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PLUG-IN PROGRAMMER

MODEL PIP 9023

OPERATING MANUAL

REFERENCE ONLY DO NOT COPY

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SAFETY NOTICE

BEFORE APPLYING POWER to the System, verify that the PIP 9023 is properly configured for the user's particular application.

WARNING

HAZARDOUS VOLTAGES IN EXCESS OF 230 VRMS, 400V PEAK MAY BE PRESENT WHEN COVERS ARE REMOVED. QUALIFIED PERSONNEL MUST USE EXTREME CAUTION WHEN SERVICING THIS EQUIPMENT. CIRCUIT BOARDS, TEST POINTS AND OUTPUT VOLTAGES MAY ALSO BE FLOATING ABOVE (BELOW) CHASSIS GROUND.

Installation and servicing must be performed by QUALIFIED PERSONNEL who are aware of properly dealing with attendant hazards. This includes such simple tasks as fuse verification and channel reconfiguration.

Ensure that the AC power line ground is properly connected to the PIP 9023 input connector. Similarly, other power ground lines including those to application and maintenance equipment MUST be properly grounded for both personnel and equipment safety.

Always ensure that facility AC input power is de-energized prior to connecting or disconnecting the power cable. Similarly, the PIP 9023 circuit breaker must be switched OFF prior to connecting or disconnecting output power.

In normal operation, the operator does not have access to hazardous voltages within the chassis. However, depending on the user's application configuration, **HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY** may be normally generated on the output terminals. The Customer/User must ensure that the output power (and sense) lines be properly labeled as to the SAFETY hazards and any that inadvertent contact with hazardous voltages is eliminated.

Guard against risks of electrical shock during open cover checks by NOT TOUCHING any portion of the electrical circuits. Even when power is OFF, capacitors are well known to retain an electrical charge. Use SAFETY GLASSES during open cover checks to avoid personal injury by any sudden component failure.

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SECTION I

GENERAL DESCRIPTION

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1.1 INTRODUCTION

The Elgar Model PIP 9023 Plug-In Programmer (PIP) provides the following capabilities:

- Full Automatic Test Equipment (ATE) Qualification for ATLAS Based Language Extension (ABLE).
- 100% Control of AC Power Source.
- General Purpose Interface Bus (GPIB) and Front Panel Control.
- Extensive Display Supports Programming, Status Indications, and Fault Indications.
- Built-in Test and True Readback of AC Power Source.
- Automatic Control of AC Power Source Range and Disconnect Relays.

1.2 GENERAL DESCRIPTION

The Elgar Model PIP 9023 is a plug-in programmable oscillator test module specifically designed for use with Elgar AC Power Sources. The PIP features a digitally controlled precision oscillator function with multiple outputs for independent three-phase stimulus. Each oscillator function output drives a respective power amplifier phase from the AC source. In addition, the PIP provides automatic regulation, and built-in-test and display, with local and remote (GPIB) control.

The PIP 9023 performs local programming setups via its front panel using plainly marked multi-function keyboard entries. Status is available via the integral light emitting diode (LED) display. Remote programming and reporting is accomplished with the GPIB using the ABLE language.

In addition to the flexible, independent multi-phase capability as an oscillator, the PIP 9023 provides powerful measurement capabilities. Measurement is provided by local and remote control, and includes:

- Output voltage;
- Load current;
- Load watts;
- Output frequency; and,
- Phase Angle.

The PIP 9023 constantly monitors each phase for proper output. The AC Power Source is immediately triggered to shut down in the event of over/under voltage and overcurrent, thus protecting the user's load and the AC Power Source during unexpected operation. The PIP 9023 also generates and responds to SRQ (Service Request) commands.

Appendix A provides a listing of acronyms commonly used in this manual and Appendix B provides a listing of the commonly used IEEE-488 interface connections.

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1.3 PHYSICAL DESCRIPTION

The PIP 9023 is contained in a rectangular module approximately 7-1/4" wide, 3-1/2" high, and 8" deep and is specifically designed to fit the standard oscillator cavity of all Elgar AC Power Sources. Electrical connections are made as the PIP is inserted into the appropriate Elgar AC Power Source.

Connections for sense lines and GPIB interface are connected through the rear panel of the AC Power Source (the PIP 9023 is not suitable for use as a stand-alone device).

1.4 SPECIFICATIONS

1.4.1 General

Input Power: 117 VAC, +42 VDC and -42 VDC from the associated AC Power Source.

Output Signal: 0 to 2.5 VAC to an 800 Ω load (per phase).

Operating Temperature Range: 0°C to 50°C (32°F to 122°F).

Programming: Front panel keyboard/display (local) and GPIB IEEE-488-1978 (remote).

Distortion (THD): <1% within the AC Power Source range.

Control: Front panel keyboard/display (local) and GPIB (IEEE-488-1978) via ABLE language (remote).

1.4.2 Frequency

Range: 45 Hz to 999.99 Hz in 0.1 Hz steps.

Auto Range: 1 kHz to 5 kHz in 1 Hz steps.

Accuracy: 0.001% of programmed value.

Temperature Coefficient: 0.003% per °C average.

Settling Time: 1/2 cycle, or less, at new frequency.

1.4.3 Amplitude

Ranges (Range Programmable): 0 to 67.5 VAC in 0.1 VAC steps; 0 to 135 VAC in 0.1 VAC steps; 0 to 270 VAC in 0.1 VAC steps.

Accuracy: ±0.15% of Full Scale (Full Scale) (45 Hz to 2 kHz) from 5% of Full Scale to Full Scale. Increases 0.015% per kHz above 2 kHz.

Temperature Coefficient: ±0.01% per °C average.

Line Regulation: ±0.01% for a 10% line change within line operating range.

Load Regulation: ±0.01% full wave average at point of sense, no load to full load.

Settling Time: <50 ms when programming from >5% of Full Scale.

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1.4.4 Phase Angle

Resolution: 0° to 399° in 0.5° steps.

Accuracy: ±1° from 45 Hz to 2 kHz. Add 1° per kHz above 2 kHz.

1.4.5 Current Limit
(With Test Option Only)

Range: 5% to 100%.

Resolution: 0.01 Ampere.

Accuracy: ±1% of Full Scale ±0.5% of Reading.

Crest Factor: 3.5:1 minimum.

Temperature Coefficient: ±0.02% of Full Scale ±0.01% of Reading per °C average.

1.4.6 Measurement System

Voltage

Range:	0 to 300.0 VRMS
Resolution:	0.1 VRMS from 0 to 300 VRMS
Accuracy:	±0.1% of Full Scale ±0.05% of Reading
Temperature Coefficient:	±0.01% of Full Scale ±0.01% of Reading per °C average

Current

Range:	5A, 10A, 20A, 40A (jumper selected)
Resolution:	0.01 Amperes
Accuracy:	±1% of Full Scale ±0.5 of Reading
Crest Factor:	3.5:1 minimum
Temperature Coefficient:	±0.02 of Full Scale ±0.01% of Reading per °C average

Power

Range:	500W, 1KW, 2KW and 4KW (jumper selected, not auto-range)
Resolution:	1 Watt
Accuracy:	1% of Full Scale ±0.5% of Reading
Temperature Coefficient:	±0.01% of Full Scale ±0.02% of Reading per °C average

Frequency

Range:	0 to 5000 Hz
Resolution:	1 Hz
Accuracy:	±1 digit
Stability:	±1 Hz
Temperature Coefficient:	±1 digit

Phase Angle

Range:	0° to 360°
Resolution:	0.5°
Accuracy:	±2° for programmed voltages of 50 VAC and higher. Accuracy degrades below 50 VAC.

NOTE

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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NOTES

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SECTION II

INSTALLATION

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2.1 INTRODUCTION

The PIP 9023 is configured, calibrated and tested prior to shipment. Therefore, this instrument is ready for immediate use upon receipt. This unit is not intended for stand-alone operation; the PIP 9023 is specifically designed for use only with Elgar AC Power Sources.

NOTE

INSTALLATION and OPERATION of the applicable AC Power Source is performed in conjunction with the PIP 9023.

WARNING

Hazardous voltages are present when operating this equipment. Read the "SAFETY" notices on page ii before performing installation, operation, or maintenance.

The PIP 9023 is normally shipped installed in its AC Power Source. However, under certain conditions, it may be shipped in a separate package. In either case, the following checks shall be performed.

2.2 UNPACKING

Inspect the shipping container prior to accepting the container from the carrier. If damage to the container is evident, a description of the damage shall be noted on the carrier's receipt, then signed by the driver of the carrier agent.

If damage is not apparent until the contents are unpacked, a claim for concealed damage shall be placed with the carrier. The shipping container(s) and filler material shall be saved for subsequent inspection.

Forward a report of damage to the Elgar Repair Department (see paragraph 3.5). Elgar will provide instructions for repair/replacement of the instrument.

If possible, save the container and packing material for subsequent return of the instrument to the factory. If the instrument needs to be shipped and proper packing material is not available, contact Elgar to provide containers and shipping instructions.

2.3 PRE-INSTALLATION INSPECTION

Inspect the PIP 9023 and its AC Power Source for shipping damage such as dents, scratches, distortion, and damaged connectors. There are no mercury relays or other internal components sensitive to chassis tilting for inspection purposes.

Remove the PIP 9023 from the AC Power Source (the PIP is usually shipped installed). Check for damage. In addition to the PIP card edge connector on the rear of the PIP, there are two flexible cables. One cable is for DFI/shutdown; the other cable is for GPIB. Reinstall the PIP to ensure proper mechanical alignment and snug connector fit (do not bind the flexible cables during re-installation).

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2.4 INSTALLATION

The following checks shall be made to the PIP to ensure proper installation:

- GPIB Address
- Measurement Power Range
- Miscellaneous
- External Sense

WARNING

AC input power must be OFF prior to removal or installation of the PIP. This is not only good practice, but the sense leads may carry potentially lethal voltages from the J1 connector. If unsure whether or not high voltages are present on the sense leads, unplug the sense lead cable at the J1 connector (outside rear) of the AC Power Source.

The PIP 9023 is installed by carefully connecting and inserting any loose cables (described below). The PIP is then aligned so its Main Board card edge connector aligns with the recessed AC Power Source motherboard connector. When this connection is firmly seated, the PIP 9023 is then secured to the AC Power Source chassis by two front panel captive screws.

Removal is the reverse of installation.

2.4.1 GPIB Address

The PIP GPIB address is set by a DIP (Dual In Line) switch on the PIP Microprocessor Board. The PIP must be partially (or fully) removed for setting.

When the PIP is partially removed (3/4 out), the GPIB cable connector and address switch are accessible on the Microprocessor Board (on the left side of the board when viewing from the front). The GPIB ribbon cable exists the rear of the AC Power Source. Connector J4 exits from the left-most corner of the PIP Microprocessor Board. Ensure that the PIP 9023 J4 connector keyway is facing toward the PIP display.

The GPIB address DIP switch sets the PIP Listen/Talk address. The switches are binary weighted (1, 2, 4, 8 and 16) from front to rear. Any GPIB address is available except:

Address 31 (reserved for Unlisten).

The address of any other device on the GPIB (the PIP 9023 has talk capability).

Sliding an individual switch bit outward (to the left) is ON, inward is OFF. AC power needs to be recycled since the microprocessor scans this switch only during the AC power on sequence. No other switch settings are associated with the GPIB. The GPIB address is not available on the display.

Remote programming via the GPIB is discussed in Section III.

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Table 2-1 lists switch settings for various addresses.

Table 2-1. GPIB Listen Address Settings

	ASCII CHARACTER	HEX	DEC	GPIB LISTEN ADDR 1	2	3	4	5
	<SP>	00	0	0	0	0	0	0
	!	01	1	1	0	0	0	0
	"	02	2	0	1	0	0	0
	#	03	3	1	1	0	0	0
	$	04	4	0	0	1	0	0
	%	05	5	1	0	1	0	0
	&	06	6	0	1	1	0	0
	'	07	7	1	1	1	0	0
	(	08	8	0	0	0	1	0
	)	09	9	1	0	0	1	0
	*	0A	10	0	1	0	1	0
	+	0B	11	1	1	0	1	0
	,	0C	12	0	0	1	1	0
	-	0D	13	1	0	1	1	0
	.	0E	14	0	1	1	1	0
	/	0F	15	1	1	1	1	0
	0	10	16	0	0	0	0	1
*	1	11	17	1	0	0	0	1
	2	12	18	0	1	0	0	1
	3	13	19	1	1	0	0	1
	4	14	20	0	0	1	0	1
	5	15	21	1	0	1	0	1
	6	16	22	0	1	1	0	1
	7	17	23	1	1	1	0	1
	8	18	24	0	0	0	1	1
	9	19	25	1	0	0	1	1
	:	1A	26	0	1	0	1	1
	;	1B	27	1	1	0	1	1
	<	1C	28	0	0	1	1	1
	=	1D	29	1	0	1	1	1
	>	1E	30	0	1	1	1	1

* - Factory Setting

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2.4.2 Measurement Power Range

The PIP 9023 Test Board measures individual phase current while the sense leads measure individual phase voltage. The Microprocessor Board combines these for true RMS power measurements.

Two jumpers are set on the Microprocessor Board to specify the power range (these jumpers are normally pre-set at the factory). Table 2-2 provides a listing of the jumper settings for various wattage ranges.

Table 2-2. W1/W2 Jumper Settings

RANGE (Watts)	Jumper W1	Jumper W2
500	Closed	Closed
1000	Open	Closed
2000	Closed	Open
4000	Open	Open

2.4.3 Miscellaneous

Sync 1/Sync 2 on the AC Power Source rear panel (J3 and J7) is automatically routed via the PIP 9023 card edge connector (P1). No separate connectors are required.

The PIP 9023 has no AC Power Source connector (J1) on the rear panel upper left corner as found in many Elgar AC Power Sources. Instead, external sensing and output power connections are located on the AC Power Source rear panel J2 connector.

2.4.4 External Sense

The external sense leads must be connected to the AC Power Source outputs. The PIP 9023 uses these sense leads as voltage sampling for its voltage regulation servo. If the servo leads are not connected, the sense voltage appears low and the PIP drives the output voltage upwards. Refer to the appropriate AC Power Source manual for additional hookup instructions.

REMINDER

Installation of the Model PIP 9023 must be performed in conjunction with installation of the appropriate AC Power Source. Proper AC input voltage and external sense must be verified prior to applying AC power to the system.

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SECTION III

OPERATION

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3.1 INTRODUCTION

The controls and display for the PIP 9023 are easily understood after a brief overview. Similarly, remote programming via ABLE ATE language is quick and simple. The PIP and processor transparently ease the burden of protocol, parsing, message format, error checks, and talker response messages to the host ATE controller.

The PIP 9023 and AC Power Source operate in unison to provide the desired output AC signal and readback measurements. Once the AC Power Source and external (sense lead, output power, input AC) wiring is configured, the PIP provides both local and remote control. Thus, with the exception of the input AC circuit breaker, all control is via the PIP.

3.2 LOCAL/REMOTE PROGRAMMING

The PIP 9023 may be operated in either local or remote. While the precise manner of control (keystrokes versus strings) differs, the overall control scheme is functionally similar.

The keyboard ENT (Enter) and GPIB programming line terminator are equivalent activate codes for the PIP 9023 internal parser. New entries are not implemented until this activate code is received.

Automatic processes such as output voltage range changes, isolation relay open/close, etc., are not intelligently performed via the processor without special implementation sequences entered by the user. The processor knows when a new programmed voltage requires an output range relay change, how sense relays are to be positioned, and that the output voltage is to be momentarily dropped to zero volts during a relay movement to avoid hot switching and contact bounce.

The display is available at all times. When in local control, the display is interactive with the keyboard. In remote, the display only updates for the keyboard selected parameter. Also, when in remote, the display does not jump from parameter to parameter as new remote setups are received.

3.2.1 Local (Keyboard/Display) Programming

All local control and display is via the PIP front panel. The keyboard/display provides the operator with local:

- AC source output setup;
- Measurement reporting of actual output parameters;
- Recall setup programming; and,
- Operator alert of error conditions.

3.2.2 IEEE-488/GPIB Definitions

The PIP 9023 implements the GPIB for all remote programming and returned messages (GPIB and IEEE-488 are interchangeable terms). The instrument GPIB listen address is set within the PIP as described in Section II. Programming of all capabilities, including all three channels, requires only the single GPIB address.

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Remote programming for the PIP 9023 complies with and conforms to the IEEE-488-1978 Standard GPIB (General Purpose Interface Bus).

For remote programming, the end of string terminator is:

<CR><LF>

Mnemonics are implemented and operate as defined by the IEEE-488 Standard (the PIP 9023 has no special nor unusual GPIB implementation requirements). However, the mnemonics listed in Table 3-1 may change name from controller to controller.

Implemented subsets of the IEEE-488 Standard for the PIP 9023 are described in Table 3-2.

Table 3-1. GPIB/Mnemonic Listing

GPIB	Mnemonic
ATN	Attention
DAB	Data Byte
DAC	Data Accepted
DAV	Data Valid
DCL	Device Clear
IFC	Interface Clear
MLA	My Listen Address
MTA	My Talk Address
REN	Remote Enable
RFD	Ready For Data
UNL	Unlisten
UNT	Untalk

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Table 3-2. Implemented Subsets on GPIB

Function	Subset	Definition
SH	SH1	Source handshake capability.
AH	AH1	Acceptor handshake capability.
T	T8	Talker (basic talker, no serial poll, no talk only mode, unaddressed to talk if addressed to listen).
TE	TE0	No extended talker capability.
L	L4	Listener (basic listener, no listener only mode, unaddressed to listen if addressed to talk).
LE	LE0	No extended listener capability.
SR	SR0	No service request capability.
RL	RL1	Remote/local capability.
PP	PP0	No parallel poll capability.
DC	DC1	Device clear and selected device clear capability.
DT	DT0	No device trigger capability.
C	C0	No controller capability.

The instrument remote interface is defined as a listen and talk device with remote and local capability. In the remote mode there is local keyboard disabling of any keystroke action which could change (modify) remote programming or output. Local keyboard disabling is indicated by the RMT (Remote) LED being illuminated.

The instrument remote interface DC (Device Clear) and SDC (Selective Device Clear) are supported for all instrument channels simultaneously.

3.3 OPERATION

Operation is organized as follows:

- Power On/Off Sequence
- Local (Display/Keyboard) Control
- Remote ABLE Control
- DAP Language Syntax

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WARNING

VOLTAGES HAZARDOUS TO HUMAN SAFETY are routinely generated at the output terminals. Ensure the user is familiar with the SAFETY notices on page ii. Use great care when any load is connected to the output of this instrument. The user MUST notify any Operator/Technician via WARNING signs or labels regarding possible hazards of voltage and current.

3.3.1 Power On/Off Sequence

1. READ and VERIFY the content of the above warning.

2. Verify proper INSTALLATION of the PIP and AC Power Source. This includes proper connection for load and sense leads.

3. Use care in operating all controls. The controls could easily be set to exceed the normal operating capabilities of the load.

4. Power OFF conditions are indicated by no output from the rear panel. Therefore, the power output relays are open circuit. Sense lines are connected to the rear panel and internally connected to the sense circuits.

5. Switch the AC Power Source input power circuit breaker to ON to power up the PIP 9023 and AC Power Source. The user load may be connected since no AC output occurs during power up. Table 3-3 describes the Power ON defaults.

Table 3-3. Power On Default Settings

Parameter	Value
Frequency	400.0 Hz
Voltage (V)	Zero VAC - all phases
Current Limit (CURL)	Zero Amps - all phases
Phase Angle A	0°
Phase Angle B	240°
Phase Angle C	120°
Sync	Off
Disconnect Relays	Open
GPIB	Local (Keyboard) Control

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The output voltages are defaulted to zero for safety reasons. The disconnect relay is open to prevent momentary output power aberration during the first moments of power ON. Phase angles are defaulted for normal (120° separation) three phase operation. Phase Angle A is defaulted to zero with respect to synchronization of another PIP oscillator (if used).

Current limit (CURL) of zero is a special value to disable the CURL circuits. Since a high in-rush of current is normal (into a load) as the user load is first powered on, it is frequently desirable to initially disable the CURL shutdown.

To power OFF, good practice encourages disconnecting the user load prior to switching the AC Power Source circuit breaker to OFF. Conveniently, the PIP controls the disconnect relay. Opening the disconnect relay is all that is required prior to switching AC Power Source input power to OFF. This virtually eliminates unpredictable power down glitches.

3.3.2 Local (Display/Keyboard) Control

3.3.2.1 Display Control

Figure 3-1 identifies the various areas of the display. The upper half of the display contains a 4 digit alphanumeric readout with a floating decimal. This displays numeric values for the following:

- Voltage (V)
- Frequency (F)
- Current (I)
- Phase Angle (<)
- Wattage (W).

An alphanumeric code identifies processor detected faults within the system.

The lower half of the display includes 9 LEDs. LEDs **a**, **b**, and **c** identify each of the three phases (normally, only one phase LED is illuminated). If all three phase LEDs are illuminated, all three phases are simultaneously affected. Frequency is a parameter that is common to all phases.

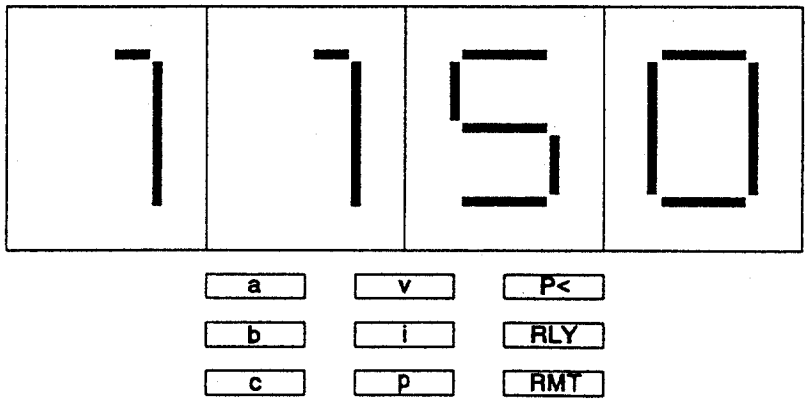


Figure 3-1. PIP 9023 Display

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Another display group consists of four parameter LEDS. However, five parameters are specified. These parameters are always accompanied by the phase LED(s) and the four digit alphanumeric display. LED interpretation is described in Table 3-4.

Table 3-4. PIP Display LED Interpretation

LED	Parameter	Phase
V	Voltage	a or b or c
I	Current	a or b or c
V and I	Wattage	a or b or c
F	Frequency	a, b and c simultaneously
P<	Phase Angle	a or b or c

A single LED (**RLY**) identifies the programmed state for the isolation relays. Since each phase has its own isolation relay, RLY is always accompanied by one, two or three phase (a, b, c) LEDS. RLY (illuminated) indicates the isolation relay is closed. Since RLY does not require the upper display (four alphanumeric digits), RLY may be accompanied by the V, I, F and P< parameter LEDS and alphanumeric display.

RMT (Remote) is independent of all other LEDS and is initially not illuminated upon AC power ON. When the PIP receives its GPIB listen address from the computer, RMT illuminates to indicate remote control. When this LED is lighted, the operator cannot edit the PIP setup (including test and reset) from the keyboard. RMT is disabled (not illuminated) only upon recycling AC input power, momentarily disconnecting the GPIB cable, or sending the GPIB GTL (Go To Local) command. RMT cannot be disabled via the keyboard.

3.3.2.2 Keyboard Control

Front panel control is via the 16-button keypad (refer to Figure 3-2). The keypad is implemented similar to the familiar calculator-like arrangement of numbers and multi-function keys.

Most of the PIP keys have a single solid white background color and are single stroke entry keys.

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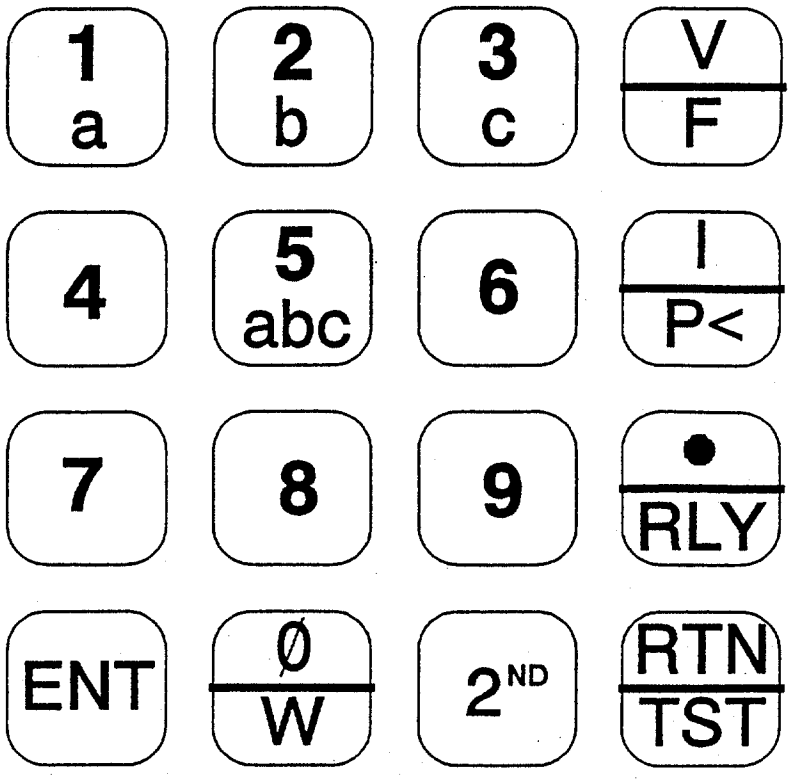


Figure 3-2. PIP 9023 Keyboard

Certain keys are dual colored with a white background on the upper half of the key and a yellow background on the lower half. The upper half function may be entered via a single keystroke. The lower half (yellow) function requires two keystrokes. The first keystroke is the all yellow background **2ND KEY**, then the desired lower half function key is pressed. For example, to specify voltage, press **V** or, to specify frequency, press **2ND** then **F**.

The **2ND** key also provides front panel control for the unmarked functions of Output Range Relay (2ND<1,...3> and for the Immediate Execute (no ENT) Output Relay control (2ND RLY).

Keys 1, 2, 3 and 5 are unique. These keys have two capabilities each and are displayed on single color background keys. First, the numeric face value is self-explanatory. Next, the keys are labeled with a, b, c and abc, respectively. These letters identify output phases individually (a or b or c) and simultaneously (abc), as required.

To avoid keyboard entries from inadvertently changing the remote programming setup, the display RMT LED signals a disabling of the keyboard edit and test functions. RMT is neither enabled nor disabled by any keyboard action; **RTN** and **TST** are the only keyboard functions which may be

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accessed while RMT is illuminated. These two keyboard functions are of inspection or monitoring nature and do not affect any output setup nor operation.

In local control, the **"OPEN SERVO"** and **"OVERVOLTAGE"** sensors are disabled. This is required for calibration.

The PIP is constantly checking for keyboard and operational errors. The PIP will not implement any erroneous or out of range instructions. If such a code is received, the previous setup is retained and an error message is displayed.

Table 3-5 identifies local control error messages. All messages are cleared by any local keystroke or remote input.

Table 3-5. Local Operation Fault Codes

Code	Interpretation
FC74	Keyboard Syntax Error
FC75	Keyboard Command Error
FC71	A Phase Current Limited
FC72	B Phase Current Limited
FC73	C Phase Current Limited

3.3.2.3 Programming Via The Keyboard

Keyboard entry is via the following sequence:

'V, I, F and P<'

For setup of Voltage (V), Current Limit (I), Frequency (F), and Phase Angle (P<) use the following format:

<FUNCTION> <PHASE> <VALUE> ENT

Refer to Table 3-6 for setup guidelines and Table 3-7 for examples of parameter setup.

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Table 3-6. Parameter Setup Guidelines

Parameter	Set To	Additional Instructions
Voltage (V)	0.1 VAC Resolution	Use the correct output voltage range ('2ND' '1', etc.).
Current Limit (I)	0.01 Amps Resolution	00.00 amps disables the current limit feature.
Frequency (F)	0.1 Hz Resolution <1000 Hz 1 Hz Resolution ≥1000 Hz	No phase entry since frequency always applies to all three phases simultaneously.
Phase Angle (P<)	0.5° (internal round off to 0.5)	None.

Table 3-7. Parameter Setup Examples

Entry	Display	Meaning
V c 82 ENT	082.0 c V	Setup voltage of 82 VAC on Phase C only.
V abc 117.19 ENT	117.2 abc V	Setup voltage on all three phases to 117.2 VAC.
I a 1.123 ENT	01.12 a I	Setup current limit of 1.12 Amps on Phase A.
I abc 0.55	00.55 abc I	Setup current limit of 0.55 Amps on all three phases.
2ND F 59.9 ENT	059.9 F	Setup frequency of 59.9 Hz (reminder: there was no phase entry).
2ND F 400 ENT	0400 F	Setup frequency of 400 Hz.
2ND P< 222.7 ENT	222.5 b P<	Setup phase angle on Phase B to 222.5° (the .7 was rounded off to .5).
2ND P< abc 123.4 ENT	123.5 abc P<	Setup phase angle to 123.5° on all phases for coherent output.

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3.3.2.4 Output Relay and Voltage Range

To setup (initiate) the output voltage range and output relay, (RLY) the below listed sequences are used. These sequences are unique by their implementation of ENT and unlabeled functions.

For these functions, hot switching is eliminated since the PIP 9023 intelligently programs the voltage momentarily to zero during relay movement and associated settling time.

For setup of the output voltage range, use:

- **'2ND 1'** for 0 to 67.5VAC;
- **'2ND 2'** for 0 to 135VAC; or
- **'2ND 3'** for 0 to 270VAC.

To change the setup of the output relay (RLY), use:

- **'2ND RLY'**

3.3.2.5 RTN (Return)

To Return (RTN) the setup parameters back to the front panel display, use:

<FUNCTION> <PHASE> RTN

Refer to Table 3-8 for Return (RTN) guidelines and Table 3-9 for RTN examples.

Table 3-8. RTN Setup Guidelines

Parameter	Meaning/Instructions
<PHASE>	Simultaneous phases (abc) are invalid.
Frequency (F)	No phase entry since frequency simultaneously applies to all three phases.
Relay (RLY)	Do not specify as a function with RTN. The Relay Status LED automatically accompanies the other functions returned.
Wattage (W)	Do not specify with RTN. This is not a setup parameter.

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Table 3-9. RTN Setup Examples

Entry	Display	Meaning
V c RTN	082.0 c V	Setup for Phase C voltage is 82.0. The RLY LED is not illuminated; thus, the output is not connected.
2ND P< b RTN	120.0 b P< RLY	Setup for Phase B phase angle is 120.0°. Output relay is connected.
2ND F RTN	0400 F abc	Setup frequency is 400 Hz.

3.3.2.6 TST (Test)

Test (TST) activates internal circuitry to measure the actual output (not setup) values of voltage, current, frequency, phase angle and wattage. Voltage, current and wattage are all true RMS values.

The power factor is included for wattage measurements. During test (TST), the selected phase angle display LED blinks. Any keystroke cancels test (TST).

To initiate Test (TST) use:

<FUNCTION> <PHASE> 2ND TEST

Refer to Table 3-10 for Test (TST) guidelines and Table 3-11 for TST examples.

3.3.2.7 Full Local Examples

Table 3-12 provides various examples of PIP 9023 inputs.

Table 3-10. TST Setup Guidelines

Parameter	Meaning/Instructions
Phase	Simultaneous phase (abc) is invalid.
Frequency	No phase entry since frequency simultaneously applies to all three phases. The voltage must be a minimum of 15 VAC or a command error will result.
Phase Angle (P<)	The voltage must be a minimum of 15 VAC or a command error will result.
Wattage (W)	Both the V and I LEDs are simultaneously illuminated.

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Table 3-11. TST Setup Examples

Entry	Display	Meaning
V a 2ND TST	121.5 a RLY	The Phase A LED is blinking. The measured value of Phase A voltage is 121.5 VAC. The output relay on Phase A is closed.
I b 2ND TST	01.12 b I RLY	The Phase B LED is blinking. The measured value of Phase B current is 1.12 amps.
2ND F 2ND TST	0400 F abc	The Phase ABC LEDs are blinking. The measured frequency is 400 Hz.
2ND W b 2ND TST	87.5 6 VI RLY	The Phase B LED is blinking. The measured output wattage on Phase B is 87.5 watts.

Table 3-12. Full Local Examples

Parameter	Meaning
2ND ENT	Initiate configuration test. After a few moments the display will indicate **0000**. The instrument then returns to power on defaults.
V a RTN	The display is **0000 a V**. No voltage is programmed.
2ND 2	This sets the output range on 0 to the 135 VAC range.
V abc 120.1 ENT	The instrument is set up for 120.1 VAC on all phases.
I abc 1.02 ENT	The instrument is set up for a current limit of 1.02 amps on all phases.
I c 0.5 ENT	This reduces the Phase C current limit to 0.5 amps.
2ND F 390 ENT	This sets the setup frequency to 390 Hz.
2ND P< c 117.4	This sets the setup phase angle on Phase C to 117.5° (note the round off from .4 to .5).
I c 2ND TST	The display is **00.00 c I**. The Phase C LED is blinking but no current is being drawn.
2ND RLY c	This command illuminates the c and RLY LEDs as the Phase C output relay is closed.
I c 2ND TST	The display now reads the output current on Phase C.
2ND RLY c	This command turns off the output on Phase C. The display shows the c LED illuminated, but the RLY LED is not illuminated.

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3.3.3 Remote ABLE Control

ABLE, via the GPIB, provides the Programmer with a flexible format for numerical entry. Channel numbers do not require the leading zero(s). Other numeric entries use the free format defined in the syntax listed in paragraph 3.3.3.1. The polarity of the voltage entered automatically determines the state of the polarity relays, so there is no need for a POL parameter.

There are no ENT or EXT commands in remote programming. The remote programming equivalent is the terminator automatically sent by the controller at the end of the programming string. Programming strings sent via the GPIB to the PIP 9023 must be terminated with carriage return line feed (HEX 0D0A).

The ABLE language format allows the message to contain several functions to be programmed in the same message string. All parts of the message string will be parsed and checked prior to entering any part of the message. There is no set sequence or priority of functions in the message string. Exceptions to the stringing are: SYNC, TST XX, and GAL. The message separator is a comma (,).

3.3.3.1 Remote Programming in ABLE

NOTE

In the following programming examples, the entire command string is enclosed in quotation marks to separate the command strings from the supporting text. In actuality, the quotation marks are not sent.

"VOLTA"

Function:

Programs voltage on Phase A.

Example:

"VOLTA 100"

This programs Phase A for 100 volts. The value must be expressed as a floating point.

"VOLTB"

Function:

Programs voltage on Phase B.

Example:

"VOLTB 100"

This programs Phase B for 100 volts. The value must be expressed as a floating point.

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"VOLTC"

Function:

Programs voltage on Phase C.

Example:

"VOLTC 100"

This programs Phase C for 100 volts. The value must be expressed as a floating point.

"VOLTS"

Function:

Programs voltage on all three phases simultaneously.

Example:

"VOLTS 100"

This programs all three phases for 100 volts. The value must be expressed as a floating point.

"CURLA"

Function:

Programs the current limit on Phase A to 10 amps.

Example:

"CURLA 10"

This programs the current limit on Phase A to 10 amps. The value must be expressed as a floating point.

"CURLB"

Function:

Programs the current limit on Phase B to 10 amps.

Example:

"CURLB 10"

This programs the current limit on Phase B to 10 amps. The value must be expressed as a floating point.

"CURLC"

Function:

Programs the current limit on Phase C to 10 amps.

Example:

"CURLC 10"

This programs the current limit on Phase C to 10 amps. The value must be expressed as a floating point.

"CURLS"

Function:

Programs current limits on all three phases simultaneously.

Example:

"CURLS 10"

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This programs the current limit on all three phases to 10 amps. The value must be expressed as a floating point.

"PANGA"

Function:

Programs the Phase A angle relative to the Master Phase A in a multiple PIP 9023 setup. Both PIP 9023s must be interconnected for sync capabilities (see SYNC command below). This command can only be sent to the slave PIP 9023.

Example:

"PANGA 60.0"

This command programs Phase A of the slave to 60.0° with respect to Phase A of the Master. The value must be expressed as a floating point.

"PANGB"

Function:

Programs the Phase B phase angle with respect to Phase A.

Example:

"PANGB 238.8"

This programs Phase B to 238.8° with respect to Phase A. The value must be expressed as a floating point.

"PANGC"

Function:

Programs the Phase C phase angle with respect to Phase A.

Example:

"PANGC 238.8"

This programs Phase C to 238.8° with respect to Phase A. The value must be expressed as a floating point.

"FREQ"

Function:

Programs the system output frequency.

Example:

"FREQ 500"

This programs the frequency to 500 Hz. The value must be expressed as a floating point.

"LOCK"

Function:

Locks out the Servo Test Functions; Open Servo and Overvoltage.

"UNLK"

Function:

Enables the Servo Test functions.

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"SYNC"

Function:

Synchronizes two interconnected PIP 9023s.

NOTE

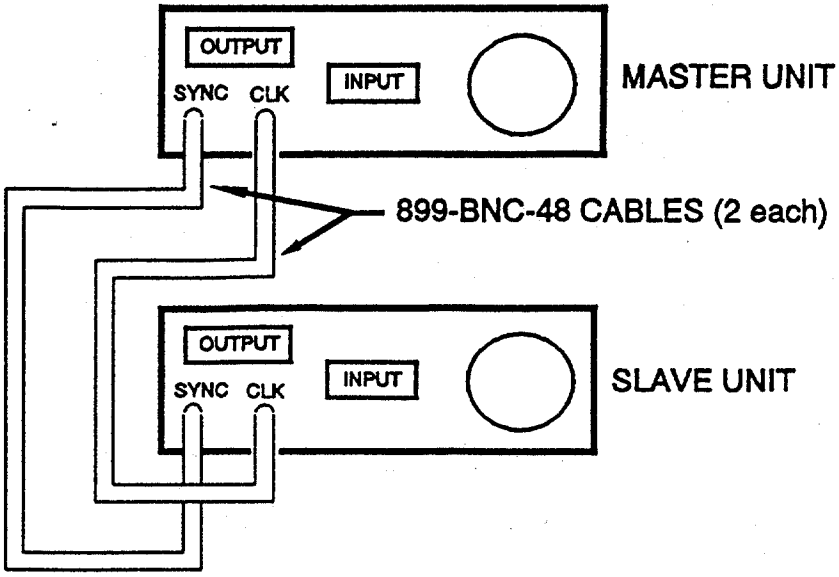
The BNC connectors on the rear panel of the AC Power Sources route the sync signals to or from the associated PIP. For PIP 9023 synchronization, two cables are attached to the BNC connector marked "SYNC" on the rear panel of both AC Power Sources and the second cable is attached to the BNC connector marked "CLK" on the rear panel of both AC Power Sources.

The PIP 9023 oscillator has the capability of either SYNC MASTER or SYNC SLAVE operation. This is determined by the position of the red DIP switch, S1, located in the center of the Main (bottom) Board.

The sync switch on the Main Board S1 is factory set for SYNC OUT or MASTER (C1 position) configuration. To set the PIP 9023 oscillator to the SYNC IN or SLAVE configuration, set the Main Board S1 to the C2 position. The "SYNC" command is sent via the IEEE-488 GPIB to the slave unit to synchronize the signals to the master unit.

Refer to Figure 3-3 for cable connections.

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NOTE

CHECK THE SETTINGS OF S1 ON THE MAIN BOARD ASSEMBLY ON BOTH PIP 9023 PLUG-INS TO DETERMINE THE MASTER/SLAVE CONFIGURATION. REFER TO THE PIP 9023 SERVICE MANUAL FOR ADDITIONAL INFORMATION.

Figure 3-3. SYNC Connections

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"TST"

Function:

Tests for specified conditions using the self-test circuitry.

To measure the indicated function, prepare the message and set **SRQ 79** (Dec) if the Talk address is not yet received. If the Talk address is sent before the measurement cycle is completed, SRQ is not set. The TST XX message MUST be sent STAND-ALONE and not part of a message string.

The **"TST"** command must be modified to select the desired test as listed below in Table 3-13.

"CLS"

Function:

Closes the Output Disconnect Relay.

"OPN"

Function:

Opens the Output Disconnect Relay.

Table 3-13. TST Commands

Command	Purpose
TST VA	To test the Voltage on Phase A.
TST VB	To test the Voltage on Phase B.
TST VC	To test the Voltage on Phase C.
TST IA	To test the Output Current on Phase A.
TST IB	To test the Output Current on Phase B.
TST IC	To test the Output Current on Phase C.
TST WA	To test the Output Power on Phase A.
TST WB	To test the Output Power on Phase B.
TST WC	To test the Output Power on Phase C.
TST PB	To test the Phase B phase angle with respect to Phase A.
TST PC	To test the Phase C phase angle with respect to Phase A.
TST FR	To test the Output Frequency.

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"GAL"
(Go Alternate Language)

Function:

To go to the Alternate Language (for example, to go to the DAP language). Refer to Table 3-14 for GAL measurement codes and messages.

NOTE

GAL must be sent STAND-ALONE and not as part of a message string.

Table 3-14. GAL Measurement Codes and Messages

Code	Returned Message	Interpretation
GAL VA	VA = XXX.X0	Phase A volts.
GAL VB	VB = XXX.X0	Phase B volts.
GAL VC	VC = XXX.X0	Phase C volts.
GAL IA	IA = XX.XX0	Phase A current.
GAL IB	IB = XX.XX0	Phase B current.
GAL IC	IC= XX.XX0	Phase C current.
GAL WA	WA = XXXX.0	Phase A watts.
GAL WB	WB = XXXX.0	Phase B watts.
GAL WC	WC = XXXX.0	Phase C watts.
GAL PB	PB = XXX.X0	Phase Angle A to B (degrees).
GAL PC	PC = XXX.X0	Phase Angle A to C (degrees).
GAL FR	FR = XXXX.0	Frequency (hertz).

NOTE

Phase angle measurements are degraded when the phase voltage is <50 VAC. <X> is a numeric digit, 0 through 9. All values end with zero.

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3.3.4 DAP Language Syntax

In the DAP language, the PIP only recognizes numbers 0 through 9 and letters A, B, C, D, E, F, G, H, L, and R. Any other ASCII character will be ignored.

The entry sequence will be as follows:

- Enter four numbers (the decimal is not sent as it would be ignored) and then a letter.
- Enter the letter. The letter, when sent, executes the function. No <CR><LF> need be sent, but if sent will be ignored. Ignored characters will receive a normal handshake, but are not further recognized.

Table 3-15 provides the meaning of the letters used in the DAP Language.

Table 3-15. Meaning of DAP Letters

Letter	Meaning
A	A Phase Voltage
B	B Phase Voltage
C	C Phase Voltage
D	B Phase Angle
E	Simultaneous Voltage to all Phases
F	Frequency
G	C Phase Angle
H	Voltage Range: 0000H = 135V range 4000H = 270V range 6000H = 67.5V range
L	Go to Alternate Language. Go to ABLE Language.
R	Disconnect Relay: 0000R = Open 0001R = Close

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Examples:

1100E

This command would set all phases to 110.0 volts.

1105A1150B1205C0400F0001R

This command would set Phase A to 110.5 volts, Phase B to 115 volts, Phase C to 120.5 volts, Frequency to 400 Hz, and close the Disconnect Relay.

NOTE

The string messages are position dependent in the DAP language. The letter, when received, executes that function at that time, prior to receiving the next part of the message. In the example immediately above, this is why the 0001R is sent last in order to allow the unit to be programmed prior to closing the Disconnect Relay. The DAP language does not allow service requests nor does it check entered values.

3.4 FAULT INDICATIONS VIA SRQ STATUS BYTES

Table 3-16 describes each Service Request status byte, its meaning, and any other effects encountered.

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Table 3-16. SRQ Status Bytes

Status Byte	Meaning	Other Effects
64	Servo Error	Will shut down power source.
67	Overvoltage Error	Will shut down power source.
71	Current Limit A Phase	Will shut down power source.
72	Current Limit B Phase	Will shut down power source.
73	Current Limit C Phase	Will shut down power source.
74	Syntax Error	Mistaken entry.
75	Command Error	Wrong value sent.
76	Input Buffer Overflow	Input message >128 bytes.
78	Test Board Overloaded	
79	Test Board Data Available	

3.5 CUSTOMER SERVICE/ PRODUCT ASSISTANCE

Answers to questions concerning installation, use, or calibration of ELGAR equipment are available from our Repair Department, 9250 Brown Deer Road, San Diego, CA 92121-2294 (858)450-0085.

Please contact ELGAR prior to returning any instrument for repair.

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APPENDIX A

LIST OF ACRONYMS

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APPENDIX A - LIST OF ACRONYMS

The following acronyms are common to this manual:

ABLE	ATLAS Based Language Extension
AH	Acceptor Handshake
ATE	Automatic Test Equipment
ATN	Attention
C	Controller
CLK	Clock
CLS	Close
CR	Carriage Return
CURL	Current Limit
DAB	Data Byte
DAC	Data Accepted
DAV	Data Valid
DC	Device Clear
DCL	Device Clear
DT	Device Trigger
ENT	Enter
EXT	Exit
F.S.	Full Scale
FREQ	Frequency
GAL	Go to Alternate Language
GTL	Go To Local
GPIB	General Purpose Interface Bus
IEEE	Institute of Electrical and Electronics Engineers
IFC	Interface Clear
L	Listener
LED	Light Emitting Diode
LF	Line Feed
MLA	My Listen Address
MTA	My Talk Address
OPN	Open
PANG	Program Angle
PIP	Plug-In Programmer
POL	Polarity
PP	Parallel Poll
REN	Remote Enable
RFD	Ready For Data
RL	Remote/Local
RLY	Relay
RMT	Remote

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RTN	Return
SDC	Selective Device Clear
SH	Source Handshake
SR	Service Request
SRQ	Service Request
T	Talker
TE	Extended Talker
THD	Total Harmonic Distortion
TST	Test
TTL	Transistor-Transistor Logic
UNL	Unlisten
UNLK	Unlock
UNT	Untalk

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APPENDIX B

IEEE-488 INTERFACE CONNECTIONS

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IEEE-488 INTERFACE CONNECTIONS

PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	D101	13	D105
2	D102	14	D106
3	D103	15	D107
4	D104	16	D108
5	EOI	17	REN
6	DAV	18	GND(6)
7	NRFD	19	GND(7)
8	NDAC	20	GND(8)
9	IFC	21	GND(9)
10	SRQ	22	GND(10)
11	ATN	23	GND(11)
12	SHIELD	24	LOGIC COMMON

NOTE

GND(n) refers to the signal common return of the referenced contact.

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NOTES

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