Operation Manual

CFS100 Series – Rev 1.12 P/N 160951-10

CFS100 Series Programmable AC & DC Power Supply

ADAPTIVE POWER SYSTEMS™

ADAPTIVE Power Systems

Worldwide Supplier of Power Equipment

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Table of Contents

Table of Tables

Table of Figures

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)

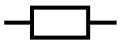

Both direct and alternating current


Three-phase alternating current


Protective Earth (ground) terminal

On (Supply)


Off (Supply)


Fuse


Caution: Refer to this manual before this using 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 CFS100 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”.

3.1 General Description

The APS CFS100 Series consists of three models at varying output power levels. 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 4, “Technical Specifications” for specific AC input specifications by model.

3.1.1 Model CFS108

This is the smallest model offered at 800VA output in AC mode and 400W output in DC mode. Output voltage is 300Vac in AC mode or 400Vdc in DC mode. The CFS108 connects the AC power grid using a standard IEC 60320 standard type C13 (15 A) modular line cord. One line cord is included in the shipkit. If the plug is not correct for your locale, country specific line cords should be readily available or the plug on the included line cord can be replaced with the correct plug. AC input can be changed between 115V and 230V using the voltage input selector switch on the rear panel of the unit.

3.1.2 Model CFS116

This CFS116 offers 1600VA output in AC mode and 800W output in DC mode. It is similar in height and width to the CFS108 but somewhat deeper (and heavier) so the CFS116 requires more depth than the CFS108 when installed in a 19” cabinet.

Output voltage is 300Vac in AC mode or 400Vdc in DC mode. The CFS116 connects the AC power grid using a standard IEC 60320 standard type C19 (20 A) modular line cord. If the plug is not correct for your locale, a country specific line cords can be used instead or the plug on the included line cord can be replaced with the correct plug

3.1.3 Model CFS140

This CFS140 offers 4000VA output in AC mode and 2000W output in DC mode. It is similar in width to the CFS108 and CFS140 but much taller and heavier. A rack handle kit for installation in a 19" cabinet is included but additional L-bracket support is required to install into a cabinet due to the unit's weight.

The CFS140 requires too much AC input current to use a modular power cord. Instead, it is equipped with an AC line disconnect circuit breaker and an AC input terminal strip. Both are located on the rear panel. Refer to Section 5, "Unpacking and Installation"

3.2 Product Features

The following key characteristics apply to all CFS100 Series models;

- Fully programmable AC and DC output modes
- Frequency range in AC mode is 40 Hz to 500 Hz
- Dual voltage ranges in both modes
- AC voltage ranges are 5-150Vac and 5-300Vac RMS
- DC voltage ranges are 5-200Vdc and 5-400Vdc.
- 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. (*on CPS100 Models with FW rev 1.02.00 or higher*)

3.3 Operating Modes

The CFS100 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	5 Vac – 300 Vac RMS
DC	5 Vdc – 200 Vdc	5 Vdc – 400 Vdc

Table 3-1: Available Voltage Ranges by Output Mode

See specifications in Sections 4.1and 4.2 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 **can** be programmed. However, at voltage settings lower than 5V, load regulation and voltage distortion (AC mode) are difficult to maintain.

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 PROGRAM and MANUAL modes 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 CFS100 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 and by output mode (AC or DC), and voltage range (high (300Vac/400Vdc) or low (150Vac/200Vdc)).

3.6.1 CFS108 AC Mode VI Curve

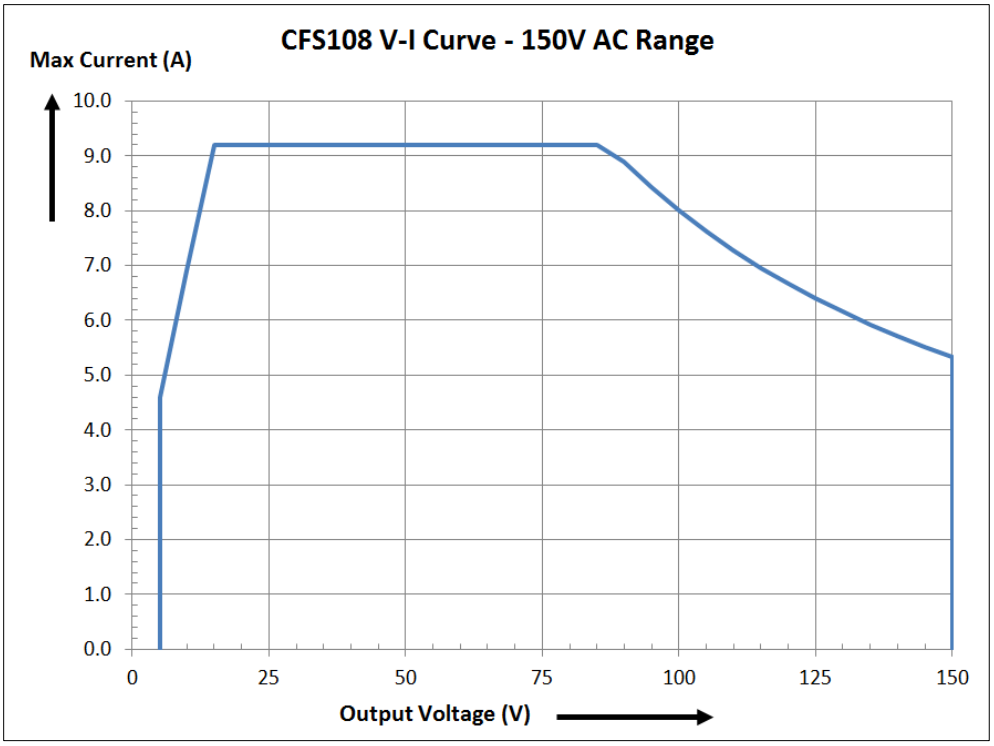


Figure 3-1:CFS108-AC-VI_Curve-150V_Range

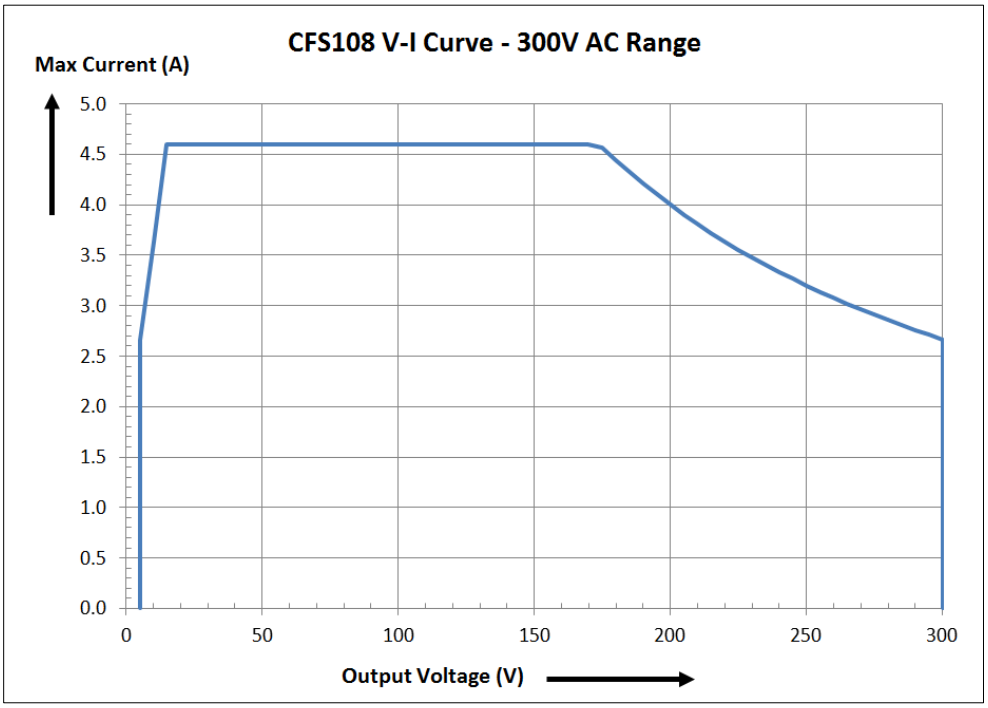


Figure 3-2: CFS108-AC-VI_Curve-300V_Range

3.6.2 CFS108 DC Mode VI Curve

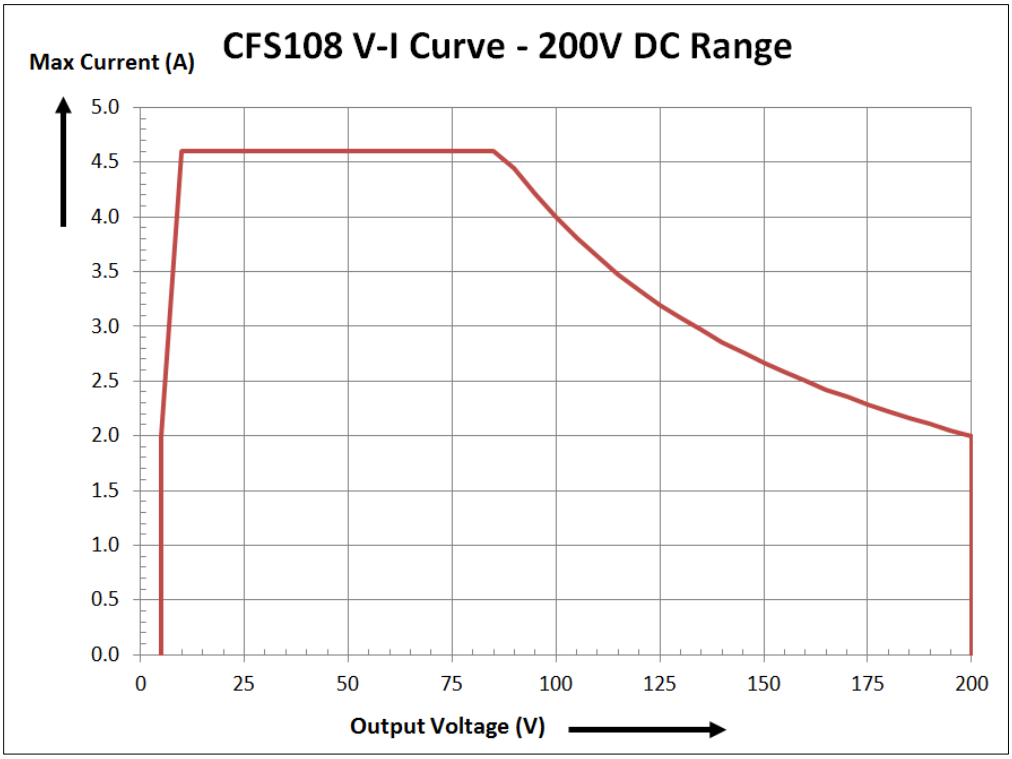


Figure 3-3:CFS108-DC-VI_Curve-200V_Range

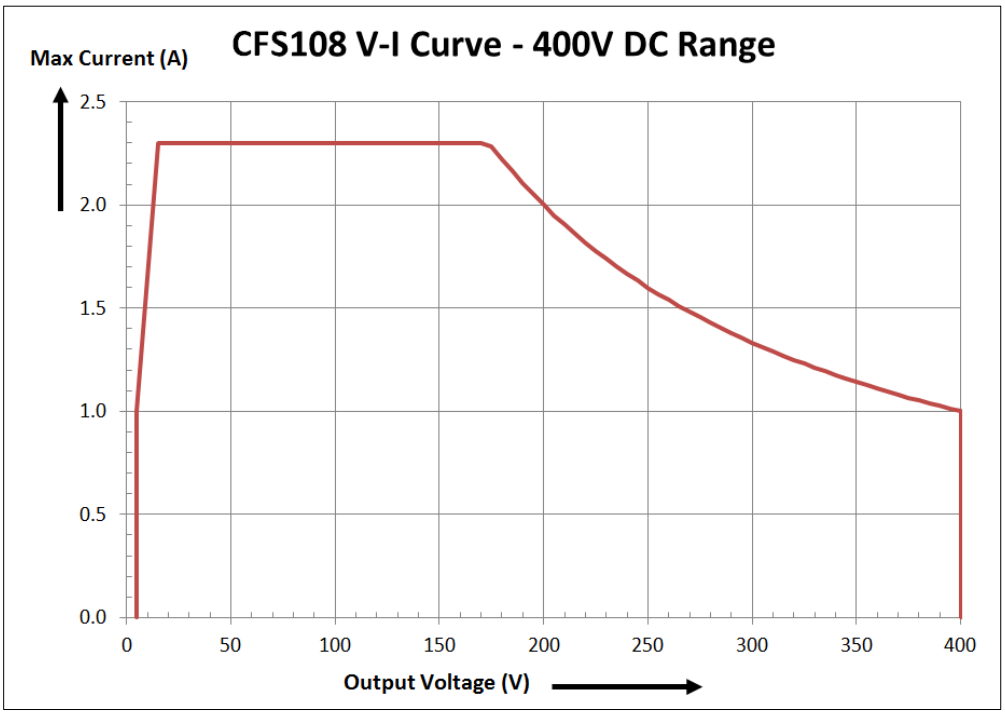


Figure 3-4: CFS108-DC-VI_Curve-400V_Range

3.6.3 CFS116 AC Mode VI Curve

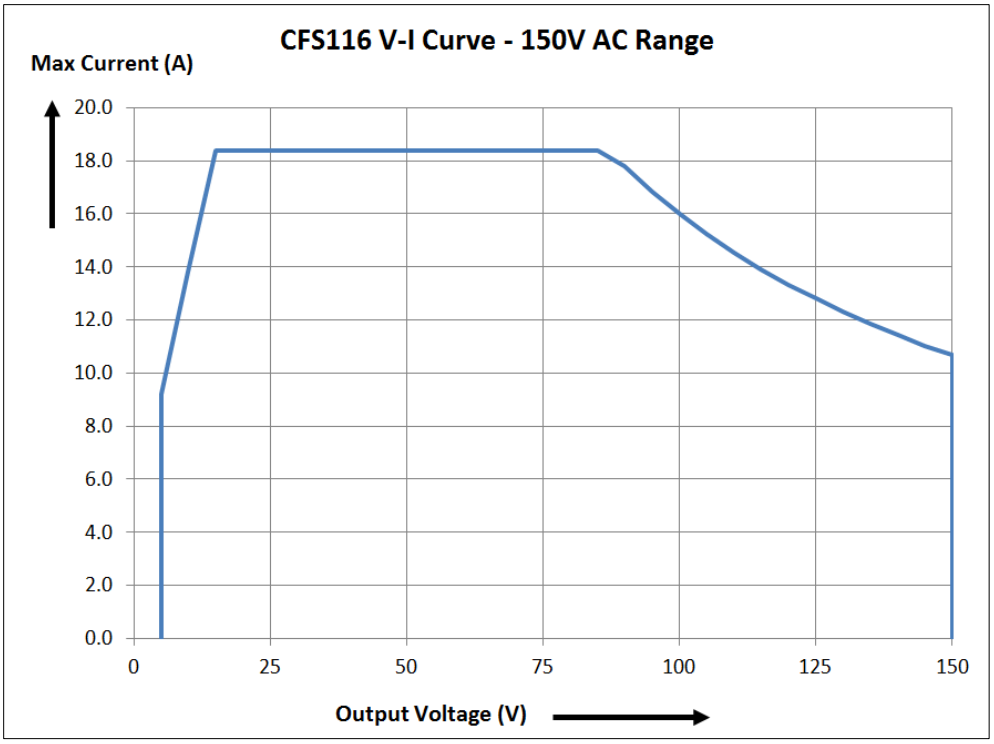


Figure 3-5:CFS116-AC-VI_Curve-150V_Range

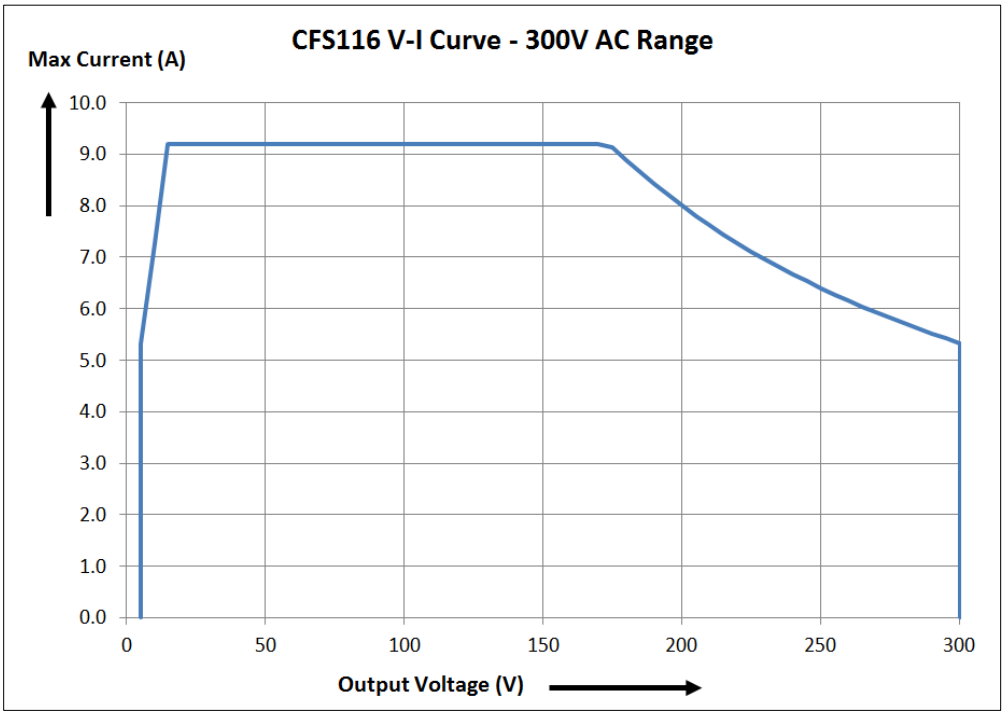


Figure 3-6: CFS116-AC-VI_Curve-300V_Range

3.6.4 CFS116 DC Mode VI Curve

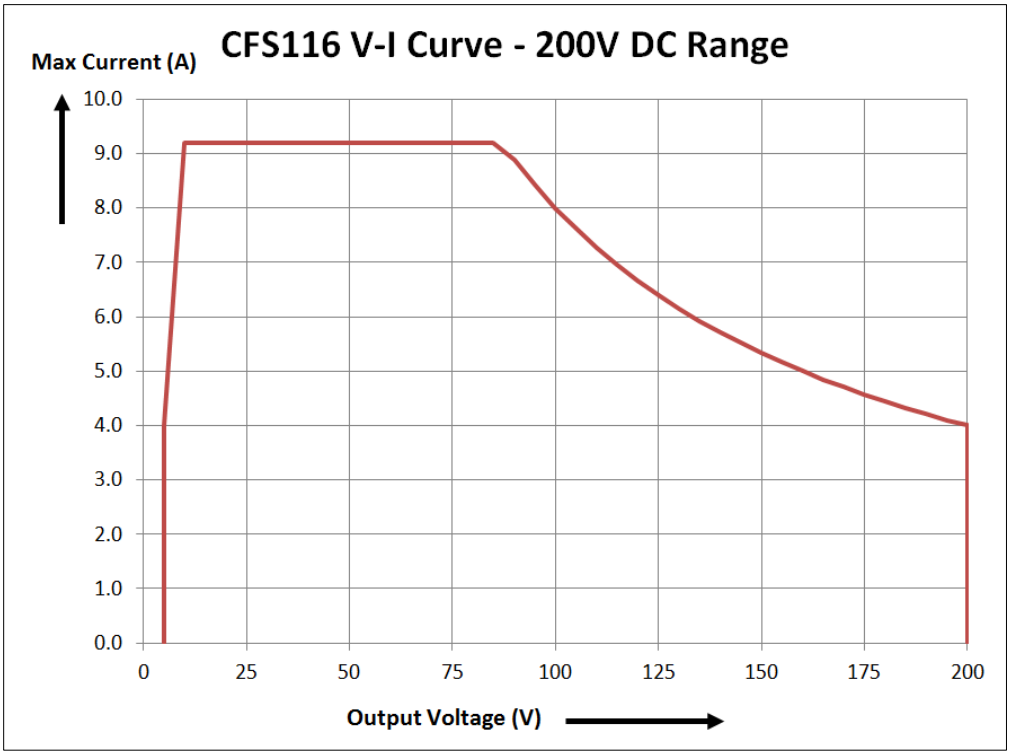


Figure 3-7:CFS116-DC-VI_Curve-200V_Range

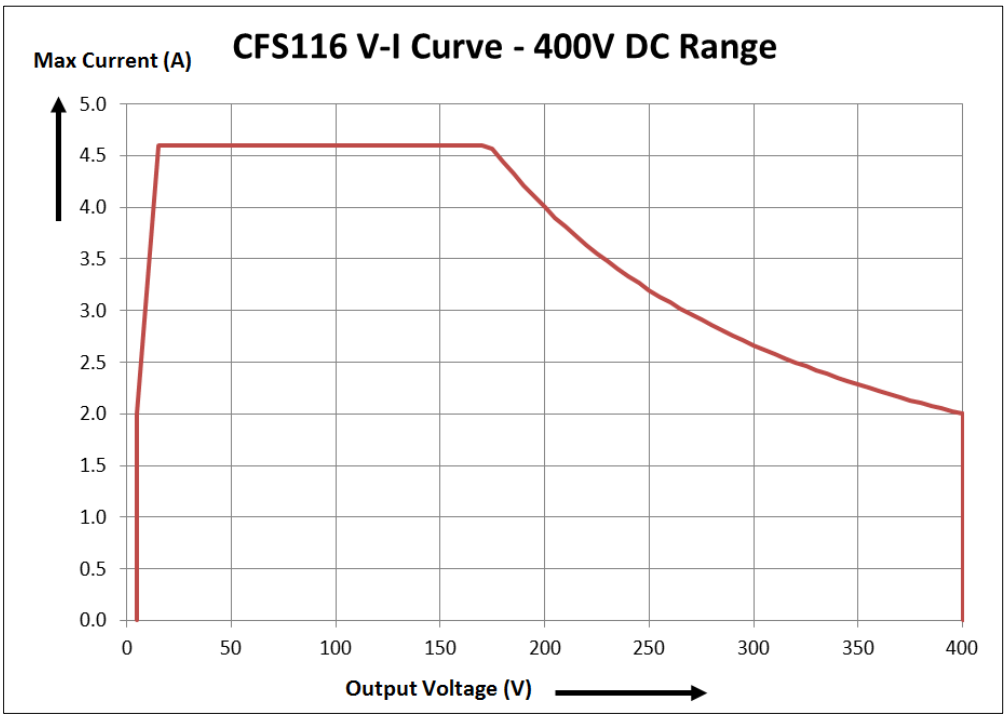


Figure 3-8: CFS116-DC-VI_Curve-400V_Range

3.6.5 CFS140 AC Mode VI Curve

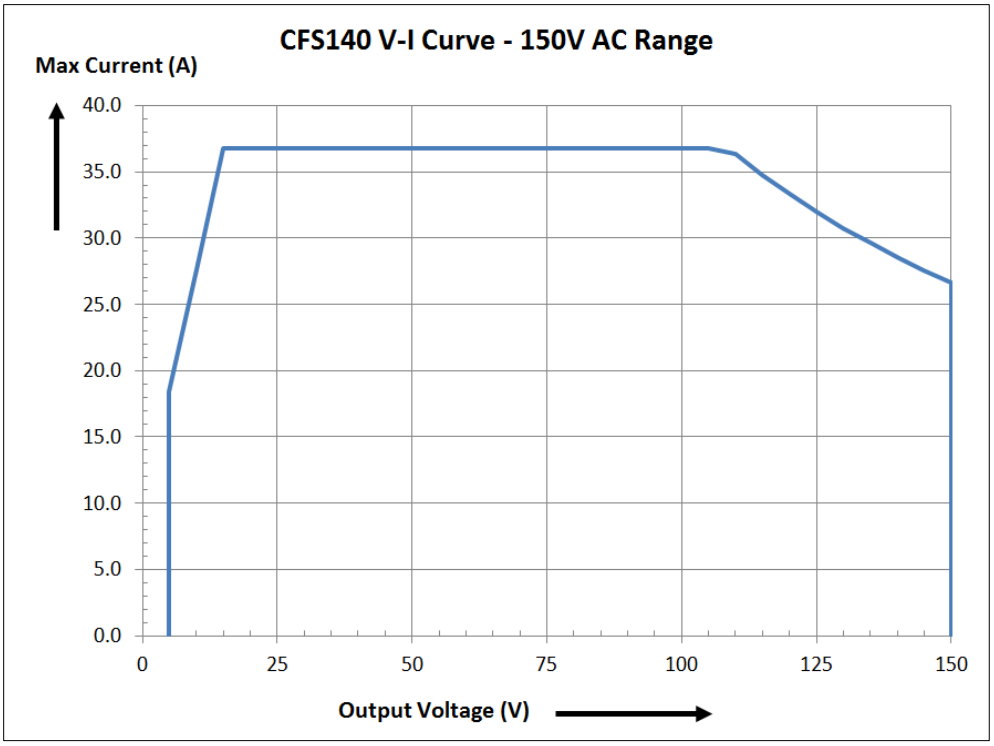


Figure 3-9:CFS140-AC-VI_Curve-150V_Range

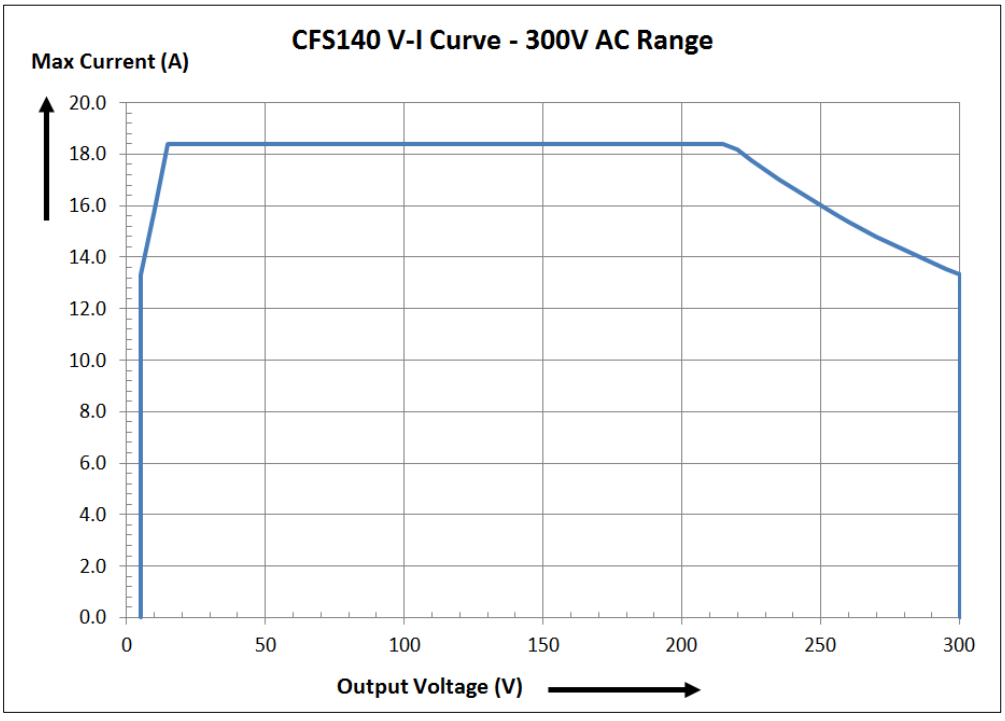


Figure 3-10: CFS140-AC-VI_Curve-300V_Range

3.6.6 CFS140 DC Mode VI Curve

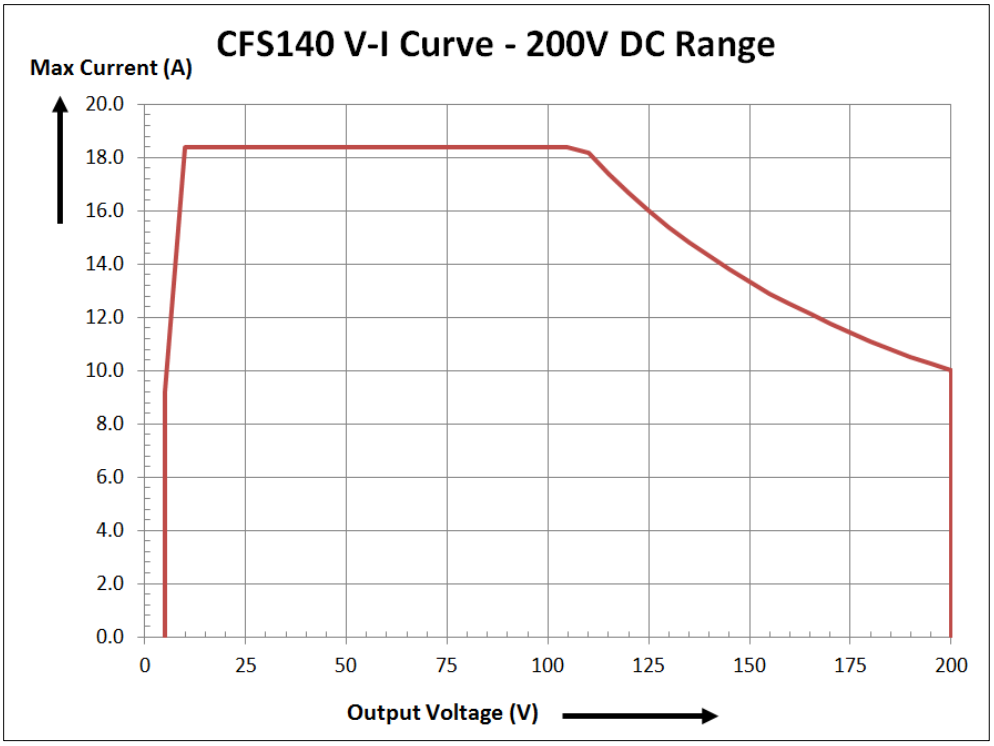


Figure 3-11:CFS140-DC-VI_Curve-200V_Range

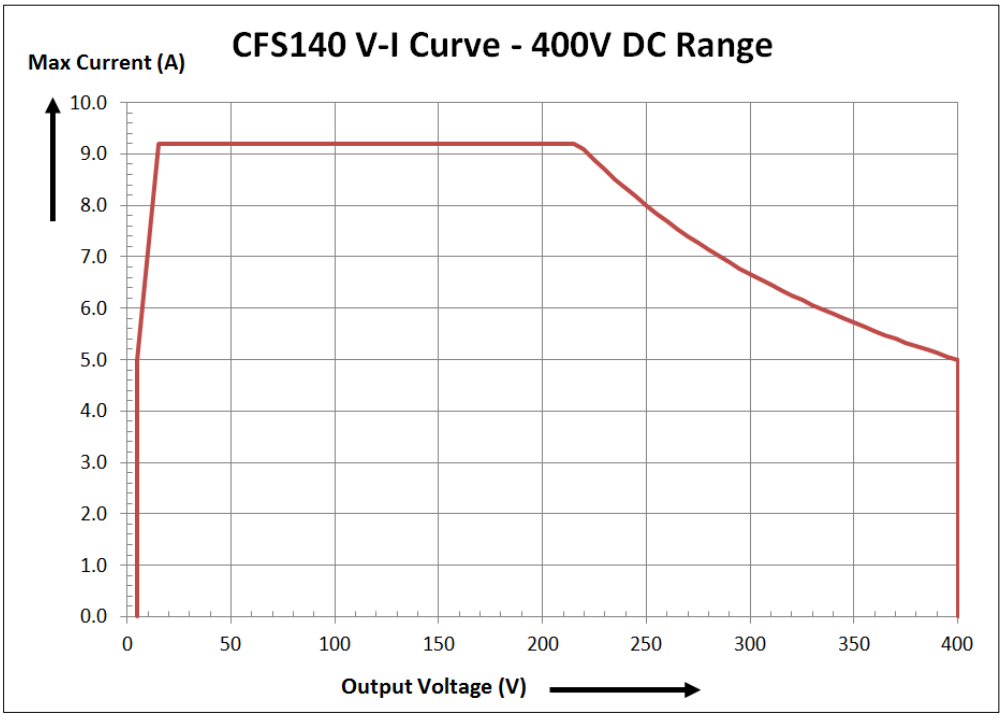


Figure 3-12: CFS140-DC-VI_Curve-400V_Range

4 Technical Specifications

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

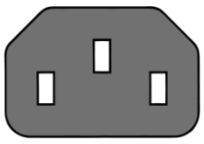
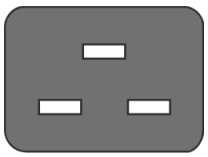
4.1 AC Output

OUTPUT SPECIFICATIONS - AC MODE				
MODEL		**CFS108**	**CFS116**	**CFS140**
Power Rating		800 VA	1600 VA	4000 VA
AC Output Terminals		Rear Panel (L, N, G), Floating Neutral		
Voltage Ranges	Low / High	5 - 150V / 5 - 300V		
	Resolution	0.1 V		
	Accuracy	± (0.2% setting + 0.3 V)		
Current Limit		CC Mode (Foldback = ON) or CC Mode (Foldback = OFF)		
Max. Current	150V Range	9.2 A (@ 87V)	18.4 A (@ 87V)	36.8 A (@ 109V)
	300V Range	4.6 A (@ 174V)	9.2 A (@ 174V)	18.4 A (@ 217V)
Resolution		0.01 A		
Accuracy		± (2% of setting + 2 counts)		
Over Current Capability - AC		110% for 1000 msec		
Peak Cur.	150V Range	36.8 A	73.6 A	147.2 A
	300V Range	18.4 A	36.8 A	73.6 A
Crest Factor		≥ 3 to 1		
Frequency	Range	40 - 500 Hz		
	Resolution	0.1 Hz		
	Accuracy	± 0.1 Hz		
Start/Stop Phase	Range	0 - 359°		
	Accuracy	±1%, 45- 65 Hz		
Harmonic Distortion (Full Resistive Load)		< 1.0%, 80-140V on Low Range		
		< 1.0%, 160-280V on High Range		
Line Regulation		± 0.1 V for a 10% Line Change		
Load Regulation		± 1.0% Range + 1V, R Load		
Response time		< 400 µsec		
Protection		Over Current, Short Circuit, Over Voltage, Under Voltage, Over		
Isolation		Input to Output: 3000 Vac / Input to Chassis: 1800 Vac		

4.2 DC Output

OUTPUT SPECIFICATIONS - DC MODE				
MODEL		**CFS108**	**CFS116**	**CFS140**
Power Rating		400 W	800 W	2000 W
DC Voltage Ranges		5 -200Vdc / 5 - 400Vdc		
	Resolution	0.1 Vdc		
	Accuracy	± (0.2% Setting + 0.3V)		
Ripple & Noise RMS	-VL VH	< 450 mV < 700 mV	< 500 mV < 800 mV	< 900 mV < 1500 mV
Ripple & Noise p-p		< 2.0 Vpp		< 3.0 Vpp
Max. Current	VL (< 87V)	4.6 A (@ 87Vdc)	9.2 A(@ 87Vdc)	18.4 A(@ 109Vdc)
	VH (<174V)	2.3 A(@ 174Vdc)	4.6 A(@ 175Vdc)	9.2 A(@ 217Vdc)
	Accuracy	± (2.0% Setting + 0.2 A)		
Over Current Capability - DC		110% for 1000 msec		

4.3 Power Connections

POWER CONNECTIONS			
MODEL	**CFS108**	**CFS116**	**CFS140**
AC Input Connector / Rating	IEC 60320 Modular Coupler C14 / 15A	IEC 60320 Modular Coupler C20 / 20A	Terminal Strip, H, Ground, L / 40A
			
AC or DC Output	Terminal Strip, H (+), Ground, L (-)		
			

4.4 Metering – AC Mode

MEASUREMENT SPECIFICATIONS- AC MODE				
MODEL		**CFS108**	**CFS116**	**CFS140**
Voltage	Range	0.0 - 400.0 V		
	Resolution	0.1 V		
	Accuracy	± (1.0% + 0.2V)		± (1.0% Rdg + 0.5V) > 5 V
Frequency	Range	0.0 - 500.0 Hz		
	Resolution	0.1 Hz		
	Accuracy	± 0.1 Hz		
Current RMS	Range (L)	0.005-1.2 A	0.005-2.4 A	n/a
	(H)	1.00-13.00 A	2.00-26.00 A	0.05-52.00 A
	Resolution (L)	0.001 A		
	(H)	0.01 A		
	Accuracy (L)	± (1.0% Rdg + 0.005A)		
	(H)	± (1.0% Rdg + 0.05A)		
Current Peak	Range	0.0 - 38.0 A	0.0 - 79.0 A	0.0 - 152.0 A
	Resolution	0.1 A		
	Accuracy	± (1.0% Rdg + 0.5A)		
Power	Range (L)	0.0- 120.0 W	0.0- 240.0 W	n/a
	(H)	100-1300 W	200-2600 W	0-5200 W
	Res. (L)	0.1 W		
	(H)	1 W		
	Acc. (L)	±(2% Rdg + 1.5W) @PF>0.2	±(2% Rdg + 3W) @PF>0.2	±(2% Rdg + 5W) @PF>0.2, V> 5V, I > 0.05A
	(H)	±(2% Rdg + 1.5W) @PF>0.2	±(2% Rdg + 3W) @PF>0.2	
Power Factor	Range	0.000 - 1.000		
	Resolution	0.001		
	Accuracy	Calculated W/VA		

4.5 Metering – DC Mode

MEASUREMENT SPECIFICATIONS -DC MODE				
MODEL		**CFS108**	**CFS116**	**CFS140**
Voltage DC	Range	0.0 - 400.0 Vdc		
	Accuracy	± (0.2% Setting + 0.3V)		
Current DC	Range	0.05-6.5Adc	0.05-13.0Adc	0.05-26.0Adc
	Accuracy	± (1.0% Setting + 0.05 Adc)		
Power	Range	0 - 1300 W	0 - 2600 W	0-5200 W
	Accuracy	±(2% Rdg+1.5W	±(2% Rdg+3W)	±(2% Rdg+5W)

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.
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	**CFS108**	**CFS116**	**CFS140**
Input Phases	1ø		
Frequency	47 - 500 Hz		
Input Voltage	115/230Vac±10%	208V or 230 Vac ± 10%	
Max. Input Current@115V	12 A	n/a	n/a
Max. Input Current@230V	6 A	12 A	30 A
Input Power Factor (PF)	0.7		
Efficiency	> 80 % @ Full Load		
AC Line Cord, IEC 60320	C13	C19	Terminal Strip

Note: AC input current values shown in the table above apply under full power output conditions. The actual AC input current will be a function of the output power and is shown at either 110Vac and 220Vac output voltage and 115Vac and 230Vac input voltage by model.

4.7.1 AC Input Current vs AC Output Current – Model CFS108

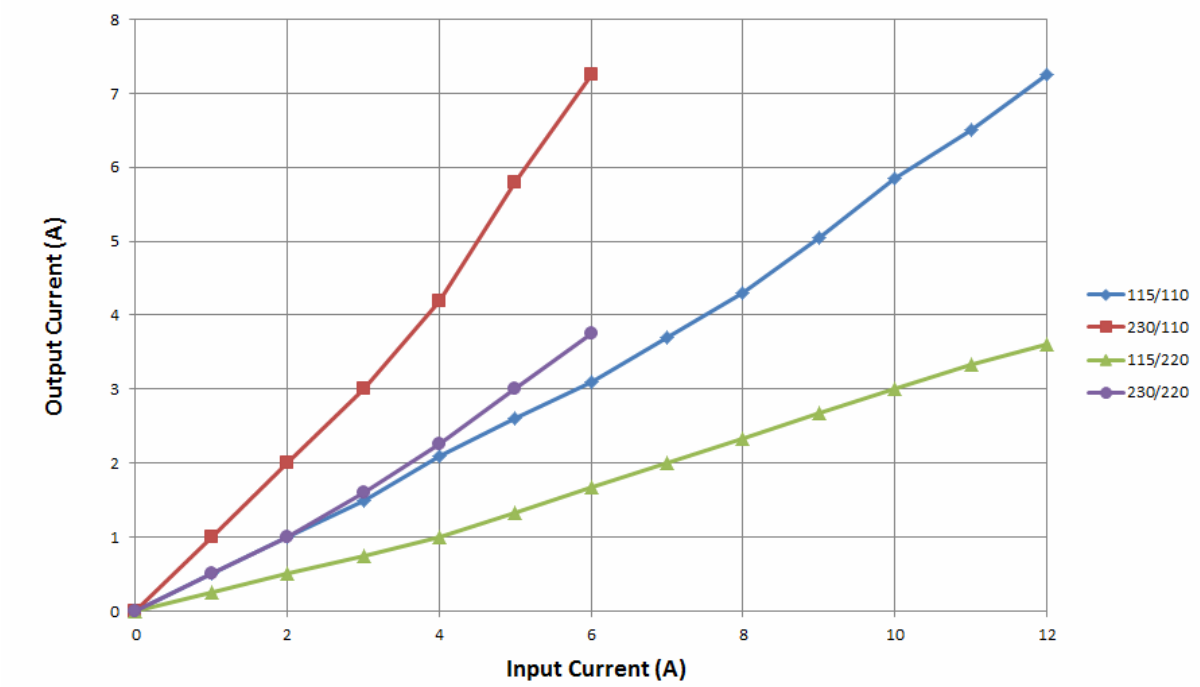


Figure 4-1: AC Input Current vs AC Output Current – Model CFS108

4.7.2 AC Input Current vs AC Output Current – Model CFS116

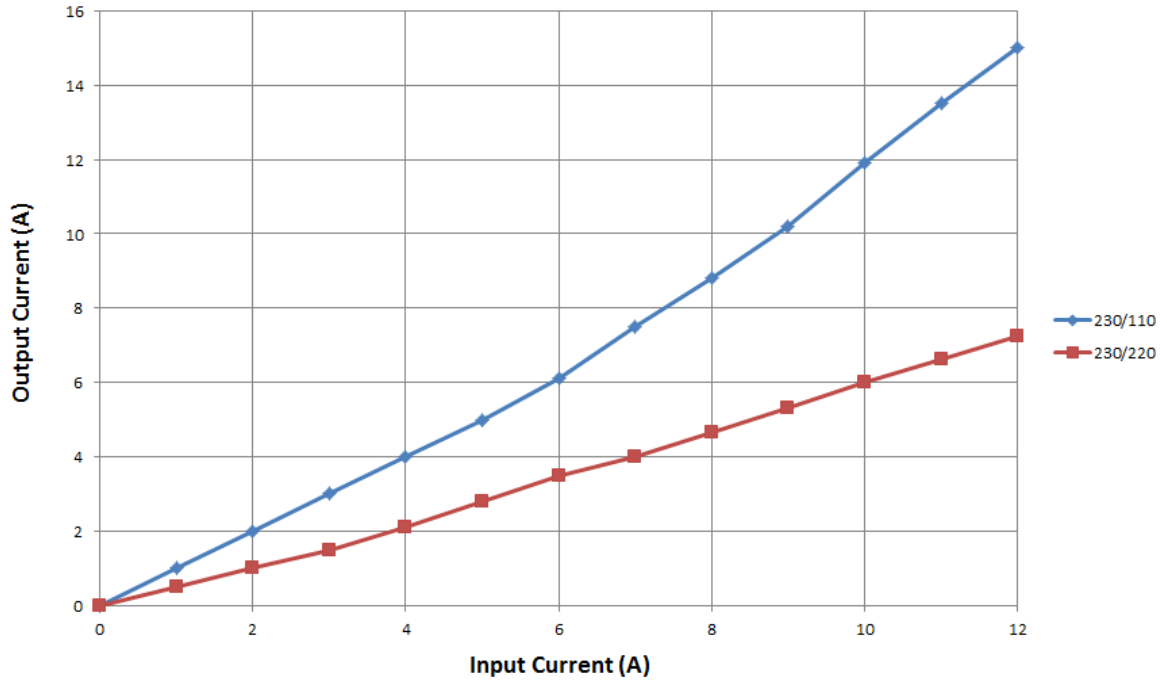


Figure 4-2: AC Input Current vs AC Output Current – Model CFS116

4.7.3 AC Input Current vs AC Output Current – Model CFS140

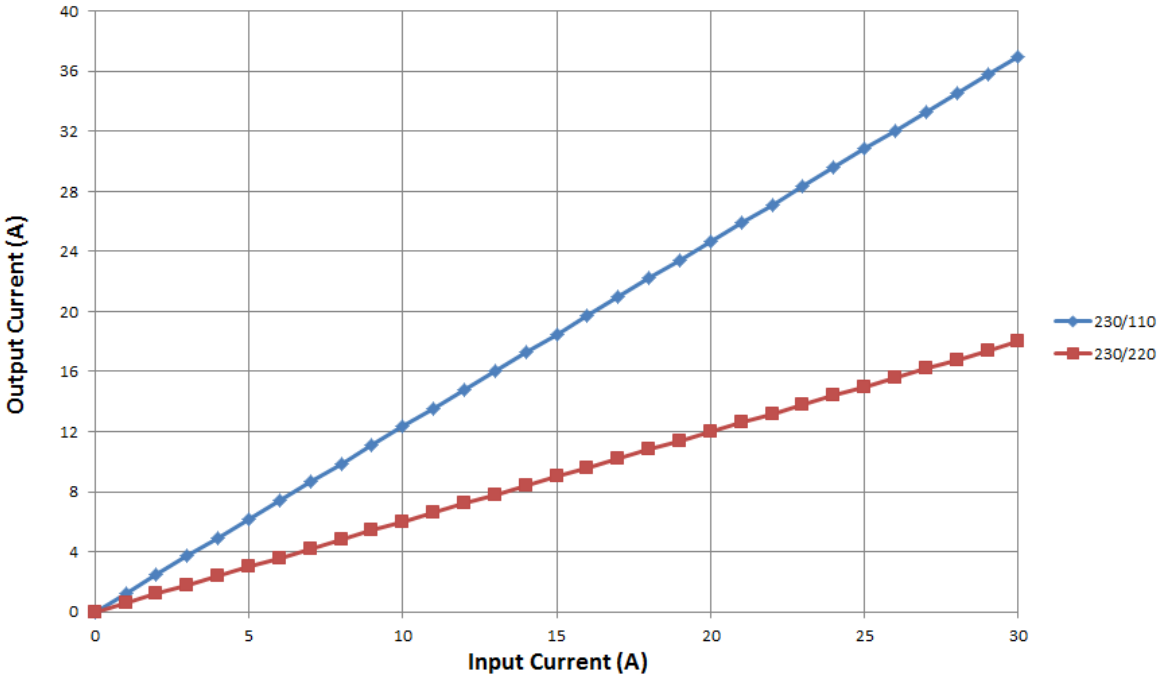


Figure 4-3: AC Input Current vs AC Output Current – Model CFS140

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
Surge / Drop Voltage	ON: Start 0-20ms, Duration 0-20ms OFF: Start 0-99ms, Duration 0-99ms

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 OUTPUT STATUS TTL Output, BNC connector, rear panel

Note1: LAN option includes RS232 but deletes USB interface.

4.11 Dimensions & Weight

MECHANICAL SPECIFICATIONS			
MODEL	**CFS108**	**CFS116**	**CFS140**
Dimensions (WxHxD)	432x89x406 mm	432x89x508 mm	432x222x508 mm
	17” x 3.5” x 16”	17” x 3.5” x 20”	17” x 8.75” x 20”
Rack Mount	Handle & Rack Ear Kit included		
Weight	19 Kg 42 lbs.	30.8 Kg 68 lbs.	64.8 Kg 143 lbs.

4.12 Environmental

ENVIRONMENTAL SPECIFICATIONS		
Cooling	Fan Cooled	
Operating Temperature	5 to 40 °C / 41 to104 °F	
Fan Cooled	Dual Speed	Variable speed
Storage Temperature	-40 to 55 °C / -4 to 158 °F	
Humidity	20 - 80% R.H. Non-condensing	
Operating Altitude (max.)	2000 m / 6500 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 11, “CE MARK Declaration of Conformity” at the end of this manual.

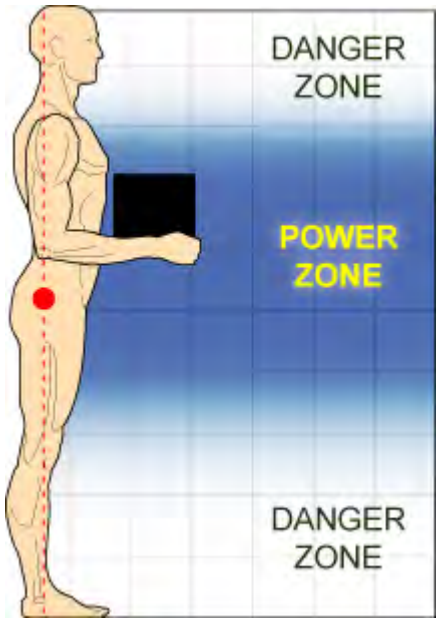
5 Unpacking and Installation

5.1 Inspection

The CFS100 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; 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 and soliciting assistance from other members of your team, in particular for CFS116 and CFS140 models.

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 5-2: Lifting Do's and Don'ts Chart

5.2.1 Unpacking CFS108 and CFS116 Models

The CFS108 and CFS116 are shipped in a cardboard box with protective foam inserts. To remove a CFS108, one or two persons may be used. To remove a CFS116, two persons **MUST** be used at all times.

Removal Steps:

1. Position the carton on a stable flat surface with sufficient clearance.
2. Make sure the carton is right-side up. Top is clearly marked on the side of the carton.
3. 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.
4. Use a box cutter to cut the tape that holds the top flaps together. Also cut the side tape on the top flaps.
5. Open all four flaps completely and fold them down along the side of the carton so they don't interfere with access to the inside of the carton.

6. Remove the small card box insert that contains some ship kit items from the top foam cutout and put in a safe place.
7. Remove the top foam insert piece and retain for future use if desired.
8. For CFS108:
    a. Stand as close to the back of the box (where the rear panel of the unit is) and bend with your knees.
    b. Get a firm hand hold underneath the units by placing your hands on each side of the unit near the middle. This will help even the weight when lifting.
    c. While keeping your back straight, lift the unit out of the box by straightening your legs.
    d. Place the unit on the intended staging surface, usually a bench or table.
9. For CFS116:
    a. Two people are required.
    b. Have each person stand as close to the front and the back of the box 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 box simultaneously by straightening legs.
    e. Place the unit on the intended staging surface, usually a bench or table.

5.2.2 Unpacking CFS140 Models

WARNING

THE CFS140 WEIGHT APROXIMATELY 64.8 Kg / 143 lbs. AT LEAST TWO PEOPLE ARE REQUIRED TO LIFT AND HANDLE

The CFS140 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 CFS140, 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. For CFS140:
    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.

5.3 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).

5.3.1 CFS108 Ship Kit Contents

The following accessories are included with each CFS108 power source. See image below for reference letters A through F.

Item	Notes	Quantity	Ref
Documentation Instruction Sheet	⚠ **READ THIS FIRST**	1	
Certificate of Conformance		1	
AC Line Cord	C13 Modular Cord	1	A
AC Input Fuse Spare		1	B
Output Safety Cover	Must be installed by user while connecting load wires. Includes mounting screws.	1	C
Rack Handle	Use screws installed on CFS to mount if needed.	2	D
USB Cable	3 feet USB Cable	1	E

Table 5-1: CFS108 Included Accessories Ship Kit

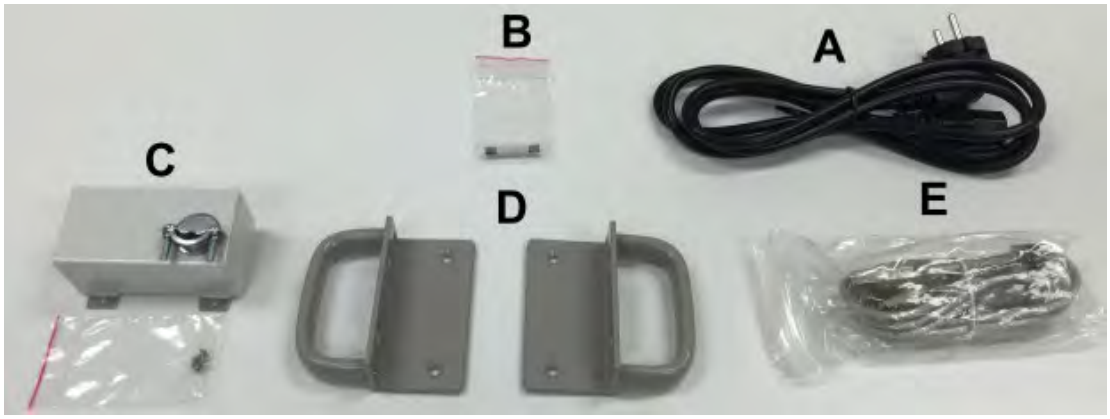


Figure 5-3: CFS108 Ship Kit Content

5.3.2 CFS116 Ship Kit Contents

The following accessories are included with each CFS108 power source. See image below for reference letters A through F.

Item	Notes	Quantity	Ref
Documentation Instruction Sheet	⚠ **READ THIS FIRST**	1	
Certificate of Conformance		1	
AC Line Cord	C13 Modular Cord	1	A
AC Input Fuse Spare		1	B
Output Safety Cover	Must be installed by user while connecting load wires. Includes mounting screws.	1	C
Rack Handle	Use screws installed on CFS to mount if needed.	2	D
USB Cable	3 feet USB Cable	1	E

Table 5-2: CFS116Included Accessories Ship Kit

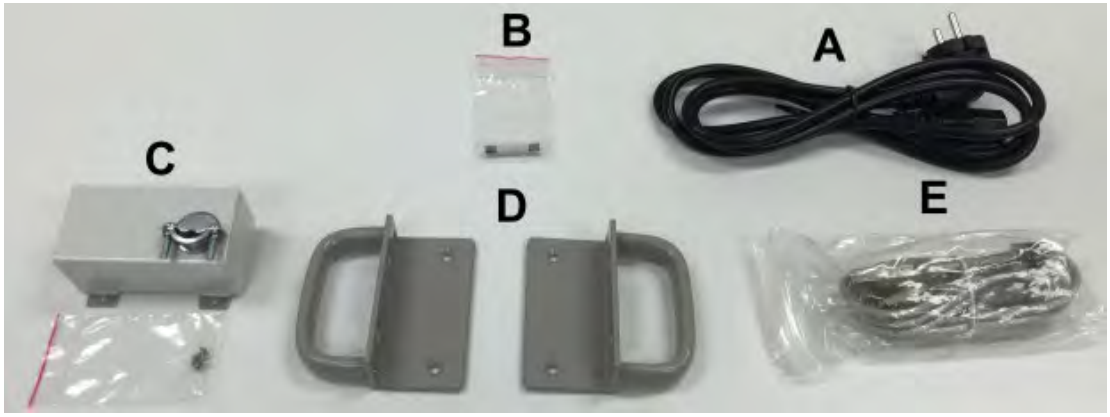


Figure 5-4: CFS116 Ship Kit Content

5.3.3 CFS140 Ship Kit Contents

The following accessories are included with each CFS108 power source. See image below for reference letters A through F.

Item	Notes	Quantity	Ref
Documentation Instruction Sheet	⚠ **READ THIS FIRST**	1	
Certificate of Conformance		1	
Rack Handle	Use screws installed on CFS to mount if needed.	2	A
AC Input and Output Combination Safety Cover	Must be installed by user while connecting ac input and load wires.	1	B
USB Cable	3 feet USB Cable	1	C

Table 5-3: CFS140 Included Accessories Ship Kit

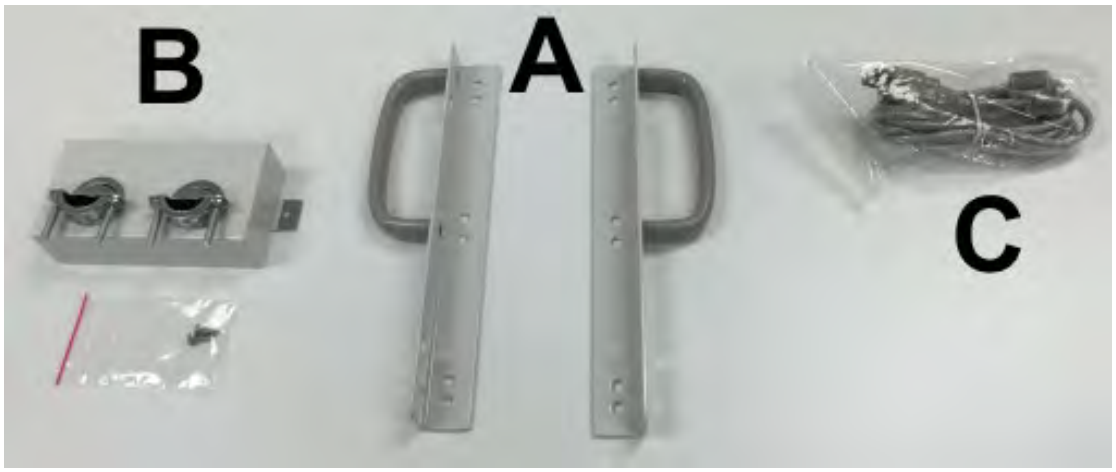


Figure 5-5: CFS140 Ship Kit Content

5.4 AC Input Connections

All CFS100 units operate on single phase AC input and are furnished with either an IEC line cord or a terminal block for AC input (CFS140). For the CFS140, a suitable line cord and power disconnect is required (but not included) to connect to the mains.

Refer to Section 5.6, “Check Line Voltage" to see how to check the line voltage selection and fuse type.

The AC input connections must be made at the rear of the CFS100 units. For the CFS140, a single safety cover is provided to cover both AC input and AC/DC Output terminal blocks.

CAUTION

The included output safety covers must be properly installed when using this equipment

- The AC input terminal on the CFS140 is marked. A three wire mains connection is required. (L1, L2 and Earth Ground).
- Model CFS108 is furnished with an IEC 60320 C13 15A line cord.
- Model CFS116 is furnished with an IEC 60320 C19 20A line cord.

5.5 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.

5.6 Check Line Voltage

CAUTION

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

5.6.1 US Line Cord Requirements

For North America:

A **UL listed** and **CSA labeled** power cord must be used with the instrument in the United States and Canada. The power cord must include a NEMA5-15 style male plug, SVT or SJT cord sets, and be rated for at least 125VAC, 10A, number 16 gauge (or 125VAC, 15A, number 14 gauge) wire or larger, and the length of the cord does not exceed 2 m must be used.

5.6.2 European Line Cord Requirements

For Europe:

A certified power cord that meets **ALL** of the following requirement must be used:

- Not lighter than light PVC sheathed flexible cord according to IEC 60227, designation H05 VV-F or H05 VVH2-F2 (for equipment mass exceeding 3 kg)
- Rated for at least 3G 1.0mm² (for rated current over 10 A up to 16 A) wire or larger
- Length of the cord does not exceed 2 meters

WARNING

The mains plug is used as the disconnecting device and shall remain readily operable. The Mains socket outlet shall be installed near the equipment and shall remain easily accessible at all times.

5.6.3 CFS108 Models

The CFS108 model power source can be ordered configured for either 115V or 230V AC input configurations. Prior to connecting the CFS108, verify the local mains' setting matches the type label on the unit to verify the AC input configuration matches the local utility power. If not, slide the RED voltage selection switch to the position that matches your local utility.

Do not connect any CFS100 Series unit to the mains if the AC input voltage, phasing and frequency does not match.

Figure 5-6: AC Input Voltage Selector Switch Location CFS108

5.6.4 CFS116 & CFS140 Models

The CFS160 and CFS140 are available with either 208V or 230V ac single phase input. 208V models may be connected to a 208V three phase power connection by using two of the three phase. The 230V models may be also used with a split-phase 230V ac line. The configured AC input is shown on the rear panel directly to the right of the C20 AC inlet connector as shown below.

Do not attempt to operate the CFS140 from a 115V AC outlet.

Table 5-4: AC Input Voltage Identification Location CFS116

Note: Models CFS108 and CFS116 are fitted with a mains input fuse located on the rear panel. A spare fuse is included in the ship kit. If any of these need to be replaced, please contact customer service.

5.6.5 CFS140 AC Input Fuses & Circuit Breaker

Model CFS140 is fitted with a protective circuit breaker located on the rear panel. To operate this CFS140, this circuit breaker must be placed in the ON position. (Level upward).

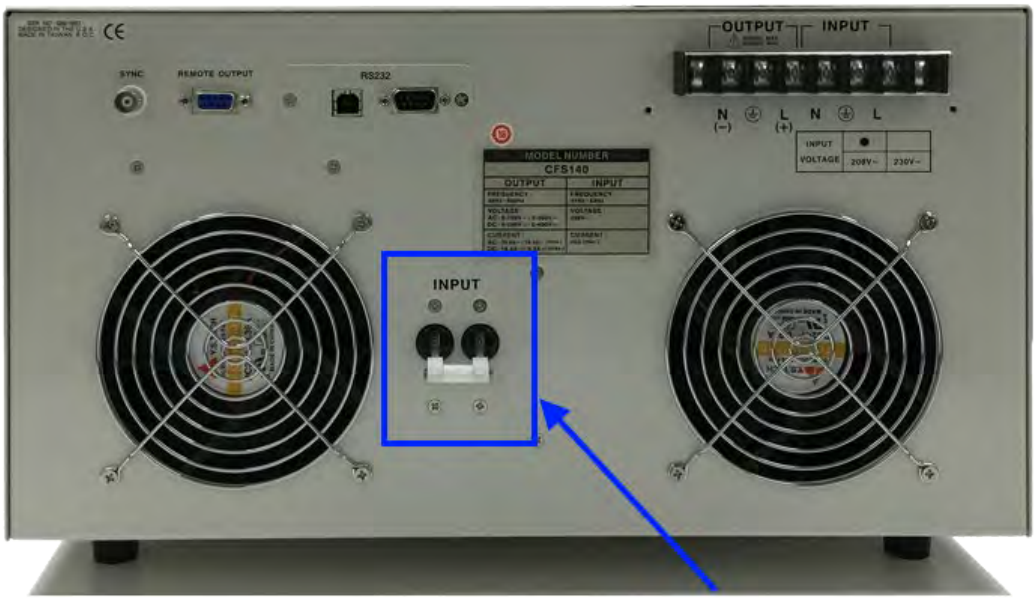


Figure 5-7: CFS140 AC Input Circuit Breaker Location

5.7 Cleaning

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

CAUTION

BEFORE you clean the unit, switch the mains power off and disconnect the input line cord.

・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.

5.8 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 DC output terminals on the rear panel.
4. Verify the AC Line input specifications on the power source match the local utility mains.
5. Connect the correct AC mains line cord to the CFS100 Series AC input terminal.
6. Plug in the line cord to apply power to the unit.
7. On model CFS140, make sure the rear panel circuit breaker is in the ON position.
8. Turn ON (I) the front panel POWER switch.
9. 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.

5.9 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.

5.10 Output Terminals

The location and size of the AC or DC output terminals is model dependent. The rear panels for each model are shown here for reference.

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

5.10.1 Model CFS108 Output Terminal Location

The output terminal block on the CFS108 is located on the far left side of the units when facing the back. See illustration 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 CFS108.

Figure 5-8: CFS108 Output Terminals

5.10.2 Model CFS116 Output Terminal Location

The output terminal block on the CFS108 is located on the far left side of the unit when facing the back. See illustration 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 CFS108.

Figure 5-9: CFS116 Output Terminals

5.10.3 Model CFS140 Output Terminal Location

The output terminal block on the CFS140 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 illustration 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 CFS140.

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 shipkit MUST be used at all times

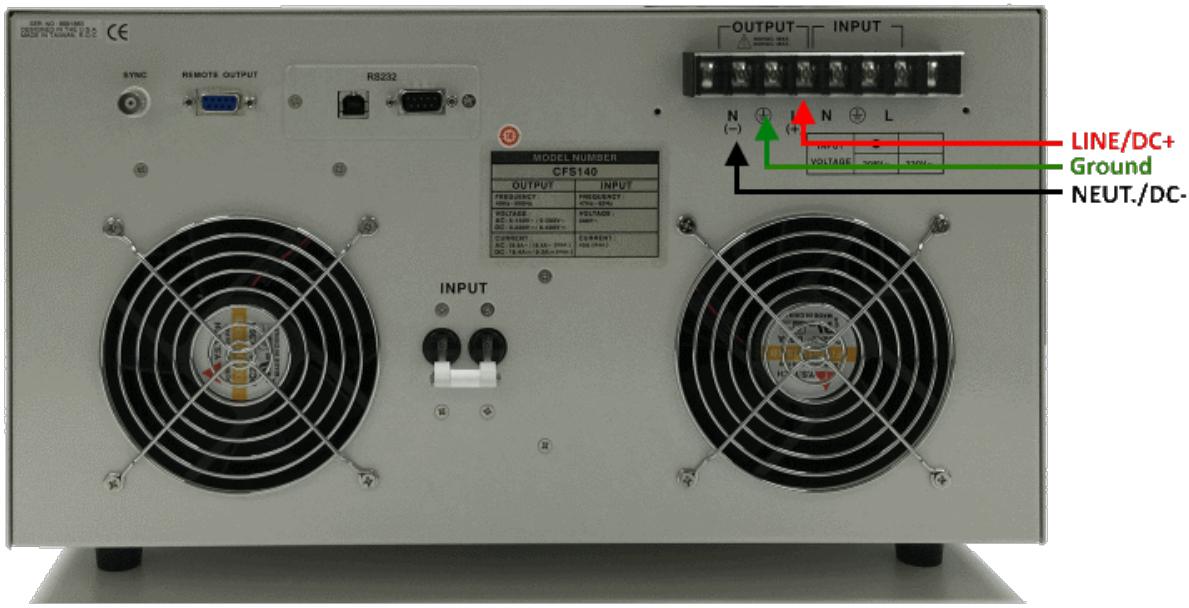


Figure 5-10: CFS140 Output Terminals

5.10.4 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 as the CFS senses at its output terminal, not the load (Internal Sense Only).

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

Model	US/Canada	Europe / Asia	
CFS108	16 AWG THWN, Copper	Ø 1.29 mm	Surface 1.31 mm^2
CFS116	12 AWG THWN, Copper	Ø 2.05 mm	Surface 3.31 mm^2
CSF140	8 AWG THWN, Copper	Ø 3.26 mm	Surface 8.36 mm^2

Table 5-5: Recommend Output Wire Sizes by model

5.10.5 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.

5.11 Rear Panel Controls and Connectors

All CFS100 Series have several controls and 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.

5.11.1 CFS108 Rear Panel Overview

The callouts for the controls and connectors located on the rear panel of the CFS108 are identified in the table below.

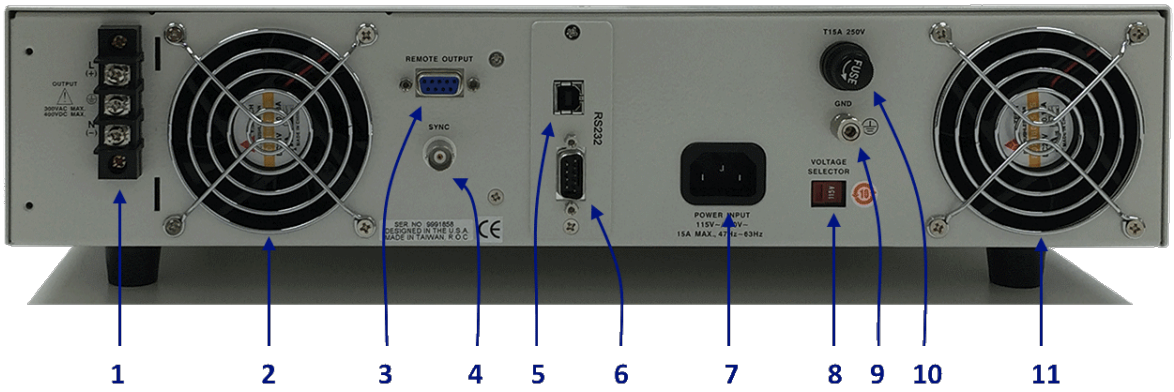


Figure 5-11: CFS108 Rear Panel Callouts

Callout	Description
1	AC and DC Terminal Block
2, 11	Cooling Fan Exhausts. Must be kept clear at all times.
3	Remote Output Connector DB9. Provides contact closure outputs for the following power source conditions: • Test in Progress • PASS • FAIL
4	SYNC Output BNC. TTL Output signal that indicates output status as ON (High) or OFF (Low). TTL high = +5Vdc
5, 6	USB/RS232 Interface Card. For models with LAN option, this location contains USB and LAN connector Card instead.
7	IEC320 Type AC Line Cord Mating Connector. Check AC input voltage setting switch (8) before applying input power.
8	AC input voltage selector switch. AC line input voltage setting is determined by the position of this switch. Note: Do not change switch position while AC input power is applied. Always disconnect AC line cord first. Use small flat blade screwdriver to change setting.
9	Earth Ground Connector. Additional ground connection to AC line cord ground.
10	AC Input Line fuse holder. Model CFS108 requires 250V, 15A protective fuse. Spare fuse included in ship kit. (See Section 5.3.1, “CFS108 Ship Kit Contents”). To change fuse, disconnect AC line cord first, then turn fuse holder counter clockwise to open.

Table 5-6: CFS108 Rear Panel Callouts

5.11.2 CFS116 Rear Panel Overview

The callouts for the controls and connectors located on the rear panel of the CFS116 are identified in the table below.

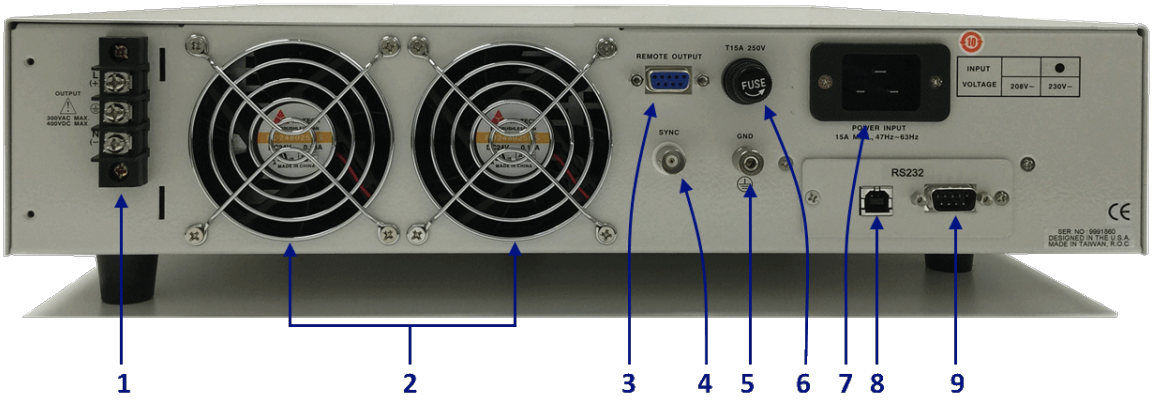


Figure 5-12: CFS116 Rear Panel Callouts

Callout	Description
1	AC and DC Terminal Block
2	Cooling Fan Exhausts. Must be kept clear at all times.
3	Remote Output Connector DB9. Provides contact closure outputs for the following power source conditions: • Test in Progress • PASS • FAIL
4	SYNC Output BNC. TTL Output signal that indicates output status as ON (High) or OFF (Low). TTL high = +5Vdc.
5	Earth Ground Connector. Additional ground connection to AC line cord ground.
6	AC Input Line fuse holder. Model CFS116 requires 250V, 20A protective fuse. Spare fuse included in ship kit. (See Section 5.3.2, "CFS116 Ship Kit Contents"). To change fuse, disconnect AC line cord first, then turn fuse holder counter clockwise to open.
7	IEC320 Type AC Line Cord Mating Connector. These are 20A rated heavy duty line cords.
8, 9	USB/RS232 Interface Card. For models with LAN option, this location contains USB and LAN connector Card instead.

Table 5-7: CFS116 Rear Panel Callouts

5.11.3 CFS140 Rear Panel Overview

The callouts for the controls and connectors located on the rear panel of the CFS140 are identified in the table below.

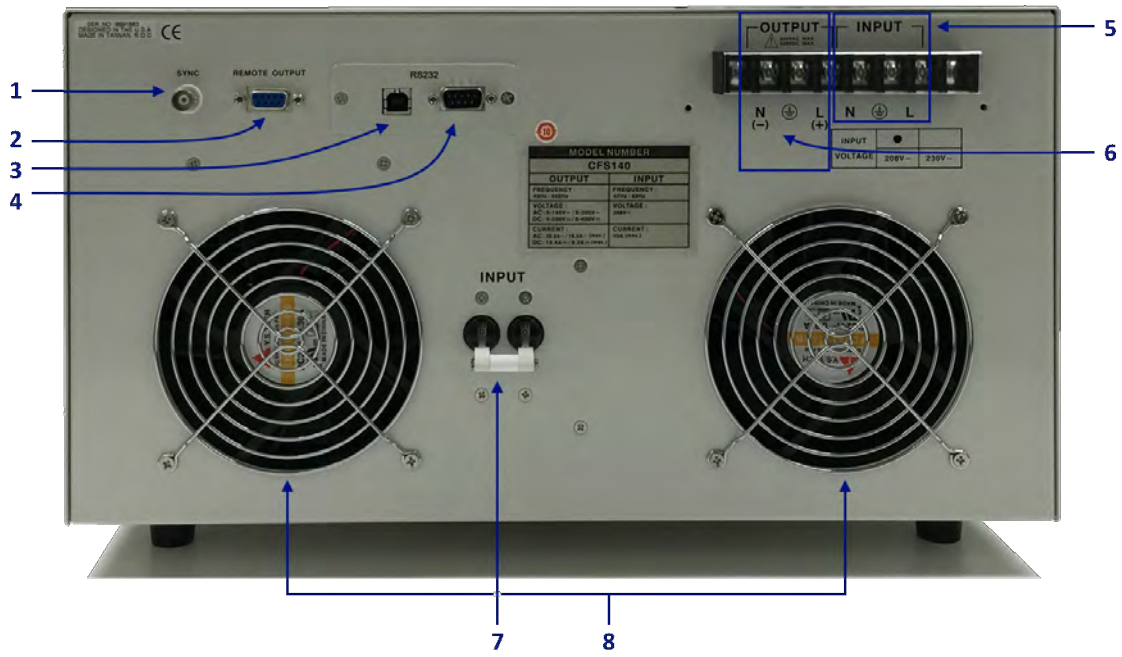


Figure 5-13: CFS140 Rear Panel Callouts

Callout	Description
1	SYNC Output BNC. TTL Output signal that indicates output status as ON (High) or OFF (Low). TTL high = +5Vdc
2	Remote Output Connector DB9. Provides contact closure outputs for the following power source conditions: • Test in Progress • PASS • FAIL
3, 4	USB/RS232 Interface Card. For models with LAN option, this location contains USB and LAN connector Card instead.
5	AC Input Terminal block. Use suitably rated power cord and location specific 250V Plug to connect single phase utility power. Terminate line cord with correct size and rating spade or ring lugs. **(SEE WARNING BELOW)**
6	AC and DC Output Terminal Block. **(SEE WARNING BELOW)**
7	AC Input Protective Circuit Breaker. Breaker is rated for 40 Amps. To enable operation of the CFS140, move the level to the up position. Level Down: Breaker Tripped or Open Level UP: Breaker On
8	Cooling Fan Exhausts. Must be kept clear at all times.

Table 5-8: CFS140 Rear Panel Callouts

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 shipkit MUST be used at all times

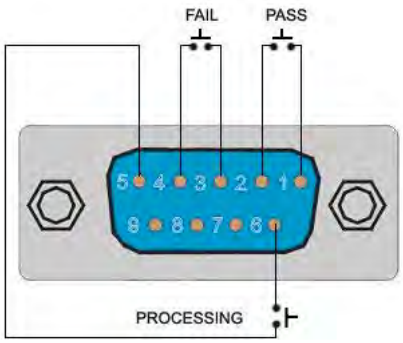
5.11.1 REMOTE OUTPUT Connecter

All CFS100 models have a blue DB9 status output connector (Female). Do not confuse this connector with the black male DB9 connector for the RS232 interface.

The rear panel REMOTE OUTPUT connector provides output signals to remotely monitor PASS, FAIL, and PROCESSING conditions. When a terminal becomes active the relay closes thereby allowing the external voltage to operate an external device. The following table provides the conditions 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 5-9: REMOTE OUTPUT CONNECTOR Pins



5.12 Remote Control Programming Interfaces

The CFS100 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)

5.12.1 RS232 Serial Interface

Figure 5-14 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 5-14: RS232 Connector

PIN	Abbreviation	Description
Pin 1	N.C.	Not connected
Pin 2	RXD	Receive Data
Pin 3	TXD	Transmit Data
Pin 4	Output Interlock	Short between pins 4 and 9 enables output ON
Pin 5	GND	Ground
Pin 6, 7, 8	N.C.	Not connected
Pin 9	Output Interlock	Not connected

Table 5-10: RS232 DB9 Pin Assignments

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

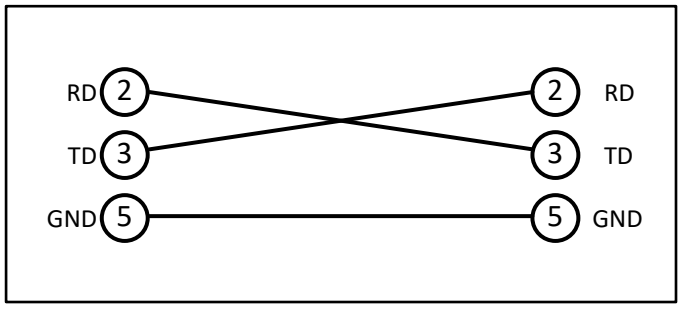


Table 5-11: Serial Cable to PC COM port

RS232 Interface Settings

Factory set RS232 settings are:

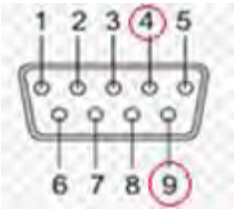
9600 baud, 8 data bits, no parity, 1 stop bit

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.

5.12.2 Output Enable Interlock Function

On CFS100 models equipped with the RS232 and USB interfaces, a remote output interlock function is provided on units with firmware revision V1.02.00 or higher. This function is available on pins 4 and 9 of the DB9 RS232 connector. To enable output control, short pins 4 and 9. When pins 4 and 9 **are not shorted**, the output **cannot** be enabled from either the front panel or the remote control interface.

To use this function at the same time as the RS232 serial interface, a wire harness needs to be constructed that breaks out pins 4 and 9 from the serial interface cable used to control the power source using the RS232 interface. If this feature is not needed, install a shorting plug on the RS232 DB9 connector.



5.12.3 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 8, “USB Driver Installation” for further setup and configuration information.

5.12.4 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:

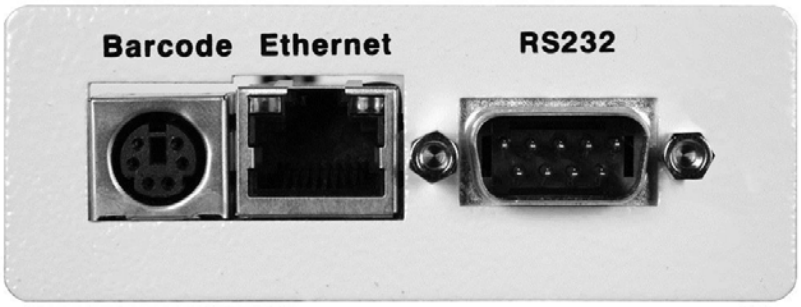


Figure 5-15: LAN Option Connectors

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 9, “LAN Interface Configuration” on page 118 for network and port configuration setup information.

The 9-pin D- type subminiature connector labeled “RS232” is the same as covered in Section 5.12.1, "RS232 Serial Interface”.

5.12.5 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 5-12 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 5-12: IEEE-488 Connector Pin Assignments

5.12.6 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 commands and parameter setting commands of the GPIB interface with the exception of the 488.2 Common Command the Status Reporting commands and SRQ capability.

For information on supported programming commands, refer to section 7, “Remote Control Programming”. The identification command *IDN is also available through USB, RS-232 and LAN interfaces.

5.12.7 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).

5.12.8 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 CFS100 Series power sources. For remote control operation, refer to Section 7 “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 6.2, “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, MANUAL or DC).

6.2 Front Panel Layout

The front panel layout is shown in Figure 6-1 below. The number of buttons is kept to a minimum to ensure simple front panel operation for casual and experienced users alike. The shuttle knob is used to slew parameter values while in Test (Output ON) mode of operation.

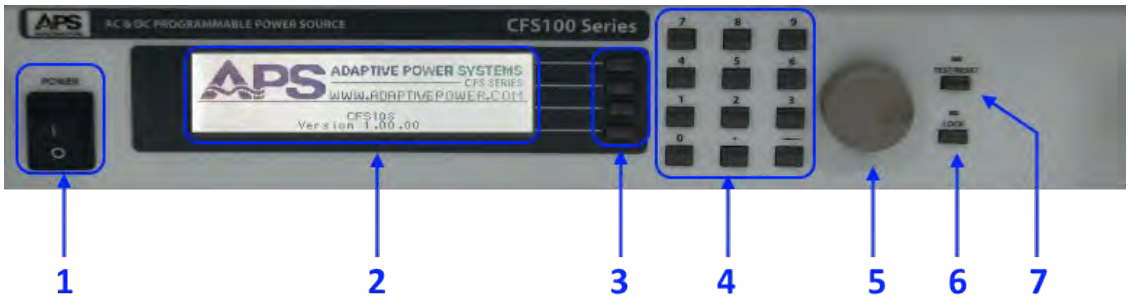


Figure 6-1: CFS100 Series Front Panel Displays and Controls

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 6.6**Error! Reference source not found.** and 6.7**Error! Reference source not found.** 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	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. Note: On CFS100 models with RS232 interface, an output enable interlock function is available on the RS232 DB9 Connector. See section 5.12.2 on page 55 for details.

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 6-1: 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
M1-1	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 6.8 through 6.17.
10.0s	Instrument Timer for Output
F: 60.0Hz	Frequency measurement value display
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
P: 0.0W	Power measurement value
Ap: 0.000A	Peak Current measurement value
PF:0.000	Power Factor measurement value
150.0v	Left hand, Large Font Voltage set value or measurement. Set value in set screens, measurement value when output is ON.
0.011A	Right hand, large Font measurement value. Can be any of the other available measurements. Default is Current (A).

Table 6-2: Setup (Set) Screen Display Fields Description

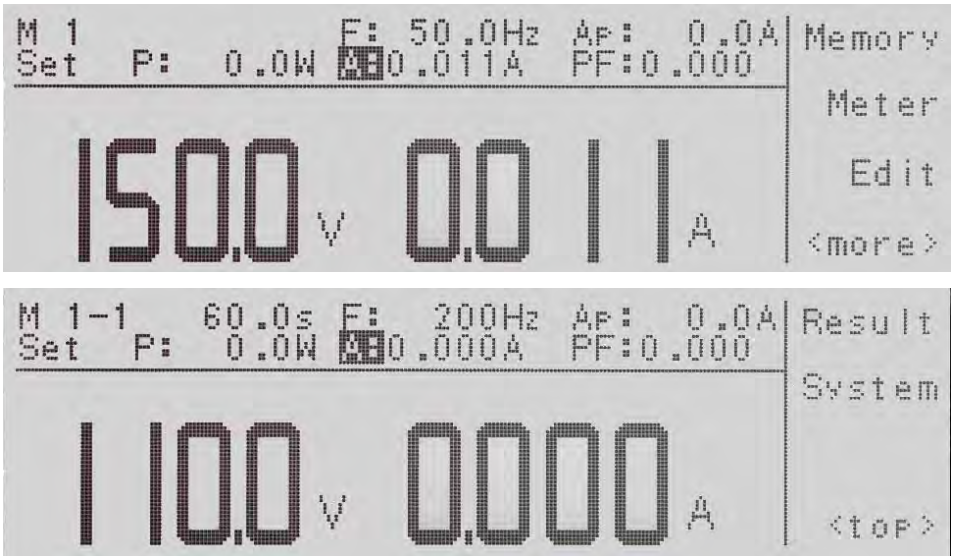
6.6 Main Menu Soft Keys

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 6-3: 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 6-4: Available Soft Key Labels

6.8 Password Protection

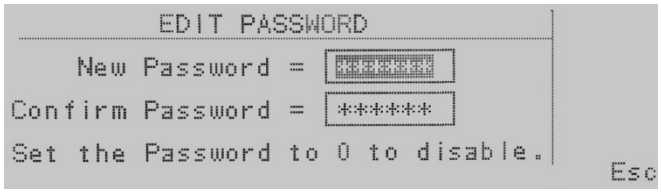
The power source supports a password lock-out feature that prevents unauthorized use of the keyboard and memory LOCK functions. If a password has been set, unlocking the front panel using the LOCK key can only be done if the correct password is entered.

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 6.10.10, "Keyboard Lock Mode Settings" and 6.10.11, "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 6.8.1, "Password Assignment or Change" or disabled by setting it to zero (0).

6.9 Operating Mode – Selecting

The CFS100 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 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 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.
- **DC** This mode is similar to the MANUAL mode but applies a DC output. There is no frequency programming in this mode but the voltage can be slewed using the shuttle knob and High and Low user limits can be set for the DC voltage setting.

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 6-2: 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 6-3: MANUAL MODE LCD indicator

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

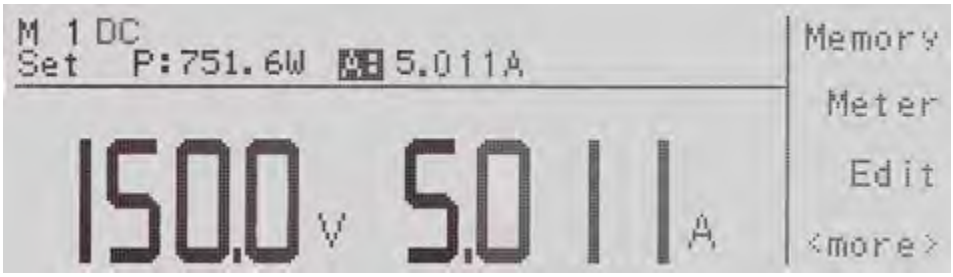


Figure 6-4: DC MODE LCD Indicator

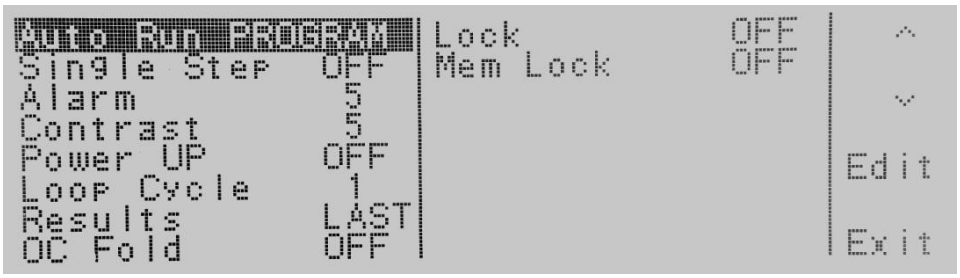
6.10 PROGRAM Mode Operation

Program mode applies to AC output mode 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.

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.



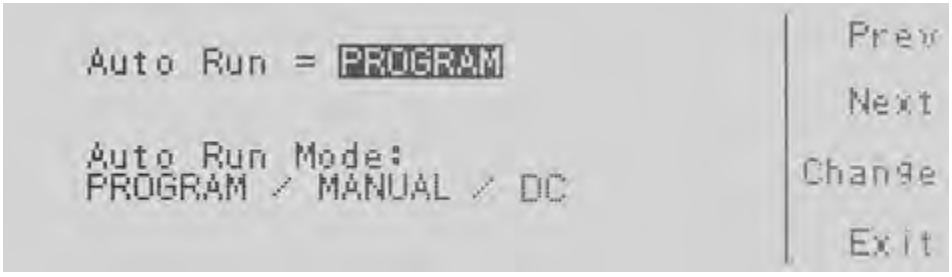
In PROGRAM mode, the following system parameters can be set from this screen:

- Auto Run Mode
- 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

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 that are display at the bottom of the screen. Available modes are:

- **PROGRAM** AC Mode with programmed steps execution
- **MANUAL** AC Mode with manual data entry using the key pad.
- **DC** Same as MANUAL mode but for DC output mode



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 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.

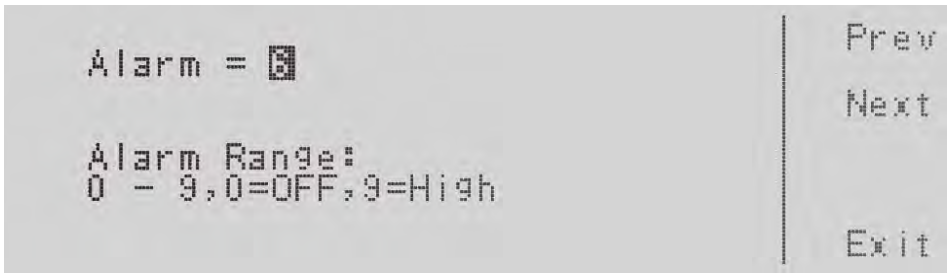
When **Single Step** mode is **ON**, the source will sequence from one test step to the next only when the Test/Reset key is pressed by an operator between each step. The source will pause after each step has completed a test routine and passed based on the

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 the next regardless if a pass or failure has occurred for a particular step.

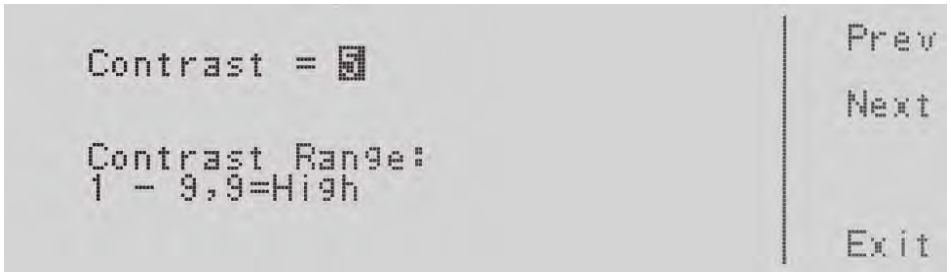
6.10.4 Alarm Settings

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.



6.10.5 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.

6.10.6 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.

6.10.7 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.

6.10.8 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.

6.10.9 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:

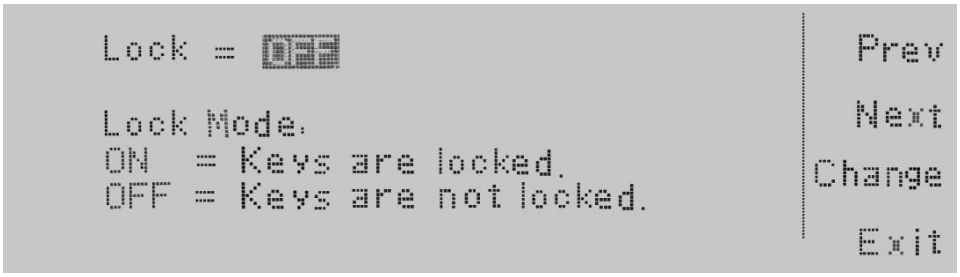
- ON In this mode, the voltage will be decreased as needed once the load current reaches the set current limit value in order to keep the load current below this current level. This limits the current to EUT to the max. value set by the user.
- OFF In this mode, the output will trip off as soon as the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

6.10.10 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 6.8, "Password Protection".



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

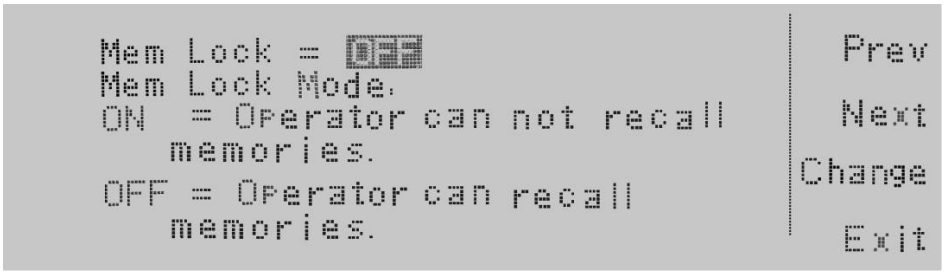
- ON In this mode, the front panel keyboard is locked out and is inoperative. The level of operator control available in keyboard lock mode is determined by the next setting, **Mem Lock**.
- OFF In this mode, front panel keyboard is enabled. (Normal operation).

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.

6.10.11 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 6.8, "Password Protection".



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.

6.11 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).

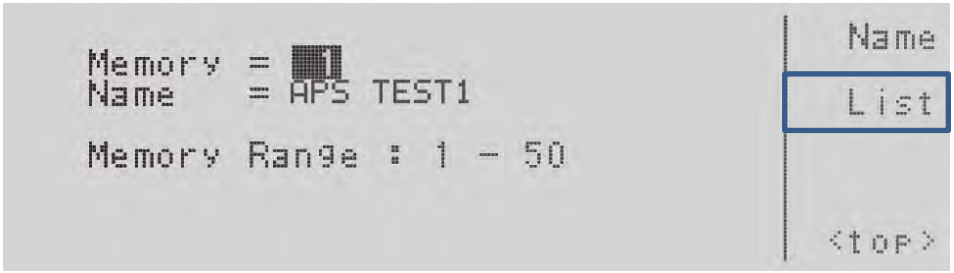
This brings up the Memory setup screen with the selected memory number indicated. There are 50 memory locations, so memory numbers can range from 1 through 50. The currently selected memory is shown in the first field; in this example, memory number one.

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

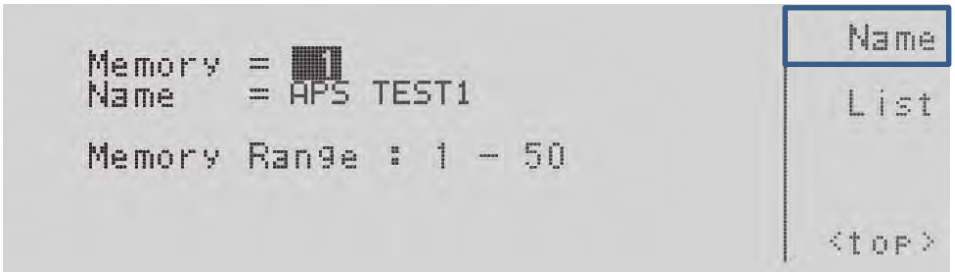
cursor is on the desired memory location, press the "**<more>**" soft key to see the bottom part of this screen and press the "**Load**" soft key to select the memory number.

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 memories 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.

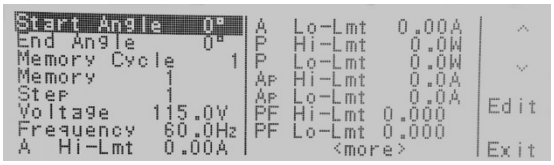
To select a step press the Step soft key and the steps will sequence through. Each time the Step soft key is pressed the step will increase by one increment. There are 9 steps available. After the 9th step you will return to step number 1.

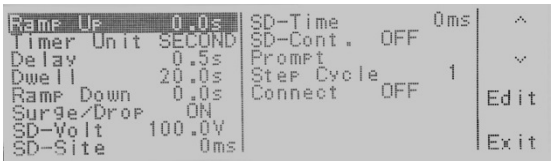
Note that any step parameters edited apply to the selected Memory number and step number only. The Memory and Step number are shown in the upper left corner of the display.

6.11.4 Program Step Parameters Available

There are 28 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.
8	A Hi-Lmt	Sets the maximum current threshold or ceiling level. When this level is exceeded, a failure will occur.
9	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.
10	P Hi-Lmt	Sets the maximum wattage threshold or ceiling level. When this level is exceeded, a failure will occur.
11	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.
12	Ap Hi-Lmt	Sets the maximum peak current threshold or ceiling level. When this level is reached a failure will occur.

Order	Parameter Field	Description
13	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.
14	PF Hi-Lmt	Sets the maximum power factor threshold or ceiling level. When this level is exceeded, a failure will occur.
15	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.
16	Ramp Up	Sets the voltage ramp up time. This is the duration of time over which the programmed output voltage will be reached.
17	Timer Unit.	Sets the time increment that will be used for testing. Available options are Second/Minute/Hour.
18	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.
19	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.
20	Ramp Down	Sets the time duration over which the output voltage is reduced to zero after the dwell time has completed.
21	Surge/Drop	Allows program or trigger surges or drops in the voltage output to be defined.
22	SD-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.
23	SD-Site[1]	Sets the specific point in the sine wave to initialize the surge or the drop voltage. For example since a 60 Hz sine wave has a 16.67 msec period, if this value is set to 8 milliseconds, the surge or the drop voltage will occur near the halfway point (8 * 360/16.67 = 172.8°) of the sine wave.
24	SD-Time[1]	24. SD-Time - gives the operator the flexibility to program the overall time duration of the surge or drop voltage. For example if the SD-Site is 8 milliseconds; the output voltage is 120 volts; the surge voltage is 150 volts; and the SD-Time is 20 milliseconds when the sine wave reaches the 8 millisecond point (180º) the voltage will surge to 150 volts. This surge will hold for 20 milliseconds before the voltage output returns to 120 volts.

Order	Parameter Field	Description
25	SD-Cont. [1]	Determines whether the surge or drop voltage will occur continuously for each sine wave of the test routine. Available settings are ON or OFF. When set to OFF, the surge or drop voltage will occur only on the first sine wave and will not repeat on any other sine waves unless the "**Trig.**" soft key is pressed.
26	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.
27	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.
28	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 6-5: PROGRAM Mode Step Parameters Available

6.11.5 Editing Step Parameters

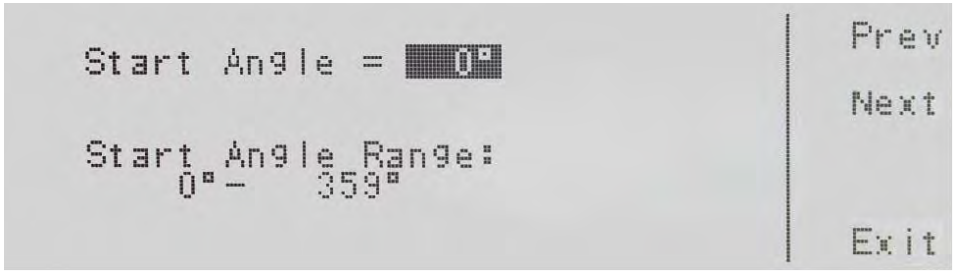
To edit any of the available step parameters, scroll to the desired parameter and press the "**Edit**" soft key. When changing a value, press the "**Enter**" soft key to confirm the new value. This generally moves the screen to the next parameter. This speeds up programming all parameters that are part 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



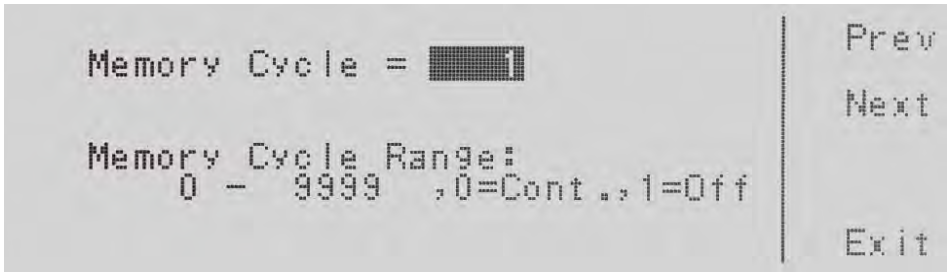
When using this feature, it is important to note the following characteristics of the CFS00 Series phase angle programming function.

- **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 SD-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 CFS00 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 CFS108, minimum voltage that can be programmed is 0.0V. For models CFS116 and CFS140, the minimum set voltage is 5.0. Maximum voltage setting is 150V on the low range and 300V on HIGH range.
- **Voltage Mode** Available voltage ranges are 0.0 to 300.0V on HIGH range or 0.0 to 150.0V on low range. Use the AUTO mode selection to allow the power source to switch to low range is the set voltage is below 150.0V. Selecting HIGH range means the power source will remain in HIGH range at all times. Note that in HIGH range, available maximum load current is reduced to half that of LOW range operation.

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.

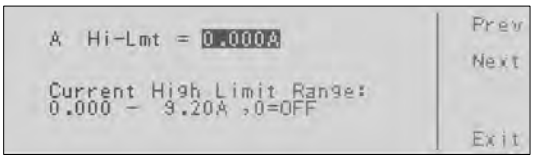
The Frequency setting is indicated in the Frequency field. Frequency Range is 40.0 Hz to 500 Hz.

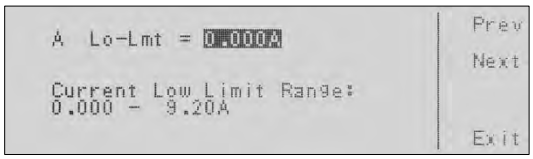
To change the frequency setting, use the numeric keypad and type the value. Once the user types in a number, a shaded black box (■) will blink, acknowledging the parameter is being changed. Press the "**Enter**" soft key to accept the parameter, or press the "**Esc**" soft key to move back to the voltage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

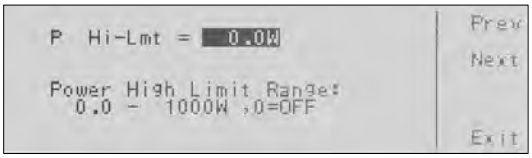
Note: The user can bypass editing this parameter and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

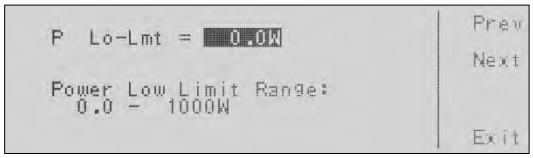
6.12.5 Measurement Limits Programming

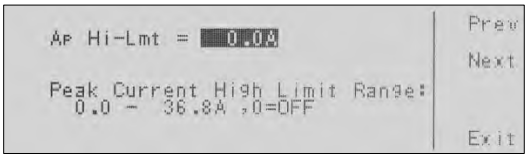
Each step contains four sets of measurement limits for Current, Power, Peak Current and Power Factor respectively. Setting these parameters is done in a similar way as setting output voltage or frequency except for each, there is an upper limit (Hi-Lmt) and a lower limit (Lo-Lmt). Each screen has only 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.

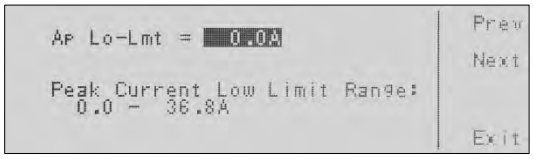


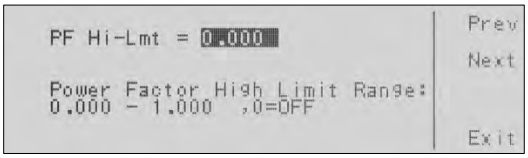


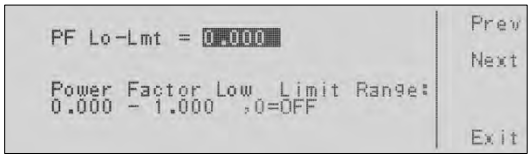












Note: The user can bypass editing any of these parameters and move to the next or previous parameter set screen by pressing the "**Prev**" or "**Next**" soft key.

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 6-6: 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.

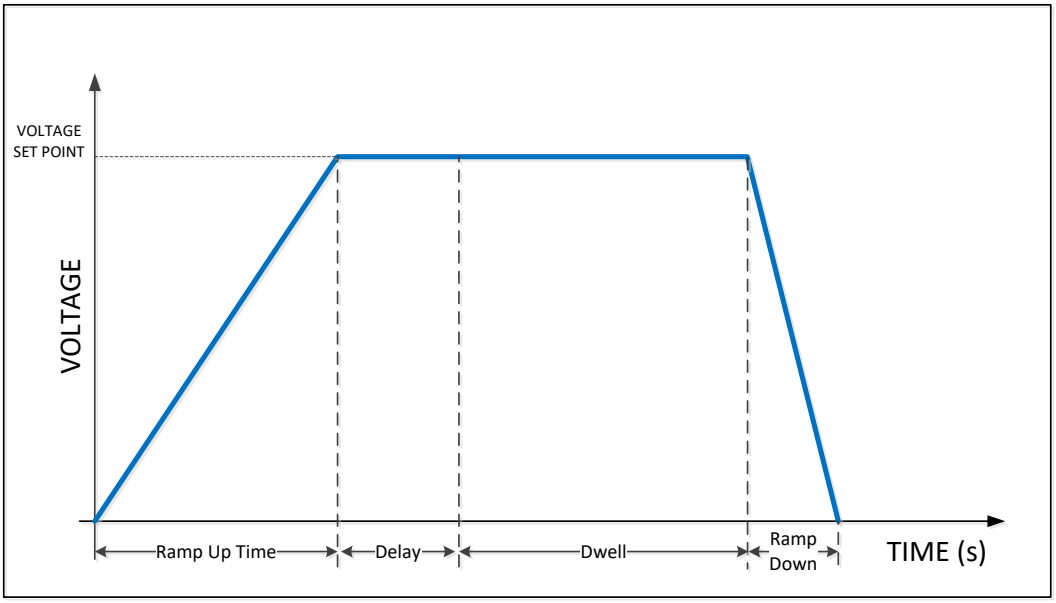
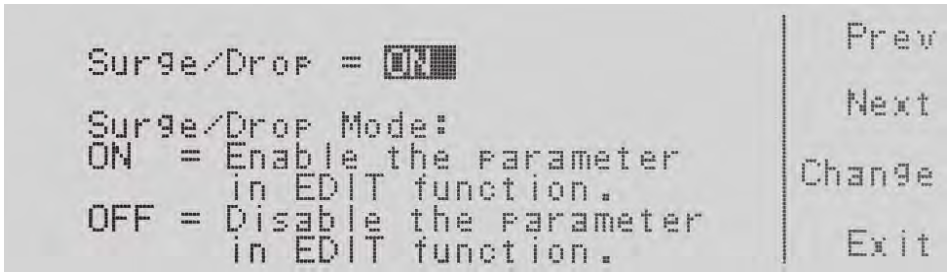


Figure 6-5: Step Time Parameters Relationship

6.12.7 Surge/Drop Programming

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



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

OFF: Surge/Drop feature is disabled so no voltage surge or sag will take place. When OFF, additional SD-Volt screens will not be visible.

ON: Surge/Drop feature is enabled. This means the SD-Volt parameters all have to be programmed to determine the level and duration of the voltage surge or sag.

To change the Surge/Drop 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 transitions the screen to the next parameter: SD-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 Surge/Drop is ON, the following additional parameter screens will be accessible in the order shown here:

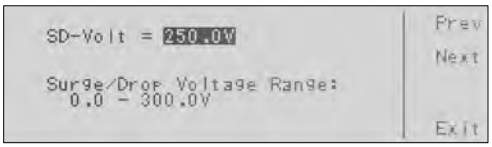
SD-Volt Surge or Drop Voltage level. Surge versus Drop is determined by the values of Voltage and SD-Volt. If Voltage > SD-Volt, a Drop will occur. If Voltage < SD-Volt, a Surge will occur.

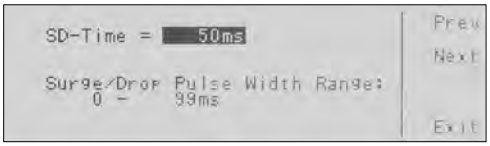
SD-Site Time offset from 0° Phase angle of output voltage where the surge or drop will start. Note that the Start and Stop phase angles for the program memory (See Section 6.12.1, "Phase Angles") do NOT apply here. The 0° is with respect to the sinewave.

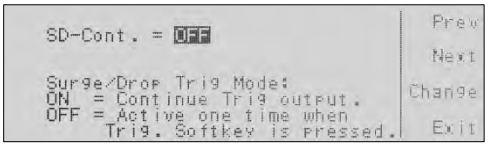
SD-Time Duration of the voltage surge or drop in msecs. Note that the range for this parameter is 0-20 msec when SD-Cont is ON or 0-99 msec when SD-Cont is OFF.

SD-Cont. Continuous Trigger mode ON or OFF.
If the Surge/Drop Cont trigger mode is ON, the surge/drop parameters programmed will trigger automatically once the test starts. The surge/drop will continue to be active until the Trig. soft key is pressed by the operator or a failure occurs.
If the Surge/Drop Trig Mode is OFF the Surge/Drop parameter previously programmed will only trigger when the Trig. soft key is pressed by the operator.

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 SD 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 Surge/Drop Voltage Output

The following example shows the output drop created by the following Surge/Drop parameter settings.

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

Table 6-7: Programmed Voltage Drop Example Settings

Pressing the “TEST/RESET” button will result in the output voltage shown in Figure 6-6 as captured on a digital storage scope.

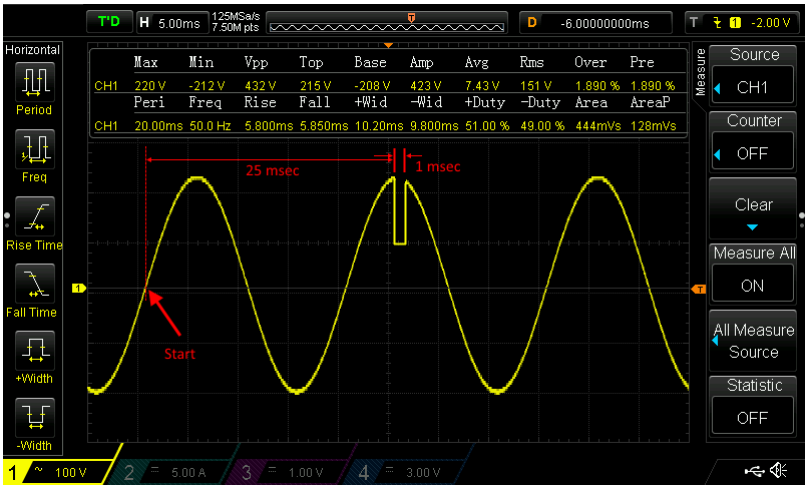


Figure 6-6: Programmed Voltage Drop Example Waveform

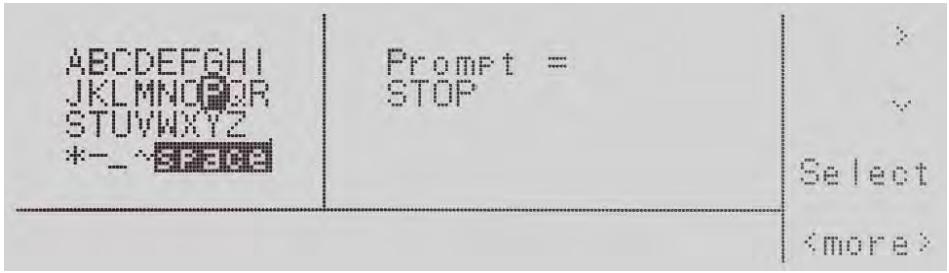
6.12.8 User Prompt Programming

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 6.11.2, "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 6.10.7 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**"

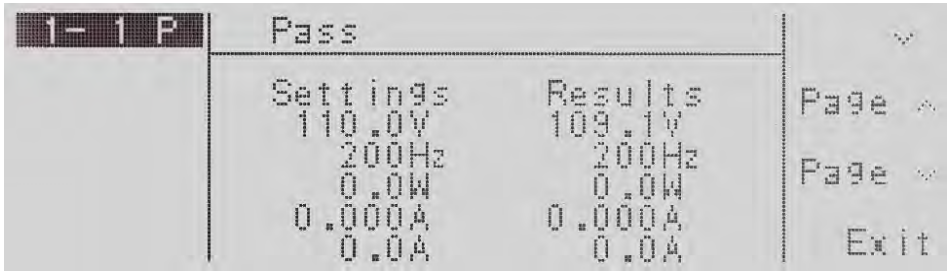
soft key. When the "**Enter**" soft key is pressed the connect mode is accepted and you loop back to the first parameter.

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 "Result" soft key 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 currently 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 mode during a test sequence 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 Surge/Sag

To trigger a programmed voltage surge or sag, 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 Surge/Drop parameters that have been entered into the program steps. The voltage Surge or Drop will occur at the start and stop 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.

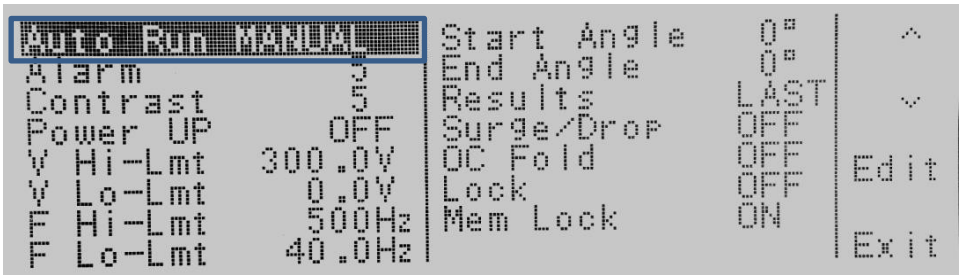
If the test passes you will see **Pass** indication in the upper left hand corner of the display.

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
- 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 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:

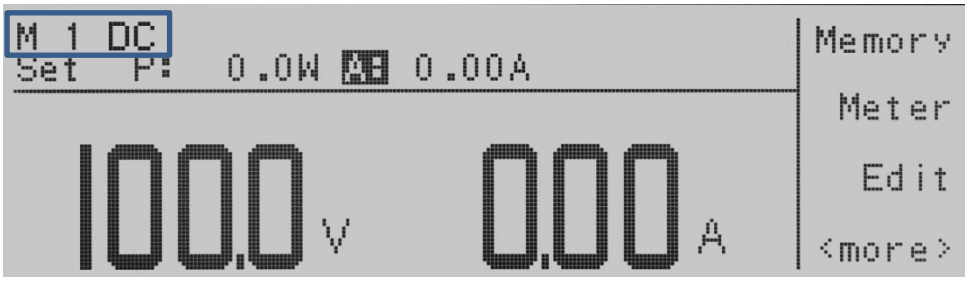
- Mode
- Alarm Volume
- Contrast of LCD Display
- Power Up Mode
- Voltage High Limit
- Voltage Low Limit
- Results display Mode
- Over Current Protection Fold Back mode
- Lock Mode
- Memory Lock Mode

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 DC Mode Execution

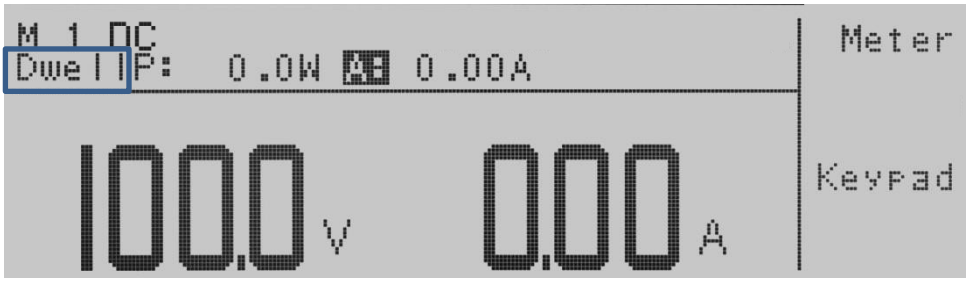
In MANUAL mode of operation, the setup screen will look as shown here. The Manual mode is indicated by the lack of a Step number after the M number and an additional "DC" indication in upper left corner of the LCD.



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 CFS100 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 CFS100 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	Value	Unit
TEST	Execute a Test	Power On	
RESET	Abort a test in Process or Reset Failures	Power Off	
TD?	Testing meters data	MEMORY,STEP,STATUS,FREQ,VOLT,CURR,WATT,CURR PEAK,PF,TIMER	
RD?	Results meters data	MEMORY,STEP,STATUS,FREQ,VOLT,CURR,WATT,CURR PEAK,PF,TIMER	
TDFREQ?	Testing frequency meter	45.0~500.0	Hz
TDVOLT?	Testing voltage meter	0.0~300.0	V
TDCURR?	Testing current meter	0.000~42.00	A
TDAP?	Testing current peak meter	0.0~59.0	A
TDP?	Testing power meter	0.0~5000	W
TDPF?	Testing pf meter	0.000~1.000	
TDTIMER?	Testing timer meter	0.0~999.9	s/m/h
METER {4|3|2|1|0}	Meter Selection	0=FREQ,1=AP,2=POWER,3=CURR, 4=PF	
METER?	Meter Selection Query	0=FREQ,1=AP,2=POWER,3=CURR,4=PF	
SDTRG	Trigger one time Surge/Drop		
STEPCYCLE?	Step Cycle Query	0 = Continuous, 1 = Off, 0-9999	
MEMORYCYCLE?	Memory Cycle Query	0 = Continuous, 1 = Off, 0-9999	
LOOPCYCLE?	Loop Cycle Query	0 = Continuous, 1 = Off, 0-9999	

Table 7-1: 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.

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.

7.5 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	0.0~300.0	V
VOLT?	Return Voltage	0.0~300.0	V
RANG {1|0}	Range Set	0=HIGH,1=AUTO	
RANG?	Return Range Set	0-1	
FREQ <value>	Input Frequency Value	45.0~500	Hz
FREQ?	Return Frequency Value	45.0~500	Hz
AHI <value>	Set Current High Limit	0.000~42.00	A
AHI?	Return Current High Limit	0.000~42.00	A
ALO <value>	Set Current Low Limit	0.000~42.00	A
ALO?	Return Current Low Limit	0.000~42.00	A
APHI <value>	Set Current Peak High Limit	0.0~59.0	A
APHI?	Return Current Peak High Limit	0.0~59.0	A
APLO <value>	Set Current Peak Low Limit	0.0~59.0	A
APLO?	Return Current Peak Low Limit	0.0~59.0	A
PHI <value>	Set Power High Limit	0.0~5000	W
PHI?	Return Power High Limit	0.0~5000	W
PLO <value>	Set Power Low Limit	0.0~5000	W

Command	Description	Value	Unit
PLO?	Return Power Low Limit	0.0~5000	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	
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
SDVOLT <value>	Set Surge Drop Voltage	0.0~300.0	V
SDVOLT?	Return Surge Drop Voltage	0.0~300.0	V
SDLT <value>	Set Surge Drop Site	0.0~99.9	ms
SDLT?	Return Surge Drop Site	0.0~99.9	ms
SDHT <value>	Set Surge Drop Time	0.0~25.0	ms
SDHT?	Return Surge Drop Time	0.0~25.0	ms
SDCT {1|0}	Set Surge Drop Mode	0=OFF,1=ON	
SDCT?	Return Surge Drop Mode	0~1	
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	
CONNECT {1|0}	Step Connect	0=OFF,1=ON	
CONNECT?	Return Step Connect	0 | 1	

Command	Description	Value	Unit
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	

Table 7-2: Parameter Setup Command and Query Summary

7.6 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
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 <value>	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	0.0-300.0	V
VHI?	Return Voltage High Limit	5.0-300.0	V
VLO <value>	Set Voltage Low Limit	5.0-300.0	V
VLO?	Return Voltage Low Limit	5.0-300.0	V
FHI <value>	Set Frequency High Limit	45.0-500.0	Hz
FHI?	Return Frequency High Limit	45.0-500.0	Hz
FLO <value>	Set Frequency Low Limit	45.0-500.0	Hz
FLO?	Return Frequency Low Limit	45.0-500.0	Hz

Command	Description	Value	Unit
RESULTS {2|1|0}	Set Results Displayed	0=ALL,1=P/F,2=LAST	
RESULTS?	Return Results Displayed Value	0-2	
SD {1|0}	Set Surge Drop	0=OFF,1=ON	
SD?	Return Surge Drop	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	
OF {1|0}	Set Over Current Fold-back	0=OFF,1=ON	
OF?	Return Over Current Fold-back	0-1	

7.7 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.

7.7.1 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 7-3: IEEE488.2 Common Commands Supported

7.7.2 *IDN?

Read the instrument identification string. Company = APS.

Example:

ADAPTIVE POWER SYSTEMS,CFS108,9991858,Version 1.00.00

7.7.3 *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.

7.7.4 *TST?

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

7.7.5 *CLS

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

7.7.6 *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.

7.7.7 *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.

7.7.8 *ESR?

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

7.7.9 *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)

7.7.10 *STB?

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

7.7.11 *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)

7.7.12 *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.

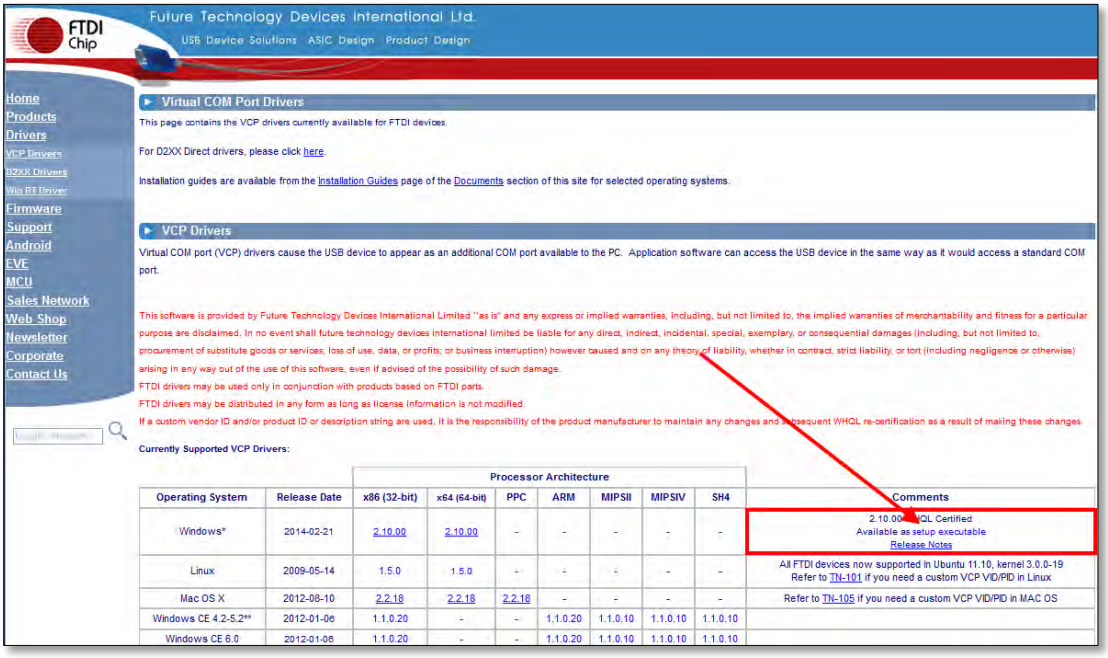
8 USB Driver Installation

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.

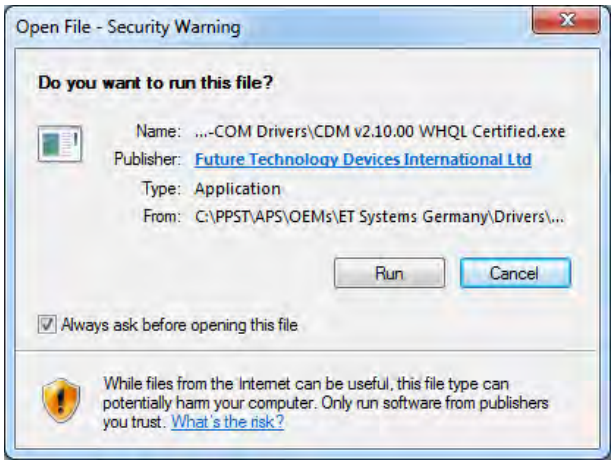


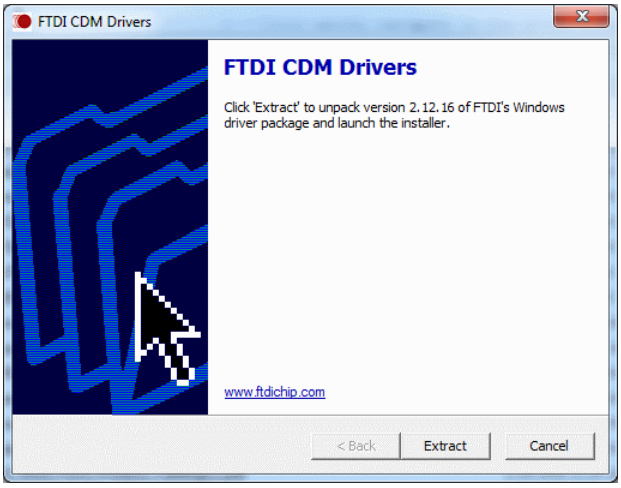
8.2 USB Driver Installation

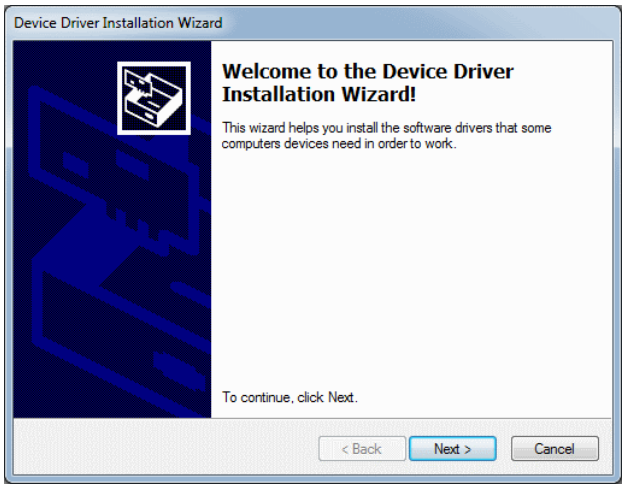
To install the USB device driver, proceed as follows:

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

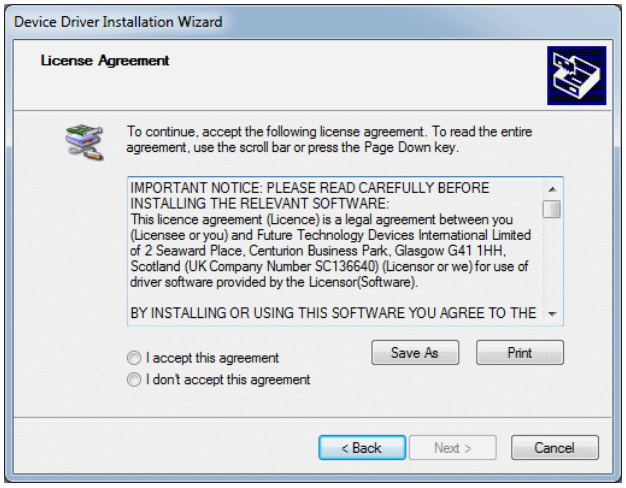
5. Select the file with the mouse and double click to launch the extraction of the installation program
6. Follow the on-screen prompts shown below to complete the driver installation.



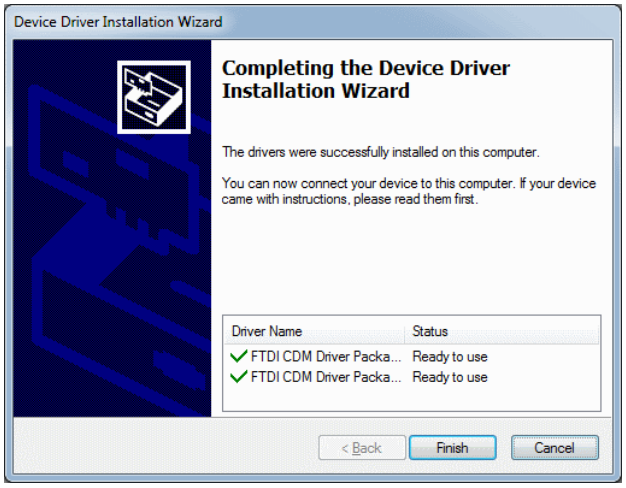




Read and accept user license by checking the “I accept this agreement” radio button at the bottom.

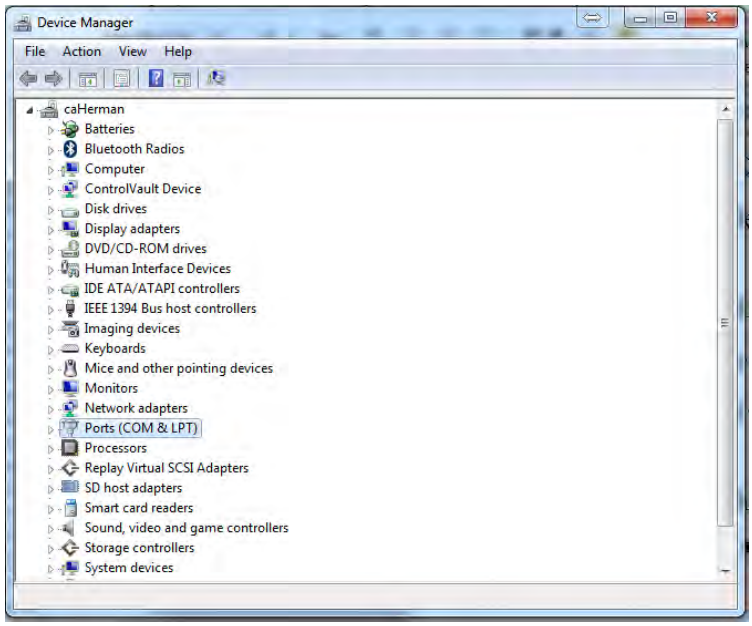


W

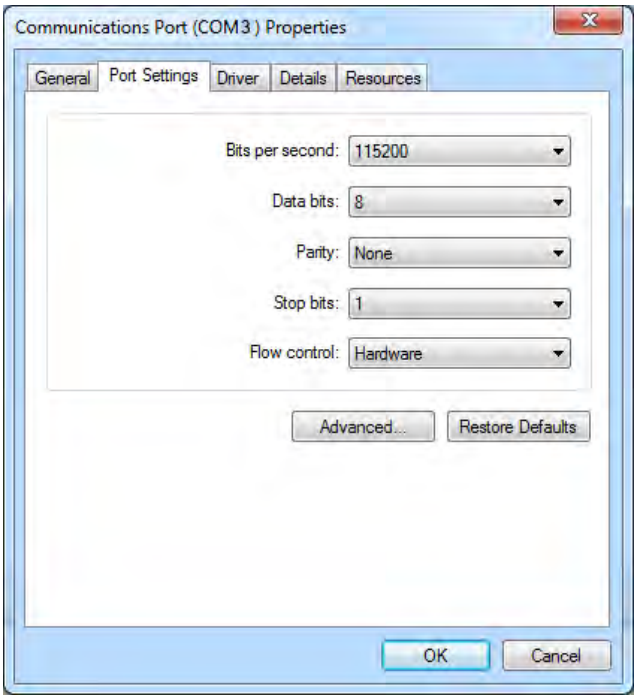


After the installation completes, open the Windows Control Panel from the Start menu and select “Device Manager”.

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 0, “

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 9-1: Network Information Required for LAN Setup

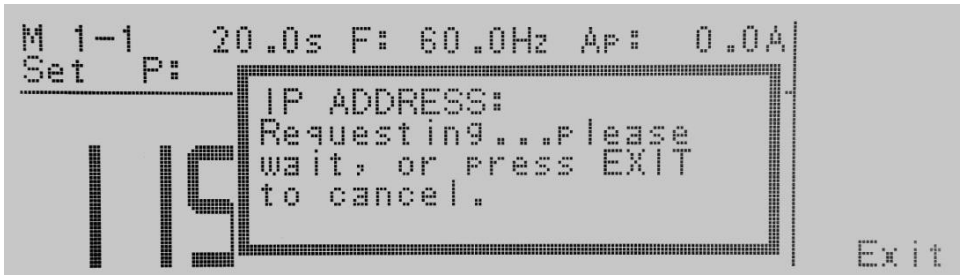
9.3 Saving LAN Settings

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 9.4.6, "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.



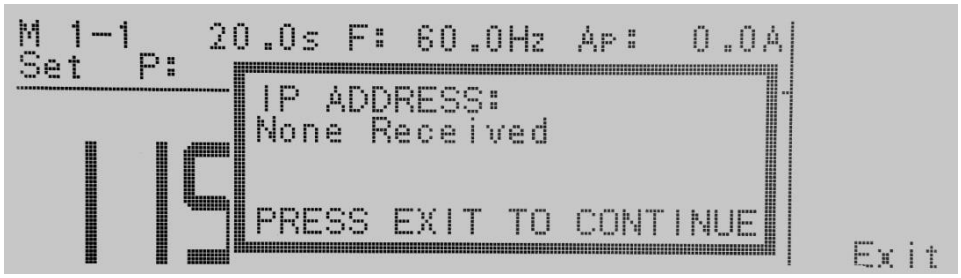
This process can take up to 20 seconds to complete. If the power source is not actually connected to a network, the user can press the "**Exit**" soft key to abort the AUTO IP configuration process and proceed using the power source immediately.

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:

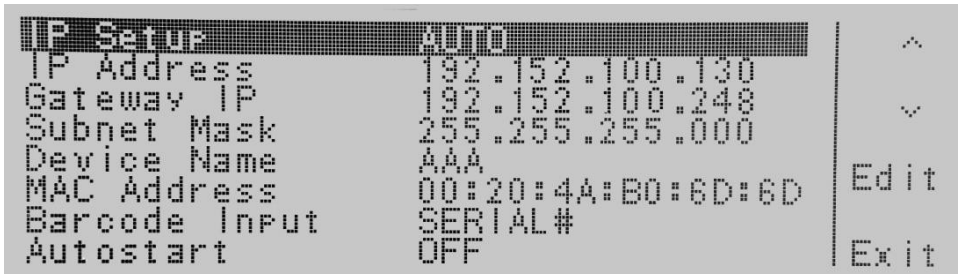


In this case, press the "Exit" soft key to exit this mode and check your Ethernet cable connection. If no cabling issues are found, contact your local IT administrator for assistance.

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

9.3. 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.

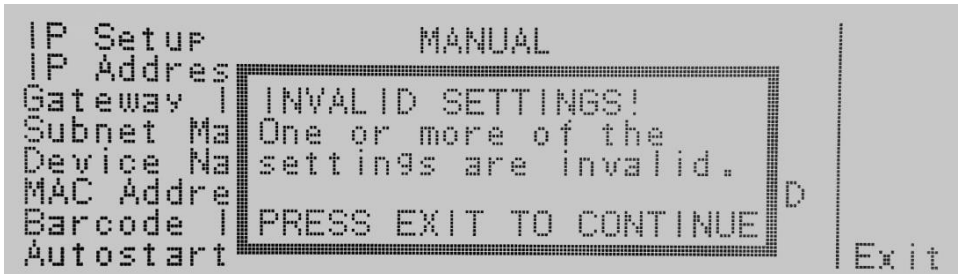
9.4.2 Manual IP Address Setting

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.

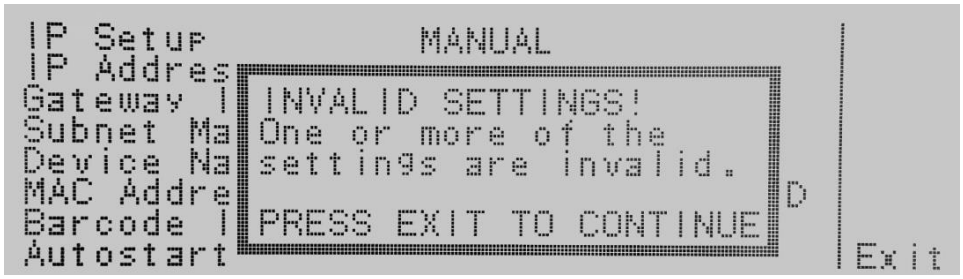
A specific Gateway IP must be entered into this field if the IP Setup parameter is set to MANUAL. Enter the Gateway IP using the numeric keypad. The Gateway IP must be entered in the following format: XXX.XXX.XXX.XXX.

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:



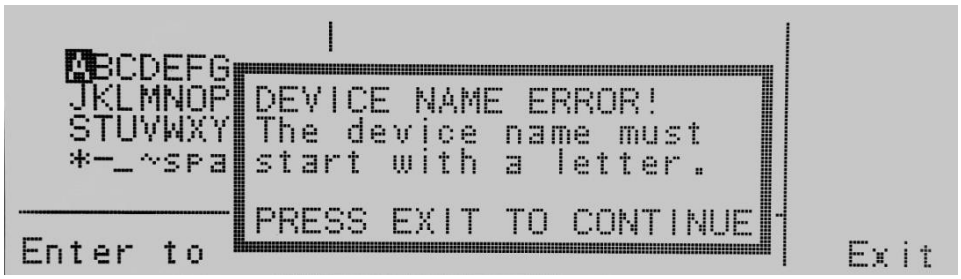
Press the "**Enter**" soft key to save the new settings. If the IP Setup parameter is set to AUTO, there is no need to enter a Subnet Mask IP manually.

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.

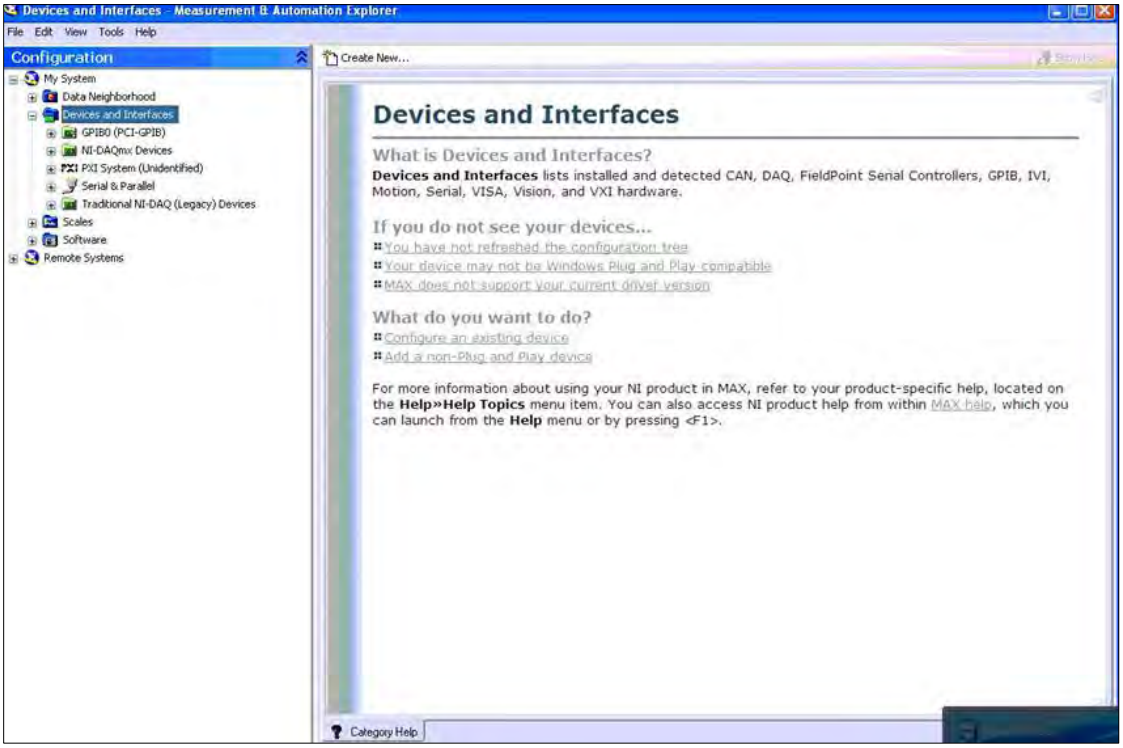
9.4.6 MAC Address

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.

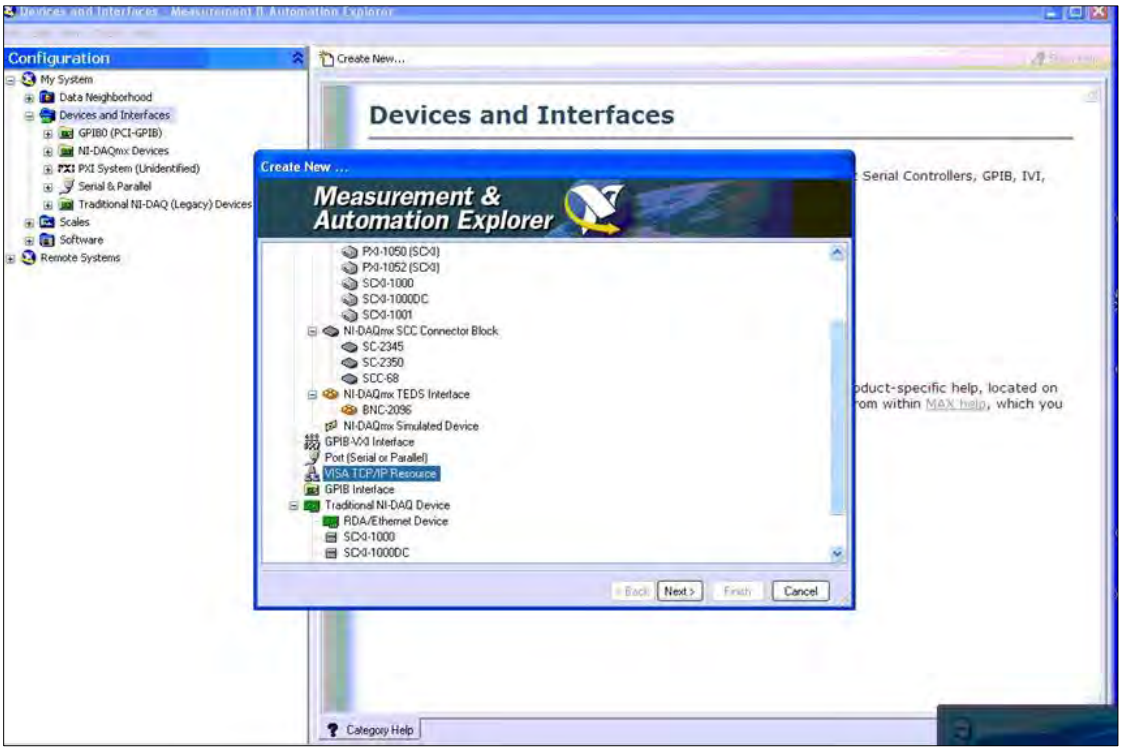
9.5 Establishing LAN connection using NI MAX Explorer

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.

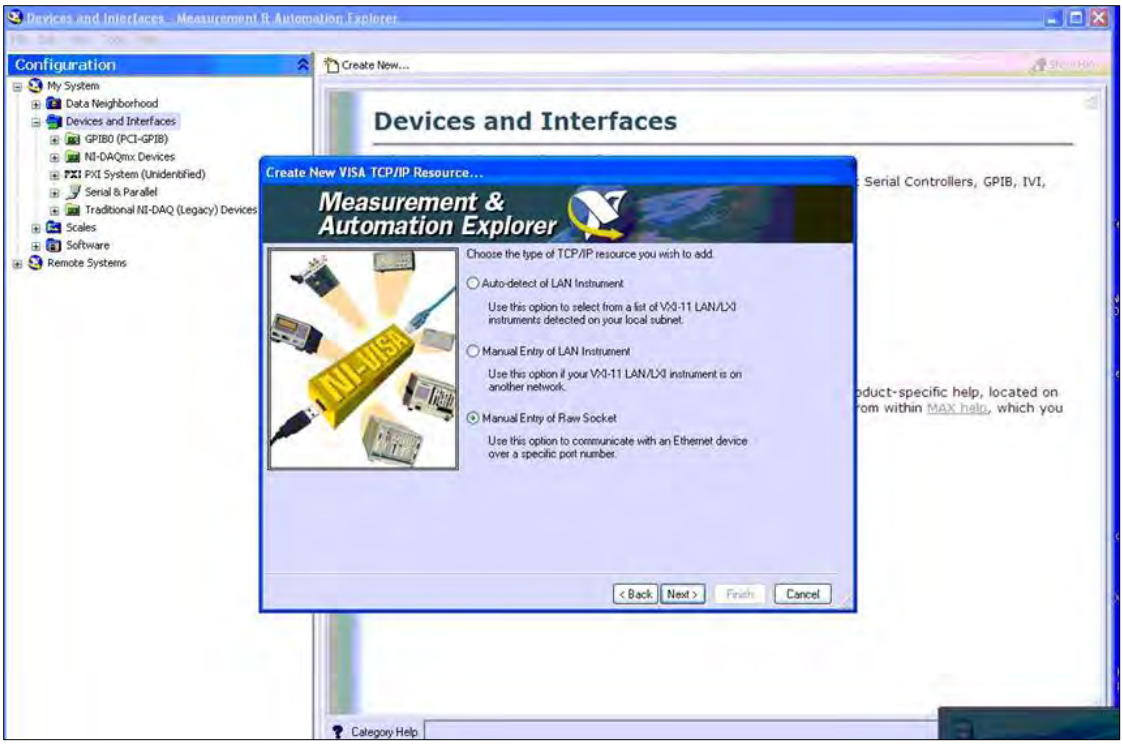
Launch the NI Max utility from the National Instruments program folder. Once open, select "Devices and Interfaces" as shown below.



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

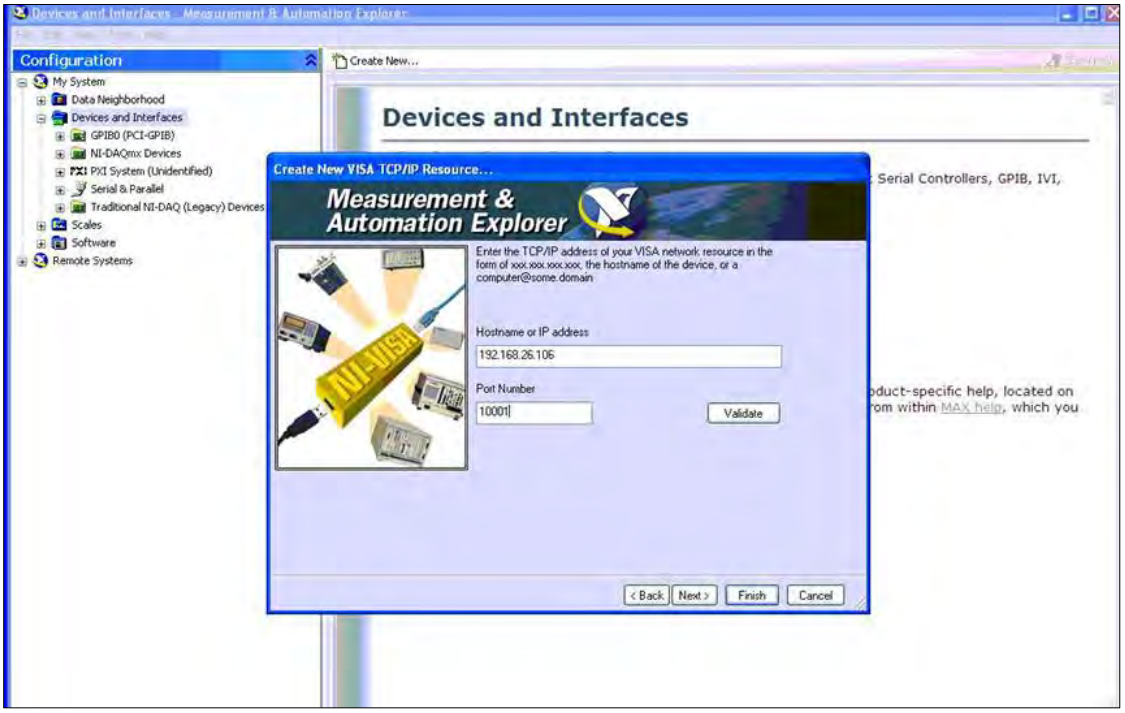


A manual Raw socket connection needs to be set up as the CFS Series does not support VXI-11 or LXI device detection protocols. Select the “Manual Entry of Raw Socket as indicated below.



Enter the IP address that was assigned to the CFS on your network per section 9.4.1 or section 9.4.2.

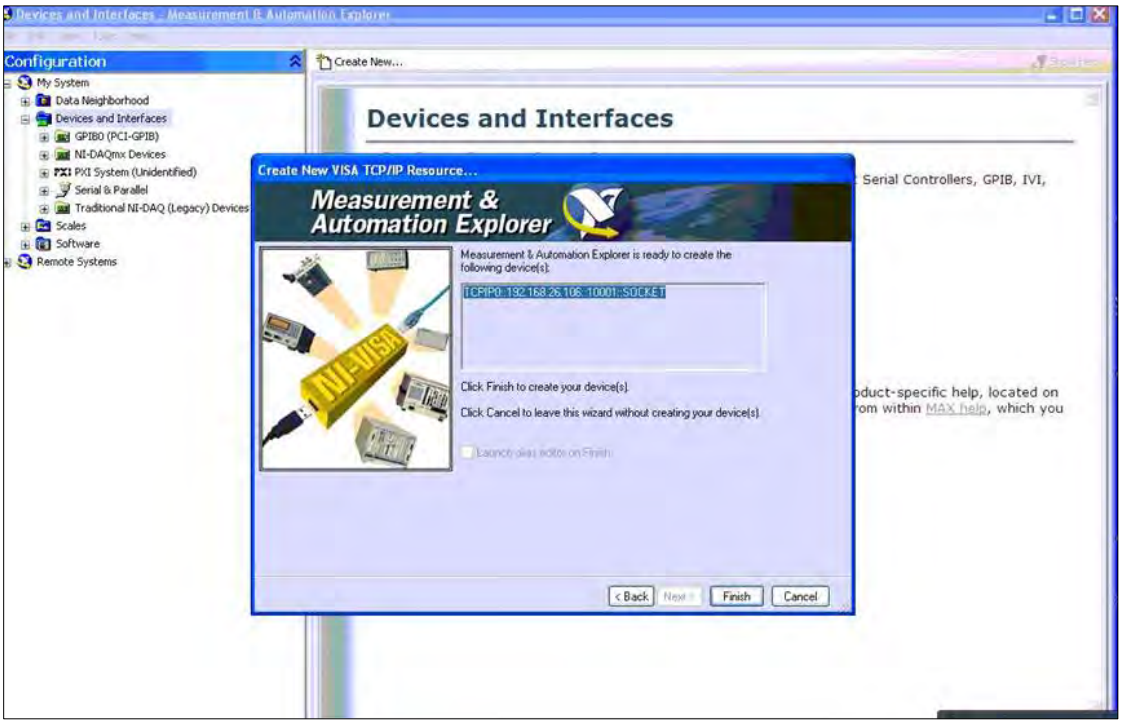
The LAN socket port number for the CFS Series is fixed to 10001 and must be entered under Port Number.



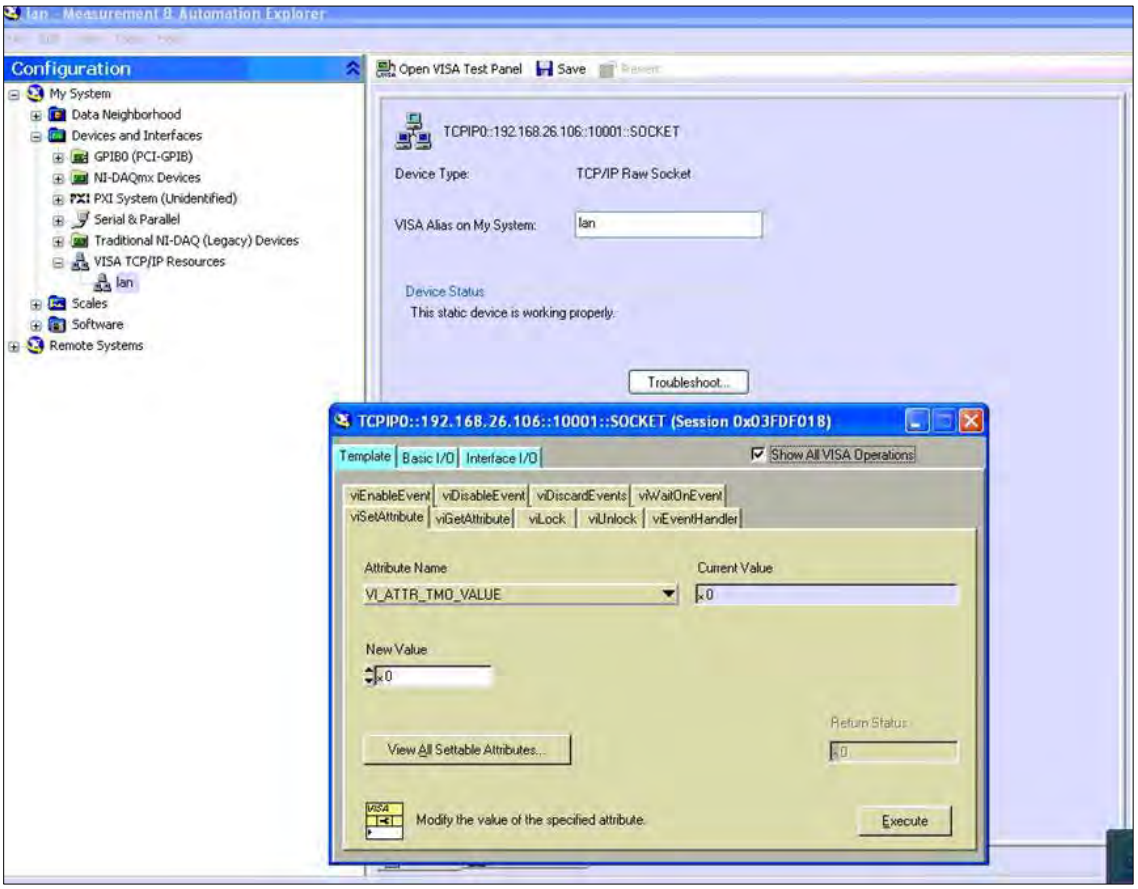
Assign a name to the newly established VISA connection. Use a relevant name that will allow you to easily recognize the device type such as “CFS100 AC”

—

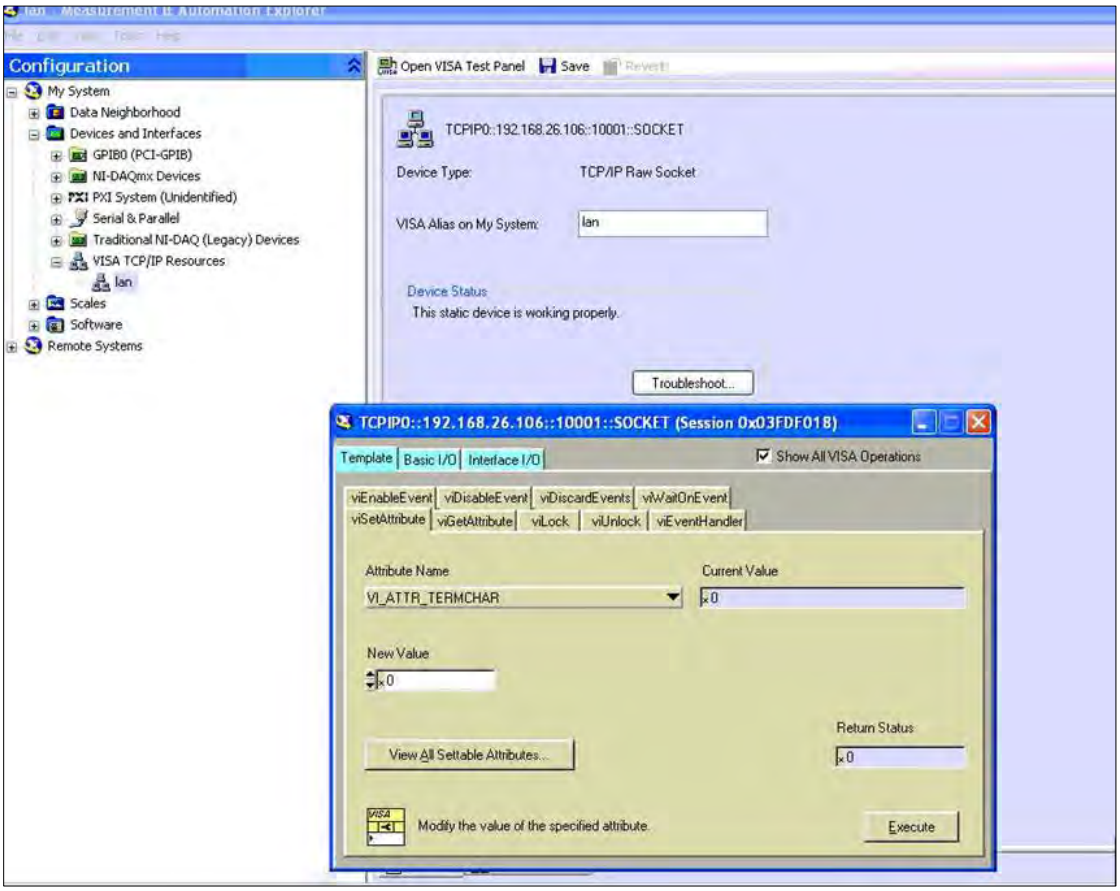
The VISA connection is now complete. The resource string is displayed in the top part of the last dialog screen. Use this resource file in your program source code or IDE.



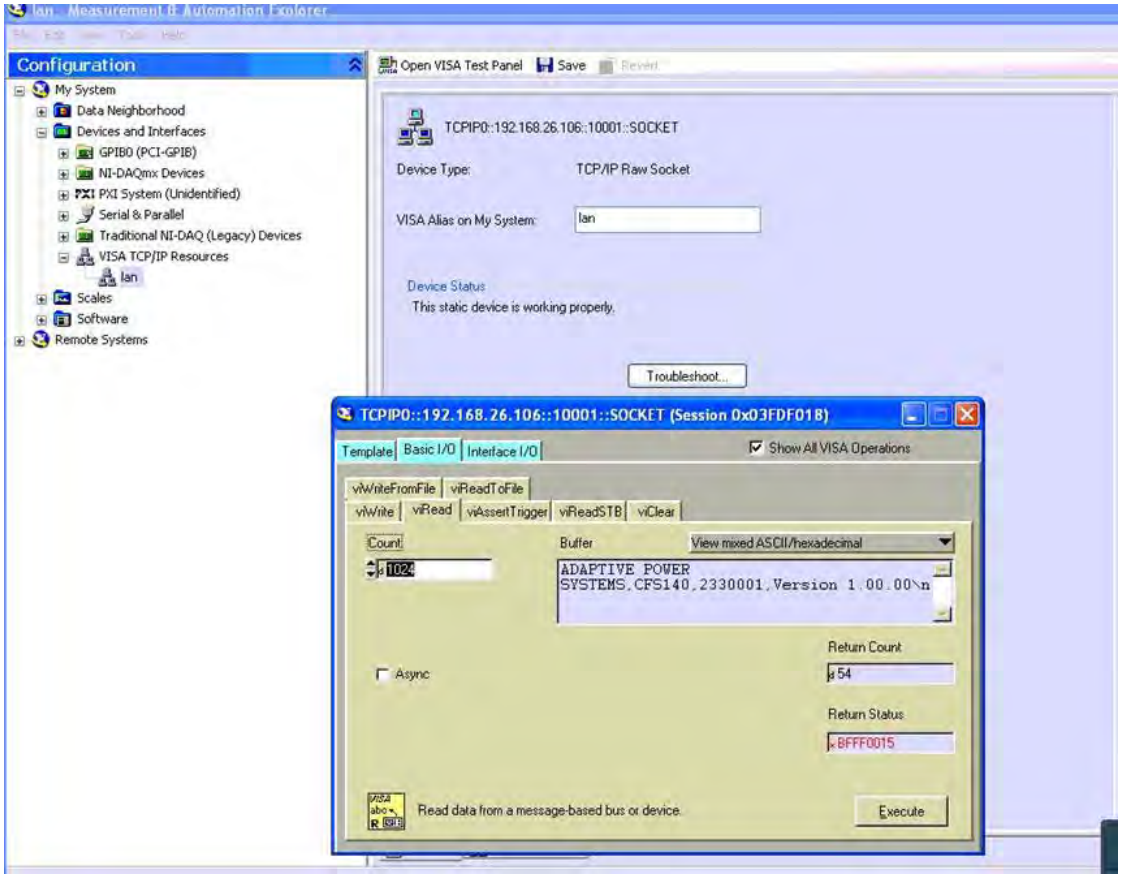
To test the VISA connection, open the VISA test panel as shown below.



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 9-1: 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 9-2: 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 CFS100 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 10.3, "Hardware Calibration Procedure".

If the hardware verification does not indicate that any adjustments are needed, proceed to Section 10.4, "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 and 115 VAC
- A 475kΩ, ¼ watt resistor
- A 10uF, 115V non-polarized capacitor

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.

Verify High Frequency Noise

2. Connect the output of the instrument to the DVM.
3. Set the DVM to measure AC mV.
4. Set the output voltage to 0V in the HIGH voltage mode and activate the output of the instrument.
5. Verify that the reading on the DVM is < 350 mV for the models CFS108 and CFS116 and < 550mV for model CFS140.

Verify “115” Volts DC Offset

1. Connect the 475kΩ resistor in series with the 10uF capacitor and connect the DVM and load to the instrument as illustrated in the following diagram:

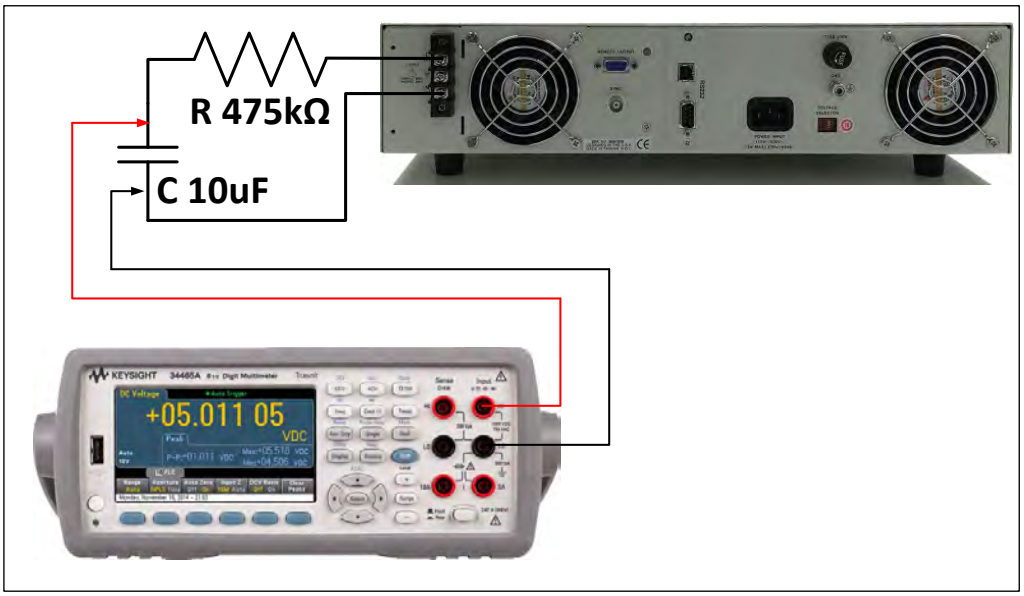


Figure 10-1: DC Offset Measurement

2. Set the DVM to read DC mV.
3. Set the output voltage to 115V in the AUTO voltage mode.
4. Push the output button and wait twenty seconds to take a measurement.
5. Verify that the DVM measures 0V +\- 100mV.
6. Disconnect the load and the DVM.

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 Hardware Calibration Procedure

This section covers the hardware calibration procedure for the CFS series power supply. The hardware verification should be performed prior to the standard calibration ONLY if any discrepancies were found in the previous section. In most cases, this non-routine hardware adjustment should not be required on a regular bases.

If needed, 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 hardware calibration.

- High Bandwidth True RMS DVM (>50kHz) capable of measuring millivolts DC and 115 VAC
- Digital Storage Oscilloscope
- A 475kΩ, ¼ watt resistor
- A 10uF, 115V non-polarized capacitor
- Power Resistors by Model:
    - CFS108: 12Ω, 1000W, Current Clamp or Meter capable of 10A rms.
    - CFS116: 6Ω, 2000W Current Clamp or Meter capable of 20A rms.
    - CFS140: 3Ω, 4000W Current Clamp or Meter capable of 40A rms.
- Trim pot adjustment tool
- Plastic RF IF Core adjustment tool

10.3.2 Hardware Calibration Procedure

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 High Frequency Noise

2. Connect the output of the instrument to the Oscilloscope.
3. Adjust the Oscilloscope to approximately 200mV/10us. This will allow viewing of the high frequency noise.
4. Set the output voltage to 0V in the AUTO voltage mode and activate the output of the instrument.
5. Adjust the variable inductor, located either on the amplifier board or the output board until the high frequency waveform displayed on the Oscilloscope is at a minimum. There may be some glue on top of the inductor. Please remove this glue

using the plastic inductor adjustment tool first. When doing this adjustment, you may see some high frequency spikes and anomalies on the scope screen which is normal and not critical or relevant to this adjustment.

6. Change the voltage mode to HIGH and check that the high frequency waveform displayed on the Oscilloscope is < 1000mVp-p for models CFS108 and CFS116 and < 1500mVp-p for the CFS140.
7. Disconnect the Oscilloscope.

Adjust "115" Volts DC Offset

1. Plug in the jumper to JP1 on the assembly marked "PWM6900C".
2. Connect the 475kΩ resistor in series with the 10uF capacitor and connect the DVM and load to the instrument as illustrated in the following diagram:

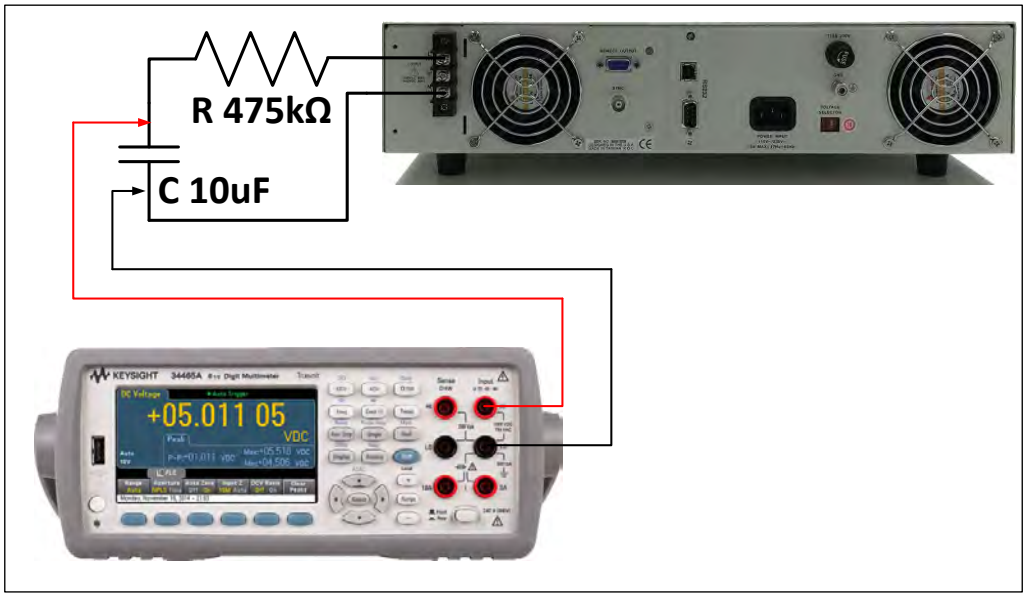


Figure 10-2: DC Offset Measurement

3. Set the DVM to a DC millivolts range
4. Set the output voltage to 0V in the Auto voltage mode and activate the output of the power source. Record the DVM reading value.
5. Set the output voltage to 115V in the AUTO voltage mode and activate the output of the power source.
6. Adjust VR2 on the CON6000 assembly so that the DVM measures the value which was recorded +\- 20mV.
7. Reset the output and power the instrument off.
8. Remove the Jumper from JP1 on the PWM6900C assembly.
9. Disconnect the load and the DVM.

OCP Set Point

1. Make sure the instrument is in normal operation mode.
2. Set the Auto Run mode to MANUAL.
3. Connect the model specific power resistor load to the output of the power source. Refer to list in Section 10.3.1,"Required Calibration Instruments and Standards".
4. Rotate VR3 of the CON6000 assembly counterclockwise to the end of its travel.
5. Set the output voltage to 110V in the AUTO voltage mode and activate the output of the power source.
6. Using the Rotary Knob, adjust the voltage up until the following RMS current is displayed on the current meter.
7. 9.75A +/- 0.10A for the Model CFS108
8. 19.50A +/- 0.20A for the Model CFS116
9. 39.00A +/- 0.40A for the Model CFS140
10. Wait 15 seconds.
11. Rotate VR3 clockwise until the LCD displays OCP.

Exit Non-Calibration Mode

Exit Non-Calibration mode for normal operation. Reset the instrument by powering it OFF and then back ON for standard operation mode.

10.4 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.

10.4.1 Required Calibration Instruments and Standards

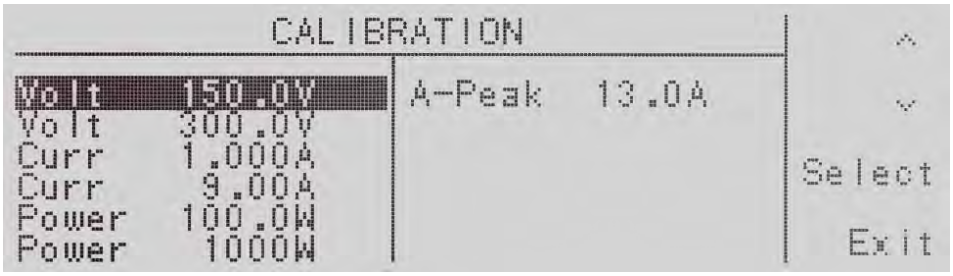
The following equipment is required to perform annual software calibration.

- High Bandwidth True RMS DVM (>50kHz) capable of measuring 300Vac
- 0-40 Amp AC True RMS Ammeter
- 4000 W Capable Wattmeter or Power Analyzer
- A 475kΩ, ¼ watt resistor
- A 10uF, 115V non-polarized capacitor
- Power Resistors by Model:
  - CFS108: 12Ω, 1000W & 100Ω, 100W
  - CFS116: 6Ω, 2000W & 50Ω, 200W
  - CFS140: 3Ω, 4000

10.4.2 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:

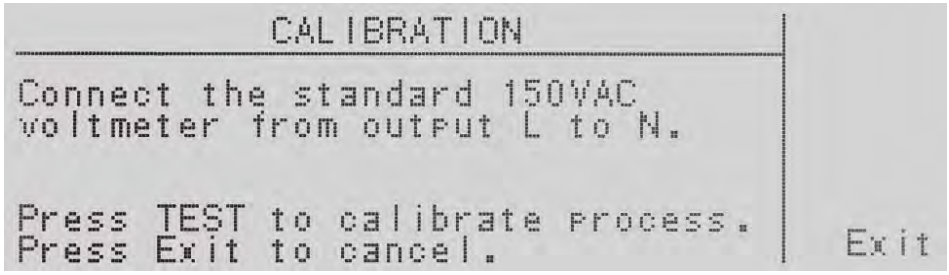


Use the up or down arrow soft keys to navigate to the parameter that you would like to calibrate. The parameters available for calibration are Voltage 150.0V, Voltage 300.0 V, Current xx.xxA, Power xxxxW, and A-Peak xx.xA. The actual values for the Current, Power, and A-Peak will change according to the model number. For example if you are calibrating the 4kVA model CFS140, the readings will be Current 2.0A, Current 36.00A, Power 4000W, and A-Peak 52.0A.

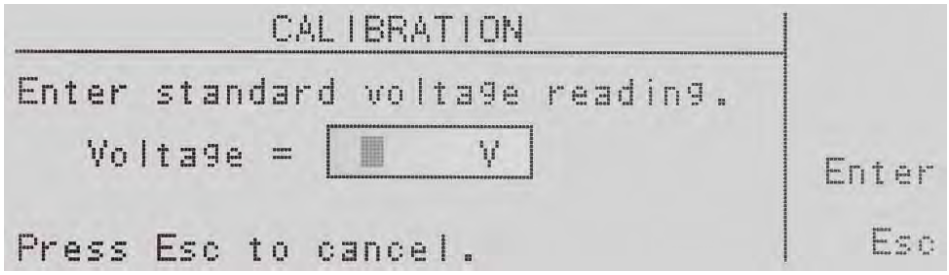
Use the "**Select"** soft key to select the parameter for calibration. If you press the "**Exit**" soft key from this screen you will be kicked out of the Calibration mode and returned to the set screen.

10.4.3 Voltage: 150.0V Calibration

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



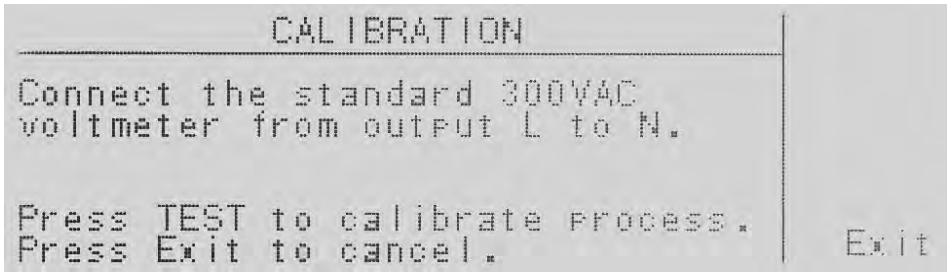
Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for voltage. If you press the "**Exit**" soft key at this screen you return to the calibration mode screen.



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 Voltage 300.0V. If you press the "**Esc**" soft key you will be returned to the calibration mode screen.

10.4.4 Voltage: 300.0V Calibration

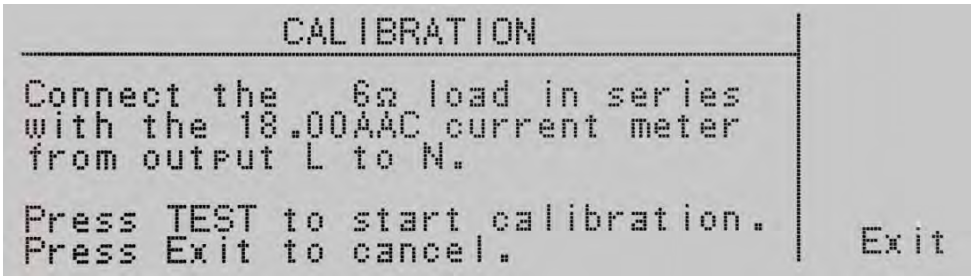
Use the up or down arrow soft keys to navigate to the Voltage 300.0V parameter and press the "**Select**" soft key.



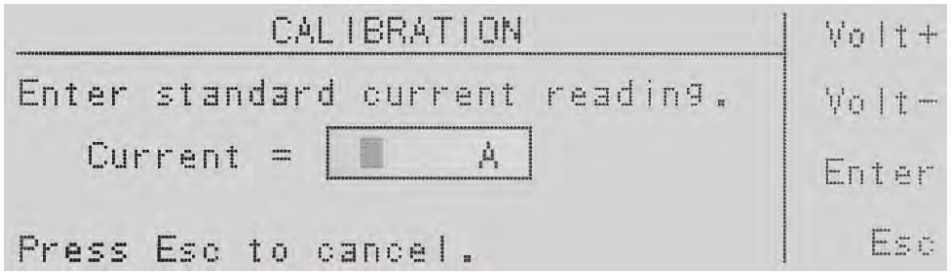
Follow the prompt message provided on the display, and press the Test/Reset button to move into the calibration screen for voltage. If you press the Exit soft key at this screen you return to the calibration mode screen.

10.4.5 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.



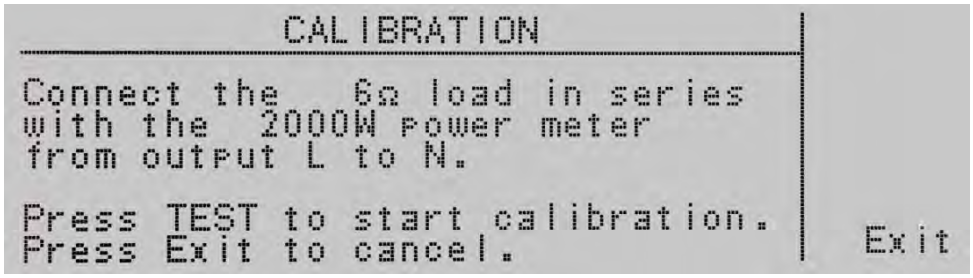
Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for current. If you press the Exit soft key at this screen you return to the calibration mode screen.



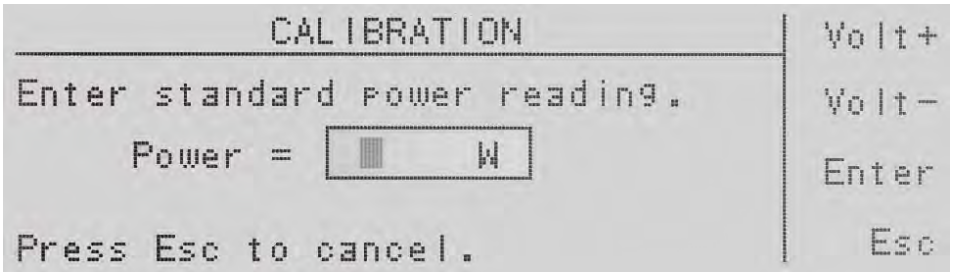
Enter the current reading from the ammeter with the numeric keypad. When the value has been selected press the "**Enter**" soft key and you will be moved to the next calibration parameter. The soft keys Volt+ and Volt- are available, if needed, to adjust the voltage output of the instrument to set a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

10.4.6 High & Low Power Range Calibration

Using the "^,v" soft keys, navigate to Power xx.xW, or Power xxxxW parameter and press the "**Select**" soft key.



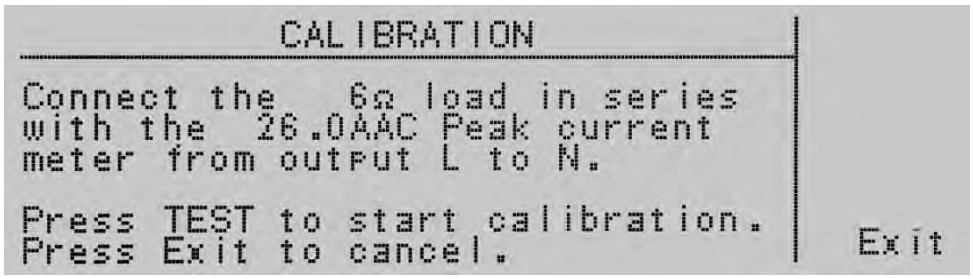
Follow the prompt message provided on the display, and press the "**Test/Reset**" button to move into the calibration screen for wattage. If you press the "**Exit**" soft key at this screen you return to the calibration mode screen.



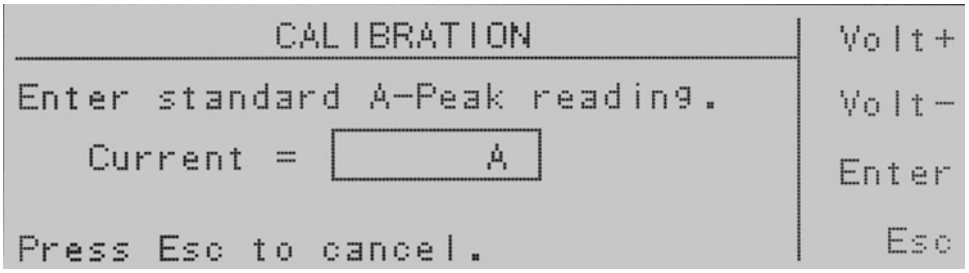
Enter the power reading from the wattmeter with the numeric keypad. When the value has been selected press the "**Enter**" soft key and you will be moved to the next calibration parameter. The soft keys "**Volt+**" and "**Volt-**" are available, if needed, to adjust the voltage output of the instrument to set a proper wattage value if a different load is used than called out in this manual. If you press the "**Esc**" soft key you will be returned to the calibration mode screen.

10.4.7 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 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 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

10.4.8 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:	**2014/30/EC**	**EMC Directive**
	2014/35/EC	**Low Voltage Directive**
	2011/65/EC	**RoHS2 directive**

Manufacturer **Adaptive Power Systems, Inc.**
Product Name CFS100 Series AC & DC Power Sources
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 2014/35/EC):
Standard applied EN 61010–1: 2010 (3rd Edition)
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
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