Established 1981
Advanced Test Equipment Rentals
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# Plug-In Programmers (PIPs) and Manual Oscillators

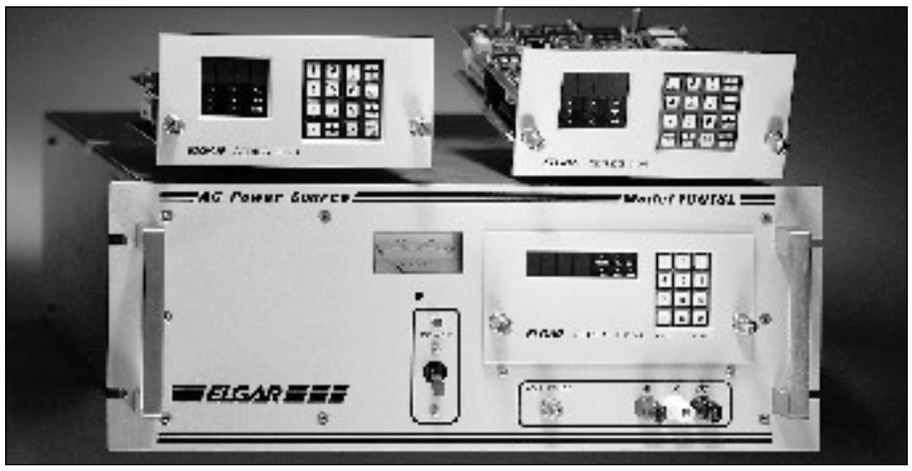
## PRODUCT OVERVIEW

To produce the output voltages and frequencies required to drive the company's broad line of AC power sources, Elgar designed a family of oscillators and plug-in programmers.

Elgar Plug-In Programmers (PIPs) are microprocessor-based, multi-function system components that can be programmed to control amplitude, frequency, phase angle, current limits and a variety of special built-in functions.

The PIP 704 is a Plug-In Programmable Transient Generator that includes all the critical test parameters of MIL-STD-704 for "Aircraft Electrical Power Characteristics" pre-programmed and ready to use at the touch of a button or over the IEEE-488 bus.

Elgar's family of plug-in oscillators provides users with maximum flexibility and optimum price performance for both manually adjustable and fixed frequency applications.




PIP 704, PIP 9023 and PIP 9012A

Elgar offers a two year warranty on the manual oscillators, PIPs and the SL, SX and B Series power supplies.

The table below cross-references application needs with the Elgar plug-in programmers and manual oscillators designed to meet them. Just turn to the indicated page number for product details.

**Selection Guide**

| Elgar Series | CE | Fixed Frequency Output | Variable Frequency Output | Manual Front Panel | IEEE-488 Programmable Operation Control | Resistance or Voltage Programming | Resistance or Voltage Programming Output Freq | Transient Testing Dropout Output Volts | Independent Voltage and Phase Output Capability | Test Readback Option Control |
|---|---|---|---|---|---|---|---|---|---|---|
| PIP 9012A | | | ■ | ■ | ■ | | | ■ | | ■ |
| PIP 9023 | | | ■ | ■ | ■ | | | | ■ | ■ |
| PIP 704 | | | ■ | ■ | ■ | | | ■ | ■ | ■ |
| 400 | | ■ | | | | | | | | |
| 400 SP | | ■ | | | | | ■ | | | |
| 400 SD | | | ■ | ■ | | | ■ | | | |
| 400 CV | | | ■ | ■ | | ■ | ■ | | | |
| PIP 9012AE | ■ | | ■ | ■ | ■ | | | ■ | | ■ |

CE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## PRODUCT OVERVIEW

Elgar PIPs are ready to plug in to any of our full line of AC linear power sources. They are programmable via the IEEE-488 GPIB bus, or locally from the front panel keypad.

Whether controlled power is needed for automated test equipment (ATE), aircraft ground support, production lines or laboratories, PIPs provide reliable programming that is easy to use. Elgar programmers are used in aerospace, military, commercial and telecommunications electronic applications around the world.

All Elgar PIPs have a two-year limited warranty.

## STANDARD ON ALL PIPS

### BUILT-IN TEST DIAGNOSTICS

Built-In Test (BIT) provides continuous self-testing for overvoltage, open sense leads and overcurrent. It shuts down the output voltage when any discrepancies occur between actual and programmed values.

### DISCONNECT RELAY

The output voltage is automatically programmed to zero during relay transfer time with off and on executed at zero crossings. This feature requires the "D" option on the AC power source.

### REMOTE SENSING

This feature provides full programming accuracy without sacrificing response time. Programming from zero volts to full scale takes less than 1 ms to within ±1% of full ms scale or to within ±0.2% of full scale in less than 50 ms.

## OPTIONS

### TEST OPTION (BITE)

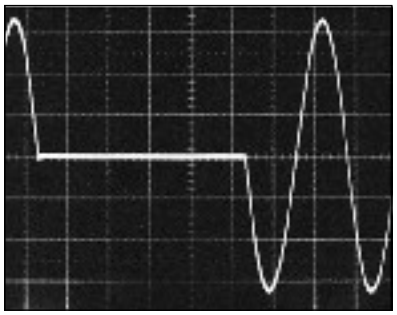
Optional Built-In Test Equipment (BITE) limits the need for extra test equipment by monitoring output frequency, RMS voltage, RMS current and true watts. It requires the test option on the AC power source. It includes current limit programming, which protects units under test (UUT's) by limiting current to each UUT's specific maximum requirements.

*The chart below details the standard functions of each PIP and the options available. If you have special power applications, please call your local representative or a member of our service team to discuss how custom functions can be added.*

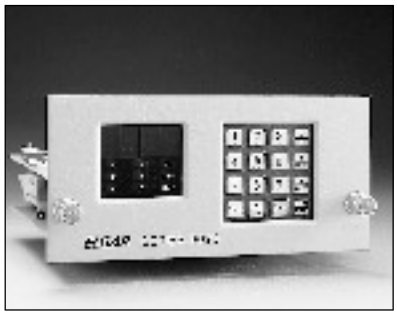
**PIP Comparison**

| | 9012A/AE | 9023 | 704 |
|---|---|---|---|
| AC transient generation | | | ■ |
| Amplitude modulation input capability | | | ■ |
| Auto-ranging frequency | | ■ | |
| Built-In Test (BIT) diagnostics | ■ | ■ | ■ |
| Local control/display | ■ | ■ | ■ |
| Multi-system phase lock | | ■ | ■ |
| Preprogrammed MIL-STD-704D testing | | | ■ |
| Programmable flat top distortion | | | ■ |
| Programmable frequency range | ■ | Auto | Auto |
| Remote sensing | ■ | ■ | ■ |
| Synchronization pulse output | ■ | | ■ |
| Voltage drop-outs | ■ | | ■ |
| Voltage range programming | ■ | ■ | ■[2] |
| Zero, peak, or random command | ■ | | |
| **Optional functions** | | | |
| Built-In Test Equipment (BITE) | ■ | ■ | ■ |
| Current limit programming | ■ | ■ | ■ |
| Output disconnect relay[1] | ■ | ■ | ■ |

[1] The AC source must have a disconnect option
[2] Switch selectable from internal range switch



PIP 9012A Line Drop-out



PIP 9023

PIP 704

## PIP 9012A/PIP 9012AE (CE)

The PIP 9012A/AE features remote programming or local control via a 12-pad keyboard with display and function enunciators. The 9012A/AE provides full GPIB control of simultaneous voltage and frequency and has a 1 to 9 full or half cycle dropout capability. With the test option, the front panel display becomes a digital meter to read the RMS volts, amps, watts and frequency.

The PIP 9012A/AE is well suited for applications such as pass/fail incoming inspection testing.

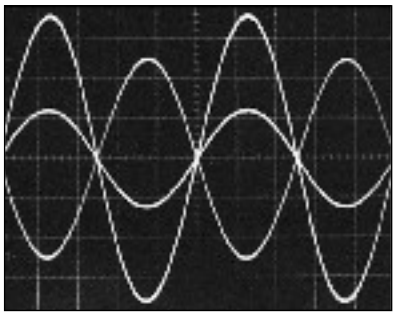
The oscilloscope picture, above (left), is a two cycle voltage drop-out from a "DROP 2" command to a PIP 9012A.

## PIP 9023

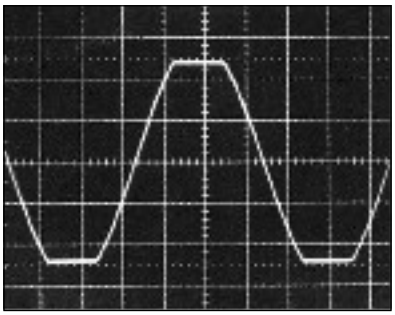
The PIP 9023 is designed for complicated, variable phase angle applications. It has three programmable voltage ranges with independent control of voltage and phase angle. The independent phase angles are programmable in 0.5 degree steps through 360 degrees. The PIP 9023 also features auto ranging frequency.

The PIP 9023 is the product of choice for complicated, variable phase applications such as gyro testing.

The oscilloscope picture above (center) is of a three phase output programmed for unbalanced voltages and special phase angles from a PIP 9023-3.



PIP 9023 Programmable Phases



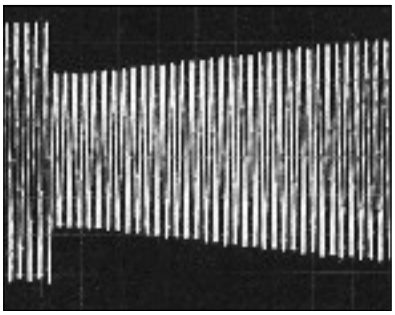
PIP 704 Flat Top Distortion

## PIP 704

The PIP 704 Plug-In Programmable Transient Generator is designed to meet the MIL-STD-704 "Aircraft Electrical Power Characteristics" test requirements for 400 Hz power.

It can also perform various voltage and frequency aberrations, such as simultaneous or independent transients (including 704D ramps), voltage surges/sags, frequency deviation, voltage phase differentiation, and waveform distortion in any single phase or in all three phases.

The PIP 704 is designed for testing aircraft avionics, shipboard electronics and jet and rocket engine controllers.



PIP 704 Voltage Ramp

The scope pictures, above, show 8% Total Harmonic Distortion (THD) simulating sudden overload of a generator and a ramp per Table 5 of MIL-STD-704.

PIP 9012A

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## Specifications

| | 9012A/AE | 9023 | 704 |
|---|---|---|---|
| **FREQUENCY** | | | |
| Range | Programmable<br>45-99.99 Hz<br>45-999.9 Hz<br>45-5000 Hz | Auto-Ranging<br>45-999.9 Hz<br>1000-5000 Hz | Single Range<br>45-999.9 Hz |
| Resolution | 0.01/0.1/1.0 Hz | 0.1/1.0 Hz | 0.1 Hz |
| Accuracy | 0.001% of<br>Set Value | 0.001% of<br>Set Value | 0.001% of<br>Set Value |
| External Frequency/<br>Phase<br>Synchronization | No | Yes-to another<br>9023 or a 704 | Yes-to another<br>704 or a 9023 |
| **VOLTAGE** | | | |
| Mode | Programmable<br>Simultaneously | Programmable<br>Independently or<br>Simultaneously | Programmable<br>Independently or<br>Simultaneously |
| Range | 0-135 VAC<br><br>0-270 VAC | 0-67.5 VAC<br><br>0-135 VAC<br><br>0-270 VAC | 0-135 VAC<br>Switch Selectable<br>0-270 VAC<br>Switch Selectable |
| Resolution | 0.1 VAC | 0.1 VAC | 0.1 VAC |
| Programming<br>Accuracy | ±0.2% of Full Scale | ±0.2% of Full Scale | ±0.2% of Full Scale |
| Load Regulation | ±0.015%; No<br>Load to Full Load | ±0.015%; No<br>Load to Full Load | ±0.015%; No<br>Load to Full Load |
| Line Regulation | ±0.015%; for a<br>10% Line Change | ±0.015%; for a<br>10% Line Change | ±0.015%; for a<br>10% Line Change |
| **CURRENT LIMIT**<br>(Requires test option) | Programmable<br>Simultaneously<br>(All Phases) | Programmable<br>Independently<br>by Phase | Programmable<br>Independently<br>by Phase |
| Range | 5%-100% | 5%-100% | 5%-100% |
| **PHASE ANGLE PROGRAMMING** | Single ø, Two ø<br>Fixed 90°<br>3ø , Fixed 120° | Three ø<br>Programmable | Three ø<br>Programmable |
| Range | N/A | 0-360° | 0-360° |
| Resolution | N/A | 0.5° Increments | 0.5° Increments |
| Accuracy | ±1°; 45-2 kHz<br>Add 1° Per kHz<br>above 2 kHz | ±1°; 45-2 kHz<br>Add 0.5° Per kHz<br>above 2 kHz | ±1°, 45-999.9 Hz |

## Specifications

| | 9012A/AE | 9023 | 704 |
|---|---|---|---|
| Fault Shutdown | Over/Under<br>Voltage<br>Overload<br>Over Current* | Over/Under<br>Voltage<br>Overload<br>Over Current* | Over/Under<br>Voltage<br>Overload<br>Over Current* |
| Programmable<br>Amplitude<br>Execution | Random/Zero<br>Crossing Peak | N/A | Zero Crossing |
| Line Cycle Drop-Out | Programmable<br>1-9 Cycles | N/A | Programmable<br>1-9999 Cycles |
| Flat Top distortion | N/A | N/A | 8% THD |
| **MEASUREMENT READBACK FREQUENCY** | | | |
| Range | 45 Hz-5 kHz | 45 Hz-5 kHz | 45 Hz-1 kHz |
| Resolution | 2 Hz | 1 Hz | 1 Hz |
| Accuracy | 0.12%<br>±0.8% Reading | ± LSD | ± LSD |
| **TRUE RMS VOLTAGE** | | | |
| Range | 0-300 VAC | 0-300 VAC | 0-300 VAC |
| Resolution | 0.1 VRMS | 0.1 VRMS | 0.1 VRMS |
| Accuracy | 0.1% FS<br>±0.1% Reading | 0.1% FS<br>±0.1% Reading | 0.1% FS<br>±0.1% Reading |
| **CURRENT** | | | |
| Range** | 0-5A, 10A, 20A,<br>40 ARMS | 0-5A, 10A, 20A,<br>40 ARMS | 0-5A, 10A, 20A,<br>40 ARMS |
| Resolution | 0.01 ARMS | 0.01 ARMS | 0.01 ARMS |
| Accuracy | 1% FS<br>±1% Reading | 1% FS<br>±1% Reading | 1% FS<br>±1% Reading |
| **POWER** | | | |
| Range** | 0-500W, 1 kW<br>2 kW, 4 kW | 0-500W, 1 kW<br>2 kW, 4 kW | 0-500W, 1 kW<br>2 kW, 4 kW |
| Resolution | 1W | 1W | 1W |
| Accuracy | 1% FS<br>±1% Reading | 0.5% FS<br>±1% Reading | 0.5% FS<br>±1% Reading |
| **PHASE ANGLE** | | | |
| Range | N/A | 0-359° | 0-399° |
| Resolution | N/A | 0.5 ° | 0.5° |

* With Programmable Current
**Depends on Power Amplifier Selection in the Power Source