



USER'S MANUAL

TCT-EU

Thermocouple Transmitter
Eurocard

No. 142-760-00 D

April 2016

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Introduction

This manual contains descriptive, calibration, and maintenance information on the Eurocard Thermocouple Transmitter, Model TCT-EU. The TCT-EU accepts millivolt input from any standard thermocouple and converts it to either a standard current or voltage output to indicate process temperature. The Eurocard housing allows for the mounting of 24 channels in a 19" rack, and each channel can have dual isolated outputs.

Description

The TCT-EU converts the input from any ISA standard thermocouple type to a 4-20mA output or any other standard process signal. In a typical application, the TCT-EU interfaces the thermocouple with recording, monitoring, or controlling instruments. However, the TCT-EU may also be used with a computer or as an interface module with a digital multiplexer to modernize existing analog control loops.

The TCT-EU minimizes the problems normally associated with using thermocouples to measure temperature. The TCT-EU automatically compensates for changes in the cold junction reference temperature and its complete isolation prevents false input due to ground loop currents.

A common mode rejection ratio of 120dB (1,000,000:1) along with a common mode limit over 500V rms, minimizes errors from induced common mode voltage. The TCT-EU's high input impedance (10M Ω , minimum) virtually eliminates any problem of converting common mode voltage to normal mode when extended thermocouple leads must be used.

The TCT-EU is configured to allow for high-density installation in a plug-in Eurorack. Twelve Eurocard transmitters may be installed in a single 19-inch (483mm) Eurorack. Installation dimensions and plug-in details are presented in figure 1.

A complete set of specifications for the TCT-EU is shown in table 1. This specification contains complete information on input, output, and performance.

Model Number Explanation and Use

Moore Industries' model numbers identify the type of instrument, functional characteristics, operating parameters, any options ordered, and housing. If all accompanying documentation of a unit is missing, the model number can be used to obtain technical information. The model number for the TCT-EU is located on the inside of the front panel.

A complete history is kept on every Moore Industries' unit. This information is keyed to the serial number. Whenever service data is required on a unit, it is necessary to provide the factory with the serial number. This information is engraved on the printed circuit board of the unit.

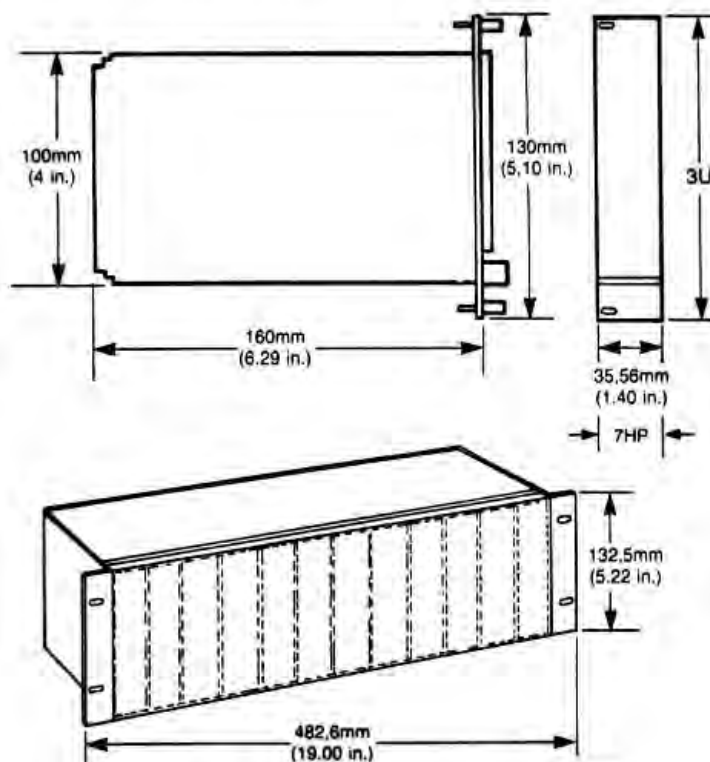


Figure 1. TCT-EU Installation Dimensions

Important Note: This document is complete as of the printing date; however, subsequent product changes may be reflected in companion documents.

Table 1. TCT-EU Specifications

Specifications		
<p>Characteristics</p> <p>Adjustments 22-turn potentiometers Zero: Adjusts output to 0% for offsets upto $\pm 20\%$ of span without -LNT (linearization) option. Adjusts output to 0% for offsets up to $\pm 10\%$ of factory set input temperature points with -LNT. Span: Output is fully adjustable over a preselected input range to 100% of selected output span.</p> <p>Performance Calibration Capability (linearity and repeatability): $\pm 0.1\%$ of span $\pm 0.25\%$ of span for LSA $\pm 0.50\%$ of span for LSB Frequency Response: 5 Hz (3dB point) Reference Junction: Cold junction compensated Input Impedance: 10 megohms minimum Burnout Protection: Upscale drive standard; downscale drive optional Ripple: Less than 10mV P/P at max. load and max. span Load Effect: $\pm 0.01\%$ of span from 0 to max. load resistance (current output) Line Voltage Effect: $\pm 0.005\%/1\%$ line change (ac or dc)</p> <p>Ambient Temperature Range: -29°C to $+82^{\circ}\text{C}$ (-20°F to $+180^{\circ}\text{F}$) Effect on amplifier: $\pm 0.005\%$ /$^{\circ}\text{F}$ over above range Effect on cold junction compensation: $\pm 1^{\circ}\text{C}$ (LSA $+2^{\circ}$, LSB $\pm 4^{\circ}$) maximum offset per 100°C ambient change</p>	<p>Output Operational feedback amplifier current source; output limited to 150% of max. output range value.</p> <p>Isolation Input, output and power supply are transformer isolated. Common mode rejection exceeds 120dB at 60Hz with a limit of 500V rms.</p> <p>Linearity Output linear with respect to input millivolts Characterization: With -LNT option, provides a minimum of 10:1 improvement $\pm 0.1\%$ in the linearity curve of the specified thermocouple temperature range (standard ranges only)</p> <p>Weight Approx. 2 lbs. (908 grams)</p>	<p>Power Input 24DC: 24Vdc $\pm 10\%$ 5 watts maximum</p> <p>Options -CS Coding strip -DD Downscale open input drive -DI Dual Input -DO Dual Output -EZ Elevated zero input (required for all inputs exceeding standard zero adjustment capability—specify input for 0% out) -FU 400mA power fuse -HI High current output, 20mA, max. 1-5V -LNT Thermocouple linearization (not available with -ST, -RO, or -DR options) -LSA Lower span – 2-5 mVFS input (consult factory for specifications) -LSB Lower span – 0.75-2 mVFS input (consult factory for spec's) -RO Reverse output, current or voltage</p>
	<p>Ordering Specifications</p> <p>Unit TCT-EU</p> <p>Standard Input Ranges (Thermocouple, all standard ISA types) 5-10MVFS: 5-10 mVFS 10-20MVFS: 10-20 mVFS 20-50MVFS: 20-50 mVFS. (Refer to -LSA & -LSB options for narrow spans)</p> <p>Output Ranges Current 1-5MA: 1-5mA into 0-4800Ω 4-20MA: 4-20mA into 0-1200Ω load 10-50MA: 10-50mA into 0-480Ω load Voltage: 1-5Vdc standard into 20KΩ minimum (other ranges available)</p>	
<p>When ordering, specify: Unit / Input Range / Output Range / Power Input / Options [Housing] Model number example: TCT-EU/J5-10MVFS/4-20MA/24DC/-EZ14 [EUR]</p>		

Calibration

This section provides information necessary to adjust and calibrate the unit. Each unit is adjusted and checked at the factory for proper performance before shipping.

After the TCT-EU unit is unpacked, general operation level checks of the individual unit are recommended. Generally these checks, which are specified in the Calibration portion of this section, require little or no adjustments.

Control Description and Location

The TCT-EU has Zero and Span controls located on the front panel of the unit. Each of these controls has a multiturn potentiometer that is adjustable with a blade screwdriver.

CAUTION

The screwdriver blade should not be more than 0.1 inches (2.54 mm) wide. A wider blade may cause permanent damage to the potentiometer mounting.

The type of potentiometer used with these controls usually requires 20 turns of the shaft to move the wiper from one end of its range to the other. It is equipped with a slip clutch at each end to prevent damage if the control is turned beyond the wiper stop. Usually a slight change can be felt when the clutch is at the end of a range (i.e., it is slipping). However, if this change is not felt, either end can be reached by turning the shaft 20 turns in the desired direction.

Equipment and Tools Required

Test equipment and tools required to calibrate the TCT-EU are listed in Table 2. Test equipment and tools are not supplied with the unit and must be provided by the user.

Calibration Setup

Off-line calibration for all TCT-EU units requires the same test equipment setup regardless of the physical configurations or types of options used. Refer to the test equipment setup for unit calibration as shown in Figure 2 or 3.

Table 2. Test Equipment and Tools Required

Equipment or Tool	Characteristics	Purpose
Screwdriver (blade)	Blade not wider than 0.1 inches (2.54 mm)	Front panel control adjustments
Adjustable Thermocouple Simulator Source	Must be capable of producing signal ranges defined by INPUT level requirements of purchased unit.	Simulate input signal levels
DC Voltmeter	Must be accurate to within $\pm 0.05\%$ or better	Input signal monitoring (voltage inputs only) and output signal monitoring (voltage outputs only)
DC Milliammeter	Must be accurate to within $\pm 0.05\%$ or better	Input signal monitoring (current inputs only) and output signal monitoring (current outputs only)

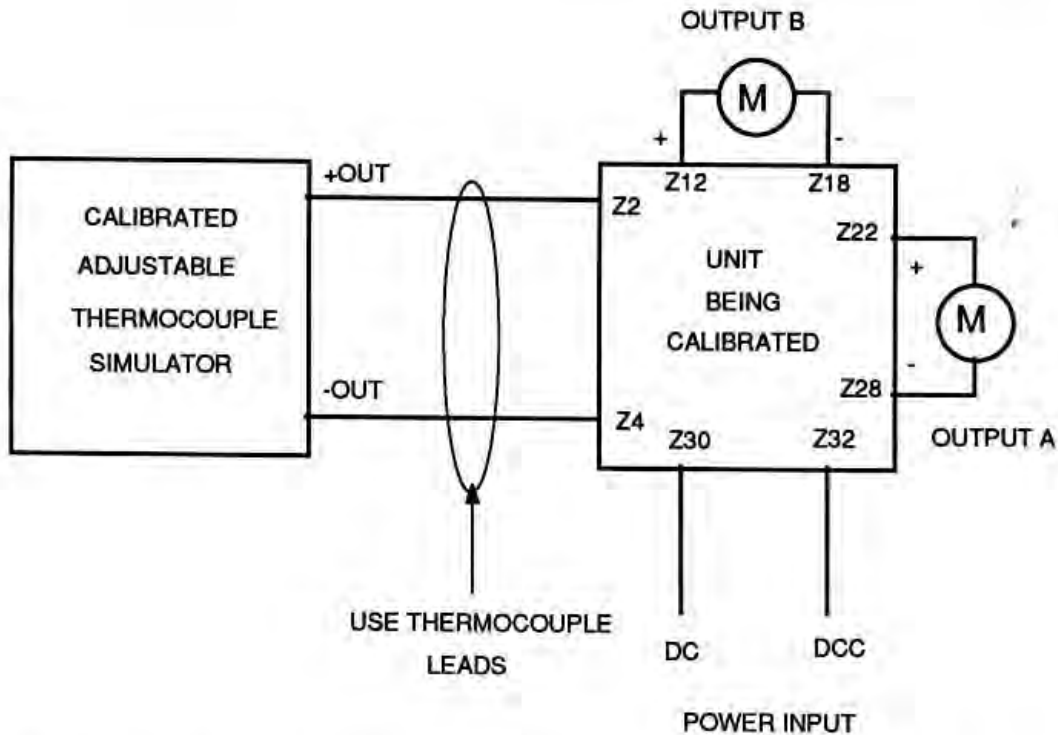


Figure 2. Test Equipment Setup for Calibration of the TCT-EU and TCT-EU Dual Output

Calibration Procedure

NOTE

This unit is supplied with temperature compensation. All adjustments and calibrations must be performed with the compensator installed. If the compensator is replaced, the unit must be completely readjusted.

Calibration consists of simulating an input signal to the TCT-EU, monitoring the output, and adjusting the controls to obtain the desired value. An adjustable thermocouple simulator and output monitoring device are required for making adjustments, as shown in table 2. These instruments must have an accuracy within $\pm 0.05\%$ or better.

When a thermocouple simulator is used, it must be connected to the TCT-EU using the same type of thermocouple wire that the system is designed to

use. This is because the built-in electronic cold reference junction generates a correction bias for the specific thermocouple type called for at the time of purchase. The use of another type of wire could result in an error signal.

Thermocouple Reference Voltage. The thermocouple reference voltage should be checked before the unit is placed into service. See table 3 for the correct voltage. If the voltage needs to be adjusted, complete the following steps:

1. Connect a high input impedance voltmeter across the Temperature Compensating Resistor (R101) with the (+) voltmeter lead to the side of R101 that is connected to the (-) IN terminal.
2. With the unit operating, the voltmeter should indicate within $\pm 0.0025V$ ($\pm 2.5mV$) the value listed in table 3, for the type of thermocouple to be used. Adjust R208 to obtain the specified voltage.

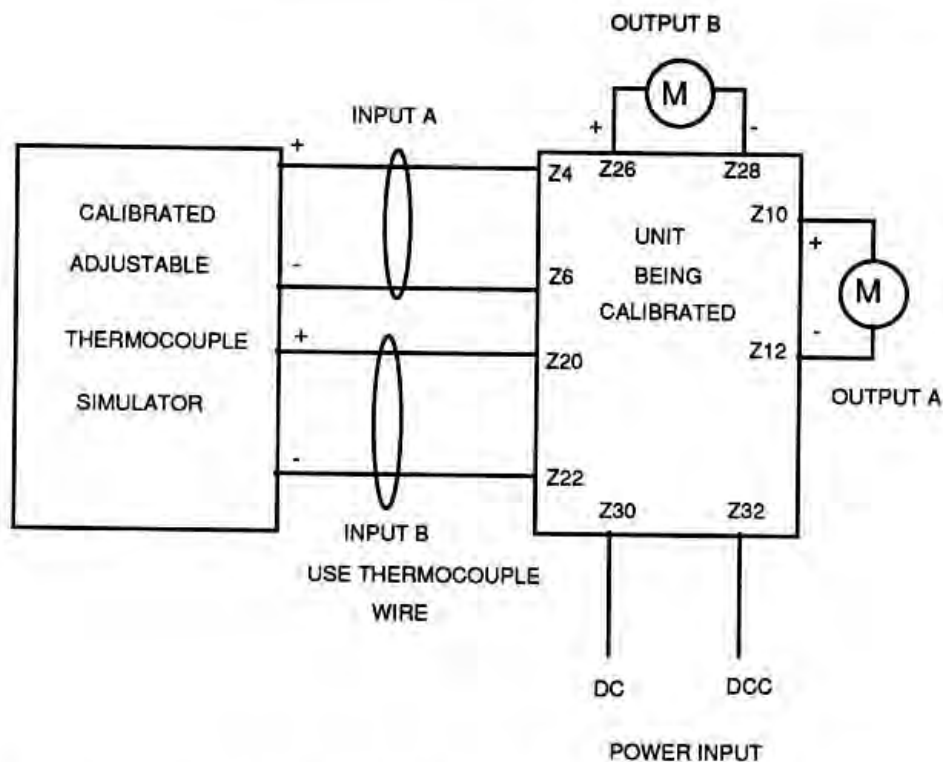


Figure 3. Test Equipment Setup for Calibration of the Dual Channel TCT-EU

Table 3. Thermocouple Reference Voltage

THERMOCOUPLE TYPE	VOLTAGE
E	.0465V
J	.0388V
K	.0303V
T	.0315V

To calibrate a unit, proceed as follows:

1. Connect the unit and test equipment as shown in figure 2.
2. Make sure the simulator is adjusted to zero percent output, then apply input power to the unit.
3. Adjust the simulator to an output equal to that of the thermocouple at the lowest temperature at which it will be used, using published tables to find the required value.
4. Adjust the Zero potentiometer to obtain 0% output (1mA, 4mA, etc.)
5. Adjust the simulator to an output equal to that of the thermocouple at the highest temperature at which it will be used.
6. Adjust the Span potentiometer to obtain 100% output with the input signal applied as in step 5.
7. Repeat steps 3 through 6 until no further adjustment of either zero or span is required.
8. Subtract the millivolts input used in step 3 from the input used in step 5. Calculate 25%, 50%, and 75% of this difference.
9. Add these calculated percentages of input span to the input used in step 3. Adjust the simulator to each of these values and check that the output is linearly proportional (to within $\pm 0.1\%$ of the output span).

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Installation

This section provides information for mechanical installation, electrical connections, and power connections for the TCT-EU. The front panel dimensions for the unit are shown in Figure 1.

Mechanical Installation

Rack Mounted (RMR-EU) Euro-Card Rack. These rack enclosures are designed to be flush-mounted in a standard 19-inch relay rack. Twelve position RMR racks are available. Each enclosure is provided with standard EIA hole patterns and is rear-accessed for rack wiring convenience. DC power supplies are available. Refer to the Electrical Connections portion of the installation section for a more detailed description of electrical connections to the card rack. Individual PC cards are front loaded. Edge connectors can be keyed to assure that the units are plugged into the proper position. Key positions may be altered in the

field if the system configuration changes. Filler cards are available for positions not used by any modules.

Electrical Connections

Terminals used for electrical connections for both standard and optional units are listed in table 4.

All electrical connections are made to the terminals on the mating connector of the unit, located in the rack. Thermocouple wire is required for signal connections to the unit so that the temperature compensation circuit properly corrects for the cold reference junction.

To avoid transients and stray pickups, it is recommended that twisted conductors be used where the signal wires run close to other services such as power wiring. The DC power source should be regulated to within $\pm 10\%$ of the nominal voltage and should be capable of delivering 5 watts.

Table 4. Terminal Nomenclature for the TCT-EU

Terminal Positions																	
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	Row
TCT	TCR +IN	TCR -IN												-OUT	(+) DC	(-) DCC	Z
TCT DUAL OUT	TCR +IN	TCR -IN				+OUT B			-OUT B		+OUT A			-OUT A	(+) DC	(-) DCC	Z
TCT DUAL CHANNEL		TCR +IN A	TCR -IN A		+OUT A	-OUT A				TCR +IN B	TCR -IN B		+OUT B	-OUT B	(+) DC	(-) DCC	Z

Legend: DC +DC Power Input ± IN Signal Input
 DCC -DC Power Input ± OUT Signal Output
 GND Chassis Ground ± TX Power Output

Theory of Operation

This section describes the unit operation. The functional description is based on the block diagram in figure 4.

Power Supply Circuit

Units are supplied for use with a dc power input that is applied directly to the power inverter, with diode protection to prevent damage to the power inverter if the dc power input is accidentally connected with reverse polarity.

Cold Junction Compensation

This circuit adds a bias to the thermocouple signal that automatically refers the thermocouple signal to 0°C. The temperature dependent variation of this voltage is adjusted at the factory to compensate for changes in ambient temperature at the TCT-EU terminals.

The bias from the ZERO adjust potentiometer is also summed with the cold junction compensation bias to complete the preconditioning of the thermocouple input signal.

Signal Processing

The composite signal is then fed to a FET switch, which chops the signal into a square wave so that it can be processed through the isolation transformer. An operational amplifier is inserted between the chopper and the transformer to provide signal buffering and ac span adjustment capability.

The chopper drive is derived from the power supply inverter and runs at a frequency of approximately 3KHz. The chopper consists of two FET switches being driven from opposite phases of the 3KHz square wave power excitation. This causes them to be turned on alternately as represented schematically by the SPDT switch in figure 4.

The ac signal generated at the secondary terminals of the isolation transformer, is applied to a synchronously driven FET switch demodulator to recover the slowly varying amplitude of the composite input signal.

A capacitor is used across the demodulator output to smooth out any spurious switching transients. It should be noted that all circuits on the output side of the isolation transformer are referenced to a circuit common that is isolated from the circuit common used on the input side.

The demodulated signal is then applied to a buffer amplifier input, which provides the control signal for the output current driver stages. The current driver is composed of two bipolar transistors in a compound connection, using dc emitter feedback to the IC buffer amplifier negative input terminal. This provides the necessary linearity and stability for the output signal.

Thermocouple Burnout

Thermocouple burnout is indicated by connecting the signal line to a (+) or (-) power source through a very high resistance that does not affect the signal unless the input thermocouple becomes open-circuited. When this happens, the output goes to the upper limit (150% of span) or to zero, depending on whether the -DD (down scale drive) option is purchased.

Maintenance

In general, maintenance is limited to checking that the unit is properly seated in the rack and that the electrical connections are tight and free from corrosion. Periodically, the calibration of the unit may be checked.

TCT-EU

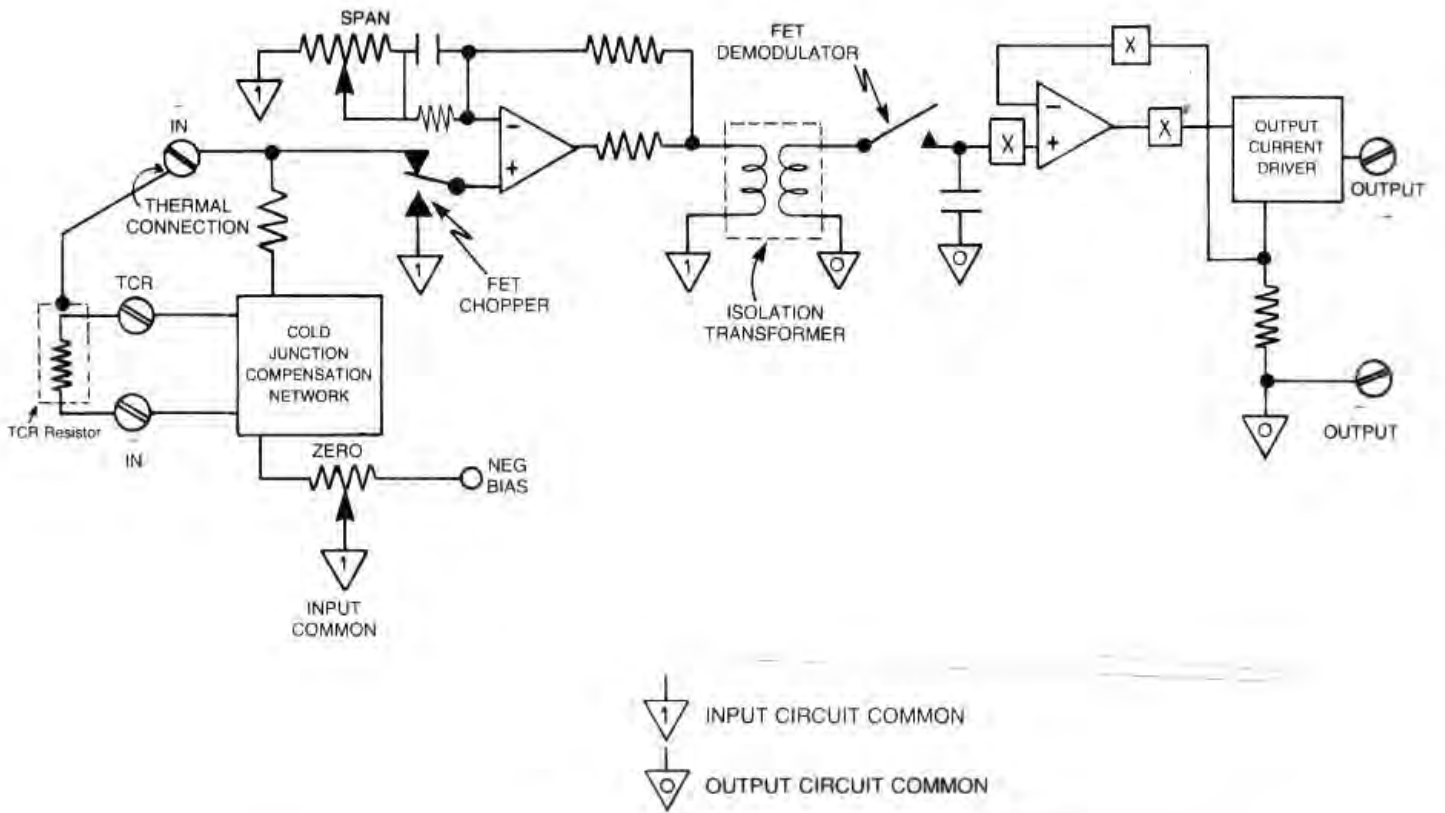


Figure 4. TCT-EU Block Diagram

Troubleshooting

The design of the TCT-EU limits maintenance primarily to keeping the input and output terminals and conductors clean and tight. This is best accomplished by initially tinning the ends of all hookup wire, and installing the unit in an area protected from dust, moisture, and corrosive atmospheres.

Troubleshooting is accomplished at a level necessary to determine whether the unit is functioning normally or abnormally. The test equipment listed in table 2 can be used to verify that the TCT-EU outputs are within specifications when a known input is injected. If a problem is suspected with the TCT-EU, it is suggested that the following checks be run as a preliminary step:

1. Make sure that all connections are clean and tight.
2. Verify that bench instruments used to take measurements have the proper range and accuracy and are currently certified.
3. Verify that the power source has the correct voltage.
4. If the signal source is the process variable thermocouple, verify that it is the proper ISA type as stated in the model number.
5. If a change in the relationship between the input and output signals has occurred, try to correct it by readjusting the ZERO and SPAN potentiometers .
6. Using a test jumper, connect one end to the metal case and touch the other end to either (+) or (-) IN. Observe the output signal, it should not change.
7. Using an ohmmeter, verify that the input thermocouple is intact and that the TCT-EU has an appropriate response when the input is opened (+150% or -150%, depending on option purchased).

Drawings

This section consists of assembly and schematic drawings, and a list of materials.

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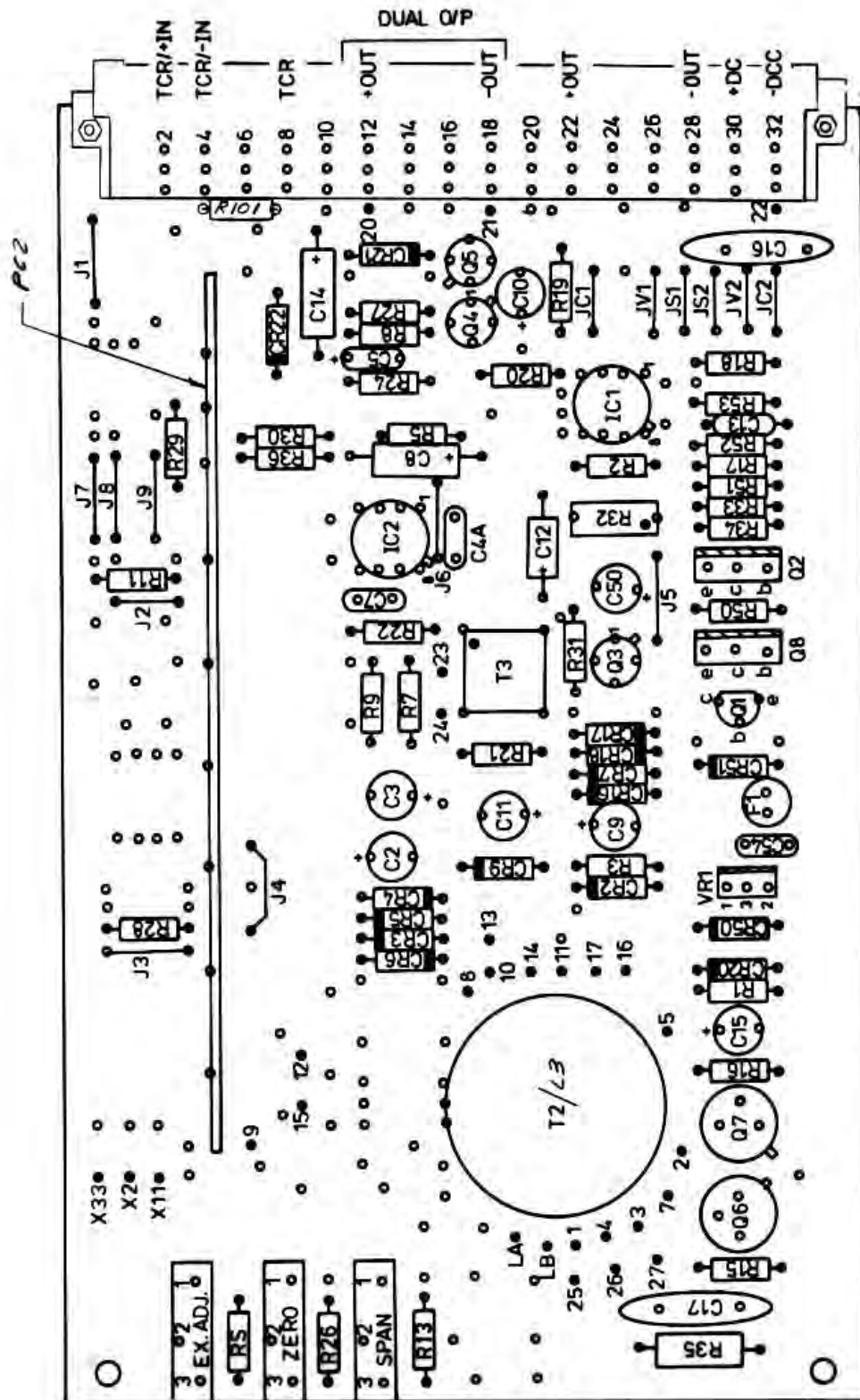


Figure 5. PC1 Assembly (not LNT Option)

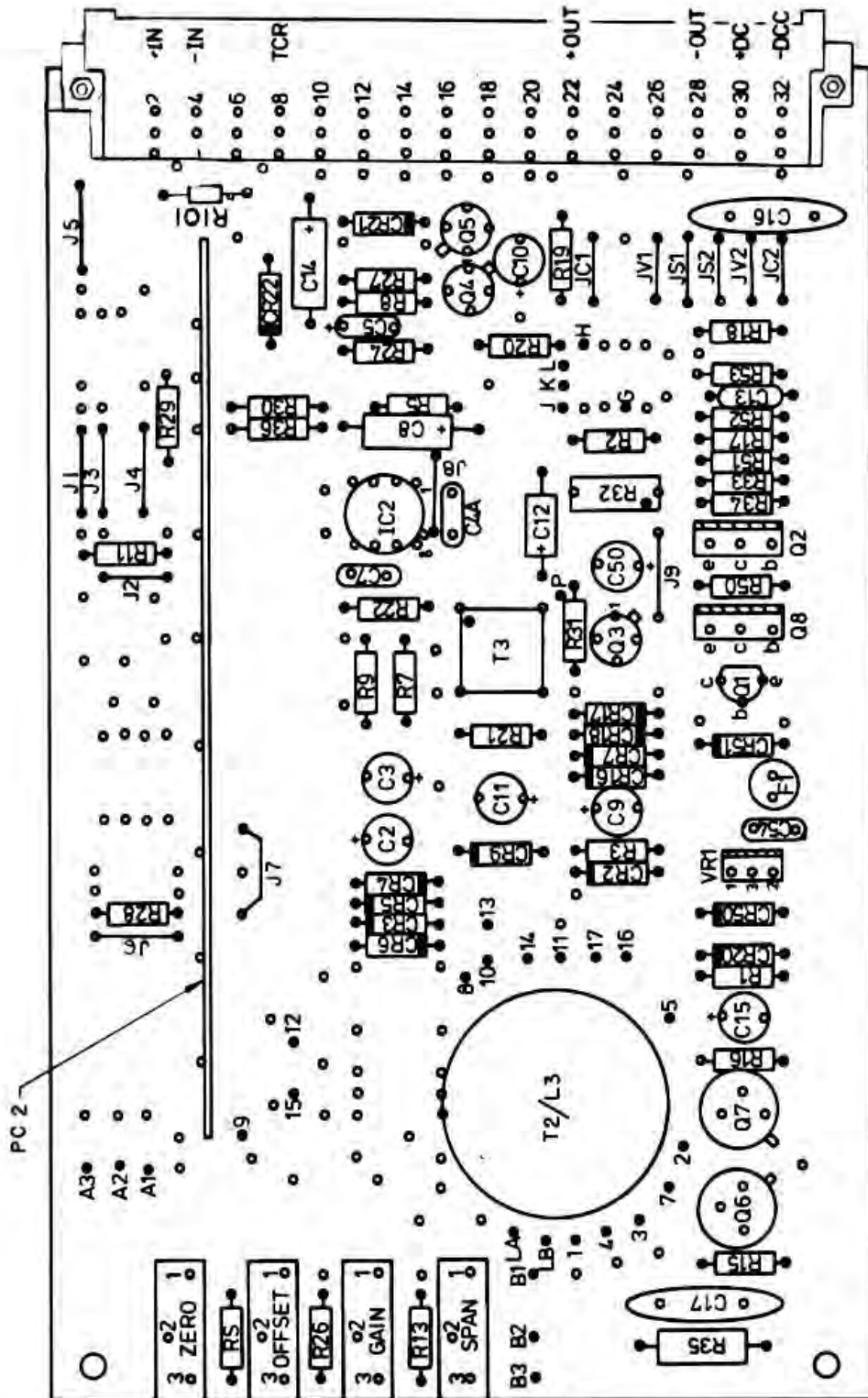


Figure 6. PC1 Assembly with LNT Option

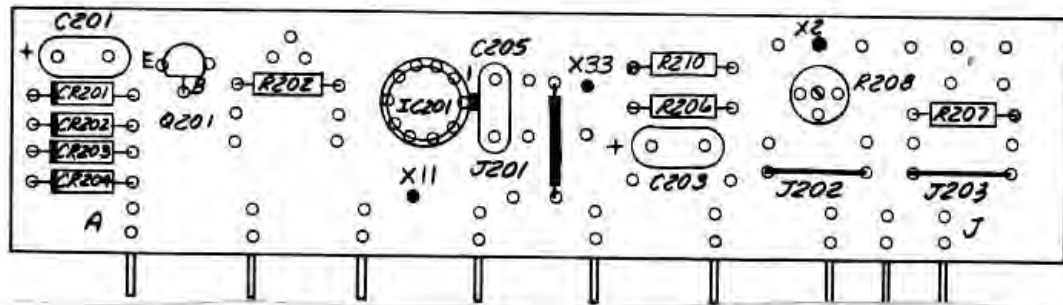


Figure 7. PC2 Assembly (not LNT Option)

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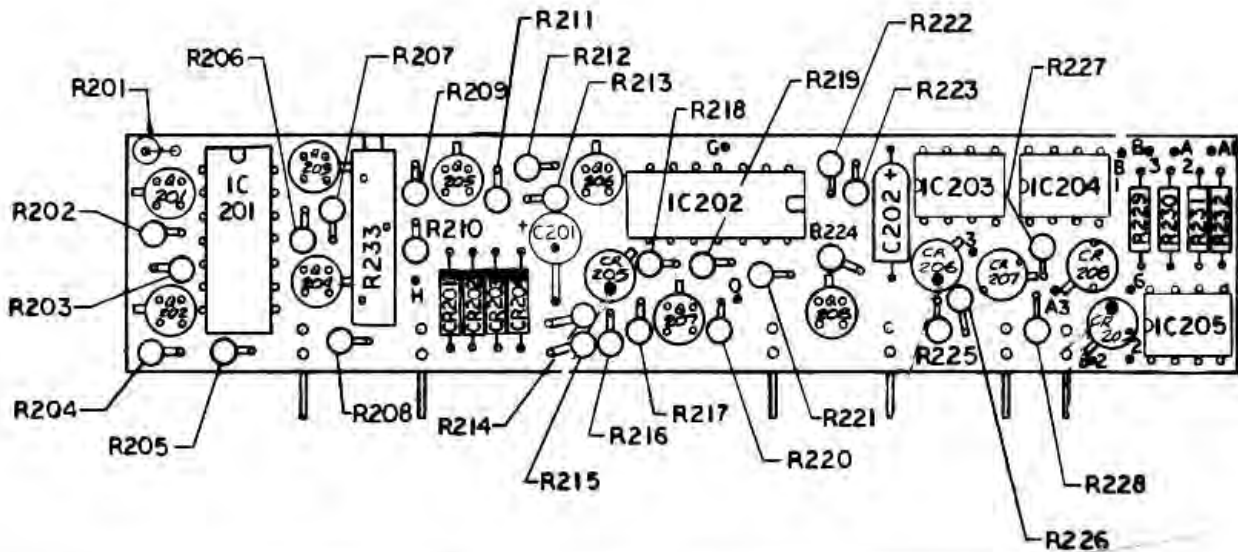
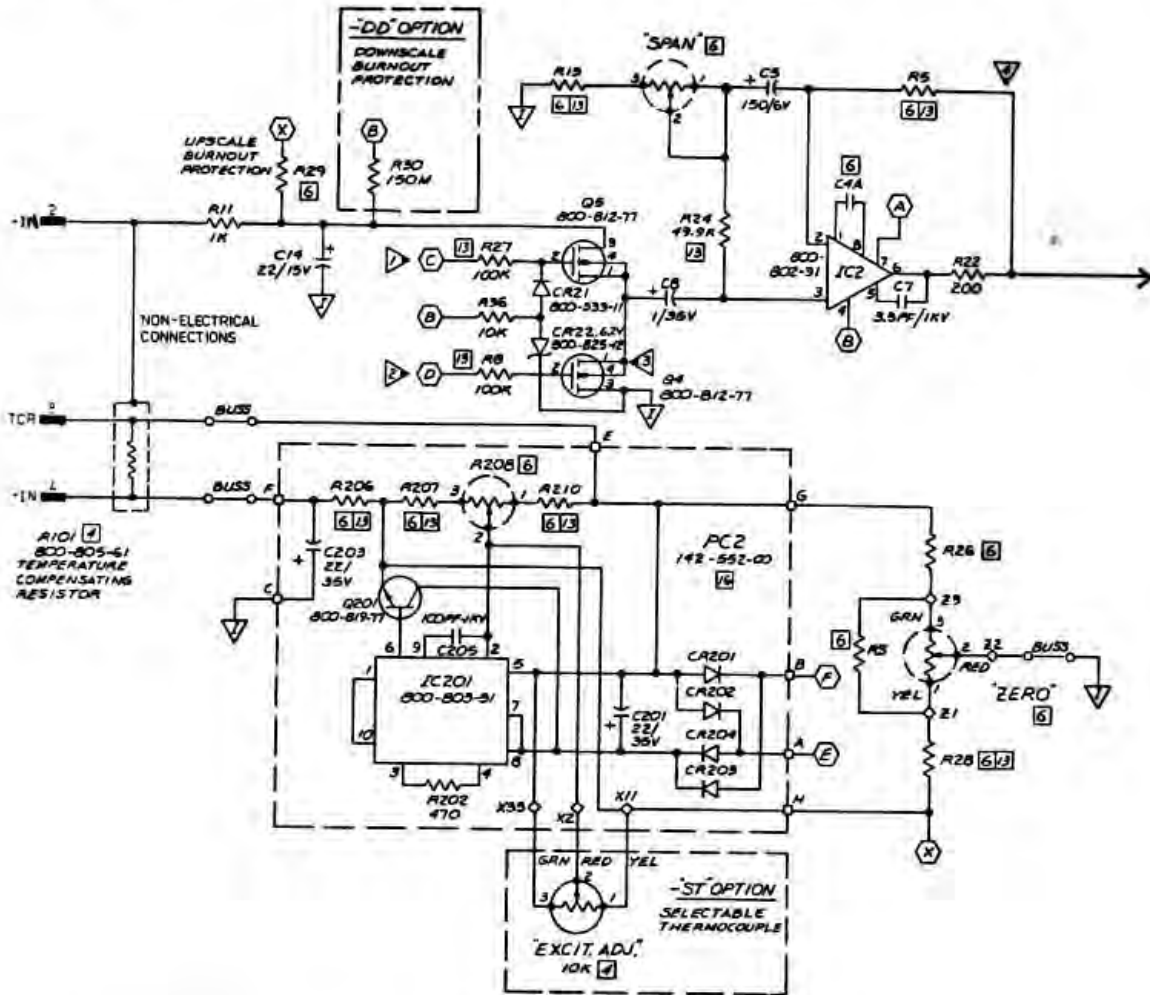


Figure 8. PC2 Assembly with LNT Option

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TCT-EU



- 16. FOR "-LNT" OPTION, USE SCHEMATIC ON SHEET 2.
- 15. FOR "-RO" OPTION, REVERSE LEADS 11 AND 14 OF T2. (LEAD 14 IS OUTPUT COMMON).
- 14. ON 24VDC POWERED UNITS, REVERSE LEADS 9 AND 12 OF T2. (LEAD 12 NOT USED).
- 13. METAL FILM RESISTOR (AN55C) $\pm 1\%$ TOL.
- 12. \blacktriangleright INDICATES TEST POINT; FILLED END IS POINTER. REFER TO SECTION 5 OF MANUAL, "MAINTENANCE."
- 11.
- 10. ∇ INDICATES INPUT SECTION COMMON (GROUND).
 \triangledown INDICATES OUTPUT SECTION COMMON (GROUND).
- 9. \blacksquare INDICATES PLUG-IN CONNECTOR POSITION.
- 8. \diamond INDICATES IDENTIFIED WIRING PAD ON AC.BD.
- 7. \square INDICATES PC1/PC2 INTERCONNECT PIN.
- 6. SEE LIST OF MATERIALS FOR USAGE, VALUE AND PART NUMBER.
- 5. \circ INDICATES ELECTRICAL COMMON (SAME LETTER).
- 4.
- 3. POTENTIOMETERS INCREASE CLOCKWISE FROM PIN 1 TO PIN 3.
- 2. DIODES ARE 1N4148; RESISTORS ARE CARBON COMP. (RCOTGF) $\pm 10\%$ TOL. $\frac{1}{4}$ W.
- 1. RESISTANCE VALUES ARE IN OHMS; CAPACITANCE IN MICROFARADS.

NOTES: UNLESS OTHERWISE SPECIFIED:

Figure 9. TCT-EU Schematic (page 1 of 3)

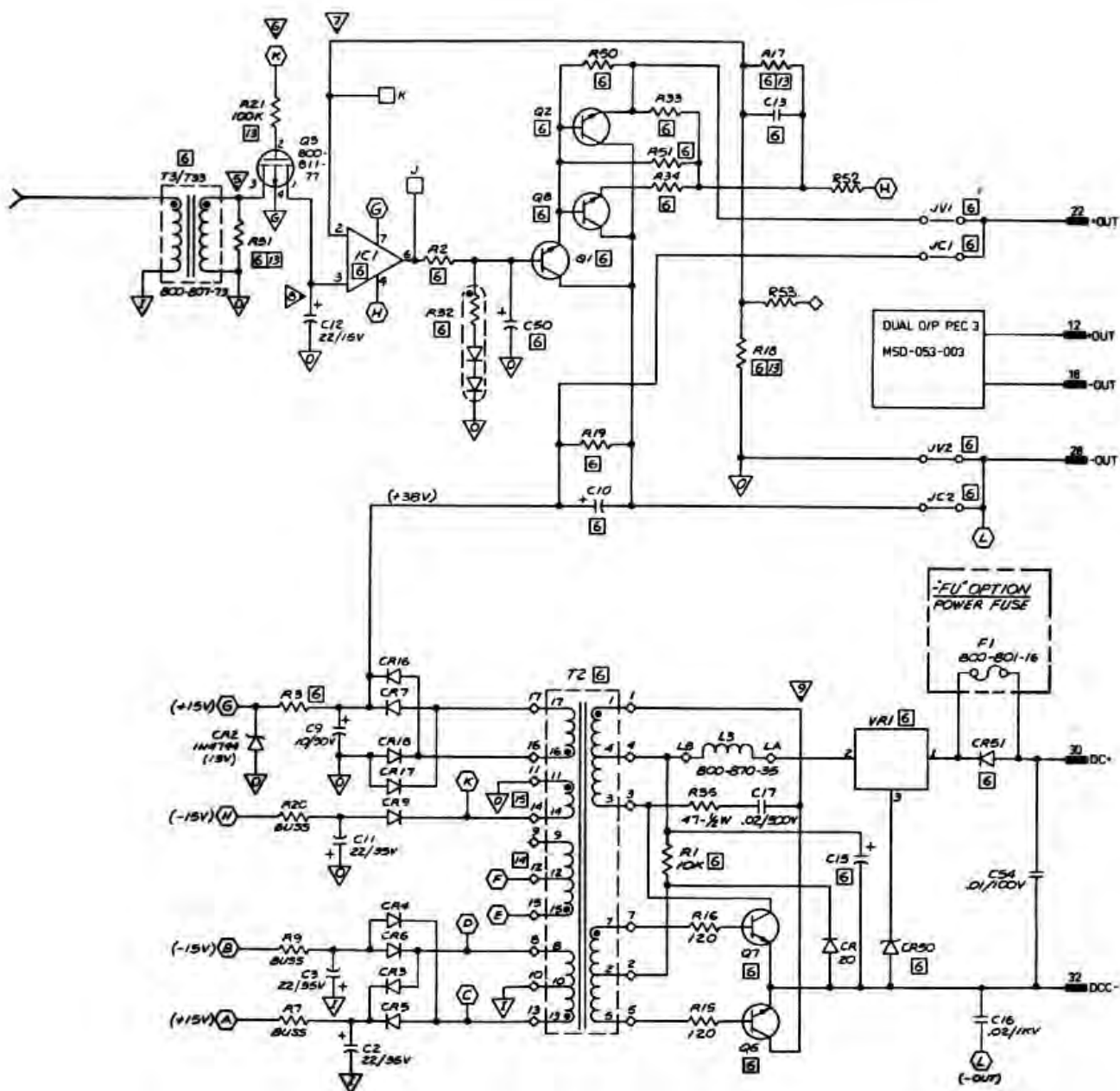


Figure 9. TCT-EU Schematic (page 2 of 3)

TCT-EU

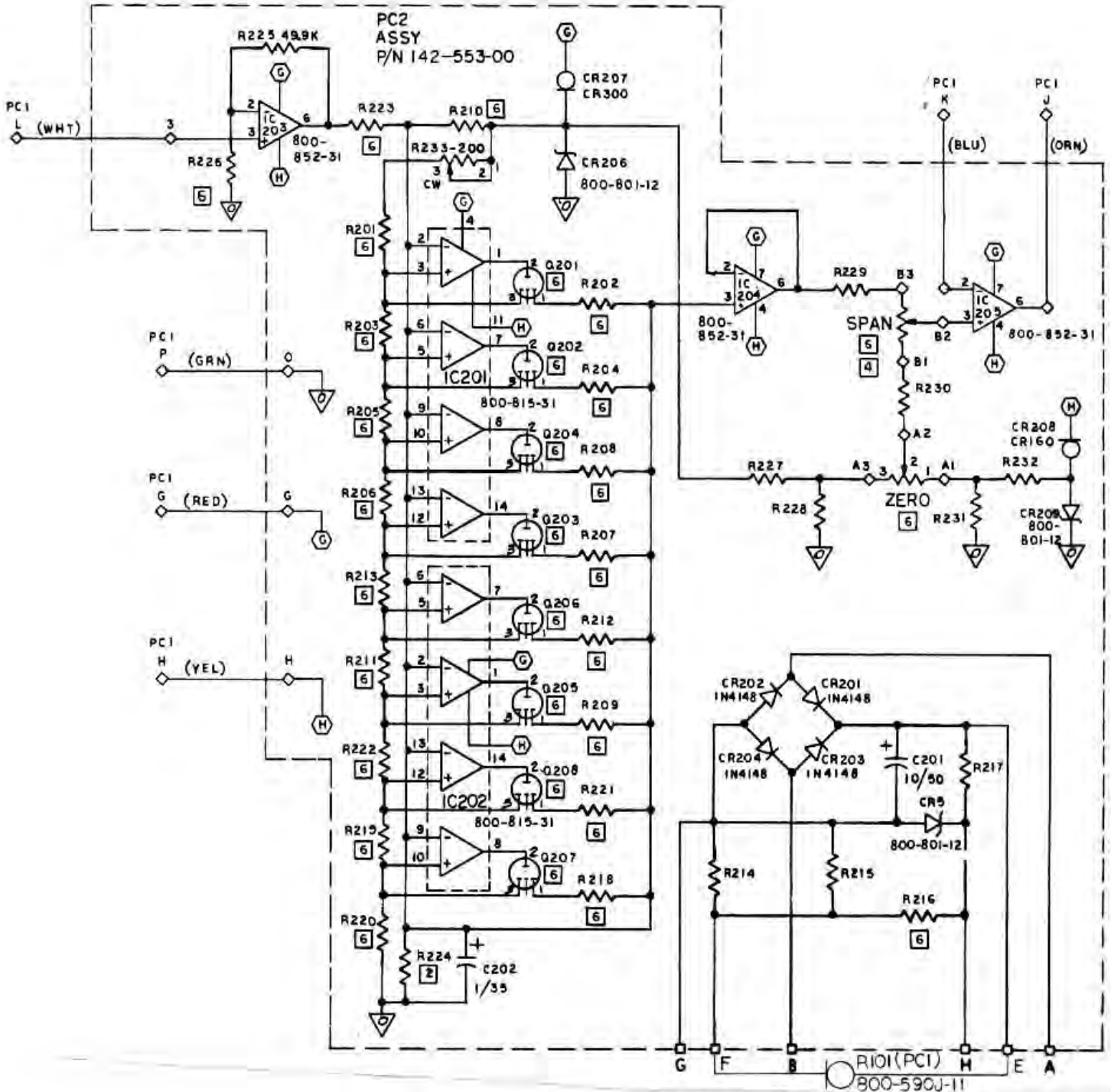


Figure 9. TCT-EU Schematic for LNT Option (page 3 of 3)

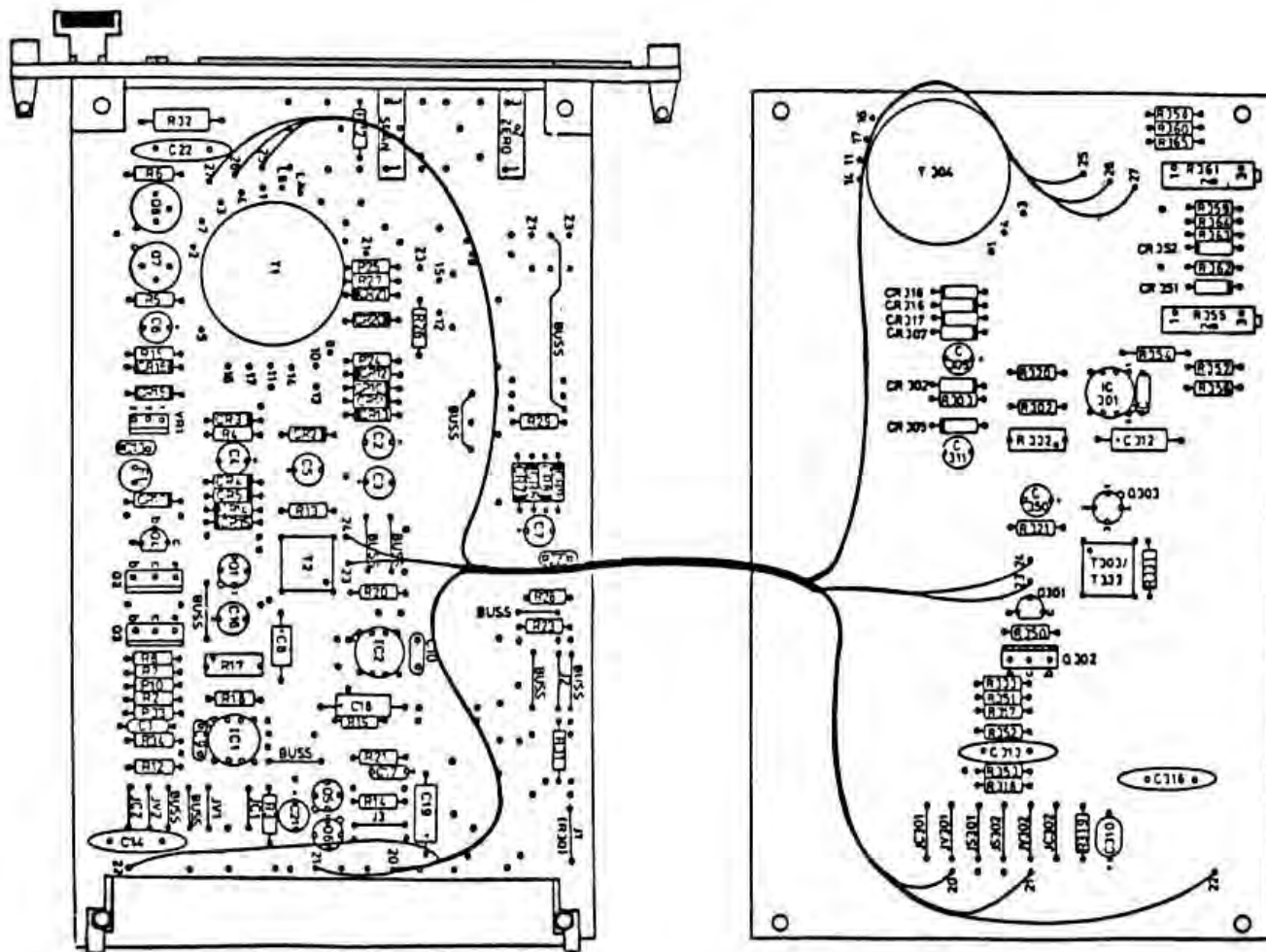


Figure 10. Dual Output Eurocard Connections

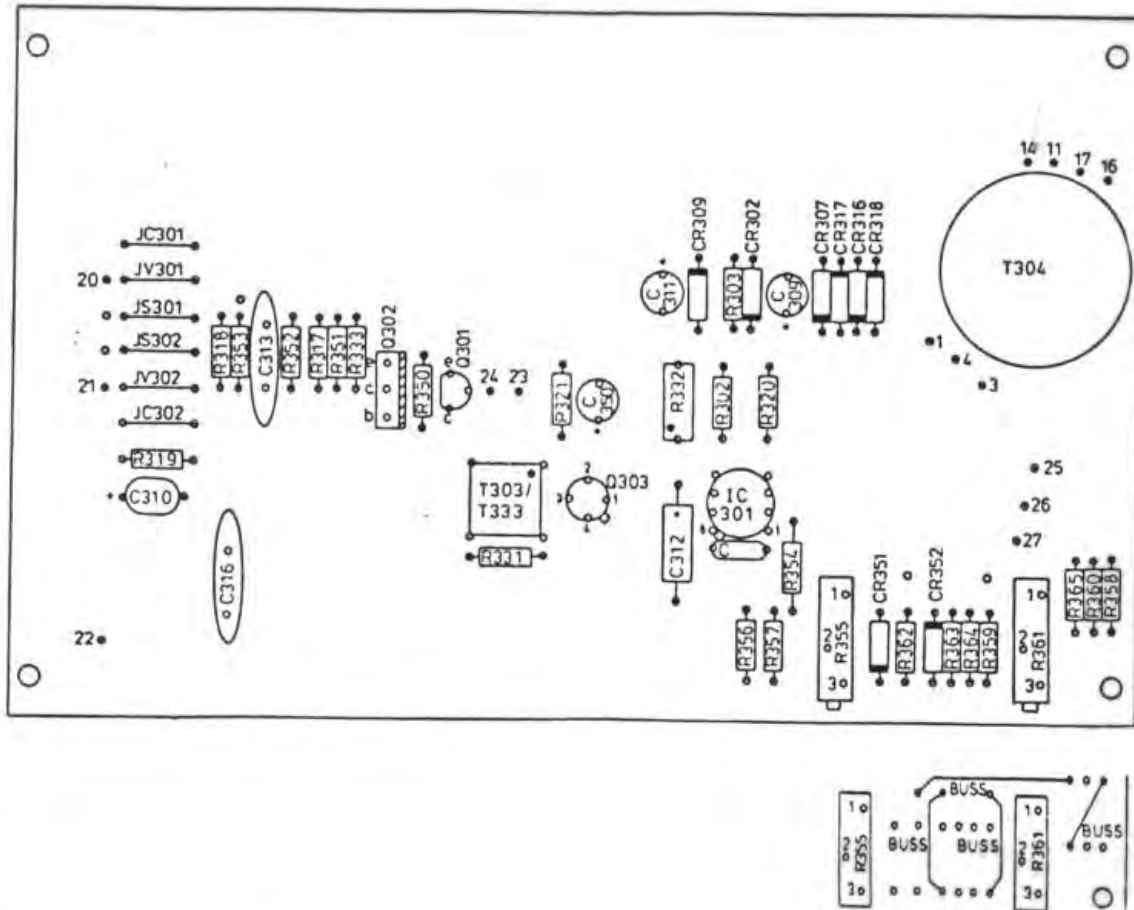
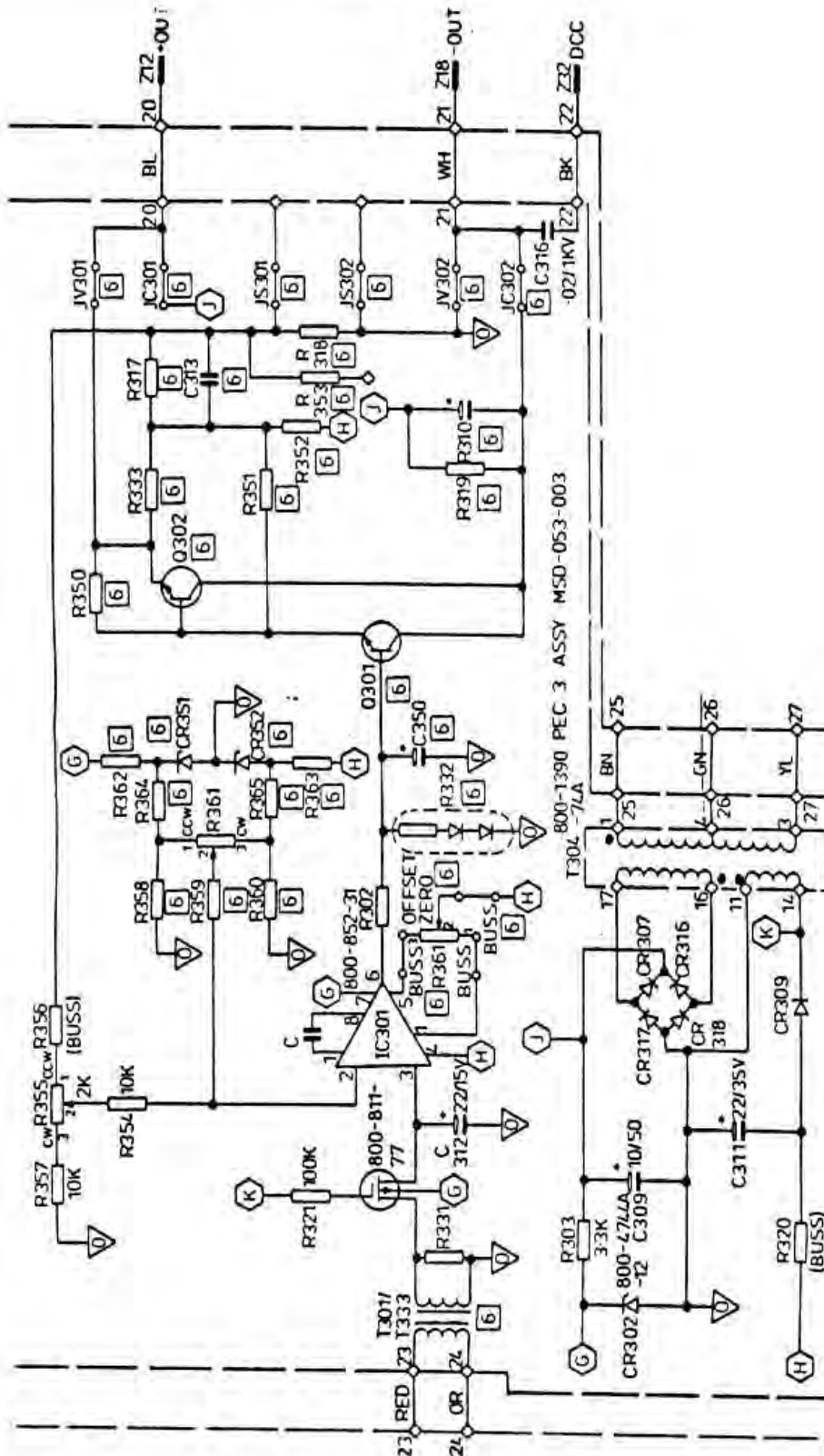


Figure 11. Dual Output Assembly



- NOTES (UNLESS OTHERWISE STATED):
- 1 RESISTANCE VALUES ARE IN OHMS; CAPACITANCE IN MICROFARADS.
 - 2 DIODES ARE IN 1A/48; RESISTORS ARE CARBON COMP (RC07G) ± 10% TOL.
 - 3 POTENTIOMETERS INCREASE CLOCKWISE FROM PIN 1 TO PIN 3.
 - 4 ○ INDICATES ELECTRICAL COMMON (SAME LETTER).
 - 5 ITEM MOUNTED EXTERNAL OF PC BOARD.
 - 6 [6] SEE LIST OF MATERIALS FOR USAGE, VALUE AND PART N°.
 - 7 ○ INDICATES PCT1/PC2 INTERCONNECT PIN.
 - 8 [6] INDICATES OUTPUT SECTION COMMON (GROUND).
 - 9 [6] INDICATES PLUG-IN CONNECTOR POSITIONS.

Figure 12. Dual Output Schematic

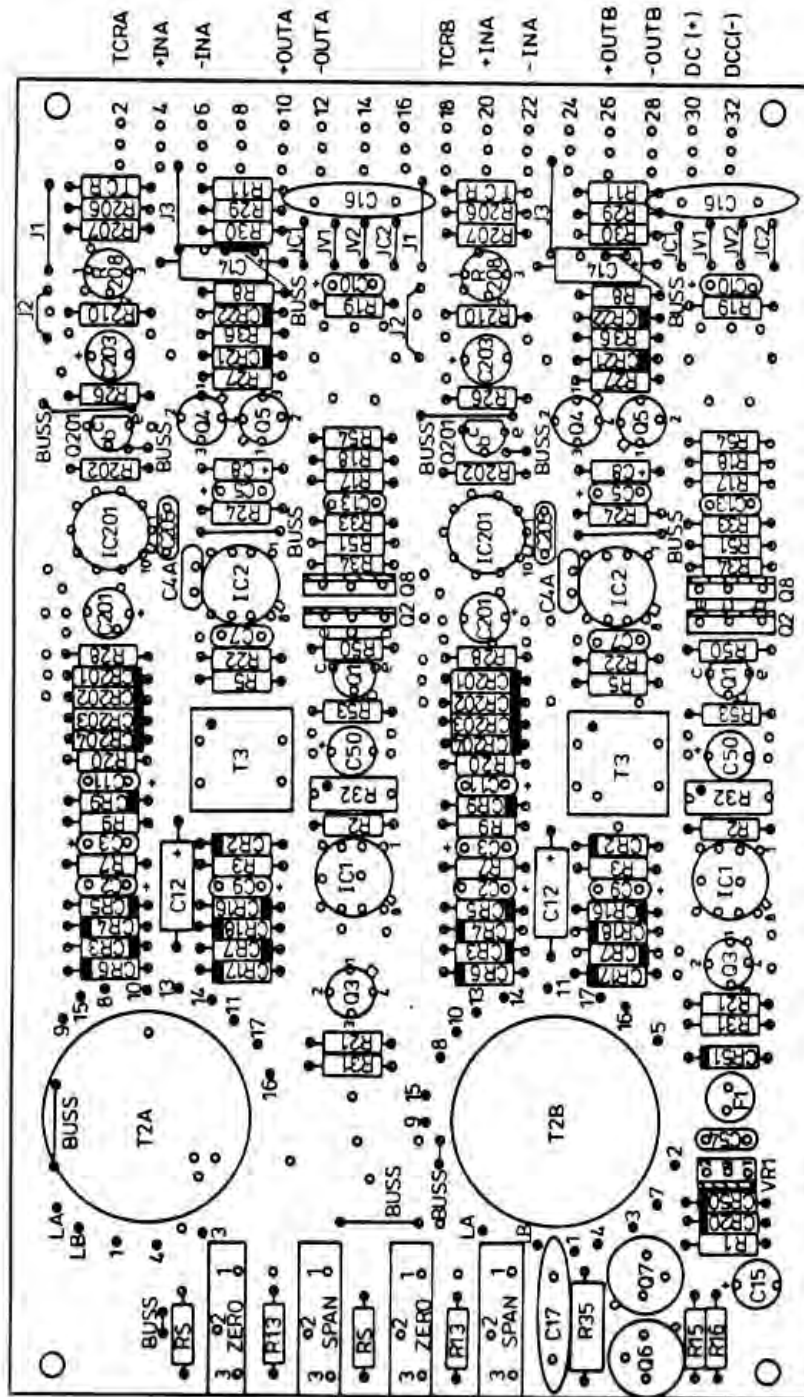
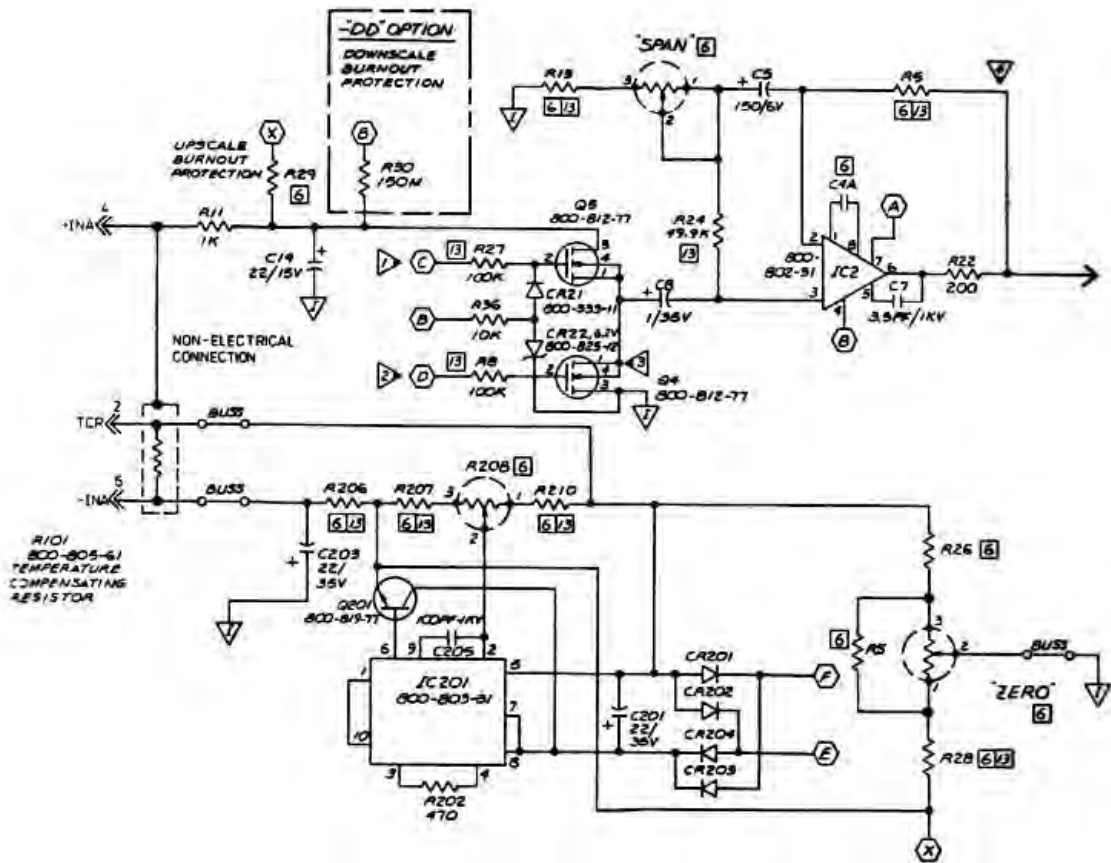


Figure 13. Dual Channel Assembly

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TCT-EU



- 16. [X] DELETED
 - 15. [15] FOR -RO OPTION, REVERSE LEADS 11 AND 14 OF T2. (LEAD 14 IS OUTPUT COMMON).
 - 14. [14] ON 24VDC POWERED UNITS, REVERSE LEADS 9 AND 12 OF T2. (LEAD 12 NOT USED).
 - 13. [13] METAL FILM RESISTOR (RN55C) ± 1% TOL.
 - 12. [12] INDICATES TEST POINT; FILLED END IS POINTER. REFER TO SECTION 5 OF MANUAL, "MAINTENANCE"
 - 11. [11] INDICATES TERMINAL BLOCK POSITION ON CARD RACK.
 - 10. [10] INDICATES INPUT SECTION COMMON (GROUND).
 - [10] INDICATES OUTPUT SECTION COMMON (GROUND).
 - 9. [9] INDICATES PLUG-IN CONNECTOR POSITION.
 - 8. [8] INDICATES IDENTIFIED WIRING PAD ON P.C. BD.
 - 7. [7] INDICATES PCI/PC2 INTERCONNECT PIN.
 - 6. [6] SEE LIST OF MATERIALS FOR USAGE, VALUE AND PART NUMBER.
 - 5. [5] INDICATES ELECTRICAL COMMON (SAME LETTER).
 - 4. [4] DELETED
 - 3. [3] POTENTIOMETERS INCREASE CLOCKWISE FROM PIN 1 TO PIN 3.
 - 2. [2] DIODES ARE 1N4148; RESISTORS ARE CARBON COMP. (RC07GF) ± 10% TOL. 1/4 W.
 - 1. [1] RESISTANCE VALUES ARE IN OHMS; CAPACITANCE IN MICROFARADS.
- NOTES: UNLESS OTHERWISE SPECIFIED:

Figure 14. Channel A Schematic (page 1 of 2)

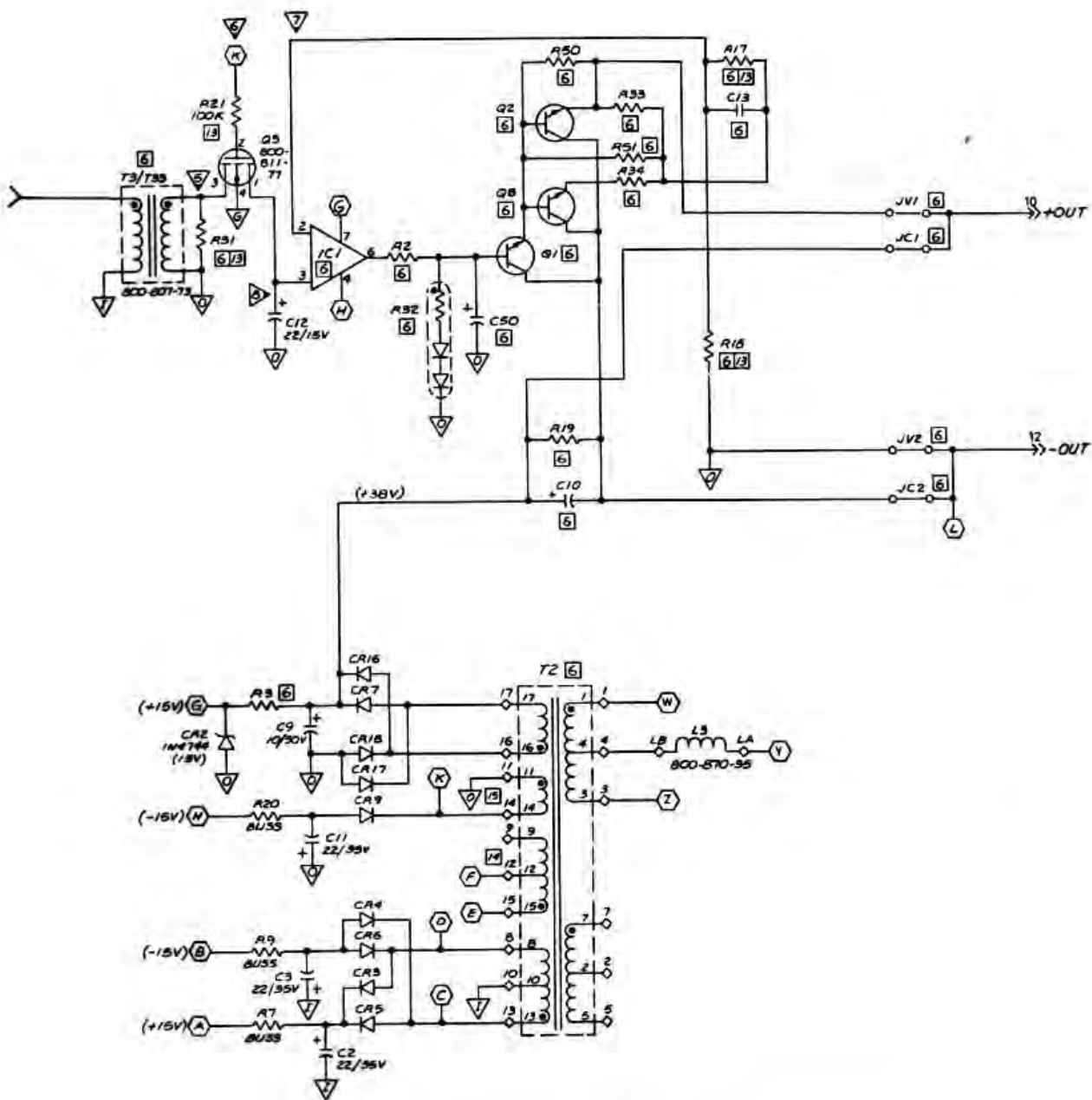
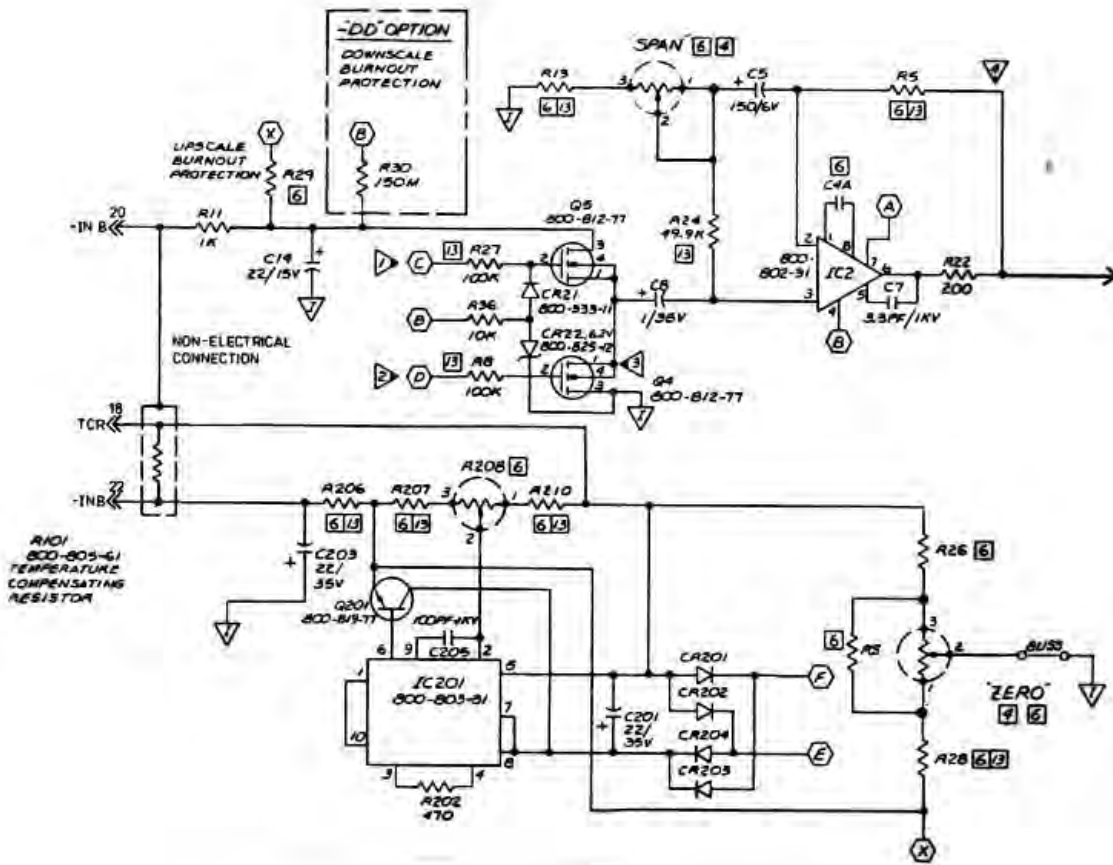


Figure 14. Channel A Schematic (page 2 of 2)

TCT-EU



- 16 DELETED
 - 15 FOR -RO OPTION, REVERSE LEADS 11 AND 14 OF T2. (LEAD 14 IS OUTPUT COMMON).
 - 14 ON 24VDC POWERED UNITS, REVERSE LEADS 9 AND 12 OF T2. (LEAD 12 NOT USED).
 - 13 METAL FILM RESISTOR (RN55C) $\pm 1\%$ TOL.
 - 12. \blacktriangleright INDICATES TEST POINT; FILLED END IS POINTER. REFER TO SECTION 5 OF MANUAL, "MAINTENANCE."
 - 11. \odot INDICATES TERMINAL BLOCK POSITION ON CARD RACK.
 - 10. ∇ INDICATES INPUT SECTION COMMON (GROUND).
 - ∇ INDICATES OUTPUT SECTION COMMON (GROUND).
 - 9. \Rightarrow INDICATES PLUG-IN CONNECTOR POSITION.
 - 8. \diamond INDICATES IDENTIFIED WIRING PAD ON AC.BD.
 - 7. \square INDICATES PCI/PC2 INTERCONNECT PIN.
 - 6. SEE LIST OF MATERIALS FOR USAGE, VALUE AND PART NUMBER.
 - 5. \circ INDICATES ELECTRICAL COMMON (SAME LETTER).
 - 4. DELETED
 - 3. POTENTIOMETERS INCREASE CLOCKWISE FROM PIN 1 TO PIN 3.
 - 2. DIODES ARE 1N4148; RESISTORS ARE CARBON COMR (RCOTGF) $\pm 10\%$ TOL. $\frac{1}{4}$ W.
 - 1. RESISTANCE VALUES ARE IN OHMS; CAPACITANCE IN MICROFARADS.
- NOTES:** UNLESS OTHERWISE SPECIFIED:

Figure 15. Channel B Schematic (page 1 of 2)

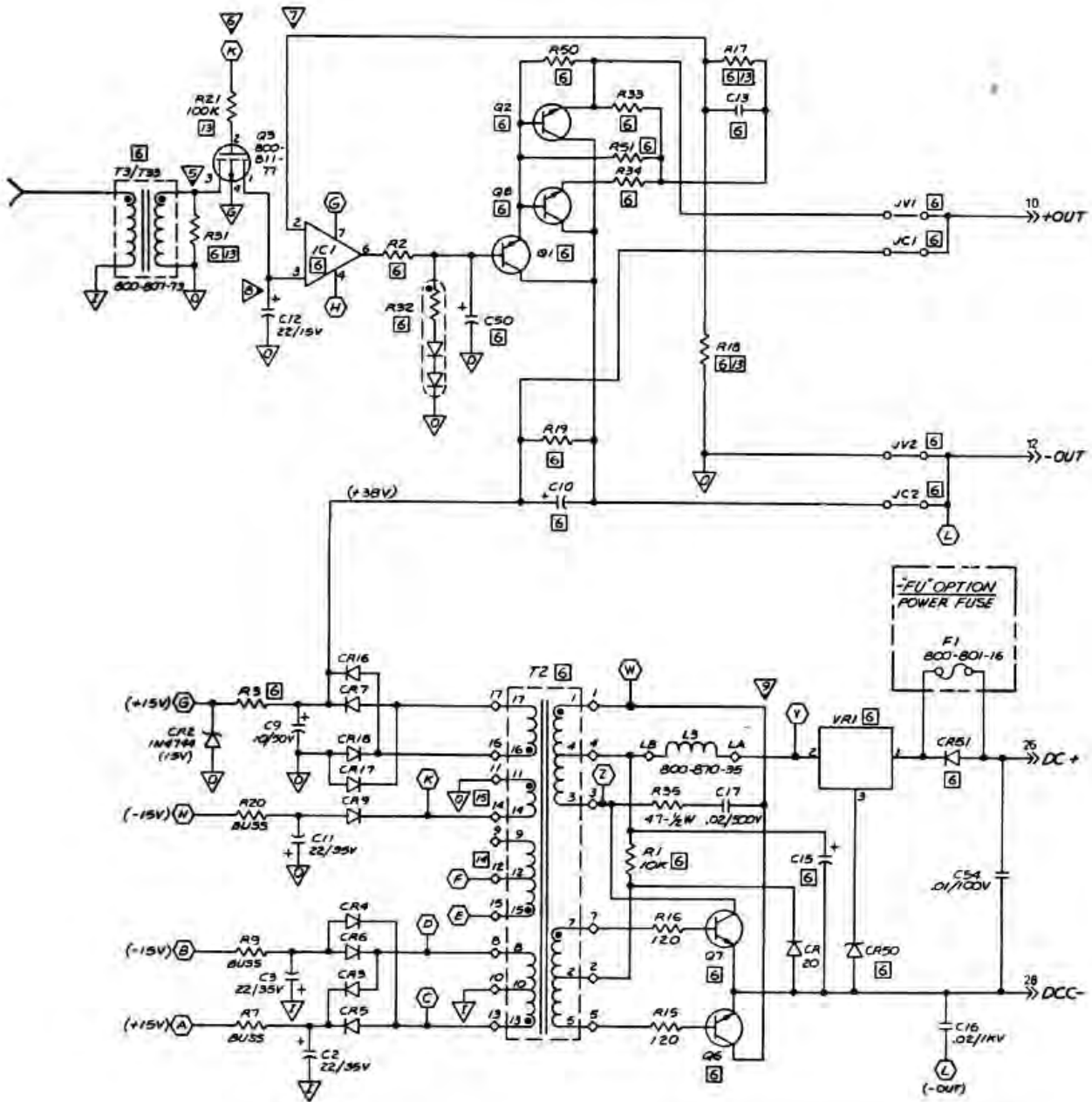


Figure 15. Channel B Schematic (page 2 of 2)

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
 - a) A note listing the symptoms that indicate the unit needs repair
 - b) Complete shipping information for return of the equipment after repair
 - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES. BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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