EG&G ORTEC

Model 934
Quad Constant-Fraction
100-MHz Discriminator
Operating and Service Manual

Model 934
Quad Constant-Fraction
100-MHz Discriminator
Operating and Service Manual

This manual applies to instruments marked
"Rev 31" on rear panel

Printed in U.S.A.

EG&G ORTEC Part Number 733700

2986 1.0C 0788

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 warrany repair and as a source of statistical information for design improvements.

Repair Service

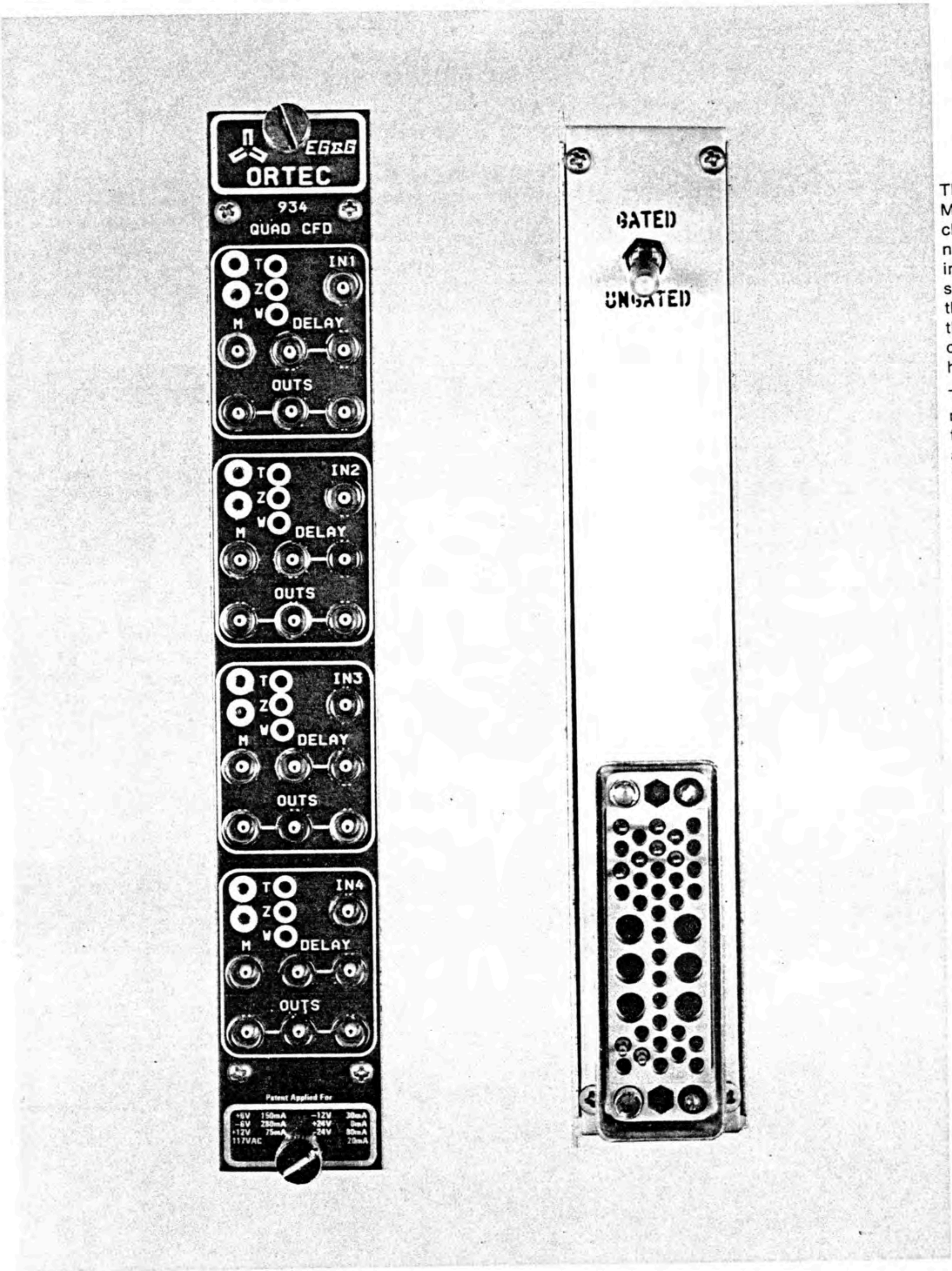
If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, EG&G ORTEC must be informed, either in writing, by telephone [(615) 482-4411] or by telex (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

ILLUSTRATIONS


EG&G
ORTEC
934
QUAD CFD
IN1
IN2
IN3
IN4
T
Z
W
M
DELAY
OUTS
Patent Applied For
GATED
UNGATED

EG&G ORTEC 934
QUAD CONSTANT-FRACTION 100-MHz DISCRIMINATOR

1. DESCRIPTION

The EG&G ORTEC 934 Quad Constant-Fraction 100-MHz Discriminator is a single-width NIM module that includes four independent fast constant-fraction discriminators. Each section of this instrument accepts negative input pulses and generates three simultaneous NIM-standard fast negative logic pulses for each input pulse that exceeds the adjusted threshold level. The design of this instrument utilizes advanced EG&G ORTEC hybrid circuit technology to achieve maximum performance and high reliability in a high-density package.

The constant-fraction technique permits optimum timing measurements to be made with photomultiplier tubes or fast solid-state detectors. Each input signal is split so that a portion of the signal is delayed and subtracted from a fraction of the undelayed signal. The resulting bipolar constant-fraction signal has a baseline crossover that is virtually independent of the input signal amplitude. The zero crossing point is detected and used to provide precisely timed logic pulses for a wide dynamic range of input signals.

Each of the four channels includes an independently adjustable threshold level to prevent output signals from being generated in response to noise or small-amplitude input signals. The input circuit has an impedance of 50Ω and is protected against overload. The input signals should be furnished through 50Ω coaxial cable to ensure proper termination with minimum reflections at the input of the 934.

Each channel of the 934 includes an updating one-shot and output voltage driver circuit. This circuit generates three simultaneous negative NIM fast logic signals for each input signal that satisfies the discriminator criteria.

The constant-fraction shaping delay for each discriminator channel is determined by the length of 50Ω coaxial cable that must be added between two front panel LEMO connectors. The shaping delay can be optimized for each specific application. This optimization requires prior knowledge of the risetime and nominal width of the input signals to the 934.

A common gating circuit can be used to control responses in all four channels simultaneously. The position of a rear panel switch determines whether the gating signals from the bin are accepted or not. The bin must be constructed with a Gate input connector on the rear panel and distribution of the gating line through pin 36 of each power connector in the bin.

The 934 operates in an EG&G ORTEC 4001C/402D or M400/N NIMBIN® 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 EG&G ORTEC 934 modules can be operated in the bin, with a total capacity of 48 constant-fraction discriminator channels.

2. SPECIFICATIONS

2.1. PERFORMANCE

NUMBER OF CHANNELS Four, completely independent except for gating.

INPUT/OUTPUT RATE >100 MHz (typically >110 MHz) for input >50 mV.

PULSE-PAIR RESOLUTION <10 ns (typically <9 ns) for input >50 mV.

WALK ≤±150 ps, 200:1 dynamic range (−50 mV to −10 V) with $t_r \leq 1$ ns, $t_{pw} \cong 10$ ns, $t_{d(Tot)} \cong 3$ ns, threshold = 30 mV.

TIME SLEWING ≤750 ps from half-fire, measured with $t_r = 1.8$ ns, $t_f = 2.0$ ns, $t_{pw} = 3.1$ ns at half-height, $t_{d(Tot)} = 1.5$ ns, threshold = 30 mV.

PROPAGATION DELAY 13 ns typical from input to output using $t_{d(Tot)} = 1.5$ ns.

OPERATING TEMPERATURE RANGE 273 to 323 K (0 to 50°C).

THRESHOLD TEMPERATURE INSTABILITY <0.1% per degree from 273 to 323 K (0 to 50°C). Referenced to −12 V bin power supply level.

PROPAGATION DELAY INSTABILITY <15 ps per degree (typically <10 ps per degree) from 273 to 323 K (0 to 50°C).

OUTPUT WIDTH TEMPERATURE INSTABILITY <0.2% per degree from 273 to 323 K (0 to 50°C).

2.2. CONTROLS

THRESHOLD (T) 20-turn front panel screwdriver adjustment for each discriminator channel; variable from −30 to −1000 mV.

THRESHOLD MONITOR Front panel test point to monitor discriminator threshold setting, located to left of Threshold adjustment; voltage is −0.3 to −10 V, which is ten times actual threshold.

WALK (Z) 20-turn screwdriver front panel adjustment in each channel for precise setting of the walk compensation network for each application.

WALK MONITOR Front panel test point permits monitoring the actual dc voltage level that is set for the zero-crossing reference, normally set in the range from −0.5 mV to −1.5 mV; located to left of Walk adjustment.

UPDATING WIDTH (W) 20-turn front panel screwdriver adjustment for each discriminator channel; variable range <6 ns to >150 ns.

SHAPING DELAY A pair of LEMO connectors for each discriminator channel accepts 50Ω coaxial cable to adjust the required shaping delay; total shaping delay is ~0.7 ns plus delay of external cable.

CF MONITOR (M) Front panel LEMO connector for each discriminator channel permits observation of the constant-fraction shaped signal; 50Ω cable required.

GATE Rear panel On/Off toggle switch to control use of a master gate signal that can be furnished to all four channels in the module.

2.3. INPUTS

INPUT Front panel LEMO connector for each discriminator channel. Linear range 0 to −10 V. Signal input impedance, 50Ω, dc coupled. Input protected. Input reflections <10% for signals with risetime >2 ns.

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 pin 36 at all module locations in the bin. When the switch is set at Gated, a clamp to ground from +5 V inhibits operation of all four discriminator channels.

2.4. OUTPUTS

OUT Three bridged, updated negative outputs are furnished through front panel LEMO connectors; each discriminator channel is independent from the other channels in the module. Amplitude at each connector, nominally −800 mV into 50Ω; width adjustable from <6 ns to >150 ns; rise and fall times typically <2 ns.

2.5. ELECTRICAL AND MECHANICAL

POWER REQUIRED +6 V, 150 mA; −6 V, 380 mA; +12 V, 75 mA; -12 V, 30 mA; +24 V, 0 mA; -24 V, 12 mA; 117 V ac, 30 mA. Total dissipation 8.0 W.

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

2.6. ACCESSORY

A small screwdriver is included with each 934 Quad CF Discriminator, and can be used for threshold, width, and walk adjustments.

3. INSTALLATION

3.1. GENERAL

The 934 power requirements must be furnished from a nuclear-standard bin and power supply that includes the ±6 V power distribution, such as the EG&G ORTEC 4001C/402D Bin and Power Supply. The EG&G ORTEC M400/N NIMBIN also provides the required power distribution and, in addition, includes the wiring and rear panel connector necessary for the common gating line that can be used with the 934.

The bin and power supply in which the 934 will normally 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 in the 934. 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. EG&G ORTEC modules are designed so that a full complement of these modules in the 12 bin positions will not overload an EG&G ORTEC 402D Power Supply. However, this may not be true when a different power supply is used or when modules not designed by EG&G ORTEC are included in the bin. To be sure of proper operation, check the dc voltage levels of the power supply after all modules have been installed in the bin. EG&G ORTEC bins and power supplies include convenient test points on the power supply control panel to permit monitoring these levels.

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 through a 50Ω coaxial cable and a mating LEMO connector. Any of the four channels can be provided with an input signal and will operate independently from all other channels.

3.4. OUTPUT CONNECTIONS

There are three output connectors for each channel. These connectors furnish three identical, simultaneous, negative NIM logic signals for each input pulse that exceeds the adjusted threshold level. The updating width of the output pulses can be adjusted by the front panel W control associated with that channel.

Each output connection should be furnished through a mating LEMO connector and a 50Ω coaxial cable to a 50Ω load impedance. For best results, terminate one unused output connector in each active channel with a 50Ω terminator on the front panel. Termination is not necessary for unused channels.

3.5. GATING

If the 934 is operated in an EG&G ORTEC M400/N NIMBIN or equivalent, gating control can be accepted simultaneously for all four discriminator channels from the common gating line that is wired through the rear panel power connector. To accept gating control, set the rear panel locking toggle switch at Gated. To inhibit this control for the module, set the switch at Ungated. The switch is accessible when the module is installed in the bin and can be changed at any time.

3.6. CONSTANT-FRACTION DELAY CABLE SELECTION

The shaping delay for each channel is adjusted by selecting an appropriate length of 50Ω coaxial cable and adding it between the two Delay LEMO connectors on the front panel. The length of cable determines the amount of external signal delay that is added to the ~0.7 ns internal delay to constitute the total constant-fraction shaping delay.

$$t_{d(Tot)} \cong t_{d(Ext)} + 0.7 \text{ ns.}$$

The primary usage of the 934 is expected to be in fast timing or counting experiments with scintillators and photomultiplier tubes (PMT's). In these applications, the constant-fraction shaping delay, $t_{d(Tot)}$, is selected so that the zero-crossing of the bipolar timing signal occurs after the attenuated, undelayed portion of the constant-fraction signal has reached its maximum amplitude. Thus the zero-crossing occurs at the same fraction of the input pulse height, regardless of the amplitude of the input signal.

Selection of the constant-fraction shaping delay for best timing performance with a given scintillator and PMT is usually accomplished experimentally. The randomly generated signals from the anode of the PMT are applied to the input of one channel of the discriminator. Each of the two CF Delay connectors should be terminated with a 50Ω terminator. The CF Monitor signal can then be observed on a fast oscilloscope (bandwidth ≥300 MHz), which is terminated in 50Ω and triggered internally. The Monitor signal represents the attenuated, undelayed portion of the constant-fraction signal with no delayed signal

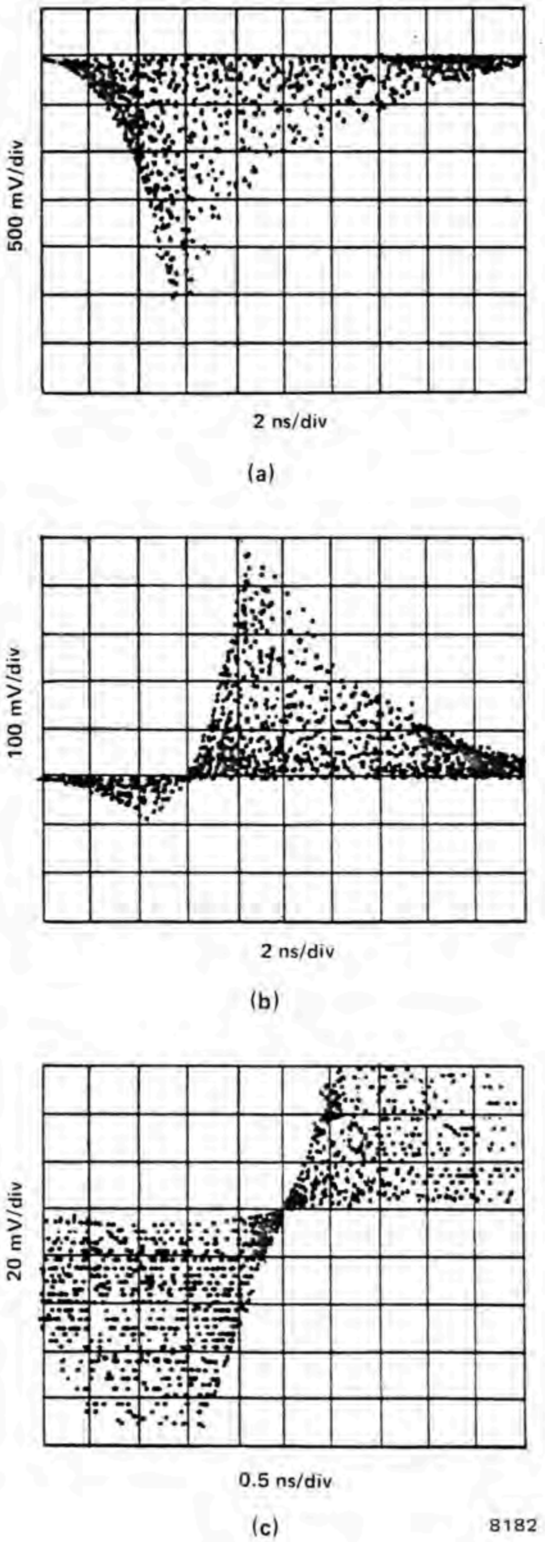


Fig. 3.1(a). RCA 8850 PMT Anode Signal with a 1-in. x 1-in. KL236 Scintillator and ^{60}Co Source. (b). Constant-Fraction Zero-Crossing Monitor Signal, Triggered by the Discriminator Output for the Anode Signal Shown Above. (c). Expanded View of the Constant-Fraction Zero-Crossing Monitor Signal.
CF delay ≅ 3 ns; threshold = 30 mV.

subtracted from it. The addition of the appropriate external CF shaping delay, $t_{d(Ext)}$, causes the resulting bipolar signal at the CF Monitor to cross the baseline after the peak of the attenuated, undelayed signal and before approximately 0.9 times its maximum amplitude. A useful empirical formula for the initial trial selection of the external shaping delay is

$$t_{d(Ext)} \cong 1.1\ t_r - 0.7\ \text{ns},$$

where t_r is the 10% to 90% risetime of the anode pulse. Walk adjustment can then be accomplished while observing the delayed CF Monitor signal on a fast oscilloscope, which is triggered externally by the output signal from the constant-fraction discriminator. The walk potentiometer (Z) should be adjusted so that the bipolar constant-fraction signals for all amplitudes cross through the baseline at approximately the same time.

Figure 3.1(a) illustrates the anode signals from an RCA 8850 PMT with a 1-in. x 1-in. KL 236 scintillator and a ^{60}Co source. The (b) and (c) portions of Fig. 3.1 show the resulting delayed CF Monitor signal seen on a sampling oscilloscope, triggered by the discriminator output signal. The CF delay and walk adjust have been set properly and the spread in the zero-crossing time is less than 100 ps.

4. OPERATING INSTRUCTIONS

Each channel has an input connection and up to three output connections. The discriminator threshold, the updating output width, and the walk characteristics are all adjustable independently in each channel as required by the application.

To adjust the threshold level, measure the dc voltage from the front panel threshold monitor test point to ground for the active channel. The nominal range of voltages at this test point is from −300 mV to −10 V, corresponding to the actual threshold which is 10% of the test point voltage. Use the special accessory screwdriver that is furnished with the 934 to set the threshold level with the control marked T.

To adjust the updating output width, provide an input pulse that exceeds the adjusted threshold at a rate less than 5 MHz and observe the width of an output pulse from any of the three output connectors. Use the special accessory screwdriver that is furnished with the 934 to set the control marked W for the output width in the active channel; the width can be adjusted within the specified range from <6 ns through >150 ns.

To adjust the walk characteristics, connect the signal source to be used to the Input connector in the active channel and connect the signal from the constant-fraction Monitor connector to a fast oscilloscope (bandwidth ≥300 MHz) through a 50Ω delay. Select the constant-fraction shaping delay according to the information in Section 3.6. The constant-fraction shaped signal can be observed on the oscilloscope, triggered by an undelayed output signal from the active discriminator channel. Adjust the walk (Z) control, which sets the zero-crossing reference, so that the bipolar constant-fraction signals for all input amplitudes cross through the baseline at approximately the same time. The adjacent test point can be used for resettability of the zero-crossing reference. Under most operating conditions, the dc voltage level at the test point should be in the range from −0.5 mV to −1.5 mV. Use the special accessory screwdriver that is furnished with the 934 to adjust the Z control.

Each unused channel can be disregarded without affecting operation in any of the active channels.

5. THEORY OF OPERATION

A complete schematic of the EG&G ORTEC 934 Quad Constant-Fracton 100-MHz Discriminator is included at the back of this manual. Figure 5.1 is a simplified block diagram of the instrument that can be used as a reference to describe how it operates.

An input of 0 to −10 V amplitude starts at time zero and is applied simultaneously to the constant-fraction (CF) circuitry and to the leading-edge discriminator (LLED) circuitry. The LLED has an adjustable threshold, ranging from −30 mV to −1 V, that determines the minimum input signal amplitude that is required to produce an output pulse from the instrument. If the input signal exceeds the LLED threshold, that comparator produces an output pulse that arms zero-crossing gate G1.

A differential transformer technique is used to passively form the constant-fraction bipolar signal. The associated

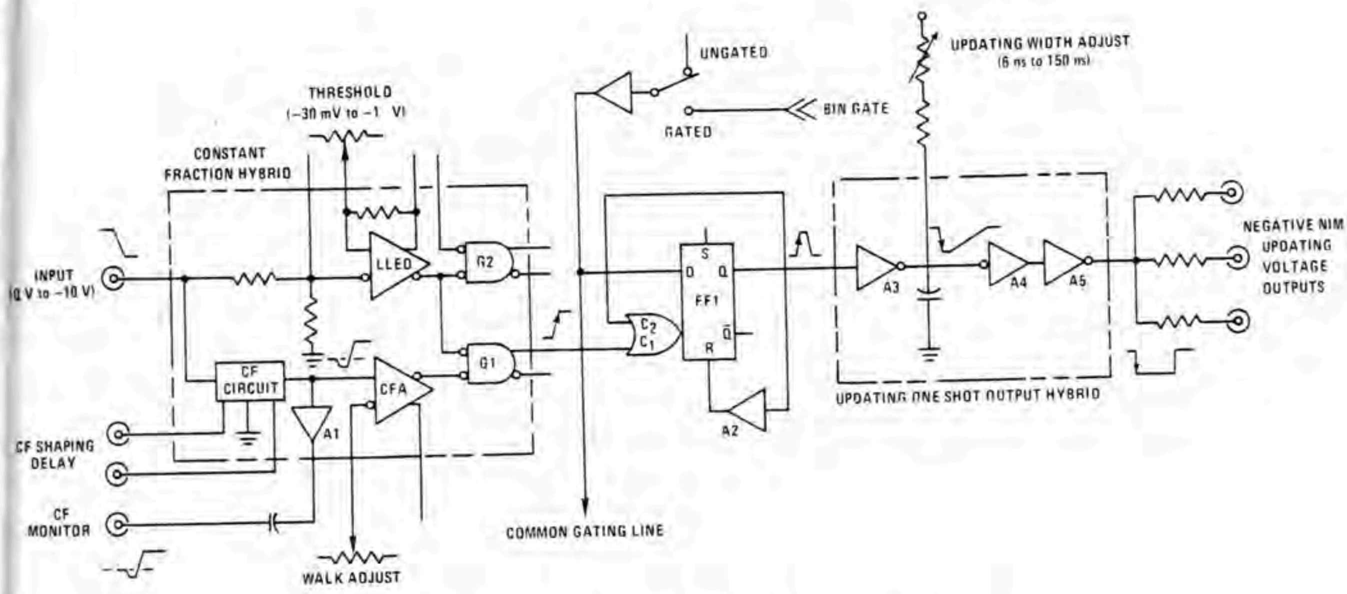


Fig. 5.1. Simplified Block Diagram of One Channel in the 934.

thick-film resistive network ensures proper impedance matching. The CF circuit sets a constant-fraction attenuation factor of f = 0.2. The passively formed constant-fraction bipolar timing signal is amplified by CFA and crosses the logic threshold at the zero-crossing gate, G1, at time t_{CF}. Time t_{CF} is determined by the selection of the external constant-fraction shaping delay, $t_{d(Ext)}$, subject to the risetimes and pulse shapes of the input signals. A fixed internal delay of ~0.7 ns must be added to $t_{d(Ext)}$ to obtain the total constant-fraction shaping delay, $t_{d(Tot)}$. Note that access for monitoring the bipolar signal is provided through buffer amplifier A1. The CFA output is furnished to gate G1, which must be armed by the LLED output to permit a response to be generated.

The timing logic signal from gate G1 triggers a fast one-shot, comprised of an ECL type D master-slave flip flop, FF1, and amplifier A2. FF1 produces a reshaped logic pulse with a fixed 2 ns width for each signal from gate G1. The reshaped signal drives a hybridized updating one-shot and output circuit that includes a capacitor and amplifiers A3 through A5. The updating capacitor is charged to its maximum voltage for each signal from A3. At the end of the 2 ns charging interval, the updating capacitor begins to discharge through the series resistance that includes the width adjustment potentiometer. A4 and A5 amplify and shape the signal on the updating capacitor to a fast voltage output signal that is capable of driving three 50Ω loads simultaneously with NIM-standard negative fast logic pulses. The output width of the updating one-shot is continuously variable from less than 6 ns to greater than 150 ns. Each reshaped logic signal that occurs at the input of the updating hybrid during the width of an output pulse extends that output pulse by one full preset updating width.

A common gating circuit can be used to simultaneously enable or inhibit the output responses of all four channels in the 934. The position of the rear panel Bin Gate switch determines whether gating signals from the bin are accepted or not. Gating control is established at the D input of the ECL type D master-slave flip flop in each channel.

The dc power requirements are shown in schematic 934-0201-S1. The power levels at +6 V, −6 V, +12 V, and −12 V dc, and at 117 V ac, are all obtained directly from the bin power supply. The EG&G ORTEC Hybrid packages also require dc power at −3.0 V, −5.2 V, and +6.0 V; each of these levels is obtained from a regulator and is adjustable on the printed circuit board. Monitor points are provided on the board for each of the adjustable dc power levels.

6. MAINTENANCE

6.1. CALIBRATIONS

Four precise dc voltage levels are generated in the 934 to provide operating power for the integrated circuit packages and the EG&G ORTEC Hybrids. There are test points on the printed circuit at which the voltage levels can be monitored while they are adjusted. If any of the levels need adjustment, use the following procedure:

1. Adjust R6 for a reading of −5.2 V at both TP1 and TP2.
2. Adjust R14 for a reading of −3.0 V at TP3.
3. Adjust R27 for a reading of +6.0 V at TP4.

6.2. TYPICAL DC VOLTAGES

Table 6.1 lists typical values for voltages at various points in the printed circuit when the instrument is operating properly. The readings are not absolute, but are furnished as a guide to check any portion of the system that is suspected of malfunction. All voltages were measured with respect to ground, with the T and W controls set at minimum, and the Z control set for −0.5 mV.

The readings shown for A101, IC101, Q101, and A102 were taken from the components in channel 1. They are typical for readings that should also be present at the equivalent circuit points in channels 2 through 8.

6.3. FACTORY SERVICE

This instrument can be returned to the EG&G ORTEC factory for service and repair at a nominal cost. The EG&G ORTEC standard procedure for repair ensures the same quality control and checkout that are used for a new instrument. Always contact Customer Services 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. This number should be written on the address label and on the package.

Table 6.1. Typical dc Voltages

Location		Voltage	Location		Voltage	Location		Voltage
IC1	pin 1	−12.0	IC101	pin 1	0.0		18	0.0
	2	−5.20		2	−1.81		19	0.0
	3	−5.20		3	+0.06		20	0.0
	4	−12.0		4	−1.74	A102	pin 1	−1.81
	5	−12.0		5	−4.87		2	−5.20
	6	−5.84		6	0.0		3	−3.0
	7	+12.0		7	−1.81		4	0.0
	8	0		8	−5.20		5	+0.43
IC2	pin 1	−12.0		9	0.0		6	+0.43
	2	−5.20		10	−0.68		7	+6.0
	3	−5.20		11	0.0		8	−3.0
	4	−12.0		12	0.0		9	0
	5	−12.0		13	0.0		10	0
	6	−5.86		14	0.0	Q1	E	−5.20
	7	−12.0		15	0.0		B	−5.82
	8	0		16	0.0		C	−8.44
IC3	pin 1	−12.0	A101	pin 1	0.0	Q2	E	−5.20
	2	−0.89		2	0.0		B	−5.87
	3	−0.89		3	−0.73		C	−6.01
	4	−12.0		4	0.0	Q3	E	−3.0
	5	−12.0		5	+5.92		B	−3.45
	6	−3.48		6	0		C	−12.0
	7	+12.0		*7	−1.15	Q4	E	+6.0
	8	0		8	−5.20		B	+6.62
IC4	pin 1	−12.0		9	+0.05		C	+12.0
	2	0		10	−1.77	Q5	E	−0.68
	3	0		11	0		B	−0.08
	4	−12.0		12	−5.09		C	0
	5	−12.0		13	+0.05	Q101	E	−1.77
	6	+6.61		14	−1.81		B	−2.50
	7	+12.0		15	0		C	−5.20
	8	0		16	−0.0138			
				17	0.0			

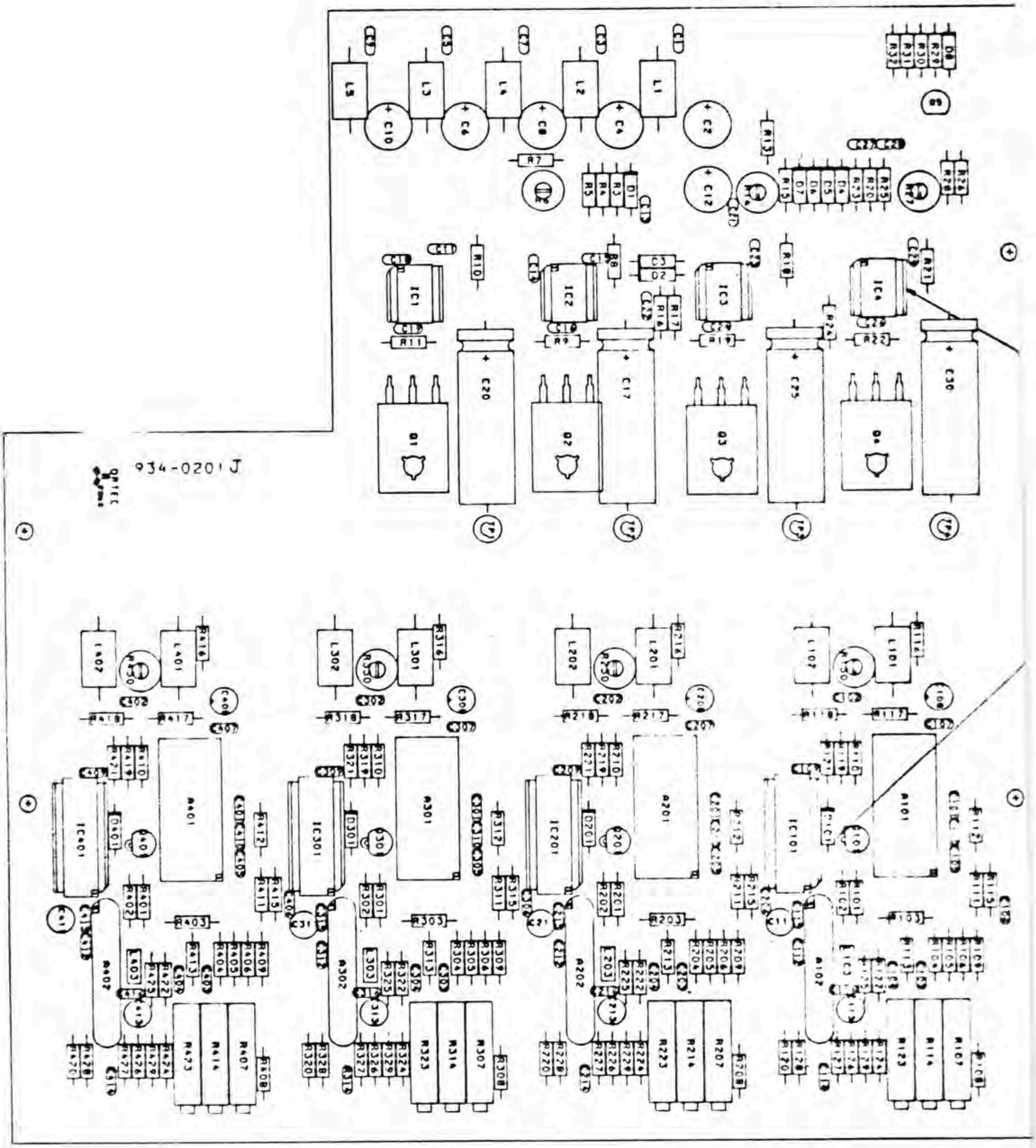
*May vary from approximately −0.8 V to −1.8 V.

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.



ORTEC INCORPORATED

100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830

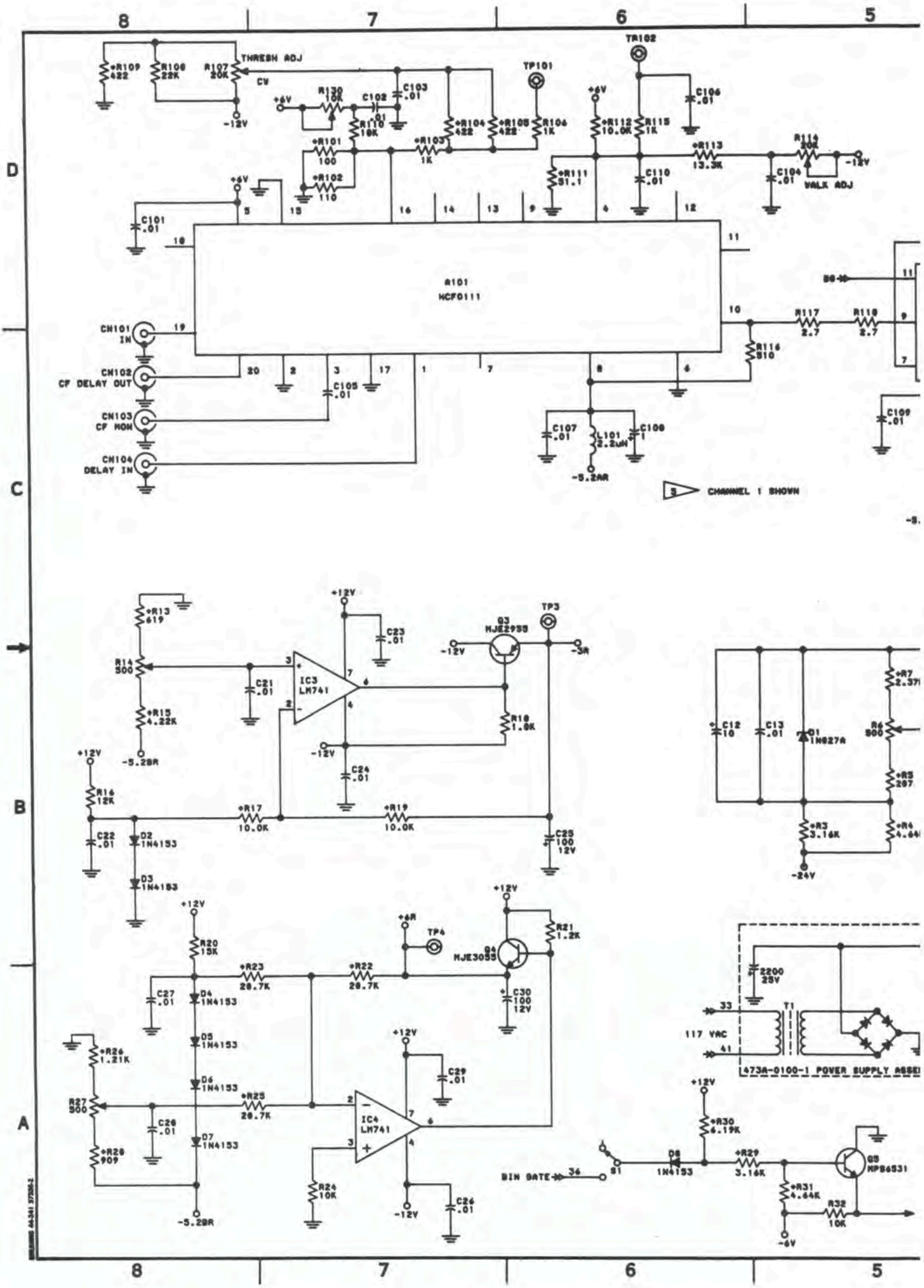
MODEL 934

COMPONENT ASSEMBLY

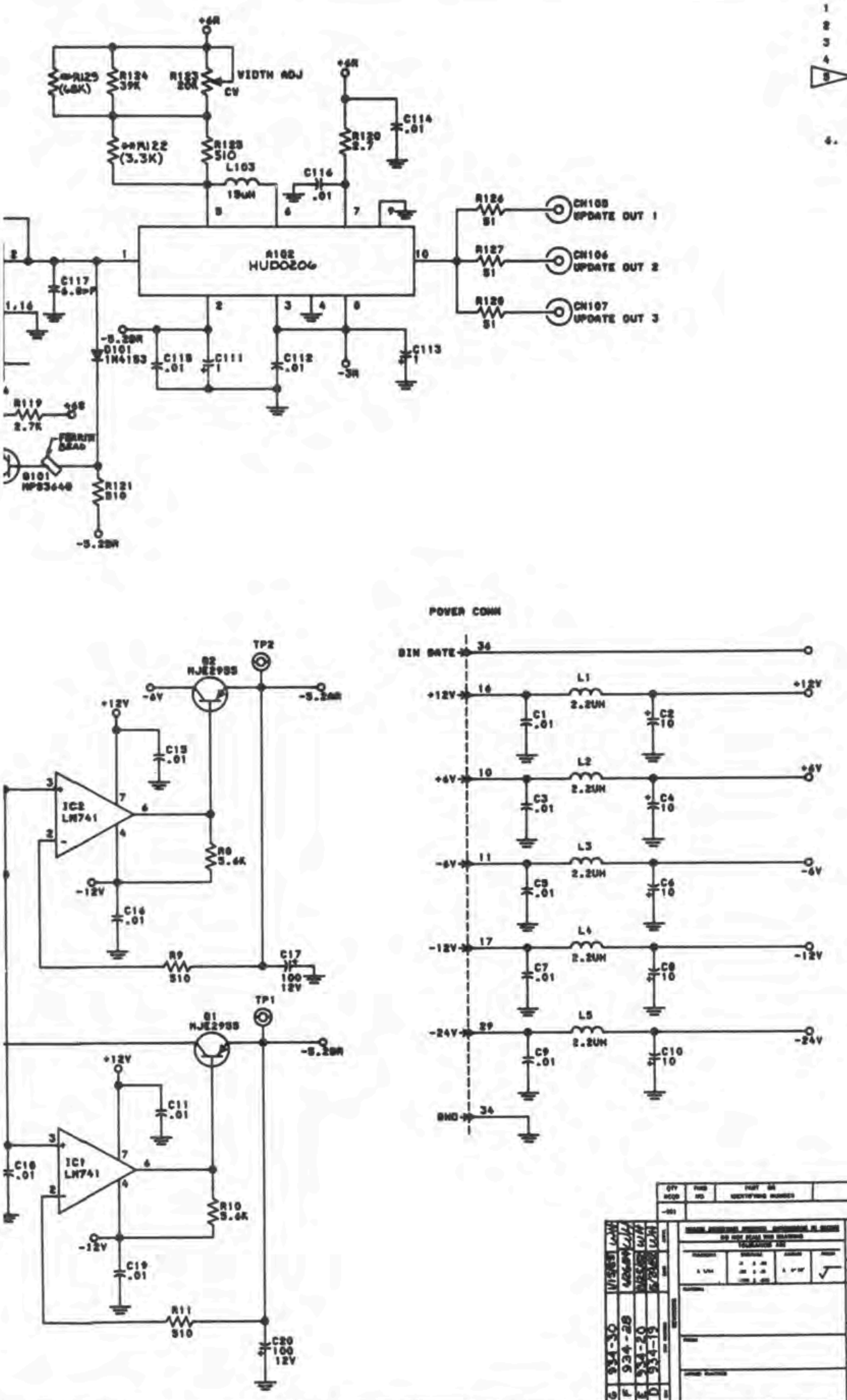
JAN 11/22/77 M. BEDWELL PCB-934-02

1/1

934-0700



THRESH ADJ
WALK ADJ
A101
MCF0111
CN101 IN
CN102 CF DELAY OUT
CN103 CF MON
CN104 DELAY IN
CHANNEL 1 SHOWN
IC3 LM741
IC4 LM741
Q3 MJE2955
Q4 MJE3055
Q5 MPS6531
117 VAC
BIN GATE
473A-0100-1 POWER SUPPLY ASSE



NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS
2. ALL CAPACITOR VALUES ARE IN MICRO FARADS
3. ALL RESISTORS ARE 1/4W 5% CC
4. ALL RESISTORS MARKED * ARE 1/8W 1% MF T-2
5. CHANNEL 1 SHOWN, CHANNEL 2 THRU 4 ARE SAME. ALL CHANNELS USE THREE DIGIT REF DES WITH FIRST DIGIT REPRESENTING THE CHANNEL. REF DES 0 THRU 99 INDICATES COMMON CIRCUIT.
6. ALL RESISTORS MARKED ** ARE SELECTED IN TEST. (NOMINAL VALUE)

INDIVIDUAL			COMMON		
TP	102		TP	4	
A	102		A		
IC	101		IC	4	
L	102		L	5	
Q	108		Q	5	
D	101		D	0	
C	117		C	31	
R	130		R	32	12
REF DES	LAST USED	NOT USED	REF DES	LAST USED	NOT USED

PARTS LIST

EG&G ORTEC

100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830

MODEL 934

DIAG, SCHEM, QUAD CFD

JDW 10/11/77

SCH-934-02-P19

M. BEDWELL

JOB 02-0449

934-0201-S1

SHEET 1 OF 1

G 934-30, F 934-28, E 934-20, D 934-19