Operation Manual

CFS300 Series – Rev 1.12 P/N 160952-10

CFS300 Series Programmable AC & DC Power Supply

ADAPTIVE POWER SYSTEMS™

ADAPTIVE Power Systems

Worldwide Supplier of Power Equipment

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1 Contact Information

AMERICA / CANADA

Adaptive Power Systems
Irvine, USA
Phone: +1(949) 752-8400
Fax: +1 (949) 756-0838
Email: support@adaptivepower.com

EUROPE

Caltest Instruments GmbH.
Kappelrodeck
Phone: +49(0)7842-99722-00
Fax: +49(0)7842-99722-29
Email: support@adaptivepower.com

CHINA

PPST Shanghai Co. Ltd.
Shanghai, China
Phone: +86-21-6763-9223
Fax: +86-21-5763-8240
Email: support@adaptivepower.com

Web: http://www.adaptivepower.com

2 Front Matter

2.1 Limited Warranty

Adaptive Power Systems, Inc. (APS) warrants each unit to be free from defects in material and workmanship. For the period of one (1) years from the date of shipment to the purchaser, APS will either repair or replace, at its sole discretion, any unit returned to the APS factory in Irvine, California or one of its designated service facilities. It does not cover damage arising from misuse of the unit or attempted field modifications or repairs. This warranty specifically excludes damage to other equipment connected to this unit.

Upon notice from the purchaser within (30) days of shipment of units found to be defective in material or workmanship, APS will pay all shipping charges for the repair or replacement. If notice is received more than thirty (30) days from shipment, all shipping charges shall be paid by the purchaser. Units returned on debit memos will not be accepted and will be returned without repair.

This warranty is exclusive of all other warranties, expressed or implied.

2.2 Service and Spare Parts Limited Warranty

APS warrants repair work to be free from defects in material and workmanship for the period of ninety (90) days from the invoice date. This Service and Spare Parts Limited Warranty applies to replacement parts or to subassemblies only. All shipping and packaging charges are the sole responsibility of the buyer. APS will not accept debit memos for returned power sources or for subassemblies. Debit memos will cause return of power sources or assemblies without repair.

This warranty is exclusive of all other warranties, expressed or implied.

2.3 Safety Information

This chapter contains important information you should read BEFORE attempting to install and power-up APS 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)

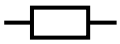
Both direct and alternating current

Three-phase alternating current

Protective Earth (ground) terminal

On (Supply)

Off (Supply)



Fuse

Caution: Refer to this manual before using this Product.

Caution, risk of electric shock

2.4 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. Adaptive Power Systems assumes no liability for the customer's failure to comply with these requirements.

GENERAL

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.

ENVIRONMENTAL CONDITIONS

This instrument is intended for indoor use in an installation category I, pollution degree 2 environments. It is designed to operate at a maximum relative humidity of 80% and at altitudes of up to 2000 meters / 6560 feet. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

GROUND THE INSTRUMENT

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the AC power source mains through a properly rated power cord, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. 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.

FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired Fuses or short circuit the fuse holder. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

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

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. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT EXCEED INPUT RATINGS.

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

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 an Adaptive Power Systems 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.

3 Product Overview

This chapter provides an overview of the APS CFS300 Series programmable, AC and DC power sources. It introduces the reader to general operating characteristics of these power sources. Operational information and menu navigation details are provided in Section 6, “Front Panel Operation” on page 59.

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3.1 General Description

The APS CFS300 Series consists of two models at output power levels of 3000VA and 6000VA. Each model has similar electrical performance and operational characteristics except for maximum AC input currents, AC and DC output currents and AC input voltage requirements. Refer to Section 5, “Technical Specifications” for specific AC input specifications by model.

3.1.1 Model CFS330

The CFS330 model offers 3000VA output in AC mode or 1500W output in DC mode. In AC mode, output configurations for single phase, split phase and three phase loads are selectable. The chassis is rack mountable and can also be used floor standing using the included casters. Output voltage is 300Vac in AC mode or 420Vdc in DC mode. The CFS330 requires single phase, 208V or 230V AC utility power input.

3.1.2 Model CFS360

The CFS360 model offers 6000VA output in AC mode or 3000W output in DC mode. In AC mode, output configurations for single phase, split phase and three phase loads are selectable. The chassis is rack mountable and can also be used floor standing using the included casters. Output voltage is 300Vac in AC mode or 420Vdc in DC mode. The CFS360 can be operated from either 230V single phase, 208V three phase Delta or 400V three phase Wye AC utility power input.

3.2 Product Features

The following key characteristics apply to all CFS300 Series models;

- Fully programmable AC and DC output modes
- Single, Split and Three Phase Output modes
- Frequency range in AC mode is 40 Hz to 1000 Hz
- Dual voltage ranges in both modes

- AC voltage ranges are 5-150Vac and 5-300Vac RMS
- DC voltage ranges are 5-210Vdc and 5-420Vdc.
- Programmable Current limit with Fold-Back (CC) and Shutoff Modes (CV)
- Full complement of output parameter metering:
    - Frequency
    - Volt AC or DC
    - Current AC or DC
    - AC Peak Current
    - Current Crest Factor
    - True Power
    - Apparent Power
    - Power Factor
- Over voltage, over current, over power and over temperature protection
- Fan Cooled
- USB and RS232 remote control interfaces
- Remote Interlock

3.3 Operating Modes

The CFS300 Series offers three modes of operation that are user selectable through the **System** soft key.

Mode	Description	Output Mode
PROGRAM	Go/No Go Limit testing for AC powered product. This mode uses one of 50 Memories that store up to nine test steps each. Each test step will apply user set output frequency, voltage and current limit to the unit under test. Duration of each test step is set by the user for each step. During each step, measurements are taken and compared against user set pass/fail limits. Any measurement that falls outside one or more limits results in a FAIL.	AC
MANUAL	MANUAL mode provides interactive operation in AC mode. In this mode, frequency, voltage and current limit can be set. After applying power to the unit under test, all measurements are shown in the Measurement display. Two measurements – one of which is always VOLTAGE - are shown in large font so they can be read from a distance. The other measurements are shown in smaller font in the top portion of the LCD display. The '**Meter**" soft key allows the user to toggle the second large readout between the other available measurements. While in measurement display mode, the shuttle can be used to adjust either voltage or frequency.	AC
DC	DC Mode is the same as MANUAL mode but, provides DC output mode instead. Measurements in DC mode are limited to Voltage DC (Volts), Current DC (Amps) and True Power (Watt)	DC

3.4 Voltage Programming

Voltage settings are similar between PROGRAM, MANAUL and DC modes. Two voltage ranges are available, a LOW (AUTO) range and a HIGH range. Low range is always half the maximum available voltage on the HIGH range. Maximum current in the LOW (AUTO) range is two times that of the HIGH Range. The HIGH range allows the maximum voltage to be programmed.

Range values are different for AC and DC modes as follows:

Mode	LOW RANGE (AUTO)	HIGH RANGE
PROGRAM or MANUAL	5 Vac – 150 Vac RMS (1 Phs) 8.7 Vac – 260Vac (3 Phs)	5 Vac – 300 Vac RMS (1 Phs) 8.7 Vac – 520Vac (3 Phs)
DC	5 Vdc – 210 Vdc	5 Vdc – 420 Vdc

Table 4-1: Available Voltage Ranges by Output Mode

See specifications in Sections 5.1and 5.2 for each mode.

3.4.1 Minimum Voltage

Programming resolution is 0.1V in all modes and on all voltage ranges. **Note** that values below 5Vac or 5Vdc cannot be programmed. At voltage lower than 5V, load regulation and voltage distortion (AC mode) are difficult to maintain.

To apply zero volts to the output, turn the output OFF using the TEST button.

3.4.2 Voltage Range AUTO mode

The CFS will auto range when set to the AUTO (LOW) VOLTAGE range so values over 150Vac or 200Vdc will cause the power source to switch to HIGH range automatically. When set to HIGH Voltage Range, the power source will remain on the high voltage range at all times, regardless of programmed voltage.

Note: If set to AUTO Range, the power source will switch from LOW range to HIGH range when a set value of 150V in AC mode or 200V in DC mode or higher is programmed, either in MANUAL mode or as part of a program memory step in PROGRAM mode.

3.5 Current Protection Modes

Current protection is an important feature on programmable power sources as it allows protection of the unit under test against damage caused by over current conditions. The default setting for current limit is the maximum supported value for the voltage range selected. However, it should be set to a value appropriate for protecting the unit under test, before applying power. Current limit set values are in Aac RMS for AC mode and Adc for DC mode.

Current protection mode is available using one of two modes of operation:

Current Fold-Back: In this mode, load current is limited to the set current limit value by reducing the output voltage. Thus, while in fold back mode, the output voltage will be less than the programmed (set) voltage. As the load impedance increases and thus the load current decreases, the voltage will go up until the load current is at or below the programmed current limit value and the voltage is at the set value.

Current Fault Mode: In this mode, the CFS300 will fault and open the output relay when the load current exceeds the set current limit value for some period of time. This time period depends on the amount of load current. At current levels slightly above the set value, this time may be fairly long. At load currents significantly higher than the set current level – i.e. a short circuit condition - , this period will be very short.

The protection mode selection is available in the System setup menu under “OC Fold”. Available settings are:

- OC Fold = ON Enables voltage fold back mode
- OC Fold = OFF Disables voltage fold back mode

3.6 Voltage & Current Output Profiles

The CFS series provides higher load current at lower voltage as long as the total output power is within its power band. This results in a constant power voltage/current profile as shown in the following charts for each model by output mode (AC or DC), and voltage range (high (300Vac/420Vdc) or low (150Vac/210Vdc)).

3.6.1 CFS330 AC Mode, Single Phase Output VI Curve

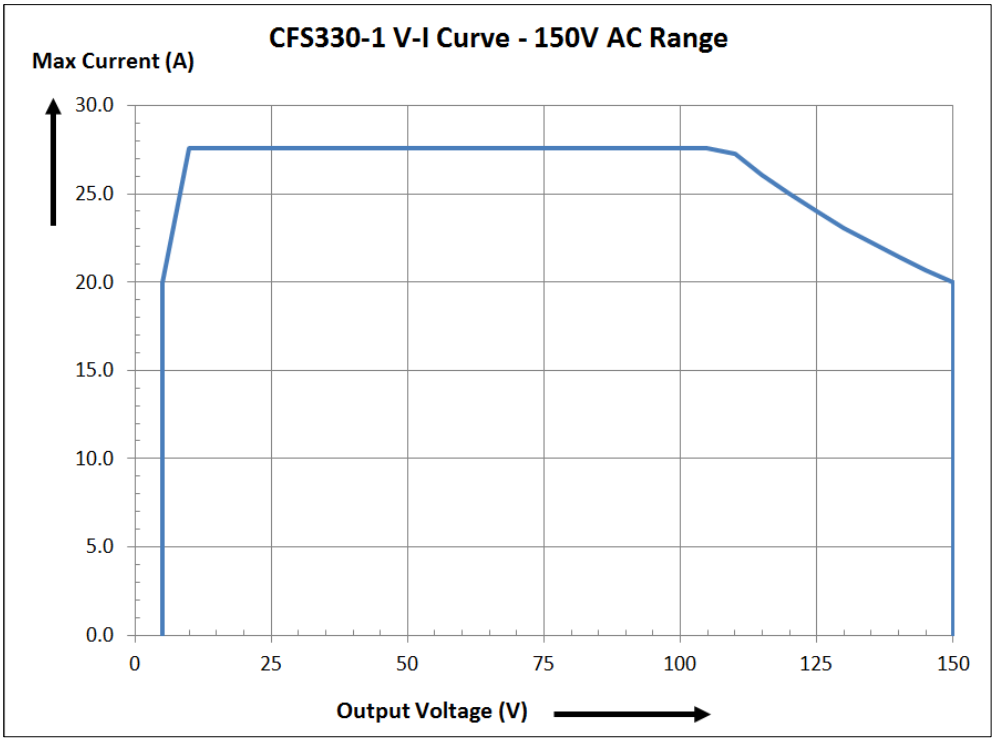


Figure 4-1: CFS330 1 Phase Output AC-VI_Curve-150V_Range

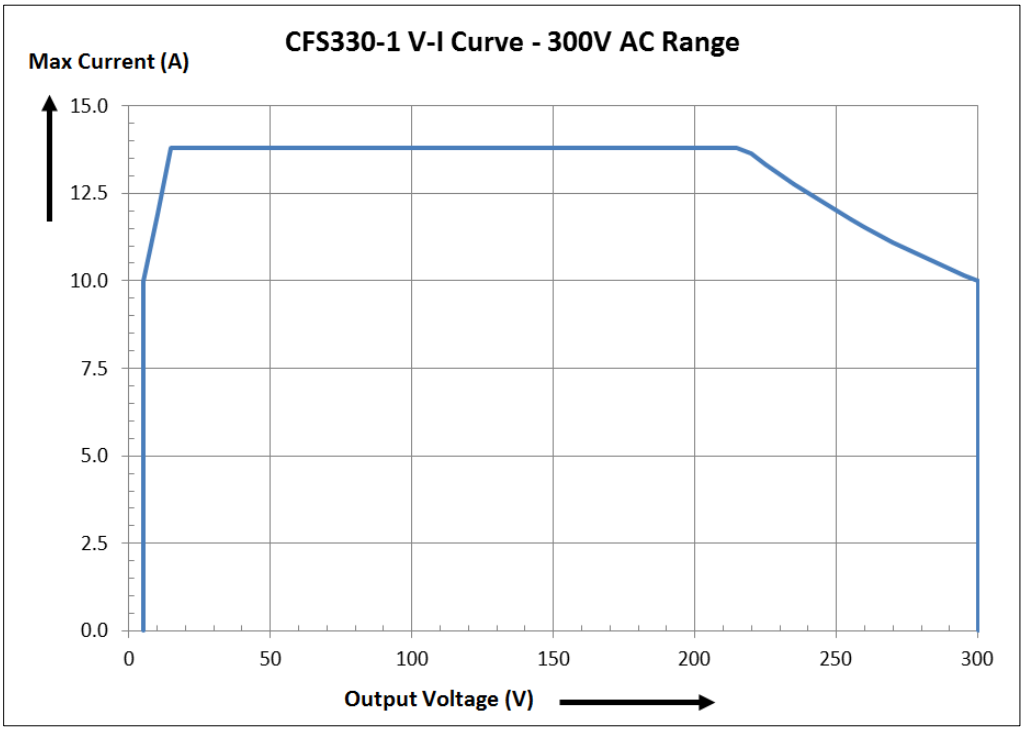


Figure 4-2: CFS330 1 Phase Output-AC-VI_Curve-300V_Range

3.6.2 CFS330 AC Mode, Three Phase Output VI Curve

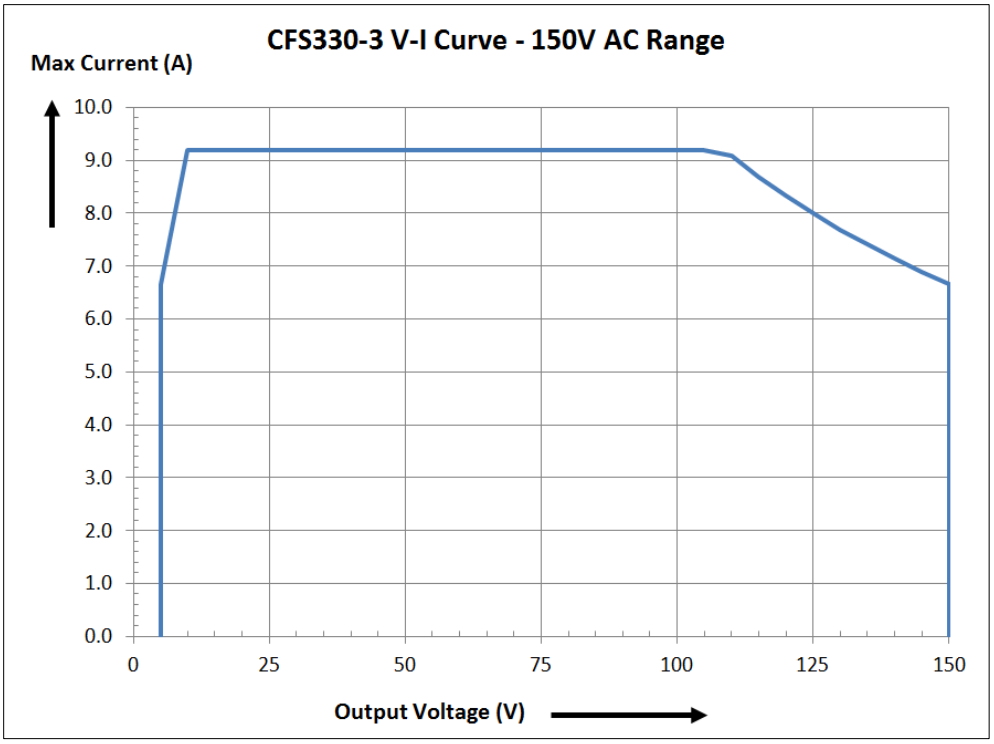


Figure 4-3: CFS330 1 Phase Output-AC-VI_Curve-150V_Range

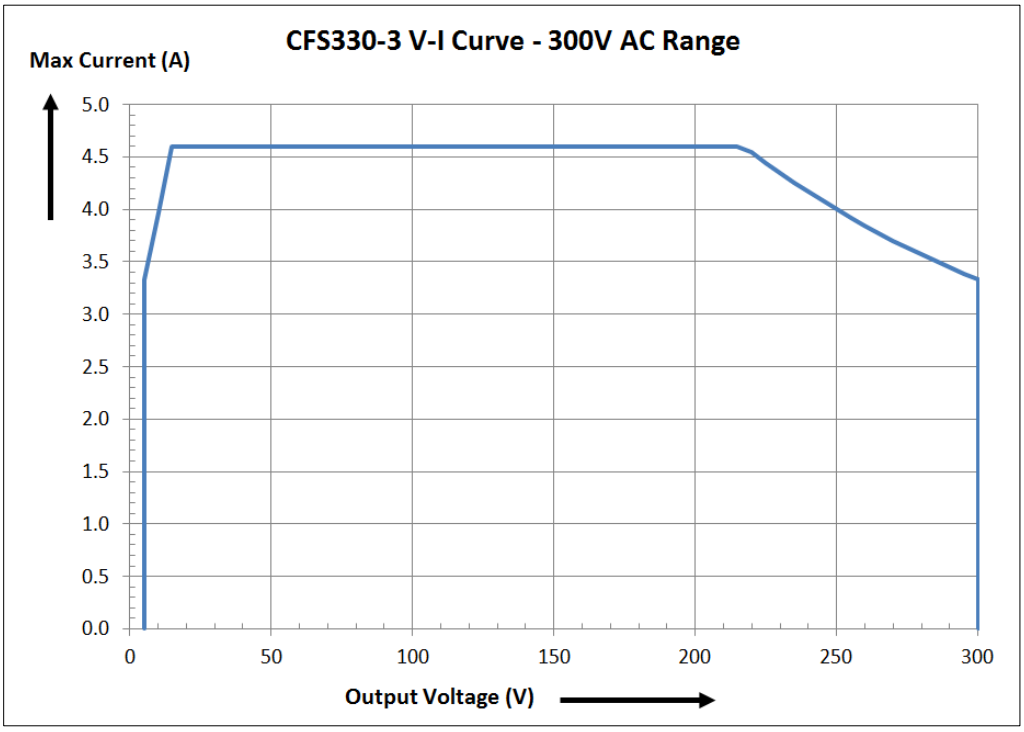


Figure 4-4: CFS330 1 Phase Output-AC-VI_Curve-300V_Range

3.6.3 CFS330 DC Mode VI Curve

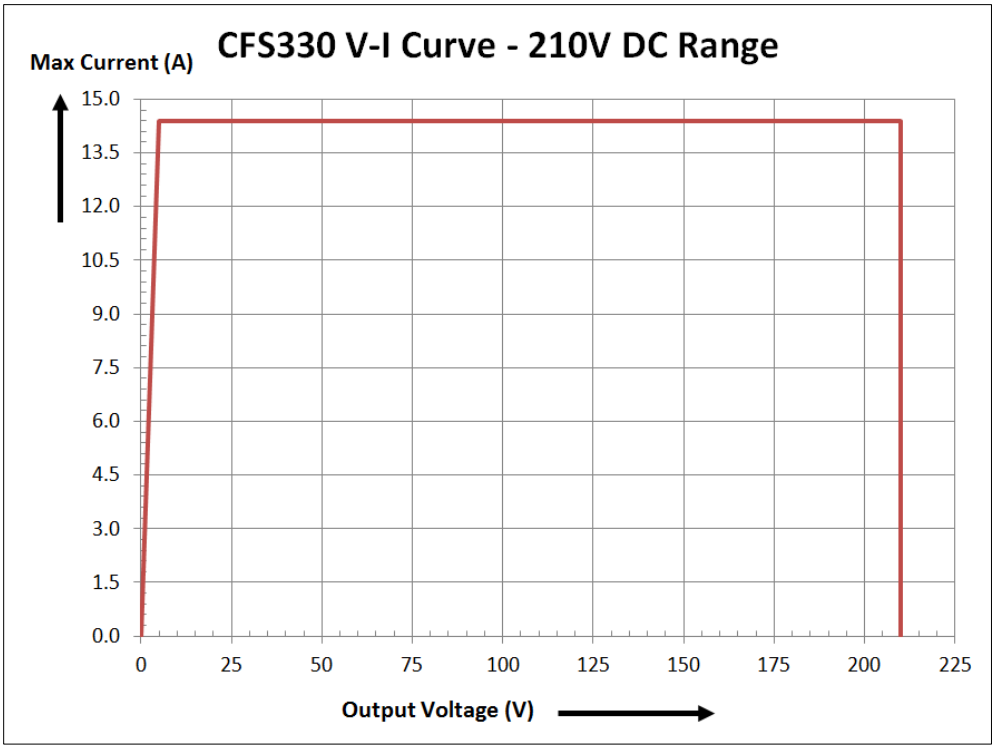


Figure 4-5: CFS330-DC-VI_Curve-210V_Range

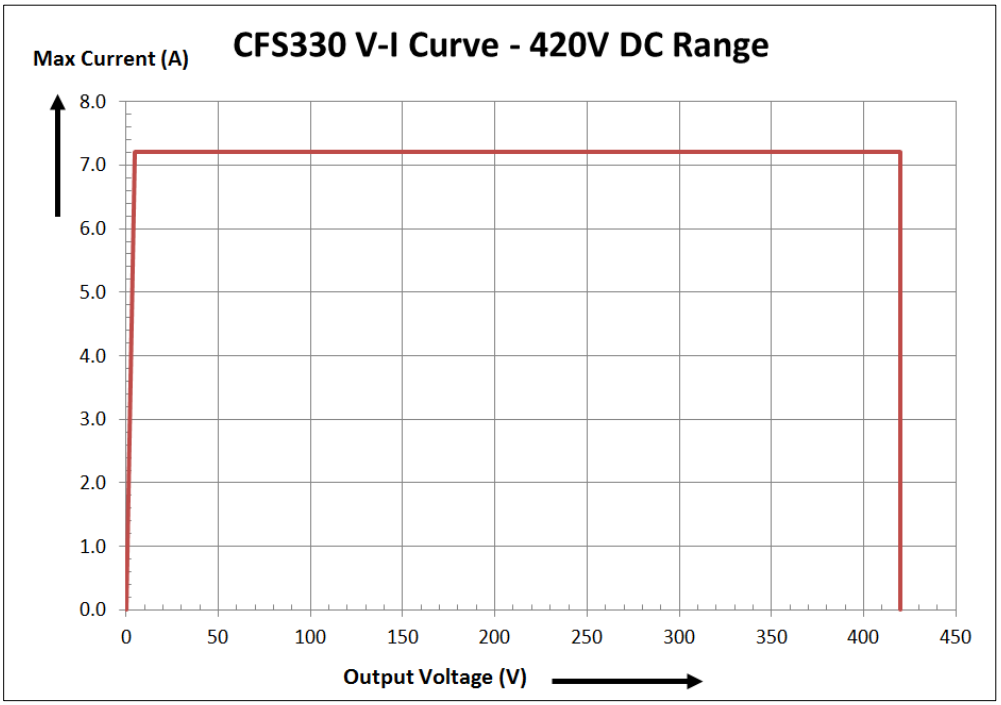


Figure 4-6: CFS330-DC-VI_Curve-420V_Range

3.6.4 CFS360 AC Mode, Single Phase Output VI Curve

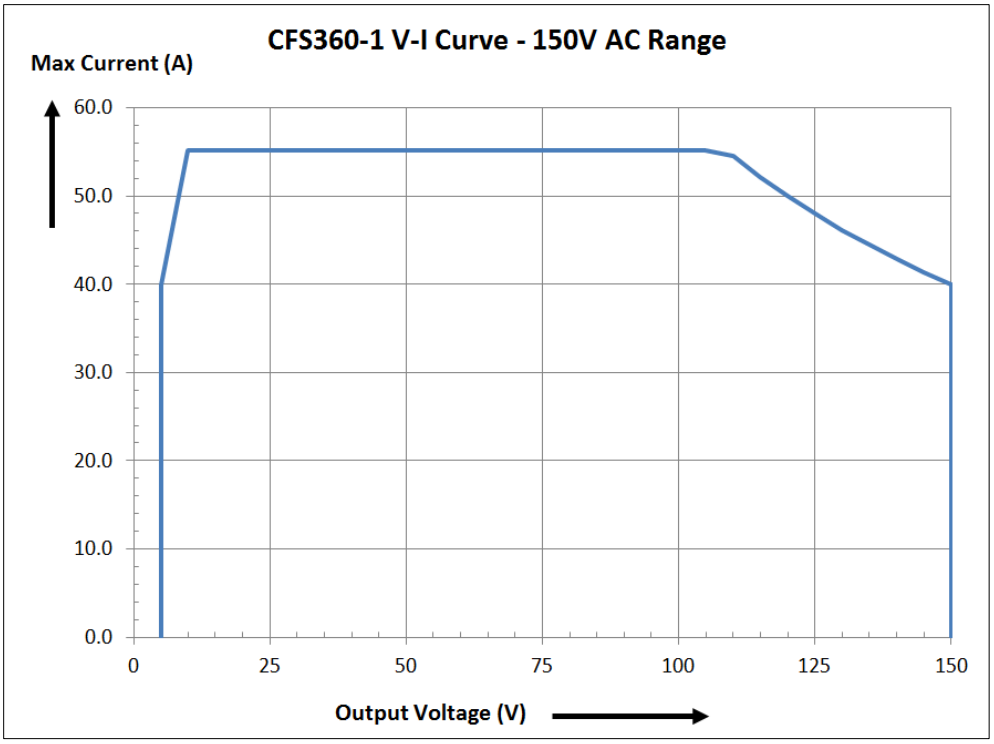


Figure 4-7: CFS360 1 Phase Output AC-VI_Curve-150V_Range

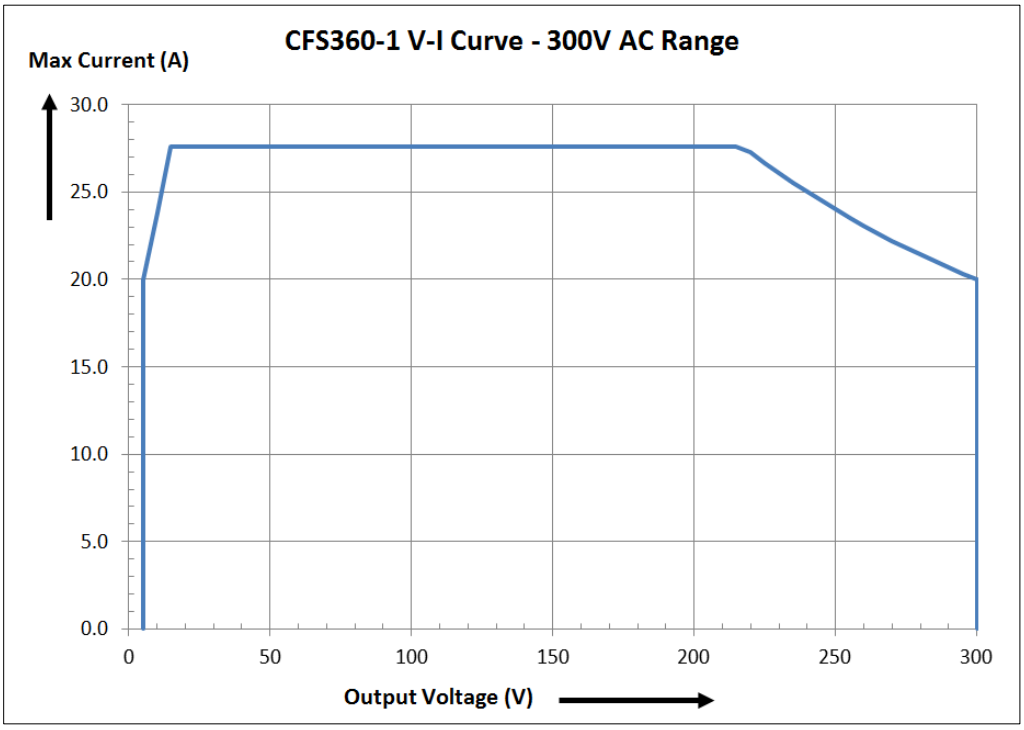


Figure 4-8: CFS360 1 Phase Output AC-VI_Curve-300V_Range

3.6.5 CFS360 AC Mode, Three Phase Output VI Curve

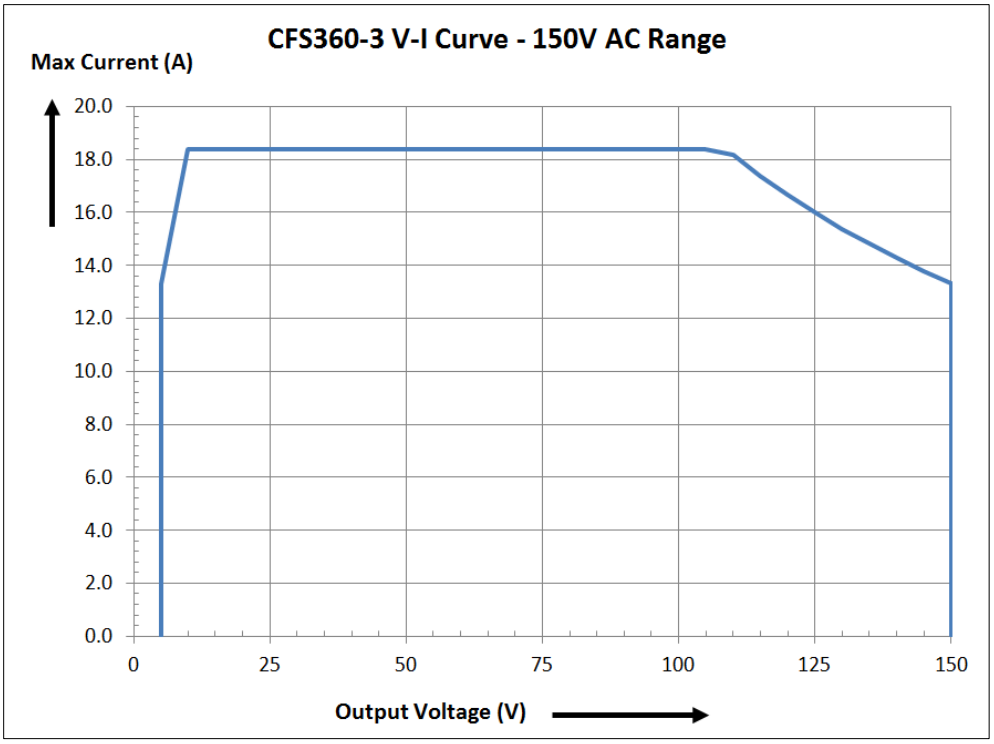


Figure 4-9: CFS360 3 Phase Output AC-VI_Curve-150V_Range

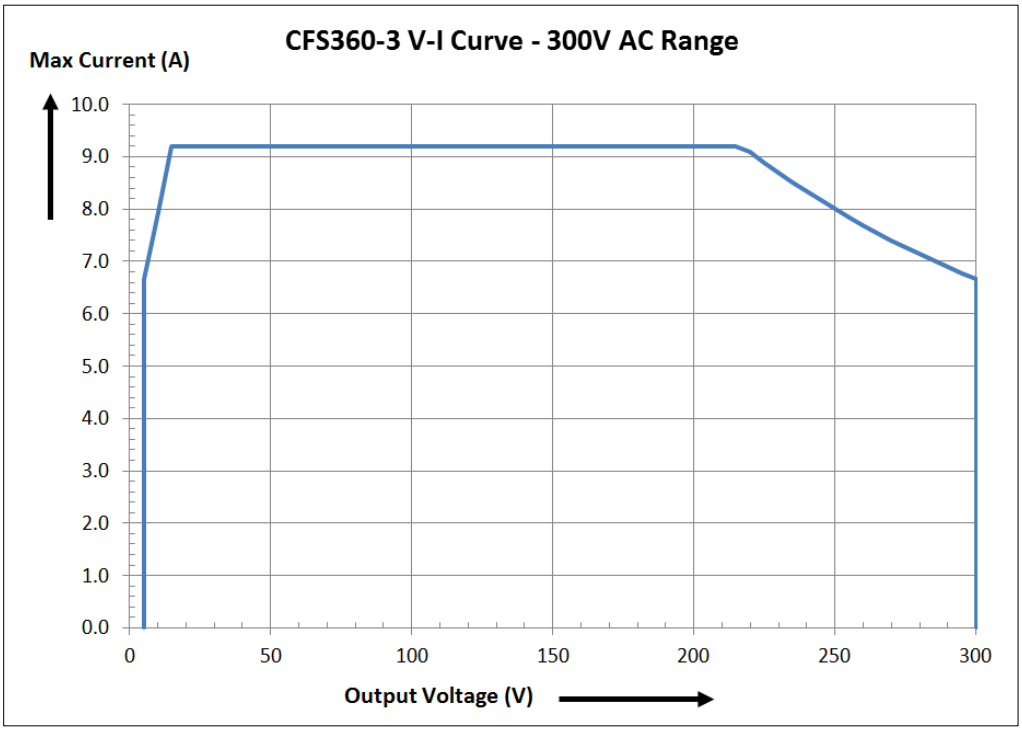


Figure 4-10: CFS360 3 Phase Output AC-VI_Curve-300V_Range

3.6.6 CFS360 DC Mode VI Curve

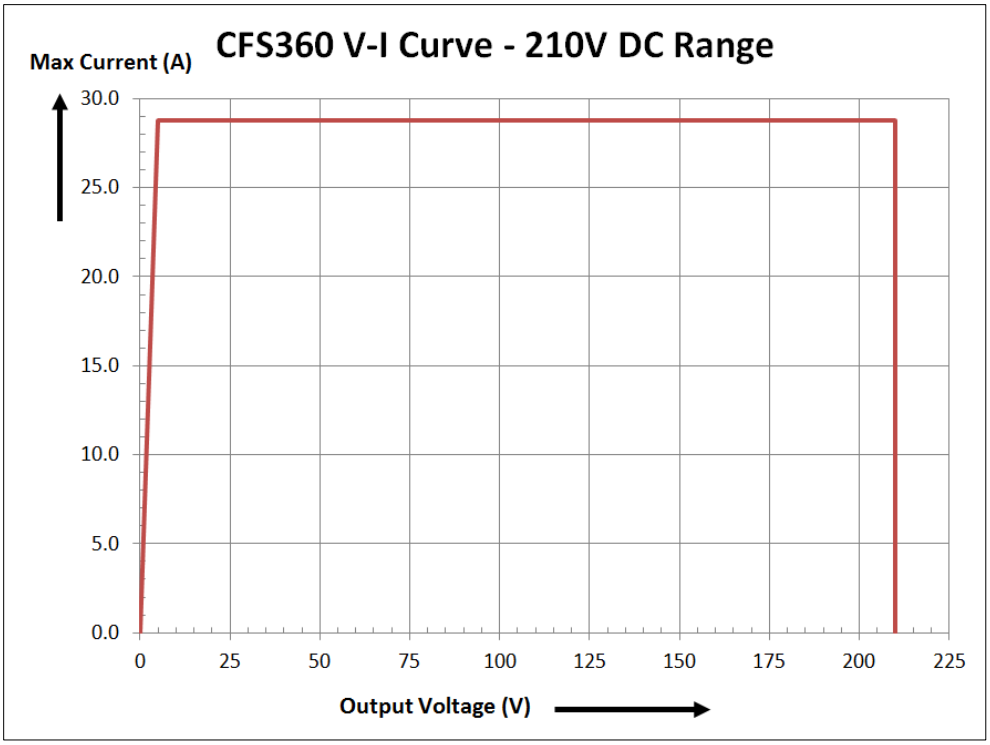


Figure 4-11: CFS360-DC-VI_Curve-210V_Range

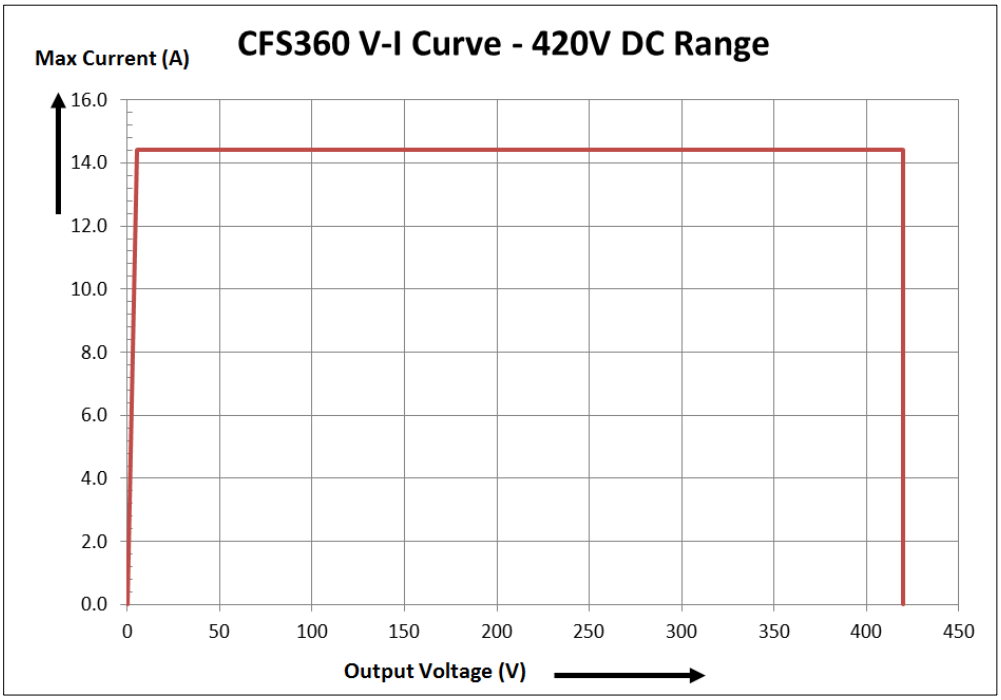


Figure 4-12: CFS360-DC-VI_Curve-420V_Range

4 Technical Specifications

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

4.1 AC Output

OUTPUT SPECIFICATIONS - AC MODE			
MODEL		**CFS330**	**CFS360**
Phase Modes		1ø/2W, 2ø/3W & 3ø/4W	
Output Neutral		Floating Neutral.	
Power Rating	Total Power	3 kVA	6 kVA
	3 & 4W/Phase	1 kVA	2 kVA
	2W	3 kVA	6 kVA
Voltage Auto Range Low/High	1ø/2W (single)	5 - 150VLN / 5 - 300VLL	
	2ø/3W (split)	5 - 300VLL / 5 - 600VLL	
	3ø/4W (three)	8.6 - 260VLL / 8.6 - 520VLL	
	Resolution	0.1 V	
	Accuracy	± (0.2% setting + 0.3 V)	
Current-2W	0-150V	27.6 A	55.2 A
	0-300V	13.8 A	27.6 A
Current-3W /4W	0-150V	9.2 A	18.4 A
	0-300V	4.6 A	9.2 A
OC Fold-back Response		< 1.4 secs	
Peak Cur. 2W	0-150V	110.4 A	220.8 A
	0-300V	55.2 A	110.4 A
Peak Cur. 3W /4W	0-150V	36.8 A	73.6 A
	0-300V	18.4 A	36.8 A
Crest Factor		≥ 3 to 1	
Frequency	Range	40 - 1000 Hz	
	Resolution	0.1 Hz from 40.0-99.9 Hz / 1 Hz from 100 - 1000 Hz	
	Accuracy	± 0.03% Setting	
	Range	0 - 359°	

OUTPUT SPECIFICATIONS - AC MODE		
Start/Stop Phase	Accuracy	±1%, 45- 65 Hz
Harmonic Distortion (Full Resistive Load)		< 0.5% 40-70 Hz, 80-140VLN on Low Range, 160-280VLN on High Range
		< 1.0% > 70 Hz, 80-140VLN on Low Range, 160-280VLN on High Range
Line Regulation		± 0.1 V for a 10% Line Change
Load Regulation		± 1.0% Range + 1V, R Load
Response time		< 400 usec
Protection		Over Current, Short Circuit, Over Voltage, Under Voltage, Over Temperature

4.2 DC Output

OUTPUT SPECIFICATIONS - DC MODE			
MODEL		**CFS330**	**CFS360**
Power Rating		3 kW	6 kW
DC Voltage Ranges		5 -210Vdc / 5 - 420Vdc	
	Resolution	0.1 Vdc	
	Accuracy	± (0.2% Setting + 0.3V)	
Ripple & Noise RMS		210 Rng <700 mV, 420 Rng <1100 mV	
Ripple & Noise p-p		< 4.0 Vpp	
Max. Current	210V Rng	14.4 A	28.8 A
	420V Rng	7.2 A	14.4 A
	Accuracy	± (2.0% Setting + 0.2 A)	

4.3 Metering – AC Mode – Single Phase Mode

MEASUREMENT SPECIFICATIONS -SINGLE PHASE MODE			
MODEL		**CFS330**	**CFS360**
Frequency	Range	0.0 - 1000.0 Hz	
	Resolution	0.1 Hz	
	Accuracy	± 0.1Hz < 500Hz, ± 0.2Hz > 500Hz	
Voltage AC	Range	0 – 420 Vrms	
	Resolution	0.1 V	
	Accuracy	± (0.2% of reading + 0.3V)	
Current RMS	Range	0.05 - 39.00 A	0.05 - 78.00 A
	Accuracy	± (1% of reading + 0.05 A) CF < 1.5 and Current (peak) ≤ 82.8 A	± (1% of reading + 0.05 A) CF < 1.5 and Current (peak) ≤ 165.6 A
Current Peak	Range	0.0 - 114.0 A	0.0 - 228.0 A
	Accuracy	± (1% of reading + 0.5A @ 40.0-70.0 Hz ± (1.5% of reading + 1A @ 70.1 - 500 Hz ± (1.5% of reading + 1A @ 501 - 1000 Hz and CF<1.5	
Power	Range	0 - 3900 W	0 - 7800 W
	Accuracy	±(2% of reading+5 W) @ 40.0-500Hz, PF>0.2 ±(2% of reading+15 W) @ 501-1000Hz, PF>0.5	
App. Power	Range	0 - 3900 VA	0 - 7800 VA
	Accuracy	V x A, Calculated	
React. Power	Range	0 - 3900 VAR	0 - 7800 VAR
	Accuracy	Sqrt(VA^2 x W^2), Calculated	
Freq., Power & Crest Factor		See Three & Two Phase Mode	

4.4 Metering – AC Mode – Three & Two Phase Mode

MEASUREMENT SPECIFICATIONS - THREE & TWO PHASE MODE				
MODEL			**CFS330**	**CFS360**
Frequency	Range		0.0 - 1000.0 Hz	
	Resolution		0.1 Hz	
	Accuracy		± 0.1Hz < 500Hz, ± 0.2Hz > 500Hz	
Voltage AC	Range		0 – 420 Vrms	
	Resolution		0.1 V	
	Accuracy		± (0.2% of reading + 0.3V)	
Current RMS	Range	L	0.005 - 1.200 A	0.005 - 2.400 A
		H	1.00 - 13.00 A	2.00 - 26.00 A
	Accuracy	L	± (1% of reading + 0.005 A) CF < 1.5 and peak Curr. ≤ 3.6 A	± (1% of reading + 0.005 A) CF < 1.5 and peak Curr. ≤ 7.2 A
		H	± (1% of reading + 0.05 A) CF < 1.5 and peak Curr. ≤ 27.6 A	± (1% of reading + 0.05 A) CF < 1.5 and peak Curr. ≤ 55.2 A
Current Peak	Range		0.0 - 38.0 A	0.0 - 76.0 A
	Accuracy		± (1% of reading + 0.5A @ 40.0-70.0 Hz ± (1.5% of reading + 1A @ 70.1 - 500 Hz ± (1.5% of reading + 1A @ 501 - 1000 Hz and CF<1.5	
Power	Range	L	0.0 - 120.0 W	0.0 - 240.0 W
		H	100 - 1300 W	200 - 2600 W
	Accuracy	L	±(2% of reading+1.5 W) @ 40.0-500Hz, PF>0.2 ±(2% of reading+3 W) @ 501-1000Hz, PF>0.5	
		H	±(2% of reading+5 W) @ 40.0-500Hz, PF>0.2 ±(2% of reading+15 W) @ 501-1000Hz, PF>0.5	
Power Factor	Range		0.000 - 1.000	
	Accuracy		W / VA, Calculated to 3 digits	
App. Power	Range	L	0.0 - 120.0 VA	0.0 - 240.0 VA
		H	100 - 1300 VA	200 - 2600 VA
	Accuracy		V x A, Calculated	
React. Power	Range	L	0.0 - 120.0 VAR	0.0 - 240.0 VAR
		H	100 - 1300 VAR	200 - 2600 VAR

MEASUREMENT SPECIFICATIONS - THREE & TWO PHASE MODE		
	Accuracy	Sqrt(VA^2 x W^2), Calculated
Crest Factor	Range	0.00 - 10.00
	Accuracy	Ap / A, Calculated to 2 digits

4.5 Metering – DC Mode

MEASUREMENT SPECIFICATIONS -DC MODE			
MODEL		**CFS330**	**CFS360**
Voltage DC	Range	0.0 - 420.0 Vdc	
	Accuracy	± (0.2% Setting + 0.3V)	
Current DC	Range	0.05 - 19.50 Adc	0.05 - 39.00 Adc
	Accuracy	± (1.0% Setting + 0.05 Adc)	
Power	Range	0 - 3900 W	0 - 7800 W
	Accuracy	± (2.0% Setting + 5 W)	

4.6 Protection Modes

PROTECTION MODES	
Available Modes	
Over Temperature (OPT)	Heatsink temperature exceeds 130° C. Test/Reset LED blinks.
Over Voltage Protection (OVP)	Trips when output voltage exceeds more than 5V over the set voltage on the 150V range or more than 10V over the set voltage on the 300V range. Test/Reset LED blinks. If an OVP error occurs, the display will show Volt Err on the next power up cycle.
Over Current Protection (OCP)	Trips when load current exceeds 110% of maximum output current rating for more than one second or there is a short-circuit at the output for less than one second. Test/Reset LED blinks.
Over Power Protection (OPP)	Trip when output power exceeds 110% of maximum rated power for more than one second. Test/Reset LED blinks.
Low Voltage Protection (LVP)	Trips when output voltage is more than 10V different from the voltage set point and over current fold back is not in effect. Test/Reset LED blinks.
Amplifier Shutdown (A-SH)	Trips if the output amplifier is in an abnormal condition. Test/Reset LED blinks.

PROTECTION MODES	
Reverse Current Protection (RPC)	Displayed if the power source detects negative current feeding back into the source. RCP will trip when negative power exceeds 75W. Test/Reset LED blinks.
LVP Low Voltage Protection (LVP)	Displayed if the power source detects a discrepancy between the output voltage and the set voltage greater than 10V for more than one second. Test/Reset LED blinks.

4.7 AC Input

AC INPUT SPECIFICATIONS			
MODEL		**CFS330**	**CFS360**
Input Phases		1ø	1ø or 3ø
Input Voltage	1ø Input	200-240Vac±10%	200-240Vac±10% LN
	3ø Input, 3W Delta		200-240Vac±10% LL
	3ø Input, 4W Wye		346-416Vac±10% LL
Max. Input Current		23A	1ø: 45A
			3ø, 3W: 26A
			3ø, 4W: 26A
Max. VA Input Power		4 kVA	8 kVA
Frequency		47 - 63 Hz	
Input Power Factor		PFC, > 0.97 @ Full Load	
Efficiency		> 78% @ Full Load	
AC Input to Output Isolation		Output is galvanically isolated from the power source AC Input (primary to secondary double insulation)	
Isolation Voltage AC Input to Output		3047 Vrms / 4309 Vdc	

Note: AC input current values shown in the table above apply under full power output conditions. The actual AC input power will be a function of the output power and is shown by model in the charts on the next page.

4.7.1 AC Input Power vs AC Output Power – Model CFS330

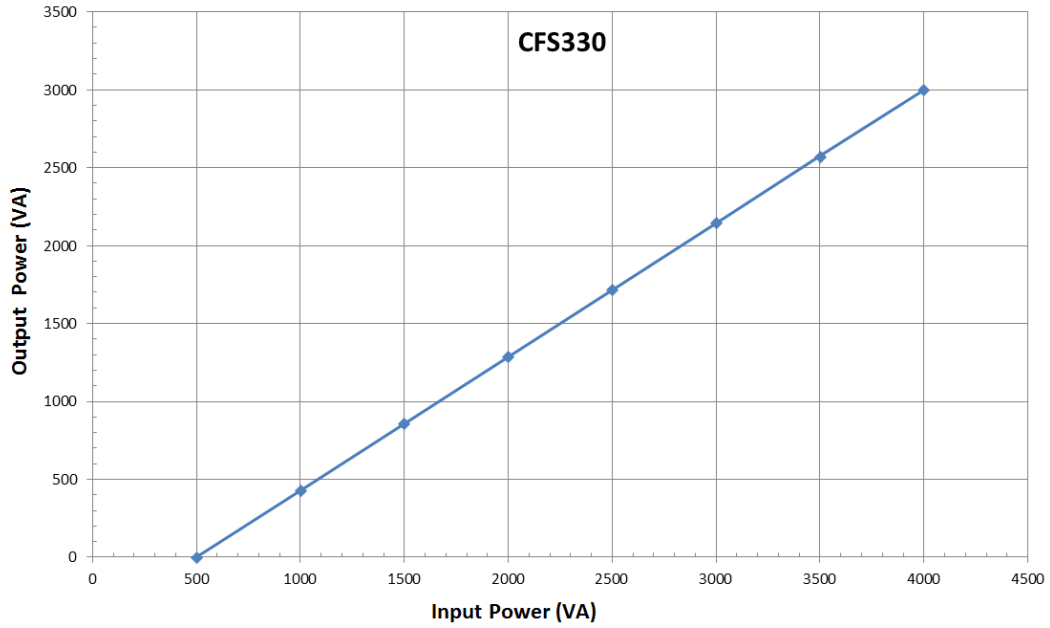


Figure 5-1: AC Input Power vs AC Output Power – Model CFS330

4.7.2 AC Input Power vs AC Output Power – Model CFS360

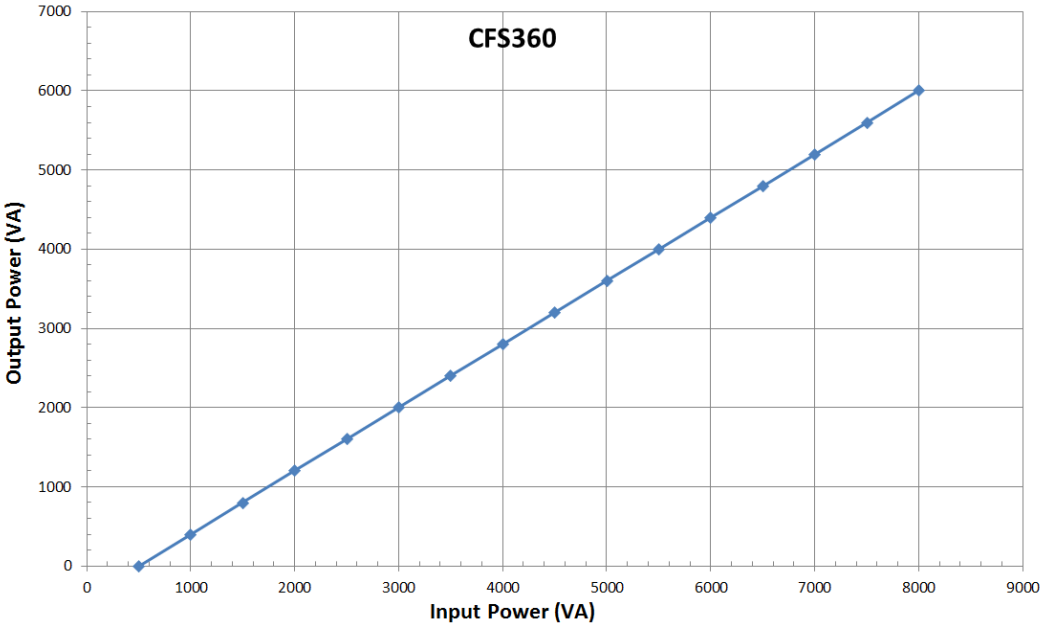


Figure 5-2: AC Input Power vs AC Output Power – Model CFS360

4.8 System Parameters

SYSTEM PARAMETERS	
Operating Modes	Program Mode, Manual Mode
Single Step Mode	On / Off selectable
Alarm Level	0 through 9, 0 = OFF, 9 = HIGH
LCD Contrast	0 through 9, 0 = OFF, 9 = HIGH
Power Up Settings	Output OFF, Output ON or LAST
Timer	Seconds, Minutes, Hours
Loop Cycle	0 - 9999, 0 = Cont. 1 = OFF
Voltage Surge/Drop	ON, OFF
Over Current Fold-back	ON, OFF

4.9 Test Mode Parameters

TEST MODE PARAMETERS	
Memories	1 through 50
Steps / Memory	1 through 9
Memory Cycling	0 - 9999, 0 = Cont., 1 = OFF
Test Limits	Frequency, Current Hi/Lo, Power Hi/Lo, App. Power Hi/Lo, PF Hi/Lo
Ramp Up or Down	0.0 - 999.9
Delay	0.5 - 999.9
Dwell	0.5 - 999.9
Step Cycles	0 - 9999, 0 = Cont., 1 = OFF
Connect	ON, OFF
Voltage Transients	Range: 0.0-300.0 V, Resolution: 0.1 V Start Angle: 0°-359°, Resolution 1° Duration: 0.5-999.9 ms, Resolution 0.1 msec Cycles: 0 – 9999, 0 = Continuous

4.10 Interface and I/O

INTERFACES AND I/O	
Remote Control	RS232, USB
LAN / Ethernet[1]	Option -LAN
Digital Outputs	Signals: Pass, Fail, Test in Progress Connector: DB9, rear panel, Relay contact closures
Output Sync Signal	+5Vdc Out, BNC connector, rear panel

Note1: LAN option includes RS232 but deletes USB interface.

4.11 Dimensions & Weight

MECHANICAL SPECIFICATIONS		
MODEL	**CFS330**	**CFS360**
Dimensions (WxHxD)	430 x 400 x 500 mm	
	16.9” x 15.75” x 19.7”	
Caster Height	89 mm / 3.5”	
Rack Mount	Handle & Rack Ear Kit included	
Weight	48 Kg / 105.8 lbs.	57 Kg / 125.6 lbs.

4.12 Environmental

ENVIRONMENTAL SPECIFICATIONS		
MODEL	**CFS330**	**CFS360**
Fan Cooled	Dual Speed	Variable speed
Operating Temperature	0° - 40° C / 32° - 104° F	
Storage Temperature	- 40°- +55° C / -40°- 131° F	
Humidity	20 - 80% R.H. Non-condensing	
Operating Altitude (max.)	2000 m / 6560 feet	
Storage Altitude (max.)	7620 m / 25000 feet	
Vibration Resistance	10 - 55 Hz, 1 minute, 2 G XYZ	
Shock	< 20 G	

4.13 Safety & Regulatory

Refer to Declaration of Conformity sheet in Section 12, “CE MARK Declaration of Conformity” at the end of this manual.

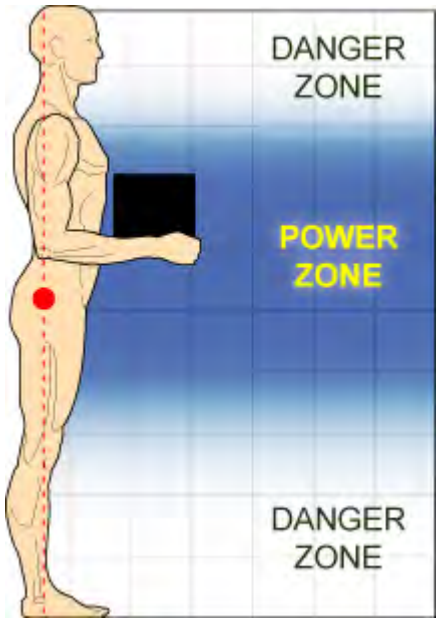
5 Unpacking and Installation

5.1 Inspection

The CFS300 Series of power sources are carefully inspected before shipment. If instrument damage has occurred during transport, please inform Adaptive Power Systems' nearest sales and service office or representative.

5.2 Proper Lifting and Handling Guidelines

Lifting properly is important. While there are some general lifting guidelines, a different approach may be needed for each load to be lifted. Generally, it is best to lift with your legs, not your back. Lifting techniques depend on the size and shape of the load, and the frequency of lifting that is required.



The CFS Series units are considered heavy so proper lifting and handling techniques must be used at all times.

Removing CFS units from their packaging should be done with ergonomics in mind. Items to be planned include determining routes between staging areas and work spaces, soliciting assistance from other members of your team.

The power zone for lifting is close to the body, between mid-thigh and mid-chest height. Comparable to the strike zone in baseball, this zone is where arms and back can lift the most with the least amount of effort.

Refer to the "LIFTING DO'S & DON'TS" chart below before removing any CFS units from its packaging or re-locating it to a different work area.

Figure 6-2: Lifting Do's and Don'ts Chart

5.3 Unpacking

WARNING

CFS300 MODELS WEIGH OVER 100 lbs. AT LEAST TWO PEOPLE ARE REQUIRED TO LIFT AND HANDLE

The CFS300 is shipped on a small pallet or skid. A cardboard cover with protective foam insert is placed over the unit to protect it during shipment.

Note: This is not a complete box with top and bottom flaps. There is no bottom so you cannot lift the carton from the pallet.

To remove a CFS300, two persons **MUST** be used at all times.

Removal Steps:

1. Position the pallet on a stable flat surface with sufficient clearance using a pallet jack or fork lift.
2. Know where the unit is to be placed before proceeding. Make sure the path between the carton and the staging area is short and clear of any obstacles.
3. Use a box cutter to cut the straps holding the cardboard cover to the pallet. These straps are not re-usable and must be discarded once cut.
4. Gently pull up on the box until it clears the top of the actual unit. There are protective foam inserts on top of the unit that may slide out with the box.
5. Remove the small card box insert that contains some ship kit items from the top foam cutout and put in a safe place.
6. Remove the top foam insert piece and retain for future use if desired.
7. Directions:
    a. Two people are required.
    b. Have each person stand as close to the front and the back of the pallet and bend with your knees.
    c. Each should get a firm hand hold underneath the unit by placing their hands on each side of the unit near the front and back of the unit respectively. This will help divide the weight between both persons when lifting.
    d. While keeping their backs straight, lift the unit out of the bottom foam insert and off the pallet simultaneously by straightening legs.
    e. Place the unit on the intended staging surface, usually a bench or table.

5.4 Ship Kits

All units are shipped with a ship kit that may contain several items. Ship kits can vary by model so check the contents of the ship kit you received against the relevant table below. If any items appear to be missing, contact Adaptive Power Systems customer service. (support@adaptivepower.com).

5.4.1 CFS330 Ship Kit Contents

The following accessories are included with each CFS330 power source. See image below for reference letters A through D.

Item	Notes	Quantity	Ref
Documentation Instruction Sheet	⚠ **READ THIS FIRST**	1	
Certificate of Conformance		1	
Rack Mount Kit	9U Mounts	2	
Rack Handle	3U Handles	2	
Output Safety Cover	Must be installed by user while connecting load wires. Includes mounting screws.	1	A
Output Interlock Disable Key	Item 1505	1	B
Shorting Bar	SB-10	1	C
USB Cable	3 feet USB Cable	1	D

Table 6-1: CFS330 Included Accessories Ship Kit

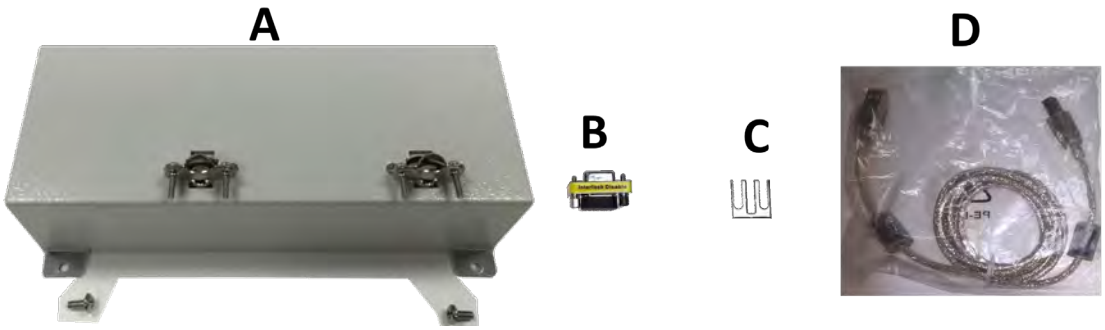


Figure 6-3: CFS330 Ship Kit Content

5.4.2 CFS360 Ship Kit Contents

The following accessories are included with each CFS360 power source. See image below for reference letters A through D.

Item	Notes	Quantity	Ref
Documentation Instruction Sheet	⚠ **READ THIS FIRST**	1	
Certificate of Conformance		1	
Rack Mount Kit	9U Mounts	2	
Rack Handle	3U Handles	2	
Output Safety Cover	Must be installed by user while connecting load wires. Includes mounting screws.	1	A
Output Interlock Disable Key	Item 1505	1	B
Shorting Bars	A-61060-COP1-A	3	
	A-61060-COP2-A	1	C
	A-61060-COP3-A	1	C
	A-61060-COP4-A	1	
USB Cable	3 feet USB Cable	1	D

Table 6-2: CFS360 Included Accessories Ship Kit

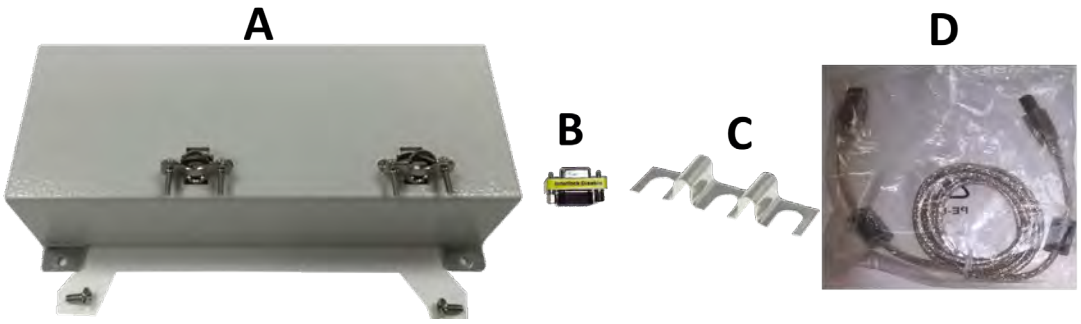


Figure 6-4: CFS360 Ship Kit Content

5.5 AC Input Connections

All CFS300 units can operate from a single phase AC input. Model CFS360 can also be operated from a three phase 208V Delta or 400V Wye AC feed.

Refer to Section 6.7, “Check Line Voltage" to see how to check the input line voltage configuration.

The AC input connections must be made at the rear of the CFS300 units. A single safety cover is provided to cover both AC input and AC/DC Output terminal blocks.

CAUTION

The included Input & Output SAFETY COVER must be properly installed when using this equipment

- The AC input terminal on the CFS330 is marked. A three wire mains connection is required. (L1, L2 and Earth Ground).
- Model CFS360 can be strapped for either single or three phase input configuration using the provided shorting straps.
- No AC line cord is provided with the CFS300 Series. A suitably rated power cable that meets local electrical codes must be used to connect the CFS300 to utility power.

5.6 Grounding Requirements

WARNING

SHOCK HAZARD

EQUIPMENT MUST BE GROUNDED

The chassis must be grounded. A proper Earth Ground connection must be used at all times. Correct grounding of your electrical system infrastructure according to applicable national standards must be observed.

5.7 Check Line Voltage

CAUTION

DO NOT REPLACE THE PROVIDED AC LINE CORD WITH AN IMPROPERLY RATED LINE CORD.
See Region Specific Details Below

5.8 AC Input Connection

A properly rated AC mains disconnect switch and current protection devices or fuses must be used to connect the CFS300 to mains power.

WARNING

A suitable AC mains disconnect switch must be used as a mains disconnecting device and shall remain easily accessible at all times.

5.8.1 CFS330 AC Input Connections

The CFS330 requires single phase AC input power. Supported AC input voltage range is from 200V to 240V L-N single phase. Input frequency is from 47 to 63 Hz. The AC input terminal block is located on the rear panel, to the right of the output terminal block.

Note: Do not connect any CFS300 Series unit to the mains if the AC input voltage, phasing and frequency does not match.

Safety Cover: Before connecting any AC line cord, make sure the cord is routed through the AC input side strain relief of the provided safety cover. After AC input and any output connections have been made, the safety cover must be installed using the slots and two screws provided. The figure on the right shows the correct installation of the safety cover.

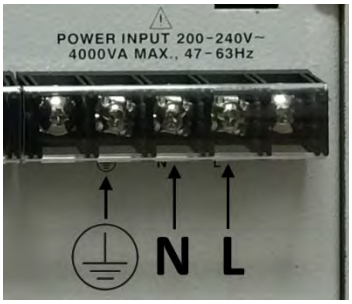
Figure 6-5: AC Input Terminal Block Location CFS330

The AC input terminal block has three positons, from left to right: Earth ground, Neutral and Line.

Use space lugs appropriate for the wire size and AC input current rating.

Recommended Wire Gauges CFS330 AC Input

Position	US/Canada	Europe / Asia
Line	12 AWG THWN, Copper	Ø 2.05 mm Surface 3.31 mm^2
Neutral	12 AWG THWN, Copper	Ø 2.05 mm Surface 3.31 mm^2
Ground	14 AWG THWN, Copper	Ø 1.63 mm Surface 2.08 mm^2



5.8.2 CFS360 AC Input Connections

The CFS360 requires either single or three phase AC input power. Phase configurations are set using the shorting bars provided in the ship kit. Figure 6-6 below shows the two shorting bars installed for single phase input.

Supported AC input voltage ranges are 200V to 240V for single phase or three phase delta input and 364V to 420V for three phase Wye input. The AC input terminal block must be configured for the available line voltage using the included shorting bars.

Input frequency is from 47 to 63 Hz. The AC input terminal blocks are located on the rear panel, to the right of the output terminal block.

Note: Do not connect any CFS300 Series unit to the mains if the AC input voltage, phasing and frequency does not match.

Safety Cover: Before connecting any AC line cord, make sure the cord is routed through the AC input side strain relief of the provided safety cover. After AC input and any output connections have been made, the safety cover must be installed using the slots and two screws provided. The figure on the right shows the correct installation of the safety cover.

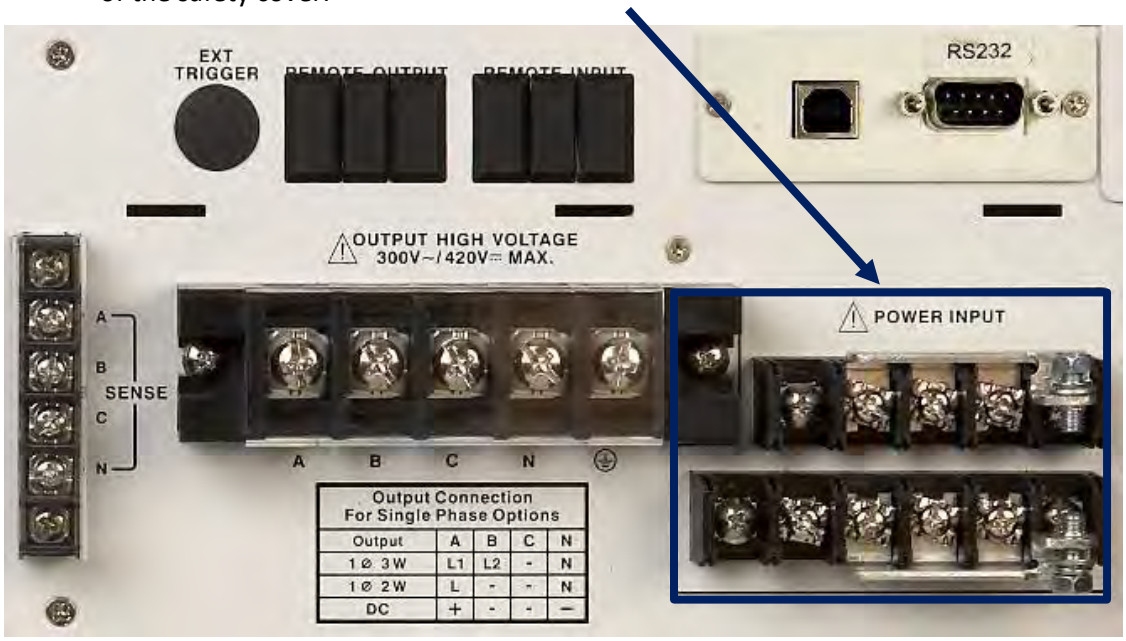


Figure 6-6: CFS360 AC Input Terminal Location

5.8.3 Available CFS360 AC Input Configurations

The CFS360 has three separate AC inputs, one for each of the three output phases. This allows several AC input configuration to be set using the provided shorting bars. The supported configurations are shown in the figure below.

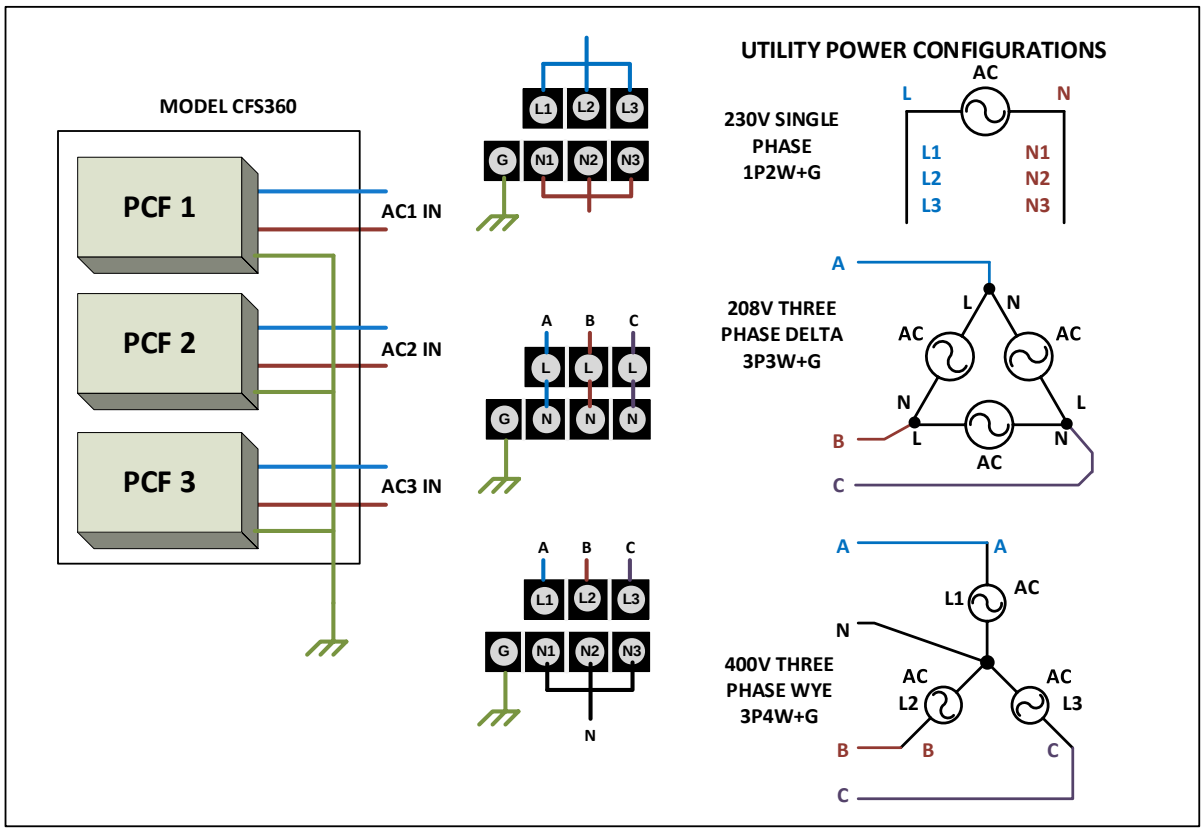


Figure 6-7: Available CFS360 AC Input Configurations

5.8.4 AC Input Shorting Bars for CFS360

The following shorting bars and mounting screw required to configure the AC input terminals by configuration are provided in the CFS360 ship kit.

Sorting Bar No:	1P2W	3P3W	3P4W
39177	-	3	-
39178	1	-	1
39179	1	-	-
Screw No:	**1P2W**	**3P3W**	**3P4W**
39243	2	-	1

Table 6-3: AC Input Shorting Bar Configurations

5.8.5 Recommend AC Input Wire Gauges

Depending on your local utility power voltage and phase configurations, make sure you configure the AC input for the correct mains voltage and phasing.

Recommended Wire Gauges CFS330 AC Input

AC Configuration	A-L, B-L, C-L	A-N, B-N, C-N	GND
Single Phase 2 Wire+Gnd	10 AWG (Ø 2. 59 mm) A-L, B-L, C-L Short	10 AWG (Ø 2. 59 mm) A-N, B-N, C-N Short	12 AWG THWN, Copper (Ø 2.05 mm)
Three Phase Delta 3 Wire+Gnd	12 AWG THWN, Copper (Ø 2.05 mm)	A-L/A-N, B-L/B-N, C- L/C-N Short	10 AWG THWN, Copper (Ø 2. 59 mm)
Single Phase Wye 4 Wire+Gnd	16 AWG THWN, Copper (Ø 1.29 mm)	10 AWG (Ø 2. 59 mm) A-N, B-N, C-N Short	10 AWG THWN, Copper (Ø 2. 59 mm)

Table 6-4: AC Input Wire Gauges by Configuration

5.9 Cleaning

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

CAUTION

BEFORE you clean the unit, disconnect from mains power.

- **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.**

5.10 Powering Up

The following procedure should be followed before applying mains power:

1. Check that the POWER switch 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. Verify the AC Line input specifications on the power source match the local utility mains.
5. Close the grid connection safety disconnect to apply power to the unit.
6. Turn ON (I) the front panel POWER switch.
7. If the instrument does not turn ON for some reason, turn OFF the POWER switch and verify the presence of the correct AC line input voltage using appropriate safety measures.

5.11 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 Adaptive Power Systems or its authorized representative to arrange for service.

5.12 Output Terminals

All load connections on the CFS300 Series are made at the rear panel output terminal strip. Output terminals used to connect the load are dependent on the mode of operations. The connection table is printed on the rear panel, directly below the output terminal block for reference.

Note: Always refer to Section 2.3 “Safety Information” and Section 2.4 “Safety Notices” before making any load connections.

5.12.1 Output Terminal Location

The output terminal block is located in the upper right hand corner of the rear panel, to the left of the AC input terminal block when facing the back. See image below. This terminal block requires the use of load wires terminated with either a ring lug or spade lug. Both wire type and lug used MUST be rated for the maximum available AC and DC current output capability of the power source model.

WARNING

A small plastic cover is mounted on both the Output and Input terminal block. This is NOT A SAFETY cover. The full safety cover supplied in the ship kit MUST be used at all times

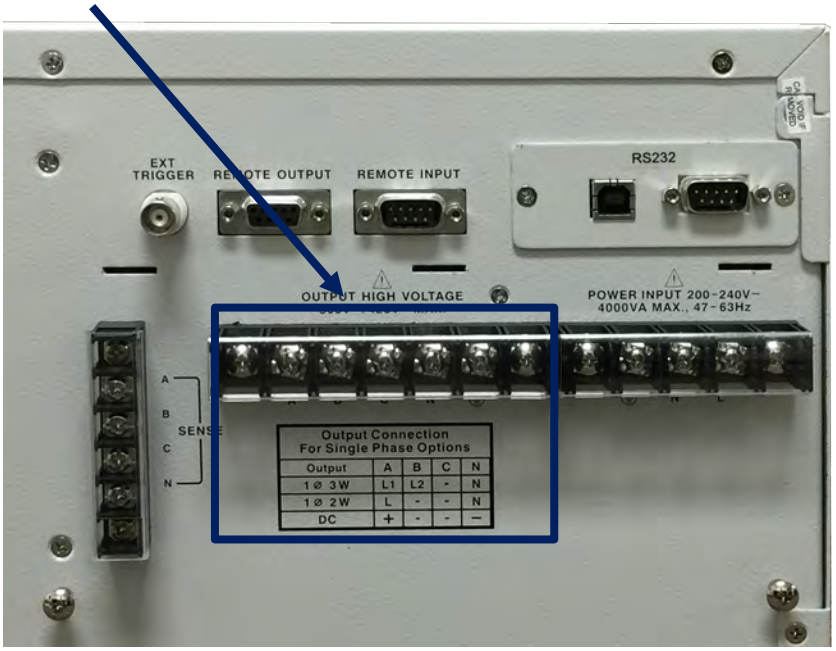


Figure 6-8: CFS300 Series Output Terminals

5.12.2 Output Load Connection Configurations

The same output terminal is used to support all output phase modes and DC output mode. The output terminal post are marked from left to right as “A” “B”, “C”, “N” and Ground (Symbol).

The correct wiring for each mode is shown in the table below and is also printed on the rear panel on the power source, directly below the output terminal block.

Output Mode	A	B	C	N
3ø, 4 Wire	A	B	C	N
2ø, 3 Wire	L1	L2	--	N
1ø, 2 Wire	L	--	--	N
DC Mode	**+ DC**	**--**	**--**	**-- DC**

Table 6-5: Output Connections by Output Mode

5.12.3 Recommended Output 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 power source to no more than 0.25V per lead when sensing internally (at the output terminal, not the load).

Recommended copper wire gauges are shown in the tables below by model and output mode for the highest current, which occurs on the low voltage range. Aluminum wire is not recommended. Keep the distance between the power source and load as short as possible for best results.

Phase	A	B	C	N	GND	Asense	Bsense	Csense	Nsense
3Ø4W	14AWG	14AWG	14AWG	14AWG	14AWG	18AWG	18AWG	18AWG	18AWG
2Ø3W	14AWG	14AWG	-	14AWG	14AWG	18AWG	18AWG	-	18AWG
1Ø2W	10AWG	-	-	10AWG	12AWG	18AWG	-	-	18AWG
DC	14AWG	-	-	14AWG	14AWG	18AWG	-	-	18AWG

Table 6-6: CFS330 Output and Sense Wire Size Table

Phase	A	B	C	N	GND	Asense	Bsense	Csense	Nsense
3Ø4W	14AWG	14AWG	14AWG	14AWG	16AWG	18AWG	18AWG	18AWG	18AWG
2Ø3W	14AWG	14AWG	-	14AWG	16AWG	18AWG	18AWG	-	18AWG
1Ø2W	8AWG	-	-	8AWG	10AWG	18AWG	-	-	18AWG
DC	10AWG	-	-	10AWG	10AWG	18AWG	-	-	18AWG

Table 6-7: CFS360 Output and Sense Wire Size Table

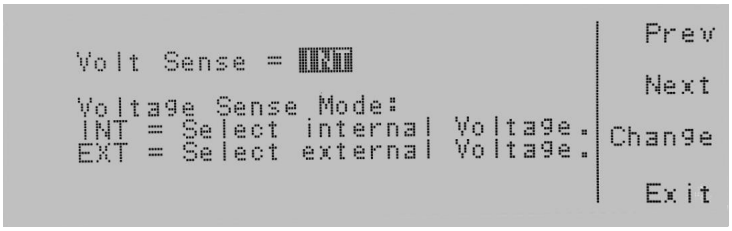
5.12.4 Voltage Sense Modes

The CFS300 series supports both internal voltage sense and external voltage sense mode. For light loads, internal sense may be used as the voltage drop across the load wires will be minimal with low load currents. In internal sense mode, the power source senses its output voltage at the rear panel output terminal block. No external sense lines need to be connected to the **V Sense** connector on the rear panel in this mode.

When using internal sense mode, make sure the load is not too far from the power source so the load wires are relatively short.

For larger loads or in situations where the load cannot be placed close to the power source, external voltage sense mode should be used.

The sense mode can be selected from the System menu. Refer to Section 7.10.1, "PROGRAM Mode System Settings" for details.



When using external sense mode, the sense lines must be connected from the rear panel V-Sense terminal block to the load. Sense inputs are marked A, B, C and N from top to bottom. Sense wires do not carry load current, so they don't require the same wire gauge as the load wires.

Note: Always twist sense wires together as the voltage sense input is high impedance and is prone to picking up noise. Twisting sense wires will reduce some of the differential mode noise.

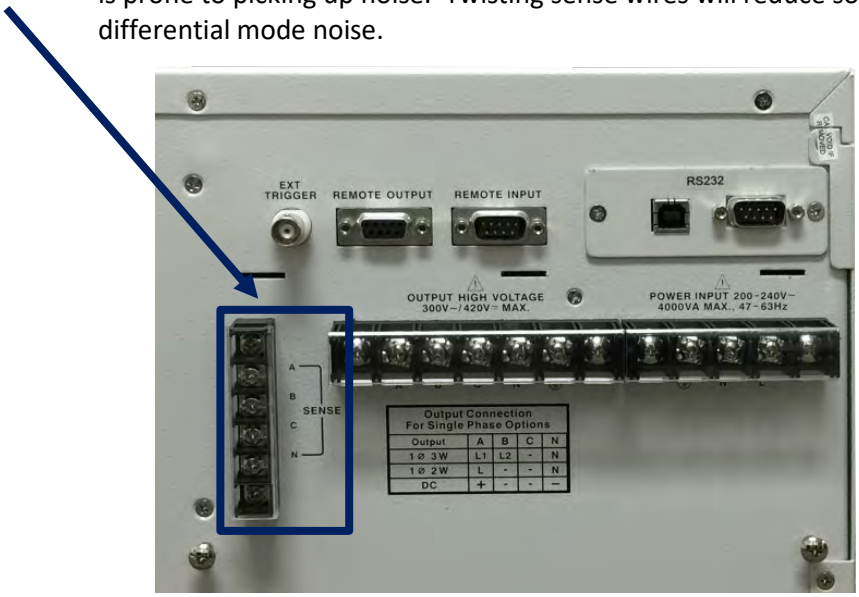


Figure 6-9: External Voltage Sense Terminal Block Location

5.12.5 Connecting a UUT

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

1. Always make sure the 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** and that the load is not still energized. This applies in particular to DC Mode when driving a load with input capacitance or batteries.
3. Connect one end of each load wire to the L/+ and N/- 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.

5.13 Rear Panel Controls and Connectors

All CFS300 Series have several connectors on the rear panel in addition to the AC input and AC output terminals covered in the previous sections. Other connectors and features are detailed in this section by model number.

The callouts for the controls and connectors located on the rear panel of the CFS300 models are identified in the table below.

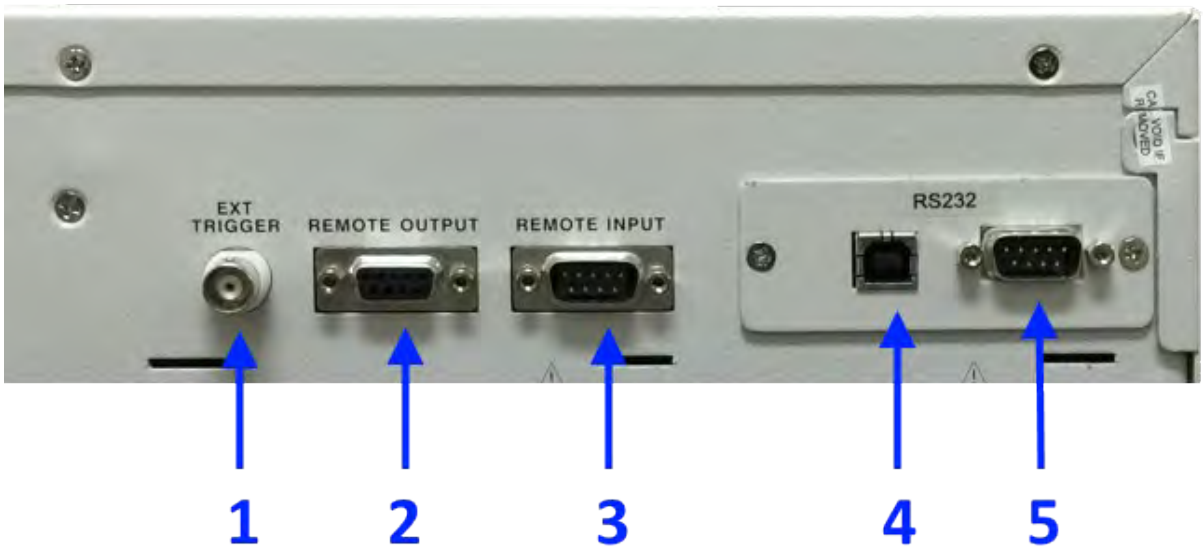


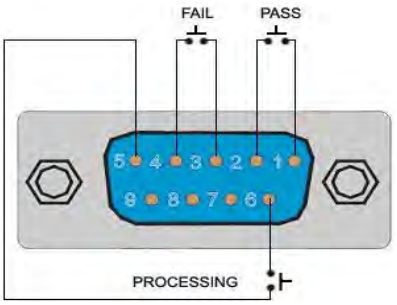
Figure 6-10: CFS300 Series Rear Panel Callouts

Callout	Description
1	SYNC Output BNC. TTL Output signal that indicates output zero crossing when in AC or PROGRAM mode. May be used to synchronize other test equipment.
-	Cooling Fan Exhausts (not shown). Must be kept clear at all times.
2	Remote Output Connector DB9. Provides contact closure outputs for: • Test in Progress • PASS • FAIL
3	Remote Input Connector DB9. Provides contact closure input signals for: • Test in Progress • PASS • FAIL
4	USB Interface connector Type B on USB/RS232 Interface Card.
5	RS232 Interface connector on USB/RS232 Interface Card. For models with LAN option, this location contains a LAN connector instead of a USB port.

Table 6-8: CFS300 Series Rear Panel Callouts

5.14 Remote Output Interface

The Remote Output interface of the CFS300 Series provides outputs to remotely monitor PASS, FAIL, and PROCESSING conditions via a 9-Pin D-Sub type connector. When a terminal becomes active the relay closes, thereby allowing the external voltage to operate an external device. The table below provides the assignments of each pin and the relay state.

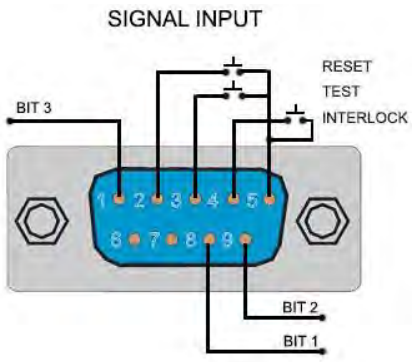


Condition	Pins	Relay State
PASS	Connection between PIN 1 & PIN 2	Closes on PASS and is opened on next test initialized
FAIL	Connection between PIN 3 & PIN 4	Closes on FAIL and is opened when next test is initialized
PROCESSING	Connection between PIN 5 & PIN 6	Closes when test initialized and opens after test is completed

Table 6-9: Remote Output DB9 Pins and Functions

5.15 Remote Input and Remote Interlock Interface

The Remote Input interface of the CFS300 Series provides inputs to control test operation using remote signals. The 9-Pin D-Sub Type connector signals are used to issue Test, Reset, and selection of the first seven (7) Memories (M1-M7. Remote functions are activated when the **"PLC Remote**" in the System setup Parameter is turned **ON**. Upon turning ON the PLC Remote setting, the TEST/RESET LED will be lit and the buzzer will beep twice before returning to the RESET condition, when any key on the front panel is pressed. Whenever an abnormal output condition is detected, the instrument can be reset by pressing the **TEST/RESET** key or by initializing a reset through the PLC remote



Condition	Pins	Relay State
TEST	Connection between PIN 3 & PIN 5	Momentary contact closure
RESET	Connection between PIN 2 & PIN 5	Momentary contact closure
INTERLOCK	Connection between PIN 4 & PIN 5	Normally open contact
MEMORY SEL.	PINS 1, 9, 8	Bit 3 = 2, Bit 2 = 1, Bit1 =0 binary code

Table 6-10: Remote Input DB9 Pins and Functions

5.15.1 Remote Memory Selection

Memory selection is accomplished by closing pins 1, 9 and 8 as a binary value. The corresponding memory selected is shown in the table below.

Note: Only the first seven memory locations can be selected using the remote input interface. Make sure any test programs are stored in these first seven memories out of the 50 available memories.

Memory	PIN 1	PIN 9	PIN 8
	OFF	OFF	OFF
M1	OFF	OFF	ON
M2	OFF	ON	OFF
M3	OFF	ON	ON
M4	ON	OFF	OFF
M5	ON	OFF	ON
M6	ON	ON	OFF
M7	ON	ON	ON

Table 6-11: Remote Input Memory Selection

5.15.2 Remote Output Interlock

The CFS300 Series is equipped with a Remote Output Interlock feature. Remote Interlock utilizes a contact closure to enable the power source's output. If the Remote Interlock contacts are open, the output of the instrument will be disabled. Remote Interlock is also referred to as a remote system lockout, utilizing "fail when open" logic.

If the Remote Interlock contacts are open and the TEST button is pushed, a pop-up message will be displayed on the screen for two seconds.

If the Remote Interlock contacts are opened during a test, the pop-up message will be displayed and the test will abort. The hardware has been configured to provide the interlock connections on pins 4 and 5 of the Remote Interface Input port. The instrument can still be used without the external interlock device as long as the Interlock Disable Key is plugged into the Remote Interface port. Refer to Section 6.4, "Ship Kits".

Note: If there is nothing connected to the Remote Interface, the instrument will not perform any tests or provide any output.

5.16 Remote Control Programming Interfaces

The CFS300 Series offers standard RS232 and USB interfaces for remote control operation. Other interfaces may be specified at the time of order as they are installed at the factory prior to shipment. It is not possible to retrofit interface options in the field. Available interface options are:

- Ethernet / LAN (Option –LAN)
- GPIB / IEEE-488 (Option –GPIB)

5.16.1 RS232 Serial Interface

Figure 6-11 shows the RS232 connector (Male) on the rear panel. This connects the power source to an RS232 port of a computer.

Signal Pin Assignments:

Figure 6-11: RS232 Connector

PIN	Abbreviation	Description
Pin1	N.C.	Not connected
Pin2	RXD	Receive Data
Pin3	TXD	Transmit Data
Pin4	N.C.	Not connected
Pin5	GND	Ground
Pin6, 7, 8, 9	N.C.	Not connected

Table 6-12: RS232 DB9 Pin Assignments

Note: A null-modem cable is required to connect to a common 9 pin PC com port.

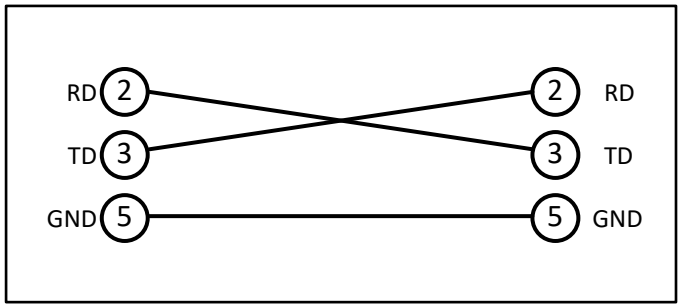


Table 6-13: Serial Cable to PC COM port

RS232 Interface Settings

Factory set RS232 settings are:

9600 baud, 8 data bits, no parity, 1 stop bit

This interface does not support XON/XOFF protocol or any hardware handshaking. The controller should be configured to ignore the Handshaking Lines DTR (PIN 4,), DSR (PIN 6)

and RTS (PIN 9). If the port cannot be configured through software to ignore the lines, the handshaking lines should then be jumped together in two different pairs. Both pins 4 & 6 and pins 7 & 8 must be jumpered together at the controller end of the cable.

5.16.2 USB Interface

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. Corresponding virtual com drivers (VCP drivers) for all Windows 8 and Windows 10 operating systems are available for download at the following URL:

http://www.adaptivepower.com/English/Resources-Login.aspx

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

5.16.3 LAN Interface (Option)

The power source can be ordered with a LAN (Ethernet) interface. The LAN interface option is located on the rear panel in place of the standard USB port.

The Ethernet Card option provides RS232 and Ethernet communication, as well as a barcode connector. The Ethernet Card has three input/output ports, shown in the figure below:

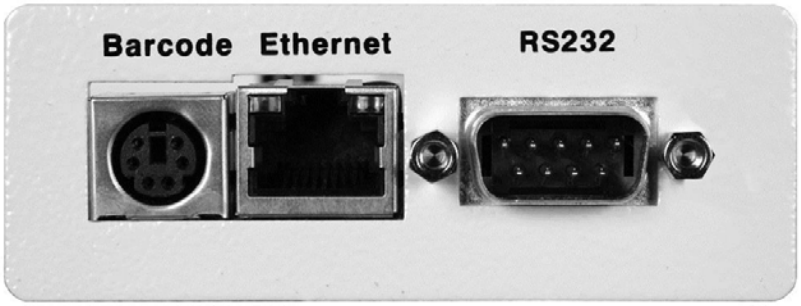


Figure 6-12: LAN Option Connectors

The port labeled “Barcode” is a PS/2-type connector that is not active on the CFS Series models.

The Ethernet port is for use with a standard CAT-5 Ethernet cable and may be connected to any Ethernet network or directly to a PC’s Ethernet port. The Ethernet interface provides all of the control functions of the standard RS-232 and USB interfaces. Refer to section 10, “LAN Interface Configuration” on page 126 for network and port configuration setup information.

The 9-pin D- type subminiature connector labeled “RS232” is the same as covered in Section 6.16.1, "RS232 Serial Interface”.

5.16.4 GPIB Interface (Special Order)

GPIB connection is via a 24pin IEEE-488 Centronics connector on the rear panel of the unit. This interface option allows the unit to be connected to a GPIB controller and other GPIB devices. A GPIB system can be connected in any configuration (star, linear, or both) as long as the following conditions are met:

- The maximum number of devices including the controller is equal or less than 15.
- The maximum length of the GPIB cable is no more than 2 meters.
- The total lead length of all devices connected together totals less than 20 meters.
- Please make sure the lock screws are firmly hand-tightened, use a screwdriver only for the removal of screws.

Each device on the GPIB (IEEE-488) interface must have a unique address. You can set the address of the CFS series to any value between 0 and 30. The address can only be set from the front panel. The address is stored in non- volatile memory and does not change when the power has been off or after a remote reset.

Note: The address is set to 8 when the power source is shipped from the factory.

The GPIB connector pin-out is defined by the IEEE-488 standard and shown for reference only in Table 6-14 below.

No	Name	Function
1	DIO1	Data line 1
2	DIO2	Data line 2
3	DIO3	Data line 3
4	DIO4	Data line 4
5	EOI	End or Identify
6	DAV	Data Valid
7	NRFD	Not Ready For Data
8	NDAC	No Data Accepted
9	IFC	Interface Clear
10	SRQ	Service Request
11	ATN	Attention
12	SHIELD	Shield
13	DIO5	Data line 5
14	DIO6	Data line 6
15	DIO7	Data line 7
16	REN	Remote Enable
18 - 23	GND	Ground
24	SGND	Signal Ground

Table 6-14: IEEE-488 Connector Pin Assignments

5.16.5 Control Commands

The USB, RS-232 and LAN interfaces use the same command set as the LAN and GPIB interface for setting of test parameters. However there are some functions of the GPIB 488.2 interface that are not available through USB/RS-232/LAN. The IEEE-488 interface option for the CFS series conforms to the requirements of the IEEE-488.2 standard.

These interfaces provide all of the control and parameter setting commands of the GPIB interface with the exception of the 488.2 Common Commands, the Status Reporting commands and the SRQ capability.

For information on supported programming commands, refer to section 8, “Remote Control Programming”. The identification command *IDN is also available through USB, RS-232 and LAN interfaces.

5.16.6 Sending Commands over RS232 / USB or LAN

When sending commands over the RS-232 interface, the instrument will send a response string of 0x06 (HEX), 6 decimal acknowledge (ACK) ASCII control code if the transfer was recognized and completed by the instrument. If there is an error with the command string that is sent, the instrument will respond with an 0x15, 21 decimal Not Acknowledge (NAK) ASCII code. The ACK or NAK response supports software handshaking in order to monitor and control data flow.

When using any of the serial style interfaces – USB, LAN or RS232 – it may be necessary to insert a delay of **up to 100 msec** between successive commands to prevent command overruns resulting in no response or possible locking up of the interface. Shorter delays may work as well depending on the programming IDE used (i.e. LabView, Visual C# etc).

5.16.7 Receiving Commands over RS232 / USB or LAN

When requesting data from the instrument, it will automatically send the data back to the controller input buffer. The controller input buffer must accumulate the data being sent from the instrument including the ACK and NAK response characters, until the controller has read it. When a string or command has been sent, it **must** be terminated by a Linefeed character (0x0A), for example ”TEST”+LF.

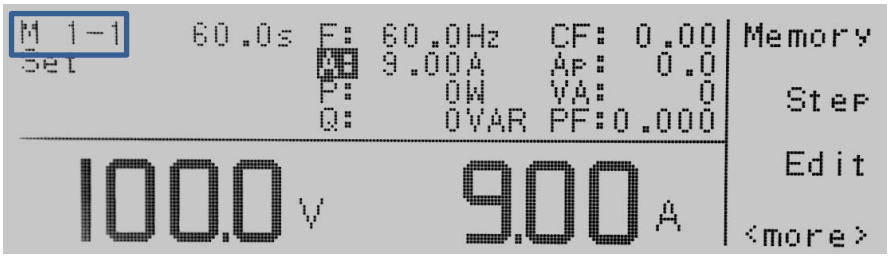
6 Front Panel Operation

This Chapter provides an overview of front panel operation for the CFS300 Series power sources. For remote control operation, refer to Section 8 “Remote Control Programming” of this manual for an overview of available programming commands.

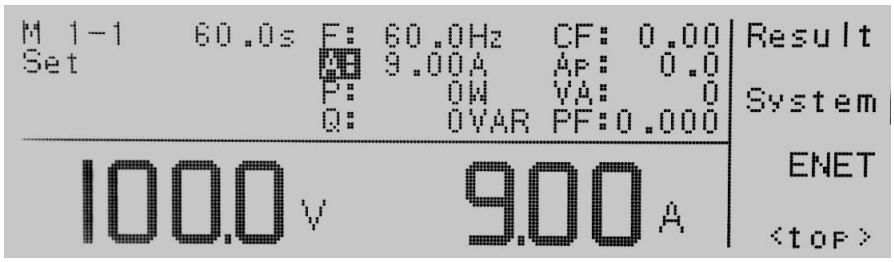
6.1 Powering On

The power source can be turned ON using the power toggle switch located on the left hand side of the front panel. (See Section 7.2, “Front Panel Layout”) A splash screen will appear as shown below.

After several seconds, the LCD will display the Setup (Set) screen. The actual screen will differ somewhat with the operating mode that was selected when the unit was turned off. (PROGRAM or MANUAL and AC or DC).



The “M 1-1” indicator in the upper left hand corner of the display shows the power source is in PROGRAM mode with Memory 1, step 1 selected. The first of several soft keys will appear on the right hand side of the display. To see the second group of soft keys, press the “**<more>**” soft key.



To return to the top of the main menu, press “**<top>**” soft key.

In **MANUAL** or **DC** Mode, the top level menu soft keys are similar except for the "Meter" soft key that is now visible.

To see the second group of soft keys which is the same as in **PROGRAM** mode, press the "**<more>**" soft key.

6.2 Front Panel Layout

The front panel layout is shown in Figure 7-1 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 while in Test (Output ON) mode of operation.

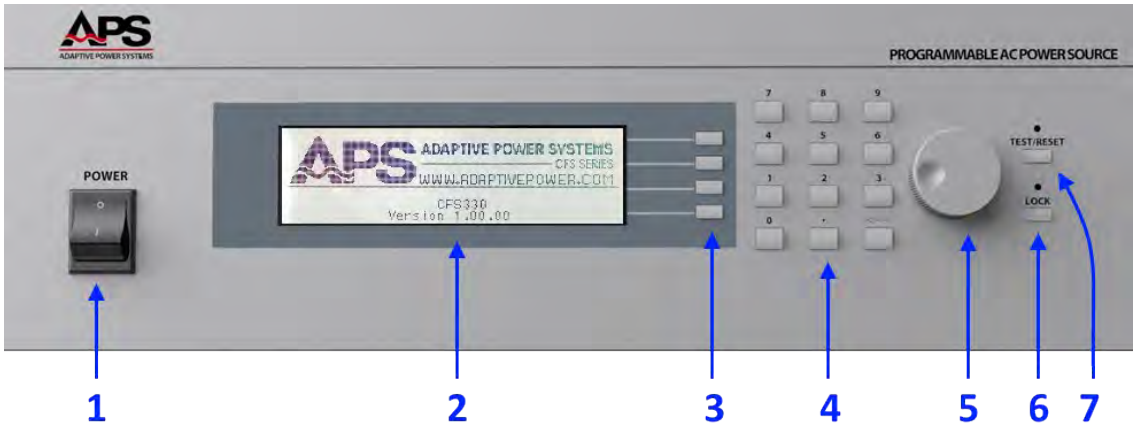


Figure 7-1: CFS300 Series Front Panel Displays and Controls

The following controls and indicators are available for use.

Item	Description	Purpose
1	Power ON / OFF Switch	Turns AC input power to the unit on or off. The ON position is marked "|". The OFF position is marker "O"
2	Backlit Monochromatic LCD Display	Displays all settings, measurements and messages
3	Soft Keys	Soft Keys change function depending on the menu and parameter selected. See Sections 7.6 and 7.7 for available soft keys
4	Decimal Keypad	Keys 0 through 9 allow direct entry of parameter values. Decimal point key allows fractional values to be entered. ← Backspace keys erases last entry
5	Shuttle Knob	Allows slewing of Voltage or Frequency while output is ON. Also referred to as 'rotary knob'
6	LOCK Key and LED Indictor	Pressing LOCK puts unit in keyboard lock mode. This mode is indicated by the green LED directly above the LOCK key.
7	TEST / RESET Key and LED Indicator	Pressing this key toggles the output between ON (Test) and OFF (Reset) states

Table 7-1: Front Panel Controls and Indicators

6.3 LED Status Indications

The two green LED's on the front panel are used to indicate the conditions of the power source as shown in the table below.

Item	Indication	Purpose
TEST/RESET LED	OFF	Output is OFF
	ON	Output is ON. In PROGRAM mode, test sequence is in progress.
	BLINKING	Fault occurred, output was turned OFF. To clear fault, remove fault condition and re-engage Output using TEST/RESET button
LOCK LED	OFF	Front panel controls are enabled
	ON	Front panel controls are locked

Table 7-2: Front Panel Status LED Indications

6.4 Shuttle Knob

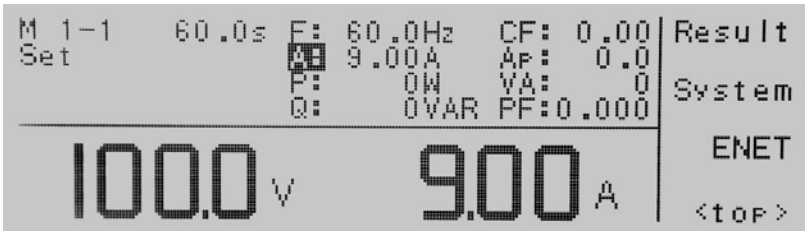
The shuttle knob or rotary digital encoder is active only in MANUAL and DC modes of operation. When the OUTPUT is ON, the shuttle can be used to adjust voltage or frequency. To adjust frequency with the shuttle, the Frequency measurement must be selected in the measurement screen. If not, the shuttle will always adjust the voltage setting when turned. Turn clock wise to increment the set value, turn counter clockwise to decrement the set point.

When the instrument is in an idle state (OUTPUT OFF), it can also be used to edit the "**Hi-Lmt**". To adjust the "**Hi-Lmt**" with the shuttle knob the meter selection must be on Hi-Lmt.

Note: If the front panel is locked (LOCK is set to ON), the shuttle knob is disabled.

6.5 Setup Screen Readouts

The setup screen is identified by the word “Set” in the upper left corner of the LCD. The table below shows the various readouts that are found in the setup screen and their meaning.



On Screen Fields	Description
M 1-1	Indicates the power source is in PROGRAM mode. Possible indicators are: Mn-m PROGRAM Mode, Memory <n>, Step <m> Mn MANUAL Mode, Memory <n> Mn DC DC Mode, Memory <n> For details on available operating modes, refer to Section 7.8 through 7.17.
60.0s	Instrument Timer for Output
Set	State of power source. Available states are: Set Setup mode Dwell Output applied, executing dwell time Pass Test completed, result = Pass Abort Test aborted by Operator Fault Test aborted due to Fault condition
F: 60.0Hz	Frequency measurement value display
CF: 0.00	Current Crest Factor measurement
A: 9.00A	Peak Current measurement value
Ap: 0.0	Peak Current measurement value
P: 0.0W	Power measurement value
VA: 0.0	Apparent Power measurement value
Q: 0VAR	Reactive Power measurement value
PF:0.000	Power Factor measurement value
100.0v	Left hand, Large Font Voltage set value or measurement. Set value in set screens, measurement value when output is ON.
9.00A	Right hand, large Font measurement value. Can be any of the other available measurements. Default is Current (A).
Note: *Phase selection indication appears on line 3, left hand side of display as follows:*	
1Φ3W: L1-N	Indicates setting applies to 1Φ3W mode (split phase) as L1-N
1Φ3W: L2-N	Indicates setting applies to 1Φ3W mode as L2-N
3Φ4W: A Phase	Indicates setting applies to 3Φ4W mode (three phase) Phase A
3Φ4W: B Phase	Indicates setting applies to 3Φ4W mode (three phase) Phase B
3Φ4W: B Phase	Indicates setting applies to 3Φ4W mode (three phase) Phase c

Table 7-3: Setup (Set) Screen Display Fields Description

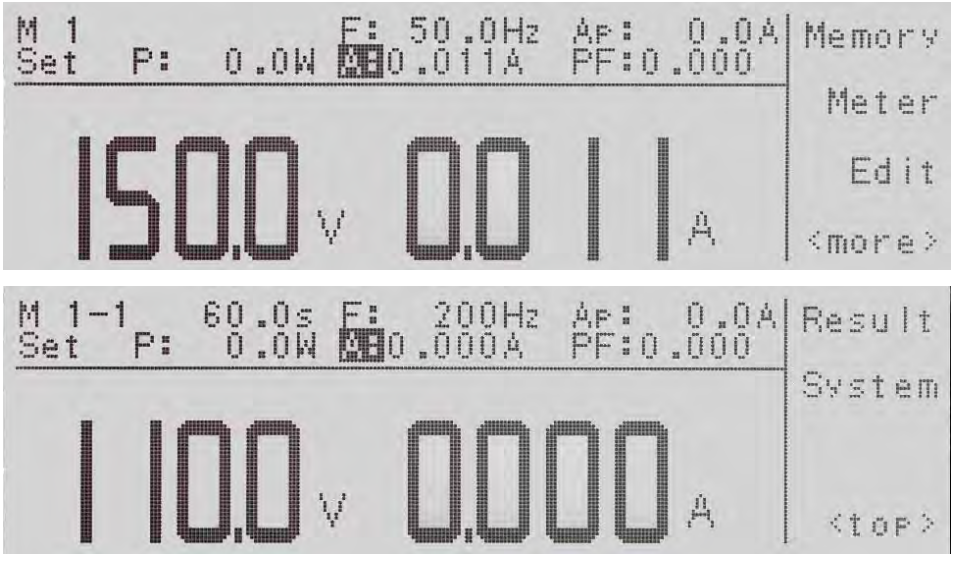
6.6 Main Menu Soft Keys

There are a total of five menus available to control all settings and display measurements. They are listed in the table below using BOLD font. The non-bold entries are navigation soft keys that allow you to move back and forth between the two menu selection screens.

Screen	Menu	Description
1 of 2	**Memory**	Displays the Memory selection screen. Also allows assigning symbolic names to memories for reference.
	Meter	Displays the Metering Screen. All measurements are displayed in this screen. Voltage is always shown in the bottom area in large fonts. Another measurement parameter is displayed in large font as well. This second parameter can be toggled to display any of the other measurements by pressing the "Meter" key repeatedly.
	Edit	Displays the Edit screen where settings stored in the selected memory can be changed.
	<more>	Displays Second Screen 2 of 2
2 of 2	**Result**	Displays the last results obtained during the last test that was run. Both settings and measurements are displayed on one screen.
	System	Displays the System Setting screen. This screen allows selection of operating mode and all available related settings for the mode selected.
	ENET	LAN interface option configuration selection. Will not be visible on models without –LAN option.
	<top>	Returns to First (top) Screen 1 of 2

Table 7-4: Available Top Level Menus

As sample of the two top level screens is shown below.



6.7 Lower Level Menu Soft Keys

On screen menus are operated using the four soft keys located directly to the right of the LCD Display. The following table shows a list of all available soft key labels. Note that only four or less soft keys will be available at any one time.

Soft Key	Description
Memory	Allows the user to enter the memory location to change a memory
Step	Allows the user to change step location
Edit	Allows the user to edit parameters
<more>	Allows the user to move to additional soft key selections
Result	Allows the user to review the results after a test
System	Allows the user to change the top level instruments settings and parameters
Exit	Allows the user to exit the current screen
Name	Allows the user to name a memory
List	Allows the user to see the list of available memories
∨	Allows the user to scroll down through a list sequentially, or move down a character listing
Page ∧	Allows the user to page up through a list
Page ∨	Allows the user to page down through a list
Load	Allows the user to load a memory
Enter	Allows the user to enter a parameter
Esc	Allows the user to exit a parameter setting screen
<top>	Allows the user to move to the previous screen of selections
>	Allows the user to move to the right through a character listing
<	Allows the user to move to the left through a character listing
Select	Allows the user to select a memory
Meter	Allows the user to toggle through the different meter settings/readings
Edit	Allows the user to enter a parameter screen to change a parameter
^	Allows the user to scroll through the list sequentially
Prev	Allows the user to scroll to the previous parameter setting
Next	Allows the user to scroll to the next parameter setting
Change	Allows the user to open up the parameter for changing
Result	Allows the user to open up the results screen
System	Allows the user to open up the parameters for the system
Cycle	Allows the user to open the cycle mode
Keypad	Allows the user to open the numeric keypad in test mode
Trig.	Allows the user to trigger the surge/drop parameters in test mode

Table 7-5: Available Soft Key Labels

6.8 Password Protection

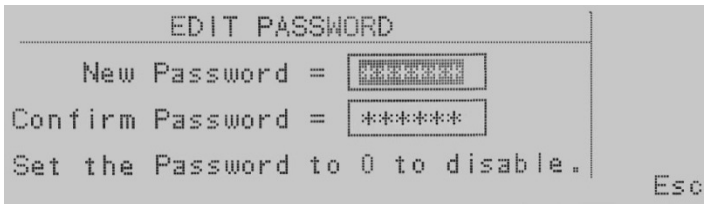
The power source supports a password lock-out feature that prevents unauthorized use of the keyboard and memory LOCK functions. If a password has been set, unlocking the front panel using the LOCK key can only be done if the correct password is entered.

6.8.1 Password Assignment or Change

The access the password entry screen, proceed as follows:

1. Turn off power to the unit if already powered up
2. Press the top soft key on the front panel (soft key 1) while turning the unit on with the power switch
3. The EDIT PASSWORD screen will appear as the unit powers up.

An authorized user can enter a new four digit password using the numeric keypad. Press the "**Enter**" soft key to accept the newly entered password or press the "**Esc**" soft key to abort.



After entering a new password, it must be confirmed by typing the same four digit code into the "Confirm Password" field as well. Press the "**Enter**" soft key to confirm the new password or press the "**Esc**" soft key to escape.

If a password has been set to any value other than 0, a password entry pop-up screen will appear any time when accessing the **Lock** and **Mem Lock** parameters as well as LOCAL key on the front panel of the unit. See sample screen below. Refer to Sections 7.10.11, "Keyboard Lock Mode Settings" and 7.10.12, "Memory Lock Mode Settings" for details on both functions.

Note: The password default is preset to 0 (no password) when shipped from the factory.

If the password is set to 0, the Lock and Mem Lock parameters can be edited in the System Parameters menu freely. In this case, the LOCAL key on the front panel is enabled as well.

6.8.2 Forgotten Password

If a password has been entered before and is forgotten, it cannot be recovered. In this case, the password must be set using the same procedure described in Section 7.8.1, "Password Assignment or Change" or disabled by setting it to zero (0).

6.9 Operating Mode – Selecting

The CFS300 Series power sources can be operated in one of three operating modes. The following sections describe each mode in detail.

6.9.1 Available Operating Modes

The following modes can be selected.

- **PROGRAM** This mode uses up to 50 memory locations in which the user can store up to nine test steps each. Each test steps contains the output settings for an AC or DC output and measurement pass fail limits as well as dwell times. Steps are recalled in sequence when the "**TEST/RESET**" button is pressed.
- **MANUAL** This mode also provides an AC or DC output, but there is only one AC output setting that is applied to the EUT when the "**TEST/RESET**" button is pressed. In MANUAL mode, the output voltage and frequency can be changed dynamically by using the shuttle knob to slew either voltage or frequency up or down. This can be done while the output is ON and the Measurement screen shows all load read back values.
  This mode also allows a number of user limits to be defined for voltage and frequency so the operator cannot accidentally output values that are too low and/or too high.

The actual output mode AC or DC is determined by the **Out Mode** parameter setting (Refer to Section 7.10.3, "Out Mode"). In DC mode, there is no frequency programming only voltage and current limit.

6.9.2 On Screen Operating Mode Indication

The selected operating mode is indicated in the upper left hand corner of the LCD display when the output is on. In PROGRAM mode, the letter "**M**" followed by a memory and step number separated by a dash is displayed as shown here. The first number (1) reference the memory location selected (from 1 through 50). The second number references the STEP number that is active (from 1 through 9). Example below ("**M 1-1**") shows Memory 1, step 1 is active.

Figure 7-2: PROGRAM MODE LCD indicator

When operating in MANUAL mode, the upper left corner of the LCD display will just show the letter "**M**" for Manual. No STEP number is shown.

Figure 7-3: MANUAL MODE LCD indicator

58In **DC mode**, the indication is similar to AC PROGRAM and AC MANUAL modes, but a "DC" will be shown after the memory number. Thus, "**M 1 DC**" indicates the CFS is operating in DC mode.

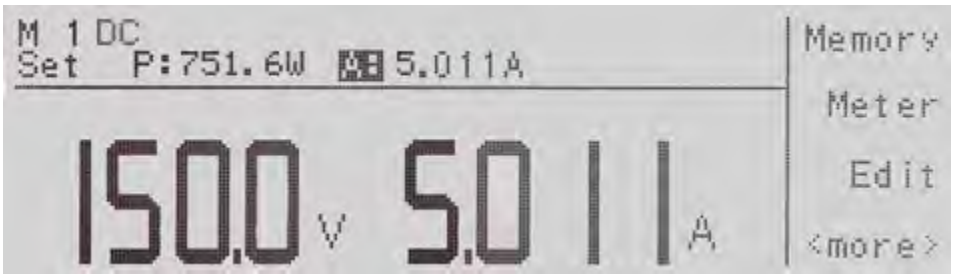


Figure 7-4: DC MODE LCD Indicator

6.10 PROGRAM Mode Operation

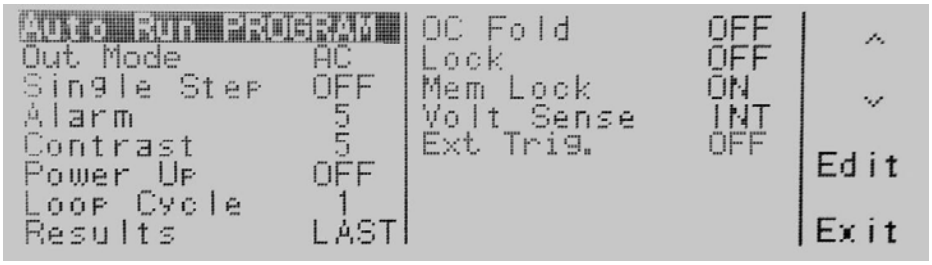
Program mode applies to either AC or DC output and allows output settings and expected load measurement limits to be defined using up to nine sequential steps. Measurement data is taken at each step and compared to preset user defined high and or low limits. If one of more measurements is outside the limits, a FAIL is generated and the test sequence is aborted. If no limit violations are detected during this program execution, a PASS result is generated instead.

Note: Some of the parameters listed in this section only apply to AC mode and will not be visible or selectable when operating in DC mode.

6.10.1 PROGRAM Mode System Settings

To select PROGRAM mode of operation, make sure the output is OFF first. Changing mode is not possible while the output is active.

From the top level Menu, select the "**System**" soft key. This brings up the System menu. The selected operating mode will be shown in the top left field as the first parameter entry.

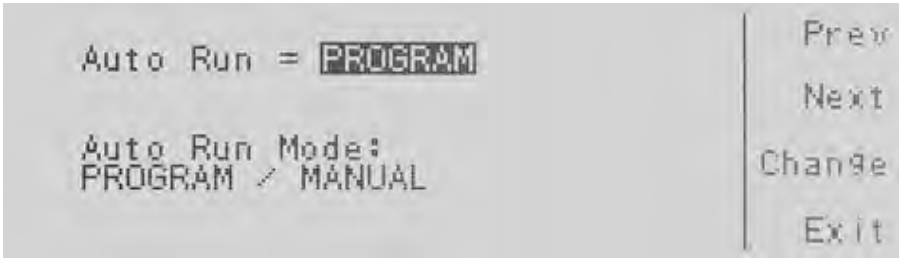


In PROGRAM mode, the following system parameters can be set from this screen:

- Auto Run Mode
- Out Mode
- Single Step Mode
- Alarm Volume
- Contrast of LCD Display
- Power Up Mode
- Loop Cycle Count
- Results display Mode
- Over Current Protection Fold Back mode
- Lock Mode
- Memory Lock Mode
- Volt Sense
- Ext Trig.

6.10.2 Auto Run Mode Selections

To change mode, press the "**Edit**" soft key while the first field is selected. This displays the MODE screen as shown below. In this case, **PROGRAM** mode is already selected but you can use the "**Change**" soft key to toggle to the available modes (**PROGRAM** or **MANUAL**) displayed at the bottom of the screen. In **PROGRAM** mode, programmed steps are executed. In **MANUAL** mode, the operator can use the shuttle to slew voltage or frequency set parameters while the output is ON. Setting and measurement limits can be set using the keypad when the output is OFF and will be applied when the output is ON.



As you toggle through the available modes, use the "**Enter**" soft key to confirm the mode selection or the "**Esc**" soft key to return with any change. This will bring up the next System parameter setup screen. The same screen can be selected using the "**Next**" soft key if needed.

6.10.3 Out Mode

The Out Mode setting allows configuration of the output for either three phase, split phase or single phase. It also allows selection of either AC or DC output mode. Press the "Change" soft key to toggle between AC or DC mode.

After toggling through the available modes, use the "**Enter**" soft key to confirm the mode selection or the "**Esc**" soft key to return with any change. This will bring up the next System parameter setup screen. The same screen can be selected using the "**Next**" soft key if needed.

6.10.4 Single Step Modes

Pressing Enter after selecting the PROGRAM mode will bring up the Single Step parameter setup screen. Available settings are shown in the bottom part of the screen.

Use the "**Change**" soft key to toggle between ON or OFF.

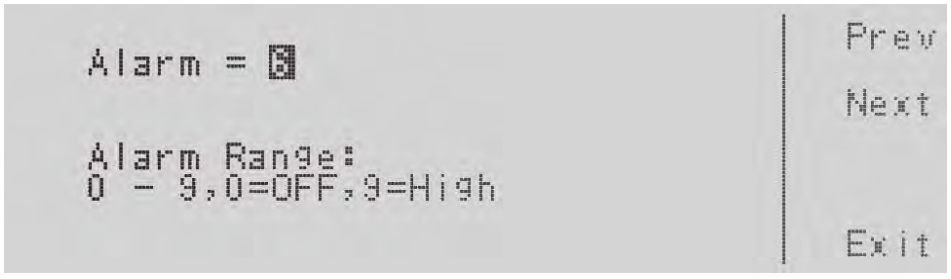
- **ON** = Program execution will take place in single step mode allowing the operator to advance to each step from the front panel.
- **OFF** = Program execution will proceed automatically using the dwell times programmed for each step.

When **Single Step** mode is **ON**, the source will sequence from one test step to the next only when the Test/Reset key is pressed by an operator between each step. The source will pause after each step has completed a test routine and passed based on the programmed testing parameters. If a PASS result occurs for the step, the operator can proceed to the next step in the sequence. If a FAIL result occurs for the step, the operator will not be able to proceed in the test sequence. He will have to restart from the beginning of the test sequence or step number one.

When the **Single Step** mode is **OFF**, the source will automatically sequence from one step to the next, regardless if a pass or failure has occurred for a particular step.

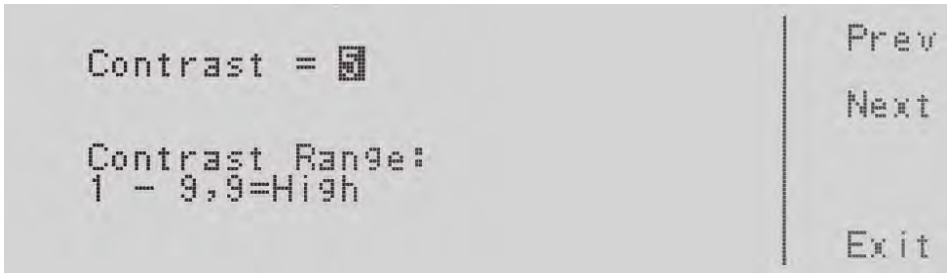
6.10.5 Alarm Settings

Press the "**Enter**" soft key to confirm you selection. This brings up the Alarm parameter setup screen. The Alarm parameter indicates the volume of the Alarm signal. Use the numeric key pad to enter a value from 0 to 9 with 0 being OFF and 9 being loudest.



6.10.6 LCD Contrast

Press the "**Next**" soft key to advance to the next parameter, the LCD contrast setting.



Use the numeric key pad to enter a value from 1 to 9 with 1 being the lowest contrast level and 9 the highest.

6.10.7 Power-Up Settings

Press the "**Next**" soft key to advance to the next parameter, the Power Up setting.

The power up setting determines in what output state the power source turns on when input power is applied. Available power-up modes are:

- ON = Output will be applied to the EUT on power-up of the unit
- OFF = Output will NOT be applied on power-up of the unit
- LAST = Output will be applied according to the last output state the unit was in prior to power OFF

Press the Change soft key to toggle the "**Power UP"** Mode between ON, OFF or LAST. To save the setting, press the "**Enter**" soft key. To cancel editing, press the "**Esc**" soft key. When the Enter soft key is pressed the "**Power UP"** Mode is accepted and you transition into the next system parameter.

6.10.8 Loop Cycle Settings

Press the "**Next**" soft key to advance to the next parameter, the Loop Cycle setting if not already there.

The Loop Cycle count indicates how many times a program will be repeated when executed. Default is OFF (1) meaning a test program will run one time and not repeat. When set to a value from 2 through 9999, the program will run the number of times set. A value of zero (0) means the program will cycle continuously until stopped by the operator. Thus for a given setting <n>:

- 1 = Program will run once
- 0 = Program will run continuously until manually stopped by operator
- 2-9999 = Program will run <n> times

Use the numeric keypad to enter in the Loop Cycle setting. Press the "**Enter**" soft key to accept the parameter. To cancel editing, press the "**Esc**" soft key.

6.10.9 Results Display Mode Settings

Press the "**Next**" soft key to advance to the next parameter, the **Results** setting.

Use the "**Change**" soft key to select from the following available Results display mode settings:

- ALL Result screen will display all available settings and measurements at the end of a test.
- P/F Results screen will only display a full screen size PASS or FAIL banner at the end of a test. The operator needs to acknowledge the result by pressing the "**Exit**" soft key in order to proceed.

- LAST Results screen will only display the last executed test step settings and results at the end of a test.

Press the Change soft key to select the desired Results display mode. To save the setting, press the "**Enter**" soft key. To cancel the editing, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed the **Results** display mode is accepted and you transition into the next system parameter.

6.10.10 Over Current Fold Mode Settings

Press the "**Next**" soft key if needed to advance to the next parameter, the **OC Fold** setting.

Use the "**Change**" soft key to select from the following available OC Fold mode settings:

- ON In this mode, the voltage will be decreased as needed once the load current reaches the set current limit value in order to keep the load current below this current level. This limits the current to EUT to the max. value set by the user.
- OFF In this mode, the output will trip off as soon as the load current exceeds the programmed current limit value to protect the EUT from over current.

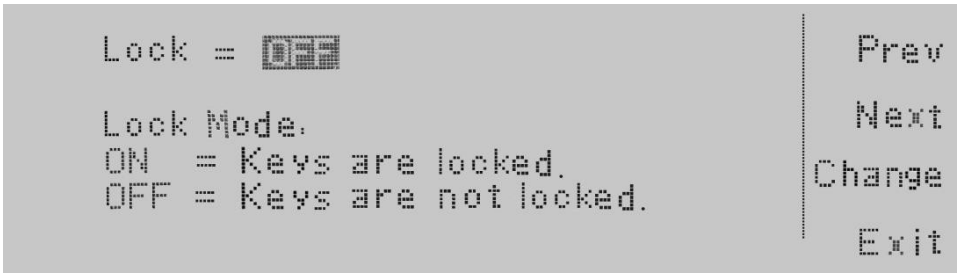
Press the Change soft key to select the desired OC Fold mode. To save the setting, press the "**Enter**" soft key. To cancel the editing, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed the **OC Fold** mode is accepted and you transition into the next system parameter.

6.10.11 Keyboard Lock Mode Settings

Press the "**Next**" soft key if needed to advance to the next parameter, the **Lock** setting.

Note: If a password has been set, a password entry dialog box will appear and the correct password must be entered to change this setting. See Section 0, "

".



Use the "**Change**" soft key to select from the following available Lock mode settings:

- ON In this mode, the front panel keyboard is locked out and is inoperative. The level of operator control available in keyboard lock mode is determined by the next setting, **Mem Lock**.
- OFF In this mode, front panel keyboard is enabled. (Normal operation).

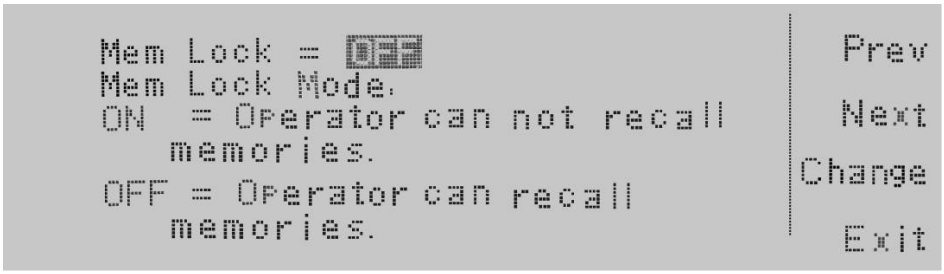
Press the Change soft key to select the desired keyboard lock mode. To save the setting, press the "**Enter**" soft key. To cancel the editing, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed the **Lock** mode is accepted and you transition into the next system parameter.

6.10.12 Memory Lock Mode Settings

Press the "**Next**" soft key if needed to advance to the next parameter, the **Mem Lock** setting.

Note: If a password has been set, a password entry dialog box will appear and the correct password must be entered to change this setting. See Section 0, "

".



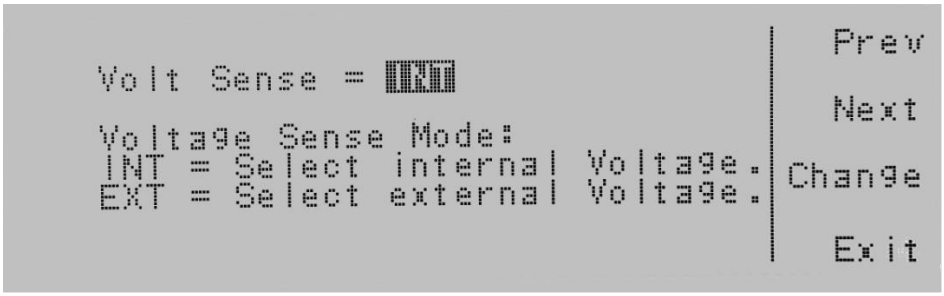
Use the "**Change**" soft key to select from the following available Mem Lock mode settings:

- ON In this mode, the operator cannot recall any stored program memories.
- OFF In this mode, the operator is able to recall stored program memories.

Press the Change soft key to select the desired Memory Lock mode. To save the setting, press the "**Enter**" soft key. To cancel the editing, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed the **Mem Lock** mode is accepted and you transition into the next system parameter.

6.10.13 Voltage Sense Mode Settings

Press the "**Next**" soft key if needed to advance to the next parameter, the **Volt Sense** setting.



Available voltage sense modes are **INT** for internal sense and **EXT** for external or remote voltage sense. For details on which mode is appropriate, refer to Section 6.12.4, "Voltage Sense Modes". Select the sense mode using the "**Change**" soft key. To save the setting, press the "**Enter**" soft key. To cancel the editing, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed the **Mem Lock** mode is accepted and you transition back to the next system parameter.

6.10.14 External Trigger Out Settings

Use the Prev, Next soft keys to navigate to the Sync Signal parameter. Pressing the Edit soft key will provide the following screen:

Ext trig: indicates the Ext Trig that is programmed into the instrument.

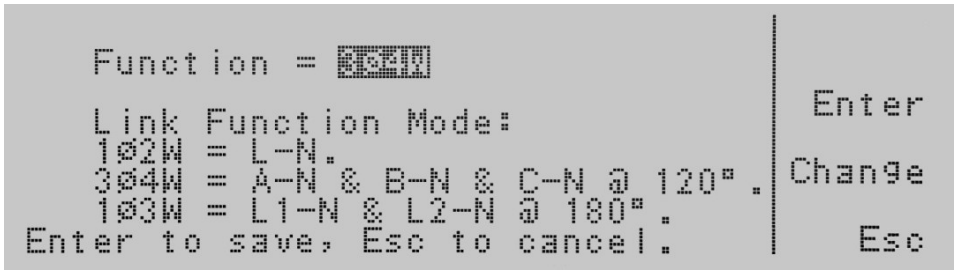
Ext Trig Mode: indicates the Ext Trig mode that can be programmed into the instrument.

The Ext Trig Modes available are OFF, Start, END, and BOTH. Press the Change soft key to toggle the mode. To save the parameter, press the Enter soft key. To cancel the editing of the Ext Trig Mode, press the Esc soft key. When the Enter soft key is pressed the Ext Trig Mode is accepted and you transition into the next system parameter: Auto Run.

If you wish to bypass editing this parameter and move to the next parameter you can press the Prev or Next soft key.

6.10.15 Function Settings (Output Phase Mode)

Press the "**Next**" soft key if needed to advance to the next parameter, the "**Function**" setting. The Function parameter determines the output mode.



When in DC mode, the output is fixed to single phase (1ø2W) and cannot be changed. When in AC, the following selections are available:

1ø2W **Single Phase Output**. Output terminals are wired as Line to Neutral. Same mode applies when in DC mode.

3ø4W **Three Phase Output**. Output terminals are wired as A, B, C with respect to Neutral. Phase offset for phase B = 120° and for phase C = 240° with respect to phase A.

1ø3W **Split Phase Output**. Output terminal are wired as L1 – N and L2 – N. Phase offset of L2 = 180° with respect to L1.

No internal configuration changes, jumpers or dip switches need to be set to change phase modes as all internal connections are controlled by firmware.

6.11 PROGRAM MODE - Using Memories and Steps

Program steps are available only in PROGRAM mode. If you are operating in MANUAL or DC modes, you can skip this section and proceed to the relevant section of the selected operating mode.

To manage memory content, select the "**Memory**" soft key from the top menu. (First entry on the first screen).

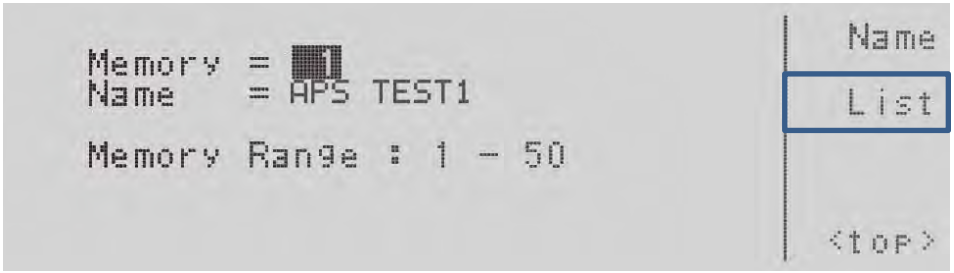
This brings up the Memory setup screen with the selected memory number indicated. There are 50 memory locations, so memory numbers can range from 1 through 50. The currently selected memory is shown in the first field;, in this example, memory number one.

The Name = parameter will list the symbolic name of the memory location if one was assigned. If no name has been programmed for the memory location, this field will be blank as shown above.

6.11.1 Selecting a Memory Location

Two methods are available for selecting a memory location:

1. Enter a memory number using the numeric keypad. Once you type in a number, a shaded black box (■) will begin blinking. This acknowledges the Memory parameter is being changed. There will also be a new text prompt at the bottom of the display stating: "Enter to save, Esc to cancel". To accept the new memory number entry select the "**Enter**" soft key, or to cancel the data entry, select the "**Esc**" soft key.
2. Press the <more> soft key to show the second Memory setup screen and press the "**List**" soft key. This brings up a list of all programmed memories of the instrument. The display will look as follows



You can use the "**Page** ∧" and "**Page** ∨**"** soft keys to scroll one page at a time or the ∨ soft key to scroll one line at a time. (Shuttle cannot be used to scroll). Once the

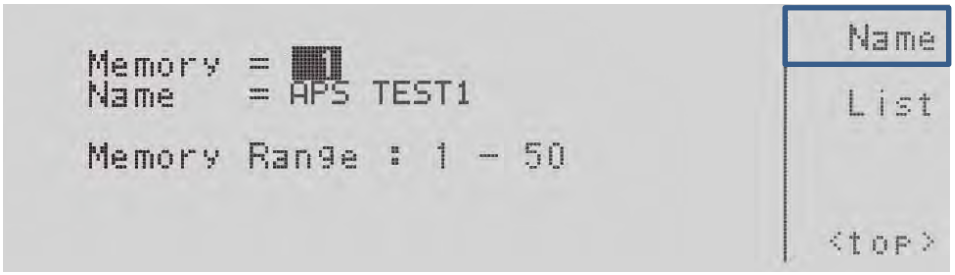
cursor is on the desired memory location, press the "**<more>**" soft key to see the bottom part of this screen and press the "**Load**" soft key to select the memory number.

Either of these two selection methods will return the user to the Memory screen with the newly selected memory location showing in the **Memory =** field.

6.11.2 Assigning a Name to a Memory Location

Naming a memory location makes it easier to remember what kind of test or for what EUT the memory content was set up. Instead of remembering by number, the name can be descriptive of the memory's content and/or purpose.

Names can be assigned by selecting a memory location number and pressing the "**<more>**" soft key to see the bottom part of this screen and press the "**Name**" soft key to enter name assignment mode.



This will bring you to the character map for entering the memory name as shown on the screen below. The numeric keypad may also be used to insert numbers 0 through 9 as part of the memory name.

To enter a memory name:

- Press the "**<top>**" soft key to use the ">" soft key and "∨" soft key to move through the character map.
- When on the desired character in the character map, press the "**Select**" soft key to choose the character. Repeat as needed with other letters.
- If you use the numeric keypad, the character will be entered automatically when the keypad is pressed.
- To delete a character, use back space ← key on the numeric keypad.
- The memory name can be no longer than ten (10) characters.

When done, press the "**<more>**" soft key to show the second part of this screen and press the "**Enter**" soft key to confirm the new name.

This will return the user to Main screen.

6.11.3 Selecting a Program Step

To enter new or edit existing steps, press the "Step" soft key from the main menu. This will display the Step setup screen as shown below.

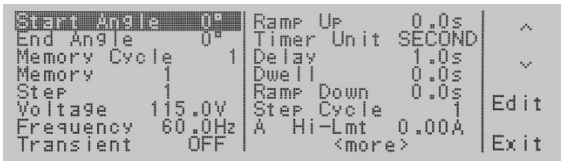
To select a step, press the Step soft key and the steps will sequence through. Each time the Step soft key is pressed the step will increase by one increment. There are 9 steps available. After the 9th step you will return to step number 1.

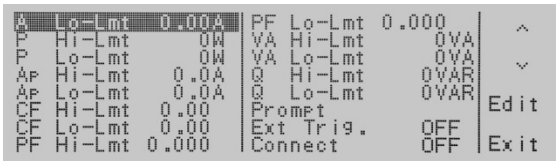
Note that any step parameters edited apply to the selected Memory number and step number only. The Memory and Step number are shown in the upper left corner of the display.

6.11.4 Program Step Parameters Available

There are 35 parameters available for each program step. These parameters appear on the Step edit screen in the order shown in the table below. To enter the Step Edit mode, press the "**Edit**" button from the Step screen.

The available step parameters are listed in table below in the order in which they appear on screen. The user can scroll through the list using the ∨ and ∧ soft keys. When the beginning or end of the list is reached, it wraps around automatically.





Step Parameter Listing

Order	Parameter Field	Description
1	Start Angle	Sets the start phase angle of the sine wave when the output voltage is generated.
2	End Angle	Sets the ending phase angle of the sine wave when output voltage is terminated.
3	Memory Cycle	Determines how many times the memory test sequence will repeat. This eliminates the need for the operator to press the Test/Reset key or send multiple test commands to the source to repeat a memory test sequence.
4	Memory	Allows the user to jump to and edit any other memory location (1-50).
5	Step	Allows the user the flexibility to change and edit a different step location (1 – 9).
6	Voltage	Sets the voltage output.
7	Frequency	Sets the frequency output. Only available in AC mode.
8	Transient	Sets mode and duration for voltage transients. Only available in AC mode.
9	Trans-Volt[1]	Allows insertion of a voltage surge or drop on the output. Whether the voltage is a surge or a drop depends on the voltage that is programmed for this parameter. For example if the output voltage is programmed at 120 volts and the operator programs in a SD-Volt of 150 volts this would be a surge of 30 volts. The opposite holds true; if the SD-Volt is programmed at 90 volts this would be a drop of 30 volts.
10	Trans-Site[1]	Sets the start phase angle of the sine wave to initialize the transient voltage in degrees. Available range is 0°-359° in 1° steps.

Order	Parameter Field	Description
11	Trans-Time[1]	Trans-Time gives the operator the flexibility to program the overall time duration of the transient voltage. For example if the Trans-Site is 90°; the output voltage is 120 volts; the transient set voltage is 150 volts; and the Trans-Time is 20 milliseconds when the sine wave reaches the 90° point, the voltage will surge to 150 volts. This transient will last for 20 milliseconds before the voltage output returns to 120 volts. Available range is from 0.5 msec through 999.9 msec in 0.1 msec steps.
12	Trans-Cycle. [1]	Determines whether the transient voltage will repeat a specific number of times or continuously for each sine wave of the test routine. Available settings are 0 through 9999 cycles with 1 cycle resolution. A zero setting will cause the transient to repeat indefinitely until stopped by pressing the **Test/Reset** key.
13	A Hi-Lmt	Sets the maximum current threshold or ceiling level. When this level is exceeded, a failure will occur.
14	A Lo-Lmt	Sets the minimum current threshold or floor level. If a minimum current level is not exceeded, a failure will occur. This ensures a load is attached to the power source and there is a minimum current present.
15	P Hi-Lmt	Sets the maximum wattage threshold or ceiling level. When this level is exceeded, a failure will occur.
16	P Lo-Lmt	Sets the minimum wattage threshold or floor level. If a minimum wattage level is not exceeded, a failure will occur. This ensures a load is attached to the power source and there is a minimum wattage present.
17	Ap Hi-Lmt	Sets the maximum peak current threshold or ceiling level. When this level is reached a failure will occur.
18	Ap Lo-Lmt	Sets the minimum peak current threshold or floor level. If a minimum peak current level is not exceeded, a failure will occur. This ensures a load is attached to the power source and there is a minimum peak current present.
19	CF Hi-Lmt	Sets the maximum current crest factor threshold or ceiling level. When this level is exceeded, a failure will occur.
20	CF Lo-Lmt	Sets the minimum current crest factor threshold or floor level. If a minimum power factor level is not exceeded, a failure will occur.
21	PF Hi-Lmt	Sets the maximum power factor threshold or ceiling level. When this level is exceeded, a failure will occur.
22	PF Lo-Lmt	Sets the minimum power factor threshold or floor level. If a minimum power factor level is not exceeded, a failure will occur.
23	VA Hi-Lmt	Sets the maximum apparent power threshold or ceiling level. When this level is exceeded, a failure will occur.

Order	Parameter Field	Description
24	VA Lo-Lmt	Sets the minimum apparent power threshold or floor level. If a minimum wattage level is not exceeded, a failure will occur. This ensures a load is attached to the power source and there is a minimum wattage present.
25	Q Hi-Lmt	Sets the maximum reactive power threshold or ceiling level. When this level is exceeded, a failure will occur.
26	Q Lo-Lmt	Sets the minimum reactive power threshold or floor level. If a minimum wattage level is not exceeded, a failure will occur.
27	Ramp Up	Sets the voltage ramp up time. This is the duration of time over which the programmed output voltage will be reached.
28	Timer Unit.	Sets the time increment that will be used for testing. Available options are Second/Minute/Hour.
29	Delay	Sets a time delay, or warm up time if needed. There is a voltage output present from the power source during this time period, but the high and low limit thresholds are essentially ignored during this period.
30	Dwell	Sets the actual test time. This time begins after any ramp up time has completed. The high and low limit thresholds are active once any delay time has completed.
31	Ramp Down	Sets the time duration over which the output voltage is reduced to zero after the dwell time has completed.
32	Prompt	Allows a user defined message prompt unique to a particular step. The message will be shown on the LCD graphic display prior to the test beginning for that particular step test routine. At this point the test routine will be paused and the operator must press the Test/Reset key to resume the test sequence.
33	Step Cycle	Sets the number of looping cycles for a particular step. For example if the operator would like to have a step repeat five times the step cycle would be programmed to five.
34	Ext Trig.	Sets the external sync output trigger mode.
35	Connect	Determines if a step will be linked or connected to the next step. For example in order to link step 1 to step 2, the Connect parameter must be turned ON. Steps can only be connected in sequential order.

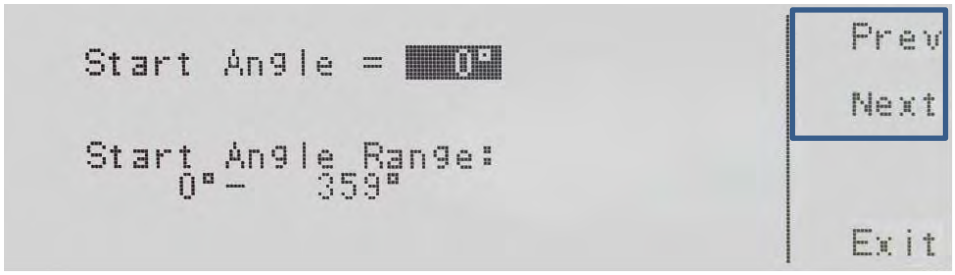
Note 1: These Surge/Drop parameter entries are only visible if the Surge/Drop setting is ON.

Table 7-6: PROGRAM Mode Step Parameters Available

6.11.5 Editing Step Parameters

To edit any of the available step parameters, scroll to the desired parameter and press the "**Edit**" soft key. When changing a value, press the "**Enter**" soft key to confirm the new value. This generally moves the screen to the next parameter. This speeds up programming all parameters that are part of each step as the user is guided through each parameter in sequence. To jump to a parameter out of sequence, just press the "**Exit**" soft key.

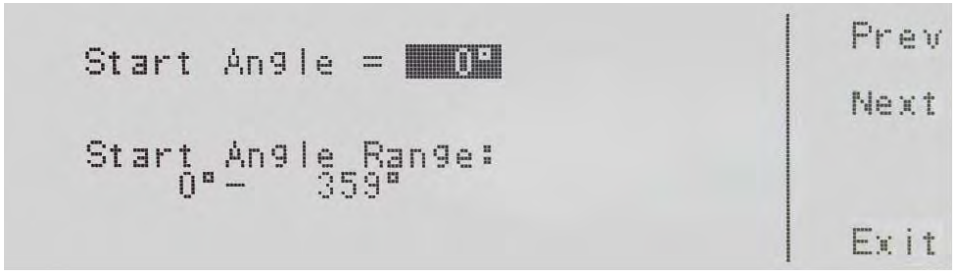
If the displayed parameter setting is already correct, then the user can use the "Prev" and "Next" soft keys to move to the previous or next parameter set screen.



6.12 PROGRAM Mode - Step Parameter Details

This section provides additional details on how to use step parameters to accomplish desired test sequences. Parameters are covered in the order they appear in the STEP edit screen.

6.12.1 Phase Angles



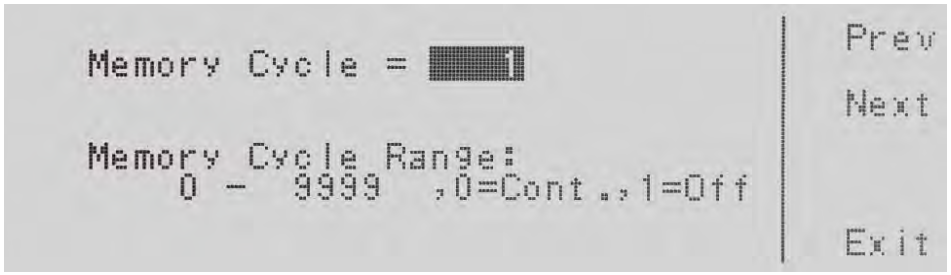
When using this feature, it is important to note the following characteristics of the CFS300 Series phase angle programming function.

- **Global Setting:** The start and stop phase angle setting in any step is global to the memory location used. Thus, when editing the start phase angle and/or end phase angle on any step, all 9 steps in that memory location will automatically be set to the same start and end angle values.
  Note: The start and stop phase angles **DO NOT** apply to the Transient Function.
- **LINKING:** If several steps are connected together to form a sequence of tests using the **Connect** feature, the start phase angle will apply to the first step in the sequence and the end phase angle will apply to the last step in that sequence. For example, memory 1 step 7 (M1-7) is linked to memory 1 step 8 (M1-8), memory 1 step 9 (M1-9) and memory 2 step 1 (M2-1) to create a four step sequence of tests. If the start angle is set to 90 degrees and the end angle is set to 180 degrees, the output voltage waveform at memory 1 step 7 will have a start angle at 90 degrees and the output voltage waveform at memory 2 step 1 will end at a 180 degree angle.
- **Data Entry:** To change the start phase angle or end phase angle, use the numeric keypad and type the value in degrees. Once you type in a number a shaded black box (■) will begin blinking acknowledging the parameter is being changed. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the Start Phase Angle or End Phase Angle parameter screen. When the "**Enter**" soft key is pressed, the angle is accepted and next parameter Memory Cycle is displayed.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.2 Memory Cycles

When using this feature, it is important to note the following characteristics of the CFS300 Series memory cycle function.



The Memory Cycle setting determines the number of cycles of the programmed frequency that will be generated when the output is active.

Memory Cycle Range is from 0 to 9999 cycles. Settings of 0 and 1 have special meaning as follows:

0: "Continuous" setting. Indicates that the test cycle will repeat forever until stopped by the operator.

1: "Off" setting. Indicates that the test will perform only one cycle.

To change the Memory Cycle, use the number keypad to select the memory cycle range and press the Enter soft key to accept the number. To cancel the editing of the Memory Cycle, press the Esc soft key. When the Enter soft key is pressed and the Memory Cycle is accepted, you transition into the next parameter: Memory.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.3 Voltage Programming

Each step can set a specific output voltage to be applied to the equipment under test. To set a step voltage, select the "Voltage" parameter and press the "**Edit**" soft key. The voltage setup screen will appear as shown below. This screen is the same as that used in the MANUAL mode.

Available voltage settings are:

- **Voltage** For model CFS330 and CFS360, the minimum voltage that can be programmed is 5.0V. Maximum voltage setting is 150V on the LOW range and 300V on HIGH range.
- **Voltage Mode** Available voltage ranges are 5.0V to 300.0V on HIGH range or 5.0V to 150.0V on LOW range. Use the AUTO mode selection to allow the power source to switch to LOW range if the set voltage is below 150.0V.

To change the voltage setting, use the numeric keypad and type the value. Once the user types in a number, a shaded black box (■) will blink, acknowledging the parameter is being changed. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the voltage parameter screen. When the "**Enter**" soft key is pressed, the voltage parameter is accepted and the system transitions into the next parameter: Frequency.

To change the Voltage mode from **AUTO** to **HIGH**, press the "**Change**" soft key to toggle between the two selections. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the voltage parameter screen. You must press the Enter soft key to accept the range.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.4 Frequency Programming

Each step can set a specific output frequency to be applied to the equipment under test. To set a step frequency, select the "Frequency" parameter and press the "**Edit**" soft key. The frequency setup screen will appear as shown below. This screen is the same as that used in the MANUAL mode.

The Frequency setting is indicated in the Frequency field. Frequency Range is 40.0 Hz to 500 Hz.

To change the frequency setting, use the numeric keypad and type the value. Once the user types in a number, a shaded black box (■) will blink, acknowledging the parameter is being changed. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the voltage parameter screen. When the "**Enter**" soft key is pressed, the voltage parameter is accepted and the system transitions into the next parameter: A-Hi Lmt.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.5 Measurement Limits Programming

Each step contains four sets of measurement limits for Current, Power, Peak Current, Crest Factor, Power Factor, Apparent Power and Reactive Power respectively. Setting these parameters is done in a similar way as setting output voltage or frequency except for each, there is an upper limit (Hi-Lmt) and a lower limit (Lo-Lmt). Each screen has only one editable parameter field that can be set using the Decimal key pad. Allowable range for each parameter varies by model and voltage range selected and is shown in the bottom half of each screen.

Note: The user can bypass editing any of these parameters and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.6 Time Duration Programming

Each step has a number of time parameters that can be set to control output timing. These parameters are:

Time Parameter	Description	Unit
Ramp Up	Sets time it will take to ramp voltage up from zero to set value	seconds
Delay Time	Sets time delay before measurements will be compared to measurement limits	Based on Timer Unit setting
Dwell	Sets time interval during which measurements will be taken and compared to limits Dwell time can be set to continuous by entering a zero value. In this case, the user can manually end the dwell period.	Based on Timer Unit setting
Ramp Down	Sets time it will take to ramp voltage down to zero	seconds
Timer Unit	Sets unit for both Delay and Dwell time to either seconds, minutes of hours	n/a

Table 7-7: Programmable Step Time Parameters

Each screen has only one editable parameter field that can be set using the Decimal key pad. Allowable range for each parameter is shown in the bottom half of each screen.

The relationship between these parameters is illustrated in the drawing shown below.

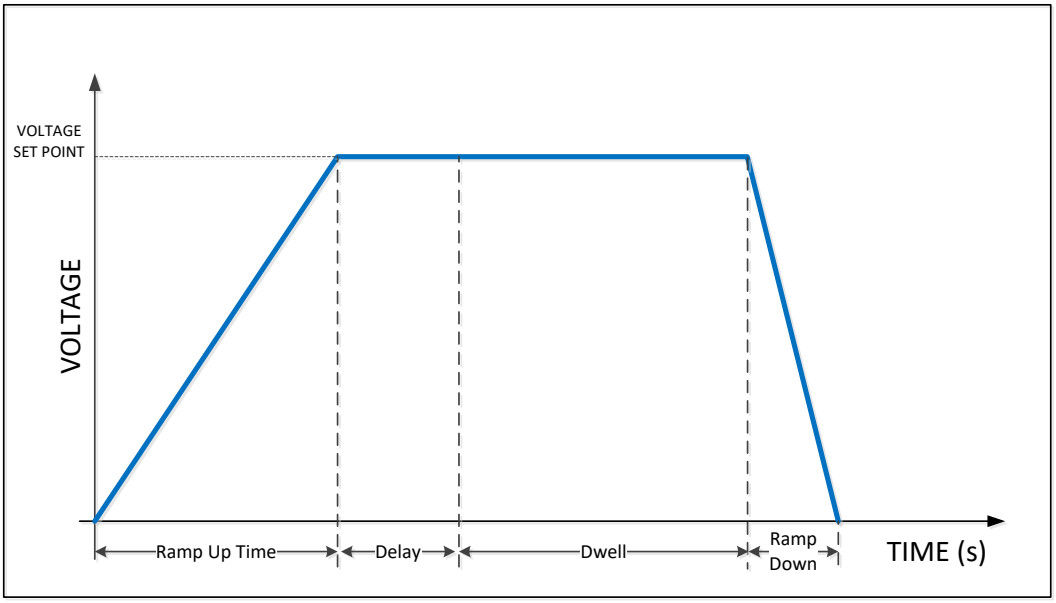
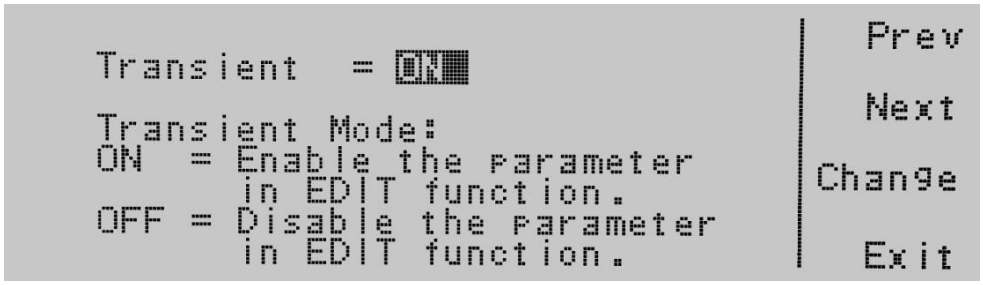


Figure 7-5: Step Time Parameters Relationship

6.12.7 Transient Programming

To program the Transient parameters, use the "∧, ∨" soft keys to navigate to the **Transient** parameter. Pressing the "**Edit**" soft key will display the screen shown below.



The Transient field is either set to ON or OFF using the "**Change**" soft key. The two modes are defined as follows:

OFF: Transient feature is disabled so no voltage transient will take place. When OFF, additional Transient setup screens will not be visible.

ON: Transient feature is enabled. This means the Transient parameters all have to be programmed to determine the level and duration of the voltage transient.

To change the Transient mode between **ON** or **OFF**, press the "**Change**" soft key to toggle between the two selections. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the voltage parameter screen. You must press the "Enter" soft key for the new setting to take effect. This transitions the screen to the next parameter: Trans-Volt.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

When Transient mode is ON, the following additional parameter screens will be accessible in the order shown here:

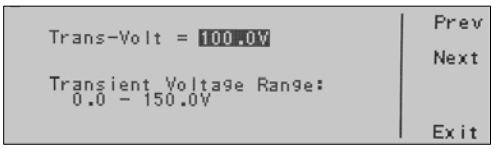
Trans-Volt Transient Voltage level. Available setting range depends on the voltage mode (AC or DC) and the selected voltage range (AUTO or HIGH).

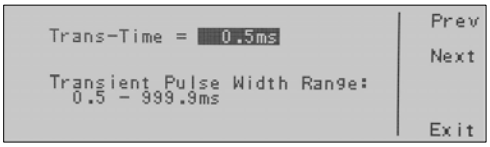
Trans-Site Phase position where the transient will start. Note that the Start and Stop phase angles for the program memory (See Section 7.12.1, "Phase Angles") do NOT apply here. The 0° is with respect to the sinewave. This setting is not available in DC mode.

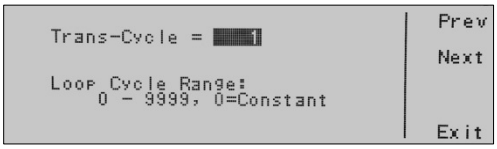
Trans-Time Duration of the voltage transient in msecs. Note that the range for this parameter is 0.5-999.9 msec.

Trans-Cycle. Transient Cycle count mode ON or OFF.
If the Trans-Cycle mode is ON, the transient programmed will repeat for the specified number of cycles. Available setting range is from 0 through 9999. A zero setting (0) indicates the transient will repeat indefinitely until stopped by the operator using the **Test/Reset** key. Default setting is 1 (one).

Programming these four Transient parameters is done using the "Edit" and "Change" soft-keys using the same procedure for all parameters. When pressing the "Enter" after each Change, the next Transient parameter screen appears. The four relevant screens are shown below and provide the input parameter value upper and lower set point limits in the lower part of each screen.







Example Transient Voltage Output

The following example shows the output drop created by the following Transient parameter settings.

Parameter	Value	Value	Value
Output Voltage	150V	Trans-Site	25ms
Output Frequency	50 Hz	Trans-Time	1ms
Trans-Mode	ON	Trans-Cont.	OFF
Trans-Voltage	70V		

Table 7-8: Programmed Voltage Drop Example Settings

Pressing the “TEST/RESET” button will result in the output voltage shown in **Error! Reference source not found.** as captured on a digital storage scope.

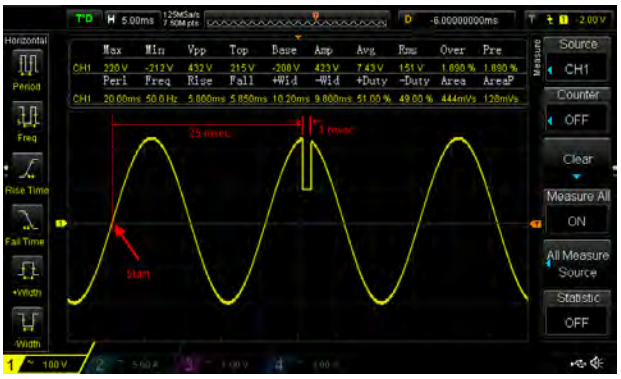


Figure 7-6: Programmed Voltage Transient Example Waveform

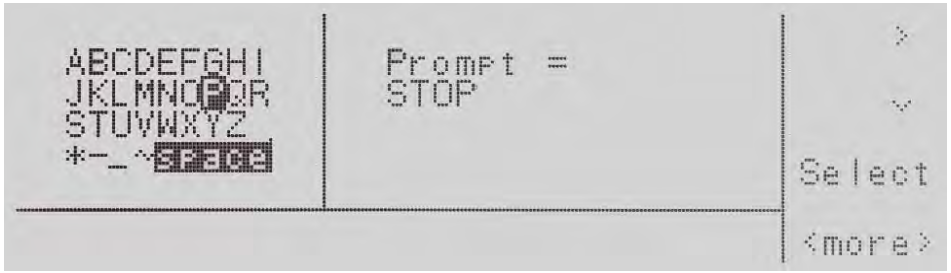
6.12.8 User Prompt Programming

A user prompt of up to 32 characters in length can be displayed at the start of each test. The operator has to press the Enter soft key to acknowledge the on screen prompt pop-up before the actual test starts.

To program the Prompt Message, use the "∧ and ∨" soft keys to navigate to the **Prompt** parameter. Pressing the "**Edit**" soft key will display the screen shown below.

Entering a prompt is accomplished in the same way as entering a test program name as described in Section 7.11.2, "Assigning a Name to a Memory Location" using both the character map for characters and the numeric keypad for numbers.

To save the prompt message press the "**<more>**" soft key which will bring you to the following screen.



Press the "**Enter**" soft key to accept the prompt message. To cancel the prompt message, press the "**Esc**" soft key. When the "**Enter**" soft key is pressed, the prompt is accepted and the next parameter screen (Step Cycle) is displayed.

Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

6.12.9 Step Cycle Programming

To program the Step Cycle settings, use the "∧ and ∨" soft keys to navigate to the Step Cycle parameter. Pressing the "**Edit**" soft key will display the screen shown below.

The Step Cycle determines how often each step in a sequence of steps is repeated. The default value is one (1) which means each step is executed only once (not repeated). A value of zero (0) indicates the step is executed continuously until manually stopped by the operator. Any other value determines the number of time each step is executed before advancing to the next step. This is similar to the Loop Cycle parameter as covered in Section 7.10.8 except the Loop Cycle applies to complete Memory (all steps) while the Step Cycle setting applies to individual steps and is only available in PROGRAM mode.

Thus for a given setting <n>:

- 1 = Step will run once
- 0 = Step will run continuously until manually stopped by operator
- 2-9999 = Step will run <n> times

Use the numeric keypad to enter in the Step Cycle setting. Press the "**Enter**" soft key to accept the parameter. To cancel editing, press the "**Esc**" soft key.

6.12.10 Connect Mode Programming

The Connect function allows a step to link to another step rather than the next step number. This allows the user to execute steps out of sequence if needed.

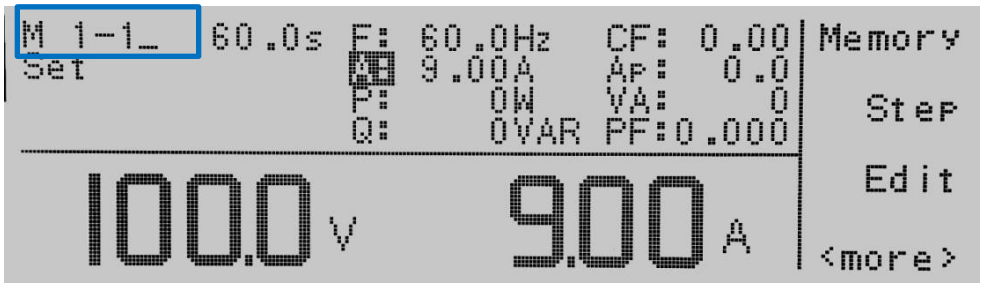
To program the Connect mode setting, use the "∧ and ∨" soft keys to navigate to the Connect parameter. Pressing the "**Edit**" soft key will display the screen shown below.

Press the "**Change**" soft key to toggle the connect mode ON or OFF. To save the parameter setting, press the "**Enter**" soft key. To cancel the editing of the step mode press the "**Esc**"

soft key. When the "**Enter**" soft key is pressed the connect mode is accepted and you loop back to the first parameter.

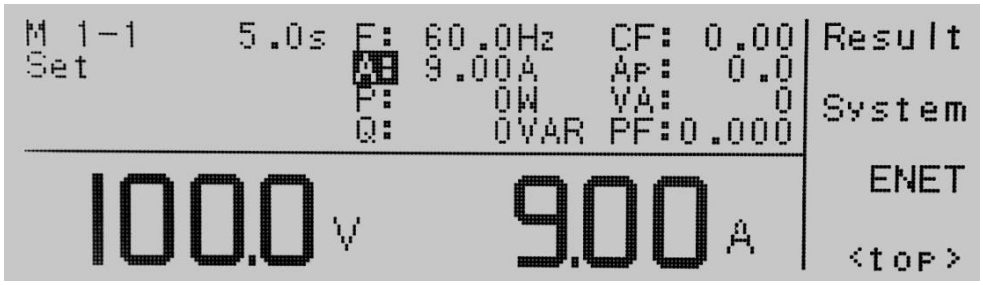
If you wish to bypass editing this parameter and move to the next parameter you can press the Prev or Next soft key.

When the connect mode is ON there will be an underscore _ next to the step number in the set screen. It will look as follows:

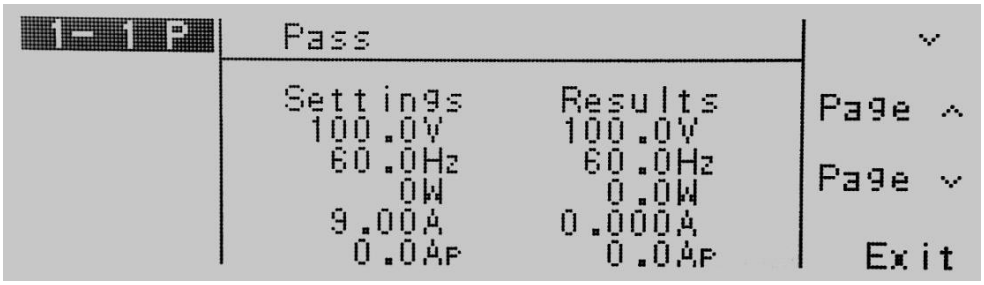


6.12.11 Reviewing Test Results

The test results can be viewed on screen after a test has been completed by pressing the "Result" soft key.



This allows the user to look at the results from the last test executed. An example result screen is shown here.



If there are multiple steps linked together, the "Page ∧" and "Page ∨" soft keys can be used to scroll through additional step's result screens

Press the Exit soft key to move back to the set screen

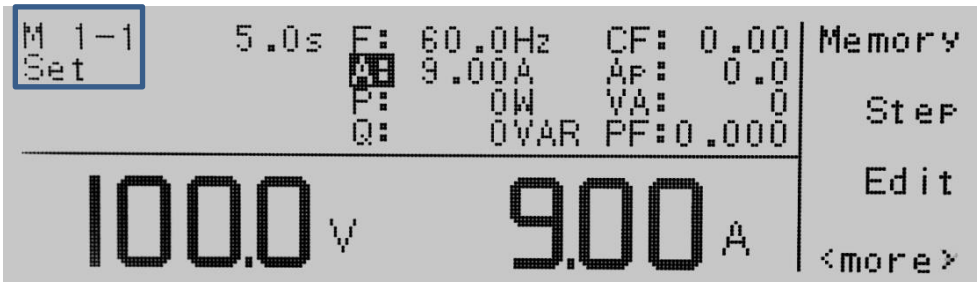
6.13 PROGRAM Mode Execution

PROGRAM mode performs pre-defined test sequences by applying output power and taking load measurements on a unit under test as determined by the program steps that are stored in memory. Program Memory is non-volatile so once programmed, the unit can be turned off and back on without losing test step settings.

6.13.1 Initiating a Test

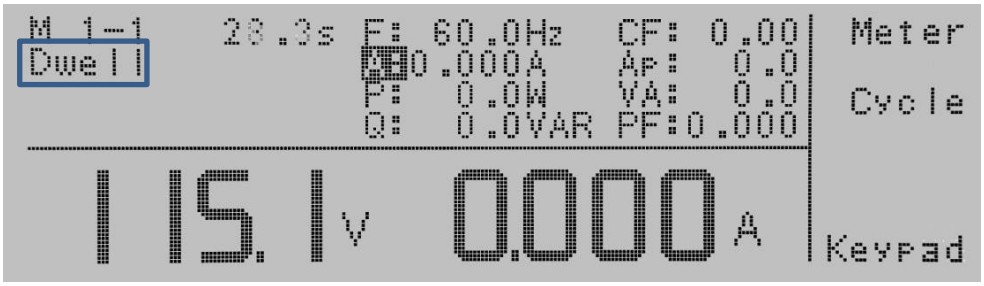
When in PROGRAM mode, a programmed test sequence will start executing as soon as the TEST/RESET button on the front panel is pushed. The Memory and Step number to start from is shown in the upper left corner of the LCD. To change the Memory and/or step to start executing, use the "Memory" and "Step" soft keys respectively. The "n-n" value will show the selected memory and test at all times. If the Connect field for a step is set to ON, execution will continue with the next step. If not, execution ends at the end of the step.

The TEST/RESET LED will illuminate while the output is ON and the test program is executed. In most cases, there will be a test duration time associated with the test steps unless Continuous mode or Cycle Mode is on.



6.13.2 Monitoring Test Execution

The LCD screen will change to the Measurement screen with soft keys shown below during program execution. The "Set" indication normally shown in the upper left corner of the LCD will change to "Dwell" to indicate a dwell time is in effect. (See image below). Other indicators that may appear in this area are: R-UP, R-DN, Dwell, Delay, VSS, Pass (at end of test) or Fail (at end of test).



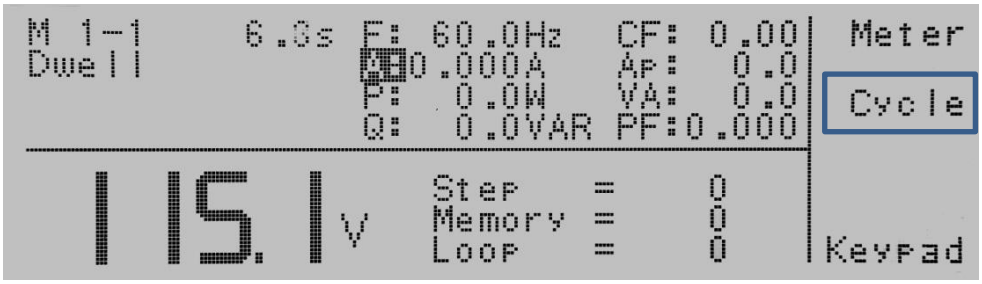
This allows the operator to monitor the load measurements. All measurements are shown on one screen. Two measurements are shown in large fonts. Pressing the "**Meter**" soft key will toggle the right hand large font reading to one of the other parameters. The reverse

background box indicator moves position to indicate which measurement is shown in a large font on the right. The sequence when pressing the "**Meter**" soft key repeatedly is:

- A RMS Current
- F Frequency
- Ap Peak Current
- P Power
- PF Power Factor

6.13.3 Cycle Display Mode

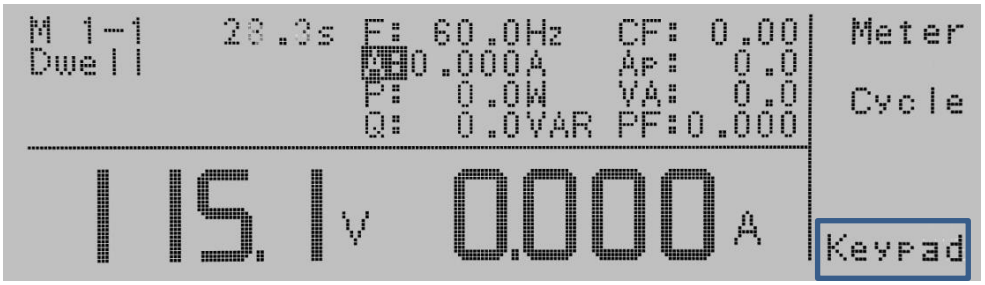
Press the "**Cycle**" soft key any time during program execution to display the current execution Memory, Step number and Cycle Loop count. This information will be shown on the right hand side of the measurement display in place of the second large font readout as shown here.



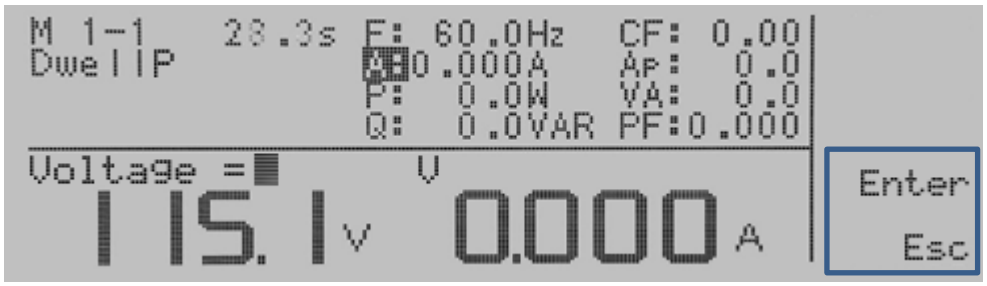
To return to the regular Measurement screen, press the "**Meter**" soft key.

6.13.4 Operator Interruption and Voltage Adjust

A test in progress can be paused by the operator if the front panel if enabled by pressing the "**Keypad**" soft key.



Doing so will pause the test at its current positon and provide a voltage adjustment field on the measurement screen as shown below.



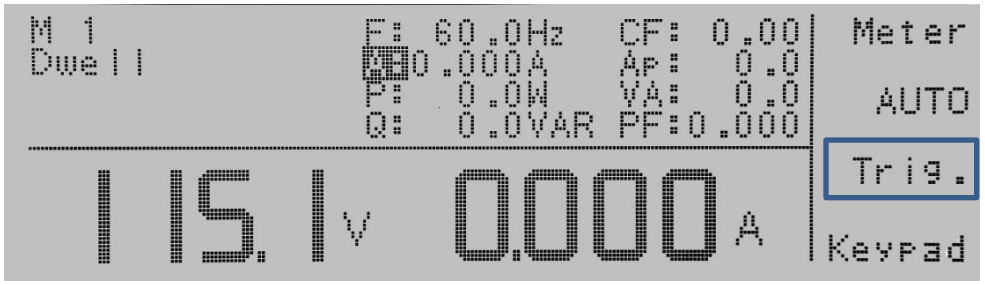
A reverse block cursor will be blinking indicating the power source is waiting for a voltage input from the operator. The numeric keypad must be used to enter a new voltage value within range of the power source to be applied to the EUT at this time in place of the active program step set voltage. To apply the voltage, press the "**Enter**" soft key. The new voltage will be applied to the EUT, then the test sequence will resume after the current Delay + Dwell time have expired. The "**Esc**" soft key may be used to exit out of this mode.

This manual interrupt mode during test sequence execution is particularly useful for pausing and troubleshooting a unit under test when the measurement data indicates a possible problem.

6.13.5 Triggering a Voltage Transient

To trigger a programmed voltage transient, the operator can press the "**Trig.**" soft key on the measurement screen as shown below.

A beep will sound to indicate that the trigger has been activated for the Transient parameters that have been entered into the program steps. The voltage transient will occur at the start phase angles programmed in the program step. After the transient, program execution will continue normally.



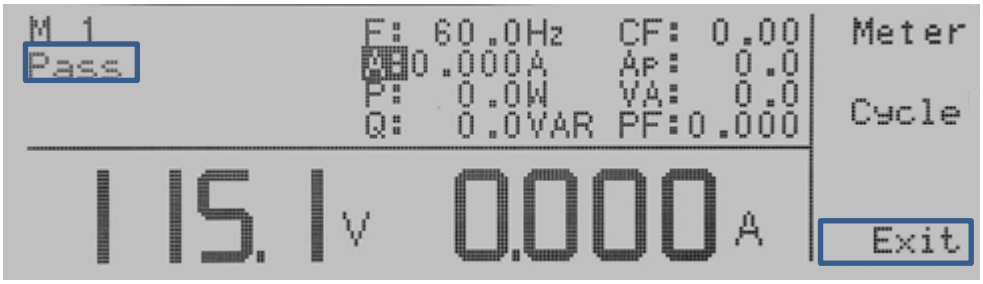
6.13.6 End of Test Status

When the test program has completed, the LCD display will show you the normal measurement screen and the soft keys will change to "**Meter**", "**Cycle**" and "**Exit**".

The operator can toggle through the last measurements using the "Meter" soft key.

The "Cycle" soft key will display the cycle information.

If the test passes you will see **Pass** indication in the upper left hand corner of the display.

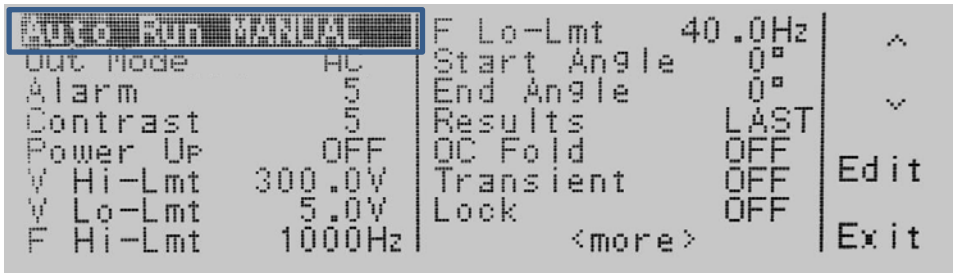


When done, press the "**Exit**" soft key to return to the regular setup screen.

6.14 MANUAL AC Mode Operation

To select MANUAL mode of operation, make sure the output is OFF first. Changing mode is not possible while the output is active.

From the top level Menu, select the "**System**" soft key. This brings up the System menu. The selected operating mode will be shown in the top left field as the first parameter entry.



6.14.1 Available Parameters in MANUAL Mode

In MANUAL mode, the following System parameters can be set from this screen:

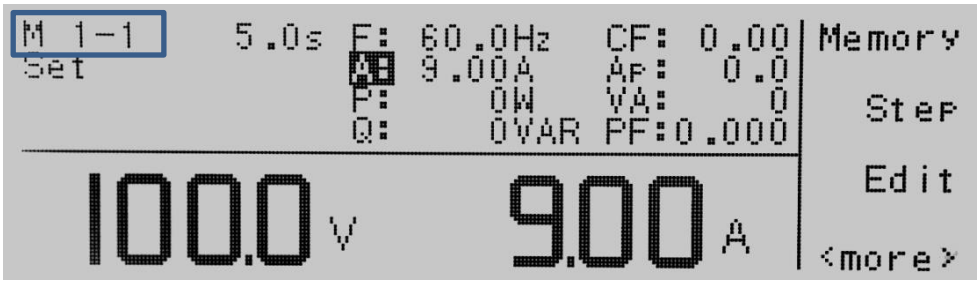
- Auto Run Mode
- Out Mode
- Alarm Volume
- Contrast of LCD Display
- Power Up Mode
- Voltage High Limit
- Voltage Low Limit
- Frequency High Limit
- Frequency Low Limit
- Start Phase Angle
- End Phase Angle
- Results display Mode
- Surge/Drop Mode
- Over Current Protection Fold Back mode
- Lock Mode
- Memory Lock Mode

6.14.2 Programming MANUAL mode parameters

Programming in MANUAL mode is similar to programming steps in PROGRAM mode except there is no step number to select as there is effectively only one "step" or setting. For details on setting any of the MANUAL Mode parameters listed above, refer to the corresponding in Section 6.12, "PROGRAM Mode - Step Parameter Details".

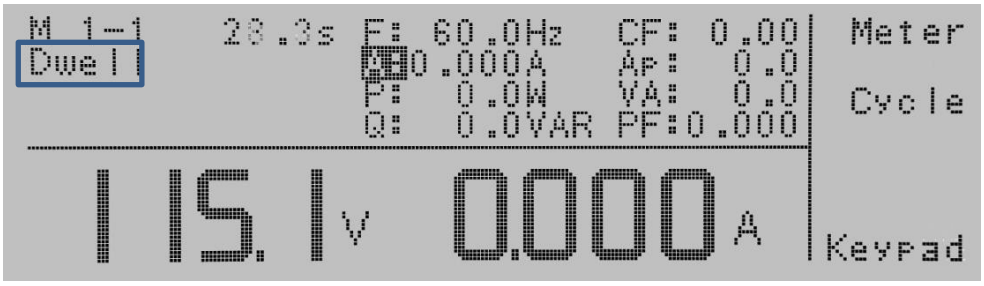
6.15 MANUAL AC Mode Execution

In MANUAL mode of operation, the setup screen will look as shown here. The Manual mode is indicated by the lack of a Step number after the M number in upper left corner of the LCD.



To enable the output and apply power to a unit under test, press the Test/Reset key and the LED for the key will illuminate. The text "**Set**" on the set screen will turn to "**Dwell**", in addition, the soft keys will change to include "Meter", "AUTO", "Keypad" and "Trig.".

In MANUAL Mode, the output will run continuously (infinite dwell time) until the Test/Reset key is pressed again, or there is a failure condition. The Test/Reset LED will be on during this time.



The following Soft keys are active during MANUAL mode output on state:

Meter — The "**Meter**" soft key allows the right hand side large font readout to be toggle between all available measurements

AUTO / HIGH — The "**AUTO**" and "**HIGH**" soft keys appear in the same location and toggle the voltage range between High and Low. **Note** that if the programmed voltage is 150V or higher, the power source will remain in high voltage range. If the programmed voltage is less than 150V, selecting AUTO will result in the low voltage range being used allowing two times the amount of current to be delivered to the unit under test.

Keypad — The "**Keypad**" soft key may be used to enter a different voltage or frequency value directly using the Key pad. This means output voltage and/or frequency can be changed without having to open the output (OFF). You can also use the shuttle knob for this. Unless the Frequency is displayed in large font on the right, the "**Keypad**" soft key and Shuttle both will adjust the output voltage. If Frequency is displayed on the right, "Keypad" soft key and shuttle will adjust the frequency.

Trig. The "**Trig.**" soft key will only appear in this screen if the Surge/Drop mode is set to ON in the MANUAL mode System menu. When present, pressing the "**Trig.**" soft key will cause the Voltage surge or drop to be executed. A beep will sound when pressed.

6.16 MANUAL DC Mode Operation

To select DC mode of operation, make sure the output is OFF first. Changing mode is not possible while the output is active.

From the top level Menu, select the "**System**" soft key. This brings up the System menu. The selected operating mode will be shown in the top left field as the first parameter entry.

6.16.1 Available Parameters in DC Mode

In DC mode, the following System parameters can be set from this screen:

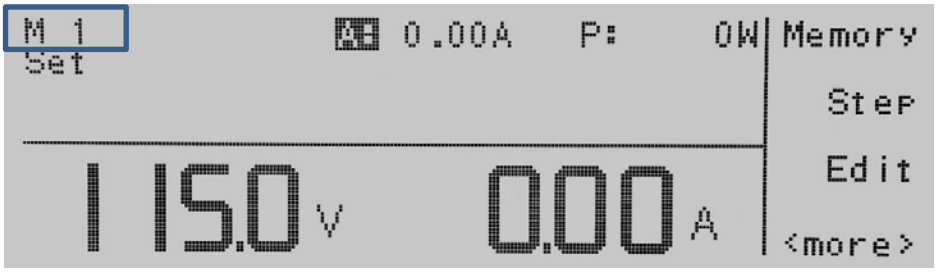
- Mode
- Alarm Volume
- Contrast of LCD Display
- Power Up Mode
- Voltage High Limit
- Voltage Low Limit
- Results display Mode
- Over Current Protection Fold Back mode
- Lock Mode
- Memory Lock Mode

6.16.2 Programming DC mode parameters

Programming in DC mode is similar to programming steps in MANUAL mode except for DC output instead of AC output. There is no Frequency setting, no start and stop phase angles, no peak current or power factor measurement. For details on setting any of the DC Mode parameters that are in common with AC mode listed above, refer to the corresponding in Section 6.12, "PROGRAM Mode - Step Parameter Details".

6.17 MANUAL DC Mode Execution

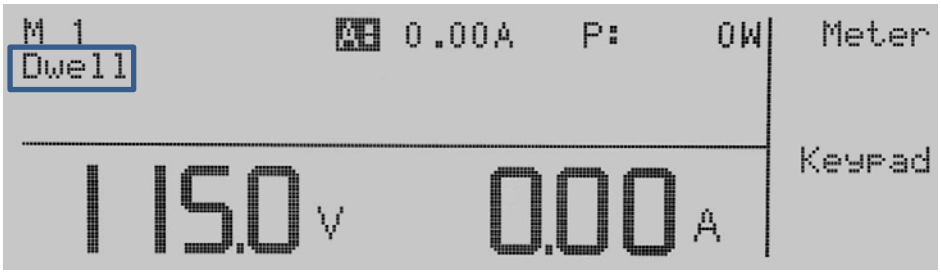
In MANUAL mode of operation, the setup screen will look as shown here. The Manual mode is indicated by the lack of a Step number after the M number in upper left corner of the LCD.



To enable the output and apply power to a unit under test, press the Test/Reset key and the LED for the key will illuminate. The text "**Set**" on the set screen will turn to "**Dwell**", in addition, the soft keys will change to include "Meter" and "Keypad".

Note: Although there is no Ramp-Up / Ramp-Down programmable setting, turning the DC output on and off is done using a 1 second up / down ramp to prevent regulation loop instability.

In MANUAL Mode, the output will run continuously (infinite dwell time) until the Test/Reset key is pressed again, or there is a failure condition. The Test/Reset LED will be on during this time.



The following Soft keys are active during MANUAL mode output on state:

Meter The "**Meter**" soft key allows the right hand side large font readout to be toggled between Current (A) and Power (W). A block cursor will show the selected measurement readout.

Keypad The "**Keypad**" soft key may be used to enter a different voltage value directly using the Key pad. This means output voltage can be changed without having to open the output (OFF). You can also use the shuttle knob for this. The "**Keypad**" soft key and Shuttle both will adjust the output voltage.

Note: The AUTO / HIGH soft key selection is not available in DC mode. The Voltage range is set in the DC mode system screen.

7 Remote Control Programming

7.1 Overview

All CFS300 models are shipped with standard USB and RS232 control interfaces. Optional LAN or GPIB are available as well. The interface allows the powers source settings to be configured remotely and measurement data to be retrieved for analysis and test report generation.

7.2 Command Syntax

All CFS300 Series power sources use a proprietary command syntax composed of a command word, one or more parameters (if required), separated from the command by commas and terminated by a command termination character. Commands are not case sensitive, so any combination of upper and lower case characters is permissible.

For consistency, this document will use UPPER CASE command syntax for consistency and to differentiate commands from regular text.

7.2.1 Command Terminators

Allowable terminator characters are:

Character	ASCII	Dec value	Hex value
Carriage Return	<CR>	13	0x0d
Line Feed	<LF>	10	0x0a

7.2.2 Numeric Parameters

If a command requires a parameter, it may be entered as a real number using a period as the decimal separator.

7.2.3 Parameter Unit Options

When sending a parameter value, it is **NOT** permissible to include a unit character such as V for voltage or A for amps. All command parameters and query response are without any unit designator characters.

7.2.4 Command Delay Recommendation

When using any of the serial style interfaces – USB, LAN or RS232 – it may be necessary to insert a delay of **up to 100 msec** between successive commands to prevent command overruns resulting in no response or possible locking up of the interface. Shorter delays may work as well depending on the programming IDE used (i.e. LabView, Visual C# etc).

7.3 Syntax Notation Convention

The following parentheses are used in the command descriptions to indicate whether a command is necessary or optional and whether a choice has to be made. The symbols { }, [ ], | are not actually used in the programming commands. The symbols { }, [ ] and | are merely used to illustrate the command syntax.

[ ] - Optional:	The contents of the [ ] symbol indicates that the command is optional. The use of the contents depends on the test application.
{ } - Selection:	The contents between the { } symbols is a list of available parameter values.
| - Required Choice:	This symbol acts as a separator between multiple parameter options. It means a choice must be made between the stated parameter key words. For example, “LOW|HIGH” Means a LOW or HIGH choice needs to be made as part of the command.
<> - Parameter Value:	Indicates a numeric value.

7.4 Test Control Command and Query Syntax

The following table lists all available remote control commands in alphabetical order. Each command is described in more detail in subsequent sections.

Command	Description	AC Program	AC Manual	DC Program	DC Manual	Unit
TEST	Execute a Test	Power On				
RESET	Reset	Power Off				
TD?	Test data	Memory, Step, Status, Freq., Volt, Curr., Power, Apeak, PF, Q, CF, VA, Timer	Memory, Status, Freq., Volt, Curr., Power, Apeak, PF, Q, CF, VA	Memory, Step, Status, Volt, Curr., Power, Timer	Memory, Status, Volt, Curr., Power	
RD XX?	Measurement					
TDFREQ?	Testing frequency meter	40.0~1000.0				Hz
TDVOLT?	Testing voltage meter	0.0~300.0		0.0~420.0		V
TDCURR?	Testing current meter	See Section 5 for range				A
TDAP?	Testing current peak meter	See Section 5 for range				A
TDP?	Testing power meter	See Section 5 for range				W
TDPF?	Testing pf meter	0.000~1.000	0.000~1.000			
TDQ?	Testing Q meter	See Section 5 for range				
TDCF?	Testing cf meter	0.00~10.00				
TDVA?	Testing VA meter	See Section 5 for range				VAR
TDTIMER?	Testing timer meter	0.0~999.9		0.0~999.9		s/m/h
METER {0|1…7|8}	Meter Selection	0=F,1=A,2=P,3=Q,4=CF,5=AP,6=VA,7=PF,8=CYCLE	0=F,1=A,2=P,3=Q,4=CF,5=AP,6=VA,7=PF	1=A,2=P,,8=CYCLE	1=A,2=P	
METER?	Meter Selection Query					
SDTRG	Surge/Drop /Transient Trigger		Trigger Transient		Trigger Transient	
STEPCYCLE?	Step Cycle Query	0=Continuous, 1= Off, 0-9999		0=Continuous, 1= Off, 0-9999		
MEMORYCYCLE?	Memory Cycle Query	0=Continuous, 1= Off, 0-9999		0=Continuous, 1= Off, 0-9999		
LOOPCYCLE?	Loop Cycle Query	0=Continuous, 1= Off, 0-9999		0=Continuous, 1= Off, 0-9999		
RR?	Read Reset Input					
RI?	Read Output Interlock	0-1: 0 = CLOSE, 1 = OPEN				
EXTP	Trigger External	Trigger one pulse on SYNC Output				

Table 8-1: Test Control Command and Query Summary

The following commands are used to control testing in PROGRAM mode of operation.

TEST

Turns on the output voltage at the selected step loaded into memory.

RESET

Turns the output voltage off or resets the instrument in the event of a failure.

TD?

Queries the active data being displayed on the LCD display while the test is in process. Will also read the last data taken when the test sequence has completed. Each parameter is separated by commas and includes memory number, step number, test status, frequency value, voltage value, current value, power value, peak current value, power factor value and timer metering. The syntax for the command response is {memory, step, status, frequency, voltage, current, power, peak current, power factor, timer}. Each measurement will contain only the value and not the units. Current and peak current are reported in amps while power is reported in Watts.

RD <step number>?

Queries the results for an individual step. The step number is the actual step number that has been saved within the file, not the order of which the steps were executed. For example if the test was executed starting from step 3 and ending with step 5, then the first step test results will be found in location 3 not in location 1. Each parameter is separated by commas and includes step number, test type, test status, and metering. The syntax for this command response is {memory, step, status, frequency, voltage, current, power, peak current, power factor, timer}. ACW test returns 4 measurements. Each measurement will contain only the value and not the units. Current and peak current are reported in amps while power is reported in Watts.

TDFREQ?

Queries the active frequency value being displayed while a test is in process.

TDVOLT?

Queries the active voltage value being displayed while a test is in process.

TDCURR?

Queries the active current value being displayed while a test is in process.

TDAP?

Queries the active peak current value being displayed while a test is in process.

TDP?

Queries the active power value being displayed while a test is in process.

TDPF?

Queries the active power factor value being displayed while a test is in process.

TDQ?

Queries the reactive power value being displayed while a test is in process.

TDCF?

Queries the current crest factor value being displayed while a test is in process.

TDVA?

Queries the apparent power factor value being displayed while a test is in process.

TDTIMER?

Queries the active timer meter value being displayed while a test is in process.

METER {4|3|2|1|0}

Selects the metered value that is displayed while a test is in process. 4 sets the meter = power factor, 3 sets the meter = current, 2 sets the meter = power, 1 sets the meter = peak current and 0 sets meter = frequency.

METER?

Queries the selected meter value. Returns value of 0 – 4.

SDTRG

Triggers a one shot surge/drop in order to simulate loading or brown out conditions.

STEPCYCLE?

Queries the value of the current step cycle signal. When the step cycle has been activated the query will return a value of 0 for continuous, 1 for Off or a range from 0~9999 cycles.

MEMORYCYCLE?

Queries the value of the current memory cycle signal. When the memory cycle has been activated the query will return a value of 0 for continuous cycling, 1 for Off or a range from 0~9999 cycles.

LOOPCYCLE?

Queries the value of the current loop cycle signal. When the loop cycle has been activated the query will return a value of 0 for continuous cycling, 1 for Off or a range from 0~9999 cycles.

RR?

Queries the remote reset input signal. When the remote reset has been activated by closing a contact, this query will return a value of 1 to indicate the instrument is being reset.

RI?

Queries the remote Interlock input signal. When the remote Interlock has been activated by opening a contact, this query will return a value of 0 to indicate the instrument is in the Interlock state and will not be able to generate output voltage or current.

EXTP?

Generates an external trigger pulse based on SYNC event setting.

7.5 Split Phase Mode Commands

The commands listed in the table below apply only to split phase mode operation and AC mode. (2ø3W).

Command	Description	AC Program	AC Manual	Unit
TDL1N?	Testing L1-N meter data	Memory, Step, Status, Freq, Volt, Curr, Power, APeak, PF, Q, CF, VA, Timer	Memory,Status, Freq,Volt,Curr, Power,APeak, PF,Q,CF,VA	
TDL2N?	Testing L2-N meter data			
TDL1L2?	Testing L1-L2 meter data			
RDL1N XX?	Results L1-N meter data			
RDL2N XX?	Results L2-N meter data			
RDL1L2 XX?	Results L1-L2 meter data			
TDL1FREQ?	Testing frequency meter	40.0~1000.0		Hz
TDL1VOLT?	Testing voltage meter	0.0~300.0		V
TDL1CURR?	Testing current meter	See Section 5 for range		A
TDL1AP?	Testing current peak meter	See Section 5 for range		A
TDL1P?	Testing power meter	See Section 5 for range		W
TDL1PF?	Testing pf meter	0.000~1.000		
TDL1Q?	Testing Q meter	See Section 5 for range		VAR
TDL1CF?	Testing cf meter	0.00~10.00		
TDL1VA?	Testing VA meter	See Section 5 for range		VA
TDL2FREQ?	Testing frequency meter	40.0~1000.0		Hz
TDL2VOLT?	Testing voltage meter	0.0~300.0		V
TDL2CURR?	Testing current meter	See Section 5 for range		A
TDL2AP?	Testing current peak meter	See Section 5 for range		A
TDL2P?	Testing power meter	See Section 5 for range		W
TDL2PF?	Testing pf meter	0.000~1.000		
TDL2Q?	Testing Q meter	See Section 5 for range		VAR
TDL2CF?	Testing cf meter	0.00~10.00		
TDL2VA?	Testing VA meter	See Section 5 for range		VA
TDL1L2VOLT?	Testing voltage meter	0.0~300.0		V
TDL1L2CURR?	Testing current meter	See Section 5 for range		A
TDL1L2P?	Testing power meter	See Section 5 for range		W
TDL1L2PF?	Testing pf meter	0.000~1.000		
TDL1L2Q?	Testing Q meter	See Section 5 for range		VAR
TDL1L2VA?	Testing VA meter	See Section 5 for range		VA

Figure 8-1: Split Phase Mode Commands and Query Summary

Note: These commands perform the same function as those described in the previous section but apply to L1-N, L2-N and L1-L2 measurements respectively.

TDL1N?

Read the selected L1-N meter values while a test is in process.

TDL2N?

Read the selected L2-N meter values while a test is in process.

TDL1L2?

Read the selected total (L1-L2) meter values while a test is in process.

RDL1N XX?

Read the selected L1-N results once a test has completed.

RDL2N XX?

Read the selected L2-N results once a test has completed.

RDL1L2 XX?

Read the total (L1-L2) results once a test has completed.

7.6 Three Phase Mode Commands

The commands listed in the tables below apply only to three phase mode operation and AC mode. 3ø4W).

7.6.1 Voltage Measurement Commands – 3 Phase

Command	Description	AC Program	AC Manual	Unit
TDA?	Testing R-N meter data	Memory, Step, Status, Freq, Volt, Curr, Power, APeak, PF, Q, CF, VA, Timer	Memory,Status, Freq,Volt,Curr, Power,APeak, PF,Q,CF,VA	V
TDB?	Testing S-N meter data			V
TDC?	Testing T-L2 meter data			V
TDE?	Testing RS, RT and ST Line to Line Voltage meter data			V
RDA XX?	Results AØ meter data			V
RDB XX?	ResultsBØ meter data			V
RDC XX?	Results CØ meter data			V
RDE XX?	Results ΣØ meter data			V

Note: These commands perform the same function as those described in the previous section but apply to R-N, S-N and T-N measurements respectively.

TDA?

Read the selected Phase A meter values while a test is in process. Query only available in AC Program mode and AC Manual mode.

TDB?

Read the selected Phase B meter values while a test is in process. Query only available in AC Program mode and AC Manual mode.

TDC?

Read the selected Phase C meter values while a test is in process. Query only available in AC Program mode and AC Manual mode.

TDE?

Read the total (Phase A + B + C) meter values while a test is in process. Query only available in AC Program mode and AC Manual mode.

RDA XX?

Read the selected Phase A results once a test has completed. Query only available in AC Program mode and AC Manual mode.

RDB XX?

Read the selected Phase B results once a test has completed. Query only available in AC Program mode and AC Manual mode.

RDC XX?

Read the selected Phase C results once a test has completed. Query only available in AC Program mode and AC Manual mode.

RDE XX?

Read the selected total (Phase A + B + C) results once a test has completed. Query only available in AC Program mode and AC Manual mode.

7.6.2 Measurement Commands – 3 Phase

Commands	Description	AC Program	AC Manual	Unit
TDA-FREQ?	Testing frequency	40.0~1000		Hz
TDA-VOLT?	Testing voltage meter	0.0~300.0		V
TDA-CURR?	Testing current meter	See Note1-1		A
TDA-AP?	Testing current peak	See Note4		A
TDA-P?	Testing power meter	See Note3-1		W
TDBA-PF?	Testing pf meter	0.000~1.000		
TDA-Q?	Testing Q meter	See Note3-1		
TDA-CF?	Testing CF meter	0.00~10.00		
TDA-VA?	Testing VA meter	See Note3-1		VAR
TDB-FREQ?	Testing frequency	40.0~1000		Hz
TDB-VOLT?	Testing voltage meter	0.0~300.0		V
TDB-CURR?	Testing current meter	See Note1-1		A
TDB-AP?	Testing current peak	See Note4		A
TDB-P?	Testing power meter	See Note3-1		W
TDB-PF?	Testing pf meter	0.000~1.000		
TDB-Q?	Testing Q meter	See Note3-1		
TDB-CF?	Testing CF meter	0.00~10.00		
TDB-VA?	Testing VA meter	See Note3-1		
TDC-FREQ?	Testing frequency	40.0~1000		Hz
TDC-VOLT?	Testing voltage meter	0.0~300.0		V
TDC-CURR?	Testing current meter	See Note1-1		A
TDC-AP?	Testing current peak	See Note4		A
TDC-P?	Testing power meter	See Note3-1		W
TDC-PF?	Testing pf meter	0.000~1.000		
TDC-Q?	Testing Q meter	See Note3-1		
TDC-CF?	Testing CF meter	0.00~10.00		
TDC-VA?	Testing VA meter	See Note3-1		VAR
TDE-VOLT?	Testing voltage meter	0.0~300.0		V
TDE-CURR?	Testing current meter	See Note1-1		A
TDE-P?	Testing power meter	See Note3-1		W
TDE-PF?	Testing pf meter	0.000~1.000		
TDE-Q?	Testing Q meter	See Note3-1		
TDE-VA?	Testing VA meter	See Note3-1		VAR

7.7 Parameter Setup Command and Query Syntax

These commands are used to modify individual test parameters within each step. Many of these commands require a parameter value to be sent with the command. The corresponding query command will return the parameter setting in effect. Parameter values are sent as numeric values so no unit info like V or Hz should be appended. Also, when the query commands are sent, the responses will not include any unit characters.

Command	Description	Value	Unit
AR {0|1|2}	Set Auto Run	0=PROGRAM,1=MANUAL, 2=DC	
AR?	Return Auto Run Value	0~2	
MC <value>	Set Memory Cycle Value	0~9999 ,0=Contine,1=OFF	
MC?	Return Memory Cycle Value	0-9999	
MEMORY <value>	Memory Number	1-50	
MEMORY?	Return Memory Number	1-50	
STEP <value>	Step Number	1-9	
STEP?	Return Step Number	1-9	
VOLT <value>	Set Voltage Value	AC: 5.0-300.0 / DC: 5.0-420.0	V
VOLT?	Return Voltage	AC: 5.0-300.0 / DC: 5.0-420.0	V
RANG {1|0}	Range Set	0=HIGH,1=AUTO	
RANG?	Return Range Set	0-1	
FREQ <value>	Input Frequency Value	40.0~1000	Hz
FREQ?	Return Frequency Value	See Section 5 for range	Hz
AHI <value>	Set Current High Limit	See Section 5 for range	A
AHI?	Return Current High Limit	See Section 5 for range	A
ALO <value>	Set Current Low Limit	See Section 5 for range	A
ALO?	Return Current Low Limit	See Section 5 for range	A
APHI <value>	Set Current Peak High Limit	See Section 5 for range	A
APHI?	Return Current Peak High Limit	See Section 5 for range	A
APLO <value>	Set Current Peak Low Limit	See Section 5 for range	A
APLO?	Return Current Peak Low Limit	See Section 5 for range	A
PHI <value>	Set Power High Limit	See Section 5 for range	W
PHI?	Return Power High Limit	See Section 5 for range	W
PLO <value>	Set Power Low Limit	See Section 5 for range	W
PLO?	Return Power Low Limit	See Section 5 for range	W
PFHI <value>	Set Power Factor High Limit	0.000~1.000	
PFHI?	Return Power Factor High Limit	0.000~1.000	
PFLO <value>	Set Power Factor Low Limit	0.000~1.000	
PFLO?	Return Power Factor Low Limit	0.000~1.000	
CFHI <value>	Set Crest Factor High Limit	0.00~10.00	
CFHI?	Return Cest Factor High Limit	0.00~10.00	
CFLO <value>	Set Crest Factor Low Limit	0.00~10.00	
CFLO?	Return Crest Factor Low Limit	0.00~10.00	
VAHI <value>	Set Apparent Power High Limit	See Section 5 for range	VA
VAHI?	Return Apparent Power High Limit	See Section 5 for range	VA
VALO <value>	Set Apparent Power Low Limit	See Section 5 for range	VA
VALO?	Return Apparent Power Low Limit	See Section 5 for range	VA

Command	Description	Value	Unit
QHI <value>	Set Reactive Power High Limit	See Section 5 for range	VAR
QHI?	Return Reactive Power High Limit	See Section 5 for range	VAR
QLO <value>	Set Reactive Power Low Limit	See Section 5 for range	VAR
QLO?	Return Reactive Power Low Limit	See Section 5 for range	VAR
RAMPUP <value>	Set Ramp Up Timer	0.1~999.9	s
RAMPUP?	Return Ramp Up Timer	0.1~999.9	s
TUNIT {2|1|0}	Set Time Unit	0=Second,1=Minute,2=Hour	
TUNIT?	Return Time Unit	0-2	
DELAY <value>	Set Delay Timer	0.1~999.9	s/m/h
DELAY?	Return Delay Timer	0.1~999.9	s/m/h
DWELL <value>	Set Dwell Timer	0.0~999.9 ,0=Const	s/m/h
DWELL?	Return Dwell Timer	0.0~999.9	s/m/h
RAMPDOWN <value>	Set Ramp Down Timer	0.1~999.9	s
RAMPDOWN?	Return Ramp Down Timer	0.1~999.9	s
SD {1|0}	Set Transient Mode	0=OFF,1=ON	
SD?	Return Transient Mode	0-1	
SDVOLT <value>	Set Transient Voltage	0.0~300.0	V
SDVOLT?	Return Transient Voltage	0.0~300.0	V
SDLT <value>	Set Transient Site	0.0~99.9	ms
SDLT?	Return Transient Site	0.0~99.9	ms
SDHT <value>	Set Transient Time	0.0~25.0	ms
SDHT?	Return Transient Time	0.0~25.0	ms
SDCT {value}	Set Transient Cycle	0-9999, 0=Continuous, 1=OFF	
SDCT?	Return Transient Cycle	0~9999	
PTD	Delete Prompt		
PT <value>	Create Prompt	1-30 BYTES of information	
PT?	Return Prompt String		
SC <value>	Set Step Cycle Value	0-9999, 0=Cont,1=OFF	
SC?	Return Step Cycle Value	0-9999	
PS <2|1|1}>	Phase Select	3ø4W: 0 = Rø, 1 = Sø, 2 = Tø 1ø3W: 0 = L1-N, 1 = L2-N	
PS?	Returns Phase Selection	3ø4W: 0 - 2 1ø3W: 0 - 1	
CONNECT {1|0}	Step Connect	0=OFF,1=ON	
CONNECT?	Return Step Connect	0 | 1	
PTD	Prompt Delete	Clears prompt string	
PT <string>	Set prompt to string value	Max 30 characters	
PT?	Returns prompt string		
ET {3|2|1|0}	Sets External Trigger out mode	0=OFF, 1=START, 2=END, 3=BOTH	
ET?	Returns External Trigger out mode	0-3	

Table 8-2: Parameter Setup Command and Query Summary

7.8 System Command and Query Syntax

These commands are used to modify the system parameters for the instrument. These commands require a parameter value to be included with the command. The associated query version of these commands will return the parameter setting in effect.

Command	Description	Value	Unit
AR {0|1}	Set Auto Run	0=PROGRAM,1=MANUAL	
AR?	Return Auto Run Value	0~2	
OM X	Output Mode 0 | 1	0 = AC, 1 = DC	
OM?	Return Output Mode	0-1	
SS {1|0}	Set Single Step	0=OFF,1=ON	
SS?	Return Single Step	0-1	
ALARM <value>	Set Alarm Volume	1-9, 0=OFF, 9=high	
ALARM?	Return Alarm Volume	0-9	
CONTRAST <1|2...8|9>	Set Contrast	1-9, 1= low, 9=high	
CONTRAST?	Return Contrast	1-9	
PUP {2|1|0}	Set Power Up Command	0=OFF,1=ON,2=LAST	
PUP?	Return Power Up Value	0-2	
LC <value>	Set Loop Cycle Value	0-9999 ,0=Cont,1=OFF	
LC?	Return Loop Cycle Value	0-9999	
VHI <value>	Set Voltage High Limit	AC: 5.0-300.0 / DC: 5.0-420.0	V
VHI?	Return Voltage High Limit	AC: 5.0-300.0 / DC: 5.0-420.0	V
VLO <value>	Set Voltage Low Limit	AC: 5.0-300.0 / DC: 5.0-420.0	V
VLO?	Return Voltage Low Limit	AC: 5.0-300.0 / DC: 5.0-420.0	V
FHI <value>	Set Frequency High Limit	40.0-1000.0	Hz
FHI?	Return Frequency High Limit	40.0-1000.0	Hz
FLO <value>	Set Frequency Low Limit	40.0-1000.0	Hz
FLO?	Return Frequency Low Limit	40.0-1000.0	Hz
SAG <value>	Set Start Angle	0-359	
SAG?	Return Start Angle	0-359	
EAG <value>	Set End Angle	0-359	
EAG?	Return End Angle Value	0-359	
RESULTS {2|1|0}	Set Results Displayed	0=ALL, 1=P/F, 2=LAST	
RESULTS?	Return Results Displayed Value	0-2	
OF {1|0}	Set Over Current Fold-back	0=OFF,1=ON	
OF?	Return Over Current Fold-back	0-1	
LOCK {1|0}	Security Lock	0=OFF,1=ON	
LOCK?	Security Lock Displayed Value	0=OFF,1=ON	
MEMLOCK {1|0}	Memory Lock	0=OFF,1=ON	
MEMLOCK?	Memory Lock Displayed Value	0=OFF,1=ON	
VS {1|0}	Voltage Sense	0 = INTERNAL, 1 = EXTERNAL	
VS?	Return Voltage Sense mode	0-1	
FUNCTION {2|1|0}	Output configuration setting	0=1ø2W, 1=3ø4W, 2=1ø3W	
FUNCTION?	Returns configuration setting	0-2	
SSI {3|2|1|0}	Set SYNC signal mode	0=OFF, 1=START, 2=EVENT	
SSI?	Returns SYNC mode setting	0-2	

7.9 IEEE488.2 Common Commands

The following IEEE488.2 common commands (a.k.a. star commands) are supported by the 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.

7.9.1 Command Commands Summary Table

Command	Name	Description
***IDN?**	Identification Query	Returns: Company, Model Number, Serial Number, Firmware Revision
***RST**	Reset Command	Resets Unit to power on condition
***TST?**	Self-Test Query	00H=OK 01H=TEST EEPROM ERROR
***CLS**	Clear Status Command	Clear Standard Event Status Register Clear Service Request Register
***OPC**	Operation Complete Command	When TEST command ok, sets ESR BIT0 to 1
***OPC?**	Operation Complete Query	0 = Test in Process 1 = Test Complete OK
***WAI**	Wait for next command	
***ESR?**	Standard Event Status Register Query	Event Status Register Bits: BIT 0 ,01H, (1) Operation Complete BIT 1 ,02H, (2) Not Used BIT 2 ,04H, (4) Query Error BIT 3 ,08H, (8) Device Error BIT 4 ,10H,(16) Execution Error BIT 5 ,20H,(32) Command Error BIT 6 ,40H,(64) Not Used BIT 7 ,80H,(128) Power On
***ESE <value>**	Standard Event Status Enable Command	value=0~255
***ESE?**	Standard Event Status Enable Query	0 – 255
***STB?**	Read Status Byte Query	Status Byte Register Bits: BIT 0 ,01H,(1) All PASS BIT 1 ,02H,(2) FAIL BIT 2, 04H,(4) ABORT BIT 3, 08H,(8) Process BIT 4, 10H,(16) Message Available BIT 5, 20H,(32) Standard Event (ESB)

Command	Name	Description
		BIT 6, 40H,(64) Request Service (MSS) BIT 7, 80H,(128) Prompt
***SRE <value>**	Service Request Enable	value=0~255
***SRE?**	Service Request Enable Query	0 – 255
***PSC {1|0}**	Power-On Status	1 = Power-on clear enable registers 0 = Power-on load previous enable registers
***PSC?**	Power-On Status Query	returns value = 0 or 1

Table 8-3: IEEE488.2 Common Commands Supported

7.9.2 *IDN?

Read the instrument identification string. Company = APT.

Example:

ADAPTIVE POWER SYSTEMS,CFS360,9991752,Version 1.00.00

7.9.3 *RST

Reset the instrument to original power on configuration. Does not clear Enable register for Standard Summary Status or Standard Event Registers. Does not clear the output queue. Does not clear the power-on-status-clear flag.

7.9.4 *TST?

Performs a self-test of the instrument data memory. Returns 0 if it is successful or 1 if the test fails.

7.9.5 *CLS

Clears the Status Byte summary register and event registers. Does not clear the Enable registers.

7.9.6 *OPC / *OPC?

Instructs the instrument to sets the operation complete bit (bit 0) in the Standard Event register, after a command is completed successfully.

The query format returns an ASCII “1” after the last command received has completed executing.

7.9.7 *WAI

After the command is executed, it prevents the instrument from executing any further query or commands until the no-operation-pending flag is TRUE.

7.9.8 *ESR?

This query returns the content of the Standard Event register. Returns the decimal value of the binary-weighted sum of bits. (0 ~ 255)

7.9.9 *ESE <value> / *ESE?

The Standard Event enable register controls which bits will be logically OR-ed together to generate the Event Summary bit 5 (ESB) within the Status Byte.

The query version of this command returns the Standard Event enable register content as the decimal value of the binary-weighted sum of bits. (0 ~ 255)

7.9.10 *STB?

This command reads the Status Byte and the decimal value of the binary-weighted sum of bits. (0 - 255)

7.9.11 *SRE <value> / *SRE?

The Service Request enable register controls which bits from the Status Byte should be used to generate a service request when the bit value = 1.

The query version of this command returns the content of the Service Request enable register as a decimal value of binary-weighted sum of bits. (0 ~ 255)

7.9.12 *PSC {1|0} / *PSC?

This command sets the power-on status clear bit. When set to 1, the Standard Event Enable register and Status Byte Enable registers will be cleared when power is turned ON. A 0 setting indicates the Enable registers will be loaded with Enable register masks from non-volatile memory at power ON.

The query version of this command returns the power-on status clear setting. Returns 0 or 1.

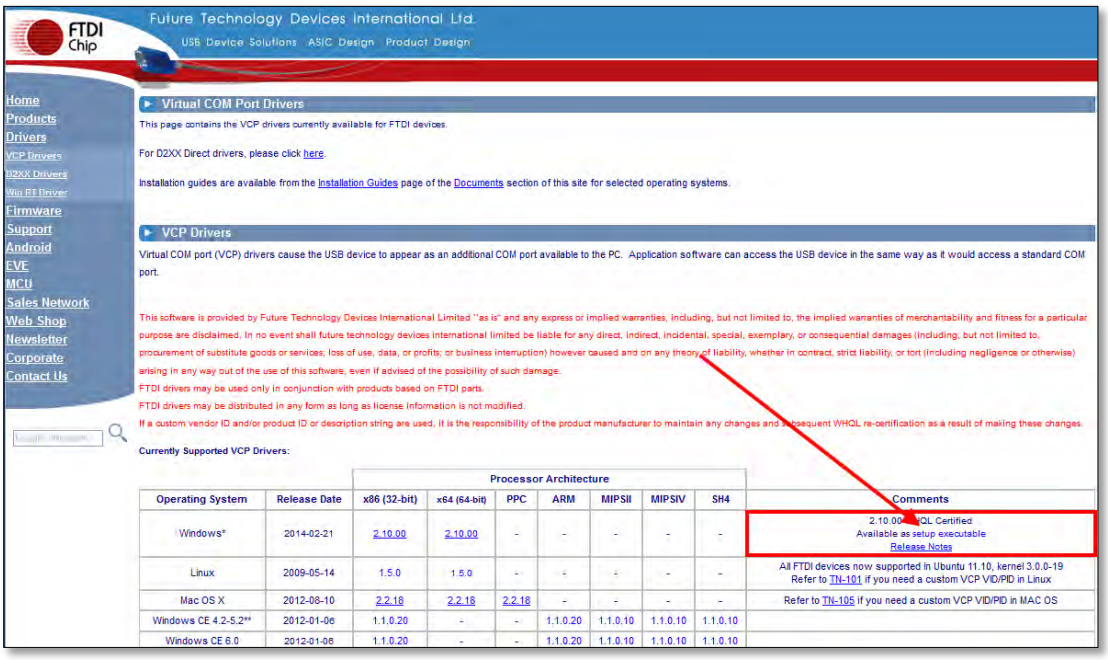
8 USB Driver Installation

8.1 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. Corresponding virtual com drivers (VCP drivers) for all current operating systems are available for download at the following URL:

http://www.ftdichip.com/Drivers/VCP.htm

Refer to the RS232 sections for further setup and configuration information.

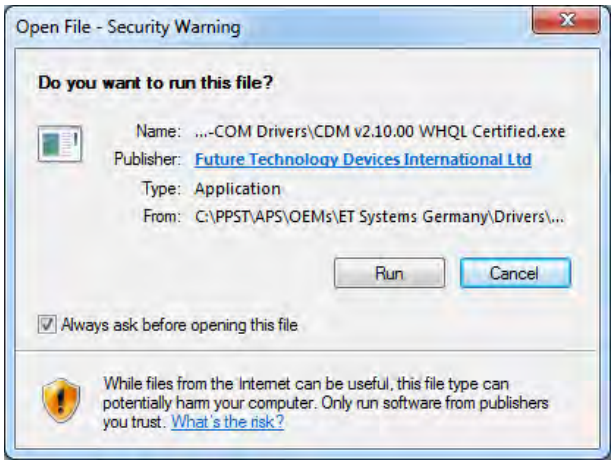


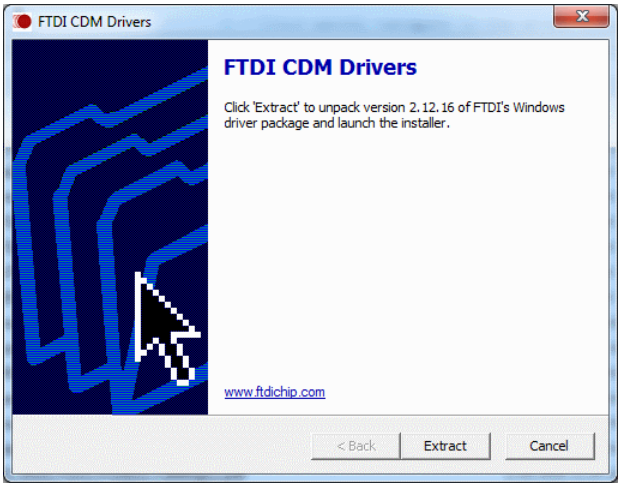
8.2 USB Driver Installation

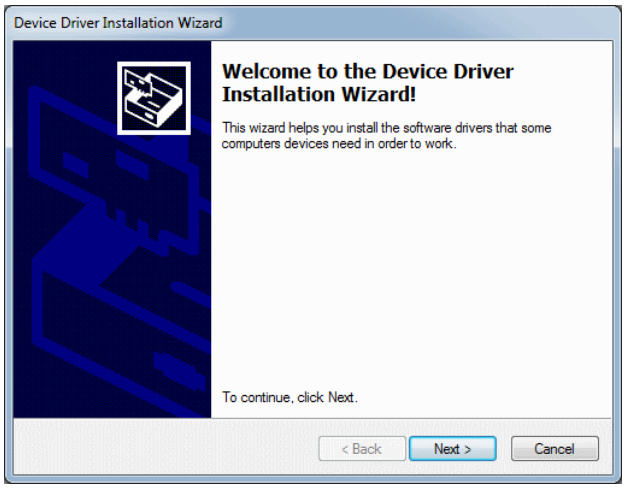
To install the USB device driver, proceed as follows:

1. Download the VCP driver for Windows from the FDTI webpage.
   http://www.ftdichip.com/Drivers/VCP.htm
2. FTDI_CDM21216_Setup
3. Save the executable driver installation file to a temporary folder on your drive.
4. Once saved, navigate to the driver installation folder assigned and locate the file named: (actual revision number may be higher than shown here)
   CDM21216_Setup

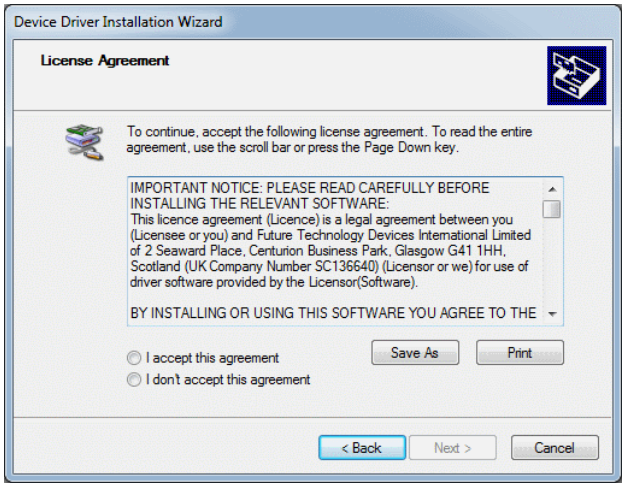
5. Select the file with the mouse and double click to launch the extraction of the installation program
6. Follow the on-screen prompts shown below to complete the driver installation.



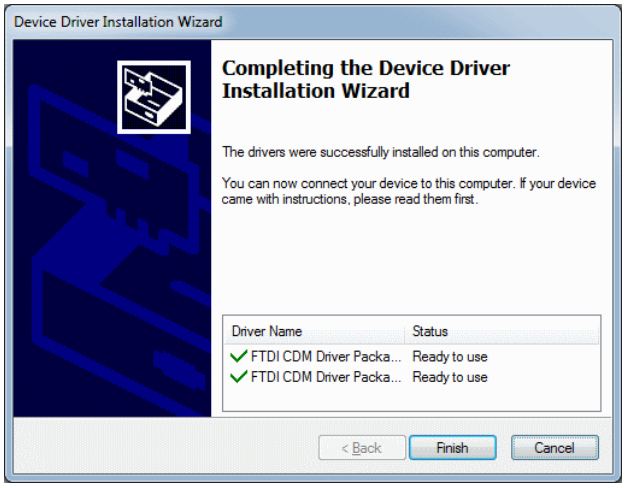




Read and accept user license by checking the “I accept this agreement” radio button at the bottom.

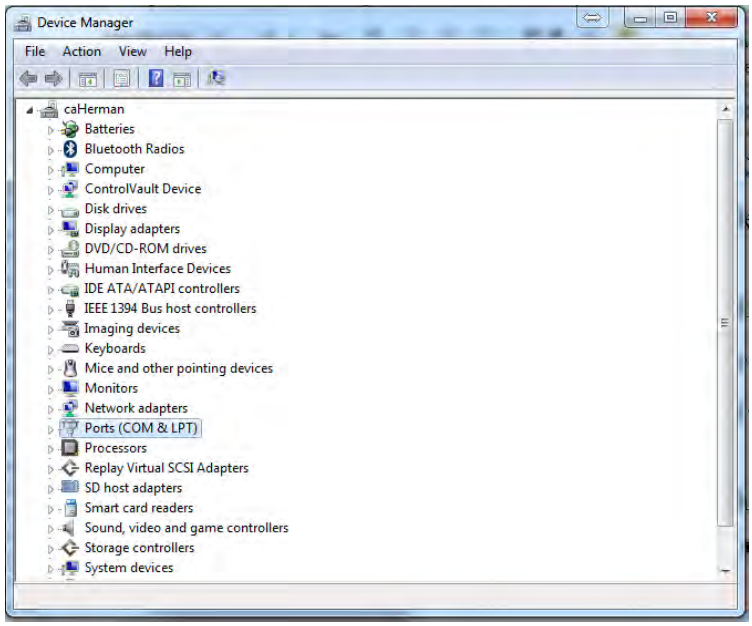


W

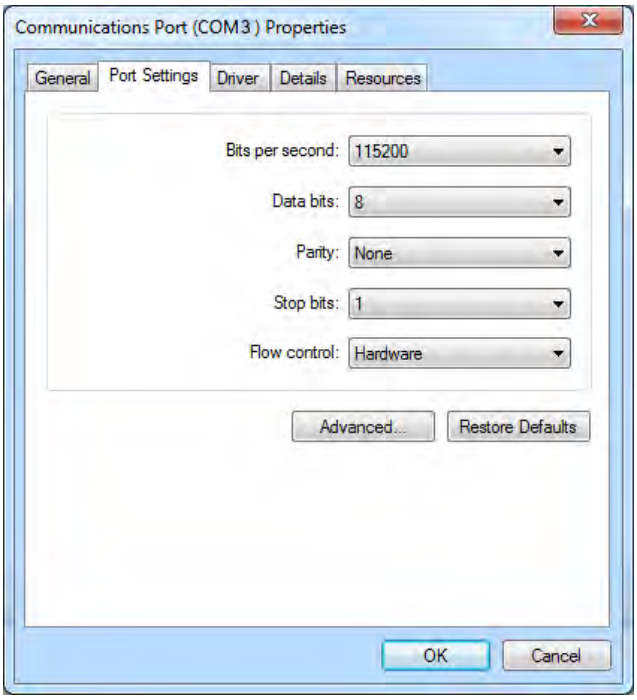


After the installation completes, open the Windows Control Panel from the Start menu and select “Device Manager”.

7. In the Device Manger Listing, locate the “Ports (COM & LPT)” entry



8. One of the entries should show “USB to Serial Port (COMx) with x any value higher than 2.
9. Note the COM port number at which the USB device is located. Right click on this COM port and select “Properties”.
10. In the Properties dialog box, select “Port Settings”.
11. Select the relevant COM port and set Bit per second (baud rate) to the same setting the as the power source.



11. Connect the power source to the PC using a suitable USB cable. (supplied with the unit as part of the ship kit).
12. You should now be able to communicate with the power source through the COM port number assigned.

9 LAN Interface Configuration

9.1 Overview

The power source may be equipped with an optional LAN (Ethernet) interface as explained in Section 6.16.3, “LAN Interface (Option)”.

9.2 Collect Network Information

To correctly set up the Ethernet card configuration and network address parameters, the operator will need information from a local IT network administrator. Have your network administrator provide the following information so you can complete the power source LAN interface setup/

Item	Description	Value
1	Ethernet MAC Address of Power Source (Hex)[1]	__:__:__:__:__:__
2	Device Name	_____
3	Device IP Address	___.___.___.___
4	Gateway IP Address	___.___.___.___
5	Subnet Mark	___.___.___.___

Figure 10-1: Network Information Required for LAN Setup

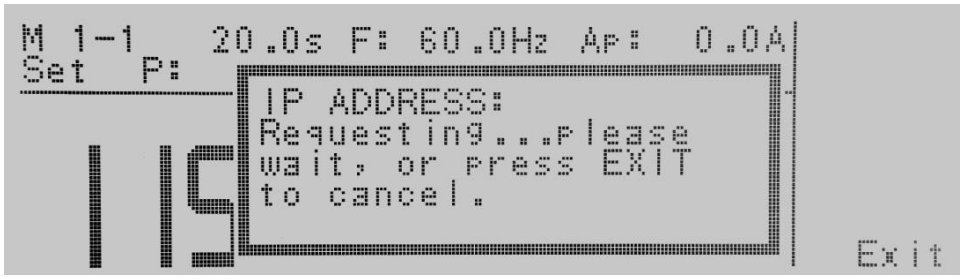
9.3 Saving LAN Settings

When turning on power of the power source using the front panel On/Off switch, the Ethernet will start initialization The operator is notified by the message on the LCD display shown here.

Any time the user edits one of the Ethernet Card parameters and exits the Ethernet Card Settings menu, the following message will be displayed:

[1] The MAC Address of the Power source LAN option card can be found in the LAN Setup screen. Refer to Section 10.4.6, “MAC Address”.

The Ethernet Card will attempt to re-establish a connection with the network server anytime a LAN setup parameter is changed and exits the Ethernet Card Parameters Menu or sends the command referenced at the end of this option section. Thus, if the IP Setup is set to AUTO, the Ethernet Card will request a new IP Address every time a parameter is edited and, as a result, the "Requesting IP Address. . ." message will appear.



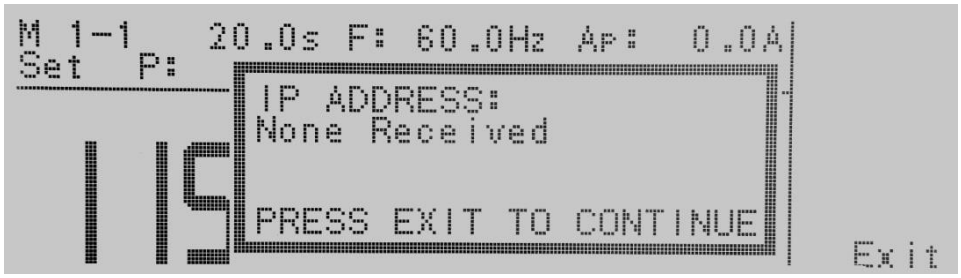
This process can take up to 20 seconds to complete. If the power source is not actually connected to a network, the user can press the "**Exit**" soft key to abort the AUTO IP configuration process and proceed using the power source immediately.

NOTE: The "Requesting IP Address…" pop-up message only appears at power up when the Ethernet Card has its IP Setup configured to **AUTO**.

The Ethernet Card will wait for an IP Address for approximately 20 seconds. If the power source successfully receives an IP Address from the server the following pop- up message will be displayed:

The actual IP address shown on the LCD will depend on your local network and is provided by the network's Dynamic Host Configuration Protocol (DHCP) server.

If the power source fails to receive a valid IP address within 20 seconds, the following message will be displayed:

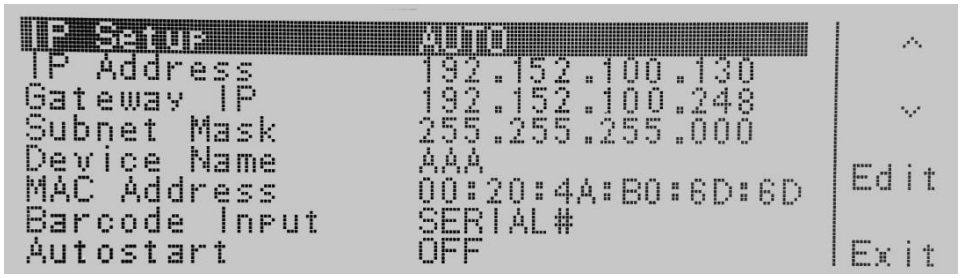


In this case, press the "Exit" soft key to exit this mode and check your Ethernet cable connection. If no cabling issues are found, contact your local IT administrator for assistance.

9.4 LAN Option Setup Menu

If the LAN option is installed, a "**ENET**" soft key at the <top> level main screen directly below the System soft key as shown here:

To access the Ethernet Setup screen, press the "**more**" soft key when in the Perform Tests screen. Then, press the "**ENET**" soft key to display the Ethernet Setup screen:



9.4.1 IP Setup Mode

To change the IP setup, proceed as follows. Scroll down to the "IP Setup" parameter using the "^,v" soft keys. Once the IP Setup parameter is highlighted, press the "**Edit**" soft key.

IP Setup is used to determine how the power source will request an IP address from the server to which it is connected. When AUTO is selected, the power source will attempt to automatically request an IP Address from the server upon power up as covered in paragraph

10.3. To resolve the IP Address automatically, the power source will use DHCP or BOOTP protocols. When MANUAL is selected, the power source will request a specific fixed IP Address from the server. The IP Address that will be requested must be entered in the subsequent IP Address parameter field.

Use the Change soft key to select how you would like the power source to resolve an IP address. Press the Enter soft key to accept the new setting or the Exit soft key to cancel and return to the original setting.

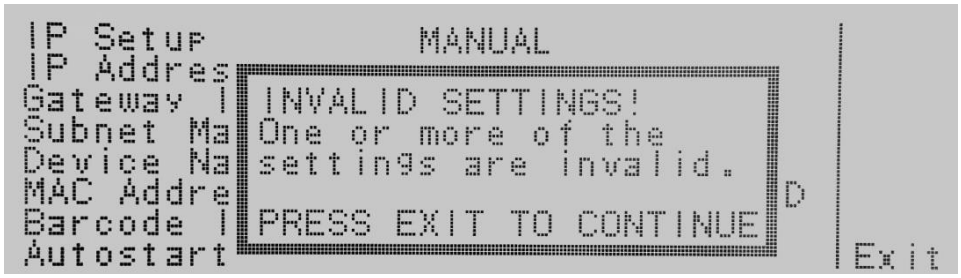
9.4.2 Manual IP Address Setting

Highlight the "IP Address" parameter using the "^,v" soft keys. When the IP Address parameter is highlighted, press the Edit soft key. A specific IP Address must be entered into this field if the IP Setup parameter is configured to MANUAL. Enter the IP Address that you wish using the numeric keypad. The IP Address must be entered in the following decimal format with period separators: XXX.XXX.XXX.XXX. Each value must be from 0 to 255. A valid IP Address must be entered. The following IP Addresses are reserved and must never be used in this screen:

255.255.255.255

000.000.000.000

Enter the preceding IP Addresses will result in the following error message display:



Press the "**Exit**" soft key to save the new IP address setting. If the IP Setup parameter is set to AUTO, you do not need to enter an IP Address manually.

9.4.3 Gateway Address Setting

To change the Gateway address setup, proceed as follows. Scroll down to the "Gateway IP" parameter using the "^,v" soft keys. Once the IP Setup parameter is highlighted, press the "**Edit**" soft key.

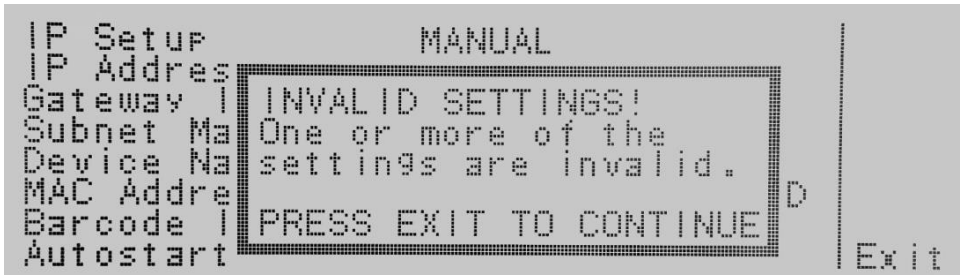
A specific Gateway IP must be entered into this field if the IP Setup parameter is set to MANUAL. Enter the Gateway IP using the numeric keypad. The Gateway IP must be entered in the following format: XXX.XXX.XXX.XXX.

Press the "**Enter**" soft key to save the new settings. If the IP Setup parameter is set to AUTO, there is no need to enter a Gateway IP manually.

9.4.4 Subnet Mask Setting

Highlight the Subnet Mask parameter using the "^,v" soft keys. When the Subnet Mask parameter is highlighted, press the "**Edit**" soft key.

A specific Subnet Mask must be entered into this field if the IP Setup parameter is set to MANUAL. Enter the Subnet Mask using the numeric keypad. The Subnet Mask must be entered in the following format: XXX.XXX.XXX.XXX. If an invalid Subnet Mask is entered, the following error message will be displayed:



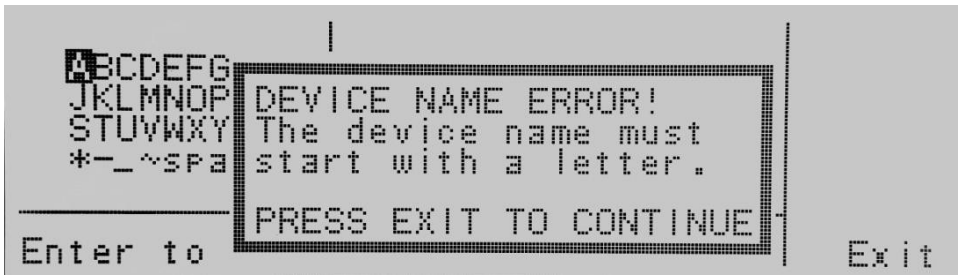
Press the "**Enter**" soft key to save the new settings. If the IP Setup parameter is set to AUTO, there is no need to enter a Subnet Mask IP manually.

9.4.5 Device Name Setting

Highlight the Device Name parameter using the "^,v" soft keys. When the Device Name parameter is highlighted, press the "**Edit**" soft key.

The following Device Name screen will appear:

From this screen you can enter a Device Name for the power source. The Device Name is used to identify the power source on your server and may be used in place of a dedicated IP Address as it is much easier to recognize for a human being. Use the "> and v" arrow keys to highlight a letter and press the "**Select**" soft key to select the highlighted letter. The Device Name can be a maximum of eight characters and **MUST** start with a letter. If the Device Name does not start with a letter, the following error message will be displayed:



When the Device Name has been entered, press the "**Enter**" soft key to save the new setting.

Note: The Device Name parameter is only active when the IP Setup is set to AUTO.

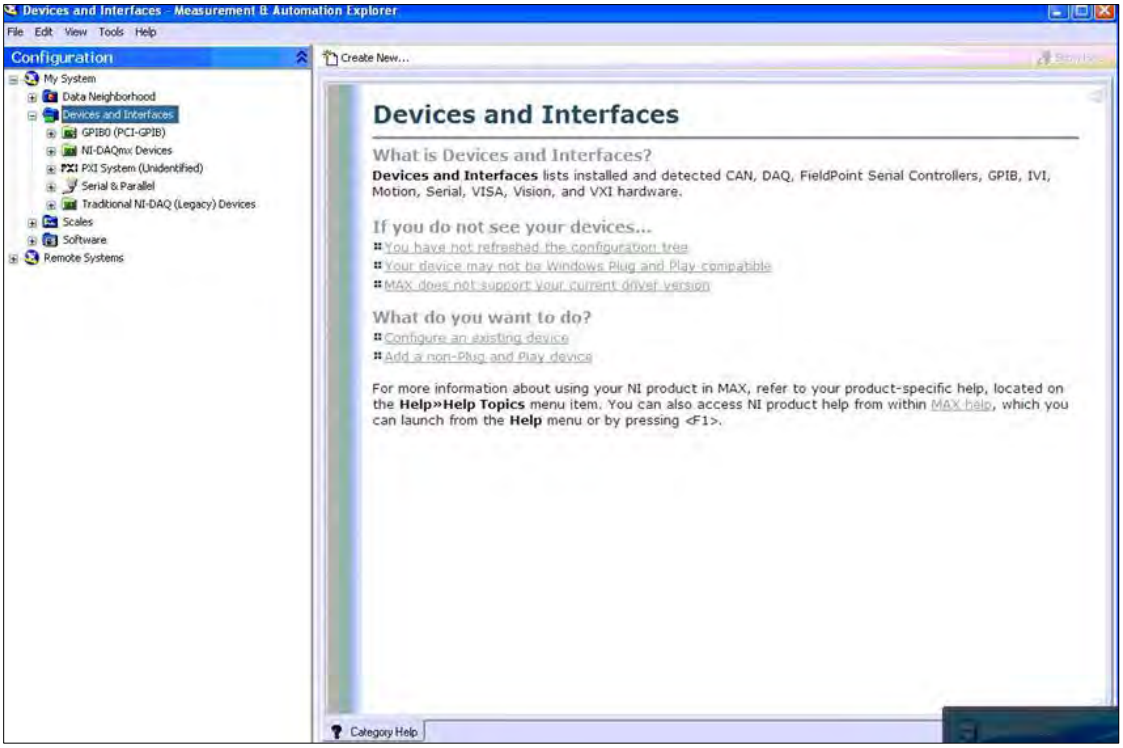
9.4.6 MAC Address

This line of the LAN Setup screen displays the MAC address of the power source. This value is hardcoded in the LAN interface option hardware of the power source and cannot be changed. Your IT administrator may be asking the end user for this information.

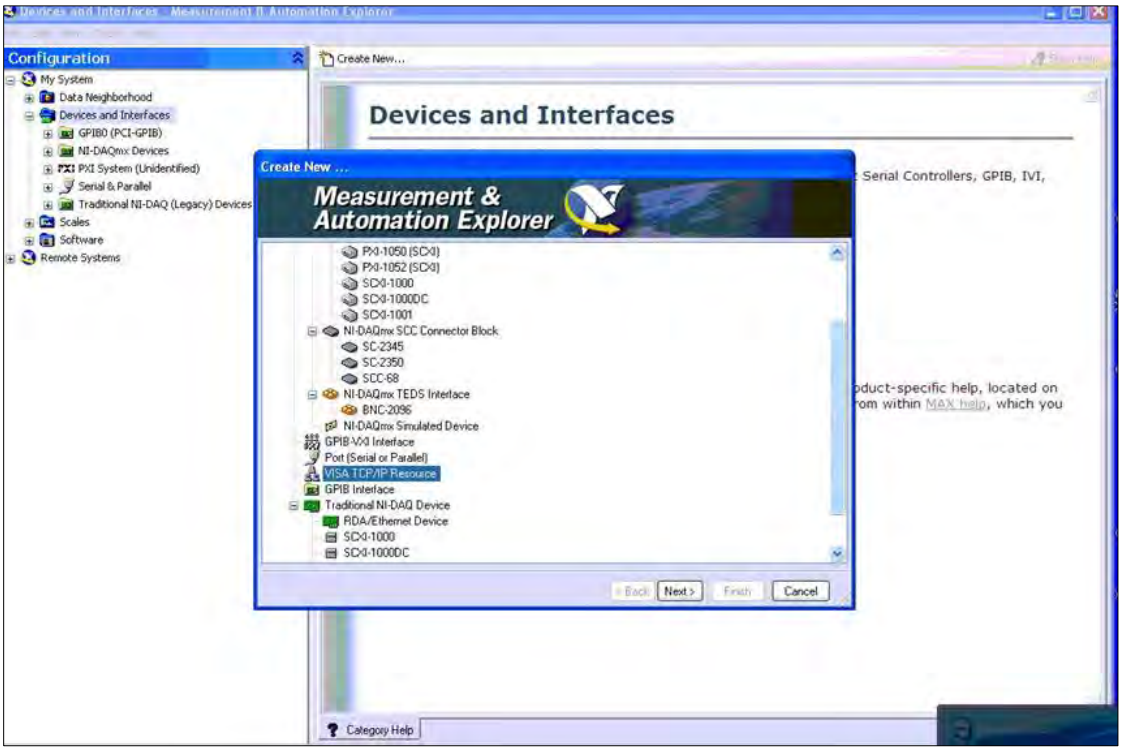
9.5 Establishing LAN connection using NI MAX Explorer

Many programming environments use VISA drivers from National Instruments. This section highlights how to use NI's MAX Explorer utility to set up a LAN connection to the CFS Series.

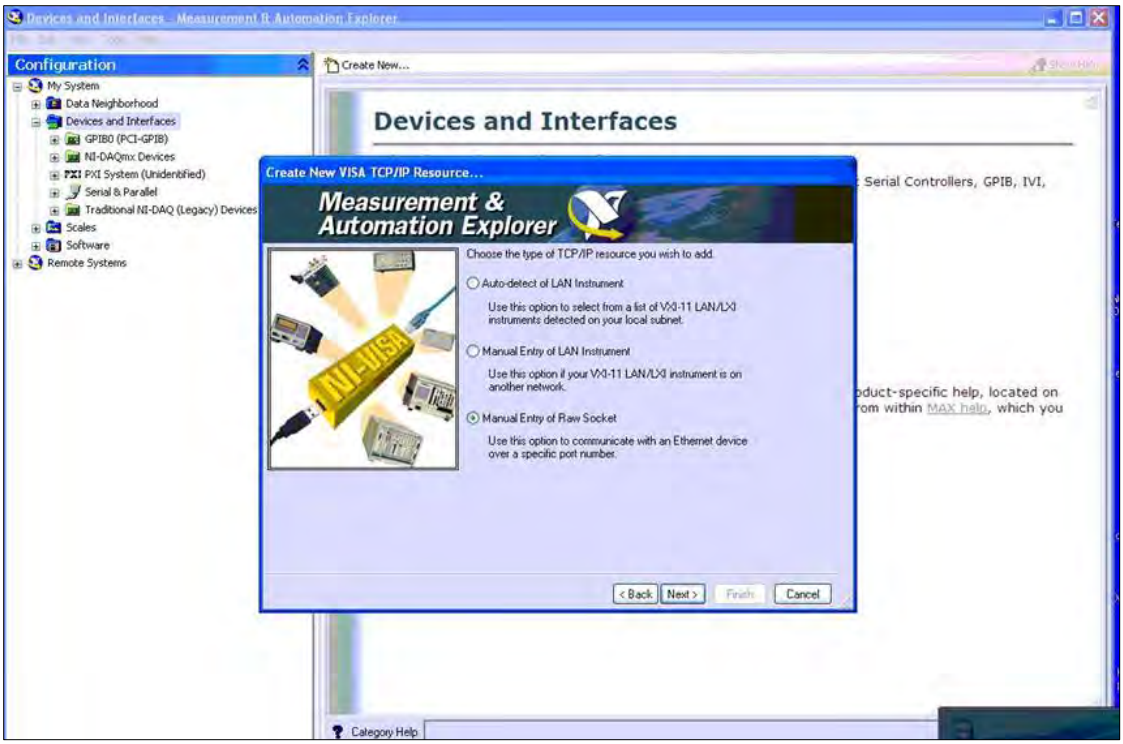
Launch the NI Max utility from the National Instruments program folder. Once open, select "Devices and Interfaces" as shown below.



This will bring up a dialog box that may be used to set up a VISA TCP connection to the power source.

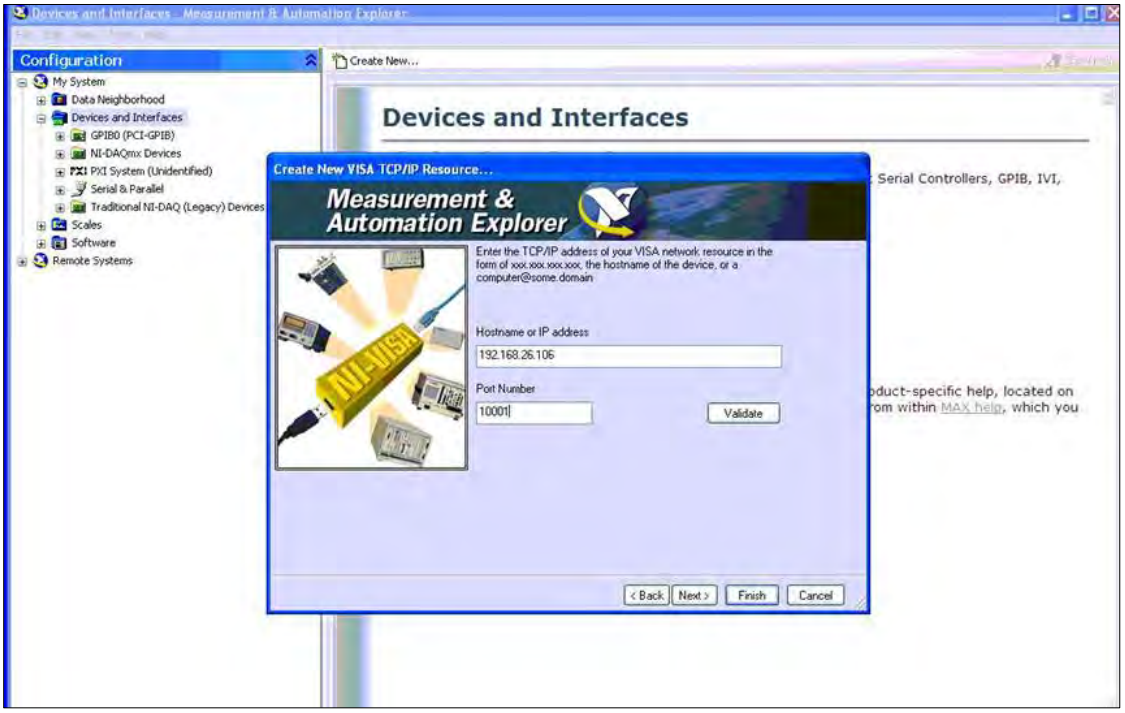


A manual Raw socket connection needs to be set up as the CFS Series does not support VXI-11 or LXI device detection protocols. Select the “Manual Entry of Raw Socket as indicated below.



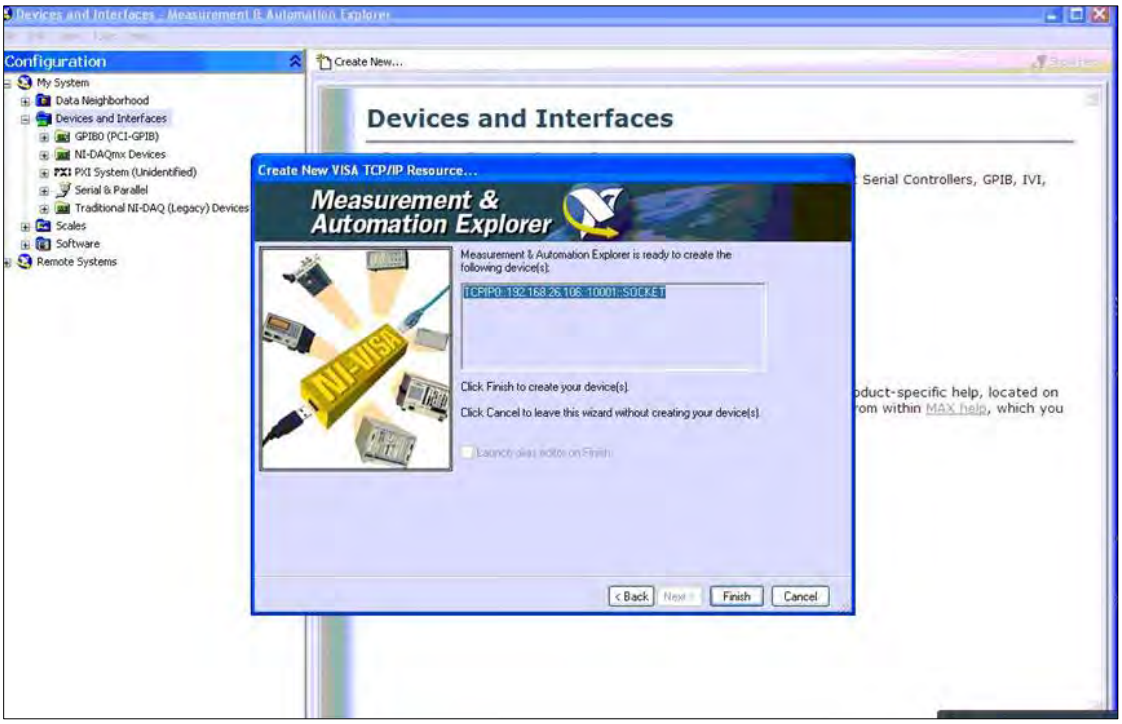
Enter the IP address that was assigned to the CFS on your network per section **Error! Reference source not found.** or section **Error! Reference source not found.**.

The LAN socket port number for the CFS Series is fixed to 10001 and must be entered under Port Number.

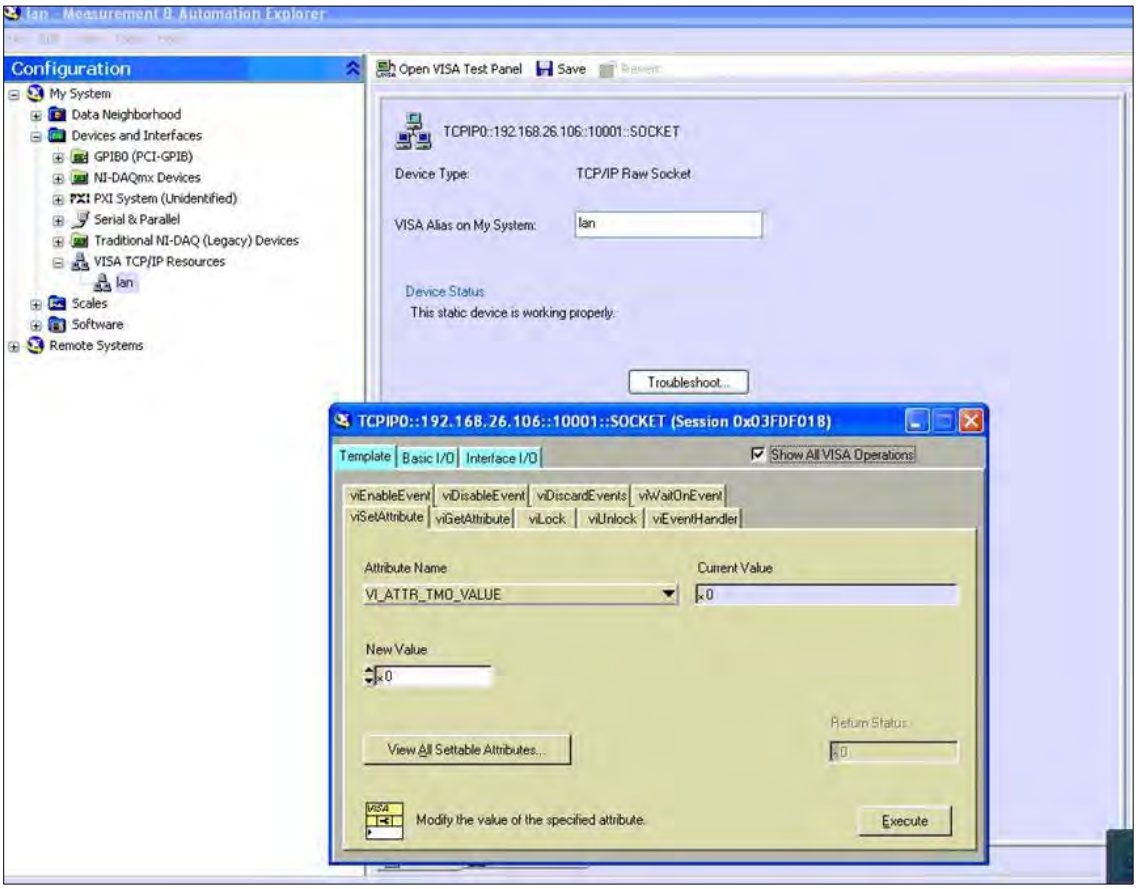


Assign a name to the newly established VISA connection. Use a relevant name that will allow you to easily recognize the device type such as “CFS300 AC”

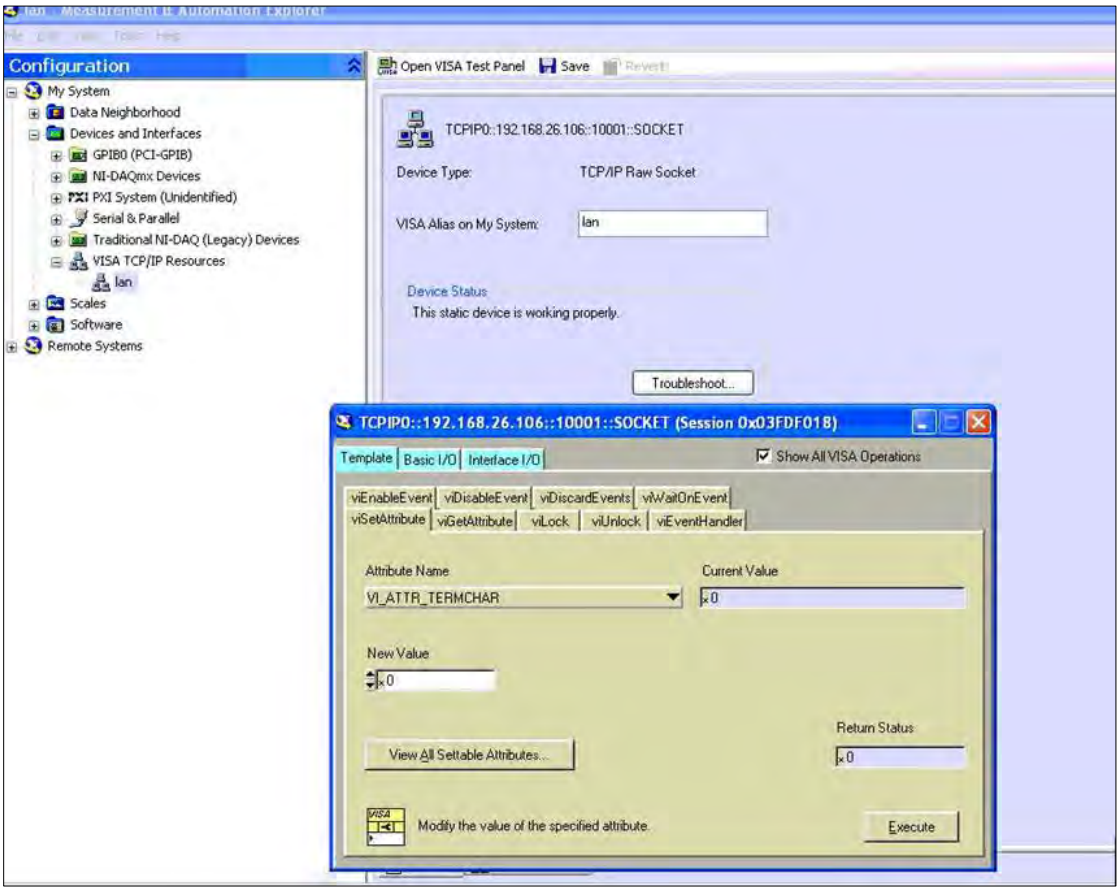
The VISA connection is now complete. The resource string is displayed in the top part of the last dialog screen. Use this resource file in your program source code or IDE.



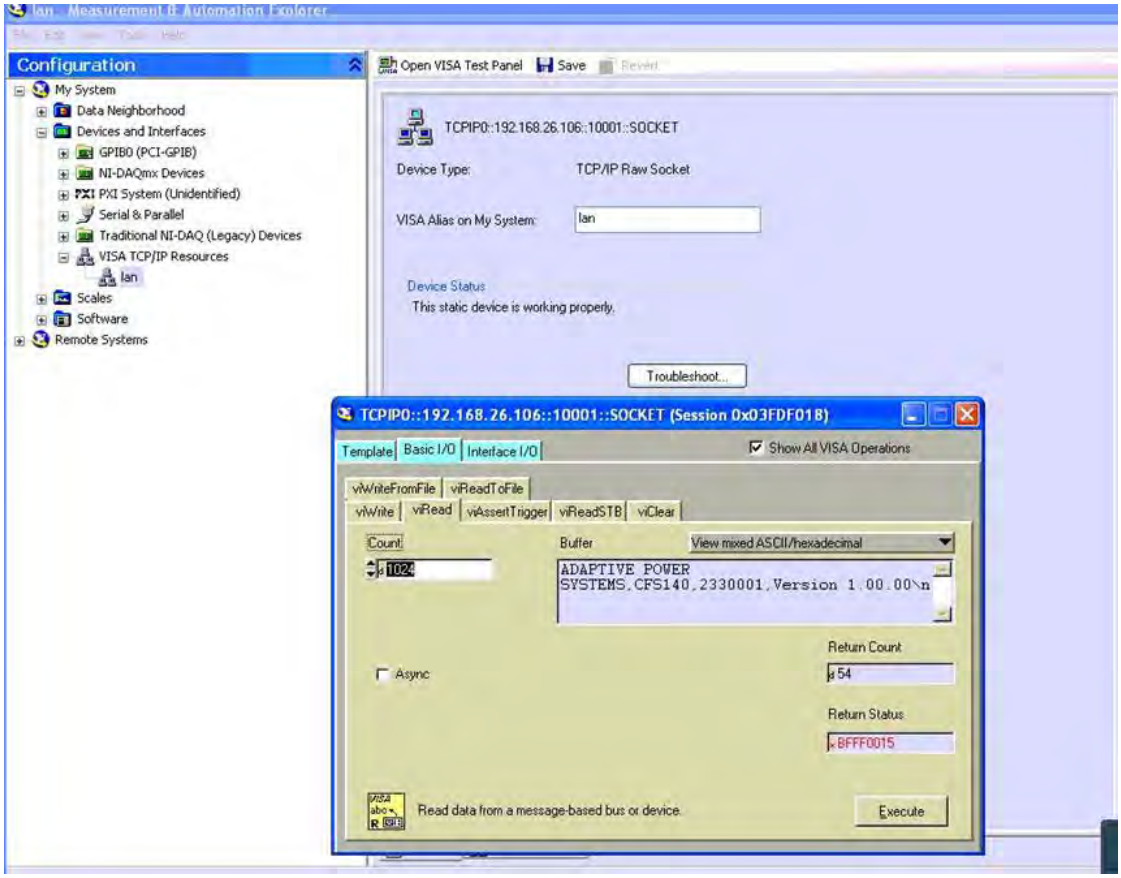
To test the VISA connection, open the VISA test panel as shown below.



In the Template tab change Attribute to: VI_ATTR_TERMCHAR and click on “execute”.



Switch to a Basic I/0 from the Template and select viWrite – execute, after that switch to viRead and execute and this message will confirm correct operation.



9.6 LAN Interface Specific Commands and Queries

As indicated before, all commands available for USB or RS232 remote control are supported over the LAN option interface as well. However, there are additional commands that allow LAN settings to be changed or queried over the LAN interface. These commands are valid only for power sources that have the LAN option and are detailed in the following paragraphs.

Command	Name	Value
SIM {1|0} **SIM?**	Set IP Mode	1=Manual, 0=Auto (DHCP/BOOTP)
SIA <value> **SIA?**	Set IP Address	Dotted decimal form. Ex. 192.168.1.50
SGA <value> **SGA?**	Set Gateway IP Address	Dotted decimal form
SSM <value> **SSM?**	Set Subnet Mask	Dotted decimal form
SDN <value> **SDN?**	Set Device Name	8 character max, must start with a letter
MAC?	MAC Address Query	Example response: 00:20:4A:8B:B4:30

Table 10-1: LAN Option Interface specific Commands

9.6.1 Communication Considerations

Consider the following protocols and conventions when using the LAN interface for remote control of the power source.

- All of the above commands (excluding the query commands) will respond with the 06 hex (6 decimal) Acknowledge (ACK) ASCII control code if the transfer was recognized by the instrument.
- If there was an error with the command string, the instrument will respond with 15 hex (21 decimal), the Not Acknowledge (NAK) ASCII control code.
- However, the presence of this response does not mean that the instrument (in the case of these commands only) completed the command. These commands require a restarting of the hardware that controls the Ethernet Protocols. Because of this, the user must wait before the Ethernet Card will respond to another command. See the table below for the approximate wait times necessary after one of the commands in the table is sent. In addition, the current socket connection between the user's terminal and the Ethernet Card is no longer valid, and the user will need to close their current connection and establish a new one.

9.6.2 Ethernet Setting Commands Wait Times

To allow reconfiguration of LAN interface settings, a period of time may be required to process the change. During this time, the LAN interface is inoperative and no other commands or queries should be sent. The following table shows the required time delays after each of the LAN commands, shown in the second column. Note, the LAN IP mode setting makes a difference.

IP Mode	Command	Wait Time after command is sent
Manual	SIA, SGA & SSM	8 seconds
	SIM 0	14 seconds
Auto	SDN	14 seconds
	SIM 1	8 seconds

Table 10-2: LAN Option Interface Command Wait Times

10 Calibration

10.1 Overview

All Adaptive Power Systems' instruments are factory calibrated prior to shipment. The recommended calibration interval for CFS300 Series instruments is one year (every 12 months).

10.2 Hardware Verification Procedure

This section covers the hardware verification procedure for the CFS series power supply. The hardware verification should be performed prior to the standard calibration. This procedure should be used to determine if a hardware calibration should be performed. All Tests should be performed at 60Hz.

If the hardware verification indicates adjustments are needed, proceed to Section **Error! Reference source not found.**, "**Error! Reference source not found.**".

If the hardware verification does not indicate that any adjustments are needed, proceed to Section 11.3, "Software Calibration Procedure".

10.2.1 Required Calibration Instruments and Standards

The following equipment is required to perform routine hardware verification.

- High Bandwidth True RMS DVM (> 50kHz) capable of measuring millivolts DC, 300Vac and 400Vdc.
- Digital Storage Scope
- A 475kΩ, ¼ watt resistor
- A 10uF, 115V non-polarized capacitor
- Trim pot adjustment tool

10.2.2 Hardware Verification Procedure Steps

To Activate Verification Mode

1. Press the "0" and "7" keys both while simultaneously turning ON the power source at the front panel switch.

Adjust Bias Power Voltage for Control Circuits

1. **Note:** The Bias Power voltage for the control board was set at the time of manufacturing. Under normal use conditions, there should be no need to adjust this voltage and this procedure is included only for non-routine situations.
2. Connect the DVM to the "+15V" and "G" points on the "FLY61000" board assembly.
3. Set the DVM to measure DCV.

4. Adjust pot “VR1” on the “FLY61000” board so the DVM measures “+15V” volts +/- 0.1V.
5. Power OFF the instrument, then disconnect the DVM.

Adjust Amplifier Inverter DC Bus Voltage

1. **Note:** The DC Bus voltage for the Amplifier Inverter board was set at the time of manufacturing. Under normal use conditions, there should be no need to adjust this voltage and this procedure is included only for non-routine situations.
2. Connect the DVM to the “TP6(+)” and “TP7(-)” points on the “DDC61000” board assembly.
3. Set the DVM to measure DCV.
4. Turn ON the instrument.
5. Leave the instrument on without any load connected.
6. Adjust the “VR1” on the “DDC61000” board assembly so the DVM measures “+320Vdc” volts +/- 0.3V

Adjust Output High Frequency Ripple and Noise

7. Adjust the Oscilloscope probe to approximately 500mV/10us. This will allow viewing of the high frequency noise.
8. Press the “0” and “7” number key while simultaneously powering the instrument ON.
9. Connect the output A and N of the instrument to the Oscilloscope.
10. Set the output voltage to “0” volts in the low voltage range and enable the output using the **TEST/RESET** button.
11. Adjust Inductor “L3” on the “OPTAC300” Output board assembly so the output high frequency waveform is at a minimum.
12. Disable the output using the **TEST/RESET** button.
13. Connect the output B and N of the instrument to the Oscilloscope.
14. Set the output voltage to “0” volts in the low voltage range and enable the output using the **TEST/RESET** button.
15. Adjust Inductor “L5” on the OPTAC300 Output board assembly so the output high frequency waveform is at a minimum.
16. Disable the output using the **TEST/RESET** button.
17. Connect the output C and N of the instrument to the Oscilloscope.
18. Set the output voltage to “0” volts in the low voltage range and enable the output using the **TEST/RESET** button.

19. Adjust Inductor L1 on the OPTAC300 Output board so that the output high frequency waveform to minimum.
20. Disable the output using the **TEST/RESET** button.
21. Disconnect the Oscilloscope probe.

Adjust Output 0 Volt and 110V DC Offset

1. Install Jumper "JP1" on the "PWMAC300" board assembly.
2. Connect the 475kΩ resistor in series with the 10uF capacitor and connect the DVM and load to the instrument output terminal block starting with Phase A and Neutral as illustrated in the following diagram:

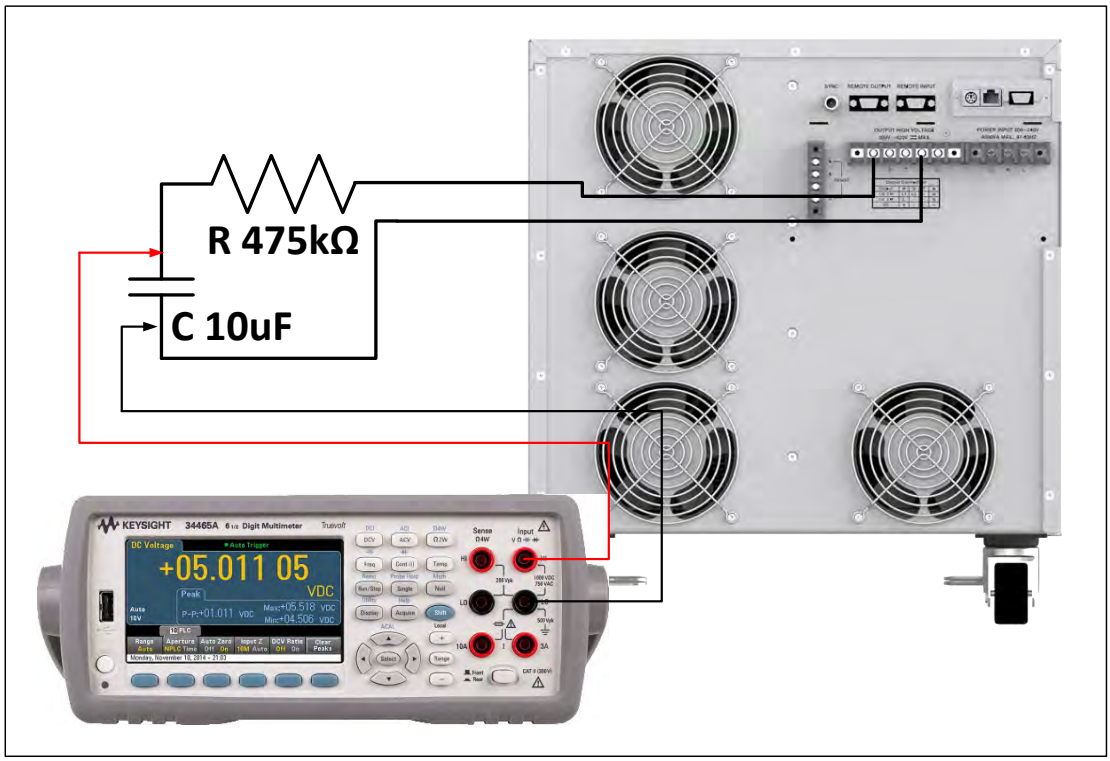


Figure 11-1: DC Offset Measurement

3. Press the "0" and "7" number key while simultaneously powering the instrument ON.
4. Set the output voltage to "0" volts in the low voltage range and enable the output using the **TEST/RESET** button
5. Adjust VR3 on the PWMAC300 board so that the DVM measures "0" volts +\- 10mV.
6. Then, set the output voltage to "110" volts in the low voltage range and activate the output of the instrument.
7. Adjust VR3 on the ANGAC300 board so that the DVM measures "0" volts +\- 20mV.

8. Disable the output using the **TEST/RESET** button.
9. Connect the 475kΩ resistor in series with the 10uf capacitor to the instrument output B and N.
10. Set the output voltage to “0” volts in the low voltage range and enable the output using the **TEST/RESET** button
11. Adjust VR2 on the PWMAC300 board so that the DVM measures “0” volts +\- 10mV
12. Then, set the output voltage to “110” volts in the low voltage range and activate the output of the instrument.
13. Adjust VR2 on the ANGAC300 board so that the DVM measures “0” volts +\- 20mV.
14. Disable the output using the **TEST/RESET** button.
15. Connect the 475kΩ resistor in series with the 10uf capacitor to the instrument output C and N.
16. Set the output voltage to “0” volts in the low voltage range and enable the output using the **TEST/RESET** button.
17. Adjust VR1 on the PWMAC300 board so that the DVM measures “0” volts +\- 10mV
18. Then, set the output voltage to “110” volts in the low voltage range and activate the output of the instrument.
19. Adjust VR1 on the ANGAC300 board so that the DVM measures “0” volts +\- 20mV.
20. Disable the output using the **TEST/RESET** button.
21. Disconnect the load and the DVM.
22. Powering the instrument OFF, then remove JP1.

Exit Verification Mode by turning the power OFF and then back ON. This returns it to normal operation mode.

This completes the verification process.

10.3 Software Calibration Procedure

This section covers the software calibration procedure for the CFS series power sources. The software verification should be performed after any hardware adjustment if any were needed. Otherwise, it can be performed annually after the Hardware Verification procedure. This procedure should be used before any software calibration is performed. All Tests should be performed at 60Hz.

10.3.1 Required Calibration Instruments and Standards

The following equipment is required to perform annual software calibration.

- Current Meter or True RMS DMM with Current Shunt capable of 40A AC.
- DMM with 300V AC range

Power resistors of the following ratings capable of withstanding 300Vac and 400Vdc by model:

CFS330 – 3000 VA loads

- AC Mode - 3 Phase Output
  - 112 Ohm, 0.9A & 12 Ohm, 9A
- AC Mode - 1 Phase Output
  - 56 Ohm, 1.8A & 6 Ohm, 18A
- DC Mode
  - 23 Ohm, 4.5Adc & 8 Ohm, 14Adc

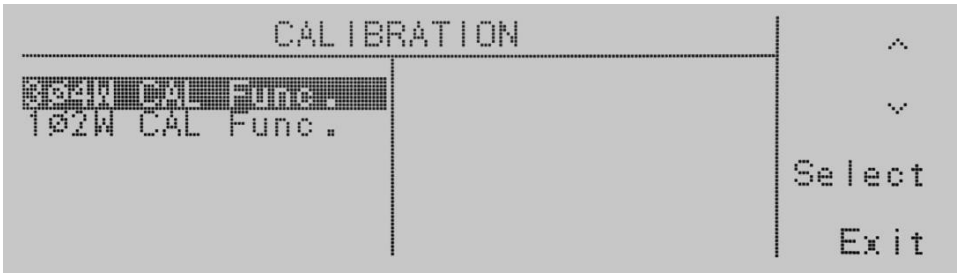
CFS360 – 6000 VA loads

- AC Mode - 3 Phase Output
  - 56 Ohm, 1.8A & 6 Ohm, 18A
- AC Mode - 1 Phase Output
  - 28 Ohm, 3.6A & 3 Ohm, 36A
- DC Mode
  - 12 Ohm, 9Adc & 4 Ohm, 28Adc

10.3.2 Software Calibration Procedure

To Activate Calibration Mode

To enter the calibration mode power on the unit while holding the 4 key on the numeric keypad. When in the calibration mode the display will look as follows:

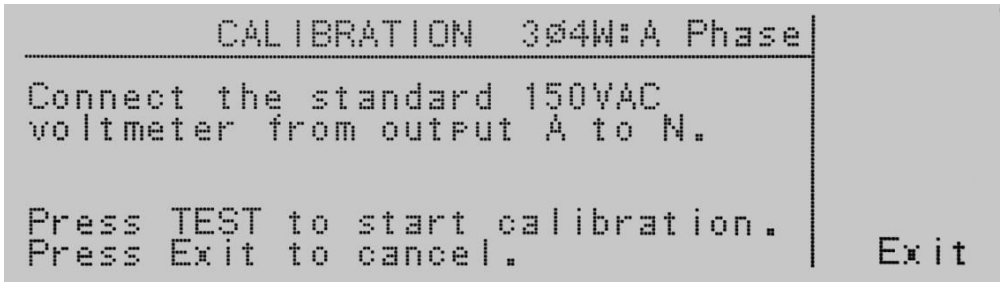


Use the up or down arrow soft keys to navigate to the parameter that you would like to calibrate. The parameters available for calibration are Voltage 150.0V, Voltage 300.0 V, Current xx.xxA and A-Peak xx.xA. The actual values for the Current and A-Peak will change according to the model number.

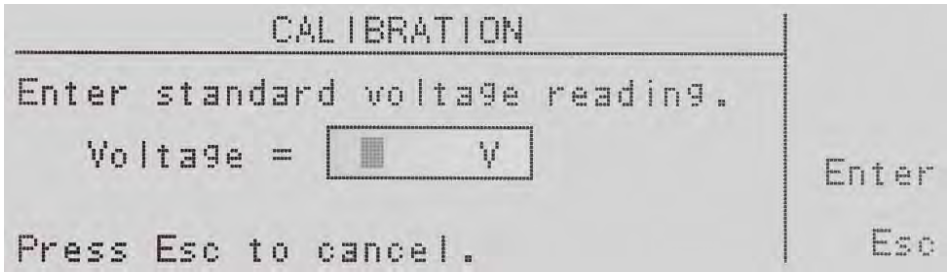
Use the "**Select"** soft key to select the parameter for calibration. If you press the "**Exit**" soft key from this screen you will be kicked out of the Calibration mode and returned to the set screen.

10.3.3 Voltage: 150.0V Calibration

Use the "^,v" soft keys to navigate to the Voltage 150.0V parameter and press the "**Select"** soft key.



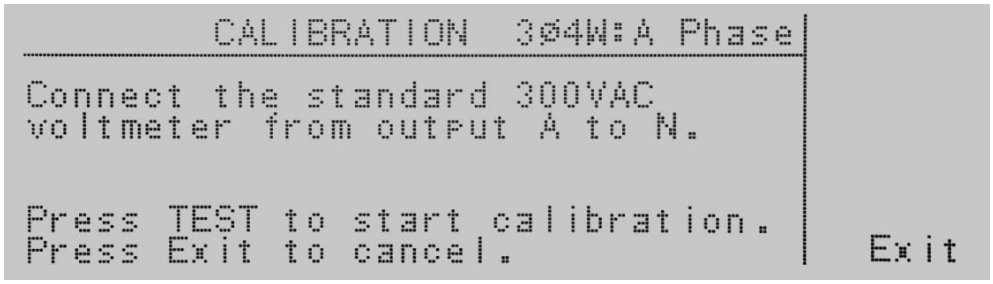
Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for voltage. If you press the "**Exit**" soft key at this screen, you will be returned to the calibration mode screen.



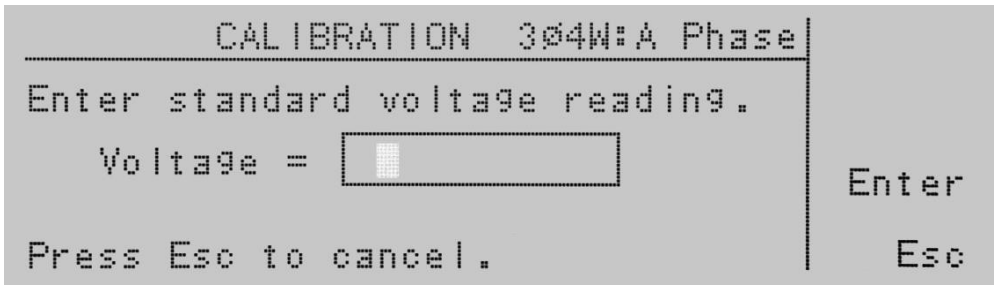
Enter the voltage reading from the voltmeter with the numeric keypad. When the value has been selected, press the "**Enter**" soft key and you will be moved to the next calibration parameter Voltage 300.0V. If you press the "**Esc**" soft key, you will be returned to the calibration mode screen.

10.3.4 Voltage: 300.0V Calibration

Use the "^,v" soft keys to navigate to the Voltage 300.0V parameter and press the "**Select**" soft key.



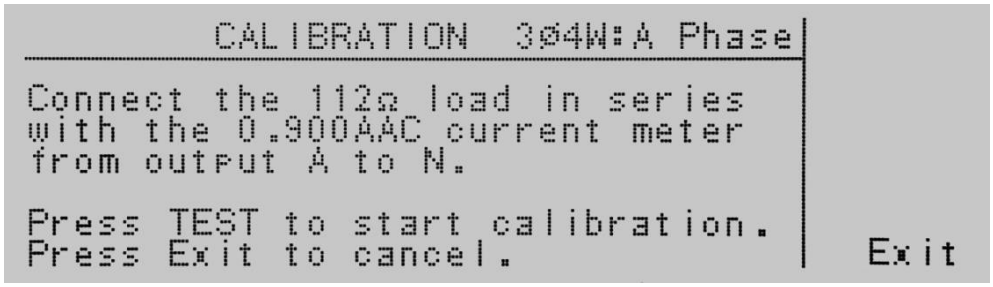
Follow the prompt message provided on the display, and press the Test/Reset button to move into the calibration screen for voltage. If you press the Exit soft key at this screen you return to the calibration mode screen.



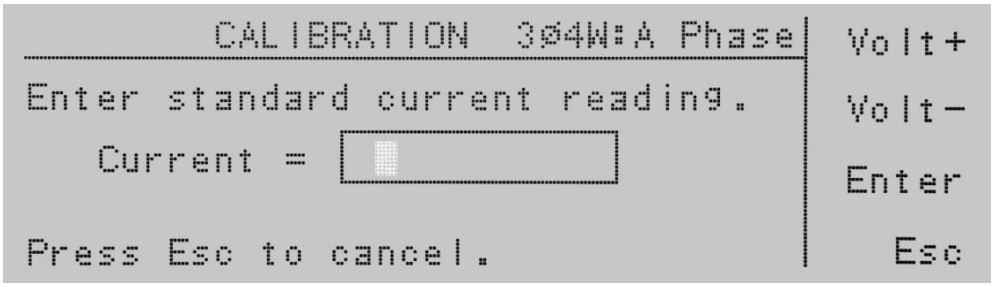
Enter the voltage reading from the voltmeter with the numeric keypad. When the value has been selected press the Enter soft key and you will be moved to the next calibration parameter Current xx.xA. If you press the Esc soft key you will be returned to the calibration mode screen

10.3.5 High & Low Current Range Calibration

Use the "^,v" soft keys to navigate to the Current x.xxxA, or Current xx.xxA parameter and press the Select soft key.



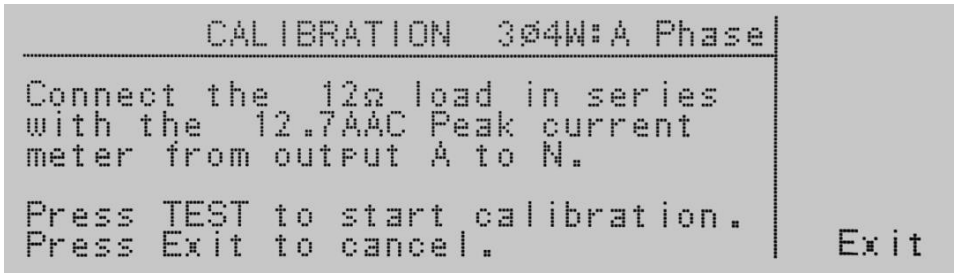
Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for current. If you press the Exit soft key at this screen you return to the calibration mode screen.



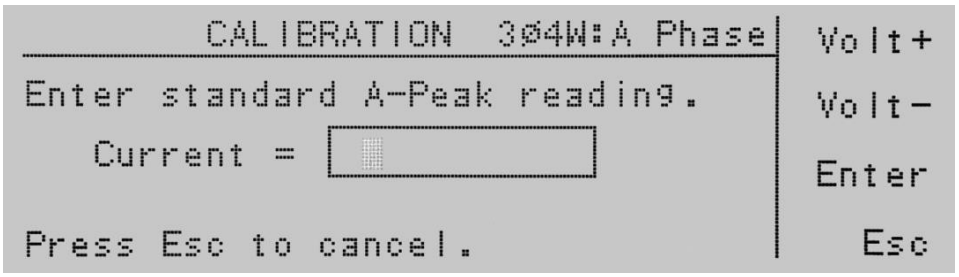
Enter the current reading from the ammeter with the numeric keypad. When the value has been selected press the "**Enter**" soft key and you will be moved to the next calibration parameter. The soft keys Volt+ and Volt- are available, if needed, to adjust the voltage output of the instrument to set a proper current value if a non-recommended load is used. If you press the "**Esc"** soft key you will be returned to the calibration mode screen.

10.3.6 Peak Current Calibration

Use the "^,v" soft keys to navigate to the A-Peak xx.xA parameter and press the "Select" soft key.



Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for current. If you press the "**Exit**" soft key at this screen, you will be returned to the calibration mode screen.



Enter the current reading from the ammeter with the numeric keypad. When the value has been selected, press the "**Enter**" soft key and you will be moved to the first calibration parameter Volt 150.0V. The soft keys "**Volt+**" and "**Volt-**" are available, if needed, to adjust the voltage output of the instrument to set a proper peak current value if a non-recommended load is used. If you press the "**Esc**" soft key, you will be returned to the calibration mode screen

10.3.7 Exiting Calibration Mode

Once all calibrations are done, cycle power to the power source using the front panel On/Off switch so the unit returns to normal operation mode.

11 CE MARK Declaration of Conformity

EU Directives:	**2006/95/EC and 93/68/EEC**
Manufacturer	**Adaptive Power Systems, Inc.**
Product Name	CFS300 Series AC & DC Power Sources: Models **CFS330** and **CFS360**
Serial Number	_____

The manufacturer hereby declares that the products are in conformity with the following standards or other normative documents:

RoHS (DIRECTIVE 2011/65/EU)
Standard applied EN 50581:2012 (Exempt as WEEE Category 9 until 22 July 2017)
SAFETY (DIRECTIVE 2006/95/EC):
Standard applied EN 61010–1: 2010 (3rd Edition)
EMC (DIRECTIVE 2014/30/EU):
Standard applied EN 61326-1: 2013
EMC (DIRECTIVE 2014/30/EU):
Standard applied EN 61326-1: 2013
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	
	1 kHz sinewave (80% AM)	80 – 1000 MHz, 10 V/m
		1.4 – 2 GHz, 3 V/m
		2.0 – 2.7 GHz, 1 V/m
Conducted RF Immunity	IEC 61000-4-6:2013	
	Conducted RF Immunity 0.15-80 MHz @ 3 Vrms	
Electrostatic Discharge	IEC 61000-4-2:2008	
	±4 kV contact discharge	
	±8 kV air discharge	
Electrical Fast Transient/Burst	IEC 61000-4-4:2004+A1:2010	
	AC or DC power ports, ±2 kV	
	Signal and I/O ports, ±1.0 kV	
Surge	IEC 61000-4-5:2005	
	AC or DC power ports, ±2 kV Line to ground and ±1.0 kV line to line	
Power Frequency Magnetic Field	IEC 61000-4-8:2009	
	30 A/M	

Supplemental Information:

When and Where Issued:	June 4, 2016
	Irvine, California, USA
Authorized Signatory	Quality Assurance Inspector
	Adaptive Power Systems
Responsible Person	Production Manager
	Adaptive Power Systems
	17711 Fitch
	Irvine, California, 92649, USA

CE **Mark of Compliance, LVD**

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