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SECTION 1 - GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual contains information pertaining to the installation, operation and calibration of California Instruments' Model 949XP AC Power Controller.

1.2 DESCRIPTION

The Model 949XP AC Power Controller is a frequency, amplitude and phase controller designed to plug into all California Instruments' XP Series AC power sources. The frequency, amplitude and phase of the power source output may be locally controlled using a keyboard on the front of the controller, or remotely controlled through its IEEE-488 interface.

The controller output is a variable frequency, variable amplitude, variable phase AC voltage. It provides the three-phase input signal for the associated power source where it is amplified to produce the high-power, multi-phase output. Sense inputs for each of the three phases assures that the voltage at the remote sense point equals the programmed value. If the programmed voltage value cannot be maintained within specified limits, the controller reduces the power source output then displays an error message on its control panel. The displayed message indicates which of the phases has not been maintained at the programmed value. Microprocessor-controlled, digital logic is employed in the controller for frequency generation. Its sine wave outputs are produced by a precision digital-to-analog converter. Frequency accuracy is maintained by a quartz crystal whose temperature stability is ± 5 parts per million per degree celsius.

The Model 949XP AC Power Controller provides many features depending on the actual configuration purchased.

These features include:

- High-reliability CMOS design uses less than 2 watts of power.
- More than 20 programmable functions.
- Multi-page menu screen and 17 parameter screens for total system programming and monitoring.
- Independent control of amplitude, phase angle, frequency, voltage range and current limit.

- Master/Slave configurations for applications requiring more than 3 phases.

- 4 decades of frequency output with resolution to 0.01 Hz.

- Automatic frequency range changing.

- Amplitude, frequency, phase angle and current limit may be ramped incrementally via program control. Start, finish, step size and step duration are independently programmable.

- Sine or square wave output independently selectable on each phase.

- Two programmable voltage ranges.

- Simple IEEE-488 software using Abbreviated Plain English (APE).

- Alphanumeric prompting display is user-friendly; no reference codes are required.

- 32 character alphanumeric display.

- 20 key keypad for complete front panel control.

- Complete programming (including IEEE-488 bus address and calibration from the front panel) - no inside adjustments are needed.

- Non-volatile memory for instant set-up to pre-programming test parameters.

- Non-volatile and volatile registers for storage of programmable parameters.

- System diagnostics with error messages on front panel display.

- Internal clock tracks total elapsed time.

- Internal counter tracks the frequency of an external signal from 45 Hz to 450 Hz to provide a low distortion output when in the external sync mode.

- Display of three phases of output: Voltage, Current, Power and Power factor.

1.3 SPECIFICATIONS

Operating specifications for the Model 949XP are shown in Table 1-1.

SPECIFICATIONS

MODEL 949XP AC POWER CONTROLLER

TABLE 1-1

Amplitude Program Independent or simultaneous voltage programming on each phase.

VOLTAGE RANGES:	67.5/135.0 Optional
VOLTAGE ACCURACY: (25 degrees C ±1 degree C) (Based on Full-Wave Avg)	±0.1% of full scale from default voltage to full scale (±0.2% above 5 KHz)
TEMPERATURE COEFFICIENT:	±0.01% of full scale per degree C average from 25 degrees C.
LOAD REGULATION:	±0.01% of full scale no-load to full load.
LINE REGULATION:	±0.01% of full scale for ±10% line change
LONG TERM STABILITY: (25 degrees C ±5 degrees C At Constant Line and Load)	±0.02% of full scale per 1000 hrs.
DISTORTION:	Less than 1% from 5% of full scale to full scale.
DEFAULT VOLTAGE:	5.0 Volts.
DEFAULT RANGE:	Either range of specified range pair.

FREQUENCY PROGRAM

FREQUENCY RANGE:	Four decade resolution from 45.00 (or other low limit) to 9999 Hz. (or other high limit)

FREQUENCY RESOLUTION:	0.01 Hz from 45.00 to 99.90 Hz 0.1 Hz from 100.0 to 999.9 Hz 1.0 Hz from 1000 to 9999 Hz
FREQUENCY ACCURACY: (25 degrees C ±1 degree C)	±0.001% of programmed value
TEMPERATURE COEFFICIENT:	±5ppm/degrees C from 25 degrees C
LONG TERM STABILITY: (25 degrees C ±1 degree C)	±15 PPM ot Programmed Value per Year.
DEFAULT (Initial Value):	ANY
PHASE ANGLE: (Phase B and C relative to A)	0 to ±999.9 degrees in .1 increments
DEFAULT (Phase C)	ANY, but 0 defines Single Phase Any value except 0 and 120 defines Two Phase 120 defines Three Phase
PHASE ACCURACY:	±1 degree; add 0.5 degrees per KHz above 2 KHz

DISPLAY:

DATA: Two lines, 16 characters long, of alphanumeric information

SCREEN	PARAMTERS
ALM	RNG,LLM,HLM
AMP	A,B,C
PHZ	A,B,C
CRL	A,B,C
ELT	H,M,S
CFG	LSN,CFB,PHZ
FLM	FRQ,LLM,HLM
VLT	A,B,C
FRQ	
WVF	SNW,SQW
RNG	A,B,C
SNC	INT,EXT
CLK	INT,EXT
CAL	A,B,C
CUR	A,B,C
PWR	A,B,C
PWF	A,B,C
MNU	

LOCAL CONTROL:	20-key keyboard
REMOTE PROGRAMMING:	
	IEEE-488-1978 SUBSETS: SH1, AH1, T6, L3, SR1, RL2, DC1, DT1
	IEEE-728-1982 OPERATING CODES AND FORMATS:
	NUMERIC REPRESENTATION; NR1, NR2 OR NR3. HEADERS; HR1 OR HR2 (UPPER OR LOWER CASE) MESSAGE SEPARATORS; SR1
DATA TRANSFER RATE:	200K bytes/second using DMA methods
DMA BUFFER SIZE:	128 bytes
END OF STRING:	Standard: (CR), (LF) or (END) Field Optional: (LF) or (END) Field Optional: (CR) or (END)
ERROR MESSAGES (Status Byte):	Data Display message and status byte.
STATUS BYTE (Decimal):	FAULT
64	Phase A
65	Phase B
66	Phase A,B
67	Phase C
68	Phase A,C
69	Phase B,C
70	Phase A,B,C
71	Current Limit
72	Current Limit A
73	Current Limit B
74	Current Limit A,B
75	Current Limit C
76	Current Limit A,C
77	Current Limit C,B
78	Current Limit A,B,C
79	
80	Keyboard Entry 0 SRQ
81	Keyboard Entry 1 SRQ
82	Keyboard Entry 2 SRQ
83	Keyboard Entry 3 SRQ
84	Keyboard Entry 4 SRQ
85	Keyboard Entry 5 SRQ
86	Keyboard Entry 6 SRQ
87	Keyboard Entry 7 SRQ

88	Keyboard Entry 8 SRQ
89	Keyboard Entry 9 SRQ
90	Amplitude Range Limit Error
91	Amplitude Range Error
92	Frequency Range Error
93	Phase Range Error
94	Current Range Error
95	Ramp Range Error
96	Program Syntax Error
97	Bus message sent with Controller in Local
98	EXT SNC Frequency Limit
99	ROM SUM Check Error
100	Exceeds DMA buffer size

PROGRAM SYNTAX: ABBREVIATED PLAIN ENGLISH

ALM	Amplitude Limit
AMP	Amplitude
CAL	Calibrate
CFG	Configuration
CLK	Clock
CRL	Current Limit
CUR	Current
DLY	Delay
ELT	Elapsed Time
EXT	External
FLM	Frequency Limit
FRQ	Frequency
HLM	High Limit
INT	Internal
LLM	Low Limit
MNU	Menu
PHZ	Phase
PRG	Program
PWF	Power Factor
PWR	Power
REC	Recall
REG	Register
RNG	Range
SNC	Synchronize
SNW	Sine Wave
SQW	Square Wave
SRQ	Service Request
STP	Step
TLK	Talk
TRG	Trigger
VAL	Value
VLT	Voltage
WVF	Waveform
#	Present Value

DATA FORMAT: Scientific notation or explicit point

MEASUREMENT SPECIFICATIONS

VOLTS

RANGE:	400.0 volts / 40.00
RESOLUTION:	0.1 Volt / 0.01 volt
ACCURACY:	±1 Volt to 5000 Hz ±2 Volts to 9999 Hz
TEMPERATURE COEFFICIENT:	±0.027 Volts per degree C.

CURRENT

RANGE:	400.0 Amps / 40.00 Amps / 4.000 Amps
RESOLUTION:	0.1 Amp / 0.01 Amp / 0.001 Amp
ACCURACY:	±1 Amps to 5000 Hz ±2 Amps to 9999 Hz
TEMPERATURE COEFFICIENT:	±0.016% of full scale current per degree C.

POWER

RANGE:	10.00 KW. / 1.000 KW / 100 Watts
RESOLUTION:	.01 KW / 0.001 KW / 0.1 W
ACCURACY:	±1 KW to 5000 Hz ±2 KW to 9999 Hz
TEMPERATURE COEFFICIENT:	±0.06% of full scale per degree C.

POWER FACTOR

RANGE:	0.000 to 1.000

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