Accel/Decel Module

Instruction Manual
ADM290-000

CAROTRON

Driven by Excellence

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

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1 General Description

Model ADM290-000 Accel Decel Module is designed to handle a variety of applications where Accel/Decel functions are required without isolation.

Inputs up to 10VDC maximum are acceptable sources. A +10VDC voltage output is available to allow the input signal to be sourced from a 1,000 to 10,000 ohm potentiometer. The Teach input allows the module to learn the minimum (0%) and maximum (100%) input levels.

A contact closure on the Ramp Enable input allows the output to ramp up (at a linear rate based on the Accel Time potentiometer) to the input level. An increase or decrease in the input signal will cause a corresponding change on the output based on the Accel and Decel Time potentiometers. When the Enable contact opens, the input signal is internally clamped to zero forcing the output to ramp down based on the Decel Time potentiometer.

Linear acceleration/deceleration times can be individually adjusted from 1 to 60 seconds. The S Curve potentiometer provides for a gradual change in the linear acceleration/deceleration rates. The S Curve adjustment allows for a 0 to 5 second setting.

A contact closure on the Ramp Reset input immediately clamps the output to minimum. Internal jumper J2 allows the selection of a voltage or current output. A 100% signal input will produce 10V or 20mA. A 0% signal input will produce an output level defined by the Bias potentiometer. This allows for industry standard output levels of 0 to 10V, 0 to 20mA, and 4 to 20mA. Onboard EEPROM is used to backup the calibration values 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

Signal Input
- Range: 0-10VDC
- Input Impedance: 10^{12} Ω

Potentiometers
- Turns: 15

Temperature Range
- 0-55º C

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.

2.2 Physical

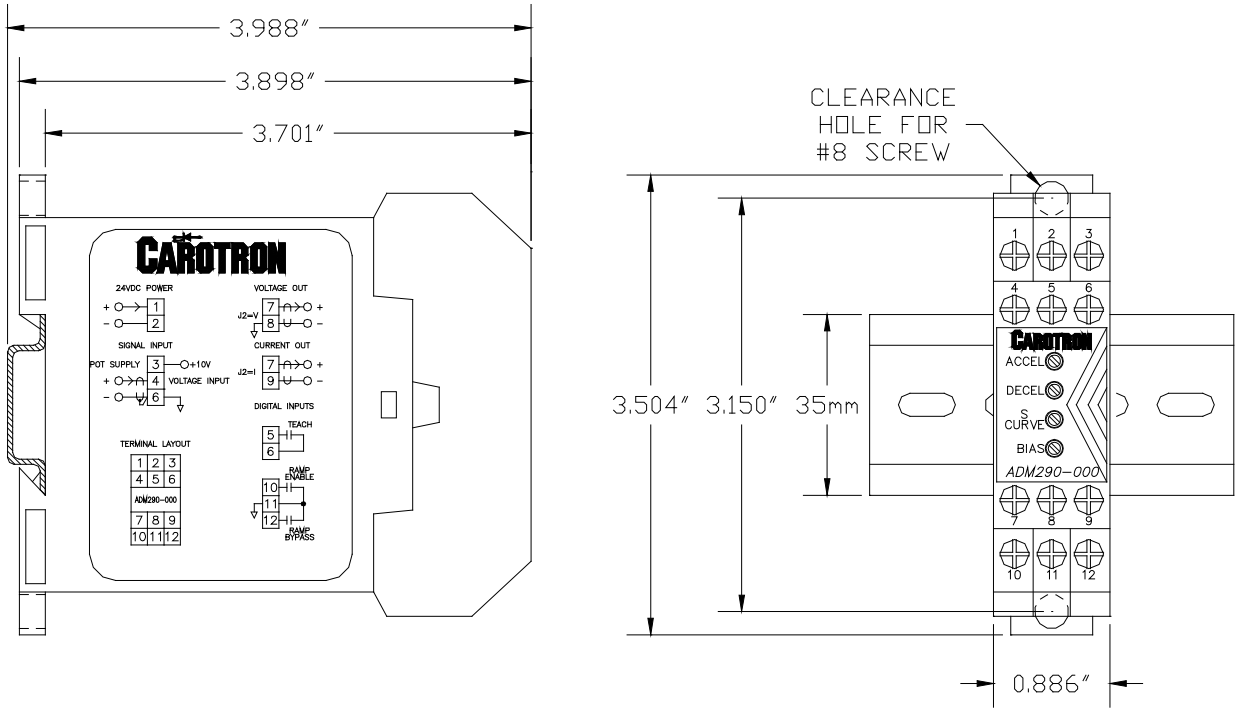


Figure 1: Physical Dimensions

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 ADM290-000 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

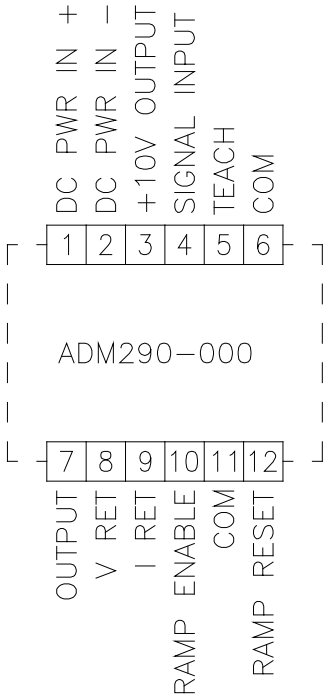


Figure 2: General Connections

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.

TEACH Input
The signal input (terminal 4) can accept a nominal 0 to 10VDC input signal. The Teach input (terminal 5) can be used to calibrate the signal input to the actual minimum and maximum signal levels. Thus, an input signal with a range less than 10V (1V to 9V for example) can be calibrated to reflect a 0 to 100% input. In addition, the order in which the voltage levels are taught can be used to invert the slope of the input. Thus the 1-9V input can reflect a 0-100% or a 100-0% signal.

Apply the signal level to the input that corresponds to 0%. Teach this level by connecting the Teach input (terminal 5) to circuit common (terminal 6 or 11). Next, apply to the input the signal level that corresponds to 100%. Teach this level by disconnecting the Teach input from circuit common. If an error is made during the teach process, simply repeat the procedure.

RAMP ENABLE Input
A contact closure between this input and circuit common (terminal 6 or 11) allows the output to increase o decrease to the level defined by the input. When the contact is opened, the input signal is internally clamped to zero, thus forcing the output to ramp down to its minimum output.

RAMP RESET Input
A contact closure between this input and circuit common (terminal 6 or 11) immediately forces the output to minimum.

ACCEL Potentiometer
This adjustment defines the time for the output signal to increase linearly from minimum output to maximum output (10V or 20mA). A fully counter-clockwise (CCW) position defines an acceleration time of 1 second and fully clockwise (CW) is 60 seconds. Refer to **Figure 3** on page 7.

DECEL Potentiometer
This adjustment defines the time for the output signal to decrease linearly from maximum output (10V or 20mA) to minimum. A fully counter-clockwise (CCW) position defines an deceleration time of 1 second and fully clockwise (CW) is 60 seconds. Refer to **Figure 3** below.

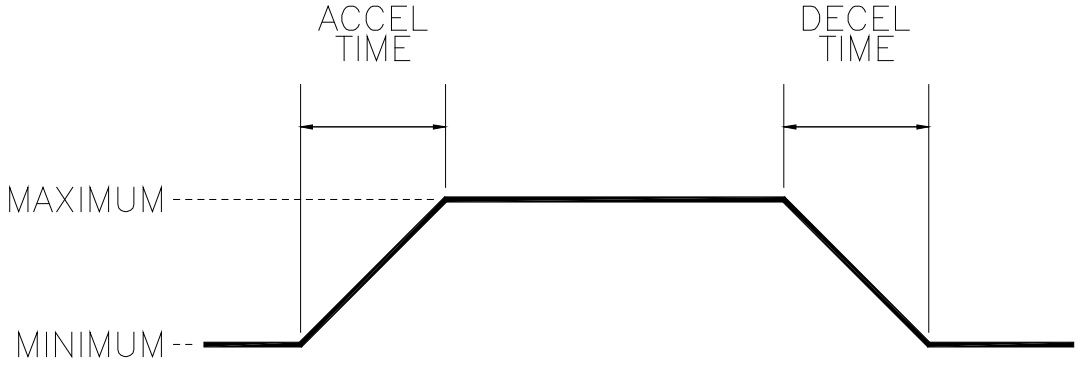


Figure 3: Linear Accel/Decel Adjustment

S CURVE Potentiometer
This adjustment softens the ramping transitions by gradually changing the linear accel or decel rate. The single adjustment affects all four points. A fully counter-clockwise (CCW) position defines no S Curves and fully clockwise (CW) defines a 5 second S Curve time. Refer to **Figure 4** below. The S Curve time adds to the linear accel or decel time. Thus, for a linear accel time of 10 seconds and an S Curve time of 2 seconds, the total acceleration time from minimum to maximum would be 14 seconds (2+10+2). Depending upon the adjustments and the signal levels, some ramps may be composed entirely of S Curves and contain no linear segment.

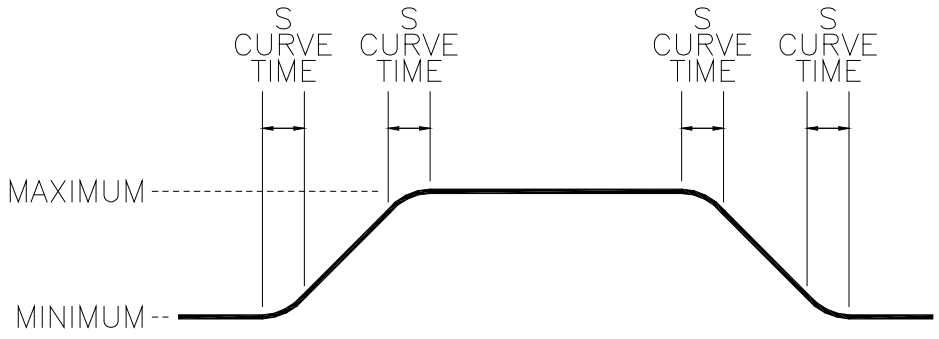


Figure 4: S Curve Adjustment

BIAS Potentiometer
This adjustment defines the minimum output level. With BIAS fully CCW, a 0 to 100% input signal will produce a nominal 0 to 10V or 0 to 20mA output signal. Rotating the BIAS potentiometer clockwise will increase the minimum output level. As the minimum output is increased, the gain is also reduced so that 100% input signal produces a nominal 10V or 20mA. Typically, this adjustment is used in the current output mode to achieve a 4 to 20mA output range.

5 Adjustment Procedure

WARNING! DURING CALIBRATION, THE MUL280-000 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 C13826 on page 12. The contact on the Teach input (terminal 5) should initially be open.

Step 3: Initial Settings

1. Initially set the potentiometers as follows:
   - ACCEL ..... mid-range
   - DECEL ..... mid-range
   - S CURVE .....fully counter-clockwise (CCW)
   - BIAS.....fully counter-clockwise (CCW)
2. Apply power to the module.

Step 4: Teach Input

1. Apply the minimum input signal to terminal 4. Connect the Teach input (terminal 5) to circuit common (terminal 6 or 11).
2. Apply the maximum input signal to terminal 4. Disconnect the Teach input from circuit common.

Step 5: Set Minimum Output

1. With the RAMP ENABLE contact open, adjust the BIAS potentiometer for minimum output on terminal 7. For a voltage output, the minimum output is typically 0V. For a current output, the minimum output is typically either 0mA or 4mA. The maximum output is fixed at 10V or 20mA.

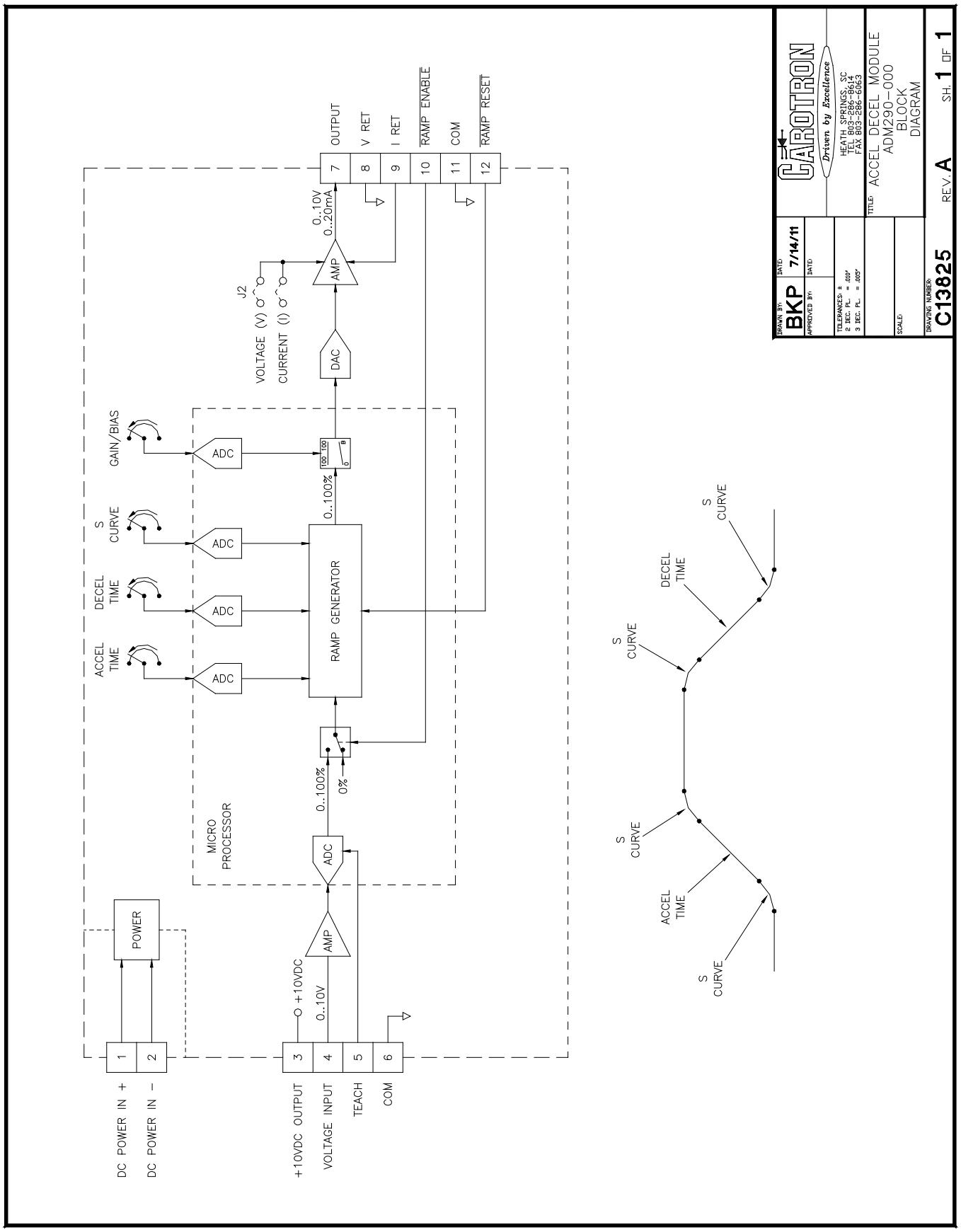
Step 6: Adjust Linear Accel Decel Times

1. Apply the maximum input signal to terminal 4.
2. Using a voltmeter or an ammeter to measure the output on terminal 7, close the RAMP ENABLE contact and note the time it takes for the output to increase from minimum to maximum (10V or 20mA).
3. Open the RAMP ENABLE contact and note the time it takes for the output to decrease from maximum to minimum.
4. Adjust the ACCEL and DECEL potentiometers to obtain shorter or longer times as needed. Repeat steps 6.2, 6.3, & 6.4 until the desired acceleration and deceleration times are achieved.

Step 7: Adjust S Curve

1. If needed, adjust the S Curve potentiometer until the desired level is achieved. Note that the addition of S Curves will add to the linear acceleration and deceleration times set in step 6.

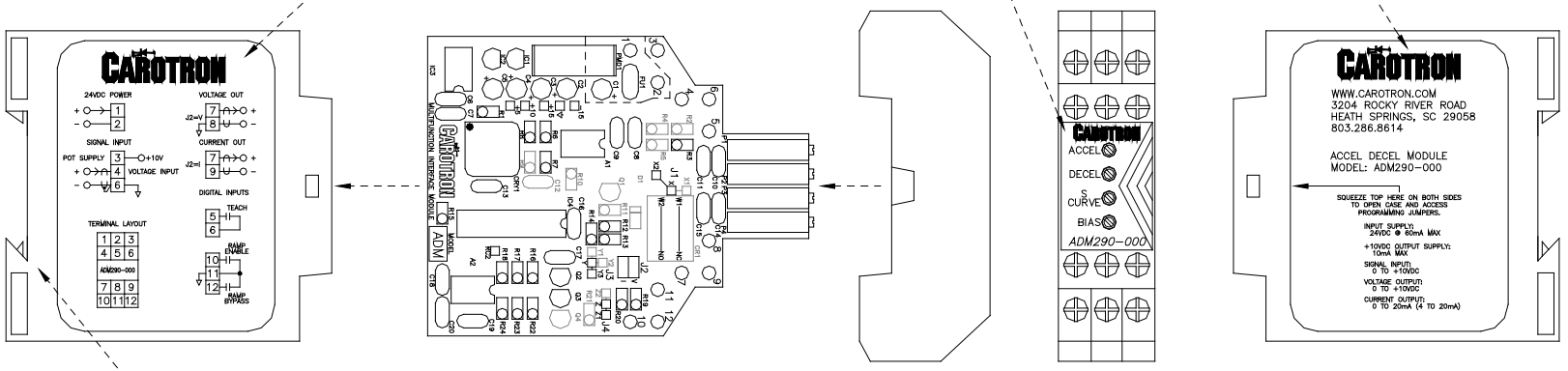
6 Prints


DC POWER IN +
DC POWER IN –
+10VDC OUTPUT
VOLTAGE INPUT
TEACH
COM
POWER
AMP
ADC
0..10V
+10VDC
0..100%
0%
MICRO PROCESSOR
ACCEL TIME
DECEL TIME
S CURVE
GAIN/BIAS
RAMP GENERATOR
DAC
AMP
0..10V
0..20mA
J2
VOLTAGE (V)
CURRENT (I)
OUTPUT
V RET
I RET
RAMP ENABLE
COM
RAMP RESET
DRAWN BY: BKP
DATED: 7/14/11
APPROVED BY:
DATED:
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"
SCALE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-4664
FAX 803-286-6063
TITLE: ACCEL DECEL MODULE ADM290-000 BLOCK DIAGRAM
DRAWING NUMBER: C13825
REV. A
SH. 1 OF 1

APPLY TOP LABEL. ENSURE POTENTIOMETER HOLES LINE UP.

APPLY MODEL NUM LABEL TO RIGHT SIDE

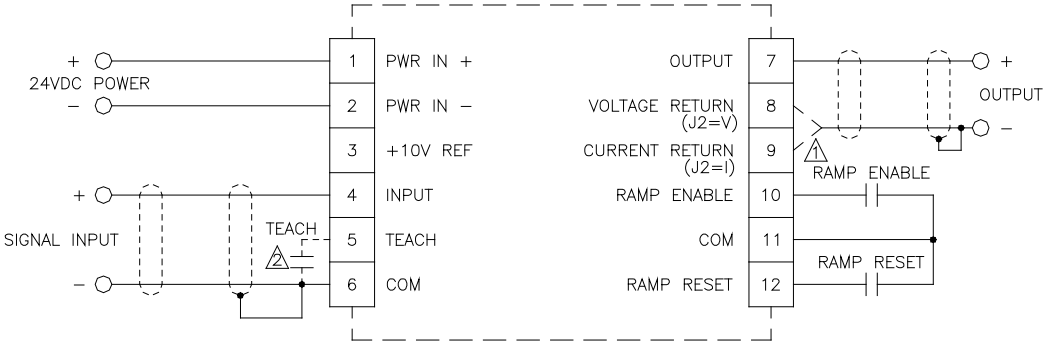
APPLY CONNECTION LABEL TO LEFT SIDE



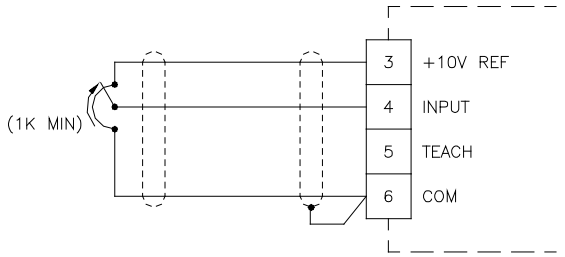
NOTE ORIENTATION OF ENCLOSURE BASE

DRAWN BY: BKP	DATE: 7/14/11	CAROTRON Driven by Excellence	
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063	
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		TITLE: ADM290-000 ACCEL DECEL MODULE ASSEMBLY	
SCALE:			
DRAWING NUMBER: C13824	REV. A	SH. 1 OF 1	

GENERAL CONNECTIONS



POTENTIOMETER INPUT



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. THE TEACH CONTACT IS ONLY NEEDED DURING INITIAL MODULE SETUP.

DRAWN BY: BKP	DATE: 7/21/2011	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		TITLE: ADM290–000 GENERAL CONNECTIONS
SCALE:		
DRAWING NUMBER: C13826	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.

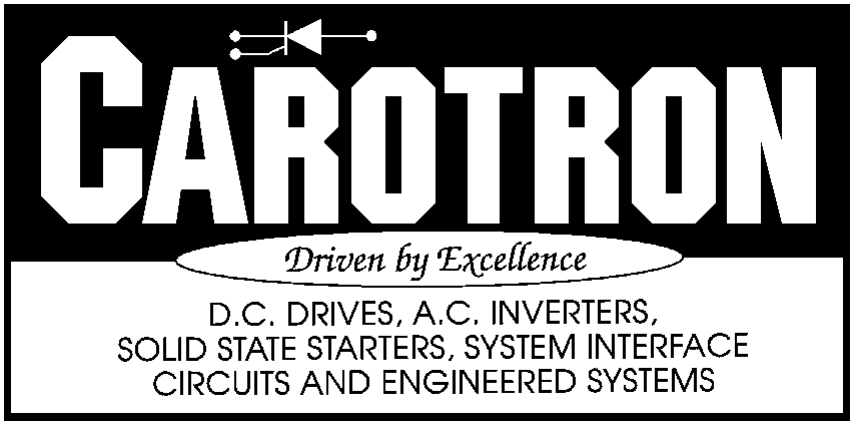
6. Order cancellation
Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either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