

SECTION 1

INTRODUCTION AND SPECIFICATION

1.0 INTRODUCTION

This instruction manual contains information on the installation, operation, calibration, and maintenance of the HGA with an AC source system. The AC source instruction manual should be used only when the HGA manual refers to the AC source manual.

1.1 GENERAL DESCRIPTION

The HGA is a waveform, harmonic and transient generator producing with a complete measurement subsystem. The HGA will interface with many AC power sources to produce a programmable power system with harmonic generator and harmonic analyzer.

The HGA gives an AC power source the following capabilities

- Programmable AC voltage, Frequency, Phase Angle (3-phase system) and Current Limit.
- Sine, Clipped sine, user defined waveforms and square waves (if capable by the AC source).
- Voltage and Frequency slew control.
- Synthesized waveform generation with high resolution, accuracy and low distortion.
- Step and Pulse output transients for generating surge, sag, dropout and other line disturbance simulation.
- Programmable lists for generation of complex output transients or test sequences
- Extensive measurement capabilities of:

AC rms Voltage and Current

Peak Current

Real and Apparent Power

Harmonic analysis of voltage and current up to the 49th harmonic

Total harmonic distortion calculation

- Trigger transient on phase angle or external bus command.
- External source synchronization.
- External Voltage Amplitude Modulation
- Nonvolatile state and waveform storage
- IEEE488 and RS232 Interface with SCPI command language.
- Over and under voltage, overcurrent and overtemperature shutdown.
- Remote shut down signal input
- Software Calibration.

ARBITRARY WAVEFORM GENERATOR/CONTROLLER SPECIFICATION

ELECTRICAL

Input (Nominal line voltage, 50 or 60 Hz, unless specified otherwise)

Line Voltage	103 - 127 VAC, 207 - 253 VAC user selectable
Line Current	0.5A/0.25A (1 amp fuse)
Line Frequency	47 - 63 Hz
Isolation Voltage (input-chassis)	1350 VAC

Refer to the AC source specification for its input specification.

Output (when used with external amplifier)

Number of Phases	1 or 3
Voltage Range	0 to 312V
Total Harmonic Distortion	Refer to AC source Output specification
Line Regulation (10% change)	2%
Load Regulation (100% load change)	0.5 %
Voltage Accuracy	0.4 %
Voltage stability	±0.25% over 24 hrs, constant line, load and temperature.
Fundamental Frequency Range	45 - 66 Hz
Frequency Temperature Coefficient	±5 ppm
Frequency Stability	±15 ppm of value per year

Protection

Refer to AC source protection specification

Measurements (23°C ±5°C)

	Range	Resolution	Accuracy
Voltage	0 - 312V	0.1V	0.5V
Current	0 - 16A	0.01A	0.05A
	0 - 160A (Opt)	0.1A	0.5A
Peak Current	80A	0.02A	2.4A
	800A (Opt)	0.2A	24A
Power	0 - 4kW	0.001kW	0.005kW
	0 - 40kW (Opt)	0.01kW	0.05kW
Apparent Power	0 - 4kVA	0.001kVA	Not specified
	0 - 40kVA (Opt)	0.01kVA	Not specified
Power Factor	0 - 1	0.001	Not specified
Frequency	45 - 66Hz	0.01Hz	0.02Hz
Phase Angle (at V>20)	0 to 359°	0.1°	2°

Individual Harmonic Voltage	0 to 312V	0.1V	1.0V
Measurements (23°C ±5°C)			
	Range	Resolution	Accuracy
Individual Harmonic Current	0 to 16A	0.005A	48mA
	0 to 8A	0.003A	24mA
	0 to 4A	0.002A	12mA
	0 to 2A	0.001A	6mA
	0 to 80A (Opt)	0.03A	240mA
	0 to 160A (Opt)	0.05A	480mA
Total Harmonic Distortion (Voltage and Current)	0 - 100%	0.1%	1%
Harmonic Bandwidth	2nd to the 49 th harmonic for a fundamental frequency of 45 to 66 Hz		
Harmonic Measurement Time	8 seconds (to measure all harmonics)		

Control

Front Panel Control

Voltage, Frequency, Current Limit, Listen Address and single-phase/three-phase. All phases are programmed simultaneously. Measurement of voltage, current, power, and frequency.

Function Selection Keys	Set, measure, voltage, freq, current, power, utility, execute, cursor control and numerical control knob.
Display	2 x 16 Backlit LCD, 4.8mm x 9.6mm character size
Indicators	Power On, Remote

Computer Control

- I. IEEE-488.1 (GPIB)
Subset:

SH1, AHI, T6, L3, SR1, RL1, DC1, DT1

Code and Format:

Conform and Support Common Commands defined by IEEE-488.2

- II. RS232

1. Data Format
Same as GPIB
2. Baud Rate
Up to 9600 bauds

- III. Language

IV. Functions (with L Series Power System)

	Range	Resolution	Accuracy	Initialization
Voltage	0 to 312 Vrms	0.1V	0.4%	00
Frequency	45 to 66 Hz	0.01Hz	.005%	60 Hz
Phase Angle	0 to 360°	1°	2°	0 to 360
Harmonic Distortion				
(Flat Top)	0 to 20%	1%	2%	0%

Single/Multiple Harmonic Voltage Generation 2-49th (for a fundamental frequency of 45 to 66 Hz). Any harmonic may be programmed from 0 to 100%.

Transient: Use the List, pulse or step subsystem for voltage, frequency, current limit and phase angle transient with slew capabilities for both voltage and frequency.

Waveform files down loaded:

Ability to store up to 18 downloaded waveforms 4096 points each.

Programmable transient start point.

Calibration Measured voltage, current, power, harmonic voltage, harmonic current and output phase angle.

Diagnostics (Self Test) Ram Test, ROM sum check

Storage Store up to 4 steady state setups

Status Byte IEEE488.2 Status Subsystem

External Control

Modulation 0 to 10Vrms = 10% amplitude modulation, DC to 550 Hz, simultaneous on 3Ø system

Shutdown Logic low

Sync Input TTL waveform to sync phase A output. Output frequency locks to the input sync from 45 Hz to 66 Hz.

Output Signals: Sync output, TTL output active high for 500 usec, 1.5 mA sink to indicate the beginning or end of transient.

Features

- Remote Sense
- Calibration of measurement and output phase offset - from Computer Bus
- Output Relay control - from Computer Bus
- Current Limit/Current Limit Delay

Options

High Current range - 160A
Single/Three-phase Programmable
Drop out switch (Independent output dropout for each phase)

Systems

Compatible with California Instruments Models 4500L, 2750L, 1501L, 751L, 3001TCA and FCS series. Consult factory for other compatible manufacturers' AC power sources.

MECHANICAL (HGA controller only)

Dimensions	3 1/2"(88.9mm)H x 17"(431.8mm)W x 22"(558.8mm)D
Weight	35 lbs.(15.9Kgm)
Material	Steel
Finish	Zinc Plate, Front Panel Gray paint
Air Intake/Exhaust	Sides/Rear
Connectors	
- Input	IEC320-C14 AC Receptacle
- Sense	1-480705-0 AMP
- AC Power Source	
Interface	3M3367-1000
- IEEE/488	3M3549-1000
- RS232	9 Pins DB9 male
Chassis Slides	Zero P/N C300-S-18

Refer to AC power source user manual for AC source Mechanical specification.

ENVIRONMENTAL

Operating Temperature	0 to 50°C
Storage Temperature	-40 to +85°C
Operating Altitude	7500 ft.
Vibration	Commercial transportation levels
Shock	Commercial transportation levels
Acoustic Noise	65 dBA, 3 ft.

Refer to AC power source user manual for AC source Environment specification.