

Model 928
Octal Discriminator
Operating and Service Manual

This manual applies to instruments marked
"Rev 11" on rear panel

ORTEC 928 OCTAL DISCRIMINATOR

1. DESCRIPTION

The ORTEC 928 Octal Discriminator is a single-width NIM module that includes eight independent general-purpose leading-edge discriminators. Each section accepts NIM-standard fast negative pulses and generates a set of three negative output pulses with controlled width for each input pulse that exceeds the adjusted input threshold. The design of this instrument utilizes advanced ORTEC hybrid circuit technology to achieve high reliability in an economical high-density package.

Each channel includes a front panel adjustable threshold and output width control. A zero deadtime updating circuit guarantees that a single set of output pulses will be generated to represent the most recent threshold crossing of the input. This feature functions regardless of the variations that random input signals and cabling techniques may produce at the input.

The input circuit has been carefully designed for 50Ω impedance matching that eliminates reflections and distortions. A protection network is included that minimizes the risk of damage from extreme overloads.

The 928 operates in an ORTEC 401A/402D or M400/N NIMBIN^R that includes distribution of dc power at ± 24 V, ± 12 V, and ± 6 V. By using either of these recommended bins and power supplies, a full complement of 12 modules can be operated in the bin, with a total capacity of 96 discriminator channels.

2. SPECIFICATIONS

2.1. PERFORMANCE

Number of Channels Eight.

Input/Output Rate 110 MHz typical, 100 MHz guaranteed.

Pulse Pair Resolution <9 ns.

Time Slewing ≤ 1 ns for input amplitudes $\geq 110\%$ of adjusted threshold.

Transmission Delay 11 ns typical, input to output.

Multiple Pulsing None; one output pulse of preset duration is generated for each input regardless of its amplitude and duration.

Threshold Temperature Instability $\leq 0.2\%/^{\circ}$, 0 to 50°C (273 to 323 K).

Output Width Temperature Instability $\leq 0.3\%/^{\circ}$, 0 to 50°C (273 to 323 K).

Operating Temperature Range 0 to 50°C (273 to 323 K).

2.2. CONTROLS

Threshold (T) Independent 20-turn front panel screwdriver adjustment for each discriminator channel; range from -30 mV to \sim -1000 mV; the adjusted level is measured on the adjacent test point, where a meter will indicate 10X threshold (-0.3 to -10 V).

Width (W) Independent 20-turn front panel screwdriver adjustment to set the output pulse width for each discriminator channel; range ≤ 6 to >150 ns.

Gate Rear panel locking toggle switch controls use of a master gate signal that can be furnished to all channels in the module.

2.3. INPUTS

In 1 through In 8 Independent front panel LEMO connector for each discriminator channel. Linear range, -30 mV to -1000 mV. Z_{in} 50 Ω . Input protected to ± 5 A for 0.5 μ s and clamped at +1 V and -7 V. Input reflections $\leq 2\%$ for signals with rise time ≥ 2 ns. Input offset ± 1 mV.

Gate Master gate signal enabled by the rear panel Gated/Ungated locking toggle switch; connected through pin 36 in the NIM power connector to a gate line that is common to all module locations in the bin. When the switch is set at Gated, a clamp to ground from +5 V inhibits operation of all eight discriminator channels.

2.4. OUTPUTS

Out Three front panel LEMO connectors in each discriminator channel provide bridged negative outputs. For optimum output pulse shape, terminate the unused outputs of an active channel in 50Ω ; failure to terminate the unused outputs will degrade the pulse shape through those that are used. Channels not in use do not require any output termination. The amplitude through each connector goes from 0 to -32 mA, width adjustable from ≤ 6 to >150 ns; rise time 1.5 ns typical, ≤ 2 ns guaranteed.

2.5. ELECTRICAL AND MECHANICAL

Power Required +6 V, 200 mA; -6 V, 585 mA; +12 V, 165 mA; -12 V, 165 mA; -24 V, 75 mA

Dimensions NIM-standard single-width module (1.35 by 8.714 in.) per TID-20893.

2.6. ACCESSORY

A small screwdriver is included with each 928 Octal Discriminator, that can be used for threshold and width adjustments.

2.7. OPTIONS

Remote Programming Permits application of dc voltages through the rear panel NIM power connector to independently control threshold and width for each discriminator channel.

High-Impedance Input Bridged high-impedance input for use in conjunction with amplitude digitizers. This option requires the substitution of one of the three LEMO connectors that are normally used for a negative output.

3. INSTALLATION

3.1. GENERAL

The 928 operates on power that must be furnished from a nuclear-standard bin and power supply that includes the ± 6 V distribution. The ORTEC 401A/402D Bin and Power Supply provides this power distribution. The ORTEC M400/N NIMBIN also provides the required power distribution and, in addition, includes wiring for the common gating line that can be used for the 928.

The bin and power supply in which the 928 will be operated is designed for relay rack mounting. If the equipment is rack mounted, be sure that there is adequate ventilation to prevent any localized heating of the components that are used in the 928. The temperature of equipment mounted in racks can easily exceed the maximum limit of 50° C (323 K) unless precautions are taken.

3.2. CONNECTION TO POWER

Turn off the Bin Power Supply before inserting or removing any modules. ORTEC modules are designed so that even a full complement of modules in the 12 bin positions will not overload an ORTEC 402D Power Supply. However, this may not be true when either a different power supply or modules other than ORTEC design are included in the bin. To be sure of proper operation, check the power supply dc voltage levels after all modules have been installed in the bin. The ORTEC bins and power supplies include convenient test points on the power supply control panel to permit monitoring these levels easily.

3.3. INPUT CONNECTIONS

Each discriminator channel includes an input connector on the front panel that is terminated internally in 50Ω . Connect the source of negative input signals to this connector with 50Ω cable and a LEMO mating connector. Any of the eight channels can be used for an input signal connection, and it will operate independent from all other channels, whether they are also being used or not.

3.4. OUTPUT CONNECTIONS

There are three output connectors for each channel. Each provides a negative signal to represent an input pulse that exceeds the adjusted threshold, and the output signals are simultaneous and have a width that has been adjusted on the front panel. Any one or more of these connectors can be used, as required for the applications of the information derived in the independent channel in the 928. Each output connection should be furnished through a mating LEMO connector and a 50Ω cable to a circuit that has a 50Ω input impedance. Always terminate the unused connectors in each active channel with a 50Ω terminator on the front panel for proper operation of the channel.

3.5. GATING

If the 928 is operated in an ORTEC M400/N NIMBIN or equal, control can be accepted simultaneously for all eight discriminator channels from the common gating line that is wired through the rear panel power connectors. To accept the gating control, set the rear panel locking toggle switch at Gated, or to ignore this control for the module, set the switch at Ungated. The switch is accessible when the module is installed in the bin, and the control function can be changed at any time as desired.

4. OPERATING INSTRUCTIONS

Each channel that is to be used will have an input connection and requires that each of its three outputs be either cabled to a 50Ω circuit or terminated with a 50Ω terminator on the front panel. The discriminator threshold and the output width can be adjusted in each channel independently as required by the application.

To adjust a threshold, measure the voltage from the front panel monitor test point for the active channel to ground. The range of meter indications will be from -300 mV to -10 V, corresponding to the screwdriver-adjusted threshold, which is 10% of the meter indication. Use the special accessory screwdriver that is furnished with the 928 to set the threshold level as desired within this range.

To adjust the output width, provide an input pulse that exceeds the adjusted threshold and observe the width of an output pulse through any of the three Out connectors; be sure that all three Out connector circuits are terminated in 50Ω . Use the special accessory screwdriver to adjust the width for the active channel within the limits of approximately 6 through 150 ns.

Each channel that does not have an input connected to it can be completely ignored without affecting the operation of any of the active channels.

5. THEORY OF OPERATION

A complete schematic of the 928 Octal Discriminator is included at the back of this manual. The block diagram in Fig. 5.1 illustrates the dc power circuits and one of the eight identical discriminators in the instrument.

The input pulses are furnished through the front panel directly into an ORTEC HED0200 Fast Leading-Edge Discriminator. The reference level is set by the front panel threshold adjustment, and its setting can be monitored at the front panel test point (measurement at the test point is ten times the threshold level). When an input pulse amplitude exceeds the threshold level the discriminator generates an output unless it is inhibited by a gate input (common to all eight discriminators).

When the discriminator is triggered, it causes the ORTEC HU 00106 Updating Output to generate an output. The output width is adjusted within the limits of about 6 to 150 ns by the front panel Width adjustment. The output has been designed to furnish -32 mA through each of the front panel output connectors providing each output circuit is terminated in 50Ω.

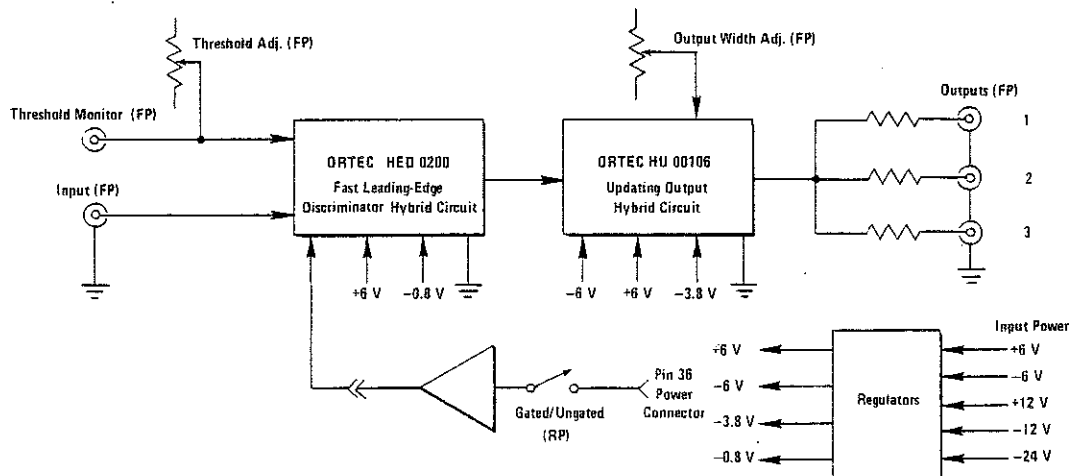


Fig. 5.1. ORTEC 928 Octal Discriminator Block Diagram (only one out of eight channels shown).

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The dc power requirements are shown in both Fig. 5.1 and the schematic, 928-0201-S1. The power levels that are identified as +6S and -6S are obtained directly from the +6 and -6 V distribution circuits of the bin in which the 928 is operated. The power levels that are identified as +6R and -6R are regulated from the +12 V and -12 V circuits, respectively, and can be adjusted on the printed circuit board. The ORTEC Hybrid packages also require dc power at -0.8 V and at -3.8 V; each of these is obtained from a regulator in the -12 V input circuit and is adjustable on the printed circuit board. Monitor points are provided on the board for each of the four adjustable dc power levels.

6. MAINTENANCE AND CALIBRATION

6.1. DC POWER LEVELS

Each of the four dc levels that are regulated on the printed circuit board can be monitored during adjustment. Use the following procedure to check and adjust these levels if necessary.

1. Observe the +6R level at TP4. Adjust R27 as necessary to obtain +6 V (+60 mV) at TP4.

2. Observe the -6R level at TP3. Adjust R14 as necessary to obtain -6 V (+60 mV) at TP3.

3. Observe the -.8R level at TP2. Adjust R18 as necessary to obtain -0.8 V (+8 mV) at TP2.

4. Observe the -3.8R level at TP1. Adjust R10 as necessary to obtain -3.8 V (+40 mV) at TP1.

5. After adjusting all three negative levels, repeat steps 2 through 4 to be sure that all are within the specified limits; all three of these levels are regulated from the -12 V common source and some interaction is possible.

6.2. TYPICAL DC VOLTAGES

Table 6.1 provides an aid for troubleshooting, if this should be necessary. The typical dc measurements in Table 6.1 were obtained with the threshold and width controls adjusted to minimum (fully counterclockwise). These dc levels should be considered as relative rather than absolute, and can vary from one unit to another and from one channel to another within the same module.

Table 6.1. Typical dc Voltages

<u>Test Point</u>	<u>Voltage</u>	<u>Test Point</u>	<u>Voltage</u>
IC1-2	-3.16	Q5E	+6.00
IC1-3	-3.16	Q5C	+12.00
IC1-4	-6.00	Q1E	-1.55
IC1-6	-4.38	Q1B	-0.82
IC1-7	+6.00	Q1C	0
Q2E	-3.80	IC5-1	0
Q2C	-5.91	IC5-2	-0.71
IC2-2	-1.08	IC5-3	-1.42
IC2-3	-1.08	IC5-4	-0.71
IC2-4	-6.00	IC5-5	+0.72
IC2-6	-0.12	IC5-6	0
IC2-7	+6.00	IC5-7	+0.72
Q4E	-0.80	IC5-8	+1.45
IC3-2	-6.00	IC5-9	-8.21
IC3-3	-6.00	IC5-10	-8.26
IC3-4	-12.00	IC5-11	-1.41
IC3-6	-6.67	IC5-12	-8.61
IC3-7	0	A101-1	-2.61
Q3E	-6.00	A101-2	+0.42
Q3C	-12.00	A101-3	-2.56
IC4-2	+0.002	A101-4	-3.29
IC4-3	-0.006	A101-5	-6.00
IC4-4	-6.00	A101-6	-2.58
IC4-6	+6.62	A101-7	-2.00
IC4-7	+12.00	A101-8	-0.82

A101-9	0	A102-1	-2.61
A101-10	+6.00	A102-2	-6.00
A101-11	0	A102-3	-3.80
A101-12	-0.024	A102-4	0
A101-13	0	A102-5	-0.032
A101-14	0	A102-6	-0.032
A101-15	-0.82	A102-7	+6.00
A101-16	-1.3	A102-8	-3.80
		A102-9	0
		A102-10	0

6.3. FACTORY SERVICE

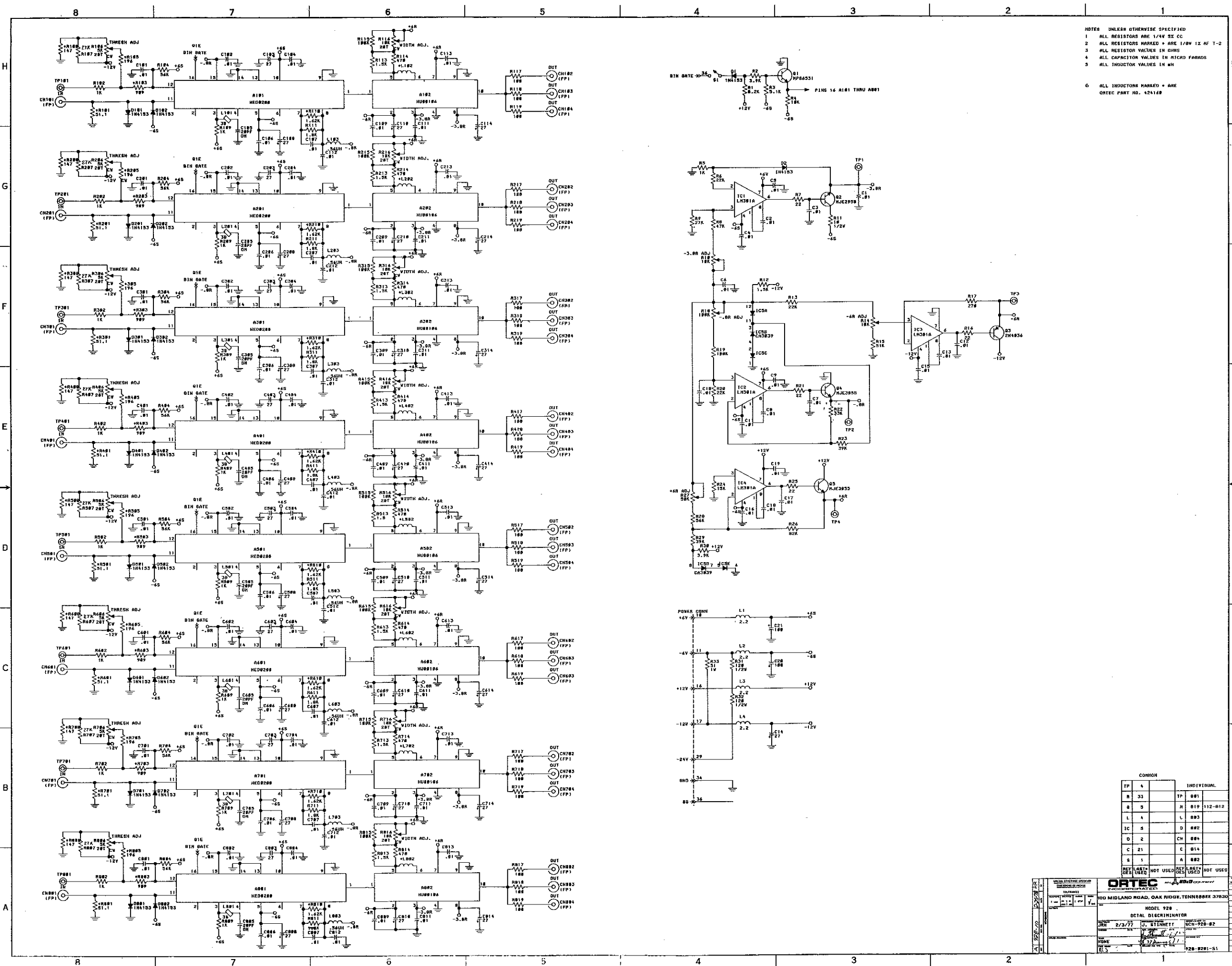
This instrument can be returned to the ORTEC factory for service and repair at a nominal cost. The ORTEC standard procedure for repair ensures the same quality control and checkout that are used for a new instrument. Always contact Customer Services at ORTEC, (615) 482-4411, before sending in an instrument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

**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR AEC STANDARD NUCLEAR INSTRUMENT MODULES
PER TID-20893**

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	115 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	115 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC 401A and 401B Modular System Bins.

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



NOTES UNLESS OTHERWISE SPECIFIED
 1 ALL RESISTORS ARE 1/4W 5% CC
 2 ALL RESISTORS MARKED * ARE 1/8W 1% T-2
 3 ALL RESISTOR VALUES IN OHMS
 4 ALL CAPACITOR VALUES IN MICRO FARADS
 5 ALL INDUCTOR VALUES IN MH
 6 ALL INDUCTORS MARKED * ARE
 ORTEC PART NO. 424189

