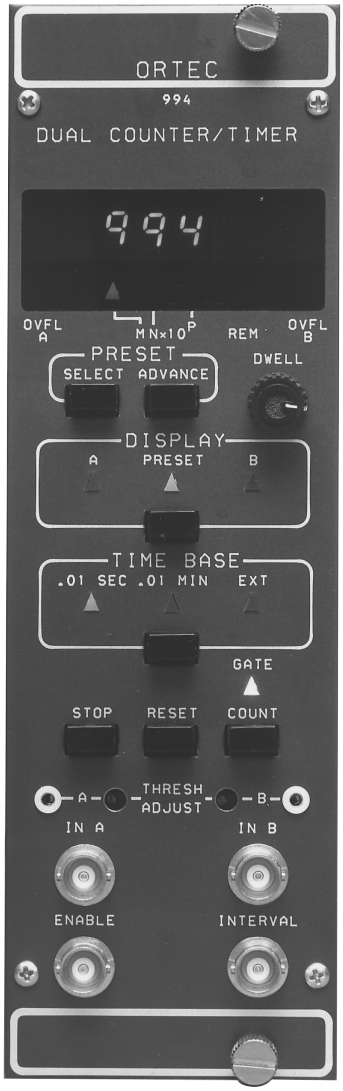
ORTEC®

AMETEK®

994
Dual Counter and Timer

- **Two 8-decade counters and a timer with the configuration flexibility to serve a variety of measurement needs**
- **RS-232-C option provides CCNIM capability with full computer control and readout**
- **Can directly drive printers having RS-232-C ports**
- **An 8-decade LED display provides instantaneous readout of the entire counter capacity, even in dimly lighted rooms**
- **All commonly used controls are easily accessible on the front panel**
- **100-MHz counting rate capability**
- **Preset time or counts set with the precision of a two-digit and decade selection**
- **All options are field-installable**



The ORTEC Model 994 Dual Counter and Timer incorporates two eight-decade counters and a blind preset timer. Considerable functional flexibility is designed into the instrument, allowing it to be configured for a variety of measurement tasks. Typically, it can be used as two counters recording separate events under the control of the preset blind timer. When continuous readout of the time is needed, Counter A can be diverted to count the time while Counter B records external events. This provides the function of a counter and a displayed preset timer. In some applications, the time taken to count a preset number of events must be measured. For this application, Counter A, coupled with the preset blind counter, can be used as a preset counter while Counter B records the time in 0.01-second intervals. In measurements where it is important to correct for the dead time of the detector and its associated electronics, the Gate A input can be switched to also gate the time clock On and Off with a 100-ns time resolution. A positive logic signal that defines the system live time is connected to the Gate A input. This configuration provides a live-time clock (Counter A) and a counter (B).

Excellent flexibility in setting the preset value is offered by the MN X 10^P selection. The M and N values provide two-digit precision, while P selects the decade. Presets can be chosen in the ranges of 0.01 to 990,000 seconds, 0.01 to 990,000 minutes, or 1 to 99,000,000 counts.

The basic Model 994 includes an 8-decade LED display that offers instantaneous visual readout of the full contents of Counter A or B, even in a dimly lighted room. By adding field-installable options, considerably enhanced readout and control capabilities can be incorporated.

The full power of CCNIM (Computer-Controlled NIM) can be obtained by adding the RS-232-C option. This plug-in board allows computer control of all functions normally selectable from the front panel, including start and stop count, readout, reset, setting the preset value, selecting the displayed counter, and selecting the desired time base. To eliminate accidental operator interference, the computer can disable all front-panel controls in the Remote mode. Computer readout with the CCNIM option includes A and B counts, the preset value, and which counter is being displayed. The CCNIM option can directly drive printers having RS-232-C ports.

The inputs to Counters A and B are individually selectable as either positive or negative sensing inputs by changing the Input Polarity Jumpers on the counter printed wiring board (PWB). The negative input mode is designed to accept NIM-standard, fast-negative logic pulses with a fixed threshold of –250 mV on a 50-Ω input impedance. The negative inputs can handle counting rates up to 100 MHz. The positive input mode can accept counting rates up to 25 MHz on a 1000-Ω input impedance. To enhance the flexibility of the positive input mode, precision discriminators are included on both counters. The discriminator thresholds are variable over the range from +100 mV to +9.5 V using front-panel, 25-turn trimpots. The thresholds can be adjusted to suit the amplitude of a specific source of logic pulses or used as precision integral discriminators on analog pulses. For the latter application, the TTL logic outputs of the discriminators are provided as test points on the front panel. These outputs can be used to trigger an oscilloscope while viewing the analog signal at the counter input on the oscilloscope. The oscilloscope trace will show the signals that are being counted by the Model 994, thus permitting a very selective adjustment of the threshold.

All the commonly used functions are conveniently accessible on the front panel. Manual control of the Count, Stop, and Reset functions is via three push-buttons. The Gate LED is illuminated when the Model 994 is enabled to count. Selection of the 0.01 second, 0.01 minute, or external time base is made by the Time Base push-button. In the external mode, the preset counter counts the events at the counter A input. The Display push-button switches the display to show the contents of Counter A, the preset stop value, or the contents of Counter B. To change the preset value, the Preset mode must first be selected with the Display push-button. Subsequently, the Preset Select push-button is used to choose M, N, or P for adjustment. Changing the value of M, N, or P is accomplished with the Preset Advance push-button. The display contains LED flags to indicate whether M, N, or P has been selected, to warn when overflows have occurred in Counter A or Counter B, and to advise when the front-panel controls are disabled by the computer in the Remote mode. When the Model 994 is used in the automatic recycle mode, the Dwell knob adjusts the dwell time of the display from 1 to 10 seconds.

The counting function of the entire module can be disabled by holding the Enable input below +1.5 V using an external signal source. This condition also turns Off the Gate LED. Open circuit or >+3 V at the Enable input allows the instrument to count, if the Count mode has been activated. The Interval output of another ORTEC timer can perform this function to synchronize the Model 994 counting with the other timer. The Interval outputs on all ORTEC timers provide nominally +5 V when counting and <+0.5 V when counting is inhibited.

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Dual Counter and Timer

Independent gating of the A and B Counter inputs can be achieved with the Gate A and Gate B inputs on the rear panel. The interface connector for the RS-232-C option is located on the rear panel. Each counter has a rear-panel output dedicated to signaling overflows. Counting these overflows on another counter extends the counting capacity of the Model 994.

The Model 994 derives its power from the ±12 V and +6 V supplies in a standard NIM bin with power supply. For bins that do not contain a +6 V supply, an Internal +6 V Supply option is available. This option is field-installable and derives its power from the 117 V AC lines in the bin.

Specifications

PERFORMANCE

COUNT CAPACITY 8 decades for counts ranging from 0 to 99,999,999 in each of 2 counters.

MAXIMUM COUNTING RATE 100 MHz for negative inputs, 25 MHz for positive inputs.

TIME BASE 10-MHz clock with minimum preset or displayed intervals of 0.01 seconds or 0.01 minutes. Synchronizing error is nominally 100 ns. Also accepts an external input from the Counter A input (In A) when the Ext (External) mode is selected.

TIME BASE INACCURACY ≤±0.0025% over the 0 to 50°C operating temperature range.

PRESET TIME/COUNTS The module stops counting when the preset value MN X 10^P is reached on the blind preset register. M and N are digits ranging from 0 to 6. With the 0.01-second time base, preset times from 0.01 to 990,000 seconds can be used. Preset times from 0.01 to 990,000 minutes are available using the 0.01-minute time base. In the Ext time base mode preset counts in the range of 1 to 99,000,000 can be used.

POSITIVE INPUT DISCRIMINATOR Threshold variable from +100 mV to +9.5 V with a 25-turn trimpot.

PULSE PAIR RESOLUTION <10 ns for negative inputs; <40 ns for positive inputs.

INDICATORS

COUNTER DISPLAY 8-digit, 7-segment LED display with leading zero suppression. When displaying time, 2 digits to the right of a decimal point are included.

OVERFLOW INDICATORS LED indicators labeled OVFL A and OVFL B illuminate when the corresponding A or B Counter exceeds its capacity of 8 decades. The indicator remains on until a reset is generated.

M, N, AND P INDICATORS 3 LED indicators aid in the selection of the preset value. When the Preset display function is activated, the Select push-button selects which of the 3 LEDs is illuminated. When one of these LEDs is On, that digit of the preset value can be incremented using the Advance push-button.

DISPLAY 3 LEDs labeled A, B, and Preset indicate the information being displayed in the counter display. Counter A, Counter B, or the Preset value may be displayed by repeatedly pressing the Display push-button until the desired LED is illuminated.

TIME BASE 3 LEDs indicate the selected time base source. By repeatedly pressing the Time Base push-button, 0.01 Sec, 0.01 Min, or the Ext mode can be chosen.

GATE A single LED indicates that the entire instrument is enabled to count. For the Gate LED to be illuminated, the module must be placed in the Count mode (either manually or via the interface option), the Enable input must be above +3 V, and the preset stop condition must not have been reached.

REMOTE A single LED labeled REM indicates that the Model 994 is under computer control, and all front-panel controls are disabled. This mode is set by the ENABLE_ REMOTE command.

CONTROLS

DISPLAY Push-button selects the contents of Counter A or B, or the Preset value for presentation in the 8-decade display. Repeatedly pushing the button cycles the selection through the three choices as indicated by the A, B, and Preset LEDs.

SELECT Push-button chooses the M, N, or P digit in the display of the preset value. Pushing the button advances the selection through the three choices as indicated by the illuminated LED. The Select push-button operates only if the Preset mode has been selected by the Display push button.

ADVANCE Push-button increments the preset digit selected by the Select push-button once each time the Advance button is depressed. The M and N digit ranges are both 0 to 9. The P digit range is from 0 to 6. The Advance push-button operates only if the Preset mode has been selected by the Display push-button.

TIME BASE Each push on this button advances the selection one step through the three time base choices of 0.01 Sec, 0.01 Min, and Ext to determine the time base source for the preset register.

STOP This push-button stops all sections of the instrument from counting.

RESET Depressing this button resets both counters to zero counts and turns Off both overflow indicators. It also clears any counts accumulated in the blind preset counter, but does not change the selected preset value. When power is turned On to the Module, a Reset is automatically generated.

COUNT Pushing this button enables the counting condition for the entire instrument, providing the Enable input is not held below +1.5 V and the preset value has not been reached.

THRESH ADJUST (A and B) Front-panel mounted, 25-turn trimpots to adjust the positive input thresholds for Counters A and B. The range is from +100 mV to +9.5 V. Adjacent test points provide the TTL logic signal outputs from the discriminators to facilitate adjustment using an oscilloscope.

DWELL A one-turn potentiometer on the front panel with an On/Off switch at the fully counterclockwise position. Adjusts the display dwell time over the nominal range from 1 to 10 seconds. When the instrument is in the Recycle mode, dwell time occurs after the preset value has been reached. Turning the switch Off at the fully counterclockwise position selects the Single Cycle mode. If the print loop option is used, the Dwell control is disabled when the print loop controller is active and controlling the dwell time.

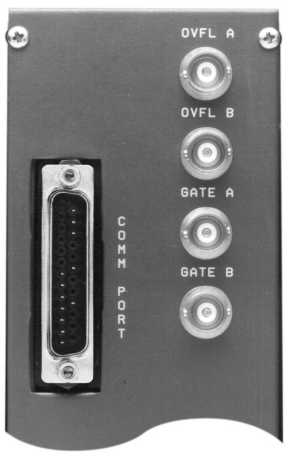
INPUT POLARITY JUMPERS Two jumpers located on the printed wiring board (PWB) separately select the desired input polarities for inputs In A and In B. P = positive, N = negative.

A COUNTER/TIMER JUMPER Two-position jumper located on the PWB. In the Counter position, Counter A always counts and displays the events connected to In A. When set to the Timer position, Counter A counts and displays the time if either the 0.01-Sec or the 0.01-Min time base is selected. If the Ext time base is selected, Counter A will count and display the events from In A.

B COUNTER/TIMER JUMPER Two-position jumper located on the PWB. In the Counter position, Counter B always counts and displays the events from In B. In the Timer position with the Ext time base selected, Counter B counts and displays the time in 0.01-second intervals. With either a 0.01-Sec or 0.01-Min time base selected, Counter B counts and displays the events from In B.

GATE A (LIVE TIME/NORMAL) JUMPER Two-position jumper mounted on the PWB. In the Normal position, the signals from the rear-panel Gate A connector gate the events from the In A connector. In the Live Time position, the signals from the Gate A connector gate the 10-MHz clock to form a live-time clock.

1 CYCLE/RECYCLE Selection of either the 1 Cycle or the Recycle mode can be made via an 8-pin DIP switch on the RS-232-C interface board. The Recycle mode can be used when the computer is able to respond with a data transfer when the Model 994 reaches the preset value. Upon reaching preset, the Model 994 latches its data into a buffer, resets the counters, and starts the next counting interval. This process takes ~50 µs. The computer reads the data in the buffer before the next counting interval ends. In the 1 Cycle mode, the Model 994 simply stops counting and waits for further commands when the preset value is reached.



INPUTS

IN A Use of this input is affected by the A Counter/Timer Jumper.

Positive Input Front-panel BNC connector for Counter A accepts positive unipolar signals; minimum width above threshold, 20 ns at a 50% duty cycle. The threshold is adjustable from +100 mV to +9.5 V via a front-panel 25-turn trimpot. Z_{in} = 1000 Ω to ground; dc-coupled.

Negative Input Changing the Input Polarity Jumper position on the counter board permits selection of the NIM-standard fast-negative logic input which is designed to accept –600 to –1800 mV pulses with a fixed discriminator threshold of –250 mV. Z_{in} = 50 Ω; dc-coupled. Minimum pulse width above threshold is 4 ns.

IN B Identical to In A except that it feeds Counter B. Use of this input is affected by the B Counter/Timer Jumper.

ENABLE Front-panel BNC input connector accepts NIM-standard, slow-positive logic pulses to control the counting condition of the entire module. A level of >+3 V or open circuit allows counting provided the instrument is in the Count mode and has not reached the preset value; <+1.5 V inhibits counting. The driving source must be capable of sinking 5 mA of positive current during inhibit; input protected to +25 V.

GATE A Rear-panel BNC input connector is identical to the Gate B input with the following exception. With the Gate A jumper on the PWB set to the Normal position, the Gate A input controls counting of the In A events in Counter A. By moving the PWB Gate A jumper to the Live Time position, the Gate A input also controls the 10-MHz clock to form a live-time clock with a 100-ns resolution. A level >+3 V or an open circuit allows counting of the clock. A level <+1.5 V is used to inhibit counting of the clock during dead-time intervals.

GATE B Rear-panel BNC connector accepts NIM-standard, slow-positive logic signals to control the counting in Counter B. A level >+3 V or open circuit allows counting; <+1.5 V inhibits counting; input protected to +25 V. The driving source must be capable of sinking 5 mA of positive current during inhibit.

OUTPUTS

INTERVAL Front-panel output BNC connector furnishes a positive level during the counting interval. The level is nominally +5 V when counting is enabled and <+0.5 V when counting is disabled. Z_o ~30 Ω.

OVFL A Rear-panel output BNC connector provides a NIM-standard, slow-positive logic signal each time Counter A overflows its 8-decade capacity. The signal has a nominal amplitude of +5 V; width ~20 µs.

OVFL B Rear-panel output identical to OVFLA except it monitors overflows from Counter B.

INTERFACE

SERIAL When the RS-232-C option board is plugged in, it furnishes a rear-panel, 25-pin, male, D connector containing all signals for standard RS-232-C communications. It also contains connections for 20-mA current loop communications. The field-installable RS-232-C option provides computer control of the following functions: Count, Stop, Reset, Remote, setting the preset value, selecting the displayed counter, and selecting the desired time base. In the Remote mode, the computer can disable all front-panel controls. Computer readout includes: A and B counts, the preset value, and which counter is being displayed.

ELECTRICAL AND MECHANICAL

POWER REQUIRED The basic Model 994 derives its power from a NIM bin furnishing ±12 V and +6 V. For NIM bins that do not provide +6 V, an optional Internal +6 V Supply is available. This option is field-installable and draws its power from the 117 V AC lines in the bin. With the Internal +6 V Supply installed, the power requirements are shown in column 4 and not required in column 3.

	Power Required		Bin Supplied	Internal +6 V Supply
	+12 V	–12 V	+6 V	117 V AC
Basic Model 994	35 mA	115 mA	1300 mA	110 mA
Model 994 plus RS-232-C option	54 mA	130 mA	1800 mA	145 mA

WEIGHT
Net 2.4 kg (5.2 lb).
Shipping 3.7 kg (8.2 lb).

DIMENSIONS NIM-standard double-width module, 6.90 X 22.13 cm (2.70 X 8.714 in.) front panel per DOE/ER-0457T.

Ordering Information

Model	Description
994	Basic module without plug-in options.
99X-1	RS-232-C Interface option (cable not included).
99X-4	Internal +6 V Supply option.
C-75	Female-to-female RS-232-C null modem cable (3-meter length).
C-80	Male-to-female RS-232-C extension cable (3-meter length).

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