INSTRUCTION MANUAL

461

ALARM CONTROL

Serial No. _____

Purchaser _____

Date Issued _____

ORTEC
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AN EG&G COMPANY

Printed in U.S.A.

February 26, 1971

ORTEC 461 ALARM CONTROL
MANUAL CHANGE SHEET

The designation for the connector that will mate with the Relay connector on the rear panel is Bendix BEN#PT06E-12-10P (SR). This connector can be obtained from ORTEC, if desired, using the ORTEC part number 42897 for identification.

October 28, 1971

ECN 1

On Schematic 461-0101-S1, make the following changes:

Delete C3.

Change the value of R20 from 390 kΩ to 147 kΩ*, change the value of R37 from 390 kΩ to 147 kΩ*, change the value of R24 from 5.1 kΩ to 8.2 kΩ, and change the value of R41 from 5.1 kΩ to 8.2 kΩ.

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STANDARD WARRANTY FOR ORTEC INSTRUMENTS

ORTEC warrants its instruments other than preamplifier FET input transistors, vacuum tubes, fuses, and batteries to be free from defects in workmanship and materials 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 on in-warranty instruments, 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 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 methods of installation or with installation results.

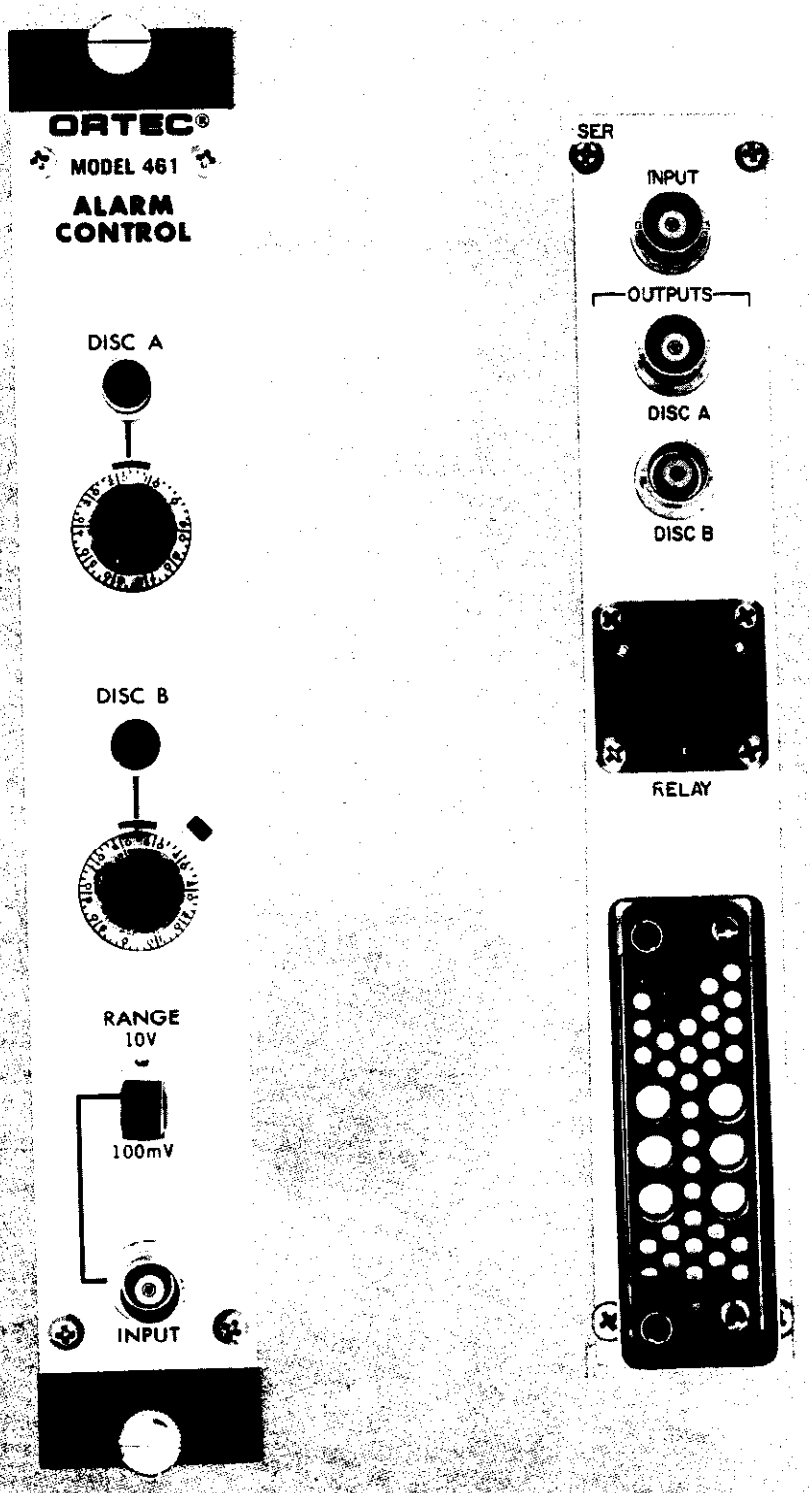
QUALITY CONTROL

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.

ORTEC must be informed in writing of the nature of the fault of the instrument being returned and of the model and serial numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. Our 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 Freight or United Parcel Service to the nearest ORTEC repair center. Instruments 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 ORTEC of the circumstances so that we may assist in damage claims and in providing replacement equipment if necessary.


ORTEC®
MODEL 461
ALARM
CONTROL
DISC A
DISC B
RANGE
10V
100mV
INPUT
SER
INPUT
OUTPUTS
DISC A
DISC B
RELAY

ORTEC 461 ALARM CONTROL

1. DESCRIPTION

The ORTEC 461 Alarm Control is a NIM single-width module that is an accessory to an ORTEC 449 or 441 Ratemeter. It includes two independent discriminators and a relay. The discriminators are adjustable with front-panel controls and are used to identify when a pulse rate, measured by the ratemeter, rises above or falls below a preset value. The relay is controlled by discriminator response and can be used to control the power to a signal and/or to a process controller as appropriate to its application.

Indicators on the front panel of the Alarm Control light to show that the discriminators have been fired. A signal from each discriminator is also available through a BNC connector on the rear panel.

The 461 accepts inputs from either a standard 100-mV ratemeter output for a recorder or from a 10-V high-level output furnished in the 449 Log/Lin Ratemeter. A front-panel slide switch sets the input circuit for either Low (100 mV) or High (10 V).

In addition to having separate level adjustments, the two discriminators can be switch-selected to either provide redundant high-level alarms or to act as a window discriminator to provide both high- and low-level alarms.

2. SPECIFICATIONS

PERFORMANCE

DISCRIMINATOR SET POINT ACCURACY ±2%.

STABILITY ±0.5% for 24 hr.

TEMPERATURE COEFFICIENT <±0.05%/°C.

NONLINEARITY <±0.5%.

CONTROLS

RANGE (Switch 1) 2-position slide switch on front panel selects either Low (100 mV) or High (10 V) input range sensitivity.

DISCRIMINATOR A 10-turn precision potentiometer to adjust the trigger level of Discriminator A.

DISCRIMINATOR B 10-turn precision potentiometer to adjust the trigger level of Discriminator B.

SWITCH 2 Slide switch on printed circuit board selects response mode for Discriminator B; the discriminator can be triggered by an input level higher than the set point or it can be triggered by an input lower than the set point.

SWITCH 3 Slide switch on printed circuit board selects the control for the alarm relay as either Discriminator A only or Discriminator A or B.

INPUT

INPUT BNC type UG-1094/U connectors on front and rear panels accept an analog output from a ratemeter; appropriate range is either 0-100 mV or 0-10 V according to the front-panel switch selection.

OUTPUTS

DISC A A BNC type UG-1094/U connector on the rear panel and an indicator lamp on the front panel show the response of Discriminator A; NIM-standard slow positive logic; 0 V for not triggered; +5 V for triggered; Z_0 = 50Ω; will deliver and sink 100 mA.

DISC B A BNC type UG-1094/U connector on the rear panel and an indicator lamp on the front panel show the response of Discriminator B; 0 V for not triggered; +5 V for triggered; Z_0 = 50Ω; will deliver and sink 100 mA.

RELAY A type MS31125 connector on the rear panel furnishes the connections to the contacts of the 4PDT internal relay; each contact circuit is rated at 5 A, 120 V ac noninductive; circuit connections shown in schematic 461-0101-S1 at the back of this manual. Note that the relay is normally energized when power is turned on for fail-safe system operation.

ELECTRICAL AND MECHANICAL

POWER REQUIRED +24 V, 0 mA; +12 V, 55 mA; -24 V, 30 mA; -12 V, 30 mA.

WEIGHT (Shipping) 3.5 lb (1.5 kg).

WEIGHT (Net) 1.5 lb (0.7 kg).

DIMENSIONS Standard NIM single-width module (1.35 x 8.714 in.) per TID-20893 (Rev.).

RELATED EQUIPMENT

The input to the 461 can be furnished from any ratemeter that has a 0- to 100-mV or a 0- to 10-V analog output. Compatible ORTEC ratemeters are the 441 and 449.

3. INSTALLATION

3.1 GENERAL

The 461 Alarm Control is designed for installation and operation in an ORTEC 401A/402A Bin and Power Supply, or equal. The Bin and Power Supply is designed for relay rack mounting and is usually installed in a rack that houses other electronic equipment. Therefore any vacuum tube equipment or other heat source that operates in the same rack with the 461 must be sufficiently cooled with circulating air to prevent localized heating of the transistorized and integrated circuits in the 461. The maximum limit for safe operation of the 461 is 50°C (120°F), and the temperature of equipment mounted in racks can easily exceed this limit unless precautions are taken.

3.2 CONNECTION TO POWER

The 461 does not include any internal power supply, but must obtain its operating power from the standard bin and power supply in which it is installed for operation. Always turn off the power before inserting or removing instrument modules. The ORTEC NIM modules are designed so that a full complement of modules in the bin will not overload the bin power supply. However, this may not be true when the bin contains modules of other than ORTEC design, and power supply voltages should be checked when other modules are inserted. The ORTEC 401A/402A has test points on the Power Supply control panel to monitor the dc voltages.

3.3 INPUT CONNECTION

Furnish the input to the 461 from an analog output of a ratemeter. If this is furnished from an ORTEC 441 Ratemeter, connect the 100-mV Recorder output of the Ratemeter to the 461 Input and set the front-panel slide switch at Low. If it is furnished from an ORTEC 449 Log/Lin Ratemeter, use either the Analog 10-V output and set the front-panel switch at High or use the 100-mV output and set the switch at Low. If the analog input to the 461 is furnished from any other source, set the front-panel switch to correspond to the range available from the source.

3.4 RELAY CIRCUITS

No power is furnished to the contacts of the internal relay. Each of its four poles furnishes a double-throw switch to transfer an input between two output contacts, and can control switching in a circuit with up to 120 V ac and up to 5 A. The four input contacts are isolated from each other. The relay is normally energized when power is applied to the 461, and the configuration shown in schematic 461-0101-S1 shows the relay contacts in their energized position. Response from the discriminator(s) will de-energize the relay and transfer each pole to its alternate position.

3.5 BNC OUTPUT CONNECTIONS

Each of the internal discriminators is adjusted independently. The rear-panel output connector for Discriminator A is high (+5 V) when the discriminator is triggered on and is low (0 V) when it is off. The discriminator will be triggered when the analog level at the input exceeds the Disc A control setting and will be off when the input level is less than the adjusted level. The independent Discriminator B output has the same characteristics, but an internal switch determines whether this discriminator is triggered on by input levels that are either above the adjusted level or below it. Application techniques will determine which switch setting is appropriate for use of Discriminator B.

4. OPERATION

4.1 GENERAL

When the 461 is installed in a bin and power supply and power is applied to its circuits, the internal relay will normally be energized. This normal condition depends on either of two internal conditions and no input; one internal condition is the selection of A Only for the relay control; the other condition is the selection of A + B for relay control and a High setting for Disc B. If the internal selection is A + B for relay control and Disc B is set for Low, Discriminator B will be triggered with no input and the relay will be de-energized.

4.2 TYPICAL APPLICATIONS

Figure 4.1 is a typical alarm circuit. For this circuit the analog output from a ratemeter is used as the 461 input, and Discriminator A in the 461 is adjusted to the level that indicates the measurement of a hazardous rate. If such a rate were to occur, the relay contacts in the 461 would close the circuit between pins C and G in the Relay connector to complete the 100-V ac circuit to the alarm. The alarm would continue until the rate is decreased sufficiently to drop the input analog signal below the adjusted Disc A level.

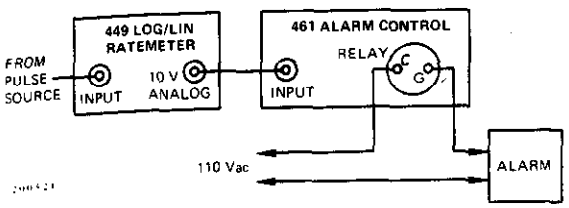


Fig. 4.1. Typical Alarm Circuit.

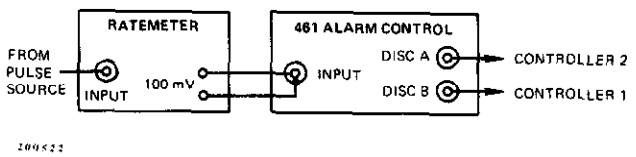


Fig. 4.2. Typical Process Control Circuit.

In Fig. 4.1 the 10-V Analog output of the 449 is suggested as the 461 Input signal. For this combination the front-panel switch of the 461 must be set at High. As an alternate, the 461 Input could be furnished from a 100-mV source and the front-panel switch set at Low, and the system would operate in the same manner.

The circuit of Fig. 4.1 does not require the use of Disc B. To prevent a false alarm that would result from triggering of the Disc B portion of the 461, the internal switch to control the relay must be set at A Only. As a suggestion, the Disc B control could be adjusted for a lower level than Disc B with the internal switch for Disc B set at High, and the Disc B front-panel light will then serve as a monitor of some intermediate rate.

Figure 4.2 shows an application of the 461 as a process controller. For an example, suppose that the internal switch for Disc B were set at Low. The Controller #1 circuit would then indicate when an input rate fell below some minimum level and Controller #2 would indicate when the input rate increases above some maximum level. By using the Disc A and Disc B controls to identify these maximum and minimum rates, the operation of an automated production line could be kept within a controlled range. The rates could represent the number of pieces in an assembly line, the average weight at a point on a moving belt, the moisture content in a slurry mixture, or any other variable quantity in an automated process. In addition to the suggested signals from the BNC connectors, the flexible relay circuits are also available for any powered functions that can be controlled automatically.

Although the 461 was designed as an accessory to a standard NIM ratemeter, and these typical applications have been for a ratemeter as a source for the input, any analog signal source could be used. The only restrictions on the analog input are that it must fall within either the 0- to +10-V High input range or the 0- to +100-mV Low input range in order for the responses of the 461 discriminators to be adjusted for sensitivity to changes in the input analog levels. The dc output of a preamplifier can be used to indicate an input rate directly. A voltage can be obtained that is proportional to accelerator beam current, and adjusted for compatability with the 461. Voltage monitoring for the appropriate dc range can be arranged easily for many various applications.

5. CIRCUIT DESCRIPTION

5.1 GENERAL

The circuits of the ORTEC 461 Alarm Control are shown in schematic 461-0101-S1 at the back of this manual. The input circuits are at the left on the diagram, Discriminator A is across the top, and Discriminator B is across the lower portion of the schematic.

5.2 INPUT CIRCUIT

An analog input can be connected into the 461 through either the front- or rear-panel BNC connector. Since these connectors are not isolated, input signals should not be furnished into both connectors simultaneously. If the front-panel switch is set at High, the input will be furnished directly to both the Disc A and Disc B circuits. If the switch is set at Low, the input is routed through an amplifier, IC 1, and then is furnished to the discriminators. Potentiometer R13 balances the dc level of the IC 1 amplifier. The actual range of voltages applied to the discriminators is 0 to 5 V.

5.3 DISCRIMINATOR A

IC 2 is Discriminator A. A bias level is furnished to pin 3 from the Disc A control, and the input level is furnished to pin 2. As long as the level at pin 3 is more positive than the level at pin 2, Disc A is not triggered. When the level at pin 2 increases above the bias at pin 3, the discriminator is triggered on and will remain in this state until the input level drops below the bias level again.

While IC 2 is not triggered, Q1 conducts and holds the Q2 emitter negative. This cuts off Q3, Q6, and Q4. With Q3 cut off, the front-panel lamp will not light. With Q6 cut off, there is no signal to the relay. With Q4 cut off, the signal through the rear-panel Disc A BNC is held at 0 V. When IC 2 is triggered, it cuts off Q1 and makes the Q2 emitter more positive. This turns on Q3 and the front-panel Disc A lamp; Q6 conducts and de-energizes the relay; and Q4 conducts and furnishes a nominal +5 V through the Disc A rear-panel BNC connector.

5.4 DISCRIMINATOR B

IC 3 is Discriminator B. It responds the same as Discriminator A except that the internal switch can reverse the connections from the Disc B control and the input between pins 2 and 3. Thus this discriminator can be triggered by an input level that is either above the bias level or below the bias level.

When IC 3 is not triggered, Q7 conducts and prevents any further response in the 461 circuits.

When IC 3 is triggered, Q7 is cut off. Q9 will then conduct and light the Disc B lamp on the front panel. Q10 conducts, and the signal out through the Disc B connector rises from 0 to a nominal +5 V.

If the internal switch for relay control is set at A Only, there will be no effect on the relay due to the condition of IC 3. If the internal switch is set at A + B, Q12 will conduct when IC 3 is triggered, and this de-energizes the relay.

5.5 RELAY CIRCUIT

Q13 controls the circuit to the relay. When power is turned on and both Q6 and Q12 are cut off, Q13 conducts and the relay is energized. The relay contacts are then in the positions shown in the schematic diagram. When either Q6 or Q12, or both, conducts, this cuts off Q13 to de-energize the relay and switch each of its four sets of contacts to the alternate circuit.

Since the relay is normally energized, the circuit between pins D and H of the Relay connector is designated as normally closed, and the circuit between pins C and G is designated normally open. The C to G circuit can be used to directly control the power to an alarm, although there are various alternate circuit configurations that are also furnished through the relay.

5.6 POWER REGULATION

Each of the four dc levels furnished from the bin and power supply is filtered in the 461. A special filter, R54 and C10, furnishes +12 V to both discriminator control circuits with an isolation from any transients that may occur in the remaining functions served by this input level.

The -6-V level required by IC 2 and IC 3 is obtained from the -12-V input. Q14 operates as a Zener diode to regulate this for the required power to the IC circuits.

6. MAINTENANCE

6.1 GENERAL

Operation of the ORTEC 461 Alarm Control is identified directly by its front-panel indications, its signals through rear-panel BNC connectors, and the operation of its internal relay. The description of its circuits in Section 5 will aid in any troubleshooting that may be necessary.

6.2 CALIBRATION

The only calibration in the 461 is the balance of its input amplifier, IC 1. This is in the input circuit only if the front-panel switch is set at Low and should amplify an analog signal in a 0- to +100-mV range for a response in the 461 at a point that is proportional to its response to a High level signal in the 0- to +10-V range. The calibrating control is potentiometer R13, a 10-turn screwdriver potentiometer mounted on the printed circuit in the instrument. This potentiometer has been factory-adjusted for the proper balance in IC 1 with a quiescent output of 0 to -20 mV at pin 6, and should not require any readjustment unless this integrated circuit is replaced.

6.3 FACTORY REPAIR

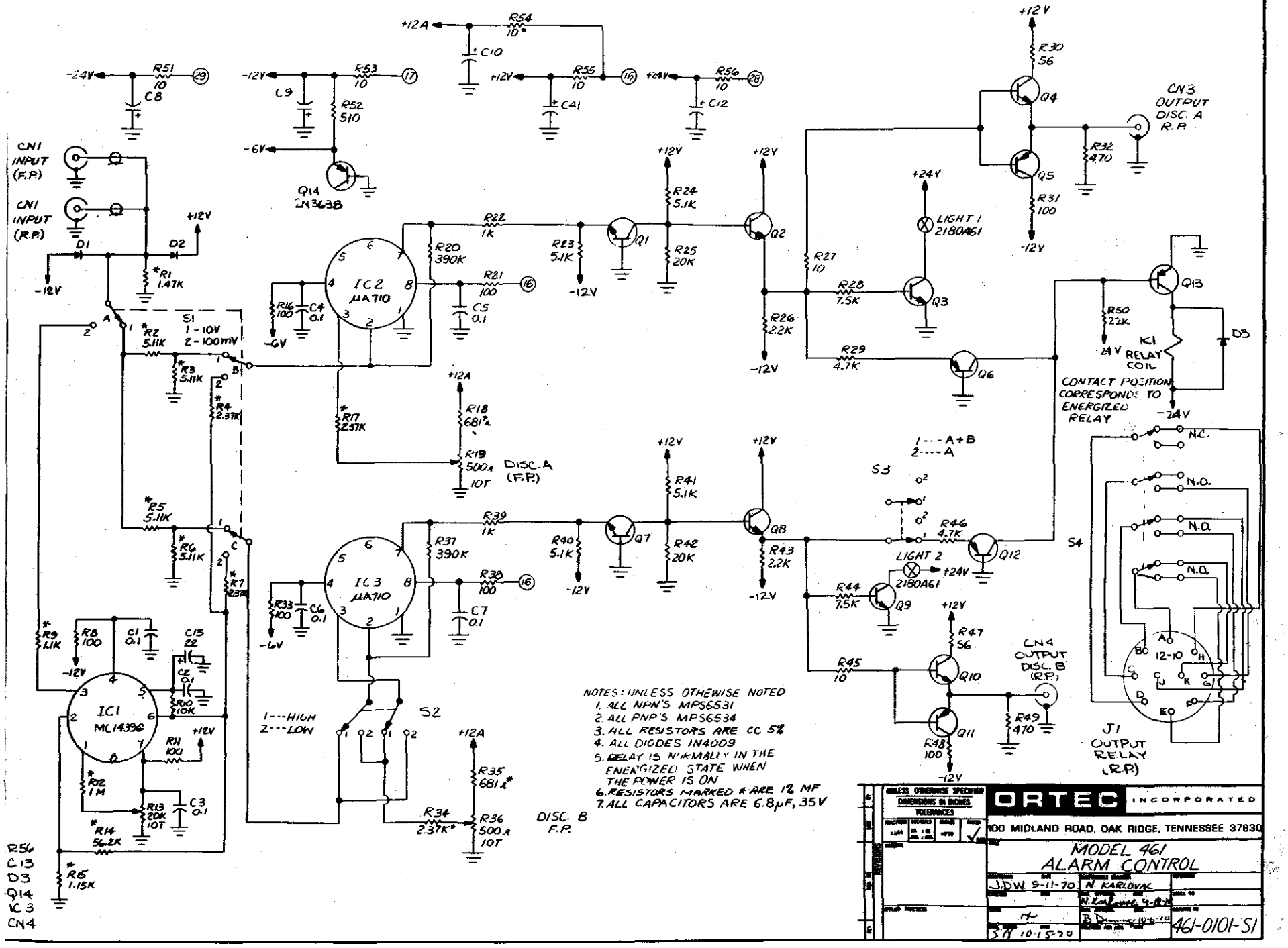
The ORTEC 461 may be returned to the factory at any time for repair or recalibration. Our standard procedure is to use the same rigid quality control and checkout that are used for a new instrument. Always contact the Customer Service Department before shipping an instrument to the factory. The telephone number is (615) 482-4411.

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 Grou
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 Groun
21	Spare	G	Ground Guide Pin
22	Reserved		

These pins are installed and wired in parallel in the ORTEC 401A 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 ór the type actually used in the instrument.


CN1 INPUT (F.P.)
CN1 INPUT (R.P.)
D1
D2
+12V
-12V
-24V
R1 1.47K
S1 1 - 10V 2 - 100mV
R2 5.11K
R3 5.11K
R4 2.37K
R5 5.11K
R6 5.11K
R7 2.37K
R8 100
R9 1.1K
C1 0.1
C13 22
CE 0.1
R10 10K
R11 100
R12 1M
R13 20K 10T
C3 0.1
R14 56.2K
R15 1.15K
IC1 MC1439G
R51 10
C8
R52 510
C9
R53 10
Q14 2N3638
-6V
R54 10
C10
R55 10
C41
R56 10
C12
IC2 µA710
R16 100
C4 0.1
R17 2.37K
R18 681Ω
R19 500Ω 10T
DISC. A (F.P.)
R20 390K
R21 100
C5 0.1
R22 1K
R23 5.1K
Q1
Q2
R24 5.1K
R25 20K
R26 2.2K
R27 10
R28 7.5K
Q3
R29 4.7K
Q6
R30 56
Q4
Q5
R31 100
R32 470
CN3 OUTPUT DISC. A R.P.
LIGHT 1 2180A61
+24V
Q13
R50 22K
K1 RELAY COIL
D3
CONTACT POSITION CORRESPONDS TO ENERGIZED RELAY
N.C.
N.O.
N.O.
N.O.
S4
J1 OUTPUT RELAY (R.P.)
IC3 µA710
R33 100
C6 0.1
R34 2.37K*
R35 681Ω*
R36 500Ω 10T
DISC. B F.P.
S2
1---HIGH 2---LOW
R37 390K
R38 100
C7 0.1
R39 1K
R40 5.1K
Q7
Q8
R41 5.1K
R42 20K
R43 2.2K
S3
1---A+B 2---A
R46 4.7K
Q12
LIGHT 2 2180A61
R44 7.5K
Q9
R45 10
R47 56
Q10
Q11
R48 100
R49 470
CN4 OUTPUT DISC. B (R.P.)
NOTES: UNLESS OTHERWISE NOTED
1. ALL NPN'S MPS6531
2. ALL PNP'S MPS6534
3. ALL RESISTORS ARE CC 5%
4. ALL DIODES IN4009
5. RELAY IS NORMALLY IN THE ENERGIZED STATE WHEN THE POWER IS ON
6. RESISTORS MARKED * ARE 1% MF
7. ALL CAPACITORS ARE 6.8µF, 35V
R56
C13
D3
Q14
IC3
CN4
ORTEC INCORPORATED
100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830
MODEL 461 ALARM CONTROL
J.D.W. 9-11-70
N. KARLOVAC
461-0101-S1