PACIFIC POWER SOURCE
2802 Kelvin Ave, Ste 100, Irvine, CA, 92614 USA

APPLICATION NOTE

AFX
ADF
AZX
LMX
LSX

Over Voltage Peak Protection Functions

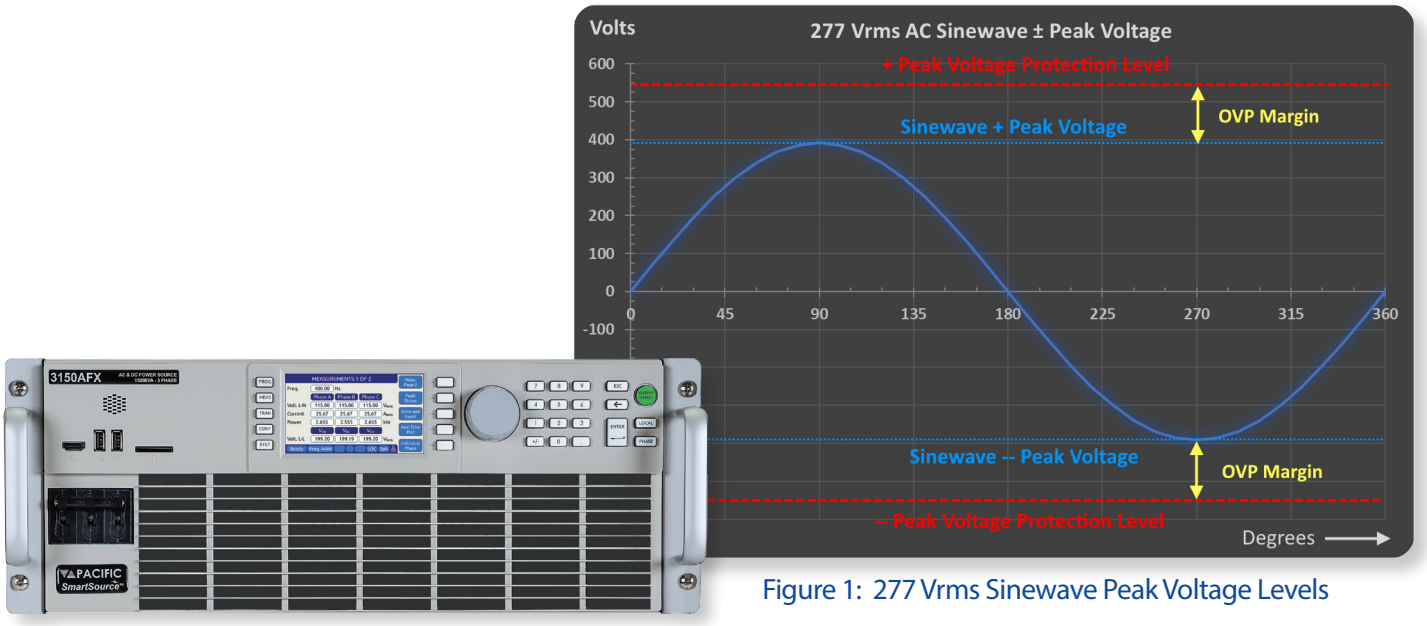


Figure 1: 277 Vrms Sinewave Peak Voltage Levels

Abstract

This application note explains the purpose and operation of the voltage peak protection function available on Pacific Power AFX, ADF, AZX, LMX and LSX Series programmable power source products. Voltage Peak Protection can prevent isolation break down of circuits on the unit under test when subjected to excessive voltage levels. It may also be used to detect abnormal interactions between the power source and the unit under test that can result in overshoot or ringing of the voltage and shut down the power source output quickly.

Peak Voltage Limits

The limiting factor for combining AC and DC output voltage together when in AC+DC mode is the maximum supported peak voltage, not just the AC RMS range or DC voltage range. The peak voltage protection limit level however can be set lower than the maximum capability of the power source model used. For example, a 3150ADF AC power source has a 300Vrms voltage range so the maximum peak voltage using a sine waveform is 300 x Sqrt(2) = ±424 Vpeak. Most power source will have some additional margin to allow short voltage transients to exceed this level so a typical maximum peak voltage would be around ±440pk to ±450Vpk.

The AFX allows a maximum trip level setting of 550V peak.

An example of the ratio between Vrms, waveform crest factor and peak voltage is shown in Figure 1. For of a sinewave programmed to 277 Vrms, which has a ±400V peak voltage, well below the maximum Peak Voltage Protection setting of 550 Volts.

Arbitrary Waveform Impact on Peak Voltage

AC power sources capable of arbitrary waveforms may have applications with higher crest factors waveforms but the maximum peak voltage of the AC source is determined by the internal DC bus voltage. As such, the maximum supported peak voltage remains the same, regardless of waveform selected.

This means higher crest factor waveshapes will not support the full 300Vrms voltage range. A lower maximum Vrms set value will result from using such higher crest factor custom waveforms.

For more details and the impact of adding a DC offset to any AC waveform, refer to application note "AFX Series AC Voltage + DC Voltage Setting Ranges".

OVP Protection Operation

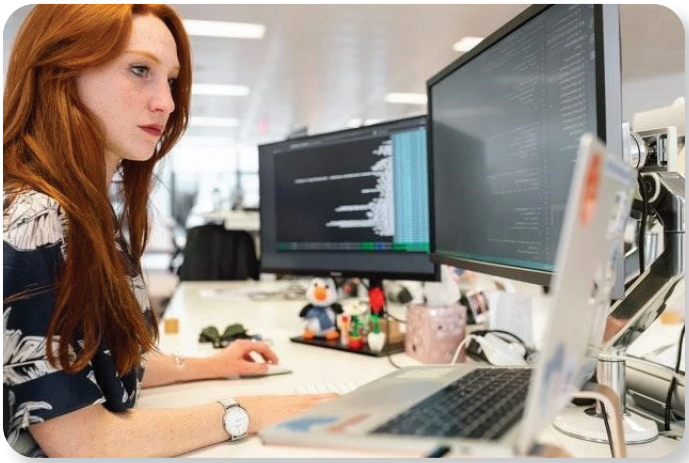
The overvoltage protection (OVP) mode supported on Pacific Power's AC sources is based on an instantaneous voltage trip level, not an RMS level. The "margin" set by the user determines how much additional voltage peak is allowed before tripping an OVP fault and turning off the output.

When the OVP Margin setting mode is used, the controller adds that value to the peak value of the programmed waveform.

For example, if you have a 50V OVP margin set point and a 100 Vrms sinewave, the OVP will trip with 50+ 100 * 1.41 = 191 Vpeak (1.41 is the ratio of the peak voltage of the sinewave versus its RMS value, a.k.a. the voltage wavefrom crest factor).

Because this protection is instantaneous, any ringing or voltage transient can make the OVP protection trip. Therefore, it is recommended to set a higher margin.

As an alternative to using this OVP Margin setting, the user can opt to set an absolute OVP trip level instead. This mode will apply a fixed OVP trip level that does not adjust with the programmed RMS Voltage and or the waveform crest factor.



OVP Protection Programming Commands

All Pacific Power Sources use SCPI standard command syntax so the commands referenced below work the same on all model series covered by this application note.

To enable (1) or disable (0) this protection mode, use this command:

SOURce:PROTect:PEAK:VOLTage:MODE 1

or

SOURce:PROTect:PEAK:VOLTage:MODE 0

The command that defines or returns the voltage peak protection fault trip level setting as a margin over expected peak voltage is:

Setting: **SOURce:PROTect:PEAK:VOLTage:MARGin <nr2>**

Query: **SOURce:PROTect:PEAK:VOLTage:MARGin?**

An alias for this command is:

Setting: **VPEAK:MARGin <nr2>**

Query: **VPEAK:MARGin?**

Both commands accomplish the same thing. Note that for three phase power sources, the protection margin can be set separately for each phase. This requires specifying the phase as part of the command using 1 for phase A, 2 for B and 3 for C:

SOUR:PROT:PEAK:VOLT1:MARG 320.0

SOUR:PROT:PEAK:VOLT2:MARG 300.0

SOUR:PROT:PEAK:VOLT3:MARG 280.0

The order is not important and all three commands can be combined in a single command string as in:

SOUR:PROT:PEAK:VOLT1:MARG 320.0;:SOUR:PROT:PEAK:VOLT2:MARG 300.0;:SOUR:PROT:PEAK:VOLT3:MARG 280.0

The corresponding query command can be used to query individual phase OVP Margin settings as well but cannot be concatenated in a single command string so three queries are required:

>**SOUR:PROT:PEAK:VOLT1:MARG?**

320.000

>**SOUR:PROT:PEAK:VOLT2:MARG?**

300.000

>**SOUR:PROT:PEAK:VOLT3:MARG?**

280.000

To determine the maximum set value for a given unit, use the MAX query command:

>**SOURce:PROTect:PEAK:VOLTage:MARGin:MAXimum?**

550.000

An alternative OVP level definition as discussed can be used to set the absolute trip level of the voltage:

SOURce:PROTect:PEAK:VOLTage:LEVel

SOURce:PROTect:PEAK:VOLTage:LEVel?

The related command to determine the maximum set value for a given unit is:

>**SOURce:PROTect:PEAK:VOLTage:LEVel:MAXimum?**

550.000

The OVP margin approach is more practical as it minimizes false tripping of the peak voltage protection when the voltage set point is changed. The absolute approach results in a fixed trip level.

Customer Support

For application support, contact Pacific Power Source's Customers Service - Toll Free US: +1 (800) 854-2433 or your local authorized Pacific Power Source distributor or send an email to support@pacificpower.com.

PACIFIC® POWER SOURCE
2802 Kelvin Ave, Suite 100
Irvine, CA 92614 USA
Phone: +1 949.251.1800
Fax: +1 949.756.0756
Toll Free: 800.854.2433
Email: sales@pacificpower.com
www.pacificpower.com