ELGAR

PLUG-IN PROGRAMMER

MODEL PIP 9012A

OPERATING MANUAL

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ELGAR TWO-YEAR WARRANTY

Elgar Electronics Corporation (hereinafter referred to as Elgar) warrants its products to be free from defects in material and workmanship. This warranty is effective for two years from the date of shipment of the product to the original purchaser. Liability of Elgar under this warranty shall exist provided that:

- the Buyer exposes the product to normal use and service and provides normal maintenance on the product;
- Elgar is promptly notified of defects by the Buyer and that notification occurs within the warranty period;
- the Buyer receives a Return Material Authorization (RMA) number from Elgar's Repair Department prior to the return of the product to Elgar for repair, phone 800-73-ELGAR (800-733-5427), ext. 2295;
- the Buyer returns the defective product in the original, or equivalent, shipping container;
- if, upon examination of such product by Elgar it is disclosed that, in fact, a defect in materials and/or workmanship does exist, that the defect in the product was not caused by improper conditions, misuse, or negligence; and,
- that Elgar QA seal and nameplates have not been altered or removed and the equipment has not been repaired or modified by anyone other than Elgar authorized personnel.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness of the product to a particular purpose. Elgar, its agents, or representatives shall in no circumstance be liable for any direct, indirect, special, penal, or consequential loss or damage of any nature resulting from the malfunction of the product. Remedies under this warranty are expressly limited to repair or replacement of the product.

CONDITIONS OF WARRANTY

- To return a defective product, contact an Elgar representative or the Elgar factory for an RMA number. Unauthorized returns will not be accepted and will be returned at the shipper's expense.
- For Elgar products found to be defective within thirty days of receipt by the original purchaser, Elgar will absorb all ground freight charges for the repair. Products found defective within the warranty period, but beyond the initial thirty-day period, should be returned prepaid to Elgar for repair. Elgar will repair the unit and return it by ground freight pre-paid.
- Normal warranty service is performed at Elgar during the weekday hours of 7:30 am to 4:30 pm Pacific time. Warranty repair work requested to be accomplished outside of normal working hours will be subject to Elgar non-warranty service rates.
- Warranty field service is available on an emergency basis. Travel expenses (travel time, per diem expense, and related air fare) are the responsibility of the Buyer. A Buyer purchase order is required by Elgar prior to scheduling.
- A returned product found, upon inspection by Elgar, to be in specification is subject to an inspection fee and applicable freight charges.
- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Elgar factory.

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SAFETY NOTICE

BEFORE APPLYING POWER to the System, verify that the PIP 9012A 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.

Ensure that the AC power line ground is properly connected to the PIP 9012A 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 9012A 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 may 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

1.1 INTRODUCTION

The Elgar Model PIP 9012A 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 9012A is a plug-in programmable oscillator test module specifically designed for use with Elgar AC Power Sources. The PIP 9012A 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 9012A 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 multi-phase capability as an oscillator, the PIP 9012A provides powerful measurement capabilities. Measurement is provided by local and remote control, and includes:

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

The PIP 9012A 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 9012A 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.

NOTE

The PIP 9012A is not recommended for use with Elgar "C" Series Power Sources due to servo problems.

1.3 PHYSICAL DESCRIPTION

The PIP 9012A is contained in a rectangular module approximately 7.25" (184.15 mm) wide, 3.5" (88.9 mm) high, and 8.0" (203.2 mm) 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 9012A 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

Ranges: 45 Hz to 99.99 Hz in 0.01 Hz steps; 45 Hz to 999.9 Hz in 0.1 Hz steps; 45 Hz to 5000 Hz 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: 0 to 135 VAC in 0.1 VAC steps; 0 to 270 VAC in 0.1 VAC steps.

Accuracy: ±0.2% of Full Scale (Full Scale) from 5% of Full Scale to Full Scale.

Temperature Coefficient: ±0.025% per °C average.

Line Regulation: ±0.015% for a 10% line change within line operating range.

Load Regulation: ±0.015% full wave average at point of sense, no load to full load.

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

1.4.4 Phase Angle

Separation: 120° for three phase; 90° for two phase; 60° for open delta.

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

1.4.5 Current Limit

Range: 5% to 100%.

Resolution: 0.01 Ampere.

Accuracy: ±1% of Full Scale ±1.0% of Reading.

Crest Factor: 3.5:1 minimum.

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

1.4.6 Measurement System (5% of Full Scale to Full Scale; 45 Hz to 5 kHz)

1.4.6.1 Voltage

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

1.4.6.2 Current

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

1.4.6.3 Power

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

1.4.6.4 Frequency

Range: 45 to 5000 Hz
Resolution: 2 Hz
Accuracy: 0.12% of Full Scale ±0.008% of Reading
Temperature Coefficient: 0.012% of Full Scale ±0.008% of Reading per °C

NOTE

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

NOTES

SECTION II

INSTALLATION

2.1 INTRODUCTION

The PIP 9012A 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 9012A is specifically designed for use only with Elgar AC Power Sources (with the exception of the "C" Series).

NOTE

INSTALLATION and OPERATION of the applicable AC Power Source is performed in conjunction with the PIP 9012A.

WARNING

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

The PIP 9012A 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 Service Department (see paragraph 3.6). 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 9012A 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 9012A 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 is a flexible GPIB ribbon cable. If the Test Board option is installed, there will be an additional cable connected to the PIP. Reinstall the PIP to ensure proper mechanical alignment and snug connector fit (do not bind the flexible cables during re-installation).

2.4 INSTALLATION

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

- GPIB Address
- Operating Modes
- Configuration
- J1 Connections on AC Power Source
- 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 9012A is installed by carefully connecting and inserting any loose cables. 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 9012A 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. After the internal GPIB connection is made, simply connect the GPIB cable (from the controller) to the 24 pin IEEE-488 connector on the rear of the associated AC Power Source.

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 9012A has talk capability).

Sliding an individual switch bit to the rear is ON, to the front 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.

Table 2-1 lists switch settings for various addresses.

Table 2-1. GPIB Listen Address Settings

	ASCII		GPIB LISTEN ADDR					
	CHARACTER	HEX	DEC	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

2.4.2 Operating Modes

2.4.2.1 Three Phase Operation

When the PIP 9012A is operated in Three Phase mode, the phase angles are fixed (120° apart). The amplitude of the B and C Phases is the same as that programmed for the A Phase.

2.4.2.2 90° Two Phase Operation

When the PIP 9012A is connected for two phase operation, the drive for the 90° phase is from the C Phase output of the PIP.

When two lows of the power sources are connected together, the A Phase is the reference (zero angle) and the second power source (driven by the C Phase) is the +90° phase.

2.4.2.3 60° Three Phase Open Delta Operation

When the PIP 9012A is connected for 60° open delta operation, the drive for the 60° phase is from the C Phase output of the PIP.

The two lows of the power source are connected together and the A Phase is taken across the A Phase power source. The C Phase is taken across the C Phase (second) power source and the B Phase is taken from the A Phase high to C Phase high.

2.4.3 Configuration

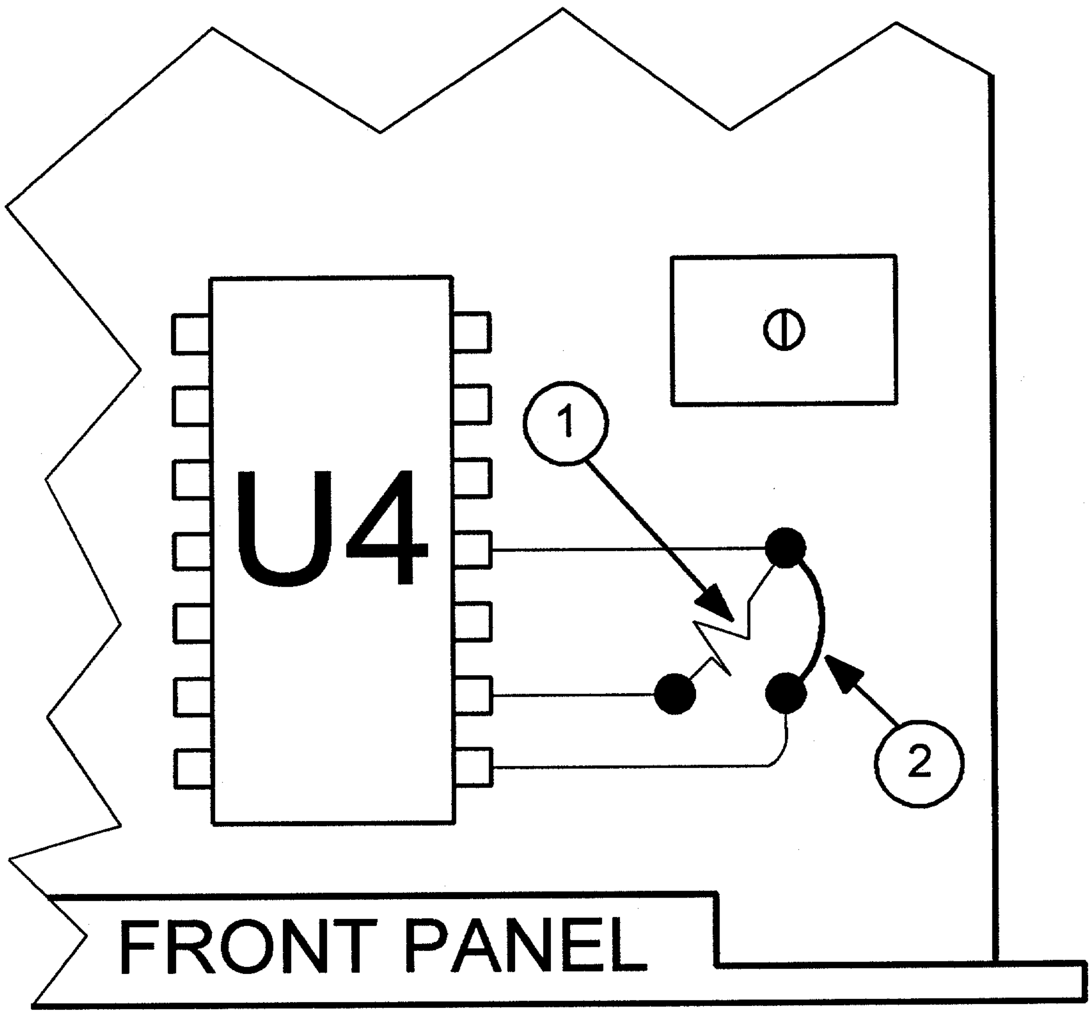
Perform the following:

2.4.3.1 Main Board

1. W1 jumper adjacent to U4 (refer to Figure 2-1). This is a clad jumper which must be cut and a jumper installed in the alternate configuration in order to activate. This will change the ZERO command so that zero crossing voltage change will always occur on the positive going swing of the sine wave and the PEAK command will no longer cause peak changes, but will now cause zero crossing changes when the sine wave is going in the negative direction. The jumper must be in the alternate position to utilize the DROP command.

2. To change from 120°/240° three phase operation to 60° open delta operation, remove R50, CR16 and CR17.

3. To change from 120°/240° three phase operation to 90° two phase operation, remove CR16 and CR17.



TOP VIEW OF MAIN BOARD

FOR ALTERNATE POSITION:

1. CUT CLAD.
2. ADD JUMPER

Figure 2-1. Main Board W1 Jumpering

2.4.3.2 Microprocessor Board

1. The memory expansion jumper is a factory configuration only and thus is not field changeable.

2. The W1 jumper (next to address switch) is normally open. If installed, this jumper causes the microprocessor to recognize DAP type language in place of the ABLE language. On models with Test Boards, this jumper determines the scaling of the readouts (refer to Program Selection below).

2.4.3.3 Program Selection

1. PROM program 1200 is used for a PIP 9012A without a Test Board.

2. PROM program 1211 is used for single phase AC Power Sources up to a power level of 1000VA. The 500VA Test Board range is set by having jumper W1 OPEN. The 1000VA Test Board range is set by having jumper W1 CLOSED.

3. PROM program 1214 is used for single phase AC Power Sources up to a power level of 4000VA. The 2000VA Test Board range is set by having jumper W1 OPEN. The 4000VA Test Board range is set by having jumper W1 CLOSED.

4. PROM program 1231 is used for three phase AC Power Sources up to a power level of 1000VA per phase. The 500VA per phase Test Board range is set by having jumper W1 OPEN. The 1000VA per phase Test Board range is set by having jumper W1 CLOSED.

5. PROM program 1234 is used for three phase AC Power Sources up toa power level of 4000VA per phase. The 2000VA per phase Test Board range is set by having jumper W1 OPEN. The 4000VA per phase Test Board range is set by having jumper W1 CLOSED.

2.4.4 J1 Connections On The Power Source

Pin	Signal
1	Output Common
2	Phase B Output
3	Phase C Output
4	Phase A Output
5	+5V Relay (50 mA max)
6	Relay Drive (Range)
7	Sync Output
8	Relay Drive (Output)
9	Sense Common
10	Phase C Sense High
11	Phase B Sense High
12	Phase A Sense High
13	CT B Phase
14	CT C Phase
15	CT Common

2.4.5 External Sense

The external sense leads must be connected to the AC Power Source outputs. The PIP 9012A 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 source manual for additional hookup instructions.

REMINDER

Installation of the Model PIP 9012A must be performed in conjunction with installation of the AC Power Source. Proper AC input voltage and external sense must be verified prior to applying AC power to the system.

SECTION III

OPERATION

3.1 INTRODUCTION

The controls and display for the PIP 9012A 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 9012A 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 9012A 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.

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; and,
- Recall setup programming; and,
- Operator alert of error conditions.

3.2.2 IEEE-488/GPIB Definitions

The PIP 9012A 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.

Remote programming for the PIP 9012A 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 9012A 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 9012A 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

Table 3-2. Implemented Subsets on GPIB

Function	Subset	Definition
SH	SH1	Source handshake capability.
AH	AH1	Acceptor handshake capability.
T	T6	Talker (basic talker, serial poll, no talk only mode, unaddressed to talk if addressed to listen).
L	L4	Listener (basic listener, no listener only mode, unaddressed to listen if addressed to talk).
SR	SR1	Complete 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
- Functional Checkout

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 9012A 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.

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.

Current limit (CURL) of zero (only available with the Test Option) 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.

Table 3-3. Power On Default Settings

Parameter	Value
Frequency Range	5 kHz
Frequency	0400 Hz
Voltage Range	0-135 V
Voltage	Zero VAC - all phases
Current Limit	Zero Amps - all phases
Phase Angle A	0°
Phase Angle B	240°
Phase Angle C	120°
Disconnect Relays	Open
GPIB	Local (Keyboard) Control

3.3.2 Local (Display/Keyboard) Control

3.3.2.1 Display Control

Figure 3-1 identifies the various areas of the display. The left hand portion of the display contains a 4 digit alpha-numeric readout. In local, keyboard entries as well as measurement results are displayed. In remote, the programmed output and results of measurements are displayed.

The right hand portion of the display includes 6 LEDs. Five of the LEDs (VOLTS, FREQ, CLS, CURL, 260) denote when a parameter or range is being programmed. Each LED has a small number; this number corresponds to the code used to program that function. For example, in the keypad sequence **"1315 # 1"** the "1" tells the processor that the parameter being programmed is Voltage (discussed in detail in paragraph 3.3.2.2). The sixth LED (RMT) indicates the instrument is in Remote control via the GPIB.

RMT is independent of all other LEDs and is initially dark upon AC power ON. When the PIP receives its GPIB listen address from the controller, the RMT LED illuminates to indicate remote control operation. When this LED is illuminated, the operator cannot edit or change the PIP setup from the keyboard. RMT is disabled (darkened) only by recycling AC input power, or by using the GPIB IEEE function GTL (Go To Local). RMT cannot be disabled via the PIP keyboard.

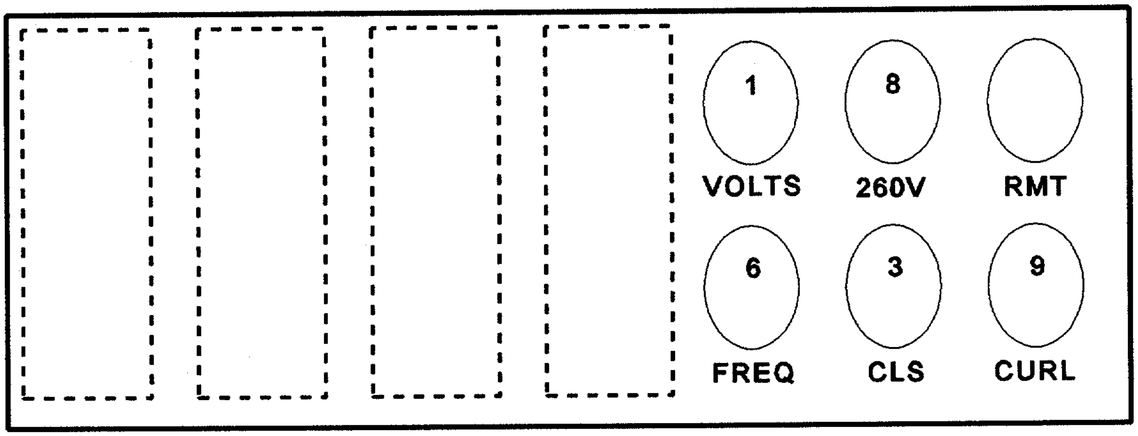


Figure 3-1. PIP 9012A Display

3.3.2.2 Keyboard Control

Front panel control is via the 12 button keypad (refer to Figure 3-2). The keypad is implemented similar to the familiar calculator-like arrangement of numbers and function keys.

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

The PIP 9012A is programmed via the keyboard by entering up to 4 digits, the "#" sign, and then a digit representing the function desired. Refer to Table 3-4 for the available functions.

Table 3-4. Local Keypad Functions

Digit	Function
1	Voltage
2	Voltage Dropout
3	Output Relay
4	Measure
5	Voltage
6	Frequency
7	Frequency Range
8	Voltage Range
9	Current Limit
#	Precedes Function Digit
*	Recall Programmed Parameter

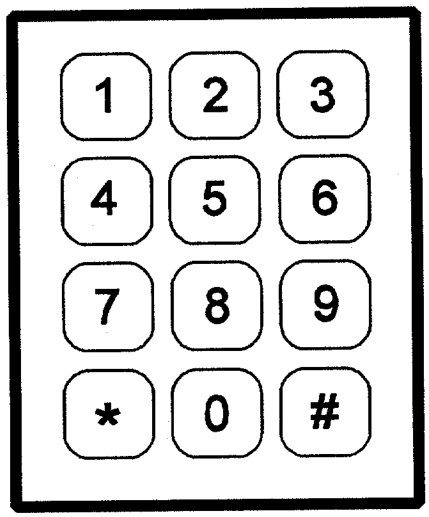


Figure 3-2. PIP 9012A Keyboard

3.3.2.3 Programming Via The Keyboard

To PROGRAM VOLTAGE:

Syntax: **<4 number keys> # 1**

Example:

1315 # 1 (Programs the voltage to 131.5V.)

The decimal is understood to be to the left of the last number. The display will now show the number with the decimal point indicating what has been loaded. If **c75** is displayed, an out of range entry has been attempted (refer to paragraph 3.4 for a list of fault indications). If this occurs, simply re-enter an in-range value and continue.

To PROGRAM FREQUENCY

Syntax: **<4 number keys> # 6**

Examples:

4775 # 6 (Programs the frequency to 47.75 Hz.)

4774 # 6 (Programs the frequency to 4774 Hz.)

The decimal is understood to be to the right of the four digits in the 5kHz range (0045Hz to 5000Hz), or to the left of the first digit in the 1kHz range (045.0Hz to 999.9Hz), or to the left of the second digit in the 100Hz range (45.00Hz to 99.99Hz). If the display reads c 75, an out of range entry has been attempted. If this occurs, simply re-enter an in-range value and continue.

To CHANGE the VOLTAGE RANGE

Syntax: **<0 or 1> # 8**

Examples:

0 # 8 (Sets the voltage range to 0-135.)

1 # 8 (Sets the voltage range to 0-270.)

The voltage drops to zero to allow the range change and must be re-programmed.

To CHANGE the FREQUENCY RANGE

Syntax: **<0 or 1 or 2> # 7**

Examples:

0 # 7 (Sets the frequency range to 45 to 99.99 Hz.)

1 # 7 (Sets the frequency range to 999.9 Hz.)

2 # 7 (Sets the frequency range to 5 kHz.)

Default frequencies are as follows:

Frequency Range	Default Frequency
45 to 99.99 Hz	60 Hz
999 Hz	400 Hz
5 kHz	400 Hz

To OPEN or CLOSE the OUTPUT RELAY

Syntax: **<0 or 1> # 3**

Examples:

0 # 3 (Opens the output relay.)

1 # 3 (Closes the output relay.)

To RECALL INFORMATION

Syntax: *** <1 or 6 or 9>**

Examples:

*** 1** (Recalls the programmed voltage.)

*** 6** (Recalls the programmed frequency.)

*** 9** (Recalls the programmed current limit.)

Information pertaining to ranges can be determined from the position of the decimal point once the value is recalled.

To DROP a NUMBER OF LINE CYCLES

Syntax: **<1 through 9> # 2**

Example:

1 # 2 (Drops two line cycles.)

This feature provides a convenient way to test power line drop out susceptibility.

The dropout programmed can be repeated by simply keying in " # 2 ".

This feature can only be operated if the Main Board W1 Jumper has been set to the alternate position. Refer to paragraph 2.4.3 for additional information.

NOTE

The following commands apply only if the optional **Test Board** is installed.

To SET a CURRENT LIMIT

Syntax: **<4 number keys> # 9**

Example:

0550 # 9 (Sets a current limit of 5.5A.)

The decimal is understood to be between the second and third digits.

NOTE

The current limit will not shut the oscillator down if the measurement function is in operation. To return the current limit to the limit of the amplifier, key in **0000 # 9**.

To MEASURE

Syntax: **<1 through 9> # 4**

Number Entered	Measurement Taken
0	Frequency
1	A Phase Voltage
2	B Phase Voltage
3	C Phase Voltage
4	A Phase Current
5	B Phase Current
6	C Phase Current
7	A Phase Wattage
8	B Phase Wattage
9	C Phase Wattage

Reading will continuously update until another key is pressed.

3.3.3 Remote ABLE Control

ABLE, via the GPIB, provides the PIP with a flexible format for numerical entry. Numeric entries use the free format defined in the syntax listed in paragraph 3.3.3.1.

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 9012A 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. 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.

"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.

"CURL"

Function:

Programs current limits on al lthree phase simultaneously.

Example:

"CURL 10"

This programs the current limit on allhree phases to 10 amps. 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.

"TEST N"

Function:

To test for specified conditions using the self-test circuitry.

All TEST N commands will cause the PIP 9012A to send SRQ and Status byte 79 when the measurement is complete. The controller should then send the PIP 9012A its talk address to receive the results. The TEST XX message MUST be sent STAND-ALONE and not part of a message string.

The "TEST" command must be modified to select the desired test as follows:

N =	Measures
0	Frequency
1	A Phase Voltage
2	B Phase Voltage
3	C Phase Voltage
4	A Phase Current
5	B Phase Current
6	C Phase Current
7	A Phase Wattage
8	B Phase Wattage
9	C Phase Wattage

"CLS"

Function:

Closes the Output Disconnect Relay. If system grounding is not clean, it will become necessary to program the output voltage to zero prior to sending "CLS". Zero volts should always be programmed first if the PIP 9012A is being programmed for over 130V.

"OPN"

Function:

Opens the Output Disconnect Relay. If system grounding is not clean, it will become necessary to program the output voltage to zero prior to sending "OPN". Zero volts should always be programmed first if the PIP 9012A is being programmed for over 130V.

"RNG"

Function:

Sets the amplitude range.

Examples:

"RNG 0"

This command sets the amplitude range to 135 V.

"RNG 1"

This command sets the amplitude range to 270 V.

"RNGF"

Function:

Sets the frequency range.

Examples:

"RNGF 0"

This command sets the 99.99 Hz range.

"RNGF 1"

This command sets the 999.9 Hz range.

"RNGF 2"

This command sets the 5 kHz range.

"ZERO"

Function:

When included in a message string, ZERO directs the PIP 9012A to wait for the next zero crossing to change voltage and frequency. ZERO will clear after each use and must be in the message string that contains the VOLT or FREQ change.

Example:

"ZERO, VOLTS 88.8"

This command programs the PIP 9012A to 88.8V at the next zero crossing.

"PEAK"

Function:

To wait for the peak of the next sine wave to change voltage and frequency. This command will clear after each use and must be in the message string that contains the VOLT or FREQ change.

Example:

"VOLTS 1.15E+2, FREQ 444, PEAK"

This command programs the PIP 9012A to change the voltage to 115V and the frequency to 444 Hz at the next peak of the waveform.

"OVER"

Function:

Inhibits checking of the voltage and frequency input limits.

CAUTION

USE "OVER" WITH CARE; DAMAGE TO THE ASSOCIATED POWER SOURCE COULD RESULT!

"DROP N"

Function:

Programs the PIP 9012A to drop out "N" number of line cycles. This command is a convenient way to test for power line problem susceptibility. N can equal any number from 1 to 9.

For this function to work, Jumper W1 on the Main Board must be in the alternate position. If the Test Board is installed, this will cause the FREQ test to read 1/2 the frequency. If R25 on the Test Board is increased to 21k ohms, then R23 will calibrate the FREQ test properly. Refer to paragraph 2.4.3 for additional information.

DROP is a stand-alone command.

A TTL compatible sync pulse, whose falling edge occurs at the start of drop out, appears at pin 7 of the rear panel J1 connector.

When using the DROP command, after approximately 15 ms of drop, there will be some undershoot when returning to the programmed voltage. This will vary from zero to approximately 7% after 100 ms of drop out. The undershoot will completely recover in approximately 5 line cycles at the programmed frequency.

Example:

"DROP 6"

This command programs the PIP 9012A to drop out 6 cycles of input power.

"OFF"

Function:

Places the output voltage to zero at the next zero crossing. OFF may be reprogrammed or changed by the ON command (see below). OFF is a stand-alone command.

"ON N"

Function:

If the previous command was "OFF", this command returns the voltage to the original value at a time determined by the variable N. ON is a stand-alone command.

Examples:

"ON 0"

This command immediately returns the voltage to the original value.

"ON 1"

This command returns the voltage to the original value at the next zero crossing of the waveform.

"ON 2"

This command returns the voltage to the original value at the next peak of the waveform.

3.3.3.2 Remote Programming Message String Examples

"VOLTS RNG1, 1.56E+2, FREQ 600, PEAK" <CR><LF>

This string changes the voltage and frequency to 156 volts at 600 Hz at the next peak of the waveform.

"ZERO, VOLTS 50" <CR><LF>

This string changes the voltage to 50 volts at the next zero crossing.

"FREQ 7500E-1" <CR><LF>

This string changes the frequency to 750 Hz without waiting for the next zero crossing or peak of the waveform.

NOTE

In all of the above examples, each string is terminated with carriage return/line feed (<CR><LF>).

3.3.4 DAP Language Syntax

DAP input format is not available if the Test Board is installed. If the PROM on the processor is labeled "1200" the DAP format may be accessed by installing the jumper W1 on the processor board. Refer to paragraph 2.4.3 for further information.

In the DAP language, the PIP only recognizes numbers 0 through 9 and letters A, E, and F ("A" and "E" are alternates). 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.

Meaning of the letters in the DAP Language:

A = Amplitude
E = Amplitude (alternate)
F = Frequency

Examples:

0400F1200A

This command would set the frequency at 400 Hz at 120 VAC.

1200A0060F

This command would set the voltage and frequency to 120V at 60 Hz.

1080A0046F

This command would set the voltage and frequency to 108V at 46 Hz.

NOTE

<CR> <LF> or <EOI> **MUST** be sent after the string. 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. The DAP language does not allow service requests nor does it check entered values.

3.4 FAULT INDICATIONS VIA SRQ STATUS BYTES

Table 3-5 describes each Service Request status byte, its meaning, and any other effects encountered.

Table 3-5. 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	Measurement Complete	Send talk address.

3.5 FUNCTIONAL CHECKOUT

Perform the following:

1. Connect a GPIB controller to the input connector on the rear of the power source.

2. Set the address switch of the PIP 9012A to a proper address (the PIP is normally shipped at 17 decimal - see Table 2-1).

3. Turn ON the AC Power Source.

4. Have the GPIB controller send **ATN/ADDRESS** with **REN** true and **IFC** false.

5. Have the GPIB controller send **"VOLTS 100, FREQ 800" <CR><LF>**. The output of the power source should be 100 volts at 800 Hz.

6. Have the GPIB controller send **"OFF" <CR><LF>**. The output should drop to zero volts.

7. Have the GPIB controller send **"ON 1" <CR><LF>**. The output should return to 100 volts at 800 Hz.

8. Open the servo loop. The output should drop to zero and the PIP 9012A should set SRQ. Upon Serial Poll, status byte **64** should be returned.

9. Close the servo loop and program **"VOLTS 1.15E+2"**. The output should go to 115 volts at 800 Hz.

10. Have the GPIB controller send **ATTN-SDC**. The output should drop to zero.

3.6 CUSTOMER SERVICE/ PRODUCT ASSISTANCE

Answers to questions concerning installation, use, or calibration of ELGAR equipment are available from our Repair Department.

Please contact ELGAR prior to returning any instrument for repair.

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APPENDIX A

IEEE–488 INTERFACE CONNECTIONS

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.

NOTES