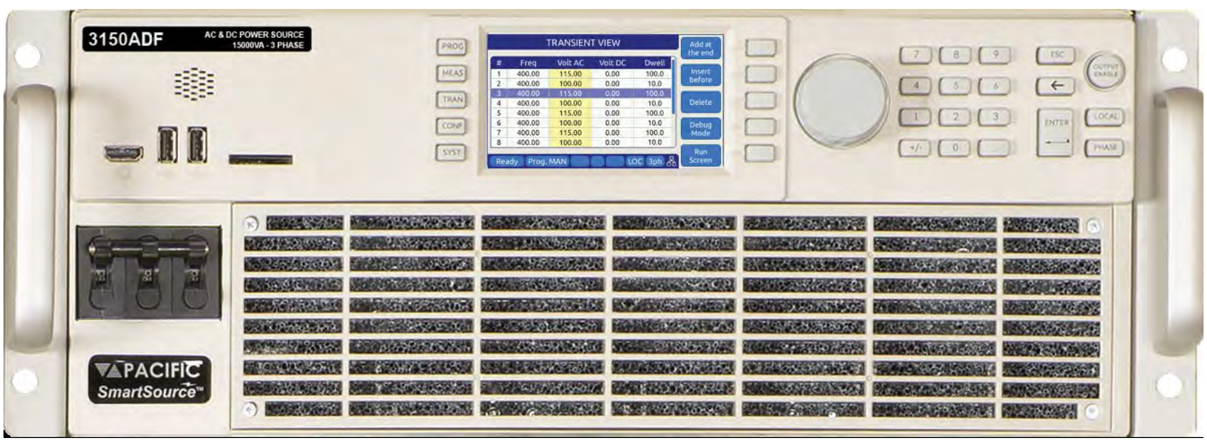
# Operation Manual

ADF Series™ – Rev 1.2.0 P/N 160670-10

# ADF Series®
# Programmable AC Power Source




LXI™
LAN eXtensions for Instrumentation

PACIFIC® POWER SOURCE

**PACIFIC POWER SOURCE**

Worldwide Supplier of Precision Programmable Power

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# 2 Safety & Warranty Information

## 2.1 General Terms & Conditions

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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 temperature 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 presence 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 cable 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.**

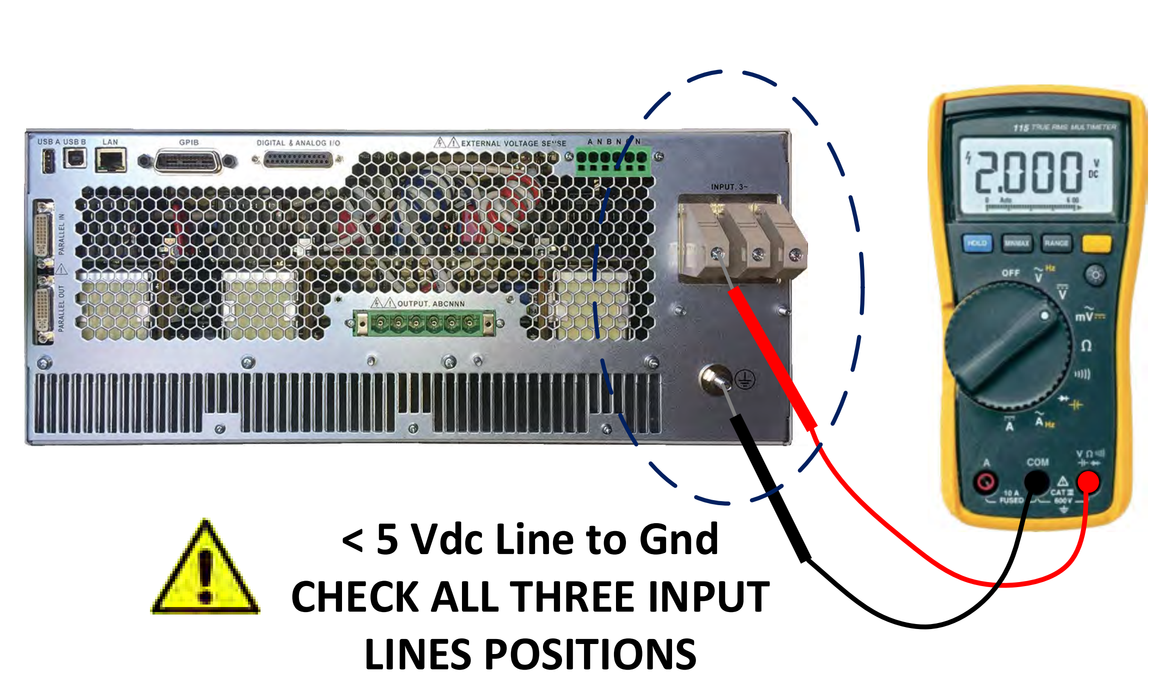



*Figure 2-1: EMI AC Input Filter Residual Voltage Check after disconnecting AC Mains power*

**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 PIECES ET DE COMPOSANTS – NE PAS MODIFIER L´EQUIPEMENT**

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.

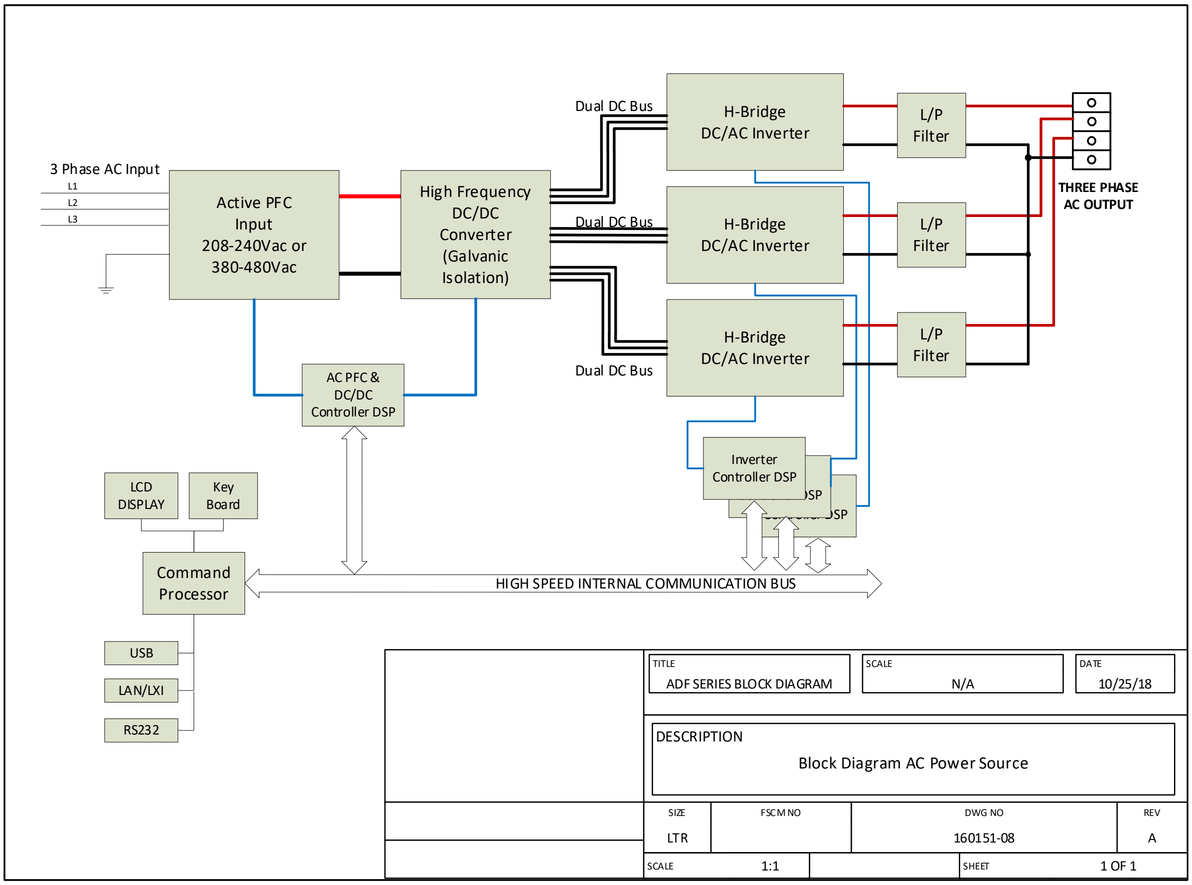



*Figure 3-1: ADF Series® Basic Block Diagram*

## 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*

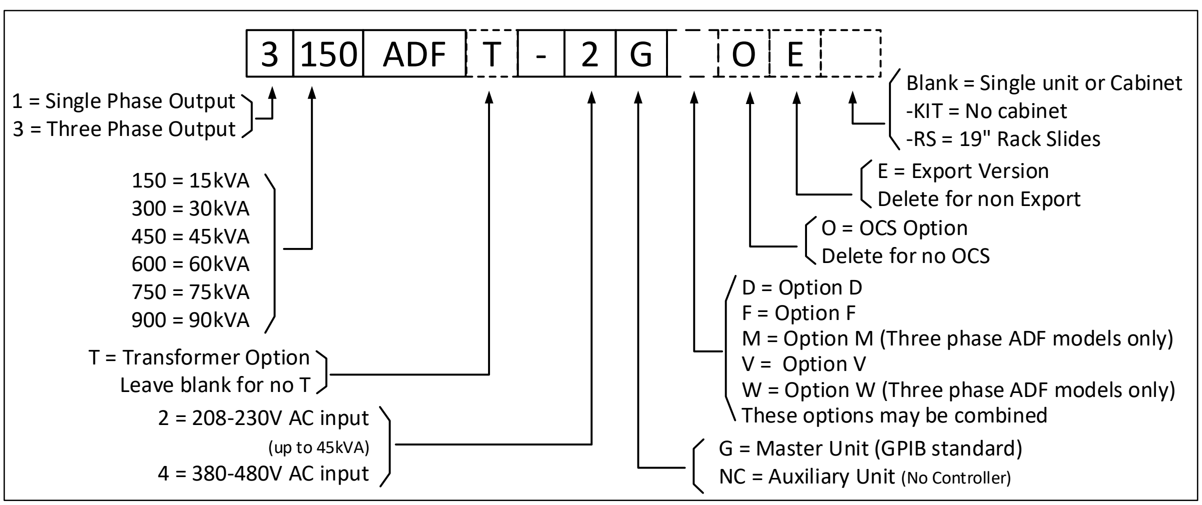
## 3.8 Available Options

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<br>Shorting adaptor for A,B,C phases P/N 160086 available. | Requires 3 Phase ADF (3150ADF) |
| O | Output Control Switch | |
| 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 |
|---|---|---|---|---|---|
| **190ADF**[1] | 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 |
|---|---|---|---|---|---|
| **390ADF**[1] | 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% \|<br>Option F: 500 to 1000 Hz < 1.0% \| > 1000 Hz < 1.5%<br>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<br>(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):**<br>*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.*<br>***Frequency Resolution for Export Models***<br>*Range* — *Resolution*<br>*1.00 - 99.99 Hz* — *0.01 Hz*<br>*100-599.9 Hz* — *0.1 Hz*<br>*600 - 999 Hz* — *2.0 Hz*<br>*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.* |

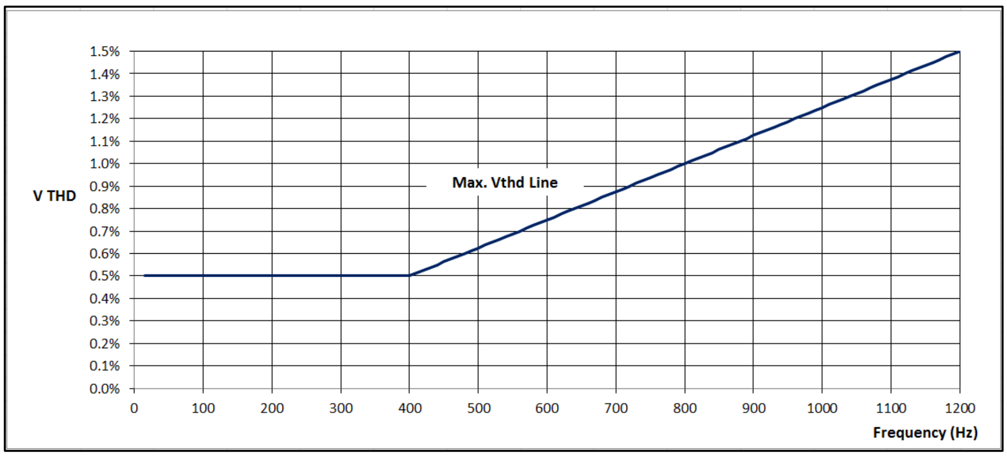
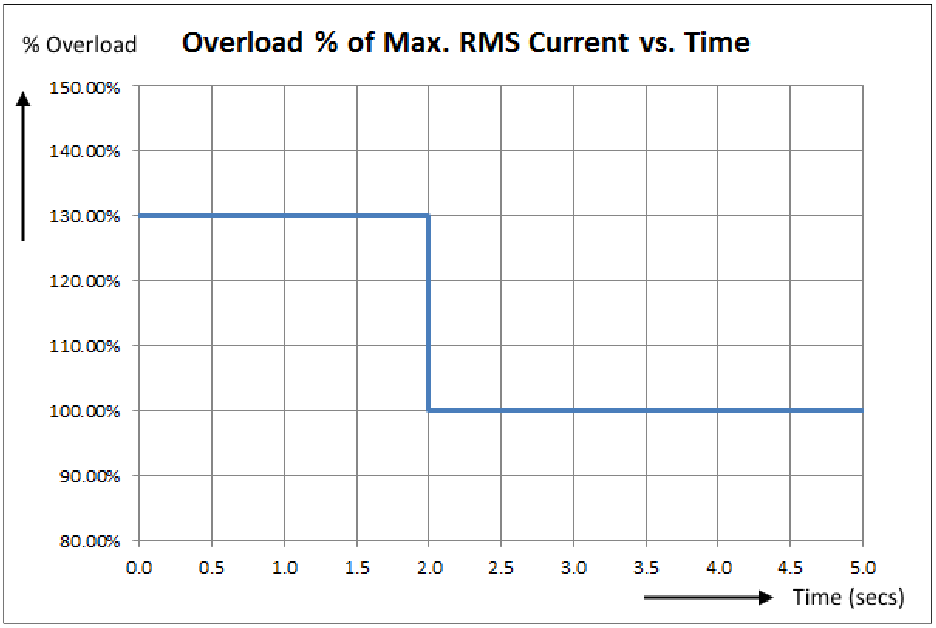



*Figure 4-1: Output Voltage distortion into full R Load as a function of Frequency*

### 4.3.1 Temporary Current Overload



### 4.3.2 AC Voltage and Current Output Charts

**AC VOLTAGE RANGES**

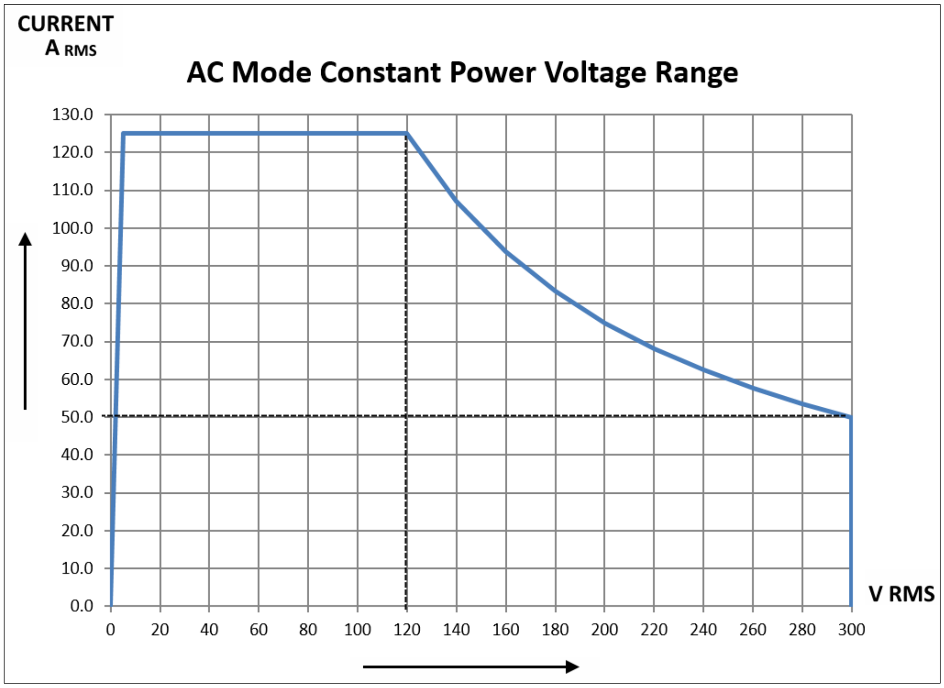



*Figure 4-3: AC Mode Voltage/Current range, 1150ADF Model*

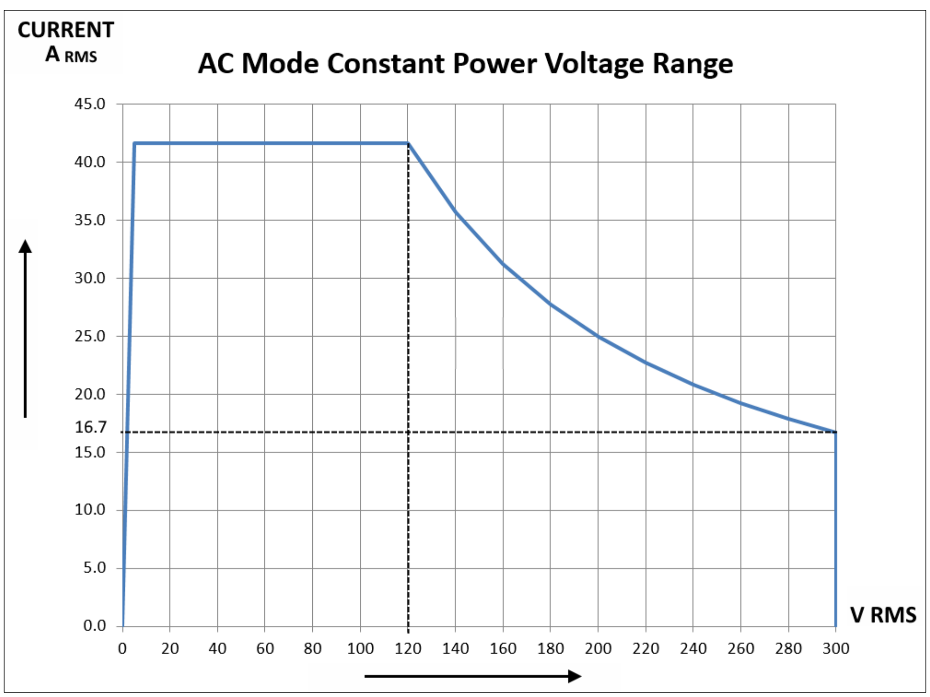



*Figure 4-4: AC Mode Voltage/Current range, 3150ADF Model per Phase*

### 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 0 312$V_{LN}$
- 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 100.

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 217.

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.

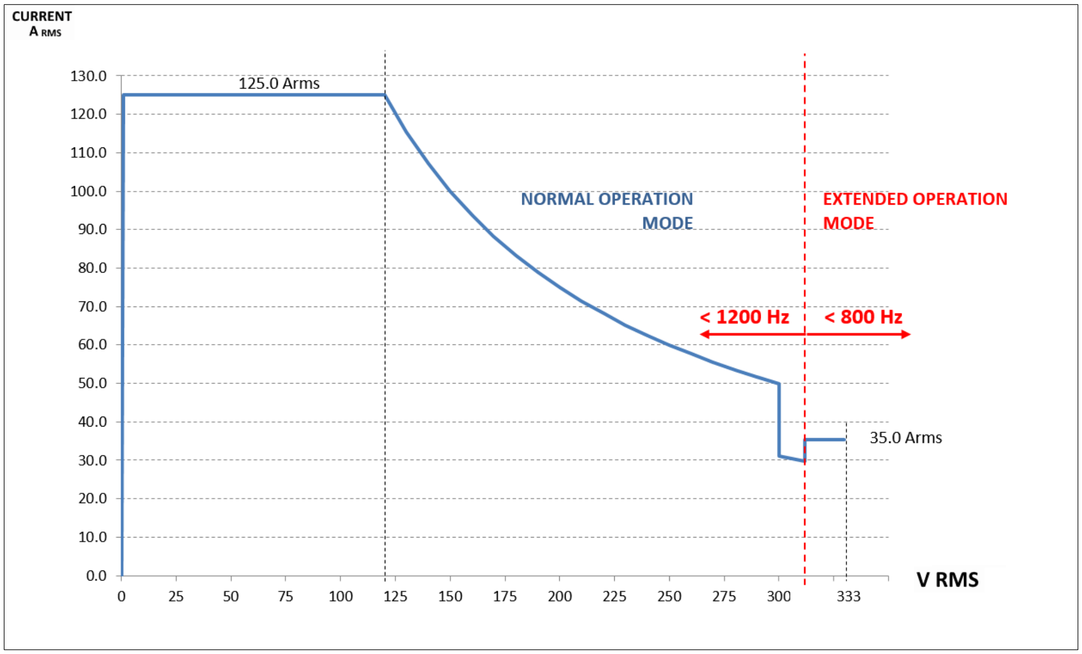



*Figure 4-5: Extended AC Voltage/Current Range, 1150ADF Model*

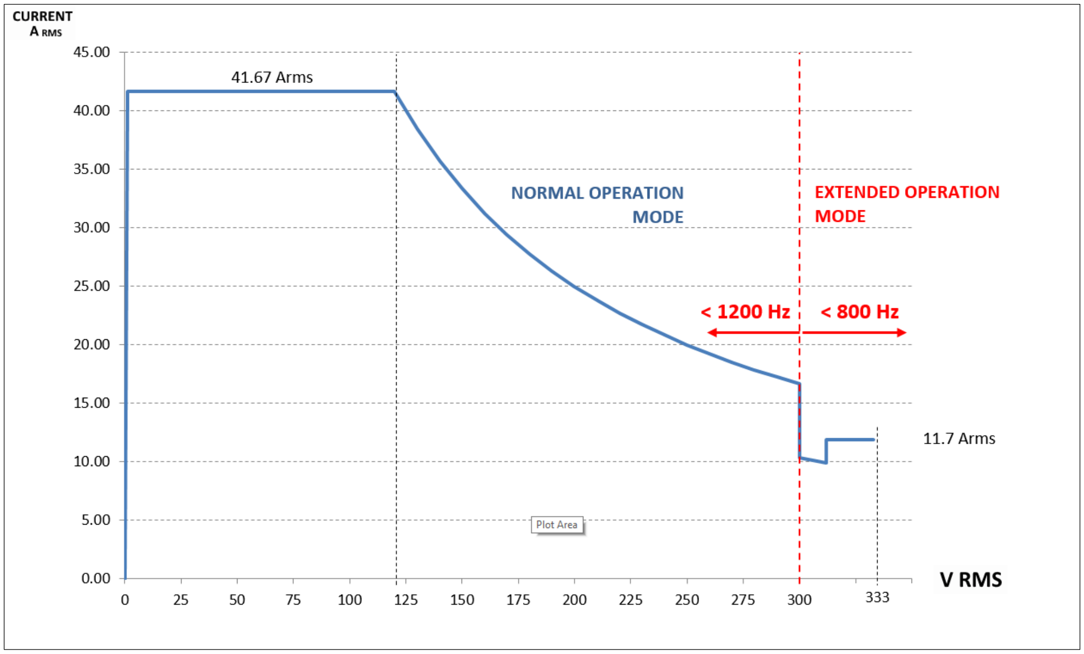



*Figure 4-6: Extended AC Voltage/Current Range, 3150ADF Model per phase*

## 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 | |
| **3600ADF- xGD** | 3 / 2 Phase | 60 / 45 kVA | | 83.5 Adc | n/a | Fully wired 36U Cabinet power system |

## 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 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 Irms | |
| 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 Irms | |
| 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.

## 4.8 Dimensions & Weight

| DIMENSIONS & WEIGHT | 9 kVA | 15 kVA |
|---|---|---|
| Dimensions | | |
| Height | 7.0” / 178 mm / 4U | |
| Width | 17.0” / 432 mm – w/o rack handles<br>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.*

[1] For nominal line input voltage
[2] For nominal line input voltage

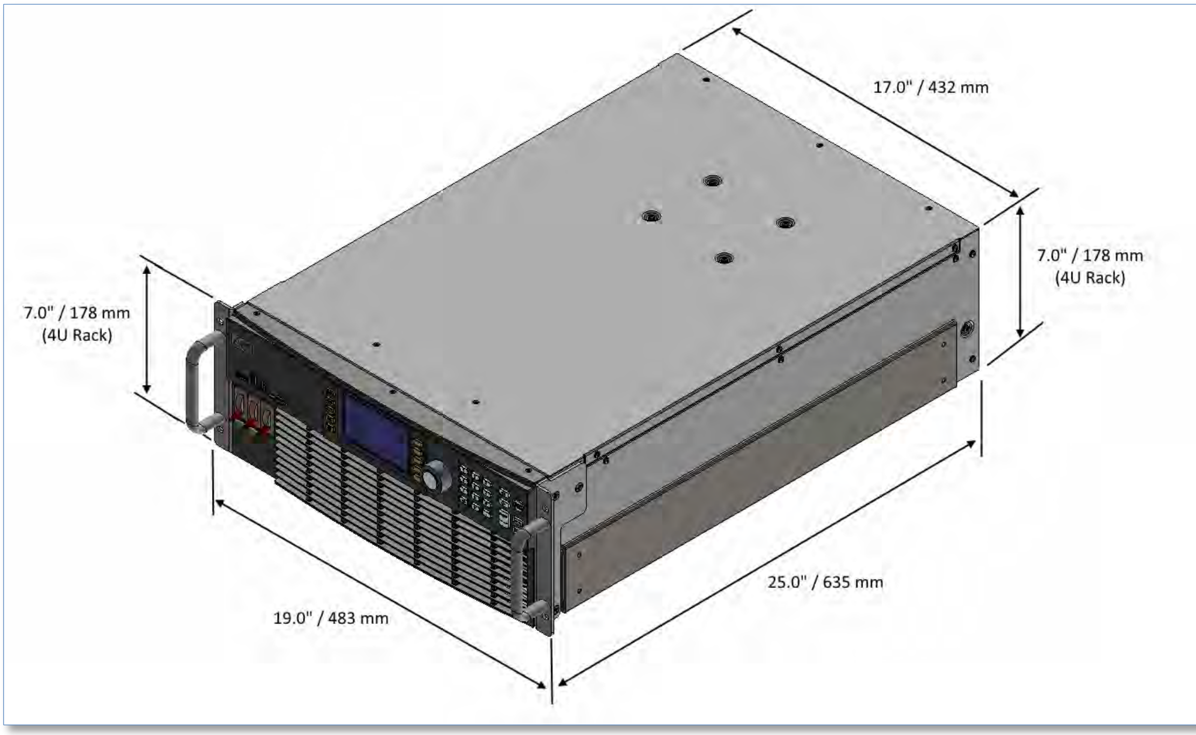



*Figure 4-7: Dimension Drawing ADF Series® 15KW Model*

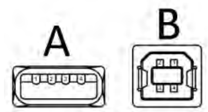
## 4.9 Environmental

| ENVIRONMENTAL | |
|---|---|
| Cooling | Fan Cooled |
| Audible Noise<br>*(at 1 meter)* | Standby: 46 dBA<br>Full power: 85 dBA typical |
| Operating Temperature | 0 to 40 °C / 32 to104 °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 |

## 4.10 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 |

## 4.11 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)<br>Type B USB Device (1) |
| Connector Types |   |

| RS232 | |
|---|---|
| Baud rate: | 9600, 14400, 19200, 38400, 57600, 62500, 115200 |
| Parity: | O = Odd = uneven parity<br>E = Even = even parity<br>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<br>Input Impedance: 5 kΩ typical<br>Switching thresholds: $V_H$ < - 3 V, $V_L$ > + 3 V |
| Outputs (TxD) | Output voltage (at $R_{LOAD}$ > 3 kΩ): min ± 5 V, typical ± 5.4 V<br>Output Impedance: < 300Ω min., 10 MΩ typical in power off state<br>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)<br>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<br>Set screws: M3.5×0.6 metric threads. |

## 4.12 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: Vin < 0.4 V<br>Logic High: Vin > 2.0 V |
| Input Impedance | 10 kΩ |
| Absolute max. voltage | 12V |
| **Digital Outputs** | |
| Output Signals | *Open Collector (0.5A max. protection):*<br>FORM Relay Control, Transformer Relay Control<br>**Note:** DO1 and DO2 are TTL outputs with 5.2V output and 200Ω output impedance. Into a 5kΩ load, the output voltage is ~5V.<br>**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.<br>*TTL Level:*<br>Relay State/Function Strobe / Trigger Out<br>Phase Reference (sync output)<br>User programmable outputs (2) |
| Voltage Levels @ 0.4 mA | Logic low: Vin < 0.4 V<br>Logic High: Vin > 4.6 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 | ± 0.1 % F.S. |
| Sampling Rate | 10 Hz or10 times/sec |
| Open Circuit Level | 2 ~ 3 % of F.S. if analog input is left floating (no connection) |
| Input Impedance | 5 kΩ |
| Absolute max. voltage | 12V |
| **Analog Outputs** | |
| Signals | Analog Outputs (4) - user defined monitor (RMS and average measurements, 100ms) |
| Voltage Range | 0V – 5V |
| Accuracy | ± 0.1 % F.S. (with 5 kΩ load or higher) |
| Update Rate | 10 Hz or 10 times/sec |
| Output Impedance | < 10 Ω |
| **Power** | |
| Output | 12.0 Vdc |
| Accuracy | ± 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.

## 4.13 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*

### 4.13.1 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.<br>Rated for 15kVA max. ,0 -400Vac$_{LN}$ / 0 – 692Vac$_{LL}$ |
| 3300ADFT | Transformers are installed in 19" Cabinet Systems along with ADF power sources<br>Rated to 30kVA max ,0 -400Vac$_{LN}$ / 0 – 692Vac$_{LL}$ |
| 3450ADFT | Transformers are installed in 19" Cabinet Systems along with ADF power sources<br>Rated to 45kVA max, 0 -400Vac$_{LN}$ / 0 – 692Vac$_{LL}$ |
| 3600ADFT | Transformers are installed in 19" Cabinet Systems along with ADF power sources<br>Rated to 60kVA max, 0 -400Vac$_{LN}$ / 0 – 692Vac$_{LL}$ |
| For higher power configurations, contact factory | |

### 4.13.2 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 | ± (0.25% + 0.25* f (kHz)) F.S. |
| Constant Power Range | From 40% to 100% of Voltage Range:<br>160Vac L-N to 400Vac L-N |
| External Voltage Sense | Automatically scaled for 400Vac Range |
| **Frequency** | |
| Range | 45.00 – 1000.0 Hz<br>For models with –F Option:<br>• Linear voltage derating from 45Hz to 15Hz<br>• Linear current derating from 1000Hz to 1200Hz. |
| Programming Resolution[1] | 0.01 Hz |
| Accuracy | ± 0.01% |
| **Current[2]** | |
| Range | Available RMS Current per phase is scaled by transformer ratio. E.g. for 3150ADF, max current at 400Vac L-N is (41.7 * ¾) = 31.27Arms 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):**
*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-xF**E** models has three resolution ranges, which round the frequency to the nearest increment, as defined in the table below.*

***Frequency Resolution for Export Models***

| *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.

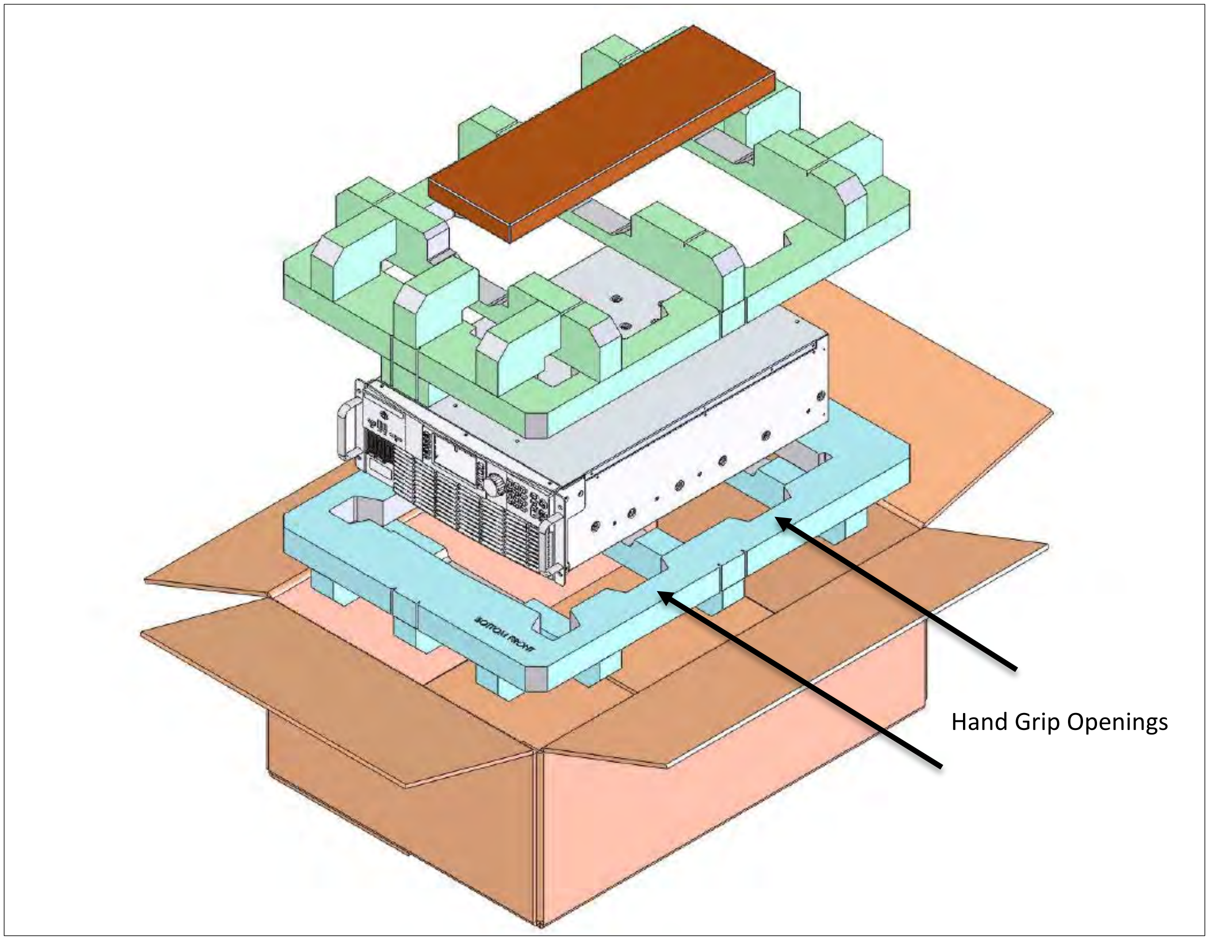



*Figure 5-2: Exploded view of ADF unit packaging*

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.

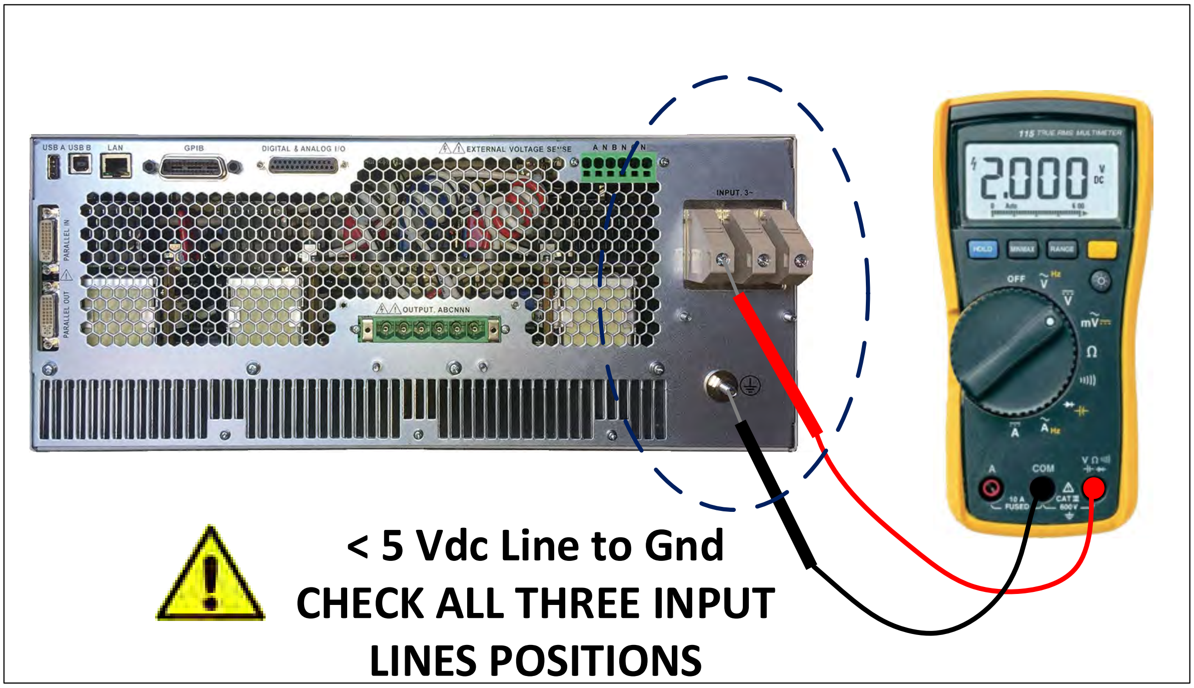
Un dispositif de protection de surintensité externe doit être fourni (par exemple, par des fusibles ou coupe-circuit). Le pouvoir de coupure du dispositif de protection contre les surintensités doit être compatible avec le courant nominal de l'installation.

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~<br>480 V ac, 3~ | 20 A rms, max<br>16 A rms, max | 25 A rms<br>20 A rms | 6 mm^2 (AWG 10)<br>4 mm^2 (AWG 12) |
| **1150ADF-4** | 380/400 V ac, 3~<br>480 V ac, 3~ | 30 A rms, max<br>24 A rms, max | 35 A rms<br>30 A rms | 10 mm^2 (AWG 8)<br>6 mm^2 (AWG 10) |
| **3150ADF-4** | 380/400 V ac, 3~<br>480 V ac, 3~ | 30 A rms, max<br>24 A rms, max | 35 A rms<br>30 A rms | 10 mm^2 (AWG 8)<br>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 instruments 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.

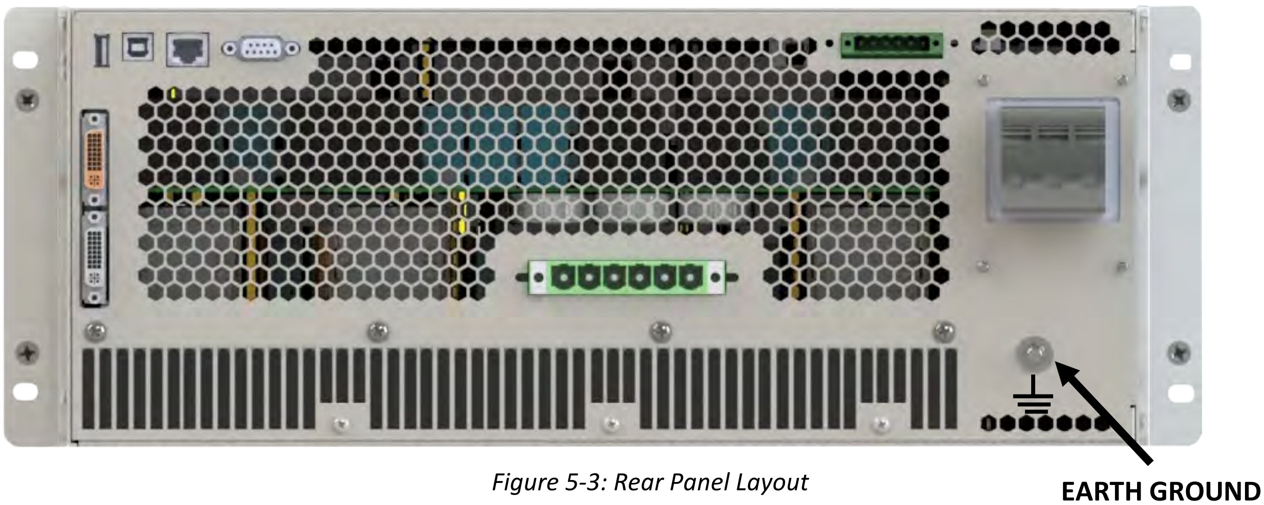



*Figure 5-3: Rear Panel Layout*

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.

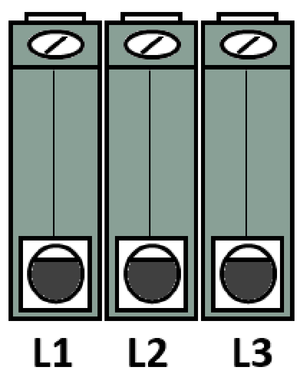



*Figure 5-4: AC Input Terminal Block - Rear Panel*

## 5.5 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.

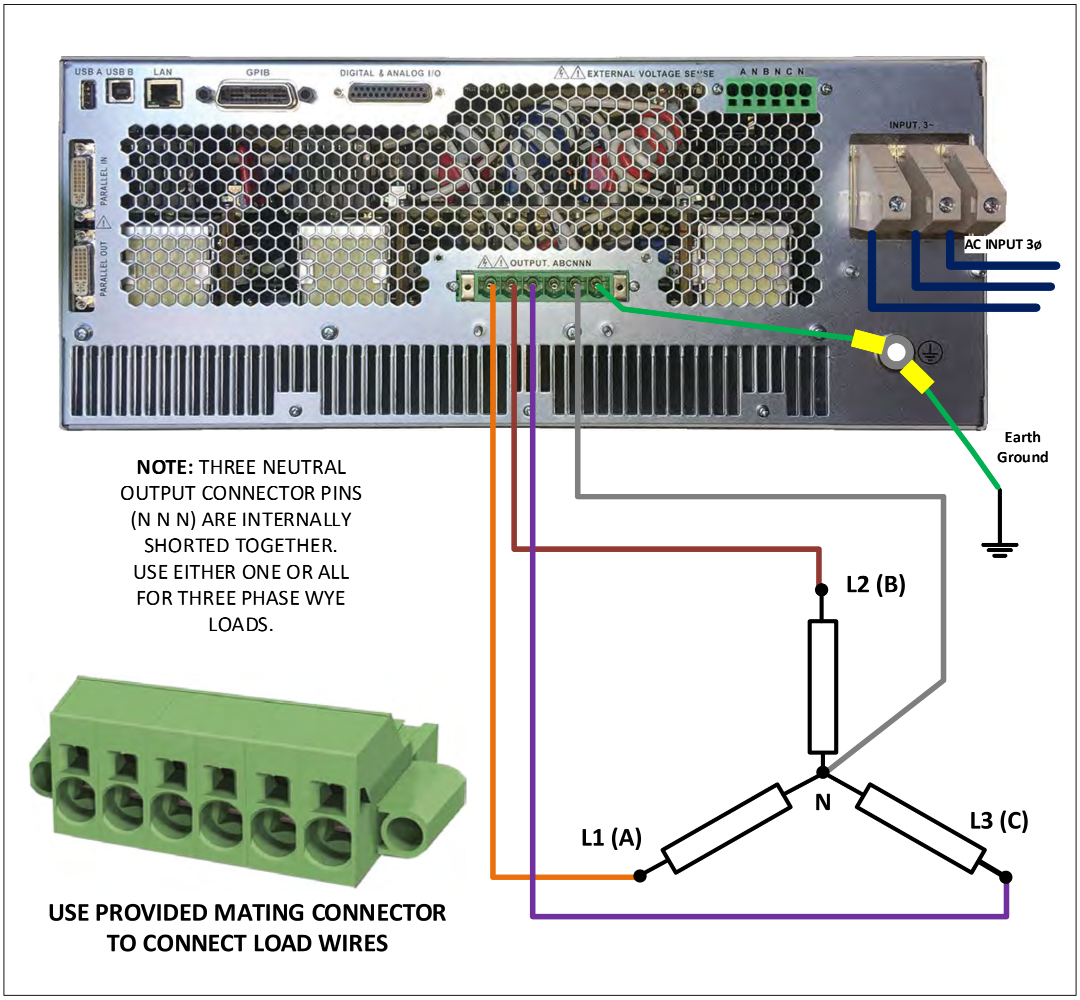



*Figure 5-5: Grounding Floating Neutral Output*

## 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, our 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 cable 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 5-6: 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.

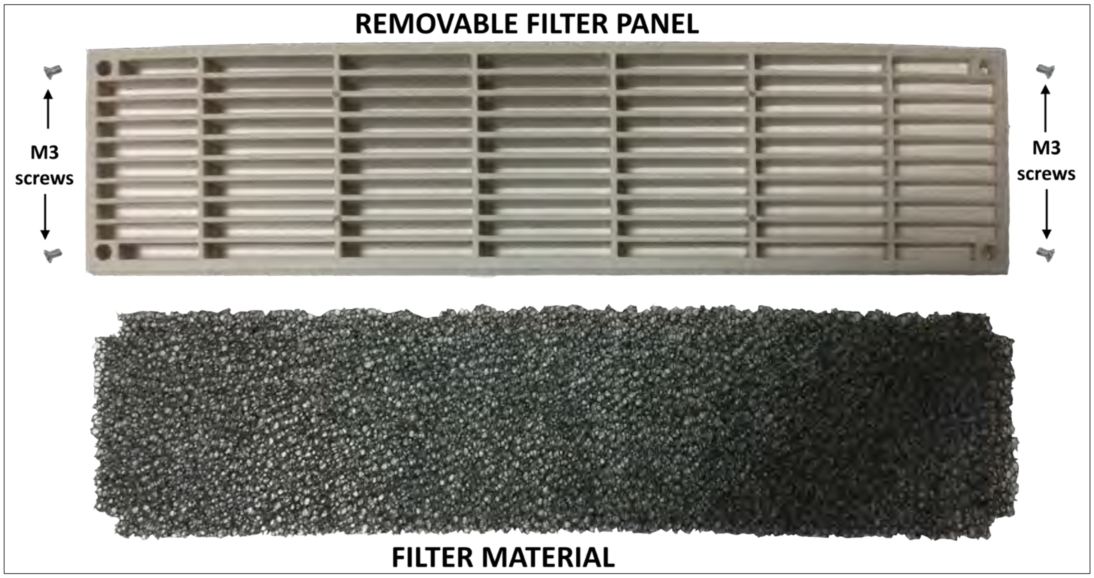



*Figure 5-7: Air Intake Filter and Filter Panel*

### 5.12.2 Filter Cleaning

Use warm water and some mild detergent to rinse all dirt out of the filter material. Allow the filter do 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 units front panel.
2. Line up the filter materials 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 and output cover. It MUST be used when connecting load wires.

Load current are a function of the load so care must be taken by the end user to select appropriately size 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 mm$^2$ 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.

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.

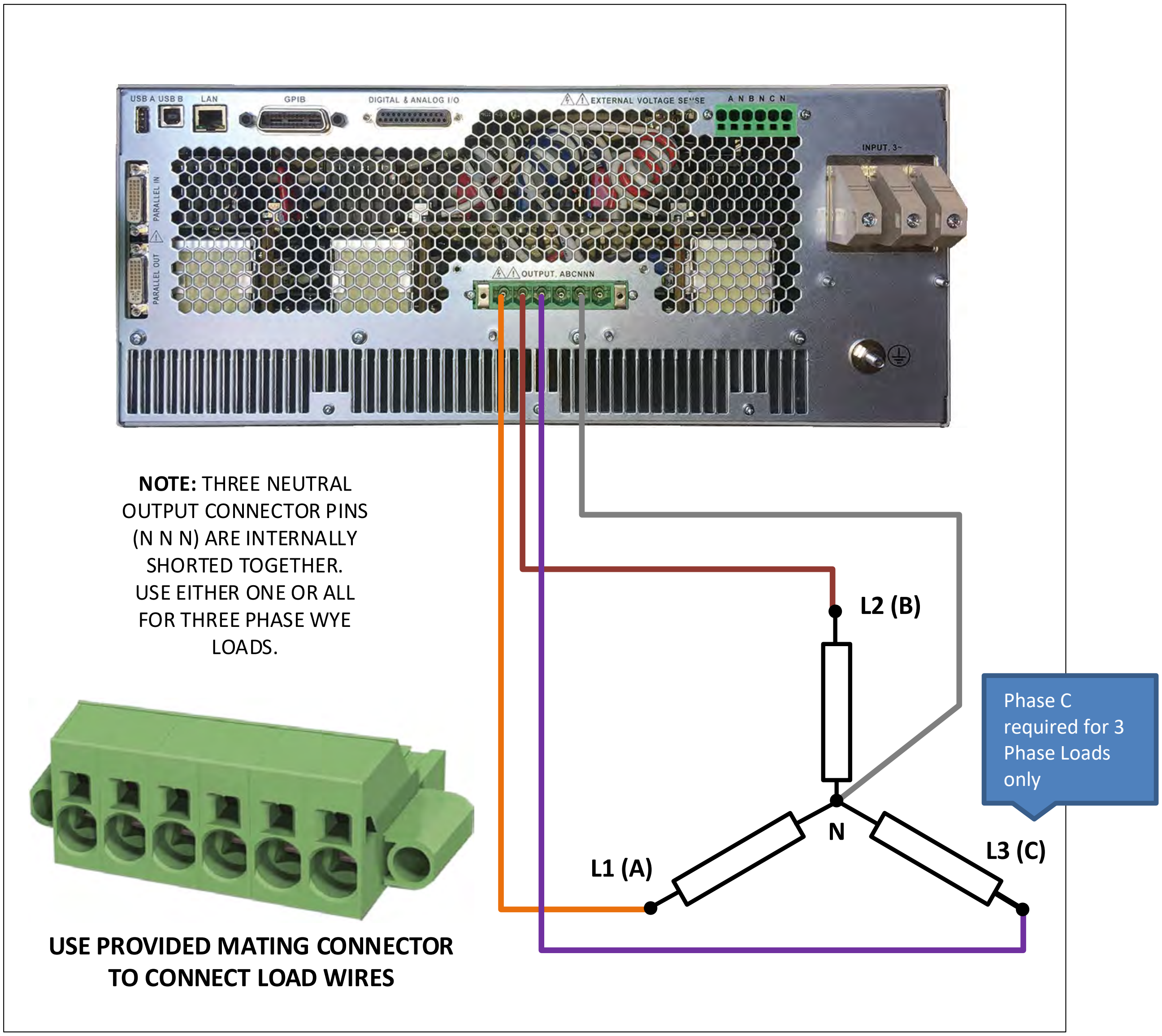



*Figure 5-8: Three phase Wye or Split phase Load Output Connections – Internal Voltage Sense*

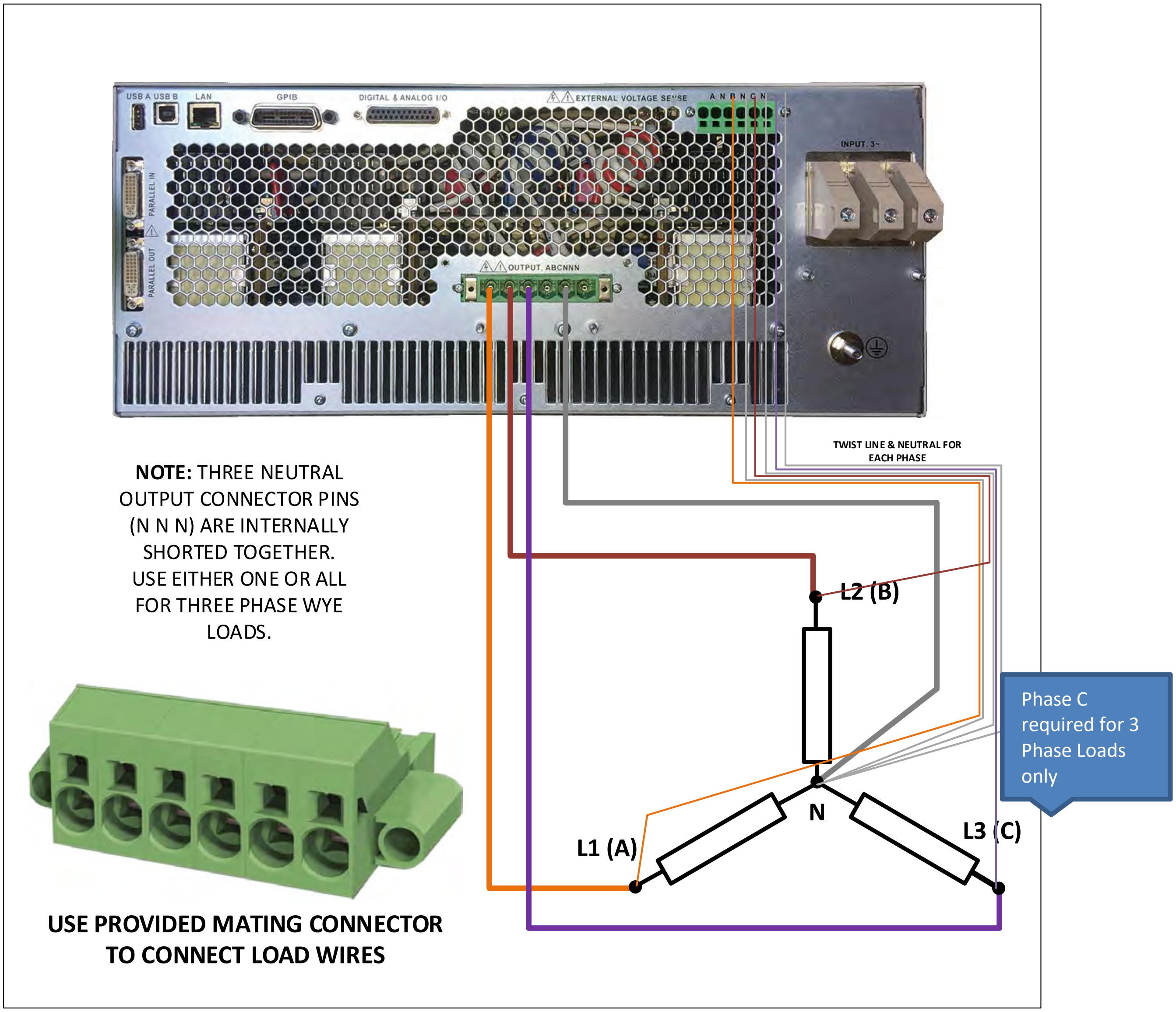



*Figure 5-9: Three phase Wye or Split phase Load Output Connections – External Voltage Sense*

### 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 $mm^2$ 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.

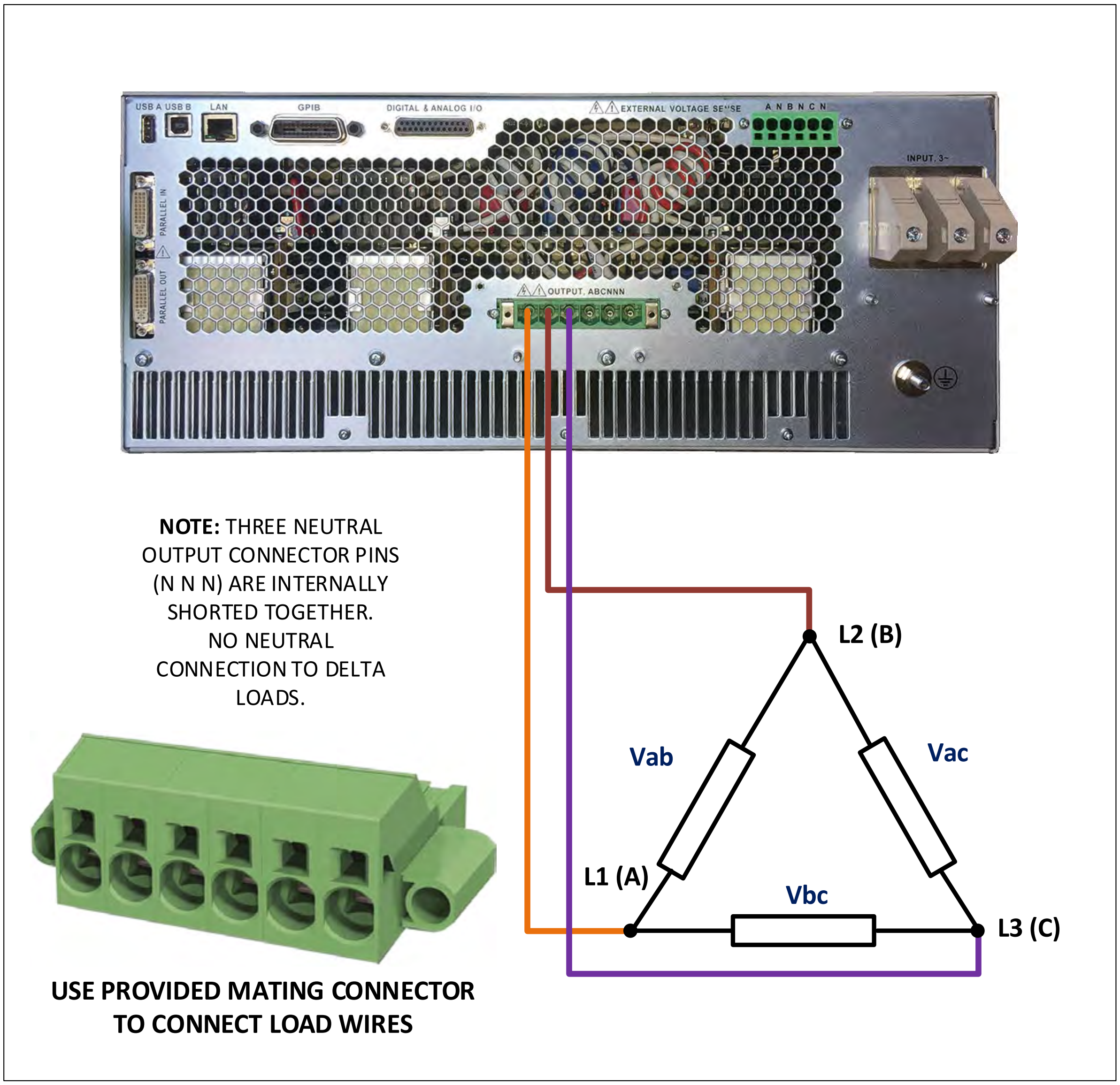



*Figure 5-10: Three phase Delta Load Output Connections – Internal Voltage Sense*

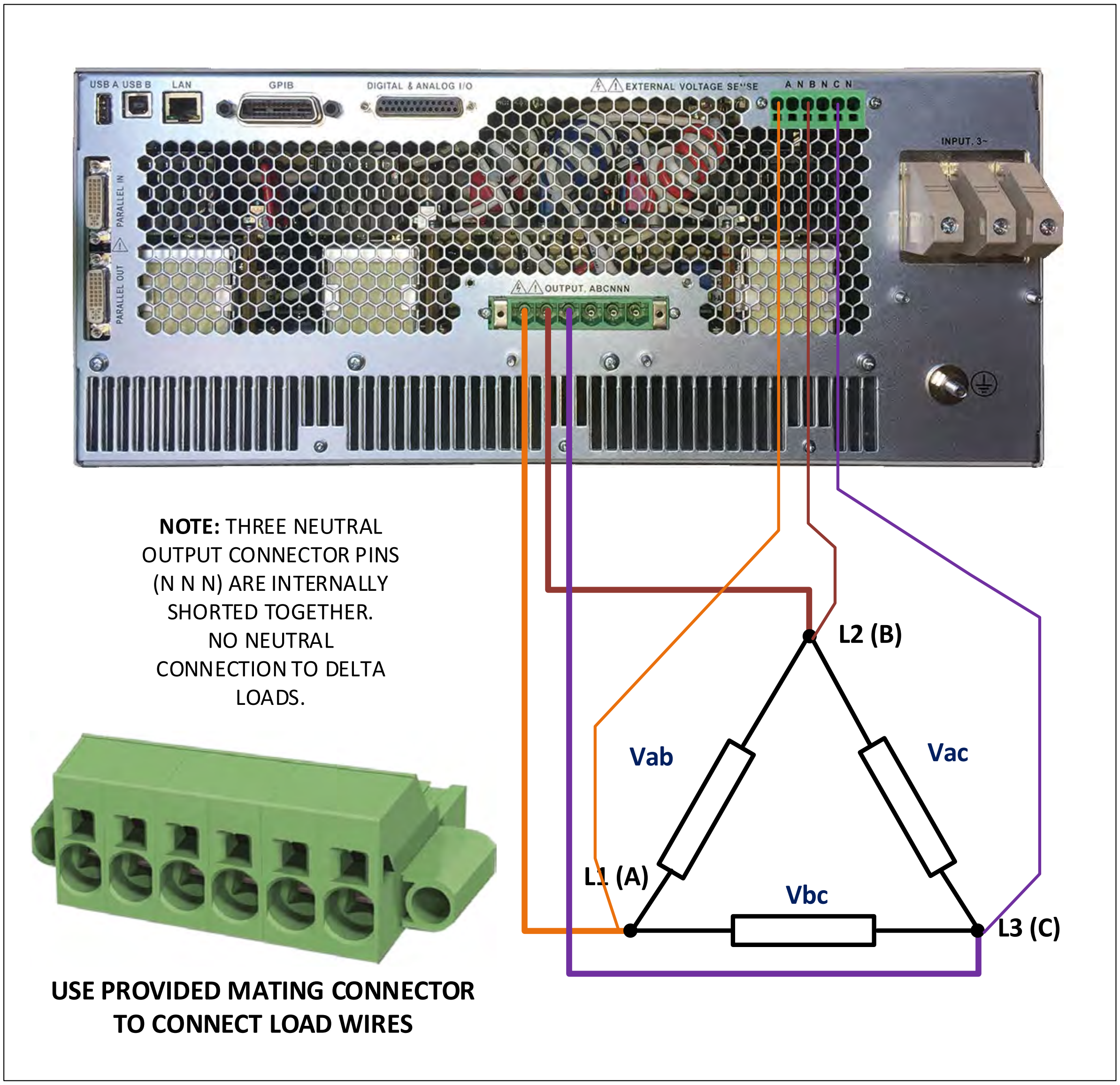



*Figure 5-11: Three phase Delta Load Output Connections – External Voltage Sense*

### 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 5-12: 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.

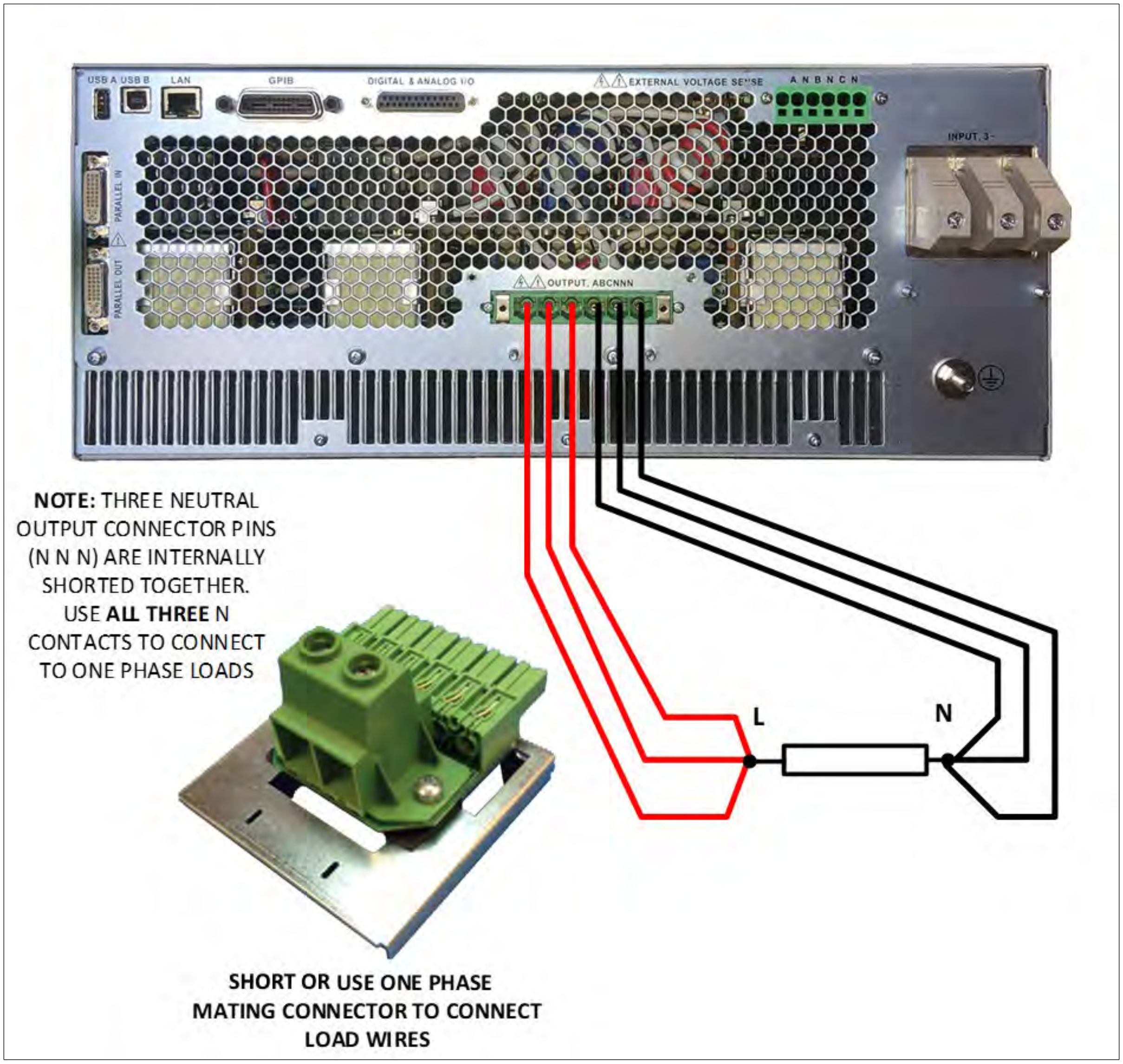



*Figure 5-13: Single phase Load Output Connections*

### 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.

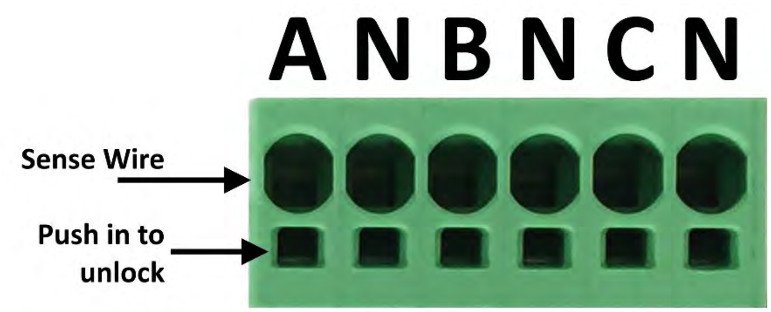
**AVERTISSEMENT**

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 screwdriver[3] to push in the locking mechanism, push in the stripped sense were ends and pull out the screwdriver to lock the wire in place. See for reference.



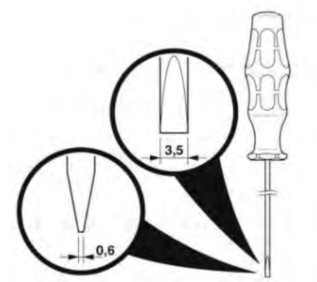




*Figure 5-14: ADF A Version External Voltage Sense Connector*

**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.**

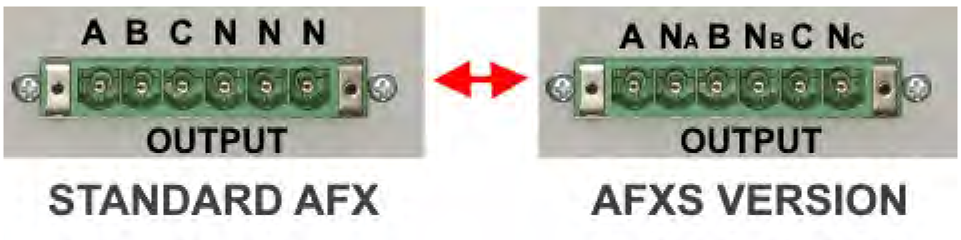



*Figure 5-15: Standard ADF model vs ADF-W Model Output Connector pins*

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.

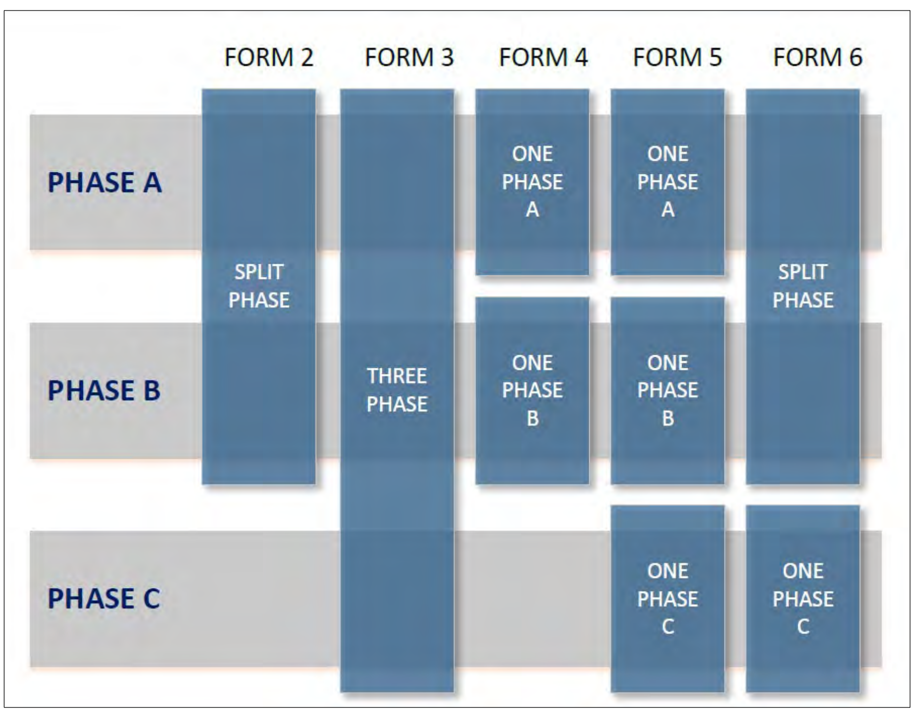
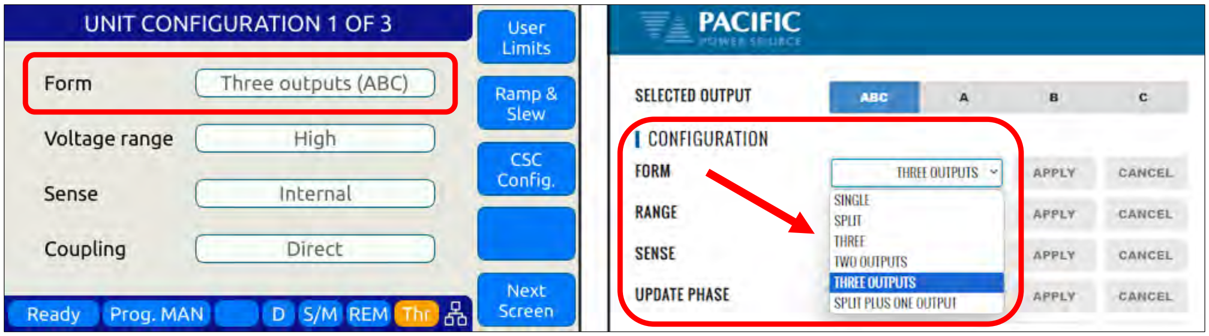



*Figure 5-16: Available Output Phase modes with Option W*

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 ($N_A$) and Phase B ($N_B$) 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 5-17: ADF Cabinet Dimensions*

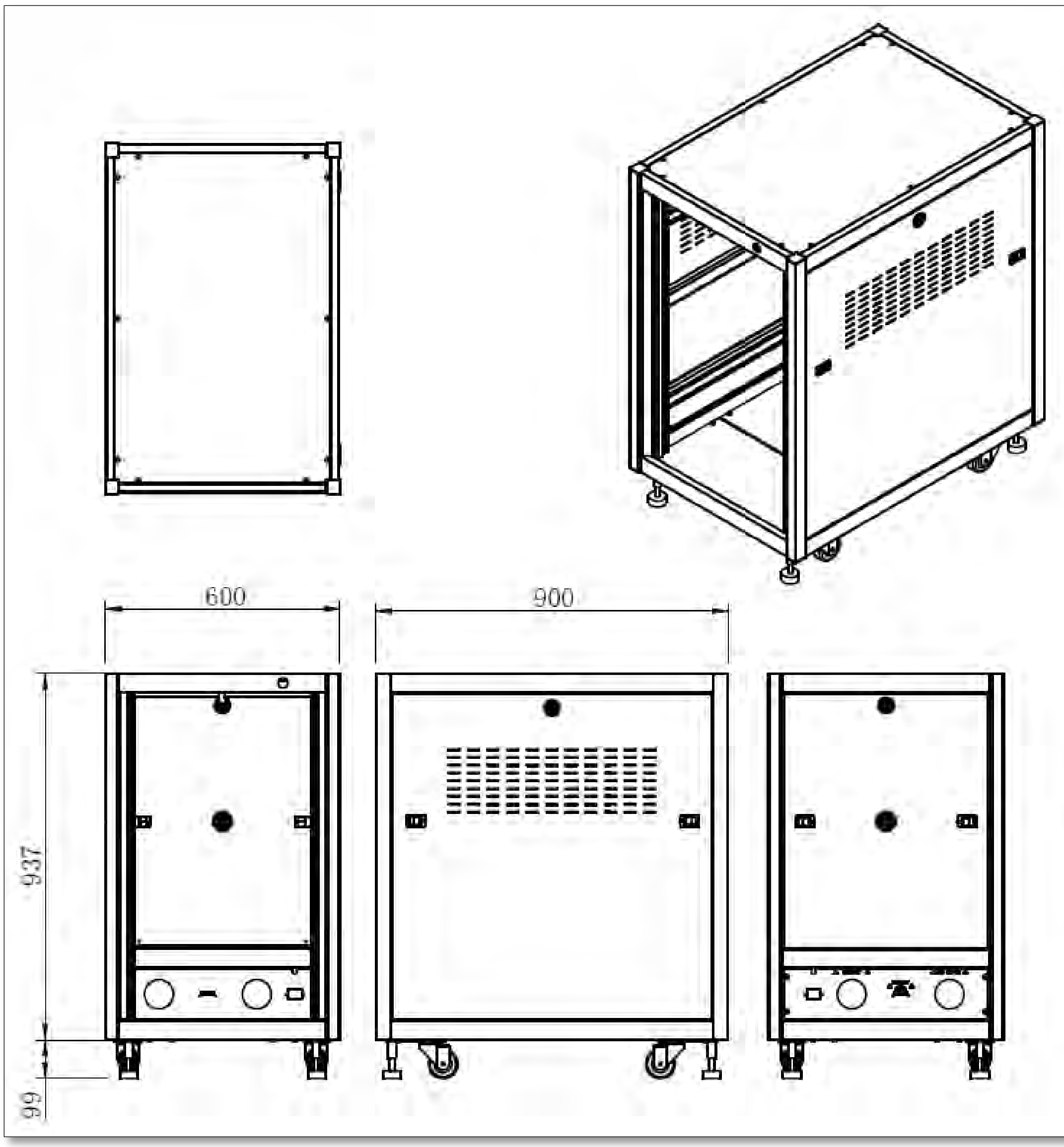



*Figure 5-18: Dimension Drawing 18 U Cabinet*

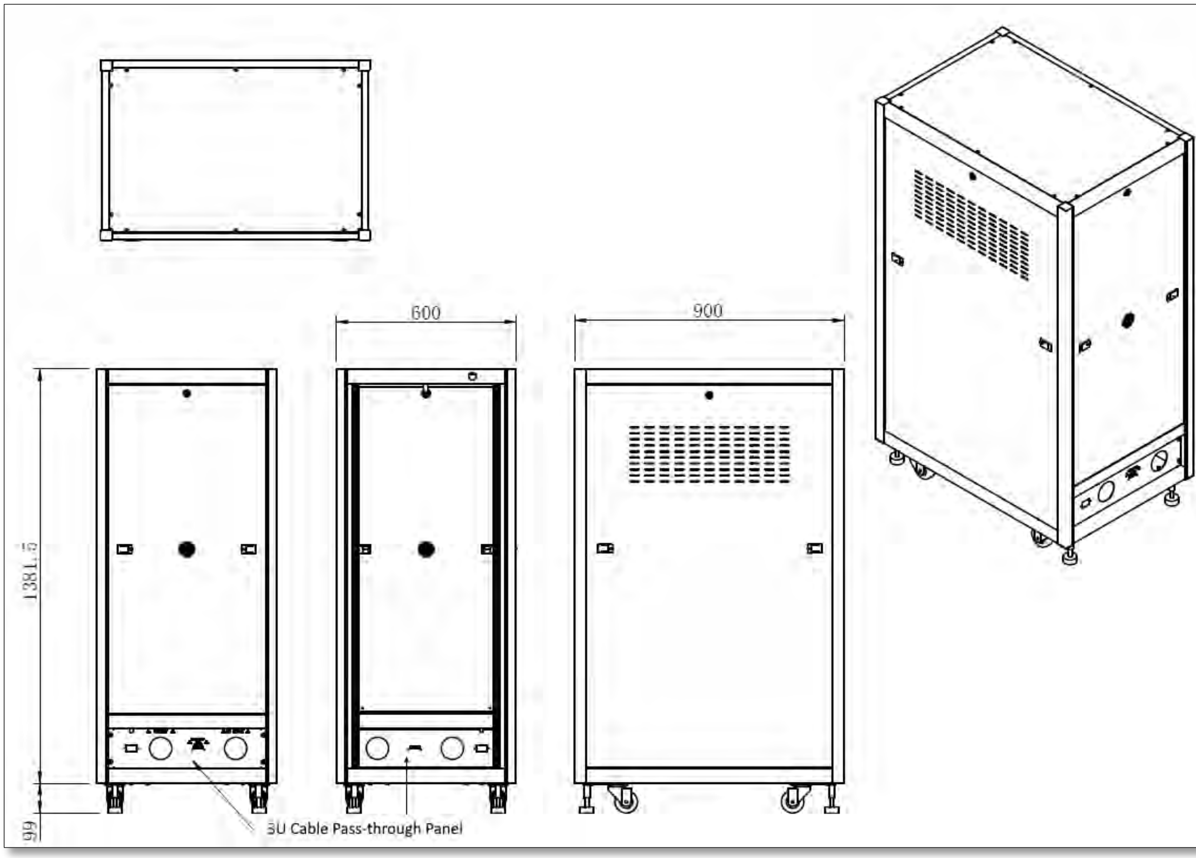



*Figure 5-19: Dimension Drawing 28 U Cabinet*

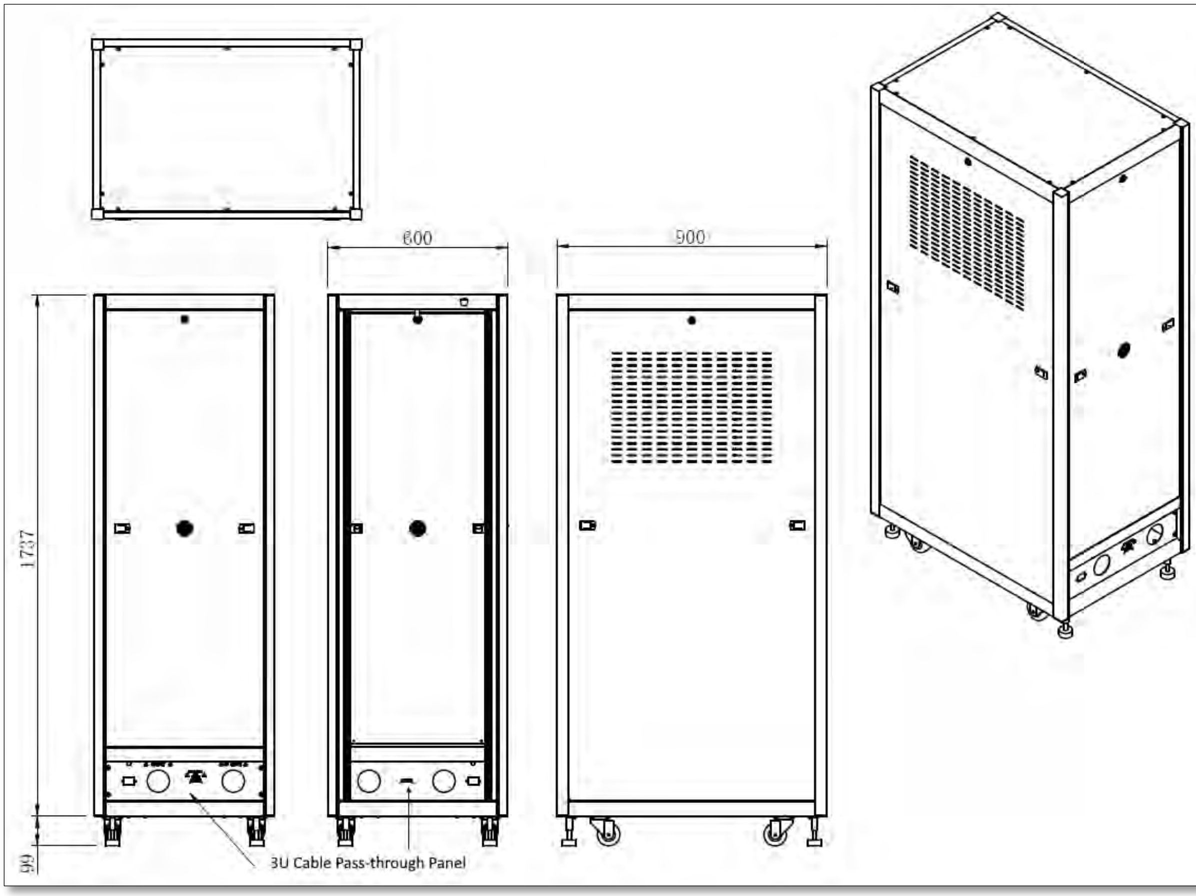



*Figure 5-20: Dimension Drawing 36 U Cabinet*

### 5.15.4 Cabinet System AC Input Connections

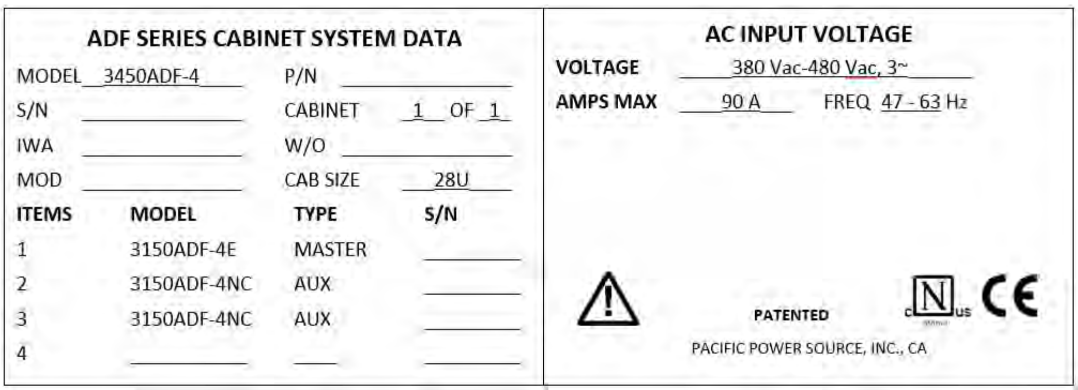
All input and output connections are located at the lower rear of the back of the cabinet. To access the internal terminal blocks, the rear panel grid must be removed temporarily by removing the screws that hold it to the cabinet's rear. Strain reliefs for both input and output cables are provided on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

MODEL 3450ADF-4 P/N
S/N CABINET 1 OF 1
IWA W/O
MOD CAB SIZE 28U

| ITEMS | MODEL | TYPE | S/N |
| --- | --- | --- | --- |
| 1 | 3150ADF-4E | MASTER | |
| 2 | 3150ADF-4NC | AUX | |
| 3 | 3150ADF-4NC | AUX | |
| 4 | | | |

AC INPUT VOLTAGE

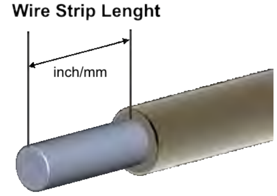
VOLTAGE 380 Vac-480 Vac, 3~
AMPS MAX 90 A FREQ 47 - 63 Hz

PATENTED
PACIFIC POWER SOURCE, INC., CA

**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.**

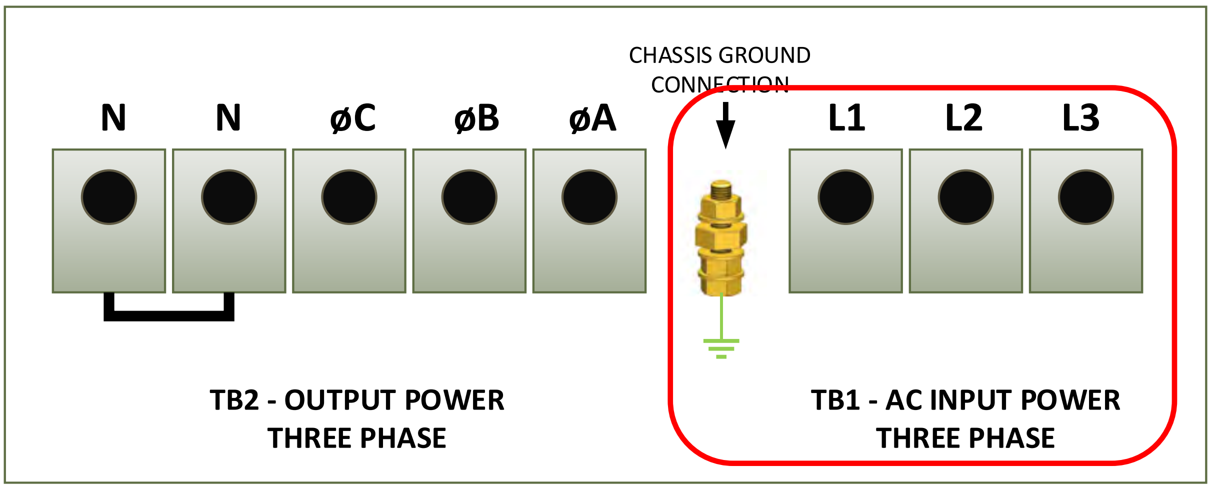



*Figure 5-21: ADF Cabinet AC Input Connection Terminal Block TB1*

### 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.

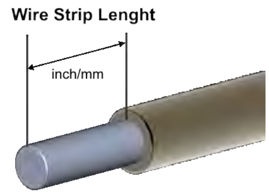
**REGLE DE SECURITE: MISE A LA TERRE**

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.

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

### 5.15.9 Cabinet Load Connections

The output terminal Neutral and phase terminals are oriented as shown below when facing the back of the cabinet.

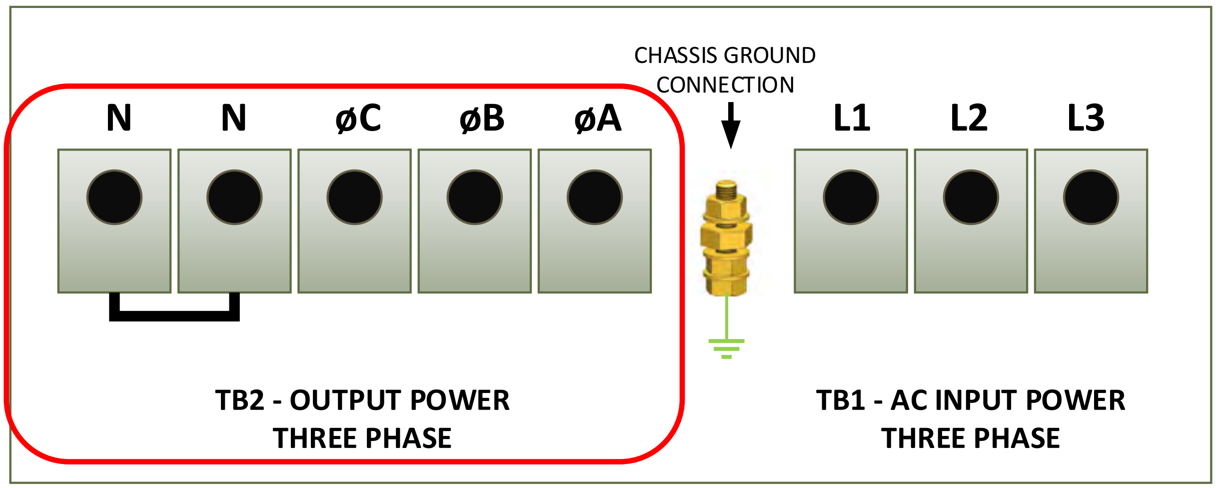



*Figure 5-22: Output Power Terminal Block TB2*

## 5.16 ADF Cabinet Systems Turn ON and turn OFF Procedures

ADF Cabinet systems can be turned on or off using the front panel mounted circuit breakers on the master and auxiliary units. Turn on and turn off sequence recommendations are listed below and illustrated in Figure 5-21. The sequence is not critical as long as units are turned on within 15 seconds of each other. If more time elapses, an error may be displayed and the master/aux discovery process should be restarted from the PARALLEL UNITS screen in the SYSTEM menu. Refer to section 6.8.7, “PARALLEL UNITS Screen”.

Alternatively, the master grid power disconnect switch that is required for cabinet installation can be used to connect or disconnect all units from grid power at the same time.

### 5.16.1 Cabinet Power Turn ON using Circuit Breakers

The following turn on sequence is recommended:

1. Turn **ON** bottom auxiliary unit **first** by pulling its front panel circuit lever to the upward (ON) position.
2. Turn **ON** any additional auxiliary units between the bottom auxiliary unit and the top Master unit by pulling each front panel circuit lever to the upward (ON) position.
3. Turn **ON** the Master unit **last** by pulling its front panel circuit lever to the upward (ON) position.

This will ensure all auxiliary units are up and will be found when the master starts the discovery process.

### 5.16.2 Cabinet Power Turn OFF using Circuit Breakers

The turn off procedures is the reverse of the turn on one as follows:

1. First, turn of ADF System output using the OUTPUT button on the Master unit front panel first to make sure any load is powered down first.
2. Then, turn **OFF** the Master unit **first** by flipping its front panel circuit lever to the down (OFF) position.
3. Turn **OFF** the first auxiliary unit located below the master unit by flipping the front panel circuit lever to the down (OFF) position.
4. Turn **OFF** the bottom auxiliary unit **last** by flipping its front panel circuit lever to the down (OFF) position.

**Note:** Turning off all ADF units in a cabinet DOES NOT remove MAINS power from it. If any service is to be performed on the cabinet, make sure the MAINS power (grid power) is disconnected first.

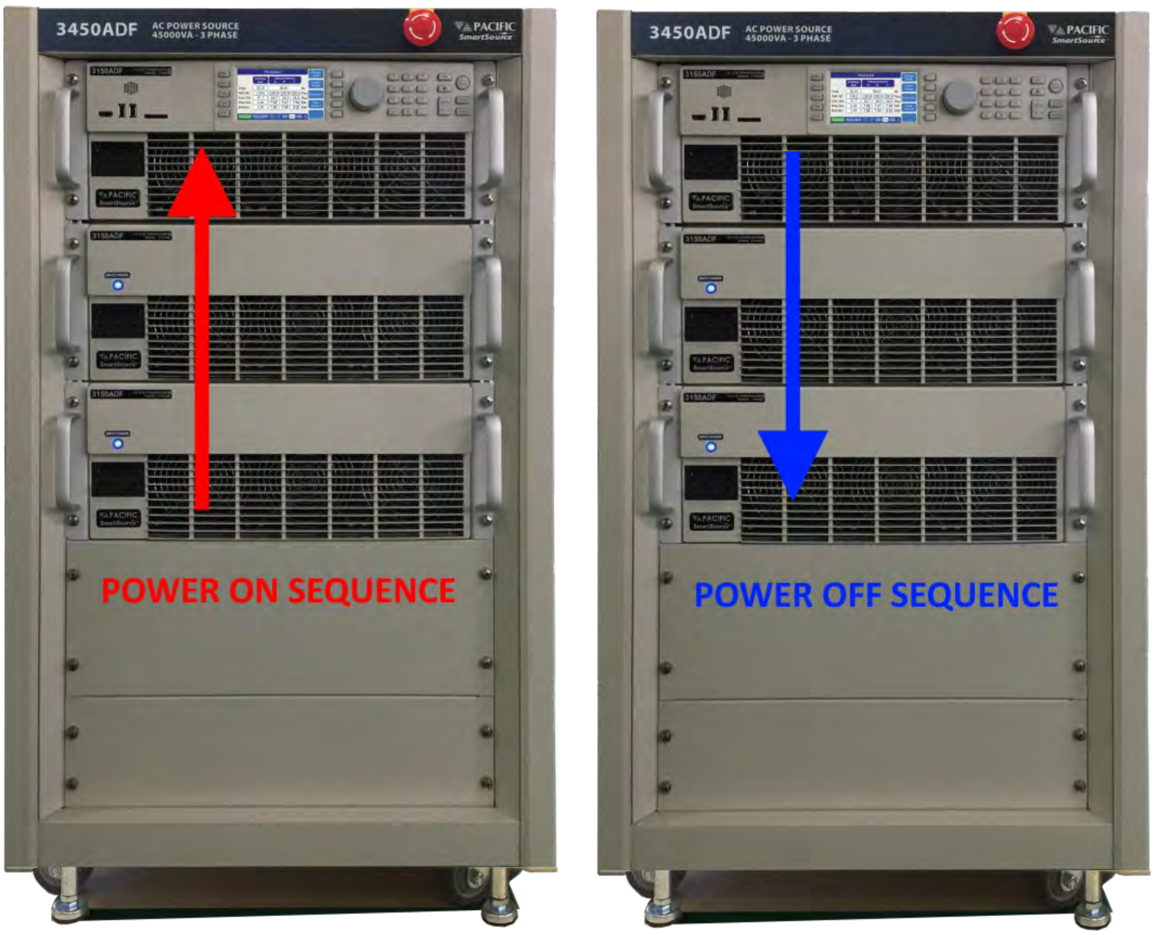



*Figure 5-23: ADF Cabinet System Power ON and OFF Sequences*

## 5.17 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".

### 5.17.1 -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).

## 5.18 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.**

### 5.18.1 Rear Panel Connector Locations

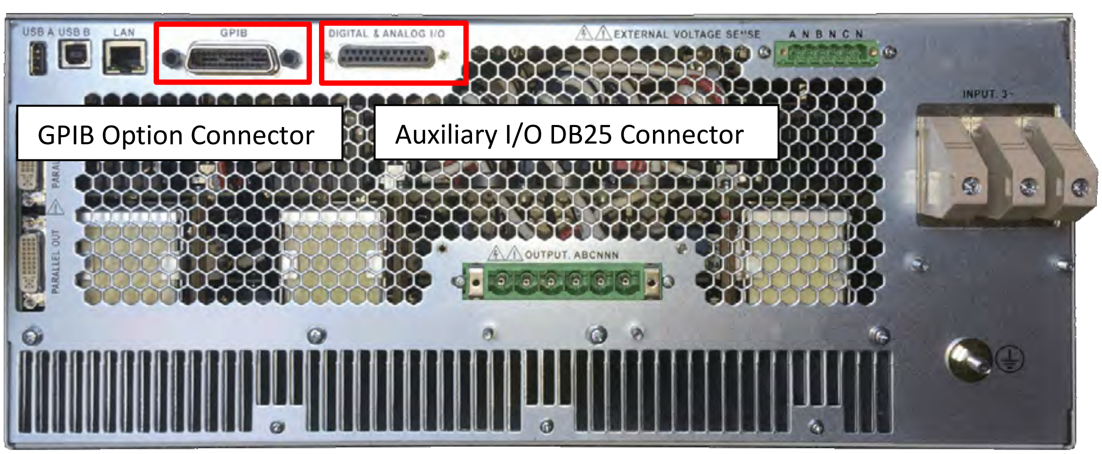



*Table 5-2: Remote Control Interface Connector Locations on Rear Panel ( A Versions w GPIB)*

### 5.18.2 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.

### 5.18.3 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-or-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 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*

### 5.18.4 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*

### 5.18.5 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.

## 5.19 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.

### 5.19.1 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.

### 5.19.2 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.

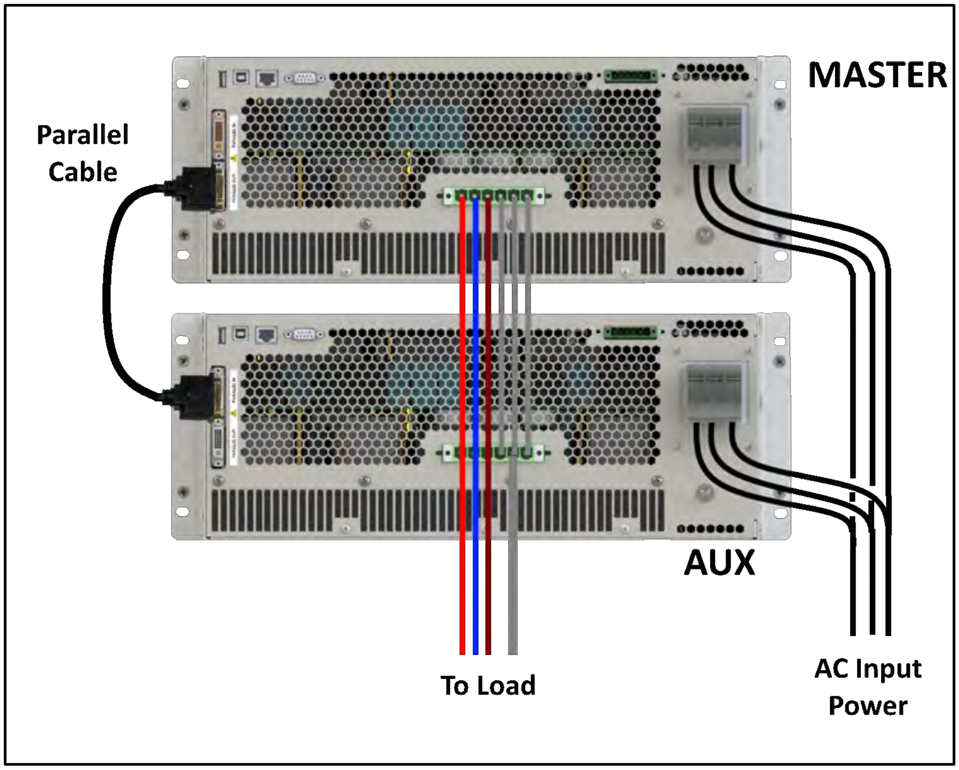



*Figure 5-25: Parallel Mode Bus Connections using parallel bus cable*

### 5.19.3 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.

## 5.20 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.

### 5.20.1 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.

### 5.20.2 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.

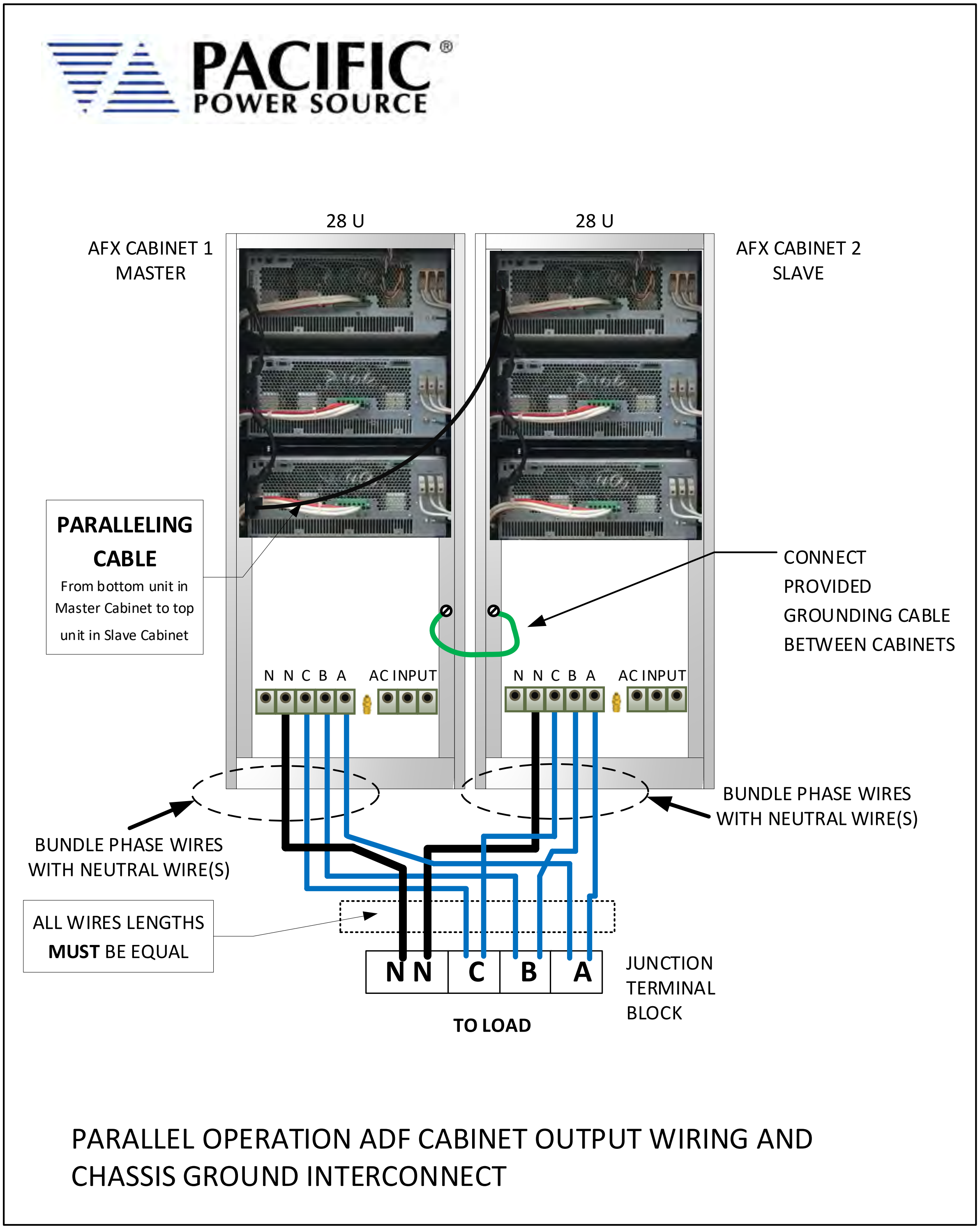



*Figure 5-26: Multi-Cabinet Parallel Configuration Output Wiring - 3 Phase*

# 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.

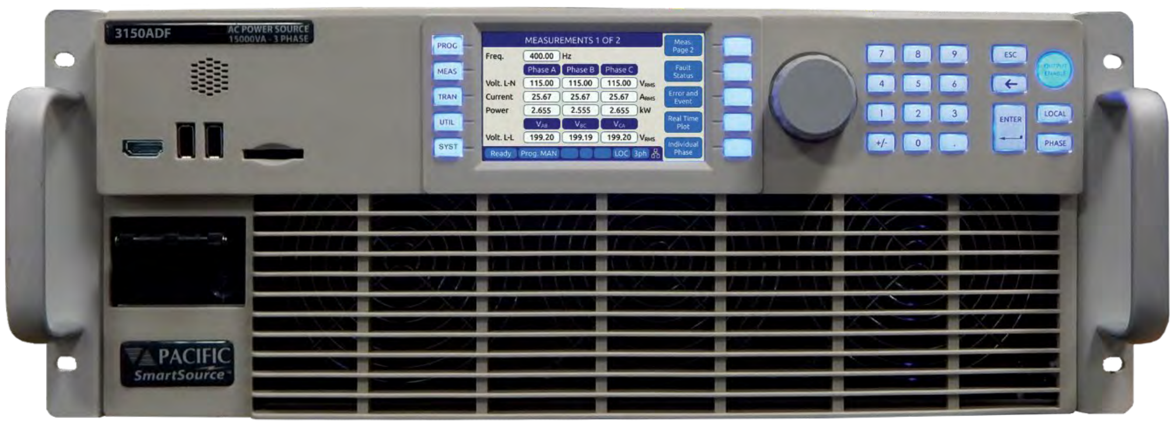



*Figure 6-1: ADF Series® Front Panel View*

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.<br>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.

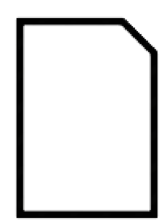
To return the display to the LCD screen, unplug the monitor.

### 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 of 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 is 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.

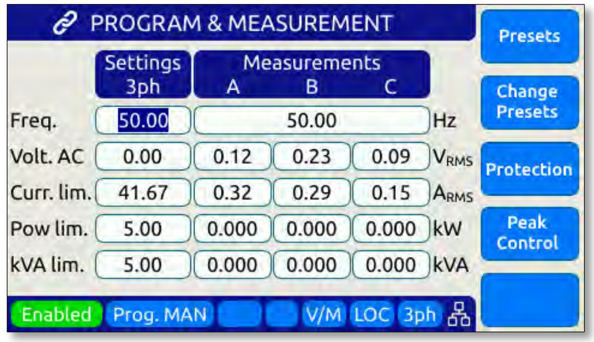
All available menus can be accessed using the Menu keys to the left of the LCD display. The following five keys are available.

| MENU KEY | MENU SCREEN | Description |
|---|---|---|
| **PROG** | PROGRAM | Programming of output parameters and Measurements read back |
| **MEAS** | MEASUREMENTS | Measurements |
| **TRAN** | N/A | Not used on ADF Series models |
| **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.

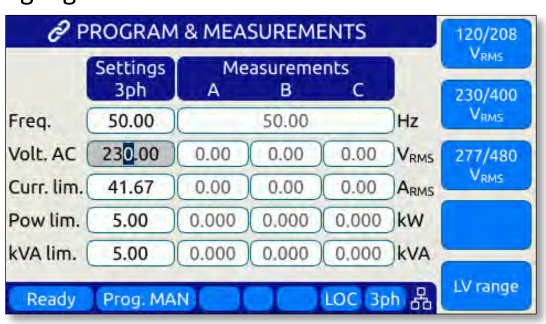
## 6.4 PROG – PROGRAM & MEASUREMENTS Screen




All output parameters can set from the PROGRAM & MEASUREMENTS 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.

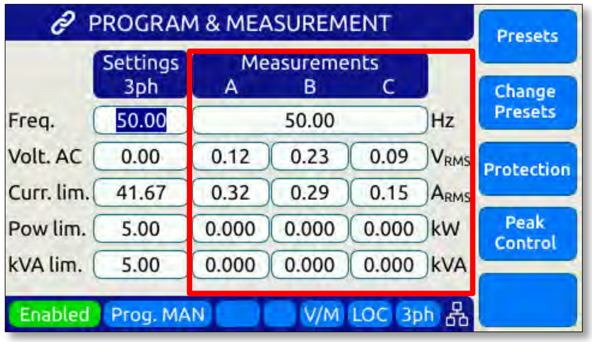
Thus to slew a value, proceed as follows:

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 213.

### 6.4.2 PROGRAM Output Parameters

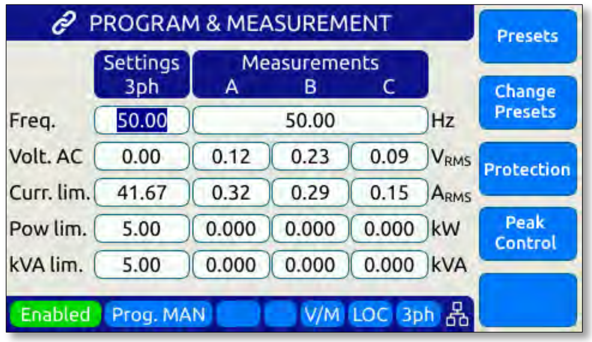



*Figure 6-2: PROGRAM Screen*

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.

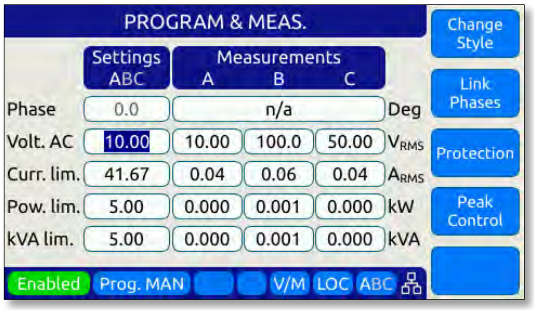
### 6.4.3 Three Phase Models – Phase Linked or Unlinked Data Entry

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.

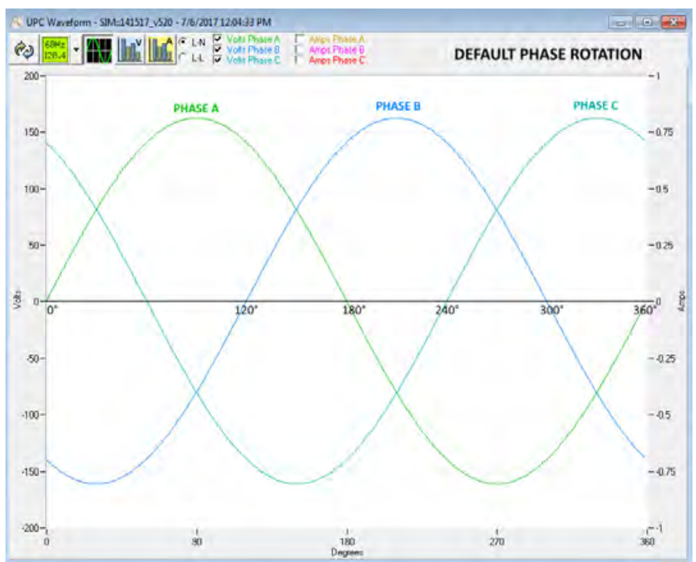



*Figure 6-3: Three Phase AC mode Default Phase Rotation*

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.

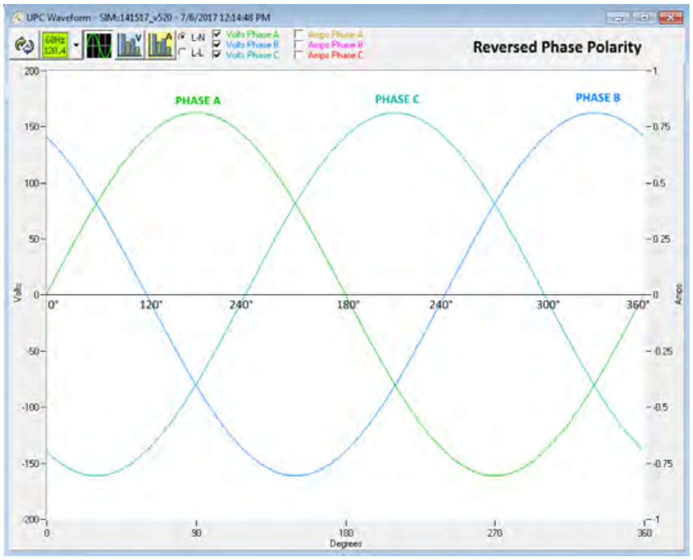



*Figure 6-4: Three Phase AC mode Reversed Phase Rotation*

## 6.4.5 Direct Data Entry - Presets

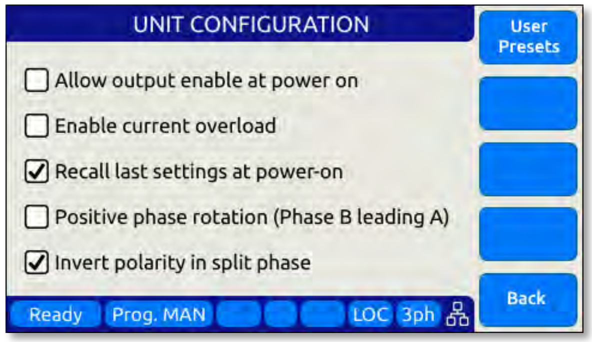
Values for Frequency, Voltage, Current, Phase and Power can be entered directly using the numeric keypad. Position the flashing cursor on the field for which you want to enter a new setting value. Once a field is selected, press the first key of the value you want.

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 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 120.

### 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.

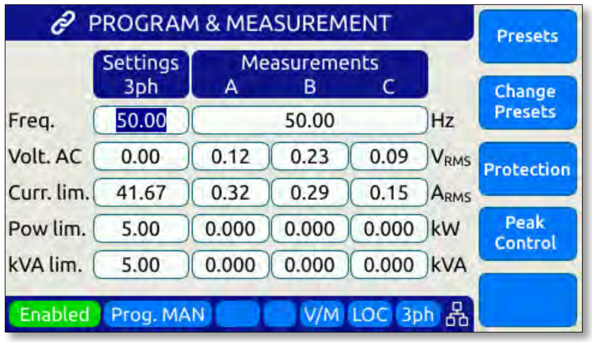
The selected resolution is reflected by the blinking character when in edit slew mode. To change the position and thus resolution, use the keypad numeric keys. The lowest number keys will select the smallest increment/decrement setting. The higher number keys will select a larger increment/decrement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

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

| Key Pad Key # | Position | Resolution |
|---|---|---|
| **1 or 2** | 0.00 | 0.01 |
| **3** | 0.00 | 0.1 |
| **4** | 0.00 | 1 |
| **5** | 0.00 | 10 |
| **6, 7, 8 or 9** | 00.00 | 100 |
| **7, 8, 9** | 000.00 | 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 94 for details.<br>The following presets are offered for the parameters listed:<br>Frequency: 50Hz, 60Hz, 400Hz (800Hz, 1200Hz with Option F)<br>Voltage AC: 115V, 230V, 300V<br>Current limit: MAX, 15A, 4A, PEAK CURRENT<br>Power limit: MAX, 4kW, 2kW, 1kW<br>kVA limit: MAX, 4kVA, 2kVA, 1kVA |
| **Change Preset (SK2)** | Access UNIT CONFIGURATION screen to change preset values. |

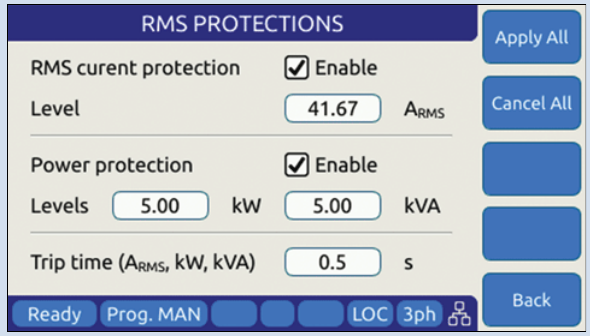
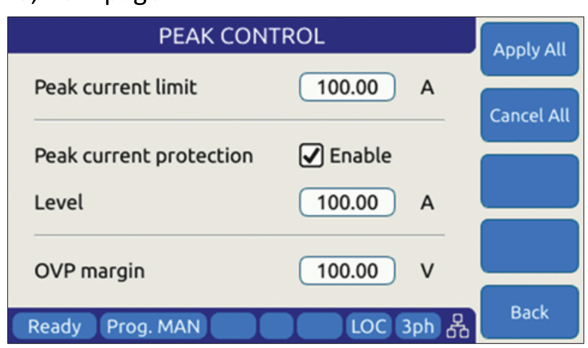
<table>
<tr><th>SOFT KEY</th><th>Description</th></tr>
<tr><td>Protection (SK3)</td><td>Displays the POWER AND CURRENT PROTECTIONS screen shown below.<br><br><br>There are two check box options and one data field on this screen that can be set as needed:<br><table><tr><td>Enable RMS current protection</td><td>Activates the programmable current limit function at the value set in the main program screen</td></tr><tr><td>Enable power protection</td><td>Activates power protection at W and kVA set points.</td></tr><tr><td>Trip time:</td><td>Determines how long the power source will allow the power level setting to be exceeded before tripping off.</td></tr></table></td></tr>
<tr><td>Peak Current (SK4)</td><td>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.<br><br><br>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.</td></tr>
</table>

*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:

**Ipk > 1 A + Vac_setpoint * 0.09 * Freq_setpoint (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:

Ipk min = 1 + 230 * 0.09 * 1 = 21.7 Apeak

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:

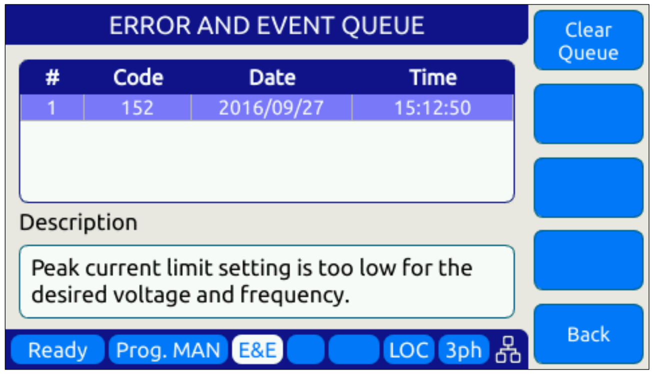
- Frequency 400Hz.
- Voltage 120Vac.
- Peak current limit 3A.
- The voltage measured at the output will be 83.22Vrms

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.

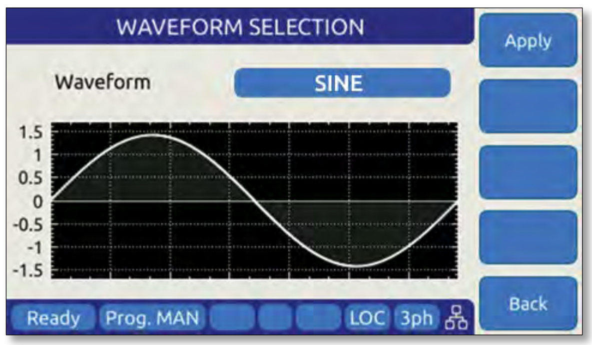
B) An Error event will be triggered in the error and event queue in order to notify the user. The error message is:

**"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.

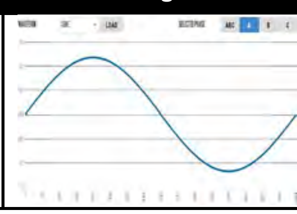
| Name | Description | Image | Notes |
|---|---|---|---|
| 1 | SINE |  | Standard sine wave. |

*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.

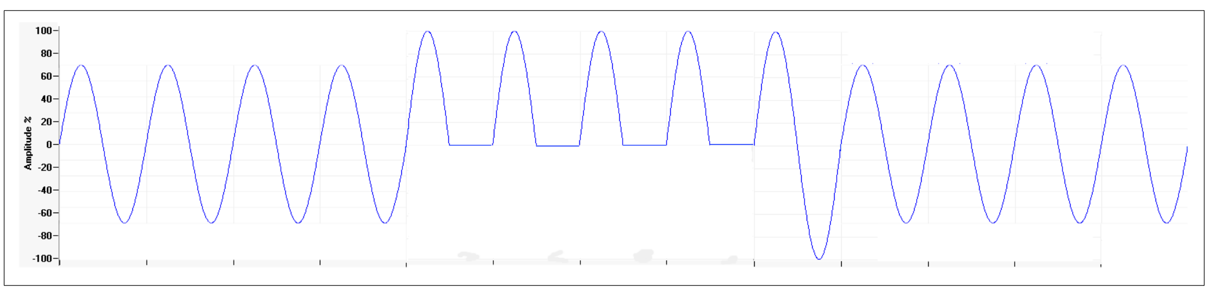
**Note:** The setting of the AUTO RMS mode is important when CSC mode is used as CSC mode uses the measured output RMS voltage to adjust the output to maintain voltage regulation.

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.

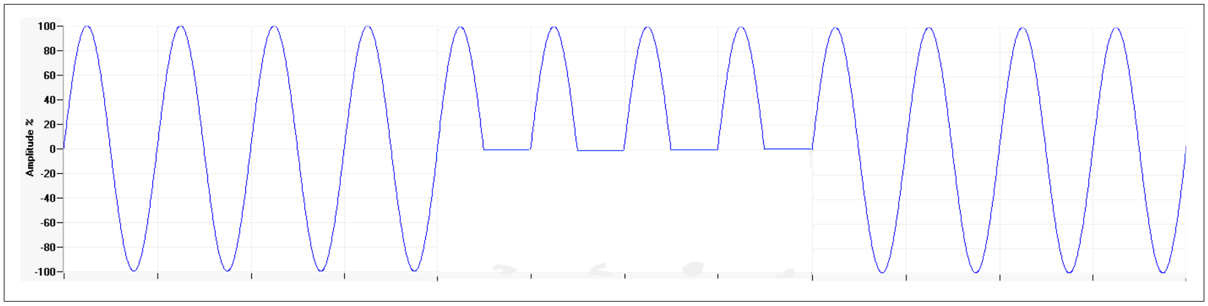
#### 6.4.11.1 AUTO RMS ON Mode:

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 277$V_{L-N}$ / 480$V_{L-N}$ 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 312$V_{L-N}$ / 540$V_{L-L}$

This setting reflects a 30% over voltage for 240$V_{L-N}$ / 415$V_{L-N}$ 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*

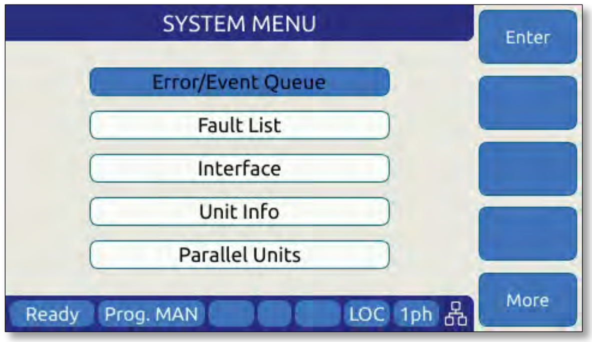
Once the Voltage AC MAX user limit has been set to a higher value, the PROGRAM screen will accept a Volt AC setting up to this new value.

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 trigger 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.

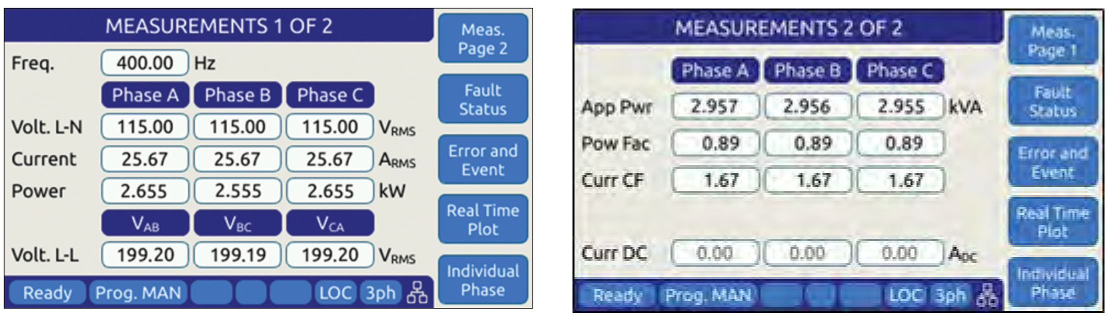


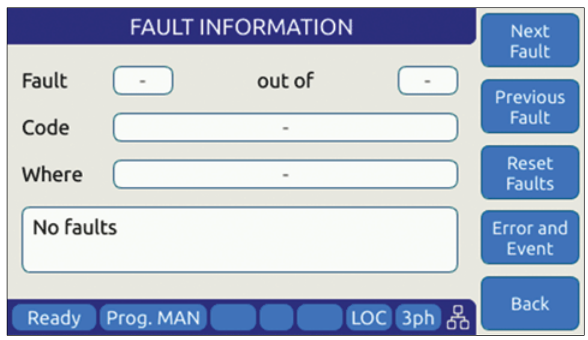

*Figure 6-6: Three Phase Measurement Screens*


*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.

<table>
<tr><th>SOFT KEY</th><th>Description</th></tr>
<tr><td>Meas. Page 2 (SK1)</td><td>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.</td></tr>
<tr><td>Fault Status (SK2)</td><td>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.<br>


<br>The following soft keys are available to review or clear fault messages:<br>
<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></td></tr>
<tr><td>(SK 4)-</td><td>N/A</td></tr>
</table>

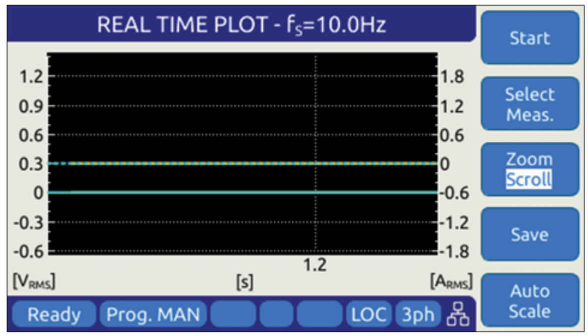
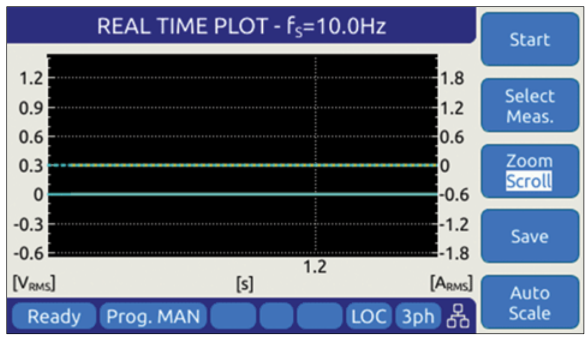
<table>
<tr><th>SOFT KEY</th><th>Description</th></tr>
<tr><td>Real Time Plot<br>(SK3)</td><td>Display strip chart of voltage, current or both against time. This provides a trend plot of any available measured parameter.<br>
<br>The following soft keys are available to control the time plot:<br><table><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></td></tr>
<tr><td>Individual Phase<br>(SK5)</td><td>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.</td></tr>
</table>

*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.

<table>
<tr><th>SOFT KEY</th><th>Description</th></tr>
<tr><td>Phase A (SK1)</td><td>Displays individual phase measurement screen for phase A if not already displayed.</td></tr>
<tr><td>Phase B (SK2)</td><td>Displays individual phase measurement screen for phase B if not already displayed.</td></tr>
<tr><td>Phase C (SK3)</td><td>Displays individual phase measurement screen for phase C if not already displayed.</td></tr>
<tr><td>Real Time Plot (SK4)</td><td>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>
</td></tr>
<tr><td>Phase ABC (SK5)</td><td>Displays the three-phase measurement screen.</td></tr>
</table>

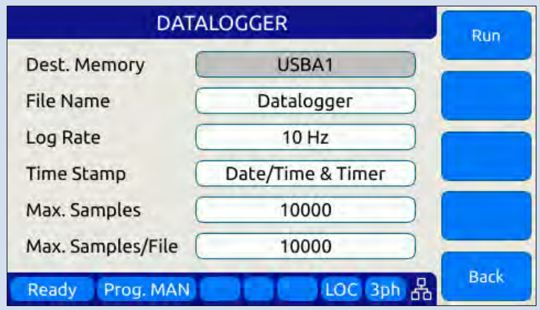
*Table 6-7: Individual Phase Measurement Screen Soft Keys*

### 6.5.4 Measurement Screen Soft Keys

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

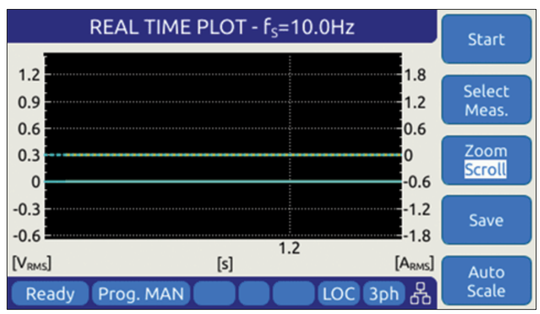
<table>
<tr><th>SOFT KEY</th><th>Description</th></tr>
<tr><td>Datalogger (SK1)</td><td>

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.




</td></tr>
<tr><td>Real Time Plot (SK2)</td><td>

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:

Start — Starts time plot.<br>
Select Meas. — Select parameters to display<br>
Zoom or Scroll — Zoom both X and Y axis<br>
Save — Saves plot data to memory device<br>
Auto Scale — Auto-scale the Y axis (Amplitude)

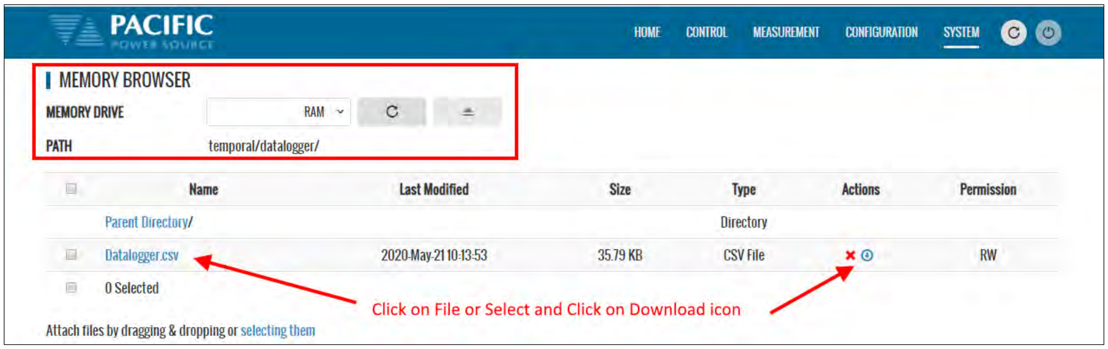
</td></tr>
<tr><td>Next Screen (SK5)</td><td>This soft key allows toggling between the two available measurement screens. The same can be accomplished by pressing the MEAS button on the left hand side of the LCD display.</td></tr>
</table>

*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 whichis easily imported into MS Excel or other programs for analyzer and / or display purposes.

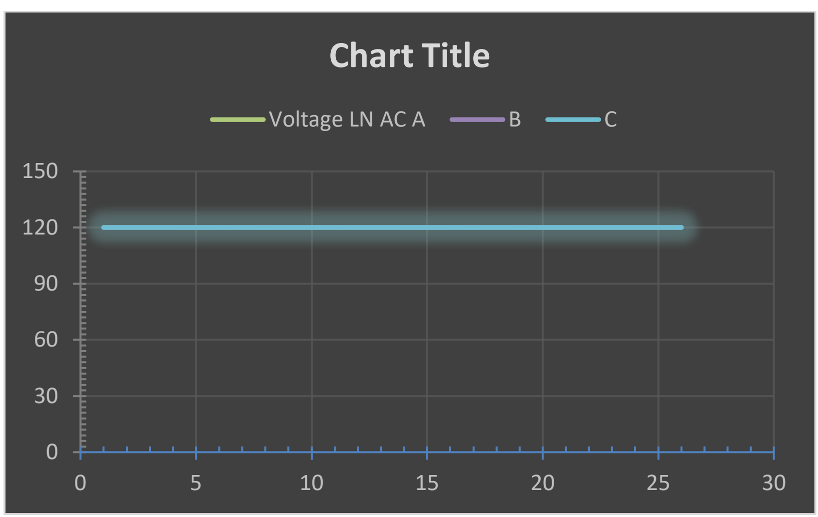
Destination memory defautls to internal RAM allowing log files to be downloaded to browsers or local drives using the web server SYSTEM -> MEMORY BROWSER menu entry.




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 10:13:17.647,0.00,60,207.846,207.845,207.846,207.846,207.845,207.846,0.0015717,0.000892723,0.000678978,120,120,120,120,120,120,5.74293e-
05,0.00162913,0.000736408,0.0961562,0.0658469,0.0389105,0.00917411,0.00100751,-
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 10:13:17.748,0.101,60,207.845,207.846,207.847,207.845,207.846,207.847,0.000484911,0.000716525,0.000231614,120,119.999,120.001,120,119.999,120.001,0.000291418,-
0.000193493,0.000523032,0.0963041,0.0660525,0.0392375,0.00873799,0.000840356,-
0.0050699,0.000142419,0.000692023,0.000528912,0.0115565,0.0079262,0.00470855,0,0,0,0.245361,0.199247,0.126651,0,0,0,

21/4/2020 10:13:17.847,0.200,60,207.845,207.843,207.844,207.845,207.843,207.844,0.00195489,0.000834307,0.0027892,120,119.999,119.998,120,119.999,119.998,0.00201776,6.2867e-05,-
0.00077144,0.0957361,0.0658142,0.0392642,0.00805068,0.000924351,-0.00582215,0.000124226,0.000720164,0.000534704,0.0114883,0.00789763,0.00471161,0,0,0,0.249,0.195608,0.128863,0,0,0,

21/4/2020 10:13:17.947,0.300,60,207.844,207.847,207.846,207.844,207.847,207.846,7.05616e-
05,0.000486062,0.000556624,119.998,119.999,120.002,119.998,119.999,120.002,0.000496289,0.000425727,-6.03351e-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

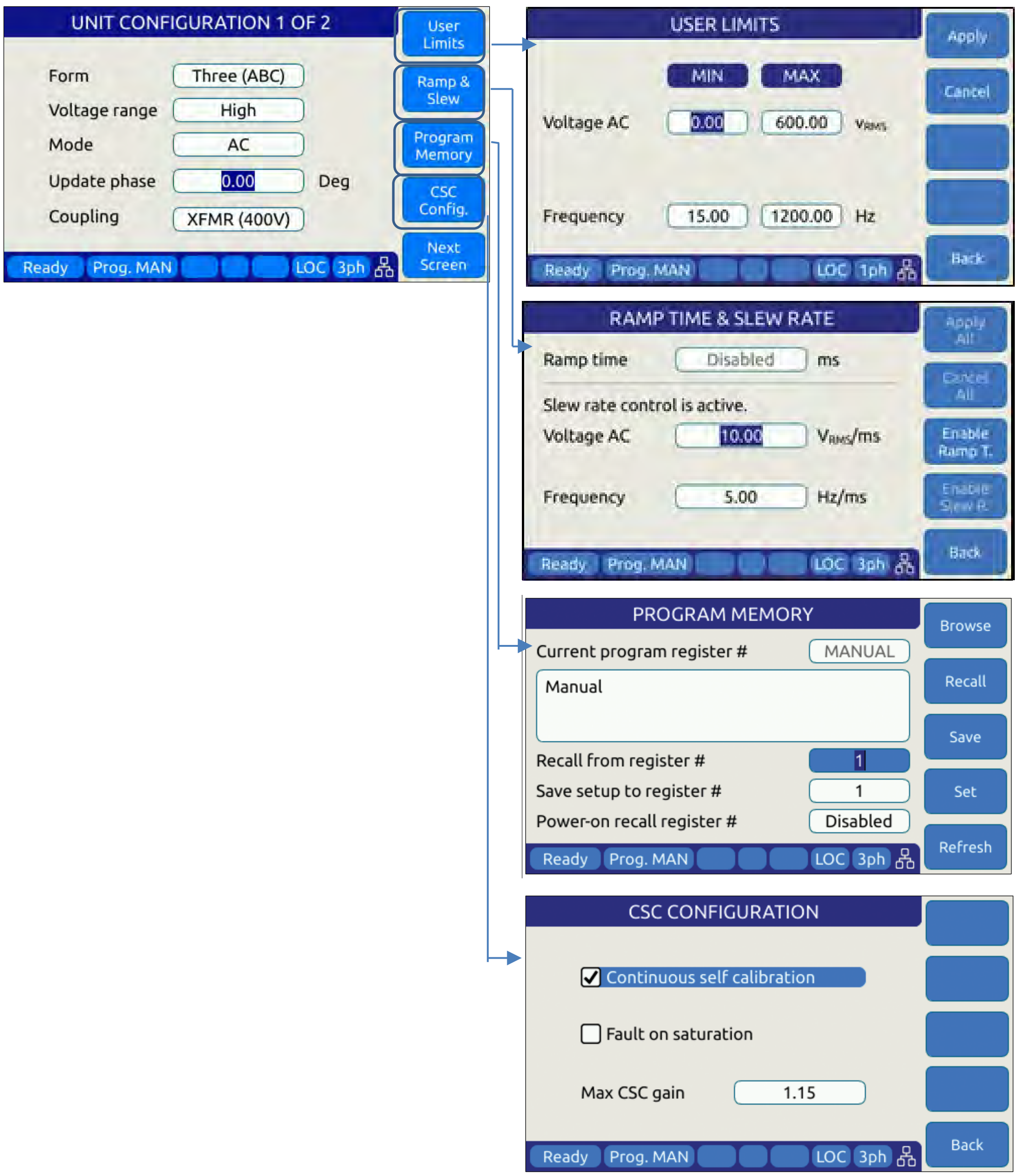
This functionality is not available on ADF Series models.

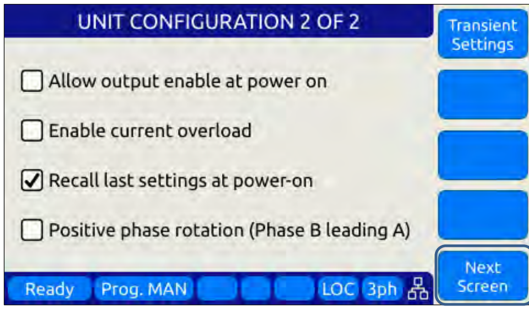
## 6.7 CONF – CONFIGURATION Screens

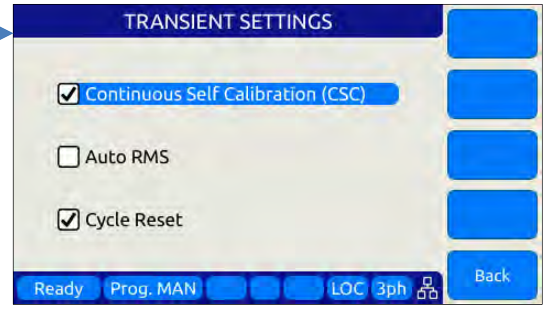
The CONFIGURATION screens 1 & 2 allow setting of secondary parameters functions. These include the following operation aspects:

- Configuration

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

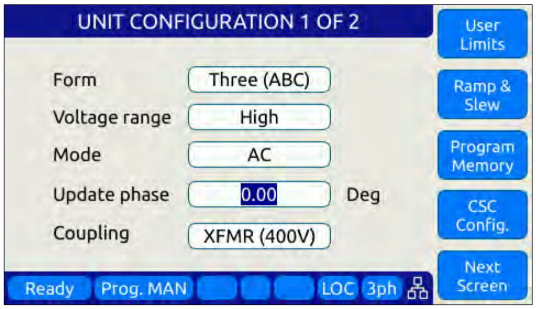


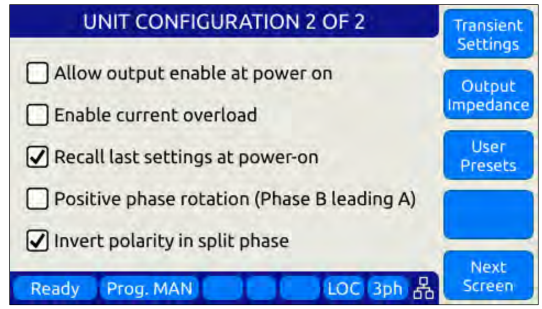



All other system related screens can be accessed using the SYST menu key. (Refer to Section 6.7.6).

### 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.

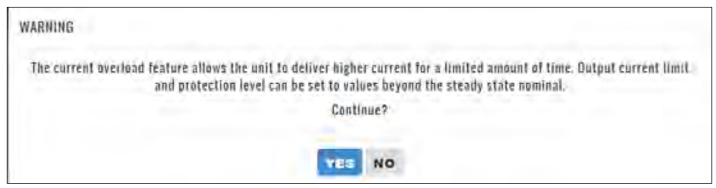
| SOFT KEY | Description |
|---|---|
| **User Limits (SK1)** | Displays SETUP MENU screen. Refer to section 6.7.2 |
| **Ramp & Slew (SK3)** | Displays SLEW RATE MENU screen. Refer to section 6.7.3 |
| **Program Memory (SK2)** | Displays PROGRAM MEMORY screen. Refer to section 6.7.4 |
| **CSC Config.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

*Table 6-9: 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 whit 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 6-10: 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 6-8: 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 6-11: 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 6-9: RAMP TIME & SLEW RATE SETTINGS Screen*

The following parameters can be set from this screen:

**Ramp time** Sets the time (in msecs) 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 6-12: 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.

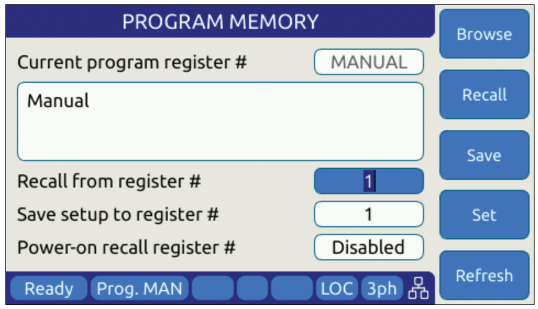
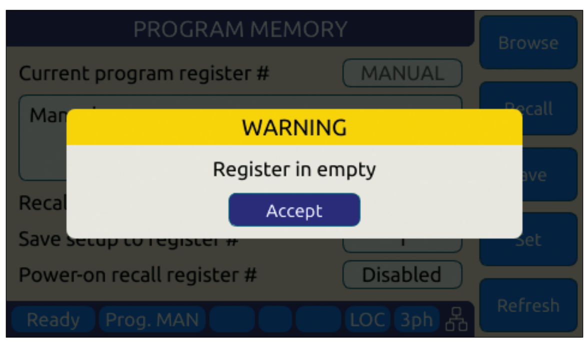



*Figure 6-10: PROGRAM MEMORY screen*

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 6-13: 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.

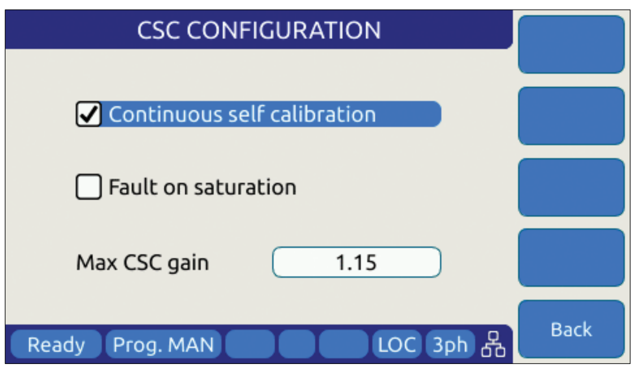



*Figure 6-11: CSC CONFIGURATION screen*

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

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

*Table 6-14: Available CSC CONFIGURATION screen soft keys*

### 6.7.6 USER PRESETS Screen

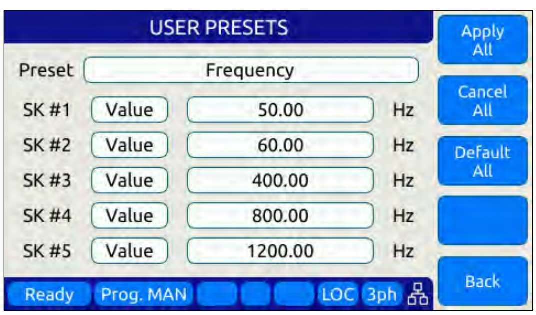
The USER PRESETS screen allows the soft key set values for output programming that appear in the PROGRAM screen to be changed to setting values preferred by the user.

Presets can be defined for the following output settings:

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

#### 6.7.6.1 AC Voltage Soft keys


#### 6.7.6.2 Frequency Soft keys



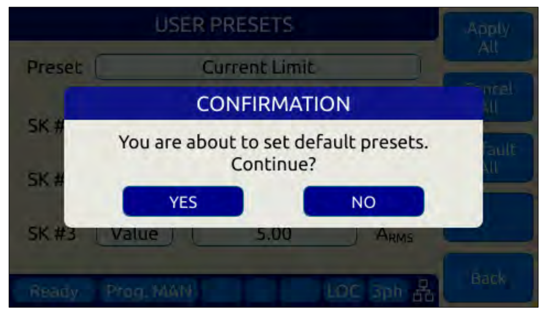

**Note:** Preset value higher than 500.00 Hz are only available on ADF Models with Option F.

#### 6.7.6.3 Current Limit Soft keys

#### 6.7.6.4 Power and VA Limit Soft keys



For each parameter, theuser 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.

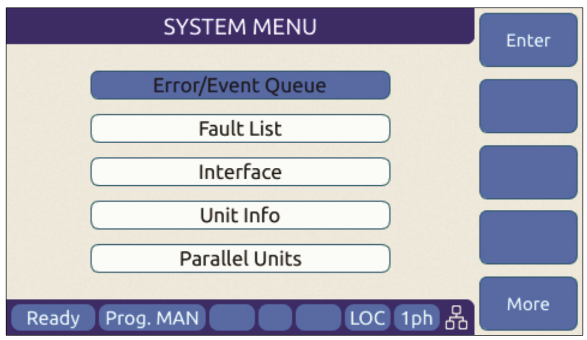



*Figure 6-12: SYSTEM MAIN MENU 1*

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

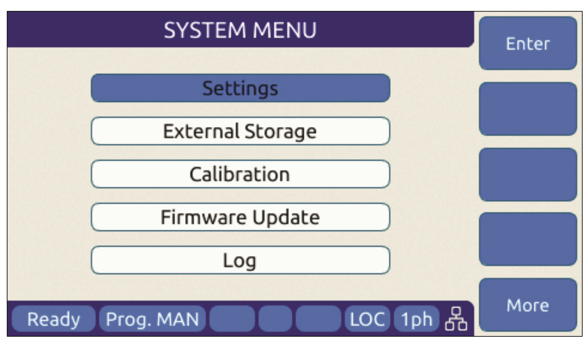


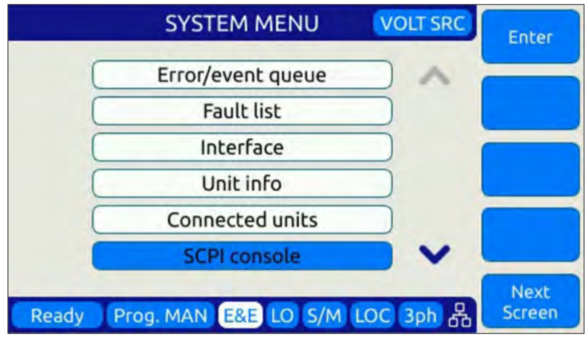

*Figure 6-13: SYSTEM MAIN MENU 2*

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

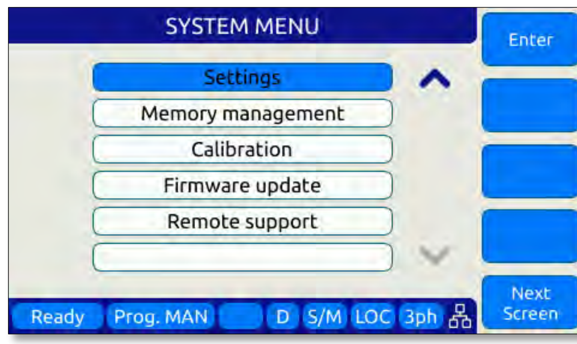



Each screen is covered in subsequent sections.

### 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 of 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.

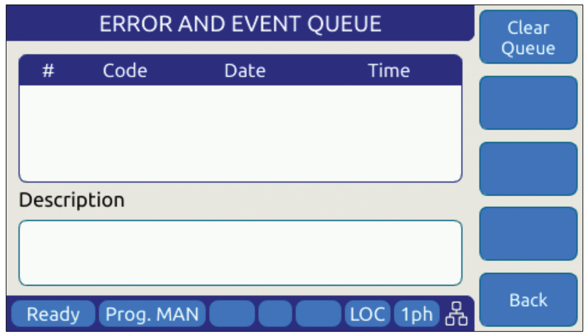



*Figure 6-14: ERROR & EVENT QUEUE Screen*

### 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.

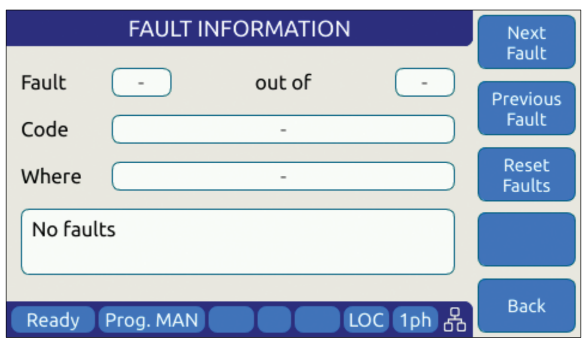



*Figure 6-15: FAULT INFORMATION screen*

### 6.8.5 INTERFACE Screen

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

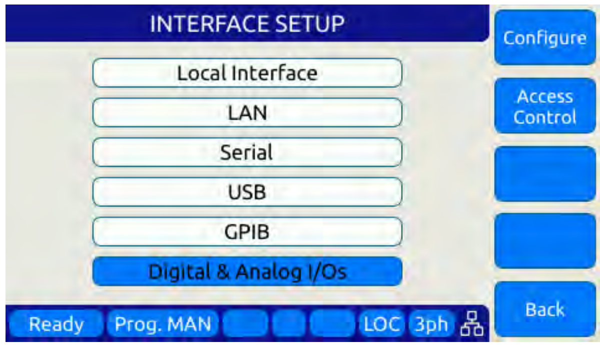


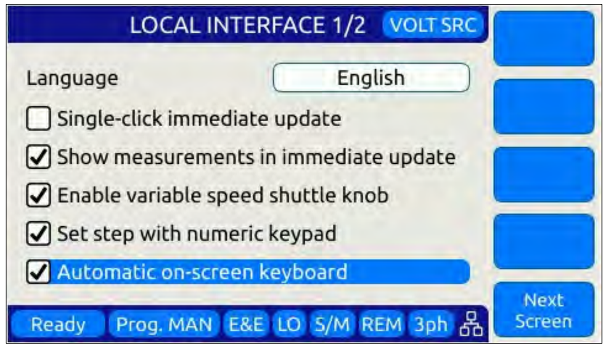

*Figure 6-16: INTERFACE SETUP Screen*

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:

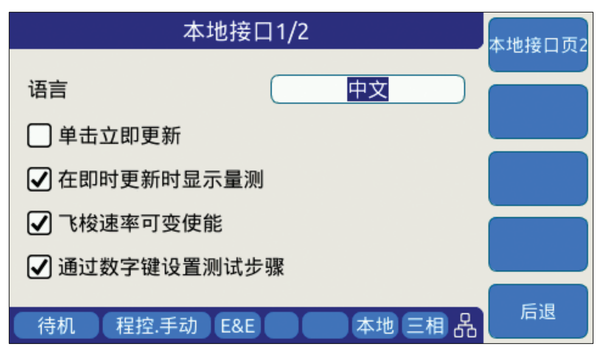
1. Scrolling values up or down
2. Single Click push function
3. Double Click push function

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 6-15: Available USER INTERFACE screen soft keys*

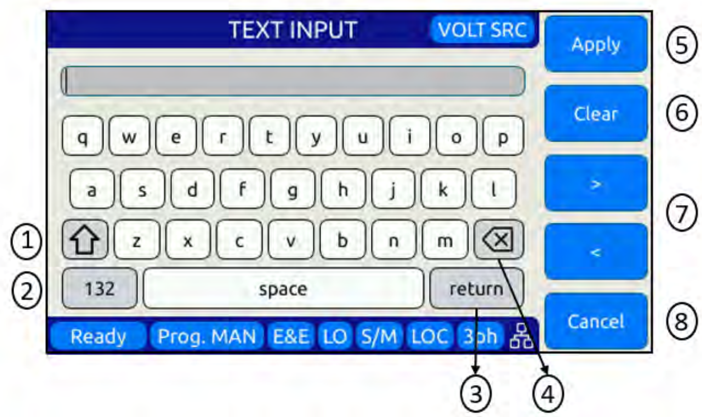
#### 6.8.5.2 TOUCHSCREEN KEYBOARD

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:

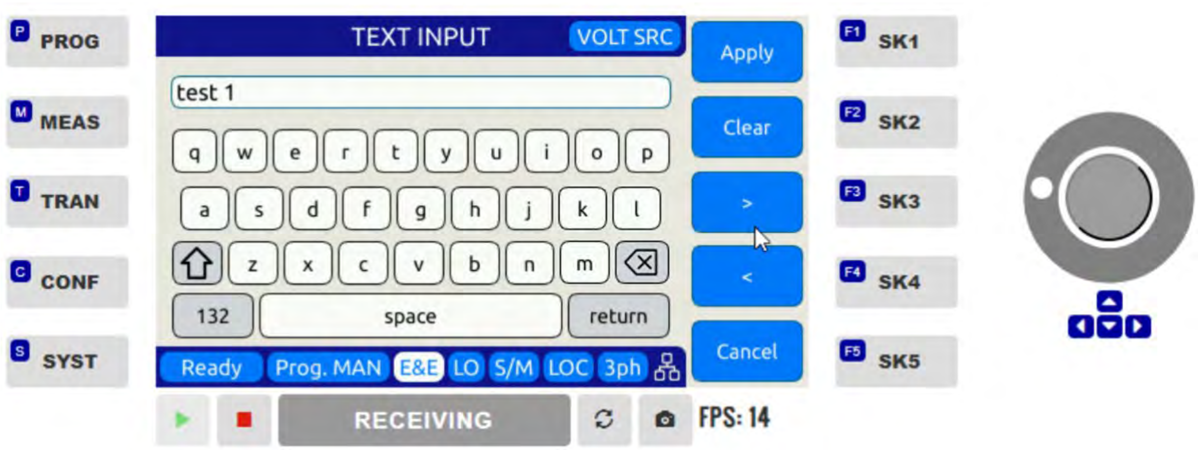



1. Shift: Allows switching between lowercase and uppercase letters, numbers and symbols.
2. 123/ABC: Allows switching from letters to numbers and symbols or vice versa.
3. Return: Places the cursor at the end of the text.
4. Backspace: Deletes the previous character depending on the cursor position
5. 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

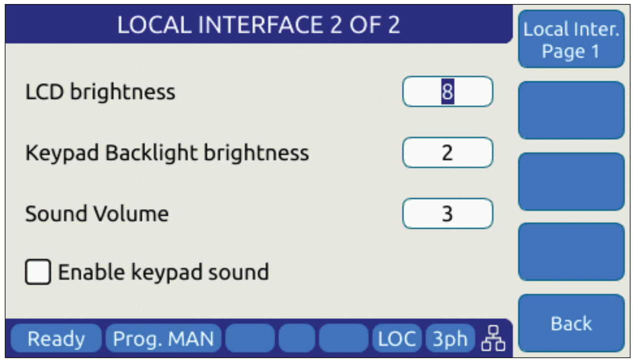
**Available Qwerty keyboard Types:**


**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 6-16: 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.**

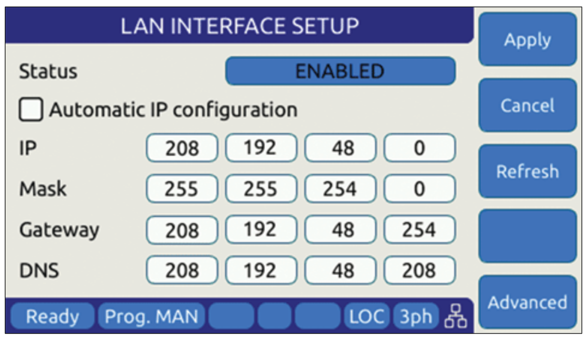



*Figure 6-17: ETHERNET INTERFACE SETUP Screen*

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 6-17: 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.

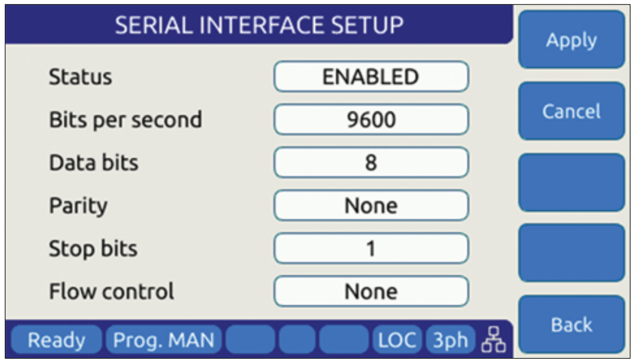



*Figure 6-18: SERIAL INTERFCE SETUP Screen*

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 6-18: 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.

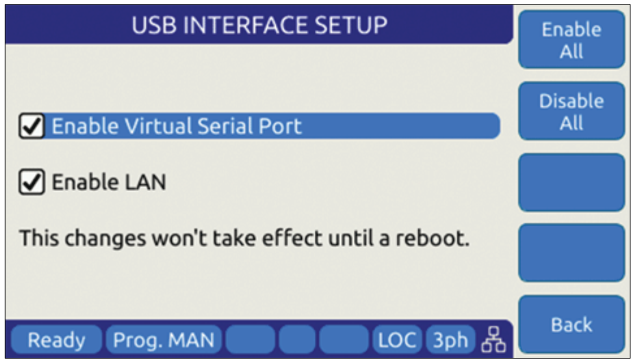



*Figure 6-19: USB INTERFACE SETUP Screen*

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 6-19: 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.

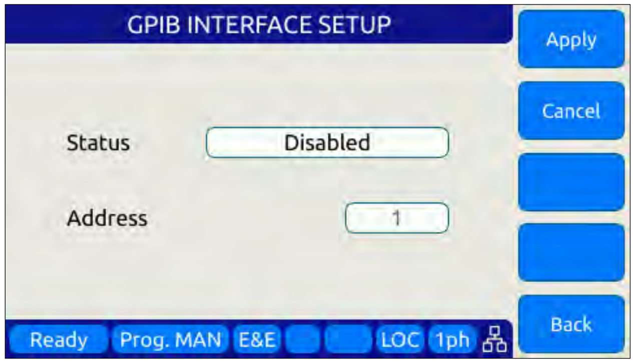



*Figure 6-20: USB INTERFACE SETUP Screen*

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 6-20: 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 154.

#### 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.

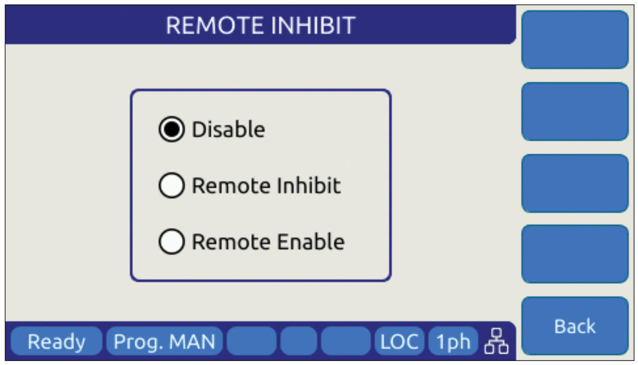



*Figure 6-21: REMOTE INHIBIT Setup Screen*

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

1. **Disable mode**: In his 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 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.

### 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).

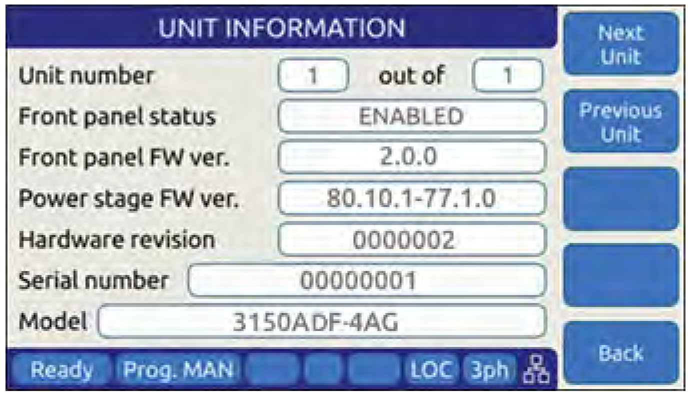



*Figure 6-22: UNIT INFORMATION Screen*

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 6-21: 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.

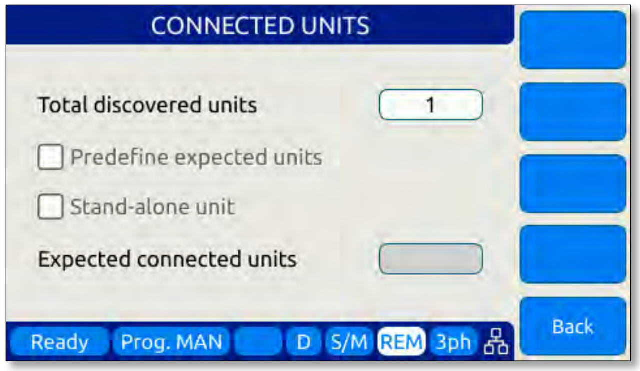



*Figure 6-23: PARALLEL UNITS Screen*

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 6-22: 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.

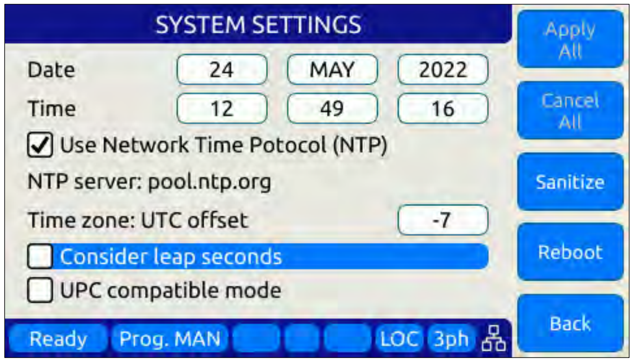



*Figure 6-24: SYSTEM SETTINGS Screen*

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 6-23: 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.

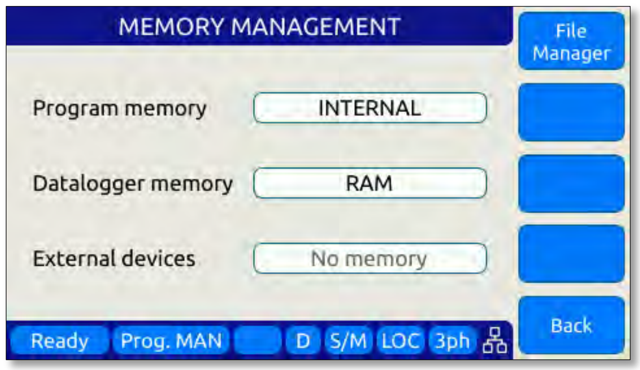



*Figure 6-25: MEMORY MANAGMENT Screen*

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.

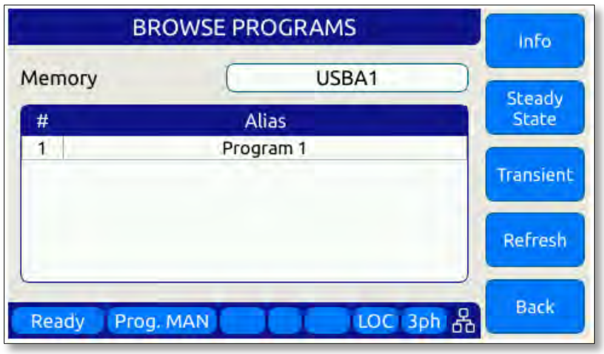
The following files types can be located in each of these directories.

| 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 10.7.4 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.



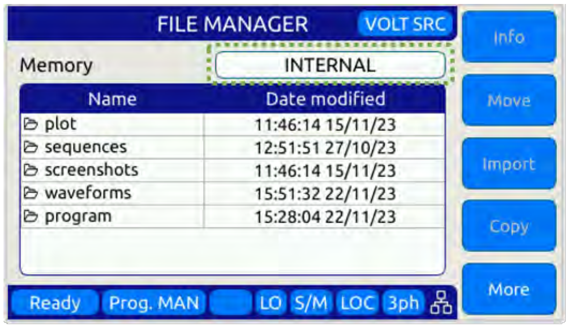

Select the USBA1 drive in the upper right corner Memory field to see the available progam files on the USB drive. Scroll down with the shuttle to select the desired program file to load.

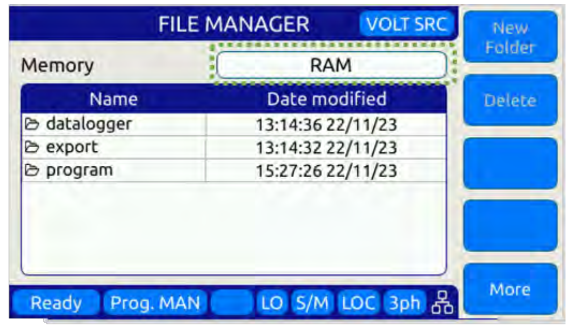
Then use the **Recall** Softkey to load the selected progam file. The program will now be available in the assigned program memory location as determined by the XML file name.

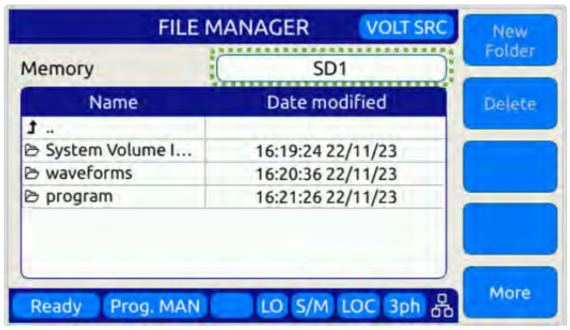

**Note:** program_xx.xml files must have a Steady State section to be valid. The Transient section may be empty in which case no transient will be loaded.

#### 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.



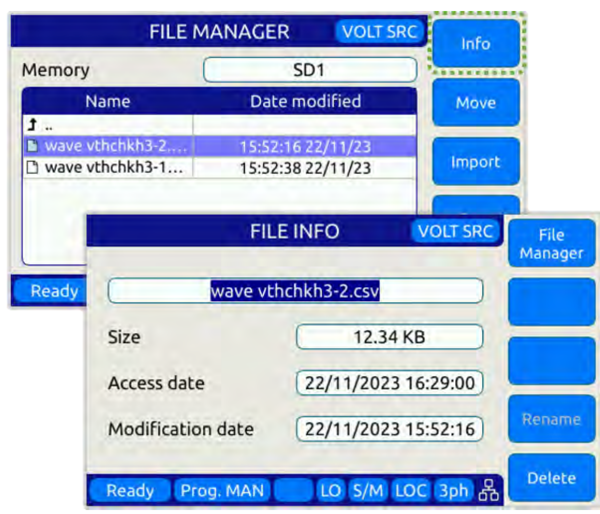




This screen contains file info such as date/time, and supports the following functions:

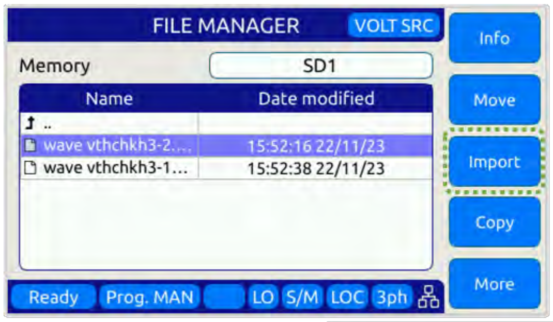
1. Move, Copy and Delete files.
2. Create new folders.
3. Import Waveforms.
4. Import Programs.

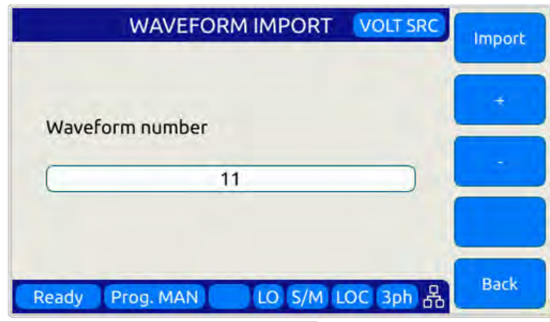
To navigate between files and folders, use the shuttle knob to select a folder and press to enter.

### 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 know to scroll the waveform number. Press the Import (Sk1) softkey and YES to confirm when prompted.

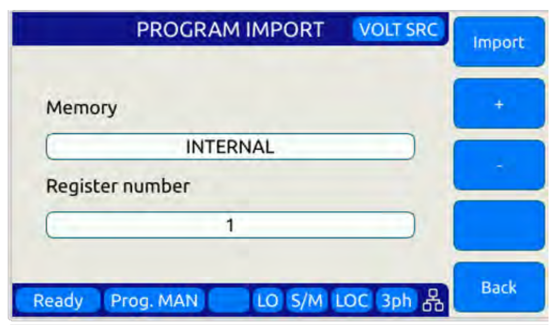


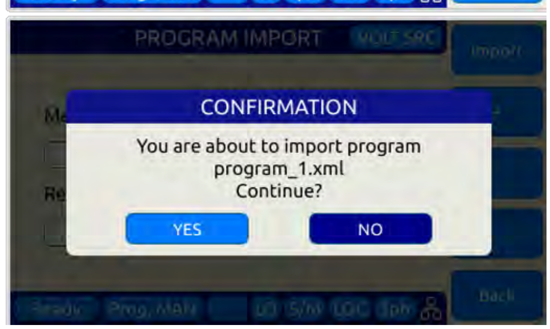





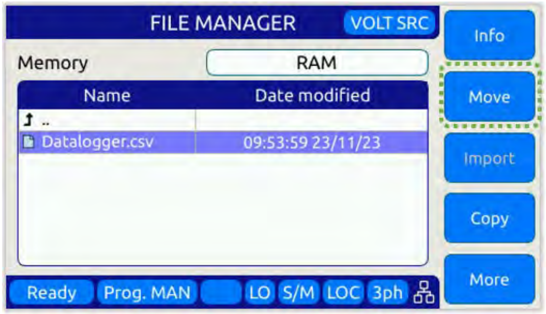
### Importing Programs

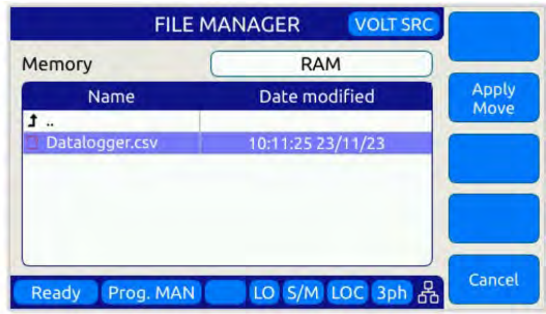
Importing xml format program files uses a similar process except they are stored in a register location by number. Select the desired program file, select the memory type and register number and press Import (Sk1), the confirm when prompted.

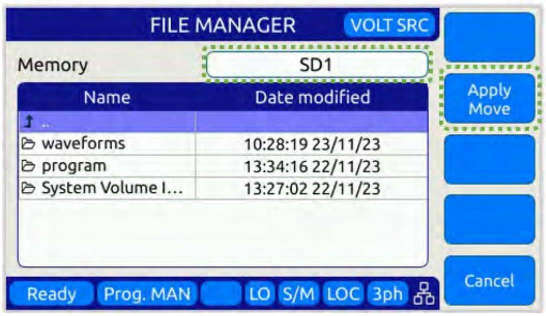



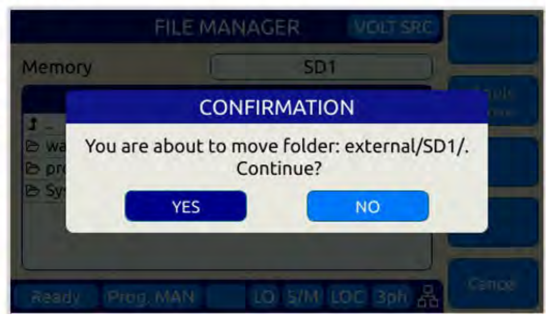
### Moving Files



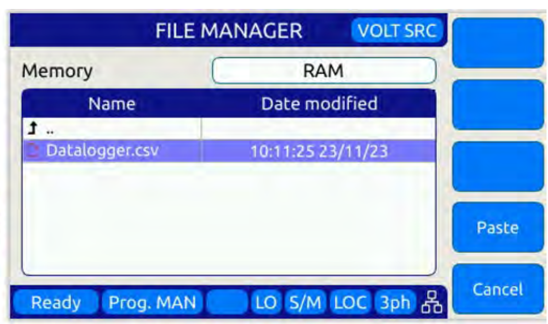




- Changes the directory and then press "**Apply Move**"

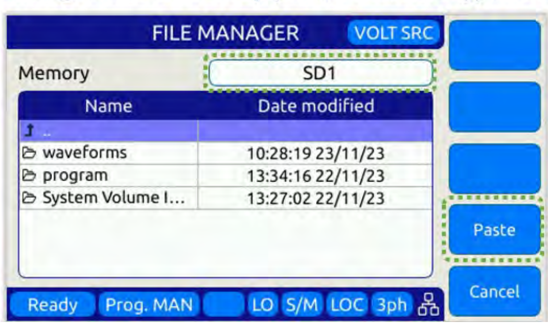


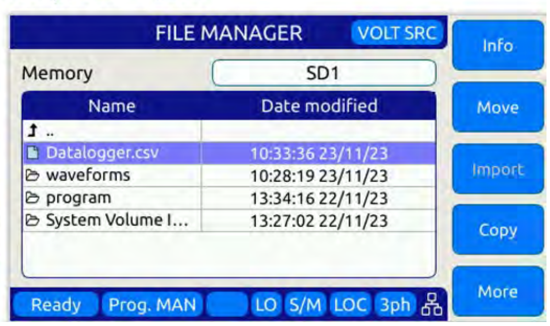




### Copy and Pasting Files

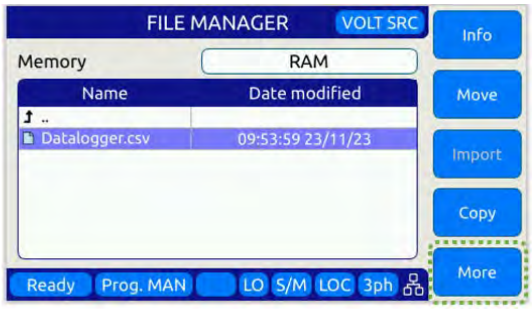



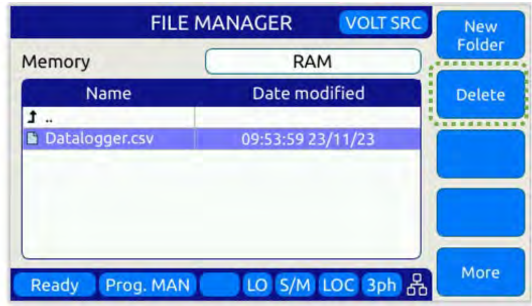

Changes the directory (and/or Memory) and then press "**Paste**"

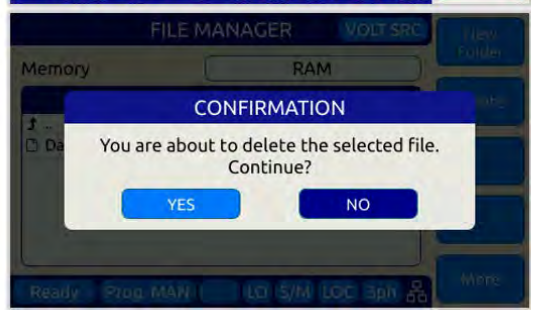


**Deleting Files**




## 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.

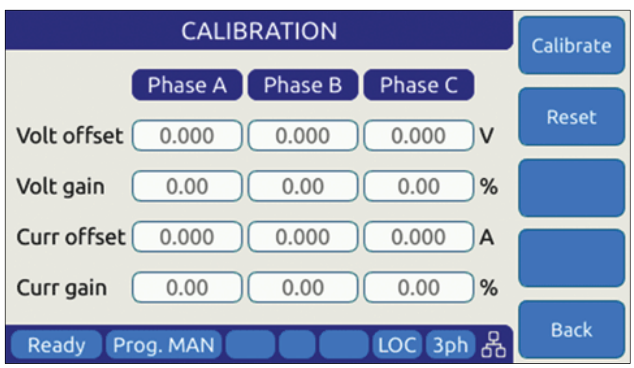



*Figure 6-26: CALIBRATION MENU Screen*

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 6-24: 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.

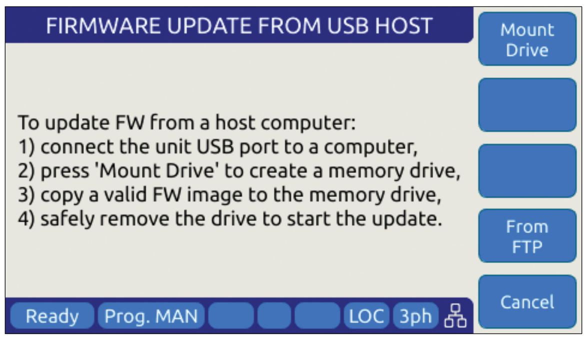



*Figure 6-27: FIRMWARE UPDATE Screen*

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 6-25: Available FIRMWARE UPDATE screen soft keys*

### 6.8.13 REMOTE SUPPORT Screen

The REMOTE SUPPORT feature cam 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.

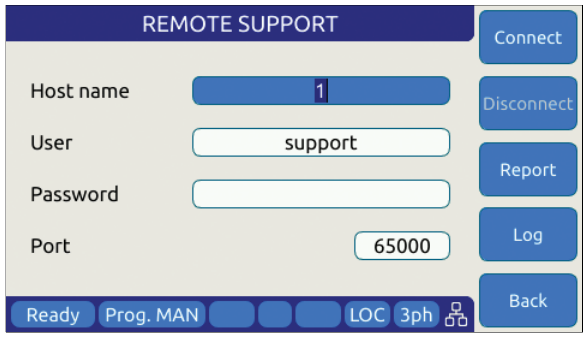



*Figure 6-28: REMOTE SUPPORT Screen*

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 6-29: 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 6-26: 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 2.3 “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 mm^2). 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 |

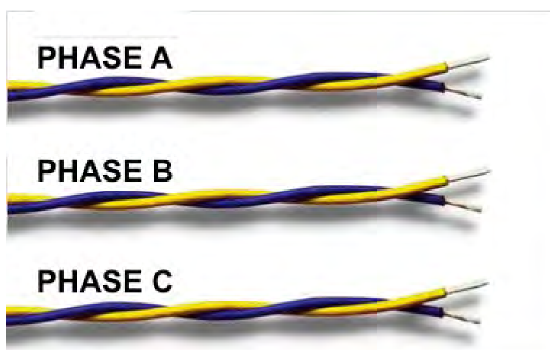
### 7.2.2 Load Connection without External Voltage Sense

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.

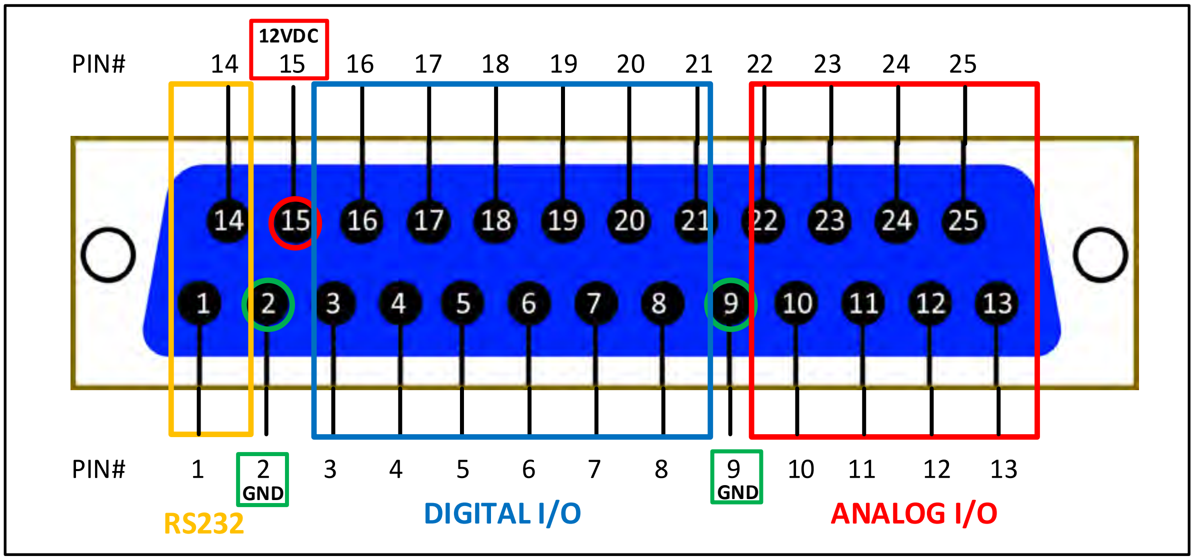



*Figure 7-2: DB25 Connector AUX I/O Pin Locations*

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.

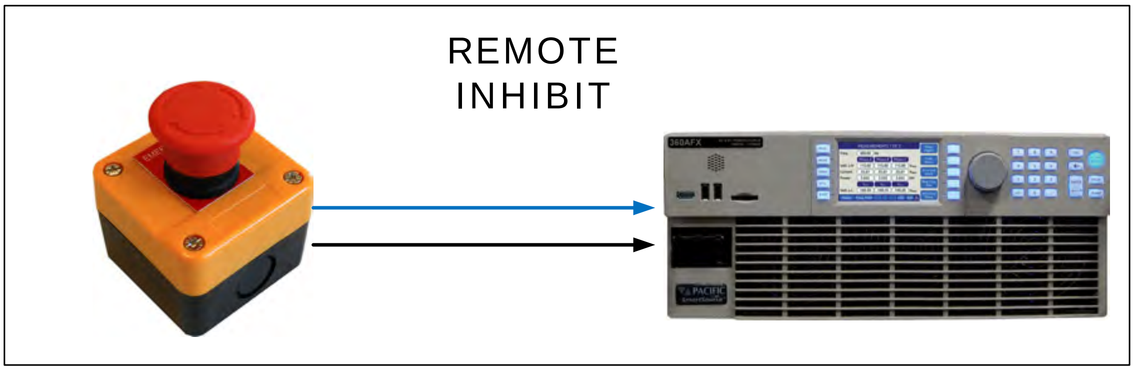
| Pin # | Name | Primary Function | Alternate Use / Comment | Type | Direction |
|---|---|---|---|---|---|
| **10** | AI1 | Analog Input – Volt RMS Phase A | Any set point | Analog | Input |
| **11** | AI2 | Analog Input – Volt RMS Phase B | Any set point | Analog | Input |
| **12** | AI3 | Analog Input – 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*

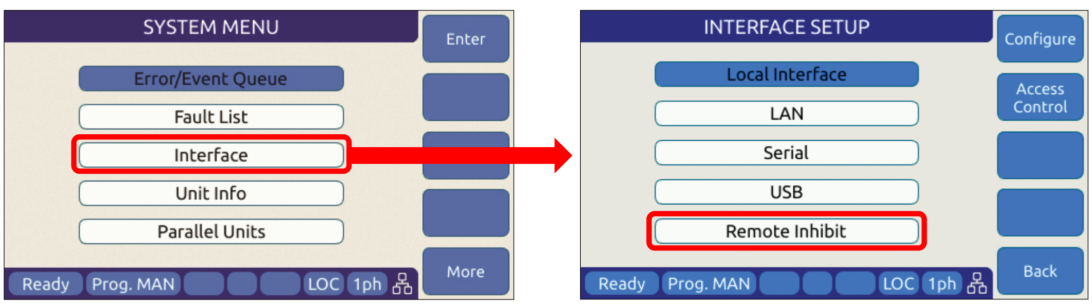
### 7.3.5 Dedicated Function Digital Inputs

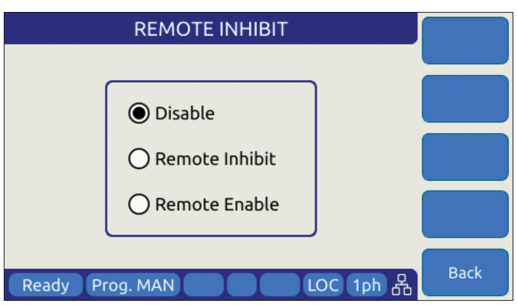
- Remote Inhibit
- External Trigger Input
- External Phase Sync Input

#### 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:

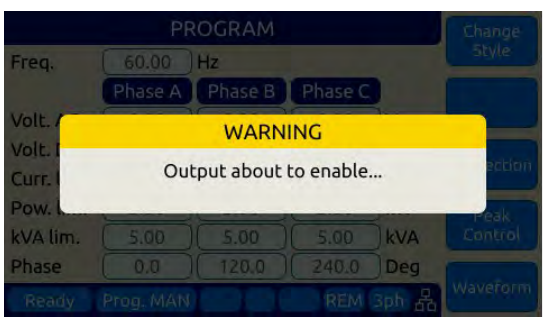
1. **Disable mode**: In his mode, the Remote Inhibit inputs are not active so this function is turned off. No short between the RI pins is required to enable the output in this mode.

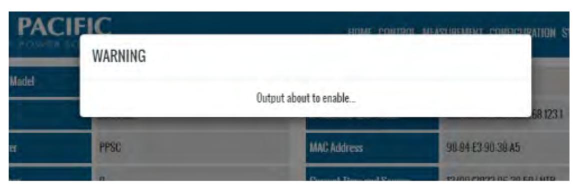
2. **Remote Inhibit mode**: The Remote Input pins 6 and 15 on the rear panel DB25 AUX I/O have to be shorted for the output to be enabled from the front panel or remote command. This is a necessary but not a sufficient condition to enable the output. If the output is enabled and the remote inhibit connection 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
   Command[4]: 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.

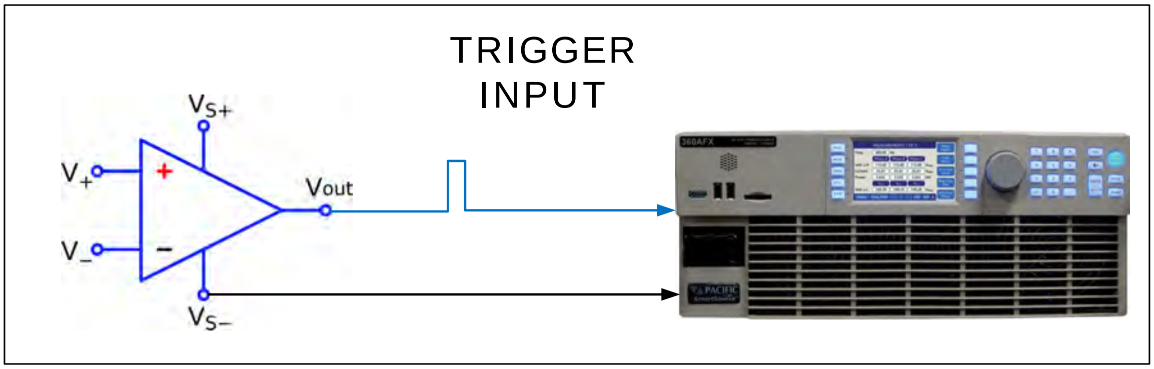
   Countdown beeping warning before enabling output, like a time boom. The warning pop-ups messages below are shown on LCD and webpage before enabling the output.




4. Transient Trigger Input

[4] 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 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 Vin < 0.4 V |
| | Log High Vin > 2.0 V |
| Impedance | 10 kΩ |
| Edge Triggered | Rising edge |

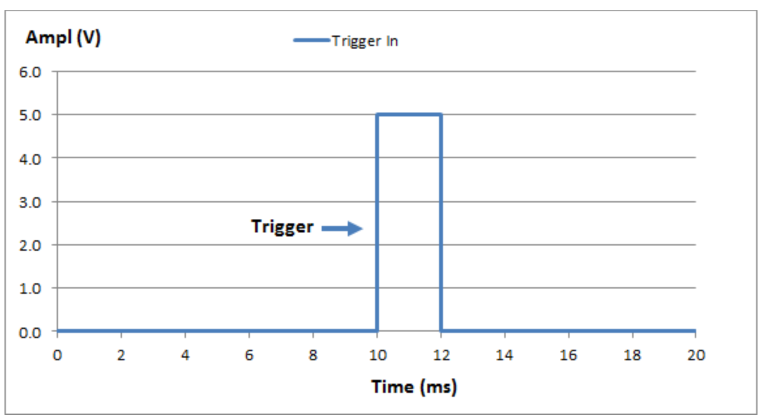
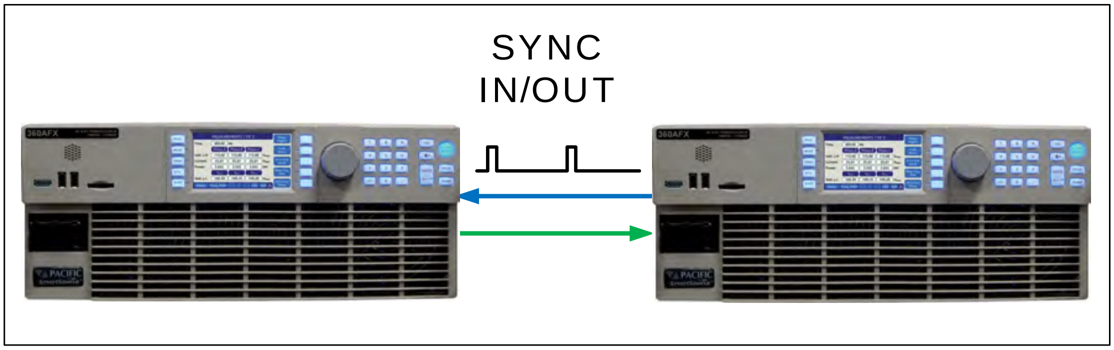



*Figure 7-3: External Trigger Input Timing*

### 7.3.6 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 than Phase B and C are still phase related to A as programmed by B and C phase angles.

#### 7.3.6.1 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 $F_{SETPOINT}$ +/- $F_{RANGE}$, 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 |

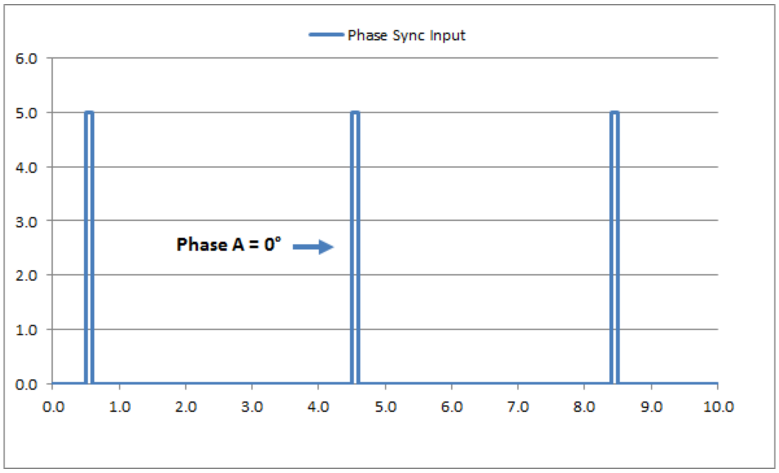
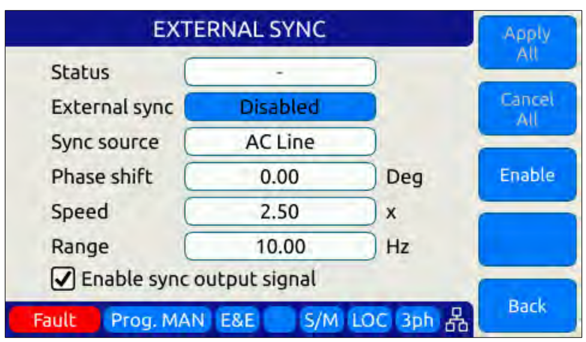



*Figure 7-4: External Sync Input Pulses*

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).



#### 7.3.6.2 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.

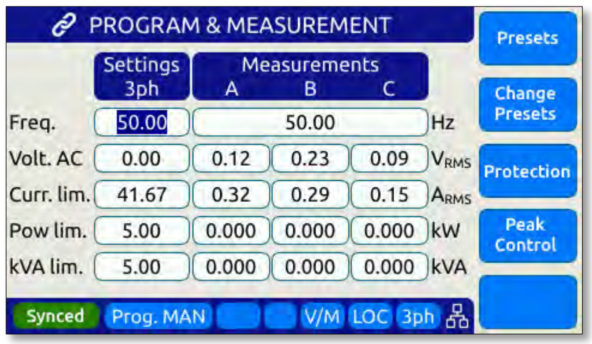



*Figure 7-5: External Sync Input Sync Status Indication*

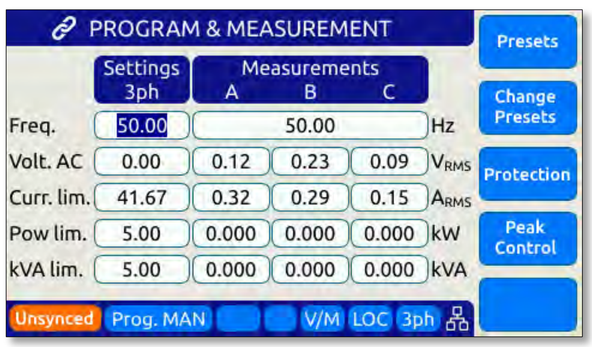



*Figure 7-6: External Sync Input Sync Lost Status Indication*

#### 7.3.6.3 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

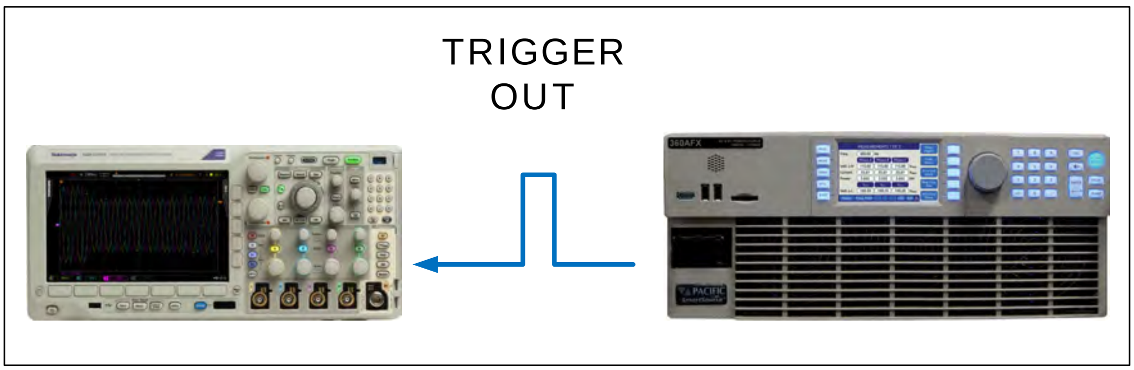
recommended to use the smallest possible speed values.
Command: SOURce:SYNChronize:SPeed

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

### 7.3.7 Digital Output control signals

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

#### 7.3.7.1 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 |

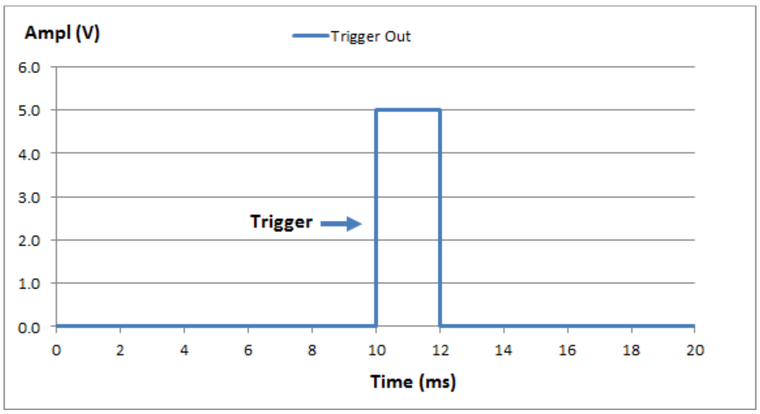



*Figure 7-7: Transient Trigger Output Pulse*

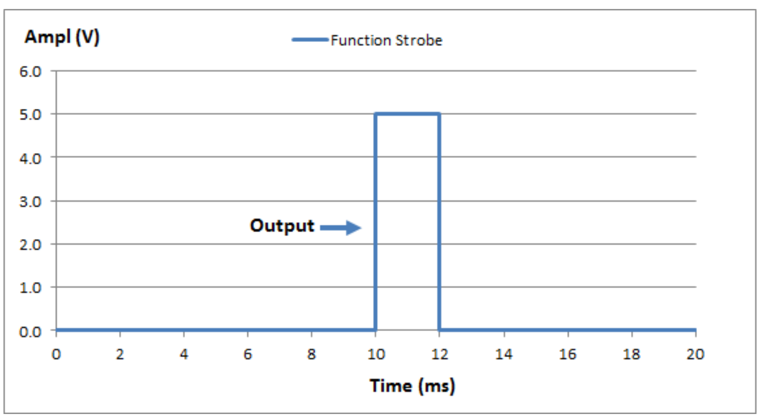
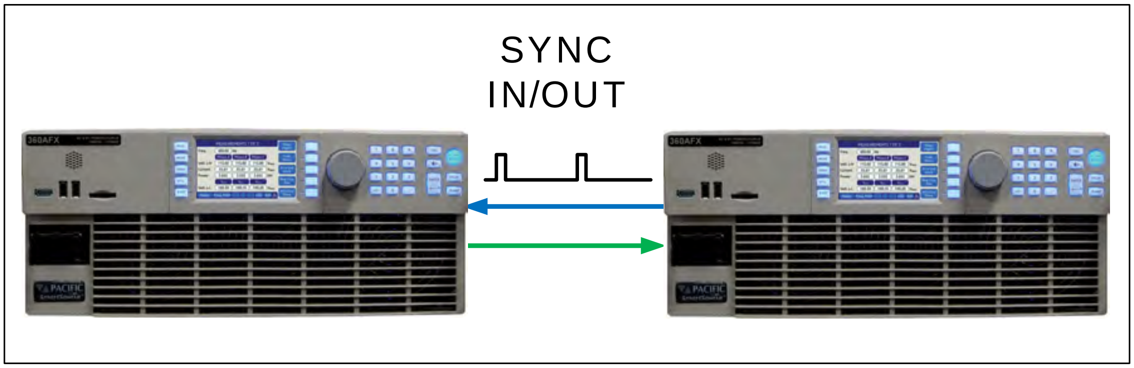



*Figure 7-8: Function Strobe Output Pulse*

### 7.3.7.2 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 |
| | Log High Vout > 4.6 V |
| Max. Current | ± 10 mA |
| Output Impedance | 100 Ω |
| Pulse Width | 100 us ± 10 us |

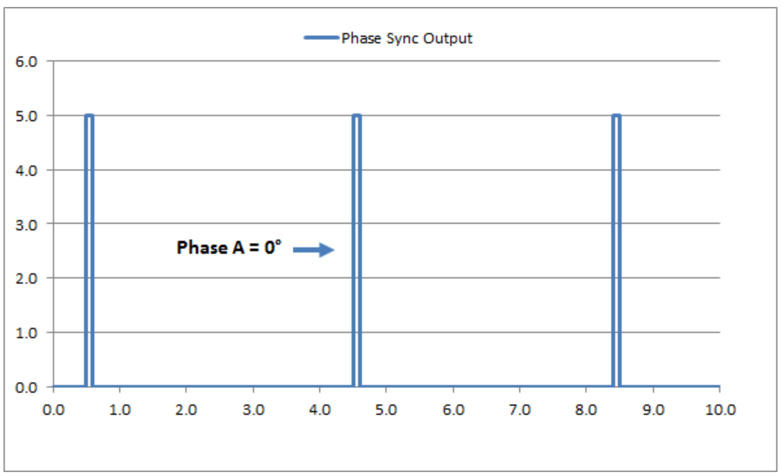
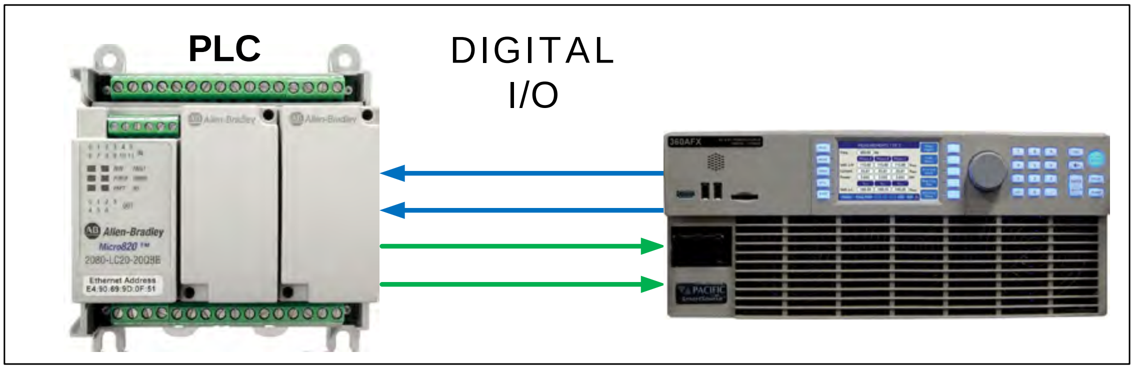



*Figure 7-9: Phase A Zero Phase Sync Output Pulse*

### 7.3.8 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:

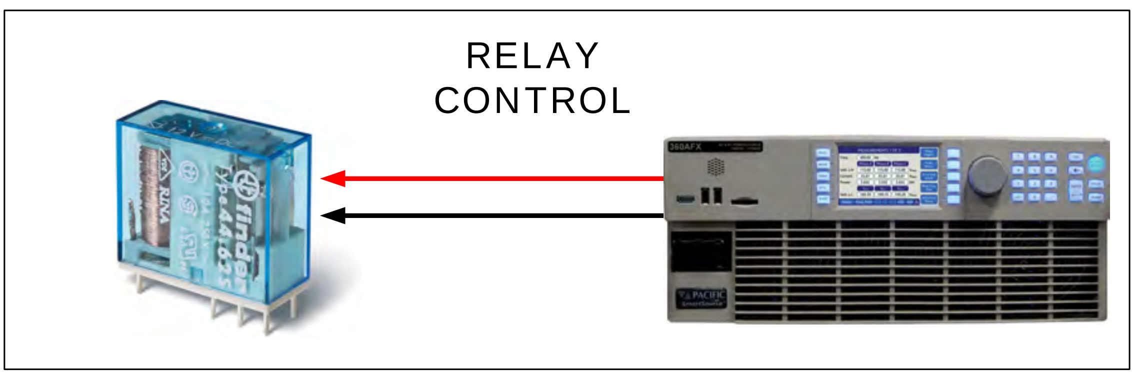
- DIO:INput1 - Digital Input #1
- DIO:INput2 - Digital Input #2
- DIO:INput3 - Digital Input #3

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.

#### 7.3.8.1 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.

#### 7.3.8.2 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.

#### 7.3.8.3 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.

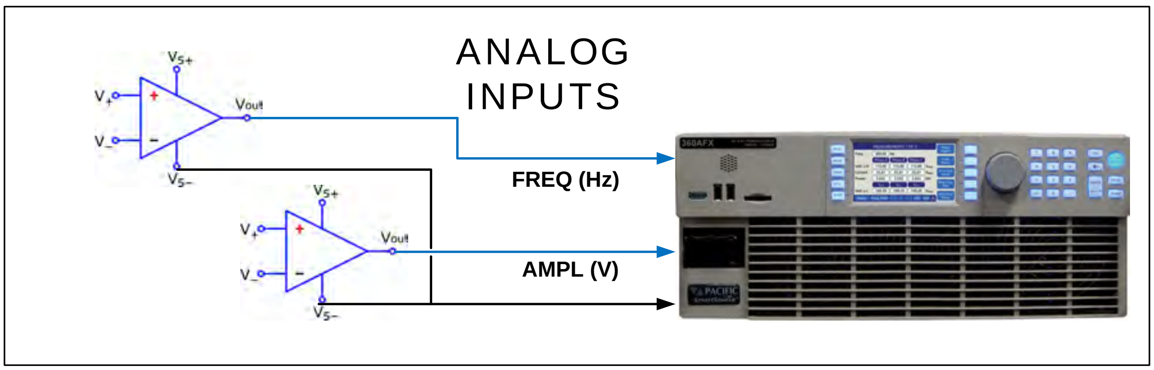
Digital outputs 1 and 2 are TTL level signals (0 to 5V), and digital outputs 3 and 4 are open-drain type outputs (with an internal pull-up) that can be used to drive external relays. Each open-drain output has a current protection of 0.5A and internal clamping diode prepared to drive a relay coil.

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

### 7.3.9 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.

#### 7.3.9.1 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 x 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.

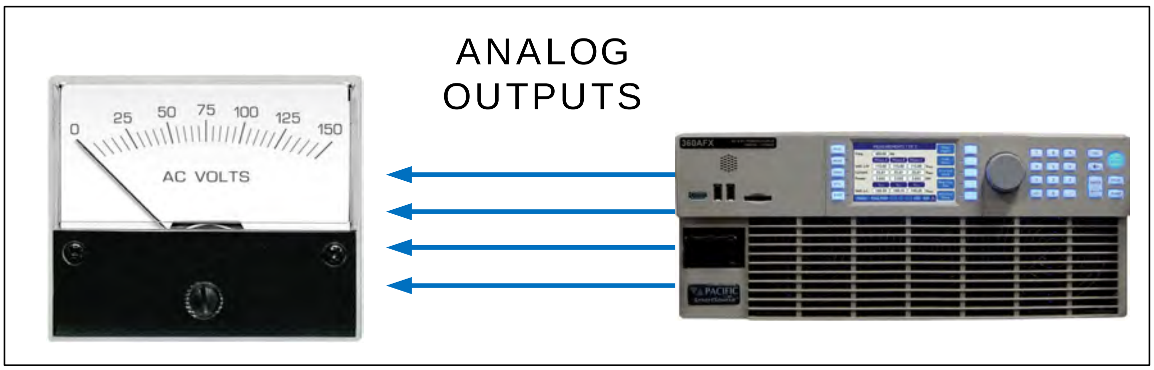
#### 7.3.9.2 Programming Analog Inputs

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).

#### 7.3.9.3 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*

### 7.3.10 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.

### 7.3.11 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.

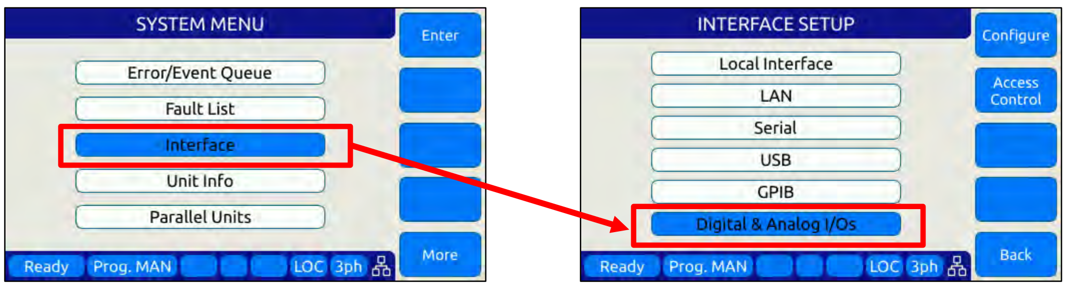
## 7.3.12 Front Panel Operation of AUX I/O Functions

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.

### 7.3.12.1 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.

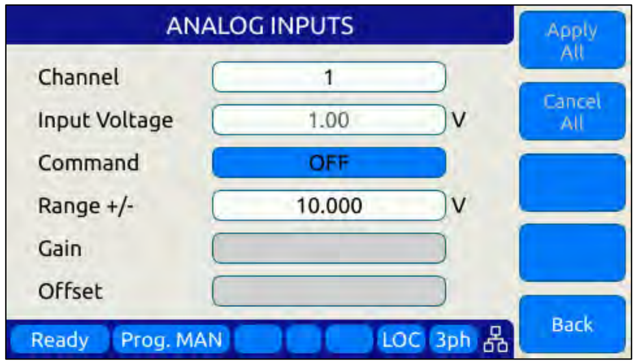



This will display a list of available Auxiliary I/O functions and features. To display the second of two DIGITAL & ANALOG I/Os screens, use the "**More"** soft key.


To select the desired function, use the knob to scroll up or down. Once selected, press the Shuttle know or ENTER key to open the relevant I/O control screen.

Each screen is covered in the following sections in more detail.

#### 7.3.12.2 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

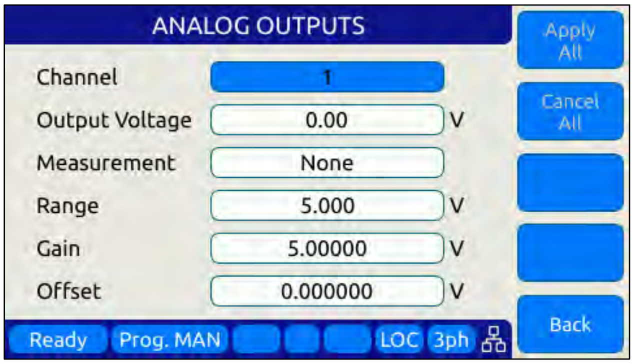
The **Command** parameter allows the user to assign the selected analog input to the parameter that will be controlled by it. The list of available setting commands for these inputs is shown below.

| 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.

### 7.3.12.3 Analog Outputs

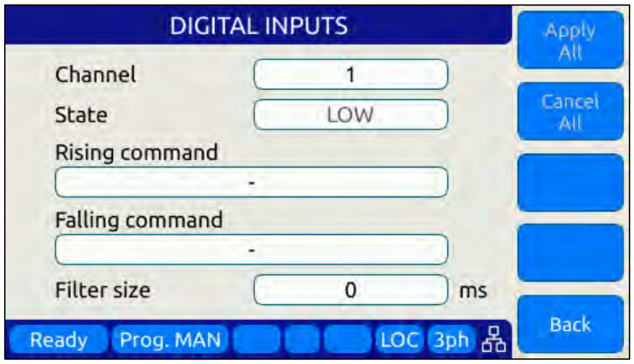



Analog outputs allow external equipment to monitor power source output values using an analog DC output signal. The assignment of measurement functions to each of four available outputs can be configured from the front panel.

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

### 7.3.12.4 Digital Inputs

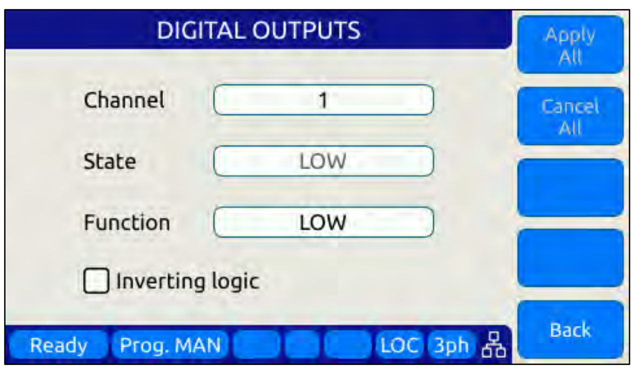



Digital Inputs allow external equipment such as PLCs. to control the power source operation. The assignment functions to each available input can be configured from the front panel.

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

### 7.3.12.5 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*

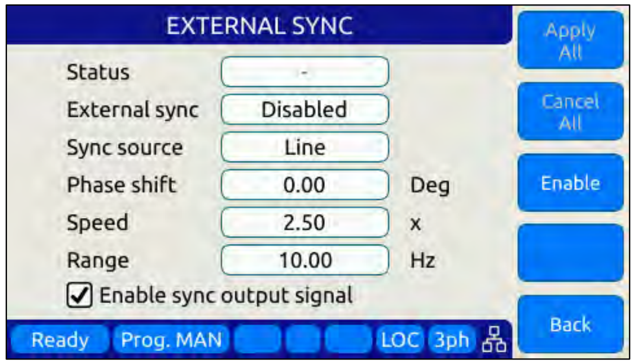
#### 7.3.12.6 Polarity Selection for DO3 and DO4 vs DO1 and DO2

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.

#### 7.3.12.7 External Sync




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 ]

#### 7.3.12.8 Trigger Input

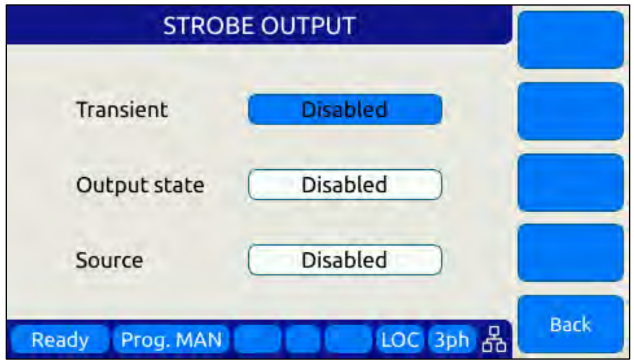

The External Trigger Input can be used to synchronize the power source's transient execution to external equipment. This

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

#### 7.3.12.9 Strobe Output

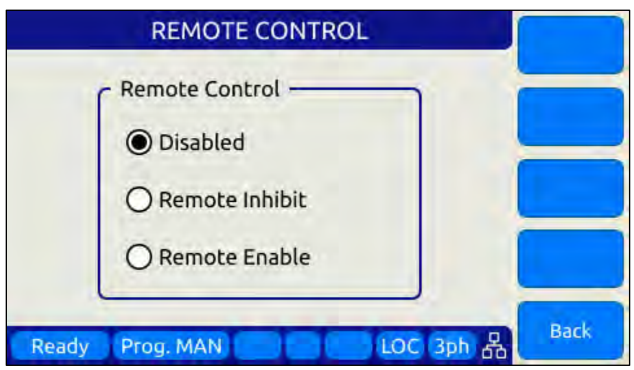



The Strobe Output is used to synchronize or trigger external equipment to an event occurring on the AC power source.

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

#### 7.3.12.10 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 6.8.5.6.

## 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:CURR |

| | |
|---|---|
| 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.<br>The first 3 values are Voltages measured at the output relay of the power source for each phase.<br>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.<br>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?<br>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_Ia, k_Ib, k_Ic, 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 292.

## 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?<br>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?<br>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:<br># = 1 $V_{AB}$, # = 2 $V_{AC}$, # =3 $V_{BC}$ |
| Returned Data Format | |
| Query Example | MEAS:VLL2?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>4.4203 |

| | |
|---|---|
| Query Format | **MEASure:POWer:MAXimum:HOLD?** |
| Description | Returns the highest total power reading obtained for all phases.<br>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?<br>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.<br>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?<br>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?<br>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?<br>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?<br>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.<br>**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:<br>0 – Stopped<br>1 – Running<br>2 – Paused |
| Returned Data Format | <nr1> |
| Query Example | MEAS:LOG:STAT?<br>1 |

| | |
|---|---|
| Command Syntax | **MEASure:LOGger:LIMit <cr>** |
| Description | 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.<br>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.<br>The rate can be set with:<br>MEASure:LOGger:RATE <nr1><br>or queried with:<br>MEASure:LOGger:RATE?. |
| Parameters | < OFF \| 0 ><br>XS where X is a time limit in seconds<br>X where X is the limit in number of samples |
| Parameter Format | <cr> |
| Examples | MEAS:LOG:LIM OFF<br>MEAS:LOG:LIM 20S<br>MEAS:LOG:LIM 100 |
| Query Format | **MEASure:LOGger:LIMit?** |
| Returned Data Format | 0 |
| Query Example | MEAS:LOG:LIM?<br>10000 |

| | |
|---|---|
| Command Syntax | **MEASure:LOGger:FILELimit <nr1>** |
| Description | 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?<br>10000 |

| | |
|---|---|
| Command Syntax | **MEASure:LOGger:FILEName <cr>** |
| Description | 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?<br>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:<br>MEAS:LOG:MEM:CAT? can be used to get the available memories. |
| Parameters | Memory name between double quotes. |
| Parameter Format | <cr> |
| Example | MEAS:LOG:MEM “USBA” |
| Query Format | **MEASure:LOGger:MEMory?** |
| Returned Data Format | <cr> |
| Query Example | MEAS:LOG:MEM?<br>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?<br>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?<br>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?<br>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 parametmer.

The user can increase of decrease the number of digits for each measurement parameter if so desired by used the RESolution commands listed in this section[5].

**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 commands active resolution setting.

<RESOLUTION> is a formatted number than 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 indepent 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 commands 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.

[5] Requires Firmware Revision 2.2.11 or higher

The following table shows the available RESolution commands.

| Measurement Resolution Commad | 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 | <b> |
| Example | OUTP:FAST ON |
| Query Format | **OUTPut:FAST?** |
| Returned Data Format | <b> |
| Query Example | OUTP:FAST?<br>1 |

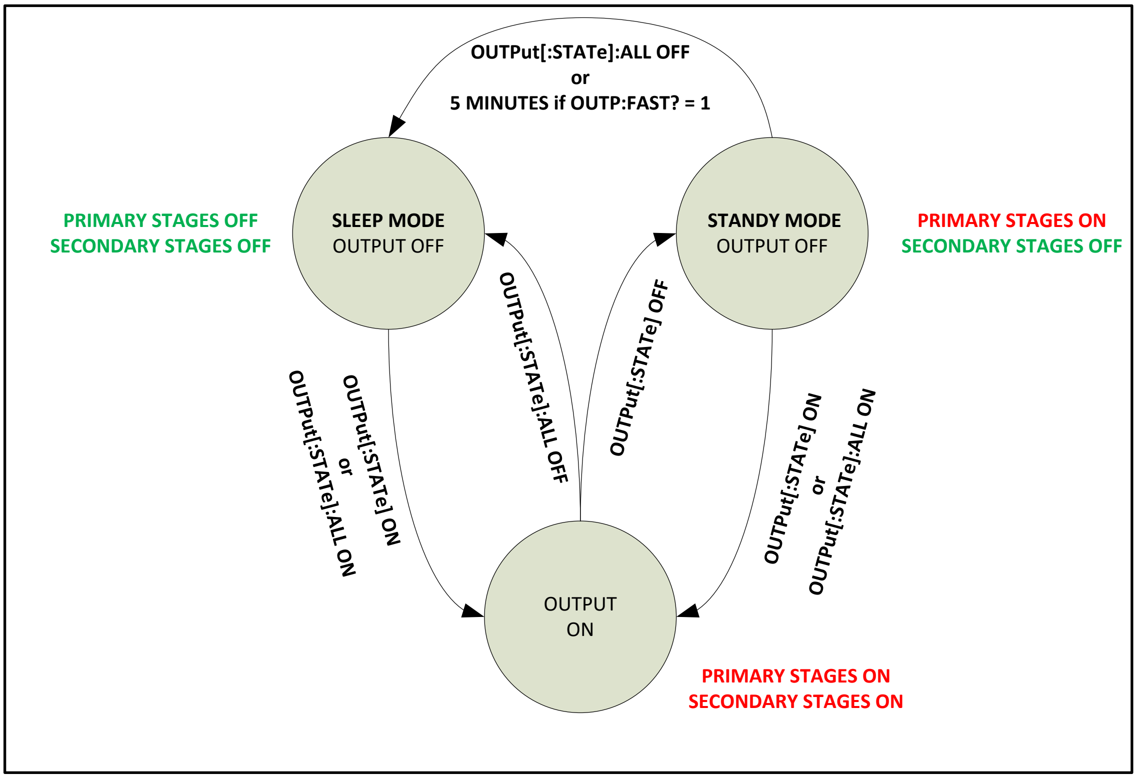



*Figure 8-1: Energy Saving Modes and Output Commands State Diagram*

| | |
|---|---|
| Command Syntax | **OUTPut[:STATe]** |
| Description | 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.<br>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.<br>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.<br>Refer to section 6.2.2, "Energy Savings Modes" for more details. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | OUTP ON |
| Query Format | **OUTPut[:STATe]?** |
| Returned Data Format | <b> |
| Query Example | OUTP?<br>1 |

| | |
|---|---|
| Command Syntax | **OUTPut[:STATe]:ALL** |
| Description | 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.<br>**Note:** The OUTP:ALL ON command has the same effect as the OUTP ON command. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | OUTP:ALL OFF |

| | |
|---|---|
| Command Syntax | **OUTPut[:STATe]:AUTO** |
| Description | This commands determines the state of the OUTPUT when the power source is turned on (powered on).<br>Enables the output automatically when the unit is energized, depending on the state of the OUTPut:STATe:AUTO:FORCE setting:<br>OUTPut:STATe:AUTO:FORCE = 0: enables output only if the output was enabled when the unit was shut down.<br>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 | <b> |
| Example | OUTP:AUTO ON |
| Query Format | **OUTPut[:STATe]:AUTO?** |
| Returned Data Format | <b> |
| Query Example | OUTP:AUTO?<br>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 | <b> |
| Example | OUTP:AUTO:FORCE 1 |
| Query Format | **OUTPut[:STATe]:AUTO:FORCE?** |
| Returned Data Format | <b> |
| Query Example | OUTP:AUTO:FORCE?<br>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/<br>**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<br>OUTPDISABLEPH -1 |
| Query Format | **OUTPut:DISABLEPHase?** |
| Returned Data Format | <nr2> |
| Query Example | OUTP:DISABLEPH?<br>90.000 |

| | |
|---|---|
| Query Syntax | **OUTPut:DISABLEPHase:MINimum**<br>**OUTPut:DISABLEPHase:MAXimum**<br>**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.<br>**Note:** Available in units with Firmware revision 1.6.6 or higher. |
| Returned Data Format | <nr2> |
| Query Example | OUTP:DISABLEPH:MIN?<br>-0.010<br>OUTP:DISABLEPH:MAX?<br>360.000<br>OUTP:DISABLEPH:DEF?<br>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 be sending OUTP:ZERO ON \| 1.<br>In this mode, the output of the power source goes to a low impedance state before disconnecting the load.<br>**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 | <b> |
| Example | OUTP:ZERO 1 |
| Query Format | **OUTPut:ZEROprogram?** |
| Returned Data Format | <b> |
| Query Example | OUTP:ZERO?<br>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.<br>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.<br>**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:ZEROprogram: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.<br>**Note:** Available in units with Firmware revision 2.2.12 or higher. |
| Parameters | Time in msecs. |
| Parameter Format | <nr1> |
| Example | OUTP:ZERO:DWELL? 20 |
| Query Format | **OUTPut:ZEROprogram:DWELL?** |
| Returned Data Format | <nr1> |
| Query Example | OUTP:ZERO:DWELL? |
| | 20 |

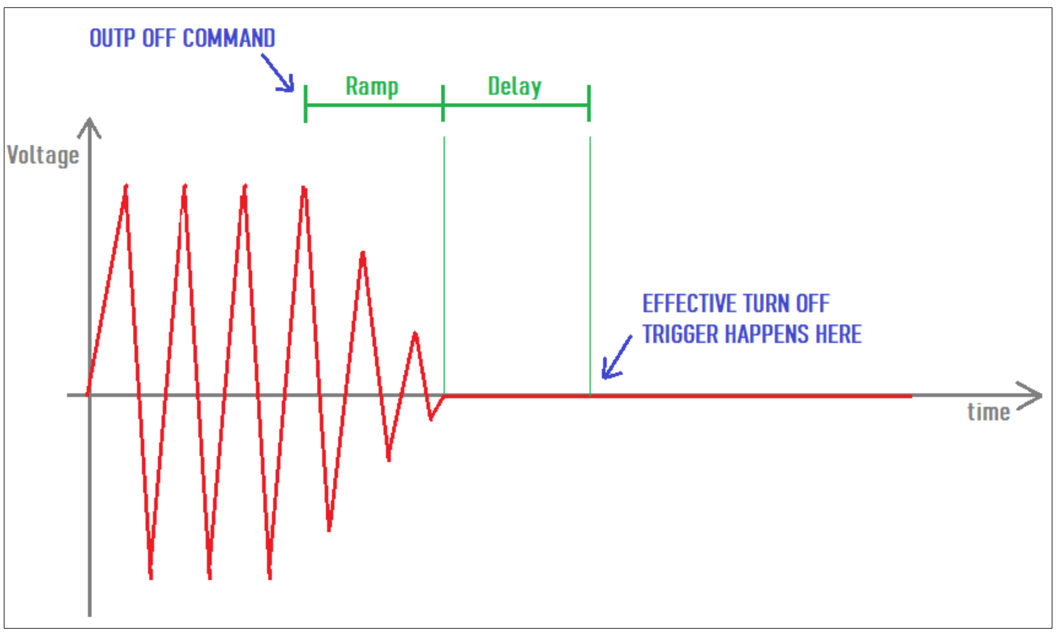



*Figure 8-2: OUTP:ZERO Command Ramp and Dwell settings*

## 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
- 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 | **PROGram:NAME [<nr1>,] [<cr>,] <cr>** |
| Description | This command selects program <nr1> for execution deletion or copying. |
| Parameters | Option: PROGRAM, NUMBER [,<cr>} or [,<nr1>] - 0 through 99<br>Option: MEMORY [,<cr>] – Available are: INTERNAL \| RAM \| USB<br>Parameter list define string <cr>,<cr>,….,<cr> |
| Parameter Format | <nr1> [,<cr>] |
| Example | PROG:NAME 4, USB |
| Query Format | **PROGram: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?<br>4 |

| | |
|---|---|
| Command Syntax | **PROGram[:SELected]:DEFine [<nr1>,] [<cr>,] <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.<br>**NOTE:** Only commas may separate the values, NO Carriage Returns or Line Feeds may separate the values within a single command message. |
| Parameters | Option: PROGRAM, NUMBER [,<cr>} or [,<nr1>]<br>Option: MEMORY [,<cr>] – Available are: INTERNAL \| RAM \| USB<br>Parameter list define string <cr>,<cr>,….,<cr> |
| Steady State list | FORM,<n>,<br>COUPLing,<s>,<br>XFMRRATIO,<n.nn>,<br>FREQuency,<n>,<br>VOLTage,<n>, see Convention #13.<br>VOLTage1,<n>,<br>VOLTage2,<n>,<br>VOLTage3,<n>,<br>CURRent:LIMit,<n>,<br>CURRent:PROTect:LEVel,<n><br>CURRent:PROTect:TOUT,<n><br>PHASe2,<n>,<br>PHASe3,<n>,<br>WAVEFORM,<n>, see Convention #13.<br>WAVEFORM1,<n>,<br>WAVEFORM2,<n>,<br>WAVEFORM3,<n>,<br>EVENTS,<n>,<br>AUTORMS,<n><br>NSEGS, <n> |
| Parameter Format | <cr>,<cr>,….,<cr>,<cr> |
| Example | |
| Query Format | **PROGram[:SELected]:DEFine? [<nr1>,] [<cr>,]** |
| Description | The Query format returns steady-state values of selected program and segment values of most recently selected segment or multiple segments if specified by a previous NSEGS parameter. "LAST" is returned with segment data if the segment is the last segment in the program. |
| Returned Data Format | Refer to parameter lists shown above |
| Query Example | PROG:DEF? 6<br><nr1>, <cr>,….,<cr> |

Example Program String:

```
FORM,3,COUPL,DIRECT,VOLT:MODE,0,CONFIG,1,RANG,1,FREQ,395.000,VOLT1,115.000,VOLT2,115.000,VOLT3,115.000,VOLT:ALC:STAT,1,CURR:OV,0,CURR:LIM1,41.670,CURR:LIM2,41.670,CURR:LIM3,41.670,IPROT:STAT,0,CURR:PROT:LEV,40.000,IPEAK:LIM,104.000,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:LIM1,5.000,POW:LIM2,5.000,POW:LIM3,5.000,KVA:LIM1,5.000,KVA:LIM2,5.000,KVA:LIM3,5.000,PPROT:STAT,0,POW:PROT:LEV,5.000,KVA:PROT:LEV,5.000,PROT:TDELAY,1,FREQ:SLEW,5.000,VOLT:SLEW,10.000,VOLT:DC:SLEW,10.000,UPDATEPH,0.000,RAMP,1.0000,VPEAK:MARG,100.000,EVENTS,0,AUTORMS,1,NSEGS,3,SEG,3,FSEG,395.00,VSEG1,115.00,VSEG2,115.00,VSEG3,115.00,VDCSEG1,0.00,VDCSEG2,0.00,VDCSEG3,0.00,PSEG2,120.00,PSEG3,240.00,WFSEG1,1,WFSEG2,1,WFSEG3,1,TSEG,2.0000,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<br>n = <1>Single Φ, <2>Split Φ, or <3>Three Φ |
| **COUPLing,<s>** | sets Output coupling of selected program<br>s = <DIRECT> <0> or <XFMR> <1> |
| **XFMRRATIO,<n.nn>** | sets Output XFMR ratio (n.nn:1) of selected program<br>n.nn = <0.0100> to <5.1111> |
| **FREQuency,<n>** | sets Output Frequency of selected program<br>n = <:SOUR:FREQ:LIM:MIN> to <:SOUR:FREQ:LIM:MAX> Hz |
| **VOLTage,<n>** | sets Output VOLTAGE ΦA,B,C of selected program<br>n = <0> to <300 x XFMRRATIO> Volts |
| **VOLTage1,<n>** | sets Output VOLTAGE ΦA of selected program<br>n = <0> to <300 x XFMRRATIO> Volts |
| **VOLTage2,<n>** | sets Output VOLTAGE ΦB of selected program<br>n = <0> to <300 x XFMRRATIO> Volts |
| **VOLTage3,<n>** | sets Output VOLTAGE ΦC of selected program<br>n = <0> to <300 x XFMRRATIO> Volts |
| **CURRent:LIMit,<n>** | sets Output Current Limit of selected program<br>n = <0> to <AMPS meter range> Amps |
| **CURRent:PROTect:LEVel,<n>** | sets Output Current level that triggers Current Protect mode<br>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.<br>n = <1> to <65535>, 1 = 100mSec. |
| **PHASe2,120** | sets Output Phase Angle B of selected program<br>n = 120 degrees |
| **PHASe3,240** | sets Output Phase Angle C of selected program<br>n = 240 degrees |
| **WAVEFORM,1** | sets Output Waveform ΦA, ΦB, ΦC of selected program<br>n = 1 |
| **WAVEFORM1,1** | sets Output Waveform ΦA of selected program<br>n = 1 |
| **WAVEFORM2,1** | sets Output Waveform ΦB of selected program<br>n = 1 |
| **WAVEFORM3,1** | sets Output Waveform ΦC of selected program<br>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 |

| | |
|---|---|
| Command Syntax | **PROGram: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.<br>**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 PROGram:SELected:DEFine command |
| Parameter Format | <cr>,<cr>,….,<cr>,<cr> |
| Example | |
| Query Format | **PROGram:EXECuted:DEFine?** |
| Returned Data Format | <cr>,<cr>,….,<cr>,<cr> |
| Query Example | PROG:EXEC:DEF?<br>-> parameter list |

| | |
|---|---|
| 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>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB<br>Parameter list define string <cr>,<cr>,….,<cr> |
| Query Example | PROG:DEF:ALL?<br>-> 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>]<br>Option: MEMORY [,<cr>]<br>Parameter list define string <cr>,<cr>,….,<cr> |
| Query Example | PROG:EXEC:DEF:ALL? 3<br>-> 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><br>Option: PROGRAM NUMBER [,<nr1>]<br>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<br>-> 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><br>Option: PROGRAM NUMBER [,<nr1>]<br>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<br>-> 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><br>Option: PROGRAM NUMBER [,<nr1>]<br>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?<br>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><br>Option: PROGRAM NUMBER [,<nr1>]<br>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?<br>TEST2 |

| | |
|---|---|
| Query Format | **PROGram[:SELected]:SST? [,<nr1>] [,<cr>]** |
| Description | This command returns the **S**teady **S**tate **T**able settings of the selected program only. The transient table data is not returned. |
| Parameters | Option: PROGRAM NUMBER [,<nr1>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB |
| Returned Data Format | <cr> |
| Query Example | PROG:SST? 2, USB<br>-> steady state table program data |

| | |
|---|---|
| Query Format | **PROGram:EXECuted:SST? [,<nr1>] [,<cr>]** |
| Description | This command returns the **S**teady **S**tate **T**able settings of the executing program only. The transient table data is not returned. |
| Parameters | Option: PROGRAM NUMBER [,<nr1>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB |
| Returned Data Format | <cr> |
| Query Example | PROG:EXEC:SST?<br>-> steady state table program data |

| | |
|---|---|
| Query Format | **PROGram[:SELected]:TT? [,<nr1>] [,<cr>]** |
| Description | This command returns the **T**ransient **T**able settings of the selected program only. The steady state table data is not returned. |
| Parameters | Option: STYLE [,<nr1]<br>0 = Human readable Style A (default if omitted)<br>1 = Human readable Style B<br>2 = Binary Data Format. Can be more useful to search for differences between programs.<br>See **PROGram:TT?** Command for formats<br>Option: PROGRAM NUMBER [,<nr1>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB |
| Returned Data Format | <cr> |
| Query Example | PROG:TT? 1<br>-> transient table program data |

| | |
|---|---|
| Query Format | **PROGram[:SELected]:CHECK? [,<nr1>] [,<cr>]** |
| Description | This command performs a check on the selected program steady state tables looking for the following conditions:<br>• Hardware Limit violations<br>• User Limit violations<br>• Saturation limits.<br>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 PROGRAM:CHECK? Query, the response will be “VOLT1 AC voltage set point cannot change due to user limit”. |
| Parameters | Option: PROGRAM NUMBER [,<nr1>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB |
| Returned Data Format | <cr> |
| Query Example | PROG:CHECK?<br>VOLT1 AC voltage set point cannot change due to user limit |

| | |
|---|---|
| Query Format | **PROGram: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>]<br>Option: MEMORY [,<cr>]– Available are: INTERNAL \| RAM \| USB |
| Returned Data Format | <cr> |
| Query Example | PROG:EXEC:CHECK?<br>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>]<br>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)<br>Bit 1: If set to 1, there are differences in the transient table (TT)<br>Bit 2: If set to 1, there are differences in the ALIAS of the program<br>Bit 3: If set to 1, there are differences in INFOrmation of the program |
| Query Example | PROG:CHAN?<br>16 |
| Example | If the query returns zero (0), the program executing is identical to the stored program referenced.<br>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.<br>**NOTE:** The destination Program specified cannot be currently executing. |
| Parameters | DESTINATION PROGRAM NUMBER <nr1><br>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><br>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>]<br>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?<br>23 |

### 8.6.3 Memory Management Commands

The Program memory subsystem commands allow management of Program memory contents.

| | |
|---|---|
| Command Syntax | **PROGram: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 PROGram commands where indicated in this manual. |
| Parameters | Memory types: INTERNAL \| RAM \| USB.<br>For a complete list of available memory types, use the "PROGram:MEMory:CATalog?" Command. |
| Parameter Format | <cr> |
| Example | PROG:MEM USB |
| Query Format | **PROGram:MEMory?** |
| Returned Data Format | <cr> |
| Query Example | PROG:MEM?<br>USB |

| | |
|---|---|
| Query Format | **PROGram: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)<br>RAM = Internal RAM. Content will be lost when power source is turned off.<br>USB[X][Y] = USB memory stick devices. X = port number, Y = partition number<br>SD[Y] = SC Card, Y = partition number<br>X = symbolizes different memory sticks connected to various available USB ports.<br>Y = symbolizes different logical partitions on a USB memory stick or SD card.<br>INTERNAL and RAM are always available. INTERNAL is default selection. Use the "PROGram:MEMory <cr>" command to select active memory selection. |
| Query Example | PROG:MEM:CAT?<br>INTERNAL,RAM,USBA1 |

| | |
|---|---|
| Query Format | **PROGram:EXECuted:MEMory?** |
| 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 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?<br>USB |

| | |
|---|---|
| Command Syntax | **PROGram:POWOn <nr1>** |
| Description | 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?<br>1 |

| | |
|---|---|
| Command Syntax | **PROGram:DELete:ALL <cr>** |
| Description | 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 | **PROGram:CATalog? <cr>** |
| Description | 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?<br>0,1,2,9,12<br>PROG:CAT? INTERNAL<br>0 |

| | |
|---|---|
| Query Format | **PROGram:CRC? <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:CRC? RAM<br>08ad55 |

| | |
|---|---|
| Query Format | **PROGram:BROWse?** |
| 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?<br>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 <b>** |
| Description | Selects alternative loop compensation mode for improved transient response. The effect of this command depends on the selected output mode as follows: |
| | AC Mode: Changes the AC loop compensation. |
| Parameters | < 0 \| 1 > ( 0 = Normal loop, 1 = Faster Loop ) |
| Parameter Format | <b> |
| Example | SOUR:CONFIG 1 |
| Query Format | **[SOURce:]CONFIG?** |
| Returned Data Format | <b> |
| Query Example | CONFIG? |
| | 0 |

| | |
|---|---|
| Command Syntax | **[SOURce:]CONFIG:AC <b>** |
| 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: |
| | AC Mode: Changes the AC loop compensation |
| Parameters | < 0 \| 1 > ( 0 = Normal loop, 1 = Faster Loop ) |
| Parameter Format | <b> |
| Example | SOUR:CONFIG:AC 1 |
| Query Format | **[SOURce:]CONFIG:AC?** |
| Returned Data Format | <b> |
| Query Example | CONFIG:AC? |
| | 0 |

| | |
|---|---|
| Command Syntax | **[SOURce:]CONFIG:HFreq <b>** |
| 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.<br>**Note:** Available in units with Firmware revision 1.6.6 or higher. |
| Parameters | < 0 \| OFF \| 1 \| ON > ( 0 = Off, 1 = On) |
| Parameter Format | <b> |
| Example | SOUR:CONFIG:HF 1 |
| Query Format | **[SOURce:]CONFIG:HFreq?** |
| Returned Data Format | <b> |
| Query Example | CONFIG:HF?<br>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.<br>**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.<br>The set points affected by this command are:<br>- Frequency<br>- Voltage AC1<br>- Voltage AC2<br>- Voltage AC3<br>- 0<br>- 0<br>- 0<br>- Form (THREE , SPLIT or SINGLE)<br>- Range (High or Low)<br>- Compatibility Mode (UPC or NORMAL) |
| [SOURce:]INITial? = OFF | Set points of the unit at power on will have a default value of:<br>- Frequency = 60Hz<br>- Voltage AC1 = 0V<br>- Voltage AC2 = 0V<br>- Voltage AC3 = 0V<br>- 0<br>- 0<br>- 0<br>- Form = THREE<br>- Range = HIGH<br>- Compatibility = NORMAL |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | :INIT ON |
| Query Format | **[SOURce:]INITial?** |
| Returned Data Format | <b> |
| Query Example | INIT?<br>0 |

Command Syntax **[SOURce:]RANGe**
Description 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 virual 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 <b>
Example RANG HIGH
Query Format **[SOURce:]RANGe?**
Returned Data Format <b>
Query Example RANG?
1

Command Syntax **[SOURce:]RAMP#**
Description 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 **[SOURce:]UPDATEPHase**
Description 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#]**<br>**[SOURce:]CSC:STATe#** |
| Description | Turns the Continuous Source Calibration (CSC) mode on or off. |
| Parameters | <0 \| OFF \| 1 \| ON> |
| Parameter Format | <b> |
| Example | VOLT:CSC ON |
| Query Format | **[SOURce:]VOLTage:CSC[:STATE]?** |
| Returned Data Format | <nr1> |
| Query Example | VOLT:CSC?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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.<br>Maximum allowable values are:<br>Maximum positive peak voltage:<br>V_peak_max = V_AC_peak_max<br>Minimum negative peak voltage:<br>V_peak_min = V_AC_peak_min<br>For a sinusoidal AC waveform, these limits are:<br>Vrms_sat = (**425** – Vdc) / 1.4142<br>Vrms_sat = (**-425** + Vdc) / 1.4142 |
| Examples | 425 = 1.41 * **300** (**V_AC_rms_sat = 300**) |
| Returned Data Format | <nr2> |
| Query Example | VOLT:AC3:LIM:SAT:RANG?<br>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.<br>See [SOURce:]VOLTage[:AC]#:LIMIT:SATuration:RANGe? for details. |
| Returned Data Format | <nr2> |
| Query Example | VOLT:AC3:LIM:SAT:MAX?<br>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.<br>See [SOURce:]VOLTage[:AC]#:LIMIT:SATuration:RANGe? for details. |
| Returned Data Format | <nr2> |
| Query Example | VOLT:AC3:LIM:SAT:MIN?<br>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 <b>
Example VOLT:AC:INIT OFF
Query Format **[SOURce:]VOLTage[:AC]:INITial?**
Returned Data Format <b>
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.<br>**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?<br>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?<br>-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?<br>-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?<br>-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.<br>Maximum allowable values are:<br>Maximum positive peak voltage:<br>V_DC = V_peak_max - V_AC_peak_max<br>Minimum negative peak voltage:<br>V_DC = V_peak_min + V_AC_peak_min |
| Examples | V_AC = 300Vrms sine wave<br>V_DC = 425 - 1.41 * **300** (**V_DC_sat = 0**)<br>V_AC = 120Vrms sine wave<br>V_DC = 425 - 1.41 * **120** (**V_DC_sat = 255**)<br>V_AC = 0Vrms<br>V_DC = 425 – **0** (**V_DC_sat = 425**) |
| Returned Data Format | <nr2> |
| Query Example | VOLT:DC1:LIM:SAT:RANG?<br>-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.<br>See [SOURce:]VOLTage:DC#:LIMIT:SATuration:RANGe? for details. |
| Returned Data Format | <nr2> |
| Query Example | VOLT:DC3:LIM:SAT:MAX?<br>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.<br>See [SOURce:]VOLTage:DC#:LIMIT:SATuration:RANGe? for details. |
| Returned Data Format | <nr2> |
| Query Example | VOLT:DC3:LIM:SAT:MIN?<br>-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 ]<br>0 = Off, 312Vac max.<br>1 = 320Vac max<br>2 = 333Vac max |
| Parameter Format | <bool> |
| Example | VOLT:EXT 1 |
| Query Format | **[SOURce:]VOLTage:EXTend?** |
| Returned Data Format | <nr1> |
| Query Example | VOLT:EXT?<br>1 |

### 8.7.3 Frequency Programming Commands

| | |
|---|---|
| Command Syntax | **[SOURce:]FREQuency** |
| Description | Sets output frequency for all phases. |
| Parameters | 45.00 – 500.0<br>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?<br>400.0000 |

| | |
|---|---|
| Command Syntax | **[SOURce:]FREQuency:LIMit:MINimum** |
| Description | Sets the lower user limit for frequency programming. Not 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<br>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?<br>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<br>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?<br>63.0000 |

| | |
|---|---|
| Query Format | **[SOURce:]FREQuency:LIMit:RANGe?** |
| Description | This command returns the lower and upper frequency user limit set value.s |
| Returned Data Format | <nr2>, <nr2> |
| Query Example | FREQ:LIM:RANG?<br>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?<br>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?<br>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.<br>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?<br>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?<br>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?<br>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?<br>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?<br>0.000 |

| | |
|---|---|
| Command Syntax | **[SOURce:]CURRent:LIMit:AUTO** |
| Description | 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.<br>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.<br>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 | <b> |
| Example | CURR:LIM:AUTO ON |
| Query Format | **[SOURce:]CURRent:LIMit:AUTO?** |
| Returned Data Format | <b> |
| Query Example | CURR:LIM:AUTO?<br>1 |

| | |
|---|---|
| Command Syntax | **[SOURce:]CURRent:OVerload** |
| Description | This command turns the overload current mode on or off |
| Parameters | [ 0 \| OFF \| 1 \| ON ] |
| Parameter Format | <b> |
| Example | SOUR:CURR:OV ON |
| Query Format | **[SOURce:]CURRent:OVerload?** |
| Returned Data Format | <b> |
| Query Example | CURR:OV?<br>1 |

### 8.7.5 Phase Programming Commands

| | |
|---|---|
| Command Syntax | **[SOURce:]PHASe:ROTation <b>** |
| 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]<br>0 = NEGATIVE<br>1 = POSITIVE |
| Parameter Format | <b> |
| Example | PHAS:ROT POS |
| Query Format | **[SOURce:]PHASe:ROTation?** |
| Returned Data Format | <b> |
| Query Example | PHAS:ROT?<br>1 |

| | |
|---|---|
| Command Syntax | **[SOURce:]PHASe:SPLIT <b>** |
| 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]<br>0 = OFF<br>1 = ON |
| Parameter Format | <b> |
| Example | PHAS:SPLIT ON |
| Query Format | **[SOURce:]PHASe:SPLIT?** |
| Returned Data Format | <b> |
| Query Example | PHAS:SPLIT?<br>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 | <b> |
| Example | PROT:PEAK:VOLT1:STAT 1 |
| Query Format | **[SOURce:]PROTect:PEAK:VOLTage#:STATe?** |
| Returned Data Format | <nr1> |
| Query Example | PROT:PEAK:VOLT1:STAT?<br>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 ><br>Encoding:<br>MARGin 0 Relative level<br>LEVel 1 Absolute level<br>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?<br>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?<br>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?<br>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?<br>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 | <b> |
| 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?<br>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?<br>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 | <b> |
| 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?<br>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:<br>*ABS(VOLTAGE_SETPOINT_RMS – VOLTAGE_MEASUREMENT_RMS) > MAX(SENSe:FAULT:LEVel:PERCentage * VOLTAGE_SETPOINT_RMS, SENSe:FAULT:LEVel:MIN)*<br>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?<br>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:<br>*ABS(VOLTAGE_SETPOINT_RMS – VOLTAGE_MEASUREMENT_RMS) > MAX(SENSe:FAULT:LEVel:PERCentage * VOLTAGE_SETPOINT_RMS, SENSe:FAULT:LEVel:MIN)*<br>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?<br>10.000 |

| | |
|---|---|
| Command Syntax | **SENSe:FAULT:STATe <b>** |
| 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 | <b> |
| Example | SENS:FAULT:STAT 1 |
| Query Format | **SENSe:FAULT:STATe?** |
| Returned Data Format | <b> |
| Query Example | SENS:FAULT:STAT?<br>1 |

| | |
|---|---|
| Command Syntax | **SENSe:PATH <b>** |
| Description | This command selects the source for metering and CSC mode as either internal (0) or external (1). |
| Parameters | < 0 \| 1 > |
| Parameter Format | <b> |
| Example | SENS:PATH 1 |
| Query Format | **SENSe:PATH?** |
| Returned Data Format | <b> |
| Query Example | SENS:PATH?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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.<br>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.<br>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:<br>SOUR:MODE1? = VOLTAGE and SOUR:MODE2? = CURRENT -><br>SOUR:MODE? = MIXED<br>If both or  phases are set to the same mode, the actual mode will be returned:<br>SOUR:MODE1? = VOLTAGE and SOUR:MODE2? = VOLTAGE -><br>SOUR:MODE? = VOLTAGE |
| Returned Data Format | <cr><br>Available protection modes:<br>0 = NONE<br>1 = VOLTAGE<br>2 = CURRENT<br>3 = POWER<br>4 = KVA<br>5 = MIXED |
| Query Example | SOUR:MODE?<br>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 | <b> \| <cr> |
| Example | PROT:POW ON |
| Query Format | **[SOURce:]PROTect[:RMS]:POWer#[:STATe]?** |
| Returned Data Format | <b> |
| Query Example | PROT:POW?<br>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 | <b> |
| Query Example | PROT:POW:LEV?<br>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?<br>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?<br>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?<br>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 | <b> |
| Query Example | PROT:POW:TDELAY?<br>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?<br>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?<br>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?<br>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?<br>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 | <b> \| <cr> |
| Example | PROT:POW ON |
| Query Format | **[SOURce:]PROTect[:RMS]:KVA#[:STATe]?** |
| Returned Data Format | <b> |
| Query Example | PROT:KVA?<br>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 | <b> |
| Query Example | PROT:KVA:LEV?<br>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?<br>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?<br>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?<br>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 | <b> |
| Query Example | PROT:KVA:TDELAY?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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 | <b> |
| Example | PROT:RMS:UV1:STAT 1 |
| Query Format | **[SOURce:]PROTect:RMS:UF#:STATe?** |
| Returned Data Format | <nr1> |
| Query Example | PROT:RMS:UV1:STAT?<br>1 |

## 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 8.12, "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?<br>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.<br>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><br>Format of response:<br>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),...<br><br>Response Legend:<br>**YYYY/MM/DD,HH:MM::SS,S.NS** is the timestamp of the latest error pushed to the queue.<br>**S** is absolute seconds and **NS** absolute nanoseconds.<br>**TOTAL_ERRORS** are the total errors in the queue.<br>**INDEX** is 1 by default if not passed as optional argument.<br>**ERRORS** is the total errors returned in the response.<br>As there may be too many errors the response may return a few of them starting from the **INDEX**.<br>The **INDEX** is useful to navigate the queue.<br>**CODE** is the error code and **DESCRIPTION** the description. |
| Query Example | SYST:ERR:ALL:NOCLEAR?<br>2018/05/29,14:29:53,1207438.903668873,0,1,0<br>For no errors:<br>*>SYSTem:ERRor:ALL:NOCLEAR?*<br>*2022/10/12,18:17:01,122450.794695832,0,1,0*<br>Two errors in the queue:<br>*>SYSTem:ERRor:ALL:NOCLEAR?*<br>*2022/10/12,18:17:19,122467.903705666,2,1,2,-102,"Command error: Syntax error. Webpage interface.;2022/10/12 18:17:18",-102,"Command error: Syntax error. Webpage interface.;2022/10/12 18:17:19"*<br>*>SYSTem:ERRor:ALL:NOCLEAR? 2*<br>*2022/10/12,18:17:19,122467.903705666,2,2,1,-102,"Command error: Syntax error. Webpage interface.;2022/10/12 18:17:19"* |

| | |
|---|---|
| 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 | <b> |
| Example | SYST:ERR:POE ON |
| Query Format | **SYSTem:ERRor:POE?** |
| Returned Data Format | <b> |
| Query Example | SYST:ERR:POE?<br>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?<br>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?<br>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?<br>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?<br>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?<br>english, chinese |

| | |
|---|---|
| Query Format | **SYSTem:LXI:FEATures?** |
| Description | R eturns 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 | <b> |
| 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.<br>**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?<br>NTP<br>**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?<br>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?<br>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 | **SYSTem:TIME:SOURce** < RTC \| NTP > |
| Description | 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 | < RTC \| NTP > |
| Example | SYST:TIME:SOUR NTP |

| | |
|---|---|
| Query Format | **SYSTem:TIME:SOURce:CATalog?** |
| Description | Returns the available time source options, NTP or RTC. |
| Returned Data | NTP, RTC |

| | |
|---|---|
| Query Format | **SYSTem:TIME:SOURce:NTP:SERVer?** |
| Description | Returns “pool.ntp.org” This is the server that uses the unit NTP service. |
| Returned Data | pool.ntp.org |

| | |
|---|---|
| Command Syntax | **SYSTem:TIME:SOURce:NTP:SYNC** <OPTIONAL: SERVER> |
| Description | 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”. |
| Parameters | < time server domain > |
| Example | SYST:TIME:SOUR:NTP:SYNC |

| | |
|---|---|
| Command Syntax | **SYSTem:TIME:SOURce:NTP:RESTart** |
| Description | Restarts the NTP service |
| Parameters | none |
| Example | SYST:TIME:SOUR:NTP:REST |

| | |
|---|---|
| Query Format | **SYSTem:VERSion?** |
| Description | Returns SCPI standard revision version. |
| Returned Data Format | <nr2> |
| Query Example | SYST:VERS?<br>1992.0 |

| | |
|---|---|
| Query Format | **SYSTem:XFMRRATIO?** |
| Description | Returns the transformer option (T Option) voltage ratio.<br>If no transformer option is installed and configured, this query will return a value of 0.000. See also the [SOURce:]COUPLing command. |
| Returned Data Format | <nr2> |
| Query Example | SYSTem:XFMRRATIO?<br>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, 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, 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, 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, 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:

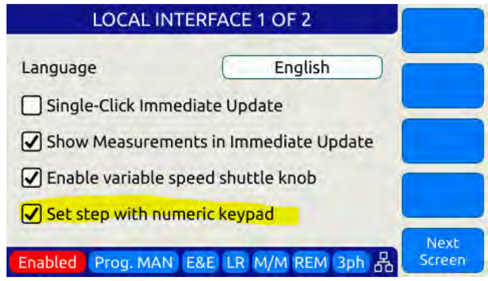
| | |
|---|---|
| SYSTem:INTERF:PRESET:VOLT:AC? | -> 115.000,230.000,300.000,MAX |
| SYSTem:INTERF:PRESET:FREQ? | -> 50.000,60.000,400.000,800.000,1200.000 |
| SYSTem:INTERF:PRESET:CURR:LIM? | -> MAX,15.000,5.000 |
| SYSTem:INTERF:PRESET:POW:LIM? | -> MAX,4.000,2.000,1.000 |
| SYSTem:INTERF:PRESET:KVA:LIM? | -> 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 Oher 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>

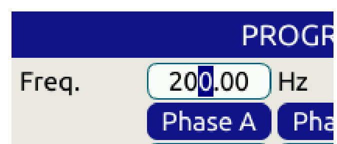
SYSTem:INTERFace:KEYS:BRIGHTness?

**Key Press Sounds:**

SYSTem:INTERFace:KEYS:SOUNDS <ON|OFF>

SYSTem:INTERFace:KEYS:SOUNDS?

**Set Resolution Step Size wih 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?<br>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?<br>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?<br>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 | <b> |
| Query Example | SYST:COMP?<br>1 |

| | |
|---|---|
| Query Format | **SYSTem:HWREVision?** |
| Description | Returns the hardware revision letter of the power source |
| Returned Data Format | <cr> |
| Query Example | SYST:HWREV?<br>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 ><br>**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 | <b> |
| Query Example | SYST:LANG?<br>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?<br>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?<br>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?<br>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 | <b> |
| Example | SYST:COMM:LAN ON |
| Query Format | **SYSTem:COMMunicate:LAN[:ENABle]?** |
| Returned Data Format | |
| Query Example | SYST:COMM:LAN?<br>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?<br>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 | **SYSTem:COMMunicate:LAN:DHCP[:ENABle]** |
| Description | 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.<br>When turned off, a static IP address must be assigned by the user instead. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:COMM:LAN:DHCP ON |
| Query Format | **SYSTem:COMMunicate:LAN:DHCP[:ENABle]?** |
| Returned Data Format | <b> |
| Query Example | SYST:COMM:LAN:DHCP?<br>1 |

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:LAN:DHCP:RENEW** |
| Description | This command renews the lease of an IP address assigned through the DCHP 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 | **SYSTem:COMMunicate:LAN:ADDress** |
| Description | 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?<br>132.18.21.105 |

| | |
|---|---|
| Query Format | **SYSTem:COMMunicate:LAN:MACaddress?** |
| Description | 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.<br>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?<br>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 DCHP. 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?<br>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?<br>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?<br>132.18.21.254 |

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:LAN:HOST:CONFigured** |
| Description | 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?<br>132.18.21.0 |

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:LAN:PASSword** |
| Description | 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.<br>**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 | **SYSTem:COMMunicate:LAN:PORT** |
| Description | 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?<br>5025 |

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:LAN:PORT:TELNET** |
| Description | 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?<br>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 | <b> |
| Example | SYST:COMM:SER ON |
| Query Format | **SYSTem:COMMunicate:SERial[:ENABle]?** |
| Returned Data Format | <b> |
| Query Example | SYST:COMM:SER?<br>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?<br>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?<br>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?<br>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 <b>
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 <b>
Example SYST:COMM:USB:VIRT ON
Query Format **SYSTem:COMMunicate:USB:VIRTualport[:ENABle]?**
Returned Data Format <b>
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 | <b> |
| Example | SYST:COMM:USB:ETH ON |
| Query Format | **SYSTem:COMMunicate:USB:LAN[:ENABle]?** |
| Returned Data Format | <b> |
| Query Example | SYST:COMM:USB:LAN?<br>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 | <b> |
| Example | SYST:COMM:USB:LAN ON |
| Query Format | **SYSTem:COMMunicate:USB:LAN:ADD?** |
| Returned Data Format | <b> |
| Query Example | SYST:COMM:USB:LAN:ADD?<br>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?<br>255.255.255.0 |

### 8.9.10 Communication GPIB Commands

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:GPIB:ADDress <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:ADDress?** |
| Returned Data Format | <nr1> |
| Query Example | SYST:COMM:GPIB:ADD?<br>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 | <b> |
| Example | SYST:COMM:GPIB:EANB 1 |
| Query Format | **SYSTem:COMMunicate:GPIB:ENABle?** |
| Returned Data Format | <b> |
| Query Example | SYST:COMM:GPIB:ENAB?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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 | <b> |
| Example | SYST:REM:ACCESS 1 |
| Query Format | **SYSTem:REMote:ACCESS?** |
| Returned Data Format | <cr> |
| Query Example | SYST:REM:ACCESS?<br>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 Acccess 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?<br>"Unit is used by John. Please contact 123456789." |

| | |
|---|---|
| Command Syntax | **SYSTem:REMote:ACCESS:MONItor <b>** |
| Description | Enables or disables remote access monitor mode only. ON by default for backward compatibility. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> or <cr> |
| Example | SYSTem:REMote:ACCESS:MONI ON |
| Query Format | **SYSTem:REMote:ACCESS:MONItor?** |
| Returned Data Format | <b> |
| Query Example | SYST:REM:ACCESS:MONI?<br>1 |

| | |
|---|---|
| Command Syntax | **SYSTem:REMote:FTP:ENAble** |
| Description | Enable/disable the FTP service. |
| Parameters | <0 \| OFF \| 1 \| ON> |
| Parameter Format | <b> |
| Example | SYST:REM:FTP:ENA 1 |
| Query Format | **SYSTem:REMote:FTP:ENAble?** |
| Returned Data Format | <b> |
| Query Example | SYST:REM:FTP:ENA?<br>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?<br>temporal |

| | |
|---|---|
| Command Syntax | **SYSTem:REMote:SMB:ENAble** |
| Description | Enable/disable the samba service. |
| Parameters | <0 \| OFF \| 1 \| ON> |
| Parameter Format | <b> |
| Example | SYST:REM:FTP:ENA 1 |
| Query Format | **SYSTem:REMote:SMB:ENAble?** |
| Returned Data Format | <b> |
| Query Example | SYST:REM:SMB:ENA?<br>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?<br>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?<br>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<br>SYST:DEL "internal/program/program_1.xml"<br>SYST:DEL temporal/program/program_1.xml<br>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<br>0<br>SYST:FILE:TYPE? INTERNAL<br>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<br>SYST:EXPORT NAME,TEST<br>SYST:EXPORT SETPOINTS,NAME,TEST2<br>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 Miscellanous Remote Restart Commands

| | |
|---|---|
| Command Syntax | **SYSTem:COMMunicate:LXI:RESTart** |
| 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 ]<br>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]?** |
| Returned Data Format | <cr> |
| Query Example | SYST:AIO:IN1?<br>VOLTAGE |

| | |
|---|---|
| Query Format | **SYSTem:AIO:INput:CATalog?** |
| Description | Returns list of available analog inputs |
| Returned Data Format | <cr> |
| Query Example | SYST:AIO:IN:CAT?<br>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?<br>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?<br>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?<br>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?<br>-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?<br>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?<br>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?<br>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?<br>-100000.000000 |

| | |
|---|---|
| Command Syntax | **SYSTem:AIO:INput[n]:RANGe <nr2>** |
| Description | Sets the range of the specified analog input.<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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:CURR1? \| MEAS:CURR2? \| MEAS:CURR3? \| MEAS:CURR:CREST1? \| MEAS:CURR:CREST2? \| MEAS:CURR:CREST3? \| MEAS:CURR:CREST? \| MEAS:CURR:DC1? \| MEAS:CURR:DC2? \| MEAS:CURR:DC3? \| MEAS:CURR:DC? \| MEAS:CURR:PEAK1? \| MEAS:CURR:PEAK2? \| MEAS:CURR:PEAK3? \| MEAS:CURR:PEAK? \| MEAS:CURR? \| 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?<br>See the “SYSTem:AIO:OUTput:CATalog?” command for a list of available paremeters. |
| Parameter Format | <cr> |
| Example | SYST:AIO:OUT1 VRMS |
| Query Format | **SYSTem:AIO:OUTput[n]?** |
| Returned Data Format | <cr> |
| Query Example | SYST:AIO:OUTP?<br>VRMS |

| | |
|---|---|
| Query Format | **SYSTem:AIO:OUTput:CATalog?** |
| Description | Returns list of available analog outputs |
| Returned Data Format | <cr> |
| Query Example | SYST:AIO:OUT:CAT?<br>MEAS:CURR1?,MEAS:CURR2?,MEAS:CURR3?,MEAS:CURR:CREST1?,MEAS:CURR:CREST2?,MEAS:CURR:CREST3?,MEAS:CURR:CREST?,MEAS:CURR:DC1?,MEAS:CURR:DC2?,MEAS:CURR:DC3?,MEAS:CURR:DC?,MEAS:CURR:PEAK1?,MEAS:CURR:PEAK2?,MEAS:CURR:PEAK3?,MEAS:CURR:PEAK?,MEAS:CURR?,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?<br>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?<br>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?<br>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?<br>-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?<br>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?<br>-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?<br>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?<br>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?<br>0 |

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:INput[n]:FALLing <cr>**<br>**SYSTem:DIO:INput[n]:RISing <cr>** |
| Description | 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”<br>SYST:DIO:IN1:RIS “OUTP 1”<br>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?**<br>**SYSTem:DIO:Input[n]:RISing?** |
| Returned Data Format | <cr> |
| Query Example | SYST:DIO:IN1:RIS?<br>OUTP 1<br>SYST:DIO:IN1:FALL?<br>- |

| | |
|---|---|
| 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.<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>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?<br>1 |

| | |
|---|---|
| Query Format | **SYSTem:DIO:OUTput[n]:STATe?** |
| Description | Returns logic level of selected output pin. |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:OUT1:STAT?<br>1 |

#### 8.10.1.5 SYSTem:DIO:REMote

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:REMote:ENAble <b>** |
| Description | Turns the remote enable state on or off |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:DIO:REMote:ENAble 1 |
| Query Format | **SYSTem:DIO:REMote:ENAble?** |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:REM:ENA?<br>1 |

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:REMote:ENAble:AUTO <b>** |
| Description | Enables or Disables the Remote Input function at power on. By default, on a regular AFX/ADF it is 1 for backward compatibility.<br>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.<br>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.<br>Both settings can be changed by the user. Sending a sanitize command returns this setting back to 1 and 0 respectively.<br>***Note:*** *This command requires firmware rev 2.2.28 or higher.* |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:DIO:REMote:ENAble:AUTO 1 |
| Query Format | **SYSTem:DIO:REMote:ENAble:AUTO?** |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:REM:ENA:AUTO?<br>1 |

Command Syntax **SYSTem:DIO:REMote:INHibit <b>**
Description Turns the remote inhibit state on or off
Parameters < 0 | OFF | 1 | ON >
Parameter Format <b>
Example SYST:DIO:REMote:INHibit 1
Query Format **SYSTem:DIO:REMote:INHibit?**
Returned Data Format <b>
Query Example SYST:DIO:REM:INH?
1

#### 8.10.1.6 SYSTem:DIO:STROBE

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:STROBE:OUTPustate <b>** |
| Description | Sets the function strobe mode active when the output relay changes state |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:DIO:STROBE:OUTP 1 |
| Query Format | **SYSTem:DIO:STROBE:OUTPustate?** |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:STROBE:OUTP?<br>1 |

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:STROBE:SOURce <b>** |
| Description | Sets the function strobe mode to program changes. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:DIO:STROBE:SOUR 1 |
| Query Format | **SYSTem:DIO:STROBE:SOURce?** |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:STROBE:SOUR?<br>1 |

| | |
|---|---|
| Command Syntax | **SYSTem:DIO:STROBE:TRANsient<b>** |
| Description | Sets the function strobe mode to generate an output at the start of a transient execution. |
| Parameters | < 0 \| OFF \| 1 \| ON > |
| Parameter Format | <b> |
| Example | SYST:DIO:STROBE:TRAN 1 |
| Query Format | **SYSTem:DIO:STROBE:TRANsient?** |
| Returned Data Format | <b> |
| Query Example | SYST:DIO:STROBE:TRAN?<br>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 | <b> |
| Example | SOUR:SYNC 1 |
| Query Format | **SOURce:SYNChronize[:INput]?** |
| Returned Data Format | <b> |
| Query Example | SOUR:SYNC?<br>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?<br>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?<br>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?<br>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?<br>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 | <b> |
| Returned Data | 0 = PLL is not locked<br>1 = PLL is locked |
| Query Example | SOUR:SYNC:STAT?<br>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 | <b> |
| Returned Data | 0 = SYNC output off<br>1 = SYNC output on |
| Query Example | SOUR:SYNC:OUT?<br>1 |

| | |
|---|---|
| Command Syntax | **SOURce:SYNChronize:OUTput:PULSE:MODE <b>** |
| Description | This sets the sync duty cycle. Supports MOD M24014. This MOD requires firmware rev. 4.9.27 or higher.<br>0 = < 1%<br>1 = 50%. |
| Query Format | **SOURce:SYNChronize:OUTput:PULSE:MODE?** |
| Returned Data Format | <b> |
| Returned Data | 0 = SYNC duty cycle < 1%<br>1 = SYNC duty cycle = 50% |
| Query Example | SOUR:SYNC:OUT:PULSE?<br>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 | <b> |
| Example | PROG:TRAN:TRIG:IN 1 |
| Query Format | **PROGram:TRANsient:TRIGger:INput?** |
| Returned Data Format | <b> |
| Query Example | PROG:TRAN:TRIG:IN?<br>1 |

| | |
|---|---|
| Command Syntax | **PROGram:TRANsient:TRIGger:INput:IMMediate <b>** |
| 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 | <b> |
| Example | PROG:TRAN:TRIG:IN:IMM 1 |
| Query Format | **PROGram:TRANsient:TRIGger:INput:IMMediate?** |
| Returned Data Format | <b> |
| Query Example | PROG:TRAN:TRIG:IN:IMM?<br>1 |

| | |
|---|---|
| Command Syntax | **PROGram:TRANsient:TRIGger:INput:AUTOrun <b>** |
| Description | 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.<br>**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 | <b> |
| Example | PROG:TRAN:TRIG:IN:AUTO 1 |
| Query Format | **PROGram:TRANsient:TRIGger:INput:AUTOrun?** |
| Returned Data Format | <b> |
| Query Example | PROG:TRAN:TRIG:IN:AUTO?<br>1 |

| | |
|---|---|
| Command Syntax | **PROGram:TRANsient:TRIGger:OUTput** |
| Description | 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 | <b> |
| Example | PROG:TRAN:TRIG:OUT 1 |
| Query Format | **PROGram:TRANsient:TRIGger:OUTput?** |
| Returned Data Format | <b> |
| Query Example | PROG:TRAN:TRIG:OUT?<br>1 |

### 8.10.4 AUX I/O Calibration Commands

```
SYSTem:AIO
    :INPut#
            :CALibration
                  :GAIN{?}
                        :DEFault[?]
                        :MAXimum
                        :MINinimum
                  :OFFset{?}
                        :DEFault[?]
                        :MAXimum
                        :MINinimum
    :OUTput#
            :CALibration
                  :GAIN{?}
                        :DEFault[?]
                        :MAXimum
                        :MINinimum
                  :OFFset{?}
                        :DEFault[?]
                        :MAXimum
                        :MINinimum
```

#### 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 | **SYSTem:AIO:INput[n]:CALibration:OFFset <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: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?**<br>Returns lower limit of calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:IN1:CAL:OFF:MIN?<br>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?**<br>Returns calibration coefficient |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:GAIN?<br>1.000 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:GAIN:DEFault?**<br>Returns default calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:GAIN:DEF?<br>1.000 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:GAIN:MAXimum?**<br>Returns upper limit of calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:GAIN:MAX?<br>1.000 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:GAIN:MINimum?**<br>Returns lower limit of calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:GAIN:MIN?<br>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?**<br>Returns calibration coefficient |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:OFF?<br>0.010 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:OFFset:DEFault?**<br>Returns default calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:OFF:DEF?<br>1.000 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:OFFset:MAXimum?**<br>Returns upper limit of calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:OFF:MAX?<br>1.000 |

| | |
|---|---|
| Query Command | **SYSTem:AIO:OUTput[n]:CALibration:OFFset:MINimum?**<br>Returns lower limit of calibration coefficient value |
| Returned Data Format | <nr2> |
| Query Example | SYST:AIO:OUT1:CAL:OFF:MIN?<br>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 | ***CLS** |
| Description | 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 | ***DCL** |
| Description | Device Clear. Resets the instrument to a default state. |
| Parameters | None |
| Parameter Format | 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.<br>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 8.12 for register bit values. |
| Parameters | Range 0-255 |
| Parameter Format | <nr1> |
| Example | *ESE 128 |
| Query Format | ***ESE?** |
| Returned Data Format | <nr1> |
| Query Example | *ESE?<br>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 8.12 for register bit values. |
| Returned Data Format | <nr1> |
| Query Example | *ESR?<br>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.<br>*Query response*: Manufacturer, model, serial number, firmware revision. |
| Returned Data Format | <cr>,<cr>,<nr1>,<nr2> |
| Query Example | *IDN?<br>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.<br>The argument is optional, if it is not sent:<br>• In UPC compatible mode default argument will be NONBLOCK or 1.<br>• In normal mode default argument will be BLOCK or 0.<br>***OPC? BLOCK \| 0**<br>Returns 1 when all pending overlapped operations have been completed. It can be used to cause the controller to wait for commands to complete.<br>***OPC? NOBLOCK \| 1**<br>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 | <b> |
| Query Example | *OPC?<br>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)<br>***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.* |
| 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 8.12 for register bit values. |
| Returned Data Format | <nr1> |
| Query Example | *SRE?<br>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 8.12 for register bit values. |
| Returned Data Format | <nr1> |
| Query Example | *STB?<br>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<br>summarizes all STATUS BYTE bits (except bit 6) for *STB?, or,<br>- REQUEST SERVICE<br>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 unmasks 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.

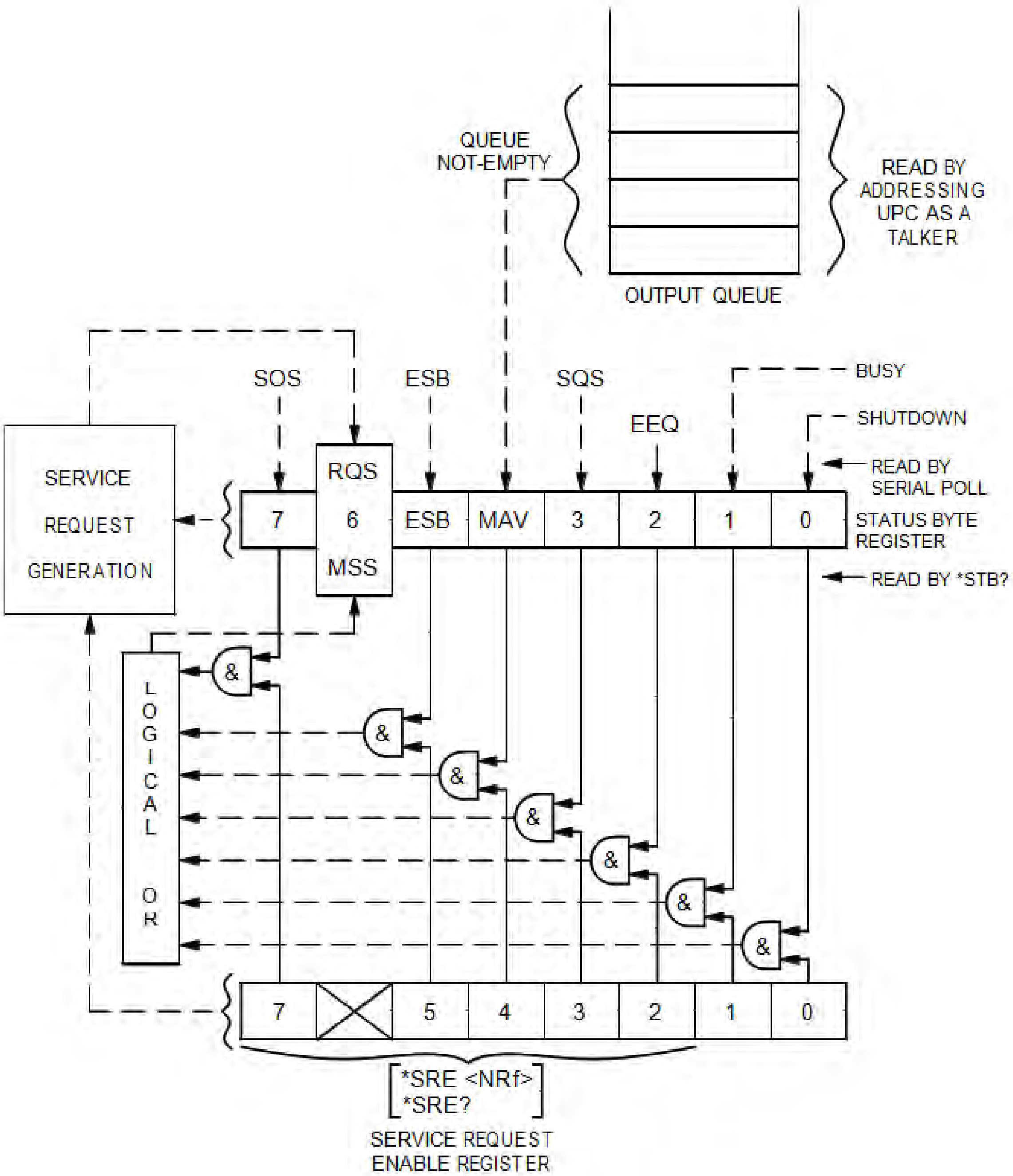



*Figure 8-3: Status Byte Logical Model*

### 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 unmasks the EVENT bit in the ESR. Also see :SYSTem:ERRor? query for relevant information.

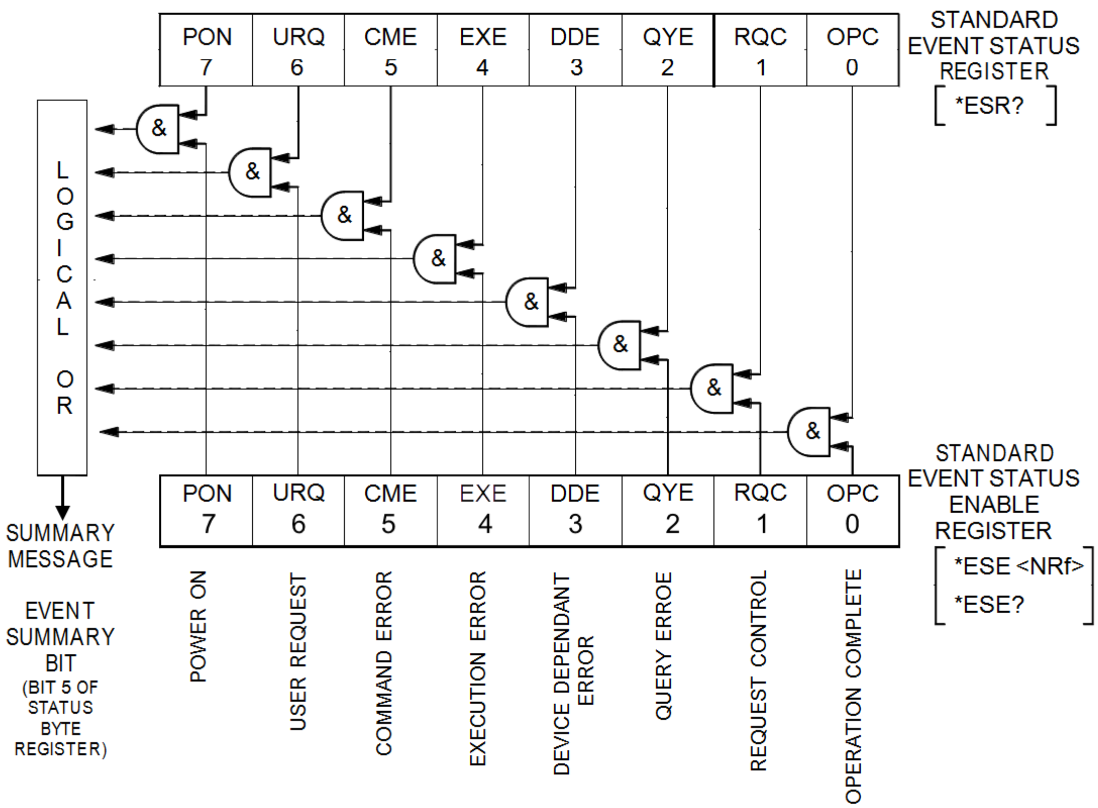



*Figure 8-4: Standard Event Register (ESR) Model*

### 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, unmasks 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.

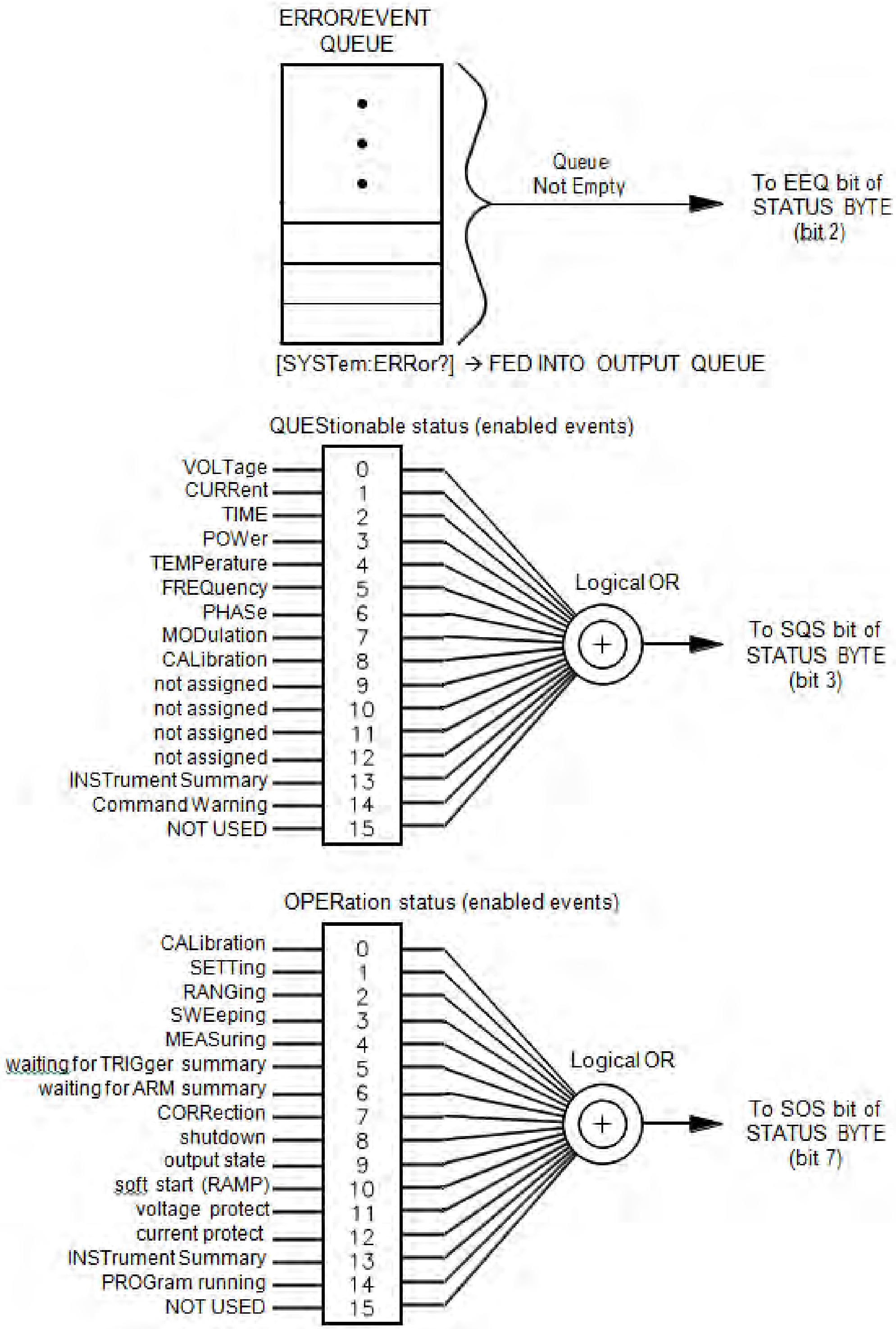



*Figure 8-5: SCPI Status Registers Model*

# 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:

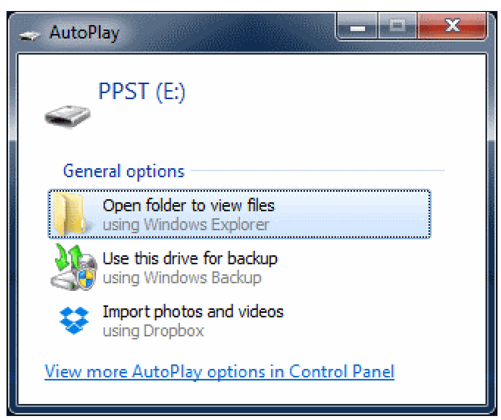
**Virtual COM driver** This allows communication with the power sources using a virtual serial port (COMx).

**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.

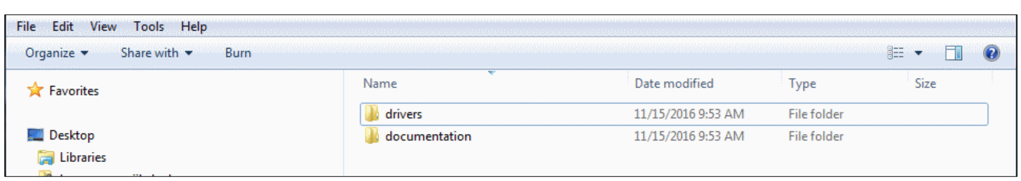
## 9.2 Installation

USB drivers are stored in the ADF controller and installed when the unit is first connected to a Windows PC. Proceed as follows:

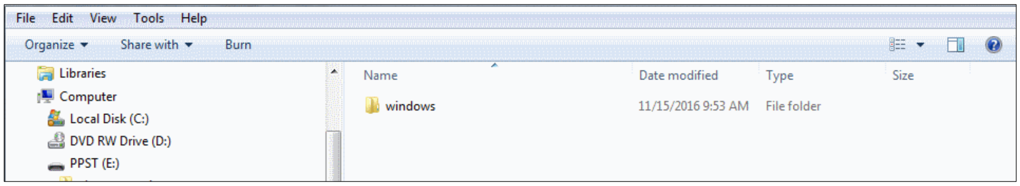
1. With the ADF unit powered up, connect a USB cable between the ADF USB Device port on the rear panel and an available USB port on a Windows PC.
2. Once plugged it, the PC should detect the present of the ADF. If this is the first time you connect to this PC, the drivers must be installed. This process 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.



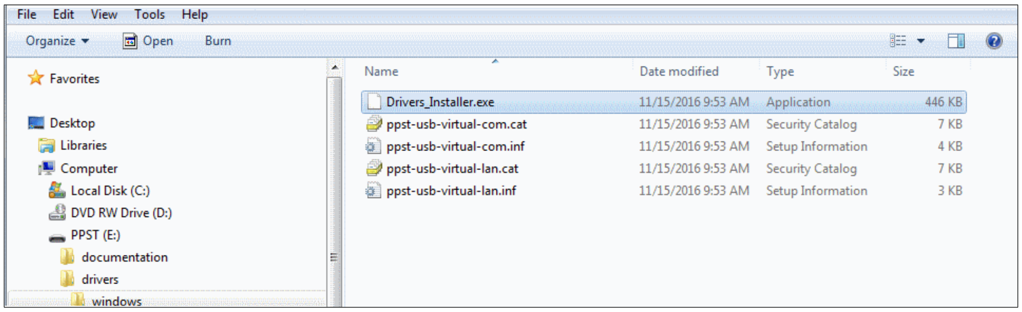

4. The directories shown below will be visible. Select the “drivers” directory



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.

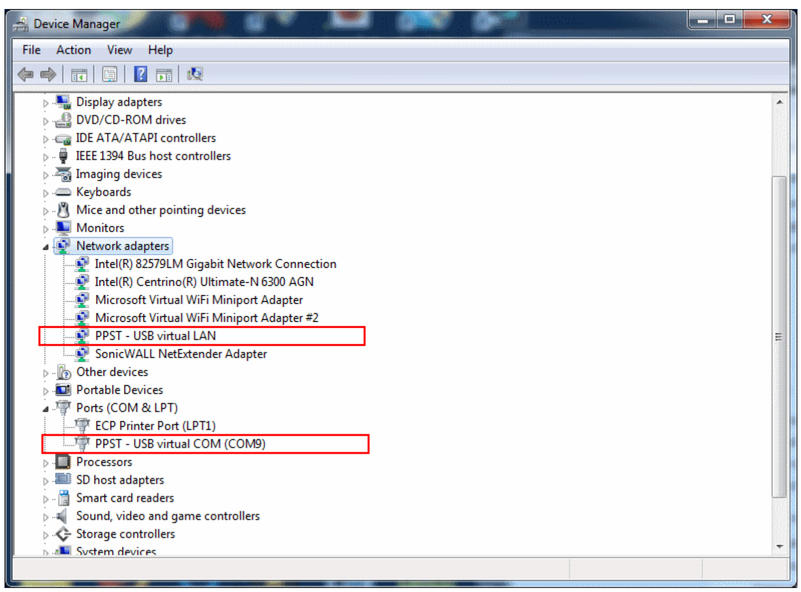



*Figure 9-1: PPST USB Drivers visible in Windows Device Manager*

# 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 DCHP 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.

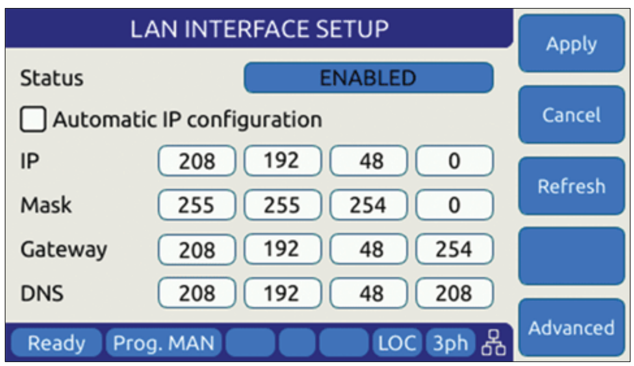
## 10.2 Web Browser Interface

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.

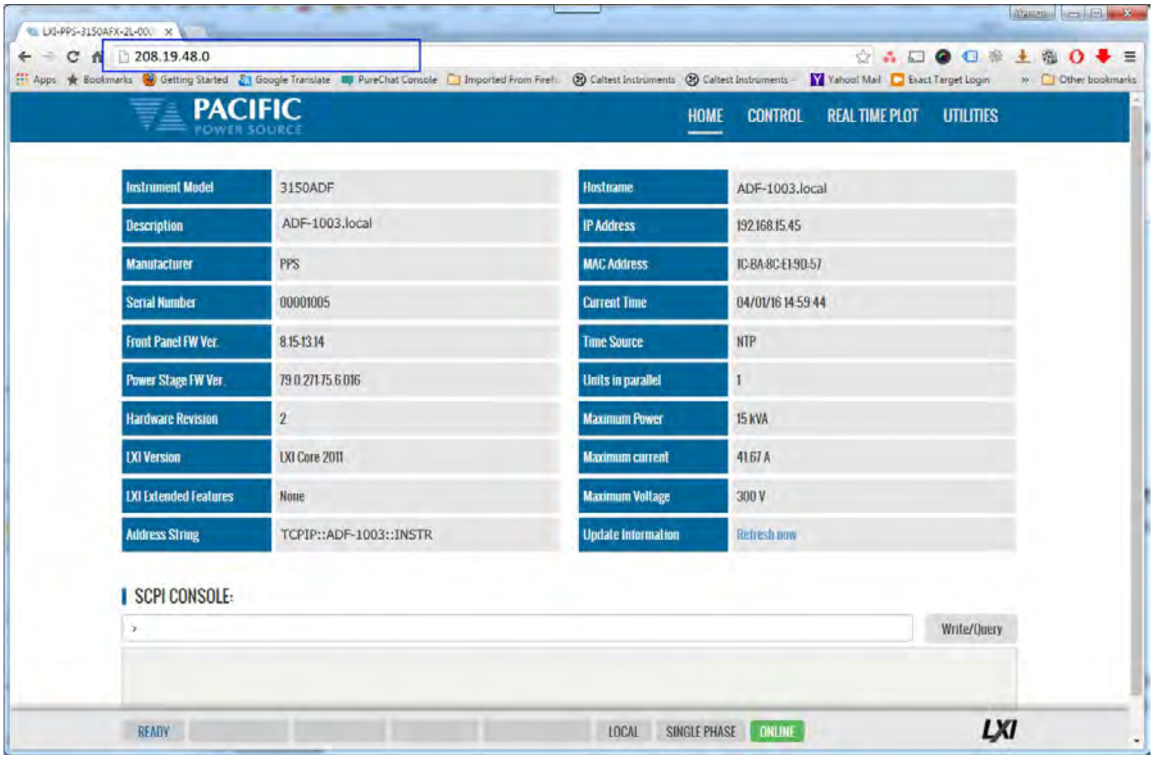



*Figure 10-1: LXI Web Server Home Screen*

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.

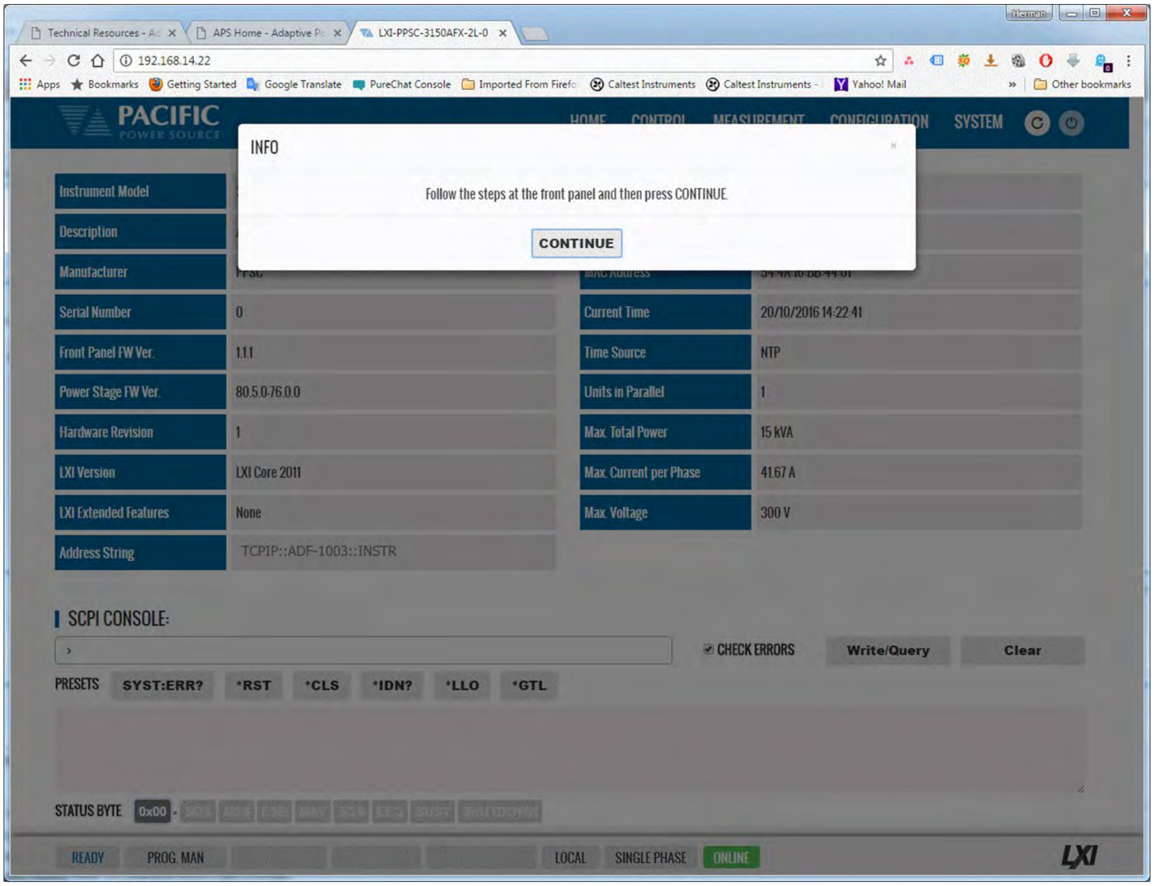



*Figure 10-2: ACCESS CONTROL Dialog Screen*

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 Monitor[6] 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.

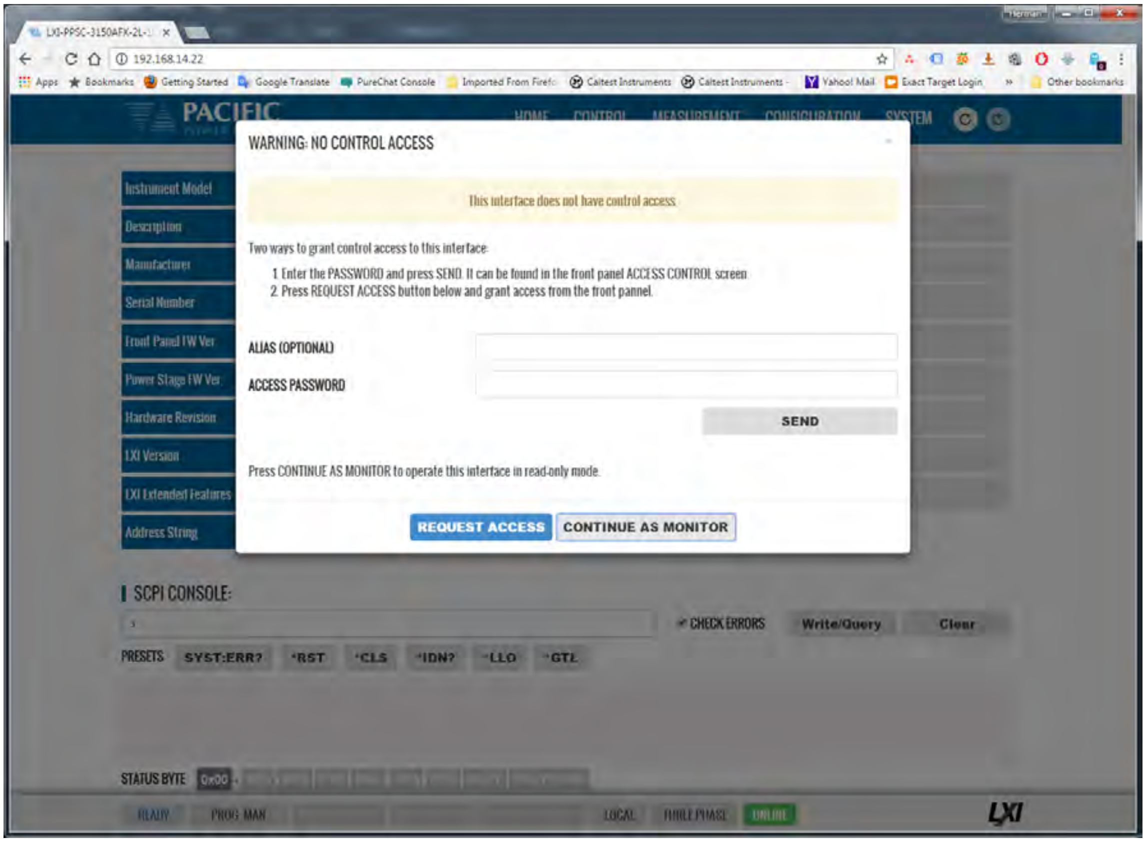
The access control password can be set/changed only by the person(s) present at the physical location of the unit. Factory default password is “1234” but it is strongly **advised** the end user changes this to his own code after receipt of the unit.

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

[6] 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 requestors 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.

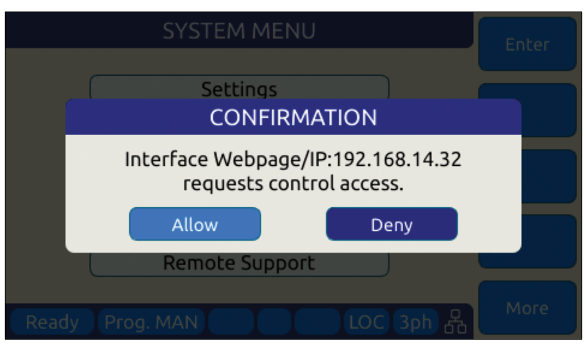
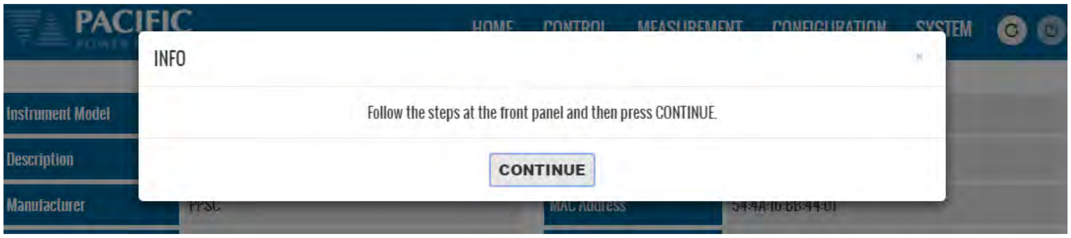



*Figure 10-3: Remote Access Control Request Dialog*

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.

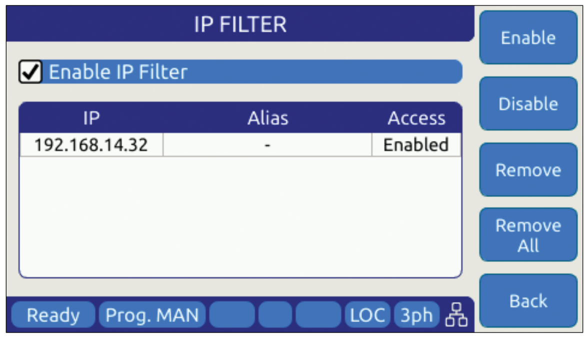
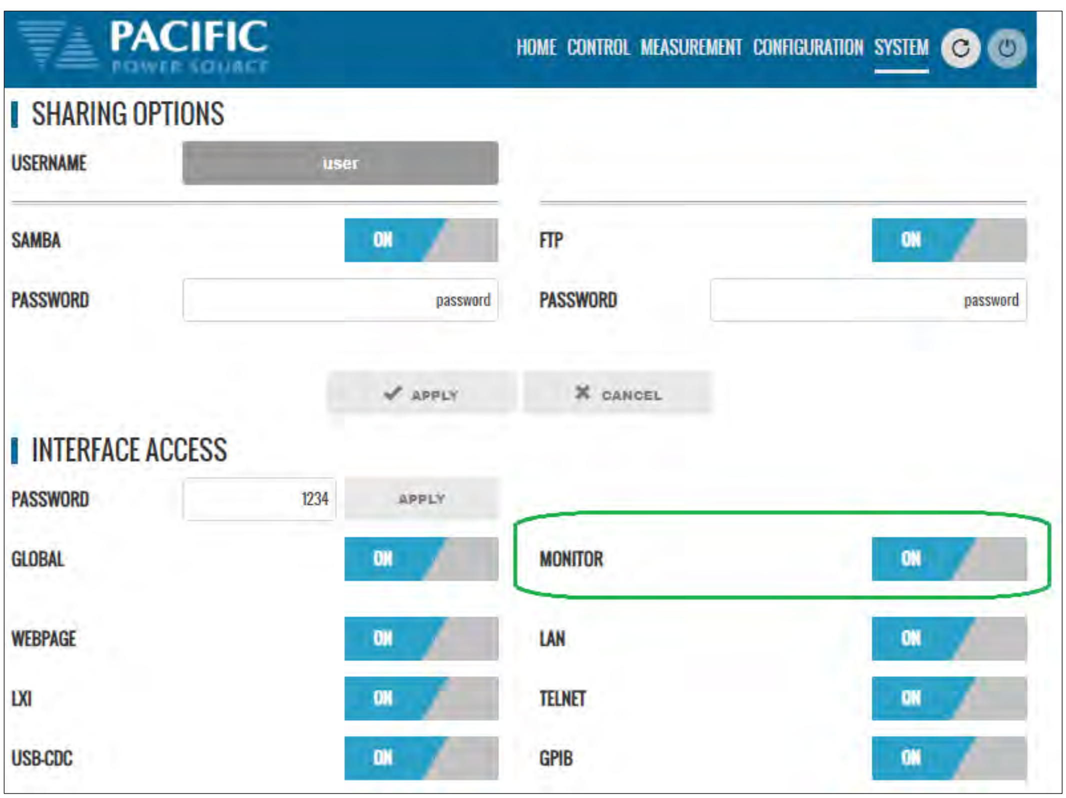
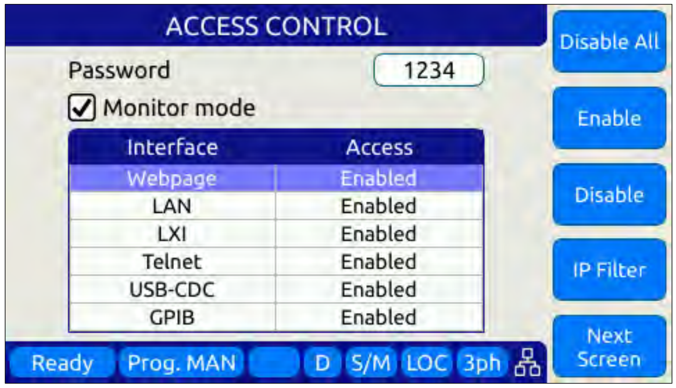



*Figure 10-4: Remote Access Control IP Filter screen*

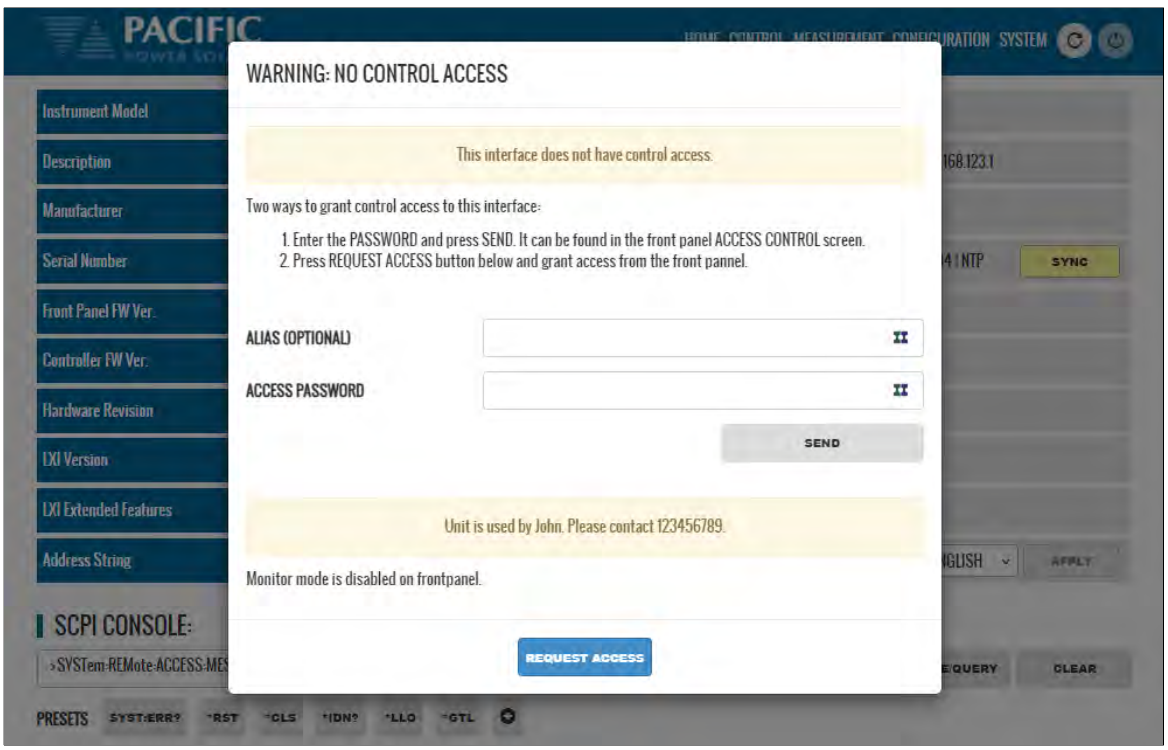
Remote access can be configured from the System menu. To enable Monitor only mode, turn MONITOR on as shown below. In this mode, settings and measurements can be viewed but no changes can be mode remotely.



Monitor mode can also be selected from the front panel using the System, Access Control screen as shown below.



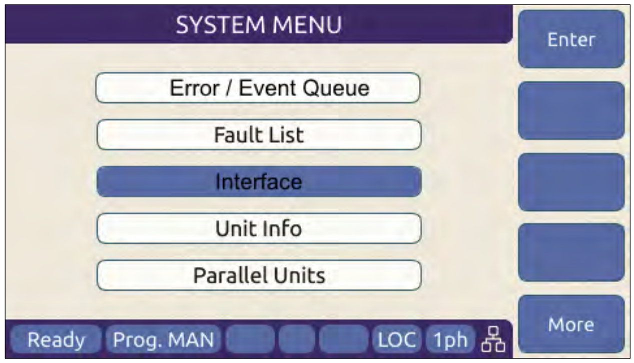

If Monitor mode is disabled, the browser access control screen will look like this.



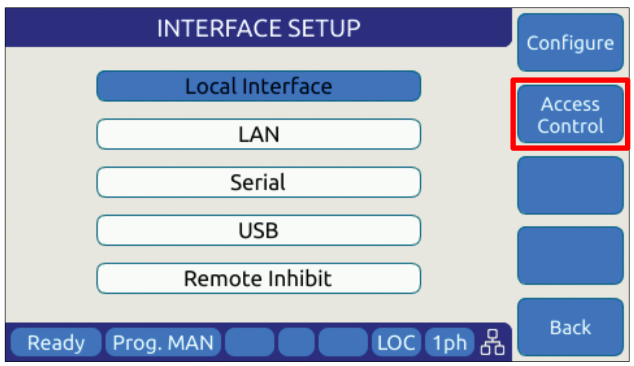

The message at the bottom of the screen can be set by the main user with the *SYSTem:REMote:ACCESS:MESSage*
SCPI command. In this example, the following command was used:
*SYSTem:REMote:ACCESS:MESSage "Unit is used by John. Please contact 123456789."*

### 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

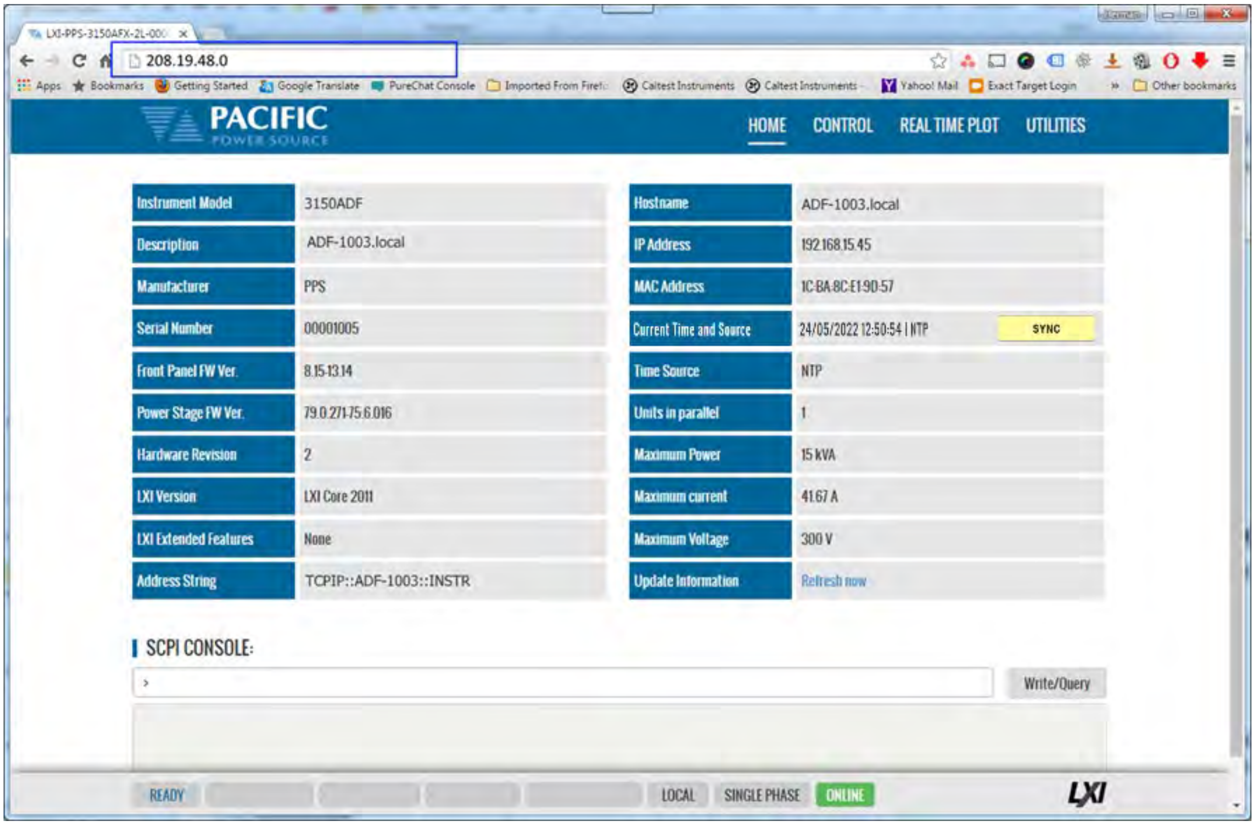
The following areas of control, monitoring and configuration of the ADF power source are available through a web browser.

- Home Screen – Required for LXI compliance
- Home Screen SCPI Console Command Line Interface
- SOURCE CONTROL
    - PROGRAM
    - PROTECTIONS
    - 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.

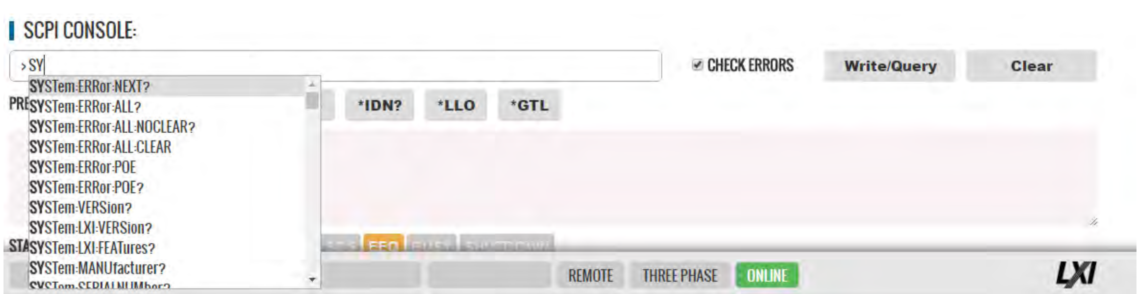
## 10.6 Home Screen

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.



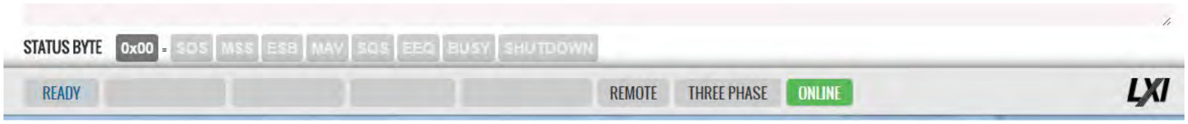

### 10.6.1 SCPI Console Command Line Interface

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 300.



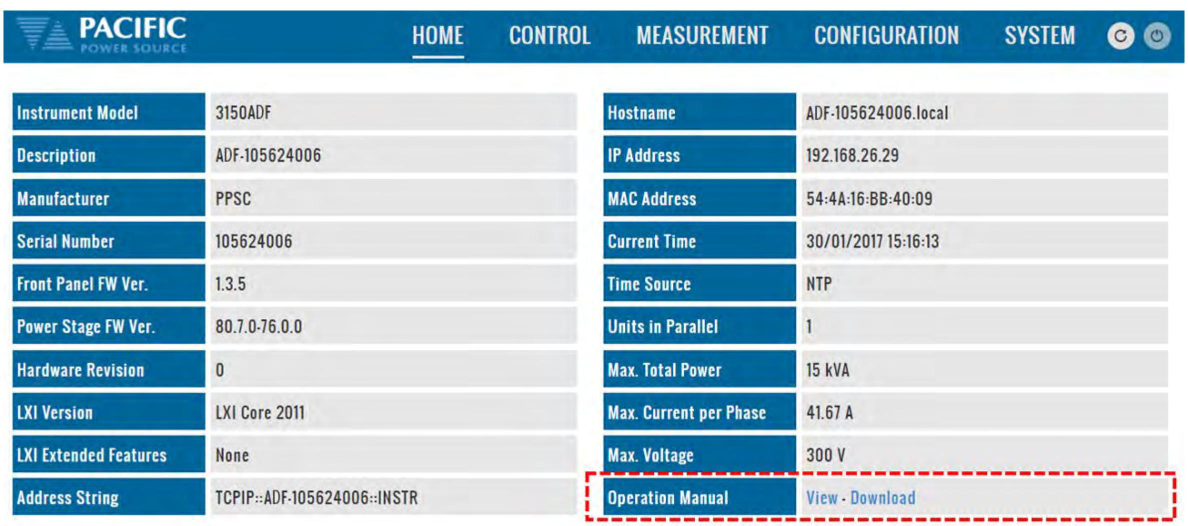

### 10.6.3 Browser Status Bar

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”).

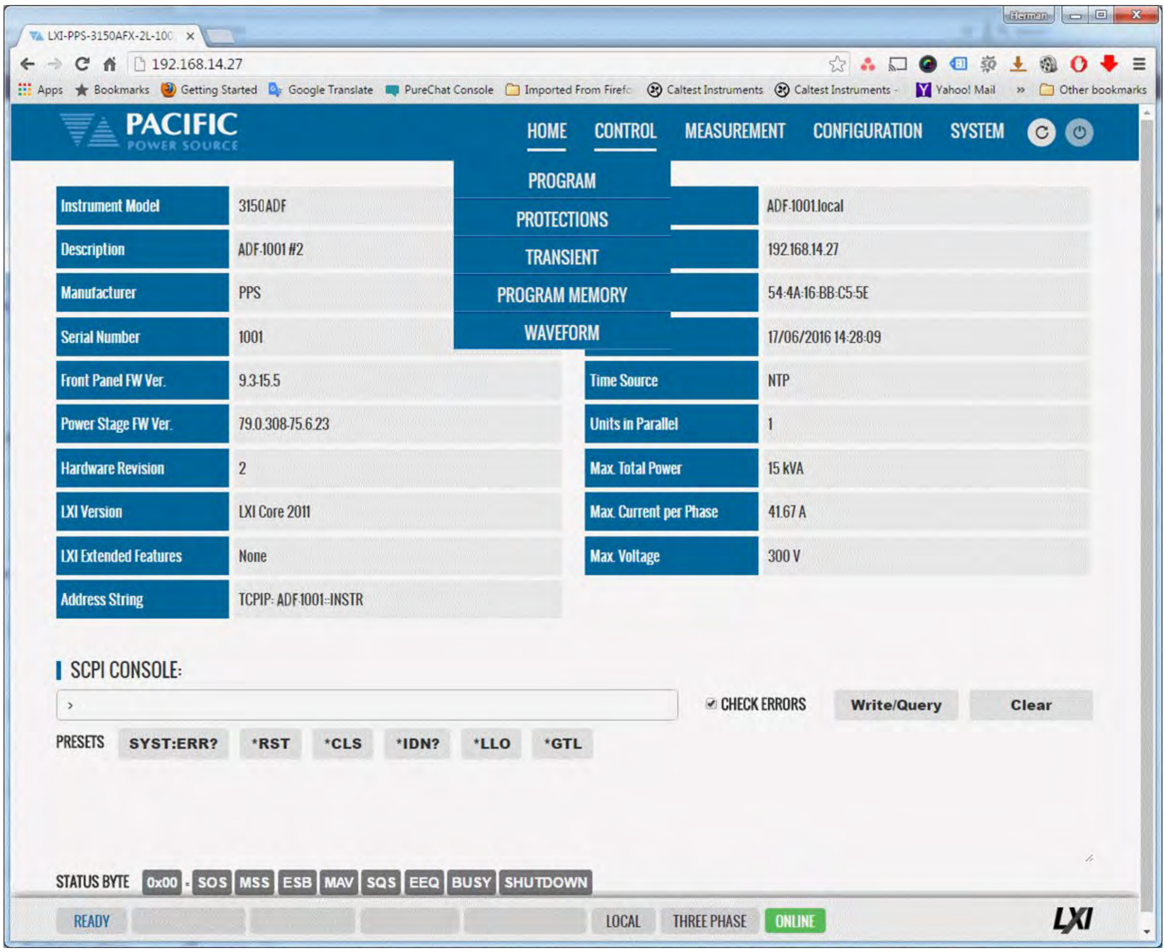


## 10.7 Source Control Screens

The CONTROL menu provides access to several screens that allow programming of the power source. Control Menu entries are as follows:

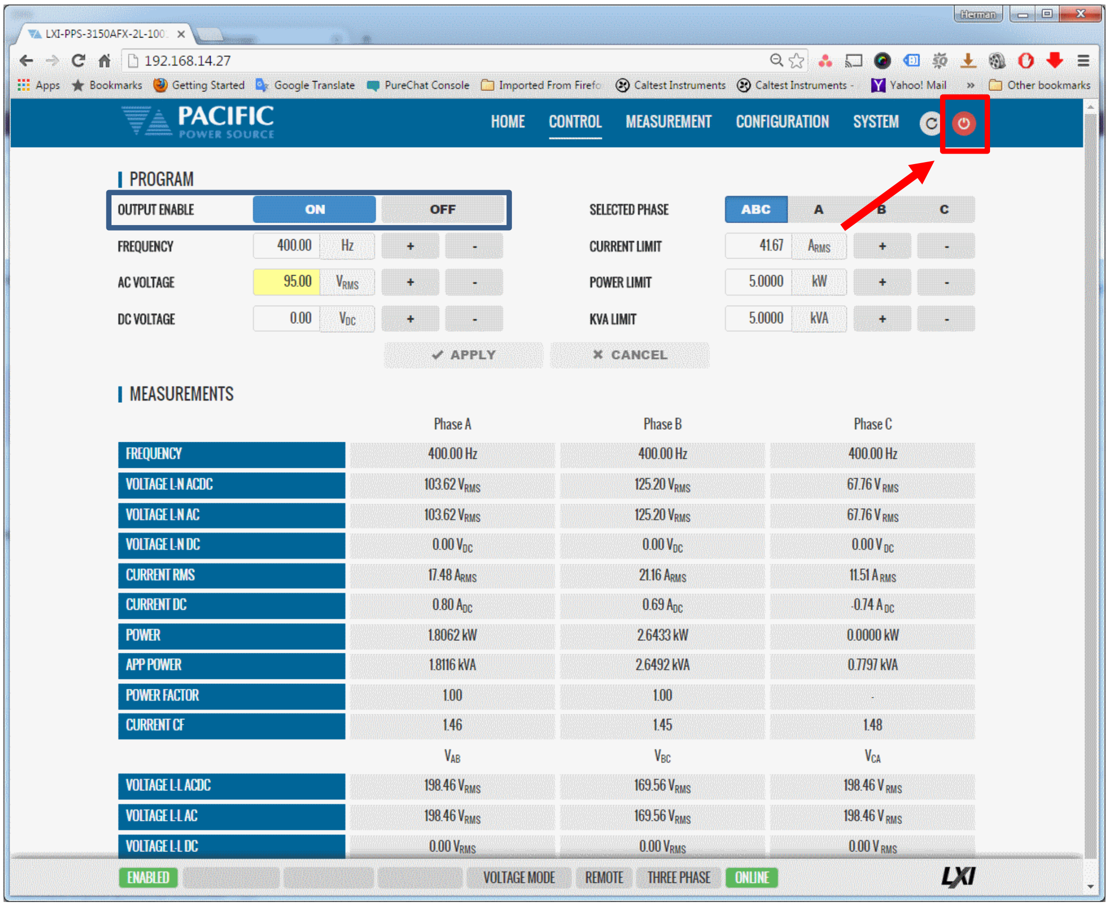
- PROGRAM
- PROTECTIONS
- PROGRAM MEMORY
- SCPI SCRIPT

Each is described in subsequent sections.



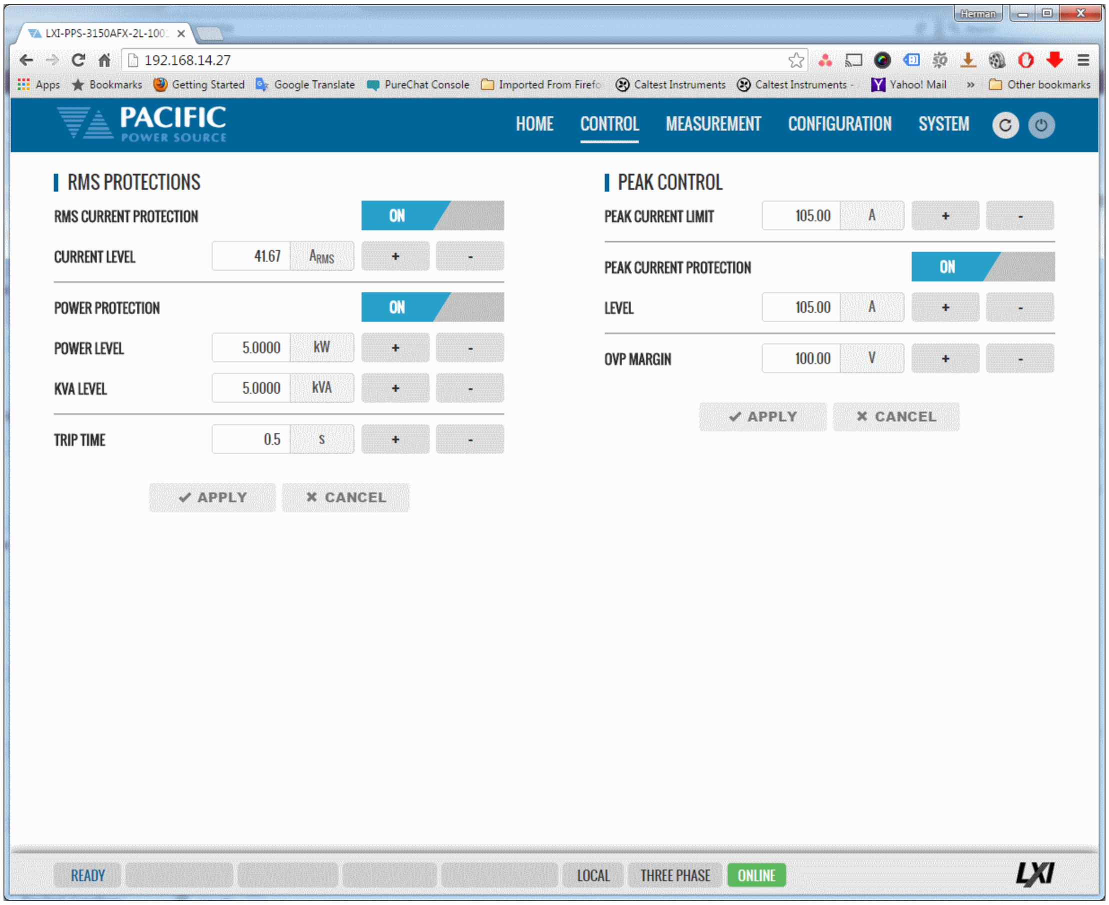
### 10.7.1 Program

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.



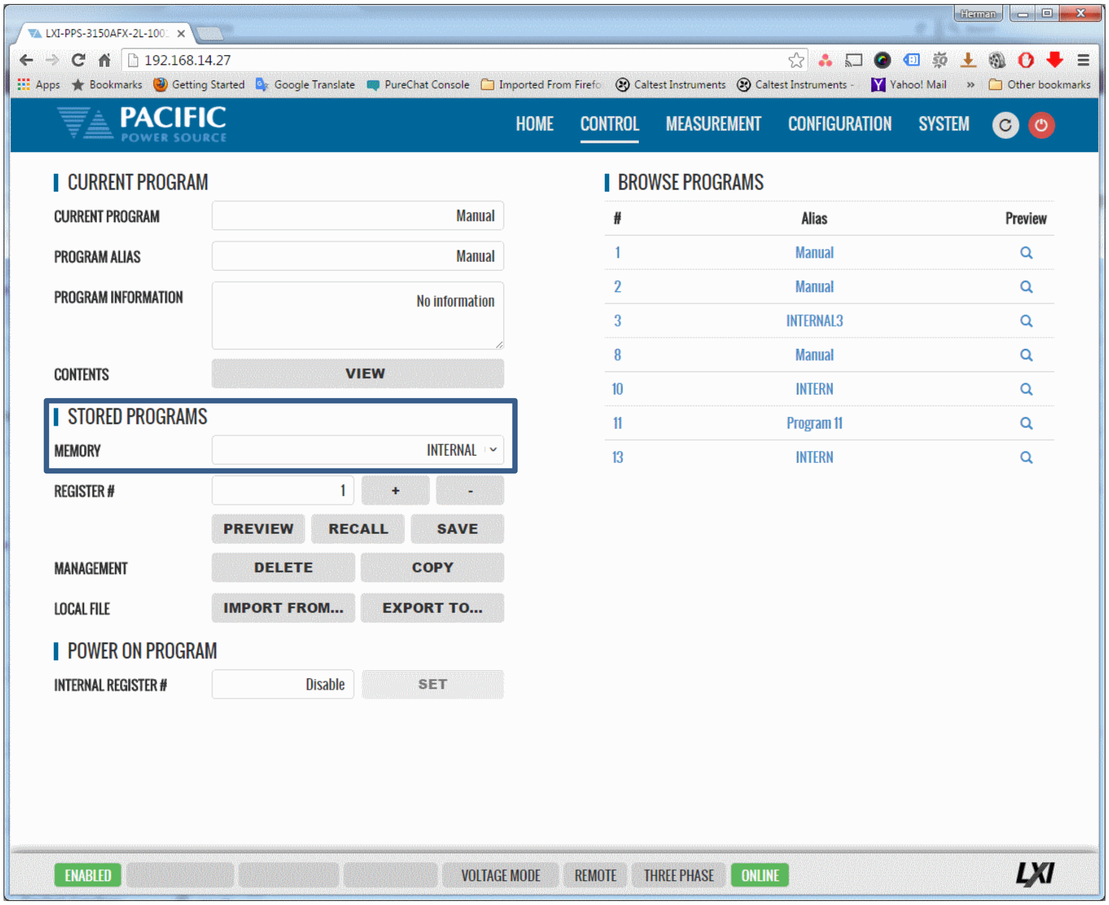
### 10.7.2 Protections

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.



### 10.7.3 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.

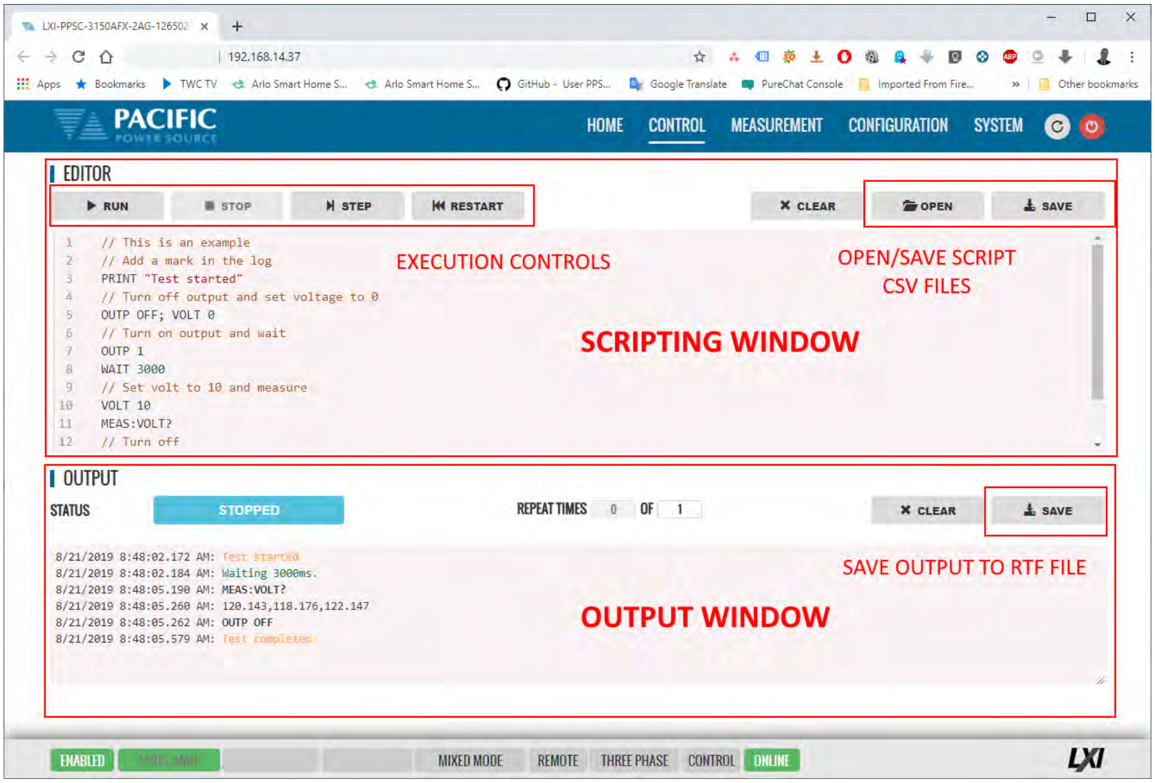



Note that external storage devices may be selected under "**STORED PROGRAMS**" using the MEMORY drop down list control.

## 10.7.4 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.




### 10.7.4.1 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*

### 10.7.4.2 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.

#### 10.7.4.3 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.cvs***) 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 MILISECONDS, 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
```

#### 10.7.4.4 "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
```

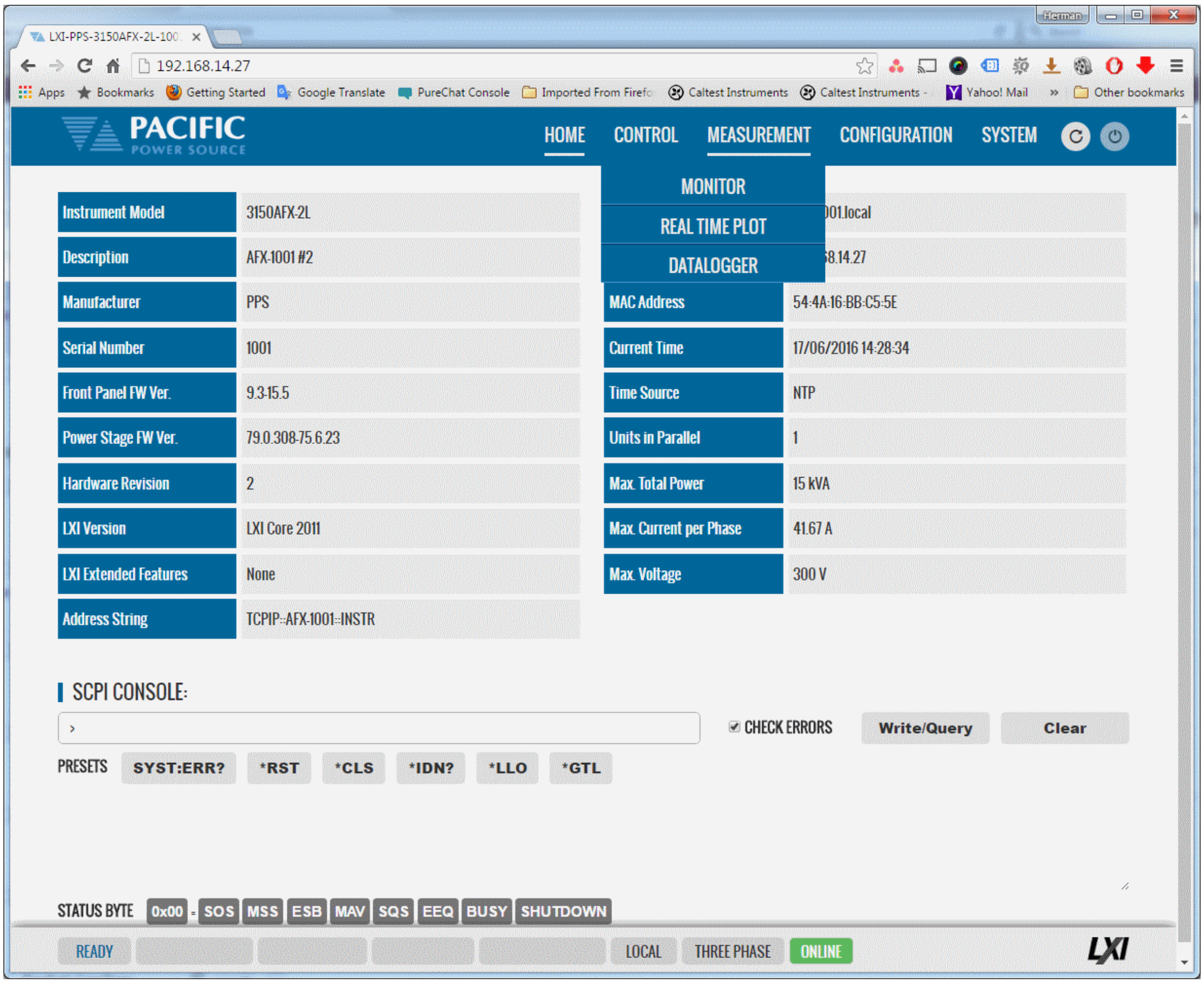
**Note:** All output files are saved to the default Download directory determined by the Browser setting.

## 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

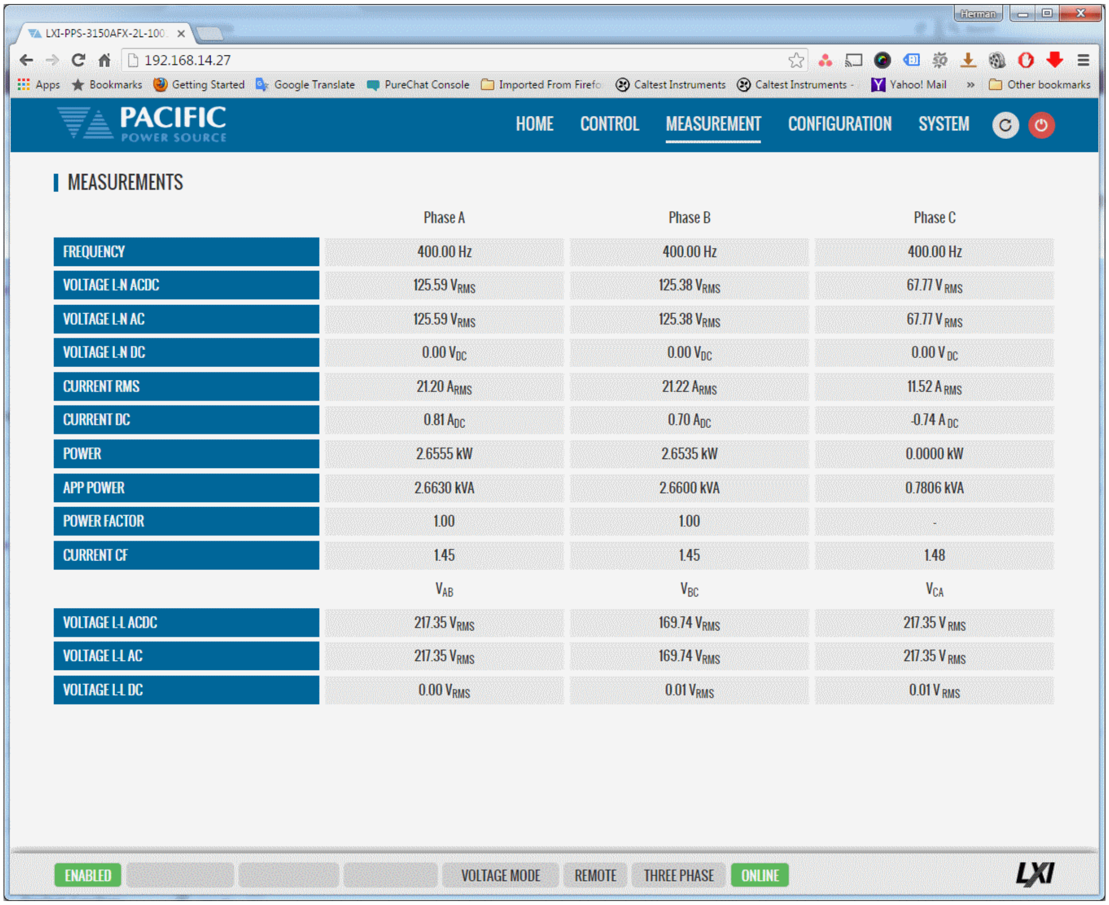
Each is described in subsequent sections.



## 10.8.1 Monitor

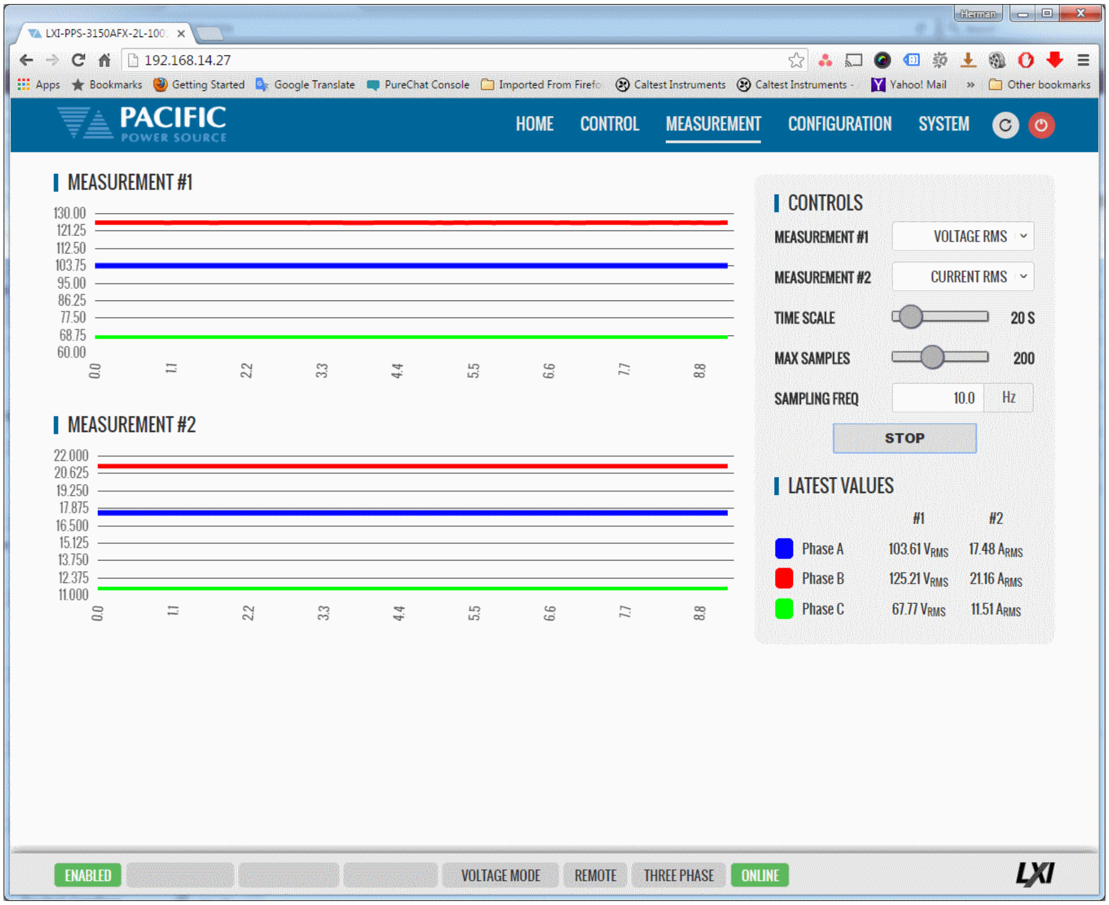
The measurement monitor screen replicates part of the CONTROL->PROGRAM screen and displays all measurement data for all available output phases. Measurements include both AC and DC components.

**Note:** There are no controls on this screen.



### 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 are 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.

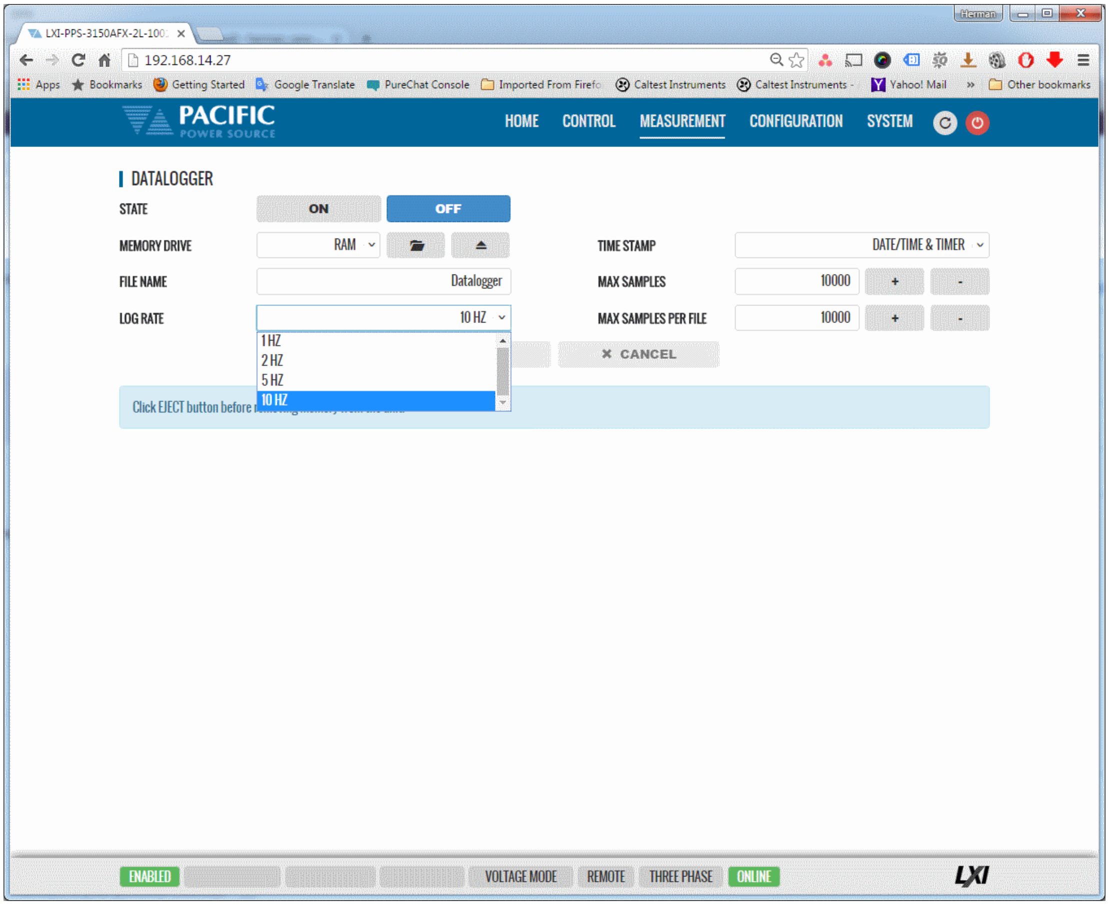

Available selections in this measurement screen are:

- 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.

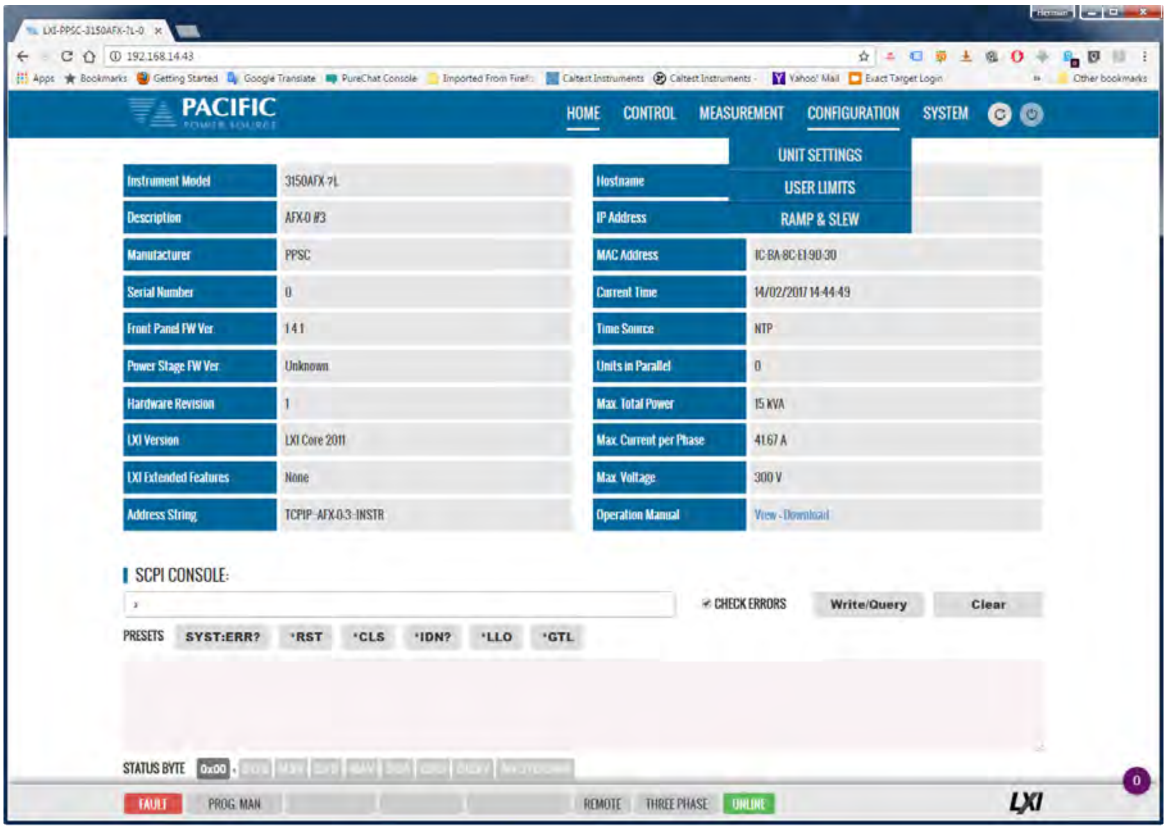


## 10.9 Configuration Screens

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.

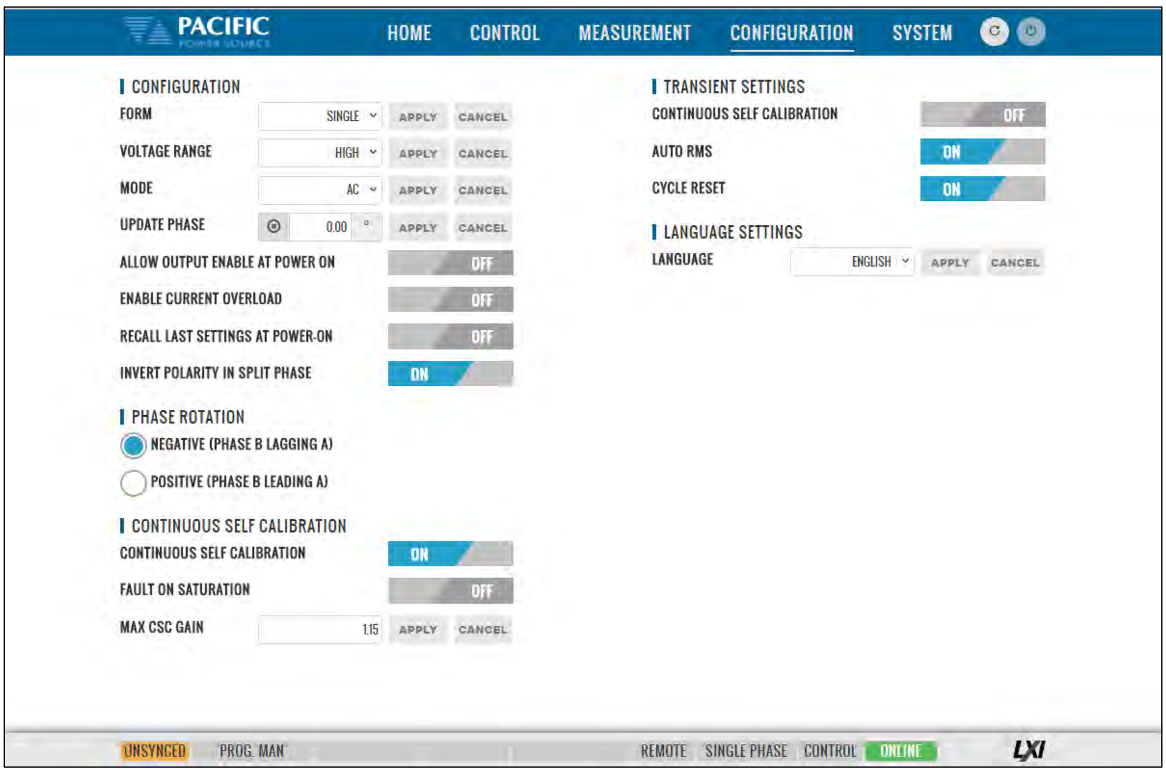


### 10.9.1 Unit Settings

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 ENGLIGH or CHINESE.

These can all be set from the CONFIGURATION -> UNIT SETTINGS screen shown below.



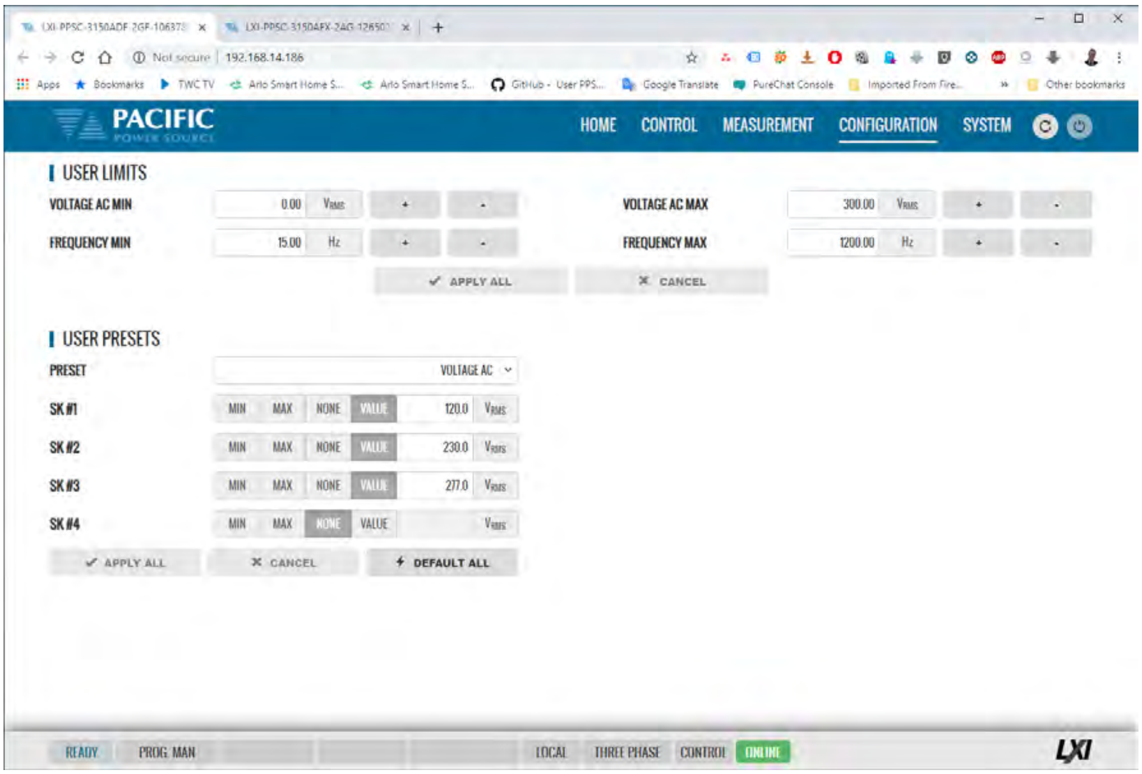
### 10.9.2 User Limits & Presets

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.

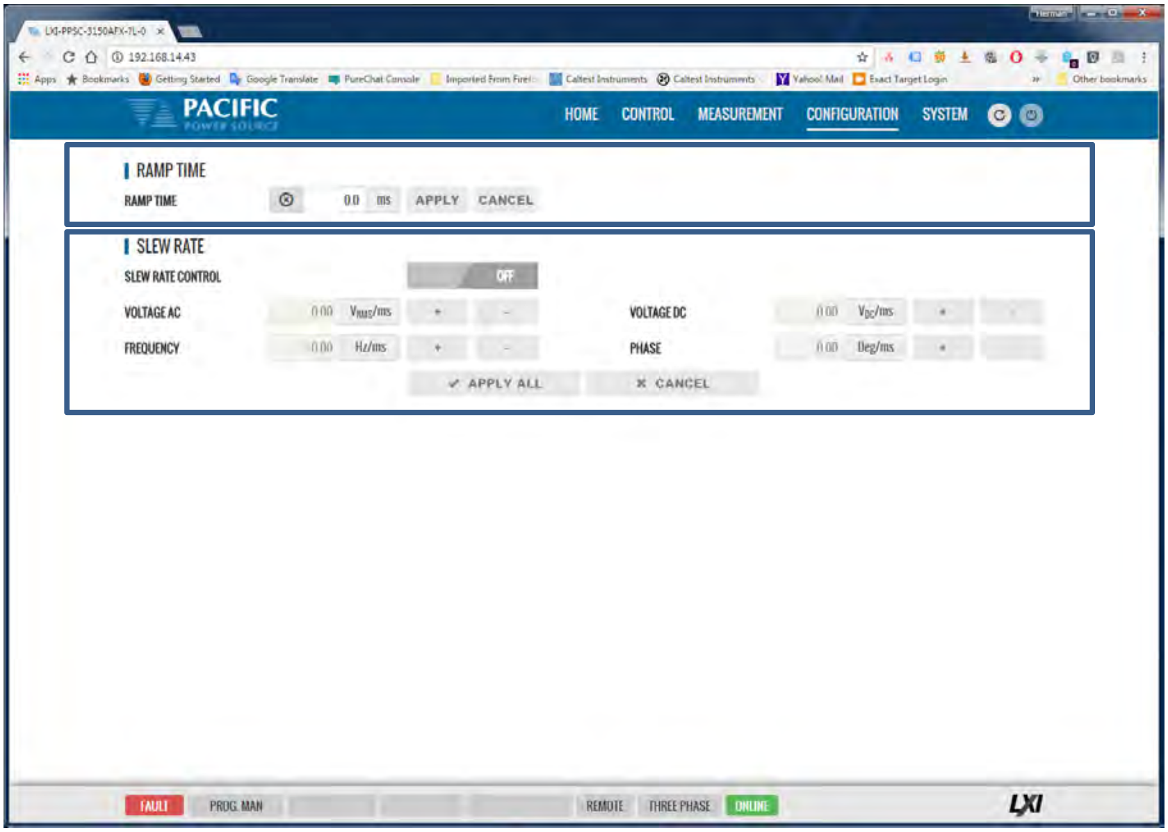



User programmable presets can be set to define the set values of the Soft keys in the program screens. This allows commonly used setting values to be selected by an operator by just pressing a single soft key. See image above for samples.

### 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.

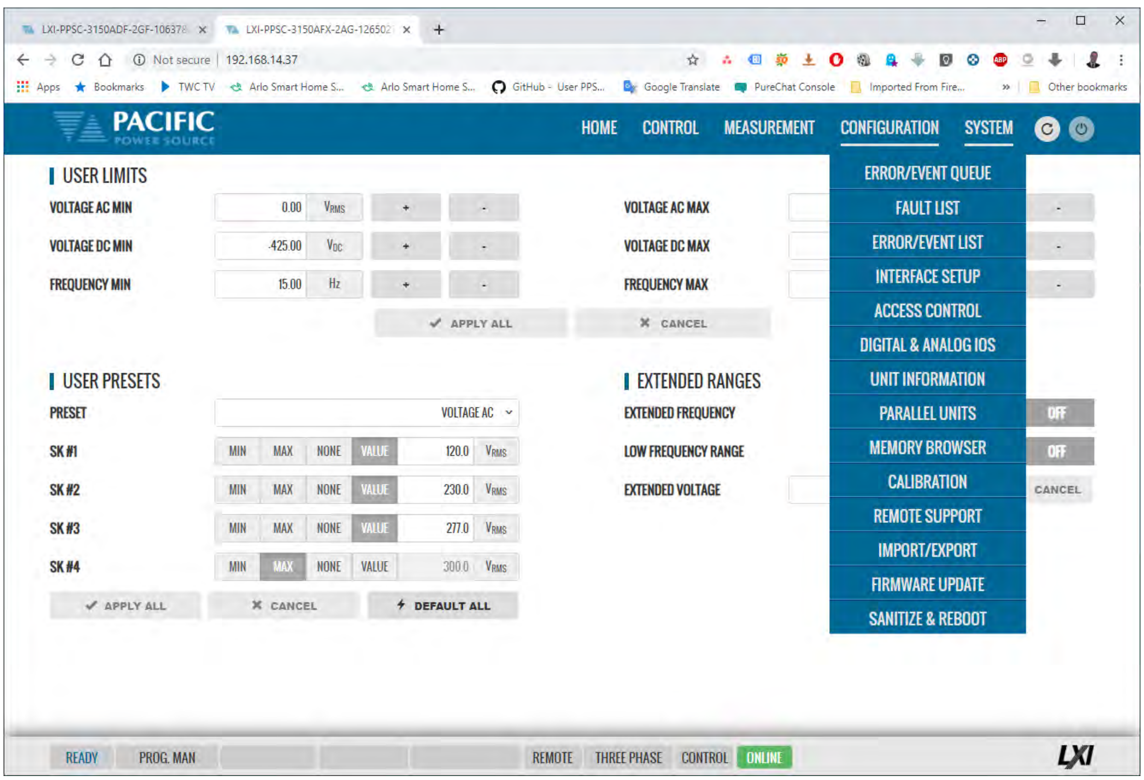


## 10.10 System Screens

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

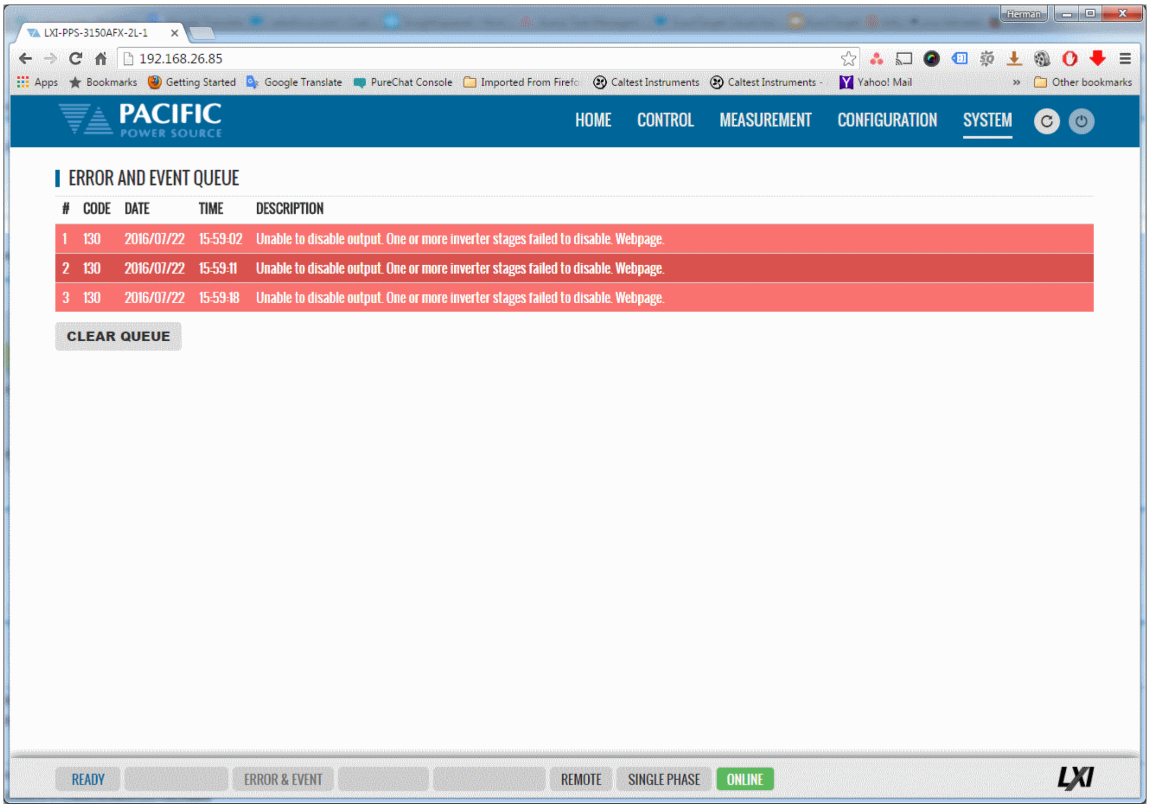
Each is described in subsequent sections.



### 10.10.1 Error/Event Queue

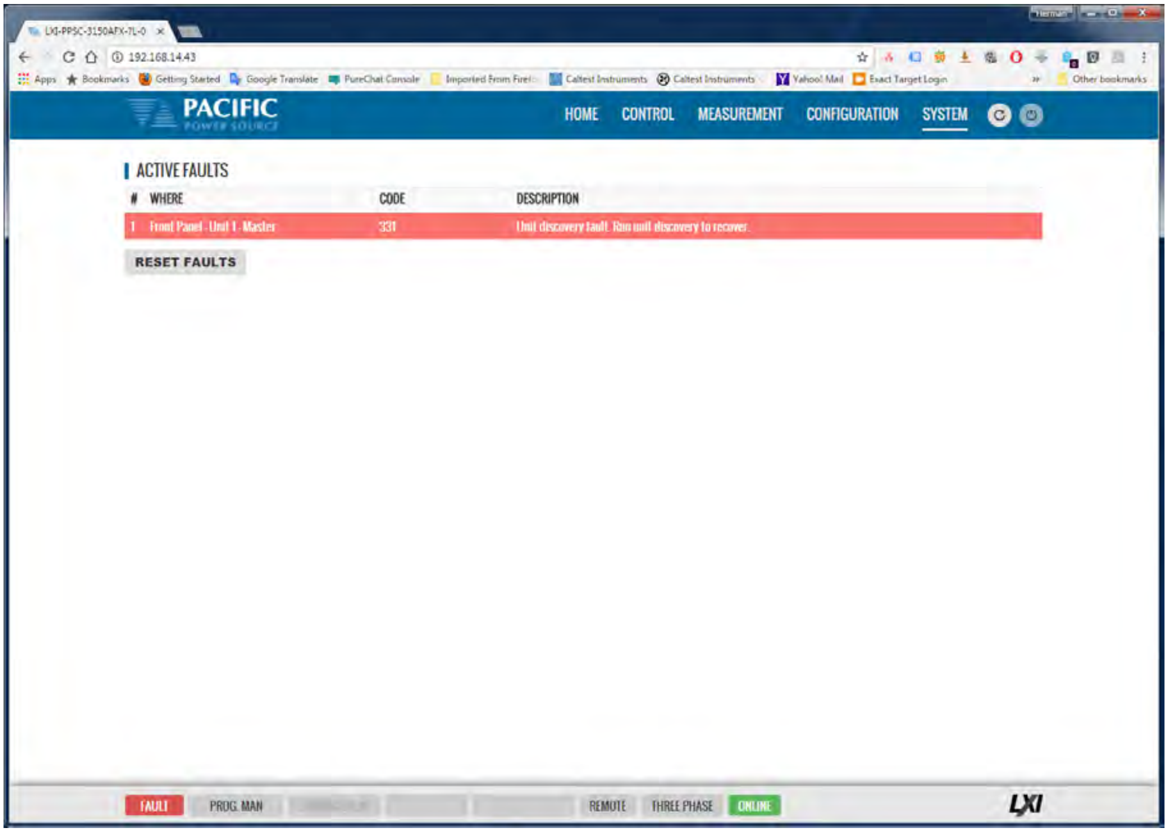
The Error and Event Queue tracks internal errors or communication errors that may occur during normal user. Generally, such errors are the results of programming conflicts or setting conflicts and are no cause for concern.  Other events may be normal, such as a power-on event and will be recorded in 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

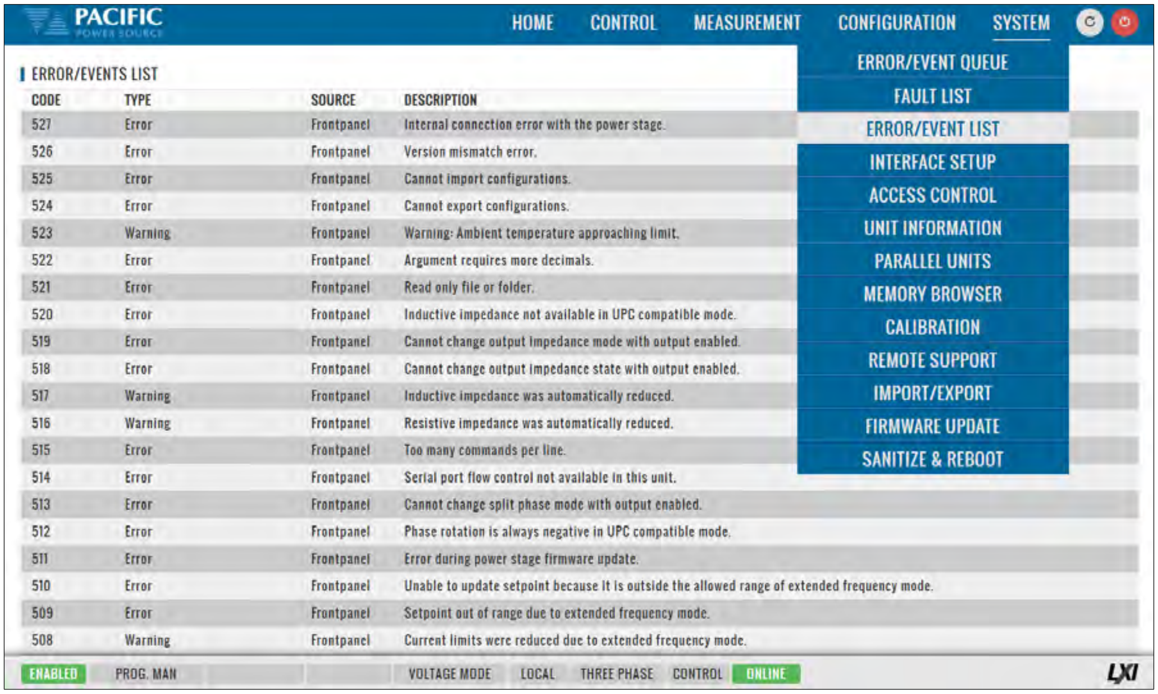
The Fault List tracks hardware faults that may occur in the power conversion stages. This information may be useful for PPS engineering staff.



### 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.

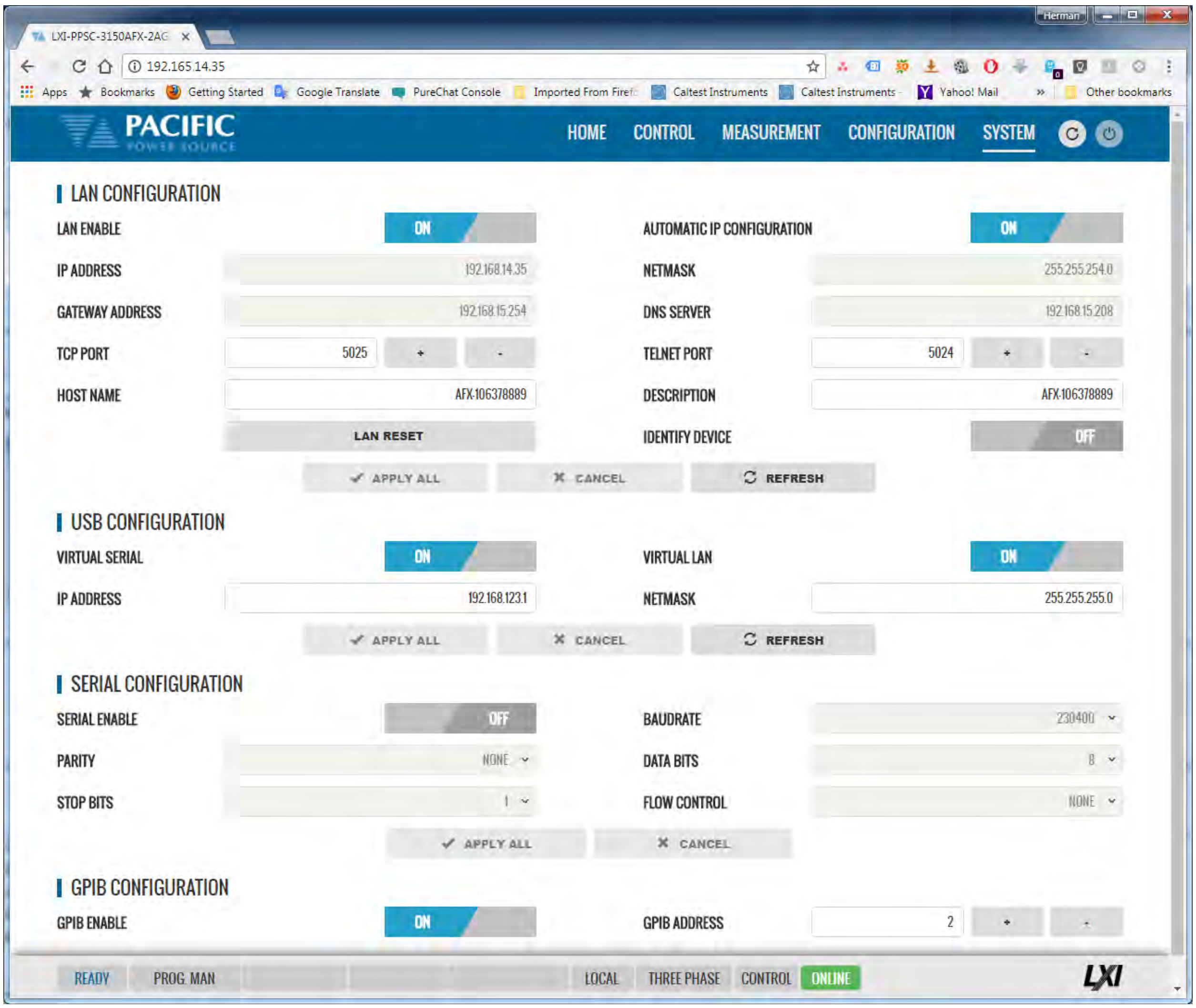


### 10.10.4 Interface Setup

The Interface setup screen allows enabling or disabling of several available interfaces and operating modes. The interfaces are arranged by type:

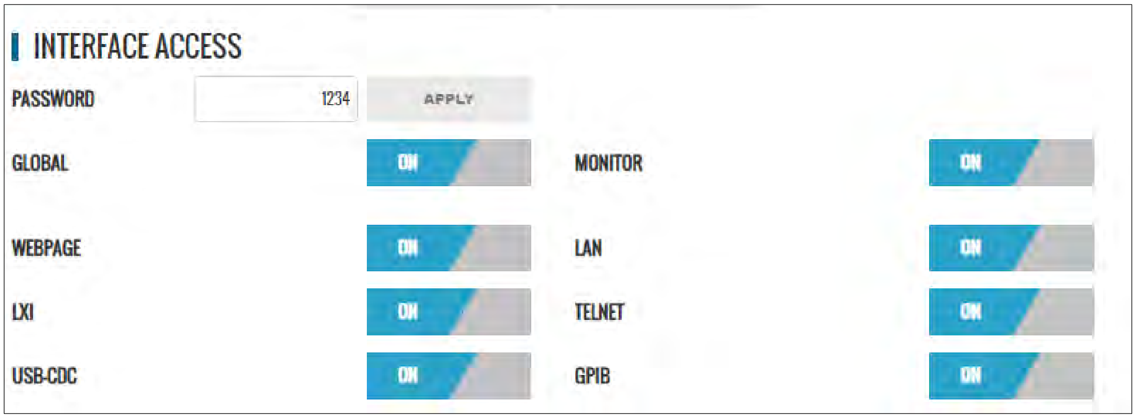
- LAN
- USB
- RS232 Serial
- GPIB (Option) (**Note:** on A version ADF Models only)

Interfaces that are not used can be turned off to avoid conflicts caused by multiple active interfaces at the user's discretion.



### 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.

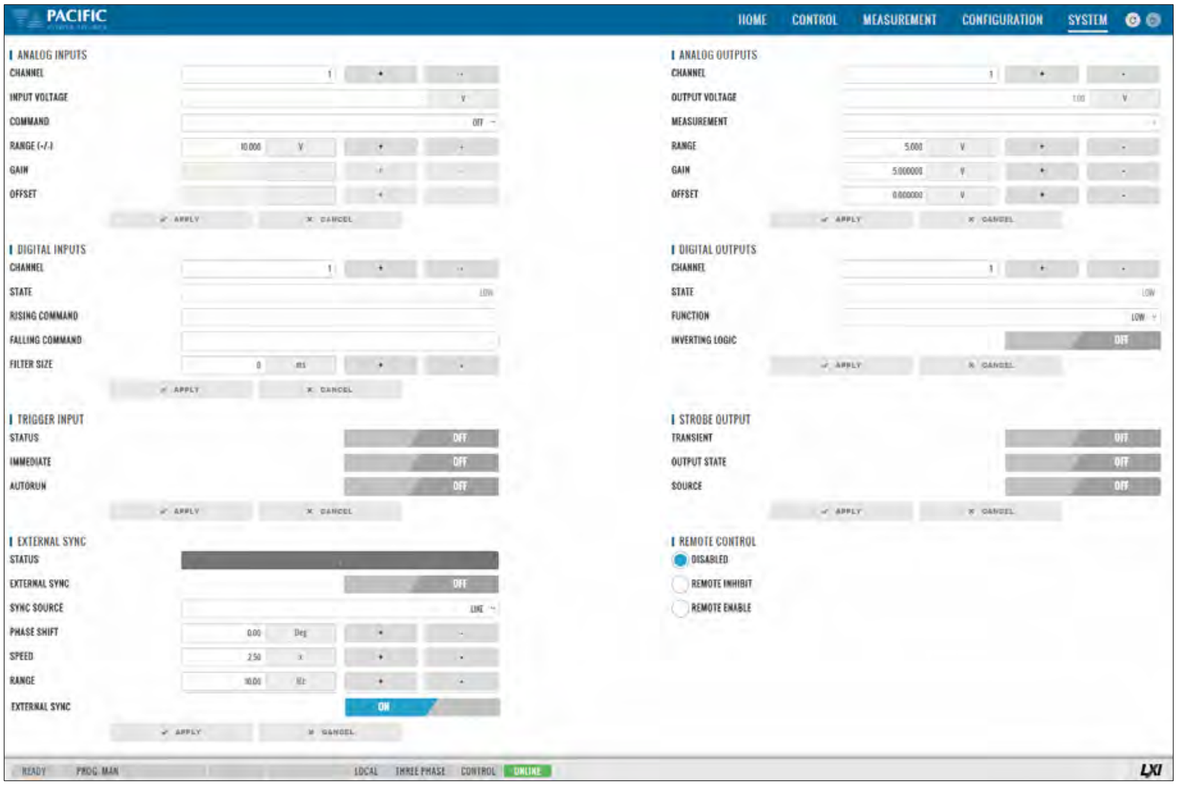



Access control can limit access from specific IP addresses only and requires someone physically present where the power source is to grant access to anyone else.

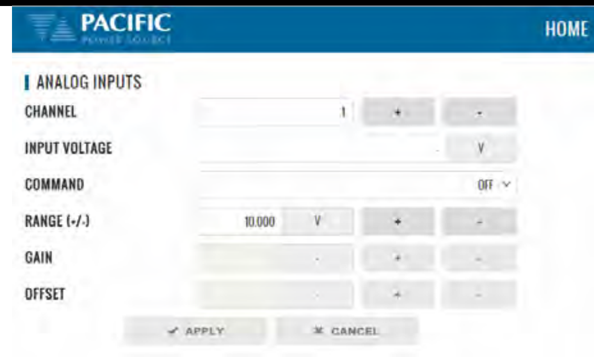
For more details, refer to section 10.3, “Access Control” on page 309 of this manual.

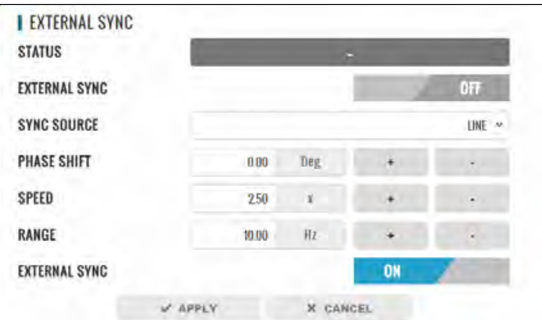
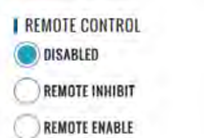
### 10.10.6 Digital & Analog IO's

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.



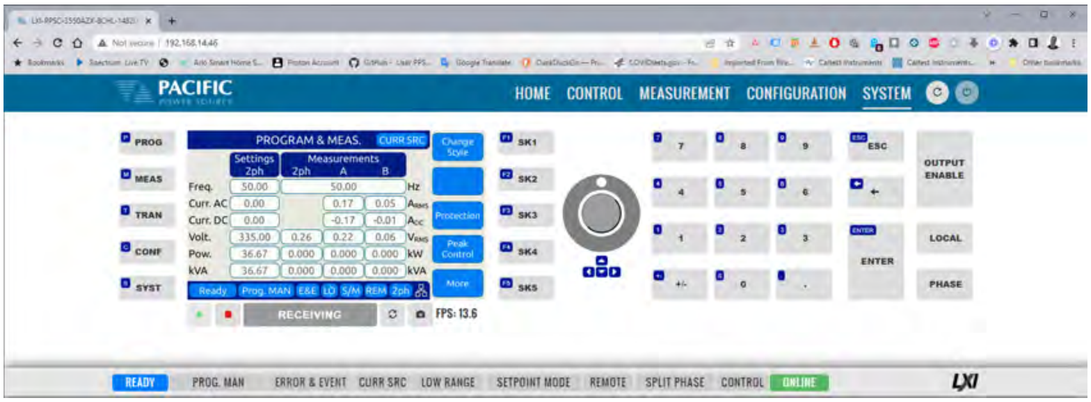

There are eight groups of functions that are available to be configured with the selectable settings listed in the table below.

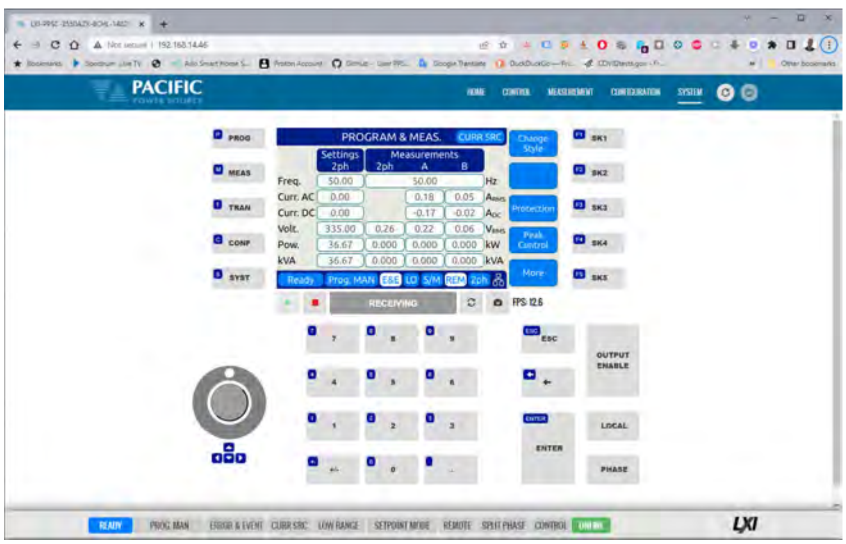
| Grouping | Controls |
|---|---|
| **Analog Inputs:**<br>CHANNEL [ 1 \| 2 \| 3 \| 4 ]<br>INPUT VOLTAGE Displays read back voltage<br>COMMAND Select command from dropdown list or OFF for none<br>RANGE 0.0000 – 10.000 V<br>GAIN Gain<br>OFFSET Offset value |  |
| **Analog Outputs:**<br>CHANNEL [ 1 \| 2 \| 3 \| 4 ]<br>OUTPUT VOLTAGE Output setting<br>MEASUREMENT Select measurement to be assigned to output<br>RANGE 0.0000 – 5.000 V<br>GAIN Gain 0.000 - 1000<br>OFFSET Offset value – 1000 ~+1000 |  |
| **Digital Inputs:**<br>CHANNEL [ 1 \| 2 \| 3 ]<br>STATE Displays input state<br>RISING CMD Set command string to execute on rising edge<br>FALLING CMD Set command string to execute on falling edge<br>FILTER SIZE 0 – 10,000,000 msec |  |
| **Digital Outputs:**<br>CHANNEL [ 1 \| 2 \| 3 \| 4 ]<br>STATE Displays current state<br>FUNCTION Assigns state to selected channel. Available states are:<br>FAULT<br>FORM<br>HIGH<br>LOW<br>OUTPUT STATE<br>PROGRAM<br>REMOTE<br>TRANSIENT<br>INV. LOGIC [ ON \| OFF ] Reverses polarity |  |

| Grouping | Controls |
|---|---|
| Trigger Input:<br><br>STATUS — [ ON \| OFF ] Enabled or disabled<br>IMMEDIATE — [ ON \| OFF ] Ignore phase update setting if ON<br>AUTORUN — [ ON \| OFF ] No RUN command required if ON | <br> |
| —Strobe Output:<br><br>TRANSIENT — ON = Strobe output on transient start<br>OUTPUT STATE — ON = Strobe output on relay close<br>SOURCE — ON = Strobe output on any program parameter change | <br> |
| External Sync:<br><br>STATUS — Display SYNC Status<br>EXTERNAL SYNC — [ ON \| OFF ]<br>SYNC SOURCE — Select Sync source<br>Available sources are:<br>- External sync input on I/O connector<br>- LINE (AC input to power source)<br>PHASE SHIFT — Offset Phase A angle<br>SPEED — 1.00 ~ 10.00<br>RANGE — 0.10 ~ 500 Hz<br>EXTERNAL SYNC — [ ON \| OFF ] | <br> |
| Remote Controls:<br><br>DISABLED — No remote output control<br>REMOTE INHIBIT — Contact closure needed to close output relay<br>REMOTE ENABLE — Contact closure or front panel can control output relay<br><br>See section 5.18.3 | <br> |

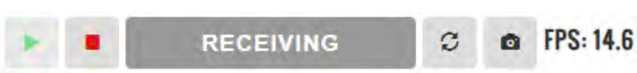
### 10.10.7 Remote Interface (Virtual Front Panel)

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 84 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 84 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.

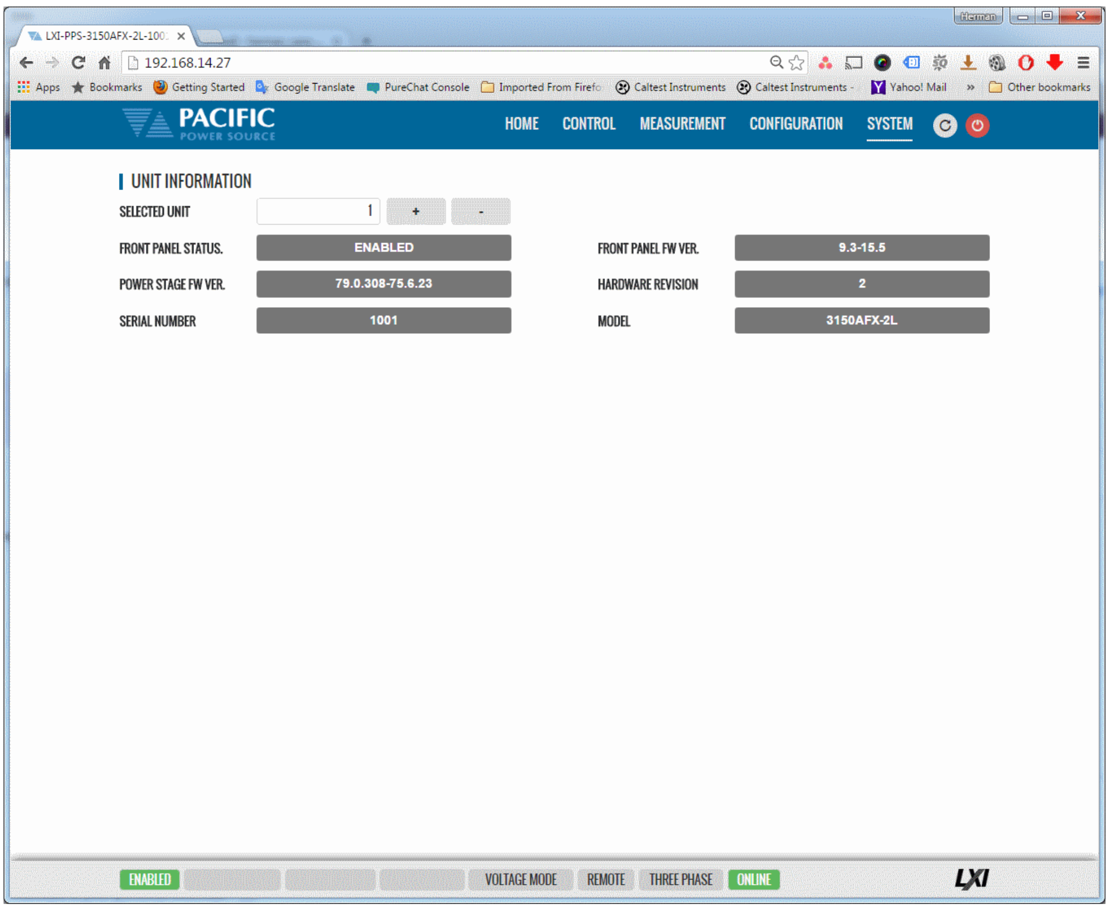
Refresh button may be used when continuous updates are off to refresh the display

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

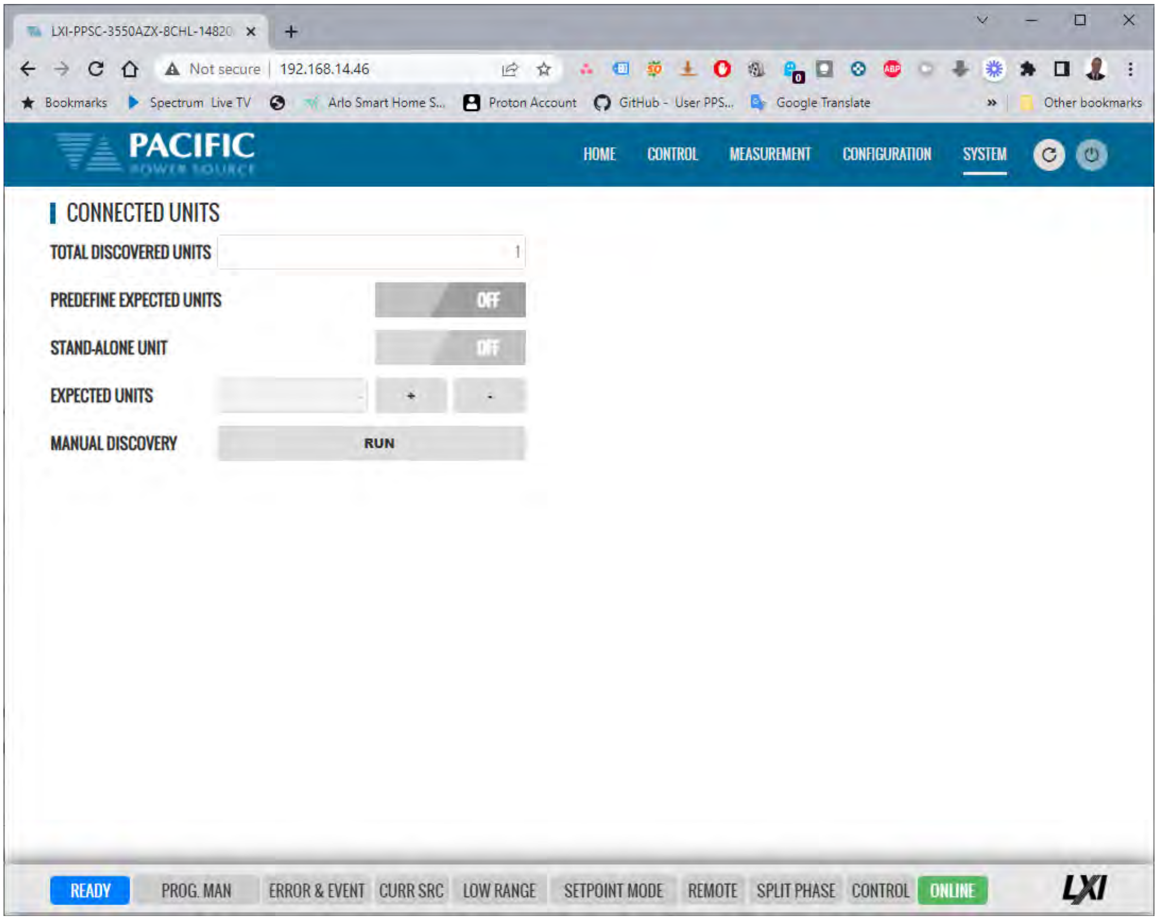
The Unit Information screen contains some of the same information as is found on the HOME screen but it can be used to query this information from one or more auxiliary unit as well in a parallel system. The HOME screen will only display information for the Master unit of a parallel configured system.  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.

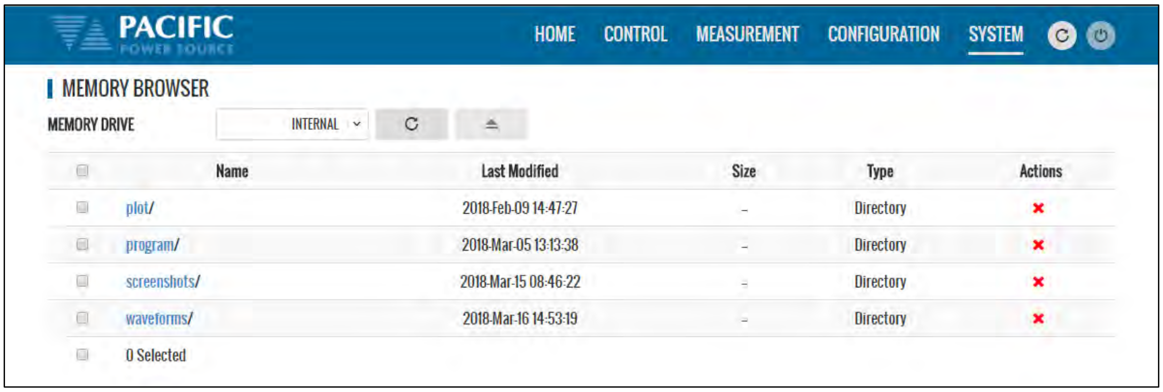
The MANUAL DISCOVERY can be run to refresh the system configuration if a unit has been turned on or off without power cycling the master.



### 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.

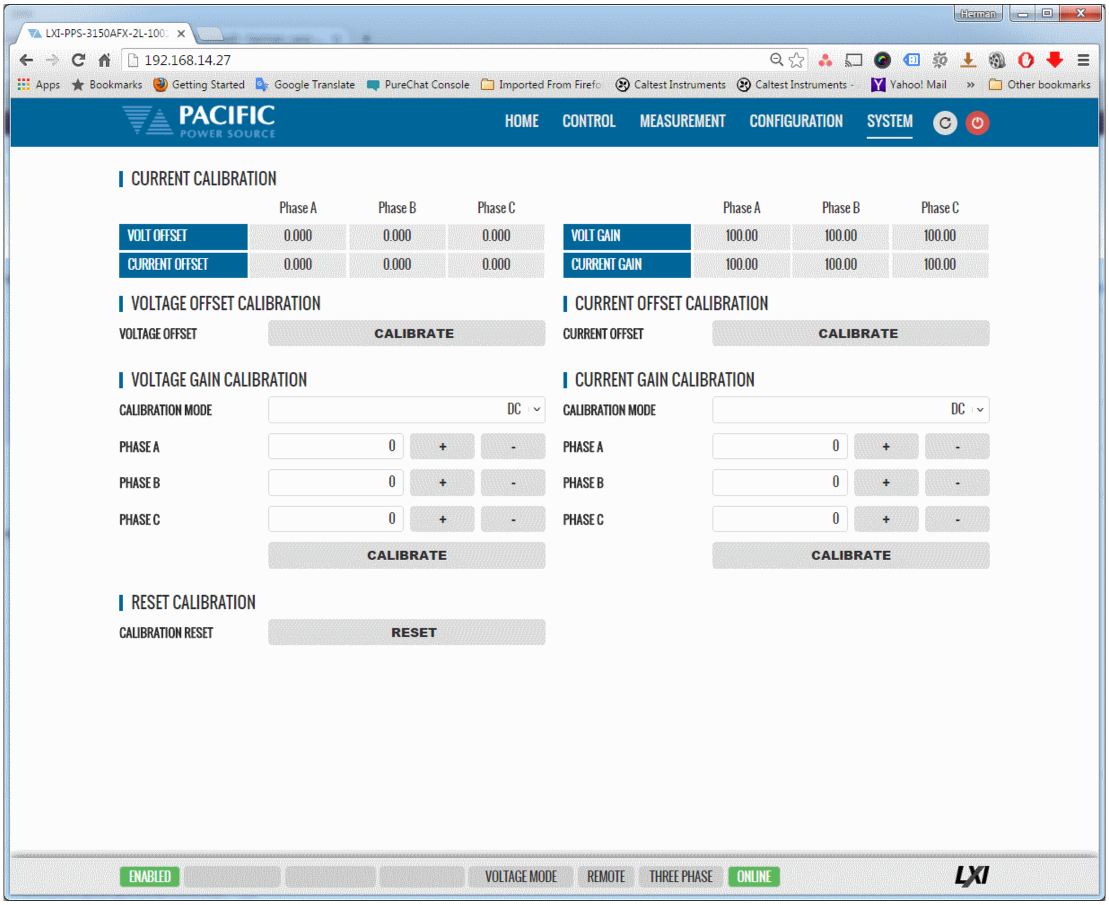



Useful directories for the user are:

| 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. |

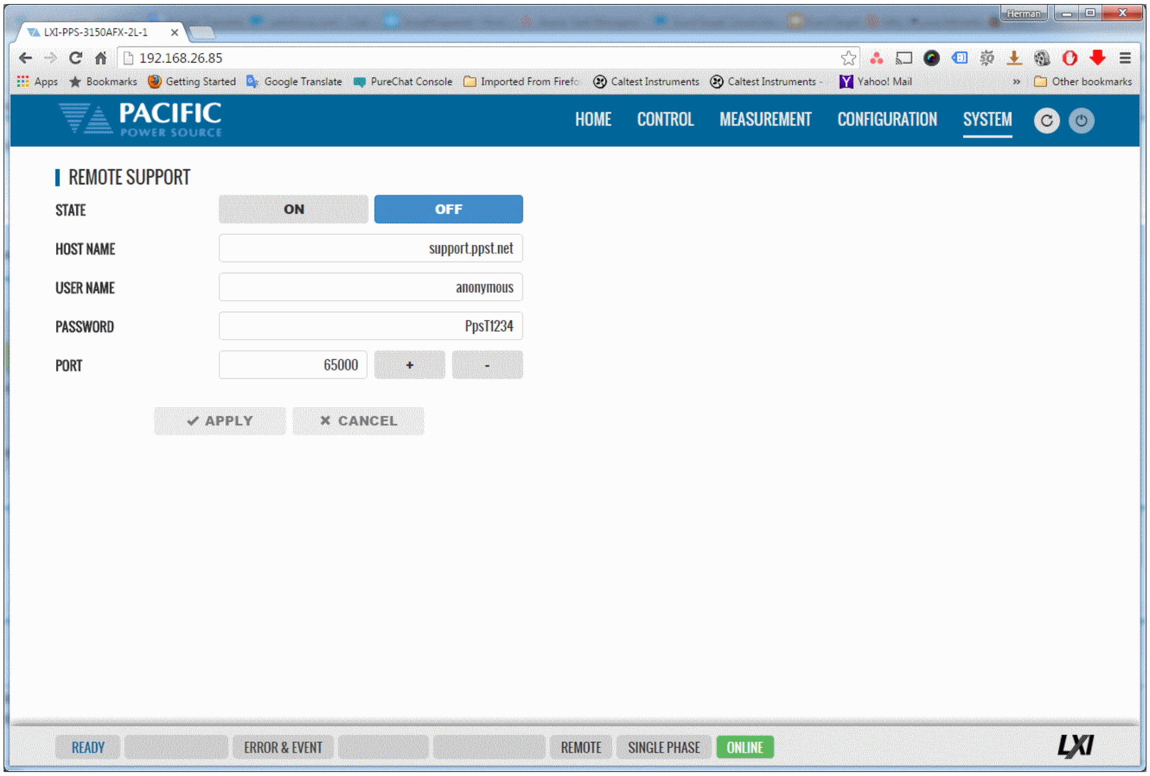
### 10.10.11 Calibration

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.



### 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.




### 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.

### 10.10.14 Firmware Update

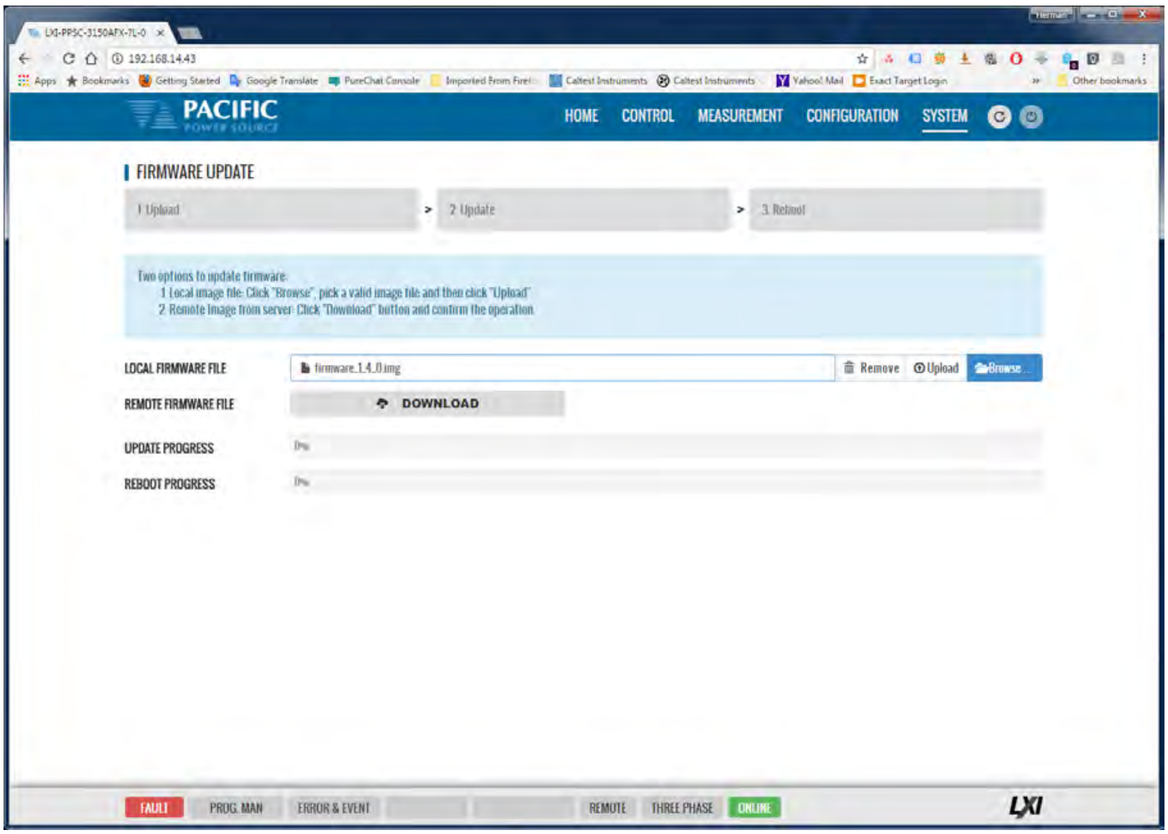
The Firmware update screen can be used to install new firmware for a file. New firmware may be distributed by email or from Pacific's FTP site. Note that the OUTPUT of the unit must be OFF to perform a firmware update.

If you received a firmware image file (.img extension):

- Use the Browse ... button to select it from the drive location you saved it to.
- Then use the Upload button to upload new firmware to the power source.

To install new firmware from the Pacific Power FTP server:

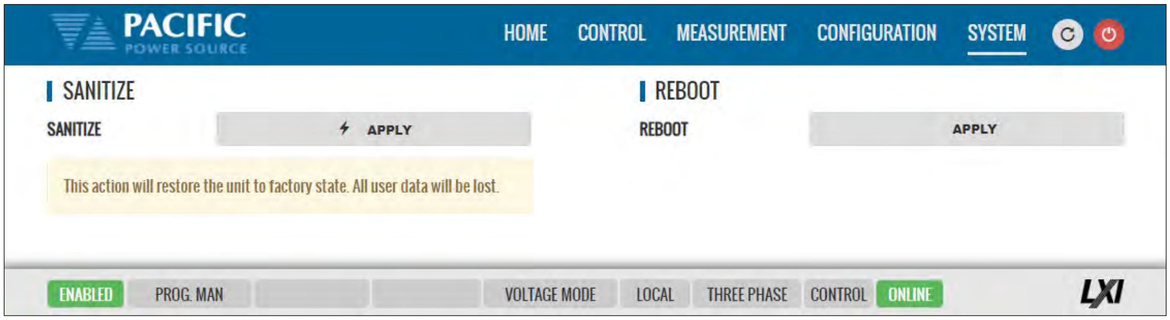
- Click the DOWNLOAD button.



### 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.




## 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 6.8.5.9, “REMOTE SHARING” on page 137.

# 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 6.8.9 for the location of the Calibration menu) or through the build-in web server using the web browser interface. Refer to Section 10.10.10, "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

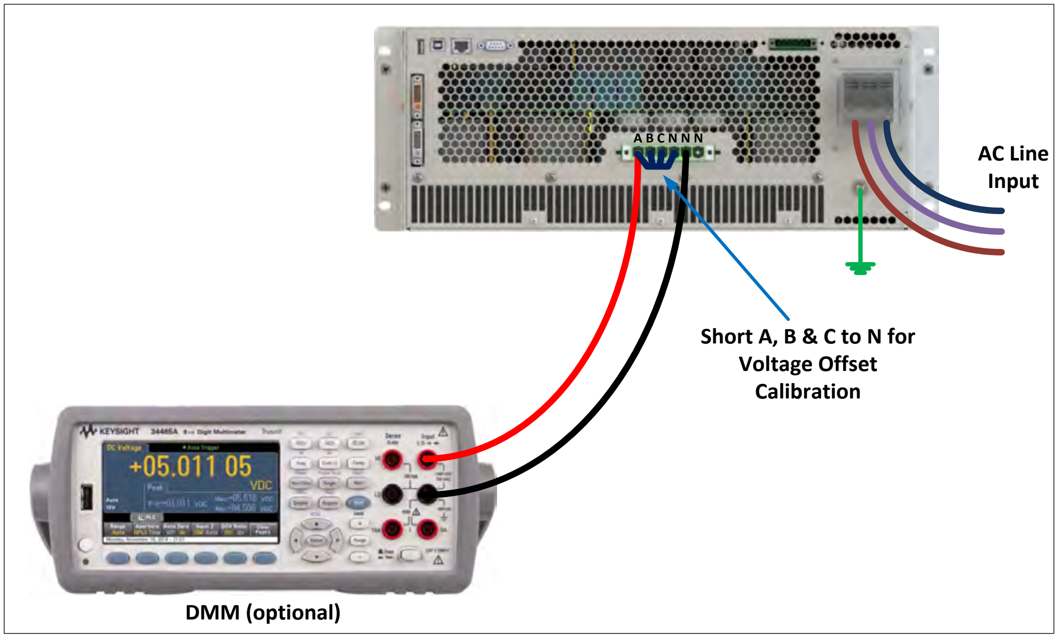



*Figure 11-1: Voltage Offset Calibration – Standard ADF*

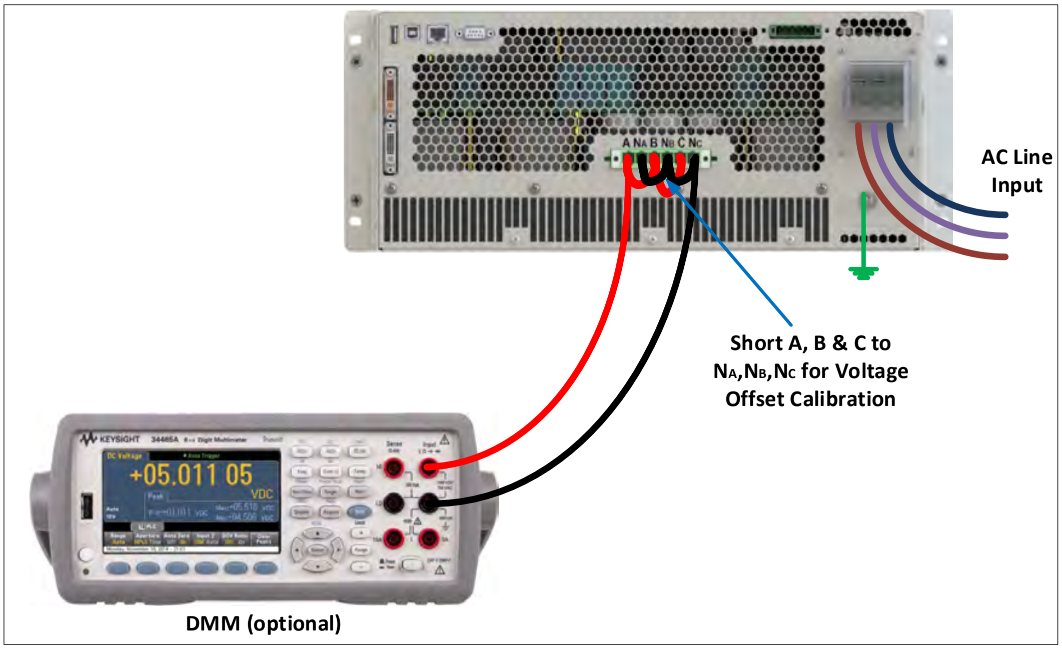
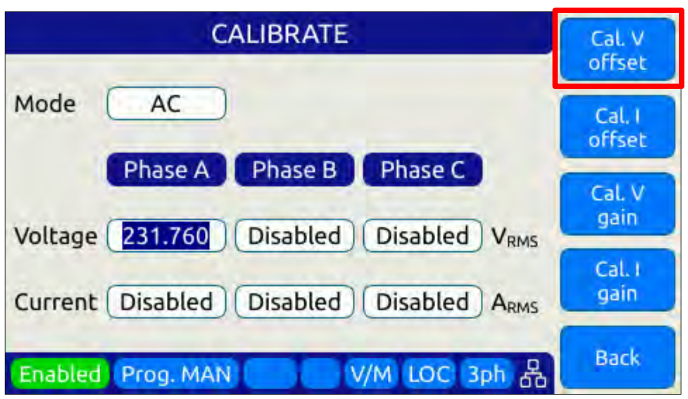



*Figure 11-2: Voltage Offset Calibration – 3xxxADF-W*

The procedure to calibrate voltage offset is:

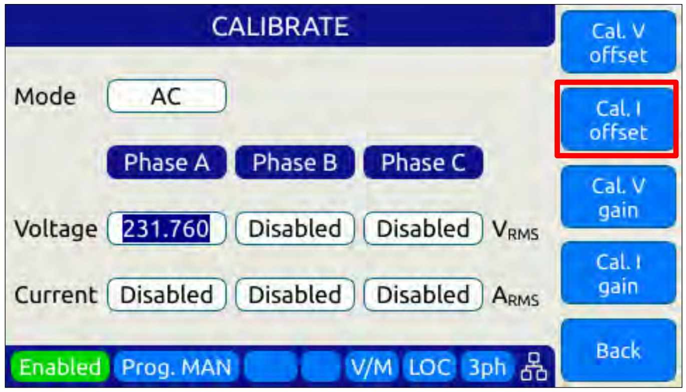



1. Select the Calibration entry from the “**System**” menu
2. Press the “Calibrate” soft key to enter calibration mode
3. Short all phases to neutral using a shorting jumper
4. You can connect the DMM to the output of phase A as shown in the figure above but it is not required for this calibration step.
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

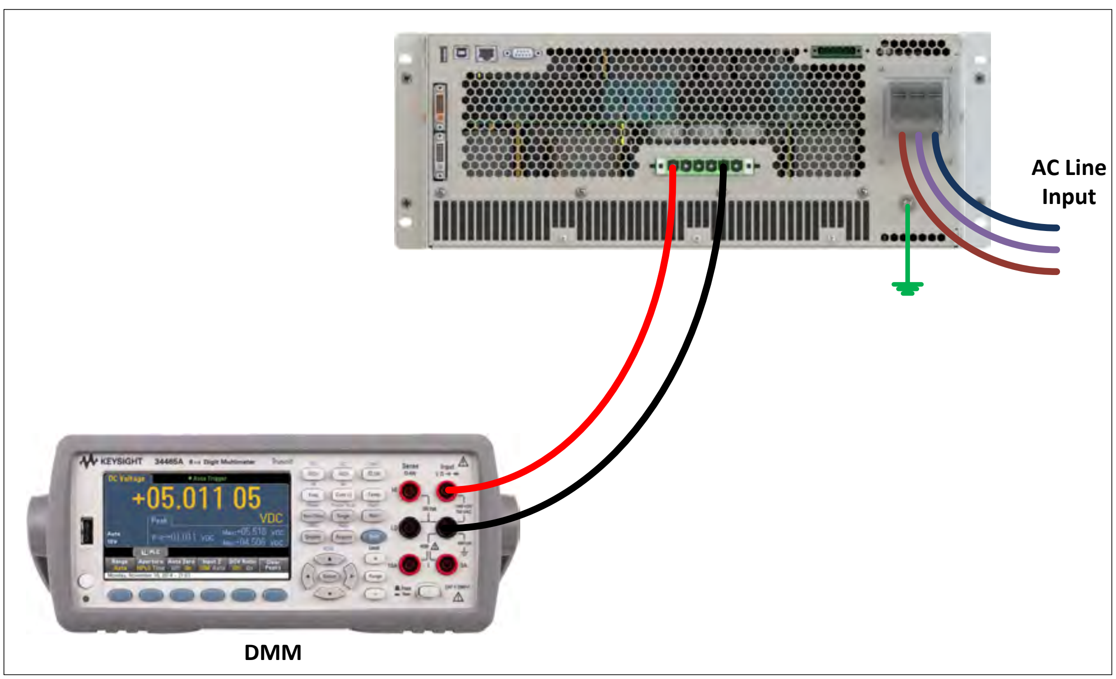



*Figure 11-3: Voltage Calibration – 1 or 3 Phase Mode – Phase A – Standard ADF*

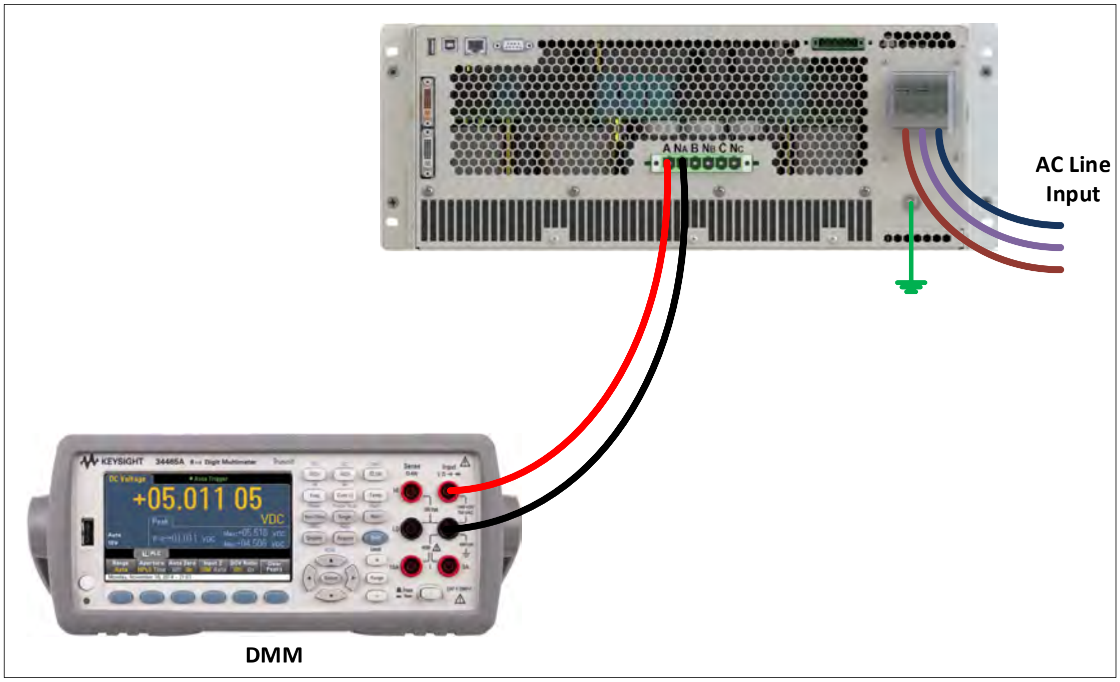
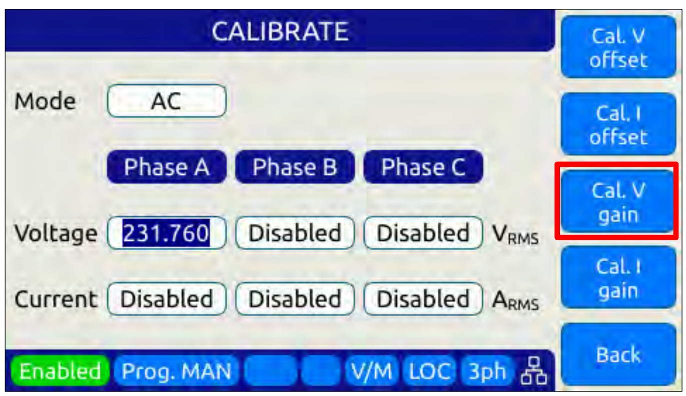



*Figure 11-4: Voltage Calibration – 1 or 3 Phase Mode – Phase A – 3xxxxADF-W*

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 Vrms 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 Vac = 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 Connecter (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**

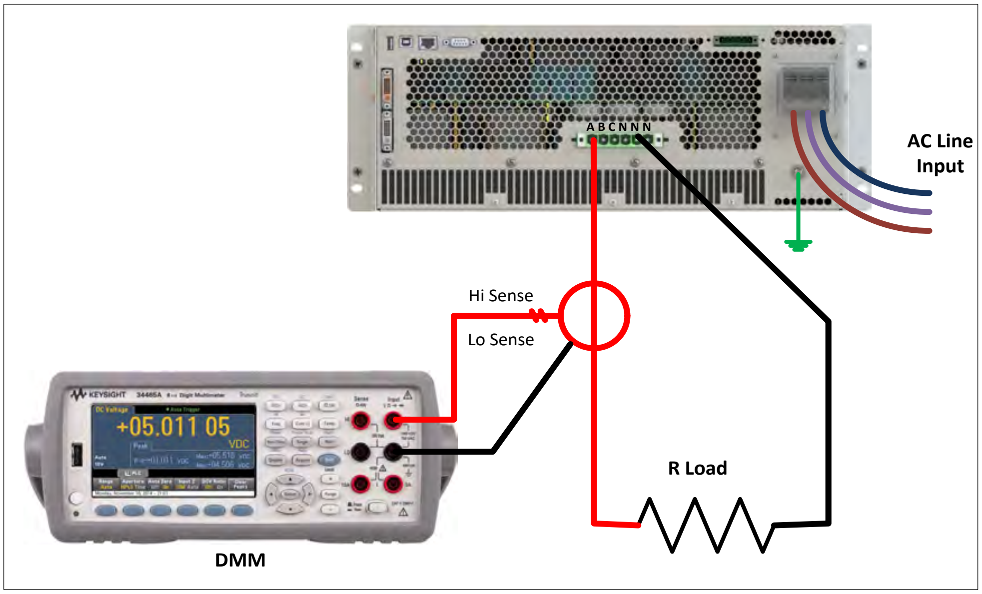



*Figure 11-5: Current Calibration – 3 Phase Mode – Phase A – Standard ADF*

**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.

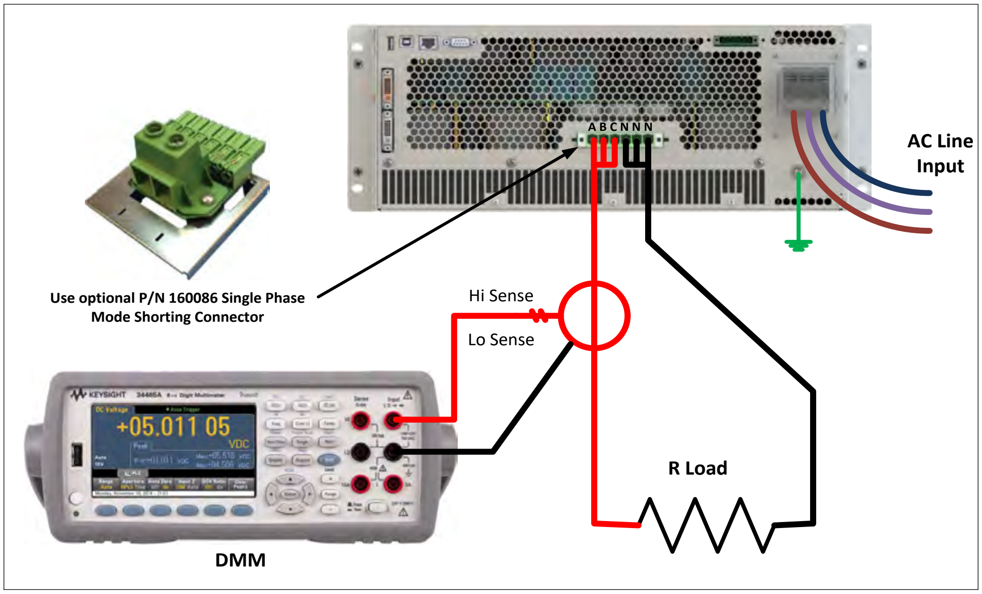



*Figure 11-6: Current Calibration Equipment Setup – 1 Phase Mode*

## 11.4.5 Current Calibration Load Values

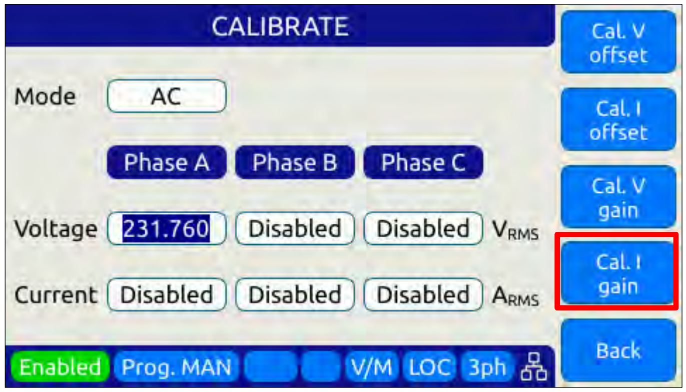
Full-scale current gain calibration is best performed at current levels that are around 90% of full scale current. Since the ADF Series® has only a single voltage range, maximum RMS current is available at 120Vrms L-N for each phase. For single-phase mode, the current is three times higher.  Thus, to 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.

| | | Three & Two Phase Mode | | | Single Phase Mode | | |
|---|---|---|---|---|---|---|---|
| Model | Rating/phs VA/W | Max. Irms/phs | Calibration Current (90%) | Recommended R Load (Ohm) | Max/ Irms | Calibration 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 emprty." | |

| 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 option readings such as measurements or settings.

Gateway devices are available front 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 sources 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 folliwng link under 'documentation':

https://github.com/PPST-Inc/ModbusTCP_Examples

| | 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 | 0 | 0000 | | | | | | | | | | | | | |
| Interface | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1144 | 0478 | | | x | | | | Displacement factor | R | float | 4 | 2 | Floating point number IEEE754 | |
| | 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 | 3000 | 0BB8 | | | | | | | Program frequency | RW | float | 4 | 2 | Floating point number IEEE754 | |
| Program | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | 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 |
| Load | 3257 | 0CB9 | | | | | | | Resistance type output A | RW | uint(16) | 2 | 1 | unsigned int 16 bits | |
| Constant | 3258 | 0CBA | | | | | | | Resistance type output B | RW | uint(16) | 2 | 1 | unsigned int 16 bits | |
| Resistance | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | 3384 | 0D38 | | | | | | | Power type | RW | uint(16) | 2 | 1 | unsigned int 16 bits | 0=APPARENT POWER RMS, 1=ACTIVE POWER RMS |
| Load | 3385 | 0D39 | | | | | | | Power type output A | RW | uint(16) | 2 | 1 | unsigned int 16 bits | |
| Constant | 3386 | 0D3A | | | | | | | Power type output B | RW | uint(16) | 2 | 1 | unsigned int 16 bits | |
| Power | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | | | | | | | | | | | | | | | |
| | 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 | |
| | | | | | | | | | | | | | | | |
| 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 | | | | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5015 | 1397 | x | | | x | | | Output C Peak voltage protection | RW | bool | | | | |
| | 5016 | 1398 | x | | | x | | | Peak power protection | RW | bool | | | | |
| | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | | | | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| Configuratio n | 6000 | 1770 | | | | | | | Ramp time | RW | float | 4 | 2 | Floating point number IEEE754 | 0.222 Seconds |
| Slew | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Configuratio n | 8000 | 1F40 | | | | | | | Configuration form | RW | uint(16) | 2 | 1 | unsigned int 16 bits | 1=SINGLE, 2=SPLIT, 3=THREE |
| Unit | 8001 | 1F41 | | | | | | | Configuration voltage range | RW | uint(16) | 2 | 1 | unsigned int 16 bits | 0=LOW, 1=HIGH |
| Settings | 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 | |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| | 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 RESISTANCE, 2=CONSTANT POWER |
| | 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#? |

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 64256 | FB00 | | | | | | | SCPI Command last answer | | | 1024 | 512 | ASCII | 0.000,0.000,0.000,0.000 |
| | 64769 | FD01 | x | | | x | | | SCPI Char 16 endianess | RW | bool | | | Coils : Endianess | 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 folliwng link in the 'python' directory:

https://github.com/PPST-Inc/ModbusTCP_Examples

This example codes 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<br>Conducted RF Immunity 0.15 – 80 MHz @ 3 Vrms | |
| Electrostatic Discharge | IEC 61000-4-2:2008<br>± 4 kV contact discharge<br>± 8 kV air discharge | |
| Electrical Fast Transient/Burst | IEC 61000-4-4:2004+A1:2010<br>AC or DC power ports, ± 2.0 kV<br>Signal and I/O ports, ± 1.0 kV | |
| Surge | IEC 61000-4-5:2006<br>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<br>30 A/m | |

**Supplemental Information:**

| | |
|---|---|
| **When and Where Issued** | September 28, 2022<br>Irvine, California, USA |
| **Authorized Signatory** | Mitchel Orr,<br>Quality Manager, acting<br>Pacific Power Source |
| **Responsible Person** | Mitchel Orr,<br>Pacific Power Source, Inc.<br>2802 Kelvin Ave, Suite 100<br>Irvine CA, 92614 |

**Mark of Compliance**

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