⚡California Instruments

The XP Series System

A California Instruments XP Series AC Power Source System consists of an XP Power Amplifier, the 948XP Power Controller (or other XP Series Power Controller) and an XP Power Monitor. The Power Amplifiers are available in configurations to 7800 VA, and the Power Monitors range from a simple overload and overtemp indicator to a digital display of voltage, current and power.

This design approach affords the user a convenient way of structuring the AC power source to suit the needs of individual, specialized applications. Since the XP Series System can be as simple or as complex as required, it is cost-effective—you select and pay for only those features you need and want.

General Description

The 948XP is a powerful microprocessor-based programmable Power Controller with complete talker/listener capability for the IEEE-488 GPIB. All programming and control features may be accessed using either the 16-key front panel keyboard or via the IEEE-488 bus. Programming is easy, using the high-level Abbreviated

Plain English (APE) language. The 16-character LCD alphanumeric display is user-friendly—the screens use the simple three-letter mnemonics that are also used for bus programming—there are no reference codes required. Four decades of frequency output are available, with resolution to 0.1 Hz and ± 0.005% accuracy. Frequency range-changing is automatic.

Local programming is simplified through the multi-page Menu Screens and seventeen parameter screens. The screens are accessed easily and quickly via the keypad.

System Measurements

The system output voltage, current, power, and power factor of all three phases may be monitored using the voltage (VLT), current (CUR), power (PWR) and power factor (PWF) screens, respectively.

Multi-Phase Systems

The amplitude, frequency, and current limit of the three outputs are simultaneously programmable.

Ramp Functions

The amplitude, frequency, and current limit values may be programmed to increment or step over a given time. The starting and ending values, step size and step duration are all selectable. Two output parameters may be ramped simultaneously with different ramp rates.
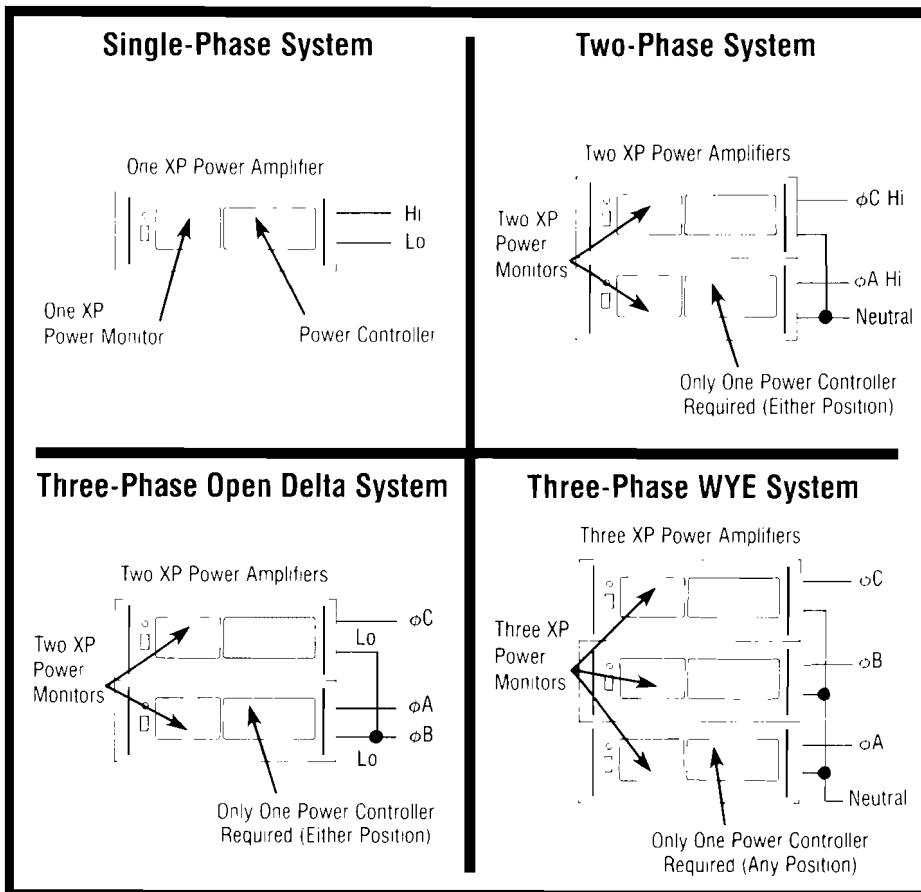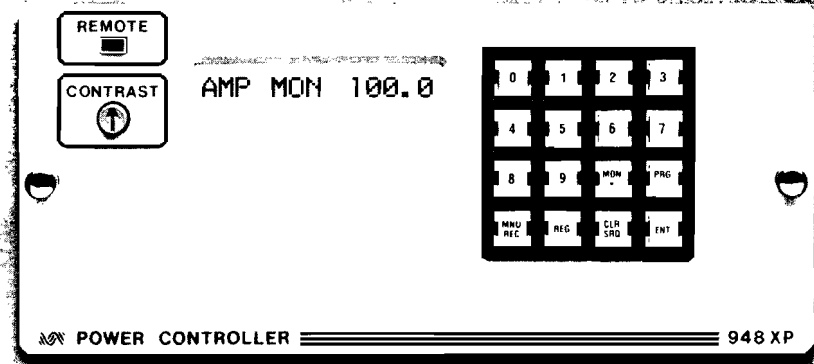
Calibration

No inside adjustments are ever needed; all calibration is performed from the front-panel keypad, or via the IEEE-488 interface.

External Sync

An external sync input is accepted which is frequency-tracked up to 450 Hz and locks the output phase precisely to the sync input.

Initialization Parameters

Non-volatile memory is provided to store the IEEE-488 address, frequency limits, initial frequency, amplitude limits, initial range and calibration coefficients.

Single-Phase System

One XP Power Amplifier

One XP Power Monitor   Power Controller

Two-Phase System

Two XP Power Amplifiers

Two XP Power Monitors

øC Hi
øA Hi
Neutral

Only One Power Controller Required (Either Position)

Three-Phase Open Delta System

Two XP Power Amplifiers

Two XP Power Monitors

øC
Lo
øA
øB
Lo

Only One Power Controller Required (Either Position)

Three-Phase WYE System

Three XP Power Amplifiers

Three XP Power Monitors

øC
øB
øA
Neutral

Only One Power Controller Required (Any Position)

Systems Programming

Press the menu key and the first selection screen appears. Thirteen separate screens provide the information for total control over your AC power system. All of the screens use the simple three-letter mnemonics that are also used for bus programming. They are:

Program Syntax	Abbreviated Plain English
ALM	Amplitude Limit
AMP	Amplitude
CAL	Calibrate
CFG	Configuration
CLK	Clock

Program Syntax	Abbreviated Plain English
CRL	Current Limit
CUR	Current
DLY	Delay
ELT	Elapsed Time
EXT	External
FLM	Frequency Limit
FRQ	Frequency
HLM	High Frequency Limit
LLM	Low Frequency Limit
LTN	Listen Address
LMT	Limit
MNU	Menu
PRG	Power Program

Program Syntax	Abbreviated Plain English
PWR	Power
PWF	Power Factor
REC	Recall
REG	Register
RMP	Ramp
RNG	Range
SNC	Synchronize
SRQ	Service Request
STP	Step
TLK	Talk
TRG	Trigger
VAL	Value
VLT	Voltage

Sample Menu Screens

    AMP MON 100.0
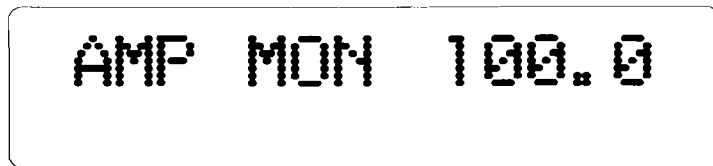
The ASCII string to program the screen shown is "**AMP 100**".

The amplitude screen provides simultaneous program of amplitude in volts RMS. Precision regulation at the sense point (load) insures accuracy.
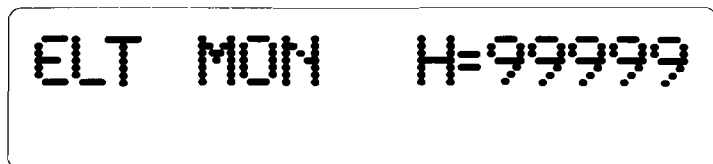

    RNG MON 135.0

The ASCII string to program the screen shown is "**RNG 135**".

The range screen allows programming of the AC power source voltage range.

    CRL MON   10.0

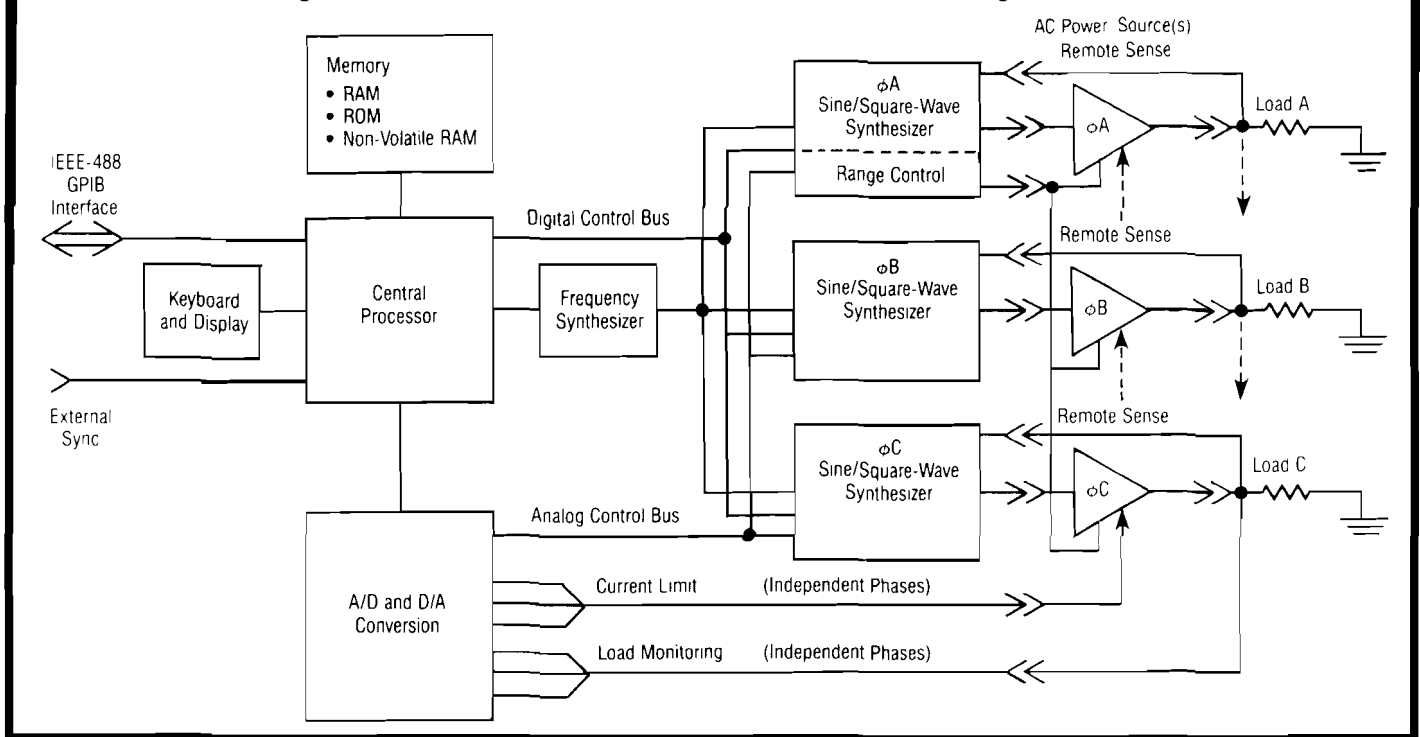The ASCII string to program the screen shown is "**CRL 10**".

The current limit screen provides programming of maximum output current.

    ELT MON H=99999

Elapsed Time Screen

This screen displays the total run time in hours.

Functional Block Diagram for 948XP Power Controller in Three-Phase Configuration

Specifications

Amplitude Program

Voltage Ranges:
The following two ranges may be defined in the limit screen to set the amplitude limits. 200.0/400.0 and 20.00/40.00 are the two range pairs available. The 200.0/400.0 pair is standard with the limits of 135.0/270.0.

Voltage Accuracy:
±0.1% of full-scale from 5% of full-scale to full-scale (±0.2% above 5 kHz) at 25°C ±1°C. (Based on full-wave average measurement.)

Load Regulation:
±0.01% of full-scale no-load to full-load.

Line Regulation:
±0.01% of full-scale for ±10% line change.

Temperature Coefficient:
±0.01% of full-scale per °C average from 25°C.

Long-Term Stability:
±0.02% of full-scale per 1000 hours at 25°C ±5°C at constant line and load.

Default:
5.0 volts.

Frequency Program (25°C ±1°C)

Frequency Range:
Four-decade resolution from 45.0 (or other low limit) to 9999 Hz (or other high limit).

Frequency Accuracy:
±0.005% of programmed value.

Temperature Coefficient:
±5 ppm per °C from 25°C.

Long-Term Stability:
±15 ppm of programmed value per year at 25°C ±5°C.

Default (Initial Value):
Any.

External Sync:
TTL input.

Phase-Angle

Phase Relationships:
Two-Phase: 90° separation.
Three-Phase: 120° separation.
Three-Phase Delta: 60° separation.

Phase Accuracy:
±1° (add 0.5° per kHz above 2 kHz).

Programming

Local:
16-key keyboard.

Remote Programming:
IEEE-488 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
Message Separators: SR1

Data Transfer Rate:
200k bytes per second using DMA methods.

DMA Buffer Size:
128 bytes.

End of String:
Standard: (CR) (LF) or (EOS).
Field Optional: (LF) or (EOS).
Field Optional: (CR) or (EOS).

Display

Data:
One line, 16-characters long, of alphanumeric information.

Screens:

Mnemonic	Screen
ALM	Amplitude Limit
AMP	Amplitude
CAL	Calibrate
CFG	Configuration
CLK	Clock
CRL	Current Limit
CUR	Current
ELT	Elapsed Time
FLM	Frequency Limit
FRQ	Frequency
LMT	Limit
MNU	Menu
PWF	Power Factor
PWR	Power
RMP(A)	Ramp Independent Parameter
RMP(B)	Ramp Dependent Parameter
RNG	Range
SNC	Synchronize
VLT	Voltage

Program Examples:

The 948XP software is designed for easy use and versatility. A few examples of actual programs via the IEEE-488 GPIB:

Program 400 Hz, 115 volts for Phase A, B, C. Actual program:
FRQ 4.00E+02 AMP 1.15E+02 (CR) (LF)
Programmed parameters are executed after the IEEE-488 message (EOS) or (END).

Program 60 Hz, 135 volts with IEEE-488 (GET) message. Actual program:
FRQ 6.0E+01 AMP 1.35E+02 TRG (CR) (LF)
With this ASCII set-up string, the 948XP will wait for the IEEE-488 Device Trigger (DT), Group Execute Trigger (GET) message.

Recall program #3 values and wait for (GET) message. Actual program:
REC 3 TRG (CR) (LF)

Store 50 Hz, 220 volts into program register #7 and execute. Actual program:
FRQ 5.0E+01 AMP 2.20E+02 REG 7 REC 7 (CR) (LF)

Program Phase A to 115 volts, Phase B to 200 volts, and 400 Hz. Actual program:
AMP A 1.15E+02 AMP B 2.2E+02 FRQ 4.0E+02 (CR) (LF)

Program Phase A, B, and C to ramp from 100 volts to 130 volts with steps of 1 volt and 0.1 second. Actual program:
AMP 100 STP 1 DLY .1 VAL 130 (CR) (LF)

Store the program sequence into Register #6 that will program Phase A from present value to 130 volts for 1 second, then to 115 volts and remain. Actual program:
AMP 130 DLY 1 VAL 115 REG 6 (CR) (LF)

Ramp frequency from 400 Hz to 500 Hz at a 1 Hz/sec rate. Actual program:
FRQ 400, STP1, DLY1, VAL 500, (CR) (LF)

Special notation in examples:
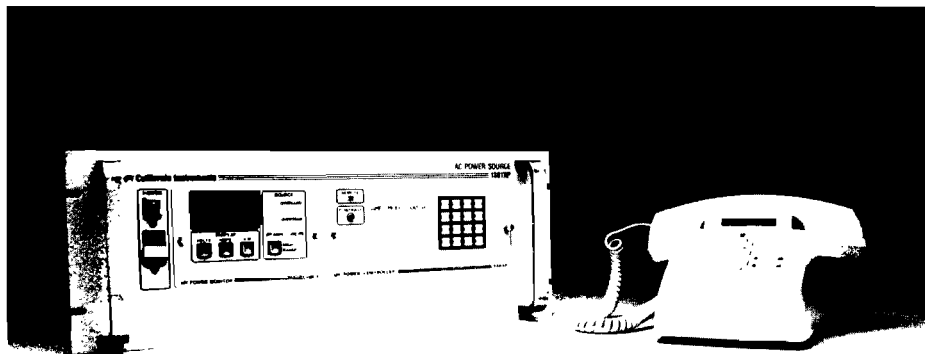**(GET)** IEEE-488 Group Execute Trigger message
(EOS) IEEE-488 End of String message
(END) IEEE-488 End message
(CR) ASCII Carriage Return
(LF) ASCII Line Feed
The ASCII characters "comma" or "semicolon" may be substituted for the "space" in the previous examples.

Ordering Information

The 948XP Power Controllers come complete and ready to install in any California Instruments XP Series Power Source System. No option or accessory codes are required. Call the factory direct or contact your local authorized representative.
TERMS: Net 30 days.
DELIVERY: Within 30 days ARO.
F.O.B.: Factory, San Diego, CA.

A Complete XP Series Power System:
948XP Power Controller
1301XP Power Amplifier
IMC1 Power Monitor

CALL TOLL FREE
800-356-2244
In California, 800-821-1634