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555 Series
Pulse Generator
User's Manual

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INTRODUCTION

This manual is designed to familiarize you with the Berkeley Nucleonics Model 555 pulse generator. Rather than the usual array of knobs and switches, the 555 uses a menu-driven user interface with "on-line" help -- once you learn the basics of operating your 555, you may never need to refer to this manual again.

The 555 has some unique features that are designed exclusively for use as a laser trigger signal generator, but can also be used as a general purpose pulse generator. Because it employs a flexible microprocessor-controlled architecture, the 555 can be customized to fit your exact requirements -- contact Berkeley Nucleonics for details.

Technical Support

For questions or comments about operating the 555 -- contact Berkeley Nucleonics via one of the following methods.

- Phone - (415)453-9955
- Fax - (415)453-9956
- Internet - www.berkeleynucleonics.com

Parts List

The following parts are included with the 555 -- contact Berkeley Nucleonics if any parts are missing.

- 555 Pulse Generator
- AC Power Cord
- User's Manual

Warranty

In addition to a 30-day money back guarantee, the 555 has a one-year limited warranty from the date of delivery. This warranty covers defects in materials and workmanship. Berkeley Nucleonics will repair or replace any defective unit. Contact us for information on obtaining warranty service. Warranty does not apply to defects resulting from:

- Improper or inadequate maintenance or calibration;
- Unauthorized modification or misuse;
- Operation outside of the published environmental specifications for the product;
- Improper site preparation or maintenance.

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Berkeley Nucleonics does not warrant the operation of this product to be uninterrupted or error free. This product is not intended for medical or life-support use, for the detonation of explosive devices, or for any other application that could cause bodily harm in the event of a product malfunction. The user assumes all risks associated with such use of this product.

Safety Issues

Normal use of test equipment presents a certain amount of danger from electrical shock because testing must be performed where exposed voltage is present. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 VDC or RMS AC should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages pose an even greater threat because such voltage can easily produce a lethal current. Your normal work habits should include all accepted practices that will prevent contact with exposed high voltage, and steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. To avoid the risk of electric shock, do not remove the instrument cover. Servicing of the instrument should only be performed by trained, qualified personnel.

2. Do not position the instrument in such a manner that makes it difficult to remove the AC power cord.

3. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment. Make certain such surfaces are not damp or wet.

4. Use the time-proven “one hand in the pocket” technique while handling an instrument probe. Be particularly careful to avoid contact with metal objects that could provide a good ground return path.

5. When testing AC powered equipment, remember that AC line voltage is usually present on power input circuits, such as the on-off switch, fuses, power transformer etc.

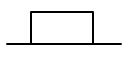
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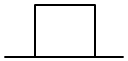
6. Never work alone. Someone should always be nearby to render aid if necessary. Training in CPR first aid is highly recommended.

7. Safety symbols used on the instrument
   - Instruction Manual symbol
     (user must refer to the instruction manual)



   - On/Standby switch symbols:

On 

Standby 



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CONTROLS & CONNECTORS

Front Panel

Display Layout and Indicators

A 4 line x 20 character vacuum fluorescent display module displays parameters and status information. The status information is located in the upper-left corner of the display, between the two brackets. There are three enunciators:

- Vertical Arrow — Indicates there are additional pages to the current menu.
- Blinking Light — Indicates the unit is actively generating pulses, or armed and waiting for an external trigger.
- Musical Note — Indicates the function key has been pressed.

The upper-right side of the display contains the title of the currently displayed menu. The rest of the display is used for system parameters. The display brightness may be adjusted allowing the instrument to be used under various lighting conditions.

Keypads

Three keypad areas provide fast access to various menus and easy editing of system parameters.

- Channel Keypad — Provides one touch access to the menus for setting up the channel parameters. Pressing the appropriate letter will display the parameters for the corresponding channel.
- Arrow Keypad — The up/down arrows are used to increment/decrement the current parameter (indicated by the blinking cursor). The position of the cursor controls the step size for each increment. The right/left arrow moves the cursor to different positions within the current parameter. The **NEXT** key selects the next parameter in the currently displayed menu. The blue Function key allows the keys to select the blue function.
- Numeric Keypad — Allows numbers and alphanumeric values to be entered. When entering alphanumeric values, pressing a key will display the first letter shown on the keypad. Repeated key presses will toggle through all the letters, both upper and lower case, shown on the keycap.

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To enter two letters which appear on the same keycap, select the first character, then use the right arrow to shift to the next position and enter the next letter. When data entry is complete the **ENTER** key must be pressed.

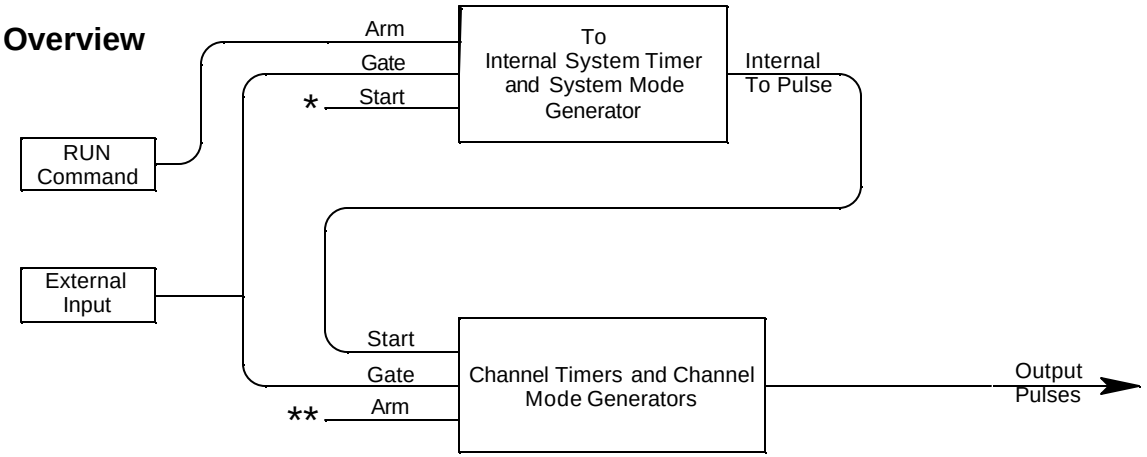
Parameter Adjustment Knob

An alternate to the Arrow Keypad, the Parameter Adjustment Knob may be used to adjust the current parameter. The step size is controlled by the position of the cursor, however turning the knob faster will increase the step size. Pushing the knob will perform functions similar to the NEXT key and switch to the next parameter in the currently displayed menu.

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Basic Operation

Overview



*Start source is: RUN button in Internal Modes
External input in External Trigger modes

**Channels are armed by the RUN button. In single shot and burst modes channels may be rearmed by pressing the RUN button.

The Model 555 Pulse Generator is designed to provide maximum flexibility, while maintaining a simple interface. A basic understanding of the architecture of the instrument will aid in fully exploiting its capabilities. Referring to the figure above, the timing generator is divided into two sections: the Internal System Timer & Mode Generator and the Channel Timer & Mode Generator.

The Channel Timer functions as a 'non-retriggerable, delayed, one shot' pulse generator. This means that the timer will only generate one delayed pulse for every start pulse received. Once the channel timer has started counting, additional start pulses will be ignored until the pulse has been completed (nonretriggerable). The start pulse for each channel is provided by the internal To pulse generated by the Internal System Timer. Whether or not a pulse is generated for each To pulse is determined by the Channel Mode Generator. Standard modes include:

Normal	a pulse is generated for each To pulse
Single Shot	a pulse is generated at the first To pulse

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Burst	a pulse is generated for each To pulse, 'n' times, after which output is inhibited
Divide-by-n	a pulse is generated every n^{th} To pulse

Different modes may be selected for each output, allowing a wide variety of output combinations. Each output may also be independently disabled or gated (using the external trigger input).

The System Timer functions as a non-retriggerable, multivibrator pulse generator. This means that once started, depending on the mode, the timer will produce pulses continuously. Before pulses will be generated, the timer must be armed and then receive a start pulse. Arming the counter is done by pressing the RUN key. With external trigger disabled, the RUN key also generates the start command for the counter. With external trigger enabled, the external trigger provides the start pulse. In either case, once started, the counter operation is determined by the System Mode Generator. Standard modes include:

Continuous	once started To pulses are generated continuously
Single Shot	one To pulse is generated for each start command
Burst Mode	'n' To pulses are generated for each start command
Duty Cycle	once started To pulses cycle on and off continuously

The To pulses are distributed to all of the start inputs of the Channel Timer and Mode Generators.

QuickStart

The default mode (channel mode = normal, system mode = continuous, and external trigger disabled) of the Model 555 generates a continuous stream of pulses when started by the RUN key. The output status is given in the upper-left corner of the display. A blinking light indicates pulses are being produced.

To generate a specific pulse train in the default mode:

- Enter the output channel menu by pressing the appropriate letter key. Set the desired pulsewidth and delay. Repeat for each output.

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- Enter the RATE menu, by pressing the FUNCTION key and then the "4" key. Set the desired pulse period. Note that in general the pulse delay plus pulsewidth should be less than the period.
- Press the RUN key.

Selecting Menus

Parameters are grouped in menus, selectable using the function keys. To select the output channel parameters press the letter key corresponding to the desired channel. To select blue menus press the FUNCTION key and then the key corresponding to the desired blue function. Menus may include a number of different pages. Each page contains up to four parameters. The status block in the upper-left corner of the display shows a vertical arrow if the current menu contains additional pages. To select the next page, select the same menu button again, pressing the FUNCTION key and blue function again for higher-order menus.

Selecting Menu Items

Within a menu, the blinking cursor indicates the current menu item for editing. The NEXT key or pressing the adjustment knob will select a different menu item.

Numeric Input Mode

When the current item is numeric, the system enters the Numeric Input Mode. In this mode data may be edited in one of three ways. Using the arrow keypad, the Left and Right arrow keys are used to select a digit to edit. The selected digit blinks to identify itself as the active digit. The Up and Down arrow keys are then used to increment or decrement this digit. Alternately, after using the Left and Right arrow keys to select an active digit, the adjustment knob may be used to increment and decrement this digit. The adjustment knob features speed dependent resolution. Slow rotation will increment or decrement the active digit by one. As you increase the speed of rotation, the parameter will be 10 to 1000 times faster depending on the speed.

The last entry mode is using the numeric keypad. Enter the number, including decimal point using the numeric keypad. When complete, enter the number using the ENTER key. Errors may be corrected using the backspace key or to start over press the clear key (CLR). Pressing the CLR key a second time will exit the numeric keypad mode and restore the original number.

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Item Edit Mode

When the current item is non-numeric, the Up and Down arrow keys are used to select among different options for the parameter. The adjustment knob may also be used to change the selection. If the item is an on/off toggle, the Up arrow (CW adjustment knob) enables the item and the Down arrow (CCW adjustment knob) disables the item.

Alphanumeric Input Mode

When the current item is alphanumeric, the system enters the Alphanumeric Input Mode. In this mode, data is entered using the alphanumeric keypad. When entering alphanumeric values, pressing a key will display the first letter shown on the keypad. Repeated key presses will toggle through all the letters, both upper and lower case, shown on the keycap. To enter two letters which appear on the same keycap, select the first character, then use the right arrow to shift to the next position and enter the next letter. The Left and Right arrow keys may be used to position the cursor to edit any character. When data entry is complete, the ENTER key must be pressed. The keys contain the following characters.

- 1 1 2 3 4 5 6 7 8 9 0
- 2 A B C a b c 2
- 3 D E F d e f 3
- 4 G H I g h i 4
- 5 J K L J k l 5
- 6 M N O m n o 6
- 7 P Q R S p q r s 7
- 8 T U V t u v 8
- 9 W X Y Z w x y z 9
- 0 0 1 2 3 4 5 6 7 8 9
- . . , # $ % & ?
- - - + * / space

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MENUS

CHANNEL Menu

CHANNEL Menus

Timing Parameters	Pulse Configuration	Special Functions	Gated Operation
Enable	Enable	Enable	Enable
	Polarity		
Pulsewidth	Output Type	Mode	Gate Enable
Delay	Output Level	Divide-by-N # / Burst	

Enable/Disable

The top of each Channel menu page is a parameter to enable or disable the output of the channel. This affects only the output of the current channel.

Timing Parameters

- PULSEWIDTH — Sets the width of the active portion of the pulse.
- DELAY — Sets the delay from the internal To or external trigger to the start of the pulse.

**NOTE: The pulsewidth + delay + 250 ns (hardware reset constant) must be less than the To period. Therefore if the sum exceeds To period, the correct pulses will be generated but at a rate slower than the To rate.*

Pulse Configuration

- POLARITY — Sets the pulse to active high or active low.
- OUTPUT TYPE — Selects between the high speed TTL/CMOS compatible output or the slower adjustable output.
- OUTPUT LEVEL — Sets the voltage level when the adjustable output is selected.

**NOTE: The unit does not generate negative output voltages. An active high TTL/CMOS pulse is: 0v - 5v - 0v. An active low pulse is: 5v - 0v - 5v. The adjustable output has a slower rise/fall time than the TTL/CMOS output and should be used only when the adjustable voltage or the extra current is needed.*

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Special Functions

- MODE — Selects the channel output mode: continuous, single shot, burst, or divide-by-n.
- #/BURST — Sets the number of pulses to be generated in the burst mode.
- DIVIDE-BY-N — Sets the divisor for the divide-by-n mode.

Gated Operation

- GATE — Enables/disables the channel gating using the external trigger input. This function is independent of any other use of the trigger input. Care should be taken to insure that all uses of the trigger are compatible.
- POLARITY — Sets the gate to active low or active high.

**NOTE: The gate function disables the channel from being triggered by the To pulse. To prevent partial pulses from being generated, the gate does not disable the channel timers. Thus, if a pulse has already started when the gate disables the channel, the pulse will continue normal output but will not restart on the next To pulse.*

MODE Menu

MODE Menus

To Mode	To Mode	To Mode	To Mode	Oscillator
MODE: Continuous	MODE: Single Shot	MODE: Burst	MODE: Duty Cycle	
			DC On	OSC Out
		# / Burst	DC Off	OSC In

Modes

- MODE — Selects the To mode: Continuous, Single Shot, Burst or Duty Cycle mode.
- #/BURST — Sets the number of pulses to be generated when in the Burst mode.

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- DC ON — Sets the number of pulses to be generated each on cycle when in the Duty Cycle mode..
- DC OFF — Sets the number of pulses to skip each off cycle when in the Duty Cycle mode.

**NOTE: Any mode may be started by either the RUN key in the internal trigger mode or armed by the RUN key and started by an external trigger in the external trigger mode. In the single shot and burst modes, (internally triggered) the unit disarms itself at the end of the pulse train. Pressing the RUN key after the unit has been disarmed will generate a new pulse train.*

RATE Menu

Rate Menu

To Period
To Period

To Period

- PERIOD — Sets the To period.

GATE/TRIGGER Menu

GATE/TRIGGER Menu

Gate/Trigger Mode	Gate/Trigger Mode	Gate/Trigger Mode
MODE: Disabled	MODE: Triggered	MODE: Gated
THRESHOLD	THRESHOLD	THRESHOLD
	EDGE	POLARITY

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Gate/Trigger Mode

- MODE — Selects external input usage for controlling To: disabled, edge triggered or level gated.
- THRESHOLD — Sets the voltage threshold for the external input. This level is applied to all uses of the external input.
- EDGE — Selects rising or falling edge for the trigger mode.
- POLARITY — Selects active high or active low in the gated mode.

**NOTE: When the gate disables the System Timer, the timer is reset. The gate edge to enable the timer will restart the System Timer, which synchronizes the To pulse to the gate and minimizes jitter relative to the gate. The trigger threshold applies to all uses, channel and system, of the trigger/gate input.*

SYSTEM Menu

SYSTEM Menus

Comm. Parameters	Keypad Parameters	Misc. Parameters
Baud Rate	Key Repeat Rate	
Echo Enable	Key Volume	Decimal Mark
GPIB Address	Knob Volume	LCD Brightness

Computer Communication Parameters

- BAUD RATE — Selects the baud rate for the RS232 interface.
- ECHO — Selects whether to echo characters back to the host computer or not.
- GPIB ADDRESS — Selects the GPIB address.

**NOTE: The unit will not respond to computer commands unless the appropriate BAUD rate or GPIB address is selected.*

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Keypad Controls

- KEY REPEAT RATE — Sets the rate at which the keys will repeat when held down. This is most useful when using the Up/Down arrows to change parameters.
- KEY VOLUME — Sets the key click volume.
- KNOB VOLUME — Sets the parameter adjustment knob click volume.

**NOTE: The key repeat rate is fairly accurate (better than one millisecond) and may be used to increase/decrease a parameter at a set rate.*

Miscellaneous

- AUTO — Auto run startup function - allows unit to automatically generate pulses after startup is complete.
- DECIMAL MARK — Selects a dot or a comma for the decimal point.
- LCD BRIGHTNESS — Sets the LCD brightness.

**NOTE: The decimal point may be replaced with a comma for display purposes, but the computer command interface always uses a decimal point.*

STORE Menu

STORE Menu

Store Menu
Configuration #
Name
Help Line

Storing a Configuration

Use the following procedure to store a complete system configuration:

- To enter the Store Menu, press the store button (function + store).
- Set all parameters to the desired value.
- Select a configuration number.

**NOTE: The number of storage locations is model dependent; see the specifications for your model. You cannot store to the zero location, as that contains the factory default values.*

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- Label the configuration as desired. Press enter key to save label.
- From the Store menu, press the store button (function + store).

Configuration #
Specifies the location to store the current system configuration. Numbers range from 1 to n, where "n" is the number of stored configuration.

Name
Prior to storing the system configuration, a label may be added to help identify the configuration later. Enter a new label using the alphanumeric keypad.

RECALL Menu

RECALL Menu

Recall Menu
Configuration #
Name
Help Line

Recalling a Configuration
Use the following procedure to recall a stored or default system configuration:

- To enter the Recall Menu, press the recall button (function + recall).
- Select a configuration number. Note that configuration 0 is the factory default setting.
- From the Recall Menu, press the recall button (function + recall).

Configuration #
Specifies the location of the system configuration. Numbers range from 0 to n, where n is the number of stored configuration. Zero is the factory default values.

Name
A label may be added to help identify the configuration. This is a read only field. The label is changed in the Store menu.

**NOTE: The number of storage locations is model dependent; see the specifications for your model.*

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AUXILIARY Menus

AUX 1 Menu

Pulsewidth	Delay
Ch A Pulsewidth	Ch A Delay
Ch B Pulsewidth	Ch B Delay
Ch C Pulsewidth	Ch C Delay
Ch DPulsewidth	Ch D Delay

The auxiliary menus provide a location for special functions to be added for semi-custom units. In addition, the Auxiliary 1 menu provides summary menus for pulsewidth and delay. Thus, providing a location to change all the delays and/or pulsewidths without having to go through all the channel menus.

**NOTE: The Auxiliary 1 Menu has summary pages for pulsewidth and delay, which allow you to change all the widths or delays from one menu.*

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BASIC OPERATION

With the channels in the normal mode, operation of the unit is controlled by the system mode and the external trigger. The basic modes are as follows:

Operational Modes w/o External Trigger

Continuous	RUN/STOP button starts and stops a continuous pulse stream at the rate specified by the RATE menu. This corresponds to the normal output mode for most pulse generators.
Single Shot	RUN/STOP button generates a single pulse.
Burst	RUN/STOP button generates a stream of "n" pulses, where "n" is specified by the Burst parameter. The rate is specified in the RATE menu. Pressing the RUN/STOP button while the burst is in process will stop the output. After the burst has been completed, pressing the RUN/STOP button will generate another burst.
Duty Cycle	RUN/STOP button starts a continuous pulse stream which oscillates for the "n" pulses and off for "m" pulses, where "n" and "m" are specified by the ON and OFF parameters, respectively. The rate is specified in the RATE menu.

Operation Modes w/External Trigger

Continuous	RUN/STOP button arms unit. The first trigger received starts continuous pulse stream at the rate specified by the RATE menu. Additional triggers are ignored. Pressing the RUN/STOP button a second time will stop and disarm the instrument.

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Single Shot	RUN/STOP button arms unit. Generates a pulse for every external trigger received. Press the RUN/STOP button a second time to disarm the instrument. This corresponds to the normal externally triggered mode for most pulse generators.
Burst	RUN/STOP button arms unit. Generates a stream of "n" pulses where "n" is specified by the Burst parameter for every external trigger received. The rate is specified in the RATE menu.
Duty Cycle	RUN/STOP button arms unit. The first trigger starts a continuous pulse stream which oscillates on for "n" pulses and off for "m" pulses, where "n" and "m" are specified by the ON and OFF parameters respectively. The rate is specified in the RATE menu. Additional triggers are ignored.

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COMPUTER INTERFACE

Serial Port Pinout

1. No Connection
2. Tx - Transmit (to computer)
3. Rx - Receive (from computer)
4. DTR - connected to pin 6
5. Ground
6. DSR - connected to pin 4
7. RTS - connected to pin 8
8. CTS - connected to pin 7
9. No connection

A standard straight through cable is used with most PCs.

Programming Command Types and Format

The Model 555 Pulse Generators use two types of programming commands: IEEE 488.2 Common Commands and Standard Commands for Programmable Instruments (SCPI). The format is the same for both the RS232 interface and the optional IEEE 488 interface. Hyperterminal (in Windows) or any other generic terminal program may be used to interactively test the commands using the RS232 interface. The format of each type is described in the following paragraphs.

IEEE 488.2 Common Command Format

The IEEE 448.2 Common Commands control and manage generic system functions such as reset, self-test, and identification. Common commands always begin with the asterisk (*) character and may include parameters. The parameters are separated from the command pneumonic by a space character. For Example:

```
*RST          <cr> <lf>
*RCL  1       <cr> <lf>
*IDN?         <cr> <lf>
```


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SCPI Command Keywords

The commands are shown as a mixture of upper and lower case letters. The upper case letters indicate the abbreviated spelling for the command. You may send either the abbreviated version or the entire keyword. Upper and/or lower case characters are acceptable.

For example: If the command keyword is given as POLarity, the POL and POLARITY are both acceptable forms; truncated forms such as POLAR will generate an error; polarity, pol, and PolAriTy are all acceptable as the pulse generator is not case sensitive.

SCPI Command and Query Format

SCPI commands control and set instrument specific functions such as setting the pulsewidth, delay and period. SCPI commands have a hierarchical structure composed of functional elements that include a header or keywords separated with a colon, data parameters and terminators.

:PULSE1:STATE ON <cr> <lf>
:PULSe1:WIDth 0.000120 <cr> <lf>
:PULSe:POL NORMal <cr> <lf>

A colon always separates one keyword from the next lower-level keyword. A space must be used to separate the keyword header from the first parameter. If more than one parameter is used, you must separate adjacent parameters with a comma.

Any parameter may be queried by sending the command with a question mark appended.

For example: :PULSE1:STATE?
Will return: 1 <cr> <lf>

:PULSE1:WIDT? <cr> <lf>
Will return: 0.000120000 <cr> <lf>

:PULSE1:POL? <cr> <lf>
Will return: NORM <cr> <lf>

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SCPI Keyword Separator
A colon (:) must always separate one keyword from the next lower-level keyword.

SCPI Option Keyword
Optional keywords and/or parameters appear in square brackets ([ ]) in the command syntax. Note that the brackets are not part of the command and should not be sent to the pulse generator. When sending a second level keyword without the optional keyword, the pulse generator assumes that you intend to use the optional keyword and responds as if it had been sent.

SCPI Specific and Implied Channel
Some commands, such as PULSe, allow specifying a channel with an optional numeric keyword suffix. The suffix will be shown in square brackets [1 / 2]. The brackets are not part of command and are not sent to the pulse generator. The numeric parameters correspond to the following channels: 0 = To, 1 = ChA, 2 = ChB, etc. Only one channel may be specified at a time.

If you do not specify the channel number, the implied channel is specified by the :INSTrument:SELect command or the last referenced channel. After power-up or reset (*RST) The instrument default is channel #1.

SCPI Parameter Types
The following parameter types are used:

<numeric value> Accepts all commonly used decimal representation of numbers including optional signs, decimal points and scientific notation:

123, 123e2, -123, -1.23e2, .123, 1.23e-2, 1.2300E-01

<boolean value> Represents a single binary condition that is either true or false. True is represented by a 1 or ON; false is represented by a 0 or OFF. Queries return 1 or 0.

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<identifier> Selects from a finite number of predefined strings.

Error Codes

The unit responds to all commands with either: ok <cr> <lf>

or ?n <cr> <lf>

Where "n" is one of the following error codes:

1	Incorrect prefix, i.e. no colon or * to start command.
2	Missing command keyword.
3	Invalid command keyword.
4	Missing parameter.
5	Invalid parameter.
6	Query only, command needs a question mark
7	Invalid query, command does not have a query form.

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Interface Examples

Example 1) - 20 ms pulsewidth, 2.3 ms delay, 10 Hz, internal, continuous operation.

:PULSE1:STATE ON <cr> <lf>	enables channel A
:PULSE1:POL NORM <cr> <lf>	sets polarity to active high
:PULSE:WIDT 0.020 <cr> <lf>	sets pulsewidth to 20 ms
:PULSE1:DELAY 0.0023 <cr> <lf>	sets delay to 2.3 ms
:PULSE0:MODE CONT <cr> <lf>	sets system mode to continuous
:PULSE0:PER 0.1 <cr> <lf>	sets period to 100 ms (10 Hz)
:PULSE0:EXT:MODE DIS <cr> <lf>	disables the external trigger

To start the pulses use either of the following commands:

:PULSE0:STATE ON <cr> <lf>	starts the pulses
:INST:STATE ON <cr> <lf>	alternate form to start pulses.

Example 2) - 25 ms pulsewidth, 0 is delay, external trigger, one pulse for every trigger.

:PULSE1:STATE ON <cr> <lf>	enables channel A
:PULSE1:POL NORM <cr> <lf>	sets polarity to active high
:PULSE:WIDT 0.000025 <cr> <lf>	sets pulsewidth to 25 ms
:PULSE1:DELAY 0 <cr> <lf>	sets delay to 0
:PULSE0:MODE SING <cr> <lf>	sets system mode to single shot
:PULS:EXT:LEV 2.5 <cr> <lf>	sets trigger level to 2.5v
:PULS:EXT:EDGE RIS <cr> <lf>	set to trigger on rising edge

To arm the instrument use either of the following commands:

:PULSE0:STATE ON <cr> <lf>	arms the instrument
:INST:STATE ON <cr> <lf>	alternate form

A software generated external trigger can be generated by using the following command:

*TRG <cr> <lf>	generates a software external trigger

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Model 555 SCPI Command Summary

Keyword	Parameter	Std/ New	Comments
:INSTrument		Std	Subsystem. Supports treating each channel as a logical instrument.
:CATalog?		Std	Query only. Returns a comma-separated list of the names of all channels. A two channel instrument would return: To, ChA, ChB.
:FULL?		Std	Query only. Returns a comma-separated list of the names of all channels and their associated number. A two channel instrument would return: To, 0, ChA, 1, ChB, 2.
:NSELect	<numeric value>	Std	Selects a channel using the channel's numeric value. All channel specific commands will refer to the selected channel.
:SELect	<identifier>	Std	Selects a channel using the channel's identifier string. All subsequent channel specific commands will refer to the selected channel.
:STATe	<boolean value>	Std	Enables/Disables the selected channel output. If To is selected all output is affected. Enabling To is the same as pressing the RUN button.

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Model 555 SCPI Command Summary

Keyword	Parameter	Std/ New	Comments
:PULSe [0]		Std	Subsystem. Contains commands to control the output pulse generation. Commands without suffix refer to the currently selected logical instrument. See INSTrument subsystem.
: STATe	<boolean value>	Std	Enables / Disables the output for all channels. Command is the same as pressing the RUN button.
:BCOunter	<numeric value>	New	Burst Counter. Number of pulses to generate in the Burst mode.
:PCOunter	<numeric value>	New	Pulse Counter. Number of pulses to generate during on cycle of the Duty Cycle mode.
:OCOunter	<numeric value>	New	Off Counter. Number of pulses to inhibit output during the off cycle of the Duty Cycle mode.
:OSCillator	INTernal / EXTernal	New	Selects the To oscillator source: Internal 80 MHz or external 10 MHz.
:EXTernal		New	Subsystem. Contains the commands to define the system use of the external input.
:LEVel	<numeric value>	New	Sets the trigger threshold. Value is in volts, with a range of 200 - 300 volts. Note: This command is an alias to :GATE:AMPLitude; both adjust the threshold for the external input.

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Model 555 SCPI Command Summary

Keyword	Parameter	Std/-New	Comments
:PULSe [1 / 2 / n]		Std	Subsystem. Contains commands to control the output pulse generation. Valid suffix range depends on the number of channels (CHA = 1, ChB = 2, etc). Command without suffix refers to the currently selected logical instrument. See INSTrument subsystem.
:STATe	<boolean value>	Std	Enables/Disables the output pulse for selected channel.
:WIDTh	<numeric value>	Std	Sets the width or duration of the output pulse.
:DELay	<numeric value>	Std	Sets the time from the start of the To period to the first edge of the pulse.
:POLarity	NORMal / COMPlement / INVerted	Std	Sets the polarity of the pulse. For NORMal operation the second nominal state is more positive than the first. COMPlement and INVerted are aliases. For both, the second state is more negative than the first.
:OUTPut		New	Subsystem. Contains command to control output mode.
:MODe	TTL / ADJustable / 35 V	New	Selects output mode: TTL/CMOS, Adjustable or 35 Volt.
:AMPLitude	<numeric value>	New	Sets Adjustable output level.
:CMODe	NORMal / SINGle / BURSt / DIVide	New	Channel Mode. Sets the channel output mode.
:BCOunter	<numeric value>	New	Burst Counter. Sets the number of pulses to generate when channel is in the BURST mode.
:DCOunter	<numeric value>	New	Divide Counter. Sets the number of pulses to generate when the channel is in the divide-by-n mode.
:CGATE		New	Channel Gate Subsystem. Contains commands to control using the gate input to control the output channel.
:STATe	<boolean value>	New	Enables/disables the use of the channel gate function.
:POLarity	NORMal / COMPlement / INVerted	New	Sets the polarity of the gate signal. NORMal output is active when gate signal is high. COMPlement and INVerted are aliases. For both, the output is active when gate signal is low.

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Model 555 SCPI Command Summary

Keyword	Parameter	Std/ New	Comments
:DISPlay		Std	Subsystem. Contains commands to control the display.
:BRIGhtness	<numeric value>	Std	Controls intensity of display. Range is 0 to 1, where 0 is off and 1 is full intensity.
:UPDate	Query	New	Query only. Forces update of display.

Keyword	Parameter	Std/ New	Comments
:SYSTem		Std	
:STATe	Query	New	Query only. Returns the state of the machine: returns ACTIVE if the machine is armed and/or generating pulses or IDLE if the machine has been disarmed, followed by a counter of the number of bursts generated by the machine. The counter ranges from 0-99 and rolls back to 0 after the 99th burst group has been completed.
:BEEPer		Std	Subsystem. Controls the audible beeper.
:STATe	<boolean value>	Std	Enables/disables the beeper.
:VOLume	<numeric value>	Std	Sets the volume of the beeper. Range is 0 to 1, where 0 is off and 1 is maximum volume.
:COMMunicate		Std	Subsystem. Controls the RS232 and GPIB interfaces.
:GPIB		Std	Subsystem. Controls the physical configuration of the GPIB port.
:ADDRess	<numeric value> [<numeric value>]	Std	Sets the GPIB address of the instrument.
:SERial		Std	Subsystem. Controls the physical configuration of the RS232 port.
:BAUD	4800 / 9600 / 19200 / 38400 /	Std	Sets the baud rate for both receiving and transmitting using the RS232 port. Valid rates are 4800, 9600, 19200 and 38400.
:ECHO	<boolean value>	New	Enables/Disables transmission of characters received by the RS232 port.
:KLOCk	<boolean value>	New	Locks the keypad.
:AUTorun	<boolean value>	New	After power-up, unit will start generating pulses automatically.
:VERSion?		Std	Query only. Returns SCPI version number in the form: YYYY.V ex. 1999.0

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IEEE 488.2 Common Commands

Mnemonic	Command Name	Parameters	Comments
*IDN?	Identification Query		Queries the Pulse Generator Identification. The ID will be in the following format: model#-option#-version#
*RCL	Recall Command	<numeric value>	Restores the state of the Pulse Generator from a copy stored in local nonvolatile memory (0 through 10 are valid memory blocks).
*RST	Reset Command		Resets the Pulse Generator to the default state.
*SAV	Save Command	<numeric value>	Stores the current state of the Pulse Generator in local nonvolatile memory (1 through 10 are valid memory blocks).
*TRG	Trigger		Generates a software trigger pulse. Operation is the same as receiving an external trigger pulse.

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SPECIFICATIONS

Internal Rate Generator

- Trigger Modes — Single shot, continuous, burst, duty cycle
- Rate — 1⁇s - 99.99999999 s (.01 Hz to 1 Mhz)
- Resolution — 100 ns
- Accuracy — 1 ns + .0001 x period
- Jitter — 1 ns (RMS)
- Burst Range — 1 - 50,000 pulses
- On/Off Cycle Range — 1 - 50,000 pulses

Channel Timing Parameters

- Delay — 0 - 99.999999999s (2 & 4 Channel Units)
  0 - 20 s (8 Channel Unit; channels 1 & 2)
  0 - 13 s (8 Channel Unit; channel 3)
  0 - 1.6 s (8Channel Unit; channels 4 - 8)
- Pulsewidth — 10 ns - 99.999999999 s (2 & 4 Channel Units)
  10 ns - 20 s (8 Channel Unit; channels 1 &2)
  10 ns - 13 s (8 Channel Unit; channel 3)
  10 ns - 1.6 s (8 Channel Unit; channels 4 - 8)
- Resolution — 1 ns
- Accuracy — 2 ns + .0001 x delay
- Timebase — 80 MHz
- Jitter — 1 ns (RMS)

Output Channel Parameters

- Impedance — 50 ohm
- Output — TTL/CMOS
  Adjustable 2.00 V - 12 V into high impedance load
  Independently adjustable for each channel
- Slew Rate — > 1 V/ns TTL/CMOS Mode
  > .1 V/ns Adjustable Mode
- Channel Modes — Single shot, normal, burst, divide-by-n
- Burst Range — 1 - 50,000 pulses
- Divide-by-n Range — 1 - 50,000

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External Trigger and Gate

- Rate — DC - 1 MHz
- Threshold — 100 mV - 12V
- Insertion Delay — < 250 ns
- Jitter — 15 ns (RMS)
- Trigger Slope — Rising or falling edge
- Gate — Active low or active high
- Impedance — 1000 ohm

Computer Interface

- RS232 — 4800, 9600, 19200, 38400 Baud. All instrument functions and settings may be controlled over the interface bus.
- GPIB (optional) — IEEE 488.2

General

- Configuration Memory — Twelve (12) complete configurations may be stored and recalled from the front panel or the computer interface.
- Weight — 6 lbs.
- Dimensions — 8.25" x 8.25" x 5.5"
- Power — 100 - 240 V~, 50 - 60 Hz, 1 A max
- Storage Temperature — -40 degrees C to +85 degrees C
- Class 1 Equipment II — Earth grounded mains supply required.
- Pollution Degree II
- Overvoltage Category II
- Safety — Designed in compliance with EN 61010-1
- EMC — Innumity: EN61326-1 : 2000 - General Requirements
  Emissions: EN55011 : 1998 - Class B

Normal Operating Conditions

- Indoor use only.
- Altitude up to 2 000 m.
- Temperature 5 degrees C to 40 degrees C.
- Maximum relative humidity 80% for temperatures up to 31 degrees C; decreasing linearly to 50% relative humidity at 40 degrees C.
- Mains supply voltage fluctuation up to $\pm$10% of the nominal voltage.

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MENU SUMMARY

CHANNEL Menus

Timing Parameters	Pulse Configuration	Special Functions	Gated Operation
Enable	Enable	Enable	Enable
	Polarity		
Pulsewidth	Output Type	Mode	Gate Enable
Delay	Output Level	Divide-by-N # / Burst	Polarity

MODE Menus

To Mode	To Mode	To Mode	To Mode	Oscillator
MODE: Continuous	MODE: Single Shot	MODE: Burst	MODE: Duty Cycle	
			DC On	OSC Out
		# / Burst	DC Off	OSC In

RATE Menu

To Period
To Period

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GATE/TRIGGER Menus

Gate/Trigger Mode	Gate/Trigger Mode	Gate/Trigger Mode
MODE: Disabled	MODE: Triggered	MODE: Gated
THRESHOLD	THRESHOLD	THRESHOLD
	EDGE	POLARITY

SYSTEM Menus

Comm. Parameters	Keypad Parameters	Misc. Parameters
Baud Rate	Key Repeat Rate	
Echo Enable	Key Volume	Decimal Mark
GPIB Address	Knob Volume	LCD Brightness

STORE Menu

Store Menu
Configuration #
Name
Help Line

RECALL Menu

Recall Menu
Configuration #
Name
Help Line

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AUX 1 Menu

Pulsewidth	Delay
Ch A Pulsewidth	Ch A Delay
Ch B Pulsewidth	Ch B Delay
Ch C Pulsewidth	Ch C Delay
Ch D Pulsewidth	Ch D Delay

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MAINTENANCE

The Model 555 pulse generator has no user-serviceable parts. For repair, contact your distributor.

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CUSTOM FEATURES

35 Volt Option

For units with the optional 35 volt output, additional BNC connectors are provided on the rear panel. The 35 volt output can be enabled independently for each of the channels from the channel output mode menu. When enabled, the rear panel outputs will provide an adjustable output from 2 volts to 38 volts and the timing will be calibrated to all other channels. The front panel output will be in the TTL/CMOS mode. The 35 volt output provides a fast, controlled rising edge. However, pulsewidth and falling edge are not tightly controlled. The front output remains calibrated. The pulsewidth can be set over the standard range of the unit to allow full use of the front panel outputs, but the 35 volt output will self limit to approximately 4 ns with some droop. To maintain the highest possible rise time, care must be taken with cabling and termination. Low capacitance cable and 50 ohm termination will provide the fastest rise times without overshoot. Faster rise times can be achieved by increasing the termination resistance, but some overshoot is likely to occur.

Keyword	Parameter	Std/ New	Comments
:MODe	TTL / ADJustable / 35 V	New	Selects output mode: TTL/CMOS, Adjustable or 35 Volt.
:AMPLitude	<numeric value>	New	Sets Adjustable output level. Note that 35 V option AMPLitude can only be set when channel is in 35 V mode.

35 Volt Specifications (@ 35 volts 1 ns unless otherwise specified)

- Output into 50 ohms 2 - 35 volts
- Risetime <10 ns
- Falltime 100 ns nominal
- Pulsewidth Accuracy 200 ns nominal
- Delay Offset Error <10 ns
- Delay Jitter <2 ns
- Pulsewidth 1 - 4 ns (width can be set longer with significant droop)
- Pulse Period single shot - .001 s (1 KHz)

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