format	<nr1>, <cr>
Query Example	STEP:PHAS:DELT1? 240.0000
Query Syntax	[SOURCE:]STEP:PHASE:DELTA#:MINimum?
Description	This command returns the minimum permissible set value of the delta STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS:DELT1:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Query Syntax	[SOURCE:]STEP:PHASE:DELTA#:MAXimum?
Description	This command returns the maximum permissible set value of the delta STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	STEP:PHAS:DELTA1:MAX? Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]STEP:PHASE:DELTA#:DEF?
Description	This command returns the default set value of the delta STEP phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	Query return values for MINimum, MAXimum and DEFAULT are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]STEP <cr> >>> Alias for PROGRAM:TRANSient command. <<<
Description	This command controls step transient execution
Parameters	< RUN STOP PAUSE STEP REStart >
Parameter Format	<cr>
Example	STEP RUN
Query Format	[SOURCE:]STEP?
Description	Query format returns the step transient execution state as either RUN, STOP, PAUS, STEP or REST
Returned Data Format	<nr1> Return values represent running state as follows: 0 Stopped 1 Running 2 Paused 3 Stepping 4 Waiting for trigger
Query Example	STEP? 1

Command Syntax	[SOURCE:]STEP:LOAD
Description	This command converts the step transient definition to the power source's regular transient segment format and loads it in the controller real-time memory for execution.
Parameters	None
Parameter Format	n/a
Example	STEP RUN
Query Format	[SOURCE:]STEP:LOAD?
Description	Query format returns a 1 if the step transient load operation was successful, otherwise returns 0.
Returned Data Format	<nr1> Return values represent: 0 Load Failed 1 Load completed
Query Example	STEP? 1
Query Syntax	[SOURCE:]STEP:PROGress?
Description	>>> <i>Alias for PROGRAM:TRANSient:PROGress command.</i> <<< This query command returns the status of the step being executed.
Parameters	None
Parameter Format	n/a
Description	Query returns the step transient execution state as either RUN, STOP, PAUS, STEP or REST
Returned Data Format	<cr> The response is a comma-separated value string representing: PROGRESS, CURRENT SEGMENT PROGRESS, CURRENT SEGMENT, CURRENT SEGMENT TIME, TOTAL TIME, TOTAL SEGMENTS, REPEAT TIME COUNTER
Query Example	STEP:PROG? 1, 45, 2, 1.2300, 2.0000, 4, 5
Query Syntax	[SOURCE:]STEP:CHECK?
Description	This query command returns the result of a check on the programmed step parameters to determine if they are ok to run.
Parameters	None
Parameter Format	n/a
Description	Query returns result of STEP parameters integrity check
Returned Data Format	<cr> The response is either OK or if not, a string containing the error.
Query Example	STEP:PROG? OK

Query Syntax
Description
[SOURCE:]STEP:ALL?

This query command returns a comma-separated values string of the entire step parameters, settings, and limits. Each set value is preceded by a tag identifying the parameter. This same data structure is used for front panel display and by the web server. The advantage is that this commands returns all step related information using just one query command.

Parameters

None

Parameter Format

n/a

Description

Returns complete STEP setup as a comma separated value string.

Returned Data Format

<cr>

Query Example

STEP:ALL?

```
form,3,loaded,0,status,0,progress,0,current element progress,0,current element,0,current element time,0,total time,0,total
elements,0,repeat times,0,hold,1,init,1,mode,0,mode max,2,mode min,0, dwell,0,dwell max,10000,dwell min,0,ramp,0,ramp
max,10000,ramp min,0,length,0,length max,10000,length min,0,repeat,1,repeat max,65535,repeat min,0,count,10,count
max,200,count min,1,count min reason,0,count max reason,0,waveform all,1,waveform all exist,1,waveform a,1,waveform a
exist,1,waveform b,1,waveform b exist,1,waveform c,1,waveform c exist,1,waveform max,200,waveform min,1,initial
frequency,0.0000,initial frequency min,0.0000,initial frequency max,0.0000,initial frequency min reason,4,initial frequency
max reason,4,initial voltage ac all,0.0000,initial voltage ac all max,0.0000,initial voltage ac all min,0.0000,initial voltage ac all
max reason,4,initial voltage ac all min reason,4,initial voltage ac a,0.0000,initial voltage ac a max,0.0000,initial voltage ac a
min,0.0000,initial voltage ac a max reason,4,initial voltage ac a min reason,4,initial voltage ac b,0.0000,initial voltage ac b
max,0.0000,initial voltage ac b min,0.0000,initial voltage ac b max reason,4,initial voltage ac b min reason,4,initial voltage ac
c,0.0000,initial voltage ac c max,0.0000,initial voltage ac c min,0.0000,initial voltage ac c max reason,4,initial voltage ac c
min reason,4,initial voltage dc all,0.0000,initial voltage dc all max,450.0000,initial voltage dc all min,-450.0000,initial voltage
dc all max reason,0,initial voltage dc all min reason,0,initial voltage dc a,0.0000,initial voltage dc a max,450.0000,initial
voltage dc a min,-450.0000,initial voltage dc a max reason,0,initial voltage dc a min reason,0,initial voltage dc b,0.0000,initial
voltage dc b max,450.0000,initial voltage dc b min,-450.0000,initial voltage dc b max reason,0,initial voltage dc b min
reason,0,initial voltage dc c,0.0000,initial voltage dc c max,450.0000,initial voltage dc c min,-450.0000,initial voltage dc c
max reason,0,initial voltage dc c min reason,0,initial phase b,120.0000,initial phase c,240.0000,initial phase
max,99999.0000,initial phase min,-99999.0000,final frequency,0.0000,final frequency min,0.0000,final frequency
max,0.0000,final frequency min reason,4,final frequency max reason,4,final voltage ac all,0.0000,final voltage ac all
max,0.0000,final voltage ac all min,0.0000,final voltage ac all max reason,4,final voltage ac all min reason,4,final voltage ac
a,0.0000,final voltage ac a max,0.0000,final voltage ac a min,0.0000,final voltage ac a max reason,4,final voltage ac a min
reason,4,final voltage ac b,0.0000,final voltage ac b max,0.0000,final voltage ac b min,0.0000,final voltage ac b max
reason,4,final voltage ac b min reason,4,final voltage ac c,0.0000,final voltage ac c max,0.0000,final voltage ac c
min,0.0000,final voltage ac c max reason,4,final voltage ac c min reason,4,final voltage dc all,0.0000,final voltage dc all
max,450.0000,final voltage dc all min,-450.0000,final voltage dc all max reason,0,final voltage dc all min reason,0,final
voltage dc a,0.0000,final voltage dc a max,450.0000,final voltage dc a min,-450.0000,final voltage dc a max reason,0,final
voltage dc a min reason,0,final voltage dc b,0.0000,final voltage dc b max,450.0000,final voltage dc b min,-450.0000,final
voltage dc b max reason,0,final voltage dc b min reason,0,final voltage dc c,0.0000,final voltage dc c max,450.0000,final
voltage dc c min,-450.0000,final voltage dc c max reason,0,final voltage dc c min reason,0,final phase b,120.0000,final phase
c,240.0000,final phase max,99999.0000,final phase min,-99999.0000,delta frequency,0.0000,delta frequency
min,0.0000,delta frequency max,0.0000,delta frequency min reason,4,delta frequency max reason,4,delta voltage ac
all,0.0000,delta voltage ac all max,0.0000,delta voltage ac all min,0.0000,delta voltage ac all max reason,4,delta voltage ac
all min reason,4,delta voltage ac a,0.0000,delta voltage ac a max,0.0000,delta voltage ac a min,0.0000,delta voltage ac a
max reason,4,delta voltage ac a min reason,4,delta voltage ac b,0.0000,delta voltage ac b max,0.0000,delta voltage ac b
min,0.0000,delta voltage ac b max reason,4,delta voltage ac b min reason,4,delta voltage ac c,0.0000,delta voltage ac c
max,0.0000,delta voltage ac c min,0.0000,delta voltage ac c max reason,4,delta voltage ac c min reason,4,delta voltage dc
all,0.0000,delta voltage dc all max,42.5000,delta voltage dc all min,-42.5000,delta voltage dc all max reason,0,delta voltage
dc all min reason,0,delta voltage dc a,0.0000,delta voltage dc a max,42.5000,delta voltage dc a min,-42.5000,delta voltage
dc a max reason,0,delta voltage dc a min reason,0,delta voltage dc b,0.0000,delta voltage dc b max,42.5000,delta voltage dc
b min,-42.5000,delta voltage dc b max reason,0,delta voltage dc b min reason,0,delta voltage dc c,0.0000,delta voltage dc c
max,42.5000,delta voltage dc c min,-42.5000,delta voltage dc c max reason,0,delta voltage dc c min reason,0,delta phase
b,0.0000,delta phase c,0.0000,delta phase max,99999.0000,delta phase min,-99999.0000
```

8.7.12 PULSE Transient Commands

The command in this section control PULSE transients. Some of these commands have the option to specify NORmal or SATurate.

- SATurate mode:** If a dwell time setting is out of limits, the dwell time will saturate to the limit min/max and it will not trip an error.
- NORmal mode:** If a dwell time setting is out of limits, an error will be generated and the dwell time setting will not be modified.

Command Syntax	[SOURCE:]PULSe:COUNT <nr1>, <opt>
Description	This command sets the pulse count or the number of pulses to execute. Minimum time set value allowed is 1.
Parameters	Count, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	PULS:COUNT 5
Query Format	[SOURCE:]PULSe:COUNT?
Returned Data Format	<nr1>
Query Example	PULS:COUNT? 5.0000
Query Syntax	[SOURCE:]PULSe:COUNT:MINimum?
Description	This command returns the minimum permissible set value for the PULSE count.
Returned Data Format	<nr1>
Query Example	PULS:COUNT:MIN? 0
Query Syntax	[SOURCE:]PULSe:COUNT:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE count.
Returned Data Format	<nr1>
Query Example	PULS:COUNT:MAX? 65535
Query Syntax	[SOURCE:]PULSe:COUNT:DEFault?
Description	This command returns the default set value for the PULSE count.
Returned Data Format	<nr1>
Query Example	PULS:COUNT:DEF? 1

Command Syntax	[SOURce:]PULSe:DCYClE <nr1>, <opt>
Description	This command sets the pulse duty cycle in percent. Minimum set value allowed is 1, max is 99.
Parameters	Duty Cycle %, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	PULS:DCYC 50
Query Format	[SOURce:]PULSe:DCYClE?
Returned Data Format	<nr1>
Query Example	PULS:DCYC? 50.0000
Query Syntax	[SOURce:]PULSe:DCYClE:MINimum?
Description	This command returns the minimum permissible set value for the PULSE duty cycle.
Returned Data Format	<nr2>
Query Example	PULS:DCYC:MIN? 0.0000
Query Syntax	[SOURce:]PULSe:DCYClE:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE duty cycle.
Returned Data Format	<nr2>
Query Example	PULS:DCYC:MAX? 100.0000
Query Syntax	[SOURce:]PULSe:DCYClE:DEFault?
Description	This command returns the default set value for the PULSE duty cycle.
Returned Data Format	<nr2>
Query Example	PULS:DCYC:DEF? 50.0000
Command Syntax	[SOURce:]PULSe:PERiod <nr2>, <opt>
Description	This command sets the pulse period in seconds.
Parameters	Period, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:PER 12.8
Query Format	[SOURce:]PULSe:PERiod?
Returned Data Format	<nr2>
Query Example	PULS:PER? 12.8000

Query Syntax	[SOURCE:]PULSe:PERiod:MINimum?
Description	This command returns the minimum permissible set value for the PULSE period setting.
Returned Data Format	<nr2>
Query Example	PULS:PER:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]PULSe:PERiod:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE period.
Returned Data Format	<nr2>
Query Example	PULS:PER:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]PULSe:PERiod:DEFault?
Description	This command returns the default set value for the PULSE period.
Returned Data Format	<nr2>
Query Example	PULS:PER:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]PULSe:WIDTh <nr2>, <opt>
Description	This command sets the pulse width in seconds.
Parameters	Width, Option: < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:WIDT 25.6
Query Format	[SOURCE:]PULSe:WIDTh?
Returned Data Format	<nr2>
Query Example	PULS:WIDT? 25.6000
Query Syntax	[SOURCE:]PULSe:WIDTh:MINimum?
Description	This command returns the minimum permissible set value for the PULSE width.
Returned Data Format	<nr2>
Query Example	PULS:WIDT:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings

Query Syntax	[SOURCE:]PULSe:WIDTh:MAXimum?
Description	This command the returns maximum permissible set value for the PULSE width.
Returned Data Format	<nr2>
Query Example	PULS:WIDT:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]PULSe:WIDTh:DEFault?
Description	This command returns the default set value for the PULSE width.
Returned Data Format	<nr2>
Query Example	PULS:WIDT:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]PULSe:MODE <nr2>, <opt>
Description	This command sets the pulse width in seconds.
Parameters	< 0 PW 1 PD 2 WD > Encoding: 0 PW program pulse by period and width 1 PD program pulse by period and duty cycle 2 WD program pulse by width and duty cycle
Parameter Format	<nr1> or <cr>
Example	PULS:MODE WD
Query Format	[SOURCE:]PULSe:MODE?
Returned Data Format	<nr1>
Query Example	PULS:MODE? 2
Query Syntax	[SOURCE:]PULSe:MODE:CATalog?
Description	This command returns the available programming modes: "0,Period and width,1,Period and duty cycle,2,Width and duty cycle".
Parameters	None
Returned Data Format	<cr>
Query Example	PULS:MODE:CAT? 0,Period and width,1,Period and duty cycle,2,Width and duty cycle
Command Syntax	[SOURCE:]PULSe:RAMP <nr2>, <opt>
Description	This command sets the pulse ramp time in seconds.
Parameters	Ramp time, Option: < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:RAMP 0.2
Query Format	[SOURCE:]PULSe:RAMP?
Returned Data Format	<nr2>
Query Example	PULS:RAMP? 0.2

Query Syntax	[SOURCE:]PULSe:RAMP:MINimum?
Description	This command returns the minimum permissible set value for the PULSE ramp time.
Returned Data Format	<nr2>
Query Example	PULS:RAMP:MIN? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]PULSe:RAMP:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE ramp time.
Returned Data Format	<nr2>
Query Example	PULS:RAMP:MAX? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Query Syntax	[SOURCE:]PULSe:RAMP:DEFault?
Description	This command returns the default setting for the PULSE ramp time.
Returned Data Format	<nr2>
Query Example	PULS:RAMP:DEF? Query return values for MINimum, MAXimum and DEFault are dependent on MODE and interdependent parameter value settings
Command Syntax	[SOURCE:]PULSe:VOLTage[:AC]# < nr2 >, <cr> [SOURCE:]PULSe:VOLTage[:AC] # Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT
Description	This command sets the PULSE voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:VOLT1 230.00, SAT
Query Format	[SOURCE:]PULSe:VOLTage[:AC]#?
Returned Data Format	<nr2>
Query Example	PULS:VOLT1? 230.0000
Query Syntax	[SOURCE:]PULSe:VOLTage[:AC]#:MINimum?
Description	This command returns the minimum permissible set value for the PULSE voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT1:MIN? 0.0000

Query Syntax	[SOURce:]PULSe:VOLTage[:AC]#:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT:MAX? 320.0000
Query Syntax	[SOURce:]PULSe:VOLTage[:AC]#:DEFault?
Description	This command returns the default set value for the PULSE voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT:DEF? 0.000,0.000,0.000 PULS:VOLT1:DEF? 0.000
Command Syntax	[SOURce:]PULSe:VOLTage:DC# < nr2 >, <cr> [SOURce:]PULSe:VOLTage:DC# Voltage phase A, OPT: Voltage phase B, OPT: Voltage phase C, OPT
Description	This command sets the PULSE DC voltage for selected phase # or for all phases if phase reference is omitted.
Parameters	Voltage , < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:VOLT:DC1 270.00
Query Format	[SOURce:]PULSe:VOLTage:DC#?
Returned Data Format	<nr2>
Query Example	PULS:VOLT:DC1? 270.0000
Query Syntax	[SOURce:]PULSe:VOLTage:DC#:MINimum?
Description	This command returns the minimum permissible set value for the initial PULSE DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT:DC1:MIN? -450.0000
Query Syntax	[SOURce:]PULSe:VOLTage:DC#:MAXimum?
Description	This command returns the maximum permissible set value for the initial PULSE DC voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT:DC1:MAX? 450.0000

Query Syntax	[SOURce:]PULSe:VOLTage:DC#:DEFault?
Description	This command returns the default set value for the initial PULSE voltage for selected phase # or for all phases if phase reference is omitted
Returned Data Format	<nr2>
Query Example	PULS:VOLT:DC1:DEF? 0.000,0.000,0.000
Command Syntax	[SOURce:]PULSe:FREQuency < nr2 >, <cr>
Description	This command sets the PULSE frequency.
Parameters	Voltage , < NORMal SATurate > Default is NORMal if optional second parameter is omitted.
Parameter Format	<nr2>, <cr>
Example	PULS:FREQ 50.00
Query Format	[SOURce:]PULSe:FREQuency?
Returned Data Format	<nr2>
Query Example	PULS:FREQ? 60.0000
Query Syntax	[SOURce:]PULSe:FREQuency:MINimum?
Description	This command returns the minimum permissible set value for the PULSE frequency.
Returned Data Format	<nr2>
Query Example	PULS:FREQ:MIN? 15.0000
Query Syntax	[SOURce:]PULSe:FREQuency:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE frequency.
Returned Data Format	<nr2>
Query Example	PULS:FREQ:MIN? 1200.0000
Query Syntax	[SOURce:]PULSe:FREQuency:DEFault?
Description	This command returns the default set value for the initial PULSE frequency.
Returned Data Format	<nr2>
Query Example	PULS:FREQ:DEF? 60.0000

Command Syntax	[SOURce:]PULSe:WAVEFORM# <nr1 >
Description	This command sets the selected waveform using the waveform number.
Parameters	Waveform number
Parameter Format	<nr1>, <cr>
Example	PULS:WAVEFORM 1
Query Format	[SOURce:]PULSe:WAVEFORM#?
Returned Data Format	<nr1>
Query Example	PULS:WAVEFORM#? 1.0000
Query Syntax	[SOURce:]PULSe:WAVEFORM#:MINimum?
Description	This command returns the minimum permissible set value for the PULSE waveform.
Returned Data Format	<nr1>
Query Example	PULS:WAVEFORM#:MIN? 1
Query Syntax	[SOURce:]PULSe:WAVEFORM#:MAXimum?
Description	This command returns the maximum permissible set value for the PULSE waveform.
Returned Data Format	<nr1>
Query Example	PULS:WAVEFORM#:MAX? 200
Query Syntax	[SOURce:]PULSe:WAVEFORM:DEFault?
Description	This command returns the default set value for the PULSE waveform.
Returned Data Format	<nr1>
Query Example	PULS:WAVEFORM:DEF? 1
Command Syntax	[SOURce:]PULSe:PHASe# < nr2 >, <cr>
Description	This command sets the initial PULSE phase angle for selected phase # number. Only phase 2 (B) and 3 (C) are allowed.
Parameters	Phase No., < NORmal SATurate > Default is NORmal if optional second parameter is omitted.
Parameter Format	<nr1>, <cr>
Example	PULS:PHAS1 245.0
Query Format	[SOURce:]PULSe:PHASe#?
Returned Data Format	<nr1>, <cr>
Query Example	PULS:PHAS1? 245.0000

Query Syntax	[SOURCE:]PULSe:PHASe#:MINimum?
Description	This command returns the minimum permissible set value of the initial PULSE phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	PULS:PHAS1:MIN? 0.0000
Query Syntax	[SOURCE:]PULSe:PHASe#:MAXimum?
Description	This command returns the maximum permissible set value of the initial PULSE phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	PULS:PHAS1:MAX? 360.000
Query Syntax	[SOURCE:]PULSe:PHASe#:DEF?
Description	This command returns the default set value of the initial PULSE phase angle for selected phase #
Returned Data Format	<nr1>
Query Example	PULS:PHAS2:DEF? 120.0000 PULS:PHAS3:DEF? 240.0000
Command Syntax	[SOURCE:]PULSe <cr> >>> <i>Alias for PROGRAM:TRANSient command.</i> <<<
Description	This command controls pulse transient execution
Parameters	< RUN STOP PAUSE STEP RESTart >
Parameter Format	<cr>
Example	PULS RUN
Query Format	[SOURCE:]PULSe?
Description	Query format returns the pulse transient execution state as either RUN, STOP, PAUS, STEP or REST
Returned Data Format	<nr1> Return values represent running state as follows: 0 Stopped 1 Running 2 Paused 3 Stepping 4 Waiting for trigger
Query Example	PULS? 1

Command Syntax	[SOURCE:]PULSe:LOAD
Description	This command converts the pulse transient definition to the power source's regular transient segment format and loads it in the controller real-time memory for execution.
Parameters	None
Parameter Format	n/a
Example	STEP RUN
Query Format	[SOURCE:]PULSe:LOAD?
Description	Query format returns a 1 if the pulse transient load operation was successful, otherwise returns 0.
Returned Data Format	<nr1> Return values represent: 0 Load Failed 1 Load completed
Query Example	STEP? 1
Query Syntax	[SOURCE:]PULSe:PROGress?
Description	>>> <i>Alias for PROGRAM:TRANSient:PROGress command.</i> <<< This query command returns the status of the step being executed.
Parameters	None
Parameter Format	n/a
Description	Query returns the step transient execution state as either RUN, STOP, PAUS, STEP or REST
Returned Data Format	<cr> The response is a comma-separated value string representing: PROGRESS, CURRENT SEGMENT PROGRESS, CURRENT SEGMENT, CURRENT SEGMENT TIME, TOTAL TIME, TOTAL SEGMENTS, REPEAT TIME COUNTER
Query Example	PULS:PROG? 1, 45, 2, 1.2300, 2.0000, 4, 5
Query Syntax	[SOURCE:]PULSe:CHECK?
Description	This query command returns the result of a check on the programmed pulse parameters to determine if they are ok to run.
Parameters	None
Parameter Format	n/a
Description	Query returns result of PULSE parameters integrity check
Returned Data Format	<cr> The response is either OK or if not, a string containing the error.
Query Example	PULS:PROG? OK

Query Syntax	[SOURCE:]PULSe:ALL?
Description	This query command returns a comma-separated values string of the entire pulse parameters, settings, and limits. Each set value is preceded by a tag identifying the parameter. This same data structure is used for front panel display and by the web server. The advantage is that this commands returns all pulse related information using just one query command.
Parameters	None
Parameter Format	n/a
Description	Returns complete PULSE setup as a comma separated value string.
Returned Data Format	<cr>
Query Example	PULS:ALL? form,3,loaded,0,status,0,progress,0,current element progress,0,current element,0,current element time,0,total time,0,total elements,0,repeat times,0,count,1,count max,65535,count min,0,dcycle,50.0000,dcycle max,100.0000,dcycle max,0.0000,period,0,period max,50000,period min,0,width,0,width max,50000,width min,0,ramp,0,ramp max,0,ramp min,0,mode,0,mode max,2,mode min,0,frequency,60.000,frequency min,15.000,frequency max,1200.000,frequency min reason,1,frequency max reason,2,waveform all,1,waveform all exist,1,waveform a,1,waveform a exist,1,waveform b,1,waveform b exist,1,waveform c,1,waveform c exist,1,waveform max,200,waveform min,1,voltage ac all,0.000,voltage ac all max,320.000,voltage ac all min,0.000,voltage ac all max reason,2,voltage ac all min reason,0,voltage ac a,0.000,voltage ac a max,320.000,voltage ac a min,0.000,voltage ac a max reason,2,voltage ac a min reason,0,voltage ac b,0.000,voltage ac b max,320.000,voltage ac b min,0.000,voltage ac b max reason,2,voltage ac b min reason,0,voltage ac c,0.000,voltage ac c max,320.000,voltage ac c min,0.000,voltage ac c max reason,2,voltage ac c min reason,0,voltage dc all,0.000,voltage dc all max,450.000,voltage dc all min,-450.000,voltage dc all max reason,0,voltage dc all min reason,0,voltage dc a,0.000,voltage dc a max,450.000,voltage dc a min,-450.000,voltage dc a max reason,0,voltage dc a min reason,0,voltage dc b,0.000,voltage dc b max,450.000,voltage dc b min,-450.000,voltage dc b max reason,0,voltage dc b min reason,0,voltage dc c,0.000,voltage dc c max,450.000,voltage dc c min,-450.000,voltage dc c max reason,0,voltage dc c min reason,0,phase b,120.000,phase c,240.000,phase max,360.000,phase min,0.000

8.8 Status Commands

Status commands control status and event registers. These commands are aliases for some of the IEEE488.2 common commands and may be used interchangeably. Refer to section 0, “

Status and Events Registers” for details on status and event register configurations.

The following status commands are supported.

Command	Description
STATus:OPERation[:EVENT]?	Queries the Operation Status Event Register
STATus:OPERation:CONDition?	Queries the Operation Status Condition Register
STATus:OPERation:ENABle <nr1>	Sets the Operation Status Enable Register
STATus:OPERation:ENABle?	Queries the Operation Status Enable Register
STATus:QUESTionable[:EVENT]?	Queries the Questionable Status Event Register
STATus:QUESTionable:CONDition?	Queries the Questionable Status Condition Register
STATus:QUESTionable:ENABle <nr1>	Sets the Questionable Status Enable Register
STATus:QUESTionable:ENABle?	Queries the Questionable Status Enable Register
STATus:PRESet	Presets the Status Registers

Query Format	STATus:OPERation[:EVENT]?
Description	Queries the Operation Status Event Register.
Returned Data Format	<nr1>
Query Example	STAT:OPER? 0
Query Format	STATus:OPERation:CONDition?
Description	Queries the Operation Status Condition Register.
Returned Data Format	<nr1>
Query Example	STAT:OPER:COND? 0
Command Syntax	STATus:OPERation:ENABle <nr1>
Description	Sets the content Operation Status Enable Register.
Parameters	0-32767
Parameter Format	<nr1>
Example	STAT:OPER:ENAB 255
Query Format	STATus:OPERation:ENABle?
Returned Data Format	<nr1>
Query Example	STAT:OPER:ENAB? 6144
Query Format	STATus:QUESTionable[:EVENT]?
Description	Queries the Questionable Status Event Register.
Returned Data Format	<nr1>
Query Example	STAT:QUES? 0

Query Format	STATus:QUEStionable:CONDition?
Description	Queries the Questionable Status Condition Register.
Returned Data Format	<nr1>
Query Example	STAT:QUES:COND? 0
Command Syntax	STATus:QUEStionable:ENABle
Description	Sets the content of the Questionable Status Enable Register.
Parameters	0-32767
Parameter Format	<nr1>
Example	STAT:QUES:ENAB 255
Query Format	STATus:QUEStionable:ENABle?
Returned Data Format	<nr1>
Query Example	STAT:QUES:ENAB? 255
Command Syntax	STATus:PRESet
Description	The Status Preset command presets the Status Registers. The Operational Status. Enable Register is set to 0 and the Questionable Status Enable Register is set to 0.
Parameters	None
Parameter Format	n/a
Example	STAT:PRES

8.9 System Commands

Systems commands control system level functions or return model and revision information on the connected unit. The following system commands are supported.

8.9.1 System Error Commands

Query Format **SYSTem:ERror[:NEXT]?**
Description This command returns next available error message from the error queue. If no more error messages are available, returns 0,"NO ERROR" result. Available error messages are:

Returned Data Format	ERROR	Description
	-0, "No error"	No error detected
	-100,"Command error"	indicates invalid command or query received
	-102,"Command error: Syntax error."	Incorrect command syntax
	-200,"Execution error"	indicates can't execute command with parameters received
	-222,"Command error: Data out of range."	Data exceeds available parameter range
	-300,"Device-specific error"	indicates UPC not properly configured
	-400,"Query error"	indicates query aborted

Query Example SYST:ERR?
-102,"Command error: Syntax error."

Query Format **SYSTem:ERror:ALL?**
Description Returns all available error messages as a of error numbers and clears the error message queue.

Returned Data Format TOTAL_ERRORS ,ERRORS,CODE(INDEX),DESCRIPTION(INDEX),
CODE(INDEX+1), DESCRIPTION(INDEX+1),..., CODE(INDEX+N),
DESCRIPTION(INDEX+N),...

Query Example SYST:ERR:ALL?
0,0
SYST:ERR:ALL?
2,2,-102,"Command error: Syntax error. Webpage
interface.;2022/10/12 18:23:37",-102,"Command error: Syntax error.
Webpage interface.++2022/10/12 18:23:50"

Command Syntax **SYSTem:ERror:ALL:CLEAR**
Description This command clears the error message queue.
Parameters None
Parameter Format n/a
Example SYST:ERR:ALL:CLEAR

Command Syntax	SYSTem:ERROr:ALL:NOCLEAR? < Optional: Index>
Description	Returns all available error messages as a single unterminated string but does not clear the error message queue .
Returned Data Format	<nr1>,<nr1>,...<nr1> Format of response: YYYY/MM/DD,HH:MM::SS,S.NS,TOTAL_ERRORS,INDEX,ERRORS,CODE (INDEX),DESCRIPTION(INDEX),CODE(INDEX+1),DESCRIPTION(INDEX+1),...,CODE(INDEX+N),DESCRIPTION(INDEX+N),... Response Legend: YYYY/MM/DD,HH:MM::SS,S.NS is the timestamp of the latest error pushed to the queue. S is absolute seconds and NS absolute nanoseconds. TOTAL_ERRORS are the total errors in the queue. INDEX is 1 by default if not passed as optional argument. ERRORS is the total errors returned in the response. As there may be too many errors the response may return a few of them starting from the INDEX. The INDEX is useful to navigate the queue. CODE is the error code and DESCRIPTION the description.
Query Example	SYST:ERR:ALL:NOCLEAR? 2018/05/29,14:29:53,1207438.903668873,0,1,0 <u>For no errors:</u> <i>>SYSTem:ERROr:ALL:NOCLEAR?</i> <i>2022/10/12,18:17:01,122450.794695832,0,1,0</i> <u>Two errors in the queue:</u> <i>>SYSTem:ERROr:ALL:NOCLEAR?</i> <i>2022/10/12,18:17:19,122467.903705666,2,1,2,-</i> <i>102,"Command error: Syntax error. Webpage</i> <i>interface.;2022/10/12 18:17:18",-102,"Command error: Syntax</i> <i>error. Webpage interface.;2022/10/12 18:17:19"</i> <i>>SYSTem:ERROr:ALL:NOCLEAR? 2</i> <i>2022/10/12,18:17:19,122467.903705666,2,2,1,-</i> <i>102,"Command error: Syntax error. Webpage</i> <i>interface.;2022/10/12 18:17:19"</i>
Command Syntax	SYSTem:ERROr:POE
Description	This command sets the Power on Error reporting mode. Returns status of Power on Error setting as 1 (enabled) or 0 (disabled).
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:ERR:POE ON
Query Format	SYSTem:ERROr:POE?
Returned Data Format	
Query Example	SYST:ERR:POE? 1

8.9.2 System Information Commands

Command Syntax	SYSTem:BEEP
Description	This command generates an audible beep at the front panel of the power source.
Parameters	None
Parameter Format	n/a
Example	SYST:BEEP
Query Format	SYSTem:FW:FRONTPANEL:VERsion?
Description	Returns the firmware revision for the front panel processor.
Returned Data Format	<cr>
Query Example	SYST:FW:FRONTPANEL:VER? 2.0.0
Query Format	SYSTem:FW:FRONTPANEL:APPS:VERsion?
Description	Returns the firmware revision for the front panel application program.
Returned Data Format	<cr>
Query Example	SYST:FW:FRONTPANEL:APPS:VER? 2.0.0
Query Format	SYSTem:FW:IO:VERsion?
Description	Returns the firmware revision for the Auxiliary I/O board processor on ADF-xA version power sources.
Returned Data Format	<cr>
Query Example	SYST:FW:IO? 1.0.4
Query Format	SYSTem:FW:POWER:VERsion?
Description	Returns the revision number of the power source's power stages.
Returned Data Format	<nr2>-<nr2>
Query Example	SYST:FW:POWER:VER? 81.0.0-77.1.0
Query Format	SYSTem:LANGuage:CATalog?
Description	Returns list of available languages that can be selected for front panel operation.
Returned Data Format	<cr>
Query Example	SYST:LANG? english, chinese

Query Format	SYSTem:LXI:FEATures?
Description	Returns string listing supported LXI features.
Returned Data Format	<cr>
Query Example	SYST:LXI:FEAT? None
Query Format	SYSTem:LXI:VERSion?
Description	Returns LXI revision compliance version number.
Returned Data Format	<cr>
Query Example	SYST:LXI:VERSION? LXI Core 2011
Query Format	SYSTem:MODE?
Description	Returns LOCAL (0) or REMOTE (1) front panel status. Use IEEE 488.2 command commands *LLO to lock front panel and *GTL to release front panel operation.
Returned Data Format	
Query Example	SYST:MODE? 1
Query Format	SYSTem:SERIALNUM?
Description	Returns the serial number of the power source. Same information can be queried with the *IDN? command
Returned Data Format	<nr1>
Query Example	SYST:HWREV? 0
Query Format	SYSTem:TIME?
Description	Returns real time clock date and time. Note: Since both date and time are returned, there is no SYSTem:DATE?
Returned Data Format	<mm/dd/yy hh:mm:ss:mm
Query Example	SYSTem:TIME? 29/05/2018 14:40:57

Query Format	SYSTem:TIME:SOURce?
Description	Queries source of date and time information.
Returned Data Format	<cr>
Query Example	SYST:TIME:SOUR? NTP Note: NTP stands for “Network Time Protocol”. A protocol built on top of TCP/IP that assures accurate local timekeeping with reference to radio, atomic or other clocks located on the Internet. This protocol is capable of synchronizing distributed clocks within milliseconds over long time periods. It is defined in STD 12, RFC 1119 (RFC = Request for comment. RFCs are used by the Internet Engineering Task Force (IETF) and other standards bodies.
Query Format	SYSTem:TIME:UTC?
Description	Returns the UTC time, independent of the zone.
Returned Data Format	DD/MM/YYYY HH:MM:SS
Query Example	SYST:TIME:UTC? 29/05/2019 14:40:57
Command Syntax	SYSTem:TIME:ZONE <ZONE>
Description	Set the zone, allowed values are GMT+/-X.
Example	SYST:TIME:ZONE GMT-7
Query Format	SYSTem:TIME:ZONE?
Description	Returns the current time zone setting, normally GMT+/-X
Returned Data Format	<cr>
Query Example	SYST:TIME:ZONE? GMT-7
Query Format	SYSTem:TIME:ZONE:CATalog?
Description	Returns the available zones.
Returned Data	GMT-12,GMT-11,GMT-10,GMT-9,GMT-8,GMT-7,GMT-6,GMT-5,GMT-4,GMT-3, GMT-2,GMT-1,GMT+0,GMT+1,GMT+2,GMT+3,GMT+4,GMT+5,GMT+6,GMT+7,GMT+8,GMT+9,GMT+10,GMT+11,GMT+12,GMT+13,GMT+14
Command Syntax	SYSTem:TIME:ZONE:LEAP <0 OFF 1 ON>
Description	Enables or Disables Leap Second mode.
Parameters	1 or ON to consider leap seconds, otherwise 0 or OFF
Example	SYST:TIME:LEAP ON
Query Format	SYSTem:TIME:ZONE:LEAP?
Description	Returns 1 if it considers leap seconds, otherwise 0.
Returned Data	1 = Leap seconds considered, 0 = Leap seconds ignored

Command Syntax Description	SYSTem:TIME:SOURce < RTC NTP > Set the time source, RTC is the local real time clock of the front panel. NTP is internet time protocol. NTP requires internet connection. If NTP is used with internet connection then the RTC is updated every time the NTP synchronizes.
Parameters Example	< RTC NTP > SYST:TIME:SOUR NTP
Query Format Description Returned Data	SYSTem:TIME:SOURce:CATalog? Returns the available time source options, NTP or RTC. NTP, RTC
Query Format Description Returned Data	SYSTem:TIME:SOURce:NTP:SERVer? Returns “pool.ntp.org” This is the server that uses the unit NTP service. pool.ntp.org
Command Syntax Description Parameters Example	SYSTem:TIME:SOURce:NTP:SYNC <OPTIONAL: SERVER> Forces an NTP sync. If the argument is not passed then it uses “pool.ntp.org”. Any IP/domain that runs a NTP server can be used. Alternative commons servers are “time.windows.com” or “time.nist.gov”. < time server domain > SYST:TIME:SOUR:NTP:SYNC
Command Syntax Description Parameters Example	SYSTem:TIME:SOURce:NTP:REStart Restarts the NTP service none SYST:TIME:SOUR:NTP:REST
Query Format Description Returned Data Format Query Example	SYSTem:VERSion? Returns SCPI standard revision version. <nr2> SYST:VERS? 1992.0
Query Format Description Returned Data Format Query Example	SYSTem:XFMRRATIO? Returns the transformer option (T Option) voltage ratio. If no transformer option is installed and configured, this query will return a value of 0.000. See also the [SOURce:]COUPLing command. <nr2> SYSTem:XFMRRATIO? 1.3333

8.9.3 System Interface Soft Key Preset Commands

These commands allow programming of the output programming preset soft key values for the front panel user interface of the power source. The same can be accomplished by the user from the front panel. Using a program to set these value can ensure they are always set to a known value if this is important for operator use of the power source in a specific test situation.

8.9.3.1 Preset Syntax

The syntax for all these commands is very similar. Prefix is always "SYSTem:INTERFace:PRESET:" followed by the parameter. Available soft key preset parameters are:

- VOLTage[:AC]
- FREQuency
- PHASe
- CURRent:LIMit
- POWEr:LIMit
- KVA:LIMit

To program or query a specific soft key number (1 ~ 5), append "SK#" to the command where # is a value from 1 through 5 for soft key 1 through 5. (Top soft key = 1, bottom soft key = 5).

8.9.3.2 Command parameters

Available softkey parameters are:

- MIN MIN is the preset value for the min allowable setting based on the power source model
- MAX MAX is the the preset value for the max allowable setting based on the power source model
- DEF DEF sets the preset value to factory default
- Value A <nr1> value between MIN and MAX may be specified instead.

Up to five sets of parameters can be appended to these commands to program more than one soft key for the same parameter setting with a single command string.

Example:

```
SYST:INTERF:PRESET:VOLT MAX, MIN, 108, 140
```

Programs the voltage AC soft keys as follows:

SK1 = MAX or 300, SK2 = MIN or 0, SK3 = 108, SK4 = 140.

8.9.3.3 Preset Commands Listing

The following lists shows all available soft key preset programming commands.

Voltage AC

SYSTem:INTERFace:PRESET:VOLTage[:AC] <REQ: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:VOLTage[:AC]? <OPT: ALL|DEF> <OPT: ALL|DEF>

SYSTem:INTERFace:PRESET:VOLTage[:AC]:SK# <REQ: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:VOLTage[:AC]:SK#?

Frequency

SYSTem:INTERFace:PRESET:FREQuency <REQ: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:FREQuency? <OPT: ALL|DEF> <OPT: ALL|DEF>

SYSTem:INTERFace:PRESET:FREQuency:SK# <REQ: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:FREQuency:SK#?

Current Limit

SYSTem:INTERFace:PRESET:CURREnt:LIMit <REQ: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:CURREnt:LIMit? <OPT: ALL|DEF> <OPT: ALL|DEF>

SYSTem:INTERFace:PRESET:CURREnt:LIMit:SK# <REQ: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:CURREnt:LIMit:SK#?

Power Limit

SYSTem:INTERFace:PRESET:POWer:LIMit <REQ: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:POWer:LIMit? <OPT: ALL|DEF> <OPT: ALL|DEF>

SYSTem:INTERFace:PRESET:POWer:LIMit:SK# <REQ: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:POWer:LIMit:SK#?

Apparent Power Limit

SYSTem:INTERFace:PRESET:KVA:LIMit <REQ: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value, OPT: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:KVA:LIMit? <OPT: ALL|DEF> <OPT: ALL|DEF>

SYSTem:INTERFace:PRESET:KVA:LIMit:SK# <REQ: MIN|MAX|DEF|Value>

SYSTem:INTERFace:PRESET:KVA:LIMit:SK#?

Examples of programming User Preset Soft keys:

SYST:INTERF:PRESET:VOLT:AC 115.000,230.000,300.000,MAX

SYST:INTERF:PRESET:FREQ 50.000,60.000,400.000,800.000,1200.000

SYST:INTERF:PRESET:CURR:LIM MAX,15.000,5.000

SYST:INTERF:PRESET:POW:LIM MAX,4.000,2.000,1.000

SYST:INTERF:PRESET:KVA:LIM MAX,4.000,2.000,1.000

Examples of programming a specific User Preset Soft key:

SYST:INTERF:PRESET:VOLT:AC:SK1 115

Examples of querying programming User Preset Soft key settings:

SYSTEM:INTERF:PRESET:VOLT:AC? -> 115.000,230.000,300.000,MAX

SYSTEM:INTERF:PRESET:FREQ? -> 50.000,60.000,400.000,800.000,1200.000

SYSTEM:INTERF:PRESET:CURR:LIM? -> MAX,15.000,5.000

SYSTEM:INTERF:PRESET:POW:LIM? -> MAX,4.000,2.000,1.000

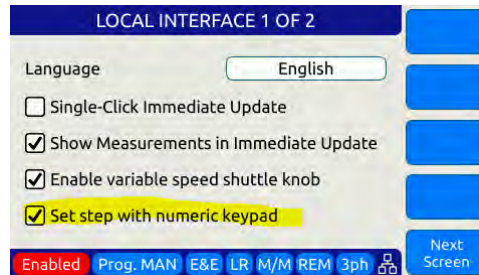
SYSTEM:INTERF:PRESET:KVA:LIM? -> MAX,4.000,2.000,1.000

Example of querying programming User Preset for a specific soft key number:

SYST:INTERF:PRESET:VOLT:AC:SK1? -> 115.000

8.9.3.4 Other Front Panel Function Commands

These commands are equivalent to some of the functions available in the LOCAL INTERFACE settings.



Beeper Volume - Range is 0 through 10:

SYSTem:INTERFace:VOLUme <VOLUME>

SYSTem:INTERFace:VOLUme?

LCD Brightness - Range is 0 through 10:

SYSTem:INTERFace:LCD[:BRIGHTness] <BRIGHTNESS>

SYSTem:INTERFace:LCD[:BRIGHTness]?

Keypad Backlit Brightness - Range is 0 through 10:

SYSTem:INTERFace:KEYS:BRIGhTness <BRIGHTNESS>

SYSTem:INTERFace:KEYS:BRIGhTness?

Key Press Sounds:

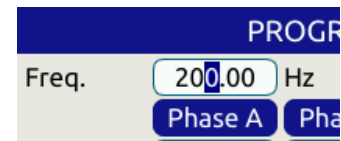
SYSTem:INTERFace:KEYS:SOUNDS <ON|OFF>

SYSTem:INTERFace:KEYS:SOUNDS?

Set Resolution Step Size with the numeric keypad

SYSTem:INTERFace:KEYS:STEPset <ON|OFF>

SYSTem:INTERFace:KEYS:STEPset?



Single Click Update Mode:

SYSTem:INTERFace:IMMEDIATEupdate:SINGLEclick <ON|OFF>

SYSTem:INTERFace:IMMEDIATEupdate:SINGLEclick?

Show Measurements in Immediate Update:

SYSTem:INTERFace:IMMEDIATEupdate:SHOWMEASurements <ON|OFF>

SYSTem:INTERFace:IMMEDIATEupdate:SHOWMEASurements?

Variable Shuttle Knob Speed - Range is 0 through 10:

SYSTem:INTERFace:KNOB:SPeed <SPEED>

SYSTem:INTERFace:KNOB:SPeed?

8.9.4 System Configuration Commands

Query Format	SYSTem:MAXKVA?
Description	Returns maximum available kVA output capability of the power source. Example for 3150ADF model = 15.000
Returned Data Format	<nr2>
Query Example	SYST:MAXKVA? 15.000
Query Format	SYSTem:MAXCURRent?
Description	Returns maximum available RMS output current capability of the power source. Example for 3150ADF model = 41.6667.
Returned Data Format	<nr2>
Query Example	SYST:MAXCURR? 41.6667
Query Format	SYSTem:MAXVOLTage?
Description	Returns maximum available RMS voltage output capability of the power source. Example for 3150ADF model = 300.
Returned Data Format	<nr1>
Query Example	SYST:MAXVOLT? 300
Command Syntax	SYSTem:COMPAtible
Description	Sets Pacific Power Source UPC controller compatibility mode. This mode allows use of the power source with legacy software.
Parameters	< 0 DISABLE 1 UPC >
Parameter Format	
Example	SYST:COMP UPC
Query Format	SYSTem:COMPAtible?
Returned Data Format	
Query Example	SYST:COMP? 1
Query Format	SYSTem:HWREVision?
Description	Returns the hardware revision letter of the power source
Returned Data Format	<cr>
Query Example	SYST:HWREV? A

Command Syntax	SYSTem:LANGuage
Description	Sets Pacific Power Source UPC controller compatibility mode. This mode allows use of the power source with legacy software.
Parameters	< english Chinese > Note: Refer to SYSTem:LANGuage:CATalog? query command for list of supported languages.
Parameter Format	<cr>
Example	SYST:LANG chinese
Query Format	SYSTem:LANGuage?
Returned Data Format	
Query Example	SYST:LANG? chinese

8.9.5 Parallel System Commands

Command Syntax	SYSTem:DISCOVERY
Description	Initiates discovery of the number of paralleled power sources
Parameters	None
Parameter Format	n/a
Example	SYST:DISCOVERY
Query Format	SYSTem:PARALLELUNITS?
Description	Returns the number of power sources found.
Returned Data Format	<nr1>
Query Example	SYST:PARALLELUNITS? 1
Command Syntax	SYSTem:PARALLELUNITS:EXPEcted
Description	Sets the number of power sources that should be connected to the system interface bus.
Parameters	1 – 200
Parameter Format	<nr1>
Example	SYST:PARALLELUNITS:EXPE 4
Query Format	SYSTem:PARALLELUNITS:EXPEcted?
Returned Data Format	<nr1>
Query Example	SYST:PARALLELUNITS:EXPE? 4

Multi-Unit System Configuration Command Examples:

30kVA Parallel ADF System

```
SOURCE:SERIES 0
SYSTem:SERIESUNITS? = 1
SYSTem:PARALLELUNITS? = 2
SYSTem:CONNECTEDUNITS? = 2
```

60kVA Parallel ADF System

```
SOURCE:SERIES 0
SYSTem:SERIESUNITS? = 1
SYSTem:PARALLELUNITS? = 4
SYSTem:CONNECTEDUNITS? = 4
```

8.9.6 System Sanitization Commands

Query Format	SYSTem:SANITIZE:CODE?
Description	Returns sanitization password string.
Returned Data Format	<nr1>
Query Example	SYSTem:SANITIZE:CODE? 0659
Command Syntax	SYSTem:SANITIZE <code>
Description	Erases all user data stored in non-volatile memory settings including settings and custom waveforms if required. The code is obtained by the query command above.
Parameters	None
Parameter Format	n/a
Example	SYST:SANITIZE 0659

8.9.7 Communication LAN Commands

Command Syntax	SYSTem:COMMunicate:LAN[:ENABle]
Description	This command turns remote control via LAN on or off. To control the power source through its LAN interface, this state has to on (1).
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:LAN ON
Query Format	SYSTem:COMMunicate:LAN[:ENABle]?
Returned Data Format	
Query Example	SYST:COMM:LAN? 1
Query Format	SYSTem:COMMunicate:LAN:STATus?
Description	This command returns all LAN settings in a single comma delimited string of values.
Returned Data Format	<cr>, <cr>,...,<cr>,<cr>
Query Example	SYSTem:COMMunicate:LAN:STATus? 192.168.14.22,255.255.254.0,192.168.15.254,192.168.15.208,ADF-106378937,ADF-106378889,0,1,0

Command Syntax Description	SYSTem:COMMunicate:LAN:DHCP[:ENABLE] This command turns DHCP mode for the LAN interface on or off. DHCP = Dynamic Host Configuration Protocol". This protocol automatically provides an IP address and other related information such as the subnet mask and default gateway. When turned off, a static IP address must be assigned by the user instead.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:LAN:DHCP ON
Query Format	SYSTem:COMMunicate:LAN:DHCP[:ENABLE]?
Returned Data Format	
Query Example	SYST:COMM:LAN:DHCP? 1
Command Syntax Description	SYSTem:COMMunicate:LAN:DHCP:RENEW This command renews the lease of an IP address assigned through the DHCP protocol. This may be necessary if the power source has not been used in a while and its IP address lease has expired. If not renewed, a different IP address may be assigned.
Parameters	None
Parameter Format	n/a
Example	SYST:COMM:LAN:DHCP:RENEW
Command Syntax Description	SYSTem:COMMunicate:LAN:ADDress This command is used to assign a fixed IP address to the power source for LAN communication.
Parameters	ddd.ddd.ddd.ddd (four octets ranging in value from 0 to 255 representing one 16 bit unsigned integer value each.
Parameter Format	<cr>
Example	SYST:COMM:LAN:ADD 132.18.21.105
Query Format	SYSTem:COMMunicate:LAN:ADDress?
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:ADD? 132.18.21.105
Query Format Description	SYSTem:COMMunicate:LAN:MACaddress? This query returns the MAC address of the connected power source. The Media Access Control address or MAC address is also referred to as physical address as it is fix and unique to any device on the network. The MAC address for the power source is also printed on the rear panel near the LAN interface connector. It consists of 8 sets of hexadecimal 16 bit unsigned integer values.
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:MAC? 3A.3F.00.4C.DE.AA.39.8F

Query Format	SYSTem:COMMunicate:LAN:VISA?
Description	Queries the VISA resource name / address string
Returned Data Format	<cr>
Query Example	TCPIP::ADF-1003::INSTR
Command Syntax	SYSTem:COMMunicate:LAN:APPLY
Description	Applies all changes send using the COMM:LAN commands.
Parameters	None
Parameter Format	n/a
Example	SYST:COMM:LAN:APP
Command Syntax	SYSTem:COMMunicate:LAN:MASK
Description	This command sets the IP mark value for the power source LAN interface. It is normally obtained through DHCP. If a static IP must be used, the mask has to set as well.
Parameters	ddd.ddd.ddd.ddd (four octets ranging in value from 0 to 255 representing one 16 bit unsigned integer value each.
Parameter Format	<cr>
Example	SYST:COMM:LAN:MASK 255.255.254.0
Query Format	SYSTem:COMMunicate:LAN:MASK?
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:MASK? 255.255.254.0
Command Syntax	SYSTem:COMMunicate:LAN:DNSaddress
Description	Sets the IP address for the DNS server
Parameters	ddd.ddd.ddd.ddd (four octets ranging in value from 0 to 255 representing one 16 bit unsigned integer value each.
Parameter Format	<cr>
Example	SYST:COMM:LAN:DNS 132.18.21.208
Query Format	SYSTem:COMMunicate:LAN:DNSaddress?
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:DNS? 132.18.21.208
Command Syntax	SYSTem:COMMunicate:LAN:GWAddress
Parameters	Sets the IP address for the Network Gateway. A default gateway is the node on the computer network that the network software uses when an IP address does not match any other routes in the routing table
Parameter Format	<cr>
Example	SYST:COMM:LAN:GWAD 132.18.21.254
Query Format	SYSTem:COMMunicate:LAN:GWAddress?
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:GWAD? 132.18.21.254

Command Syntax Description	SYSTem:COMMunicate:LAN:HOST:CONFigured Sets the network host address. The host address is the portion of the address used to identify hosts (any device requiring a Network Interface Card, such as a PC or networked printer) on the network. The network ID, by contrast, is the portion of the address that refers to the network itself.
Parameters	ddd.ddd.ddd.ddd (four octets ranging in value from 0 to 255 representing one 16 bit unsigned integer value each.
Parameter Format	<cr>
Example	SYST:COMM:LAN:HOST 132.18.21.0
Query Format	SYSTem:COMMunicate:LAN:HOST:CONFigured?
Returned Data Format	<cr>
Query Example	SYST:COMM:LAN:HOST:CONF? 132.18.21.0
Command Syntax Description	SYSTem:COMMunicate:LAN:PASSword Assign a password to enable or disable LAN communications. This feature allows the owner/operator to disable or enable remote LAN access or limit functionality over LAN. Note: There is no query format for this command so the password code cannot be queried back.
Parameters	Four digit passcode
Parameter Format	<nr1?>
Example	SYST:COMM:LAN:PASS 1234
Command Syntax Description	SYSTem:COMMunicate:LAN:PORT Sets LAN interface port address. For SCPI message communications, the standard port number is 5025.
Parameters	1024–49151, default = 5025
Parameter Format	<nr1>
Example	SYST:COMM:LAN:PORT 5025
Query Format	SYSTem:COMMunicate:LAN:PORT?
Returned Data Format	<nr1>
Query Example	SYST:COMM:LAN:PORT? 5025
Command Syntax Description	SYSTem:COMMunicate:LAN:PORT:TELNET Sets the port address for TELNET protocol
Parameters	1024–49151, default = 5024
Parameter Format	<nr1>
Example	SYST:COMM:LAN:PORT:TELNET 5024
Query Format	SYSTem:COMMunicate:LAN:PORT:TELNET?
Returned Data Format	<nr1>
Query Example	SYST:COMM:LAN:PORT:TELNET? 5024

8.9.8 Communication Serial Port Commands

Command Syntax	SYSTem:COMMunicate:SERial[:ENABle]
Description	This command is used to turn the RS232 serial interface on or off. To use this interface for remote control of the power source, it must be set to ON.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:SER ON
Query Format	SYSTem:COMMunicate:SERial[:ENABle]?
Returned Data Format	
Query Example	SYST:COMM:SER? 1
Query Format	SYSTem:COMMunicate:SERial:STATus?
Description	This command returns all serial port settings
Returned Data Format	Baud rate, status,data bits, stop bits, parity, flow control
Query Example	SYST:COMM:SER:STAT? 921600,0,8,1,0,0
Command Syntax	SYSTem:COMMunicate:SERial:BAUD
Description	This command sets the baud rate for the serial port.
Parameters	< 1200 1800 2400 4800 9600 14400 19200 38400 57600 62500 115200 230400 460800 500000 576000 921600 >
Parameter Format	<nr1>
Example	SYST:COMM:SER:BAUD 115200
Query Format	SYSTem:COMMunicate:SERial:BAUD?
Returned Data Format	<cr1>
Query Example	SYST:COMM:SER:BAUD? 115200
Command Syntax	SYSTem:COMMunicate:SERial:PARity
Description	This command sets the parity for the serial port.
Parameters	< 0 NONE 1 OFF 2 EVEN >
Parameter Format	<nr1>
Example	SYST:COMM:SERial:PAR NONE
Query Format	SYSTem:COMMunicate:SERial:PARity?
Returned Data Format	<nr1>
Query Example	SYST:COMM:SER:PAR? 0

Command Syntax	SYSTem:COMMunicate:SERial:BITS
Description	This command sets the number of data bits used for serial communications. Available settings are 7 or 8
Parameters	< 7 8 >
Parameter Format	<nr1>
Example	SYST:COMM:SER:BITS 8
Query Format	SYSTem:COMMunicate:SERial:BITS?
Returned Data Format	<nr1>
Query Example	SYST:COMM:SER:BITS? 8
Command Syntax	SYSTem:COMMunicate:SERial:SBITS
Description	This command sets the number of stop bits used for serial communications. Available settings are 1 or 2.
Parameters	< 1 2 >
Parameter Format	<nr1>
Example	SYST:COMM:SER:SBIT 2
Query Format	SYSTem:COMMunicate:SERial:SBITS?
Returned Data Format	<nr1>
Query Example	SYST:COMM:SER:SBIT? 2
Command Syntax	SYSTem:COMMunicate:SERial:FLOWcontrol
Description	This command sets the method of handshaking used for serial communications. Available settings are Xon/Xoff or Hardware handshake.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:SER:FLOW ON
Query Format	SYSTem:COMMunicate:SERial:FLOWcontrol?
Returned Data Format	<nr1>
Query Example	SYST:COMM:SER:FLOW? 1

8.9.9 Communication USB Commands

Command Syntax	SYSTem:COMMunicate:USB:VIRTualport[:ENABLE]
Description	This command enables USB device control using virtual comm driver.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:USB:VIRT ON
Query Format	SYSTem:COMMunicate:USB:VIRTualport[:ENABLE]?
Returned Data Format	
Query Example	SYST:COMM:USB:VIRT? 1

Command Syntax	SYSTem:COMMunicate:USB:LAN[:ENABLE]
Description	Enables access to embedded webserver using virtual IP Address through USB interface.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:USB:ETH ON
Query Format	SYSTem:COMMunicate:USB:LAN[:ENABLE]?
Returned Data Format	
Query Example	SYST:COMM:USB:LAN? 1
Command Syntax	SYSTem:COMMunicate:USB:LAN:ADDress
Description	Sets the embedded webserver virtual IP Address for USB interface.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:USB:LAN ON
Query Format	SYSTem:COMMunicate:USB:LAN:ADD?
Returned Data Format	
Query Example	SYST:COMM:USB:LAN:ADD? 192.168.123.1
Command Syntax	SYSTem:COMMunicate:USB:LAN:APPLY
Description	Applies IP settings for Virtual USB Lan interface.
Parameters	None
Parameter Format	N/A
Example	SYST:COMM:USB:LAN:APP
Command Syntax	SYSTem:COMMunicate:USB:LAN:MASK
Description	Sets the embedded webserver virtual IP Mask Address for USB interface.
Parameters	IP Mask
Parameter Format	<cr>
Example	SYST:COMM:USB:LAN ON
Query Format	SYSTem:COMMunicate:USB:LAN:MASK?
Returned Data Format	<cr>
Query Example	SYST:COMM:USB:LAN:MASK? 255.255.255.0

8.9.10 Communication GPIB Commands

Command Syntax	SYSTem:COMMunicate:GPIB:ADdRes <nr1>
Description	This command sets the GPIB address.
Parameters	< 1..30 >
Parameter Format	<nr1>
Example	SYST:COMM:GPIB:ADD 5
Query Format	SYSTem:COMMunicate:GPIB:ADdRes?
Returned Data Format	<nr1>
Query Example	SYST:COMM:GPIB:ADD? 5
Command Syntax	SYSTem:COMMunicate:GPIB:ENABle
Description	Enables access to embedded webserver using virtual IP Address through USB interface.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:COMM:GPIB:ENAB 1
Query Format	SYSTem:COMMunicate:GPIB:ENABle?
Returned Data Format	
Query Example	SYST:COMM:GPIB:ENAB? 1
Command Syntax	SYSTem:COMMunicate:GPIB:BAUDrate
Description	Sets the internal serial link speed between the GPIB interface and the front panel processor. This setting is set to 921600 bps as a default and should only be changed to a lower setting if there is a problem with the GPIB interface not working reliably.
Parameters	< 1200 1800 2400 4800 9600 14400 19200 38400 57600 62500 115200 230400 460800 500000 576000 921600 >
Parameter Format	<nr1>
Example	SYST:COMM:GPIB:BAUD 921600
Query Format	SYSTem:COMMunicate:GPIB:BAUDrate?
Returned Data Format	<nr1>
Query Example	SYST:COMM:GPIB:BAUD? 921600

8.9.11 System Firmware Commands

Query Format	SYSTem:FW:POWER[:VERsion]?
Description	This command returns the firmware revision of the power converter DSP's. This information is for reference only.
Returned Data Format	<cr>-<cr>
Query Example	SYST:FW:POWER:VER? 81.0.0.RC8-77.1.0
Query Format	SYSTem:FW:FRONTPANEL:VERsion?
Description	This command returns the firmware revision of front panel controller processor. This information is for reference only.
Returned Data Format	<cr>
Query Example	SYST:FW:FRONTPANEL:VER? 2.0.0
Query Format	SYSTem:FW:FRONTPANEL:APPS:VERsion?
Description	This command returns the firmware revision of front panel controller user interface application. This information is for reference only. Note: This revision number is also returned as part of the *IDN? query response.
Returned Data Format	<cr>
Query Example	SYST:FW:FRONTPANEL:APPS:VER? 2.0.0
Query Format	SYSTem:HWREVision?
Description	This command returns the hardware revision (build) of the power source.
Returned Data Format	<nr2>
Query Example	SYST:HWREV? 0

8.9.12 System Remote Access Commands

Command Syntax	SYSTem:REMOte:ACCESS
Description	Sets remote access permission.
Parameters	<0 DISABLED 1 ENABLED>
Parameter Format	
Example	SYST:REM:ACCESS 1
Query Format	SYSTem:REMOte:ACCESS?
Returned Data Format	<cr>
Query Example	SYST:REM:ACCESS? 1
Command Syntax	SYSTem:REMOte:ACCESS:REQuest
Description	This commands results in a pop up dialog on the front panel display requesting the local user to ACCEPT. Confirms presence of a person at the location of the instrument.
Parameters	Alias name. (This argument is optional)
Parameter Format	<cr>
Example	SYSTem:REMOte:ACCESS:REQuest
Query Format	None
Command Syntax	SYSTem:REMOte:ACCESS:LOGIN
Description	This command uses a password as an argument to request access to the instrument. The password can be set on the front panel or using the SYSTem:REMOte:PASSword command
Parameters	Password
Parameter Format	<nr1>
Example	SYSTem:REMOte:ACCESS:LOGIN 1234
Query Format	None
Command Syntax	SYSTem:REMOte:ACCESS:MESSAge <cr>
Description	Allows a user specific message to be displayed at the bottom of the Access Control Browser dialog informing anyone requesting access whom to contact.
Parameters	User Message
Parameter Format	<cr>
Example	SYSTem:REMOte:ACCESS:MESS "Unit is used by John. Please contact 123456789."
Query Format	SYSTem:REMOte:ACCESS:MESSAge?
Returned Data Format	<cr>
Query Example	SYST:REM:ACCESS:MESS? "Unit is used by John. Please contact 123456789."

Command Syntax	SYSTem:REMOte:ACCESS:MONItor
Description	Enables or disables remote access monitor mode only. ON by default for backward compatibility.
Parameters	< 0 OFF 1 ON >
Parameter Format	 or <cr>
Example	SYSTem:REMOte:ACCESS:MONI ON
Query Format	SYSTem:REMOte:ACCESS:MONItor?
Returned Data Format	
Query Example	SYST:REM:ACCESS:MONI? 1
Command Syntax	SYSTem:REMOte:FTP:ENABle
Description	Enable/disable the FTP service.
Parameters	<0 OFF 1 ON>
Parameter Format	
Example	SYST:REM:FTP:ENA 1
Query Format	SYSTem:REMOte:FTP:ENABle?
Returned Data Format	
Query Example	SYST:REM:FTP:ENA? 1
Command Syntax	SYSTem:REMOte:FTP:PASSword
Description	Sets remote FTP access permission password.
Parameters	password
Parameter Format	<cr>
Example	SYST:REM:FTP:PASS temporal
Query Format	SYSTem:REMOte:FTP:PASSword?
Returned Data Format	<cr>
Query Example	SYST:REM:FTP:PASS? temporal
Command Syntax	SYSTem:REMOte:SMB:ENABle
Description	Enable/disable the samba service.
Parameters	<0 OFF 1 ON>
Parameter Format	
Example	SYST:REM:FTP:ENA 1
Query Format	SYSTem:REMOte:SMB:ENABle?
Returned Data Format	
Query Example	SYST:REM:SMB:ENA? temporal

Command Syntax	SYSTem:REMOte:SMB:PASSword
Description	Sets remote Samba services access permission password
Parameters	password
Parameter Format	<cr>
Example	SYST:REM:SMB:PASS temporal
Query Format	SYSTem:REMOte:SMB:PASSword?
Returned Data Format	<cr>
Query Example	SYST:REM:SMB:PASS? temporal

8.9.13 Miscellaneous System Commands

Command Syntax	SYSTem:BEEP
Description	This command generates a beep from the front panel speaker. May be used in ATE programs to get operator's attention. Make sure the beep volume is not set to 0. See SYSTem:INTERFace:VOLume cmd.
Returned Data Format	<cr>, ..., <cr>
Query Format	None
Query Format	SYSTem:MEMory:CATalog?
Description	This command returns the available memory types catalog.
Returned Data Format	<cr>, ..., <cr>
Query Example	SYST:MEM:CAT? INTERNAL, RAM
Command Syntax	SYSTem:MEMory:REMove
Description	This command unmounts system memory.
Returned Data Format	<cr>, ..., <cr>
Query Format	None
Command Syntax	SYSTem:DELeTe <PATH>
Description	This command deletes a file or folder. The path or filename can be between double quotation marks or not.
Parameters	PATH or FILE
Parameter Format	<cr>
Example	SYST:DEL internal/program/program_1.xml SYST:DEL "internal/program/program_1.xml" SYST:DEL temporal/program/program_1.xml SYST:DEL "temporal/program/program_1.xml"
Query Format	none
Query Format	SYSTem:FILE:TYPE? <MEM>
Description	This command returns the file type in numeric available memory types catalog.
Returned Data Format	<nr1>
Query Example	SYST:FILE:TYPE? RAM 0 SYST:FILE:TYPE? INTERNAL 0

Command Syntax	SYSTem:SCREENshot
Description	This command takes a screen shot of the LCD display. The LCD image is saved as a “.png” format image file to folder “internal/screenshots”
Parameters	None
Parameter Format	N/A
Example	SYST:SCREEN
Query Format	none

8.9.14 System Import / Export Commands

These commands allow complete system configurations to be exported or imported.

Command Syntax	SYSTem:EXPort <OPT: CONFIGURATION, OPT: WAVEFORMS, OPT: PROGRAMS, OPT: SETPOINTS, OPT: [NAME, NAMEFILE]>
Description	Exports complete record of system configuration of the power source to a compressed file. If argument name is omitted it is stored in temporal/DATE—TIME.7z otherwise in temporal/NAMEFILE.7z. The others arguments indicate what is going to be exported, if none of them are passed all is going to be exported.
Parameters	<OPT: CONFIGURATION, OPT: WAVEFORMS, OPT: PROGRAMS, OPT: SETPOINTS, OPT: [NAME, NAMEFILE]>
Parameter Format	<cr>
Example	SYST:EXPORT SYST:EXPORT NAME,TEST SYST:EXPORT SETPOINTS,NAME,TEST2 SYST:EXPORT SETPOINTS, WAVEFORMS,NAME,TEST3
Command Syntax	SYSTem:IMPort <OPT: CONFIGURATION, OPT: WAVEFORMS, OPT: PROGRAMS, OPT: SETPOINTS, [NAME, NAMEFILE]>
Description	Imports complete system configuration records of the power source. The compressed file has to be in /temporal/NAMEFILE.7z. The other others arguments indicate what will be imported, if none of them are passed all is going to be imported.
Parameters	<OPT: CONFIGURATION, OPT: WAVEFORMS, OPT: PROGRAMS, OPT: SETPOINTS, [NAME, NAMEFILE]>
Parameter Format	<cr>
Example	SYST:IMPORT NAME,TEST

8.9.15 System Regional Setting Commands

These commands are used to set regional setting for Dates, Times and Decimal separators. They are relevant when exporting or importing CSV files for use in applications like MS Excel or MS Word.

These commands are used to set regional setting for Dates, Times and Decimal separators. They are relevant when exporting or importing CSV files for use in applications like MS Excel or MS Word.

Command: **SYSTem:REGion:DATEFormat <FORMAT>**

Sets the date display format as either **DD/MM/YYYY** (Asia) EU or **MM/DD/YYYY** (USA)

Example: SYST:REG:DATE DD/MM/YYYY

Query: **SYSTem:REGion:DATEFormat?**

Example: SYST:REG:DATE?
DD/MM/YYYY

Command: **SYSTem:REGion:DATEFormat:CATalog?**

Returns: MM/DD/YYYY,DD/MM/YYYY

Command: **SYSTem:REGion:DECImalsymbol <SEPARATOR>**

Sets the decimal separator to either a comma (Asia, EU) or a period (USA). Parameters are "." Or ",".

Example: SYST:REG:DECI ","

Query: **SYSTem:REGion:DECImalsymbol?**

Returns decimal separator setting.

Examples SYST:REG:DATE?

,

8.9.16 Miscellaneous Remote Restart Commands

Command Syntax	SYSTem:COMMunicate:LXI:REStart
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Description	Restarts the LXI interface.
-------------	-----------------------------

Parameters	None
------------	------

Parameter Format	n/a
------------------	-----

Example	SYST:COMM:LXI:REST
---------	--------------------

Command Syntax	SYSTem:REMote:FTP:REStart
----------------	----------------------------------

Description	Restarts the FTP Server.
-------------	--------------------------

Parameters	None
------------	------

Parameter Format	n/a
------------------	-----

Example	SYST:REM:FTP:REST
---------	-------------------

Command Syntax	SYSTem:REMOte:SMB:REStart
Description	Restarts the Samba Server.
Parameters	None
Parameter Format	n/a
Example	SYST:REM:SMB:REST
Command Syntax	SYSTem:RESTART
Description	Restarts the SPCI Processor.
Parameters	None
Parameter Format	n/a
Example	SYST:RESTART
Command Syntax	SYSTem:INTERFace:REStart
Description	Restarts the Display Processor.
Parameters	None
Parameter Format	n/a
Example	SYST:INTERF:REST

8.10 Auxiliary I/O System Commands

Commands specific to the auxiliary I/O functions are listed in this section.

8.10.1 System Analog & Digital IO Commands

SYSTem:AIO

```
:INput[1 | 2 | 3 | .4][?]  
:CATalog?  
:GAIN[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
: OFFSET[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
:RANGe[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
:UNITs?  
:VOLTage?  
:OUTput[1 | 2 | 3 | .4][?]  
:CATalog?  
:GAIN[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
:OFFSET[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
:RANGe[?]  
:DEFault?  
:MAXimum?  
:MINimum?  
:UNITs?  
:VOLTage?
```

```

SYSTem:DIO
    :INput[1 | 2 | 3 | .4][?]
        :FALLing[?]
        :FILtersize[?]
            :DEFault?
            :MAXimum?
            :MINimum?
        :RISing[?]
    :OUTput[1 | 2 | 3 | .4][?]
        :CATalog?
        :INVert[?]
        :STATe?
    :REMote
        :ENable[?]
        :INHibit[?]
    :STROBE
        :OUTPutstate[?]
        :SOURce[?]
        :TRANsient[?]

```

8.10.1.1 SYSTem:AIO:Input

Command Syntax	SYSTem:AIO:INput[n] <cr>
Description	Sets the ADF parameter to be controlled by the analog input.
Parameters	[CURR:LIM CURR:LIM1 CURR:LIM2 CURR:LIM3 FREQ KVA:LIM KVA:LIM1 KVA:LIM2 KVA:LIM3 OFF PHAS2 PHAS3 POW:LIM POW:LIM1 POW:LIM2 POW:LIM3 VOLT:AC VOLT:AC1 VOLT:AC2 VOLT:AC3 VOLT:DC VOLT:DC1 VOLT:DC2 VOLT:DC3] See the “SYSTem:AIO:INput:CATalog?” command response for a list of supported parameters.
Parameter Format	<cr>
Example	SYST:AIO:IN1 VOLTAGE
Query Format	SYSTem:AIO:INput[n]? <cr>
Returned Data Format	<cr>
Query Example	SYST:AIO:IN1? VOLTAGE
Query Format	SYSTem:AIO:INput:CATalog? <cr>
Description	Returns list of available analog inputs
Returned Data Format	<cr>
Query Example	SYST:AIO:IN:CAT? CURR:LIM,CURR:LIM1,CURR:LIM2,CURR:LIM3,FREQ,KVA:LIM,KVA:LIM1,KVA:LIM2,KVA:LIM3,OFF,PHAS2,PHAS3,POW:LIM,POW:LIM1,POW:LIM2,POW:LIM3,VOLT:AC,VOLT:AC1,VOLT:AC2,VOLT:AC3,VOLT:DC,VOLT:DC1,VOLT:DC2,VOLT:DC3

Command Syntax	SYSTem:AIO:INput[n]:GAIN <nr2>
Description	Sets the full-scale gain of the ADF parameter controlled by the analog input.
Parameters	Full scale value
Parameter Format	<nr2>
Example	SYST:AIO:IN1:GAIN 230.0
Query Format	SYSTem:AIO:INput[n]:GAIN?
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:GAIN? 230.00
Query Format	SYSTem:AIO:INput[n]:GAIN:DEFault?
Description	Returns the default full-scale gain for the specified analog input.
Parameters	None
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:GAIN:DEF? 300.0
Query Format	SYSTem:AIO:INput[n]:GAIN:MAXimum?
Description	Returns the maximum full-scale gain for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:GAIN:MAX? 100000.000000
Query Format	SYSTem:AIO:INput[n]:GAIN:MINimum?
Description	Returns the minimum full-scale gain for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:GAIN:MIN? -100000.000000
Command Syntax	SYSTem:AIO:INput[n]:OFFSET <nr2>
Description	Sets the offset of the ADF parameter controlled by the analog input.
Parameters	Offset
Parameter Format	<nr2>
Example	SYST:AIO:IN1:OFFSET 50.0
Query Format	SYSTem:AIO:INput[n]:OFFSET?
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:OFFSET? 15.00

Query Format	SYSTem:AIO:INput[n]:OFFSET:DEFault?
Description	Returns the default offset for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:OFFSET:DEF? 15.0
Query Format	SYSTem:AIO:INput[n]:OFFSET:MAXimum?
Description	Returns the maximum offset for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:OFFSET:MAX? 100000.000000
Query Format	SYSTem:AIO:INput[n]:OFFSET:MINimum?
Description	Returns the minimum offset for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:OFFSET:MIN? -100000.000000
Command Syntax	SYSTem:AIO:INput[n]:RANGe <nr2>
Description	Sets the range of the specified analog input. Available range is 0.0 ~ 10.
Parameters	Offset
Parameter Format	<nr2>
Example	SYST:AIO:IN1:RANG 50.0
Query Format	SYSTem:AIO:INput[n]:RANGe?
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:RANG? 10.00
Query Format	SYSTem:AIO:INput[n]:RANGe:DEFault?
Description	Returns the default range for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:RANG:DEF? 0.0
Query Format	SYSTem:AIO:INput[n]:RANGe:MAXimum?
Description	Returns the maximum range for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:RANG:MAX? 10.0

Query Format	SYSTem:AIO:INput[n]:RANGe:MINimum?
Description	Returns the minimum range for the specified analog input.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:IN1:RANG:MIN? 0.0
Query Format	SYSTem:AIO:INput[n]:UNITs?
Description	Returns the assigned unit for the specified analog input port.
Parameters	None
Returned Data Format	<cr>
Query Example	SYST:AIO:IN2:UNIT? Vrms
Query Format	SYSTem:AIO:INput[n]:VOLTage?
Description	Returns the voltage value at the specified analog input port.
Parameters	None
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN2:VOLT? 4.895

8.10.1.2 SYSTem:AIO:OUTput

Command Syntax	SYSTem:AIO:OUTput[n] <cr>
Description	Sets the ADF measurement that is mapped to each analog output port.
Parameters	[MEAS:CURRE1? MEAS:CURRE2? MEAS:CURRE3? MEAS:CURRE:CREST1? MEAS:CURRE:CREST2? MEAS:CURRE:CREST3? MEAS:CURRE:CREST? MEAS:CURRE:DC1? MEAS:CURRE:DC2? MEAS:CURRE:DC3? MEAS:CURRE:DC? MEAS:CURRE:PEAK1? MEAS:CURRE:PEAK2? MEAS:CURRE:PEAK3? MEAS:CURRE:PEAK? MEAS:CURRE? MEAS:FREQ? MEAS:KVA1? MEAS:KVA2? MEAS:KVA3? MEAS:KVA? MEAS:PF1? MEAS:PF2? MEAS:PF3? MEAS:PF? MEAS:POW1? MEAS:POW2? MEAS:POW3? MEAS:POW? MEAS:VLL:AC1? MEAS:VLL:AC2? MEAS:VLL:AC3? MEAS:VLL:AC? MEAS:VLL:ACDC1? MEAS:VLL:ACDC2? MEAS:VLL:ACDC3? MEAS:VLL:ACDC? MEAS:VLL:DC1? MEAS:VLL:DC2? MEAS:VLL:DC3? MEAS:VLL:DC? MEAS:VOLT:AC1? MEAS:VOLT:AC2? MEAS:VOLT:AC3? MEAS:VOLT:AC? MEAS:VOLT:ACDC1? MEAS:VOLT:ACDC2? MEAS:VOLT:ACDC3? MEAS:VOLT:ACDC? MEAS:VOLT:DC1? MEAS:VOLT:DC2? MEAS:VOLT:DC3? MEAS:VOLT:DC?] See the “SYSTem:AIO:OUTput:CATalog?” command for a list of available parameters.
Parameter Format	<cr>
Example	SYST:AIO:OUT1 VRMS
Query Format	SYSTem:AIO:OUTput[n]?
Returned Data Format	<cr>
Query Example	SYST:AIO:OUTP? VRMS
Query Format	SYSTem:AIO:OUTput:CATalog?
Description	Returns list of available analog outputs
Returned Data Format	<cr>
Query Example	SYST:AIO:OUT:CAT? MEAS:CURRE1?,MEAS:CURRE2?,MEAS:CURRE3?,MEAS:CURRE:CREST1?,MEAS:CURRE:CREST2?,MEAS:CURRE:CREST3?,MEAS:CURRE:CREST?,MEAS:CURRE:DC1?,MEAS:CURRE:DC2?,MEAS:CURRE:DC3?,MEAS:CURRE:DC?,MEAS:CURRE:PEAK1?,MEAS:CURRE:PEAK2?,MEAS:CURRE:PEAK3?,MEAS:CURRE:PEAK?,MEAS:CURRE?,MEAS:FREQ?,MEAS:KVA1?,MEAS:KVA2?,MEAS:KVA3?,MEAS:KVA?,MEAS:PF1?,MEAS:PF2?,MEAS:PF3?,MEAS:PF?,MEAS:POW1?,MEAS:POW2?,MEAS:POW3?,MEAS:POW?,MEAS:VLL:AC1?,MEAS:VLL:AC2?,MEAS:VLL:AC3?,MEAS:VLL:AC?,MEAS:VLL:ACDC1?,MEAS:VLL:ACDC2?,MEAS:VLL:ACDC3?,MEAS:VLL:ACDC?,MEAS:VLL:DC1?,MEAS:VLL:DC2?,MEAS:VLL:DC3?,MEAS:VLL:DC?,MEAS:VOLT:AC1?,MEAS:VOLT:AC2?,MEAS:VOLT:AC3?,MEAS:VOLT:AC?,MEAS:VOLT:ACDC1?,MEAS:VOLT:ACDC2?,MEAS:VOLT:ACDC3?,MEAS:VOLT:ACDC?,MEAS:VOLT:DC1?,MEAS:VOLT:DC2?,MEAS:VOLT:DC3?,MEAS:VOLT:DC?

Command Syntax	SYSTem:AIO:OUTput[n]:GAIN <nr2>
Description	Sets the full-scale gain of the ADF measurement mapped to the analog input.
Parameters	Full scale value
Parameter Format	<nr2>
Example	SYST:AIO:OUT1:GAIN 230.0
Query Format	SYSTem:AIO:OUTput[n]:GAIN?
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:GAIN? 425.0000
Query Format	SYSTem:AIO:OUTput[n]:GAIN:DEfault?
Description	Returns the default full-scale gain for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:DEF? 425.0000
Query Format	SYSTem:AIO:OUTput[n]:GAIN:MAXimum?
Description	Returns the maximum gain for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MAX? 100000.00000
Query Format	SYSTem:AIO:OUTput[n]:GAIN:MINimum?
Description	Returns the minimum gain for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MIN? -100000.00000
Command Syntax	SYSTem:AIO:OUTput[n]:OFFSET <nr2>
Description	Sets the offset of the specified analog output port.
Parameters	Offset
Parameter Format	<nr2>
Example	SYST:AIO:OUT1:OFFSET 50.0
Query Format	SYSTem:AIO:OUTput[n]:OFFSET?
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:OFFSET? 50.00

Query Format	SYSTem:AIO:OUTput[n]:OFFSET:DEFault?
Description	Returns the default offset for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:OFFSET:DEF? 0.00000
Query Format	SYSTem:AIO:OUTput[n]:OFFSET:MAXimum?
Description	Returns the maximum gain for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MAX? 100000.00000
Query Format	SYSTem:AIO:OUTput[n]:OFFSET:MINimum?
Description	Returns the minimum gain for the specified analog output port.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MIN? -100000.00000
Command Syntax	SYSTem:AI:OUTput[n]:GAIN <nr2>
Description	Sets the full-scale gain of the specified analog output port.
Parameters	Full scale value
Parameter Format	<nr2>
Example	SYST:AIO:OUT1:GAIN 230.0
Query Format	SYSTem:AIO:OUTput[n]:GAIN?
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:GAIN? 230.00
Query Format	SYSTem:AIO:OUTput[n]:GAIN:DEFault?
Description	Returns the default full-scale gain for the specified analog output.
Parameters	None
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:GAIN:DEF? 425.00000
Query Format	SYSTem:AIO:OUTput[n]:GAIN:MAXimum?
Description	Returns the maximum full-scale gain for the specified analog output.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MAX? 100000.00000

Query Format	SYSTem:AIO:OUTput[n]:GAIN:MINimum?
Description	Returns the minimum full-scale gain for the specified analog output.
Parameters	None
Returned Data Format	n/a
Query Example	SYST:AIO:OUT1:GAIN:MIN? -100000.00000
Query Format	SYSTem:AIO:OUTput[n]:UNITs?
Description	Returns the assigned unit for the specified analog output port.
Parameters	None
Returned Data Format	<cr>
Query Example	SYST:AIO:OUT2:UNIT? Vrms
Query Format	SYSTem:AIO:OUTput[n]:VOLTage?
Description	Returns the voltage at the analog output port.
Parameters	None
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT2:VOLT? 7.2590

8.10.1.3 SYSTem:DIO:Input

Query Format	SYSTem:DIO:INput[n]?
Description	Queries status of Digital Input 1, 2 or 3. If I/O number is omitted, all three input values are returned. n = 1, 2 or 3.
Parameters	none
Returned Data Format	<cr>
Parameter Format	<nr1>
Query Example	SYST:DIO:IN2? 0

Command Syntax	SYSTem:DIO:INput[n]:FALLing <cr>
Description	SYSTem:DIO:INput[n]:RISing <cr> Sets the SCPI command to be executed at the rising or falling event of that digital input [n]. n = 1, 2 or 3.
Parameters	SPCI command string
Parameter Format	<cr>
Example	SYST:DIO:IN1:FALL "OUTP 0" SYST:DIO:IN1:RIS "OUTP 1" These settings will enable the output at the rising edge of the pulse and disable it at the falling edge.
Query Format	SYSTem:DIO:INput[n]:FALLing? SYSTem:DIO:INput[n]:RISing?
Returned Data Format	<cr>
Query Example	SYST:DIO:IN1:RIS? OUTP 1 SYST:DIO:IN1:FALL? -
Command Syntax	SYSTem:DIO:INput[n]:FILtersize <nr1>
Description	Defines the time in ms (milliseconds) that the digital input has to keep the state after a transition in order to generate the event. If filtersize is zero, then the event is immediately generated, otherwise the specified time will prevent short pulses from generating events. This is useful in noisy environments and also if the digital signal is controlled by a switch or a mechanical actuator.
Parameters	0 – 1000
Parameter Format	<nr1>
Example	SYST:DIO:IN1:FIL 8
Query Format	SYSTem:DIO:INput[n]:FILtersize?
Returned Data Format	<nr1>
Query Example	SYST:DIO:IN1:FIL? 8
Query Format	SYSTem:DIO:INput[n]:FILtersize:DEFault?
Description	Returns the default filter size value.
Returned Data Format	<nr1>
Query Example	SYST:DIO:IN1:FIL:DEF? 0
Query Format	SYSTem:DIO:INput[n]:FILtersize:MAXimum?
Description	Returns the maximum allowed filter size value.
Returned Data Format	<nr1>
Query Example	SYST:DIO:IN1:FIL:MAX? 1000

Query Format	SYSTem:DIO:INput[n]:FILtersize:MINimum?
Description	Returns the minimum allowed filter size value.
Returned Data Format	<nr1>
Query Example	SYST:DIO:IN1:FIL:MIN?
	1

8.10.1.4 SYSTem:DIO:OUTput

Command Syntax	SYSTem:DIO:OUTput[n] <MODE>
Description	Sets output value of digital output n. n = 1 or 2.
Parameter 1	MODE The mode determines when an output is generated. Available MODE settings are: 1, ON, 0, OFF it is used as general purpose output. [0 LOW 1 HIGH] - OUTPUT_STATE indicates output enabled(1) or disabled(0). - FORM indicates single(1) or split/three(0). - FAULT indicates fault(1) or no fault(0). - TRANSIENT indicates when a transient is running/paused/stepping(1) or stopped(0). - PROGRAM indicates when a program is in execution at steady state level(1) or manual mode(0). - REMOTE indicates remote(1) or local(0) state Defaults are: OUTPUT1: OUTPUT_STATE OUTPUT2: FORM
Parameter Format	<cr>
Example	SYST:DIO:OUT1 FAULT
Query Format	SYSTem:DIO:OUTput[n]?
Description	Returns settings for selected pin number n
Returned Data Format	<nr1>
Query Example	SYST:DIO:OUT1? OUTPUT STATE,NON-INVERTING
Query Format	SYSTem:DIO:OUTput:CATalog?
Description	Returns list of available digital outputs
Returned Data Format	<cr>
Query Example	SYST:DIO:OUT:CAT? COUPLING,FAULT,FORM,HIGH,LOW,OUTPUT STATE,PROGRAM,REMOTE,TRANSIENT

Command Syntax	SYSTem:DIO:OUTput[n]:INVert
Description	Inverts the logic polarity of the selected digital output.
Parameters	[0 NORMAL 1 INVERT]
Example	SYST:DIO:OUT1 1
Query Format	SYSTem:DIO:OUTput[n]:INVert?
Description	Returns logic inversion setting
Returned Data Format	<nr1>
Query Example	SYST:DIO:OUT1:INV?
	1

Query Format	SYSTem:DIO:OUTput[n]:STATe?
Description	Returns logic level of selected output pin.
Returned Data Format	
Query Example	SYST:DIO:OUT1:STAT?
	1

8.10.1.5 SYSTem:DIO:REMOte

Command Syntax	SYSTem:DIO:REMOte:ENABle
Description	Turns the remote enable state on or off
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:REMOte:ENABle 1
Query Format	SYSTem:DIO:REMOte:ENABle?
Returned Data Format	
Query Example	SYST:DIO:REM:ENA?
	1

Command Syntax	SYSTem:DIO:REMOte:ENABle:AUTO
Description	Enables or Disables the Remote Input function at power on. By default, on a regular AFX/ADF it is 1 for backward compatibility. When it is 1 it enables the output immediately when remote enable is set to 1 or when the unit boots. A warning will be displayed on the LCD and a beep will sound before the output enables. When it is 0 it only enables the output when it detects a 0 to 1 change in the input and disables the output with a 1 to 0. Both settings can be changed by the user. Sending a sanitize command returns this setting back to 1 and 0 respectively. Note: This command requires firmware rev 2.2.28 or higher.

Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:REMOte:ENABle:AUTO 1
Query Format	SYSTem:DIO:REMOte:ENABle:AUTO?
Returned Data Format	
Query Example	SYST:DIO:REM:ENA:AUTO?
	1

Command Syntax	SYSTem:DIO:REMOte:INHibit
Description	Turns the remote inhibit state on or off
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:REMOte:INHibit 1
Query Format	SYSTem:DIO:REMOte:INHibit?
Returned Data Format	
Query Example	SYST:DIO:REM:INH? 1

8.10.1.6 SYSTem:DIO:STROBE

Command Syntax	SYSTem:DIO:STROBE:OUTPustate
Description	Sets the function strobe mode active when the output relay changes state
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:STROBE:OUTP 1
Query Format	SYSTem:DIO:STROBE:OUTPustate?
Returned Data Format	
Query Example	SYST:DIO:STROBE:OUTP? 1
Command Syntax	SYSTem:DIO:STROBE:SOURce
Description	Sets the function strobe mode to program changes.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:STROBE:SOUR 1
Query Format	SYSTem:DIO:STROBE:SOURce?
Returned Data Format	
Query Example	SYST:DIO:STROBE:SOUR? 1
Command Syntax	SYSTem:DIO:STROBE:TRANSient
Description	Sets the function strobe mode to generate an output at the start of a transient execution.
Parameters	< 0 OFF 1 ON >
Parameter Format	
Example	SYST:DIO:STROBE:TRAN 1
Query Format	SYSTem:DIO:STROBE:TRANSient?
Returned Data Format	
Query Example	SYST:DIO:STROBE:TRAN? 1

8.10.2 SOURce:SYNChronize Commands

```
SOURce:SYNChronize
[:INput][?]
:PHASEshift[?]
:RANGE[?]
:SOURCE[?]
:SPeed[?]
:STATe?

SOURce:SYNChronize
:OUTPut[?]
:PULSE:MODE
```

8.10.2.1 SOURce:SYNChronize[:INput]

Command Syntax	SOURce:SYNChronize[:INput]
Description	This command enables or disables the external sync input mode.
Parameters	[0 OFF 1 ON]
Parameter Format	
Example	SOUR:SYNC 1
Query Format	SOURce:SYNChronize[:INput]?
Returned Data Format	
Query Example	SOUR:SYNC? 1
Command Syntax	SOURce:SYNChronize[:Input]:PHASEshift <nr2>
Description	Defines a fixed phase shift between phase A waveform generation and the external sync source. Used to calibrate any phase difference between the sync signal and the power source output on phase A.
Parameters	Phase shift
Parameter Format	<nr>
Example	SOUR:SYNC:PHASE 2.8
Query Format	SOURce:SYNChronize[:Input]:PHASEshift?
Returned Data Format	<nr2>
Query Example	SOUR:SYNC:PHASE? 0.5

Command Syntax	SOURce:SYNChronize[:Input]:RANGe <nr2>
Description	Allows configuration of how much the synchronization engine is able to deviate from the ADF programmed frequency. This helps to keep the waveform frequency under control, even if the external source is not present all the time. The synchronization engine is limited to frequencies of FSETPOINT +/- FRANGE.
Parameters	Range in Hz
Parameter Format	<nr2>
Example	SOUR:SYNC:RANG 5.0
Query Format	SOURce:SYNChronize[:Input]:RANGe?
Returned Data Format	<nr2>
Query Example	SOUR:SYNC:RANGe? 10.000
Command Syntax	SOURce:SYNChronize[:Input]:SOURce <cr>
Description	This command selects either the external sync TTL (1) or the internal AC line sync (0) mode. The internal AC sync signal is derived from the power sources three phase L-L voltages so a phase adjustment for Phase A output will be needed using the SOURce:SYNChronize[:Input]:PHASEshift command.
Parameters	[0 AC 1 TTL]
Parameter Format	<cr>
Example	SOUR:SYNC:SOUR TTL
Query Format	SOURce:SYNChronize[:Input]:SOURce?
Returned Data Format	<cr>
Query Example	SOUR:SYNC:SOUR? 1
Command Syntax	SOURce:SYNChronize[:Input]:SPeEd <nr2>
Description	Allows accelerating the speed of the internal synchronization engine (PLL) in case the external sync source is not constant and presents periodic or continuous changes. A slower speed improves the stability of the waveform frequency, so it is recommended to keep use the smallest possible speed values.
Parameters	Speed (multiplier value)
Parameter Format	<nr1> Range is 1.000 ~ 10.000
Example	SOUR:SYNC:SP 0.50
Query Format	SOURce:SYNChronize[:Input]:SPeEd?
Returned Data Format	<nr2>
Query Example	SOUR:SYNC:SP? 2.500

Query Command	SOURce:SYNChronize[:Input]:STATe?
Description	This query only command returns the status of the Phase Lock Loop (PLL). A "0" response indicates the PLL has not locked on to the sync input yet. A 1 response indicates the PLL is locked.
Returned Data Format	
Returned Data	0 = PLL is not locked 1 = PLL is locked
Query Example	SOUR:SYNC:STAT? 1

8.10.2.2 SOURce:SYNChronize[:OUTput]

Command Syntax	SOURce:SYNChronize:OUTput
Description	This command enables the SYNC output
Query Format	SOURce:SYNChronize:OUTput?
Returned Data Format	
Returned Data	0 = SYNC output off 1 = SYNC output on
Query Example	SOUR:SYNC:OUT? 1
Command Syntax	SOURce:SYNChronize:OUTput:PULSE:MODE
Description	This sets the sync duty cycle. Supports MOD M24014. This MOD requires firmware rev. 4.9.27 or higher. 0 = < 1% 1 = 50%.
Query Format	SOURce:SYNChronize:OUTput:PULSE:MODE?
Returned Data Format	
Returned Data	0 = SYNC duty cycle < 1% 1 = SYNC duty cycle = 50%
Query Example	SOUR:SYNC:OUT:PULSE? 1

8.10.3 PROGram:TRANSient Triggers Commands

```

PROGram:TRANSient:TRIGger
    :Input[?]
        :IMMediate[?]
        :AUTOrun[?]

    :OUTput[?]
  
```

8.10.3.1 PROGram:TRANSient

The following **PROGram:TRANSient:TRIGger** commands are available.

Command Syntax	PROGram:TRANSient:TRIGger:INput
Description	When the trigger input is active, this command selects the trigger input source mode as on or off. When ON, the external trigger input is enabled.
Parameters	[0 OFF 1 ON]
Parameter Format	
Example	PROG:TRAN:TRIG:IN 1
Query Format	PROGram:TRANSient:TRIGger:INput?
Returned Data Format	
Query Example	PROG:TRAN:TRIG:IN? 1
Command Syntax	PROGram:TRANSient:TRIGger:INput:IMMediate
Description	When the trigger input is active, this command starts the transient segments immediately after the trigger input is received, without waiting for the zero crossing, as determined by the update phase setting. Refer to SOURce:UPDATEPhase
Parameters	[0 OFF 1 ON]
Parameter Format	
Example	PROG:TRAN:TRIG:IN:IMM 1
Query Format	PROGram:TRANSient:TRIGger:INput:IMMediate?
Returned Data Format	
Query Example	PROG:TRAN:TRIG:IN:IMM? 1

Command Syntax
Description

**PROG:TRANSient:TRIGger:INput:AUTOrun **

When the trigger input is active and segments are running state, each trigger event (pulse) will automatically start a new sequence, without the need of a new RUN command before each trigger. The RUN command has to be executed only once, and then each subsequence trigger input event will cause a new segment sequence to run.

Note: the trigger signal is level-sensitive; hence if it is kept high, it will continuously issue a trigger.

Parameters

[0 | OFF | 1 | ON]

Parameter Format

Example

PROG:TRAN:TRIG:IN:AUTO 1

Query Format

PROG:TRANSient:TRIGger:INput:AUTOrun?

Returned Data Format

Query Example

PROG:TRAN:TRIG:IN:AUTO?
1

Command Syntax
Description

PROG:TRANSient:TRIGger:OUTput

This command causes a trigger output pulse to be generated when a transient execution is started. Note that this output is used as a function strobe during steady state operation.

Parameters

[0 | OFF | 1 | ON]

Parameter Format

Example

PROG:TRAN:TRIG:OUT 1

Query Format

PROG:TRANSient:TRIGger:OUTput?

Returned Data Format

Query Example

PROG:TRAN:TRIG:OUT?
1

8.10.4 AUX I/O Calibration Commands

```

SYSTem:AIO
  :INPut#
    :CALibration
      :GAIN{?}
        :DEFault{?}
        :MAXimum
        :MINimum
      :OFFset{?}
        :DEFault{?}
        :MAXimum
        :MINimum
  :OUTput#
    :CALibration
      :GAIN{?}
        :DEFault{?}
        :MAXimum
        :MINimum
      :OFFset{?}
        :DEFault{?}
        :MAXimum
        :MINimum

```

8.10.4.1 SYSTem:AIO:INPut#:CALibration

Command Syntax	SYSTem:AIO:INput[n]:CALibration:GAIN <nr2>
Description	Calibrates the full scale gain of the ADF parameter controlled by the analog input.
Parameters	Reference
Parameter Format	<nr2>
Example	SYST:AIO:IN1:CAL:GAIN 100.0
Query Format	SYSTem:AIO:INput[n]:CALibration:GAIN?
	Returns calibration coefficient
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:GAIN? 1.000
Query Command	SYSTem:AIO:INput[n]:CALibration:GAIN:DEFAult?
	Returns default calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:GAIN:DEF? 1.000
Query Command	SYSTem:AIO:INput[n]:CALibration:GAIN:MAXimum?
	Returns upper limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:GAIN:MAX? 1.000

Query Command	SYSTem:AIO:INput[n]:CALibration:GAIN:MINimum? Returns lower limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:GAIN:MIN? 0.000
Command Syntax Description	SYSTem:AIO:INput[n]:CALibration:OFFset <nr2> Calibrates the full scale gain of the ADF parameter controlled by the analog input.
Parameters	Reference
Parameter Format	<nr2>
Example	SYST:AIO:IN1:CAL:OFF 0.01
Query Format	SYSTem:AIO:INput[n]:CALibration:OFFset? Returns calibration coefficient
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:OFF? 0.010
Query Command	SYSTem:AIO:INput[n]:CALibration:OFFset:DEFault? Returns default calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:OFF:DEF? 1.000
Query Command	SYSTem:AIO:INput[n]:CALibration:OFFset:MAXimum? Returns upper limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:OFF:MAX? 1.000

Query Command	SYSTem:AIO:INput[n]:CALibration:OFFset:MINimum? Returns lower limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:IN1:CAL:OFF:MIN? 1.000

8.10.4.2 SYSTem:AIO:OUTput#:CALibration

Command Syntax	SYSTem:AIO:OUTput[n]:CALibration:GAIN <nr2>
Description	Calibrates the full scale gain of the ADF parameter controlled by the analog output.
Parameters	Reference
Parameter Format	<nr2>
Example	SYST:AIO:OUT1:CAL:GAIN 100.0
Query Format	SYSTem:AIO:OUTput[n]:CALibration:GAIN? Returns calibration coefficient
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:GAIN? 1.000

Query Command	SYSTem:AIO:OUTput[n]:CALibration:GAIN:DEFault? Returns default calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:GAIN:DEF? 1.000

Query Command	SYSTem:AIO:OUTput[n]:CALibration:GAIN:MAXimum? Returns upper limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:GAIN:MAX? 1.000

Query Command	SYSTem:AIO:OUTput[n]:CALibration:GAIN:MINimum? Returns lower limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:GAIN:MIN? 0.000

Command Syntax	SYSTem:AIO:OUTput[n]:CALibration:OFFset <nr2>
Description	Calibrates the full scale gain of the ADF parameter controlled by the analog output.
Parameters	Reference
Parameter Format	<nr2>
Example	SYST:AIO:OUT1:CAL:OFF 0.01
Query Format	SYSTem:AIO:OUTput[n]:CALibration:OFFset?
	Returns calibration coefficient
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:OFF? 0.010
Query Command	SYSTem:AIO:OUTput[n]:CALibration:OFFset:DEFault?
	Returns default calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:OFF:DEF? 1.000
Query Command	SYSTem:AIO:OUTput[n]:CALibration:OFFset:MAXimum?
	Returns upper limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:OFF:MAX? 1.000
Query Command	SYSTem:AIO:OUTput[n]:CALibration:OFFset:MINimum?
	Returns lower limit of calibration coefficient value
Returned Data Format	<nr2>
Query Example	SYST:AIO:OUT1:CAL:OFF:MIN? 1.000

8.11 IEEE488.2 Common Commands

The following IEEE488.2 common commands (a.k.a. star commands) are supported by the AC power source. These commands are provided for compatibility with the IEEE488.2 standard. They are aliases to the relevant proprietary command and can be used interchangeably. Commands are shown in alphabetical order.

IEEE488.2 Command	Description	Group	Mandatory
*CLS	Clear Status	Status and Event	Yes
*DCL	Device Clear	Internal Operations	
*ESE <n>	Event Status Register Enable	Status and Event	Yes
*ESE?	ESE Query	Status and Event	Yes
*ESR?	Event Status Register Query	Status and Event	Yes
*GTL	Goto Local	Control	
*IDN?	Identify	System Data	Yes
*LLO	Local Lock Out	Control	Yes
*OPC	Operation Complete	Synchronization	Yes
*OPC?	OPC Status Query	Synchronization	Yes
*RST	Reset	Internal Operations	Yes
*SRE	Service Request Enable	Status and Event	Yes
*SRE?	SRE Query	Status and Event	Yes
*STB?	Status Byte Query	Status and Event	Yes
*TRG	Trigger	Synchronization	
*WAI	Wait	Synchronization	Yes

Table 8-2: Mandatory IEEE488.2 Common Commands

Command Syntax
Description

***CLS**

Clear Status. The Clear Status (CLS) command clears the status byte by emptying the error queue and clearing all the event registers including the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register and any other registers that are summarized in the status byte.

Command Syntax
Description
Parameters
Parameter Format

***DCL**

Device Clear. Resets the instrument to a default state.

None

n/a

Command Syntax	*ESE<nr1>
Description	Selects the desired bits from the standard event status enable register. The variable <nr1> represents the sum of the bits that will be enabled. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, status execution error, command error and power on. The selected bits are OR'd to become a summary bit (bit 5) in the byte register which can be queried. The setting by this command is not affected by *RST. However, cycling the power will reset this register to zero. Refer to section 0 for register bit values.
Parameters	Range 0-255
Parameter Format	<nr1>
Example	*ESE 128
Query Format	*ESE?
Returned Data Format	<nr1>
Query Example	*ESE? 193
Query Format	*ESR?
Description	Event Status Register Query. Reads the contents of the Status Event Register (ESR). After this query, the content of the ESR register is reset. Refer to section 0 for register bit values.
Returned Data Format	<nr1>
Query Example	*ESR? 0
Command Syntax	*GTL
Description	Goto Local. Releases lock of front panel controls.
Returned Data Format	N/A
Query Example	N/A
Query Format	*IDN?
Description	Identification Query. Returns the unit's Identity string. The IDN string response contains several fields separated by a comma. <i>Query response:</i> Manufacturer, model, serial number, firmware revision.
Returned Data Format	<cr>,<cr>,<nr1>,<nr2>
Query Example	*IDN? PPSC,3150ADF-4,106378889,2.0.0
Command Syntax	*LLO
Description	Local Lock out. Locks out front panel LOCAL function.
Parameters	None
Parameter Format	n/a

Command Syntax	*OPC			
Description	The Operation Complete (OPC) command sets bit 0 in the Standard Event Status Register when all pending operations have finished.			
Parameters	Optional: < BLOCK 0 NOBLOCK 1>			
Example	*OPC			
Query Format	*OPC? < BLOCK 0 NOBLOCK 1>			
Description	IEEE488.2 standard command. The parameter is optional. The argument is optional, if it is not sent:			
	• In UPC compatible mode default argument will be NONBLOCK or 1. • In normal mode default argument will be BLOCK or 0.			
	*OPC? BLOCK 0			
	Returns 1 when all pending overlapped operations have been completed. It can be used to cause the controller to wait for commands to complete.			
	*OPC? NOBLOCK 1			
	Returns 1 if all pending overlapped operations have been completed or 0 if there are pending overlapped operations. It will not cause the controller to wait for commands to complete. Pending overlapped operations can be a transient or a soft start using ramp time/slew rates.			
Returned Data Format				
Query Example	*OPC? 1			
Command Syntax	*RST			
Description	RESET. The *RST command (reset) has the same effect as an IEEE-488 Device Clear bus command but can be used over the RS232C, USB or LAN interface as well. This command resets the unit to its power on default state. User defined waveforms or programs are not erased but the mode is set to manual and the transient list table is cleared. (Unless there is a power-on program configured using the [SOURCE:]INITIAL command)			
	<i>Note: A reset cycle of the power source can take up to 20 seconds to complete. When developing test programs, allow this time to pass before sending other commands. Adjust interface time-out settings as needed.</i>			
Parameters	None			
Parameter Format	n/a			
RESET STATE	FORM	3	VOLT:MODE	AC
	VOLT:AC	0.0000	COUPLING	DC
	VOLT:DC	0.0000	RANGE	AC
	CURR:AC	41.6667		
	CURR:DC	20.8333		

Command Syntax	*SRE <nr1>
Description	Before reading a status register, bits must be enabled. This command enables bits in the service request register. The current setting is saved in non-volatile memory.
Parameters	0-255
Parameter Format	<nr1>
Example	*SRE 255
Query Format	*SRE?
Description	Reads the current state of the service request enable register. The register is cleared after reading it. Refer to section 0 for register bit values.
Returned Data Format	<nr1>
Query Example	*SRE? 255
Query Format	*STB?
Description	Status Byte Query. The *STB? query returns the contents of the status byte register (STB). After this query, the content of the STB register is reset. Refer to section 0 for register bit values.
Returned Data Format	<nr1>
Query Example	*STB? 4
Command Syntax	*TRG
Description	Triggers pending operation.
Parameters	None
Parameter Format	n/a
Command Syntax	*WAI
Description	Prohibits the instrument from executing any new commands until all pending overlapped commands have been completed.
Parameters	None
Parameter Format	n/a

8.12 Status and Events Registers

The IEEE488.2 standard defines a standardized status and events register system. Refer to the ANSI/IEEE-488.2 1987 standard for more information. This section provides an overview of these registers and bit positions for various status and error events.

8.12.1 Status Byte Register (STB)

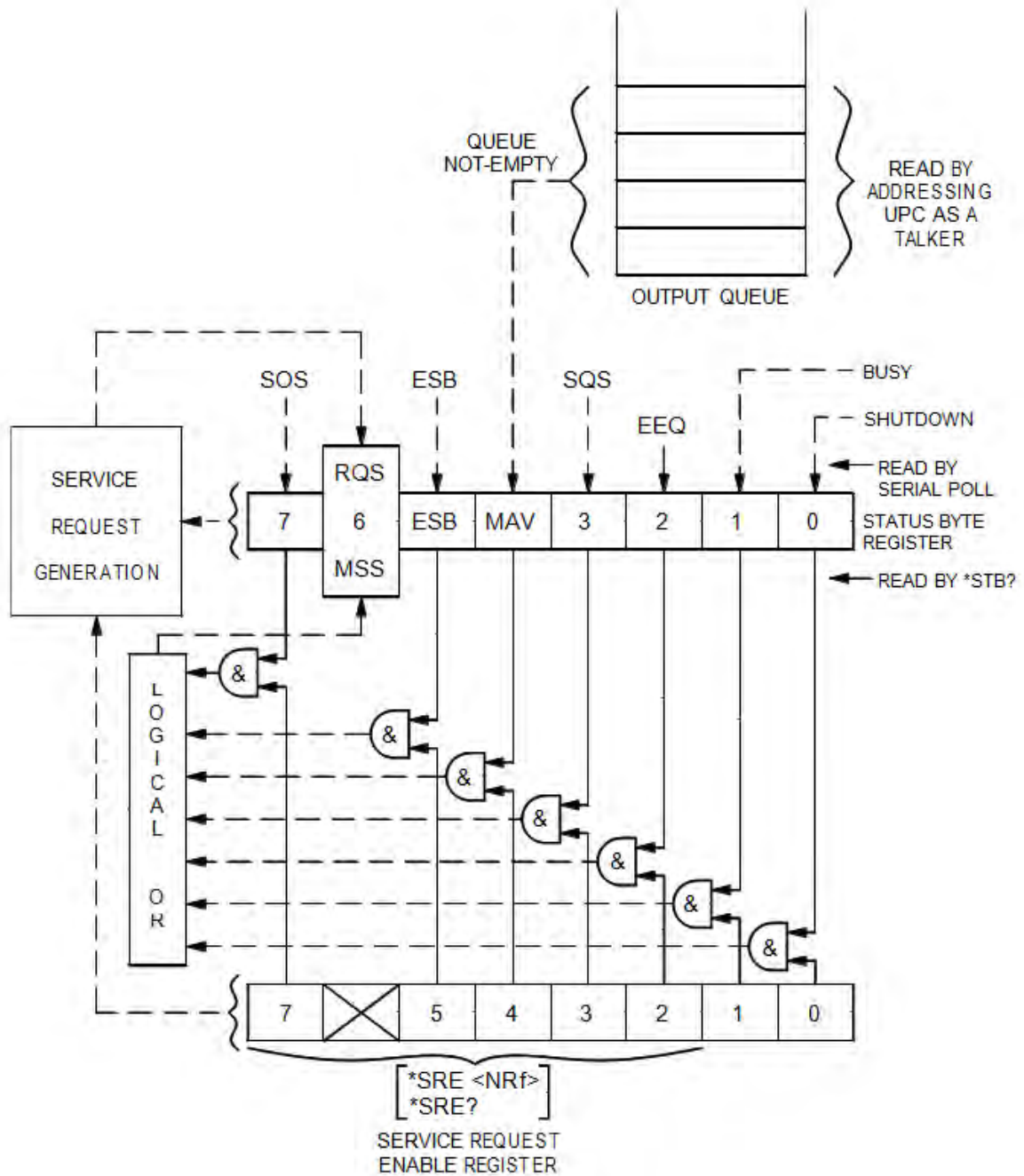
The status register content is returned on a *STB? query. It contains 8 bits as shown in the table below. The return value represents the 8 bits positions and can range from 0-255. A *CLS command will clear the Status Byte Register (STB) and the Event Status Register (ESR). Refer to Figure 8-3, "Status Byte Logical Model".

BIT	NAME	DEFINITION
7	SOS	:STATus:OPERation register bit summary
6	MSS/RQS	- MASTER SUMMARY summarizes all STATUS BYTE bits (except bit 6) for *STB?, or, - REQUEST SERVICE indicates this device requested service when a Serial Poll was performed.
5	ESB	STANDARD EVENT STATUS REGISTER bit summary
4	MAV	MESSAGE AVAILABLE indicates Query response data is available
3	SQS	:STATus:QUESTionable register bit summary
2	EEQ	ERROR/EVENT QUEUE indicates an SCPI Error/Event message is available
1	BUSY	indicates UPC front panel not in V/I mode
0	FAULT	indicates Power Source FAULT

Table 8-3: Status Byte Register (STB)

Note: Setting a SERVICE REQUEST ENABLE (SRE) bit true unmask the STATUS bit in the STB. Bit 6 of the SRE is not applicable as the MASTER SUMMARY bit of the STB cannot be masked. The STB, SRE, ESR and ESE registers are 8 bits each.

The status byte logical model is shown in the figure below.



8.12.2 Status Event Register (ESR)

Events reported by the STANDARD EVENT STATUS register may be queried via the *ESR? command. Reading the ESR register clears it. The EVENT STATUS summary bit in the STATUS BYTE (STB) will be set when an unmasked EVENT STATUS bit goes true.

BIT	NAME	DEFINITION
7	PON	POWER ON indicates Input power was just applied
6	URQ	USER REQUEST indicates "LOCAL" key was just pressed
5	CME	COMMAND ERROR indicates invalid command or query received
4	EXE	EXECUTION ERROR indicates can't execute command with data received
3	DDE	DEVICE DEPENDANT ERROR indicates UPC not properly configured
2	QYE	QUERY ERROR indicates cannot respond with data
1	RQC	REQUEST CONTROL - not used
0	OPC	OPERATION COMPLETE indicates previous operation complete

Table 8-4: Status Event Register (ESR)

Setting an EVENT STATUS ENABLE (ESE) bit true unmask the EVENT bit in the ESR. Also see :SYSTEM:ERROR? query for relevant information.

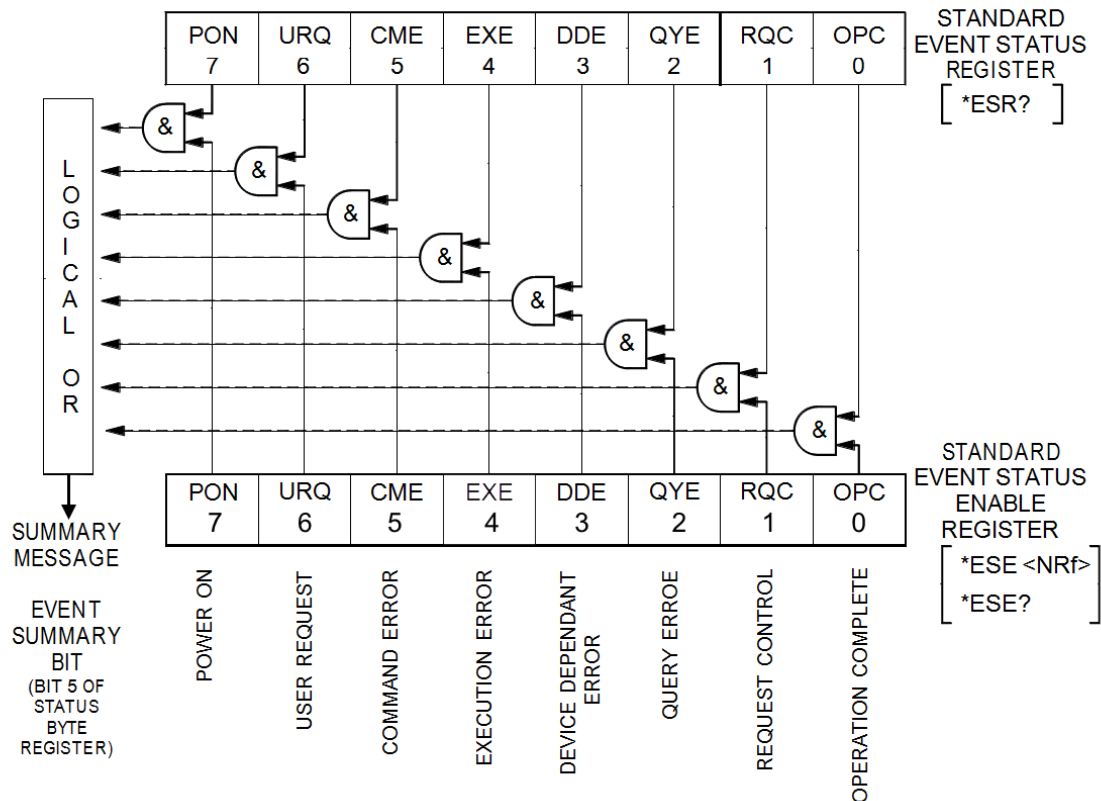


Figure 8-4: Standard Event Register (ESR) Model

8.12.3 SCPI Status Registers

The STATUS:OPERation and STATUS:QUESTIONable registers provide information about the present mode of operation.

- Transition of a CONDITION bit to the true state causes the EVENT bit to be set true.
- Unmasked ENABLE bits allow an EVENT bit to be reported in the summary bit for that EVENT register in the STATUS BYTE register.
- Setting an ENABLE bit true, unmask the corresponding EVENT bit.
- Reading an EVENT register clears it.
- All :STATUS registers are 16 bits (Figure 5.3).

The STATUS:OPERation register provides information about the present mode of operation.

Relevant commands for the STATUS:OPERation register are:

:STATUS:OPERation:CONDition?

:STATUS:OPERation:ENABle

:STATUS:OPERation:ENABle?

:STATUS:OPERation:EVENT?

The STATUS:QUESTIONABLE register provides information about errors and questionable measurements.

Relevant commands for the STATUS:QUESTIONABLE register are:

:STATUS:QUESTIONable:CONDition?

:STATUS:QUESTIONable:ENABle

:STATUS:QUESTIONable:ENABle?

:STATUS:QUESTIONable:EVENT?

Refer to Figure 8-5, “SCPI Status Registers Model” for details on registers.

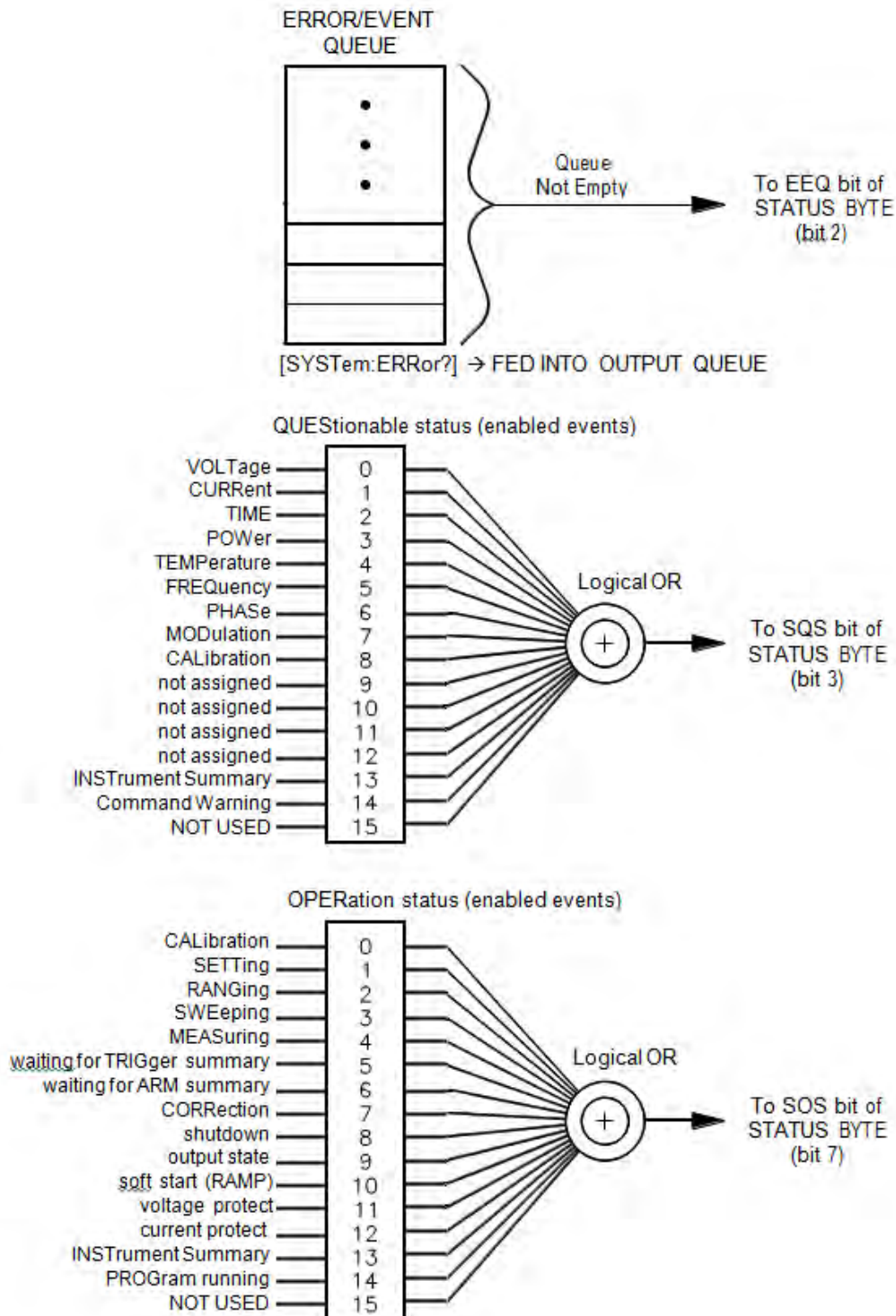


Figure 8-5: SCPI Status Registers Model

9 USB Driver Installation

9.1 Overview

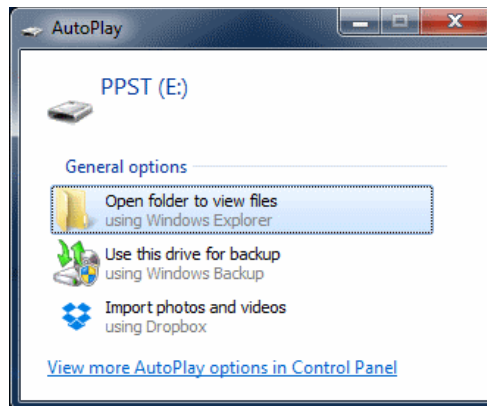
The USB interface provides a virtual COM port for the PC. Via this port, the unit can be controlled as a normal RS232 interface, e. g. with a terminal program or user application program. There are two drivers provided with the ADF units:

- | | |
|---------------------------|---|
| Virtual COM driver | This allows communication with the power sources using a virtual serial port (COMx). |
| Network Driver | This allows communication with the power source using a virtual IP address. Using this driver, all built-in web server functions are available via USB using a browser. |

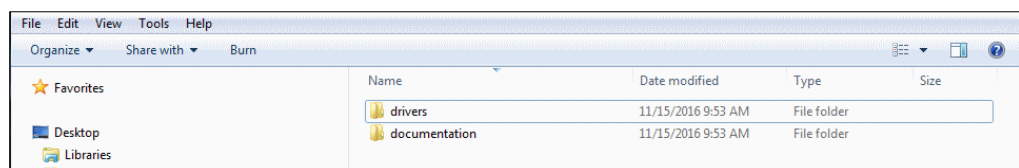
9.2 Installation

USB drivers are stored in the ADF controller and installed when the unit is first connected to a Windows PC. Proceed as follows:

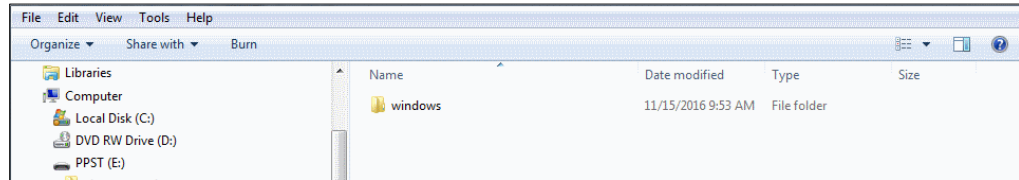
1. With the ADF unit powered up, connect a USB cable between the ADF USB Device port on the rear panel and an available USB port on a Windows PC.
2. Once plugged it, the PC should detect the present of the ADF. If this is the first time you connect to this PC, the drivers must be installed. This process should run automatically but if for some reason it does not, follow the subsequent steps.
3. On the drive popup shown below, select the “Open folder to view files” entry.



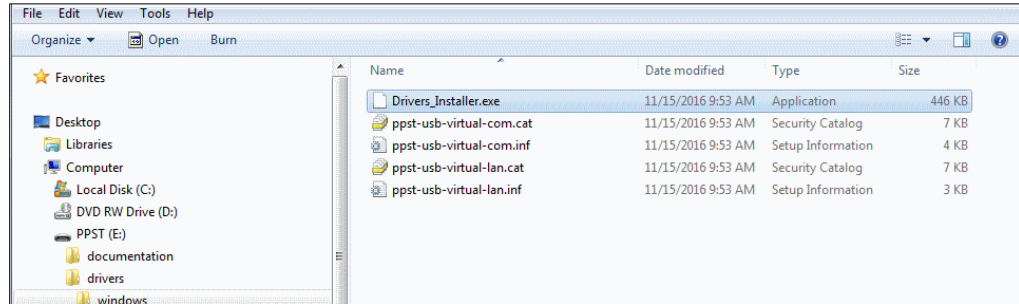
4. The directories shown below will be visible. Select the “drivers” directory



5. Next, select the “Windows” directory



6. Run the “Driver_Installer.exe” located in this directory as shown below.,



7. Allow the installation to complete.

At the end of this process, you should be able to see the two PPST USB drivers in the Windows Device Manager window under “Network Adaptors” and “Ports (COM & LPT)” respectively. The USB interface is now ready for use.

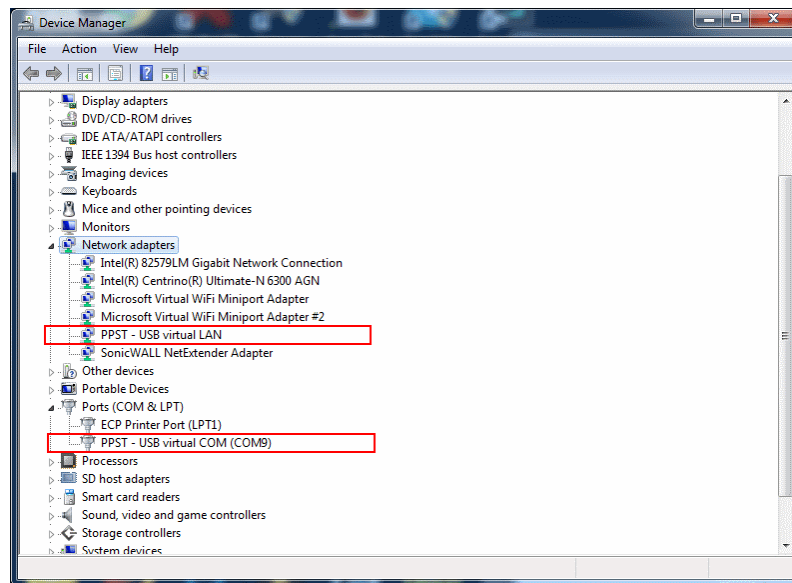


Figure 9-1: PPST USB Drivers visible in Windows Device Manager

10 LAN Interface Configuration

10.1 Overview

All ADF models are equipped with a LAN (Ethernet) interface. As shipped, the unit automatically obtains an IP address from the network using the DHCP protocol. If the instrument is turned off for long periods, the IP address lease may expire and a new IP address will be assigned. If this is the case, it is possible to assign a fixed IP address instead.

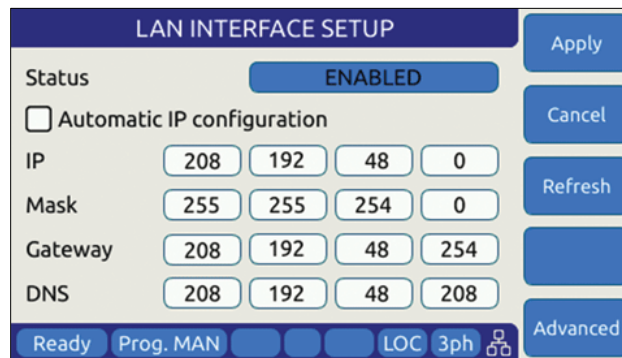
10.2 Web Browser Interface

The ADF Series® conforms to the LXI (Lan eXtensions for Instrumentation) standard and as such as a built in web server. This allows communication with the ADF from any web browser as long as the ADF is on the same network.

Note: The ADF web server has been tested with Google Chrome and Mozilla Firefox browsers only. Microsoft Internet Explorer is now obsolete and is not supported. Other browser like Edge or Safari may not fully operate or display information correctly.

Note: Web server use from a browser is **not** supported in *UPC Compatibility* mode. Disable this mode when operating the ADF from a web browser.

Use the IP address shown in the LAN INTERFACE SETUP screen under the SYSTEM key to determine the IP address to type into the web browser.




CAUTION: BEFORE USING BROWSER CONTROL

Verify that the level of remote access control is appropriate for the situation at hand. The power source is capable of producing lethal output voltage and operating it without being physically in the same room or space present a safety risks to others. Refer to 10.3.2, “**Front Panel Access Control**”.

If the unit is on the same network or reachable through the internet, the home screen of the ADF web server will appear.

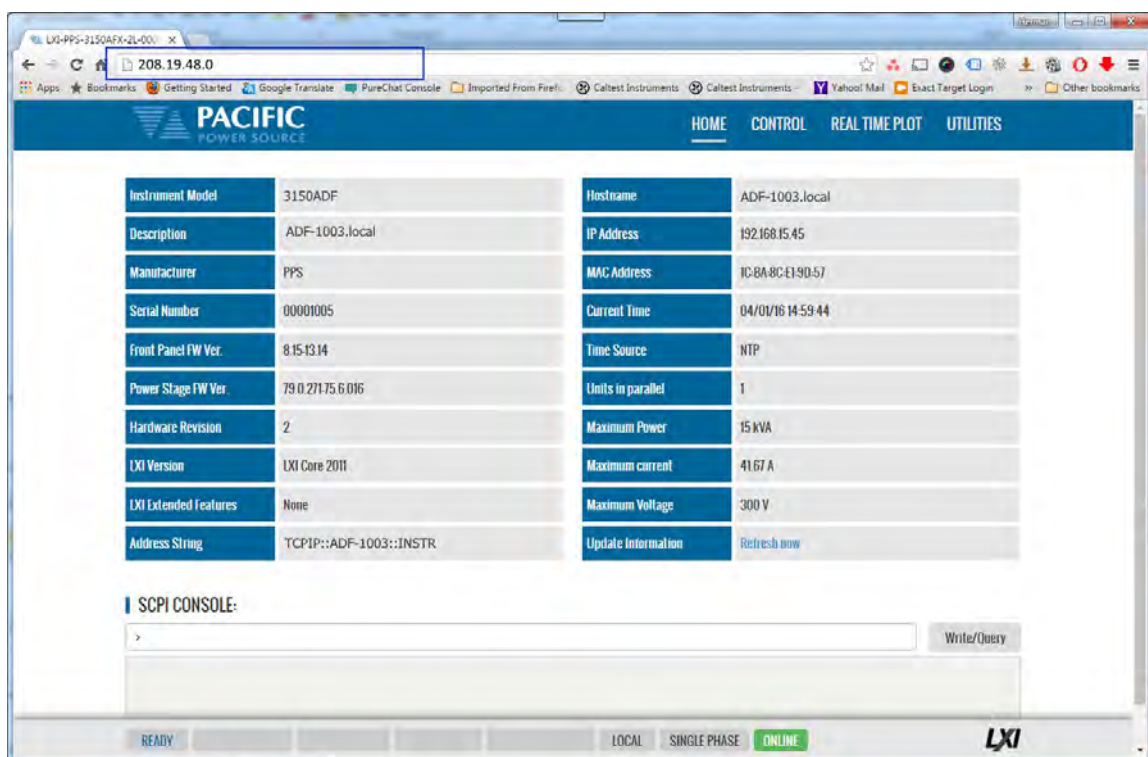


Figure 10-1: LXI Web Server Home Screen

When permitted, the browser interface allows monitoring of measurements and/or full control of the power source. If the operator is not near the actual instruments being controlled, care must be taken to the appropriate access control limits.

10.3 Access Control

Since the power source is capable of producing hazardous voltages at its output terminals, remote operation of the product over a LAN connection or any other available remote control interface can be restricted by the user to include only monitoring functions rather than full programming controls.

This feature is provided to ensure the safety of anyone near the unit in its actual physical location. This access control mechanism requires granting specific access to certain functions and features from the front panel by a person present at the location of the power source and requesting permission first trying to access a unit remotely.

These access control functions can be set from the SYSTEM Menu, INTERFACE screen or via the webserver using any browser.



WARNING

All ADF Units are shipped from the factory with ACCESS CONTROL **DISABLED**. It is the instrument's owner's responsibility to enable these features.

10.3.1 Browser Access Control

When connecting to the power source via a browser on which access has been restricted, the following message will appear:

The browser Access dialog is shown below.

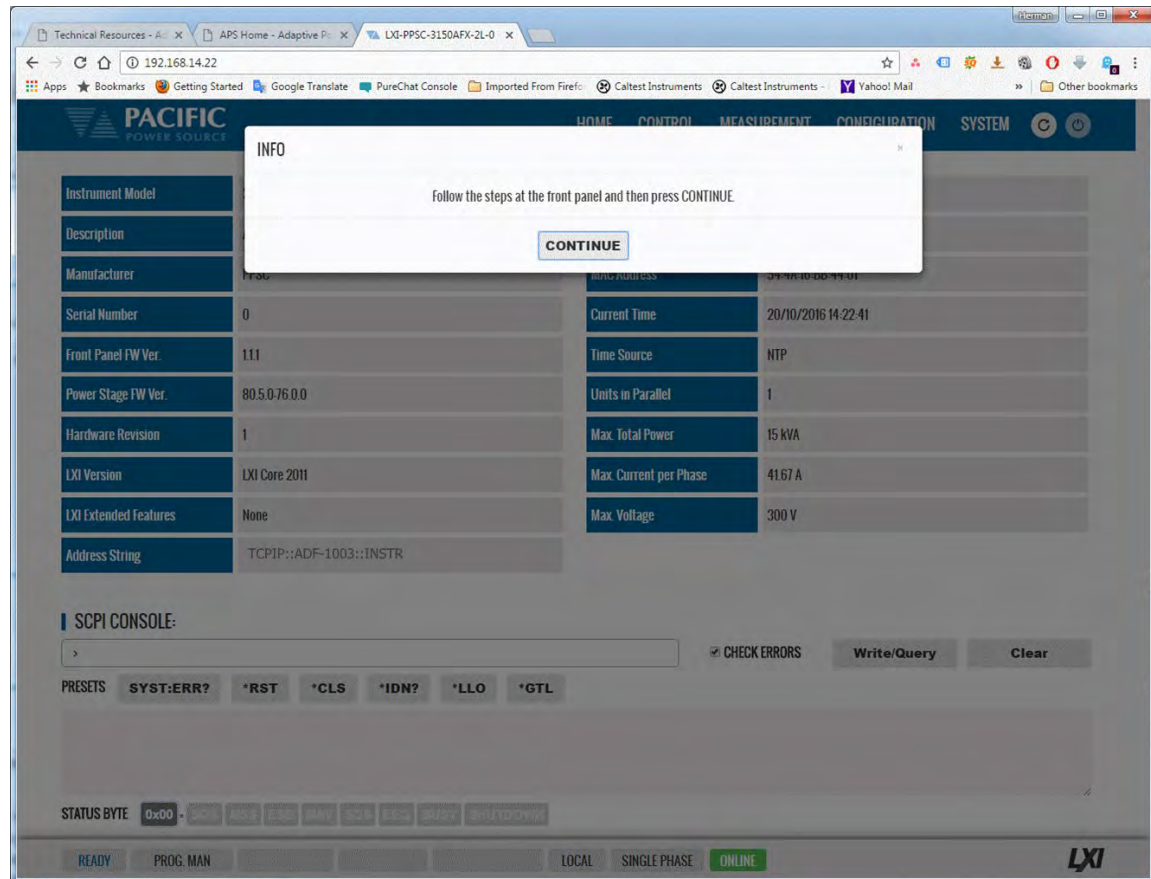


Figure 10-2: ACCESS CONTROL Dialog Screen

If the operator knows the four-digit access password that was set on the actual unit, he can enter the password code and gain full control of the source or Monitor⁸ only access depending on which mode was selected.

If the operator does not know the password, he can request access. Such a request can only be granted by a person who is in front of the actual unit however. This prevents unauthorized access from a remote location and protects the local user from possible harm. An Access Request will result in a Pop-Up message on the power source LCD screen.

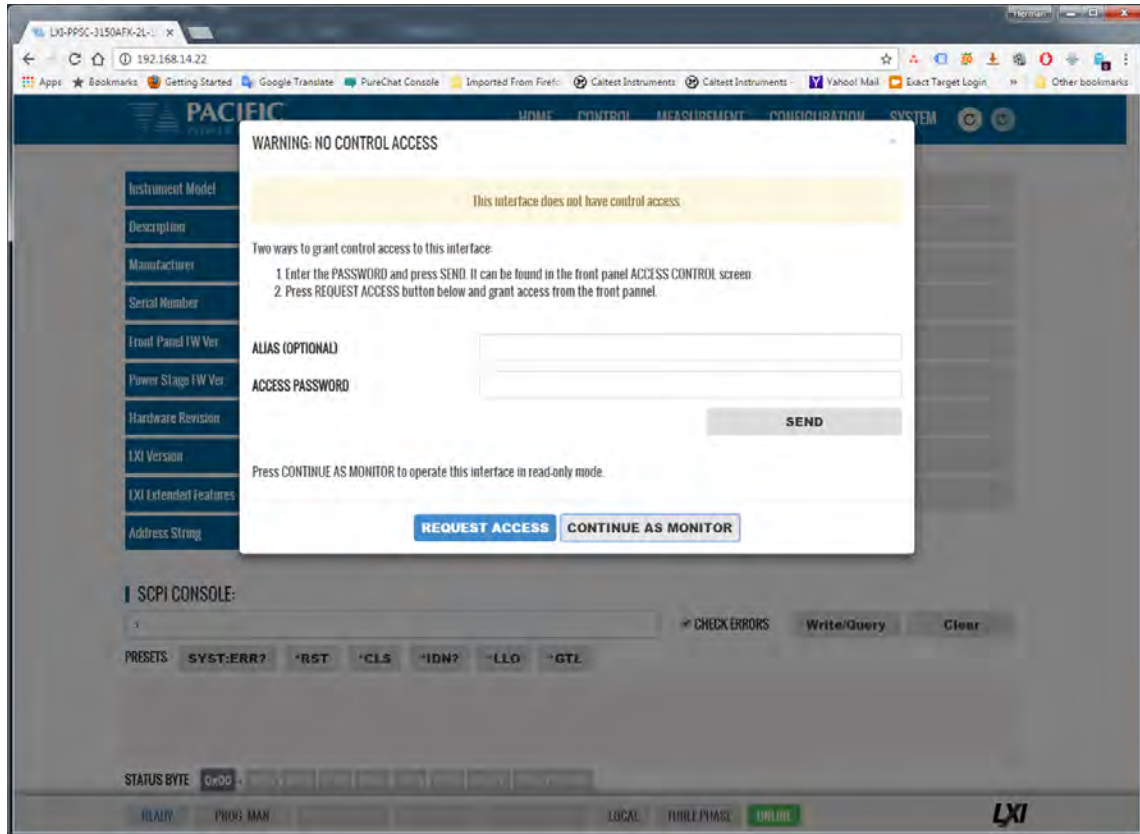
The access control password can be set/changed only by the person(s) present at the physical location of the unit. Factory default password is "1234" but it is strongly **advised** the end user changes this to his own code after receipt of the unit.

If access is denied, the browser interface will enter MONITOR only mode in which measurements and settings can be viewed remotely but control is possible. When in this mode, a user with knowledge of the access password can enter FULL CONTROL mode by supplying the

⁸ Note: Monitor Only access mode requires firmware revision 3.6.44 or higher.

correct password or request full access from a local operator that is present at the unit's location.

This dialog will appear when opening the browser interface while a unit is under ACCESS CONTROL and MONITOR mode is OFF (disabled).



Clicking on "REQUEST ACCESS" will result in a dialog box appearing on the unit's LCD screen displaying the requestor's IP address. A message on the browser will indicate action is needed by the local operator. Now, the local operator can either DENY or GRANT access.

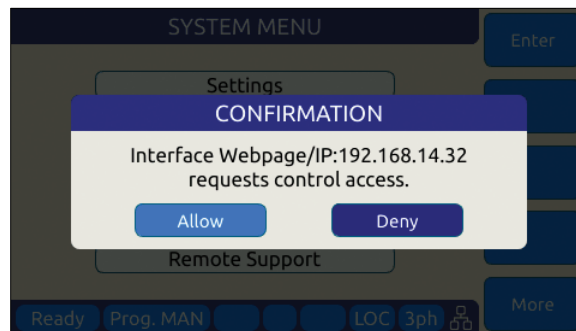
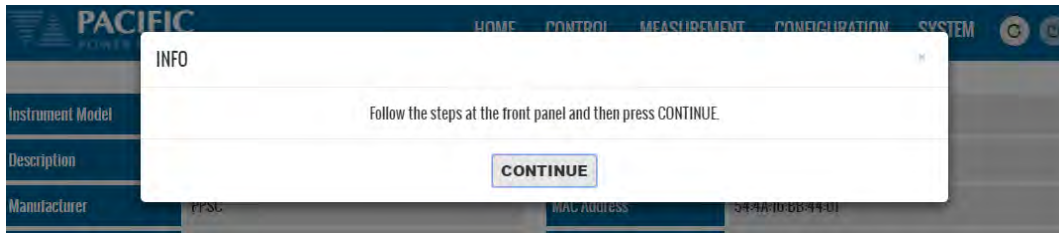


Figure 10-3: Remote Access Control Request Dialog

If remote access is granted, full control is provided. If denied, only monitoring is available.

Note: If the remote operator was given the ACCESS passcode, he can use it to gain access without a local operator's intervention.



When granted, the requestor's IP address will be added to the whitelist IP. The operator can remove any of the white listed IP address at any time if needed. This will lock out remote access for that PC until access is re-granted anew.

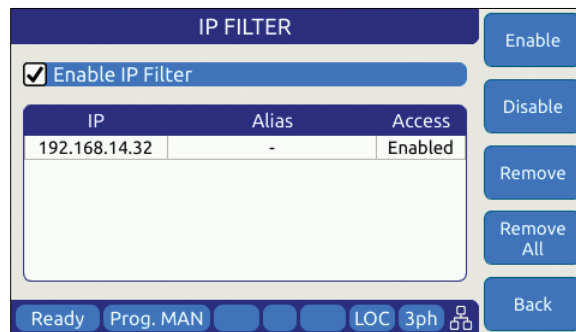
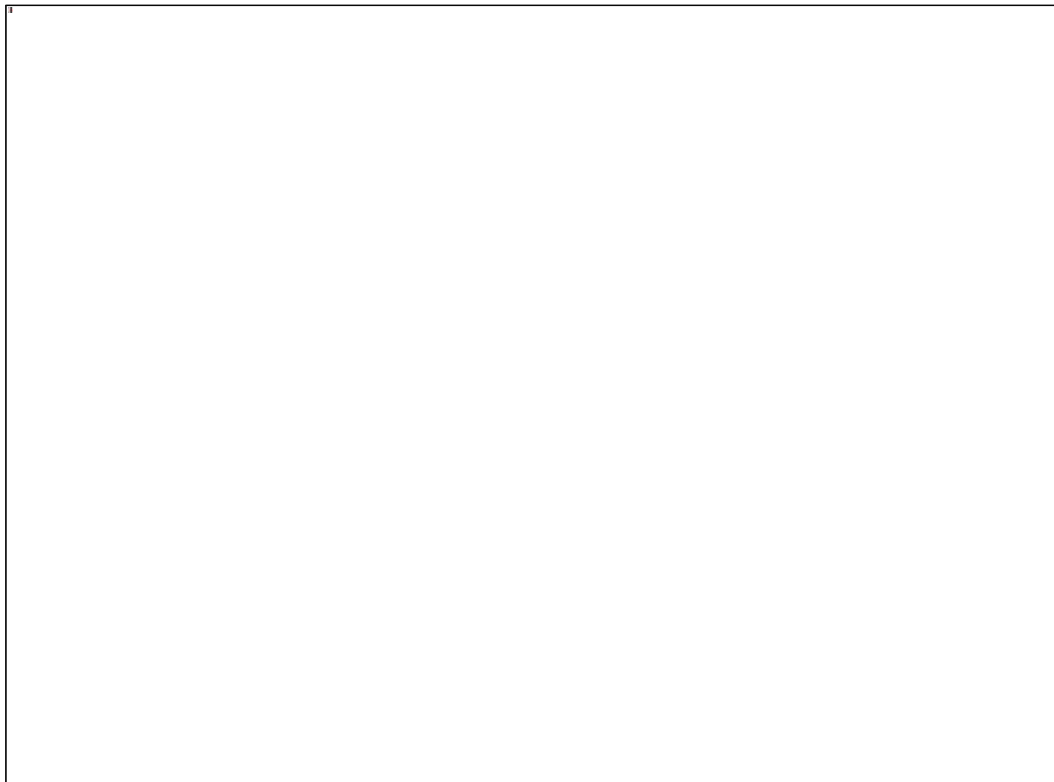
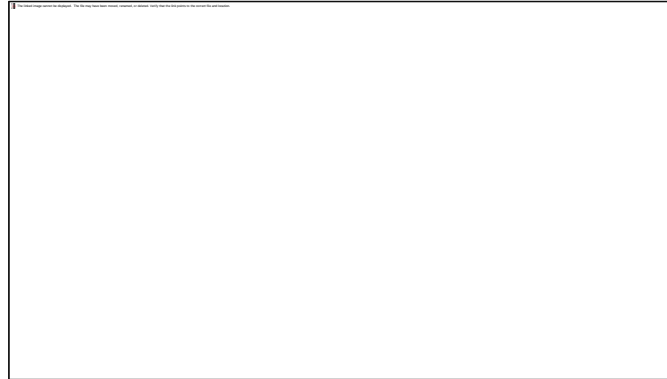


Figure 10-4: Remote Access Control IP Filter screen

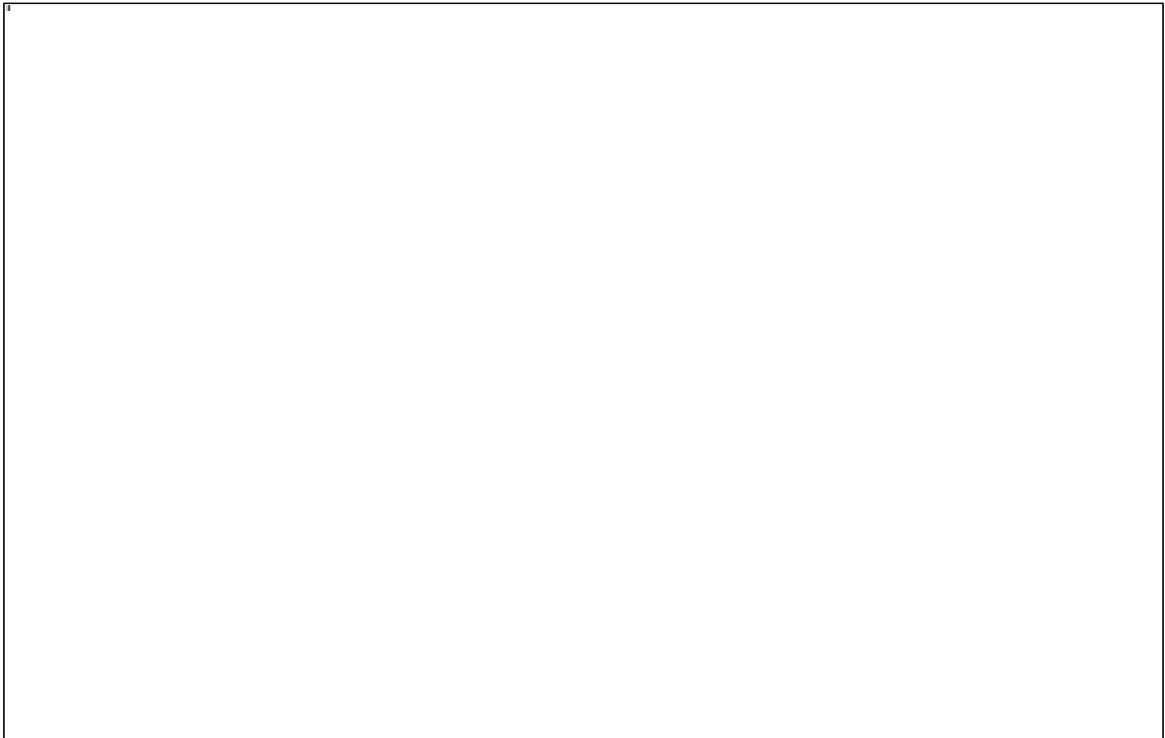
Remote access can be configured from the System menu. To enable Monitor only mode, turn MONITOR on as shown below. In this mode, settings and measurements can be viewed but no changes can be mode remotely.



Monitor mode can also be selected from the front panel using the System, Access Control screen as shown below.



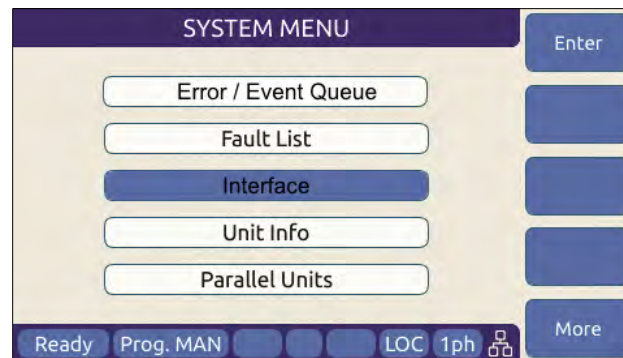
If Monitor mode is disabled, the browser access control screen will look like this.



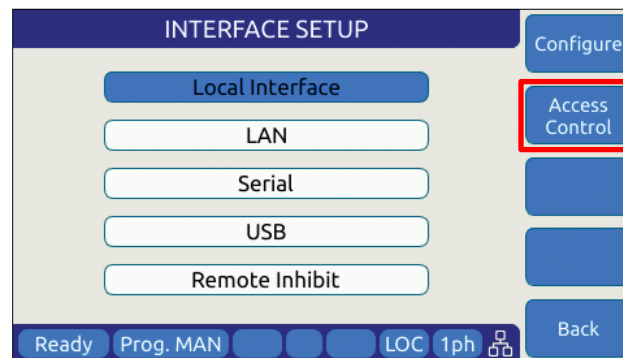
The message at the bottom of the screen can be set by the main user with the *SYSTem:REMOte:ACCESS:MESSa*
SCPI command. In this example, the following command was used:
SYSTem:REMOte:ACCESS:MESSa "Unit is used by John. Please contact 123456789."

10.3.2 Front Panel Access Control

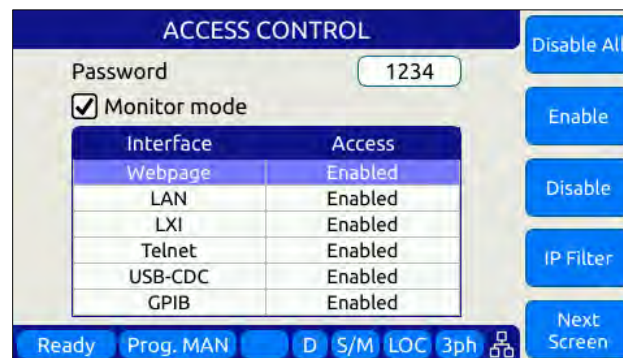
Setting remote control access levels and interface types is accomplished from the SYSTEM menu under Interfaces.



Scroll down to the INTERFACE entry and press Enter to access the available INTERFACE SETUP screen.



The second soft key is labelled “Access Control” and brings up the access control screen shown below.



The IP Filter list will provide access to the list of IP addresses that have been granted access by the local operator. This list can be erased if it is necessary to deny future access to the power source.

10.4 Web Browser Interface

The ADF Series® conforms to the LXI (Lan eXtensions for Instrumentation) standard and features a built-in web server with a greatly expanded feature set. This allows communication with the ADF from any web browser as long as the ADF is reachable through the network or internet. The expanded feature set of the web server often eliminates the need to use additional Windows or other platform based software.

10.5 Available Web Interface Menu Tree

The following areas of control, monitoring and configuration of the ADF power source are available through a web browser.

- Home Screen – Required for LXI compliance
- Home Screen SCPI Console Command Line Interface
- SOURCE CONTROL
 - PROGRAM
 - PROTECTIONS
 - TRANSIENTS
 - PROGRAM MEMORY
 - SCPI SCRIPT
- MEASUREMENTS
 - MONITOR
 - REAL TIME PLOT
 - V/I PLOT
 - DATALOGGER
- CONFIGURATION
 - UNIT SETTINGS
 - USER LIMITS & PRESETS
 - RAMP & SLEW
- SYSTEM
 - ERROR/EVENT QUEUE
 - FAULT LIST
 - INTERFACE SETUP
 - ACCESS CONTROL
 - DIGITAL & ANALOG IOS
 - UNIT INFORMATION
 - PARALLEL UNITS
 - MEMORY MANAGER
 - CALIBRATION
 - REMOTE SUPPORT
 - IMPORT/EXPORT
 - FIRMWARE UPDATE
 - SANITIZE & REBOOT

Following sections provide an overview of each page of the web browser interface.

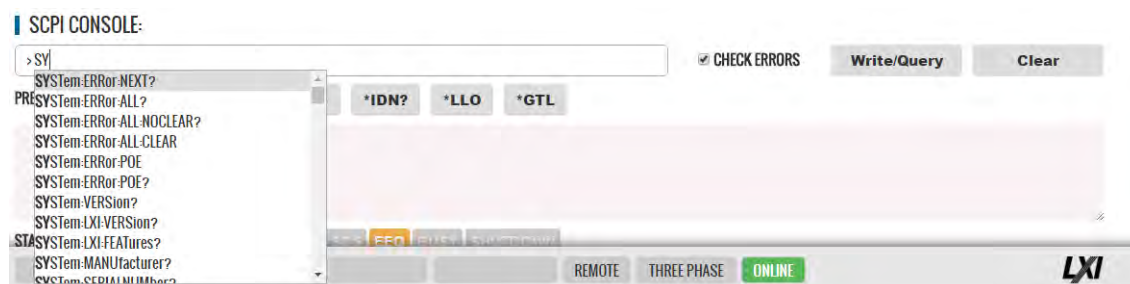
10.6 Home Screen

The Home screen contains all required information relating to the instrument and its LAN connection as required by the LXI standard. This includes hardware and firmware revision information. The NTP clock **SYNC** button in the Current Time field is yellow if it detects that the date, time or zone is different than the computer, otherwise is in gray. Press the button to sync to the NTP time server.



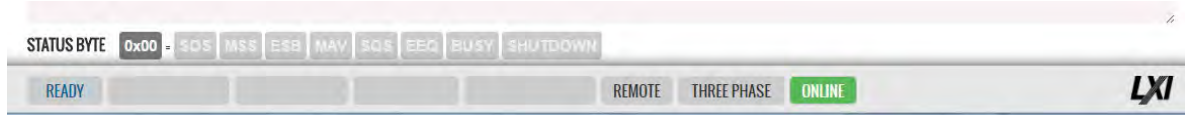
10.6.1 SCPI Console Command Line Interface

Near the bottom of the screen is an interactive command line interface that allows individual SCPI commands to be sent to the instrument. Any query results are shown in the text box below the command line. A drop-down list of all available commands is integrated in the command line and as you type a command, a match will be tracking in the drop down list allowing you to select the complete command without typing it out. See sample below after typing "SY".



10.6.2 Status Byte Display

At the very bottom of the Home Screen, the status byte register value and decoded fields are displayed for reference. Status byte fields are described in section 8.12.1, “Status Byte Register (STB)” on page 357.



10.6.3 Browser Status Bar

The browser status bar shows configuration information about the instrument. This includes any error or event flags, remote or local status, phase mode selection and on or off line status.



The first field will display **READY** while the power source output is OFF and **ENABLED** when it is ON (enabled).

10.6.4 Operation Manual PDF

The ADF Operation Manual is stored on the ADF’s internal memory and available for download to the user’s PC (“Download”) or for viewing using a suitable browser of PDF viewer (“View”).



PACIFIC
POWER SOURCE

HOME

CONTROL

MEASUREMENT

CONFIGURATION

SYSTEM



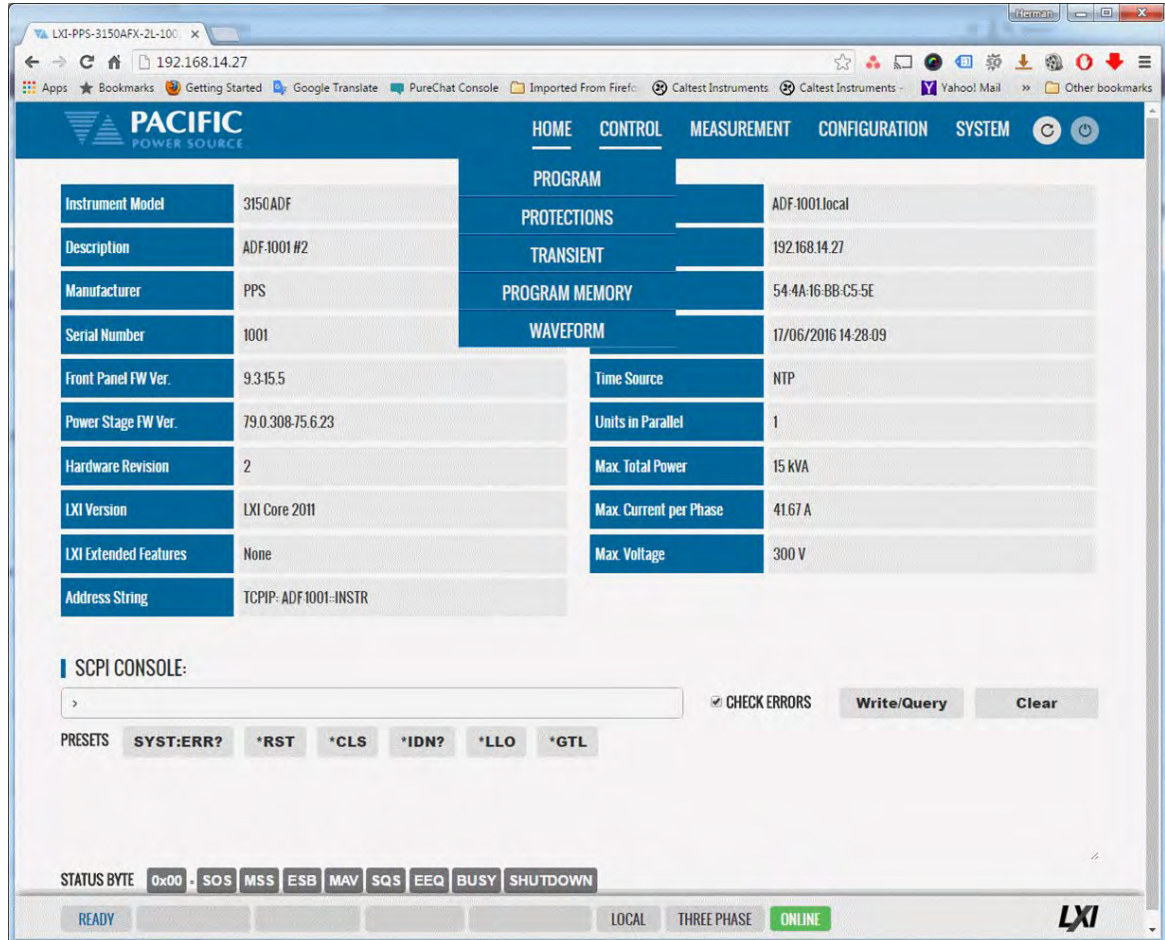
Instrument Model	3150ADF	Hostname	ADF-105624006.local
Description	ADF-105624006	IP Address	192.168.26.29
Manufacturer	PPSC	MAC Address	54-4A-16-BB-40-09
Serial Number	105624006	Current Time	30/01/2017 15:16:13
Front Panel FW Ver.	1.3.5	Time Source	NTP
Power Stage FW Ver.	80.7.0-76.0.0	Units in Parallel	1
Hardware Revision	0	Max. Total Power	15 kVA
LXI Version	LXI Core 2011	Max. Current per Phase	41.67 A
LXI Extended Features	None	Max. Voltage	300 V
Address String	TCPIP::ADF-105624006::INSTR	Operation Manual	View - Download

10.7 Source Control Screens

The CONTROL menu provides access to several screens that allow programming of the power source. Control Menu entries are as follows:

- PROGRAM
- PROTECTIONS
- PROGRAM MEMORY
- SCPI SCRIPT

Each is described in subsequent sections.



The screenshot displays the Pacific Power Source web interface for an LXI-PPS-3150AFX-2L-100. The browser address bar shows the IP 192.168.14.27. The interface has a blue header with the Pacific Power Source logo and navigation tabs: HOME, CONTROL (selected), MEASUREMENT, CONFIGURATION, and SYSTEM. Below the header, there are two main sections. The left section contains a table of instrument details:

Instrument Model	3150ADF
Description	ADF-1001 #2
Manufacturer	PPS
Serial Number	1001
Front Panel FW Ver.	9.3.15.5
Power Stage FW Ver.	79.0.308.75.6.23
Hardware Revision	2
LXI Version	LXI Core 2011
LXI Extended Features	None
Address String	TCPIP: ADF-1001-INSTR

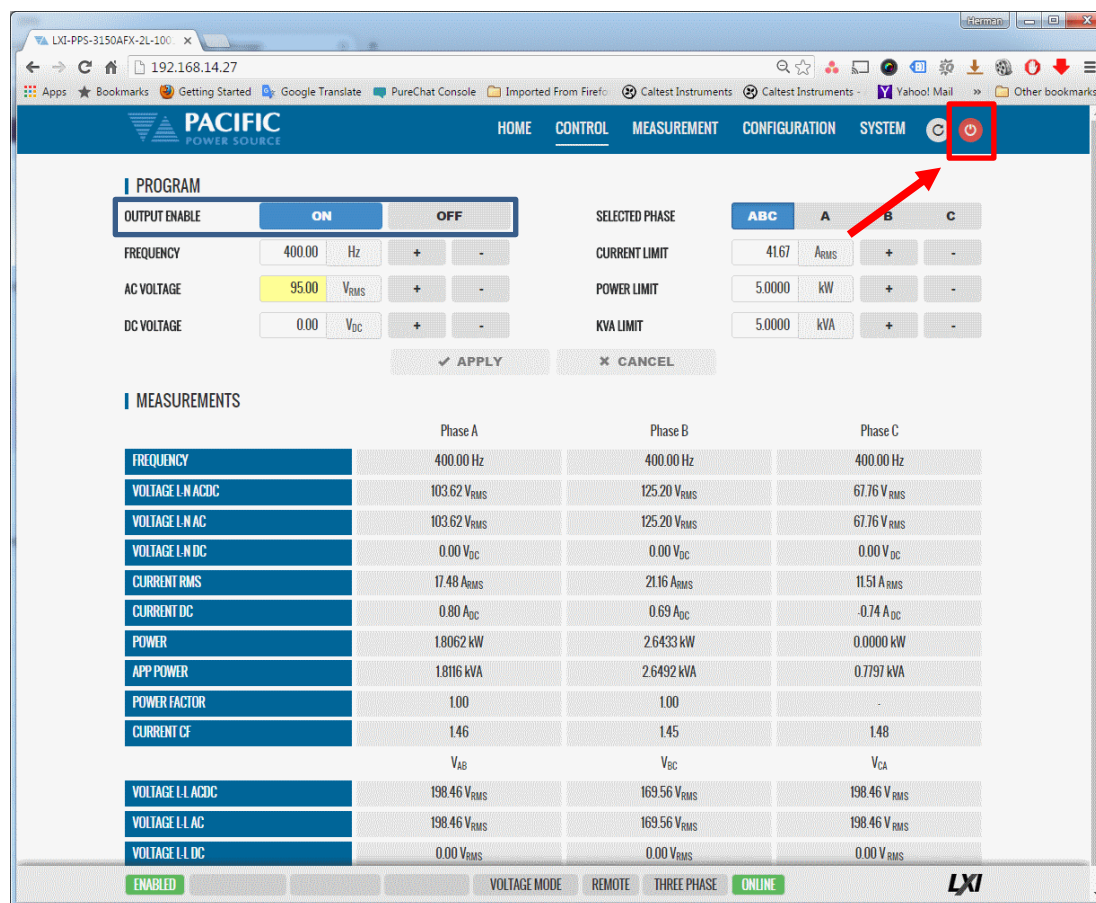
The right section contains a table of control parameters:

PROGRAM	ADF-1001.local
PROTECTIONS	192.168.14.27
TRANSIENT	54-4A-16-BB-C5-5E
PROGRAM MEMORY	17/06/2016 14:28:09
WAVEFORM	NTP
Time Source	1
Units in Parallel	15 kVA
Max. Total Power	4167 A
Max. Current per Phase	300 V
Max. Voltage	

Below these tables is the SCPI CONSOLE section, which includes a text input field, a "CHECK ERRORS" checkbox, and buttons for "Write/Query" and "Clear". There are also buttons for "PRESETS", "SYST:ERR?", "*RST", "*CLS", "*IDN?", "*LLO", and "*GTL". At the bottom, there is a STATUS BYTE section showing various status indicators: 0x00, SOS, MSS, ESB, MAV, SQS, EEQ, BUSY, SHUTDOWN. Below this, there are buttons for "READY", "LOCAL", "THREE PHASE", and "ONLINE". The LXI logo is visible in the bottom right corner.

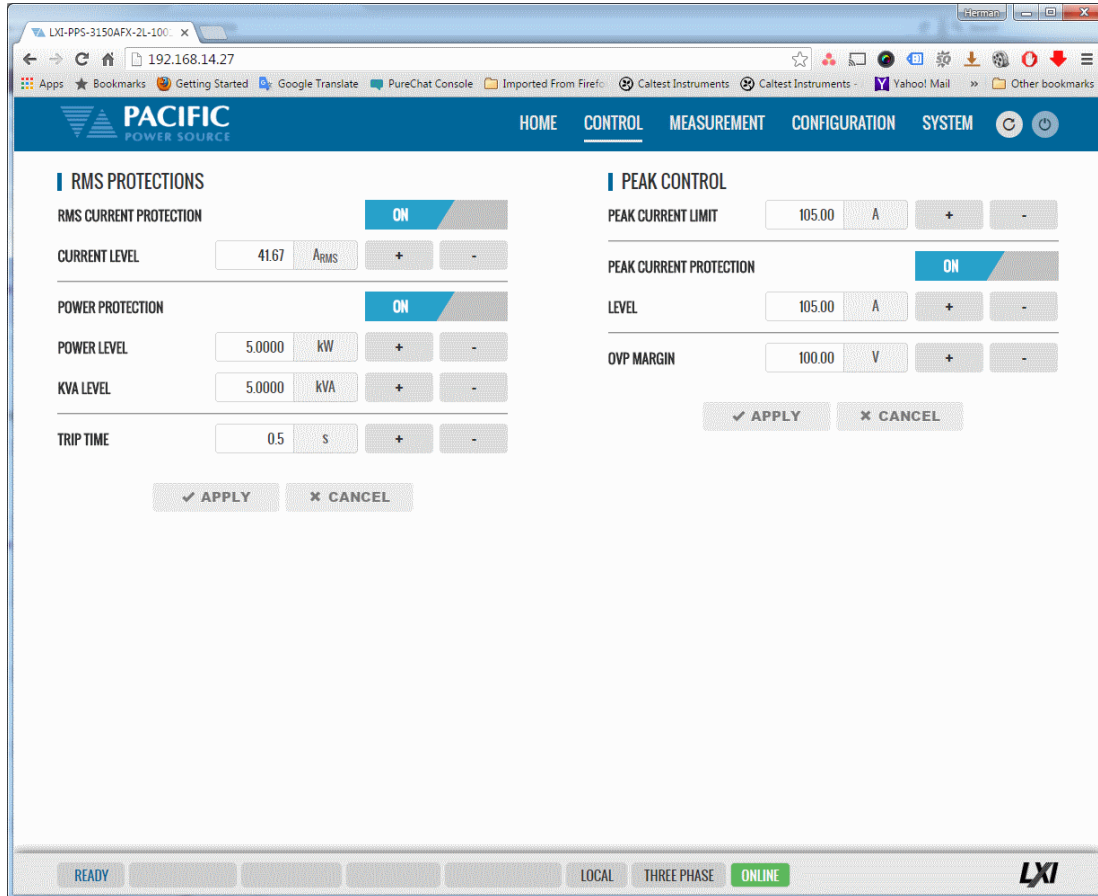
10.7.1 Program

The program control screen allows programming of all output parameters, operating modes etc. It also displays measurement data for all available phases in the lower part of the screen. In three or two phase mode, Line-to-Line voltage measurements are displayed at the bottom of the screen. The Output can be enabled using the “OUTPUT ENABLE” controls in the upper PROGRAM screen. The Output can also be turned **OFF** from any screen using the RED On/Off symbol in the menu bar, which is accessible from all screens. This allows quick opening of the output relay if needed from any screen without have to first select the PROGRAM screen. Note that the output can only be turned **ON** (or OFF) from the PROGRAM screen however.



10.7.2 Protections

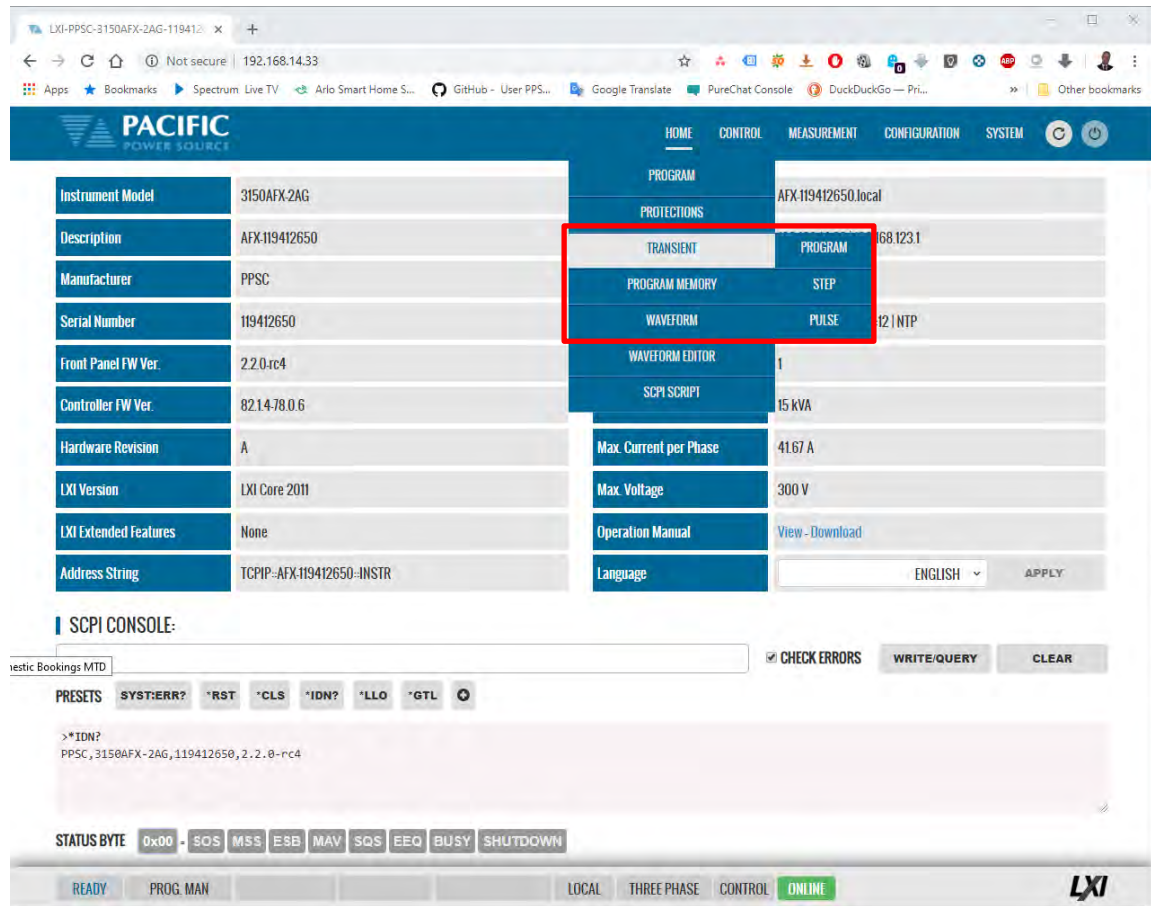
The Protections screen may be used to change protection modes and threshold values. This includes RMS current, Peak Current, True Power and Apparent Power protection modes. Modes can be toggled on or off individually.



The screenshot displays the LXI-PPS-3150AFX-2L-100 web interface. The browser address bar shows the IP address 192.168.14.27. The interface has a blue header with the Pacific Power Source logo and navigation tabs: HOME, CONTROL, MEASUREMENT, CONFIGURATION, and SYSTEM. The main content area is divided into two columns. The left column, titled 'RMS PROTECTIONS', contains: 'RMS CURRENT PROTECTION' with a toggle switch set to 'ON'; 'CURRENT LEVEL' with a value of 41.67 A_{RMS} and increment/decrement buttons; 'POWER PROTECTION' with a toggle switch set to 'ON'; 'POWER LEVEL' with a value of 5.0000 kW and increment/decrement buttons; 'KVA LEVEL' with a value of 5.0000 kVA and increment/decrement buttons; and 'TRIP TIME' with a value of 0.5 s and increment/decrement buttons. At the bottom of this column are 'APPLY' and 'CANCEL' buttons. The right column, titled 'PEAK CONTROL', contains: 'PEAK CURRENT LIMIT' with a value of 105.00 A and increment/decrement buttons; 'PEAK CURRENT PROTECTION' with a toggle switch set to 'ON'; 'LEVEL' with a value of 105.00 A and increment/decrement buttons; and 'OVP MARGIN' with a value of 100.00 V and increment/decrement buttons. At the bottom of this column are 'APPLY' and 'CANCEL' buttons. The bottom status bar shows 'READY', 'LOCAL', 'THREE PHASE', and 'ONLINE' indicators, along with the LXI logo.

10.7.3 Transients (Option R)

The transient control screen allows programming of new transients or execution control of new or stored transient programs. The power source supports LIST, STEP and PULSE transient modes.



10.7.3.1 LIST Transients

For LIST transients, both STEP mode and SEGMENT mode is supported. The bottom part of the screen shows the editable transient table. Execution controls are located in the top part of the screen.

Data entry mode can be selected as either STEP or SEGMENT. Dwell times can be entered using msec (TIME BASED) or cycles (CYCLE BASED). A sample TIME BASED Segment mode list is shown below.

TRANSIENT EXECUTION

▶ RUN ■ STOP ⏮ STEP ⏭ RESTART

STATE: STOPPED

PROGRESS: 0%

REPEAT TIMES COUNTER: 0

CONFIGURATION: ⚙ SETTINGS

RUN FROM SEGMENT #: 1

RUN TO SEGMENT #: 4

REPEAT TIMES: Infinite

✓ APPLY ✗ CANCEL

TRANSIENT TABLE

MODE: STEP **SEGMENT**

EDIT MODE: CYCLE BASED **TIME BASED**

#	TIME [ms]	FREQ [Hz]	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C	
> 1	1000.0	60.00	120.00	0.02	1	120.00/240.00	+ ✕
> 2	16.6	60.00	132.00/120.00/120.00	0.01	1	120.00/240.00	+ ✕
> 3	5000.0	60.00	120.00	0.00	1	120.00/240.00	+ ✕
> 4	100.0	60.00	120.00/132.00/108.00	0.00	1	120.00/240.00	+ ✕

✓ APPLY ✗ CANCEL ⚡ IMPORT ⚡ EXPORT + ADD ROW - DELETE ROW 🗑 CLEAR

READY PROG. MAN REMOTE THREE PHASE CONTROL **ONLINE** LXI

Import / Export Function

List Transients can be saved to excel compatible CSV files using the EXPORT button at the bottom of the List transient screen. A sample is shown to the right.

These same files can be Imported later eliminate the need to re-enter the transient list. The IMPORT button opens a file browser so select and load previously save CSV transient files. This function automatically changes between step or segment mode and edit mode according to the CSV file content.

A sample CYCLE BASED Segment mode list is shown below.

```
transient.csv - Notepad
File Edit Format View Help
SEP=,
Mode=Segment
Edit Mode=Time based
Time[ms],Frequency [Hz],AC [RMS],DC,Phase [Deg], Waveform
10.0,60,5/6/7,30/20/10,0/120/240,1/1/1
200.0,65,5/6/7,30/20/10,0/120/240,1/1/1
200.0,75,0/0/0,0/0/0,0/120/240,2/2/2
```

TRANSIENT EXECUTION

▶ RUN ■ STOP ⏮ STEP ⏮ RESTART

STATE: STOPPED

PROGRESS: 0%

REPEAT TIMES COUNTER: 0

CONFIGURATION: ⚙ SETTINGS

RUN FROM SEGMENT #: 0

RUN TO SEGMENT #: 0

REPEAT TIMES: Infinite

✓ APPLY ✕ CANCEL

TRANSIENT TABLE

MODE: STEP **SEGMENT** EDIT MODE: **CYCLE BASED** TIME BASED

#	CYCLES	FREQ [Hz]	V _{AC} [V _{rms}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C	
> 1	60	60.00	120.00	0.02	1/1/1	120.00/240.00	+ ✕
> 2	1	60.00	132.00/120.00/120.00	0.01	1/1/1	120.00/240.00	+ ✕
> 3	300	60.00	120.00	0.00	1/1/1	120.00/240.00	+ ✕
> 4	6	60.00	120.00/132.00/108.00	0.00	1/1/1	120.00/240.00	+ ✕

✓ APPLY ✕ CANCEL 📁 IMPORT 📁 EXPORT ➕ ADD ROW ➖ DELETE ROW 🗑 CLEAR

READY PROG MAN REMOTE THREE PHASE CONTROL ONLINE LXI

Continued on next page...

A sample TIME BASED STEP mode list is shown below. (Not to be confused with STEP Transient mode, see next section.)

The screenshot displays the Pacific Power Source web interface. The 'TRANSIENT EXECUTION' section includes controls for running, stopping, and restarting a transient sequence. The 'TRANSIENT TABLE' section shows a list of transient steps with parameters such as RAMP, DWELL, FREQ, V_{AC}, V_{DC}, Waveform, and Phase. The 'STEP' and 'TIME BASED' buttons are highlighted with red boxes.

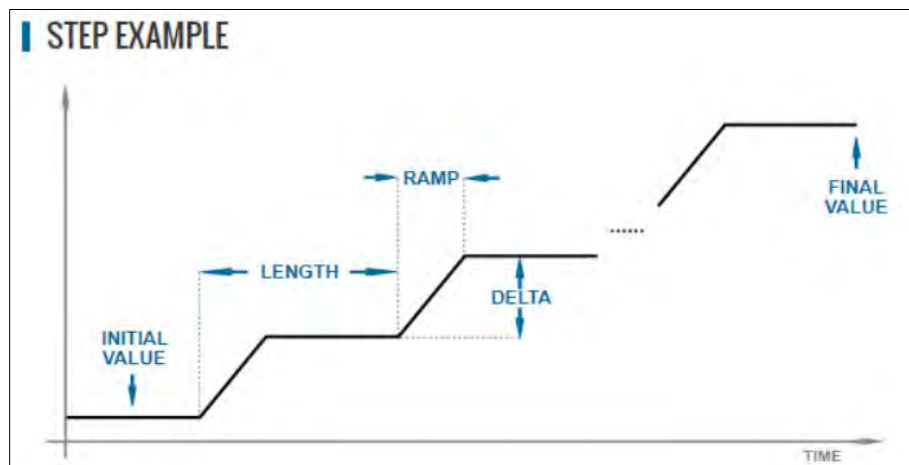
#	RAMP [ms]	DWELL [ms]	FREQ [Hz]	V _{AC} [V _{RMS}] A/B/C	V _{DC} [V] A/B/C	Waveform [#] A/B/C	Phase [deg] B/C
> 1	0.2	1000.0	60.00	120.00	0.02	1	120.00/240.00
> 2	0.2	16.8	60.00	132.00/120.00/120.00	0.01	1	120.00/240.00
> 3	100.0	5000.0	60.00	120.00	0.00	1	120.00/240.00
> 4	100.0	0.0	60.00	120.00/132.00/108.00	0.00	1	120.00/240.00

During transient execution, a progress indicator is visible showing percent completion.

10.7.3.2 STEP Transients

STEP transients allow a ramp or stairstep output profile to be programmed without creating LIST transients with multiple entries. In STEP transient mode, the user enters initial value, end value, delta step size, step duration, step count and no of repeats.

The STEP EXAMPLE shows the relationship between the various parameters.



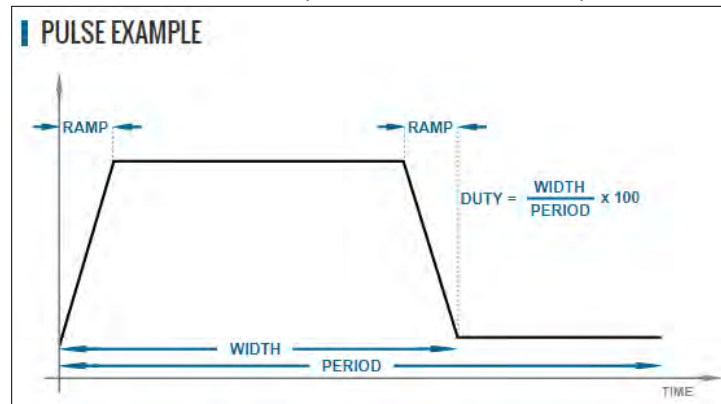
This information is transformed to a standard Segment based transient list by the power source when the LOAD button is pressed.

During transient execution, a progress indicator is visible showing percent completion.

10.7.3.3 PULSE Transients

PULSE transients allow series of pulsed output levels to be programmed without creating LIST transients with repetitive entries. In PULSE transient mode, the user enters Level, duty cycle, ramp time, period initial value and pulse count. This mode is useful for high and low line testing for voltage and frequency operating limits of an EUT.

The PULSE EXAMPLE shows the relationship between the various parameters.



This information is transformed to a standard Segment based transient list by the power source when the LOAD button is pressed.

The screenshot displays the Pacific Power Source web interface. The **PULSE EXECUTION** section includes buttons for RUN, STOP, STEP, and RESTART. The **PULSE VALUES** section shows settings for PULSE FREQUENCY (60.00 Hz), PULSE VOLTAGE AC (0.00 Vrms), PULSE VOLTAGE DC (0.00 Vdc), and PULSE WAVEFORM (1). The **PULSE SETTINGS** section, highlighted with a red box, includes fields for PULSE PERIOD (200.0 ms), PULSE WIDTH (100.0 ms), PULSE DUTY CYCLE (50.0 %), PULSE RAMP TIME (0.2 ms), and PULSE COUNT (1). A **PULSE EXAMPLE** diagram is also visible on the right side of the interface.

During transient execution, a progress indicator is visible showing percent completion.

10.7.4 Program Memory

Program settings and transients can be stored in a number of different memory types. The Program Memory screen allows the user to manage available stored programs. The program to be recalled on power up can be selected at the bottom of this screen in the “POWER ON PROGRAM” area.

The screenshot displays the Pacific Power Source ADF Series LAN Interface Configuration web application. The 'CONTROL' tab is active, showing the 'Program Memory' screen. The interface is divided into several sections:

- CURRENT PROGRAM:** Includes fields for 'CURRENT PROGRAM' (set to 'Manual'), 'PROGRAM ALIAS' (set to 'Manual'), and 'PROGRAM INFORMATION' (set to 'No information'). A 'VIEW' button is present.
- STORED PROGRAMS:** A section highlighted with a blue border. It features a 'MEMORY' dropdown menu currently set to 'INTERNAL'. Below this, the 'REGISTER #' is displayed as '1', with '+' and '-' buttons for navigation. Action buttons include 'PREVIEW', 'RECALL', 'SAVE', 'DELETE', 'COPY', 'IMPORT FROM...', and 'EXPORT TO...'.
- POWER ON PROGRAM:** Located at the bottom, it includes an 'INTERNAL REGISTER #' field set to 'Disable' and a 'SET' button.
- BROWSE PROGRAMS:** A table on the right side of the screen listing stored programs.

#	Alias	Preview
1	Manual	Q
2	Manual	Q
3	INTERNAL3	Q
8	Manual	Q
10	INTERN	Q
11	Program 11	Q
13	INTERN	Q

The top navigation bar includes links for 'HOME', 'CONTROL', 'MEASUREMENT', 'CONFIGURATION', and 'SYSTEM'. The bottom status bar shows 'ENABLED', 'VOLTAGE MODE', 'REMOTE', 'THREE PHASE', 'ONLINE', and the LXI logo.

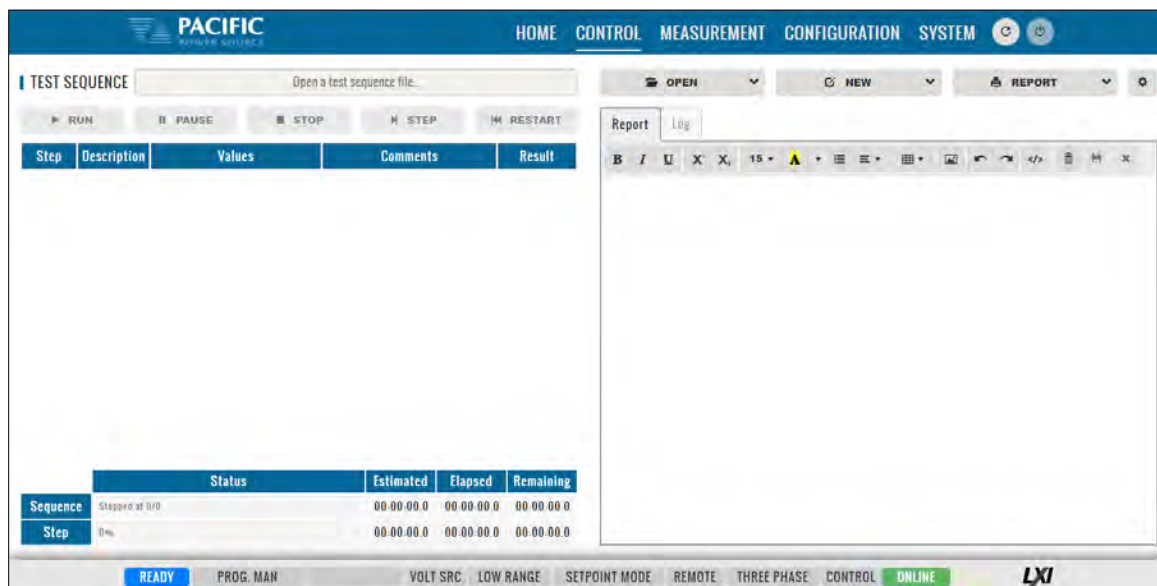
Note that external storage devices may be selected under “**STORED PROGRAMS**” using the MEMORY drop down list control.

10.7.5 Test Sequence

The test sequence feature can be found on the webpage CONTROL menu under “TEST SEQUENCE”. **Note** that this function requires firmware revision 3.7.x or higher.

CONTROL -> TEST SEQUENCE.

It is off by default to save unit memory and takes a few seconds to start once the Test Sequence screen is open the first time after power on.



A Test Sequence consists of a group of steps that are executed sequentially. Each step logs the details of said step to a test report. After test execution, this test report can be downloaded or printed using the browser interface.

A Test Sequence step can be any of the following types:

- Configuration
- Steady state
- Transient
- Timer (To perform a delay)
- User prompt (Show information)
- Meter (Performs different measurements)
- Control (Power source control shortcut)
- User input
- Script (For custom procedures, the coding language is Javascript)
- SCPI list (Executes a list of SCPI commands)
- SCPI (Executes a SCPI command)

Note that the sequence engine runs on the power source controller. The browser based webpage only acts as the graphical user interface for test sequence development, execution and reporting. As such, the browser can be closed and reopened without losing any of the test sequence information.

The test sequence functions can also be fully controlled remotely using SCPI commands and the sequences can be stored in the power sources' nonvolatile flash memory. The file format is the industry standard 7z extension compressed file format.

To familiarize yourself with test sequence use and operation, it is recommended to study the four example files provided:

- Sample-test-1.7z
- Sample-test-2.7z
- Sample-test-3.7z
- Sample-test-4.7z

For example, sample-test number 4 performs an IEC 61000-4-11 short voltage interrupt test on any number of user selectable phases. It's content is shown in the browser screen below.

Step	Description	Values	Comments	Result
1	Configuration	Form/Frequency/Voltage/Coupl...	EN/IEC61000-4-11 - Short Interru...	Passed
2	Script	AC Mode	Check Voltage Mode	Passed
3	User Input	UUT Part Number:UUT Serial No...	EN/IEC61000-4-11 - Short Interru...	Passed
4	Control	Output Enable:Off,CSC:Off	Open Output Relays, Set to 0.0V...	Passed
5	User Prompt	Wait for user confirmation	EN/IEC61000-4-11 - Short Interru...	Passed
6	Steady State	A-115(VAC), f-60(Hz)	EN/IEC61000-4-11 - UUT Warm-Up	Running
7	User Prompt	Wait for user confirmation	Please allow UUT to warm-up an...	
8	Steady State	A-115(VAC), f-60(Hz)	EN/IEC61000-4-11 - Short Interru...	
9	Transient	Total time- 45s		
10	Meter	Vrms,Irms	Measure power source output IV...	
11	User Prompt	Wait for user confirmation	Caution: Output Disable	

Report Log

Item Value

Output Enable Off

CSC Off

Passed - [08/19/2022 - 06:36:55]

Step 5 - User Prompt

EN/IEC61000-4-11 - Short interruptions, Class 2, 3, 60Hz Test

Connect UUT to the AC Power Source

WARNING

Note:

- The following Step will **ENABLE** the Output Power of the AC Power Source
- The Test will begin once **PASS** button has been clicked.
- If you choose not to begin the test, please click **STOP** button at this time.

Passed - [08/19/2022 - 06:36:57]

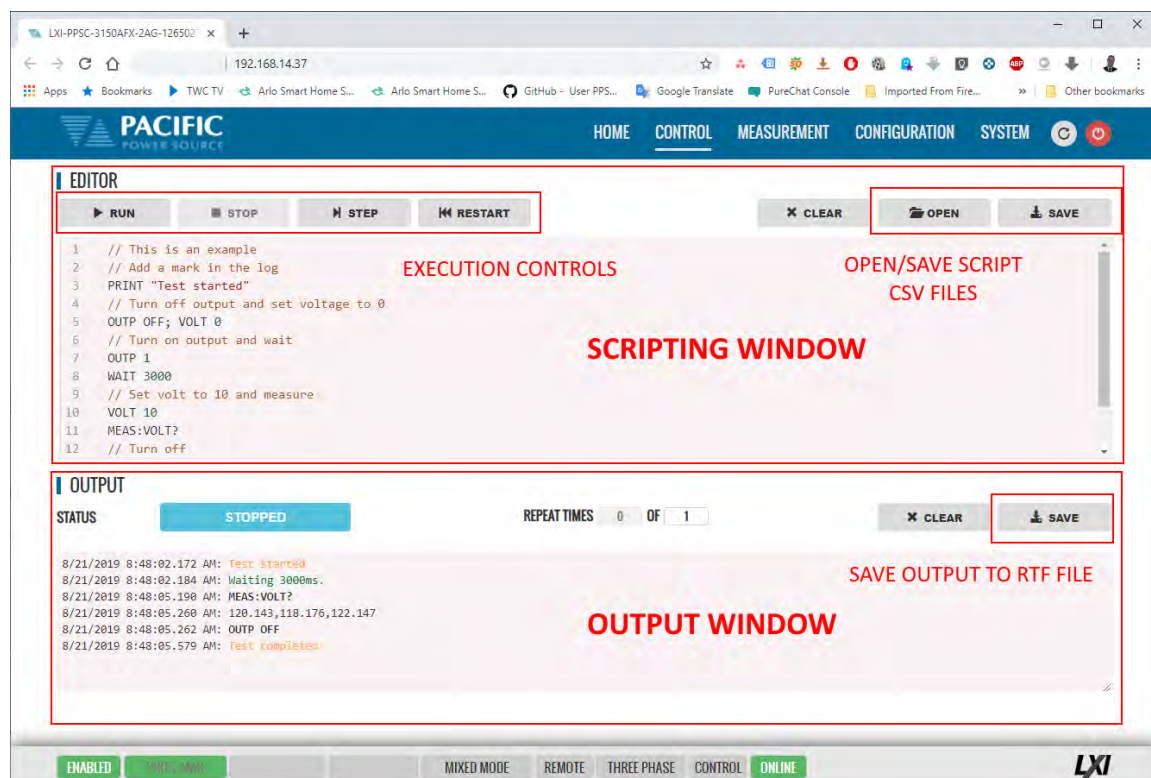
READY PROG. MAN VOLT SRC LOW RANGE SETPOINT MODE REMOTE THREE PHASE CONTROL ONLINE LXI

For an overview of the available Test Sequence SCPI control command syntax, refer to the Remote Control Programming Section of this manual. (Section **Error! Reference source not found.**).

10.7.6 SCPI Script

The SCPI Script menu entry displays the command scripting screen. These user generated scripts can contain any sequence of SCPI commands, comments and output statements to automate simple repetitive tasks. Scripts may be used to automate repetitive tasks more quickly and are simpler to write than an actual application program.

A script can be saved to the PC or tablet on which the browser runs.



10.7.6.1 Supported Keywords and Commands

The following script entries are supported:

Entry Type	Description
USER COMMENT	// Any test preceded by a two forward slash characters
PRINT	Sends text strings after PRINT key word to the OUTPUT window located at the bottom half of the browser window.
WAIT	Pauses script execution by no of msecs specified.
SCPI COMMAND	Any support SCPI command. Data returned by a query command (?) will be printed in the output window.

Table 10-1: Supported Script Entries

10.7.6.2 Script Execution Control

To run a script, click the ► **RUN** button in the upper left corner of the Editor window. You can also single step through a script during development using the ► | **STEP** button. The ■ **STOP** button will abort execution of a running script. To run a script multiple times, set the REPEAT TIMES value to a value higher than the default 1 (one). Max. repeat count is TBD.

10.7.6.3 Managing multiple script files.

Script files can be saved to the PC or device on which the browser runs, i.e. Windows PC, Tablet, or Smartphone. Use the **OPEN** and **SAVE** buttons in the upper right corner of the Editor window to save and retrieve scripts. Scripts are saved in Comma Separated File format, which can be edited in Excel or any text editor like Notepad. The sample script csv file content (*scpi_script.csv*) is shown below. When saving a new script, replace the default scpi_script file name with a more descriptive file name.

```
// Available commands are:
// - WAIT MILLISECONDS, example -> WAIT 2000
// - PRINT "TEXT", example -> PRINT "Test started"
// - SCPI COMMAND/s, example -> OUTP OFF; VOLT 0
// Comments starts with // as this line
// The following is an example
// Add a mark in the log
PRINT "Test started"
// Turn off output and set voltage to 0
OUTP OFF; VOLT 0
// Turn on output
OUTP 1
// Wait three seconds
WAIT 3000
// Set output voltage to 10 volts
VOLT 10
// Get output voltage measurement
MEAS:VOLT?
// Turn off
OUTP OFF
PRINT "Test completed"
```

10.7.6.4 "Script Execution Output"

The OUTPUT window located in the bottom half of the browser window shows all script output, including any user comments, events like script start and stop as well as any PRINT commands. Each output entry is date and time stamped.

The content of the **OUTPUT** window can be saved to a Rich Text File using the **SAVE** button in the upper right corner of the OUTPUT window. (Do not confuse with the SAVE button in the script EDITOR window.) The default output file name is "*scpi_script_output.rtf*". A sequence number (1), (2) etc will be appended each time the output window content is saved.

A sample RFT file is shown below.

```
8/21/2019 8:48:02.172 AM: Test started
8/21/2019 8:48:02.184 AM: Waiting 3000ms.
8/21/2019 8:48:05.190 AM: MEAS:VOLT?
8/21/2019 8:48:05.260 AM: 120.143,118.176,122.147
8/21/2019 8:48:05.262 AM: OUTP OFF
8/21/2019 8:48:05.579 AM: Test completed
```

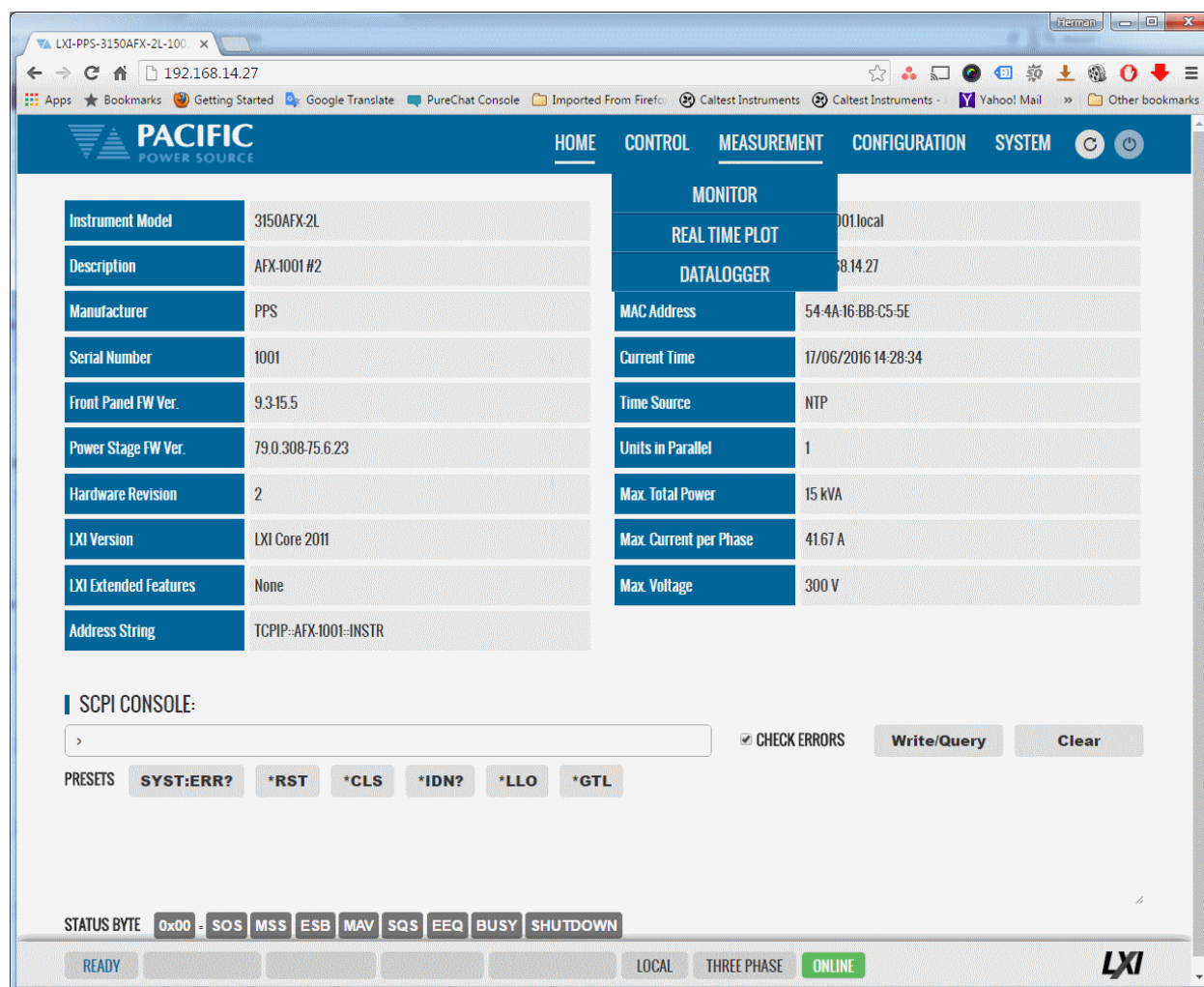
Note: All output files are saved to the default Download directory determined by the Browser setting.

10.8 Measurement Screens

The MEASUREMENT menu provides access to several measurement screens. Measurement screens available are:

- MONITOR
- REAL TIME PLOT
- V/I PLOT
- DATALOGGER

Each is described in subsequent sections.



The screenshot shows the LXI-PPS-3150AFX-2L-100 web interface. The top navigation bar includes HOME, CONTROL, MEASUREMENT, CONFIGURATION, and SYSTEM. The MEASUREMENT menu is expanded, showing MONITOR, REAL TIME PLOT, and DATALOGGER. The MONITOR screen displays the following information:

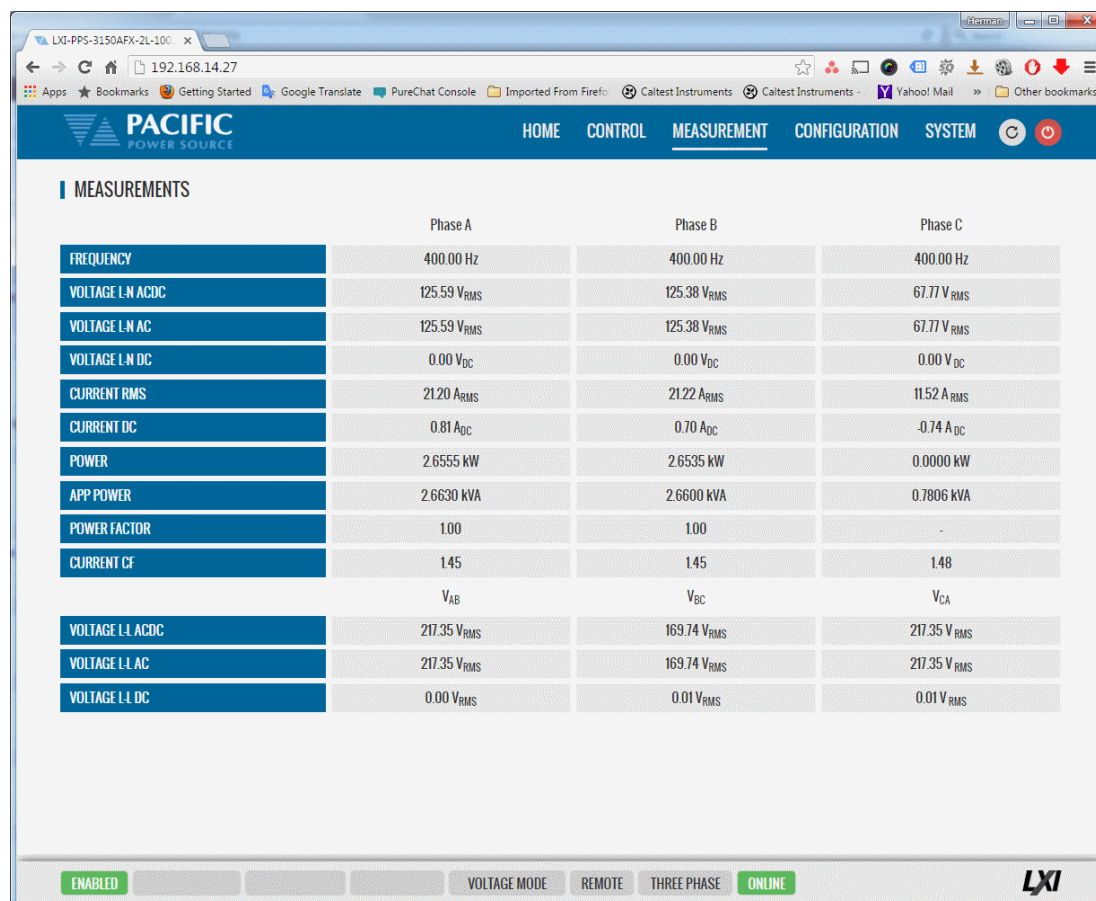
Instrument Model	3150AFX2L
Description	AFX-1001 #2
Manufacturer	PPS
Serial Number	1001
Front Panel FW Ver.	9.3.15.5
Power Stage FW Ver.	79.0.308.75.6.23
Hardware Revision	2
LXI Version	LXI Core 2011
LXI Extended Features	None
Address String	TCP/IP:AFX-1001-INSTR

Below the table, there is a SCPI CONSOLE section with a text input field and buttons for PRESETS (SYST:ERR?, *RST, *CLS, *IDN?, *LLO, *GTL), CHECK ERRORS, Write/Query, and Clear. At the bottom, there is a STATUS BYTE section showing 0x00 - SOS, MSS, ESB, MAV, SQS, EEQ, BUSY, SHUTDOWN, and a row of buttons: READY, LOCAL, THREE PHASE, and ONLINE.

10.8.1 Monitor

The measurement monitor screen replicates part of the CONTROL->PROGRAM screen and displays all measurement data for all available output phases. Measurements include both AC and DC components.

Note: There are no controls on this screen.

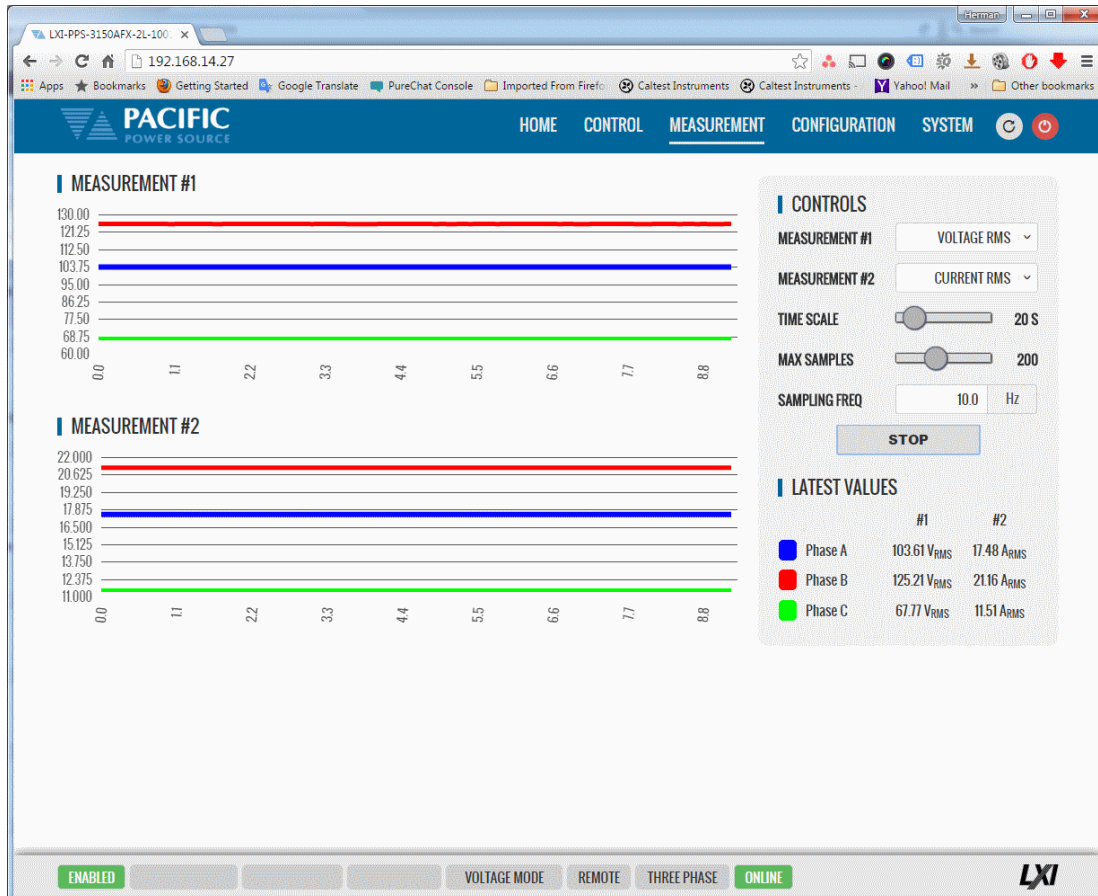


	Phase A	Phase B	Phase C
FREQUENCY	400.00 Hz	400.00 Hz	400.00 Hz
VOLTAGE L-N AC/DC	125.59 V _{RMS}	125.38 V _{RMS}	67.77 V _{RMS}
VOLTAGE L-N AC	125.59 V _{RMS}	125.38 V _{RMS}	67.77 V _{RMS}
VOLTAGE L-N DC	0.00 V _{DC}	0.00 V _{DC}	0.00 V _{DC}
CURRENT RMS	21.20 A _{RMS}	21.22 A _{RMS}	11.52 A _{RMS}
CURRENT DC	0.81 A _{DC}	0.70 A _{DC}	-0.74 A _{DC}
POWER	2.6555 kW	2.6535 kW	0.0000 kW
APP POWER	2.6630 kVA	2.6600 kVA	0.7806 kVA
POWER FACTOR	1.00	1.00	-
CURRENT CF	1.45	1.45	1.48
	V _{AB}	V _{BC}	V _{CA}
VOLTAGE L-L AC/DC	217.35 V _{RMS}	169.74 V _{RMS}	217.35 V _{RMS}
VOLTAGE L-L AC	217.35 V _{RMS}	169.74 V _{RMS}	217.35 V _{RMS}
VOLTAGE L-L DC	0.00 V _{RMS}	0.01 V _{RMS}	0.01 V _{RMS}

ENABLED VOLTAGE MODE REMOTE THREE PHASE ONLINE LXI

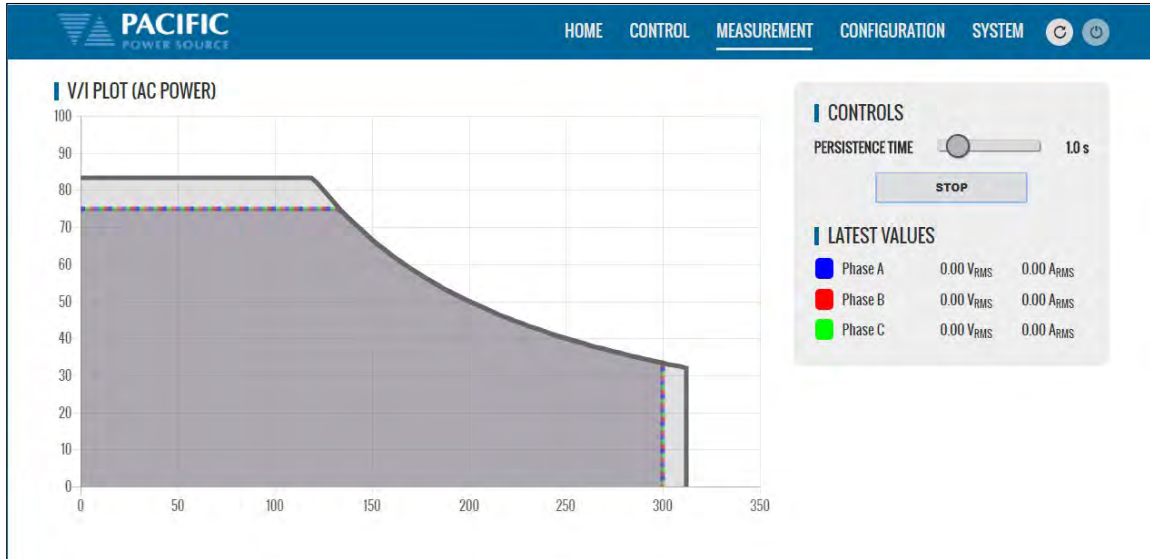
10.8.2 Real-Time Plot

This measurement screens provides a strip-chart style graphical display for up to two measurement parameters, #1 and #2. The CONTROLS allows selection of the desired parameter for each graph. Available choices are Voltage, Current and Power. Depending on phase mode, up to three phase values are displayed per chart.



10.8.3 V/I Plot

The V/I plot shows the power operating point at any moment in time by plotting measured Voltage as a function of measured Current. This plot has a persistence mode so the user can observe power fluctuations and changes over a set period.



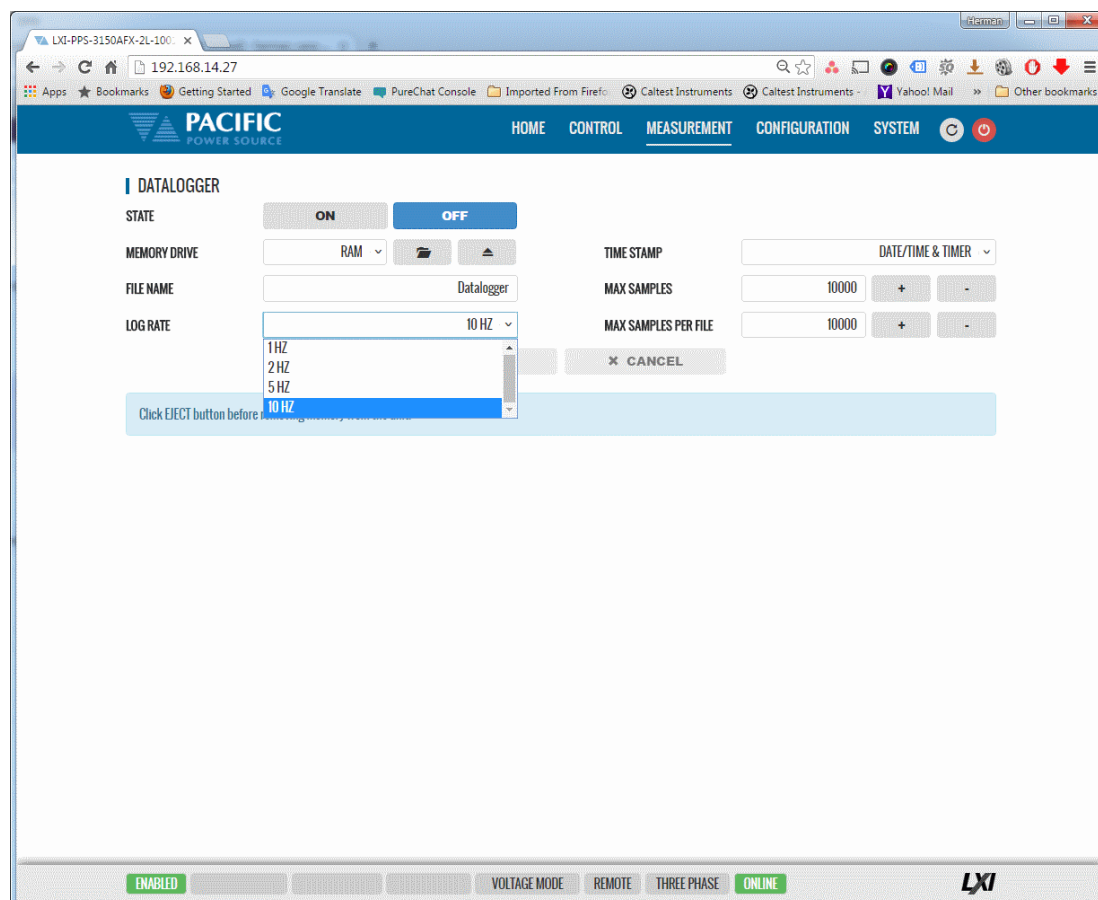
Available selections in this measurement screen are:

- Persistence Time: 1 ~ 60 sec

10.8.4 Data Logger

The measurement data logger screen allows measurement data to be written to a memory device, using a comma delimited file format. These files are easy to open in an Excel™ spreadsheet or other math oriented software program.

Available controls are for State on/off, memory destination device, file name assignment and data logging rate in Hz. All file entries are time stamped.

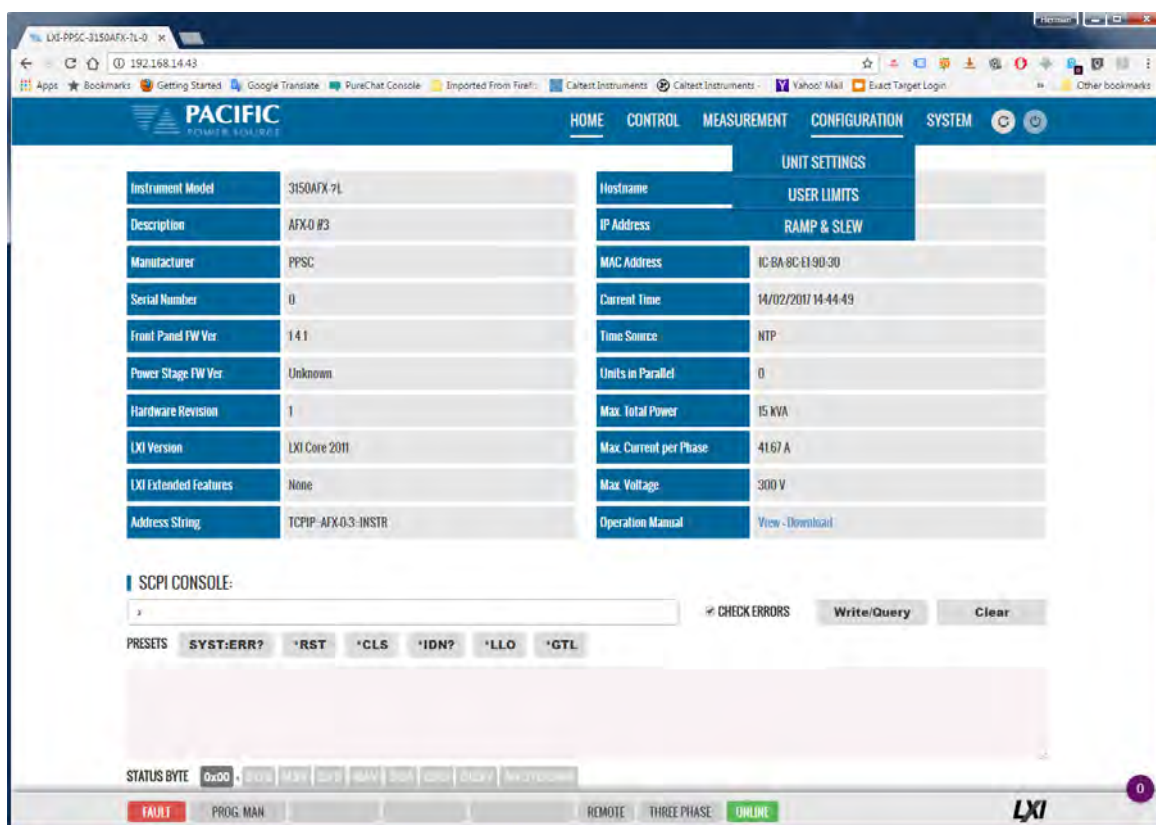


10.9 Configuration Screens

The CONFIGURATION menu provides access to secondary power source settings that are less frequency changed than those on the PROGRAM screen. Configuration screens available are:

- UNIT SETTINGS
- USER LIMITS & PRESETS
- RAMP & SLEW

Each is described in subsequent sections.

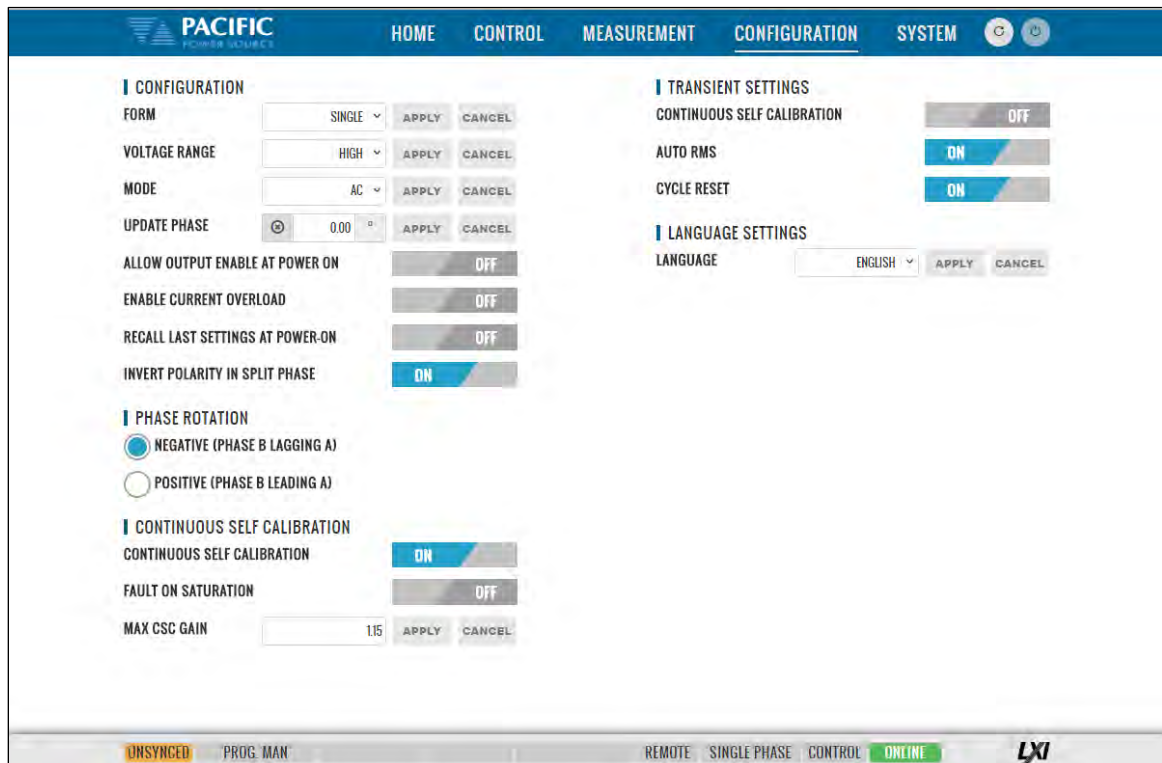


10.9.1 Unit Settings

Unit settings determine the mode of operation of the power source. This includes phase mode, voltage range, output mode, update phase angle and ramp time for any output value changes made.

- Output enable at power on allows the unit to power up with the output enabled.
- The Enable Current Overload setting allows short duration overloads up to 30% over the normal continuous mode current limit set point.
- Phase Rotation selection changes output phasing between positive (leading) and negative (lagging) phase rotation in three phase output mode.
- The maximum adjustment limit for continuous self-calibration mode and fault generation on saturation can be set from this screen as well.
- The right hand side of the screen contains Transient mode execution settings.
- Language selections are either ENGLISH or CHINESE.

These can all be set from the CONFIGURATION -> UNIT SETTINGS screen shown below.



CONFIGURATION

FORM: SINGLE [APPLY] [CANCEL]

VOLTAGE RANGE: HIGH [APPLY] [CANCEL]

MODE: AC [APPLY] [CANCEL]

UPDATE PHASE: 0.00 [APPLY] [CANCEL]

ALLOW OUTPUT ENABLE AT POWER ON: OFF

ENABLE CURRENT OVERLOAD: OFF

RECALL LAST SETTINGS AT POWER-ON: OFF

INVERT POLARITY IN SPLIT PHASE: ON

PHASE ROTATION

☒ NEGATIVE (PHASE B LAGGING A)

☐ POSITIVE (PHASE B LEADING A)

CONTINUOUS SELF CALIBRATION

CONTINUOUS SELF CALIBRATION: ON

FAULT ON SATURATION: OFF

MAX CSC GAIN: 1.15 [APPLY] [CANCEL]

TRANSIENT SETTINGS

CONTINUOUS SELF CALIBRATION: OFF

AUTO RMS: ON

CYCLE RESET: ON

LANGUAGE SETTINGS

LANGUAGE: ENGLISH [APPLY] [CANCEL]

STATUS BAR: UNSYNCD | PROG. MAN | REMOTE | SINGLE PHASE | CONTROL | ONLINE | LXI

10.9.2 User Limits & Presets

User limits can be used to minimize operator error by setting upper and/or lower limits on programmable parameter ranges.

Limits can be set for Voltage AC Voltage and Frequency.

Note: When changing user limits, make sure programmed parameter settings in effect are not outside the new upper and lower limits entered.

All user limits can be set from the CONFIGURATION -> USER LIMITS screen shown below.

The screenshot displays the Pacific Power Source web interface. The top navigation bar includes links for HOME, CONTROL, MEASUREMENT, CONFIGURATION (selected), and SYSTEM. The main content area is divided into two sections: USER LIMITS and USER PRESETS.

USER LIMITS Section:

- VOLTAGE AC MIN:** Set to 0.00 Vrms. Controls: +, -.
- FREQUENCY MIN:** Set to 15.00 Hz. Controls: +, -.
- VOLTAGE AC MAX:** Set to 300.00 Vrms. Controls: +, -.
- FREQUENCY MAX:** Set to 1200.00 Hz. Controls: +, -.
- Buttons: APPLY ALL, CANCEL.

USER PRESETS Section:

- PRESET:** A dropdown menu currently set to VOLTAGE AC.
- SK #1:** MIN, MAX, NONE, VALUE (120.0 Vrms).
- SK #2:** MIN, MAX, NONE, VALUE (230.0 Vrms).
- SK #3:** MIN, MAX, NONE, VALUE (277.0 Vrms).
- SK #4:** MIN, MAX, NONE, VALUE (Vrms).
- Buttons: APPLY ALL, CANCEL, DEFAULT ALL.

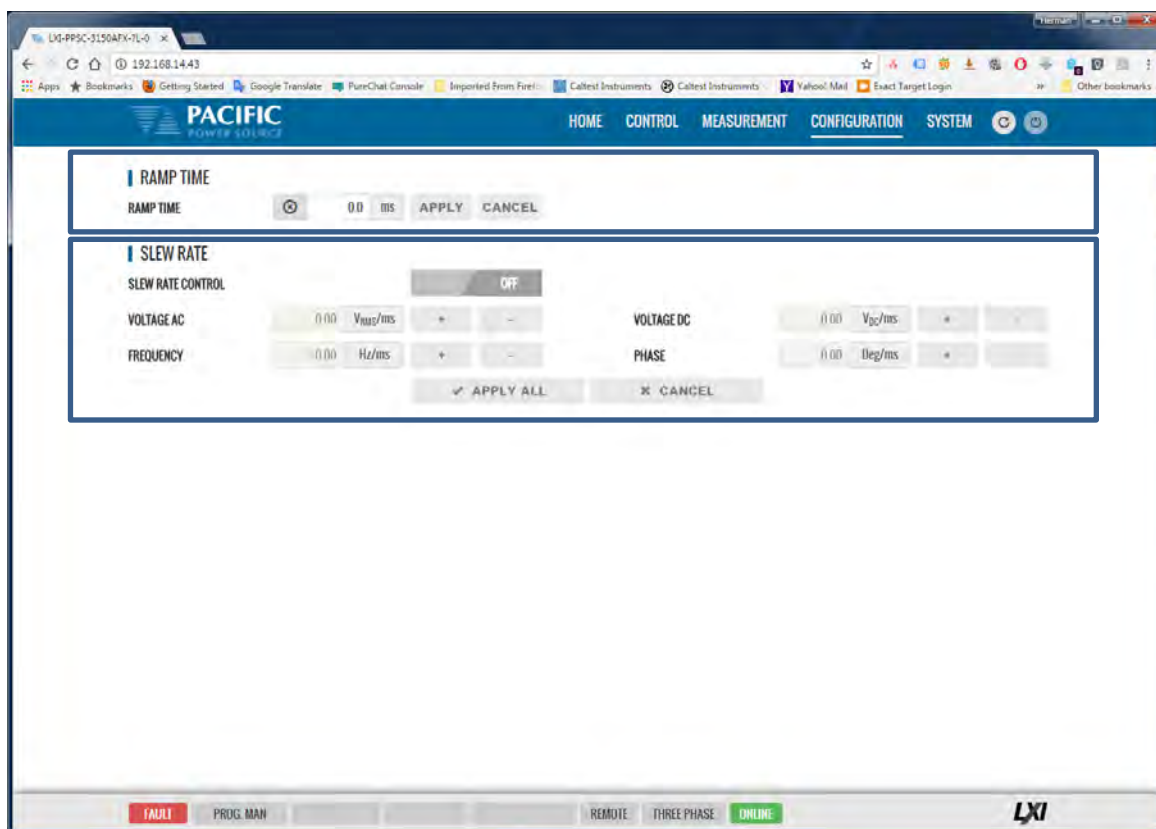
The bottom status bar shows: READY, PROG. MAN, LOCAL, THREE PHASE, CONTROL, and ONLINE (highlighted in green). The LXI logo is on the right.

User programmable presets can be set to define the set values of the Soft keys in the program screens. This allows commonly used setting values to be selected by an operator by just pressing a single soft key. See image above for samples.

10.9.3 Ramp Time & Slew Rate

The Slew Rate screen has entries for all available programmable slew rate settings. This includes Voltage AC and Frequency. Note that both are mutually exclusive as they would conflict with each other. To use programmable slew rates, the RAMP TIME must be disabled.

Slew Rates can be set for Voltage AC and Frequency.

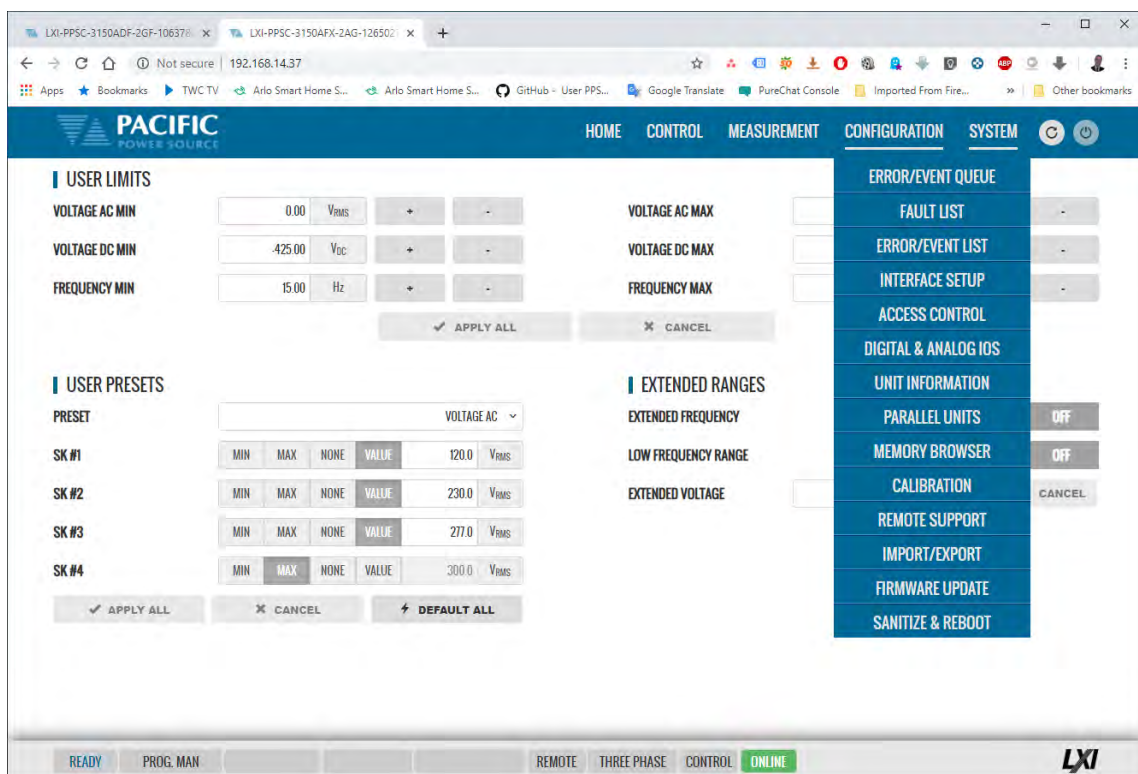


10.10 System Screens

The SYSTEM menu provides access to system level settings. System setting screens available are:

- ERROR/EVENT QUEUE
- FAULT LIST
- ERROR/EVENT LIST
- INTERFACE SETUP
- ACCESS CONTROL
- DIGITAL & ANALOG IOS
- UNIT INFORMATION
- PARALLEL UNITS
- MEMORY BROWSER
- CALIBRATION
- REMOTE SUPPORT
- IMPORT/EXPORT
- FIRMWARE UPDATE
- SANITIZE & REBOOT

Each is described in subsequent sections.

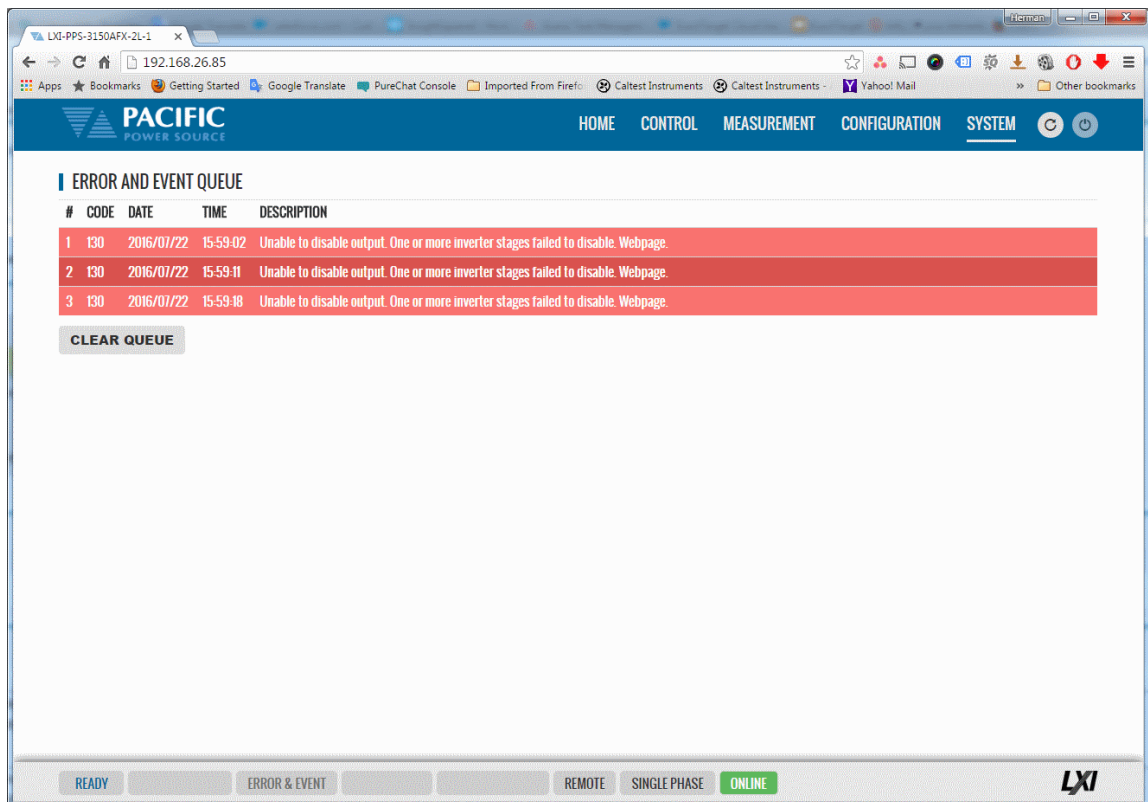


10.10.1 Error/Event Queue

The Error and Event Queue tracks internal errors or communication errors that may occur during normal user. Generally, such errors are the results of programming conflicts or setting conflicts and are no cause for concern. Other events may be normal, such as a power-on event and will be recorded in the same queue. The user can clear the queue at any time using the

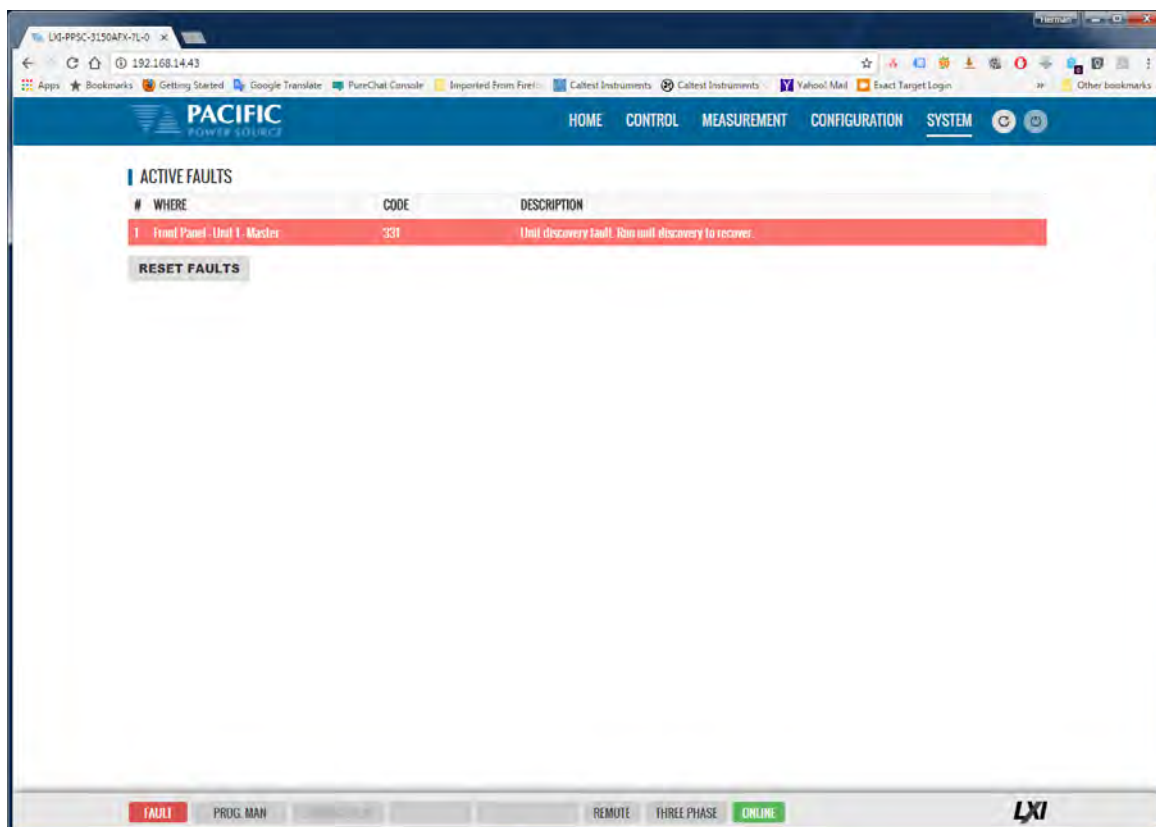
CLEAR QUEUE button.

Actual hardware faults are tracked in the FAULT queue. See next section.



10.10.2 Fault List

The Fault List tracks hardware faults that may occur in the power conversion stages. This information may be useful for PPS engineering staff.



10.10.3 Error/Event List

The Error Event list provides a complete listing of all possible error and event messages. The description may include possible troubleshooting hints to resolve any error conditions.

Errors are listed in numerical order.

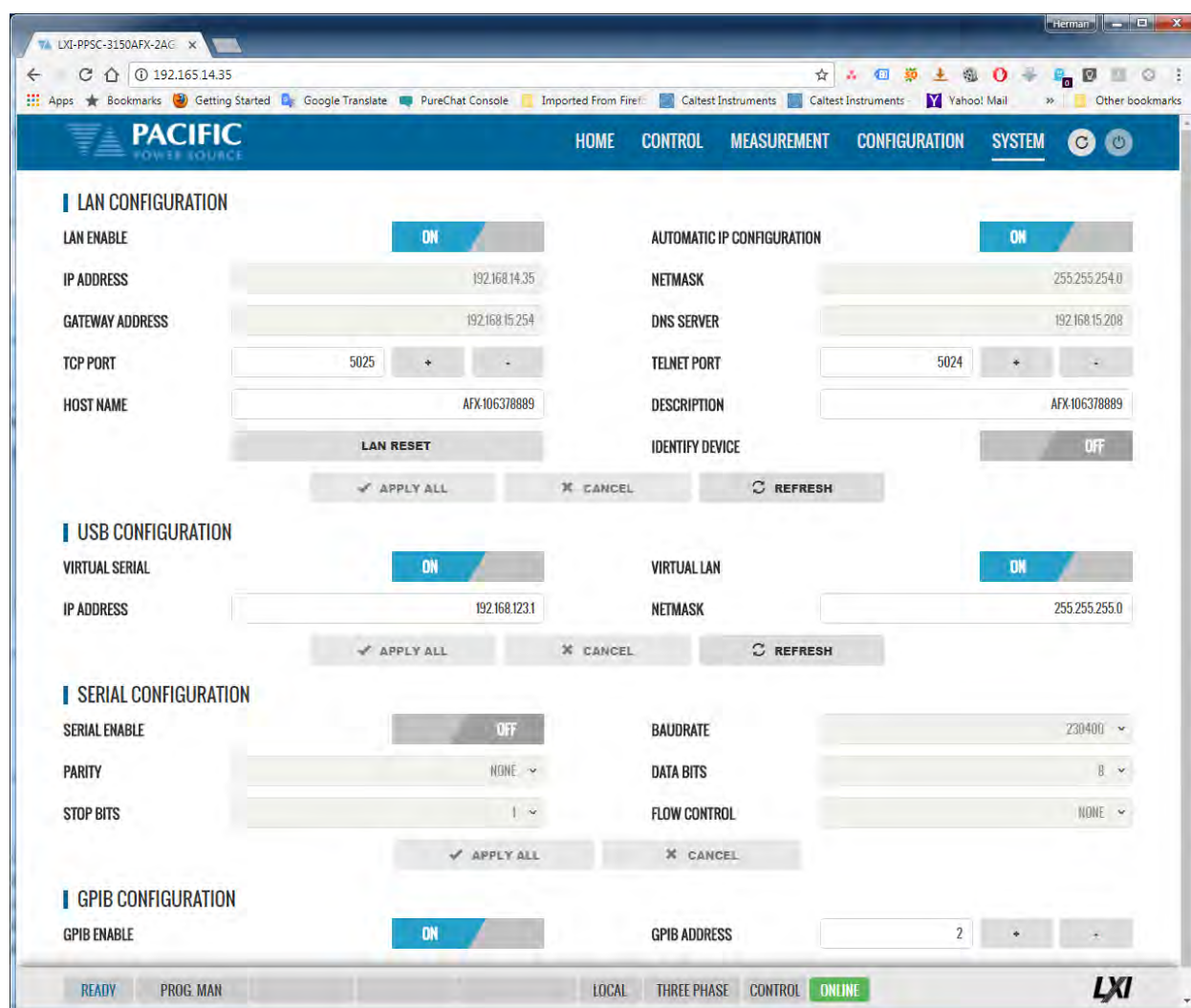
PACIFIC POWER SOURCE				HOME	CONTROL	MEASUREMENT	CONFIGURATION	SYSTEM		
ERROR/EVENTS LIST										
CODE	TYPE	SOURCE	DESCRIPTION							ERROR/EVENT QUEUE
527	Error	Frontpanel	Internal connection error with the power stage.							FAULT LIST
526	Error	Frontpanel	Version mismatch error.							ERROR/EVENT LIST
525	Error	Frontpanel	Cannot import configurations.							INTERFACE SETUP
524	Error	Frontpanel	Cannot export configurations.							ACCESS CONTROL
523	Warning	Frontpanel	Warning: Ambient temperature approaching limit.							UNIT INFORMATION
522	Error	Frontpanel	Argument requires more decimals.							PARALLEL UNITS
521	Error	Frontpanel	Read only file or folder.							MEMORY BROWSER
520	Error	Frontpanel	Inductive impedance not available in UPC compatible mode.							CALIBRATION
519	Error	Frontpanel	Cannot change output impedance mode with output enabled.							REMOTE SUPPORT
518	Error	Frontpanel	Cannot change output impedance state with output enabled.							IMPORT/EXPORT
517	Warning	Frontpanel	Inductive impedance was automatically reduced.							FIRMWARE UPDATE
516	Warning	Frontpanel	Resistive impedance was automatically reduced.							SANITIZE & REBOOT
515	Error	Frontpanel	Too many commands per line.							
514	Error	Frontpanel	Serial port flow control not available in this unit.							
513	Error	Frontpanel	Cannot change split phase mode with output enabled.							
512	Error	Frontpanel	Phase rotation is always negative in UPC compatible mode.							
511	Error	Frontpanel	Error during power stage firmware update.							
510	Error	Frontpanel	Unable to update setpoint because it is outside the allowed range of extended frequency mode.							
509	Error	Frontpanel	Setpoint out of range due to extended frequency mode.							
508	Warning	Frontpanel	Current limits were reduced due to extended frequency mode.							
ENABLED				PROG. MAN		VOLTAGE MODE	LOCAL	THREE PHASE	CONTROL	ONLINE

10.10.4 Interface Setup

The Interface setup screen allows enabling or disabling of several available interfaces and operating modes. The interfaces are arranged by type:

- LAN
- USB
- RS232 Serial
- GPIB (Option) **(Note: on A version ADF Models only)**

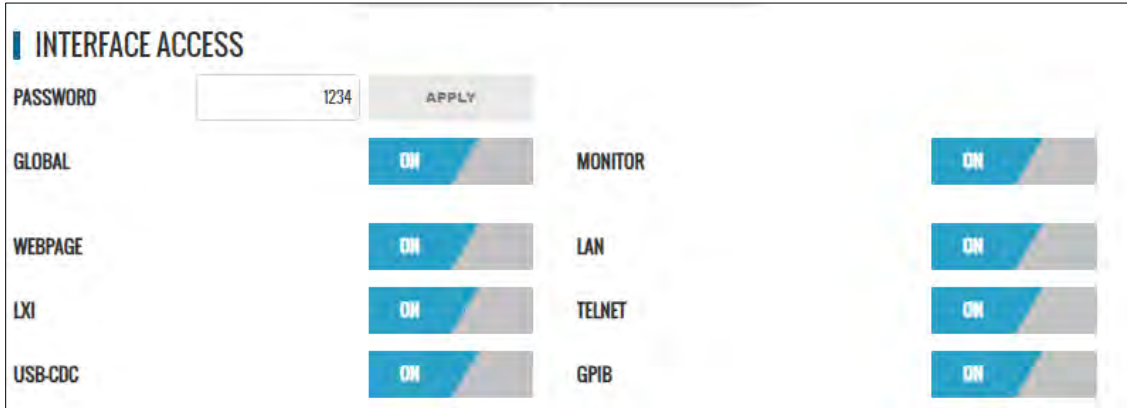
Interfaces that are not used can be turned off to avoid conflicts caused by multiple active interfaces at the user's discretion.



The screenshot displays the Pacific Power Source web interface for LAN configuration. The browser address bar shows the IP address 192.165.14.35. The interface has a blue header with the Pacific Power Source logo and navigation tabs: HOME, CONTROL, MEASUREMENT, CONFIGURATION, and SYSTEM. The CONFIGURATION tab is selected, and the LAN CONFIGURATION section is expanded. This section includes fields for IP ADDRESS (192.168.14.35), GATEWAY ADDRESS (192.168.15.254), TCP PORT (5025), and HOST NAME (AFX106378889). It also has a LAN RESET button and a LAN ENABLE toggle set to ON. To the right, there are fields for AUTOMATIC IP CONFIGURATION (ON), NETMASK (255.255.254.0), DNS SERVER (192.168.15.208), TELNET PORT (5024), and a DESCRIPTION (AFX106378889). Below these are buttons for APPLY ALL, CANCEL, and REFRESH. The USB CONFIGURATION section below it has fields for VIRTUAL SERIAL (ON), IP ADDRESS (192.168.123.1), and NETMASK (255.255.255.0), with similar apply buttons. The SERIAL CONFIGURATION section shows SERIAL ENABLE (OFF), PARITY (NONE), STOP BITS (1), and BAUDRATE (230400). The GPIB CONFIGURATION section shows GPIB ENABLE (ON) and GPIB ADDRESS (2). At the bottom, there are status buttons: READY, PROG. MAN, LOCAL, THREE PHASE, CONTROL, and ONLINE (highlighted in green), along with the LXI logo.

10.10.5 Access Control

The access control screen allows restricting access to the power source over the LAN interface. This is an important requirement for power sources connected to a company wide Ethernet network. Without access restrictions, persons not present where the power source is located could inadvertently cause a dangerous condition by either enabling the OUTPUT or changing programmed settings.



INTERFACE ACCESS	
PASSWORD	1234 APPLY
GLOBAL	ON
MONITOR	ON
WEBPAGE	ON
LAN	ON
LXI	ON
TELNET	ON
USB-CDC	ON
GPIB	ON

Access control can limit access from specific IP addresses only and requires someone physically present where the power source is to grant access to anyone else.

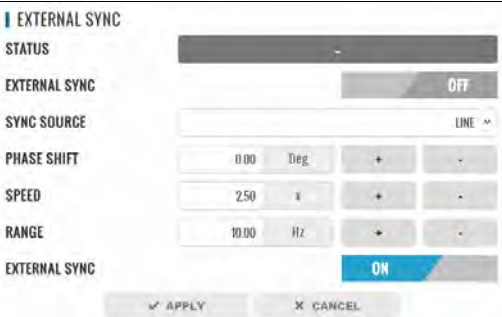
For more details, refer to section 10.3, “Access Control” on page 366 of this manual.

10.10.6 Digital & Analog IO's

The Digital and Analog IO screen allows configuration of the available Auxiliary I/O functions. Note that this feature is not available on ADF-2L and ADF-4L models.

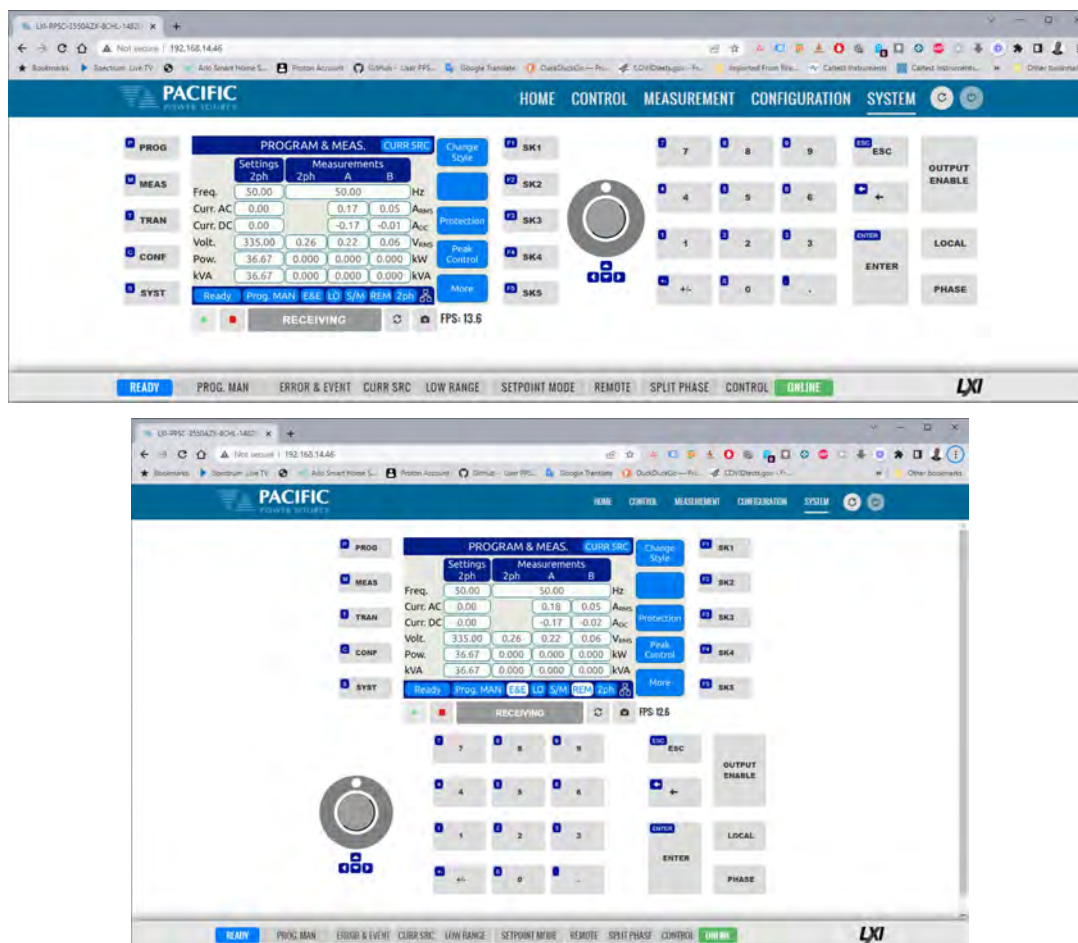
There are eight groups of functions that are available to be configured with the selectable settings listed in the table below.

Grouping	Controls
Analog Inputs: CHANNEL [1 2 3 4] INPUT VOLTAGE Displays read back voltage COMMAND Select command from dropdown list or OFF for none RANGE 0.0000 – 10.000 V GAIN Gain OFFSET Offset value	
Analog Outputs: CHANNEL [1 2 3 4] OUTPUT VOLTAGE Output setting MEASUREMENT Select measurement to be assigned to output RANGE 0.0000 – 5.000 V GAIN Gain 0.000 - 1000 OFFSET Offset value – 1000 ~+1000	
Digital Inputs: CHANNEL [1 2 3] STATE Displays input state RISING CMD Set command string to execute on rising edge FALLING CMD Set command string to execute on falling edge FILTER SIZE 0 – 10,000,000 msec	
Digital Outputs: CHANNEL [1 2 3 4] STATE Displays current state FUNCTION Assigns state to selected channel. Available states are: FAULT FORM HIGH LOW OUTPUT STATE PROGRAM REMOTE TRANSIENT INV. LOGIC [ON OFF] Reverses polarity	

Grouping	Controls
Trigger Input: STATUS [ON OFF] Enabled or disabled IMMEDIATE [ON OFF] Ignore phase update setting if ON AUTORUN [ON OFF] No RUN command required if ON	
—Strobe Output: TRANSIENT ON = Strobe output on transient start OUTPUT STATE ON = Strobe output on relay close SOURCE ON = Strobe output on any program parameter change	
External Sync: STATUS Display SYNC Status EXTERNAL SYNC [ON OFF] SYNC SOURCE Select Sync source Available sources are: - External sync input on I/O connector - LINE (AC input to power source) PHASE SHIFT Offset Phase A angle SPEED 1.00 ~ 10.00 RANGE 0.10 ~ 500 Hz EXTERNAL SYNC [ON OFF]	
Remote Controls: DISABLED No remote output control REMOTE INHIBIT Contact closure needed to close output relay REMOTE ENABLE Contact closure or front panel can control output relay See section 5.18.3	

10.10.7 Remote Interface (Virtual Front Panel)

The Remote Interface browser screen provides a virtual front panel that allows controlling the power source from a remote location using a PC, tablet or smart phone. The screen layout is a function of the web hosting device screen width. If wide enough, the layout will match that of the actual front panel of the power source. If too narrow for a landscape view, the front panel will be divided between the LCD screen, function and soft keys on top and the know plug decimal keypad and other control beneath it. Both layouts are shown below.



The operation of this Virtual Front panel is identical of that of the physical front panel so refer to Section 6, “Front Panel Operation” on page 81 for user information. The operation of this Virtual Front panel is identical of that of the physical front panel so refer to Section 6, “Front Panel Operation” on page 81 for user information. The controls located directly below the virtual LCD screen may be used when the internet connection used is slow or there is too much latency.



Available controls are:

-  Enable continuous update mode. In this mode, the status bar will show .
-  Stop continuous updated mode. The connection status will show .

RECEIVING Status Bar shows state of connection to the power source. Clicking on it will toggle connections status between **DISCONNECTED** and **CONNECTED**.

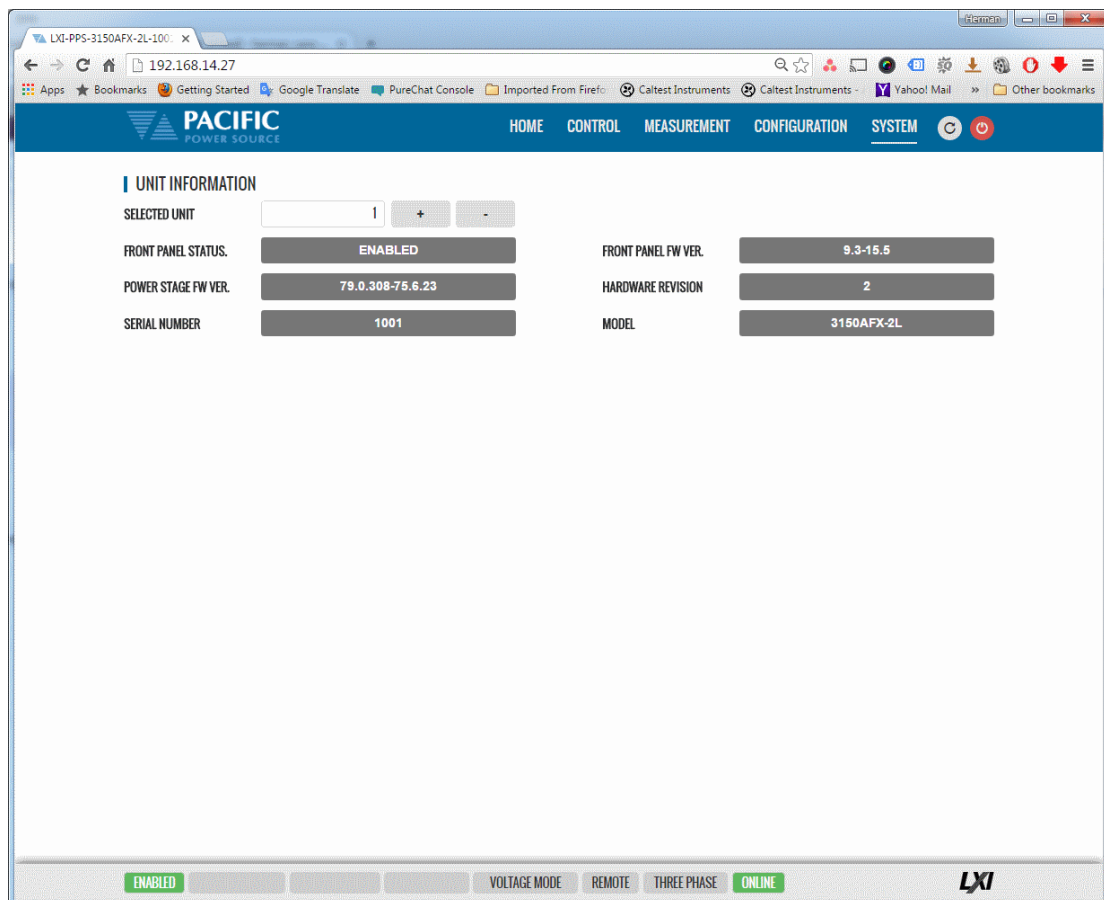
 Refresh button may be used when continuous updates are off to refresh the display

 Click to download a .png image of the virtual LCD display.

The status field to the right of the control buttons display the measurement frame update rate. In the example shown here the frame rate is 14.6 frames per second.

10.10.8 Unit Information

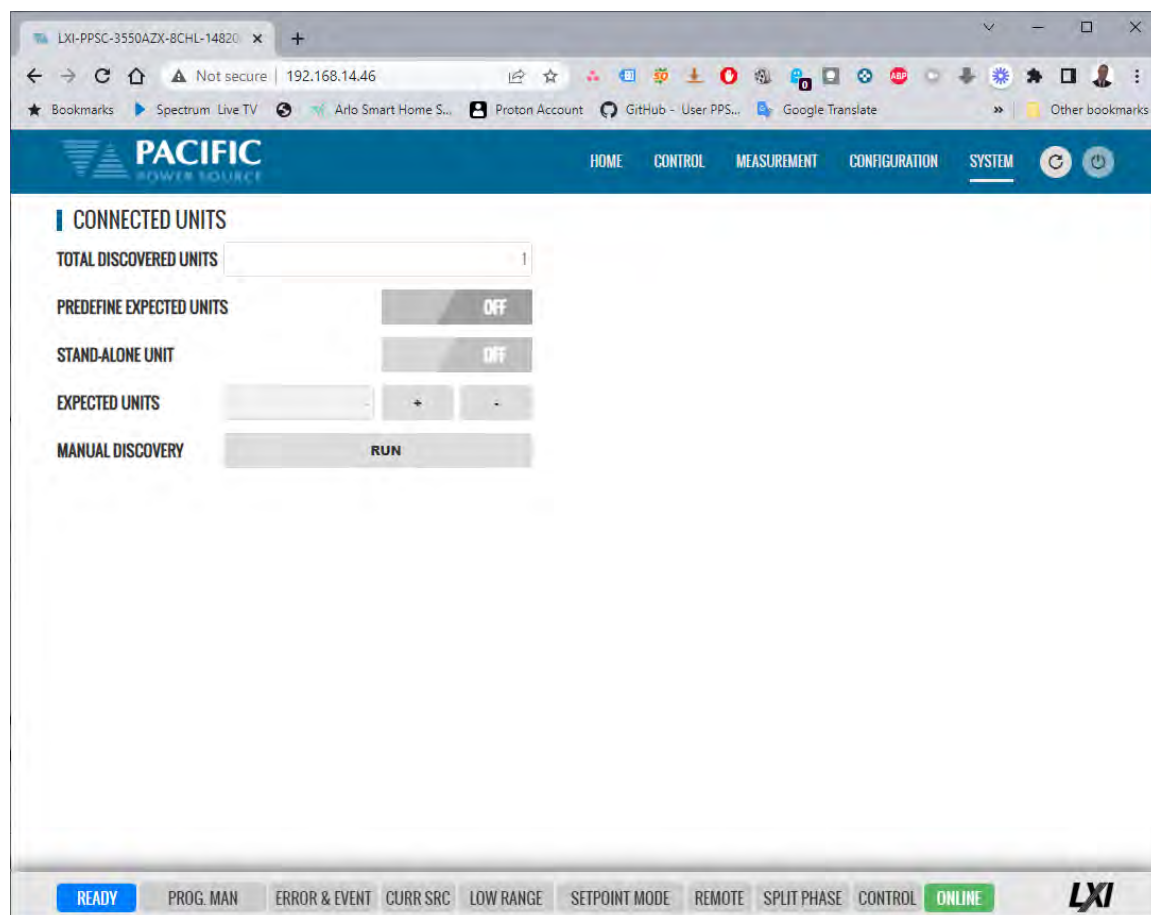
The Unit Information screen contains some of the same information as is found on the HOME screen but it can be used to query this information from one or more auxiliary unit as well in a parallel system. The HOME screen will only display information for the Master unit of a parallel configured system. Use the SELECTED UNIT control to select units downstream from the master (1).



10.10.9 Connected Units

The Connected Units screen displays the number of powered on units connected in either a Parallel or Series system. It also allows the expected number of units to be set so the master can determine if all connected units are indeed turned on before starting operation.

The MANUAL DISCOVERY can be run to refresh the system configuration if a unit has been turned on or off without power cycling the master.



The screenshot shows a web browser window with the URL 192.168.14.46. The page title is 'LXI-PPSC-3550AZX-8CHL-14820'. The browser's address bar shows 'Not secure | 192.168.14.46'. The page features a blue header with the 'PACIFIC POWER SOURCE' logo and navigation tabs: 'HOME', 'CONTROL', 'MEASUREMENT', 'CONFIGURATION', and 'SYSTEM'. The 'CONNECTED UNITS' section is active, displaying the following controls:

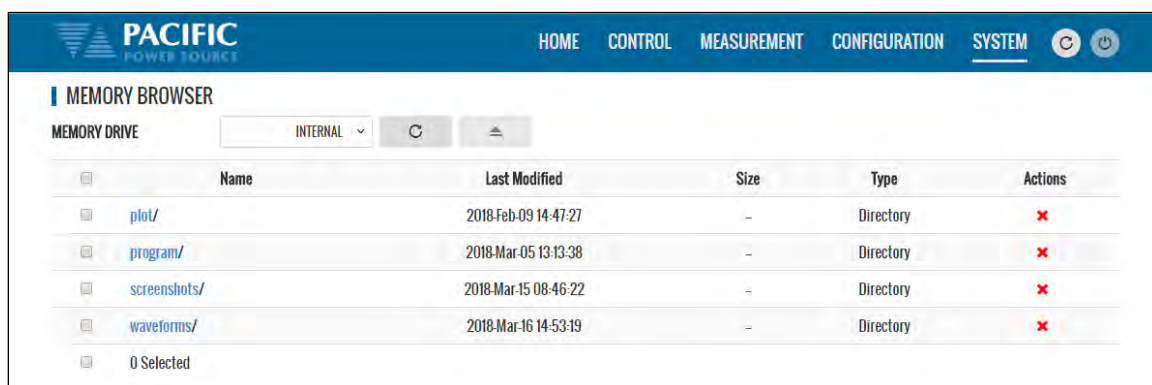
- TOTAL DISCOVERED UNITS:** A text input field showing the value '1'.
- PREDEFINE EXPECTED UNITS:** A toggle switch set to 'OFF'.
- STAND-ALONE UNIT:** A toggle switch set to 'OFF'.
- EXPECTED UNITS:** A range selector with a minimum of 1, a maximum of 10, and a '+' button to increase the value.
- MANUAL DISCOVERY:** A button labeled 'RUN'.

The bottom status bar includes the following indicators: 'READY', 'PROG. MAN', 'ERROR & EVENT', 'CURR SRC', 'LOW RANGE', 'SETPOINT MODE', 'REMOTE', 'SPLIT PHASE', 'CONTROL', 'ONLINE', and the 'LXI' logo.

10.10.10 Memory Browser

The Memory Browser screen shows available memory devices connected to the instrument including internal memory and available directories and files. All data and setup files are in XML format. Waveform files are stored in CSV format. Screen captures are stored in PNG image format.

Available MEMORY DRIVES are INTERNAL, RAM and any USB or SD-Card memory devices that are mounted.

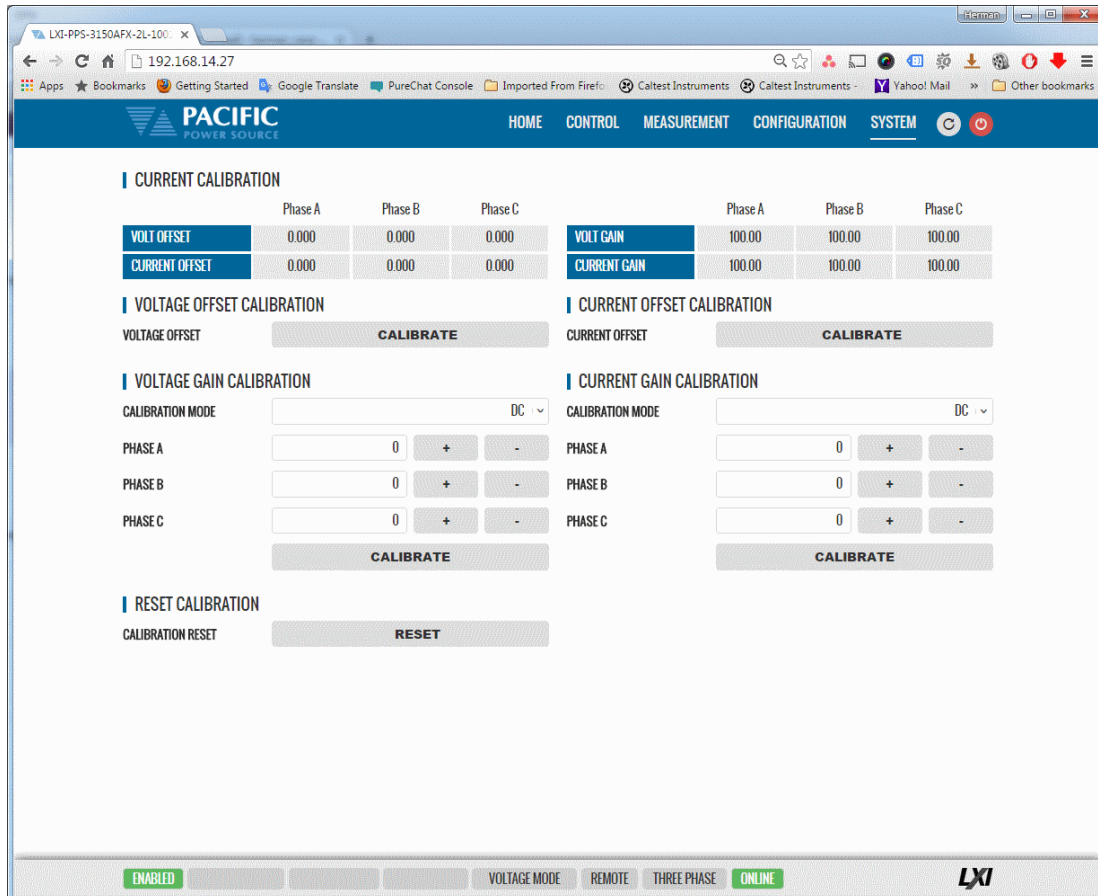


Useful directories for the user are:

DIRECTOR	FILES IN THIS DIRECTORY
plot/	Data logger plots in csv file format with date and time stamp
program/	Power source program settings
screenshots/	Screen capture image files in .png format with date and time stamp. To capture any LCD display, press the LOCAL key and the number 1 key on the decimal keypad at the same time.
waveforms/	User waveform data points in csv file format.

10.10.11 Calibration

The Calibration screen shows all user accessible calibration coefficients. It also allows for user calibration of voltage and current to be performed. The Web Browser user interface is specific but the procedures and equipment are the same as calibration from the front panel. Refer to Section 11.4, “Calibration Procedures” for details.



CURRENT CALIBRATION

	Phase A	Phase B	Phase C
VOLT OFFSET	0.000	0.000	0.000
CURRENT OFFSET	0.000	0.000	0.000

	Phase A	Phase B	Phase C
VOLT GAIN	100.00	100.00	100.00
CURRENT GAIN	100.00	100.00	100.00

VOLTAGE OFFSET CALIBRATION

VOLTAGE OFFSET

VOLTAGE GAIN CALIBRATION

CALIBRATION MODE

PHASE A

PHASE B

PHASE C

CURRENT OFFSET CALIBRATION

CURRENT OFFSET

CURRENT GAIN CALIBRATION

CALIBRATION MODE

PHASE A

PHASE B

PHASE C

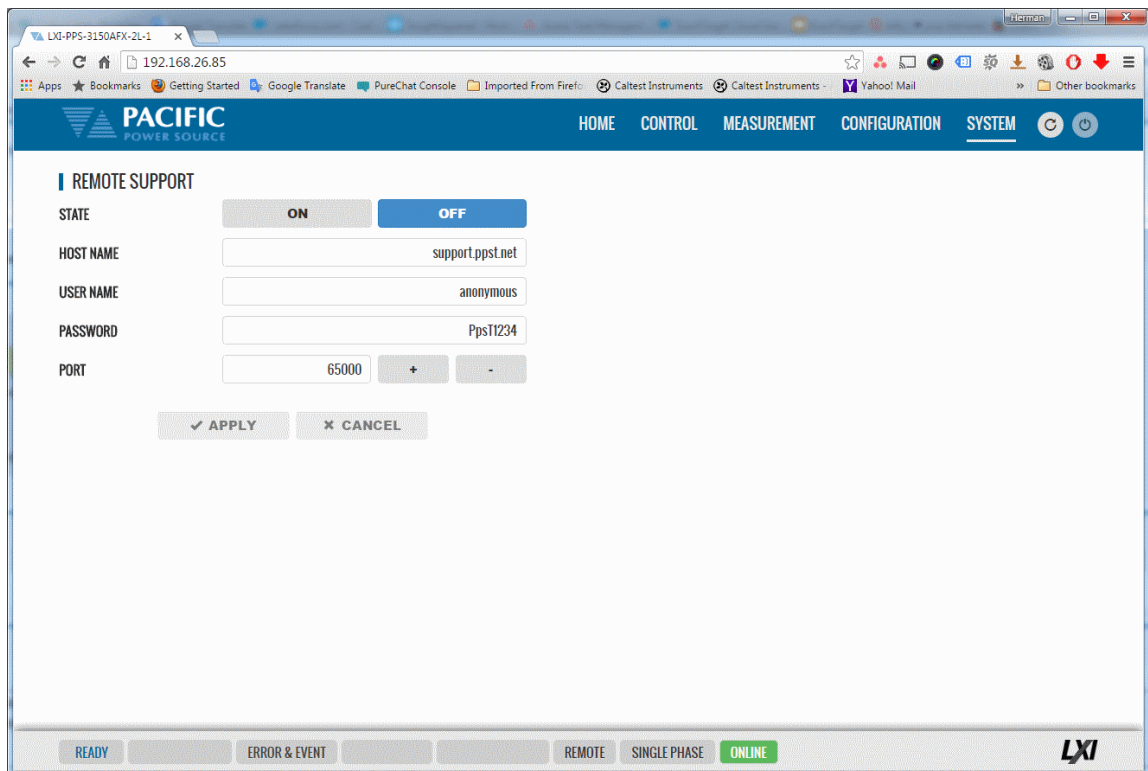
RESET CALIBRATION

CALIBRATION RESET

ENABLED LXI

10.10.12 Remote Support

The Remote Control screen allows Pacific Power’s technical support staff to access the unit remotely if granted permission. Internet access is required for this feature.



The screenshot shows the 'REMOTE SUPPORT' configuration page. The 'STATE' is set to 'OFF'. The 'HOST NAME' is 'support.ppst.net', 'USER NAME' is 'anonymous', 'PASSWORD' is 'PpsT1234', and 'PORT' is '65000'. There are 'APPLY' and 'CANCEL' buttons at the bottom of the form. The top navigation bar includes 'HOME', 'CONTROL', 'MEASUREMENT', 'CONFIGURATION', and 'SYSTEM'. The bottom status bar shows 'READY', 'ERROR & EVENT', 'REMOTE', 'SINGLE PHASE', and 'ONLINE'.

10.10.13 Import / Export

A compressed file containing complete system configuration data for the power source can be exported to a file and imported back into the unit as needed. Files are .7z compressed to maximize storage space. Use the Export button on the right to export (save) current configuration data. Use the Browse button to select and import (load) a previously saved configuration file.



The screenshot shows the 'SYSTEM IMPORT' and 'SYSTEM EXPORT' sections. The 'SYSTEM IMPORT' section has a 'SYSTEM FILE' field and a 'Browse' button. The 'SYSTEM EXPORT' section has a 'SYSTEM FILE' field and an 'EXPORT' button. A blue box contains the text: 'The system importation uses a compressed file (.7z) that could include unit configurations, waveforms, programs and setpoints. After an importation process the unit will perform a reboot.' The top navigation bar includes 'HOME', 'CONTROL', 'MEASUREMENT', 'CONFIGURATION', and 'SYSTEM'. The bottom status bar shows 'READY', 'ERROR & EVENT', 'REMOTE', 'SINGLE PHASE', and 'ONLINE'.

10.10.14 Firmware Update

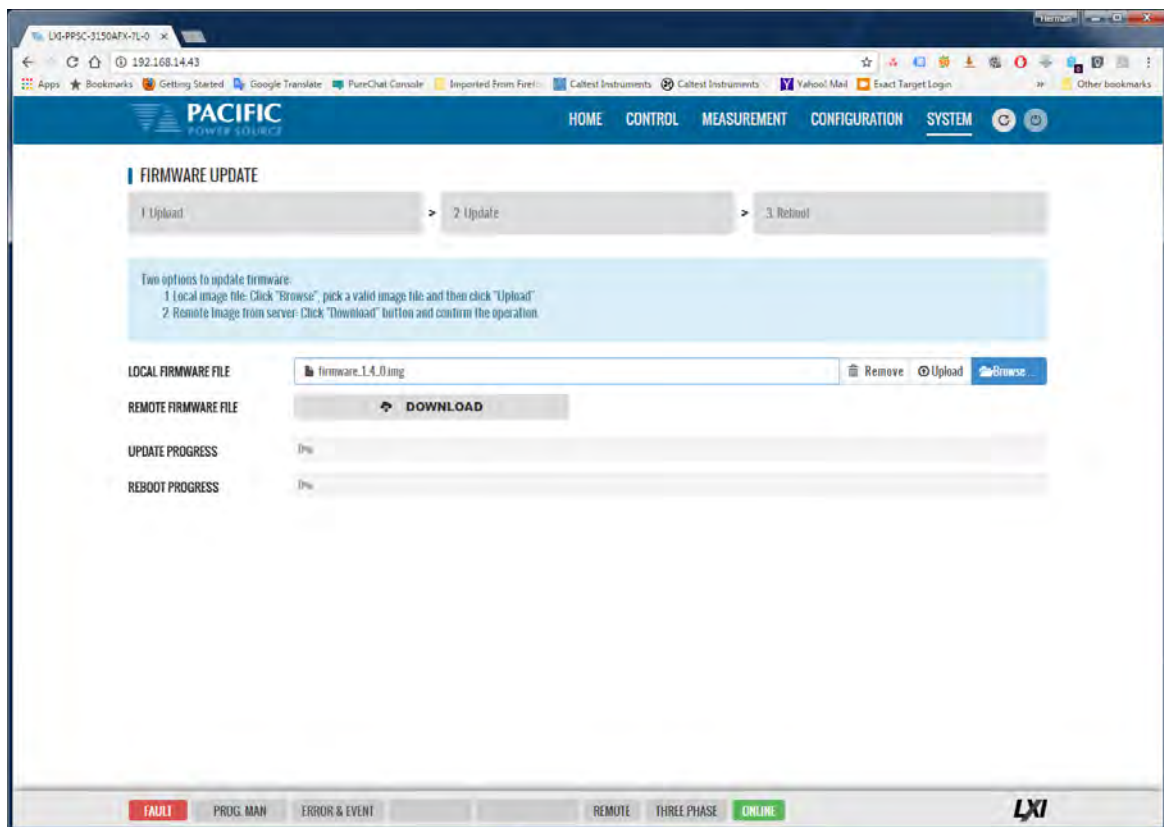
The Firmware update screen can be used to install new firmware for a file. New firmware may be distributed by email or from Pacific's FTP site. Note that the OUTPUT of the unit must be OFF to perform a firmware update.

If you received a firmware image file (.img extension):

- Use the  button to select it from the drive location you saved it to.
- Then use the  button to upload new firmware to the power source.

To install new firmware from the Pacific Power FTP server:

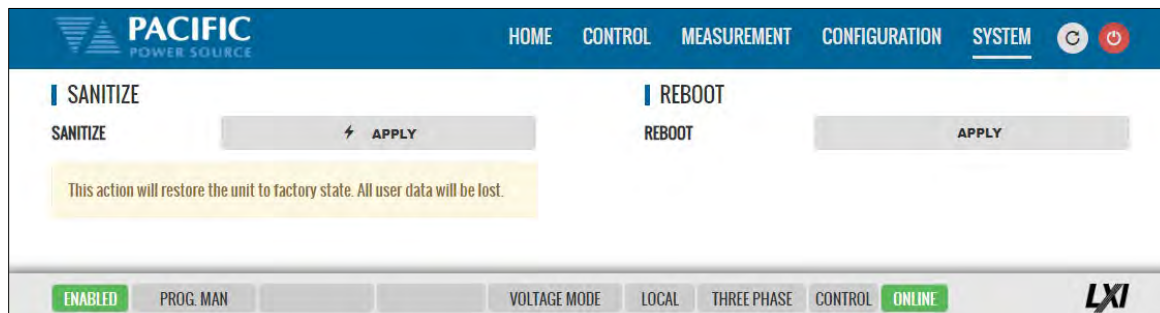
- Click the  button.



10.10.15 Sanitize and Reboot

This screen allows the unit to be cleared of all user settings. This applies to waveforms, settings, transients etc. The unit will be reset to factory default conditions.

The Reboot allows the power source to be rebooted (reset) without cycling AC input power.



The screenshot shows the Pacific Power Source web interface. The top navigation bar includes links for HOME, CONTROL, MEASUREMENT, CONFIGURATION, and SYSTEM. The SYSTEM tab is active. Below the navigation bar, there are two main sections: SANITIZE and REBOOT. The SANITIZE section has a button labeled 'APPLY' with a lightning bolt icon. The REBOOT section has a button labeled 'APPLY'. A yellow warning box states: 'This action will restore the unit to factory state. All user data will be lost.' At the bottom of the interface, there is a status bar with various indicators: ENABLED, PROG. MAN, VOLTAGE MODE, LOCAL, THREE PHASE, CONTROL, and ONLINE. The LXI logo is also present in the bottom right corner.

10.11 Additional Functions

Additional function may be added over time through firmware updates that may not be covered by this user manual revision. If so, check the Pacific Power website for update manual versions. (www.pacificpower.com).

10.11.1 Sharing Options – FTP & SAMBA

Units with firmware revision 2.1.0 or higher support a network based sharing feature. Two protocols. These can be enabled from the Sharing Options screen. For more details, refer to 6.8.5.10, “REMOTE SHARING” on page 150.



The screenshot shows the Pacific Power Source web interface. The top navigation bar includes links for HOME, CONTROL, MEASUREMENT, CONFIGURATION, and SYSTEM. The SYSTEM tab is active. Below the navigation bar, there is a section titled 'SHARING OPTIONS'. This section contains two main areas: SAMBA and FTP. The SAMBA area has a 'USERNAME' field with the value 'user', a 'PASSWORD' field with the value 'password', and a toggle switch for 'ON'. The FTP area has a 'PASSWORD' field with the value 'password' and a toggle switch for 'ON'. The LXI logo is also present in the bottom right corner.

11 Calibration

11.1 Calibration Interval

All units are shipped new from the factory with NIST traceable calibration. It is recommended to perform an annual calibration check to ensure performance to specifications. Under normal circumstances, no adjustment will be needed but can be made as part of the user calibration coefficients.

11.2 Closed Case User Calibration

This section covers routine calibration that can be performed by the user. User calibration does not affect the factory set calibration coefficients that were determined and set at the time of shipment to ensure compliance with published specifications. Rather, user calibration can be used to obtain enhanced performance at typical operating conditions by adjusting these user coefficients at these conditions. For example, if the unit is used primary for testing 400Hz, three phase 115V L-N three phase operation, calibrating the user coefficients to these operating conditions against an external precision reference can provide enhanced performance versus published specifications (See Section 4, “Technical Specifications”).

Since user calibration does not affect factory calibration settings, resetting all user calibration coefficients does not invalidate the units specified performance and it can be used with all user coefficients reset as needed.

Note: There are no analog adjustment pots in this instrument and all calibration can be performed from the front panel or over one of the digital control interfaces.

11.3 Equipment Required

The following list of equipment or equivalent is required to perform routine annual calibration of the instrument. Current sensor options are determined by need for AC, DC or both.

Item	Make	Model	Notes
1	Keysight	34465A	6 ½ Digit DMM or equivalent
2	Current Transformer (AC Only)	Pearson	Model 110, 65 Arms Max. 5000Apk Max. 0.1V/A +1/-0%, Rout = 50 Ohms http://www.pearsonelectronics.com/products/current-monitors
3	Current Sensor (AC and DC)	LEM	IT 200-S ULTRASTAB, 200 A, ± 0.0086% Accuracy, 50 kHz BW or equivalent. https://www.lem.com/en/product-list/it-200s-ultrastab Requires precision burden resistor for direct DMM measurements, i.e. Reidon, P/N SM10-100RX, 0.01% 100 Ohm, 0.3W, qty 2 or 3 in parallel for 50 Ohm or 33.3 Ohm burden https://www.digikey.com/product-detail/en/riedon/SM10-100RX/696-1568-ND/4832952
4	Current Shunt (DC)	Ohm-Labs	CS-200, Shunt, 1 mOhm, 0.02% Accuracy @ DC to 50/60 Hz or equivalent http://www.ohm-labs.com

Table 11-1: Required Calibration Equipment

11.4 Calibration Procedures

Calibration of output and measurements is performed by a single procedure so there is no need to calibrate each separately. Calibration involves voltage and current full scale and offset on each phase. For three-phase mode, this means there are twelve calibration points, for single-phase mode, there are four.

The calibration can be performed manually using the Calibration menu (refer to Section 6.8.10 for the location of the Calibration menu) or through the build-in web server using the web browser interface. Refer to Section 10.10.11, "Calibration" for access to the Web based calibration screens.

Note: Output Terminals pin configurations differ between standard 3xxxADF units and ADF units with the "W" isolated neutrals option configured. Calibration setup figures for both are included in this section.

11.4.1 Voltage Calibration - Offset

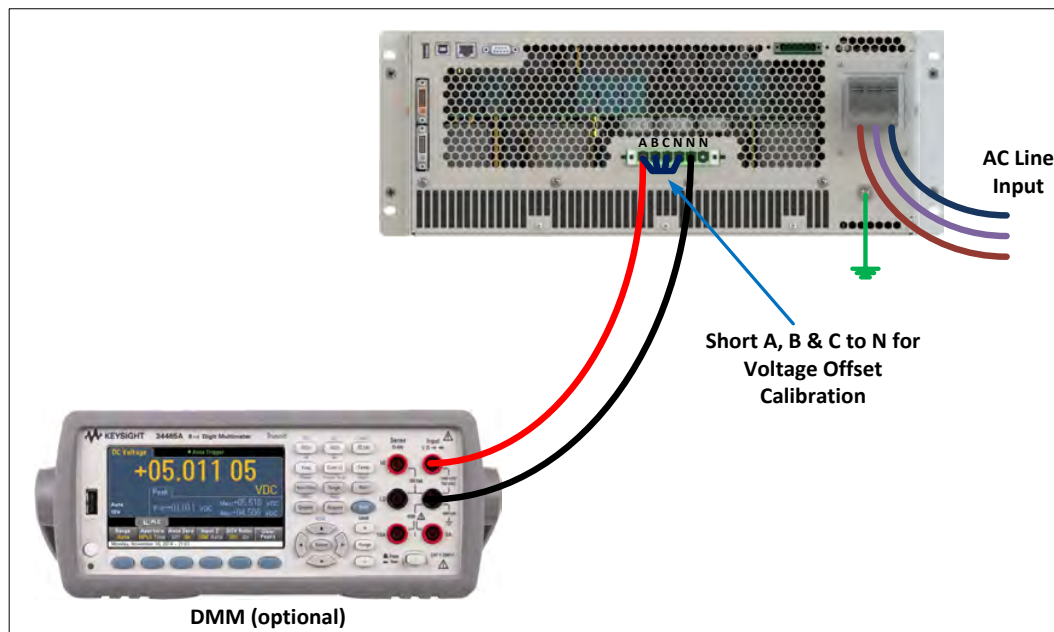


Figure 11-1: Voltage Offset Calibration – Standard ADF

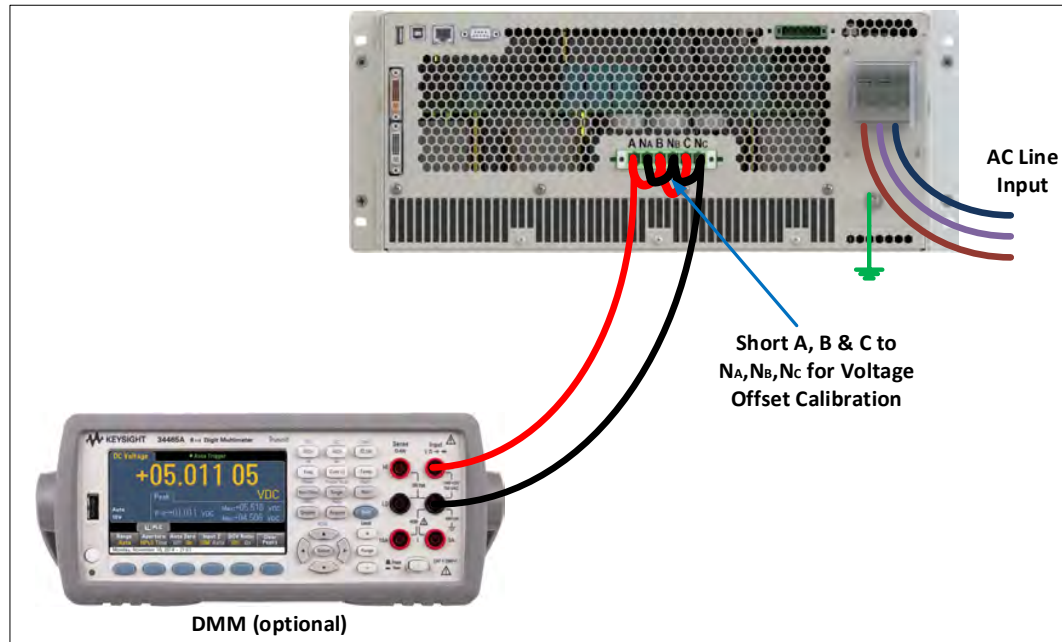
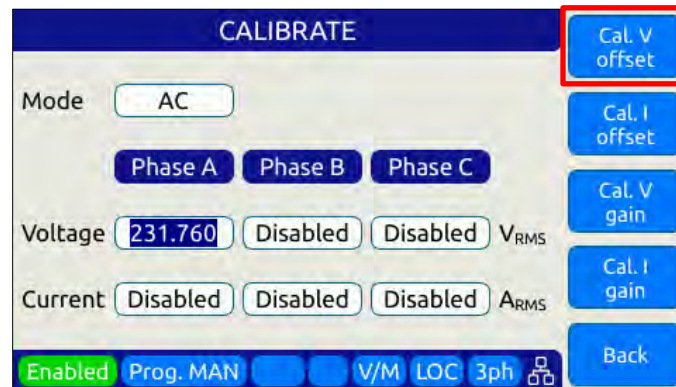


Figure 11-2: Voltage Offset Calibration – 3xxxADF-W

The procedure to calibrate voltage offset is:

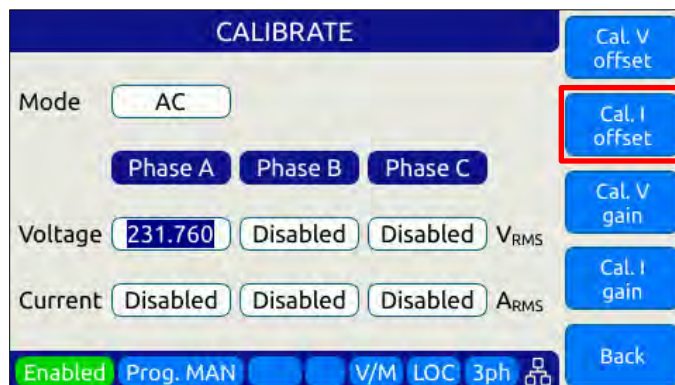


1. Select the Calibration entry from the “System” menu
2. Press the “Calibrate” soft key to enter calibration mode
3. Short all phases to neutral using a shorting jumper
4. You can connect the DMM to the output of phase A as shown in the figure above but it is not required for this calibration step.
5. **IMPORTANT:** Program AC voltage to all **zero volts** to avoid any current from flowing into the shorted outputs. Use PROGRAM screen to make sure AC settings are zero.
6. Enable the Output with the output shored.
7. Press "Cal V. offset" soft key
8. Wait for the V offset coefficients for all phases to be calculated and displayed
9. Remove the shorting jumper when done

Note: The Mode, Voltage and Current edit boxes do not affect this function.

11.4.2 Current Calibration - Offset

The procedure to calibrate current offset is:



1. Select the Calibration entry from the “System” menu
2. Press the “Calibrate” soft key to enter calibration mode
3. Do not connect any load to the output
4. Enable the Output with no load connected
5. Press "Cal I. offset" soft key
6. Wait for the I offset coefficients for all phases to be calculated and displayed

Note: The Mode, Voltage and Current edit boxes do not affect this function.

11.4.3 Voltage Calibration - Gain

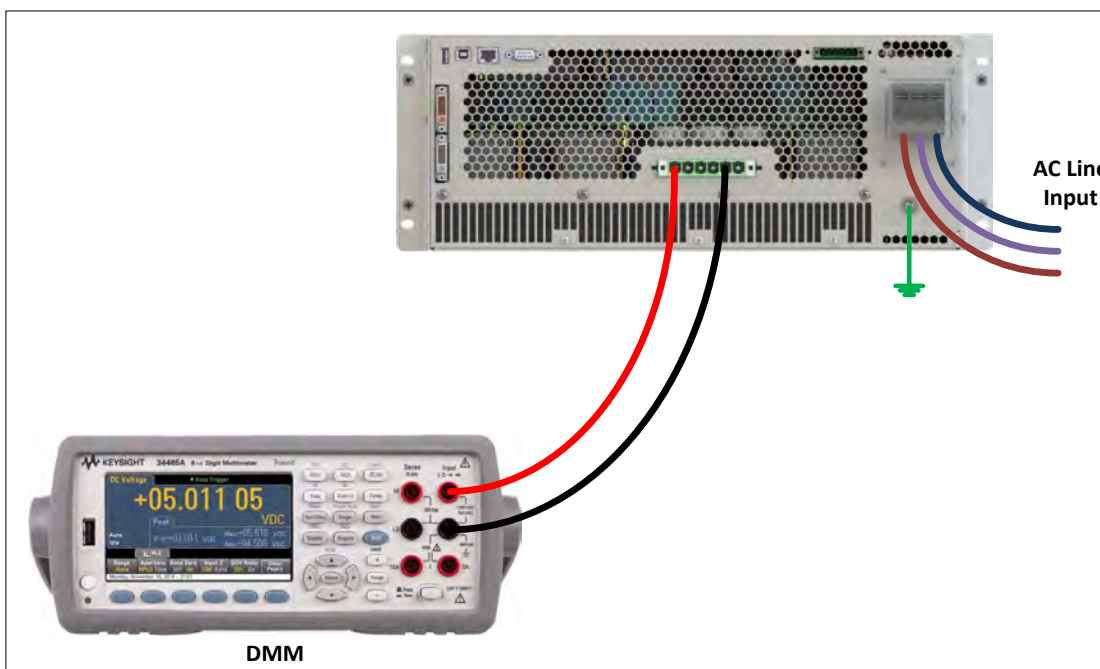


Figure 11-3: Voltage Calibration – 1 or 3 Phase Mode – Phase A – Standard ADF

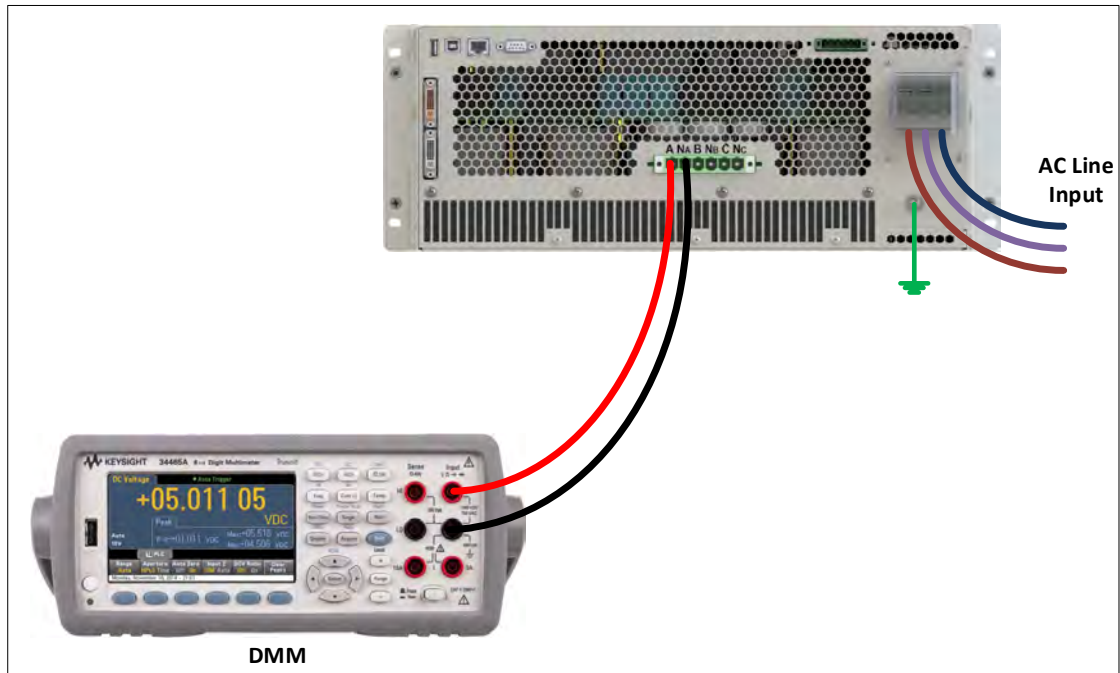
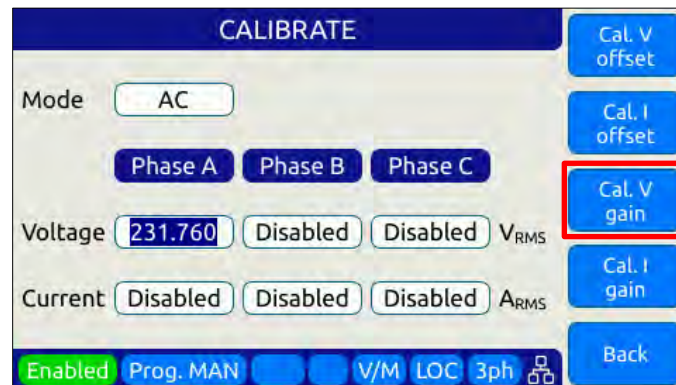


Figure 11-4: Voltage Calibration – 1 or 3 Phase Mode – Phase A – 3xxxxADF-W

The procedure to calibrate voltage gain is:



1. Select the Calibration entry from the “**System**” menu
2. Press the “Calibrate” soft key to enter calibration mode
3. Do not connect any load to the output
4. Program AC voltage to full scale 300.0 V_{rms} L-N for AC mode calibration on all phases. Use the PROGRAM screen for this.
5. For AC mode calibration, set the Frequency to the most commonly used value depending on typical applications
6. NOTE: If the user calibration is targeted for specific operating conditions, for example V_{ac} = 115V L-N and Freq = 400 Hz, use these settings instead of those suggested in steps 4 and 5
7. Enable the Output with no load connected

8. Enter the DMM VAC readings for all three phase in the respective Voltage data entry text boxes in the Calibration screen. Move the DMM probe from phase A, to B to C respectively to obtain each phase reading.
9. Press "Cal V. gain" soft key
10. Wait for the V gain coefficients for all phases to be calculated and displayed

11.4.4 Current Gain Calibration Setup Diagrams

For current calibration, a resistive load equivalent to 90% of maximum available RMS phase current for the phase mode selected is recommended. It is permissible to use only one load and move it between phases for three-phase mode calibration. For single-phase mode current calibration, a load capable of supporting 90% of maximum available single-phase current is recommended. The A, B and C outputs must be shorted together for single-phase mode operation. The optional Single Phase Shorting Connector (P/N 160086) can be used to accomplish this.

Note: To guarantee that the current doesn't change during the calibration process, it is recommended that the unit is operated at current limit, but reducing its set point to the desired value. It is also recommended to use a stable load that provides a constant linear impedance to the unit.

A suitable current shunt must be connected in series with the load as shown below for three-phase mode. The sense terminals of the current shunt must be connected to the DMM Voltage input.

Three Phase Mode Setup

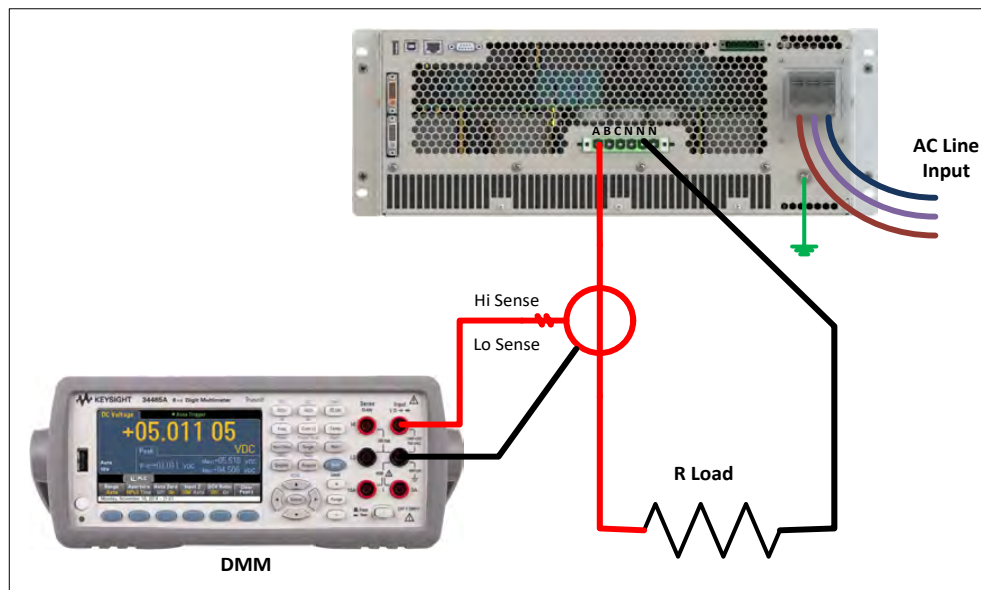


Figure 11-5: Current Calibration – 3 Phase Mode – Phase A – Standard ADF

Single Phase Mode Setup

For Single-phase mode current Calibration, the load must have the appropriate size. See next section for recommended load value by model and phase mode.

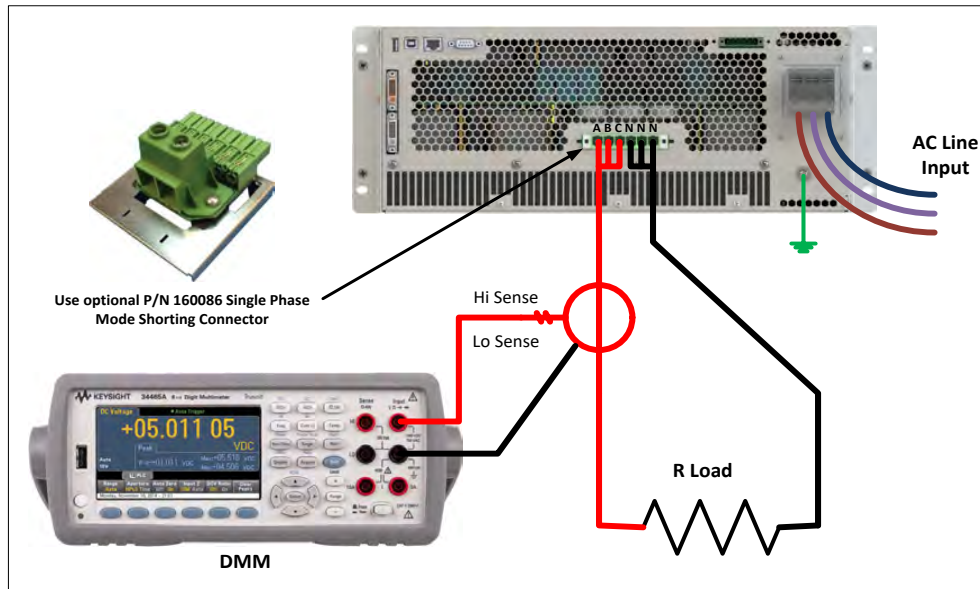


Figure 11-6: Current Calibration Equipment Setup – 1 Phase Mode

11.4.5 Current Calibration Load Values

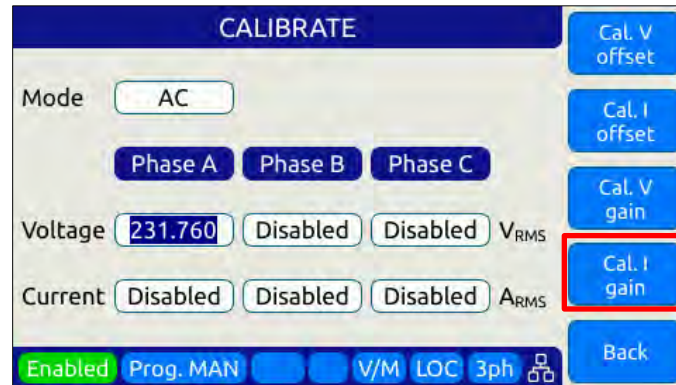
Full-scale current gain calibration is best performed at current levels that are around 90% of full scale current. Since the ADF Series® has only a single voltage range, maximum RMS current is available at 120Vrms L-N for each phase. For single-phase mode, the current is three times higher. Thus, to obtain 90% of load current, resistor value that is sized to draw this current level at around 120Vrms is required. Since the maximum current varies by model and phase mode, the table below shows the recommended resistor values or resistive load bank settings.

Model	Rating/phs VA/W	Three & Two Phase Mode Calibration			Single Phase Mode Calibration		
		Max. I _{rms} /phs	Current (90%)	Recommended R Load (Ohm)	Max/ I _{rms}	Current (90%)	Recommended R Load (Ohm)
190ADF	9000				75.0	67.5	1.07
390ADF	3000	25.0	23	5.33			
1150ADF	15000				125.0	113	1.07
3150ADF	5000	41.7	38	3.20			
3300ADF	10000	83.3	75	1.60			
3450ADF	15000	125.0	113	1.07			
3600ADF	20000	166.7	150	0.80			

Table 11-2: Calibration Load Values by Model and Phase Mode

11.4.6 Current Calibration - Gain

The procedure to calibrate current gain is:



1. Select the Calibration entry from the “**System**” menu
2. Press the “Calibrate” soft key to enter calibration mode
3. Connect the required resistive load value to the output of phase A or all three outputs if three loads are available.
4. Program AC voltage to 120.0 Vrms L-N on all phases
5. Set the Frequency to the most commonly used value depending on typical applications
6. Enable the Output
7. Allow the load current to stabilize by monitoring the DMM current reading for each phase.
8. Enter the DMM VAC readings for all three phase in the respective Current data entry text boxes in the Calibration screen. If only one shunt and load is available, repeat the above steps for phase B and C making sure to turn OFF the output before moving the load and shunt to the next phase.
9. Press "Cal I. gain" soft key
10. Wait for the I gain coefficients for all phases to be calculated and displayed

11.4.7 Exit Calibration Mode

To exit the calibration mode once done, press the “**Back**” software.

12 Warnings & Error Messages

12.1 Preface

During normal operation, a series of error and/ or warning messages may be displayed on the front panel LCD display or reported by the error queue over one of the remote control interfaces. This section of the manual lists available warning and error messages in numerical order and provided some additional information on their meaning and possible causes. Where relevant, suggested remedies to resolve any conditions are included as well.

Note: There are some Error and Warning messages that may appear in the Errors & Events that are **NOT** listed in the next section. In case you encounter an unlisted error or warning message and code, contact Pacific Power customer service (support@pacificpower.com) and describe the number and description to obtain further information.

After reporting such an event, try rebooting the power sources by cycling power as most of these conditions will clear up with a reboot.

12.2 Errors & Warnings Messages in Numeric Order

Source	Code	Type	Description	Possible cause
Frontpanel	-500	"SCPI standard event"	"Event: Power ON."	Power on event detected. Normal after power on
Frontpanel	-350	"SCPI standard event"	"E&E queue overflow."	
Frontpanel	-360	"SCPI standard error"	"Communication error with an interface."	
Frontpanel	-320	"SCPI standard error"	"Storage fault."	
Frontpanel	-310	"SCPI standard error"	"System error"	
Frontpanel	-290	"SCPI standard error"	"Execution error: Memory use error."	
Frontpanel	-286	"SCPI standard error"	"Execution error: Not allowed command with the current configuration."	
Frontpanel	-285	"SCPI standard error"	"Execution error: Program syntax error."	
Frontpanel	-284	"SCPI standard error"	"Execution error: Program is currently running."	
Frontpanel	-282	"SCPI standard error"	"Execution error: Invalid program name."	
Frontpanel	-281	"SCPI standard error"	"Execution error: Cannot create program."	
Frontpanel	-256	"SCPI standard error"	"Execution error: File not found."	
Frontpanel	-253	"SCPI standard error"	"Execution error: Media is corrupted."	
Frontpanel	-240	"SCPI standard error"	"Execution error: Hardware error."	
Frontpanel	-224	"SCPI standard error"	"Execution error: Illegal parameter value."	
Frontpanel	-222	"SCPI standard error"	"Execution error: Argument out of range."	
Frontpanel	-221	"SCPI standard error"	"Execution error: Conflict in configuration setting."	
Frontpanel	-203	"SCPI standard error"	"Execution error: Permission denied."	
Frontpanel	-158	"SCPI standard error"	"Command error: String data is not allowed."	
Frontpanel	-138	"SCPI standard error"	"Command error: Numeric suffix is invalid."	

Source	Code	Type	Description	Possible cause
Frontpanel	-131	"SCPI standard error"	"Command error: Numeric suffix is out of range."	
Frontpanel	-113	"SCPI standard error"	"Command error: Undefined header."	
Frontpanel	-109	"SCPI standard error"	"Command error: Invalid number of parameters."	
Frontpanel	-108	"SCPI standard error"	"Command error: Parameters error."	
Frontpanel	-103	"SCPI standard error"	"Command error: Invalid separator."	
Frontpanel	-102	"SCPI standard error"	"Command error: Syntax error."	
Frontpanel	18	"Error"	"Unavailable transient element."	
Frontpanel	19	"Error"	"Maximum number of transient elements."	
Frontpanel	21	"Error"	"Internal communication: error during SDO upload."	
Frontpanel	22	"Error"	"Internal communication: error during SDO download."	
Frontpanel	29	"Error"	"USB interface unknown state."	
Frontpanel	31	"Error"	"Interface request packet	Not empty."
Frontpanel	32	"Error"	"Interface request packet	Unknown type"
Frontpanel	33	"Error"	"Interface request packet	Incompatible type."
Frontpanel	34	"Error"	"Interface request packet out of space."	
Frontpanel	35	"Error"	"Interface request packet	Unavailable command request
Frontpanel	36	"Error"	"Interface request packet has invalid arguments."	
Frontpanel	37	"Error"	"Interface response packet out of space."	
Frontpanel	42	"Error"	"Memory in use was removed."	
Frontpanel	47	"Error"	"Front panel is shutting down."	
Frontpanel	48	"Error"	"Fault state cannot be automatically reset."	
Frontpanel	51	"Error"	"The command cannot be executed in auxiliary unit."	
Frontpanel	53	"Error"	"Error during firmware update."	
Frontpanel	54	"Error"	"Calibration coefficient cannot be negative."	
Frontpanel	57	"Error"	"Waveform is not available."	
Frontpanel	58	"Error"	"Waveforms lengths are different between inverter controllers."	
Frontpanel	59	"Error"	"Unit does not exist."	
Frontpanel	60	"Error"	"Cannot read ambient temperature."	
Frontpanel	64	"Error"	"Unexpected reset."	
Frontpanel	65	"Error"	"Front panel is in passive mode."	
Frontpanel	66	"Error"	"Invalid host name."	
Frontpanel	67	"Error"	"DC voltage setpoint cannot change due to waveform saturation."	
Frontpanel	68	"Error"	"AC voltage setpoint cannot change due to waveform saturation."	
Frontpanel	69	"Error"	"Maximum user limit is lower than setpoint."	

Source	Code	Type	Description	Possible cause
Frontpanel	70	"Error"	"Minimum user limit is higher than setpoint."	
Frontpanel	72	"Error"	"Minimum limit is higher than maximum."	
Frontpanel	73	"Error"	"Maximum limit is lower than minimum."	
Frontpanel	75	"Error"	"IP address conflict. May be duplicated."	
Frontpanel	76	"Error"	"Invalid filename."	
Frontpanel	77	"Error"	"External memory storage is not available."	
Frontpanel	78	"Error"	"Datalogger rate not allowed."	
Frontpanel	79	"Error"	"Datalogger is running"	Yyou must stop it to change the configuration
Frontpanel	80	"Error"	"Datalogger execution error."	
Frontpanel	83	"Error"	"Internal error: File system partition blocked."	
Frontpanel	84	"Error"	"Unable to change form while output is enabled."	
Frontpanel	85	"Error"	"Unable to clear one or more fault."	
Frontpanel	86	"Error"	"Unable to enable output. One or more primary stages failed to enable."	
Frontpanel	89	"Error"	"Digital I/Os interface conflict: Remote inhibit is active."	
Frontpanel	90	"Error"	"Digital I/Os interface conflict: Remote enable is active."	
Frontpanel	91	"Error"	"Internal error: Unknown phase mode."	
Frontpanel	92	"Error"	"Unable to disable output. One or more primary stages failed to disable."	
Frontpanel	95	"Error"	"Digital I/Os interface conflict: Serial interface flow control is active."	
Frontpanel	96	"Error"	"Datalogger storage error."	
Frontpanel	97	"Error"	"Output enable in progress."	
Frontpanel	98	"Error"	"DC Voltage not allowed in "AC mode"."	
Frontpanel	99	"Error"	"AC Voltage not allowed in "DC mode"."	
Frontpanel	100	"Error"	"DC voltage setpoint cannot change due to user limit."	
Frontpanel	101	"Error"	"AC voltage setpoint cannot change due to user limit."	
Frontpanel	102	"Error"	"DC voltage setpoint cannot change due to low range."	
Frontpanel	103	"Error"	"AC voltage setpoint cannot change due to low range."	
Frontpanel	104	"Error"	"Waveform change in progress."	
Frontpanel	105	"Error"	"Error changing service name"	
Frontpanel	106	"Error"	"Error getting service name"	
Frontpanel	109	"Error"	"Transient step mode not available on UPC compatible mode."	
Frontpanel	110	"Error"	"System is about to reboot."	
Frontpanel	111	"Error"	"Cannot reboot system."	
Frontpanel	115	"Error"	"Unable to renew the DHCP lease. Changing to Auto-IP mode."	

Source	Code	Type	Description	Possible cause
Frontpanel	116	"Error"	"Failed starting firmware update."	
Frontpanel	117	"Error"	"Unable to execute this action with output enabled."	
Frontpanel	118	"Error"	"Frequency setpoint cannot change due to waveform saturation."	
Frontpanel	119	"Error"	"Frequency setpoint cannot change due to user limit."	
Frontpanel	120	"Error"	"Frequency not allowed in "DC mode"."	
Frontpanel	121	"Error"	"Waveform setpoint cannot change due to waveform saturation."	
Frontpanel	122	"Error"	"Cannot load program. Run PROG:CHECK? for more information."	
Frontpanel	125	"Error"	"Remote inhibit cannot be disabled in this model."	
Frontpanel	126	"Error"	"Line to line measurements only available with sinewaves."	
Frontpanel	127	"Error"	"Digital I/Os interface conflict: Single-Phase relay control is active."	
Frontpanel	128	"Error"	"Digital I/Os interface conflict: Single-Phase relay cannot change with output enabled."	
Frontpanel	129	"Error"	"Digital I/Os interface conflict: Single-Phase relay cannot change due relay closed."	
Frontpanel	130	"Error"	"Unable to disable output. One or more inverter stages failed to disable."	
Frontpanel	131	"Error"	"Cannot set EEPROM field"	
Frontpanel	132	"Error"	"EEPROM field already set"	
Frontpanel	133	"Error"	"Cannot read EEPROM field"	
Frontpanel	148	"Error"	"Serial number mismatch: Front panel does not match power stages."	
Frontpanel	150	"Error"	"Suffix not allowed in single form."	
Frontpanel	151	"Error"	"Suffix not allowed in split form."	
Frontpanel	152	"Error"	"Peak current limit setting is too low for the desired voltage and frequency."	
Frontpanel	153	"Error"	"Program transient trigger input is disabled."	
Frontpanel	154	"Error"	"Steady state not yet stabilized."	
Frontpanel	155	"Error"	"Trigger output not available in this model."	
Frontpanel	156	"Error"	"Trigger input not available in this model."	
Frontpanel	157	"Error"	"Filter size must be an odd number."	
Frontpanel	158	"Error"	"Voltage mode not available in UPC compatible mode."	
Frontpanel	159	"Error"	"Waveform is unique in UPC compatible mode."	
Frontpanel	160	"Error"	"Phase is 180 for split in UPC compatible mode."	
Frontpanel	161	"Error"	"Voltage AC is unique in UPC compatible mode."	
Frontpanel	162	"Error"	"CSC is always disabled during transient in UPC compatible mode."	
Frontpanel	163	"Error"	"Auto RMS is always enabled in UPC compatible mode."	

Source	Code	Type	Description	Possible cause
Frontpanel	166	"Error"	"Unable to set extended voltage because frequency is outside the allowed range."	
Frontpanel	169	"Error"	"Unable to update setpoint because it is outside the allowed range of extended voltage mode."	
Frontpanel	172	"Error"	"Command not allowed during power stage firmware update."	
Frontpanel	173	"Error"	"Cannot change Current RMS Overload mode with output enabled."	
Frontpanel	174	"Error"	"Strobe feature not available in this model."	
Frontpanel	175	"Error"	"Feature not available in this model."	
Frontpanel	176	"Error"	"Setpoints cannot be changed while transient program is running."	
Frontpanel	177	"Error"	"Cycle reset is always enabled in UPC compatible mode."	
Frontpanel	178	"Error"	"Command not available in this unit model."	
Frontpanel	179	"Error"	"Digital output is being used for transformer option."	
Frontpanel	180	"Error"	"Unknown processor type detected. Run unit discovery to recover."	
Frontpanel	181	"Error"	"Undiscovered node detected. Run unit discovery to recover."	
Frontpanel	182	"Error"	"Incorrect parallel unit count"	
Frontpanel	183	"Error"	"Invalid processor type"	
Frontpanel	184	"Error"	"Daisy chain invalid type"	
Frontpanel	185	"Error"	"Undiscovered controller node was detected. "	
Frontpanel	186	"Error"	"No master front panel was detected."	
Frontpanel	187	"Error"	"More than enabled master controller is was detected. Going to inactive state."	
Frontpanel	188	"Error"	"One or more units are not energized or have a failure."	
Frontpanel	189	"Error"	"Incompatible node detected."	
Frontpanel	190	"Error"	"Master unit nodes not found."	
Frontpanel	191	"Error"	"Fastscan failed."	
Frontpanel	192	"Error"	"Undetectable node exists."	
Frontpanel	193	"Error"	"An invalid firmare type exists."	
Frontpanel	501	"Error"	"Frequency is too high to enable xfmr coupling."	
Frontpanel	502	"Error"	"Extended voltage range is not allowed when overload modes are enabled."	
Frontpanel	503	"Error"	"Frequency is too high for extended voltage mode."	
Frontpanel	504	"Error"	"Cannot change extended voltage mode with output enabled."	
Frontpanel	505	"Error"	"Cannot enable current overload mode when extended voltage range is enabled."	
Frontpanel	506	"Error"	"Cannot enable extended frequency when extended voltage range is enabled."	
Frontpanel	509	"Error"	"Setpoint out of range due to extended frequency mode."	

Source	Code	Type	Description	Possible cause
Frontpanel	510	"Error"	"Unable to update setpoint because it is outside the allowed range of extended frequency mode."	
Frontpanel	511	"Error"	"Error during power stage firmware update."	
Frontpanel	512	"Error"	"Phase rotation is always negative in UPC compatible mode."	
Frontpanel	513	"Error"	"Cannot change split phase mode with output enabled."	
Frontpanel	514	"Error"	"Serial port flow control not available in this unit."	
Frontpanel	515	"Error"	"Too many commands per line."	
Frontpanel	518	"Error"	"Cannot change output impedance state with output enabled."	
Frontpanel	519	"Error"	"Cannot change output impedance mode with output enabled."	
Frontpanel	520	"Error"	"Inductive impedance not available in UPC compatible mode."	
Frontpanel	521	"Error"	"Read only file or folder."	
Frontpanel	522	"Error"	"Argument requires more decimals."	
Frontpanel	524	"Error"	"Digital I/Os interface conflict: Serial interface is active."	
Frontpanel	525	"Error"	"New IO firmware available. Must split system in two to perform update."	
Frontpanel	526	"Error"	"Cannot export configurations."	
Frontpanel	527	"Error"	"Cannot import configurations."	
Frontpanel	528	"Error"	"Version mismatch error."	
Frontpanel	529	"Error"	"Internal connection error with the power stage."	
Frontpanel	530	"Error"	"Fault during output enable."	
Frontpanel	531	"Error"	"Incorrect password."	
Frontpanel	533	"Error"	"This setpoint is being set by an analog input."	
Frontpanel	534	"Error"	"Image model not compatible."	
Frontpanel	535	"Error"	"Frontpanel not compatible."	
Frontpanel	536	"Error"	"Cannot convert cycle based transient to time based."	
Frontpanel	537	"Error"	"Cannot load pulse."	
Frontpanel	539	"Error"	"Parameter below minimum saturation."	
Frontpanel	540	"Error"	"Parameter below minimum range."	
Frontpanel	541	"Error"	"Parameter below minimum unit scope."	
Frontpanel	542	"Error"	"Parameter below minimum user limit."	
Frontpanel	543	"Error"	"Parameter below voltage mode."	
Frontpanel	544	"Error"	"Parameter above maximum saturation."	
Frontpanel	545	"Error"	"Parameter above maximum range."	
Frontpanel	546	"Error"	"Parameter above maximum unit scope."	
Frontpanel	547	"Error"	"Parameter above maximum user limit."	
Frontpanel	548	"Error"	"Parameter above voltage mode."	

Source	Code	Type	Description	Possible cause
Frontpanel	549	"Error"	"Locked unit"	Please unlock with command SYST:UNLOCK PASSWORD
Frontpanel	550	"Error"	"Unit model changed to ADF."	
Frontpanel	551	"Error"	"Series parallel mode switch not available."	
Frontpanel	552	"Error"	"Series connection requires an even number of units."	
Frontpanel	553	"Error"	"Digital output is being used for series units option."	
Frontpanel	554	"Error"	"Series connection is disabled. A Series connection should be set with SYSTem:SERIES command."	
Frontpanel	555	"Error"	"Transformer option is configured."	
Frontpanel	556	"Error"	"Series connection option is configured."	
Frontpanel	557	"Error"	"Series connection not detected."	
Frontpanel	558	"Error"	"Series connection inhibit."	
Frontpanel	559	"Error"	"Digital input 3 is fixed to series connection inhibit."	
Frontpanel	560	"Error"	"Series connection requires series remote sense board."	
Frontpanel	561	"Error"	"Series connection incorrect units order."	
Frontpanel	562	"Error"	"Series connection protection cannot be disabled."	
Frontpanel	71	"Warning"	"Setpoint reduced due to low range."	
Frontpanel	107	"Warning"	"Redundant segments were combined."	
Frontpanel	108	"Warning"	"Redundant steps were combined."	
Frontpanel	144	"Warning"	"Internal battery needs to be replaced."	
Frontpanel	164	"Warning"	"Warning: CSC is enabled and Auto-RMS is disabled. Output RMS may not be regulated properly."	
Frontpanel	165	"Warning"	"Maximum AC voltage limit was reduced due to extended voltage range."	
Frontpanel	167	"Warning"	"Power limits were reduced due to extended voltage range."	
Frontpanel	168	"Warning"	"AC voltage setpoints and/or AC voltage maximum limit were reduced due to extended voltage range."	
Frontpanel	171	"Warning"	"Warning: Repeated waveform alias."	
Frontpanel	500	"Warning"	"AC voltage setpoint was automatically reduced to 0 Vrms."	
Frontpanel	507	"Warning"	"Power limits were reduced due to extended frequency mode."	
Frontpanel	508	"Warning"	"Current limits were reduced due to extended frequency mode."	
Frontpanel	516	"Warning"	"Resistive impedance was automatically reduced."	
Frontpanel	517	"Warning"	"Inductive impedance was automatically reduced."	
Frontpanel	523	"Warning"	"Warning: Ambient temperature approaching limit."	

Source	Code	Type	Description	Possible cause
Frontpanel	532	"Warning"	"Frontpanel firmware image model do not match frontpanel model."	
Frontpanel	563	"Warning"	"VLL estimation accuracy is lower."	
Frontpanel	331	"Fault"	"Unit discovery fault. Run unit discovery to recover."	
Frontpanel	332	"Fault"	"Undiscovered unit/node detected. Run unit discovery to recover."	
Frontpanel	334	"Fault"	"Power failure."	
Frontpanel	335	"Fault"	"Remote inhibit was issued from remote interface."	
Frontpanel	336	"Fault"	"System about to reboot."	
Frontpanel	338	"Fault"	"One or more inverters did not get enabled."	
Frontpanel	339	"Fault"	"One or more primaries did not get enabled."	
Frontpanel	342	"Fault"	"Mismatch between hardware revision of units in parallel."	
Frontpanel	343	"Fault"	"Power stage firmware update failed. Run SYSTem:FW:INT:UPDATE:STAT? for more information. Run unit discovery to recover."	
Frontpanel	344	"Fault"	"Firmware update was interrupted"	Recovery is needed. Run unit discovery to recover."
Frontpanel	345	"Fault"	"GPIB hardware not found in this unit."	
Frontpanel	346	"Fault"	"GPIB hardware detected"	Unit model mismatch."
Frontpanel	347	"Fault"	"IO hardware not found in this unit."	
Frontpanel	348	"Fault"	"IO hardware detected"	Unit model mismatch."
Frontpanel	350	"Fault"	"Transformer hardware detected"	Unit model mismatch."
Frontpanel	351	"Fault"	"Ambient temperature exceeded maximum limit."	
Frontpanel	352	"Fault"	"Mismatch between models of units in parallel."	
Frontpanel	353	"Fault"	"Unit model mismatch."	
Frontpanel	355	"Fault"	"Series connection hardware detected"	Unit model mismatch."
Frontpanel	329	"Internal fault"	"Global fault detected."	
Frontpanel	330	"Internal fault"	"Global fault detected. Possible unenergized unit or node."	
Frontpanel	333	"Internal fault"	"Node in non-operational mode. Run unit discovery to recover."	
Frontpanel	337	"Internal fault"	"Missed node."	
Frontpanel	340	"Internal fault"	"Firmware version mismatch. Power stage version is older than expected. Contact technical support."	
Frontpanel	341	"Internal fault"	"Firmware version mismatch. Front panel version is older than expected. Contact technical support."	
Frontpanel	349	"Internal fault"	"Analog inputs cannot be read."	

Source	Code	Type	Description	Possible cause
Frontpanel	354	"Internal fault"	"Digital inputs cannot be read."	
Frontpanel	356	"Internal fault"	"Did not receive MDO 1 - Inverter A."	
Frontpanel	357	"Internal fault"	"Did not receive MDO 2 - Inverter A."	
Frontpanel	358	"Internal fault"	"Did not receive MDO 3 - Inverter A."	
Frontpanel	359	"Internal fault"	"Did not receive MDO 4 - Inverter A."	
Frontpanel	360	"Internal fault"	"Did not receive MDO 5 - Inverter A."	
Frontpanel	361	"Internal fault"	"Did not receive MDO 6 - Inverter A."	
Frontpanel	362	"Internal fault"	"Did not receive MDO 7 - Inverter A."	
Frontpanel	363	"Internal fault"	"Did not receive MDO 8 - Inverter A."	
Frontpanel	364	"Internal fault"	"Did not receive MDO 9 - Inverter A."	
Frontpanel	365	"Internal fault"	"Did not receive MDO 10 - Inverter A."	
Frontpanel	366	"Internal fault"	"Did not receive MDO 1 - Inverter B."	
Frontpanel	367	"Internal fault"	"Did not receive MDO 2 - Inverter B."	
Frontpanel	368	"Internal fault"	"Did not receive MDO 3 - Inverter B."	
Frontpanel	369	"Internal fault"	"Did not receive MDO 4 - Inverter B."	
Frontpanel	370	"Internal fault"	"Did not receive MDO 5 - Inverter B."	
Frontpanel	371	"Internal fault"	"Did not receive MDO 6 - Inverter B."	
Frontpanel	372	"Internal fault"	"Did not receive MDO 7 - Inverter B."	
Frontpanel	373	"Internal fault"	"Did not receive MDO 8 - Inverter B."	
Frontpanel	374	"Internal fault"	"Did not receive MDO 1 - Inverter C."	
Frontpanel	375	"Internal fault"	"Did not receive MDO 2 - Inverter C."	
Frontpanel	376	"Internal fault"	"Did not receive MDO 3 - Inverter C."	
Frontpanel	377	"Internal fault"	"Did not receive MDO 4 - Inverter C."	
Frontpanel	378	"Internal fault"	"Did not receive MDO 5 - Inverter C."	
Frontpanel	379	"Internal fault"	"Did not receive MDO 6 - Inverter C."	
Frontpanel	380	"Internal fault"	"Did not receive MDO 7 - Inverter C."	
Frontpanel	381	"Internal fault"	"Did not receive MDO 8 - Inverter C."	
Frontpanel	1	"Internal error"	"Unknown fault or error."	
Frontpanel	2	"Internal error"	"Cannot initialize command thread."	
Frontpanel	3	"Internal error"	"Cannot initialize global semaphore."	
Frontpanel	4	"Internal error"	"Cannot create SCPI status object."	
Frontpanel	5	"Internal error"	"Cannot create network manager object."	
Frontpanel	6	"Internal error"	"Cannot initialize CANOpen stack."	
Frontpanel	7	"Internal error"	"Cannot initialize process class array."	
Frontpanel	8	"Internal error"	"Cannot initialize local CANOpen object dictionary."	
Frontpanel	9	"Internal error"	"Cannot create FastCGI interface."	
Frontpanel	10	"Internal error"	"Cannot create TCP interface."	
Frontpanel	11	"Internal error"	"Cannot create TELNET interface."	
Frontpanel	12	"Internal error"	"Cannot create UART serial interface."	
Frontpanel	13	"Internal error"	"Cannot create USB serial interface."	

Source	Code	Type	Description	Possible cause
Frontpanel	14	"Internal error"	"Cannot create keyboard interface."	
Frontpanel	15	"Internal error"	"Cannot create front panel interface."	
Frontpanel	16	"Internal error"	"Cannot create SCPI program interface."	
Frontpanel	17	"Internal error"	"Cannot cast process class in runtime."	
Frontpanel	20	"Internal error"	"Unknown operation."	
Frontpanel	23	"Internal error"	"Unavailable node."	
Frontpanel	24	"Internal error"	"Cannot initialize GPIO library."	
Frontpanel	25	"Internal error"	"Process class: not implemented type."	
Frontpanel	25	"Internal error"	"Cannot attach GPIO."	
Frontpanel	26	"Internal error"	"Process class: invalid initialization."	
Frontpanel	27	"Internal error"	"SCPI program dynamic cast."	
Frontpanel	28	"Internal error"	"Cannot initialize node discovery."	
Frontpanel	38	"Internal error"	"Static null pointer."	
Frontpanel	39	"Internal error"	"Cannot create file system object"	
Frontpanel	40	"Internal error"	"Linux system call error"	
Frontpanel	41	"Internal error"	"XML library error."	
Frontpanel	43	"Internal error"	"Cannot create fault manager interface."	
Frontpanel	44	"Internal error"	"Global fault UIO driver."	
Frontpanel	45	"Internal error"	"Global fault interrupt disabled."	
Frontpanel	46	"Internal error"	"Cannot create global fault thread."	
Frontpanel	49	"Internal error"	"Cannot initialize communications reset mutex."	
Frontpanel	50	"Internal error"	"Cannot initialize communications reset condition variable."	
Frontpanel	52	"Internal error"	"Error in internal communications heartbeat."	
Frontpanel	55	"Internal error"	"Cannot initialize waveform manager."	
Frontpanel	61	"Internal error"	"Cannot initialize firmware update manager."	
Frontpanel	62	"Internal error"	"Cannot initialize buffer manager."	
Frontpanel	81	"Internal error"	"Internal error: Socket send error."	
Frontpanel	82	"Internal error"	"Internal error: Interface request packet has incorrect CRC."	
Frontpanel	87	"Internal error"	"Internal error: Cannot get system time."	
Frontpanel	88	"Internal error"	"Internal error: Unknown sequence."	
Frontpanel	93	"Internal error"	"Internal error: Cannot configure timer."	
Frontpanel	94	"Internal error"	"Internal error: Cannot create timer."	
Frontpanel	136	"Internal error"	"NVRAM CRC mismatch"	
Frontpanel	137	"Internal error"	"NVRAM cannot open."	
Frontpanel	138	"Internal error"	"NVRAM cannot close."	
Frontpanel	139	"Internal error"	"NVRAM cannot lock."	
Frontpanel	140	"Internal error"	"NVRAM cannot unlock."	
Frontpanel	141	"Internal error"	"NVRAM cannot read."	

Source	Code	Type	Description	Possible cause
Frontpanel	142	"Internal error"	"NVRAM cannot write."	
Frontpanel	143	"Internal error"	"Cannot reset EEPROM."	
Frontpanel	145	"Internal error"	"NVRAM hardware error. Using temporal storage."	
Frontpanel	146	"Internal error"	"Invalid command ID."	
Frontpanel	147	"Internal error"	"Command argument not exist."	
Frontpanel	149	"Internal error"	"This does not seems to be a front panel."	
Frontpanel	2000	"Internal error"	"Command request argument: argument cannot be null."	
Frontpanel	2001	"Internal error"	"Command request argument: cannot parse unknown argument."	
Frontpanel	2002	"Internal error"	"Command request argument: cannot parse argument."	
Frontpanel	2003	"Internal error"	"Command request argument: cannot append string to non string argument."	
Frontpanel	2004	"Internal error"	"Command request argument: cannot serialize due to small buffer."	
Frontpanel	2005	"Internal error"	"Command request argument: cannot deserialize due to small buffer."	
Frontpanel	2006	"Internal error"	"Command request argument: cannot get string due non string argument."	
Frontpanel	2007	"Internal error"	"EEPROM Data: Write header error."	
Frontpanel	2008	"Internal error"	"EEPROM Data: Write data error."	
Frontpanel	2009	"Internal error"	"EEPROM Data: Data too big."	
Frontpanel	2010	"Internal error"	"EEPROM Data: Cannot open temporal file."	
Frontpanel	2011	"Internal error"	"EEPROM Data: Close error."	
Frontpanel	2012	"Internal error"	"EEPROM Data: Offset error."	
Frontpanel	2013	"Internal error"	"EEPROM Data: Read error."	
Frontpanel	2014	"Internal error"	"Transformer: Corrupted internal database."	
Frontpanel	2015	"Internal error"	"XFMR ratio not found."	
Frontpanel	2016	"Internal error"	"Coupling cannot be changed with output enabled."	
Frontpanel	2017	"Internal error"	"XFMR ratio cannot be changed with output enabled."	
Frontpanel	2018	"Internal error"	"Transformer option not available in this model."	
Frontpanel	2019	"Internal error"	"XFMR ratio is disabled. A XFMR ratio should be set with SYSTem:XFMRratio command."	
Frontpanel	2020	"Internal error"	"Transformer control circuits not detected."	
Frontpanel	2021	"Internal error"	"DC voltage not allowed with transformer coupling."	
Frontpanel	2022	"Internal error"	"Command request: command request cannot be null."	
Frontpanel	2023	"Internal error"	"Command request: command request argument is null."	
Frontpanel	2024	"Internal error"	"Command request: argument is null."	
Frontpanel	2025	"Internal error"	"Command request: argument number is null."	

Source	Code	Type	Description	Possible cause
Frontpanel	2026	"Internal error"	"Command request: argument number does not exist."	
Frontpanel	2027	"Internal error"	"Command request: there are no arguments."	
Frontpanel	2028	"Internal error"	"Command request: cannot serialize due small buffer."	
Frontpanel	2029	"Internal error"	"Command request: cannot deserialize due small buffer."	
Frontpanel	2030	"Internal error"	"Command request: cannot deserialize due argument count mismatch."	
Frontpanel	2031	"Internal error"	"Command request: cannot deserialize due size mismatch."	
Frontpanel	2032	"Internal error"	"Command request vector: request number does not exist."	
Frontpanel	2033	"Internal error"	"Command request vector: request number is null."	
Frontpanel	2034	"Internal error"	"Command request vector: request is null."	
Frontpanel	2035	"Internal error"	"Command request vector: vector is empty."	
Frontpanel	2036	"Internal error"	"Command request vector: cannot serialize due small buffer."	
Frontpanel	2037	"Internal error"	"Command request vector: cannot deserialize due small buffer."	
Frontpanel	2038	"Internal error"	"Command request vector: cannot deserialize due command count mismatch."	
Frontpanel	2039	"Internal error"	"Command request vector: cannot deserialize due size mismatch."	
Frontpanel	2040	"Internal error"	"Interface request packet: cannot deserialize due size mismatch."	
Frontpanel	2041	"Internal error"	"Command thread: cannot post command semaphore."	
Frontpanel	2042	"Internal error"	"Command thread: cannot initialize command semaphore."	
Frontpanel	2043	"Internal error"	"Debug message file: seek file error."	
Frontpanel	2044	"Internal error"	"Debug message file: tell file error."	
Frontpanel	2045	"Internal error"	"Debug message file: close file error."	
Frontpanel	2046	"Internal error"	"Debug message file: open file error."	
Frontpanel	2047	"Internal error"	"Debug message file: write file error."	
Frontpanel	2048	"Internal error"	"Debug message file: flush file error."	
Frontpanel	2049	"Internal error"	"Debug message file: unlink file error."	
Frontpanel	2050	"Internal error"	"Debug message ring buffer: cannot allocate buffer."	
Frontpanel	2051	"Internal error"	"Debug message ring buffer: seek file error."	
Frontpanel	2052	"Internal error"	"Debug message ring buffer: tell file error."	
Frontpanel	2053	"Internal error"	"Debug message ring buffer: close file error."	
Frontpanel	2054	"Internal error"	"Debug message ring buffer: open file error."	
Frontpanel	2055	"Internal error"	"Debug message ring buffer: write file error."	

Source	Code	Type	Description	Possible cause
Frontpanel	2056	"Internal error"	"Debug message ring buffer: flush file error."	
Frontpanel	2057	"Internal error"	"Debug message ring buffer: unlink file error."	
Frontpanel	2058	"Internal error"	"Debug message system: print error failed."	
Frontpanel	2059	"Internal error"	"Debug message system: print output failed."	
Frontpanel	2060	"Internal error"	"Debug: cannot get core limit."	
Frontpanel	2061	"Internal error"	"Debug: cannot set core limit."	
Frontpanel	2062	"Internal error"	"Debug: cannot initialize mutex attributes."	
Frontpanel	2063	"Internal error"	"Debug: cannot set mutex attributes."	
Frontpanel	2064	"Internal error"	"Debug: cannot initialize mutex."	
Frontpanel	2065	"Internal error"	"Debug: cannot destroy mutex."	
Frontpanel	2066	"Internal error"	"Debug: cannot lock mutex."	
Frontpanel	2067	"Internal error"	"Debug: cannot unlock mutex."	
Frontpanel	2068	"Internal error"	"Debug: cannot allocate debug message system."	
Frontpanel	2069	"Internal error"	"Debug: cannot allocate debug message ring buffer."	
Frontpanel	2070	"Internal error"	"Debug: cannot allocate debug message file."	
Frontpanel	2071	"Internal error"	"Timer: cannot initialize mutex attributes."	
Frontpanel	2072	"Internal error"	"Timer: cannot set mutex attributes."	
Frontpanel	2073	"Internal error"	"Timer: cannot initialize mutex."	
Frontpanel	2074	"Internal error"	"Timer: cannot destroy mutex."	
Frontpanel	2075	"Internal error"	"Timer: cannot lock mutex."	
Frontpanel	2076	"Internal error"	"Timer: cannot unlock mutex."	
Frontpanel	2077	"Internal error"	"Timer: cannot allocate mark."	
Frontpanel	2078	"Internal error"	"Timer: cannot get time."	
Frontpanel	2079	"Internal error"	"Timing: cannot initialize mutex attributes."	
Frontpanel	2080	"Internal error"	"Timing: cannot set mutex attributes."	
Frontpanel	2081	"Internal error"	"Timing: cannot initialize mutex."	
Frontpanel	2082	"Internal error"	"Timing: cannot destroy mutex."	
Frontpanel	2083	"Internal error"	"Timing: cannot lock mutex."	
Frontpanel	2084	"Internal error"	"Timing: cannot unlock mutex."	
Frontpanel	2085	"Internal error"	"Timing: cannot allocate timer."	
Frontpanel	2086	"Internal error"	"Timing: timer not found."	
Frontpanel	2087	"Internal error"	"Command response item: cannot get string of non string type."	
Frontpanel	2088	"Internal error"	"Command response item: cannot get two items."	
Frontpanel	2089	"Internal error"	"Command response item: cannot get three items."	
Frontpanel	2090	"Internal error"	"Command response item: cannot get item."	

Source	Code	Type	Description	Possible cause
Frontpanel	2091	"Internal error"	"Command response item: cannot set null item."	
Frontpanel	2092	"Internal error"	"Command response item: cannot set item with null data."	
Frontpanel	2093	"Internal error"	"Command response item: cannot set null item vector."	
Frontpanel	2094	"Internal error"	"Command response item: cannot append item of different type."	
Frontpanel	2095	"Internal error"	"Command response item: item not compatible."	
Frontpanel	2096	"Internal error"	"Command response item: cannot serialize due small buffer."	
Frontpanel	2097	"Internal error"	"Command response item: cannot deserialize due small buffer."	
Frontpanel	2098	"Internal error"	"Command response vector: vector is empty."	
Frontpanel	2099	"Internal error"	"Command response vector: last response is null."	
Frontpanel	2100	"Internal error"	"Command response vector: response does not exist."	
Frontpanel	2101	"Internal error"	"Command response vector: cannot serialize due small buffer"	
Frontpanel	2102	"Internal error"	"Command response vector: cannot deserialize due response count mismatch."	
Frontpanel	2103	"Internal error"	"Command response vector: cannot deserialize due size mismatch."	
Frontpanel	2104	"Internal error"	"Command response: cannot set null response."	
Frontpanel	2105	"Internal error"	"Command response: cannot append null data."	
Frontpanel	2106	"Internal error"	"Command response: vector is empty."	
Frontpanel	2107	"Internal error"	"Command response: last item is null."	
Frontpanel	2108	"Internal error"	"Command response: item does not exist."	
Frontpanel	2109	"Internal error"	"Command response: cannot serialize due small buffer."	
Frontpanel	2110	"Internal error"	"Command response: cannot deserialize due item count mismatch."	
Frontpanel	2111	"Internal error"	"Command response: cannot deserialize due size mismatch."	
Frontpanel	2112	"Internal error"	"Interface response packet: cannot convert due small buffer."	
Frontpanel	2113	"Internal error"	"Interface response packet: cannot deserialize due size mismatch."	
Frontpanel	2114	"Internal error"	"DB9 GPIOs: owner not allowed."	
Frontpanel	2115	"Internal error"	"Signals: system call sigemptyset."	
Frontpanel	2116	"Internal error"	"Signals: system call sigaddset."	
Frontpanel	2117	"Internal error"	"Signals: system call pthread_sigmask."	
Frontpanel	2118	"Internal error"	"Signals: system call sigaction."	
Frontpanel	2119	"Internal error"	"Signals: cannot initialize destructor semaphore."	
Frontpanel	2120	"Internal error"	"Signals: cannot destroy destructor semaphore."	

Source	Code	Type	Description	Possible cause
Frontpanel	2121	"Internal error"	"Thread: cannot initialize mutex."	
Frontpanel	2122	"Internal error"	"Thread: cannot create thread."	
Frontpanel	2123	"Internal error"	"Thread: cannot cancel thread."	
Frontpanel	2124	"Internal error"	"Thread: cannot join thread."	
Frontpanel	2125	"Internal error"	"NVRAM: field is not double."	
Frontpanel	2126	"Internal error"	"NVRAM: field is not bool."	
Frontpanel	2127	"Internal error"	"NVRAM: field is not unsigned char."	
Frontpanel	2128	"Internal error"	"XML file: default document is null."	
Frontpanel	2129	"Internal error"	"XML file: cannot lock mutex."	
Frontpanel	2130	"Internal error"	"XML file: cannot unlock mutex."	
Frontpanel	2131	"Internal error"	"XML file: cannot lock file."	
Frontpanel	2132	"Internal error"	"XML file: cannot truncate file."	
Frontpanel	2133	"Internal error"	"XML file: cannot seek file."	
Frontpanel	2134	"Internal error"	"XML file: cannot write file."	
Frontpanel	2135	"Internal error"	"XML file: cannot flush file."	
Frontpanel	2136	"Internal error"	"XML file: cannot sync file."	
Frontpanel	2137	"Internal error"	"XML file: cannot initialize mutex attributes."	
Frontpanel	2138	"Internal error"	"XML file: cannot set mutex attribute."	
Frontpanel	2139	"Internal error"	"XML file: cannot initialize mutex."	
Frontpanel	2140	"Internal error"	"XML file: cannot unlink file."	
Frontpanel	2141	"Internal error"	"XML file: cannot convert to double."	
Frontpanel	2142	"Internal error"	"XML file: cannot convert to float."	
Frontpanel	2143	"Internal error"	"XML file: cannot convert to int."	
Frontpanel	2144	"Internal error"	"XML file: cannot convert to unsigned int."	
Frontpanel	2145	"Internal error"	"XML file: cannot convert to bool."	
Frontpanel	2146	"Internal error"	"XML file: cannot convert attribute."	
Frontpanel	2147	"Internal error"	"XML file: cannot convert attribute to bool"	
Frontpanel	2148	"Internal error"	"XML file: document is null."	
Frontpanel	2149	"Internal error"	"XML file: element is null."	
Frontpanel	2150	"Internal error"	"XML file: element data is null."	
Frontpanel	2151	"Internal error"	"XML file: attribute is null."	
Frontpanel	2152	"Internal error"	"XML file: attribute data is null."	
Frontpanel	2153	"Internal error"	"XML file: system call access failed."	
Frontpanel	2154	"Internal error"	"XML file: cannot rename file."	
Frontpanel	2155	"Internal error"	"XML file: cannot allocate document."	
Frontpanel	2156	"Internal error"	"XML file: CRC mismatch."	
Frontpanel	2157	"Internal error"	"XML file: version mismatch."	
Frontpanel	2158	"Internal error"	"XML file: cannot amend file."	
Frontpanel	2159	"Internal error"	"XML file: data out of range."	
Frontpanel	2160	"Internal error"	"XML file: cannot insert element."	

Source	Code	Type	Description	Possible cause
Frontpanel	2161	"Internal error"	"XML file: cannot clone element."	
Frontpanel	2162	"Internal error"	"CAN interface: cannot initialize mutex."	
Frontpanel	2163	"Internal error"	"CAN open stack: cannot initialize running mutex."	
Frontpanel	2164	"Internal error"	"CAN open stack: cannot initialize reset mutex."	
Frontpanel	2165	"Internal error"	"CAN open stack: cannot initialize CO mutex."	
Frontpanel	2166	"Internal error"	"CAN open stack: cannot initialize READ mutex."	
Frontpanel	2167	"Internal error"	"CAN open stack: cannot destroy CO mutex."	
Frontpanel	2168	"Internal error"	"CAN open stack: cannot destroy reset mutex."	
Frontpanel	2169	"Internal error"	"CAN open stack: cannot destroy running mutex."	
Frontpanel	2170	"Internal error"	"CAN open stack: cannot initialize CO."	
Frontpanel	2171	"Internal error"	"CAN open stack: cannot create timer thread."	
Frontpanel	2172	"Internal error"	"CAN open stack: cannot create RX thread."	
Frontpanel	2173	"Internal error"	"CAN open stack: cannot CAN socket."	
Frontpanel	2174	"Internal error"	"CAN open stack: cannot configure CAN socket."	
Frontpanel	2175	"Internal error"	"CAN open stack: cannot bind CAN socket."	
Frontpanel	2176	"Internal error"	"CAN open stack: cannot close CAN socket."	
Frontpanel	2177	"Internal error"	"CAN open stack: cannot write CAN socket."	
Frontpanel	2178	"Internal error"	"CAN open stack: write CAN socket size mismatch."	
Frontpanel	2179	"Internal error"	"CAN open stack: CAN socket not initialized."	
Frontpanel	2180	"Internal error"	"CAN open stack: cannot initialize CO timer semaphore."	
Frontpanel	2181	"Internal error"	"CAN open stack: cannot destroy CO timer semaphore."	
Frontpanel	2182	"Internal error"	"CAN main: cannot initialize background semaphore mutex."	
Frontpanel	2183	"Internal error"	"CAN main: cannot destroy background semaphore mutex."	
Frontpanel	2184	"Internal error"	"CAN main: cannot initialize background semaphore."	
Frontpanel	2185	"Internal error"	"CAN main: cannot destroy background semaphore."	
Frontpanel	2186	"Internal error"	"Discovery: cannot initialize daisy chain GPIO."	
Frontpanel	2187	"Internal error"	"Discovery: daisy chain GPIO not initialized."	
Frontpanel	2188	"Internal error"	"Discovery: cannot get processor types due small vector."	
Frontpanel	2189	"Internal error"	"Discovery: cannot get inverters due small vector."	
Frontpanel	2190	"Internal error"	"Discovery: cannot get primaries due small vector."	
Frontpanel	2191	"Internal error"	"Discovery: cannot allocate discovery."	

Source	Code	Type	Description	Possible cause
Frontpanel	2192	"Internal error"	"DSP commands: NMT."	
Frontpanel	2193	"Internal error"	"DSP commands: SDO download."	
Frontpanel	2194	"Internal error"	"DSP commands: SDO upload."	
Frontpanel	2195	"Internal error"	"DSP commands: LSS INCRS."	
Frontpanel	2196	"Internal error"	"DSP commands: LSS SSDC."	
Frontpanel	2197	"Internal error"	"DSP commands: LSS CNI."	
Frontpanel	2198	"Internal error"	"DSP commands: LSS SC."	
Frontpanel	2199	"Internal error"	"DSP commands: LSS FS."	
Frontpanel	2200	"Internal error"	"DSP commands: LSS PPSTFS."	
Frontpanel	2201	"Internal error"	"DSP commands: invalid node ID."	
Frontpanel	2202	"Internal error"	"DSP commands: invalid DSP type."	
Frontpanel	2203	"Internal error"	"DSP commands: invalid mapping number."	
Frontpanel	2204	"Internal error"	"DSP commands: invalid COB ID."	
Frontpanel	2205	"Internal error"	"DSP commands: invalid heart beat number."	
Frontpanel	2206	"Internal error"	"DSP commands: invalid tries number."	
Frontpanel	2207	"Internal error"	"DSP commands: read SDO buffer length."	
Frontpanel	2208	"Internal error"	"DSP commands: read bootloader DSP types."	
Frontpanel	2209	"Internal error"	"DSP commands: read bootloader state."	
Frontpanel	2210	"Internal error"	"DSP update commands: flag for update."	
Frontpanel	2211	"Internal error"	"DSP update commands: check device type."	
Frontpanel	2212	"Internal error"	"DSP update commands: check bootloader update state."	
Frontpanel	2213	"Internal error"	"DSP update commands: unlock flash CSM."	
Frontpanel	2214	"Internal error"	"DSP update commands: lock flash CSM."	
Frontpanel	2215	"Internal error"	"DSP update commands: erase flash sector."	
Frontpanel	2216	"Internal error"	"DSP update commands: write flash block."	
Frontpanel	2217	"Internal error"	"DSP update commands: firmware run."	
Frontpanel	2218	"Internal error"	"Condition comparison: unknown condition."	
Frontpanel	2219	"Internal error"	"Observer program: SCPI program not initialized."	
Frontpanel	2220	"Internal error"	"Command vector: invalid initialization order."	
Frontpanel	2221	"Internal error"	"Command vector: incomplete initialization."	
Frontpanel	2222	"Internal error"	"Observer vector: invalid initialization order."	
Frontpanel	2223	"Internal error"	"Observer vector: incomplete initialization."	
Frontpanel	2224	"Internal error"	"Operation file system: XML file not initialized."	
Frontpanel	2225	"Internal error"	"Operation SDO: cannot get node ID."	
Frontpanel	2226	"Internal error"	"Operation generic: command ID vector empty."	

Source	Code	Type	Description	Possible cause
Frontpanel	2227	"Internal error"	"Operation IEEE4882: long IDN string."	
Frontpanel	2228	"Internal error"	"Operation system: DB9 GPIOs invalid state."	
Frontpanel	2229	"Internal error"	"Operation source: DB9 GPIOs invalid state."	
Frontpanel	2230	"Internal error"	"Operation source: waveform invalid state."	
Frontpanel	2231	"Internal error"	"Operation source: XML configuration file not initialized."	
Frontpanel	2232	"Internal error"	"Operation source: XML program file not initialized."	
Frontpanel	2233	"Internal error"	"Operation simulation: invalid variable ID."	
Frontpanel	2234	"Internal error"	"Operation program: invalid transient status"	
Frontpanel	2235	"Internal error"	"Operation program: command not available."	
Frontpanel	2236	"Internal error"	"Firmware update manager: firmware up to date."	
Frontpanel	2237	"Internal error"	"DSP firmware update log: mutex lock error."	
Frontpanel	2238	"Internal error"	"DSP firmware update log: mutex unlock error."	
Frontpanel	2239	"Internal error"	"DSP firmware update log: error opening log file."	
Frontpanel	2240	"Internal error"	"DSP firmware update log: error flushing log file."	
Frontpanel	2241	"Internal error"	"DSP firmware update log: error closing log file."	
Frontpanel	2242	"Internal error"	"DSP firmware update log: error writing log file."	
Frontpanel	2243	"Internal error"	"DSP firmware update log: no file open to write."	
Frontpanel	2244	"Internal error"	"DSP firmware update log: class null."	
Frontpanel	2245	"Internal error"	"Application: invalid application command."	
Frontpanel	2246	"Internal error"	"Application: cannot initialize running mutex."	
Frontpanel	2247	"Internal error"	"Application: cannot initialize application mutex."	
Frontpanel	2248	"Internal error"	"Application: cannot create timer."	
Frontpanel	2249	"Internal error"	"Application: cannot configure timer."	
Frontpanel	2250	"Internal error"	"Application: cannot close timer."	
Frontpanel	2251	"Internal error"	"XML handler: cannot load XML."	
Frontpanel	2252	"Internal error"	"Application: cannot save XML."	
Frontpanel	2253	"Internal error"	"Avahi XML: folder does not exist."	
Frontpanel	2254	"Internal error"	"Avahi XML: file does not exist."	
Frontpanel	2255	"Internal error"	"Avahi XML: invalid field number."	
Frontpanel	2256	"Internal error"	"Network manager: thread not initialized."	
Frontpanel	2257	"Internal error"	"Network manager: invalid variable ID."	
Frontpanel	2258	"Internal error"	"Network manager: invalid configuration type."	
Frontpanel	2259	"Internal error"	"Network manager: netconfig call failed."	

Source	Code	Type	Description	Possible cause
Frontpanel	2260	"Internal error"	"Network manager: avahi call failed."	
Frontpanel	2261	"Internal error"	"Network manager: udhcp call failed."	
Frontpanel	2262	"Internal error"	"Network manager: netconfig field not found."	
Frontpanel	2263	"Internal error"	"Network manager: invalid service name."	
Frontpanel	2264	"Internal error"	"Network manager: avahi close process."	
Frontpanel	2265	"Internal error"	"External interface: invalid socket path."	
Frontpanel	2266	"Internal error"	"External interface: cannot create from socket."	
Frontpanel	2267	"Internal error"	"External interface: cannot bind from socket."	
Frontpanel	2268	"Internal error"	"External interface: cannot listen from socket."	
Frontpanel	2269	"Internal error"	"External interface: cannot create to socket."	
Frontpanel	2270	"Internal error"	"External interface: cannot bind to socket."	
Frontpanel	2271	"Internal error"	"External interface: cannot listen to socket."	
Frontpanel	2272	"Internal error"	"External interface: cannot initialize to socket mutex."	
Frontpanel	2273	"Internal error"	"External interface: cannot allocate thread."	
Frontpanel	2274	"Internal error"	"External interface: invalid packet type."	
Frontpanel	2275	"Internal error"	"External interface: invalid response type."	
Frontpanel	2276	"Internal error"	"XML SCPI program file: buffer is null."	
Frontpanel	2277	"Internal error"	"XML SCPI program file: buffer is small."	
Frontpanel	2278	"Internal error"	"Program is undefined."	
Frontpanel	2279	"Internal error"	"XML SCPI program file: element is null."	
Frontpanel	2280	"Internal error"	"EEPROM: call failed."	
Frontpanel	2281	"Internal error"	"EEPROM: field not found."	
Frontpanel	2282	"Internal error"	"Memories: invalid folder."	
Frontpanel	2283	"Internal error"	"Memories: invalid name."	
Frontpanel	2284	"Internal error"	"XML access file: invalid IP."	
Frontpanel	2285	"Internal error"	"XML access file: invalid alias size."	
Frontpanel	2286	"Internal error"	"XML access file: cannot convert to bool."	
Frontpanel	2287	"Internal error"	"XML access file: invalid tag."	
Frontpanel	2288	"Internal error"	"Temperature: cannot open file."	
Frontpanel	2289	"Internal error"	"Temperature: file not opened."	
Frontpanel	2290	"Internal error"	"Temperature: cannot seek file."	
Frontpanel	2291	"Internal error"	"Temperature: cannot read file."	
Frontpanel	2292	"Internal error"	"Remote: DB9 GPIO not initialized."	
Frontpanel	2293	"Internal error"	"Remote: cannot open UIO."	
Frontpanel	2294	"Internal error"	"Remote: cannot write UIO."	
Frontpanel	2295	"Internal error"	"Interface vector: cannot initialize mutex attributes."	
Frontpanel	2296	"Internal error"	"Interface vector: cannot set mutex attributes."	

Source	Code	Type	Description	Possible cause
Frontpanel	2297	"Internal error"	"Interface vector: cannot initialize mutex."	
Frontpanel	2298	"Internal error"	"Interface vector: cannot allocate VXI interface."	
Frontpanel	2299	"Internal error"	"Interface vector: cannot lock mutex."	
Frontpanel	2300	"Internal error"	"Interface vector: cannot unlock mutex."	
Frontpanel	2301	"Internal error"	"SCPI program: destination program cannot be manual mode."	
Frontpanel	2302	"Internal error"	"SCPI program: invalid define string."	
Frontpanel	2303	"Internal error"	"SCPI program: missing voltage A."	
Frontpanel	2304	"Internal error"	"SCPI program: missing voltage B."	
Frontpanel	2305	"Internal error"	"Cannot get waveform field."	
Frontpanel	2306	"Internal error"	"Cannot delete waveform in use."	
Frontpanel	2307	"Internal error"	"Waveform #1 cannot be deleted or modified."	
Frontpanel	2308	"Internal error"	"Sequential interface: cannot initialize command executed semaphore."	
Frontpanel	2309	"Internal error"	"Sequential interface: cannot initialize execute command semaphore."	
Frontpanel	2310	"Internal error"	"Sequential interface: cannot initialize pending commands mutex."	
Frontpanel	2311	"Internal error"	"IEEE488.2 status: cannot initialize mutex."	
Frontpanel	2312	"Internal error"	"IEEE488.2 status: item does not exist."	
Frontpanel	2313	"Internal error"	"Fault manager: MDO not received."	
Frontpanel	2314	"Internal error"	"Measurement logger manager: cannot write file."	
Frontpanel	2315	"Internal error"	"Synchronization: cannot initialize operation complete mutex."	
Frontpanel	2316	"Internal error"	"Synchronization: cannot initialize operation complete mutex attributes."	
Frontpanel	2317	"Internal error"	"Synchronization: cannot set operation complete mutex attributes."	
Frontpanel	2318	"Internal error"	"Synchronization: cannot initialize operation complete condition variable."	
Frontpanel	2319	"Internal error"	"SCPI parser: cannot initialize mutex."	
Frontpanel	2320	"Internal error"	"SCPI parser: cannot lock mutex."	
Frontpanel	2321	"Internal error"	"SCPI parser: cannot unlock mutex."	
Frontpanel	113	"Internal warning"	"Missed second heartbeat."	
Frontpanel	114	"Internal warning"	"Missed first heartbeat."	
Frontpanel	123	"Internal warning"	"Warning: input voltage in EEPROM does not match the Primary DSP. Using DSP value."	
Frontpanel	0	"Success"	"No error"	
Inverter	265	"Fault"	"Inverter gate driver fault."	
Inverter	266	"Fault"	"Internal bias supply fault."	
Inverter	267	"Fault"	"No waveform loaded. Load waveform before enabling arbitrary waveform mode."	
Inverter	268	"Fault"	"Exceeded RMS current limit."	
Inverter	269	"Fault"	"Exceeded active power limit."	

Source	Code	Type	Description	Possible cause
Inverter	270	"Fault"	"Exceeded apparent power limit."	
Inverter	271	"Fault"	"Internal SCIA communication error."	
Inverter	272	"Fault"	"Internal McBSP communication CRC error."	
Inverter	273	"Fault"	"Inverter current negative peak protection."	
Inverter	274	"Fault"	"Inverter current positive peak protection."	
Inverter	275	"Fault"	"DC bus voltage minimum limit exceeded."	
Inverter	276	"Fault"	"DC bus voltage maximum limit exceeded."	
Inverter	277	"Fault"	"Temperature protection	Mmaximum limit
Inverter	278	"Fault"	"Temperature protection	Minimum limit
Inverter	279	"Fault"	"Output relay voltage protection	Minimum limit
Inverter	280	"Fault"	"Output relay voltage protection	Maximum limit
Inverter	281	"Fault"	"Output terminals common mode voltage protection	Minimum limit
Inverter	282	"Fault"	"Output terminals common mode voltage protection	Maximum limit
Inverter	283	"Fault"	"Inductor current RMS protection	Exceeded maximum limit for too long
Inverter	284	"Fault"	"Inductor current DC protection	Exceeded maximum limit for too long
Inverter	285	"Fault"	"Global fault input signal detected."	
Inverter	286	"Fault"	"Fan under voltage protection."	
Inverter	287	"Fault"	"Inductor current cycle-by-cycle protection trip limit."	
Inverter	288	"Fault"	"Fan current consumption is abnormal	Fan may be blocked
Inverter	292	"Fault"	"Output current has too much high frequency content	Possible oscillation. RQ monitor fault
Inverter	293	"Fault"	"Controller missed heartbeats from master front panel."	
Inverter	294	"Fault"	"Output over-voltage protection."	
Inverter	296	"Fault"	"Output current peak protection."	
Inverter	297	"Fault"	"Remote voltage sensing fault."	
Inverter	298	"Fault"	"Internal capacitors over-current protection."	
Inverter	299	"Fault"	"Internal bus over-voltage protection. Possible regenerative load."	
Inverter	300	"Fault"	"CSC loop has saturated"	
Inverter	301	"Fault"	"Output current overload. RMS current exceeded limit."	
Inverter	302	"Fault"	"Internal muxed ADC protection fault."	
Inverter	303	"Fault"	"Internal fan current regulation fault."	
Inverter	304	"Fault"	"Parallel units model mismatch."	
Inverter	289	"Internal fault"	"Hardware revision does not match expected by firmware. Firmware must be reloaded."	

Source	Code	Type	Description	Possible cause
Inverter	290	"Internal fault"	"Invalid node ID. Run unit discovery to recover."	
Inverter	291	"Internal fault"	"Incorrect DSP type detected. Cycle-power to re-try."	
Inverter	295	"Internal fault"	"Invalid constants loaded from EEPROM."	
Inverter	326	"Internal fault"	"Controller is not in operational node."	
Inverter	327	"Internal fault"	"Missing controller node."	
Inverter	328	"Internal fault"	"Cannot read fault information."	
Primary	200	"Fault"	"LLC primary/auxiliary current peak limit exceeded."	
Primary	201	"Fault"	"LLC/PFC gate driver fault or hardware OVP."	
Primary	202	"Fault"	"Controller missed heartbeats from master front panel."	
Primary	203	"Fault"	"LLC primary current average limit exceeded."	
Primary	204	"Fault"	"LLC auxiliary current average limit exceeded."	
Primary	205	"Fault"	"PFC current peak limit exceeded."	
Primary	206	"Fault"	"PFC DC bus voltage limit exceeded."	
Primary	207	"Fault"	"Gate driver fault"	Input buck converter
Primary	208	"Fault"	"Input buck switching time."	
Primary	209	"Fault"	"AC input current exceeded RMS limit for too long."	
Primary	210	"Fault"	"Unbalanced current in PFC boost converters."	
Primary	211	"Fault"	"PFC efficiency protection."	
Primary	212	"Fault"	"AC input: voltage is below minimum."	
Primary	213	"Fault"	"AC input: missing phase."	
Primary	214	"Fault"	"PFC DC bus voltage regulation lost."	
Primary	215	"Fault"	"PFC DC bus voltage limit exceeded. CLA OVP Trip"	
Primary	216	"Fault"	"Temperature 1 protection (input stage)"	Exceeded maximum limit
Primary	217	"Fault"	"Temperature 1 protection (input stage)"	Exceeded minimum limit
Primary	218	"Fault"	"Temperature 2 protection (PFC/LLC)"	Exceeded maximum limit
Primary	219	"Fault"	"Temperature 2 protection (PFC/LLC)"	Exceeded minimum limit
Primary	220	"Fault"	"Temperature 3 protection (PFC/LLC)"	Exceeded maximum limit
Primary	221	"Fault"	"Temperature 3 protection (PFC/LLC) exceeded minimum limit."	
Primary	222	"Fault"	"Temperature 4 protection (main transformer)"	Exceeded maximum limit
Primary	223	"Fault"	"Temperature 4 protection (main transformer)"	Exceeded minimum limit
Primary	224	"Fault"	"Internal bias supply fault."	
Primary	230	"Fault"	"PFC output current peak protection."	

Source	Code	Type	Description	Possible cause
Primary	231	"Fault"	"PFC output current slow protection"	
Primary	232	"Fault"	"AC input: voltage is above maximum."	
Primary	234	"Fault"	"Firmware task execution error."	
Primary	225	"Internal fault"	"Global fault input signal detected."	
Primary	226	"Internal fault"	"Hardware does not match input voltage setting."	
Primary	227	"Internal fault"	"Primary capacitor board not detected."	
Primary	228	"Internal fault"	"Invalid node ID. Run unit discovery to recover."	
Primary	229	"Internal fault"	"Incorrect DSP type detected. Cycle-power to re-try."	
Primary	233	"Internal fault"	"Invalid constants loaded from EEPROM."	
Primary	261	"Internal fault"	"Controller is not in operational node."	
Primary	262	"Internal fault"	"Missing controller node."	
Primary	263	"Internal fault"	"Cannot read fault information."	
IO board	399	"Fault"	"Transformer coupling / series connection circuits hardware fault."	
IO board	400	"Fault"	"Transformer coupling / series connection circuits not detected."	
IO board	401	"Fault"	"Remote inhibit was issued from remote interface."	
IO board	393	"Internal fault"	"Global fault detected."	
IO board	394	"Internal fault"	"Internal board fault."	
IO board	395	"Internal fault"	"Invalid node ID. Run unit discovery to recover."	
IO board	396	"Internal fault"	"Incorrect DSP type detected. Cycle-power to re-try."	
IO board	397	"Internal fault"	"Invalid constants loaded from EEPROM."	
IO board	398	"Internal fault"	"Controller is not in operational node."	
IO board	454	"Internal fault"	"Controller is not in operational node."	
IO board	455	"Internal fault"	"Missing controller node."	
IO board	456	"Internal fault"	"Cannot read fault information."	

Table 12-1: Warnings and Error Messages Listing

13 Service and Maintenance

13.1 Warnings



WARNING

THIS EQUIPMENT CONTAINS HIGH ENERGY, LOW IMPEDANCE CIRCUITS! LETHAL POTENTIALS ARE CONTAINED WITHIN THIS UNIT.

CARE MUST BE EXERCISED WHEN SERVICING THIS EQUIPMENT IN ORDER TO PREVENT SERIOUS SERVICE PERSONNEL INJURY OR EQUIPMENT DAMAGE.

OBSERVE THE FOLLOWING WHEN SERVICE OR MAINTENANCE ARE REQUIRED:

- 1. REMOVE ALL JEWELRY FROM ARMS AND NECK WHEN SERVICING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY AND CAUSING BURNS TO SERVICE PERSONNEL.**
- 2. WEAR SAFETY GLASSES WHEN SERVICING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.**
- 3. DO NOT REMOVE ANY PANEL OR COVER WITHOUT FIRST REMOVING THE INPUT SERVICE BY OPENING ALL CIRCUIT BREAKERS.**
- 4. DO NOT REMOVE ANY PANEL OR COVER WITHOUT FIRST WAITING 20 MINUTES FOR ALL INTERNAL CHARGES TO DISSIPATE TO A SAFE LEVEL.**
- 5. SERVICE OTHER THAN EXTERNAL CLEANING SHOULD BE REFERRED TO PERSONNEL AUTHORIZED BY THE FACTORY TO SERVICE THIS EQUIPMENT.**



WARNING

THIS EQUIPMENT CONTAINS HIGH ENERGY, LOW IMPEDANCE CIRCUITS! LETHAL POTENTIALS ARE CONTAINED WITHIN THIS UNIT.

CARE MUST BE EXERCISED WHEN SERVICING THIS EQUIPMENT IN ORDER TO PREVENT SERIOUS SERVICE PERSONNEL INJURY OR EQUIPMENT DAMAGE.

OBSERVE THE FOLLOWING WHEN SERVICE OR MAINTENANCE ARE REQUIRED:

- 1. REMOVE ALL JEWELRY FROM ARMS AND NECK WHEN SERVICING THIS EQUIPMENT. THIS PREVENTS THE POSSIBILITY OF SHORTING THROUGH THE JEWELRY AND CAUSING BURNS TO SERVICE PERSONNEL.**
- 2. WEAR SAFETY GLASSES WHEN SERVICING THIS EQUIPMENT TO PREVENT EYE INJURY DUE TO FLYING PARTICLES CAUSED BY ACCIDENTAL SHORT CIRCUIT CONDITIONS.**
- 3. DO NOT REMOVE ANY PANEL OR COVER WITHOUT FIRST REMOVING THE INPUT SERVICE BY OPENING ALL CIRCUIT BREAKERS.**
- 4. DO NOT REMOVE ANY PANEL OR COVER WITHOUT FIRST WAITING 20 MINUTES FOR ALL INTERNAL CHARGES TO DISSIPATE TO A SAFE LEVEL.**
- 5. SERVICE OTHER THAN EXTERNAL CLEANING SHOULD BE REFERRED TO PERSONNEL AUTHORIZED BY THE FACTORY TO SERVICE THIS EQUIPMENT.**

13.2 Authorized Service Centers

There are **NO** end-user serviceable parts in this product. In case of a problem or malfunction, **DO NOT ATTEMPT TO REPAIR!** Instead, contact one of Pacific Power Source's authorized service centers or your local Pacific Power Source distributor. For a list of authorized service centers, refer to section 1, "Contact Information".

14 ModBus TCP Server / Slave Interface

14.1 TCP ModBus TCP Interface

The ModBus TCP Server/Slave Interface provides a means to communicate with industrial bus protocols. This is a register based interface so no SCPI programming commands apply. Instead of sending commands, the user can write to specific register addresses to change various settings and read from other registers to obtain readings such as measurements or settings.

Gateway devices are available from third parties to connect to other bus protocols.

<https://www.anybus.com/products/gateway-index?Network-Interface-1=Modbus-TCP-Client/Master>

These gateways perform an intelligent protocol translation that allows devices and control systems using different protocols to communicate with each other seamlessly.

To use this interface, the user needs to reference the register addresses provided in the next section.

14.2 Modbus TCP Register Tables

The following tables apply to ADF, AFX, AZX, LMX and LSX Series power source models. Some functions may not be supported on specific model series depending on supported modes of operation and feature sets.

Note: The information contained in the table below is available for download in MS Excel file [modbustcp-registers.xlsx](#) at the following link under 'documentation':

https://github.com/PPST-Inc/ModbusTCP_Examples

If the power source is connected to a network with internet access, this table can also be downloaded using the web browser interface from the SYSTEM -> INTERFACE SETUP -> MODBUS-TCP -> Download (Registers)

See tables on subsequent pages.

Note: Entries with **RED background** may not be implemented at the time of this manual revision and may require a firmware update.

Command Processing Times

Some operations like changing operating mode, form, range, reset, and others are operations that may take several seconds to complete due to the number of internal operations required.

The unit processes the request received sequentially. The unit can reply to a new command only after the operation finishes. Make sure any timeout set in your application program is sufficient to allow for this processing time. If you experience time-outs, it may be necessary to set a longer timeout request.

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
Modbus Interface	0	0000													
	1	0001			x				Modbus Ver	R	uint(16)	2	1		
	2	0002			x				Modbus Info	R	uint(16)	2	1		
Measurements	1000	03E8			x				Frequency	R	float	4	2	Floating point number IEEE754	60
	1002	03EA			x				Output A frequency	R	float	4	2	Floating point number IEEE754	
	1004	03EC			x				Output B frequency	R	float	4	2	Floating point number IEEE754	
	1006	03EE			x				Output C frequency	R	float	4	2	Floating point number IEEE754	
	1008	03F0			x				Voltage line to line ACDC	R	float	4	2	Floating point number IEEE754	
	1010	03F2			x				Output A voltage line to line ACDC	R	float	4	2	Floating point number IEEE754	
	1012	03F4			x				Output B voltage line to line ACDC	R	float	4	2	Floating point number IEEE754	
	1014	03F6			x				Output C voltage line to line ACDC	R	float	4	2	Floating point number IEEE754	
	1016	03F8			x				Voltage line to line AC	R	float	4	2	Floating point number IEEE754	
	1018	03FA			x				Output A voltage line to line AC	R	float	4	2	Floating point number IEEE754	
	1020	03FC			x				Output B voltage line to line AC	R	float	4	2	Floating point number IEEE754	
	1022	03FE			x				Output C voltage line to line AC	R	float	4	2	Floating point number IEEE754	
	1024	0400			x				Voltage line to line DC	R	float	4	2	Floating point number IEEE754	
	1026	0402			x				Output A voltage line to line DC	R	float	4	2	Floating point number IEEE754	
	1028	0404			x				Output B voltage line to line DC	R	float	4	2	Floating point number IEEE754	
	1030	0406			x				Output C voltage line to line DC	R	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	1032	0408			x				Voltage ACDC	R	float	4	2	Floating point number IEEE754	
	1034	040A			x				Output A voltage ACDC	R	float	4	2	Floating point number IEEE754	
	1036	040C			x				Output B voltage ACDC	R	float	4	2	Floating point number IEEE754	
	1038	040E			x				Output C voltage ACDC	R	float	4	2	Floating point number IEEE754	
	1040	0410			x				Voltage AC	R	float	4	2	Floating point number IEEE754	
	1042	0412			x				Output A voltage AC	R	float	4	2	Floating point number IEEE754	
	1044	0414			x				Output B voltage AC	R	float	4	2	Floating point number IEEE754	
	1046	0416			x				Output C voltage AC	R	float	4	2	Floating point number IEEE754	
	1048	0418			x				Voltage DC	R	float	4	2	Floating point number IEEE754	
	1050	041A			x				Output A voltage DC	R	float	4	2	Floating point number IEEE754	
	1052	041C			x				Output B voltage DC	R	float	4	2	Floating point number IEEE754	
	1054	041E			x				Output C voltage DC	R	float	4	2	Floating point number IEEE754	
	1056	0420			x				Current ACDC	R	float	4	2	Floating point number IEEE754	
	1058	0422			x				Output A current ACDC	R	float	4	2	Floating point number IEEE754	
	1060	0424			x				Output B current ACDC	R	float	4	2	Floating point number IEEE754	
	1062	0426			x				Output C current ACDC	R	float	4	2	Floating point number IEEE754	
	1064	0428			x				Current DC	R	float	4	2	Floating point number IEEE754	
	1066	042A			x				Output A current DC	R	float	4	2	Floating point number IEEE754	
	1068	042C			x				Output B current DC	R	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	1070	042E			x				Output C current DC	R	float	4	2	Floating point number IEEE754	
	1072	0430			x				Active power	R	float	4	2	Floating point number IEEE754	
	1074	0432			x				Output A active power	R	float	4	2	Floating point number IEEE754	
	1076	0434			x				Output B active power	R	float	4	2	Floating point number IEEE754	
	1078	0436			x				Output C active power	R	float	4	2	Floating point number IEEE754	
	1080	0438			x				Apparent power	R	float	4	2	Floating point number IEEE754	
	1082	043A			x				Output A apparent power	R	float	4	2	Floating point number IEEE754	
	1084	043C			x				Output B apparent power	R	float	4	2	Floating point number IEEE754	
	1086	043E			x				Output C apparent power	R	float	4	2	Floating point number IEEE754	
	1088	0440			x				Peak current	R	float	4	2	Floating point number IEEE754	
	1090	0442			x				Output A peak current	R	float	4	2	Floating point number IEEE754	
	1092	0444			x				Output B peak current	R	float	4	2	Floating point number IEEE754	
	1094	0446			x				Output C peak current	R	float	4	2	Floating point number IEEE754	
	1096	0448			x				Power factor	R	float	4	2	Floating point number IEEE754	
	1098	044A			x				Output A power factor	R	float	4	2	Floating point number IEEE754	
	1100	044C			x				Output B power factor	R	float	4	2	Floating point number IEEE754	
	1102	044E			x				Output C power factor	R	float	4	2	Floating point number IEEE754	
	1104	0450			x				Crest factor	R	float	4	2	Floating point number IEEE754	
	1106	0452			x				Output A crest factor	R	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	1108	0454			x				Output B crest factor	R	float	4	2	Floating point number IEEE754	
	1110	0456			x				Output C crest factor	R	float	4	2	Floating point number IEEE754	
	1112	0458			x				Peak current recorded	R	float	4	2	Floating point number IEEE754	
	1114	045A			x				Output A peak current recorded	R	float	4	2	Floating point number IEEE754	
	1116	045C			x				Output B peak current recorded	R	float	4	2	Floating point number IEEE754	
	1118	045E			x				Output C peak current recorded	R	float	4	2	Floating point number IEEE754	
	1120	0460			x				Voltage thd	R	float	4	2	Floating point number IEEE754	
	1122	0462			x				Output A voltage thd	R	float	4	2	Floating point number IEEE754	
	1124	0464			x				Output B voltage thd	R	float	4	2	Floating point number IEEE754	
	1126	0466			x				Output C voltage thd	R	float	4	2	Floating point number IEEE754	
	1128	0468			x				Current thd	R	float	4	2	Floating point number IEEE754	
	1130	046A			x				Output A current thd	R	float	4	2	Floating point number IEEE754	
	1132	046C			x				Output B current thd	R	float	4	2	Floating point number IEEE754	
	1134	046E			x				Output C current thd	R	float	4	2	Floating point number IEEE754	
	1136	0470			x				Power factor angle	R	float	4	2	Floating point number IEEE754	
	1138	0472			x				Output A power factor angle	R	float	4	2	Floating point number IEEE754	
	1140	0474			x				Output B power factor angle	R	float	4	2	Floating point number IEEE754	
	1142	0476			x				Output C power factor angle	R	float	4	2	Floating point number IEEE754	
	1144	0478			x				Displacement factor	R	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	1146	047A			x				Output A displacement factor	R	float	4	2	Floating point number IEEE754	
	1148	047C			x				Output B displacement factor	R	float	4	2	Floating point number IEEE754	
	1150	047E			x				Output C displacement factor	R	float	4	2	Floating point number IEEE754	
	1152	0480			x				Distortion factor	R	float	4	2	Floating point number IEEE754	
	1154	0482			x				Output A distortion factor	R	float	4	2	Floating point number IEEE754	
	1156	0484			x				Output B distortion factor	R	float	4	2	Floating point number IEEE754	
	1158	0486			x				Output C distortion factor	R	float	4	2	Floating point number IEEE754	
	1160	0488			x				Kilowatt hour	R	float	4	2	Floating point number IEEE754	
	1162	048A			x				Output A kilowatt hour	R	float	4	2	Floating point number IEEE754	
	1164	048C			x				Output B kilowatt hour	R	float	4	2	Floating point number IEEE754	
	1166	048E			x				Output C kilowatt hour	R	float	4	2	Floating point number IEEE754	
	1168	0490			x				Kilowatt hour elapsed time	R	float	4	2	Floating point number IEEE754	
	1170	0492			x				Output A kilowatt hour elapsed time	R	float	4	2	Floating point number IEEE754	
	1172	0494			x				Output B kilowatt hour elapsed time	R	float	4	2	Floating point number IEEE754	
	1174	0496			x				Output C kilowatt hour elapsed time	R	float	4	2	Floating point number IEEE754	
	2800	0AF0	x			x			Reset KWH	RW	bool			Coils : Kreset	ON=reset, self clear
	2801	0AF1	x			x			Enable KWH	RW	bool			Coils : Kwhenable	ON=enable, OFF=disable
Setpoints Program	3000	0BB8							Program frequency	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3002	0BBA							Program frequency A	RW	float	4	2	Floating point number IEEE754	
	3004	0BBC							Program frequency B	RW	float	4	2	Floating point number IEEE754	
	3006	0BBE							Program frequency C	RW	float	4	2	Floating point number IEEE754	
	3008	0BC0							Program voltage AC	RW	float	4	2	Floating point number IEEE754	
	3010	0BC2							Program voltage AC output A	RW	float	4	2	Floating point number IEEE754	
	3012	0BC4							Program voltage AC output B	RW	float	4	2	Floating point number IEEE754	
	3014	0BC6							Program voltage AC output C	RW	float	4	2	Floating point number IEEE754	
	3016	0BC8							Program voltage DC	RW	float	4	2	Floating point number IEEE754	
	3018	0BCA							Program voltage DC output A	RW	float	4	2	Floating point number IEEE754	
	3020	0BCC							Program voltage DC output B	RW	float	4	2	Floating point number IEEE754	
	3022	0BCE							Program voltage DC output C	RW	float	4	2	Floating point number IEEE754	
	3024	0BD0							Power limit	RW	float	4	2	Floating point number IEEE754	
	3026	0BD2							Power limit output A	RW	float	4	2	Floating point number IEEE754	
	3028	0BD4							Power limit output B	RW	float	4	2	Floating point number IEEE754	
	3030	0BD6							Power limit output C	RW	float	4	2	Floating point number IEEE754	
	3032	0BD8							Current limit ABC	RW	float	4	2	Floating point number IEEE754	
	3034	0BDA							Current limit output A	RW	float	4	2	Floating point number IEEE754	
	3036	0BDC							Current limit output B	RW	float	4	2	Floating point number IEEE754	
	3038	0BDE							Current limit output C	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3040	0BE0							KVA Limit	RW	float	4	2	Floating point number IEEE754	
	3042	0BE2							KVA Limit output A	RW	float	4	2	Floating point number IEEE754	
	3044	0BE4							KVA Limit output B	RW	float	4	2	Floating point number IEEE754	
	3046	0BE6							KVA Limit output C	RW	float	4	2	Floating point number IEEE754	
	3048	0BE8							Phase offset output	RW	float	4	2	Floating point number IEEE754	
	3050	0BEA							Phase offset output A	RW	float	4	2	Floating point number IEEE754	
	3052	0BEC							Phase offset output B	RW	float	4	2	Floating point number IEEE754	
	3054	0BEE							Phase offset output C	RW	float	4	2	Floating point number IEEE754	
	3056	0BF0							Waveform	RW	uint(16)	2	1	unsigned int 16 bits	
	3057	0BF1							Waveform output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3058	0BF2							Waveform output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3059	0BF3							Waveform output C	RW	uint(16)	2	1	unsigned int 16 bits	
	3060	0BF4							Waveform smoothing filter	RW	uint(16)	2	1	unsigned int 16 bits	Min=1, Max=101
	3061	0BF5							Waveform smoothing filter output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3062	0BF6							Waveform smoothing filter output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3063	0BF7							Waveform smoothing filter output C	RW	uint(16)	2	1	unsigned int 16 bits	
Setpoints Current source	3128	0C38							Program current AC	RW	float	4	2	Floating point number IEEE754	
	3130	0C3A							Program current AC output A	RW	float	4	2	Floating point number IEEE754	
	3132	0C3C							Program current AC output B	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3134	0C3E							Program current AC output C	RW	float	4	2	Floating point number IEEE754	
	3136	0C40							Program current DC	RW	float	4	2	Floating point number IEEE754	
	3138	0C42							Program current DC output A	RW	float	4	2	Floating point number IEEE754	
	3140	0C44							Program current DC output B	RW	float	4	2	Floating point number IEEE754	
	3142	0C46							Program current DC output C	RW	float	4	2	Floating point number IEEE754	
	3144	0C48							Voltage limit	RW	float	4	2	Floating point number IEEE754	
	3146	0C4A							Voltage limit output A	RW	float	4	2	Floating point number IEEE754	
	3148	0C4C							Voltage limit output B	RW	float	4	2	Floating point number IEEE754	
	3150	0C4E							Voltage limit output C	RW	float	4	2	Floating point number IEEE754	
Setpoints Load Constant Resistance	3256	0CB8							Resistance type	RW	uint(16)	2	1	unsigned int 16 bits	0=RESISTANCE RMS, 1=CONDUCTANCE RMS, 2=INSTANTANEOUS RESISTANCE, 3=INSTANTANEOUS CONDUCTANCE
	3257	0CB9							Resistance type output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3258	0CBA							Resistance type output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3259	0CBB							Resistance type output C	RW	uint(16)	2	1	unsigned int 16 bits	
	3260	0CBC							Resistance modulation	RW	uint(16)	2	1	unsigned int 16 bits	0=AC, 1=DC, 2=AC&DC, 3=AC=DC
	3261	0CBD							Resistance modulation output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3262	0CBE							Resistance modulation output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3263	0CBF							Resistance modulation output A	RW	uint(16)	2	1	unsigned int 16 bits	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3264	0CC0							Resistance AC	RW	float	4	2	Floating point number IEEE754	
	3266	0CC2							Resistance AC output A	RW	float	4	2	Floating point number IEEE754	
	3268	0CC4							Resistance AC output B	RW	float	4	2	Floating point number IEEE754	
	3270	0CC6							Resistance AC output C	RW	float	4	2	Floating point number IEEE754	
	3272	0CC8							Resistance DC	RW	float	4	2	Floating point number IEEE754	
	3274	0CCA							Resistance DC output A	RW	float	4	2	Floating point number IEEE754	
	3276	0CCC							Resistance DC output B	RW	float	4	2	Floating point number IEEE754	
	3278	0CCE							Resistance DC output C	RW	float	4	2	Floating point number IEEE754	
	3280	0CD0							Conductance AC	RW	float	4	2	Floating point number IEEE754	
	3282	0CD2							Conductance AC output A	RW	float	4	2	Floating point number IEEE754	
	3284	0CD4							Conductance AC output B	RW	float	4	2	Floating point number IEEE754	
	3286	0CD6							Conductance AC output C	RW	float	4	2	Floating point number IEEE754	
	3288	0CD8							Conductance DC	RW	float	4	2	Floating point number IEEE754	
	3290	0CDA							Conductance DC output A	RW	float	4	2	Floating point number IEEE754	
	3292	0CDC							Conductance DC output B	RW	float	4	2	Floating point number IEEE754	
	3294	0CDE							Conductance DC output C	RW	float	4	2	Floating point number IEEE754	
	3296	0CE0							Filter frequency	RW	float	4	2	Floating point number IEEE754	
	3298	0CE2							Filter frequency output A	RW	float	4	2	Floating point number IEEE754	
	3300	0CE4							Filter frequency output B	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3302	0CE6							Filter frequency output C	RW	float	4	2	Floating point number IEEE754	
	3304	0CE8							Stabilization factor	RW	float	4	2	Floating point number IEEE754	
	3306	0CEA							Stabilization factor output A	RW	float	4	2	Floating point number IEEE754	
	3308	0CEC							Stabilization factor output B	RW	float	4	2	Floating point number IEEE754	
	3310	0CEE							Stabilization factor output C	RW	float	4	2	Floating point number IEEE754	
Setpoints Load Constant Power	3384	0D38							Power type	RW	uint(16)	2	1	unsigned int 16 bits	0=APPARENT POWER RMS, 1=ACTIVE POWER RMS
	3385	0D39							Power type output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3386	0D3A							Power type output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3387	0D3B							Power type output C	RW	uint(16)	2	1	unsigned int 16 bits	
	3388	0D3C							Power modulation	RW	uint(16)	2	1	unsigned int 16 bits	0=AC, 1=DC, 2=AC&DC
	3389	0D3D							Power modulation output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3390	0D3E							Power modulation output B	RW	uint(16)	2	1	unsigned int 16 bits	
	3391	0D3F							Power modulation output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3392	0D40							Power AC	RW	float	4	2	Floating point number IEEE754	
	3394	0D42							Power AC output A	RW	float	4	2	Floating point number IEEE754	
	3396	0D44							Power AC output B	RW	float	4	2	Floating point number IEEE754	
	3398	0D46							Power AC output C	RW	float	4	2	Floating point number IEEE754	
	3400	0D48							Power DC	RW	float	4	2	Floating point number IEEE754	
	3402	0D4A							Power DC output A	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3404	0D4C							Power DC output B	RW	float	4	2	Floating point number IEEE754	
	3406	0D4E							Power DC output C	RW	float	4	2	Floating point number IEEE754	
	3408	0D50							kVA AC	RW	float	4	2	Floating point number IEEE754	
	3410	0D52							kVA AC output A	RW	float	4	2	Floating point number IEEE754	
	3412	0D54							kVA AC output B	RW	float	4	2	Floating point number IEEE754	
	3414	0D56							kVA AC output C	RW	float	4	2	Floating point number IEEE754	
	3416	0D58							kVA DC	RW	float	4	2	Floating point number IEEE754	
	3418	0D5A							kVA DC output A	RW	float	4	2	Floating point number IEEE754	
	3420	0D5C							kVA DC output B	RW	float	4	2	Floating point number IEEE754	
	3422	0D5E							kVA DC output C	RW	float	4	2	Floating point number IEEE754	
Setpoints Load Circuit Emulation															0=R, 1=SERIES RL, 2=SERIES RC, 3=R // SERIES RL, 4=R // SERIES RC, 5=R (L // C), 6.L (R // C), 7=C (R // L), 8=SERIES RLC, 9=R // SERIES RLC, 10=SERIES RL // SERIES RC, 11=R // SERIES RL // SERIES RC, 12=SERIES RL (R // C), 13=RECTIFIER SINGLE PHASE, 14=RECTIFIER THREE PHASE
	3512	0DB8							Circuit emulation type	RW	uint(16)	2	1	unsigned int 16 bits	
	3513	0DB9							Circuit emulation type output A	RW	uint(16)	2	1	unsigned int 16 bits	
	3514	0DBA							Circuit emulation type output B	RW	uint(16)	2	1	unsigned int 16 bits	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	3515	0DBB							Circuit emulation type output C	RW	uint(16)	2	1	unsigned int 16 bits	
	3516	0DBC							Resistance	RW	float	4	2	Floating point number IEEE754	
	3518	0DBE							Resistance output A	RW	float	4	2	Floating point number IEEE754	
	3520	0DC0							Resistance output B	RW	float	4	2	Floating point number IEEE754	
	3522	0DC2							Resistance output C	RW	float	4	2	Floating point number IEEE754	
	3524	0DC4							Resistance (RL)	RW	float	4	2	Floating point number IEEE754	
	3526	0DC6							Resistance (RL) output A	RW	float	4	2	Floating point number IEEE754	
	3528	0DC8							Resistance (RL) output B	RW	float	4	2	Floating point number IEEE754	
	3530	0DCA							Resistance (RL) output C	RW	float	4	2	Floating point number IEEE754	
	3532	0DCC							Resistance (RC)	RW	float	4	2	Floating point number IEEE754	
	3534	0DCE							Resistance (RC) output A	RW	float	4	2	Floating point number IEEE754	
	3536	0DD0							Resistance (RC) output B	RW	float	4	2	Floating point number IEEE754	
	3538	0DD2							Resistance (RC) output C	RW	float	4	2	Floating point number IEEE754	
	3540	0DD4							Inductance	RW	float	4	2	Floating point number IEEE754	
	3542	0DD6							Inductance output A	RW	float	4	2	Floating point number IEEE754	
	3544	0DD8							Inductance output B	RW	float	4	2	Floating point number IEEE754	
	3546	0DDA							Inductance output C	RW	float	4	2	Floating point number IEEE754	
	3548	0DDC							Capacitance	RW	float	4	2	Floating point number IEEE754	
	3550	0DDE							Capacitance output A	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example	
	3552	0DE0							Capacitance output B	RW	float	4	2	Floating point number IEEE754		
	3554	0DE2							Capacitance output C	RW	float	4	2	Floating point number IEEE754		
	3556	0DE4							Initial voltage	RW	float	4	2	Floating point number IEEE754		
	3558	0DE6							Initial voltage output A	RW	float	4	2	Floating point number IEEE754		
	3560	0DE8							Initial voltage output B	RW	float	4	2	Floating point number IEEE754		
	3562	0DEA							Initial voltage output C	RW	float	4	2	Floating point number IEEE754		
	3564	0DEC							Filter frequency	RW	float	4	2	Floating point number IEEE754		
	3566	0DEE							Filter frequency output A	RW	float	4	2	Floating point number IEEE754		
	3568	0DF0							Filter frequency output B	RW	float	4	2	Floating point number IEEE754		
	3570	0DF2							Filter frequency output C	RW	float	4	2	Floating point number IEEE754		
	4000	0FA0	x			x			Enable output	RW	bool			Coils: Output	ON=enable, OFF=disable	
	4001	0FA1	x			x			Enable output A	RW	bool			Coils: Output		
	4002	0FA2	x			x			Enable output B	RW	bool			Coils: Output		
	4003	0FA3	x			x			Enable output C	RW	bool			Coils: Output		
	4004	0FA4	x			x			Sync frequency	RW	bool			Coils: Sync frequency	ON=enable, OFF=disable	
	4005	0FA5	x			x			Sync frequency	RW	bool			Coils: Sync frequency		
	4006	0FA6	x			x			Sync frequency	RW	bool			Coils: Sync frequency		
	4007	0FA7	x			x			Sync frequency	RW	bool			Coils: Sync frequency		
	4008	0FA8	x			x			Circuit emulation	RW	bool			Coils: Circuit emulation	ON=enable, OFF=disable	
4009	0FA9	x			x			Circuit emulation output A	RW	bool			Coils: Circuit emulation			

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	4010	0FAA	x			x			Circuit emulation output B	RW	bool			Coils: Circuit emulation	
	4011	0FAB	x			x			Circuit emulation output C	RW	bool			Coils: Circuit emulation	
Protection	5000	1388	x			x			RMS Current protection	RW	bool				
	5001	1389	x			x			Output A RMS Current protection	RW	bool				
	5002	138A	x			x			Output B RMS Current protection	RW	bool				
	5003	138B	x			x			Output C RMS Current protection	RW	bool				
	5004	138C	x			x			RMS Power protection	RW	bool				
	5005	138D	x			x			Output A RMS Power protection	RW	bool				
	5006	138E	x			x			Output B RMS Power protection	RW	bool				
	5007	138F	x			x			Output C RMS Power protection	RW	bool				
	5008	1390	x			x			Peak current protection	RW	bool				
	5009	1391	x			x			Output A Peak current protection	RW	bool				
	5010	1392	x			x			Output B Peak current protection	RW	bool				
	5011	1393	x			x			Output C Peak current protection	RW	bool				
	5012	1394	x			x			Peak voltage protection	RW	bool				
	5013	1395	x			x			Output A Peak voltage protection	RW	bool				
	5014	1396	x			x			Output B Peak voltage protection	RW	bool				
	5015	1397	x			x			Output C Peak voltage protection	RW	bool				
	5016	1398	x			x			Peak power protection	RW	bool				

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	5017	1399	x			x			Output A Peak power protection	RW	bool				
	5018	139A	x			x			Output B Peak power protection	RW	bool				
	5019	139B	x			x			Output C Peak power protection	RW	bool				
	5024	13A0							Current level	RW	float	4	2	Floating point number IEEE754	
	5026	13A2							Output A Current level	RW	float	4	2	Floating point number IEEE754	
	5028	13A4							Output B Current level	RW	float	4	2	Floating point number IEEE754	
	5030	13A6							Output C Current level	RW	float	4	2	Floating point number IEEE754	
	5032	13A8							Power level	RW	float	4	2	Floating point number IEEE754	
	5034	13AA							Output A Power level	RW	float	4	2	Floating point number IEEE754	
	5036	13AC							Output B Power level	RW	float	4	2	Floating point number IEEE754	
	5038	13AE							Output C Power level	RW	float	4	2	Floating point number IEEE754	
	5040	13B0							KVA Level	RW	float	4	2	Floating point number IEEE754	
	5042	13B2							Output A KVA Level	RW	float	4	2	Floating point number IEEE754	
	5044	13B4							Output B KVA Level	RW	float	4	2	Floating point number IEEE754	
	5046	13B6							Output C KVA Level	RW	float	4	2	Floating point number IEEE754	
	5048	13B8							Trip time	RW	float	4	2	Floating point number IEEE754	minimum step of 0.1 seconds
	5050	13BA							Output A Trip time	RW	float	4	2	Floating point number IEEE754	
	5052	13BC							Output B Trip time	RW	float	4	2	Floating point number IEEE754	
	5054	13BE							Output C Trip time	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	5056	13C0							Peak current limit	RW	float	4	2	Floating point number IEEE754	
	5058	13C2							Output A Peak current limit	RW	float	4	2	Floating point number IEEE754	
	5060	13C4							Output B Peak current limit	RW	float	4	2	Floating point number IEEE754	
	5062	13C6							Output C Peak current limit	RW	float	4	2	Floating point number IEEE754	
	5064	13C8							Peak current protection level	RW	float	4	2	Floating point number IEEE754	
	5066	13CA							Output A Peak current protection level	RW	float	4	2	Floating point number IEEE754	
	5068	13CC							Output B Peak current protection level	RW	float	4	2	Floating point number IEEE754	
	5070	13CE							Output C Peak current protection level	RW	float	4	2	Floating point number IEEE754	
	5072	13D0							Peak voltage protection margin	RW	float	4	2	Floating point number IEEE754	
	5074	13D2							Output A Peak voltage protection margin	RW	float	4	2	Floating point number IEEE754	
	5076	13D4							Output B Peak voltage protection margin	RW	float	4	2	Floating point number IEEE754	
	5078	13D6							Output C Peak voltage protection margin	RW	float	4	2	Floating point number IEEE754	
	5080	13D8							Peak voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5082	13DA							Output A Peak voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5084	13DC							Output B Peak voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5086	13DE							Output C Peak voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5088	13E0							Peak voltage protection mode	RW	uint(16)	2	1	unsigned int 16 bits	0=MARGIN, 1=LEVEL, 2=MARGIN&LEVEL
	5089	13E1							Output A Peak voltage protection mode	RW	uint(16)	2	1	unsigned int 16 bits	
	5090	13E2							Output B Peak voltage protection mode	RW	uint(16)	2	1	unsigned int 16 bits	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	5091	13E3							Output C Peak voltage protection mode	RW	uint(16)	2	1	unsigned int 16 bits	
	5092	13E4							Peak current protection margin	RW	float	4	2	Floating point number IEEE754	
	5094	13E6							Output A Peak current protection margin	RW	float	4	2	Floating point number IEEE754	
	5096	13E8							Output B Peak current protection margin	RW	float	4	2	Floating point number IEEE754	
	5098	13EA							Output C Peak current protection margin	RW	float	4	2	Floating point number IEEE754	
	5100	13EC							Peak current protection mode	RW	uint(16)	2	1	unsigned int 16 bits	0=MARGIN, 1=LEVEL, 2=MARGIN&LEVEL
	5101	13ED							Output A Peak current protection mode	RW	uint(16)	2	1	unsigned int 16 bits	
	5102	13EE							Output B Peak current protection mode	RW	uint(16)	2	1	unsigned int 16 bits	
	5103	13EF							Output C Peak current protection mode	RW	uint(16)	2	1	unsigned int 16 bits	
	5104	13F0							Peak power protection level	RW	float	4	2	Floating point number IEEE754	
	5106	13F2							Output A Peak power protection level	RW	float	4	2	Floating point number IEEE754	
	5108	13F4							Output B Peak power protection level	RW	float	4	2	Floating point number IEEE754	
	5110	13F6							Output C Peak power protection level	RW	float	4	2	Floating point number IEEE754	
	5112	13F8	x			x			Over voltage protection	RW	bool				
	5113	13F9	x			x			Output A Over voltage protection	RW	bool				
	5114	13FA	x			x			Output B Over voltage protection	RW	bool				
	5115	13FB	x			x			Output C Over voltage protection	RW	bool				
	5116	13FC	x			x			Under voltage protection	RW	bool				
5117	13FD	x			x			Output A Under voltage protection	RW	bool					

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	5118	13FE	x			x			Output B Under voltage protection	RW	bool				
	5119	13FF	x			x			Output C Under voltage protection	RW	bool				
	5120	1400	x			x			Over frequency protection	RW	bool				
	5121	1401	x			x			Output A Over frequency protection	RW	bool				
	5122	1402	x			x			Output B Over frequency protection	RW	bool				
	5123	1403	x			x			Output C Over frequency protection	RW	bool				
	5124	1404	x			x			Under frequency protection	RW	bool				
	5125	1405	x			x			Output A Under frequency protection	RW	bool				
	5126	1406	x			x			Output B Under frequency protection	RW	bool				
	5127	1407	x			x			Output C Under frequency protection	RW	bool				
	5128	1408							Over voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5130	140A							Output A Over voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5132	140C							Output B Over voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5134	140E							Output C Over voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5136	1410							Under voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5138	1412							Output A Under voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5140	1414							Output B Under voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5142	1416							Output C Under voltage protection level	RW	float	4	2	Floating point number IEEE754	
	5144	1418							Over frequency protection level	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	5146	141A							Output A Over frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5148	141C							Output B Over frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5150	141E							Output C Over frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5152	1420							Under frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5154	1422							Output A Under frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5156	1424							Output B Under frequency protection level	RW	float	4	2	Floating point number IEEE754	
	5158	1426							Output C Under frequency protection level	RW	float	4	2	Floating point number IEEE754	
Configuration Slew	6000	1770							Ramp time	RW	float	4	2	Floating point number IEEE754	0.222 Seconds
	6002	1772							Output A Ramp time	RW	float	4	2	Floating point number IEEE754	
	6004	1774							Output B Ramp time	RW	float	4	2	Floating point number IEEE754	
	6006	1776							Output C Ramp time	RW	float	4	2	Floating point number IEEE754	
	6008	1778							Voltage AC	RW	float	4	2	Floating point number IEEE754	
	6010	177A							Output A Voltage AC	RW	float	4	2	Floating point number IEEE754	
	6012	177C							Output B Voltage AC	RW	float	4	2	Floating point number IEEE754	
	6014	177E							Output C Voltage AC	RW	float	4	2	Floating point number IEEE754	
	6016	1780							Frequency	RW	float	4	2	Floating point number IEEE754	
	6018	1782							Output A Frequency	RW	float	4	2	Floating point number IEEE754	
	6020	1784							Output B Frequency	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	6022	1786							Output C Frequency	RW	float	4	2	Floating point number IEEE754	
	6024	1788							Voltage DC	RW	float	4	2	Floating point number IEEE754	
	6026	178A							Output A Voltage DC	RW	float	4	2	Floating point number IEEE754	
	6028	178C							Output B Voltage DC	RW	float	4	2	Floating point number IEEE754	
	6030	178E							Output C Voltage DC	RW	float	4	2	Floating point number IEEE754	
	6032	1790							Phase	RW	float	4	2	Floating point number IEEE754	
	6034	1792							Output A Phase	RW	float	4	2	Floating point number IEEE754	
	6036	1794							Output B Phase	RW	float	4	2	Floating point number IEEE754	
	6038	1796							Output C Phase	RW	float	4	2	Floating point number IEEE754	
	6040	1798	x			x			Slew rate control	RW	bool				
	6041	1799	x			x			Output A Slew rate control	RW	bool				
	6042	179A	x			x			Output B Slew rate control	RW	bool				
	6043	179B	x			x			Output C Slew rate control	RW	bool				
	6048	17A0							Voltage	RW	float	4	2	Floating point number IEEE754	
	6050	17A2							Output A Voltage	RW	float	4	2	Floating point number IEEE754	
	6052	17A4							Output B Voltage	RW	float	4	2	Floating point number IEEE754	
	6054	17A6							Output C Voltage	RW	float	4	2	Floating point number IEEE754	
	6056	17A8							Current	RW	float	4	2	Floating point number IEEE754	
	6058	17AA							Output A Current	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	6060	17AC							Output B Current	RW	float	4	2	Floating point number IEEE754	
	6062	17AE							Output C Current	RW	float	4	2	Floating point number IEEE754	
	6064	17B0							Current AC	RW	float	4	2	Floating point number IEEE754	
	6066	17B2							Output A Current AC	RW	float	4	2	Floating point number IEEE754	
	6068	17B4							Output B Current AC	RW	float	4	2	Floating point number IEEE754	
	6070	17B6							Output C Current AC	RW	float	4	2	Floating point number IEEE754	
	6072	17B8							Current DC	RW	float	4	2	Floating point number IEEE754	
	6074	17BA							Output A Current DC	RW	float	4	2	Floating point number IEEE754	
	6076	17BC							Output B Current DC	RW	float	4	2	Floating point number IEEE754	
	6078	17BE							Output C Current DC	RW	float	4	2	Floating point number IEEE754	
	6080	17C0							Resistance AC	RW	float	4	2	Floating point number IEEE754	
	6082	17C2							Output A Resistance AC	RW	float	4	2	Floating point number IEEE754	
	6084	17C4							Output B Resistance AC	RW	float	4	2	Floating point number IEEE754	
	6086	17C6							Output C Resistance AC	RW	float	4	2	Floating point number IEEE754	
	6088	17C8							Resistance DC	RW	float	4	2	Floating point number IEEE754	
	6090	17CA							Output A Resistance DC	RW	float	4	2	Floating point number IEEE754	
	6092	17CC							Output B Resistance DC	RW	float	4	2	Floating point number IEEE754	
	6094	17CE							Output C Resistance DC	RW	float	4	2	Floating point number IEEE754	
	6096	17D0							Conductance AC	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	6098	17D2							Output A Conductance AC	RW	float	4	2	Floating point number IEEE754	
	6100	17D4							Output B Conductance AC	RW	float	4	2	Floating point number IEEE754	
	6102	17D6							Output C Conductance AC	RW	float	4	2	Floating point number IEEE754	
	6104	17D8							Conductance DC	RW	float	4	2	Floating point number IEEE754	
	6106	17DA							Output A Conductance DC	RW	float	4	2	Floating point number IEEE754	
	6108	17DC							Output B Conductance DC	RW	float	4	2	Floating point number IEEE754	
	6110	17DE							Output C Conductance DC	RW	float	4	2	Floating point number IEEE754	
	6112	17E0							Power AC	RW	float	4	2	Floating point number IEEE754	
	6114	17E2							Output A Power AC	RW	float	4	2	Floating point number IEEE754	
	6116	17E4							Output B Power AC	RW	float	4	2	Floating point number IEEE754	
	6118	17E6							Output C Power AC	RW	float	4	2	Floating point number IEEE754	
	6120	17E8							Power DC	RW	float	4	2	Floating point number IEEE754	
	6122	17EA							Output A Power DC	RW	float	4	2	Floating point number IEEE754	
	6124	17EC							Output B Power DC	RW	float	4	2	Floating point number IEEE754	
	6126	17EE							Output C Power DC	RW	float	4	2	Floating point number IEEE754	
	6128	17F0							kVA AC	RW	float	4	2	Floating point number IEEE754	
	6130	17F2							Output A kVA AC	RW	float	4	2	Floating point number IEEE754	
	6132	17F4							Output B kVA AC	RW	float	4	2	Floating point number IEEE754	
	6134	17F6							Output C kVA AC	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	6136	17F8							kVA DC	RW	float	4	2	Floating point number IEEE754	
	6138	17FA							Output A kVA DC	RW	float	4	2	Floating point number IEEE754	
	6140	17FC							Output B kVA DC	RW	float	4	2	Floating point number IEEE754	
	6142	17FE							Output C kVA DC	RW	float	4	2	Floating point number IEEE754	
Configuration Unit Settings	8000	1F40							Configuration form	RW	uint(16)	2	1	unsigned int 16 bits	1=SINGLE, 2=SPLIT, 3=THREE, 4=TWO OUTP, 5=THREE OUTP, 6=SPLIT+ONE
	8001	1F41							Configuration voltage range	RW	uint(16)	2	1	unsigned int 16 bits	0=LOW, 1=HIGH
	8002	1F42							Configuration mode	RW	uint(16)	2	1	unsigned int 16 bits	0=AC, 1=DC, 2=AC-DC
	8003	1F43							Phase rotation	RW	uint(16)	2	1	unsigned int 16 bits	0=NEGATIVE, 1=POSITIVE
	8004	1F44							Output impedance mode	RW	uint(16)	2	1	unsigned int 16 bits	0=REAL TIME, 1=RMS
	8005	1F45							Output A impedance mode	RW	uint(16)	2	1	unsigned int 16 bits	
	8006	1F46							Output B impedance mode	RW	uint(16)	2	1	unsigned int 16 bits	
	8007	1F47							Output C impedance mode	RW	uint(16)	2	1	unsigned int 16 bits	
	8016	1F50							Update phase	RW	float	4	2	Floating point number IEEE754	
	8018	1F52							Output A update phase	RW	float	4	2	Floating point number IEEE754	
	8020	1F54							Output B update phase	RW	float	4	2	Floating point number IEEE754	
	8022	1F56							Output C update phase	RW	float	4	2	Floating point number IEEE754	
	8024	1F58							Output phase disable	RW	float	4	2	Floating point number IEEE754	
	8026	1F5A							Output A phase disable	RW	float	4	2	Floating point number IEEE754	

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
	8028	1F5C							Output B phase disable	RW	float	4	2	Floating point number IEEE754	
	8030	1F5E							Output C phase disable	RW	float	4	2	Floating point number IEEE754	
	8032	1F60							Max CSC gain	RW	float	4	2	Floating point number IEEE754	
	8034	1F62							Output A max CSC gain	RW	float	4	2	Floating point number IEEE754	
	8036	1F64							Output B max CSC gain	RW	float	4	2	Floating point number IEEE754	
	8038	1F66							Output C max CSC gain	RW	float	4	2	Floating point number IEEE754	
	8048	1F70	x			x			Continuous self calibration	RW	bool				
	8049	1F71	x			x			Output A continuous self calibration	RW	bool				
	8050	1F72	x			x			Output B continuous self calibration	RW	bool				
	8051	1F73	x			x			Output C continuous self calibration	RW	bool				
	8052	1F74	x			x			Fault on saturation	RW	bool				
	8053	1F75	x			x			Output A fault on saturation	RW	bool				
	8054	1F76	x			x			Output B fault on saturation	RW	bool				
	8055	1F77	x			x			Output C fault on saturation	RW	bool				
	8056	1F78							Operating mode	RW	uint(16)	2	1	unsigned int 16 bits	0=VOLTAGE SOURCE, 1=CURRENT SOURCE, 2=ACTIVE LOAD
	8057	1F79							Output A Operating mode	RW	uint(16)	2	1	unsigned int 16 bits	Requires FORM to be set to 4, 5, or 6. (4 = Two outputs, 5 = Three outputs, 6 = Split plus one output)
	8058	1F7A							Output B Operating mode	RW	uint(16)	2	1	unsigned int 16 bits	
8059	1F7B							Output C Operating mode	RW	uint(16)	2	1	unsigned int 16 bits		
8060	1F7C								Load type	RW	uint(16)	2	1	unsigned int 16 bits	0=CONSTANT CURRENT, 1=CONSTANT

	Modbus address (dec)	Modbus address (hex)	Read coils	Read holding registers	Read input registers (0x06)	Write single coil (0x05)	Write single register (0x06)	Write multiple registers (0x10)	Description	Access	Data type	Data length in bytes	Number of registers	Data	Example
															RESISTANCE, 2=CONSTANT POWER, 3=CIRCUIT EMULATION
	8061	1F7D							Output A Load type	RW	uint(16)	2	1	unsigned int 16 bits	
	8062	1F7E							Output B Load type	RW	uint(16)	2	1	unsigned int 16 bits	
	8063	1F7F							Output C Load type	RW	uint(16)	2	1	unsigned int 16 bits	
SCPI	64000	FA00							SCPI Write/query	RW	char	246	123	ASCII	MEASure:VOLTage:DC:NC#?
	64256	FB00							SCPI Command last answer			1024	512	ASCII	0.000,0.000,0.000,0.000
	64769	FD01	x			x			SCPI Char 16 endianness	RW	bool			Coils : Endianness	OFF= little; ON= Inverted
	64770	FD02	x			x			SCPI Response next page	RW	bool			Coils : Next Page	ON=next, self clear

14.3 ModBus Control Example using Python

For those not familiar with using the ModBus TCP protocols, the example code shown here using Python may be of assistance in getting started.

Note: The example code named “modbustcp-example-1.py” referenced below is available for download at the following link in the ‘python’ directory:

https://github.com/PPST-Inc/ModbusTCP_Examples

This example code performs the following tasks in the order shown below.

```
> python.exe modbustcp-example-1.py
Enter the IP address of the unit: 192.168.107.183
Connecting
Setting voltage AC to 0 Vrms
Setting frequency to 50 Hz
Turning output on...
Setting voltage AC to 30 Vrms
Reading RMS voltage measurement
Voltage RMS measurement: 29.93 Vrms
Reading RMS current measurement
Current RMS measurement: 2.74 Arms
Turning output off
Disconnecting
Done
```

The dependencies and requirements to run the sample code are shown in the program comments and are:

```
# PPST ModbusTCP python example 1
# Version: 1.0.0
# Date: 11/07/2022
# Dependences:
# - pip install pymodbus
# - pip install pyModbusTCP
# Last tested with:
# - Python 3.10.5
# - pymodbus 3.0.2
# - pyModbusTCP 0.2.0
```

More advanced samples can be found using the link referenced above.

15 CE MARK Declaration of Conformity

The Manufacturer hereby declares that the products:

Product Name: AFX Series & ADF Series® Power Sources, All Models in Series

Conforms to the following standards or other normative documents:

RoHS (DIRECTIVE 2015/863/EU)

Standard applied EN IEC 63000:2018

SAFETY (DIRECTIVE 2014/35/EU):

Standard applied EN 61010-1: 2010; ED3/A1:2019

EMC (DIRECTIVE 2014/30/EU):

Standard applied EN 61326-1: 2013

Reference Standards:

ELECTROMAGNETIC EMISSIONS:

Radiated Emissions CISPR 11/22, CLASS A LIMITS
Conducted Emissions CISPR 11/22, CLASS A LIMITS

ELECTROMAGNETIC IMMUNITY:

RF Electromagnetic Field IEC 61000-4-3:2006+A1:2007+A2:2010
80 – 1000 MHz, 10 V/m
1 Khz sinewave (80% AM) 1.4 – 2 GHz, 3 V/m
2.0 – 2.7 GHz, 1 V/m
Conducted RF Immunity IEC 61000-4-6:2013
Conducted RF Immunity 0.15 – 80 MHz @ 3 Vrms
Electrostatic Discharge IEC 61000-4-2:2008
± 4 kV contact discharge
± 8 kV air discharge
Electrical Fast Transient/Burst IEC 61000-4-4:2004+A1:2010
AC or DC power ports, ± 2.0 kV
Signal and I/O ports, ± 1.0 kV
Surge IEC 61000-4-5:2006
AC or DC power ports, ± 2.0 kV Line to ground and ± 1.0 kV Line to Line
Power Frequency Magnetic Field IEC 61000-4-8:2009
30 A/m

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