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Tektronix PSPL10050A, PSPL10060A, PSPL10070A & PSPL10300B Programmable Pulse Generators

User Manual

071-3416-00

Tektronix PSPL10050A, PSPL10060A, PSPL10070A & PSPL10300B
Programmable Pulse Generators

User Manual

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Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

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- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, additional information is provided at the end of this section. (See page vii, *Service safety summary*.)

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

Comply with local and national safety codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Do not use the provided power cord for other products.

Use proper voltage setting. Before applying power, make sure that the line selector is in the proper position for the source being used.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be

connected to earth ground. Before making connections to the input or output terminals of the product, make sure that the product is properly grounded.

Do not disable the power cord grounding connection.

Power disconnect. The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

Connect and disconnect properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

The measuring terminals on this product are not rated for connection to mains or Category II, III, or IV circuits.

Do not operate without covers. Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Use proper fuse. Use only the fuse type and rating specified for this product.

Wear eye protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

Provide proper ventilation. Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product.

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock. Do not touch exposed connections.

Do not service alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect power. To avoid electric shock, switch off the product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.

Use care when servicing with power on. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

Verify safety after repair. Always recheck ground continuity and mains dielectric strength after performing a repair.

Terms in this manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

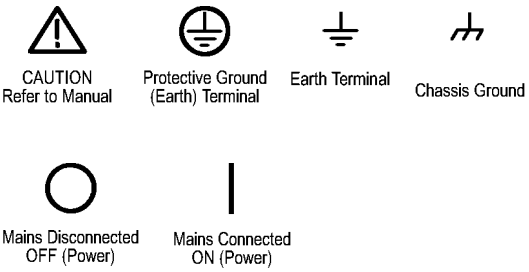
Symbols and terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbol(s) may appear on the product:



Preface

This document provides information for installing and using the Tektronix PSPL10050A, PSPL10060A, PSPL10070A, and PSPL10300B Programmable Pulse Generators.

The pulse generators offer premium signal integrity with convenient front panel or computer control. The outputs have fast edge rates, smooth transitions and minimal overshoot & ringing. Adjustable output levels are obtained using internal step attenuators, ensuring consistent signal shape at all settings. The outputs are designed for a 50 Ω impedance, but can safely drive any load from a short circuit to an open.

The following features are common to all models:

- Keypad interface
- Programmable IEEE-488
- Internal, external, manual or GPIB trigger modes
- Gated output

PSPL10050A description

The PSPL10050A is a pulse generator capable of producing fast pulses. It is fully programmable over the GPIB bus.

- Remote Pulse Head for direct connection to the device under test
- 45 ps risetime, 110 ps fall time
- Duration adjustable from 0.1 ns to 10 ns in 2.5 ps steps
- Delay adjustable from 0 ns to 63 ns in 1 ns steps
- Pulse repetition rate from single shot to 100 kHz
- 10 battery-backed up generator setup memories

PSPL10060A description

The PSPL10060A is a pulse generator similar to the PSPL10050A, key differences include the following:

- The Remote Pulse Head has been replaced by an SMA output port on the generator.
- 55 ps risetime, 115 ps fall time
- Amplitude adjustable from 900 µV to 10 V in 1 dB steps

PSPL10070A description

The PSPL10070A is a pulse generator similar to the PSPL10060A, key differences include the following:

- Positive or negative polarity pulses
- 65 ps risetime, 125 ps fall time
- Amplitude adjustable from -7.5 V to 7.5 V in 1 dB steps
- Baseline offset adjustable from -5 V to +5 V in 1.25 mV steps

PSPL10300B description

The PSPL10300B is a high-voltage model based on the same platform as the PSPL10070A generator. The key differences with respect to the PSPL10070A include the following:

- 300 ps rise time, 750 ps fall time
- Adjustable amplitude from -45 V to 50 V in 1 dB steps
- Adjustable duration from <1 ns to 100 ns in 25 ps steps
- External connection for user-supplied baseline offset from -50 V to 50 V at up to 500 mA

Documentation

The following documentation is available:

- This user manual, shipped with the product
- Product datasheets (PDF versions only, downloadable from the Tektronix Web Site)

Check the Tektronix Web Site for additional product documentation at www.Tektronix.com.

Getting started

Your instrument was carefully inspected electrically and mechanically before shipment. After unpacking all items from the shipping carton, check for any obvious signs of physical damage that may have occurred during transit (there may be a protective film over the display lens, which can be removed). Report damage to the shipping agent immediately. Save the original packing carton for possible future shipment.

The following items are included with every instrument order unless otherwise specified:

- Pulse generator with line cord
- Remote pulse head and 4 ft. coaxial cable (PSPL10050A only)
- Rack mount kit
- Printed user manual
- Accessories as ordered

Power requirements

CAUTION. *The instruments can be damaged by static discharge or applied voltages. To avoid damaging the instruments, take appropriate precautions when using the pulse generator. Always discharge the coaxial cables before connecting them to the instrument. The instrument is designed to be operated into 50 ohms or an open or short circuit. Do not apply external bias voltages.*

CAUTION. *Operating the instrument on an incorrect line voltage can cause damage, possibly voiding the warranty. To avoid this, operate the instrument with the correct line voltage.*

The instrument has an AC Mains Voltage Selector switch on the rear panel used to select the proper voltage, power, and frequency selection. The following table describes the switch selections and fuse information for your instrument. Check to ensure the operating voltage in your area is compatible.

Table 1: Line voltage selector switch settings

Mains voltage	Switch positions	Frequency	Power	Fuse type and rating
100 V	AD	50 Hz	65 VA	5 x 20 T 800 mA, 250 V
115 V	AC	60 Hz	48 VA	3AG-SB 750 mA, 250 V
230 V	BC	50 Hz	65 VA	5 x 20 T 400 mA, 250 V

Ventilation

The pulse generator has an internal fan as well as cooling vents to keep it from overheating.

CAUTION. *Inadequate ventilation can damage the instrument; to avoid damaging the instrument, observe the following precautions:*

Do not block the cooling vents.

Do not position any devices adjacent to the instrument that force air (heated or unheated) into or onto the instrument surfaces or cooling vents. This additional airflow could compromise performance.

When rack mounting the instrument, ensure there is adequate airflow around the instrument rear, sides, and bottom to ensure proper cooling. Adequate airflow enables air temperatures within approximately one inch of the instrument surfaces to remain within specified limits under all operating conditions.

Environmental considerations

The following table describes the maximum operating environmental ratings for your instrument.

Table 2: Maximum operating environmental considerations

Feature	Description
Temperature	0 to 40 °C (32 to 104 °F)
Humidity	80% for temperatures up to 31 °C (88 °F) decreasing linearly to 50% at 40 °C (104 °F)
Altitude	2000 m (6562 ft.)

Front panel controls and connectors

NOTE. *The exact location and spacing of the controls and connectors may be different depending on your instrument. Unless specified otherwise, the controls and connectors are common between instruments.*

The following figure shows describes the front panel controls and connectors of the PPG10070A Programmable Pulse Generator. Other models have similar controls and connectors.

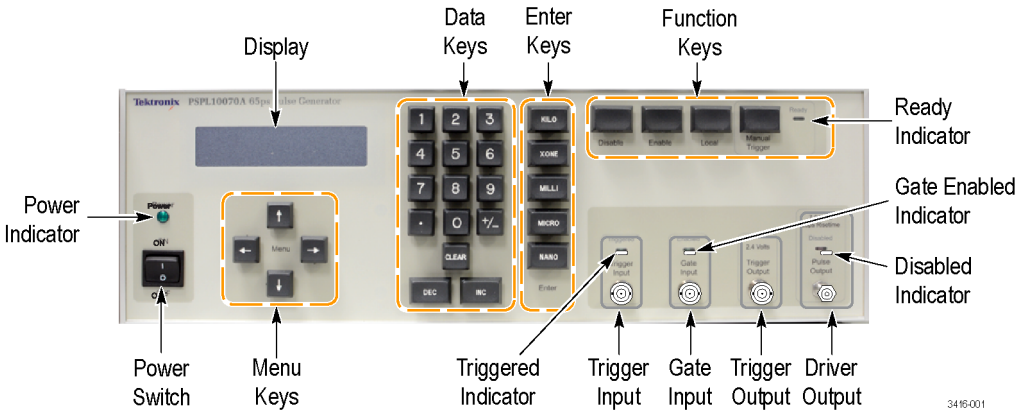


Figure 1: PSPL10070A Front panel controls and connectors

The keys on the front panel are organized into several groups. The group with the four arrow keys is the menu key group. The next group to the right is the data group. The next is the enter group, then the function group.

The various features of the pulse generator are arranged in a menu. This menu can be thought of as a rectangular grid of option boxes, one of which can be viewed on the LCD (display) at any given time. Each column of boxes is related in some way, with a box at the top describing what the relationship is (such as, time parameters).

Use the arrow keys to move around within the menu. The up and down arrow keys move up and down within a column. The right and left move to the top of the adjacent columns.

To change a numeric value displayed on the display, enter a new number using the data keys. The number will be entered along with a multiplier by pressing an enter key.

To change an on/off or pos/neg value displayed on the LCD, press either the +/- key or any enter key.

To change a Not Selected value to Selected, use any enter key.

In the save or recall boxes, press the digit corresponding to the memory location desired (0 through 9).

Function keys

Four function keys in a group are located near the upper right of the front panel. These keys are independent of the menu and can be used at any time.

DISABLE key. Press this key to disable the pulse output. No pulses are generated when the output is disabled.

ENABLE key. Press this key to enable the output. When the output is enabled, a pulse will be generated whenever the generator is triggered by the current selected trigger source.

LOCAL key. Press this key to return the generator to local control when it has been placed in the remote state by the GPIB. When the generator is in remote, the local key is the only active key on the front panel except for the power switch. If the GPIB has placed the generator in local lockout, then no keys on the front panel other than the power switch are active. Remote and local lockout states will be indicated on the display.

MANUAL TRIGGER key. Press this key to trigger the generator when the manual trigger source is selected in the menu.

LED indicators

This section describes the function of each of the LED indicator lights on the front panel. Refer the front panel control illustration as needed. (See Figure 1.)

Power LED. This indicator is on whenever the generator is on.

Triggered LED. This indicator flashes once each time a valid trigger input signal is received if the external trigger source is selected. It will appear to stay on if it is flashing at a rate greater than about 10 Hz.

Gate Enabled LED. This indicator is on whenever the trigger gating feature is on.

Disabled LED. This indicator flashes whenever the pulse output is disabled.

Ready LED. This indicator is on whenever the generator is ready for the manual trigger key to be pressed. If the LED is not on, the manual trigger key is ignored.

Rear panel controls and connectors

The following figure shows the rear panel controls and connectors of the PPG10070A Programmable Pulse Generator. Other models have similar controls and connectors with the exception of the PSPL10300B which has two additional BNC connectors..

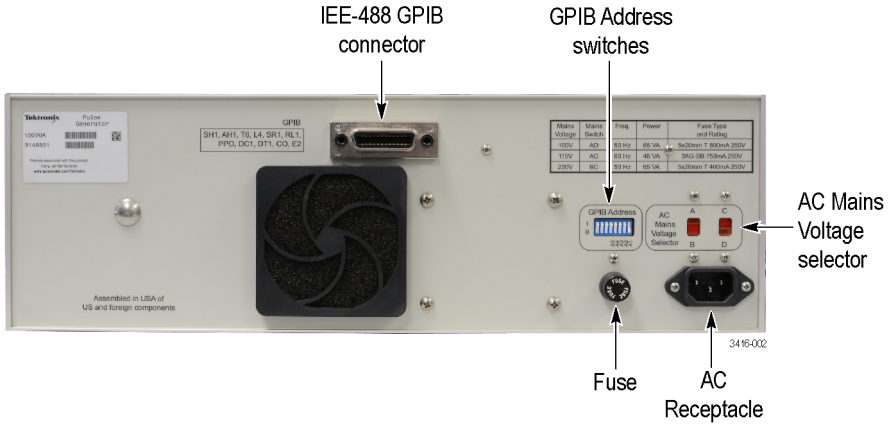


Figure 2: PSPL10050A Rear panel controls and connectors

Line voltage and fuse selection

Information on the line voltage and fuse selection are described under the *Power requirements* and the associated table. (See Table 1 on page 2.)

GPIB Address switches

The GPIB address is set on the rear panel. If the generator will not be connected to the GPIB, these settings are not important. The address is set using five binary weighted DIP switches which can represent the numbers 0 through 31. Only addresses 0 through 30 constitute valid GPIB addresses. If 31 is selected, the generator will run in keyboard-only mode. In this mode the pulse generator will ignore all GPIB commands. Note that the switch settings are only read on power-up, so that the generator must be switched from off to on to update a new switch setting. The following figure shows the address switches set to 6. (See Figure 3.) An "X" represents the pushed in side of the rocker switch.

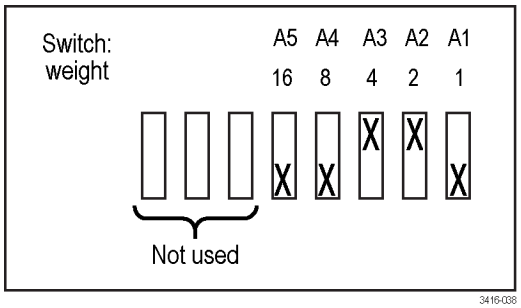


Figure 3: GPIB DIP switch on rear panel

PSPL10300B BNC connectors

Two BNC connectors are located on the rear panel of the PSPL10300B instruments:

- Baseline Offset DAC Output. This connector provides access to the -5 V to +5 V digital-to-analog converter output on the rear panel.
- Baseline Offset Input to Bias Tee. This connector provides access to the baseline offset Tee on the rear panel.

For normal operation, attach a BNC jumper cable between these two connectors.

Power up

Before connecting the power cord to the AC line, be sure to set the line voltage selector switches properly. The correct switch setting for each voltage is printed on the rear panel. In addition, check that the correct fuse is installed. (See Table 1 on page 2.)

CAUTION. *Operating the instrument on an incorrect line voltage may cause damage, possibly voiding the warranty.*

To connect the instrument to line power and turn it on:

1. Before plugging in the power cord, ensure the instrument is turned off.
2. Connect the female end of the supplied power cord to the AC receptacle on the rear panel.

WARNING. *The power cord supplied with the instrument contains a separate ground for use with grounded outlets. When proper connections are made, the chassis is connected to power line ground through the ground wire in the power cord. Failure to use a grounded outlet may result in personal injury or death due to electric shock.*

3. Power up the instrument by pressing the front-panel on/off button.

   The generator powers up with the output disabled as indicated by the flashing Disable indicator on the front panel. Push the Enable key and a trace should appear on the oscilloscope.

Setup information

The Tektronix PSPL10xxx family of pulse generators are very similar; there are some key differences between them. This section describes information needed to get started using the instruments.

Use an oscilloscope with a rise time less than half that of the signal you are trying to measure to represent the pulse reasonably accurately. When connecting to the oscilloscope, use a short length of good quality cable to connect the output of the pulse generator to the input attenuator on the oscilloscope.

CAUTION. *Applying too great a voltage can destroy the oscilloscope input circuitry. Check the maximum allowed input for your oscilloscope and use enough attenuation on the input to reduce the output pulse of the generator to within the limits of the oscilloscope. In general, 46 dB will be needed for the PSPL10300B and 30 dB will be sufficient for the lower voltage models. Also ensure that the trigger input of the oscilloscope has enough attenuation to reduce a 2.4V trigger pulse to within the allowed limits.*

PSPL10050A

The PSPL10050A uses an external remote pulse head to connect to an oscilloscope. The pulse head (Tektronix part number, 1198499XX) and a 48-inch cable are shipped with the PSPL10050A.

The pulse head is built into the other pulse generators.

CAUTION. *The remote pulse head can easily be damaged by static discharge. To avoid damaging the pulse head or other equipment, observe standard antistatic procedures during the setup process.*

Refer to the following figure and connect the 48-inch cable from the output of the pulse generator to the Drive Input connector on the remote pulse head. Connect the Pulse Output of the remote pulse head to the input attenuators on the oscilloscope.

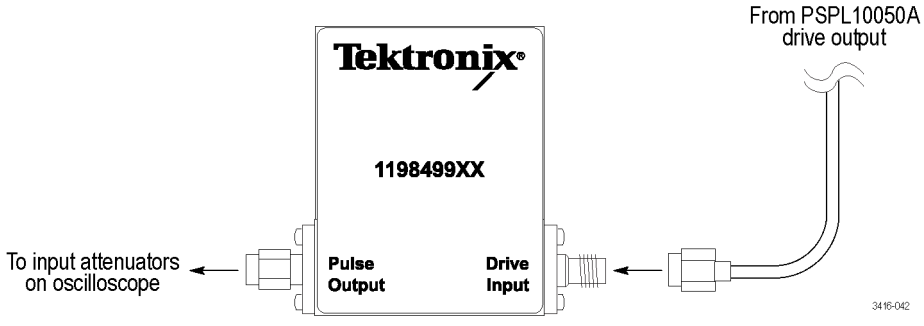


Figure 4: Remote pulse head connections (PSPL10050A only)

Connect the trigger output of the pulse generator to the trigger input attenuators on the oscilloscope. Set up the oscilloscope as follows:

- 10 ns/div
- Minimum delay
- 2 V/div (including attenuator effect)
- 6 V offset
- 1.2 V trigger level
- Positive trigger slope

PSPL10060A and PSPL10070A

The PSPL10060A and PSPL10070A setup information is similar to the PSPL10050A except that the remote pulse head is built into the instrument. Use the same setup information as with the PSPL10050A while observing the standard antistatic procedures.

PSPL10300B

The PSPL10300B setup information is similar to the above with the following exceptions:

- Use a BNC coaxial cable to connect the BNC rear panel connectors, labeled Baseline Offset DAC Output and Baseline Offset Input to Bias Tee, together.
- Set the time per division to 20 ns.
- Set the trigger level to 500 mv.

Turn on the pulse generator

After completing that above setups, turn on the pulse generator. The generator powers up with the output disabled as indicated by the flashing Disable indicator on the front panel. Push the Enable key and a trace should appear on the oscilloscope.

Operation

The pulse generator uses a menu-based method of operation; the menus are laid out in a rectangular grid of nodes. The display can show one node at a time. To see other nodes, use the menu keys (arrow keys) to move around in the menu. Most nodes display one feature of the pulse generator. Change the features using the data and enter keys.

Each column of the menu grid will consist of a related group of features. At the top of each column is a node (column header) describing the type of features in that column. Each node below the column header displays the current value for one of the generator features. This value can be changed using the data and enter keys.

The following figures show the menu grids for the different pulse generators. The menu grids are very similar between instruments; for example the PSPL10050A does not have a Voltage column, but the other columns are the same as other instruments.

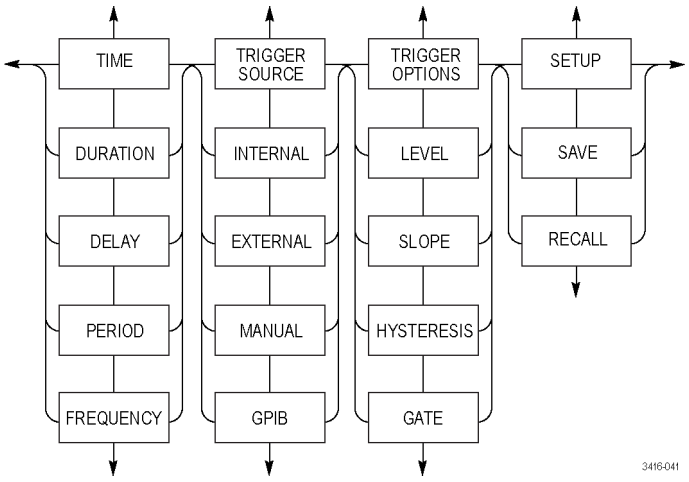


Figure 5: PSPL10050A menu grid

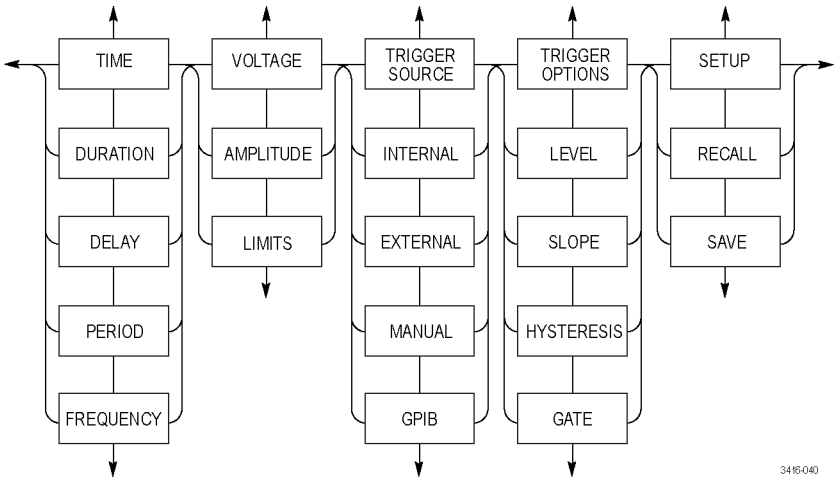


Figure 6: PSPL10060A menu grid

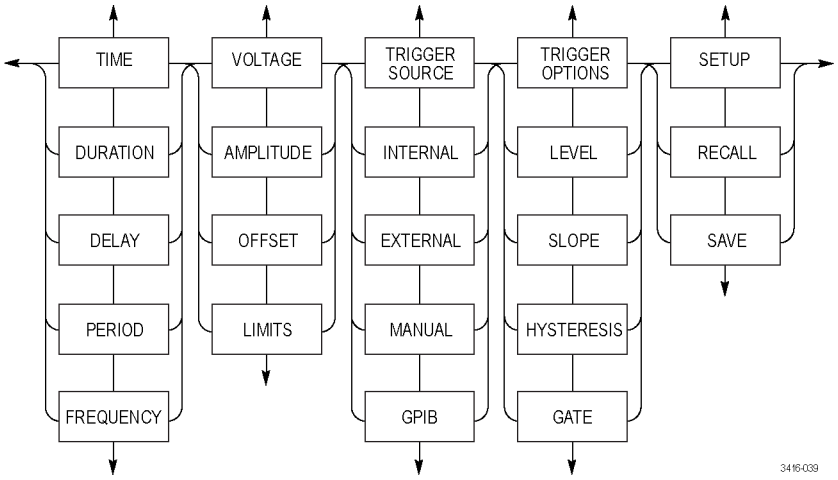


Figure 7: PSPL10070A and PSPL10300B menu grid

Menu node descriptions

This section describes the different columns in the Menu node. Unless otherwise specified, the descriptions apply to all version of the pulse generators.

Time column

DURATION. This node sets the pulse duration.

For the PSPL10050A, PSPL10060A, and PSPL10070A allowed values are from 0 ns through 10.2 ns with a 2.5 ps resolution. The allowed range is larger than the nominal range of 100 ps to 10 ns so that the nominal range can be achieved in the presence of drift.

For the PLSPL10300B allowed values are from 0 ns to 102 ns with 25 ps resolution.

DELAY. This value is the delay between the trigger output and the pulse output.

For the PSPL10050A, PSPL10060A, and PSPL10070A allowed values are 0 ns through 63 ns. Resolution is 1 ns.

For the PLSPL10300B allowed values are from 0 ns to 100 ns with 25 ps resolution.

PERIOD. This value is the pulse period when the internal trigger is selected. Its value ranges from 10 us through 1 s with 0.1 us resolution. This value is the reciprocal of the value displayed in the frequency node (changing one changes the other as well).

FREQUENCY. This value is the pulse repetition rate when the internal trigger is selected. Its value ranges from 1 Hz through 100 kHz. The resolution will vary, since the period resolution is constant. This value is the reciprocal of the value displayed in the period node.

Voltage column

This column does not apply to the PSPL10050A.

AMPLITUDE. This node displays the amplitude of the pulse into 50 ohms.

The allowed amplitude values depend on the instrument type:

- For the PSPL10060A, the amplitude ranges from 0 V to 10 V. The pulse generator determines the nearest possible value to the value that you requested.
- For the PSPL10070A, the amplitude is a signed quantity, it represents the pulse magnitude and polarity. Allowed values are -7.5V through +7.5V.
- For the PSPL10300B, the amplitude ranges from 4.5 mV to +50 V positive or -4 mV to -45 V negative.

For all versions of the pulse generators, the resolution is 1 dB with a maximum attenuation of 81 dB.

OFFSET. (PSPL10070A and PSPL10300B only.)

This is the baseline offset of the output. Into 50 ohms, it ranges from -5 V to +5 V in 1.25 mV steps. The baseline offset has a DC source impedance of 50 ohms. Thus, the offset would range from -10 V to +10 V into an open circuit. The displayed offset is accurate only when driven into 50 ohms.

(PSPL10300B only.)

Provision is made to add an external offset voltage DC amplifier to obtain higher offset voltages (up to ±50 V or ±500 mA). Two BNC connectors are provided on the rear panel: the baseline offset digital-to-analog converter (DAC) -5 V to +5 V output and the baseline offset Bias Tee. For normal operation, connect a BNC jumper cable on the rear panel between these two connectors.

LIMITS. (PSPL10060A, PSPL10070A, and PSPL10300B only.)

This is a safety feature built into the pulse generator to help avoid damaging sensitive sampling oscilloscopes. When the limits value is changed from OFF to ON, the pulse generator stores the current highest and lowest output voltage excursions. As long as the limits remain ON, any request to change the amplitude or offset which exceeds the stored limits is rejected. When the limits are OFF, the amplitude and offset can be set to any value.

Trigger source column

Each node under this column header represents one of the available trigger sources. Only one trigger source can be selected at a time. The previous or old trigger source is automatically deselected when a new trigger source is assigned.

INTERNAL. This is the internal pulse repetition rate clock. When this source is selected, the generator is triggered at a rate determined by the period or frequency parameters.

EXTERNAL. Selecting external activates the front panel Trigger Input. The generator is then triggered whenever a valid trigger signal is applied at the trigger input BNC connector. What constitutes a valid trigger signal is determined in the Trigger Options menu. Note that the repetition rate is internally limited to approximately 100 kHz, even if a higher frequency trigger signal is applied.

MANUAL. When manual is selected, the Manual Trigger key on the front panel is activated. The Ready light next to the manual trigger key indicates that the generator is ready to receive a manual trigger. Pushing the manual trigger key will trigger the generator one time; the ready light turns off until the generator is ready again (approximately 1 second). While the ready light is off, manual triggers will not be accepted.

GPIB. Selecting GPIB allows the generator to receive a trigger signal from the GPIB bus. See the programming chapter for more information on how to send a trigger signal over the GPIB bus.

Trigger options column

LEVEL. This node sets the voltage level at which triggering will occur for a signal is applied to the Trigger Input connector. Allowed values are -2 V through +2 V with 1 mV resolution. Applying signals to the trigger input with amplitude greater than ±5 V can result in damage to the trigger input circuitry. Note that the trigger input is 50 ohm terminated.

SLOPE. This node determines whether the trigger input circuitry will trigger on the rising edge or falling edge of the input signal. It takes on the values Positive or Negative.

HYSTERESIS. This node can be set to ON or OFF and determines whether or not the trigger input circuitry uses hysteresis. This should normally be set to ON. Situations where one might want the hysteresis off include triggering on very small input signals (<75 mv_{p-p}) or triggering on high frequency trigger signals.

GATE. This node controls the trigger gating. When this is set ON, the generator will not trigger unless there is a high TTL logic level signal applied at the gate input. When set to OFF, the generator will trigger regardless of the signal at the gate input. A high TTL logic signal is in the range 2.0 V to 5.0 V, a low TTL logic signal is in the range 0.0 V to 0.8 V. Only signals in the range 0 V to 5 V should be applied to the GATE input to avoid damage. The gate input is 50 ohm terminated.

Setup column

RECALL. This node can be used to recall the generator setups which have been stored using the Save node. Setups can be recalled from 10 setup memories, numbered 0 through 9. To recall a particular memory, press the digit key corresponding to the memory number. When a setup is recalled, all parameters of the generator are recalled from memory except for the limits setting and the enable/disable setting. Those do not change, and the new setting must be within the limits if the limits were on. The setup memories are battery backed up.

SAVE. This node can be used to save generator setups to one of 10 setup memories. The setup memories are numbered 0 through 9. To save the current setup, press the digit key corresponding to the setup memory desired. Every parameter of the generator is stored except the limits setting and the enable/disable setting. The setup memories are battery backed up.

Changing settings

To change a generator setting, display the parameter with the menu keys and the menu map from the Menu section. Then key in the new setting. The setting depends on what type of response is sensible for that node.

Number settings

To change a setting where the setting is a number, enter a new setting using the data keys. The new setting will appear on the display as the keys are pressed.

To enter the new setting, press an enter key. Each enter key has a different multiplier which is applied to the value keyed in. For example, to enter 5.63 ns, key in 5.63, then press the Nano key. The setting is not actually changed until an enter key is pressed.

If you make a mistake keying in the number, use the Clear key. Alternatively, use the DEC and INC keys to instantly change the settings by a small amount. The DEC and INC keys will repeat if held down.

Toggle settings

To change the setting when it is a toggle, such as on/off or pos/neg, use the +/- key to toggle the setting. Alternatively, any of the enter keys will toggle the setting.

Selected/Not Selected settings

When the setting is Selected/Not Selected, this means that only one of the nodes in that menu column can be selected. This occurs in the Trigger Source menu, because only one trigger source can be selected at a time. To change a setting from "Not Selected" to "Selected," use any enter key. This selects the new node and automatically deselects the old one. Other than by selecting a new node, there is no way to deselect a node.

Digit settings

When a digit is expected, such as in the save and recall nodes, press the desired 0 through 9 key. No enter key is necessary.

Power up conditions

Except for the GPIB address setting. the generator will always power up in a given state. The GPIB address setting is determined on power-up by the DIP switches on the rear panel. The rest of the power-up states are listed in the following table.

Table 3: Power up conditions

Item	Power up state
Output	disabled
Duration	10 ns (20 ns for the PSPL10300B)
Delay	60 ns (100 ns for the PSPL10300B)
Period	10 µs (100 µs for the PSPL10300B)
Frequency	100 kHz, (10 KHz for the PSPL10300B)
Amplitude [1]	0.5 V
Offset [1]	0 V
Trigger source	Internal
Trigger level	1.0 V
Trigger slope	Positive
Trigger hysteresis	On
Trigger gate	Off
Header	Off (See page 33, *HEADer*.)

[1] These conditions do not apply to the PSPL10050A.

Specifications

Specifications listed in this manual are those which applied at the time of printing. Tektronix reserves the right to change specifications at any time without notice and without incurring any obligation to incorporate new features in products previously sold. Tektronix also reserves the right to discontinue products at any time without notice.

The duration and delay values displayed on the front panel LCD and programmed over the GPIB are only to be considered nominal values and not absolute values. The duration and delay parameters exhibit some thermal drift, rep rate dependency and interaction. There will be some loss in amplitude at minimum pulse durations. The amplitude tolerance of ±0.2 V holds only for >2 ns durations for the PSPL100xxA series and for >10 ns durations for the PSPL10300B (the amplitude has a minor repetition rate dependency). Always use an oscilloscope as an independent check of these pulse parameters. The instrument is adjusted and calibrated at the factory in an ambient temperature of 23 °C ±3 °C (73.4 °F ±37.4 °F) at a repetition rate of 100 kHz. The instrument will operate over a temperature range of 0 to 50 °C (32 to 122 °F) but will not meet all specifications over this range.

NOTE. *The performance parameters listed in the following tables are typical values, parameters are guaranteed only when maximum and/or minimum limits are given.*

Table 4: Model overview

Parameter	PSPL10050A	PSPL10060A	PSPL10070A	PSPL10300B
Amplitude into 50 Ω	10 V (fixed)	900 µV to 10 V, adjustable in 1 dB steps	±700 µV to ±7.5 V, adjustable in 1 dB steps	4.5 mV to 50 V positive, -4 mV to -45 V negative, adjustable in 1 dB steps
Amplitude accuracy, into 50 Ω	±0.2 V			±2 V positive, ±3 V negative (full output amplitude)
Polarity	Positive only	Positive only	Positive or negative	Positive or negative
Baseline	0 V	0 V	-5 V to +5 V in 1.25 mV steps	Adjustable from -5 V to +5 V in 1.25 mV steps, external input provided for usersupplied offset of ±50 V
Transition time, leading edge				
(10 – 90%)	≤45 ps typ, ≤55 ps max	≤55 ps typ, ≤65 ps max	≤65 ps typ, ≤75 ps max	300 ps, 325 ps max.
(20 – 80%)	-	-	≤40 ps typ, ≤50 ps max	-
Transition time, trailing edge				
(10 – 90%)	≤110 ps typ, ≤130 ps max	≤115 ps typ	-	750 ps, 1 ns max.
(20 – 80%)	-	-	≤80 ps typ ≤100 ps max	-
Reflection coefficient	±5% during pulse +80%, -40% after pulse	±5% during pulse +80%, -40% after pulse (improves with increasing attenuation)	50% @ 0 dB (7.5 V) 20% @ 6 dB (3.7 V) -10% @ >10 dB (<2.3 V)	30% during pulse, +50% after pulse (improves with increasing attenuation)
Source impedance (nominal)	50 Ω			
Duration (FWHM)	100 ps to 10 ns in 2.5 ps steps			< 1 ns to 100 ns, adjustable in 25 ps steps
Baseline precursor	< 1%			< ±1%
Topline overshoot	< 4%			2%
Topline perturbations	< ±3% for t < 2 ns			±1% for t < 3 ns (±2% for negative pulse)
Topline flatness	< ±0.5% for 2 ns < t < 10 ns			±0.5% for t > 3 ns (±2% for negative pulse)
Spurious pulse at 120 ns				+6% with pulse duration ≤ 20 ns, +30% for pulse duration = 100 ns

Table 5: Trigger and timing

Parameter	PSPL10050A	PSPL10060A	PSPL10070A	PSPL10300B
Trigger in/out delay	90 ns	90 ns	100 ns	185 ns
Repetition rate	1 Hz to 100 kHz			
Period	10 µs to 1 s, 0.1 µs steps			
Trigger mode	Internal, external, manual, or GPIB			
External trigger input level	-2 to +2 V, 1 mV steps, positive or negative slope			
Maximum external trigger input	±5 V			
External trigger impedance	50 Ω			
Trigger output into 50 Ω	2.4 V, 50 ns			1 V, 1 µs
Delay	0 to 63 ns, 1 ns steps			0 to 100 ns, 25 ps steps
Delay jitter, RMS	1.5 ps			< 10 ps
External trigger jitter, RMS	5 ps (<1 ns rise)			-
External gate input	TTL, > 2 V on, < 0.5 V off			
External gate impedance	50 Ω			

Table 6: General specifications

Parameter	PSPL10050A	PSPL10060A	PSPL10070A	PSPL10300B
Accessories included	Remote Pulse Head & 4 ft coaxial cable, power cord, rack mount kit, manual	Power cord, rack mount kit, manual	Power cord, rack mount kit, manual	Power cord, BNC cable, rack mount kit, manual
Connectors	SMA output, BNC trig in, gate in, trig out, GPIB on rear panel			SMA output, BNC trig in, gate in, trig out, BNC on rear panel for baseline offset d/a output and bias tee input, GPIB on rear panel
Controls	Power, menu, data entry, disable/enable, local and manual trigger			
Power supply (mains)	100, 115, or 230 VAC, ±10% switch selectable, 50 or 60 Hz			
Power consumption	48 VA (60 Hz), 65 VA (50 Hz)			
Operating environment				
Temperature	40 °C (104 °F); low limit of 0 °C (32 °F)			
Humidity	80% for temperatures up to 31 °C (88 °F), decreasing linearly to 50% at 40 °C (104 °F)			
Elevation	2000 m (6562 ft.)			
Dimensions	19.0 x 15.2 x 5.5 in. (48.3 x 38.6 x 14.0 cm)			
Weight	21 lbs (9.5 kg)			
GPIB standard	IEEE-488.1-1987			
GPIB interface functions	SH1, AH1, T6, L4, SR1, RL1, PPO, DC1, DT1, CO and E2.			
Set up	Save/recall in 10 memories with battery back up			
Warranty	One year			

Remote programming

The pulse generator can be connected to the IEEE-488 bus (also known as the GPIB or General Purpose Interface Bus) through a cable equipped with standard IEEE-488 connectors. It conforms to the IEEE-488.2 standard which defines a syntax for sending data to and from instruments, how an instrument interprets this data, what registers should exist to record the state of the instrument, and a group of common commands.

NOTE. *Note that the IEEE-488 bus is limited to a maximum of 15 devices, including the controller. The maximum cable length is 20 meters or two meters times the number of devices, whichever is less. Failure to observe these limits may result in erratic bus operation.*

NOTE. *Cycle the power after selecting a different interface or making changes to the communication parameters.*

Interface functions

This section describes the interface capabilities of the pulse generator and how it responds to GPIB interface messages, as well as giving some general background on what interface messages are.

Interface capabilities

The pulse generator has the following interface capabilities: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, and E2. The meaning of these interface capability codes is specified in IEEE Std. 488.1-1987.

Interface messages

The GPIB has two modes of operation. These are the data mode and the command mode. In the data mode, devices send and receive device-dependent bytes of data. When the ATN line is true, the device is in the command mode. In this mode, interface messages specified by IEEE-488.1 are sent. These messages can be used for such things as addressing instruments to talk or listen, controlling an instrument's remote/local status, or controlling its Device Trigger status.

Group Execute Trigger (GET)

The Group Execute Trigger command is an interface message which has exactly the same effect on the pulse generator as receiving a *TRG command. (*TRG is described in the Programming Commands section) A GET should not be sent to the instrument inside a program message.

Device Clear (DCL)

When a Device Clear command is received by the pulse generator, the input and output buffers are cleared and the parser is reset.

Interface Clear (IFC)

The IFC command unaddresses the pulse generator as both a talker and listener, and resets its serial poll function.

Remote, Local, and Local Lockout

These modes can be used by the GPIB to control the amount of front panel input allowed. In local mode, the front panel is fully functional. In remote mode only the LOCAL key is functional. The LOCAL key will then return the generator to the local mode. In local lockout mode, the front panel is completely locked out. (except for the power switch) Cycling the power will always return the instrument to local mode.

To put the pulse generator in remote mode, the controller should set the REN (remote enable) line true, then address the pulse generator to listen. To put it in local lockout mode, the controller should set the REN line true, send the LLO interface message, then address the instrument to listen. Most controllers will do these sequences automatically or with one command.

The pulse generator will show what mode it is in on the display. If it is in remote or local lockout, the display will show a message to that effect. In local mode, the menu will be displayed. In addition, in remote or local lockout modes, the display will indicate if the instrument is addressed to talk or listen.

Addresses

Each instrument on the GPIB needs to have its own unique address. This address can range from 0 through 30. The address on the pulse generator can be set using DIP switches on the rear panel. The DIP switch settings are read on power-up only.

Protocols

This section describes the GPIB protocols to use when controlling the pulse generator. It will also cover some of the components of the pulse generator which allow a better understanding of how it communicates.

Messages

The pulse generator communicates with the controller using program messages and response messages. The controller sends program messages to the instrument. The instrument generates a response message in response to a query, which is a program message with one or more queries in it. These messages consist of strings of data bytes. These data bytes represent ASCII encoded characters.

Message termination

To mark the end of a message, a terminator is required. The instrument accepts any one of several common program message termination styles: a newline with EOI asserted, last byte with EOI asserted, or newline. The response message terminator sent by the pulse generator is always a newline with EOI asserted. Complete syntax details are in the *Program syntax information* section.

Message execution order

The pulse generator executes all program messages in the order they were received.

Addressing

GPIB protocol specifies that for a device to talk, it must first be addressed to talk by the controller. For a device to listen, it must be addressed to listen by the controller. A device will not be able to talk unless there is at least one device listening.

Message components

The pulse generator has three components whose function should be understood.

Input buffer. The input buffer is a first-in, first-out (FIFO) buffer which stores program messages received from the GPIB until the pulse generator processes them. The size of this buffer is one kilobyte, meaning the buffer can hold about 1000 characters.

Output buffer. The output buffer is a FIFO buffer which stores response messages ready to be sent out on the GPIB. The size of this buffer is one kilobyte, meaning the buffer can hold about 1000 characters.

Parser. The parser is the component which processes the program messages in the input buffer and determines what action to take in response to the program messages. The parser is activated when a program message terminator is sent to the pulse generator. Thus, one can send a long string of commands followed by a program message terminator to the pulse generator, and then talk to other instruments while the pulse generator is parsing the commands.

Normal operation

Normal operation should proceed as follows. The controller will send a complete program message to the pulse generator, where it is stored in the input buffer. When the Program Message Terminator is received, the pulse generator will parse and execute the message. If the Program Message contained a query, a response will be generated and stored in the output buffer. When the pulse generator is addressed to talk, it will send the entire response message.

To maintain this normal flow of messages, observe the following rules:

- Limit the Program Message length. The input buffer will overflow if a single Program Message is sent which fills it up. Thus, all Program Messages should be shorter than about 1000 characters.
- Avoid overflowing the output buffer. The output buffer will overflow if enough queries are sent to the pulse generator to create over 1024 characters of response data without reading any of the responses. This can be avoided by always reading a Response Message before sending any more Query Messages. Adhering to that practice will also avoid any confusion about which query generated a particular response. Multiple Response Messages may be stacked up in the output buffer without creating errors, but it is bad practice.

- If a Program Message contains multiple queries, the responses to those queries will all be in one Response Message.
- A simple rule to follow regarding Queries and Responses is: “The generator will not talk unless it is queried, and if it is queried, it should be allowed to talk before querying it again”.

Protocol exceptions

The pulse generator will take various actions for differing protocol exceptions. Following is a list of protocol exceptions and the resulting actions:

- Input Buffer Overflow. The input buffer overflows when a single Program Message longer than the input buffer is sent. If that occurs, the offending Program Message is discarded and an Input Buffer Overflow error is reported.
- Output Buffer Overflow. The output buffer will overflow when response data exceeding 1024 characters is stored in the output buffer. In this case the response to the query which caused the overflow is discarded. In addition, the remainder of the Program Message after the offending query is discarded. An Output Buffer Overflow error is also reported.
- Addressed to Talk with Nothing to Say. This occurs when the controller attempts to read a Response Message when it has not sent a valid Query Message. In this case, a Query Error is reported.
- No Listener on Bus. This occurs when the pulse generator is addressed to talk but there are no listeners. In this case, the generator will wait for a listener to assert NDAC TRUE or for the controller to take control.
- Command Error. A command error occurs when the parser detects an invalid command. The parser checks for syntax but not for argument range. A command error is reported and the rest of the Program Message is discarded.
- Execution Error. An argument whose syntax is correct but is out of the allowed range will cause an execution error. An Execution error is reported and the rest of the Program Message is discarded.

Program syntax information

This section outlines the programming syntax the instrument will accept when listening and the syntax it will output when talking. This section only describes the syntax of the commands. The specific allowed commands are covered in the *Programming Commands* section.

The listening syntax is more flexible, or "forgiving" than the talking syntax. This allows for more readable programs which are more tolerant of minor syntax variations. The talking syntax is more precise to make it easier for a computer program to accept.

Syntax example

As an example, the following message can be broken down as shown in the following figure.

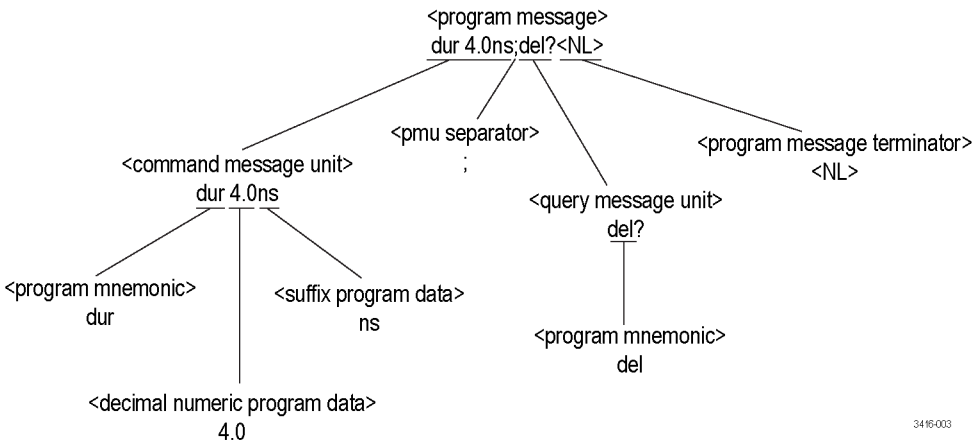


Figure 8: Sample program message diagram

Syntax diagram notation

The syntax used for the pulse generator is based on the IEEE-488.2 standard. It is, however, not a complete implementation of the standard.

Syntactic elements in the following diagrams are connected by lines with arrows. The diagrams may be traversed along the lines only in the direction of the arrows. When a path branches, either route may be taken.

An oval with ^END inside it means the preceding byte is transmitted with EOI set TRUE and ATN set FALSE.

A circle with a character inside it represents the ASCII encoded byte which represents that character. Two capital letters in a circle represent the ASCII code for that unprintable character. For instance, SP represents the ASCII encoding for a space.

Device listening syntax

A complete controller-to-instrument message consists of a Terminated Program Message. Its syntax follows.

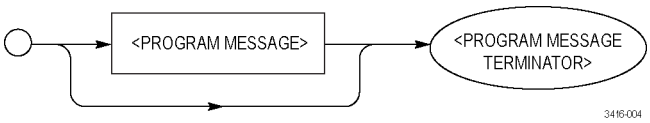


Figure 9: Terminated program message

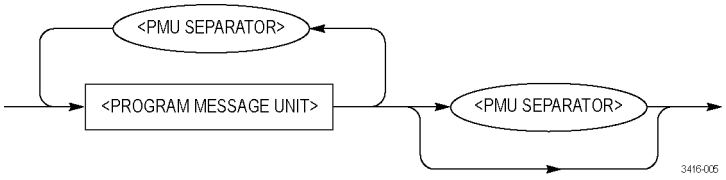


Figure 10: Program message

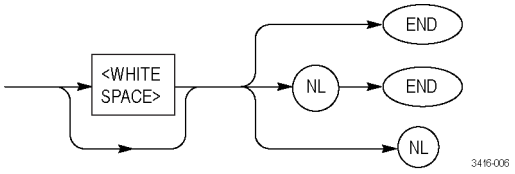


Figure 11: Program message terminator

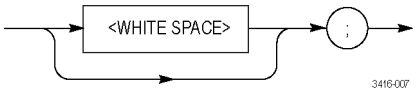


Figure 12: Program message unit separator

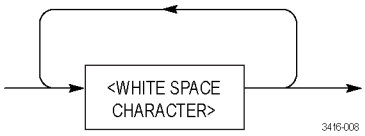


Figure 13: White space

A White space character is defined as a single ASCII-encoded byte in the range 0-9 or 11-32 (00-09 or 0B-20 hex). This range includes ASCII control characters and the space character but excludes the newline character.

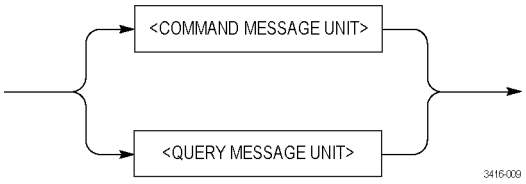


Figure 14: Program message unit

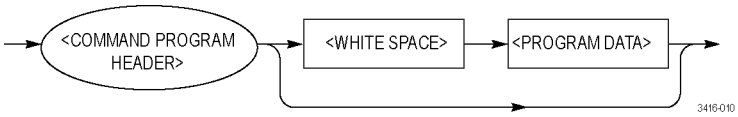


Figure 15: Command message unit

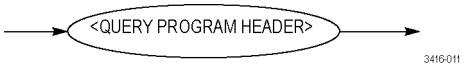


Figure 16: Query message unit

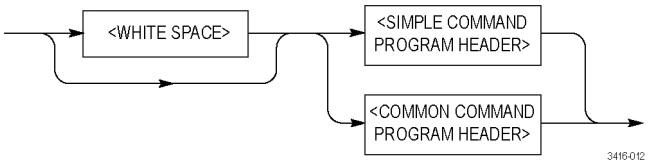


Figure 17: Command program header

Figure 18: Simple command program header

Figure 19: Common command program header

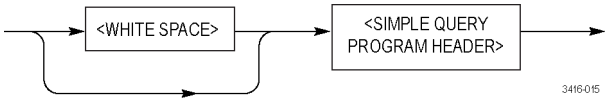


Figure 20: Query program header

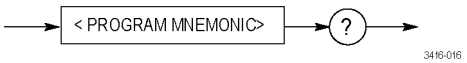


Figure 21: Simple query program header

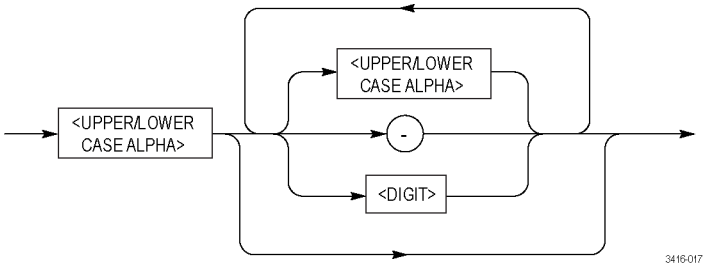


Figure 22: Program Mnemonic

The <upper/lower case alpha> is defined as a single ASCII-encoded byte in the range 65-90, 97-122 (41-5A, 61-7A hex). This range includes upper and lower case alphabet characters (A-Z, a-z).

<digit> is defined as a single ASCII-encoded byte in the range 48-57 (30-39 hex). This range includes the digits 0-9.

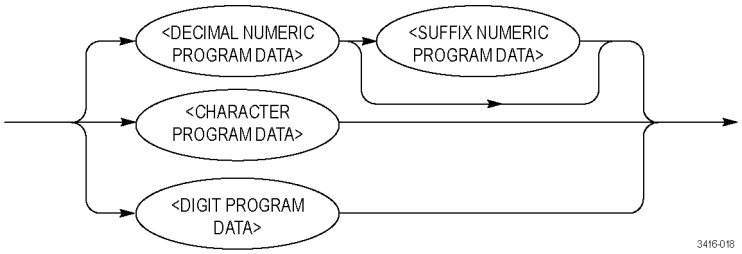


Figure 23: Program data

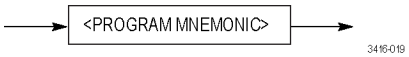


Figure 24: Character program data

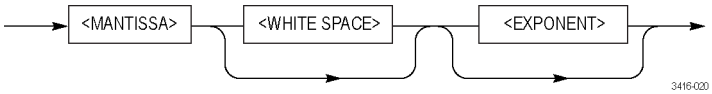


Figure 25: Decimal numeric program data

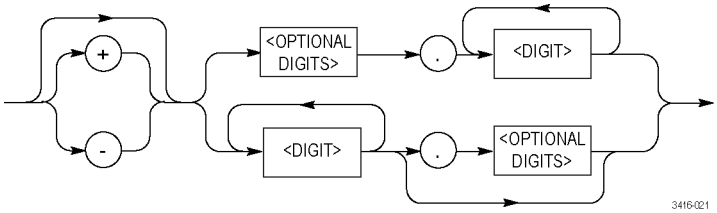


Figure 26: Mantissa

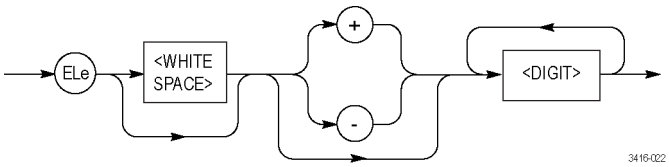


Figure 27: Exponent

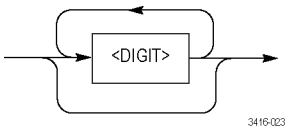


Figure 28: Optional digits

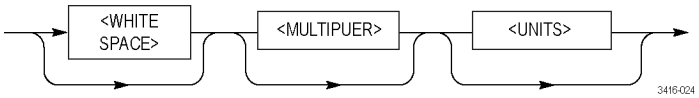


Figure 29: Suffix program data

The <Multiplier> can be any one of the entries in the following table. The multiplier will multiply the preceding decimal numeric program data by the amount shown in the table.

Table 7: Allowed Multiplier mnemonics

Definition	Mnemonic
IE18	EX
IE15	PE
IE12	T
1E9	G
1E6	MA [1]
1E3	K
1E-3	M [1]
1E-6	U
1E-9	N
1E-12	P
1E-15	F
1E-18	A

[1] The table has one exception. When the M multiplier is combined with the Hz units, the result is 1E6, not 1E-3.

The <Units> is defined as one of the following: V, Hz, or S. The <Units> are implemented syntactically but not semantically. That is, the parser ignores them as long as they are one of the allowed elements.

Figure 30: Digit program data

Device talking syntax

A complete instrument-to-controller message consists of a Terminated Response Message. Its syntax follows.

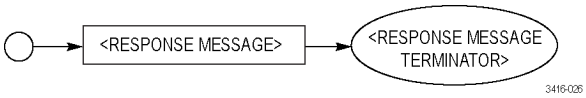


Figure 31: Terminated response message

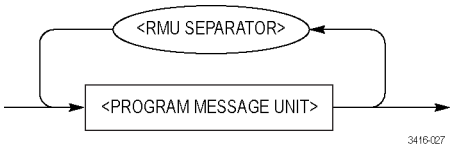


Figure 32: Response message

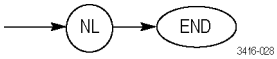


Figure 33: Response message terminator

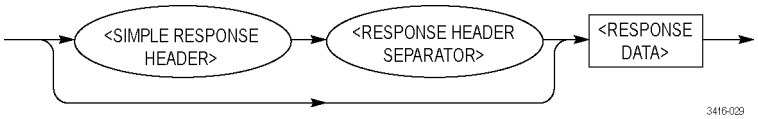


Figure 34: Response message unit

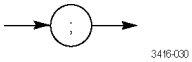


Figure 35: Response message unit separator

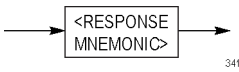


Figure 36: Simple response header

Figure 37: Response header separator

Figure 38: Response data

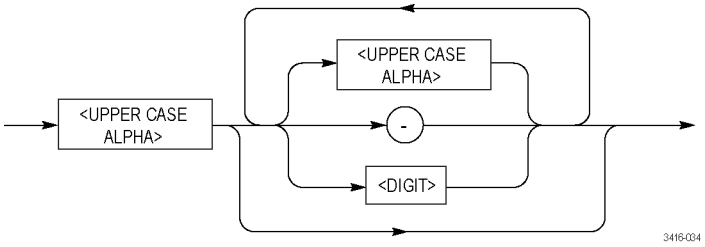


Figure 39: Response Mnemonic

The <upper case alpha> is defined as a single ASCII-encoded byte in the range 65-90 (41-5A hex). This range includes upper case alphabet characters (A-Z).

The <digit> is defined as a single ASCII-encoded byte in the range 48-57 (30-39 hex). This range includes the digits 0-9.

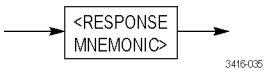


Figure 40: Character response data

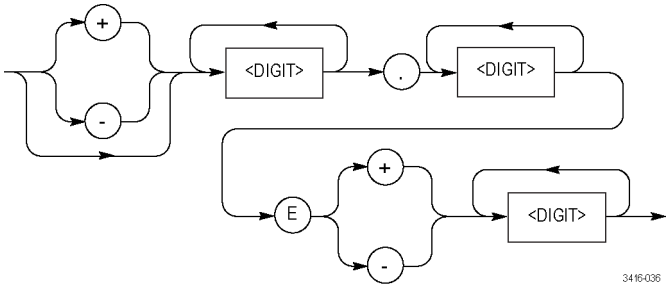


Figure 41: NR3 Numeric response data

Programming commands

This section covers the commands used to control the pulse generator. The commands are listed alphabetically along with a description of each command. The following table summarizes the syntax used with the programming commands.

Table 8: Syntax symbols and their meanings

Symbol	Meaning
< >	Defined element
::=	Is defined as
|	Exclusive OR
{ }	Group, one element is required
[ ]	Optional, can be omitted
. . .	Previous elements can be repeated
( )	Comment

Command types

The commands can be divided into two categories: common commands and system commands. Common commands have an asterisk as the first character. The common commands are often implemented on other GPIB instruments in a similar way. For the pulse generator, there is no functional difference between common and system commands. In this manual, they will all be referred to as commands.

Query form

If a command has a query form, this will be listed along with the command form of the command. The query form is the command followed by a question mark.

Short/long form

Commands can be sent in either short form or long form. Long form uses the complete command. This form is useful for more easily readable programs. Short form uses a truncated form of the command. Using the short form of commands requires less bus time. The truncation rule is as follows: The short form is the first 4 characters of the command unless the fourth character is a vowel, then the short form is the first 3 characters. Commands of 4 characters or less are not truncated.

Parameter resolution

Parameters which take decimal numeric arguments each have a maximum resolution. When the generator is commanded to set a parameter to a particular numerical value, the pulse generator will set the parameter to the nearest possible value. When queried for the value of the parameter, it will return the value it determined, rather than what was sent in the command. These two values will be similar, but not necessarily identical.

AMPLitude

The amplitude command sets the output pulse amplitude of the instrument. Resolution is 1 dB, up to a maximum attenuation of 81 dB. The amplitude setting is accurate only when driving into a 50 ohm load. The amplitude value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current output pulse amplitude in the <NR3 Numeric response data> format.

Allowed values (Not available for the PSPL10050A.)

PSPL10060A: 0 to 10 V

PSPL10070A: -7.5 V to +7.5 V

PSPL10300B: 4.5 mV to 50 V positive, -4 mV to -48 V

Syntax
amplitude <value>
amplitude?

DELay

The delay command sets the delay between the trigger output and the pulse output. The delay value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current delay setting in the <NR3 Numeric response data> format.

Allowed values PSPL10050A, PSPL10060A, PSPL10070A: 0 to 63 ns with 1 ns resolution

PSPL10300B: 0 to 100 ns with 25 ps resolution

Syntax
delay <value>
delay?

DISable

The disable command disables the pulse output of the generator. It takes no arguments.

The query returns the current status of the generator's enable/disable feature. It returns the string "YES" if the generator is disabled, or the string "NO" if it is not.

Syntax

disable
disable?

DURation

The duration command sets the output pulse duration. The allowed range is larger than the specified limit so that the nominal range can be achieved in the presence of drift. The duration value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current duration setting in the <NR3 Numeric response data> format.

Allowed values

PSPL10050A, PSPL10060A, PSPL10070A: 0 to 10.2 ns with 2.5ns resolution

PSPL10300B: 0 to 102 ns with 25 ps resolution

Syntax

duration <value>
duration?

ENABle

The enable command enables the pulse output of the generator. It takes no arguments.

The query returns the current status of the generator's enable/disable feature. It returns the string "YES" if the generator is enabled, or the string "NO" if it is not.

Syntax

enable
enable?

FREQuency

The frequency command sets the output pulse repetition frequency. The allowed frequencies range from 1 Hz to 100 kHz. Resolution varies; it is determined by a period resolution of 0.1 us. Note that frequency is linked to period. Changing one changes the other. The frequency value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current frequency setting in the <NR3 Numeric response data> format.

Syntax
frequency <value>
frequency?

GATE

The gate command controls the trigger gating, depending on its argument. The argument "ON" turns gating on, "OFF" turns it off.

The query returns the current status of the generator's gate feature. If the gating is on, it returns "ON", if off, it returns "OFF".

Syntax
gate {ON | Off}
gate?

HEADer

The header command determines whether or not the generator will return a header along with the setting value in a response message. For instance, in response to a frequency? query, the generator might return ”FREQUENCY 10E3" if headers are on, or simply "10E3" if headers are off. It takes the arguments "ON" and "OFF".

The query returns the current status of the generator's header feature. If the header is on, it returns "ON", if off, it returns "OFF".

Syntax
header {ON | OFF}
header?

HYSTeresis

The hysteresis command controls the trigger input hysteresis. An argument of "ON" turns it on, an argument of "OFF" turns it off.

The hysteresis query returns the current hysteresis setting. It returns "ON" if it is on, "OFF" if it is off.

Syntax
hysteresis {ON | OFF}
hysteresis?

LEVel

The level command sets the trigger input level. Allowed level values range from -2V to +2V, with 1mV resolution. The level value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current level setting in the <NR3 Numeric response data> format.

Syntax

level <value>
level?

LIMit

(Not available for the PSPL10050A.)

The limit command controls the generator's limit feature. An argument of "ON" turns it on, an argument of "OFF" turns it off.

The query returns the current limit setting. It returns "ON" if it is on, "OFF" if it is off.

Syntax

limit {ON | OFF}
limit?

OFFSet

(Not available for the PSPL10050A and the PSPL10060A.)

The offset command sets the baseline offset value. Allowed values range from -5 V to +5 V, with 1.25 mV resolution. The offset value has 50 ohm source impedance and is accurate only if driven into a 50 ohm load. The offset value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current baseline offset setting in the <NR3 Numeric response data> format.

Syntax

offset <value>
offset?

PERiod

The period command sets the pulse repetition period. Allowed period values are 10 microseconds to 1 second. Resolution is 0.1us. Note that period is linked to frequency. Changing one changes the other. The period value is expected to be in the <decimal numeric program data> format with optional <suffix program data>.

The query returns the current period setting in the <NR3 Numeric response data> format.

Syntax

period <value>
period?

*RCL (No query form)

The *RCL command will recall a setup from the setup memory specified in the argument. The argument must be a digit in the range 0-9. This command can be used to save bus time when switching between frequently used setups.

Syntax

*RCL <digit>

*RST (No query form)

The *RST command will set the generator functions to the power-up settings. (See page 14, *Power up conditions*.) The command takes no argument.

Syntax

*RST

*TRG (No query form)

The *TRG command triggers the generator to output one pulse. If the trigger source is not set to GPIB when this command is received, an execution error will result. Note that whether a pulse is actually generated is still subject to the gating and enable/disable features.

Syntax

*TRG

TRIGger

The trigger command selects the trigger source. Its argument can be one of the following sources: "INT", "EXT", "MAN", or "GPIB".

The query returns the current trigger source setting.

Syntax

trigger {INT | EXT | MAN | GPIB}
trigger?

*SAV (No query form)

The *SAV command will save a setup to the setup memory specified in the argument. The argument must be a digit in the range 0-9.

Syntax

*SAV <digit>

SLOPe

The slope command selects the trigger slope. Its argument can be either "POS" or "NEG", to select positive or negative trigger slope.

The query returns the string "POS" or "NEG" depending on the current slope setting.

Syntax

slope {POS | NEG}
slope?

Error reporting

When the pulse generator detects an error, it requests service by pulling the SRQ line TRUE. The controller should then perform a serial poll of all instruments on the bus to determine the source of the service request. When an instrument is polled, it will return its status byte. From the status byte, the controller will be able to determine whether or not the pulse generator is the instrument requesting service.

Status byte

The status byte contains all of the information concerning errors for the pulse generator. Each type of error is associated with a particular bit in the status byte. By checking which bits are set TRUE, the problem can be identified. Note that more than one error can occur simultaneously. The status byte is arranged as shown in the following figure.

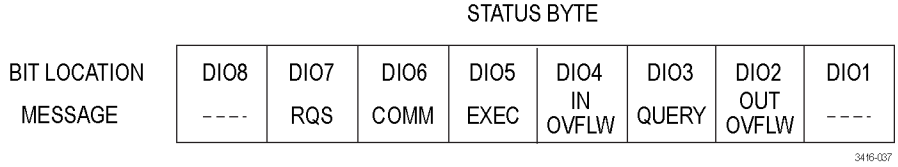


Figure 42: Status byte diagram

RQS message

The RQS bit is TRUE when the instrument is requesting service. It is, in effect, the logical OR of DIO2-DIO6. After the status byte is sent in a serial poll, the RQS bit is reset to FALSE.

Error messages

If one of the bits DIO2-DIO6 is set TRUE, then the associated error has occurred. After the status byte is sent in a serial poll, all of the error bits are reset to FALSE. A description of each error message follows.

COMM. This is a Command Error. A command error is caused when the parser detects bad syntax. Some possible causes might be a misspelling, missing argument, invalid argument, or an invalid command. When a command error is detected, the rest of the program message beyond the error is discarded.

EXEC. This is an Execution Error. An execution error is caused by a command which passed the syntax check but could not be executed. The most common cause of an execution error is when an argument is out of range. Another possible

cause is sending a *TRG command to the generator when the trigger source is not set to GPIB. When an execution error is detected, the rest of the program message beyond the error is discarded.

IN OVFLW. This error occurs when the input buffer overflows. The input buffer overflows when a single Program Message longer than the input buffer is sent to the instrument. If that occurs, the offending Program Message is discarded. See the Protocols section for information about the input buffer.

QUERY. A Query Error occurs when the instruement is addressed to talk when it has not received a valid query message. This is known as being "Addressed to talk with nothing to say."

OUT OVFLW. This error occurs when the output buffer overflows. The output buffer will overflow when too many responses are stored in the output buffer. In this case the response to the query which caused the overflow is discarded. In addition, the remainder of the Program Message after the offending query is discarded. See the Protocols section for information about the output buffer.

User service

This section describes high-level service information and procedures for your instrument.

Service offerings

Tektronix provides service to cover repair under warranty and other services that are designed to meet your specific service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians are well equipped to service your instruments. Services are provided at Tektronix Service Centers and on-site at your facility, depending on your location.

Warranty repair service

Tektronix warrants this product as described in the warranty statements at the front of this manual. Tektronix technicians provide warranty service at most Tektronix service locations worldwide. The Tektronix product catalog lists all service locations worldwide.

Calibration and repair service

In addition to warranty repair, Tektronix Service offers calibration and other services that provide cost-effective solutions to your service needs and quality standards compliance requirements. Tektronix instruments are supported worldwide by the leading-edge design, manufacturing, and service resources of Tektronix to provide the best possible service.

General care

Protect the instrument from adverse weather conditions. The instrument is not waterproof. Do not store or leave the instrument where the display will be exposed to direct sunlight for long periods of time.

CAUTION. *To avoid damage to the instrument, do not expose it to sprays, liquids, or solvents.*

Preventive maintenance

Preventive maintenance mainly consists of periodic cleaning. Periodic cleaning reduces instrument breakdown and increases reliability. Clean the instrument as needed, based on the operating environment. Dirty conditions may require more frequent cleaning than computer room conditions.

Clean the flat panel display

The flat panel display is a soft plastic display and must be treated with care during cleaning.

CAUTION. *Improper cleaning agents or methods can damage the flat panel display.*

- Do not use abrasive cleaners or commercial glass cleaners to clean the display surface.
- Do not spray liquids directly on the display surface.
- Do not scrub the display with excessive force.
- Avoid getting moisture inside the instrument while cleaning the display; use only enough solution to dampen the wipe.
- Clean the flat panel display surface by gently rubbing the display with a cleanroom wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation).
- If the display is very dirty, moisten the wipe with distilled water or a 75% isopropyl alcohol solution and gently rub the display surface. Avoid using excess force or you may damage the plastic display surface.

Clean the exterior surfaces

Clean the exterior surfaces with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

To avoid damaging the instrument follow these precautions:

- Avoid getting moisture inside the instrument during external cleaning and use only enough solution to dampen the cloth or swab.
- Do not wash the front-panel power switch. Cover the switch while washing the instrument.
- Use only deionized water when cleaning. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.
- Do not use chemical cleaning agents; they may damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Battery information

The battery in the instrument is not a user replaceable part. If you suspect problems with the battery, it is recommended that you arrange to have the instrument serviced at one of the Tektronix service centers.

NOTE. *The generator can function with a low battery or none at all in every respect except that it will lose its setup memory when it is turned off.*

Fuse replacement

The instrument is protected by a fuse placed in series with the power line input. The fuse is conservatively rated and should never open through the life of the instrument. A blown fuse would generally indicate a problem with the instrument which requires factory service. It is recommended that you arrange to have the instrument serviced if you experience a blown fuse.

Repack the instrument for shipment

If the instrument is to be shipped to a Tektronix service center for repair, attach a tag showing the following information:

- Name of the product owner
- Address of the owner
- Instrument serial number
- A description of the problems encountered and/or service required

When packing an instrument for shipment, use the original packaging. If it is unavailable or not fit for use, contact your Tektronix representative to obtain new packaging.

Compliance information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

Safety compliance

This section lists the safety compliance information.

Equipment type Test and measuring equipment.

Safety class Class 1 – grounded product.

Pollution degree descriptions A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
- Pollution degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution degree rating Pollution degree 2 (as defined in IEC 61010-1). Rated for indoor, dry location use only.

Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- Category II. Circuits directly connected to the building wiring at utilization points (socket outlets and similar points).
- Category III. In the building wiring and distribution system.
- Category IV. At the source of the electrical supply to the building.

NOTE. *Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.*

Mains overvoltage category rating

Overvoltage category II (as defined in IEC 61010-1).

Environmental considerations

This section provides information about the environmental impact of the product.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

Equipment recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

Mercury notification. This product uses an LCD backlight lamp that contains mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities or, within the United States, refer to the E-cycling Central Web page (www.eiae.org) for disposal or recycling information.