

GP1552AH

**Dual Channel,
Programmable Pulse
Generator Series**

User's Guide

November 12, 2009

GEOTEST

MARVIN TEST SYSTEMS, INC.

Safety and Handling

Each product shipped by Geotest is carefully inspected and tested prior to shipping. The shipping box provides protection during shipment, and can be used for storage of both the hardware and the software when they are not in use.

The circuit boards are extremely delicate and require care in handling and installation. Do not remove the boards from their protective plastic coverings or from the shipping box until you are ready to install the boards into your computer.

If a board is removed from the computer for any reason, be sure to store it in its original shipping box. Do not store boards on top of workbenches or other areas where they might be susceptible to damage or exposure to strong electromagnetic or electrostatic fields. Store circuit boards in protective anti-electrostatic wrapping and away from electromagnetic fields.

Be sure to make a single copy of the software CD for installation. Store the original CD in a safe place away from electromagnetic or electrostatic fields. Return compact disks (CD) to their protective case or sleeve and store in the original shipping box or other suitable location.

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Chapter 1 - Overview

Introduction

This section of the manual contains a general description of the GP1552AH Dual Channel, Programmable Pulse Generator and complete electrical, environmental, and physical specifications. Standard and optional accessories are also listed.

Description

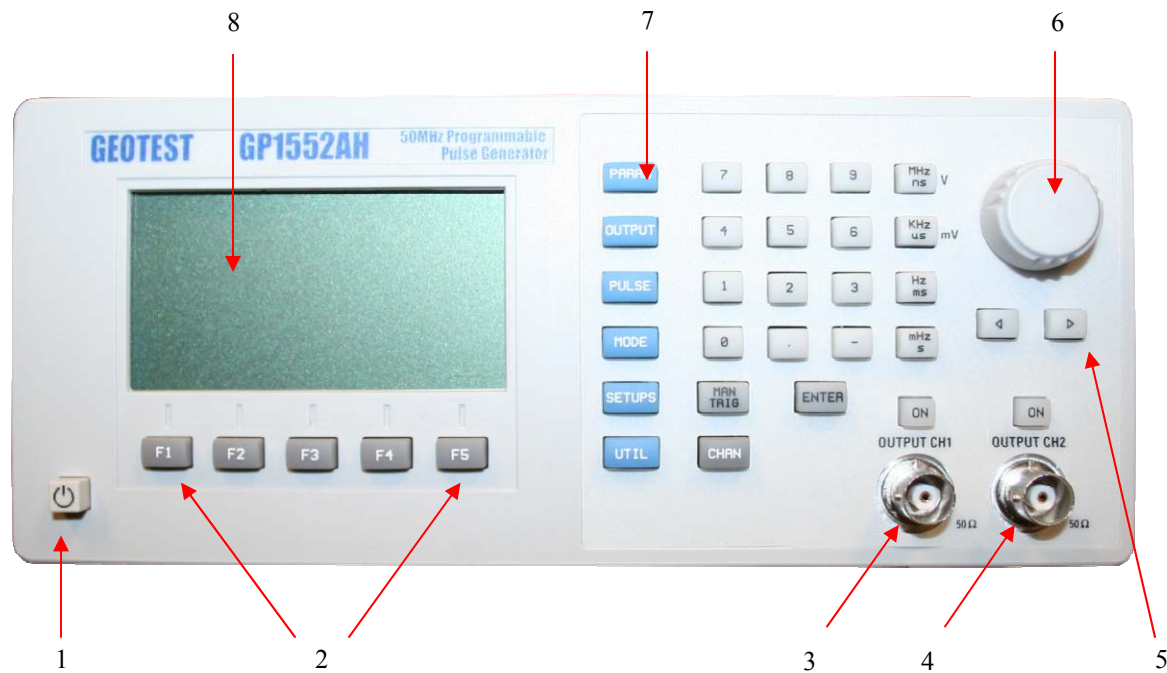
The GP1552AH is a stand-alone pulse generator that can be used as direct replacements for the obsolete **Hewlett Packard 8160A** instrument. When used as a replacement for this obsolete product, existing test software does not need to be modified as the GP1552AH operates and responds exactly as the product it replaces. The GP1552AH supports both single and dual channel configurations for the HP8160A pulse generator.

Features

- Form-Fit-Function compatibility with Hewlett Packard 8160A
- Two independent 50 MHz output channels
- Variable width and delay
- Variable transitions
- 20 Vpk-pk output into 50 Ω
- Automatic calibration

The Front Panel

The following image provides a quick description for the instrument front panel:



1: PG1552AH Front Panel

Location	Function	Location	Function
1	Power On-Off	5	Cursor Keys
2	Select menu options: F1- F5 Keys	6	Rotary Input Knob
3	SYNC Out	7	Menu Keys
4	Output Connector	8	Display Window

The Rear Panel

The following Figure 1-1 provides a quick description for the instrument rear panel:

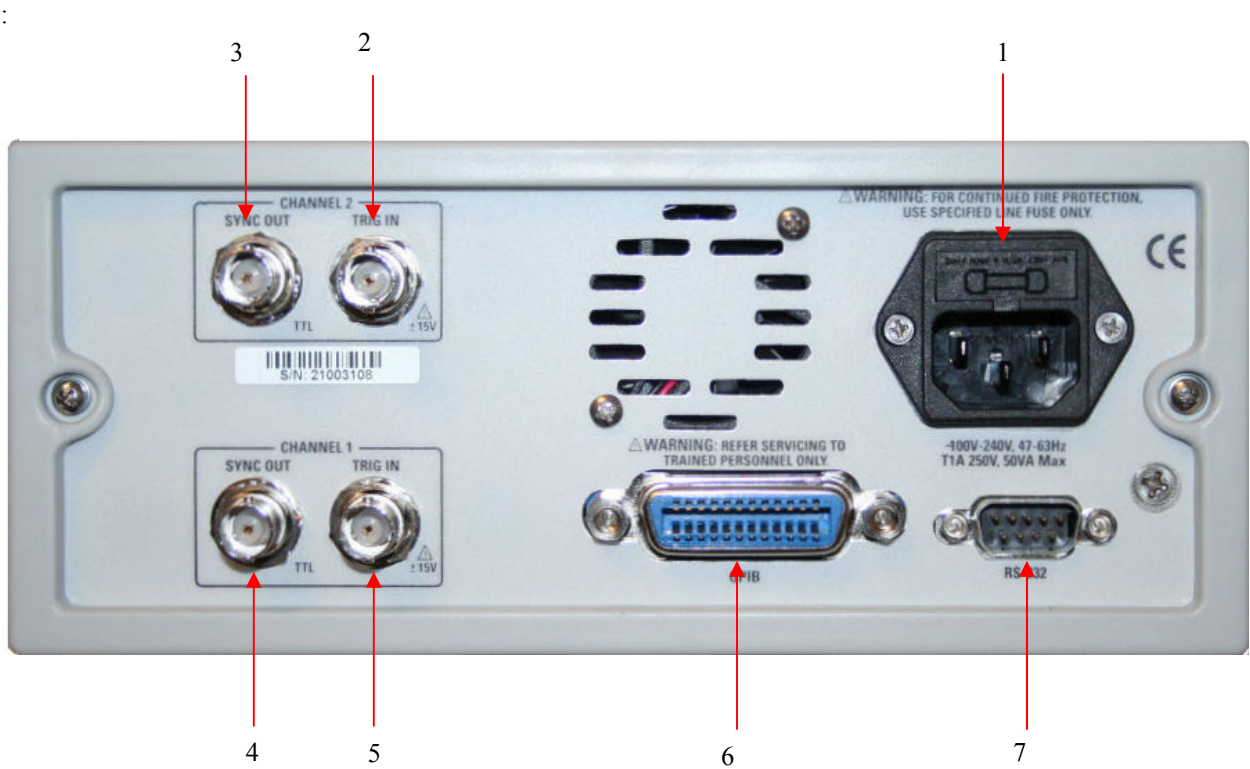


Figure 1-1: GP1552AH Rear Panel

Location	Function	Location	Function
1	Power Cord Receptacle	5	Main Trigger Input
2	Ch2 Trigger Input. DO NOT USE	6	GPIB Connector
3	Ch2 SYNC Output. DO NOT USE	7	RS-232 Connector
4	Main SYNC Output		

Instrument Description

The GP1552AH is dual channel, 50 MHz Programmable Pulse Generator designed as monolithic unit. Fully programmable both from the front panel and over the GPIB, the GP1552AH can be a useful stimulus tool either on the bench or in a system.

The GP1552AH is a programmable pulse generator featuring programmable repetition rates from 0.1 Hz -50 MHz (periods from 20 ns to 10 S), widths from 10ns - 9.99999 S, and delays from 0 ns - 9.99999 S.

Variable transitions (rise and fall) times can be programmed from 5ns to 25ms within six ranges with output levels adjustable from -9.99 to +9.99V into a 50 Ω load (pulse amplitudes from 0.5 - 10V p-p). The user can also select a TTL, CMOS, ECL, or custom defined level.

Input/output controls include standard and sync output, as well as triggering, gating, and external width input.

In addition to the essential hardware features, there are several hardware and firmware enhancements such as counted burst and internal triggering to augment the output control; 25 stored front panel settings capability with nonvolatile memory; rear interface I/O; selectable pulse polarity; and paired pulse mode.

Optional Accessories

The following options are available:

GP1552AHR - GP1552AH with Rack Mount kit



Figure 1-2: GP1552AH With a Rack Mount Kit

Safety Information

The GP1552AH is a Safety Class 1 instrument. Before operation, review this section.

The following safety precautions apply to both operating and maintenance personnel and must be observed during all phases of operation, service, and repair of this instrument. Specific warnings and cautions are found throughout the manual where they apply. Before applying power, follow the installation instructions and become familiar with the operating instructions for this instrument.

Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Geotest assumes no liability for a customer's failure to comply with these requirements.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. This instrument is grounded through the ground conductor of the supplied, three-conductor ac power cable. The power cable must be plugged into an approved three-conductor electrical outlet. Do not alter the ground connection. Without the protective ground connection, all accessible conductive parts (including control knobs) can render an electric shock. The power jack and mating plug of the power cable meet IEC safety standards.

Do not operate in an explosive atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep away from live circuits

Instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be made by qualified maintenance personnel. Disconnect the power cord before removing the instrument covers and replacing components. Under certain conditions, even with the power cable removed, dangerous voltages may exist. To avoid injuries, always disconnect power and discharge circuits before touching them.

Do not service or adjust alone

Do not attempt any internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do not substitute parts or modify the instrument

Do not install substitute parts or perform any unauthorized modifications to this instrument. Return the instrument to Geotest for service and repair to ensure that safety features are maintained.

Warnings and cautions

WARNING and **CAUTION** statements, such as the following examples, denote a hazard and appear throughout this manual. Follow all instructions contained in these statements.

A **WARNING** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in injury or death to personnel.

A **CAUTION** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in damage to or destruction of part or the entire product.



Warning – Do not alter the ground connection. Without the protective ground connection, all accessible conductive parts (including control knobs) can render an electric shock. The power jack and mating plug of the power cable meet IEC safely standards.



Warning – To avoid electrical shock hazard, disconnect power cord before removing covers. Refer servicing to qualified personnel.



Warning – To avoid electrical shock hazard, disconnect power cord before removing covers. Refer servicing to qualified personnel.



Caution – Before connecting the line cord to the AC mains, check the rear panel AC line voltage indicator. Applying a line voltage other than the indicated voltage can destroy the AC line fuses. For continued fire protection, replace fuses only with those of the specified voltage and current ratings.



Caution – This product uses components which can be damaged by electro-static discharge (ESD). To avoid damage, be sure to follow proper procedures for handling, storing and transporting parts and subassemblies which contain ESD-sensitive components.

Chapter 2 - Specifications

General Information

The following specifications describe the instrument performance after a 20 minute warm-up period into a 50 ohms load providing an internal calibration has been performed at the current operating temperature $\pm 5^{\circ}\text{C}$. All timing characteristics are measured at 50% of amplitude with fastest edges.

General Characteristics

Power Requirements	90-256V, 48-66 Hz, 70VA maximum
Memory	Non-volatile. Stores up to 99 complete panel settings. Last user setup also retained at power down.
Weight	4.1 Kg
Dimensions	Height: 89 mm (3.5 in) Width: 213 mm (8.4 in) Depth: 357 mm (14 in)
Recalibration	1 year recommended

Environmental

Characteristic	Performance Requirement
Temperature: Operating Non-Operating	0 -- 50° C -20 -- + 60° C
Humidity	95% RH, 0 – 30° C 75% RH -- 40° C 45% RH -- 50° C

Electrical Characteristics

Performance Conditions

The following characteristics in this specification are valid with the following conditions:

- The instrument must have been calibrated at an ambient temperature between 20°- 30°C.
- The instrument must be in a non-condensing environment whose limits are described under "Environmental".
- Allow 20 minutes warm-up time for operation to specified accuracy; sixty minutes after exposure to or storage in high humidity (condensing) environment.
- The instrument's main outputs must be terminated into a 50Ω load.
- Unless otherwise specified, leading and trailing edges are set to a 6 ns transition time.

- Specifications are valid with only those connections to the instrument that are required to verify each specification.
- *INT CAL* has been performed at the current operating temperature ($\pm 5^{\circ}\text{C}$).
- Any conditions that are unique to a particular characteristic are expressly stated as part of that characteristic.
- The electrical and environmental performance limits together with their related validation procedures comprise a complete statement of the electrical and environmental performance of a calibrated instrument.

Performance Requirements

The following formulas express the limits on Period, Width, and Delay. The parameters in these formulas are interactive upon each other.

Single Pulse per Period Modes

(Undelayed, Delayed, Counted Burst with single pulse)

Period - (Width + Delay) must be $> 8\text{ ns}$

$0.99 * \text{Period}$ must be $> (\text{Width} + \text{Delay})$

$P_{\text{max}} = 10.00\text{ S}$

$P_{\text{min}} = W + D + 8\text{ ns}$, but not less than 20 ns

$W_{\text{max}} = (\text{Period} * 0.99) - \text{Delay} - 8\text{ ns}$, but not more than 9.99999 S

$W_{\text{min}} = 10\text{ ns}$

$D_{\text{max}} = (\text{Period} * 0.99) - \text{Width} - 8\text{ ns}$, but not more than 9.99999 S $D_{\text{min}} = 0$

Single Pulse Transition Time Restrictions

Width must be $> 1.3 * \text{Leading Edge}$

Period - Width must be $> 1.3 * \text{Trailing Edge}$

Double Pulse per Period Modes

(Paired Pulse and Counted Burst with Paired pulses)

Delay must be $> \text{Width}$

$0.99 * \text{Delay}$ must be $> (\text{Width} + 8\text{ ns})$

$P_{\text{max}} = 10.00\text{ S}$

$P_{\text{min}} = \text{Width} + \text{Delay} + 8\text{ ns}$, but not less than 40 ns

$W_{\text{max}} = (0.99 * \text{Delay}) - 8\text{ ns}$, but not $> 4.99999\text{ S}$

$W_{\text{min}} = 10\text{ ns}$

$D_{\text{max}} = (\text{Period} * 0.99) - \text{Width} - 8\text{ ns}$, but not $> 9.99999\text{ S}$

$D_{\text{min}} = W + 8\text{ ns}$

Double Pulse Transition Time Restrictions

Width must be $> 1.3 * \text{Leading Edge}$

Delay - Width must be $> 1.3 * \text{Trailing Edge}$

Period - (Delay + Width) must be $> 1.3 * \text{Trailing Edge}$

Internal Trigger Burst Mode

0.99 * Trig Rate must be > Period * Burst Count

Period

Characteristic	Performance Requirement	Supplemental Information
Range: Single Pulse	20 ns -- 10.0 s (Repetition rate: 50 MHz -- 0.1 Hz)	
Double Pulse	40 ns - 10.0 s in Paired Pulse per period mode (Repetition rate: 25 MHz -- 0.1 Hz.)	
Accuracy	$\pm 1\%$ of setting ± 1 ns	Measured at 50% point of rising edge of sync pulse
Resolution	Up to 6 digits limited to 0.1 ns	
Jitter	$\leq 0.1\%$ of setting + 50ps, decreasing to 0.01% on slowest range	

Table 2-1: Period

Note: The Period Generator is common to both channels.

Width

Characteristic	Performance Requirement	Supplemental Information
Range: Single Pulse	10 ns - 9.99999 S limited by 8ns of off time	
Resolution	Up to 6 digits limited to 0.1nS	
Accuracy	$\pm 2\%$ of setting, ± 2 nS, measured at 50% point of leading and trailing edges set to fastest transition time (± 2 V Pulse)	Measured at 50% point of leading and trailing edges set to fastest transition time (± 2 V)
Jitter	$\leq (0.1\% \text{ of setting} + 50\text{pS})$ decreasing to 0.005% on slowest range.	
External Width	Determined by the external trigger signal, the trigger level and slope setting.	

Table 2-2: Width

Note: Width is independent for each channel.

Delay

Characteristic	Performance Requirement	Supplemental Information
Range:	0 ns – 9.99999 S	Limited by 8nS off time
Resolution	Up to 6 digits limited to 0.1nS	
Accuracy	$\pm 2\%$ of setting $\pm 2\text{nS}$ measured at 50% point of leading edge of sync to 50% point of leading of the fastest transition time ($\pm 2\text{V}$ Pulse)	Measured from 50% point of leading edge of sync to 50% point of leading edge of the fastest transition time ($\pm 2\text{V}$)
Jitter	$\leq (0.1\%$ of setting + 50 pS) decreasing to 0.005% on slowest range	

Table 2-3: Delay

Note: Delay is independent for each channel.

Duty Cycle Performance

Delay Characteristic	Performance Requirement	Supplemental Information
Range:	1 – 99%	Duty Cycle may be programmed with DUTY function key or through GPIB in Single Pulse per period mode).
Accuracy	Determined by pulse and width accuracy.	
Resolution	3 digits (0.1%)	

Table 2-4: Duty Cycle Performance

Note: Duty Cycle is independent for each channel.

Transition Times

Characteristic	Performance Requirement	Supplemental Information
Transition time	Variable: $\leq 6\text{nS}$ - 10mS Leading edge and trailing edge settable separately. Limited to 20:1 ratio between settings into one of the following ranges: 6nS - 100 ns 50nS - $1.0\text{ }\mu\text{s}$ 500nS - $10\text{ }\mu\text{s}$ $5.0\text{ }\mu\text{s}$ - 100nS $50\text{ }\mu\text{s}$ - 1.0 ms $500\text{ }\mu\text{s}$ - 10mS	Measured at $+5\text{ V}$ to $\pm 2\text{V}$ and -5V to -2V .
Resolution	3 digits, limited to 0.1 nS	
Accuracy	$\pm 5\%$ of setting $\pm 2\text{ ns}$ measured between 10 – 90% points	$\leq 5\%$ for transition time $\geq 10\text{ ns}$
Linearity	$< 5\%$ deviation from a straight line between 10% ND 90% points	

Table 2-5: Transition Time

Note: Transition Time is independent for each channel.

Amplitude

Characteristic	Performance Requirement	Supplemental Information
High level range	-9.90 - $+10\text{ V}$ into 50Ω load.	Typically -19.80V to $+20\text{V}$ into open circuit
Low level range	-10 - $+9.90\text{ V}$ into 50Ω load.	Typically -20V to 19.80V into open circuit
Pulse amplitude range	0.1 V to 10Vp-p into 50Ω load	20V p-p maximum into open circuit
Resolution	3 digit limited to 10mV	
Accuracy: (HIGH level or LOW level)	$\pm 1\%$ of level setting $\pm 2\%$ of p-p amplitude $\pm 50\text{ mV}$ into 50Ω load	
Aberrations	$\leq 5\%$ + 50 mV into a 50Ω load for pulse levels between $\pm 5\text{V}$	

Characteristic	Performance Requirement	Supplemental Information
Setting Time	50 ns + transition time	Settling time is the interval required for the pulse level to enter and remain in the specified accuracy range measured from the 90% point on the leading edge or the 10% point on the trailing edge
Output Source Resistance	50 $\Omega \pm 2\%$	
Modes	Normal Complement A Add B	

Table 2-6: Amplitude

Note: Amplitude specifications are for each channel, with an accurate (0.1%) 50 Ω load installed.

Auxiliary Outputs

Characteristic	Performance Requirement	Supplemental Information
Sync output levels	TTL Levels	Delay always measured from sync out leading edge 50% point V low ≤ 0.2 V into 50 Ω V high ≥ 2 V into 50 Ω
Width	Square Wave	
Output Resistance	Nominal 50 Ω	
Rise time	3 – 3.5 ns	

Table 2-7: Auxiliary Outputs

Operating Modes

Characteristic	Performance Requirement
Continuous	Output continuous at programmed period rate.
Triggered	Output quiescent until triggered by an internal, external, GPIB, or manual trigger; then generates one cycle at the programmed periodic rate.
Gated	Same as triggered mode except pulses are output for the duration of the gated signal; once gate deactivates, the last waveform's period continues to completion.
Burst	Same as triggered mode for programmed number of cycles from 1 – 10,000.
External width	Trigger duration and rate sets pulse width and repetition

Table 2-8: Operating Modes

Trigger/Gating Input

Characteristic	Performance Requirement	Supplemental Information
Triggering/Gating Input:		
Sensitivity	150 mV p-p minimum, DC – 50 MHZ	
Minimum Input Pulse Width	10 ns; 250 mV amplitude required for triggering	
Maximum repetition rate	50 MHZ	
Input Impedance	1 M Ω \pm 5%; =30 pF	
Maximum Input Voltage	\pm 15 V DC plus peak AC	
Threshold:		
Range	Selectable from \pm 9.99 V	
Resolution	3 digits limited to 10 mV	
Accuracy	\pm 5% of setting \pm 25 mV	
Slope Selection	Positive or Negative; for triggering and for gating, respectively	
Internal Trigger:		

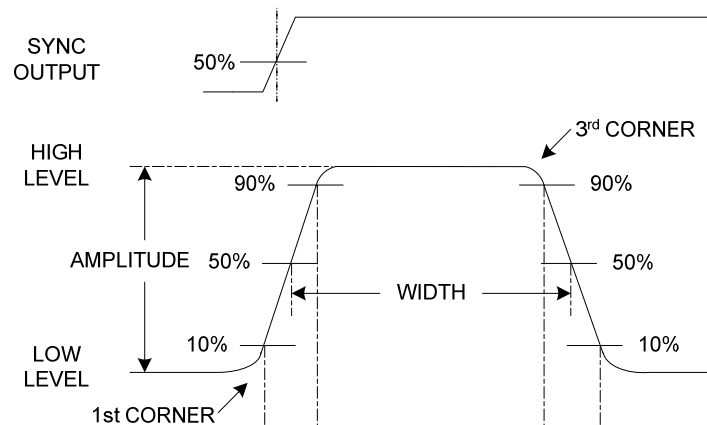
Characteristic	Performance Requirement	Supplemental Information
Repetition Rate	100 nS – 100s	
Range		
Resolution	4 digits limited to 100 nS	
Accuracy	$\pm 0.01\% \pm 1 \text{ nS}$	
Jitter	$\leq (0.1\% \text{ of setting} + 50\text{pS})$	

Table 2-9: Trigger/Gating Input

Timing Charts

Figure 2-1 and Figure 2-2 show how the instrument defines the various pulse parameters in the single and double pulse modes, respectively. Pulse parameters are specified and displayed with reference to the 50% point using the fastest transition times of 6 ns. As the transition time of the observed pulse increases the corresponding reference points approach the pulse start point.

Figure 2-3 through Figure 2-8 illustrate the output and timing for each mode and function. These charts assume the GP1552AH is set for the fastest transition time which is the reference used by the instrument when pulse parameters are specified and/or displayed.

**Figure 2-1: Single Pulse Parameter**

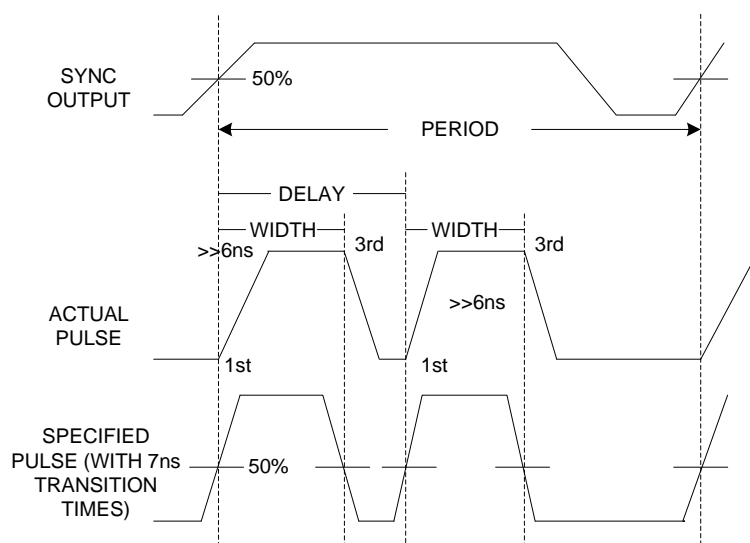


Figure 2-2: Double Pulse Parameters

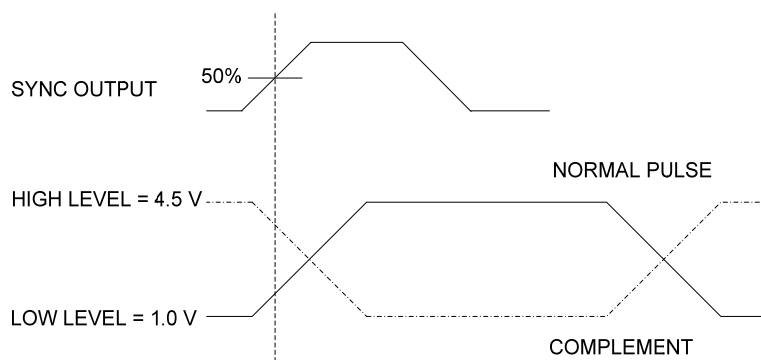


Figure 2-3: Complement Pulse Parameters

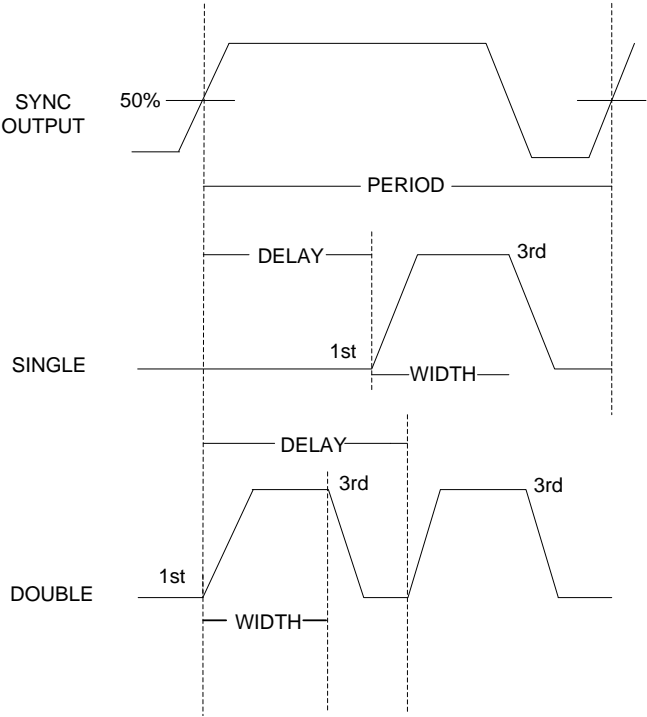
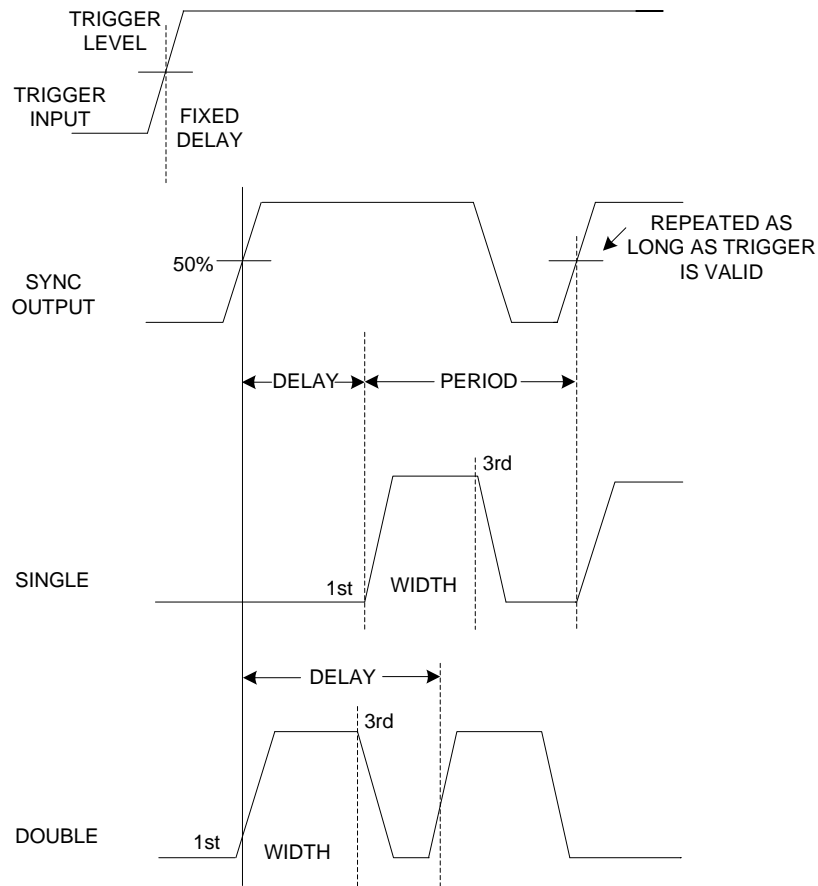


Figure 2-4: Continuous Mode

**Figure 2-5: Trigger Mode**

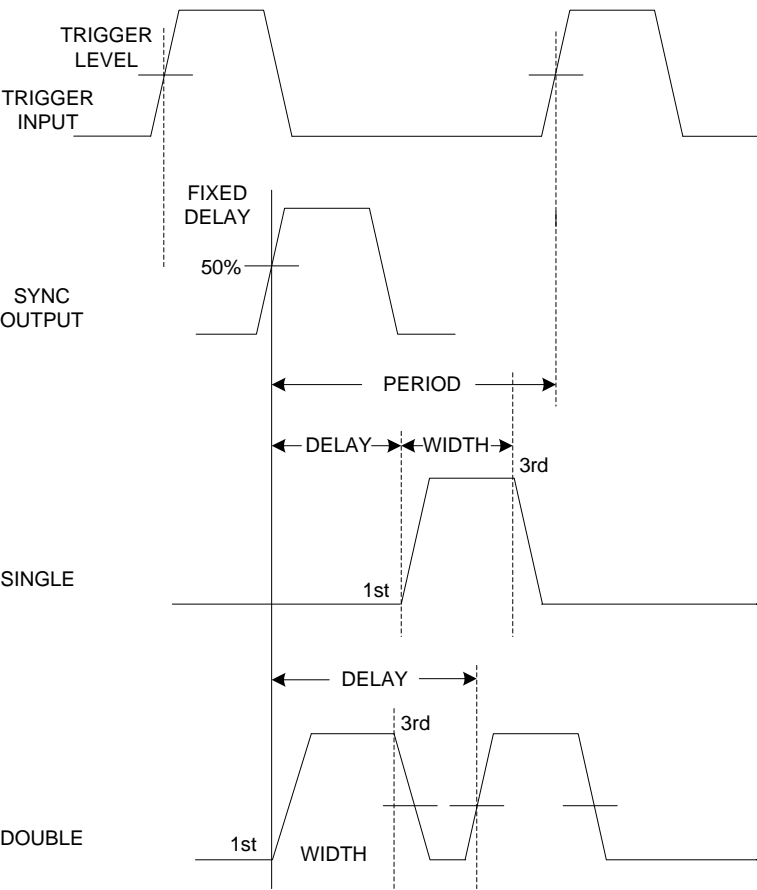


Figure 2-6: Gated Mode

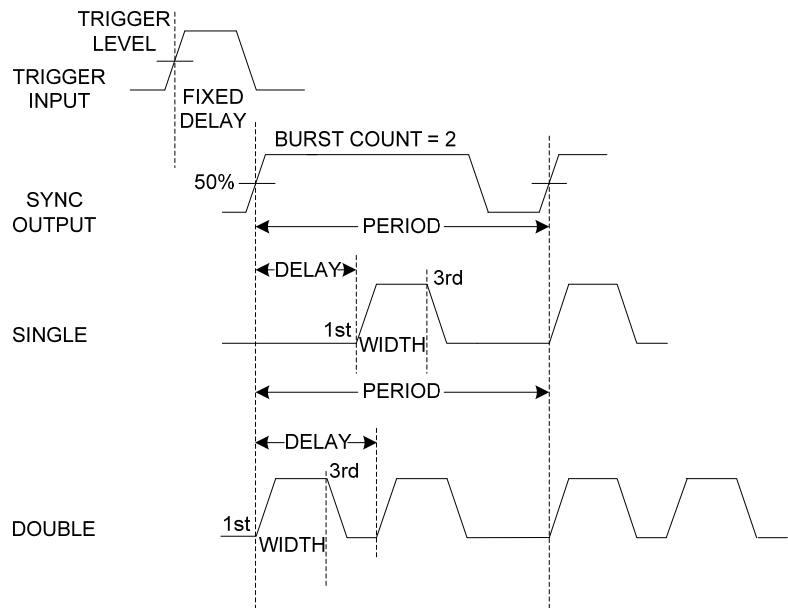


Figure 2-7: Burst Mode

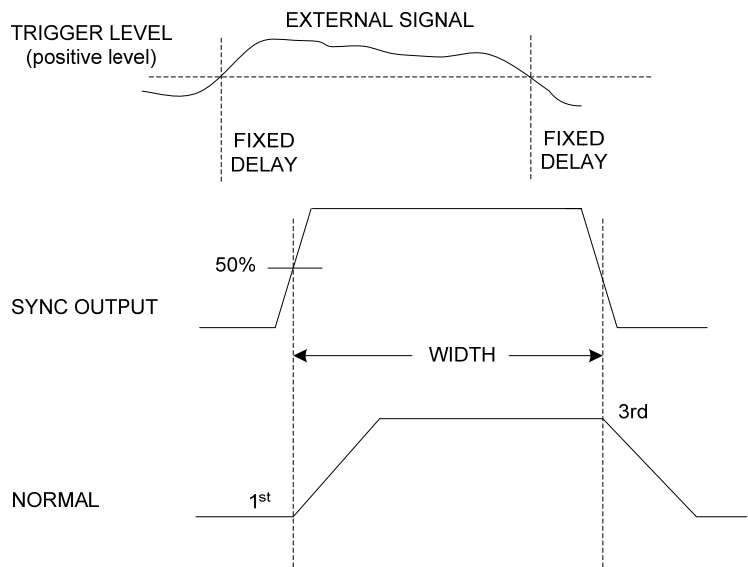


Figure 2-8: External Width

Chapter 3 - Installation

Introduction

This section contains installation information, power requirements, initial inspection and signal connections for the GP1552AH Programmable Pulse Generator.

Mechanical Inspection

The GP1552AH Programmable Pulse Generator is calibrated and ready for use when received. Upon receipt inspect the instrument for damage that might have occurred in transit. If there is damage due to shipping, file a claim with the carrier who transported the unit. The shipping and packing material should be saved if reshipment is required. If the original container is not to be used, then use a heavy carton box. Wrap the unit with plastic and place cardboard strips across the face for protection. Mark the box "FRAGILE". Cushion the instrument with urethane foam between the carton and instrument on all sides. Seal the carton with shipping tape and mark the box "FRAGILE".

Initial Inspection



Warning – To avoid hazardous electric shock, do not perform electrical tests when there are signs of shipping damage to any part of the outer covers or panels.

After the mechanical inspection, verify the contents of the shipment (accessories and installed options). If the contents are incomplete, or if the instrument does not pass the specification acceptance tests, notify the local GEOTEST service center.

Power Requirements and Line Voltage Selection



Caution– Before Applying AC Line Power ensure that the instrument is set to the local line voltage and the correct line fuse is installed in the fuse holder.

The instrument requires a power source of 90 to 250 V rms (+5%, -10%) at a frequency of 48-440 Hz single phase. The maximum power consumption is 120 VA.

The instrument power fuse is located on the rear panel.

Grounding Requirements

For the safety of operating personnel, the instrument must be grounded. The central pin on the AC plug grounds the instrument when properly connected to the ground wire and plugged into proper receptacle.



Warning – To avoid personal injury due to shock, the third wire earth ground must be continuous to the power outlet. Before connection to the power outlet, examine all cables and connections between the unit and the facility power. For a continuous earth ground path, the power cable must meet IEC safety standards.

Signal Connections

Use RG58U 50 Ohm or equivalent coaxial cables for all input and output signals to and from the instrument.

GPIO Connector

The rear panel GPIO connector (Figure 1-1), is compatible with the connector on Cable Assemblies 10833A, B, C and D. If a cable is to be locally manufactured, use male connector.

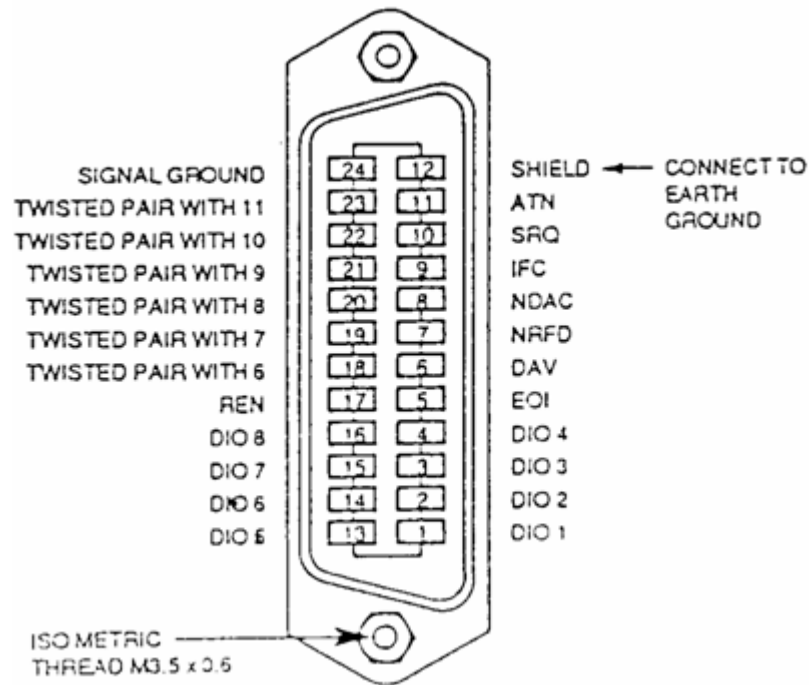


Figure 3-1: GPIO Connector

GPIO Logic Levels

The GP1552AH lines use standard TTL logic, the levels being as follows:

- True = Low = digital ground or 0 Vdc to 0.4 Vdc,
- False = High = open or 2.5 Vdc to 5 Vdc.

All GPIO lines have LOW assertion states. High states are held at 3.0 Vdc by pull-ups within the instrument. When a line functions as an input, approximately 3.2 mA of current is required to pull it low through a closure to digital ground. When a line functions as an output, it will sink up to 48 mA in the low state and approximately 0.6 mA in the high state.



Caution – The GPIO line screens are isolated from ground.

Operating Environment



Warning – The GP1552AH is not designed for outdoor use. To prevent potential fire or shock hazard, do not expose the GP1552AH to rain or other excessive moisture.

Temperature The GP1552AH may be operated in temperatures from 0°C to 55°C.

Humidity The GP1552AH may be operated in environments with humidity up to 95% (0°C to +40°C). However, the GP1552AH should be protected from temperatures or temperature changes which cause condensation within the instrument.

Instrument Cooling

The GP1552AH is equipped with a cooling fan mounted inside the rear panel. The instrument should be mounted so that air can freely circulate through it. When operating the GP1552AH, choose a location that provides at least 75 mm (3 inches) of clearance at the rear, and at least 25 mm (1 inch) of clearance at each side. Failure to provide adequate air clearance will result in excessive internal temperature, reducing instrument reliability.

Storage and Shipment

The instrument can be stored or shipped at temperatures between —40°C and +75°C. The instrument should be protected from temperature extremes which may cause condensation within it.

Claims

If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and Geotest Sales/Service Office. The Sales/Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.

Return Shipment to Geotest

If the instrument is to be shipped to Geotest, attach a tag showing owner, return address, model number and full serial number and the type of service required.

The original shipping carton and packing material may be re-usable, but the Geotest Sales/Service Office will also provide information and recommendations on materials to be used if the original packing is no longer available or reusable. General instructions for repacking are as follows:

1. Obtain RMA by submitting a support issue using the following link: <http://www.geotestinc.com/magic>
2. Wrap instrument in heavy paper or plastic.
3. Use strong shipping container. A double wall carton made of 350-pound test material is adequate.
4. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside container. Protect control panel with cardboard.
5. Seal shipping container securely.
6. Mark shipping container FRAGILE to encourage careful handling.
7. In any correspondence, refer to instrument by model number and serial number.

Chapter 4 - Operating

Introduction

The GP1552AH uses a graphical LCD display with a menu driven front panel interface. Character mnemonics describe the function/parameter being displayed with its current value. The value of a displayed parameter can be changed only if it is selected (preceded by a right carat in the display). A value is changed by using increment/decrement keys or the DATA keypad and ENTER. A decimal numeric entry can include the leading zero. Figure 4-1 shows the display, controls, and connectors on the GP1552AH front panel.

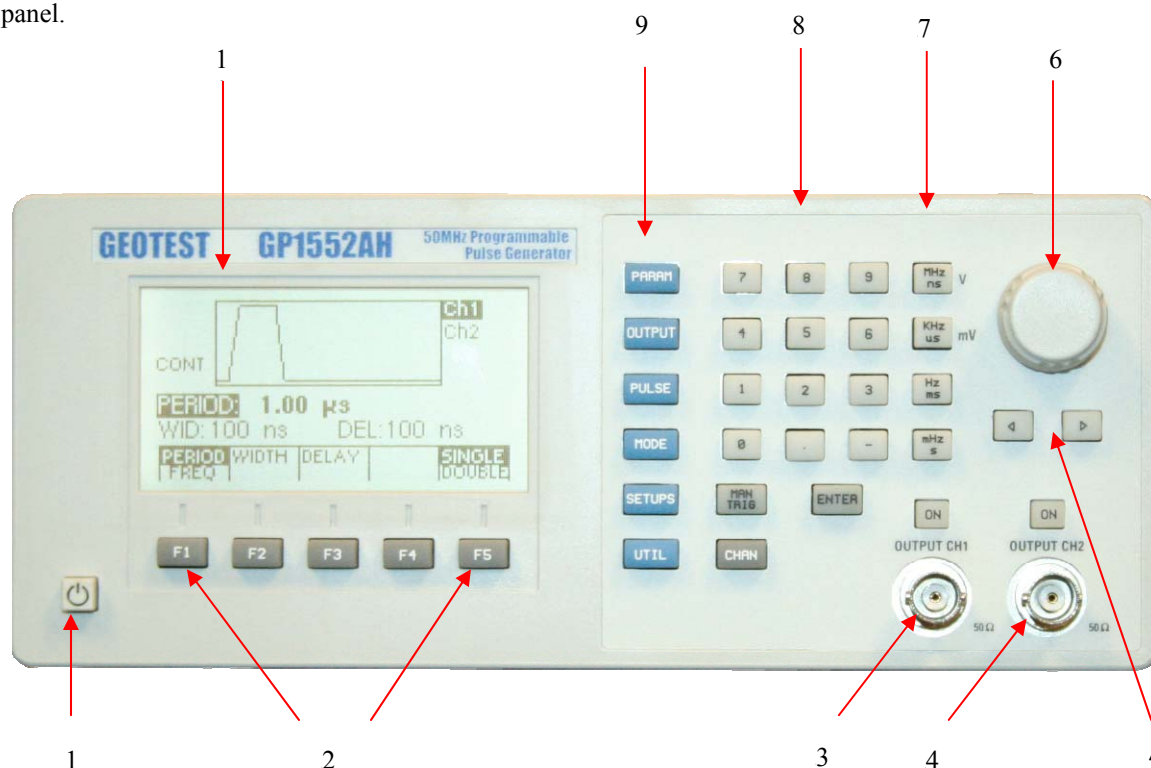


Figure 4-1: GP1552AH Front Panel

1	Power On-OFF: Applies and removes power to the unit.
2	F1 through F5 keys: Select menu options that appear on the display window. Menus differ depending on the selected parameter, function or mode.
3-4	Output Connectors: Signals output.
5	Cursor Keys: Used to move the cursor (when visible) to either left or right.
6	ROTARY INPUT knob: Used to increment/decrement numeric values or to scan through the possible values of non-numeric values.
7	Unit of Measure keys
8	Data Entry keys
9	MENU keys: Select parameters, functions or modes whose settings you want to display or change. Each key causes a different menu to appear on the lower part of the display.
10	Display Window: Displays all instrument data and settings on a LCD.

The following sections describe the function of each key and connector.

Parameter Units of Measure Keys

The units of measure keys are located in a column to the right of the DATA keypad; these keys are used to scale a numeric entry. The units of measure selected by each key depend on the function or parameter for which the numeric entry is being made. The units associated with each key are as follows:

- MHz/ns/V
- KHz/ μ s/mV
- Hz/ms
- mHz/S

Connectors

Trigger Input

The input connector for external trigger and gate functions, and for external width for the A and B channels. An LED indicator above the TRIGGER INPUT connector illuminates to indicate a valid trigger signal (flashes for an actively changing trigger signal).

SYNC Output

The output connector provides TTL level triggering for an external device.

PULSE Out

The output connectors are used for pulse output from channels 1 (A) and 2 (B). To turn on the output press the ON button next to the connector. These keys have internal LEDs that turn on and remain on while outputs are turned on.

Front Panel Controls

Selection of parameters for pulse output is accomplished through the instrument's menu system. The desired menu is accessed by pressing the corresponding menu key on the front panel. The CHAN button toggles between channels to select the correct channel for setting. After selecting the appropriate menu, the current pulse parameters controlled by that menu are displayed and their values may be changed, if desired. The Data Entry keys or the Rotary Input knob are used to change the value of the selected item. See "Standard Numeric Parameter Entry".

A key function remains selected until it is replaced by pressing another key. The typical sequence to change a value is: menu key, parameter key, new value entered with the data entry keys, unit of measure, ENTER; or, menu key, parameter key, rotary knob. To clear a partially entered value, press the menu or parameter key again.

Soft Key Operation

Operation of the menus is controlled by the use of five "soft keys" (F1 through F5) which are located in a row under the LCD display. The function of a particular soft key is defined by the specific menu being displayed and may vary between menus. The function of each soft key, within a specific menu, is indicated by a mnemonic located at the bottom edge of the LCD display immediately above the key. A blank space in the LCD display above a soft key indicates that it is not used in that menu and pressing the key will have no effect on the operation of the instrument.

Depending on the particular menu which is being displayed, pressing a soft key may select another lower level menu. To return to a higher level menu, press the appropriate menu key on the front panel. An outline of the instrument's functional menu operation is given in the next section.

Standard Numeric Parameters Entry

There are two ways of accomplishing a numeric entry:

Using the appropriate soft keys identified in the display by the mnemonics to change a value. A value is increased or decreased by using the cursor key to select which digit of the value to change and the rotating the Rotary knob. When a numeric value has been changed using the Rotary knob, it is automatically executed, and use of the ENTER key is not required.

Using the Data key pad and Unit of Measure or ENTER keys. This is accomplished by pressing the appropriate keys on the Data Entry keys followed by the ENTER key or a Unit of Measure key. If the ENTER key or a Unit of Measure key is not pressed after keying a value with the Data Entry keys, the value will not be saved and will be replaced by the previous value shown.

Moving Between Menus

To move from one menu tree to another press one of the six menu keys on the front panel. Pressing one of these keys always selects the corresponding root menu allowing an escape from any other menu.

When a menu is selected the parameters displayed by that menu have also been selected.

Note: Certain parameters only appear in a menu if appropriate. For example: In the Trigger Mode menu (see Figure 4-10), if the GP1552AH is set for internal trigger source, the slope and level parameters do not appear; they do appear, however, if the instrument is set for an external trigger source.

Menu Keys

These keys select the main menus for displaying or changing a parameter, function or mode.

Parameters Menu

This key selects and displays the waveform parameters Frequency, Amplitude and Offset, High Level and Low Level.

To display a parameter, press PARAMETERS, then press the F1, F2, F3, F4 or F5 key that corresponds to the desired Parameter menu option (see Figure 4-2).

- | | |
|-------------------|---|
| F1: PERIOD/FREQ | Selects between Frequency and Period for setting and display. |
| F2: WIDTH | Pulse duty cycle is variable from 1% to 99%. Percentage values are shown on the display. Not available if F4 is SQUARE. |
| F3: DELAY | Enables the operator to set the desired delay |
| F5: SINGLE/DOUBLE | Toggles between single or double pulse modes. Not available if F4 is SQUARE. |

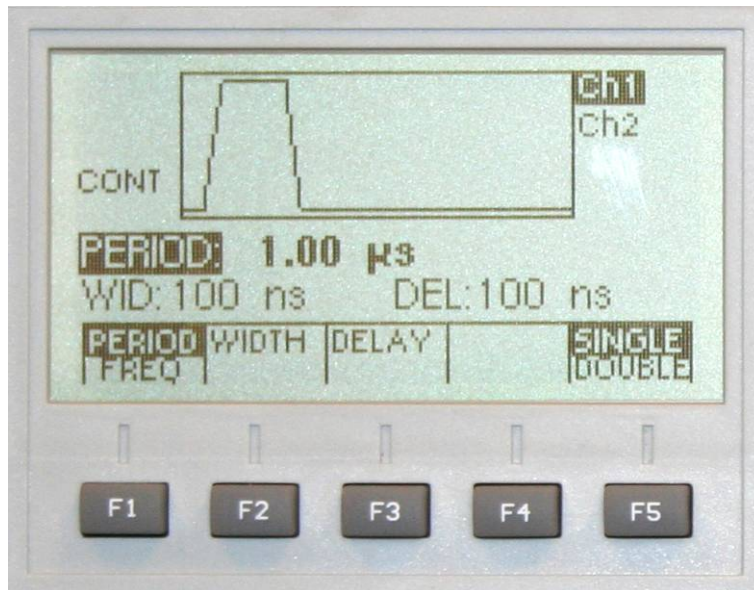


Figure 4-2: Parameter Menu

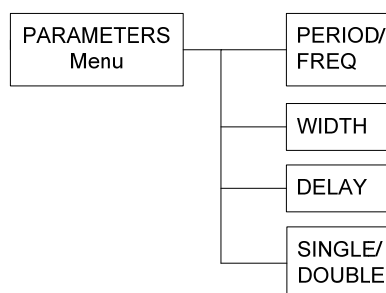


Figure 4-3: Parameters Menu Options

Output Menu

Displays the waveforms available: SINE, TRI (Triangle), and SQR (Square), Pulse and DC.

To select the output waveform, press WAVWFORM, then press the function key that corresponds to the desired Waveform menu option.

- F1: HILVL Hi Level setting. To set the level uses the key pad or the knob.
 F2: LOLVL Low Level setting. To set the level uses the key pad or the knob.
 F4: SEP/SUM Toggles between Separate mode and Channel Summing mode (A+B).
 F5: 50 Ohm/1 KOhm Selects channel output impedance, 50 Ohms or 1 KOhms.

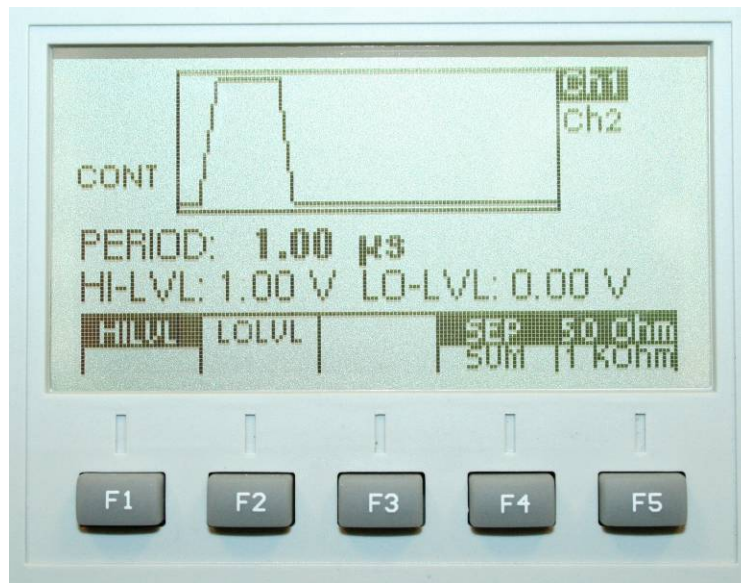


Figure 4-4: Output Menu

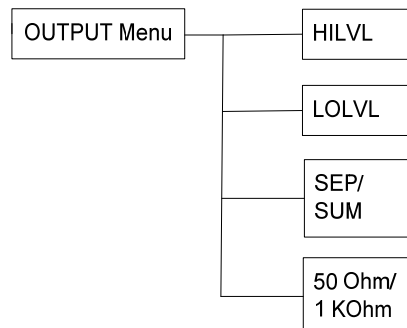


Figure 4-5: Output Menu Options

Pulse Menu

Displays the programmable pulse attributes: Rise, Fall, Equal, Comp and Norm.

To modify a pulse attribute, press PULSE, then press the function key that corresponds to the desired Pulse attribute.

- | | |
|---------------|--|
| F1: RISE | Sets the pulse rise time. |
| F2: FALL | Sets the pulse fall time. |
| F3: EQUAL | Sets the pulse fall time to be the same as the rise time. |
| F5: NORM/COMP | Toggles output format between normal (not inverted) and complement (inverted). |

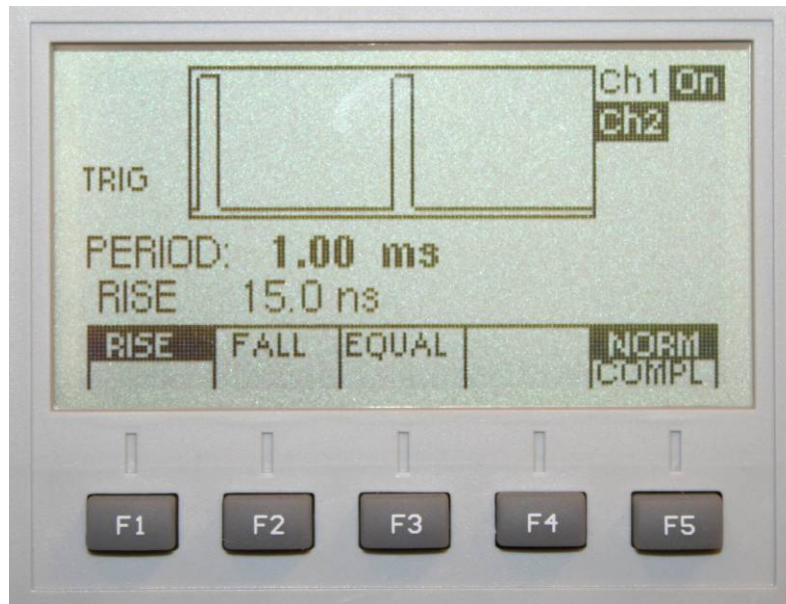


Figure 4-6: Pulse Menu

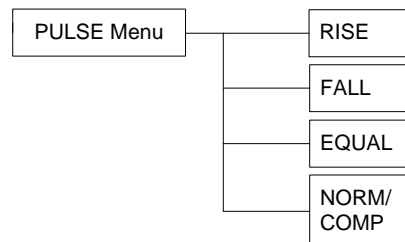


Figure 4-7: Pulse Menu Options

Mode Menu

Selects the output mode: CONT (Continuous), TRIG (Triggered), GATE (Gated), BURST and EXT WIDTH. To select the output mode, press MODE, then press the function key that corresponds to the desired Mode menu option:

- F1: CONT (Continuous) Selects continuous output.
- F2: TRIG (Triggered) Triggers one output cycle of the selected waveform for each trigger event.
- F3: GATE (Gated) Triggers output cycles as long as the trigger source asserts the gate signal.
- F4: BURST (Burst) Trigger outputs N cycles for each trigger event, where N ranges from 1 to 10000. Change N by using either the data keys or the rotary input knob.
- F5: EXTWID External Width. Output follows timing of trigger input.

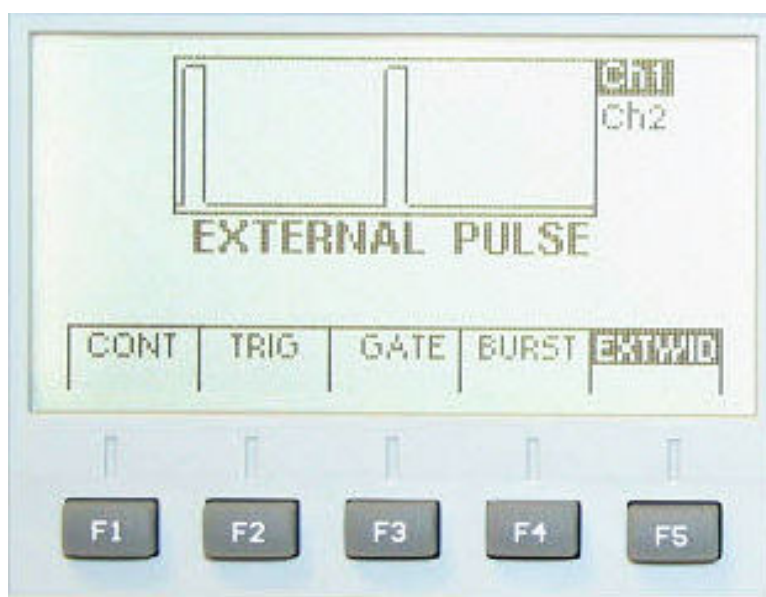
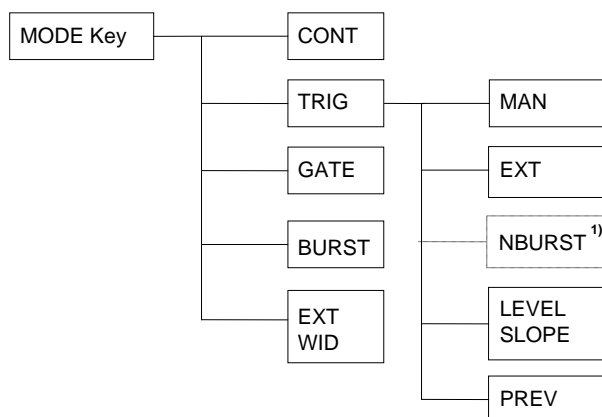


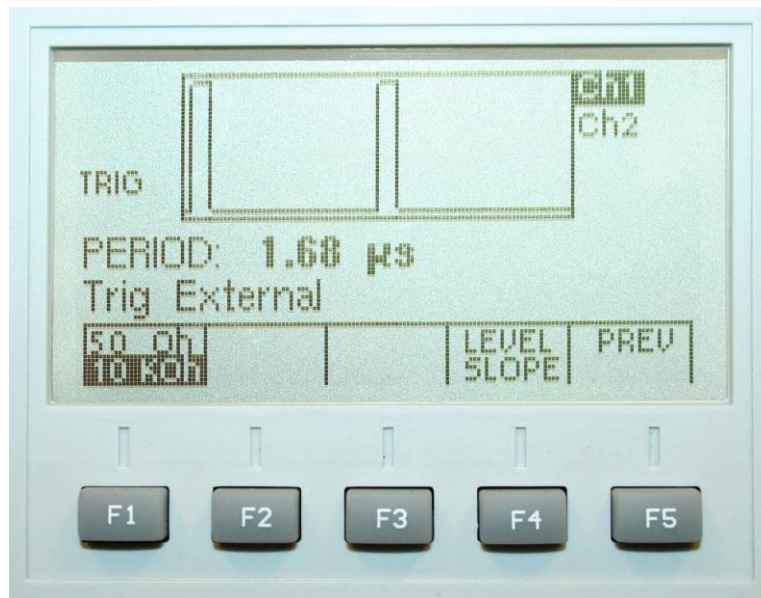
Figure 4-8: Mode Menu



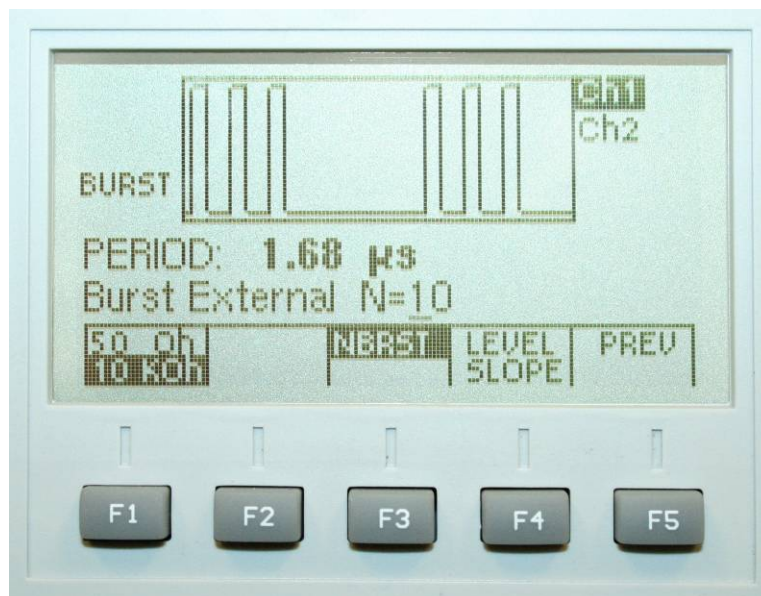
¹⁾ Burst only

Figure 4-9: Mode Menu Options**Mode Sub Menu**

After selecting the TRIG in the Mode menu, the Mode sub menu is available:

**Figure 4-10: Mode sub Menu – TRIG and GATE**

- F1: 50 Oh 10KOh Selects input impedance for External Trigger, 50ohms or 10Kohms.
- F3: EXT Selects the external trigger signal as the trigger source. The trigger source is supplied through the Main (Ch1)TRIG IN connector.
- F4: LEVEL SLOPE Toggles between trigger level settings or trigger slope settings
- F5: PREV Returns to Mode menu

**Figure 4-11: Mode sub Menu - BURST**

- F1: MAN Generates a manual trigger. To trigger the waveform generator, press this F1.
- F3: EXT Selects the external trigger signal as the trigger source. The trigger source is supplied through the Main (Ch1)TRIG IN connector.
- F4: NBRST Sets the Burst count. Valid count values are between 1-9999.
- F5: LEVEL SLOPE Toggles between trigger level settings or trigger slope settings.

Setups Menu

The waveform generator can store the current front-panel settings, called a setup, into one of 49 storage buffers. When you recall a setup, the waveform generator restores the front-panel settings to those that you stored in the selected buffer. All waveform data is stored in the setup

Selects the Sweep mode parameters

- F1: RECALL Recalls a previously stored front-panel setup from the selected buffer. Change the buffer number by using the rotary input knob or data keys. Valid storage buffer numbers are from 1 to 49.

Buffer 0 is the factory default setup; buffer 50 is the last front panel setup before power-off.

- F2: STORE Stores the current front-panel setup to the specified storage buffer. Change the buffer number by using the data keys or the rotary input knob. Valid storage buffer numbers range from 1 to 49.

- F4: CLEAR Clears all stored locations and sets the GP1552AH to the default parameters.

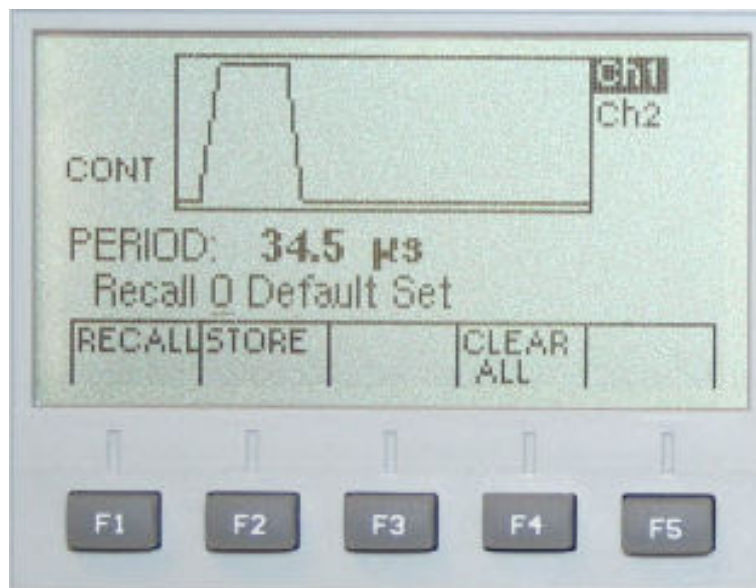


Figure 4-12: Setups Menu

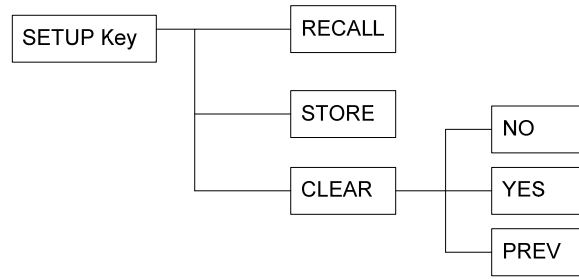


Figure 4-13: Setups Menu Options

UTIL Menu

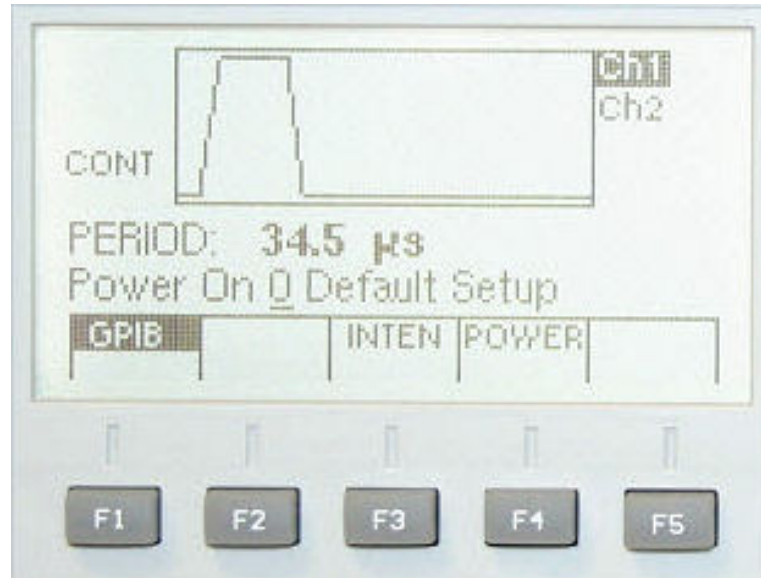
Allows setting of the instrument's GPIB address and to adjust the LCD intensity.

To set GPIB address, press UTIL and select GPIB. To adjust LCD intensity, press UTIL and select INTEN.

F1: GPIB Sets the instrument's GPIB address

F3: INTEN Adjusts the LCD intensity

F4: POWER Selects which save setting location to load on power up



4: Util Menu

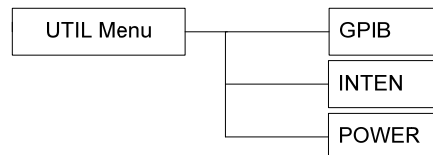


Figure 4-14: UTIL Menu Options

Connectors

The Pulse Generator has two BNC connectors on the front panel and four on the rear panel where you can connect coaxial cables. These coaxial cables provide input and output signals to and from the Pulse Generator.

Output Connector	Use this connector to transfer the main output signal from the waveform generator front.
Sync Out Connector	This output provides a TTL pulse at the beginning of each period. Use this output to synchronize with other instruments
Trig In Connector	Use this connector to transfer an external trigger or gate signal, depending on the setting, to the pulse generator.

Rest of connectors are reserved and currently not in use.

Output Connections

The Programmable Pulse Generator output circuits operate as a 50 ohm voltage source working into a 50 ohm load. At higher frequencies, unterminated or improperly terminated output can cause aberrations on the output waveform. In addition, loads less than 50 ohms reduce the waveform amplitude, while loads more than 50 ohms increase waveform amplitude.

Excessive distortion or aberrations caused by improper termination are less noticeable at lower frequencies, especially with sine and triangle waveforms. To ensure waveform integrity, follow these precautions:

1. Use good quality 50 ohms coaxial cable and connectors.
2. Make all connections tight and as short as possible.
3. Use good quality attenuators if it is necessary to reduce waveform amplitudes applied to sensitive circuits.
4. Use termination or impedance-matching devices to avoid reflections.
5. Ensure that attenuators and terminations have adequate power handling capabilities.

If there is a DC voltage across the output load, use a coupling capacitor in series with the load. The time constant of the coupling capacitor and load must be long enough to maintain pulse flatness.

Operating Considerations



Caution - Observe the specified maximum input voltage ratings listed in the Electrical Specifications in this document; otherwise, instrument damage can occur if the maximum input ratings are exceeded.

Impedance Matching

If the waveform generator is driving a high impedance, such as the 1 mega Ohm input impedance (paralleled by a shunt capacitance) of an oscilloscope vertical input, connect the transmission line to a 50 ohm attenuator, a 50 ohm termination, and the oscilloscope input. The attenuator isolates the input capacitance of the device and terminates the waveform generator properly.

Error Check

At power-on, the waveform generator performs a diagnostic self-test procedure to check itself for errors. If it finds an error, an error code and text appear in the display window. Other error codes appear when you enter an invalid front-panel setting. For more information on error codes, see the topic **Displaying Errors** in Chapter 4 – Operating Instruction.

Power-On Settings

When the waveform generator finishes the diagnostic self-test routine, it enters the local state (LOCS) and assumes the last saved settings.

Chapter 5 - Programming

Introduction

The GP1552AH can be operated by remote control over the digital bus specified in **IEEE Standard 488-1987**, commonly called the General Purpose Interface Bus (GPIB). The command set supports emulations to the HP model 8160A command set.

This chapter describes the GPIB operation in general and the command set offered by the instrument.

GPIB Programming

Setting the GPIB Bus Address

The GPIB address is stored in non-volatile Flash memory. The address is selected by use of the UTIL root menu via the front panel using the following procedures.

Setting the GPIB address

Select the UTIL root menu by pressing the corresponding key on the front panel, then press the GPIB soft key. Use the rotary knob or the data entry keys and ENTER to select the desired GPIB address. The legal values are 0 - 31. Address 31 disconnects the GP1552AH from bus communication; however, the instrument remains an active electrical load. (At shipment, the GPIB address is set to 10.)

Control Messages

The GP1552AH responds to interface control messages as described below. All of the following messages, except IFC, are sent with ATN (Attention) asserted:

DCL - Device Clear. This message terminates device dependent message processing, resets the input and output buffers, clears any buffered settings waiting for the *GET* message, and clears the instrument status, except for the power on status.

GET - Group Execute Trigger. If the instrument is in the DT SETTINGS mode, decoded settings are buffered but not executed until the receipt of the *GET* message. If the PG511 0 is in the DT TRIGGER mode, and the instrument is in TRIGGERED or NBURST mode, each *GET* received will cause one cycle (TRIGGER) or a programmed number of cycles (NBURST) to be generated. If the GP1552AH is in the DT GATE mode, the instrument gate setting will be toggled each time *GET* is received. The instrument responds to *GET* only if it is listen addressed. DT OFF disables response to *GET*.

GTL - Go-To-Local. This causes the instrument to go to a local state. This state is described under Remote-Local Functions. The instrument responds to *GTL* only if it is listen -addressed.

IFC - Interface Clear. When the IFC line is pulsed, the instrument is taken to an idle state. Pulsing IFC is the equivalent of sending *UNT UNL, SPD*.

ILLO - Local Lockout. This causes the instrument to go to the Local With Lockout State (LWLS) or the Remote With Lockout State (RWLS) if REN is asserted.

SDC - Selected Device Clear. Same as *DCL* message. The instrument responds to SDC only if it is listen addressed.

SPE, SPD - Serial Poll Enable and Serial Poll Disable. Configures instrument for serial poll capability.

Remote-Local Function Operation

The Remote-Local functions of the GP1552AH are controlled by the system controller and the front panel controls. There are four states associated with the Remote-Local functions of the GP1552AH; two "local" states and two "remote" states:

Local State (LOCS). While in LOCS, the front panel controls are under the control of the operator; the front panel settings cannot be changed via setting commands from the bus. However, the instrument will respond to query commands via the GPIB bus (REN bus line need not be asserted). In a "local" state, all front panel controls are operational. If a remote command cannot be executed because the instrument is in a "local" state, an execution error will be reported to the controller.

Local With Lockout State (LWLS). If the GP1552AH enters the Local With Lockout State, the RMT indicator light will not be lit and the instrument operates exactly as it does in the Local State (LOCS).

Remote State (REMS). When the GP1552AH receives its listen address, with the REN bus line asserted, and RTL is false, it enters the Remote State and the front display indicates "Remotely Controlled – GPIB". While in REMS, the instrument responds to and executes all setting commands, queries, and interface messages from the bus. If the GP1552AH is in REMS, there are three conditions under which it will return to the Local State (LOCS):

- When any key is depressed by the operator.
- When the instrument receives the Go To Local (GTL) interface message.
- If the REN bus line becomes unasserted (false).

Note: The GP1552AH can be in either the Local State (LOCS) or Remote State (REMS) when the Local Lockout (LLO) interface message is received. If in LOCS and REN is asserted, it will enter the Local With Lockout State (LWLS) or if in REMS, it will enter the Remote With Lockout State (RWLS) when LLO is received. The RWLS and LWLS state transitions are completely controlled by the controller.

Remote With Lockout State (RWLS). When the GP1552AH enters the Remote With Lockout State, the operator cannot return the instrument to local control by depressing a front panel key. While in RWLS, the front display will indicate "Remotely Controlled – GPIB", all settings, commands, queries, and interface messages from the bus will be executed, and all front panel controls, will be ignored. If the GTL message is received while in RWLS, the instrument goes to the Local With Lockout State (LWLS).

Note: The GP1552AH returns to the Local State (LOCS) any time the REN bus line becomes unasserted (false).

GPIB Interface Function Subsets

IEEE Standard 488-1987 identifies the interface function repertoire of a device on the bus in terms of interface function subsets. These subsets are defined in the standard. The subsets that apply to the GP1552AH are shown in Table 5-1: IEEE Subsets.

Mnemonic	Description	Comments
SH1	Source Handshake	Complete capability.
A1	Acceptor Hand-shake.	Complete capability.
T6	Basic Talker.	Responds to Serial Poll, Untalk if My Listen Address (MLA) is received. No Talk Only Mode.
TE0	Extended Talker (secondary address)	No capability.
L4	Basic Listener	Unlisten if My Talk Address (MTA) is received. No Listen Only Mode.
LEO	Extended Listener (secondary address)	No capability.
SR1	Service Request	Complete capability.
RL1	Remote Local	Complete capability including local lockout.
PPO	Paralleled Poll	Does not respond to Paralleled Poll.
DC1	Device Clear	Complete capability.
DT1	Device Trigger	Complete capability.
C0	Controller	No Capability.
E2	Electrical Interface	Three-state driver capability.

Table 5-1: IEEE Subsets

Talk Mode

If the GP1552AH is talked without being specifically told what to say, it will return a hexadecimal 'FF' (decimal 255) byte with the selected message terminator to indicate the "talked with nothing to say" condition.

Instrument Commands

The instrument is controlled by the front panel or via commands received from the controller. These commands are of three types:

Setting Commands. These commands control instrument settings. They are not executed until an operational command or an EOI is issued.

Query-output commands. These commands ask for data.

Operational commands. These commands cause a particular action. They are executed immediately.

The instrument responds to and executes all commands when in the remote state. When in the local state, setting and operational commands generate errors since instrument functions are under front panel control; only query-output commands are executed.

Each command begins with a header, which is a word that describes the function implemented. Many commands require an argument following the header; an argument is a word or number that specifies the desired state for the function.

In the command descriptions that follow, commands and arguments are shown in upper and lower case characters; the upper case characters are required characters, the lower case characters are optional but are checked for errors if they are sent.

Command Set Conventions

The following conventions are used to describe the commands which are used to control the operation of the GP1552AH:

Format

The relevant mnemonic or symbol is presented in bold type and its meaning or explanation is given in italic. Example: *<defined further>* means that statements found within the bold brackets are explained further in the text; *:* = argument *link* means that a colon links arguments.

<defined further> | = or: = argument link

[optional] (block) = repeat

::= defined as (comments)

CAPitals = The use of capitals indicates the smallest legal abbreviation.

Use of the given lowercase letters is optional. The actual command sent can be in upper or lower case. Refer to the following examples:

CAP = This is the minimum abbreviation.

CaPit = This is an intermediate abbreviation.

Capitals

CAPITALS -- Examples of full commands.

<NR1> = 10 <NR2> = 10.0 <NR3> = 10.0 E-6

<NRf> ::= <NR1> or <NR2> or <NR3>

? = the instrument will return a value when it becomes a talker.

Note: instrument commands must be sent with a space between Header and Argument. Query commands must be sent without a space between Header and "?" (question mark). Commands that change settings are not executed in the Local Mode.

The use of abbreviations shorter than those indicated should be done with caution. Erroneous results or damage can result if such data is sent to the wrong instrument type.

GPIB Operation

The GP1552AH operates on the GPIB as follows:

Listens to messages from GPIB system controller by means of which all GP1552AH operating parameters and modes can be programmed; access time (the time between program command and the implementation at the GP1552AH output) is 20 ms,

Talks; provides error messages and reports operating or stored parameters.

The bus lines are as follows (all use negative logic):

8-bit data bus (lines DIO 1 to 8),

Handshake lines - DAV (data valid), N R F D (not ready for data), NDAC (data not accepted),

Control lines - I FC (interface clear), ATN (attention), SRQ (service request), REN (remote enable), EOI (end or identify).

The GP1552AH uses all lines except EOI. In this manual, bus information will generally be restricted to GP1552AH specifics, for this reason, the handshake lines will not be discussed and the control lines will only be mentioned in connection with specific GP1552AH activity.

To use the GP1552AH on the bus, remote control must be implemented. This is done by setting the REN line true. A return to local control can be made manually (LOCAL RESET button), by sending the command GTL (go to local), or by setting REN false. Refer to Local, Remote and Local Lockout in this chapter).

Mode and Parameter Setting

When the GP1552AH has been listening addressed, it will be prepared to accept messages which will change a parameter or its operating mode. Each mode and parameter-setting message consists of a number of ASCII data bytes transmitted serially over the data lines with ATN false. The coding for the bytes is given on the front panel and also shown in † For multi-channel instruments the channel must be specified when programming these parameters.

which summarizes all mode and parameter-setting messages, and provides an example.

Programmed Trigger

When the GP1552AH is in trigger or burst modes, a trigger message (GET) will initiate a single cycle or a burst.

GP1552AH / HP 8160A Programming Reference

Programming Instructions

The following table summarizes the GP1552AH's HP 8160A GPIB command set:

Message	ASCII bytes	Comments
Input modes		
select normal	I1	
select trigger	I2	Trigger message(Table---can be used)
select gate	I3	
select burst	I4	Trigger message(Table---can be used)
External slope		
positive	E1	
negative	E2	
Parameters		
set period	PER	18NS-999MS
set delay	DEL ↗	0NS-999MS
set double pulse	DBL ↗	18NS-999MS
set width	WID ↗	8NS-999MS
set leading edge	LEE ↗→	3NS-9.99MS
set trailing edge	TRE ↗→	-9.89V ≤HIL ≤ 9.99V } 50Ω
set high level	HIL ↗→	-9.99V ≤LOL ≤9.89V
set low level	LOL ↗→	-19.7V≤HIL ≤ 19.9V } 1kΩ -19.9V≤LOL ≤19.7V
set burst	BUR	0-9999 pulses
Channel		
A	A	
B	B	
Unit		
nanoseconds	NS	
microseconds	US	

Message	ASCII bytes	Comments
milliseconds	MS	
burst entry	BT	
volts	V	
Output mode		
A add B	AA	
A sep B	AS	
disable outputs	DI	
enable outputs	EN	
A complement	AC	
A normal	AN	
A 1 kΩ impedance	A1	
A 50Ω impedance	A5	
B complement	BC	→
B normal	BN	Only effective if channel B is
B 1 kΩ impedance	B1	fitted(option 020)
B 50Ω impedance	B5	→
Sign		
-	-	
+	+	
Decimal point		
.	.	
Memory		
Store current operating modes and parameters		
in 1552A store location 'n'	STO 'n'	N is an integer 1-9
recall and adopt parameters		
in store location 'n'	RCL 'n'	N is an integer 0-9

† For multi-channel instruments the channel must be specified when programming these parameters.

Table 5-2: Mode and Parameter-setting messages (ATN false)

	Parameter	Channel	Unit
Examples:	↓	↓	↓
	DEL	A	500NS
	HIL	A	1.5 V
	BUR		64

Notes: *Lower case letters* can replace any or all of the ASCII capitals.

The order in which parameters are programmed is not significant. (but consideration should be taken of SRQ – see Error Reporting in this chapter)

Learn Mode

When the GP1552AH is addressed as a talker after receiving the 'SET': message, it will output its current operating parameters to the bus (same coding as in Table 5-2). The message 'SET n' accesses addressable memory n (where n is an integer 0-9). In neither case is the store contents changed in any way. SET 0 will return the standard parameter set.

Message/Command	GP1552AH	Serial ASCII bytes or ASCII character	Comments
Trigger (GET)	Listen	BS *	ATN true
Remote control	-	-	REN true
Local lockout (LLO)	Listen	DC1 *	ATN true
Cancel local lockout	-	-	REN false
Go to local (GTL)	Listen	SOH *	ATN true
Give current	Listen	SET:	ATN false
operating parameters	Talk	Transmits operating state.	
Give parameter set	Listen	Set <i>n</i>	<i>n</i> an integer 0-9
in location n	Talk	Transmits operating state.	
Service request	Listen	-	Instrument sets SRQ true
Serial poll (SPE)		CAN *	
Talk		GP1552AH transmits error message: DIO 7 true if instrument has set SRQ true, DIO 7 false if SRQ false (or SRQ ser true by other instrument). Other bits: see Table 5-4	
		GP1552AH clears SRQ when transmission completed.	
Serial poll disable (SPD)	EM *		Controller disables SPE.
* Single ASCII character, 1 byte only.			

Table 5-3: Control Messages and Commands

Error Reporting

In the event of a program attempting to put the GP1552AH into an error condition, the GP1552AH will remain in its previous condition (except for particular transition time error) and make a service request, i.e. set SRQ line true. Under these circumstances the system controller will normally respond by addressing the GP1552AH as a talker using a serial poll command (SPE). The GP1552AH will then place a status byte message on the data bus. The contents of this byte are shown in Table 5-4.

Message Value	DIO 8	SRQ DIO 7	Status Bits		
			DIO 6	DIO 5	DIO 4 –DIO 1
0	Not	Not Service Request	X	not	X X X X
1	used	Service Request	X	used	X X X X

DIO 6 '0' = allowed error

DIO 6 '1' = un-allowed error

Table 5-4: Status Byte (1)

Status Bits 6 4 3 2 1	meaning	Description
0 0 0 0 0	Syntax error	This type of error can only occur from an incorrect character sequence when programming the GP1552AH via the GPIB.
0 0 0 0 1	Parameter error	1. The desired parameter or channel does not exist. 2. You attempt to STO 0. You attempt to RCL n (n=1 to 9) when the desired memory location contains invalid data.
0 0 0 1 1	Slope error (allowed)	The leading the trailing edge sloped are still within the same range but are excessively long and cause loss of amplitude.
Status Bits 6 4 3 2 1	meaning	Description
1 0 0 1 0	Timing error	1. Period, delay, width or double pulse settings that are out of the GP1552AH's range.* 2. Period, delay, width or double pulse settings that are incompatible with one another.
1 0 0 1 1	Slope error (unallowed)	1. A pulse with leading or trailing edges that are out of the GP1552AH total range. * 2. A pulse with leading and trailing edges that are in different slope ranges.

Status Bits 6 4 3 2 1	meaning	Description
1 0 1 0 0	Level error	<ol style="list-style-type: none"> 1. An output with high (HIL) or low (LOL) levels that are out of the GP1552A's range.* 2. An output with high and low levels that are spaced too far apart or too close. 3. Two outputs with a difference between highest high level and lowest low level that exceeds 20V. 4. A pulse amplitude that is too great for the output impedance being used. 5. A pulse amplitude that is too small for the output impedance being used.

* This errors will only be reported if the parameter is programmed alone, or if within a string it has the last position.

Table 5-5: Status Byte (2)

Chapter 6 - Maintenance

Calibration

Periodic calibration of all boards is needed because of component aging, which depends on instrument, time and environment. Use six months as an initial calibration period. If possible keep records of the parameter values, and modify the time between calibrations if the records indicate.

Required Equipment

The equipment required to perform the calibration procedure is:

1. Two BNC cable, 2-4 feet long
2. BNC to Banana Jack adapter
3. A calibrated 4½ digits or better DMM.
4. A calibrated 100MHz oscilloscope that can measure rise and fall times with two channels or more.

Amplitude Calibration Procedure

1. Set DMM to measure VDC at Auto-Range.
2. Power up the GP1552AH.
3. Let the GP1552AH warm up 15 minutes before starting calibration.
4. Verify that channel 1 is selected (ch1 is highlighted on the top right of the display). Use CHAN push button if need to change.
5. Using a BNC cable and a BNC to Banana Jack adapter, connect channel 1 output to DMM.
6. Push the SETUP menu key on the GP1552AH front panel and then push F5 quickly three times.
7. On the new menu select CALIB.
8. Push soft button 'VOLTS' (F1)

Follow the instructions on the GP1552AH display:

9. Adjust the knob on the front panel to get a reading of $0.000V \pm 0.001$ on the DMM and push Enter.
10. Adjust the knob on the front panel to get a reading of $4.500V \pm 0.001$ on the DMM and push Enter.
11. Wait for the 'Calibration Completed' message and push Enter.
12. Repeat steps 4-11 for Channel 2.
13. Turn OFF the unit.

Delay Calibration Procedure

1. Set oscilloscope scale to 5nS and 1V. Trigger on channel 1 positive edge. Channel 2 input impedance 50 ohms.
2. Using a BNC cable, connect channel 1 SYNC Output to channel 1 of oscilloscope.
3. Power up the GP1552AH.
4. Let the GP1552AH warm up 15 minutes before starting calibration.
5. Verify that channel 1 is selected (ch1 is highlighted on the top right of the display). Use CHAN push button if need to change.
6. Using a BNC cable, connect channel 1 output to channel 2 of oscilloscope.
7. Push the SETUP menu key on the GP1552AH front panel and then push F5 quickly three times.
8. On the new menu select CALIB.
9. Push soft button 'SYNC' (F2). You should see two rising edges on the scope. Adjust scope scale for optimum display.

Follow the instructions on the GP1552AH display:

10. Adjust the knob on the front panel to get a zero delay between edges on oscilloscope and push Enter.
11. Again adjust the knob on the front panel to get a zero delay between edges on oscilloscope and push Enter.
12. Wait for the 'Calibration Completed' message.
13. Repeat steps 5-12 for Channel 2. Channel 1 of oscilloscope should still be connected to GP1552AH channel 1 SYNC Output.

Delay Calibration Procedure

1. Set oscilloscope scale to 5nS and 1V. Trigger on channel 1 rising slope. Channel 1 input impedance 50 ohms.
2. Power up the GP1552AH.
3. Let the GP1552AH warm up 15 minutes before starting calibration.
4. Verify that channel 1 is selected (ch1 is highlighted on the top right of the display). Use CHAN push button if need to change.
5. Using a BNC cable, connect channel 1 output to channel 1 of oscilloscope.
6. Push the SETUP menu key on the GP1552AH front panel and then push F5 quickly three times.
7. On the new menu select CALIB.
8. Push soft button 'TRANS' (F3). You should see a rising edge on the scope. Adjust scope scale for optimum display.
9. The instrument will prompt you to enter a measured value - V13. Enter the measurement for the rise time and press ENTER.
10. Repeat for V14 through V40 for the rise time. Adjust scope time base as needed for optimum display.
11. Change the oscilloscope trigger slope to falling.
12. For V41 enter the value for the fall time.
13. Repeat for V42 through V68 for the fall time.
14. The unit will save the calibration values.
15. Connect channel 1 of oscilloscope to GP1552AH channel 2 Output.
16. On the GP1552AH front panel select CH2 using the CHAN button.
17. Repeat steps 9-14.
18. Wait for the 'Calibration Completed' message.

Firmware Upgrade

Overview

From time to time a new firmware revision may be released to correct bugs and enhance features. The GP1552AH supports field upgrade of the firmware.

The upgrade process requires a special loader software application. To obtain this application contact Geotest - Marvin Test Systems, Inc. at +1-949-263-2222 or on the web at www.geotestinc.com.

Required Equipment

The equipment required to perform the upgrade procedure is:

1. Computer with RS232 COM port and the loader software application installed
2. NULL modem cable

Connections

1. Connect null modem cable between the computer COM port and the RS232 connector in the back of the GP1552AH.

Operation

1. Set the COM port to 9600 baud rate, 8 data bits, no parity, 1 stop bit and no flow control. On most Windows operating systems this can be done from the Windows Control panel by opening the Windows Device Manager from the System applet. Please refer to Windows Help for more details.
2. Run the special loader software application
3. In the loader dialog box select the text file to load for the new revision, which you received from Geotest.
4. In the loader dialog box select the correct computer COM port that is connected to the GP1552AH.
5. In the loader dialog box click the Load button
6. Turn on instrument.
7. The loading process should start and should take about 5 minutes (about 9000 lines).
8. If an error message appears in the status bar, click Abort, turn off instrument, and go back to step 5.

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