Electronic M.O.P Card

Instruction Manual

Model D10341-000

CAROTRON

Driven by Excellence

D.C. DRIVES, A.C. INVERTERS,
SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

Table of Contents

1 General Description

Model D10341-000 Electronic M.O.P. is an electronic replacement for a traditional motor operated potentiometer (M.O.P.). Through a combination of digital and analog circuits, Model D10341-000 provides a means to control a D.C. output voltage level via external contact closures for Increase, Decrease and Reset.

When the Increase input is closed, a 12 bit counter begins to count clock pulses and increases the output voltage. When the Decrease input is closed, the clock pulses are subtracted from the 12 bit counter to decrease the voltage output. When neither Increase nor Decrease is closed, the output holds at the last level. When the Reset button is pressed the counter resets to zero and the analog output instantly drops to zero.

The clock rate is adjustable to control the rate of change in output voltage. This rate of change is controlled by the Acceleration adjustment. The 12 bit counter counts 4095 clock pulses to transition from minimum to maximum output voltage.

The output voltage can be controlled in the Unipolar or Bipolar modes. If the Unipolar mode is selected, the output changes between a minimum level of 0.0 and typically +10 VDC. Turning power on or closing the Reset causes the output to reset to zero.

For Bipolar operation, the output typically changes between –10 VDC and +10 VDC. Turning power on or closing the Reset causes the 12 bit counter to reset to a mid-point and causes the output voltage to reset to zero.

The range of the analog output can be controlled by two sources:

- +10 VDC fixed reference on the p.c. board.
- External fixed or variable voltage from –10 VDC to +10 VDC.

These voltages become the reference to the 12 bit Digital to Analog converter, which is a four quadrant multiplying type. This multiplying type converter allows the circuit to ratio the reference input and provide a percentage of the reference as output. When operating in the Bipolar Mode, a single polarity input can provide positive or negative polarities for the output.

The output of the Digital to Analog converter is further modified by multiturn potentiometers for Offset, Gain, and Bias. A Summing input is provided to allow an external voltage to be summed directly with the output. The input to this Summing circuit must be limited to a range of -10 VDC to +10 VDC. A selection is supplied to change the polarity of the Summing input if desirable.

2 Specification

A.C. Input
115 VAC, ±10%, 50/60 Hz., fused for 1 Amp

Increase, Decrease, Reset Inputs
Contact closure, contacts must be rated for 115 VAC @ 75 mA

- **External Reference Input**
  Fixed or variable – 10 VDC to +10 VDC
- **Summing Input**
  Fixed or variable – 10 VDC to +10 VDC with selectable inverter circuit for changing polarity on board

Acceleration Rate Adjustment
- **Unipolar Mode**
  1 to 60 seconds from 0 to full output
- **Bipolar Mode**
  0.5 to 30 seconds from 0 to full output

Adjustable Gain Range
(With Offset set for 0.0 VDC and Bias set for 0.0 VDC)

- **Unipolar Mode**
  Vout / Vin = .4 to 2.0 (12 VDC Max. output)
- **Bipolar Mode**
  Vout / Vin = ± .4 to ± 2.0 (±12 VDC Max. output)

Min. and Max. Count Output
Two open collector transistors each rated 100 mA for switching up to 120 VDC are provided to indicate Min. and Max. count on the Digital counter.

3 Description of Jumpers and Adjustments

Jumper J1
Selects non-inverting (+ position) and inverting (- position) for the summing signal input. When the summing signal is positive on TB1-12 with reference to TB1-11, the jumper position also indicates the polarity of output due to the summing input. The summing input can be added or subtracted from the signal modified by the digital converter circuit.

Jumper J2
Selects either internal or external source for reference to the digital to analog converter. In the "INT" position, a fixed internal +10 VDC is selected as the reference. In the "EXT" position, the reference is supplied from terminals TB1-9 (-) and TB1-10 (+). The external reference can be a fixed or variable voltage ranging from –10 to +10 VDC.

Jumper J3 and Switch SW1
These two devices work together to determine the operation of the digital to analog converter for Unipolar or Bipolar operation. For Unipolar operation, select "Unipolar" on SW1 and "Unipolar" on J3. With Unipolar selected, the output varies from 0 to +10 VDC (typical) and power on or Reset causes the output to reset to 0 VDC.

For Bipolar operation SW1 and J3 are placed in the "Bipolar" position. This allows the output to vary from –10 VDC to +10 VDC (typical) and power on or Reset causes the output to reset to 0VDC.

If SW1 is set for "Unipolar" and J3 is set for "Bipolar", the digital converter will still operate as described for Unipolar mode with output from 0 to +10 VDC (typical). However, at power on or Reset the output voltage will reset to mid-range or +5 VDC (typical).

Offset Pot

This multiturn potentiometer is used to null the analog circuit with a zero count on the digital circuit in Unipolar Mode or at mid-count on the digital circuit when Bipolar Mode is selected.

Bias Pot

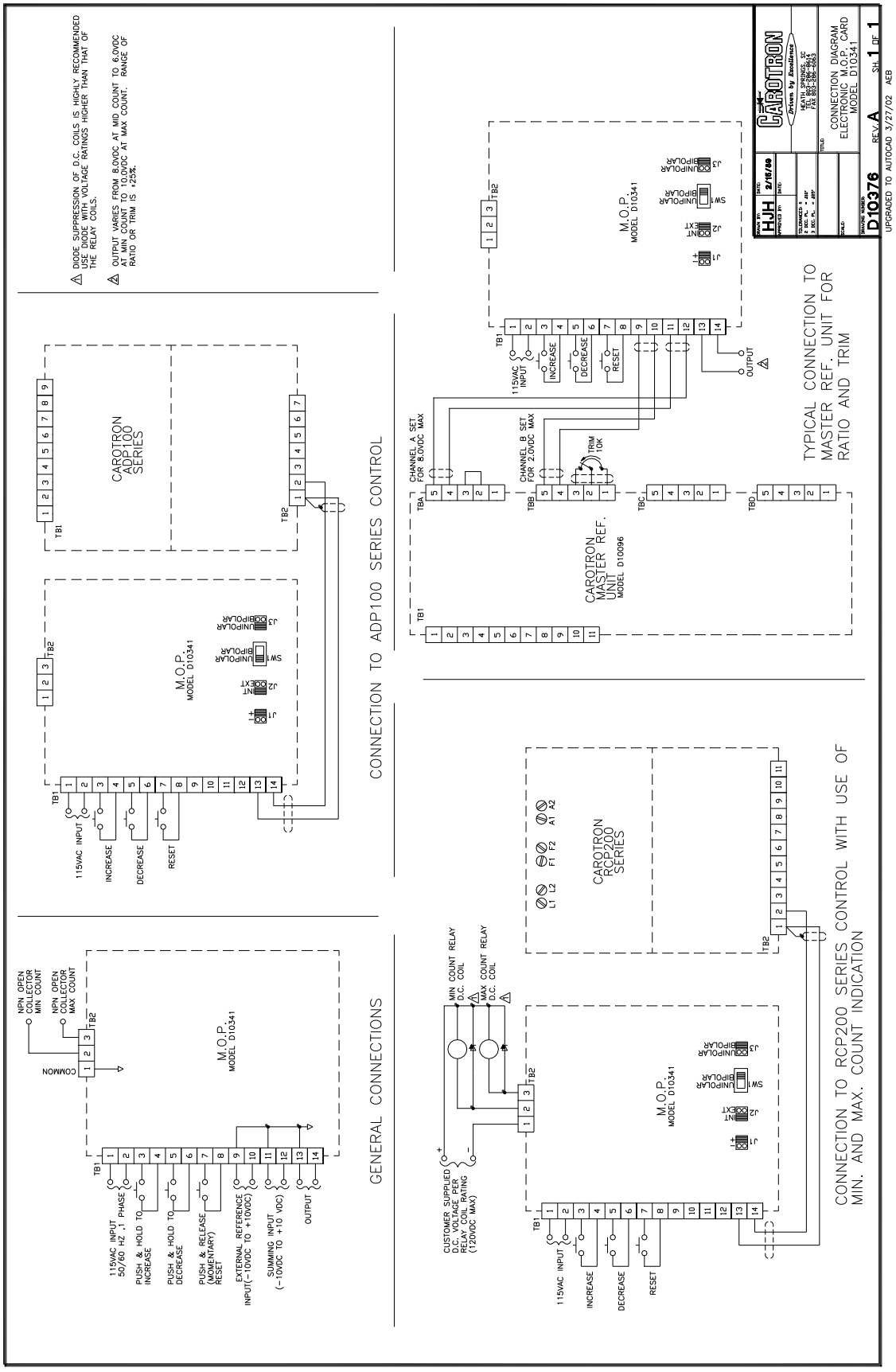
This multiturn potentiometer is used to set the minimum output level at TB1-13 and -14 when the digital circuit is at zero count for Unipolar Mode or mid-count for Bipolar Mode.

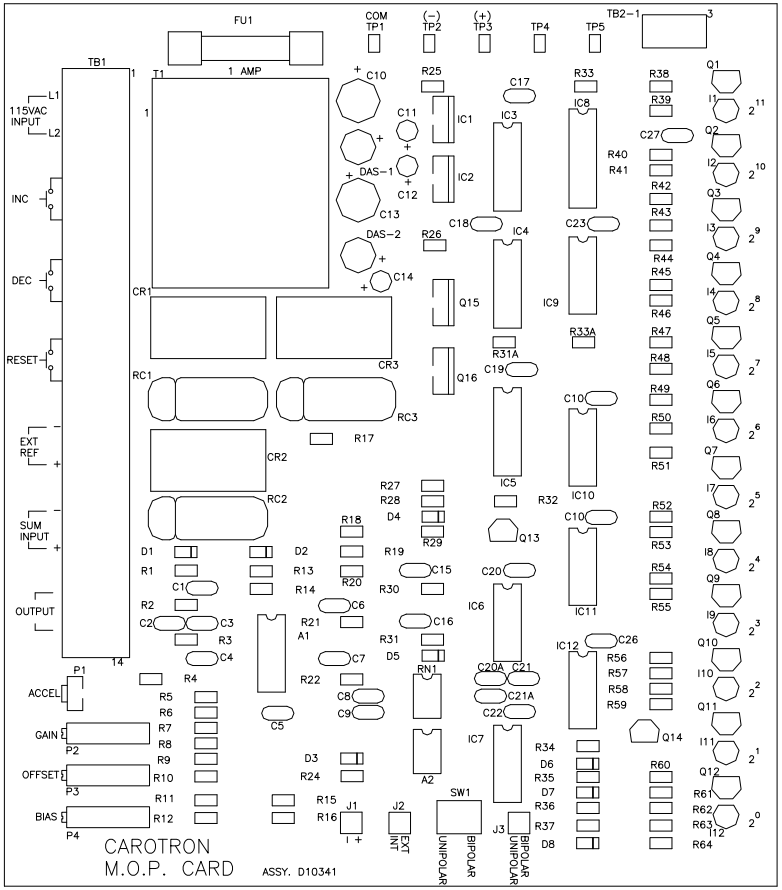
Gain Pot

This multiturn potentiometer is used to scale the range of the analog output from the Digital to Analog converter circuit with maximum count on the digital circuit and maximum reference applied.

4 Adjustment Procedure

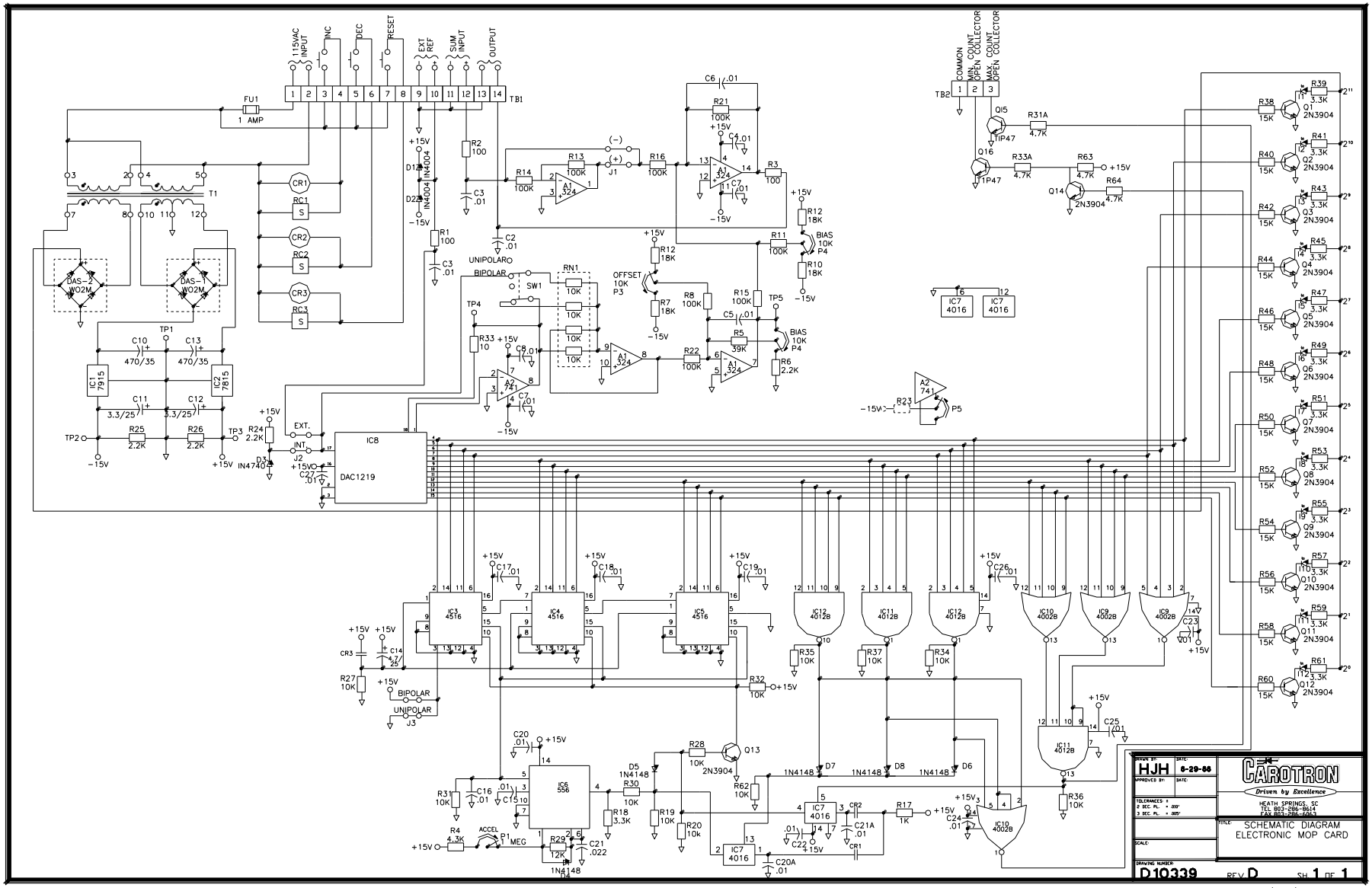
- Refer to connection diagram D10376 to assure proper connection of the Model D10341-000 Electronic M.O.P. Card. Make proper jumper and switch selections per Section 3 for the type of operation desired. If a summing signal is used, make sure this signal is at 0.0 VDC. If an external reference is used, make sure that the maximum reference level is applied. Use the following adjustment procedure:
- Turn on 115 VAC power to the unit. Check LED's I1 to I12 to see that the digital circuit is reset properly. For Unipolar Mode, all LED's I1 to I12 should be off. For Bipolar Mode, LED I1 should be on and LED's I2 to I12 should be off.
- Turn the GAIN pot full clockwise, approximately 20 turns. Monitor the voltage between TP1 (common) and TP5 with a digital voltmeter. Adjust the OFFSET pot. for a reading of 0.0 VDC. Turn the GAIN pot full counter-clock-wise, approximately 20 turns.
- Monitor the voltage between TB1-13 (common) and TB1-14. Adjust the BAIS pot for 0.0 VDC or the minimum output level desired.
- With the reference input at maximum, close the increase circuit at TB1-3 and TB1–4. Keep the increase circuit closed until the LED's I1 to I12 are all on, indicating that maximum count is achieved.
- Monitor the voltage between TB1-13 (common) and TB1-14. Adjust the GAIN pot. clockwise until the maximum output level is reached.
- Close the reset circuit between TB1-7 and TB1–8. The output should reset to the minimum level set by BIAS pot. Monitor the output on TB1-13 (common) and TB1-14. Close the increase circuit on TB1-3 and TB1–4. Use the ACCEL pot. to adjust the time for the output to rise to full output. Clockwise adjustment of the ACCEL pot. increases time. Repeat this until ACCEL is satisfactory.
- If a summing input is to be used, apply the summing input. Check the output at TB1-13 (common) and TB1-14 to be sure that the proper addition or subtraction is achieved with respect to the digital to analog converter circuit.


DIODE SUPPRESSION OF D.C. COILS IS HIGHLY RECOMMENDED USE DIODE WITH VOLTAGE RATINGS HIGHER THAN THAT OF THE RELAY COILS.
OUTPUT VARIES FROM 8.0VDC AT MID COUNT TO 6.0VDC AT MIN COUNT TO 10.0VDC AT MAX COUNT. RANGE OF RATIO OR TRIM IS +25%.
CONNECTION TO ADP100 SERIES CONTROL
CAROTRON ADP100 SERIES
M.O.P. MODEL D10341
115VAC INPUT
INCREASE
DECREASE
RESET
GENERAL CONNECTIONS
NPN OPEN COLLECTOR MIN COUNT
NPN OPEN COLLECTOR MAX COUNT
COMMON
115VAC INPUT 50/60 HZ. 1 PHASE
PUSH & HOLD TO INCREASE
PUSH & HOLD TO DECREASE
PUSH & RELEASE (MOMENTARY) RESET
EXTERNAL REFERENCE INPUT(-10VDC TO +10VDC)
SUMMING INPUT (-10VDC TO +10 VDC)
OUTPUT
CONNECTION TO RCP200 SERIES CONTROL WITH USE OF MIN. AND MAX. COUNT INDICATION
CAROTRON RCP200 SERIES
MIN COUNT RELAY D.C. COIL
MAX COUNT RELAY D.C. COIL
CUSTOMER SUPPLIED D.C. VOLTAGE PER RELAY COIL RATING (120VDC MAX)
TYPICAL CONNECTION TO MASTER REF. UNIT FOR RATIO AND TRIM
CAROTRON MASTER REF. UNIT MODEL D10096
CHANNEL A SET FOR 8.0VDC MAX
CHANNEL B SET FOR 2.0VDC MAX
TRIM 10K
OUTPUT
CONNECTION DIAGRAM ELECTRONIC M.O.P. CARD MODEL D10341
D10376 REV. A SH. 1 OF 1
UPGRADED TO AUTOCAD 3/27/02 AEB



NOTES:
1. REF. A10341 FOR BILL OF MATERIAL.
2. REF. SCHEMATIC D10339.

DRAWN BY: SJG	DATE: 05/16/02	CAROTRON
APPROVED BY:	DATE:	Driven by Excellence
TOLERANCES: 0 DEC PL. = .010" 2 DEC PL. = .005"		HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:		TITLE: ASSEMBLY DRAWING MODEL D10341-000 ELECTRONIC M.O.P. CARD
DRAWING NUMBER: D10341	REV.–	SH. 1 OF 1



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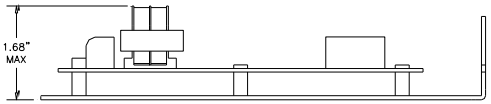

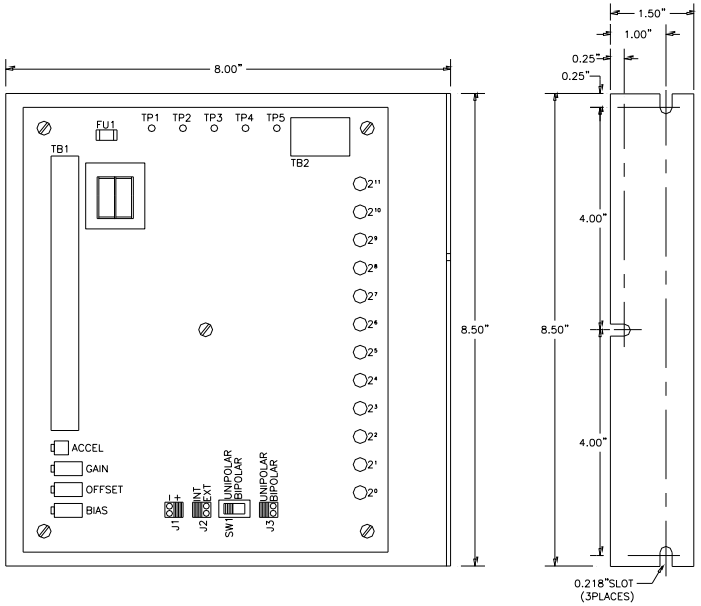

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TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"	
SCALE:	
DRAWING NUMBER: D10377	REV A

CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-9614
FAX 803-286-8063

TITLE: DIMENSIONAL DRAWING
M.O.P. CARD
MODEL D10341

SH 1 OF 1

Standard Terms and Condition of Sale

1. General

The Standard Terms and Conditions of Sale of Carotron, Inc. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company. In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that Cc) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warrant in regard to such systems, including but not limited to remedy for consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the
Company's satisfaction to have failed to so perform, or refund to the Purchaser the purchase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during reasonable hours, and (b) the Company is notified of the failure within one (1) year after date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

a. Products and parts damaged or abused in shipment without fault of the Company.

b. Defects and failures due to operation, either intentional or otherwise, (l) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.

c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.

d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.

e. Products, parts and systems designed by the Purchaser.

f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

5. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

8. Returned material

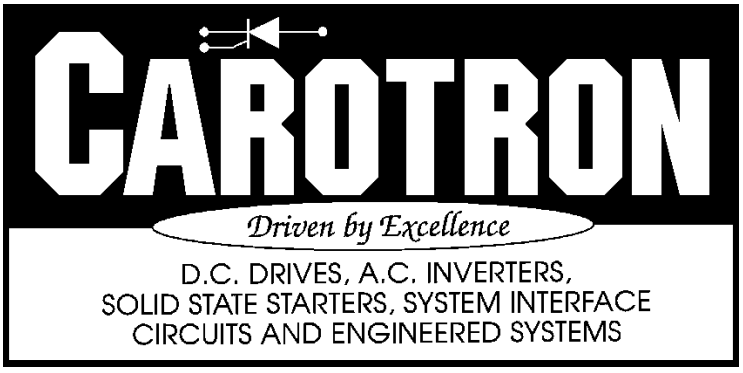
If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURNTAG" attached thereon which has been issued by the Company.

9. Packing

Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefor shall cease when the carrier signs for and accepts the shipment.



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