Electronic MOP Module

Instruction Manual
MOP250-000

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1 General Description

In many industrial applications, a potentiometer is used to provide a reference signal (typically speed) to a machine. Often, it would be advantageous to allow the machine operator to adjust this potentiometer from multiple locations (especially on large machines). However, this is not possible with a standard analog potentiometer.

Initially, this feature was implemented by connecting a motor shaft to a potentiometer. INCREASE and DECREASE buttons could then be used to slowly rotate the motor one direction or the other, thus changing the output signal from the potentiometer. Multiple buttons could be wired in parallel, allowing INCREASE and DECREASE adjustment in multiple locations. This setup was called a Motor Operated Potentiometer (MOP).

Model MOP250-000 (Electronic Motor Operated Potentiometer Module) provides the MOP function in an small DIN rail mountable electronic package. The module has dedicated inputs for INCREASE and DECREASE pushbuttons. Pressing both inputs simultaneously, serves as the RESET function, causing the output to instantly drop to minimum. Opening the ENABLE input forces the output to ramp down to minimum output. Closing the ENABLE input forces the unit to ramp back up to the previous level.

Additionally, an EXTERNAL REF input allows the MOP to ratio (scale) an external signal if desired. Multiturn potentiometers are provided for adjusting the ACCEL, DECEL, BIAS, and GAIN settings. An internal jumper allows selection of a voltage or current output. Internal EEPROM is used to backup and retain the current MOP output during a power loss.

2 Specifications

2.1 Electrical

D.C. Power Input
- 24 VDC ±10%, 60mA max, internally fused

+10VDC Reference Output
- 10mA max

External Ref Voltage Input
- Range: 0-10VDC
- Input Impedance: 10^{12} Ω

Potentiometers
- Turns: 15
- Accel Range: 0 to 60s
- Decel Range: 0 to 60s
- Bias Range: 0 to 2.5V or 5mA
- Gain Range: 0 to 10V or 20mA

Accel/Decel
- Linear control adjustable to 60s max

Signal Output
- **Voltage Output**
  Selected by position V on J2. This circuit allows the output to source a voltage level of up to +10 VDC into a minimum resistance of 600 Ohms. If resistance is too low, output linearity may be affected.
- **Current Output**
  Selected by position I on J2. This circuit allows the output to source a regulated current up to 20mA into a maximum resistance of 500 Ohms. Using the BIAS pot, the output can source a 4 to 20mA signal.

Temperature Range
- 0-55º

2.2 Physical

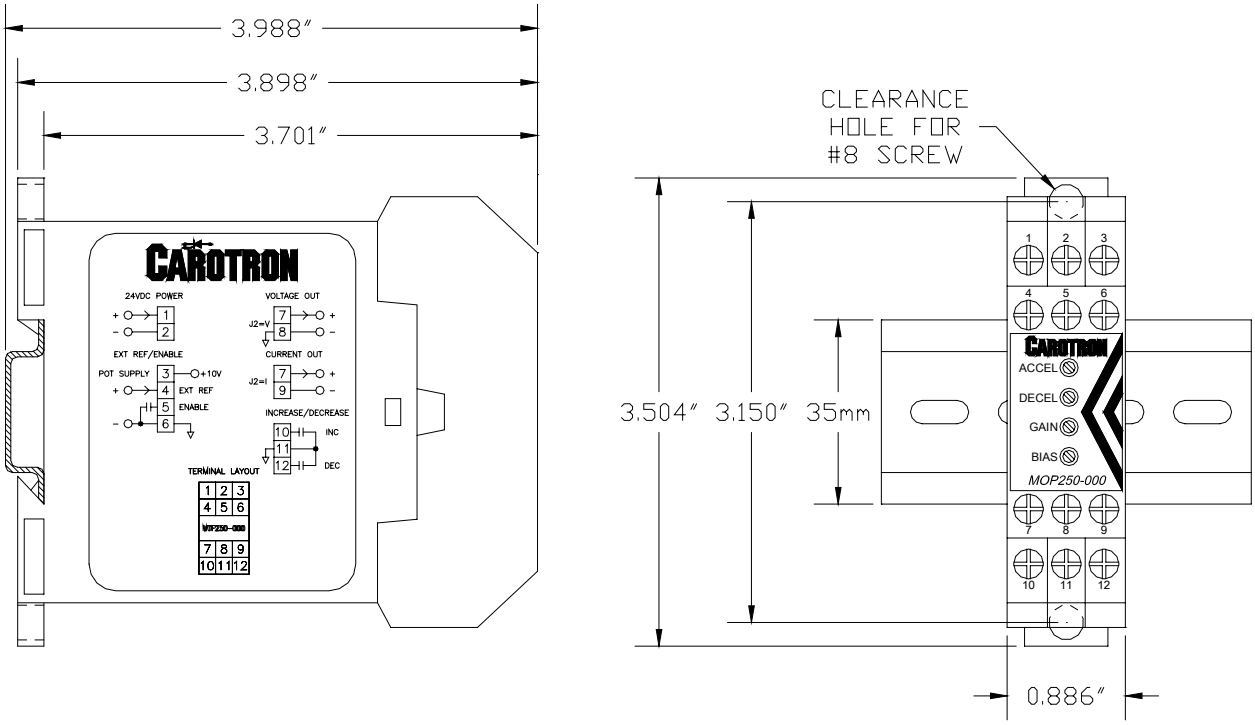


Figure 1: Physical Dimensions

3 Installation

3.1 Wiring Guidelines

To prevent electrical interference and to minimize start-up problems, adhere to the following guidelines:

Use fully insulated and shielded cable for all signal wiring. The shield should be connected to circuit common at one end only. The other end of the shield should be clipped and insulated to prevent the possibility of accidental grounding.

Signal level wiring such as listed above should be routed separately from high level power wiring (such as the A.C. line, motor, operator control, and relay control wiring). When these two types of wire must cross, they should cross at right angles to each other.

Any relay, contactor, starter, solenoid or other electro-mechanical device located in close proximity to or on the same line supply as the MOP250-000 should have a transient suppression device such as an MOV or R-C snubber connected in parallel with its coil. The suppressor should have short leads and be connected as close to the coil as possible.

3.2 Signal Connections

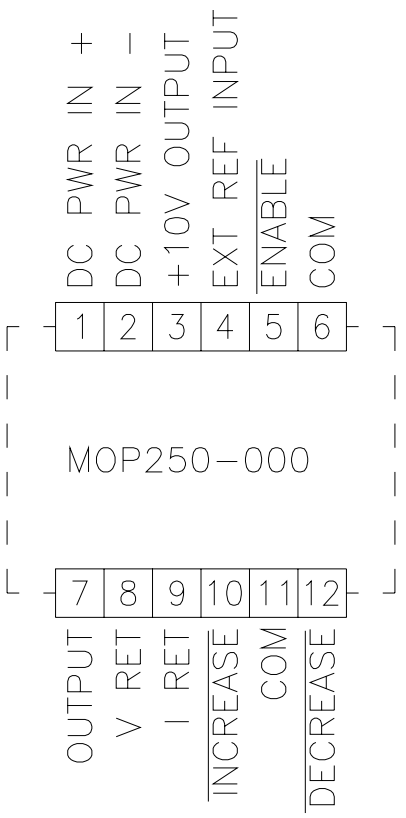


Figure 2: General Connections

4 Description of Features & Adjustments

JUMPER J2
Selects the Output Mode between Voltage or Current. Position V on J2 selects the Voltage Mode and the output is sourced from terminals 7 & 8. Position I on J2 selects the Current Mode and the output is sourced on terminals 7 & 9.

ENABLE Input
This input is used to enable the module output. The ENABLE contact must be closed to allow the INCREASE or DECREASE inputs to change the analog output. When the ENABLE contact is opened, the output will ramp down to the level set by the BIAS potentiometer at a rate controlled by the DECEL potentiometer. When the ENABLE contact is closed, the output will ramp back up to the previous output value at a rate controlled by the ACCEL potentiometer.

INCREASE Input
While the INCREASE input is held closed (and the unit is ENABLED), the output will increase at a rate controlled by the ACCEL potentiometer. When the input is opened, the output will hold at its present value.

DECREASE Input
While the DECREASE input is held closed (and the unit is ENABLED), the output will decrease at a rate controlled by the DECEL potentiometer. When the input is opened, the output will hold at its present value.

RESET Function
The output can be reset instantly to minimum by simultaneously closing the INCREASE and DECREASE inputs for one second. The reset function can be used regardless of the state of the ENABLE input.

ACCEL Potentiometer
This adjustment is used to set the amount of time that the output takes to increase from minimum output to maximum output. Range is from 0 to 60s. Clockwise rotation increases the time, counter-clockwise decreases the time.

DECEL Potentiometer
This adjustment is used to set the amount of time that the output takes to decrease from maximum output to minimum output. Range is from 0 to 60s. Clockwise rotation increases the time, counter-clockwise decreases the time.

GAIN Potentiometer
This adjustments is used to set the maximum analog output level. When J2=V, the range is 0 to 10VDC. When J2=I, the range is 0 to 20mA. Clockwise rotation increases the gain, counter-clockwise decreases the gain.

BIAS Potentiometer
This adjustments is used to set the minimum analog output level. When J2=V, the range is 0 to 2.5VDC. When J2=I, the range is 0 to 5mA. Clockwise rotation increases the bias, counter-clockwise decreases the bias.

EXT REFERENCE
If desired, the MOP module can trim an external signal connected to terminal 4. In this

setup, the MOP module outputs a percentage (0-100%) of the external signal. A jumper must be connected from terminal 3 to 4 if this feature is not used.

MEMORY Feature

The MOP250-000 module has a memory feature that saves the MOP output to internal non-volatile EEPROM memory. Thus, if a power failure occurs, the MOP output will return to its previous value whenever power is re-applied and the ENABLE contact is closed. In order to limit the number of writes to the EEPROM, the module waits until the MOP output has not changed for one minute before a write is initiated.

5 Adjustment Procedure

WARNING! DURING CALIBRATION, THE MOP250-000 MODULE WILL PRODUCE AN OUTPUT. PLEASE DISCONNECT ANY EQUIPMENT FROM THE MODULE THAT COULD BE DAMAGED OR CAUSE INJURY DURING THIS PROCESS.

Step 1: Select Output Type

1. Select the type of output desired using Jumper J2. If a Voltage output is desired, select V on J2 and use output terminals 7 (OUTPUT) and 8 (VOLTAGE RETURN). If a Current output is desired, select I on J2 and use output terminals 7 (OUTPUT) and 9 (CURRENT RETURN).

Step 2: Connections

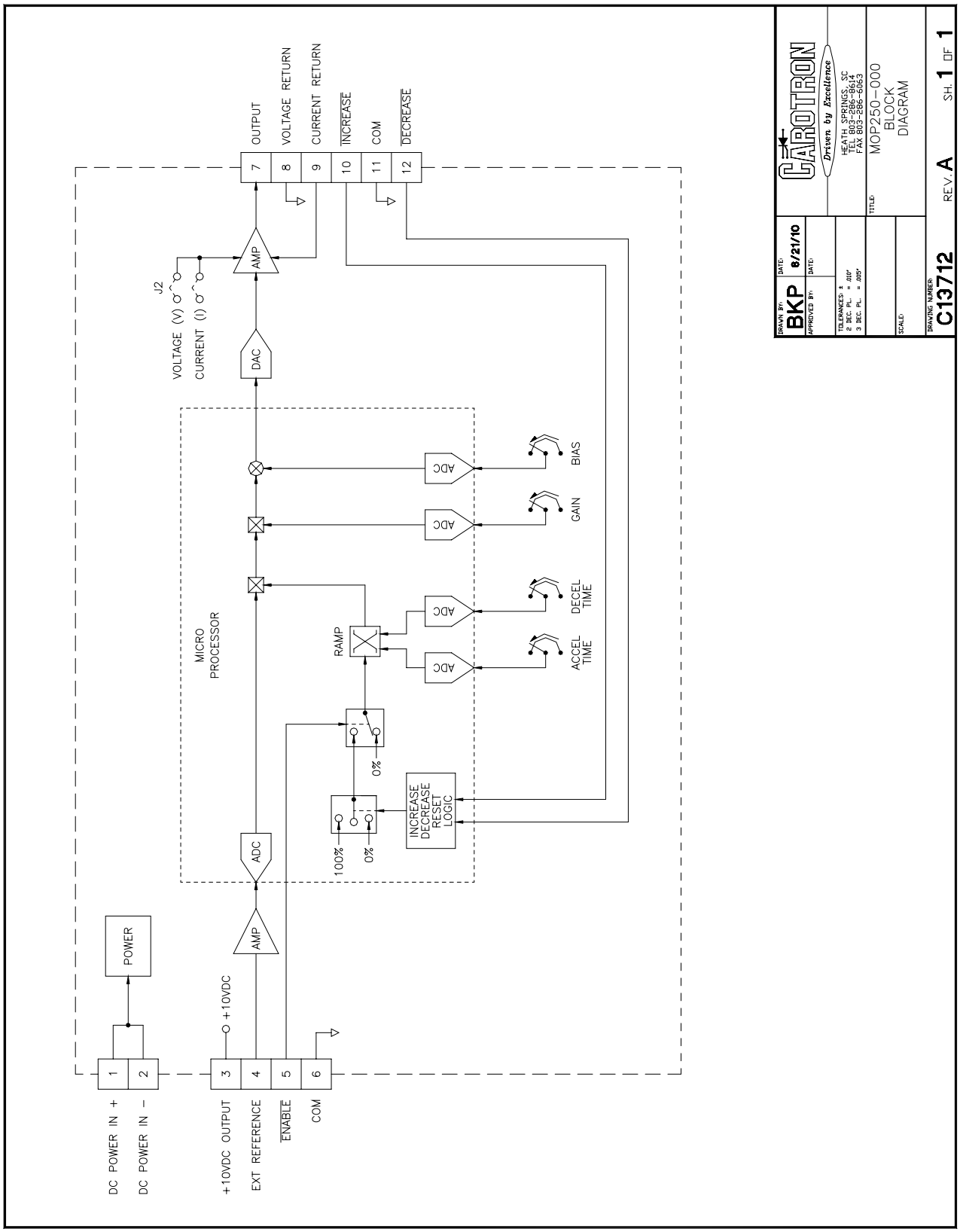
1. Make connections per drawing C13713 on page 10.
2. Apply power to the MOP250-000 Module.

Step 3: Set Bias and Gain

1. With the ENABLE contact open, adjust the BIAS potentiometer until the minimum desired output is reached on terminal 7.
2. Close the ENABLE contact. If an external reference signal is used, set it to its maximum level. Force the MOP output to maximum by closing the INCREASE contact until the output on terminal 7 stops increasing. Adjust the GAIN potentiometer until the desired maximum output level is reached on terminal 7. Reset the MOP output to minimum by momentarily closing both the INCREASE and DECREASE contacts.

Step 4: Set Accel/Decel Times

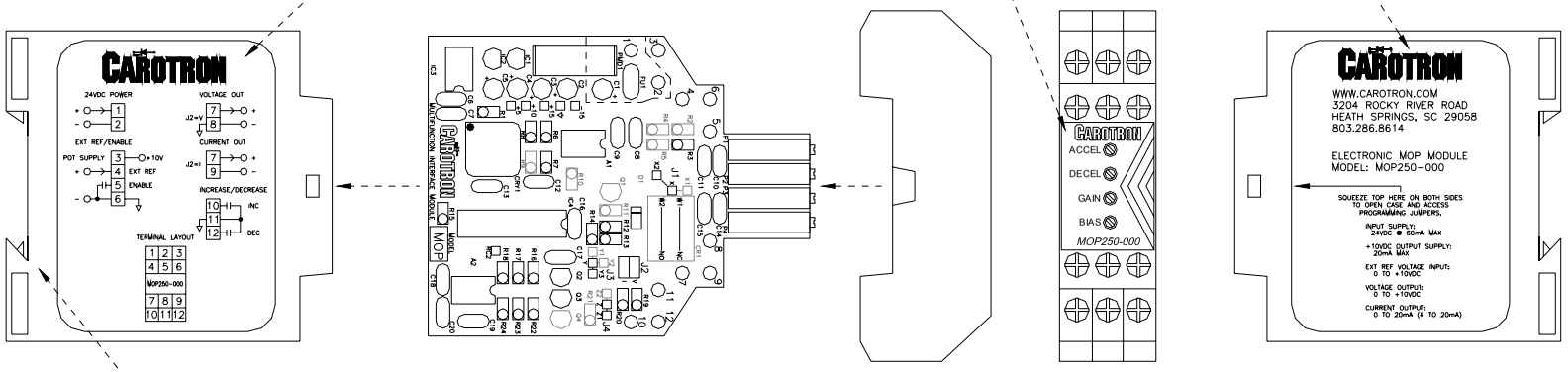
1. Close the INCREASE contact and adjust the ACCEL potentiometer to adjust the time for the output to increase from minimum to maximum. Turn the ACCEL potentiometer clockwise to increase the time and counter-clockwise to decrease the time.
2. Similarly, close the DECREASE contact and adjust the DECEL potentiometer to adjust the time for the output to decrease from maximum to minimum. Turn the DECEL potentiometer clockwise to increase the time and counter-clockwise to decrease the time. Repeat these steps until the desired accel and decel times are achieved.


DC POWER IN +
DC POWER IN –
+10VDC OUTPUT
EXT REFERENCE
ENABLE
COM
1
2
3
4
5
6
POWER
+10VDC
AMP
ADC
MICRO PROCESSOR
RAMP
100%
0%
0%
INCREASE DECREASE RESET LOGIC
ADC
ADC
ADC
ADC
ACCEL TIME
DECEL TIME
GAIN
BIAS
DAC
J2
VOLTAGE (V)
CURRENT (I)
AMP
OUTPUT
VOLTAGE RETURN
CURRENT RETURN
INCREASE
COM
DECREASE
7
8
9
10
11
12
DRAWN BY: BKP
DATE: 8/21/10
APPROVED BY:
DATE:
TOLERANCES: 2 DEC. PL. = .010" 3 DEC. PL. = .005"
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-6641
FAX 803-286-6643
TITLE: MOP250-000 BLOCK DIAGRAM
SCALE:
DRAWING NUMBER: C13712
REV. A
SH. 1 OF 1

APPLY TOP LABEL. ENSURE POTENTIOMETER HOLES LINE UP.

APPLY MODEL NUM LABEL TO RIGHT SIDE

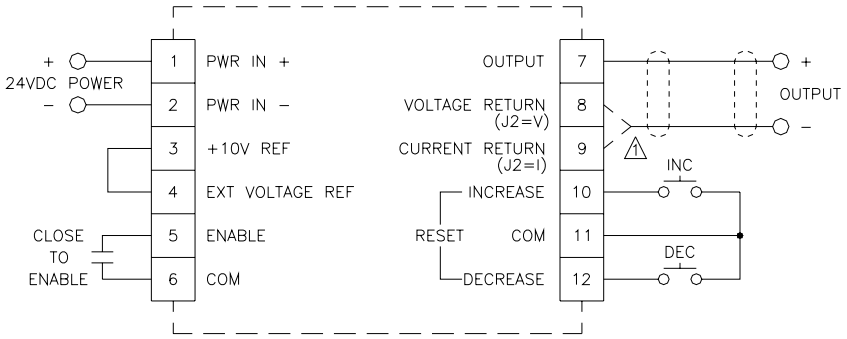
APPLY CONNECTION LABEL TO LEFT SIDE



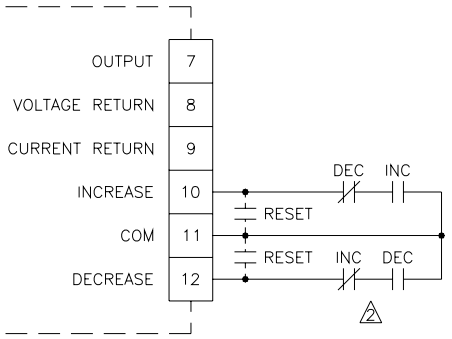
NOTE ORIENTATION OF ENCLOSURE BASE

DRAWN BY: BKP	DATE: 6/22/10	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: X 2 DEC PL. = .010" 3 DEC PL. = .005"		TITLE: MOP MODULE MOP250-000 ASSEMBLY
SCALE:		
DRAWING NUMBER: C13711	REV. A	SH. 1 OF 1

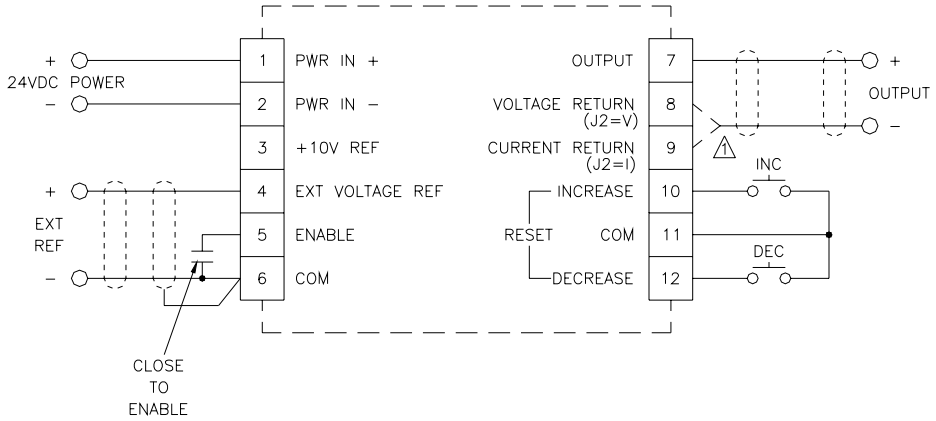
INTERNAL REFERENCE



ALTERNATE RESET WIRING SCHEME



EXTERNAL REFERENCE



NOTES:

1. FOR A VOLTAGE OUTPUT, SET J2=V AND CONNECT THE NEGATIVE OUTPUT WIRE TO TERMINAL 8. FOR A CURRENT OUTPUT, SET J2=I AND CONNECT THE NEGATIVE OUTPUT WIRE TO TERMINAL 9.

2. RESETTING THE MOP BY PRESSING BOTH THE INCREASE AND DECREASE CAN BE DISABLED BY USING THIS ALTERNATE RESET WIRING SCHEME. IF DESIRED, SEPARATE RESET CONTACTS CAN ALSO BE USED.

DRAWN BY: BKP	DATE: 6/22/2010
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"	CAROTRON *Driven by Excellence* HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:	TITLE: MOP250–000 GENERAL CONNECTIONS
DRAWING NUMBER: C13713	REV. A SH. 1 OF 1

7 Standard Terms & Conditions 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.

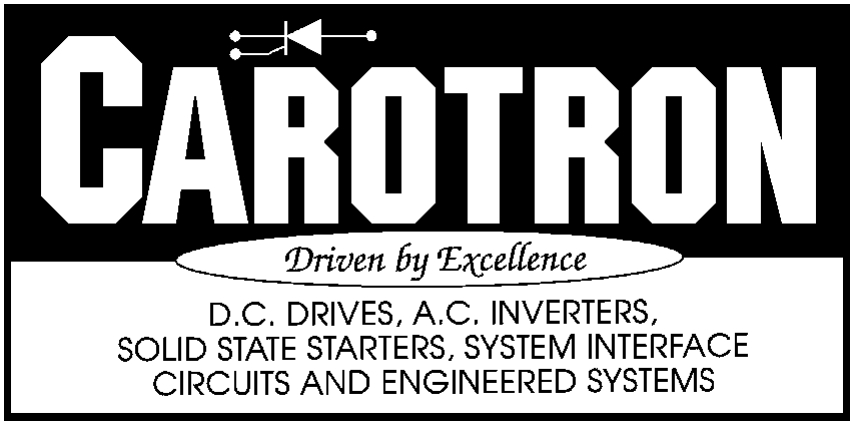
6. Order cancellation
Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either 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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