

Model 875 Counter Instruction Manual

This manual applies to instruments marked
"Rev 06" on rear panel

WARNING

This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Standard Warranty

for

EG&G ORTEC Nuclear Electronic Instruments

EG&G ORTEC warrants that the items will be delivered free from defects in material or workmanship. EG&G ORTEC makes no other warranties, express or implied, and specifically **NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

EG&G ORTEC's exclusive liability is limited to repairing or replacing at EG&G ORTEC's option, items found by EG&G ORTEC to be defective in workmanship or materials within **two years** from the date of delivery. EG&G ORTEC's liability on any claim of any kind, including negligence, loss or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event EG&G ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, EG&G ORTEC's exclusive liability and buyer's exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall EG&G ORTEC be liable for special or consequential damages.

Quality Control

Before being approved for shipment, each EG&G ORTEC nuclear electronic instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, EG&G ORTEC must be informed, either in writing, by telephone [(615) 482-4411] or by telex (55-7450) of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The EG&G ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped **PREPAID** via Air Parcel Post or United Parcel Service to the nearest EG&G ORTEC repair center. (In the case where the instrument did not function upon purchase, EG&G ORTEC will pay shipment costs both ways.) The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty will be repaired at the standard charge unless they have been grossly misused or mishandled, in which case the user will be notified prior to the repair being done. A quotation will be sent with the notification.

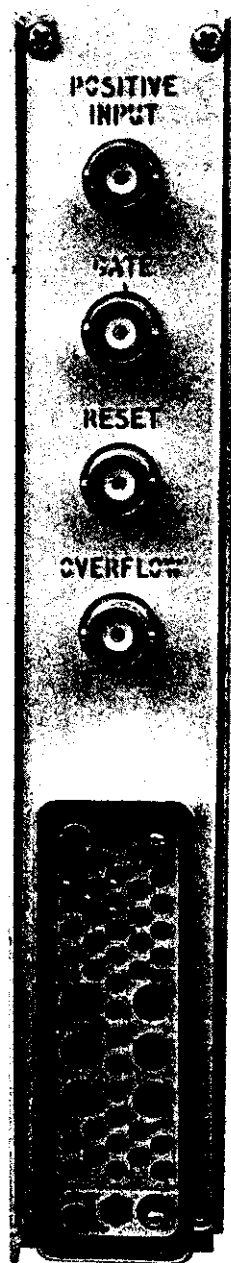
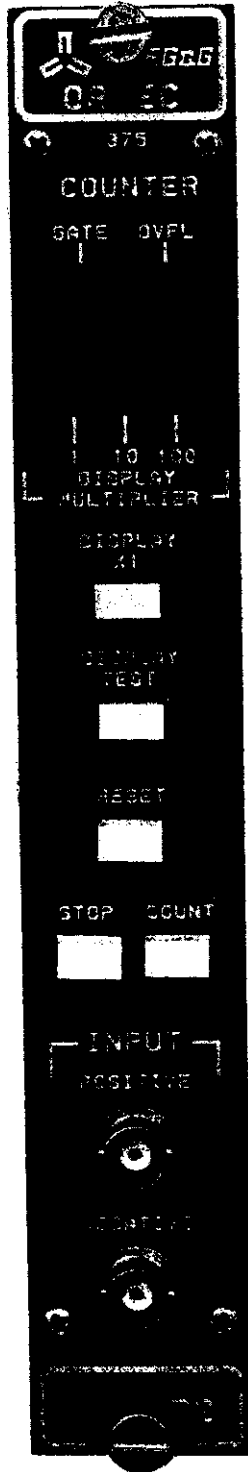
Damage in Transit

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify EG&G ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment if necessary.

CONTENTS

	Page
WARRANTY	ii
PHOTOGRAPHS	iv
1. DESCRIPTION	1
1.1. Purpose	1
1.2. General Description	1
2. SPECIFICATIONS	1
2.1. Performance	1
2.2. Indicators	1
2.3. Controls	1
2.4. Inputs	2
2.5. Output	2
2.6. Electrical and Mechanical	2
3. INSTALLATION	2
3.1. General	2
3.2. Connection to Power	2
3.3. Signal Connections	2
4. OPERATION	3
5. CIRCUIT DESCRIPTION	3
5.1. General	3
5.2. Counter Input	3
5.3. Pulse Shaper	3
5.4. Counting Decades	4
5.5. Auto-Ranging Circuit	4
5.6. Reset	4
5.7. Overflow	4
5.8. Internal Power Distribution	4
6. MAINTENANCE	4
6.1. General	4
6.2. Factory Repair	4
APPENDIX	5

Replaceable Parts List
Schematic 875-0201-S1



1. DESCRIPTION

1.1. PURPOSE

The EG&G ORTEC 875 Counter is a modular, general-purpose counting instrument with a capacity of eight decades. Since only six decade digits are included in its display, the unit is auto-ranging and will display the six most significant digits of an accumulated count. A front panel switch permits the operator to shift the range and observe the six least significant digits at any time without interfering with the accumulation of additional counts.

The 875 counts both NIM-standard slow positive and fast negative input logic pulses. The input count rate is guaranteed to 25 MHz with a 40-ns pulse pair resolution. An overflow output pulse is provided for cascading counters when a capacity of more than eight decades is required.

1.2. GENERAL DESCRIPTION

The 875 is a NIM-standard single-width module that must be installed in a standard bin and power supply, such as the EG&G ORTEC 401/402 Series, for operation. Positive inputs can be furnished through either a front- or a rear-panel connector. Negative inputs are accommodated on the front panel only.

A Gate LED indicator in the digital display area of the front panel lights when the 875 is in a counting condition. The gate is controlled by Stop and Count pushbuttons on the front panel and by the rear panel Gate input circuit.

Reset is generated automatically when power is applied to the module from the bin and power supply. Reset can be provided manually by pressing the front panel Reset pushbutton at any time, whether the 875 is counting or not. Reset can also be provided at any time by a signal

through the rear panel Reset connector.

The auto-ranging status is indicated by three LEDs that are included in the front panel display area. When the counter is reset, the LED for X1 is illuminated. As the count rate starts to accumulate, the X1 LED will remain illuminated until the number of counts exceeds 999 999. At a count level of 1 000 000, the LED for X10 illuminates to show that the display indicates the count level in decades 2 through 7. When the count level reaches 10 000 000, the display monitors decades 3 through 8 and the LED for X100 illuminates to show the status. At any time, the operator can press the Display X1 pushbutton and the display will monitor decades 1 through 6 without affecting the counting status of all eight decades. When the pushbutton is released, the 875 resumes its auto-ranging mode.

The six most significant digits are always displayed in the auto-ranging mode. By using the Display X1 pushbutton, all eight digits can be monitored regardless of the counting condition. Leading zero suppression is provided in the display until an overflow occurs. At each overflow, a positive logic pulse is furnished through the rear panel Overflow connector and can be used as the positive input to a second counting module. At the first overflow, the Overflow LED in the display area on the front panel illuminates and will remain on until the module is reset.

When the Display Test pushbutton is pressed, all seven segments in each digit in the display should light. The display reads 888 888 for this test regardless of the counting status or count level in the 875. It returns to the condition in which it monitors the count level when the switch is released.

2. SPECIFICATIONS

2.1. PERFORMANCE

COUNT CAPACITY 8 decades.

COUNTING RATE 25 MHz guaranteed.

PULSE PAIR RESOLUTION 40 ns minimum.

AUTOMATIC RESET Generated when power is applied.

2.2. INDICATORS

COUNTER DISPLAY Contains six characters, 7 LED segments per character.

X1 An LED illuminates when the unit displays decades 1 through 6 of the counter.

X10 An LED illuminates when the unit displays decades 2 through 7 of the counter.

X100 An LED illuminates when the unit displays decades 3 through 8 of the counter.

GATE An LED illuminates when the unit is in the counting condition.

OVFL An LED illuminates from the first overflow until reset.

2.3. CONTROLS

DISPLAY X1 Pushbutton switch that forces the unit to display decades 1 through 6 when depressed; unit returns to auto-ranging status when the switch is released.

DISPLAY TEST Pushbutton switch that illuminates all seven segments in each of the six characters in the display as a test function.

RESET Pushbutton switch that resets the counter to zero and turns off the OVFL LED (if illuminated).

STOP Pushbutton switch selects noncounting condition when depressed.

COUNT Pushbutton switch enables the counting condition when depressed; the counting condition can be inhibited by holding the Gate input below +1.5 V; Gate LED lights when counting condition is enabled.

2.4. INPUTS

POSITIVE Front and rear panel BNC connectors; either accepts positive unipolar or bipolar signals to ± 10 V linear, 25 V max; threshold set at +1.5 V; minimum pulse width above threshold 20 ns. $Z_{in} = 1K$ to ground, dc-coupled.

NEGATIVE Front panel BNC connector accepts fast negative logic pulses, 16 mA into 50 Ω ; threshold set at -250 mV; minimum pulse width over threshold 4 ns; input protected to ± 25 V at 10% duty cycle.

GATE Rear panel BNC accepts standard slow positive logic or dc level to control counter input gate; $> +3$ V or open circuit allows counting; $< +1.5$ V inhibits counting; 25 V max; driving source must be capable of sinking 0.5 mA positive current during inhibit.

RESET Rear panel BNC accepts standard slow positive logic signal to cause counter reset to zero; $> +3$ V to reset; $< +1.5$ V or open circuit to not reset; 25 V max; pulse width > 100 ns; $Z_{in} = 2K$ to ground, dc-coupled.

2.5. OUTPUT

OVERFLOW Rear panel BNC provides a standard slow positive logic pulse at each overflow of the eight decade counter; $Z_o < 10\Omega$, dc-coupled and short-circuit protected.

2.6. ELECTRICAL AND MECHANICAL

POWER REQUIRED +24 V, 55 mA; -24 V, 0 mA; +12 V, 165 mA; -12 V, 60 mA.

DIMENSIONS NIM-standard single width module, 1.35 by 8.714 in. front panel, per TID-20893 (Rev).

3. INSTALLATION

3.1. GENERAL

The 875 Counter operates on input power that must be furnished from a NIM-standard Bin and Power Supply such as the EG&G ORTEC 401/402 Series. If any vacuum tube equipment is operated in the same rack with the 875, there must be sufficient cooling air circulating to prevent any localized heating of the integrated circuitry used throughout the 875. The temperature of equipment mounted in racks can easily exceed the maximum limit of 120°F (50°C) unless precautions are taken.

3.2. CONNECTION TO POWER

Turn off the Bin Power Supply when inserting or removing any modules. The EG&G ORTEC modules are designed so that it is not possible to overload the Power Supply with even a full complement of modules in the Bin. Since, however, this may not be true when the Bin contains modules other than those of EG&G ORTEC design, the Power Supply voltages should be checked after all modules have been inserted. The 401/402 has test points on the Power Supply control panel to permit monitoring the dc voltages easily.

When power is turned on for the Bin and Power Supply in which the 875 is installed for operation, the power is automatically turned on for the 875. When power is first ap-

plied, an automatic reset function in the 875 resets its counter to zero.

3.3. SIGNAL CONNECTIONS

COUNT INPUTS The 875 accepts and counts either fast negative logic pulses or slow positive logic pulses. Determine the type of input pulses that will be furnished and use the appropriate input connector.

Positive logic or analog signals can be connected to either the front or rear panel Positive input connector. These two connectors are **not isolated** from each other, so signals from two sources should not be connected simultaneously to the two Positive input connectors. The input circuit in the 875 is dc-coupled to eliminate baseline shifts associated with changing count rates. External capacitance coupling must be provided by the user for signals superimposed on a dc level greater than +1.5 V since the counter is designed to respond to signal transitions through the fixed threshold level of +1.5 V.

Negative logic signals must be furnished to the front panel Negative input connector. The input impedance in this circuit is 50 Ω , dc-coupled. This is the standard impedance for which the fast negative logic pulse is defined.

There are two important points to remember when supplying signals to either input: (1) The signal should cross

the threshold level only one time. Signals with overshoot, ringing, etc., will be counted more than once if the discriminator level coincides with a level at which perturbations occur. (2) Signals with slow rise and fall times should be as clean (noise free) as possible because of the high gain and bandwidth of the 875 discriminator. As a slow signal approaches the threshold, a small spurious noise pulse can traverse the threshold and return, causing an extra count to be added to the contents of the counter.

GATE INPUT A gate input signal or dc level can be connected to the 875 through the rear panel connector. With no connections made to this BNC, the input voltage level is about +3 V and the counter gate will permit the unit to operate. To cut off the gate, the signal input must be pulled down to below +1.5 V. To do this, the driving circuit must be capable of absorbing 0.5 mA from the gate input circuit. The gate circuit will permit counting when the signal level is +3 V or greater.

RESET INPUT A reset input signal can be connected to the 875 through the rear panel BNC Reset connector. To reset the counter to zero, a positive signal of 3 V or greater, with a minimum width of 100 ns, must be used. The input impedance is approximately 2K to ground. Negative signals will not perform any useful function at the Reset input.

OVERFLOW OUTPUT The Overflow signal is available through the Overflow BNC on the rear panel. A slow positive logic signal appears at this connector each time the contents of the counter change from 99 999 999 to 0. The output signal is 500 ns wide. Z_o is less than 10 Ω , dc-coupled. To increase the counting capacity beyond the eight decades that are included in the 875, furnish this output signal as the positive input into another counting module.

4. OPERATION

After the 875 has been installed according to the information in Section 3, no further operating adjustments are required. Each input pulse within specifications that is furnished while the 875 is in a counting condition will be counted and displayed.

If there is a power interruption, the 875 will be automatically reset when the power is restored. The counter can be reset to zero by using the front panel pushbutton switch or by furnishing an input pulse through the rear panel Reset connector.

Each accepted input pulse will add one count to the previous count level that is in the counter, regardless of whether the counting period has been interrupted, gated, or otherwise caused to be discontinuous. The contents of the counter are not affected by use of the Display Test switch or the Display X1 switch, although each of these switches does affect the actual characters shown in the display.

5. CIRCUIT DESCRIPTION

5.1. GENERAL

The schematic for the EG&G ORTEC 875 Counter is 875-0201-S1, included at the back of this manual. The circuits are included on the main printed circuit board and on a printed circuit board that is installed on the front panel. The 875 is designed to accommodate computer-aided testing, using the test points that are identified in the schematic.

5.2. COUNTER INPUT

Integrated circuit IC13 is a dual discriminator. One section is used for positive inputs and the other for negative inputs. The positive input threshold is set by R50 and R53, while the negative input threshold is set by R48 and R52. The positive input impedance is set by R49 and R51 at 1K,

and these resistors also divide the input signal by two and protect the comparator to ± 25 V. Negative input protection is provided by R9, R46, R59, D1, D3, and C23. Transistors Q1 and Q2 stretch the negative input signal on C20 for a sufficient time to permit IC13 to change states. The time constant is set by R45 and C20 such that a pulse pair resolution of less than 40 ns can be achieved while allowing a 4 ns wide fast NIM signal to be counted.

5.3. PULSE SHAPER

Integrated circuit IC3 is connected as a positive edge triggered monostable. Any input signal through IC13, from either the positive or the negative input circuit, will be furnished to pin 3 of IC3 to trigger the monostable. The pulse width is set at about 20 ns by R42 and C17. As long

as the count condition is selected and the Gate input is not held below +1.5 V, IC3 can provide the shaped pulses to IC4. The counting condition is selected by depressing the Count pushbutton, which forces pin 15 of IC11 low and sets pin 13 of IC11 high until the Stop pushbutton is depressed.

5.4. COUNTING DECADES

The first two counting decades are included in IC4. These decades are latched into IC5, which contains the remaining six decades. IC5 also contains the circuitry for multiplexing the eight decades to the 7-segment character displays. The BCD outputs are connected to IC8 for one selected character at a time to convert from BCD code to a 7-segment format. A multiplexer, included in IC6, selects the characters to be displayed sequentially at a scan rate determined by C6. All eight characters are scanned in each cycle, and the auto-ranging circuit defines which of the six characters that are to be displayed will be illuminated when they are transferred in the scan cycle.

5.5. AUTO-RANGING CIRCUIT

Integrated circuits IC7, IC8, and IC9 determine which decade characters are to be displayed in the 7-segment LEDs by passing the appropriate digit strobe lines from IC5 to display driver IC10. For the X1 mode, IC7 is enabled and it selects digits 1 through 6. For the X10 mode, IC8 is enabled for digits 2 through 7. For the X100 mode, IC9 is enabled for digits 3 through 8. The D6 output of IC5 (pin 16) is used to trigger the X10 mode on the negative edge by Q5, R36, R37, C22, and D5. Similarly, the D7 output from IC5 triggers the X100 mode by Q6, R29, R40, C21,

and D4. These pulses are latched into IC11 and decoded by IC12 to enable IC7, IC8, or IC9. At reset, IC11 is reset to return the auto-ranging circuit to the X1 mode. Switch S1 will force the X1 mode regardless of the condition of IC11, and the auto-ranging circuit is effective when S1 is released again.

5.6. RESET

A reset is accepted from the front panel pushbutton or through the rear panel BNC. An input protection circuit includes R30, R31, R34, R35, D6, D9, and Q8, and this circuit also buffers pin 9 of IC1. The power-up reset is generated by R38 and C16. A section of IC11 is connected as a monostable to generate the reset signal, using D13, C15, R26, and a section of IC1.

5.7. OVERFLOW

When the total count exceeds 99 999 999, the D8 output of IC5 (pin 14) clocks IC3, connected as a monostable. The width of the monostable output is about 500 ns. This pulse is inverted by IC1 and presented to Q3 and Q4 to drive the overflow output.

5.8. INTERNAL POWER DISTRIBUTION

The circuits of the 875 require operating dc power levels at ± 12 V and +24 V, furnished from the bin and power supply in which the 875 is installed for operation. The circuit of IC14 uses +24 V and +12 V as a reference to generate +5 V, which is also required for the integrated circuits in the module.

6. MAINTENANCE

6.1. GENERAL

The EG&G ORTEC 875 Counter should require very little maintenance other than the replacement of some parts that may deteriorate with age. The circuit description of Section 5 can aid in any troubleshooting that may be required.

6.2. FACTORY REPAIR

This instrument can be returned to the EG&G ORTEC

factory for service and repair at a nominal cost. Our standard procedure for repair ensures the same quality control and checkout that are used for a new instrument. Always contact the Customer Service Department at EG&G ORTEC, (615) 482-4411, before sending in an instrument for repair to obtain shipping instructions and so that the required Return Authorization Number can be assigned to the unit. Write this number on the address label and on the package to ensure prompt attention when it reaches the EG&G ORTEC factory.

**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR AEC STANDARD NUCLEAR INSTRUMENT
MODULES PER TID-20893 (Rev 4)
(adopted by DOE)**

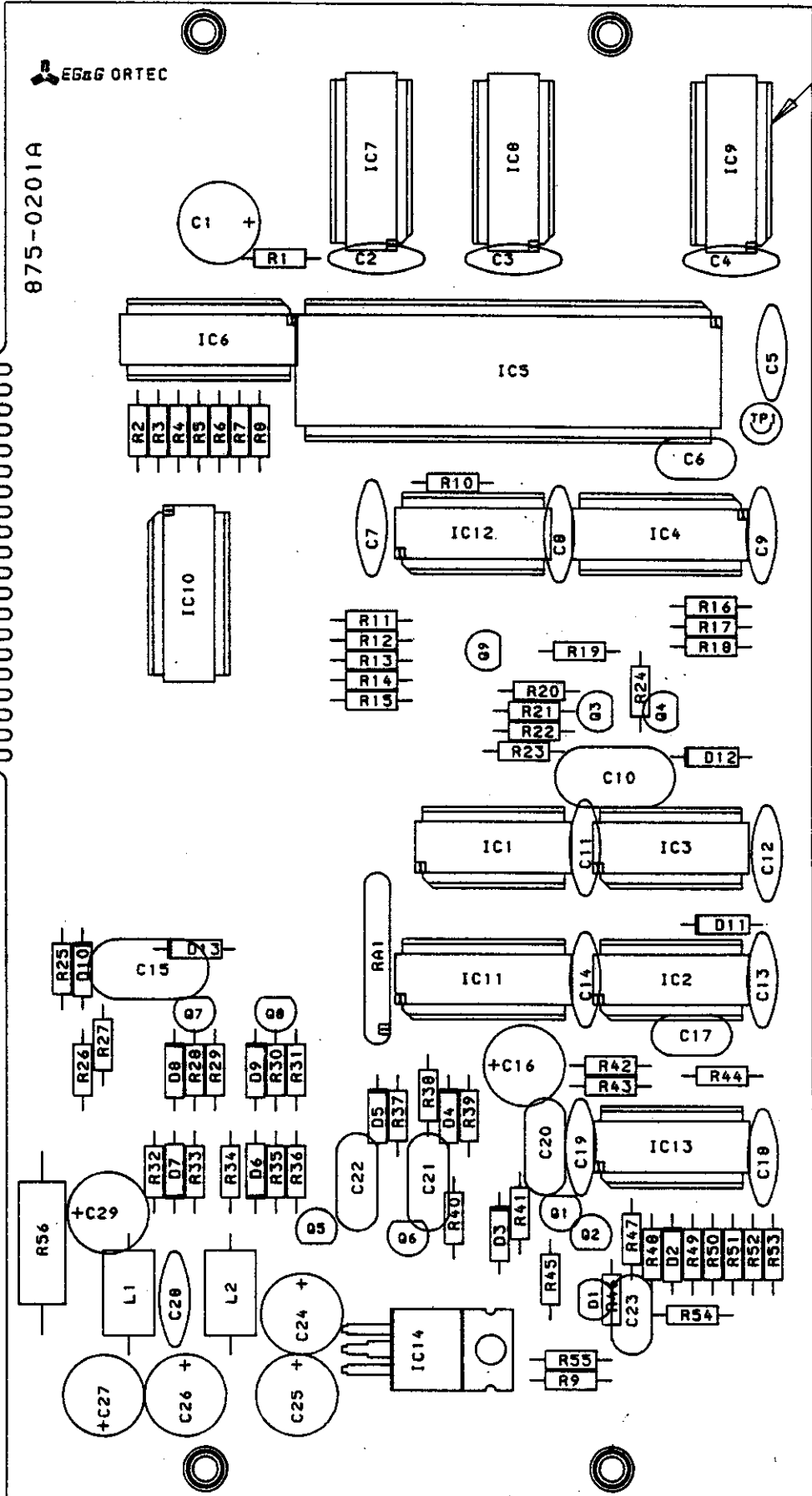
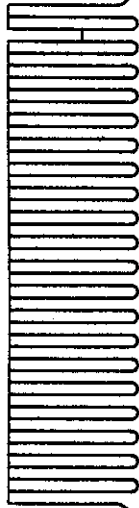
Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	-3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	-24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	-6 volts	*33	117 volts ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Spare	**35	Reset (Scaler)
14	Spare	**36	Gate
15	Reserved	**37	Reset (Auxiliary)
*16	+12 volts	38	Coaxial
*17	-12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	117 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in EG&G ORTEC's 4001A, 4001B, 4001C, 401A, and 401B Modular System Bins.

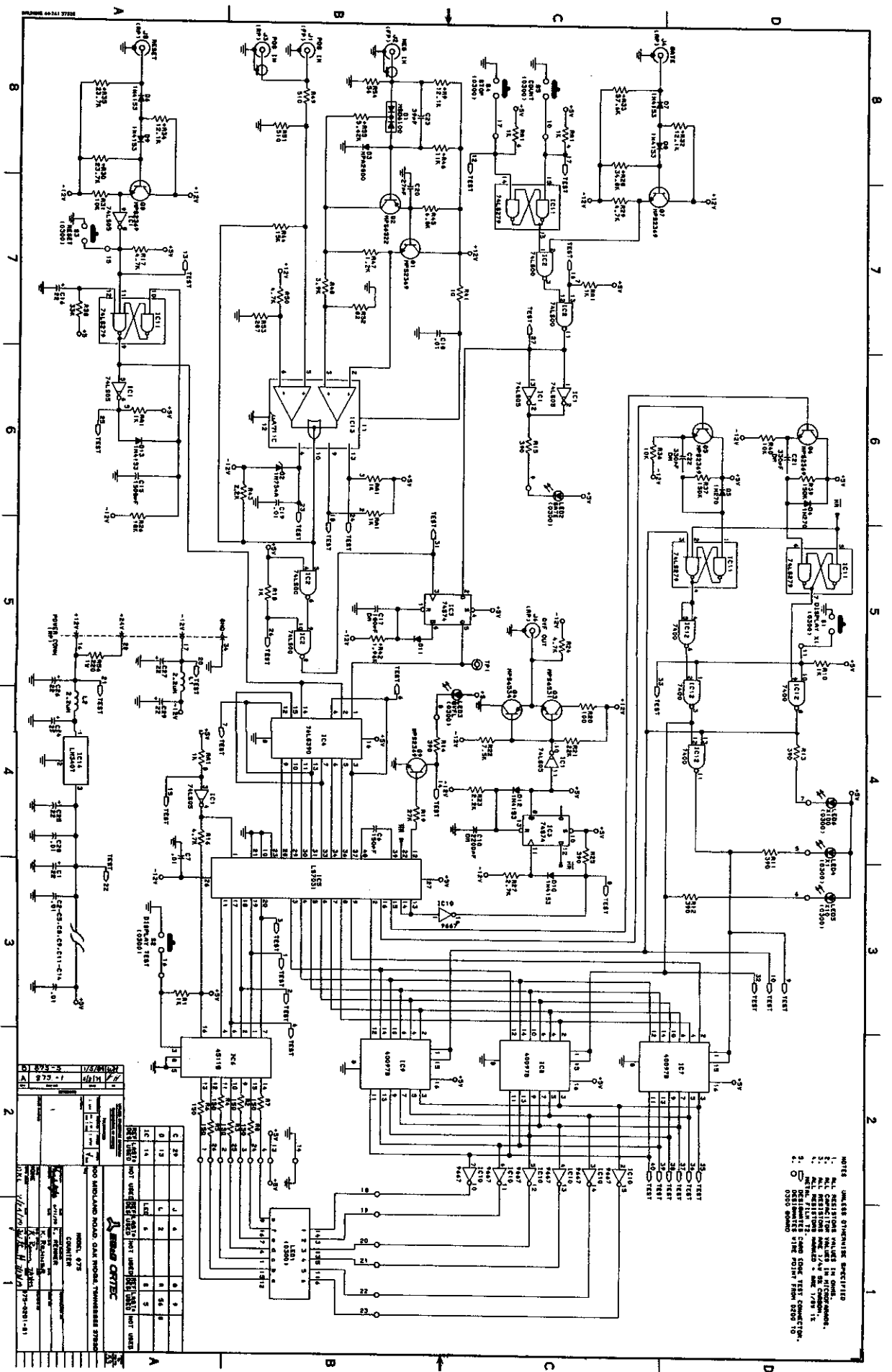
Pins marked (*) and (**) are installed in EG&G ORTEC-HEP-M250/N and M350/N NIMBINS.

EG&G ORTEC

875-0201A



3



IC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC1																
IC2																
IC3																
IC4																
IC5																
IC6																
IC7																
IC8																

MODEL: 4007B
 MANUFACTURER: NATIONAL SEMICONDUCTOR
 PART NUMBER: 4007B
 DATE: 1/78
 REVISION: 1
 DRAWN BY: J. H. BROWN
 CHECKED BY: K. R. SMITH
 APPROVED BY: M. J. DAVIS
 TITLE: 4-BIT PARALLEL ADDER

NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS IN OHMS.
 2. ALL RESISTORS ARE 1/4 WATT.
 3. ALL RESISTORS ARE 5% TOLERANCE.
 4. ALL CAPACITORS ARE 50V DC.
 5. UNLESS OTHERWISE SPECIFIED, THE POWER RATING IS 0.500 WATT.