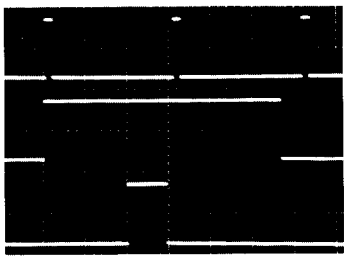
50 MHz Pulse Generator



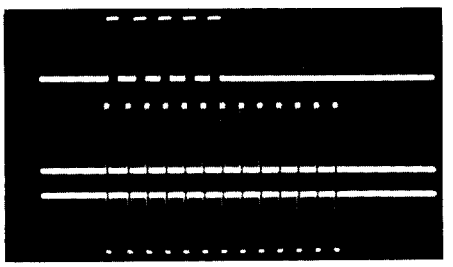
- **0.5 Hz to 50 MHz Frequency Range**
- **Full 20 Volt Output**
- **Variable Transition Times**
- **Second Channel Output Option**
- **GPIB and Stored Settings**

Wide Frequency Range
Model 859 provides 0.5 Hz (2s periods) to 50 MHz (0.02 μs periods), in a 5¼ inch high, rack mountable instrument that is fully programmable for systems applications.

Pulse Capabilities
Pulse widths can vary from 10 nanoseconds to 1 second, delays to 1 second, transition times from 5 nanoseconds to 25 milliseconds, and output levels up to 20 volts. All pulse parameters have a resolution of 3 digits. Extreme accuracy and microprocessor assisted programming ensure that the generator is producing exactly the pulse you want without having to verify its output. Output may be one pulse per period, double pulses or symmetrical square. Pulses may also be complemented.

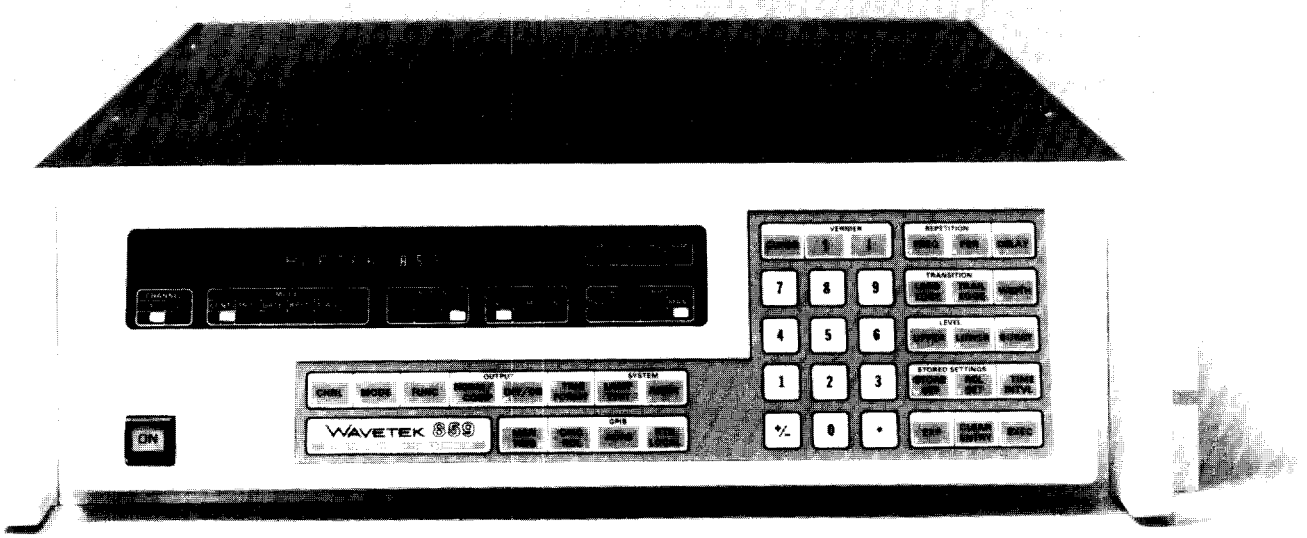
Mode Versatility
Operating modes include continuous, triggered, gated burst (1 to 10,000 pulse periods), external width mode to reconstruct or shape an external signal, and unique time interval mode for extremely long pulses.

Trigger status is always shown. Front panel annunciators give positive indication of the selection of manual triggering (pushbutton or GPIB), external rising or falling edge triggering and of trigger presence.

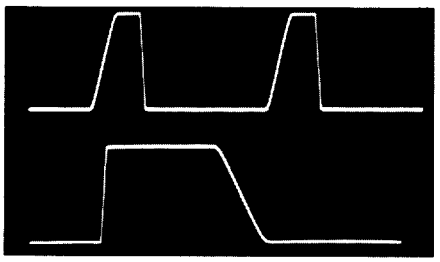


Pulse Burst

Second Channel Option
Second channel output is available for dual pulse applications. Second



channel delay, width, function, transition times, output levels and complement parameters are fully indeendent of the first channel parameters. The two channels have common repetition rate and mode.



Double and Single Pulse

GPIB Programmable
Model 859 is fully compatible with the IEEE Standard 488-1978 for your General Purpose Interface Bus (GPIB) system. All parameters can be readily bus or manually programmed using the same simple prefix/ value notation. You are not tied to a rigid format. Any combination of numerals, floating decimal points and exponents that can express values will be correctly interpreted. The combination of LED annunciators and alphanumeric display easily verifies your setup, and in case of a programming error, an error message is displayed and the bus controller is informed.

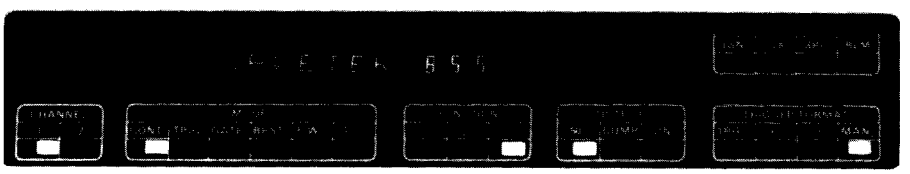
Parameter Independence
You can vary a pulse parameter with full assurance that the other parameters remain exactly as programmed. We did not redefine the parameters in order to make them independently adjustable. For example pulse width is still measured at the 50% point (not leading edge to trailing edge start) and, yes, it remains constant as the transition times are varied, or pulse height, or frequency, or any other programming parameter. If your new parameter value is not compatible with the existing setup you are informed by an error message on both the display and the bus.

False Errors Eliminated
When programming a new setup, error checking is delayed until the entire set of new parameters has been entered and executed. You do not have to concern yourself with the order in which you program a setup to avoid tedious false errors.

Stored Settings
Operation is further simplified through stored settings and vernier features standard in the Model 859. You can store and recall up to 25 complete setups in battery-backed RAM which can eliminate the need for a controller in repetitive tests.

Rapid Incrementing
Vernier controls increment or decrement a single parameter value at a rate determined by positioning the front panel cursor to the digit to be modified. Vernier control eliminates repetitive rekeying of values when you are determining exact limitations of a device under test.

Front Panel
Using the front panel keyboard and display is quite straight forward and makes pulse design and programming easily understood. The internal microprocessor "converses" with the operator via the front panel informing him of what is possible to program, what was programmed and when an error is made. The front panel display shows the parameter being programmed and its value. Adjacent to the parameter display, annunciators give the status of the 859's operating conditions. The 859 front panel lets you know what's happening.



Display and Annunciators

Optional MATE Interface

Model 859 is available with a factory-installed MATE interface per USAF Standard 2806763 (Option 010). The MATE interface consists of both hardware and software. The software accepts IEEE 488-1978 interface bus (GPIB) commands in Control Interface Intermediate Language (CIIL) as well as the "native" Model 859 language. The hardware includes expanded memory to support the additional software, shallower handles to allow the instrument to be mounted in a rack equipped with a front door, and a status monitor interface to report catastrophic failures to the control computer in real-time. The status monitor interface is independent of the GPIB.

VERSATILITY

Pulse Outputs

Four pulse outputs:
Variable main channel pulse;
A 2nd channel variable pulse (optional);
TTL compatible fixed sync pulse at lowest frequency in generation system;
Fixed symmetrical (approximately 50% duty cycle) clock output which follows repetition rate generator.

Pulse Functions

Single: One pulse each pulse period. Up to 50 MHz repetition rate.

Double: One pair of pulses each pulse period. Up to 25 MHz repetition rate. Both pulses have programmed width. Position of 2nd pulse set by delay control.

Square: Pulse is fixed symmetrical (50% duty cycle) up to 50 MHz repetition rate with variable transition times to 5 ns. 50% ±2% ±2 ns to 25 MHz. 50% ±10% ±2 ns for >25 MHz.

Inhibit: Disconnected output and no error checking on channel.

Operational Modes

Continuous: Output continuous at programmed frequency.

Triggered: Output quiescent until triggered for one pulse (or double pulse).

Gated: As triggered mode, except repetition rate generator is enabled for duration of input trigger. Last pulse period started is completed. Maximum gate rate is 25 MHz.

Burst: As triggered mode, except repetion rate generator is enabled for programmed number of pulse periods from 1 to 10,000.

External Width: Trigger duration and rate sets pulse width and repetition rate.

Time Interval: Trigger causes one pulse with programmed width.
Width 20 ns to 9999s.
Resolution: To nearest 20 ns for width <100 μs; to 4 digits for width ≥100 μs.
Accuracy: 2% ±2 ns.
Duty Cycle: 90% limited by 100 ns off time.

PULSE OUTPUTS

Main Output

Upper and lower pulse levels of both main output channels (2nd channel optional) are independently programmable. High impedance or 50Ω source impedance is automatically selected. If upper level, lower level or peak-to-peak amplitude absolute value is >10V, 50Ω internal source is changed to high impedance. The values in table 1 are for a 50Ω load impedance. Pulses of either output channel may be normal or complement. In complement, upper and lower levels are interchanged. Transition times remain as programmed.

Sync Output

A pulse of approximately −0.6 to 3V from 50Ω source at lowest frequency in generator system.

Clock Output

A pulse of approximately −0.6 to 3V from 50Ω source, 50% duty cycle and with programmed repetition rate in continuous, gate and burst modes. Repetition rate in time interval mode determined by microprocessor.

TIME DOMAIN

Repetition Rate

Frequency Range:
0.5 Hz to 50 MHz.
Period Range: 20 ns to 2s.
Resolution: 3 digits of programmed value.
Accuracy: 2% ±1 ns.
Repeatability: 2% ±1 ns.
Jitter: ±0.1% ±50 ps.

Width

Width control affects pulses of the main channels.
Range: 10 ns to 999 ms.
Resolution: 1 ns from 10 ns to 19.999 μs; 3 digits of programmed value from 20 μs to 999 ms.
Accuracy: ±1% ±2 ns.
Repeatability: ±1% ±1 ns.
Jitter:
±0.1% ±50 ps width <1 μs;
±0.05% width 1 to 10 μs;
±0.005% width >10 μs.
Duty Cycle: 90% limited by 10 ns minimum off time.

Delay

Delay control affects pulses of the main channels.
Range: 0 ns to 999 ms.
Resolution: 1 ns from 0 ns to 19.999 μs; 3 digits of programmed value from 20 μs to 999 ms.
Accuracy: ±1% ±2 ns.
Repeatability: ±1% ±1 ns.
Jitter:
±0.1% ±50 ps delay <1 μs;
±0.05% delay 1 to 10 μs;
±0.005% delay >10 μs.
Duty Cycle: 90% limited by 10 ns minimum off time for delay <25 ns and by 20 ns minimum off time for delay ≥25 ns.

Transition Time

For pulses of either main channel, leading and trailing edge transition times independently adjustable from 5 ns to 25 ms (10% to 90% points of programmed amplitude).

Table 1

Characteristics	Hi Impedance Source	50Ω Source
Upper Level Range	−12.00 to +20.00V	−9.96 to +10.0V
Lower Level Range	−20.00 to +12.00V	−10.0 to +9.96V
Resolution (digits of programmed value)	3 digits (20 mV)	3 digits (10 mV)
Amplitude	8.00 to 20.00V	40 mV to 10V
Accuracy	3% program value ±1% ampl ±100 mV	2% program value ±1% ampl ±50 mV
Repeatability	Highly dependent upon cable length and load impedance	±1% ampl ±50 mV
Preshoot		±3% ampl ±10 mV
Overshoot & Ringing		±3% ampl ±10 mV

Range: Variable to 50:1. Leading and trailing edge times must be in the same range.
5 to 100 ns;
50 ns to 2.50 μs;
500 ns to 25 μs;
5 to 250 μs;
50 μs to 2.5 ms;
500 μs to 25 ms.

Resolution: 3 digits of programmed value when both transitions are in the first 10:1 portion of their transition time range, decreasing to 2 digits at 50:1.
Accuracy: ±5% ±2 ns.
Repeatability: ±1% ±1 ns.
Linearity: ±3% for transitions >50 ns.
System Delays
Fixed trigger input to sync output delays for each mode.
Triggered: 60 ± 10 ns;
Gated: 100 ± 10 ns;
Burst: 100 ± 10 ns;
External Width: 40 ± 10 ns;
Time Interval: 80 ± 10 ns.

INPUT CHARACTERISTICS

External Trigger
Arbitrary trigger signals accepted. Rising or falling edge triggering selectable.
Trigger Point: −5 to +5V, adjustable at rear panel.
Impedance: Approximately 1 kΩ paralleled by 22 pf.
Width: 10 ns minimum.
Amplitude: 700 mV minimum.
Repetition Rate:
50 MHz maximum.

Manual Trigger
Front panel key. In gate and external width modes, output active while key depressed.

GPIB Trigger
ASCII "J". In gate and external width modes, "H" signals and of active interval.

GPIB
IEEE 488-1978 compatible for direct connection to GPIB. Optical isolation.
Capabilities:
Listener: AH1 and L4;
Talker: SH1 and T6;
Service Request: SR1;
Remote Local: RL1;
Device Clear: DC1;
Device Trigger: DT1.

Parameter	Typical Programming Time
Command Handshake	2 μs
Data Handshake	220 μs
Frequency	15 ms
Period	20 ms
Upper Level	20 ms
Lower Level	20 ms
Delay	15 ms
Width	18 ms
Leading Edge	35 ms
Trailing Edge	35 ms
Time Interval	10 ms
Mode	10 ms
Function	5 ms
Channel	7 ms
Trigger Format	5 ms
Normal/Complement	5 ms
Output ON/OFF	5 ms
Burst Number	8 ms
Trigger	3 ms
Store Settings	20 ms
Recall Setting	8 ms*
Next Setting	5 ms*
Previous Setting	5 ms*
Execute	20 ms*
GET	2 ms

*2.5 ms when via GET.

Measurements made with HP9825 controller. Times will vary with different controllers. Data rate will follow slowest listener on bus.

GENERAL

Features
Trigger Indicator: Indicates when generator is properly triggered or a burst or time interval is in progress.
Error Detection: Microprocessor detected errors are displayed.
Vernier: Key controlled step or continuous incrementing of any pulse parameter. Cursor selects digit to be updated. Automatic over and under flow.
Nonvolatile Stored Settings: 25 complete front panel setups can be stored and recalled from internal memory. 30 day back-up time.
Reset: Generator is returned to standard setup for confidence check.
Command Recall: Key controlled display of last 36 characters sent via GPIB interface or keyboard.
Return to Local: Key controlled return from GPIB to front panel operation.
Manual Trigger: Key controlled trigger for trigger, gate burst, external width and time interval modes.

Environment
Specifications apply for 25 ± 5°C after 30 minute warm-up. Instrument will operate from 0 to 50°C, 0 to 10,000 feet altitude at 25°C and 0 to 95% relative humidity at 25°C.

Dimensions
Fits standard 48.3 cm (19 in.) rack. Dimensions behind front panel are 43.2 cm (17 in.) wide; 13.3 cm (5¼ in.) high; 58.4 cm (23 in.) deep. Supplied with rack mount adapters.

Weight
26.3 kg (58 lb) net; 30.4 kg (67 lb) shipping.

Power
90 to 105V, 108 to 128V, 198 to 231V or 216 to 252V; 48 to 66 Hz. Single channel, 200 VA. Dual channel, 250 VA.

OPTION

001: Additional Channel
Second channel of delay, width, transition times and output levels. Channels share operating mode and internal clock period only. All other functions and parameters are independent.

010: MATE Interface
Factory installed MATE interface per USAF Standard 2806763.

NOTE: Specifications apply with transition time set to minimum and the 50Ω source driving a 50Ω load.

FACTORY/FOB

San Diego, CA