ORTEC®

INSTRUCTION MANUAL
MODEL 411
PULSE STRETCHER

Serial No. ____________________

Purchaser ____________________

Date Issued ____________________

ORTEC
INCORPORATED
P. O. BOX C
OAK RIDGE, TENNESSEE 37830
Telephone (615) 483-8451
TWX 810-572-1078

Printed in U.S.A.

TABLE OF CONTENTS

STANDARD WARRANTY FOR ORTEC ELECTRONIC INSTRUMENTS

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, notify ORTEC of the circumstances so that we may assist in damage claims and in providing replacement equipment when necessary.

WARRANTY

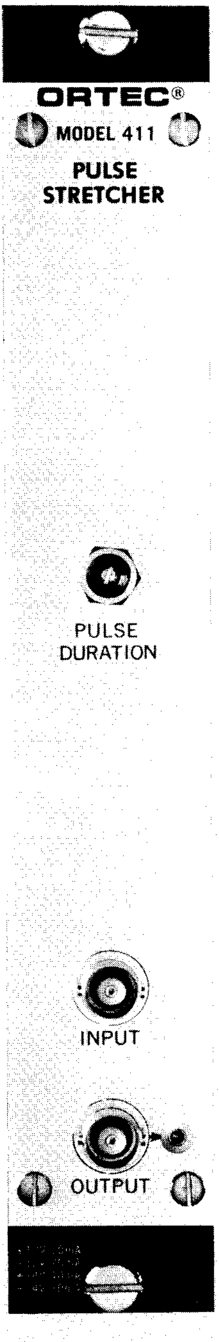
ORTEC warrants its electronic products to be free from defects in workmanship and materials, other than vacuum tubes and semiconductors, for a period of twelve months from date of shipment, provided that the equipment has been used in a proper manner and not subjected to abuse. Repairs or replacement, at ORTEC option, will be made without charge at the ORTEC factory. Shipping expense will be to the account of the customer except in cases of defects discovered upon initial operation. Warranties of vacuum tubes and semiconductors, as made by their manufacturers, will be extended to our customers only to the extent of the manufacturers' liability to ORTEC. Specially selected vacuum tubes or semiconductors cannot be warranted. ORTEC reserves the right to modify the design of its products without incurring responsibility for modification of previously manufactured units. Since installation conditions are beyond our control, ORTEC does not assume any risks or liabilities associated with the methods of installation, or installation results.

QUALITY CONTROL

Before being approved for shipment, each ORTEC 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

ORTEC instruments not in warranty may be returned to the factory for repairs or checkout at modest expense to the customer. Standard procedure requires that returned instruments pass the same quality control tests as those used for new production instruments. Please contact the factory for instructions before shipping equipment.



Model 411 Pulse Stretcher

MODEL 411
PULSE STRETCHER

DESCRIPTION

1.1 General Description

The ORTEC Model 411 linear Pulse Stretcher is designed to be used with linear amplifiers and biased amplifiers such as the ORTEC Model 410 and Model 408, respectively. The Pulse Stretcher is used to stretch the peak voltage of narrow input signals to a minimum pulse width. This effectively reduces the bandwidth requirements of analog-to-digital circuits in multichannel pulse height analyzers. By reducing the bandwidth requirements, an improvement of linearity in the linear system is accomplished.

1.2 Description of Basic Function

The basic function of the Pulse Stretcher is to accept linear signals from some source such as a linear amplifier, linear gate, or a biased amplifier, and reshape the input signal to a waveform that is suitable for driving a multichannel analyzer. The reshaping of the input pulse must be performed in a manner that does not destroy the linear nature of the input signal, the linear parameter of the input signal being its relative amplitude. The pulse width of the input signal is of no significant importance except from the practical viewpoint of having a pulse wide enough to allow accurate amplitude analysis of the signal.

When using a biased amplifier in a linear system, the problem of pulse width variations below some minimum impractical width feeding into the multichannel analyzer can be eliminated by using a Model 411 Pulse Stretcher to stretch all input pulses to the analyzer to a minimum value selected by the front panel control. The PULSE DURATION control allows variation of the output pulse width from 0.7 to 3 microseconds.

2. SPECIFICATIONS

2.1 General Specifications

The ORTEC Model 411 is housed in a Nuclear Standard Module; it is one standard module wide and weighs 2.1 pounds. It contains no internal power supply, and therefore must obtain the necessary operating power from a Nuclear Standard Bin and Power Supply such as the ORTEC Model 401A/402A. All signals in and out of the module are on front panel BNC connectors, and the input power is via the standard connector on the rear panel.

2.2 Pulse Stretcher

Input	Unipolar or bipolar, with the positive portion leading; 0.2 to 10 volts rated range, 12 volts maximum
Input Impedance	Approximately 1000 ohms
Linearity	Integral nonlinearity is less than 0.2% from 0.2 to 10 volts
Temperature Stability	Gain shift is less than 0.015%/°C
Counting Rate	The shift in gain as a function of counting rate is less than 0.2% for 50K cts/sec from a ^{137}Cs source with a 60-keV threshold on the counting
Output	Positive 0 to 10V rated full output, 12V maximum
Output Pulse Width	Minimum output is continuously variable from 0.7 to 3 microseconds. Maximum pulse width is dependent on input pulse shape and amplitude.
Output Impedance	Approximately 1 ohm, short-circuit protected
Operating Temperature Range	0 to 50 °C
Power Requirements	+24V, 40 mA +12V, 9 mA -12V, 17 mA -24V, 30 mA
Mechanical	One module wide, and designed to meet the recommended interchangeability standards outlined in Atomic Energy Commission Report TID-20893, it is 1.35 inches wide, 8.714 inches high, and 9.75 inches long.

3. INSTALLATION

3.1 General Installation Considerations

The Model 411, used in conjunction with a Model 401A/402A Bin and Power Supply, is intended for rack mounting, and therefore it is necessary to ensure that vacuum tube equipment operating in the same rach with the Model 411 have sufficient cooling air circulating to prevent any localized heating of the all-transistor circuitry used throughout the Model 411. The temperature of equipment mounted in racks can easily exceed the recommended maximum unless precautions are taken. The Model 411 should not be subjected to temperatures in excess of 120°F (50 °C).

3.2 Connection to Power - Nuclear Standard Bin, ORTEC Model 401A/402A

The Model 411 contains no internal power supply and therefore must obtain power from a Nuclear Standard Bin and Power Supply such as the ORTEC Model 401A/402A. It is recommended that the bin power supply be turned off when inserting or removing modules. The ORTEC 400 Series is designed so that it is not possible to overload the bin power supply with a full complement of modules in the Bin. However, this may not be true when the Bin contains modules other than those of ORTEC design. In such instances, therefore, the power supply voltages should be checked after the insertion of modules. The ORTEC Model 401A/402A has test points on the power supply control panel to monitor the dc voltages.

When using the Model 411 outside the Model 401A/402A Bin and Power Supply, be sure that the jumper cable used properly accounts for the power supply grounding circuits provided in the recommended AEC standards of TID-20893 (Rev). Both clean and dirty ground connections are provided to ensure proper reference voltage feedback into the power supply, and these must be preserved in remote cable installations. Care must also be exercised to avoid ground loops when the module is not physically in the bin.

3.3 Connection to Biased Amplifier

The input to the Model 411 is on the front panel BNC connector and is directly compatible with the output of the ORTEC Model 408 Biased Amplifier. The input is also directly compatible with the output of all the linear amplifiers, linear gates, and delay amplifiers of the ORTEC 400 Series. The input to the Model 411 is ac coupled and the input operating range is from threshold, typically 200 millivolts, to 10 volts.

If the input of the Model 411 is driven from a source with a low driving impedance , e.g., the Model 408 output, the input should be terminated in the characteristic impedance of the connecting coaxial cable.

3.4 Linear Output Signal Connections and Terminating Impedance Considerations

The source impedance of the 0-10 volt standard linear outputs of most 400 Series modules is approximately 1 ohm. Interconnection of linear signals is, thus, non-critical since the input impedance of circuits to be driven is not important in determining the actual signal span, e.g., 0-10 volts, delivered to the following circuit. Paralleling several loads on a single output is therefore permissible while preserving the 0-10 volt signal span. Short lengths of interconnecting coaxial cable (up to approximately 4 feet) need not be terminated. However, if a cable longer than approximately 4 feet is necessary on a linear output, it should be terminated in a resistive load equal to the cable impedance. Since the output impedance is not purely resistive, and is slightly different for each individual module, when a certain given length of coaxial cable is connected and is not terminated in the characteristic impedance of the cable, oscillations will generally be observed. These oscillations can be suppressed for any length of cable by properly terminating the cable either in series at the sending end or in shunt at the receiving end of the line. To properly terminate the cable at the receiving end, it may be necessary to consider the input impedance of the driven circuit, choosing an additional parallel resistor to make the combination produce the desired termination resistance. Series terminating the cable at the sending end may be preferable in some cases where receiving and terminating is not desirable or possible. When series terminating at the sending end, full signal span, i.e., amplitude, is obtained at the receiving end only when it is essentially unloaded or loaded with an impedance many times that of the cable. This may be accomplished by inserting a series resistor equal to the characteristic impedance of the cable internally in the module between the actual amplifier output on the etched board and the output connector. It must be remembered that this impedance is in series with the input impedance of the load being driven, and in the case where the driven load is 900 ohms, a decrease in the signal span of approximately 10% will occur for a 93-ohm transmission line. A more serious loss occurs when the driven load is 93 ohms and the transmission system is 93 ohms. In this case, a 50% loss will occur. BNC connectors with internal terminators are available from a number of connector manufacturers in nominal values of 50, 100, and 1000 ohms. ORTEC stocks in limited quantity both the 50 and 100 ohm BNC terminators. The BNC terminators are quite convenient to use in conjunction with a BNC tee.

4. OPERATING INSTRUCTIONS

4.1 Initial Testing and Observation of Pulse Waveforms

The Model 411 has no operational controls on the front panel. The only adjustment in the unit is the threshold adjustment which sets the minimum amplitude of an incoming signal required before stretching will occur. No controls are necessary for operation, as the input-to-output amplitude is set at unity and the pulse width is internally controlled to a minimum of 1.5 microseconds. Refer to Section 6.2 of this manual for threshold adjustment procedure.

Refer to Section 6.1 for the actual testing routine for the Model 411.

4.2 Connector Data

PGI — INPUT (BNC)

Input impedance is 1000 ohms, ac coupled. Maximum input voltage is 12 volts. To minimize reflections when driving into the Model 411 input from a low impedance voltage source such as the Model 408 output, the input should be terminated in the characteristic impedance of the connecting coaxial cable.

PG2 — OUTPUT (BNC)

Output driving source impedance is approximately 1 ohm, short-circuit protected. The output is ac coupled.

Output Test Point

There is an oscilloscope test point for monitoring a signal on the OUTPUT BNC connector on the front panel. This test point has a 470-ohm series resistor connecting it to the OUTPUT BNC.

Power Connector

The power connector is a Nuclear Standard Module power connector, AMP 202515-5.

4.3 Typical Operating Conditions

Most multichannel pulse height analyzers are sensitive to the relative pulse shape of the input signal. When using a biased amplifier in a linear system, the pulse shape, i.e., the full width at half maximum of the pulse, will change dramatically as a function of the pulse amplitude. This can be seen with reference to Figure 4-1, which shows the change in pulse shape as the bias level is changed on a given amplitude signal. It is recognized that as either pulse amplitude or bias level is changed, the resultant output pulse from the biased amplifier will change. As a consequence of this change, the analog-to-digital converter (ADC) of the multichannel analyzer will have pulses at its input that vary in width. Since the ADC has a finite bandwidth, some of the input pulses will suffer distortion in amplitude as they are processed by the converter. This distortion exhibits itself as nonlinearity in the linear system, but the nonlinearity can be greatly decreased by using a pulse stretcher to ensure that all input pulses to the multichannel analyzer have a minimum pulse width.

Figure 4-2 illustrates the nonlinearity that can be present under the conditions mentioned above. Figure 4-2(A) represents the spectrum obtained without the Model 411 Pulse Stretcher, and Figure 4-2(B) is the spectrum obtained with the Model 411 incorporated into the same system.

The output of the Model 411 is a unipolar positive pulse, ac coupled. For applications where the Model 411 feeds a dc input of an ADC, consideration must be given to baseline shifting as a result of high count rate and ac coupling.

The Model 411 can be used to stretch both linear and logic pulses for applications where it is desired to hold or move a given pulse on the time axis. Logic pulses are stretched at their input amplitude, just as are the linear pulses. An interesting application of the Model 411 is to stretch an incoming signal and then feed the stretched pulse to a Model 409 Linear Gate and Slow Coincidence. The linear gate can be opened at the desired time by application of a logic pulse to one of the Slow Coincidence inputs. In this application it may be desirable to lengthen the stretch period from its nominal 1.5 microseconds.

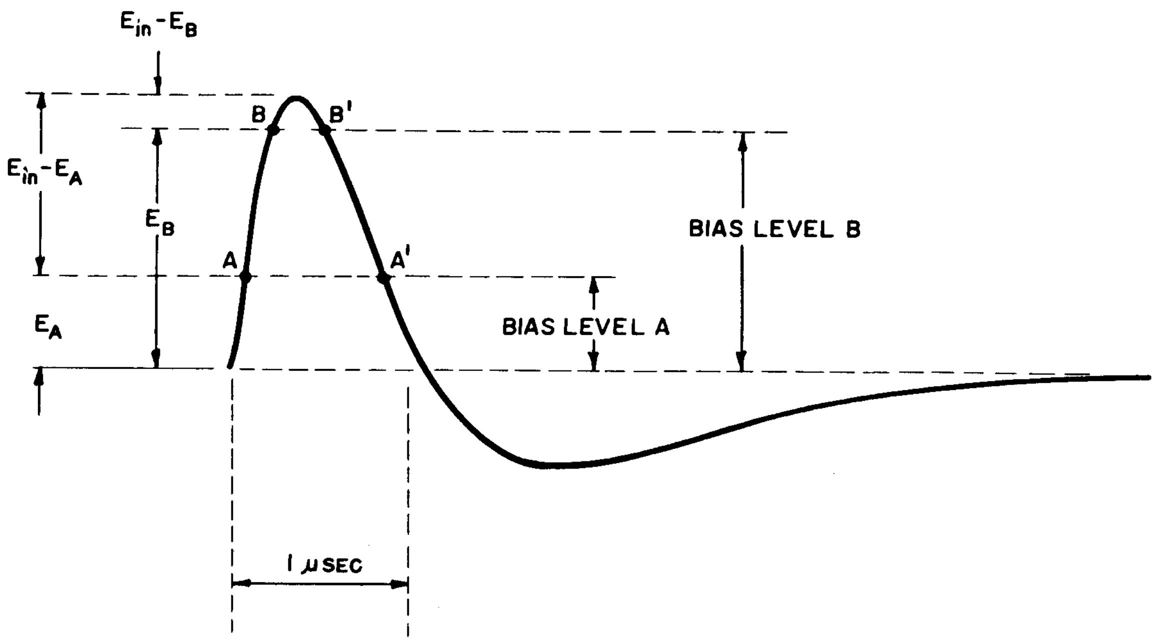
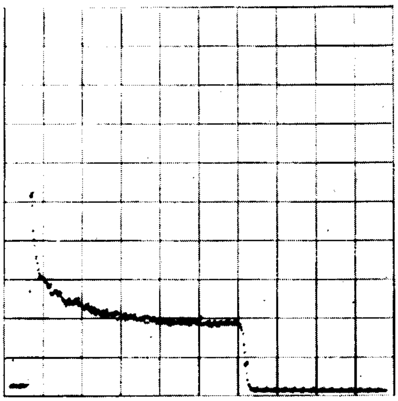
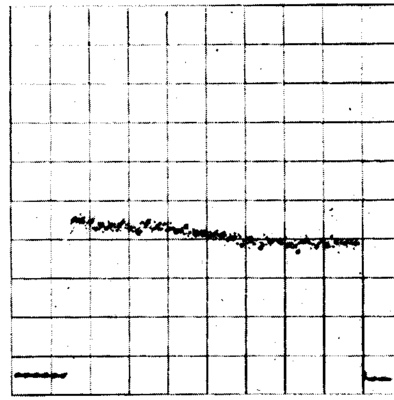


Figure 4-1. Bipolar RC Shaped Input Pulse

(A)



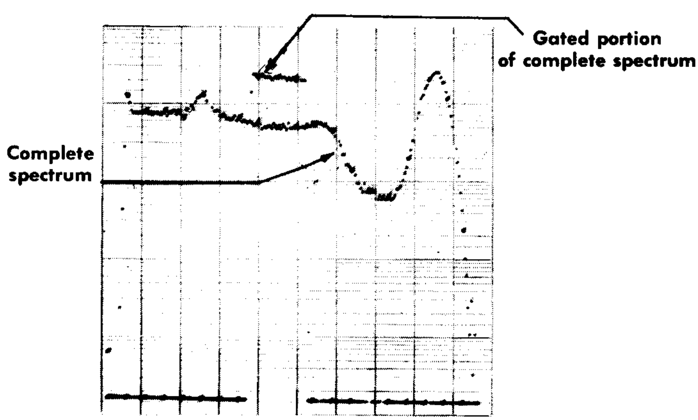
(B)



(A) shows the spectrum stored in a multichannel analyzer with the output of a biased amplifier fed directly into the multichannel analyzer.

(B) shows the spectrum of (A) when the output of the biased amplifier was fed first through the Model 411 Pulse Stretcher and then into the multichannel analyzer.

(C)



(C) shows a complete spectrum and a gated portion of the same spectrum. The gated portion was used in the following manner to obtain (A) and (B): The biased amplifier bias level was raised to an energy corresponding to channel 150 in (C). With a bias gain of 5, an essentially flat output pulse spectrum was stored from channel 58 to channel 368, as illustrated in (B) above. Note that in (A), severe system differential nonlinearity results due to the inability of the multichannel ADC to correctly analyze the varying input pulse shapes.

Figure 4-2 Differential Nonlinearity With and Without the Model 411 Pulse Stretcher (illustrates nonlinearity that can be introduced into a system with indiscriminate use of a biased amplifier)

4.4 Front Panel Controls

PULSE DURATION — A single-turn potentiometer is provided to adjust the output pulse width to the desired value within the nominal range of 0.7 to 3 microseconds. This control is recess mounted and is a screwdriver adjustment. However, it may be panel mounted and have a knob added to the potentiometer shaft to allow finger-thumb adjustment if desired.

5. CIRCUIT DESCRIPTION, PULSE STRETCHER (Etched Board 411-0187)

5.1 The Model 411 Pulse Stretcher accepts a positive input pulse whose width may vary from a minimum of 0.1 microsecond upward, and produces a flat-topped output pulse with a duration selectable from 0.7 to 3 microseconds, which is highly desirable for pulse height analyzers. The pulse stretcher consists basically of a three-transistor feedback amplifier consisting of Q6, Q7, and Q8. (See Drawings 411-0187-B1 and 411-0187-S1.) The feedback amplifier maintains capacitor C8, a 220-pF capacitor, charged to the peak amplitude of the input positive signal. Emitter-followers Q9, Q10, and Q11 avoid loading the capacitor during the duration of the stretching action.

The input to the Schmitt trigger circuit, Q2 and Q3, is preceded with a 1-volt limiter consisting of diodes D1 and D2, resistors R3, R4, R5, and the limiter load resistor, R6.

5.2 The ac-coupled Schmitt trigger circuit, Q2 and Q3, together with the one-shot trigger circuit, Q4 and Q5, supplies the discharge current for capacitor C8 at the end of the stretch period. Q6 and Q7 constitute a difference amplifier that measures the difference in potential between the input voltage appearing at the emitter of Q1 and the voltage across capacitor C8. With a positive input pulse, the current increases in Q7, driving Q8 into conduction, which, in turn, causes the potential across C8 to follow the input pulse, due to the action of the difference amplifier.

When the positive input pulse exceeds the discriminator trigger point of the ac-coupled discriminator, Q2 and Q3, a positive pulse is generated at the collector of Q3, causing Q5 to become nonconducting. The ceasing of conduction through Q5 back biases diode D9, and the current flow out of the 220-pF capacitor through diode D9 and into the collector of Q5 ceases. The rise in voltage across C8 continues until the input pulse reaches its peak amplitude. Diode D4 becomes back biased when the input pulse is reduced below its peak amplitude. Emitter-follower Q9 senses the peak voltage across C8 and feeds the peak voltage out to emitter-followers Q11 and Q10.

5.3 With the removal of the input signal, the difference amplifier input at the base of Q6 is held clamped at the peak input amplitude by emitter-followers Q9 and Q10, and diodes D11 and D5. Diode D10 has its cathode clamped to the peak amplitude due to emitter-follower Q10, and is in the ON condition from the duration of t_0 to t_2. (See Drawing 411-0187-B1.) The conduction of D10 holds diode D9 in the OFF state for the duration of t_0 to t_2. Diode D7 clamps the collector of Q8 to the peak potential of the input signal, thus effectively opening the feedback path in the difference amplifier for the duration of the stretched pulse. Diode D8 is back biased, since the potential on capacitor C8 is equal to the potential on the anode of D8. The stretch period is set by the time constant of C6, R16 and R2, the PULSE DURATION front panel control. At the termination of the stretch period, transistor Q5 again goes into hard conduction, thereby discharging capacitor C8 through the path C8-R23-D9 into the collector of Q5. The input to the difference amplifier, i.e., the base of Q6, is likewise restored to the potential of the Q1 emitter through the discharge diode, D6, and resistor R22.

5.4 It is important to note here that if the duration of the input signal exceeds the bias level for the trigger circuit, Q2 and Q3, for a period longer than the nominal stretch duration, as set by the PULSE DURATION control, the Schmitt trigger circuit, Q2 and Q3, will be held in the ON state for a period longer than the nominal stretch period. When this condition occurs, the one-shot current switch, Q4 and Q5, will likewise be held in its set state longer than the nominal stretch period; this will result in a stretching of the output pulse for a period longer than the minimum set by the PULSE DURATION control. The duration of the stretched pulse in this case will be equal to the time that the input pulse exceeds the discriminator level of the Schmitt trigger circuit, Q2 and Q3. For a given pulse shaping configuration, e.g., 5-microsecond integration and 5-microsecond differentiation, the duration that the output pulse will be stretched is a function of the amplitude. In the general case, with pulse shaping other than delay line, the output pulse nominally has a duration that is dependent upon the magnitude of the input signal, but will in no case be less than the minimum set by the PULSE DURATION control.

5.5 The output voltage from emitter-follower Q11 is equal to the input voltage on pin 2 of the etched board. The output of emitter-follower Q11 is followed by two amplifier loops, one loop consisting of Q12 and Q13 with a gain of approximately −0.46, and the other loop consisting of the output cable driver loop formed of transistors Q14 and Q17, with its nominal gain of approximately −2.38. Figure 5-1 shows a typical npn-pnp feedback loop, and illustrates both the ac and dc negative feedback. The gain of the loop is defined by the simple ratio of R_f/R_{in}.

The output driver loop consists of transistors Q14 through Q17. Q14 and Q16 constitute the typical npn-pnp loop and they drive quite well in the negative direction but not in the positive direction. The addition of emitter-follower Q15 in this loop allows the overall loop to handle both positive and negative signals quite easily to plus or minus 12 volts into 100 ohms, but an accidental short circuit of the output will cause Q15 to be destroyed. For this reason Q17 was added to protect Q15. The function of Q17 is to provide a method of limiting the average current through Q15 to a value less than that required to destroy Q15. Q17 can supply large peak currents from the collector-capacitor, C17, and these currents can flow directly through Q17 and Q15 and thence into the load. In the event of a short circuit on the output, the absolute magnitude of current that can be supplied through Q17 and Q15 from C17 is less than that required to destroy either Q17 or Q15. Capacitor C17 charges back to the B+ voltage through R45 in the absence of any input pulse.

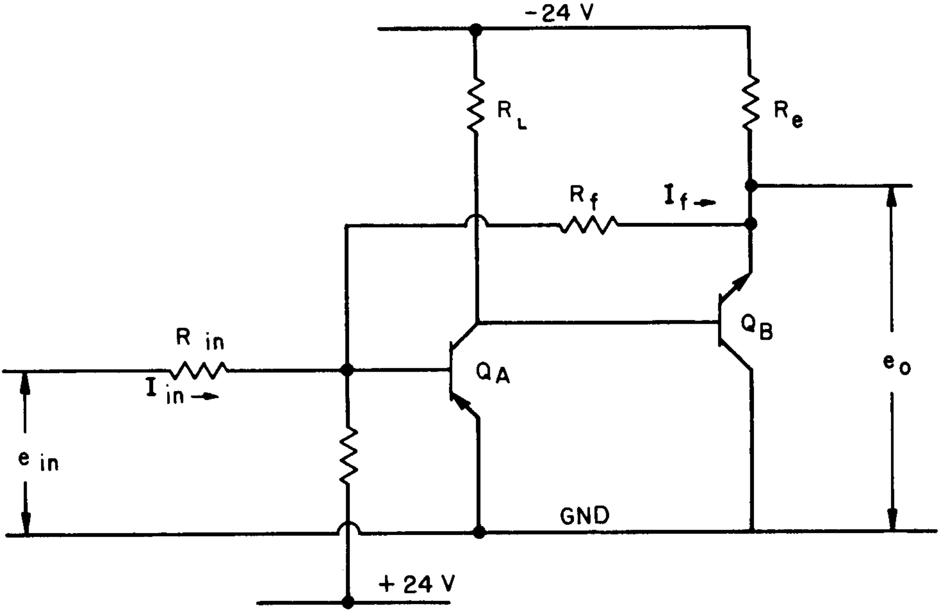


Figure 5-1. Basic Feedback Amplifier Loop

6. MAINTENANCE

6.1 Testing Performance of Pulse Stretcher

6.1.1 Introduction

The following paragraphs are intended as an aid in the installation and checkout of the Model 411. These instructions present information on waveforms at test points and output connectors.

6.1.2 Test Equipment

The following, or equivalent, test equipment is needed:

(1) ORTEC Model 419 Pulse Generator
(2) Tektronix Model 580 Series Oscilloscope
(3) 100-ohm BNC terminators
(4) Vacuum tube voltmeter
(5) ORTEC Model 410 Amplifier
(6) Schematic and block diagrams for Model 411 Pulse Stretcher

6.1.3 Preliminary Procedures

(1) Visually check module for possible damage due to shipment.
(2) Connect ac power to Nuclear Standard Bin, ORTEC Model 401A/402A.
(3) Plug module into Bin and check for proper mechanical alignment.
(4) Switch ac power on and check the dc power supply voltages at the test points on the 401 Power Supply control panel.

6.1.4 Pulse Stretcher

The Pulse Stretcher threshold has been set at the factory and steps 1 through 5 can be omitted in original stallations.

(1) Feed the output of the Model 419 Pulse Generator into the input of the Model 410 Amplifier.
(2) Set the Model 410 Amplifier controls as follows:

1 INPUT ATTENUATOR	3 COARSE GAIN	.5 INTEGRATION	
NEG. INPUT POLARITY	1.5 FINE GAIN	.5 1st DIFFERENTIATION (outer concentric control)	.5 2nd DIFFERENTIATION (inner concentric control)

(3) Adjust the Model 419 Pulse Generator for a 100-millivolt pulse from the unipolar output of the Model 410.
(4) Feed the 100-millivolt unipolar output of the Model 410 into the input of the Model 411. Load the Model 411 output with a 100-ohm terminator.
(5) Adjust the trimpot at the front of the etched circuit board until triggering of the stretcher circuit just occurs, as evidenced by a lengthening of the output pulse from the Model 411.
(6) Increase the input signal to the Model 411 (by adjusting the Model 419 Pulse Generator) to 200 millivolts.
(7) The output of the Model 411 should have a peak amplitude of 210

±20 millivolts; the top of the pulse should exhibit a smooth slope of less than 60 millivolts/μsec.

(8) The duration of the top of the waveform should be adjustable over its entire range of 0.7 to 3 microseconds.

(9) Increase the input signal to the Model 411 to 8 volts; the output should be essentially 8 volts.

(10) Increase the input to the Model 411 to the saturation level of the Model 410, approximately 12 volts; the output of the Model 411 should be greater than 10.8 volts.

6.2 Pulse Stretcher Threshold Adjustment

The Pulse Stretcher has a threshold adjustment that sets the voltage level at which stretching of the input pulse will occur. The threshold is normally set to trip on input signals greater than 100 millivolts. The threshold should be set on 100 millivolts except for special applications.

The setting of the threshold trimpot, which is located at the front of etched board 411-0187, is accomplished by observing the output of the Model 411 and feeding a 100-mV input signal into the input. With the 100-mV input, the output of the Model 411 is observed and the trimpot is adjusted until the output is just being stretched for about one-half of the input signals; i.e., the stretcher threshold is half-firing. Refer to Sections 5 and 6.1 of this manual and see Drawings 411-0187-B1 and 411-0187-S1.

6.3 Suggestions for Troubleshooting

In situations where the Model 411 is suspected of malfunction, it is essential to verify such malfunction in terms of simple pulse generator impulses at the input and output. In consideration of this, the Model 411 must be disconnected from its position in any system, and routine diagnostic analysis performed with a test pulse generator and oscilloscope. It is imperative that testing not be performed with a source and detector until the amplifier-pulse stretcher system performs satisfactorily with the test pulse generator.

The testing instructions in Section 6.1 of this manual and the circuit descriptions in Section 5 should provide assistance in locating the region of trouble and repairing the malfunction. The guide plate and shield cover can be completely removed from the module to enable oscilloscope and voltmeter observations with a minimal chance of accidentally short-circuiting portions of the etched board.

The Model 411 utilizes the modular concept in that all the active circuitry on etched boards can be removed. This has the advantage of servicing the unit by substitution of the affected etched board either from spares kept on hand or obtained from the ORTEC factory.

The Model 411, or the etched circuit board, may be returned to ORTEC for repair service at nominal cost. The standardized procedure requires that each repaired instrument receive the same extensive quality control tests that a new instrument receives.

6.4 Tabulated Test Point Voltages on Etched Board

The following voltages are intended to indicate the typical dc voltages measured on the etched circuit board. In some cases the circuit will perform satisfactorily even though, due to component variation, there may be some voltages that measure outside the given limits. Therefore, the voltages given should not be taken as absolute values, but rather are intended to serve as an aid in troubleshooting.

Table 6.1 Typical DC Voltages

NOTES:

1. All voltages were measured from ground with vtvm having input impedance of 10 megohms or greater.

2. Voltages are dc values with no input pulses.

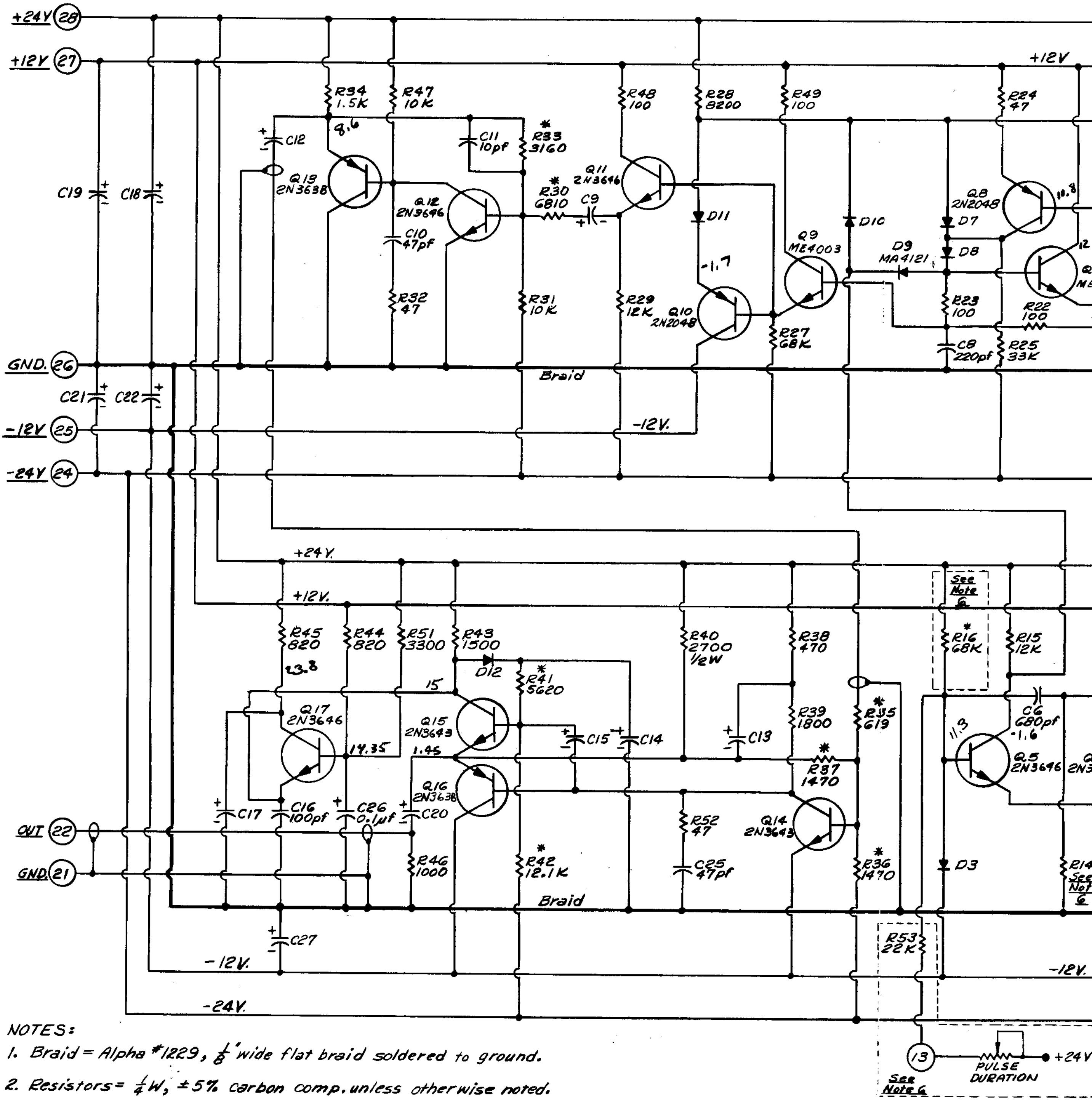
Location	Transistor No. and Element	Voltage Limits Lower	Voltage Limits Upper
1	Q3c	+ 7.5	+ 8.3
2	Q5b	- 11.0	- 11.6
3	Q6b	- 1.45	- 1.8
4	Q5c	- 1.20	- 1.90
5	Q6c	+11.5	+12.1
6	Q10e	- 1.55	- 1.90
7	Q13e	+ 8.3	+ 8.95
8	Q15c	+14.5	+15.5
9	Q16e	+ 1.2	+ 1.7
10	Q17b	+14.2	+14.5
11	Q17c	+23.7	+24.0

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	Carry No. 2
*10	+6 volts	32	Spare
*11	−6 volts	*33	115 volts ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Carry No. 1	35	Reset
14	Spare	36	Gate
15	Reserved	37	Spare
*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		

**These pins are installed and wired in parallel in the ORTEC Model 401 Modular System Bin.*

The transistor types installed in your instrument may differ from those shown in the schematic diagram. In such cases, necessary replacements can be made with either the type shown in the diagram or the type actually used in the instrument.

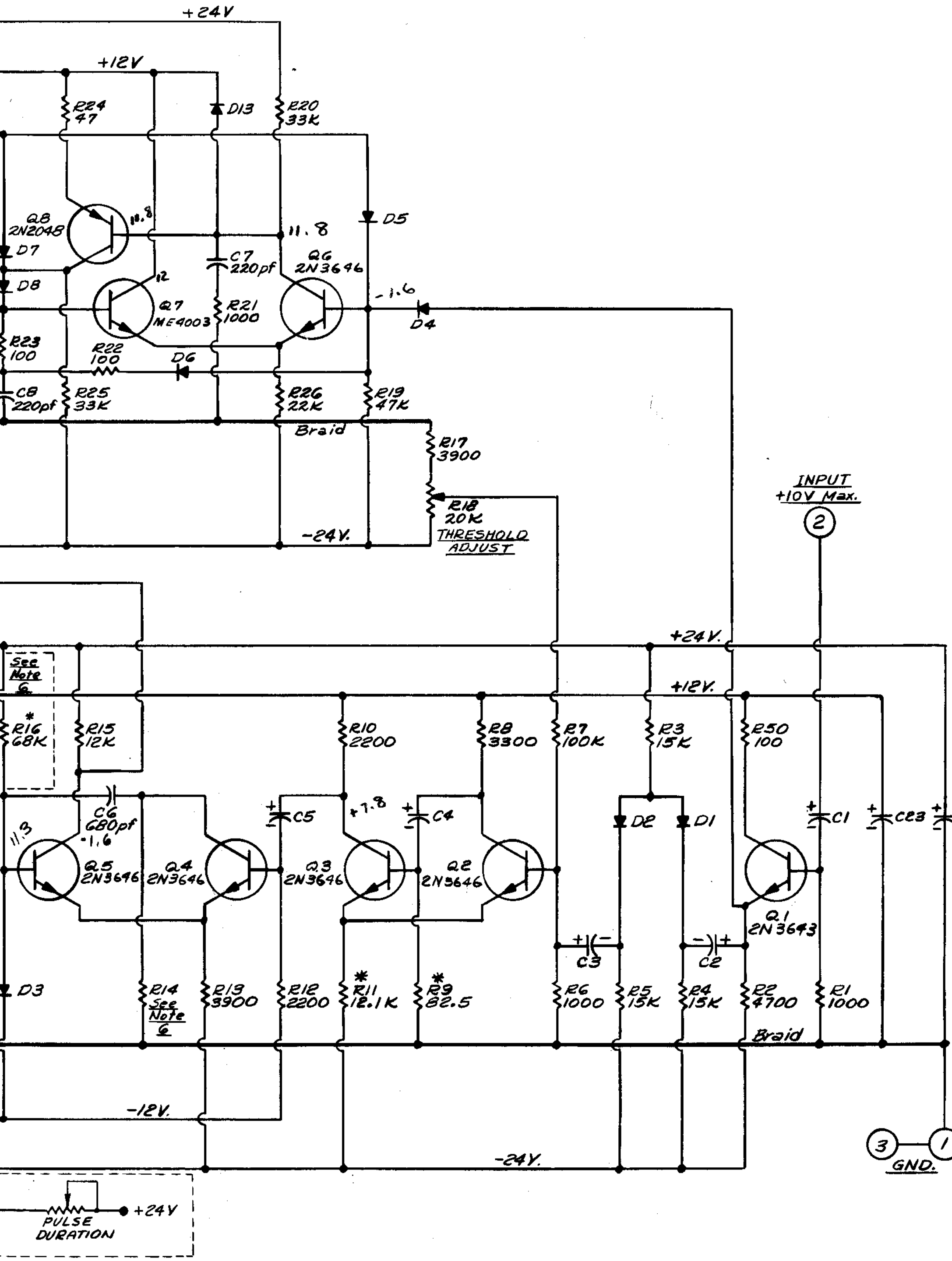


NOTES:

1. Braid = Alpha #1229, 1/8" wide flat braid soldered to ground.
2. Resistors = 1/4 W, ±5% carbon comp. unless otherwise noted.
3. Resistors marked (*) 1/8 W, ±1% MF (TO).
4. Capacitors = 6.8μf, 35V Tantalum unless otherwise noted.
5. Diodes = 1N4009
6. For Model 220 application: Omit R53 (22K) to pin 13; R14 to be 1K.
For Model 411 application: Omit R16 (68K) to +24V; R14 to be 1.8K.

C1-C27
D1-D13
Q1-Q17
R1-R53

2-21-67	C	ECN 411-
9-8-66	B	ECN 411-
1-10-66	A	ECN 411-1
DATE	NO.	R
DESIGN		DR

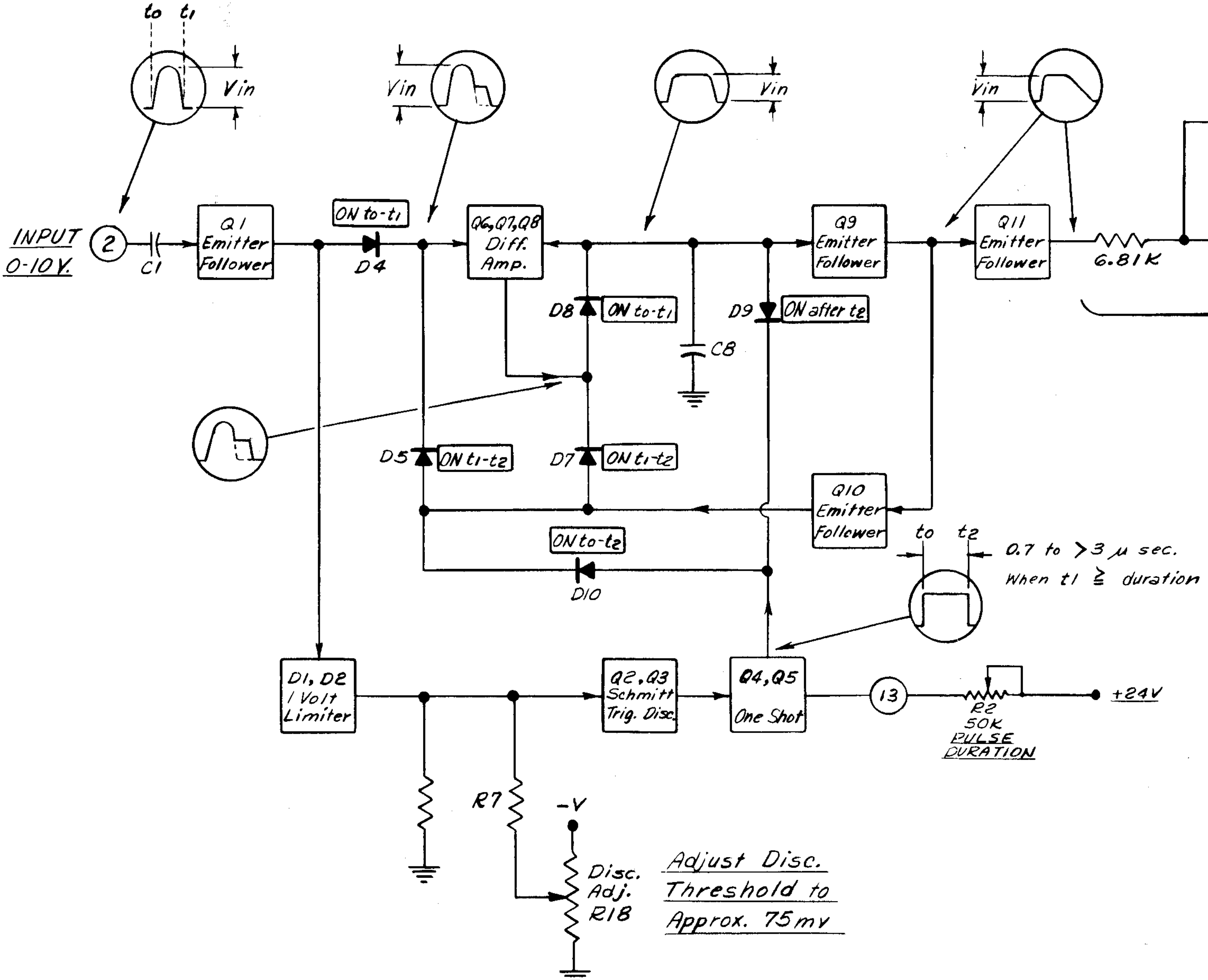


OAK RIDGE TECHNICAL ENTERPRISES CORP.
OAK RIDGE, TENN.

OUTPUT PULSE STRETCHER

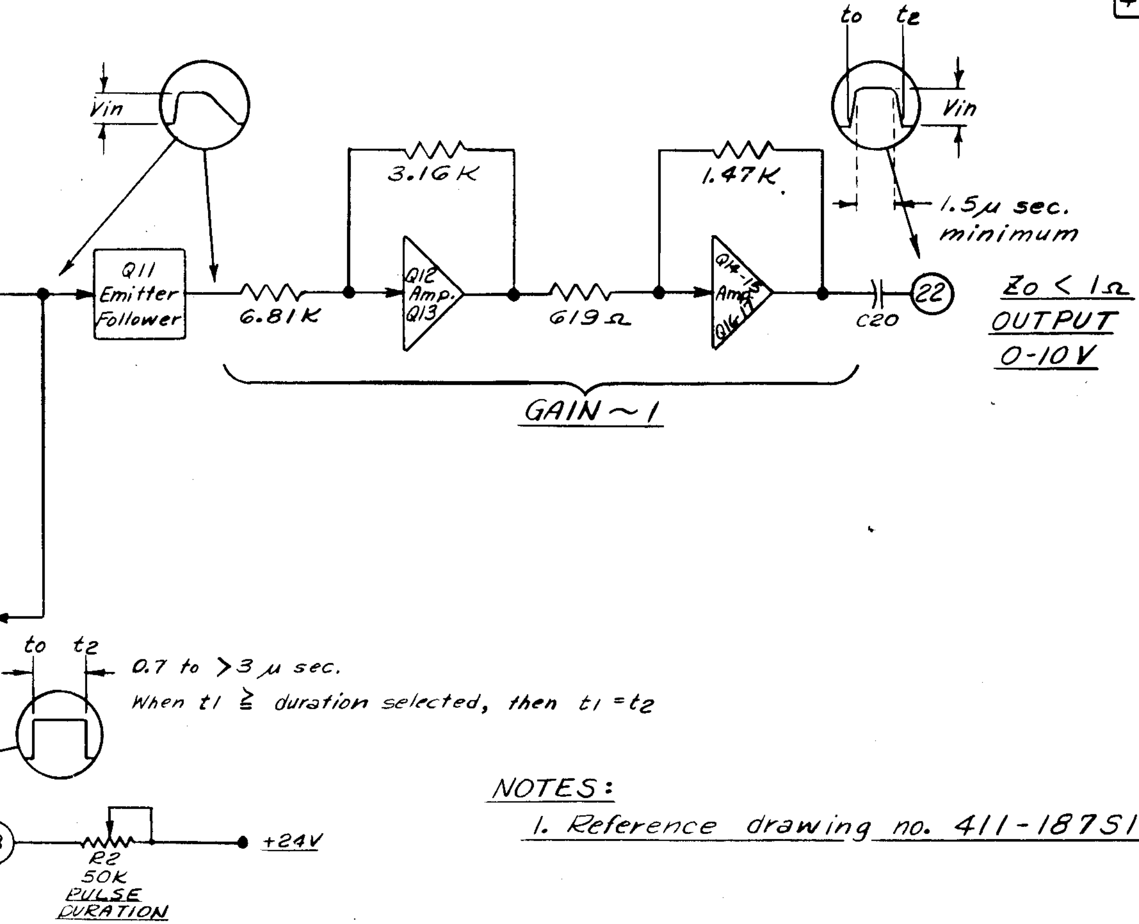
NO.	REVISION	BY
C	ECN 411-5	JDW
B	ECN 411-3	JDW
A	ECN 411-1	JRP

DRAWN	DATE	RESP. ENGR.	APPR.	SCALE	DRAWING NO.
J.R. Prueitt	5-16-64	R. Scroggs	B.S.	~	411-187-S1



2-9-66	A	ECN 411-1
DATE	NO.	REVI
DESIGN		

411-187B1

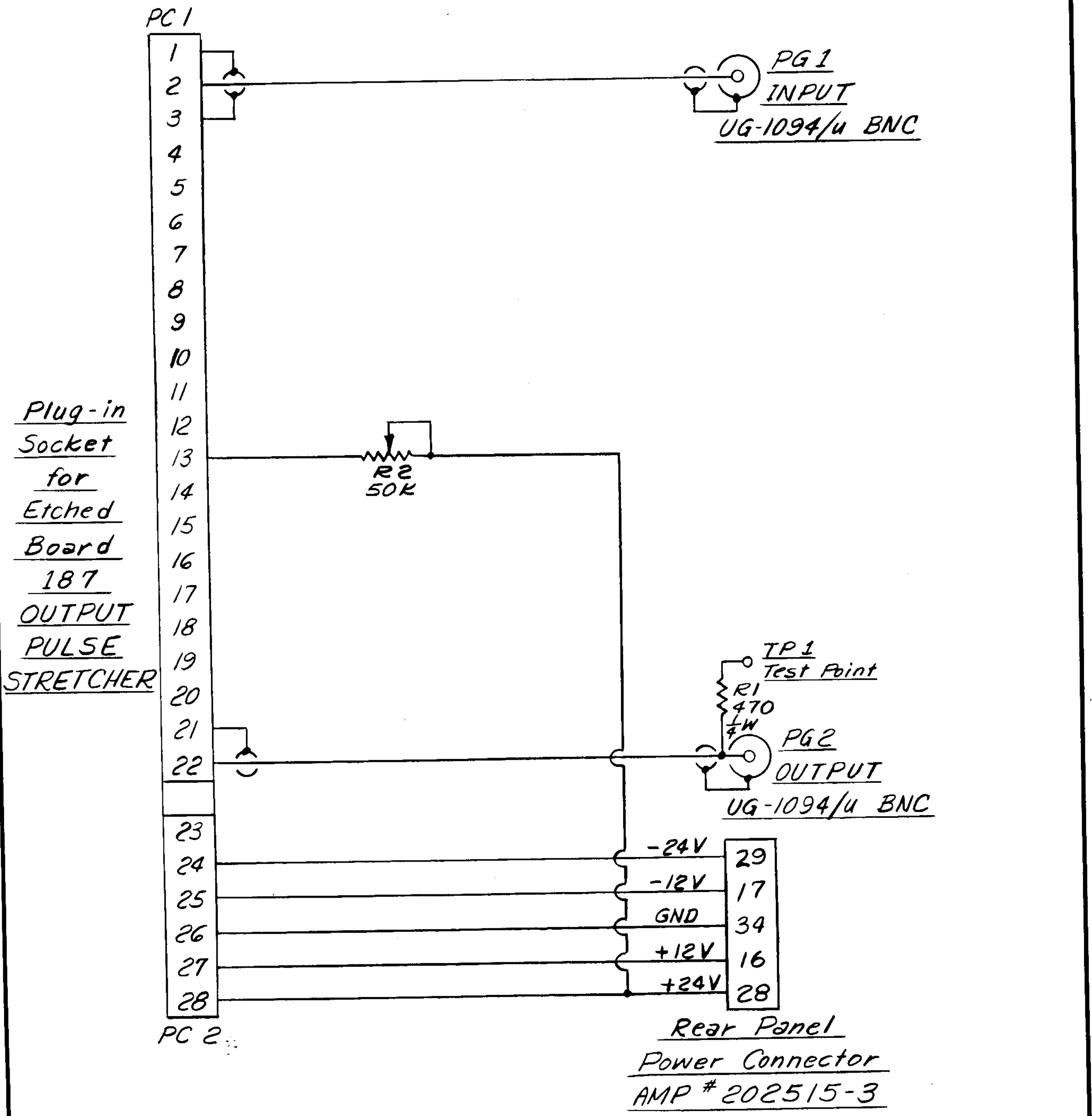


NOTES:

1. Reference drawing no. 411-187S1.

2-9-66	A	ECN 411-1		JRP
DATE	NO.	REVISION		BY
DESIGN		DRAWN J.R. Prueitt	DATE 4-27-64	

OAK RIDGE TECHNICAL ENTERPRISES CORP. OAK RIDGE, TENN.			
OUTPUT PULSE STRETCHER			
RESP. ENGR. R. Scroggs	APPR. B.S.	SCALE ~	DRAWING NO. 411-187-B1



OAK RIDGE TECHNICAL ENTERPRISES CORP.
OAK RIDGE, TENN.

MODEL 411 PULSE STRETCHER

CHASSIS WIRING SCHEMATIC

DATE	NO.	REVISION	BY
2-3-66	A	ECN 411-1	JRP

DESIGN	DRAWN	DATE	RESP. ENGR.	APPR.	SCALE	DRAWING NO.
	J R Pruitt	2-20-65	B. Scroggs	B.S.	~	411-0201A-S1