



SM-1015 Digital Actuator

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Due to wide variations in the terminal numbering of actuator products, actual wiring of this device should follow the print supplied with the unit.

GENERAL INFORMATION

INTRODUCTION

Jordan Controls, Inc., designs, manufactures, and tests its products to meet many national and international standards. For these products to operate within their normal specifications, they must be properly installed and maintained. The following instructions must be followed and integrated with your safety program when installing, using and maintaining Jordan Controls products:

- Read and save all instructions prior to installing, operating and servicing this product.
- If you do not understand any of the instructions, contact your Jordan Controls representative for clarification.
- Follow all warnings, cautions and instructions marked on, and supplied with, the product.
- Inform and educate personnel in the proper installation, operation and maintenance of the product.
- Install equipment as specified in Jordan Controls installation instructions and per applicable local and national codes. Connect all products to the proper electrical sources.
- To ensure proper performance, use qualified personnel to install, operate, update, tune and maintain the product.
- When replacement parts are required, ensure that the qualified service technician uses replacement parts specified by Jordan Controls. Substitutions may result in fire, electrical shock, other hazards, or improper equipment operation.
- Keep all product protective covers in place (except when installing, or when maintenance is being performed by qualified personnel), to prevent electrical shock, personal injury or damage to the actuator.

WARNING

Before installing the actuator, make sure that it is suitable for the intended application. If you are unsure of the suitability of this equipment for your installation, consult Jordan Controls prior to proceeding.

WARNING - SHOCK HAZARD

Installation and servicing must be performed only by qualified personnel.

WARNING - ELECTROSTATIC DISCHARGE

This electronic control is static-sensitive. To protect the internal components from damage, never touch the printed circuit cards without using electrostatic discharge (ESD) control procedures.

RECEIVING/INSPECTION

Carefully inspect for shipping damage. Damage to the shipping carton is usually a good indication that it has received rough handling. Report all damage immediately to the freight carrier and Jordan Controls, Inc.

Unpack the product and information packet—taking care to save the shipping carton and any packing material should return be necessary. Verify that the items on the packing list or bill of lading agree with your own.

STORAGE

If the product will not be installed immediately, it should be stored in a clean, dry area where the ambient temperature is not less than -20° F. The actuator should be stored in a non-corrosive environment. The actuator is not sealed to NEMA 4 until the conduit entries are properly connected.

EQUIPMENT RETURN

A Returned Goods authorization (RG) number is required to return any equipment for repair. This must be obtained from Jordan Controls. (Telephone: 414/461-9200) The equipment must be shipped, freight prepaid, to the following address after the RG number is issued:

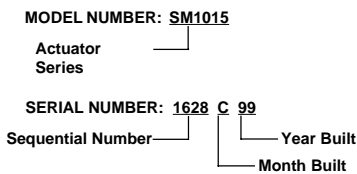
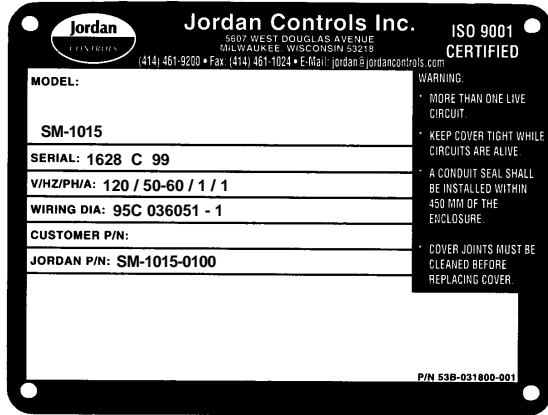
Jordan Controls, Inc.
5607 West Douglas Avenue
Milwaukee, Wisconsin 53218
Attn: Service Department

To facilitate quick return and handling of your equipment, include:
RG Number on outside of box
Your Company Name, Contact Person, Phone/Fax No.
Address
Repair Purchase Order Number
Brief description of the problem

GENERAL INFORMATION

IDENTIFICATION LABEL

An identification label is attached to each actuator cover. When ordering parts, requesting information or service assistance, provide all of the label information.



GENERAL ACTUATOR DESCRIPTION

The SM-1015 series are full-featured actuators offered as a standard package with the capability to accept analog current and voltage control signals. The design provides smooth, highly accurate positioning, with positive position-lock when not in motion. These rugged actuators may be mounted in any position and will withstand the most adverse environmental conditions.

A stepper motor produces torque, which is transmitted to the output shaft through a gear or arrangement. This allows the low torque, high speed motor output to be converted to high torque, low speed for actuator output shaft motion. The built-in servo drive amplifier controls the stepper motor's speed and direction. It also controls actuator end limits, motor torque, deadband, 4-20 mA transmitter, and auxiliary electronic limit switches.

ABBREVIATIONS USED IN THIS MANUAL

A or Amps	Ampere
ac	Alternating Current
° C	Degrees Celsius
CW	Clockwise
CCW	Counterclockwise
dc	Direct Current
° F	Degrees Fahrenheit
G	Earth Ground
Hz	Hertz
kg	Kilogram
L	Line (power supply)
lbs	Pounds
lbf.	Lbs. Force
LVDT	Linear Variable Differential Transformer
mA	Milliamp
mfd	Microfarad
mm	Millimeters
N	Newton (force)
NEMA	National Electrical Manufacturing Assoc.
Nm	Newton Meter
NPT	National Pipe Thread
Ph	Phase
PL	Position Limit Switch
P/N	Part Number
RPM	Revolutions per Minute
SEC	Second
TL	Thrust Limit Switch
Vac	Volts ac
Vdc	Volts dc
VR	Variable Resistance
W	Watt

WARRANTY INFORMATION

Warranty: Subject to the following, Jordan expressly warrants the products manufactured by it as meeting the applicable Jordan product specifications and that such products are free from defects in material and workmanship for a period of one (1) year from the date of delivery. The foregoing is the sole and exclusive warranty made by Jordan with respect to the products. Jordan makes no other warranties, either express or implied (including, without limitation, warranties as to merchantability or fitness for a particular purpose). The purchaser retains responsibility for the application and functional adequacy of the offering. See Jordan's General Conditions of Sale - Product, for complete warranty information.

SM-1015 DIGITAL ACTUATOR SPECIFICATIONS

Standard Line Voltage: 120/240 Vac, $\pm 10\%$
(Slide switch selectable)

Frequency: 50/60 Hz

Power: 18 VA

Command Signal Inputs:

Current: 4-20 mA

Voltage: 0-5 Vdc, 0-10 Vdc

Incremental: Dry contact closures, one for each direction

End of Travel Limit Signals:

Internal: Part of servo control

External: Open transistor, low level logic outputs, adjustable over stroke range. 40 Vdc and 40 mA max.

Intermediate Limit Signals:

Two 40 Vdc, 1 amp contacts

Position Feedback Signal: Isolated 4-20 mA, loop powered with 12-36 Vdc external power supply

Field Wiring Terminations: Barrier terminal block, wire size range 26-14 AWC

Command Signal Monitor: (current command only)
The 1000 series loss-of-signal circuitry monitors the command signal input. If the command signal drops below 3.2 mA or above 20.7 mA, the actuator will either lock in place, drive to the low limit position or drive to the high limit position. (DIP switch selectable)

Current Limit: Automatic adjusting of the current limit

Speed/Force: See speed/torque curve below

Rotation:

90° to 2 turns or 2 to 20 turns. Infinitely adjustable within either range

Output Shaft Motion: All models can go in either direction on an increasing command signal. (DIP switch selectable)

Weight: 16 lbs. (7.3 kg)

Conduit Entry: Two 1/2 NPT, (option for three)

Handwheel: Push to engage, spring return on release (to be used with power off)

Temperature Limits: -40° F to 150° F (-40° C to 65° C)

Enclosure: Explosion-proof for Class I, Division 1, Groups C and D; Dust-ignition-proof for Class II, Division 1, Groups E, F, and G. Type 4 (IP65), indoor or outdoor

Positioning Accuracy: +/-0.25% of full range or better

Duty Cycle: Unrestricted modulating duty. (Cont. duty)

SPEED/TORQUE CURVE

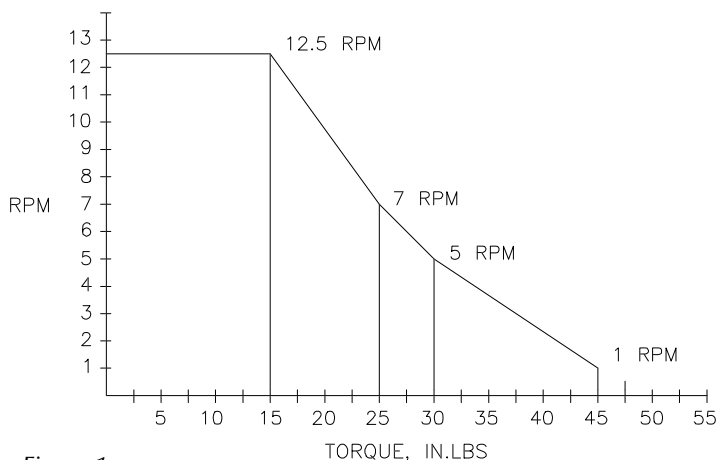


Figure 1

To calculate shift time (total stroke), use:

$$\text{Shift time (sec.)} = \frac{\text{maximum revolutions required} \times 60}{\text{RPM}}$$

Example:
90° rotation at 1 RPM, 45 in. lbs. torque = $\frac{0.25 \times 60}{1} = 15 \text{ sec.}$

INSTALLATION WIRING

GENERAL

All wiring should be done in accordance with prevailing codes by qualified personnel.

Typical wiring diagrams are shown on page 10. Actual wiring should follow the print supplied with the actuator.

Fusing must be installed in line power, and should be of the slow blow type. Recommend 1 amp for ac input models and 5 amp for dc input models.

Wiring should be routed to the actuator through one of the 1/2 inch conduit openings. Generally, one conduit will contain input power and earth ground wires. The other conduit would then contain low level input and output signal wiring. It is required that all low level signal wiring be a shielded type with the shield grounded at source common.

After installation, it is required that all conduits be sealed to prevent water damage.

Maximum recommended wire size is 14 AWG, and minimum is 26 AWG.

WIRING TO TB2

Input power terminates at TB2. For ac models, terminal 1 is hot, and terminal 2 is neutral. For dc models, terminal 1 is positive (+), and terminal 2 is negative (-).

WIRING TO TB3

Current command (4-12 mA, 12-20 mA, or 4-20 mA) wires terminate at terminal 3 (-) and to terminal 4 (+). Voltage command (0-5 Vdc or 0-10 Vdc) wiring terminates on terminals 5 (+) and 6 (-).

The incoming power supply earth ground should be securely connected to the green ground screw located inside the actuator base between the two conduit entries.

WIRING TO TB1

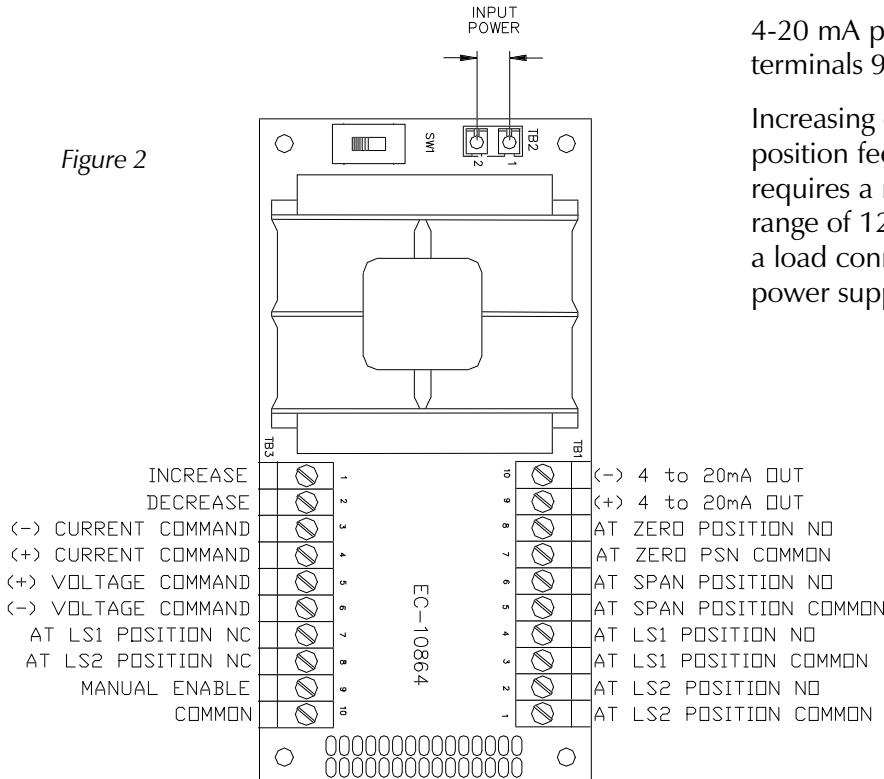
If ZERO and SPAN are used as auxiliary position limit switches, the connection is TB1, 5 to 8. Maximum voltage is 40 Vdc and maximum current is 40 mA.

If LS1 and LS2 are used as auxiliary limit switches, the connection can be normally open or normally closed. The NO configuration uses TB1, 1 through 4. The NC configuration uses TB1, 1 & 3 and TB3, 7 & 8. The contacts are rated for 40 Vdc, 1 amp.

4-20 mA position feedback signal wires connect to terminals 9 (+) and 10 (-).

Increasing command signal will result in an increasing position feedback signal. Operation of the transmitter requires a regulated external dc power supply in the range of 12 Vdc (minimum) to 36 Vdc (maximum) and a load connected in series with one lead from the power supply. (see typical wiring diagrams on page 10)

Figure 2



SETUP INFORMATION

AMPLIFIER SETUP

WARNING: *This setup must be done with power off.*

INPUT POWER

If input power is 120 or 240 Vac, the upper pc board slide switch must be placed in the appropriate position.

Failure to do this can result in extensive damage.

Dc powered units do not have this slide switch.

DIP SWITCH SETTINGS

Refer to table 3, page 7.

Switch 1 – Direct or reverse acting selection

- A) For direct action on increasing command signal (Clockwise rotation of the output shaft), place Dip switch #1 into the “OFF” position.
- B) For reverse action on increasing command signal (counter clockwise rotation of the output shaft), place Dip switch #1 into the “ON” position.

Switch 2 & 3 – Loss of signal action

The loss of signal monitors the current command signals only (See switch 2&3 setting). This is active when the input command signal drops below 3.2 mA, or goes above 20.7 mA.

- A) Loss of signal lock in place is active when switch 2 is in the “OFF” position and switch 3 is in the “OFF” position. When a loss of signal condition is present, the actuator will stay in its current position.
- B) Loss of signal goto zero position is active when switch 2 is in the “ON” position and switch 3 is in the “OFF” position. When a loss of signal condition is present, the actuator will move to the preset zero position.
- C) Loss of signal goto span is active when switch 2 is in the “OFF” position and switch 3 is in the “ON” position. When a loss of signal condition is present, the actuator will move to the preset span position.
- D) If both switch 2 and switch 3 are in the “ON” position, then the actuator will lock in place during a loss of signal condition (see point A).

Switch 4 – Local operation

The local operation is active when switch 4 is placed in the “ON” position. This mode of operation is used for the setting of the zero, LS1, LS2, and span positions. In the mode of operation the actuator can be jogged using the increase and decrease push buttons located on the lower PC board. The entire range of motion of the actuator can be moved in this mode of operation, regardless of the zero and span settings.

Switch 5 – 0 to 5 volt command

This switch is used in conjunction with switch 7. When this switch is in the “ON” position, and switch 7 is in the “ON” position the actuator will respond to a 0 to 5 Vdc command signal. This is used, so that the actuator will go to its zero position when a 0 Vdc input command is received. The actuator will go to its span position when a 5 Vdc input command is received.

Switch 6 – Current command

The current command signal is enabled by placing switch 6 into the “ON” position. In this mode of operation, the actuator will go to the zero position on a 4 mA command. The actuator will goto the span position on a 20 mA command. The loss of signal mode is only active in this mode of operation.

Switch 7 – Voltage command

The volatage command is activated by placing switch 7 into the “ON” position. This mode of operation will work with a 0 to 10 Vdc command signal, or a 0 to 5 Vdc command signal, depending on the position of switch 5. If switch 5 is in the “OFF” position, then a 0 to 10 Vdc command signal will be used. If switch 5 is in the “ON” position, then a 0 to 5 Vdc command signal will be used.

Switch 8 – Local setpoint

This switch is currently intended for factory use only, and should always remain in the “OFF” position.

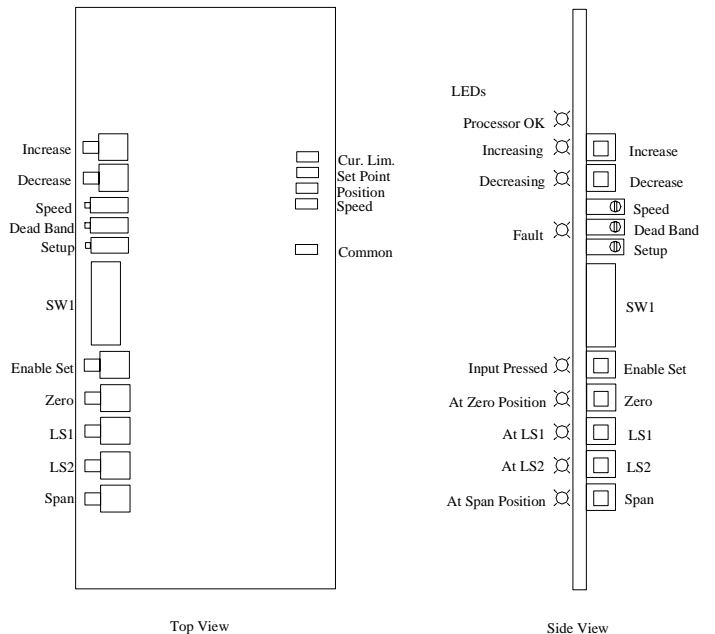


Figure 3

NORMAL OUTPUT SHAFT MOTION FOR INCREASING SIGNAL

OBSERVATION	SM-1015
Standard output shaft motion for an increasing signal	CW
Switch 1 position for normal actuator operation	OFF Position
Stepper motor rotation for an increasing signal	CCW
Stepper motor drive indication for an increasing motion	INC LED is ON
Stepper motor drive indication for an decreasing motion	DEC LED is ON
ZERO and LS1 trip direction (for standard operation only)	CCW
SPAN and LS2 trip direction (for standard operation only)	CW
Output shaft movement with a CW handwheel rotation	CCW

The SM-1015 series servo amplifier has directional references: NORMAL/REVERSE, HIGH/LOW, HI/LOW SETPOINTS and INCREASE/DECREASE.

Jordan Controls has established a standard for actuator output motion for all actuators including the SM-1015. Wiring drawings conform to this standard. For rotary actuators, the actuator will rotate CW (when looking into the shaft) for increasing signal.

Table 1

RECOMMENDED SPARE PARTS LIST

PART NUMBER	DESCRIPTION
68C-039430-001	Lower logic board
68C-039280-001	SM-1015B upper power supply
68C-039280-003	SM-1015E upper power supply
74B-010957-159	Cover O-Ring
18A-032667-001	Output shaft bushing
19B-003815-030	Output shaft seal
61B-036257-001	Feedback nut 7/8 acme, bronze
61B-036258-001	Feedback nut 7/8-24, bronze
62B-032198-001	Output shaft, 7/8 acme
62B-032197-001	Output shaft 7/8-24
61B-010954-116	Output shaft key
17B-003813-009	Output shaft bearing
16B-032189-001	Motor pinion gear
61A-034422-001	Handwheel shaft
74B-010957-014	Handwheel shaft O-Ring
20A-034422-001	Handwheel spring
61A-034423-001	Handwheel knob

Table 2

DIP SWITCH CONFIGURATIONS

Dip Switch Configurations SW1		
Switch	Switch Position	Function
1	OFF	Direct Acting
	ON	Reverse Acting
2	ON	LOS go to ZERO (see switch 2&3)
3	ON	LOS go to SPAN (see switch 2&3)
4	OFF	Remote Operation Enabled
	ON	Local Operation Enabled
5	ON	0-5 Vdc Command Signal (switch 7 must be ON)
6	ON	4-20 mA Command Signal
7	ON	Voltage Command Signal (0-10 Vdc if switch 5 is OFF)
8	OFF	Factory Use Only

Table 3

START-UP INFORMATION

START UP FOR LOW LEVEL CURRENT OR VOLTAGE COMMAND SIGNALS

- 1) **Power.** Before applying AC or DC power to TB2 of the upper power supply board, as the appropriate model requires, set slide switch to the correct voltage.
- 2) **Setpoints.** These are the end of travel extremes corresponding to the actuator output shaft positions desired for low and high command signal levels. They are set by the ZERO and Span push buttons
 - A) Place the actuator into the local mode of operation by placing switch 4 into the "ON" position.
 - B) Place the command signal to the lowest level (i.e. 4 mA).
 - C) Jog the actuator using the increase or decrease push buttons, until the desired position has been reached.
 - D) Set the ZERO position by pressing the "ENABLE SET" and the "ZERO" push buttons at the same time. The LED under the "ENABLE SET" push button should come on while these push buttons are pressed.
 - E) Place the command signal to the highest level (i.e. 20 mA).
 - F) Jog the actuator using the increase push button, until the desired maximum position has been reached.
 - G) Set the SPAN position by pressing the "ENABLE SET" and the "SPAN" push buttons at the same time. The LED under the ENABLE SET push button should come on while these buttons are pressed.
 - H) Remove the actuator from local mode by placing switch 4 into the "OFF" position
- 3) **Deadband** This adjustment establishes the actuator servo sensitivity and is set to tolerate electrical "noise" on the command signal, mechanical instability, backlash, etc. It governs the "tightness" of the operating servo loop. It is factory set and "sealed" at ± 0.1 mA command signal in current before actuator position is changed. If the actuator begins to oscillate (Green and Yellow LEDs turn on and off rapidly), decrease the sensitivity by turning the deadband pot slowly CW until oscillation stops.
- 4) **Speed Adjust** Actuator output speed is set by the motor speed pot. Adjust the motor speed pot to desired actuator output shaft speed. CW rotation increases speed. The desired speed can be adjusted by using the graph shown in Figure 4 with a

voltmeter connected between "SPEED" and "COMMON" test points (Figure 3).

- 5) **Auxillary limit switches.** These are electronic position switches that can be set throughout the range of the actuator. LS1 is "ON" when the actuator position is less than the set position. LS2 is "ON" when the actuator position is greater than the set position. These positions are set as follows:
 - A) Place the actuator into the local mode of operation by placing switch 4 into the "ON" position.
 - B) Jog the actuator using the increase or decrease push buttons, until the desired LS1 position has been reached.
 - C) Set the LS1 position by pressing the "ENABLE SET" and the "LS1" pushbuttons at the same time. The LED under the "ENABLE SET" push button should come on while these push buttons are pressed.
 - D) Jog the actuator using the increase or decrease pushbuttons, until the desired LS2 position has been reached.
 - E) Set the LS2 position by pressing the "ENABLE SET" and the "LS2" pushbuttons at the same time. The LED under the ENABLE SET push button should come on while these push buttons are pressed.
 - F) Remove the actuator from local mode by placing switch 4 into the "OFF" position
- 6) **Verify all settings** by running the actuator through its travel range several times. Also verify loss of signal (LOS) action.
- 7) **Transfer to Automatic** control and observe that operation is proper before leaving the actuator unattended.

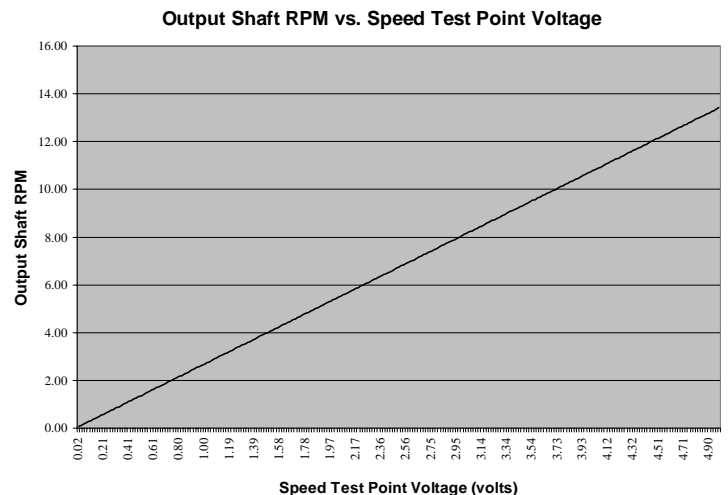


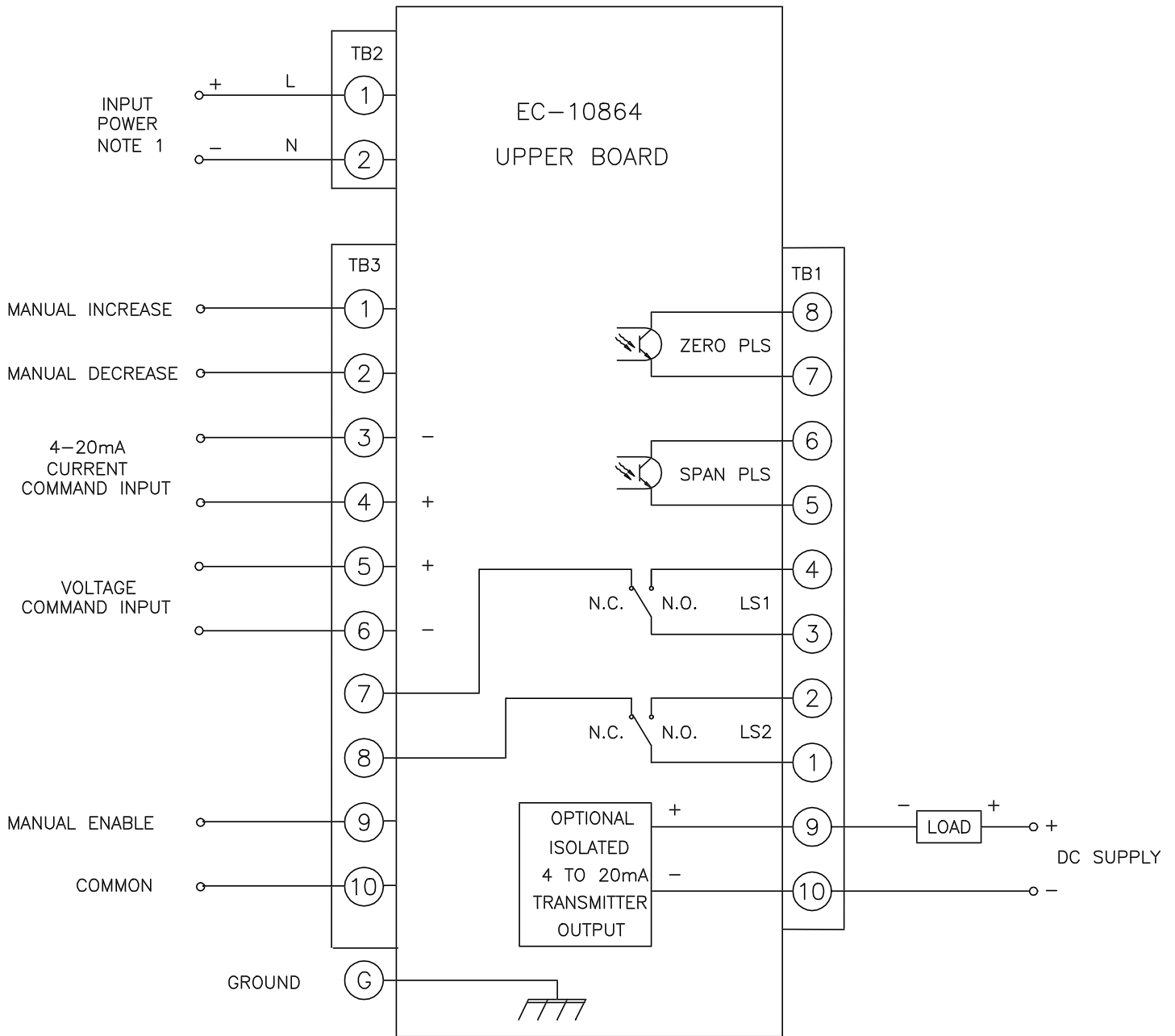
Figure 4

START-UP INFORMATION

START UP FOR INCREMENTAL CONTROL

- 1) **Power.** Before applying AC or DC power to TB2 of the upper power supply board, as the appropriate model requires, set slide switch to the correct voltage.
- 2) Place a jumper between terminals 9 and 10 on terminal block TB3 on the upper power supply board. If there is a need for remotely enabling/disabling the incremental mode of operation, then a dry contact relay can be used.
- 3) Two isolated, dry contact closures are used to position the actuator. These contacts may be within a remotely located controller or may take the form of external pushbuttons or switches for manual control. NOTE: the Hi and Lo setpoint pots have no influence in this mode.
- 4) **Setpoints.** These are the end of travel extremes corresponding to the actuator output shaft positions desired for low and high command signal levels. They are set by the ZERO and SPAN push buttons
 - A) Place the actuator into the local mode of operation by placing switch 4 into the "ON" position.
 - B) Place the command signal to the lowest level (i.e. 4 mA).
 - C) Jog the actuator using the increase or decrease push buttons, until the desired position has been reached.
 - D) Set the ZERO position by pressing the "ENABLE SET" and the "ZERO" push buttons at the same time. The LED under the "ENABLE SET" push button should come on while these push buttons are pressed.
 - E) Place the command signal to the highest level (i.e. 20 mA).
 - F) Jog the actuator using the increase push button, until the desired maximum position has been reached.
 - G) Set the SPAN position by pressing the "ENABLE SET" and the "SPAN" push buttons at the same time. The LED under the ENABLE SET push button should come on while these push buttons are pressed.
 - H) Remove the actuator from local mode by placing switch 4 into the "OFF" position
- 5) **Deadband** This adjustment establishes the actuator servo sensitivity and is set to tolerate electrical "noise" on the command signal, mechanical instability, backlash, etc. It governs the "tightness" of the operating servo loop. It is factory set and "sealed" at ± 0.1 mA change in current before actuator position is changed. If the actuator begins to oscillate (Green and Yellow LEDs turn on and off rapidly), decrease the sensitivity by turning the deadband pot slowly CW until oscillation stops.
- 6) **Speed Adjust** Actuator output speed is set by the motor speed pot. Adjust the motor speed pot to desired actuator output shaft speed. CW rotation increases speed. The desired speed can be adjusted by using the graph shown in Figure 4 with a voltmeter connected between "SPEED" and "COMMON" test points (Figure 3).
- 7) **Auxillary limit switches.** These are electronic position switches that can be set throughout the range of the actuator. LS1 is "ON" when the actuator position is less than the set position. LS2 is "ON" when the actuator position is greater than the set position. These positions are set as follows:
 - A) Place the actuator into the local mode of operation by placing switch 4 into the "ON" position.
 - B) Jog the actuator using the increase or decrease push buttons, until the desired LS1 position has been reached.
 - C) Set the LS1 position by pressing the "ENABLE SET" and the "LS1" push buttons at the same time. The LED under the "ENABLE SET" push button should come on while these push buttons are pressed.
 - D) Jog the actuator using the increase or decrease push buttons, until the desired LS2 position has been reached.
 - E) Set the LS2 position by pressing the "ENABLE SET" and the "LS2" push buttons at the same time. The LED under the ENABLE SET push button should come on while these push buttons are pressed.
 - F) Remove the actuator from local mode by placing switch 4 into the "OFF" position
- 8) **Verify all settings** by running the actuator through its travel range several times. Also verify loss of signal (LOS) action.
- 9) **Transfer to Automatic** control and observe that operation is proper before leaving the actuator unattended.

TYPICAL WIRING DIAGRAMS



Due to wide variations in the terminal numbering of actuator products, actual wiring should follow the print supplied with the actuator.

Note 1

Input Power:
 120/240 Vac, 50/60 Hz
 Input power to terminals TB2-1 & TB2-2
 Select desired input power by sliding power selection switch on Upper P.C. Board

24 Vdc
 Input power to terminals TB2-1 & TB2-2

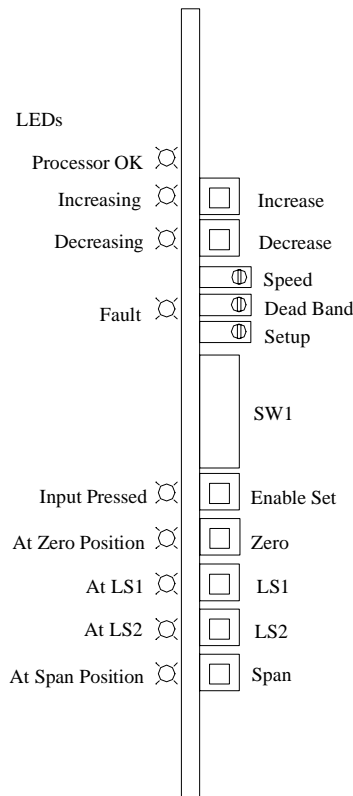
TROUBLESHOOTING GUIDE

VISUAL TROUBLESHOOTING

For visual troubleshooting, LEDs are provided to display the status of the actuator. These are located on the same side of the lower board as SW1. The identification of these LEDs are shown in the table below, and are ordered as the LEDs appear: left to right.

LED	Function
Microprocessor running	This LED is on when power is applied to the microprocessor, and the microprocessor is running. If this is not on, then verify power to the board, as well as the SW1 setting on the top board
Actuator Increasing	This LED is on when the actuator is moving in the increasing direction
Actuator Decreasing	This LED is on when the actuator is moving in the decreasing direction.
Fault	This LED will flash when a fault is present. The LED will flash at a given rate. If the LED is flashing at 0.5 second intervals, then a LOS for the remote set point is present. If the LED is flashing a 2 second intervals, then the remote operation is disabled because the zero and span positions have not been set.
Set Point Pressed	This LED will be on when the set push button and one of the other four setup push buttons have been pressed at the same time
Zero Position	This LED will be on when the actuator is at or below its set zero position.
LS1 Position	This LED will be on when the actuator position is less than the LS1 set position.
LS2 Position	This LED will be on when the actuator position is greater than the LS2 set position.
Span Position	This LED will be on when the actuator is at or above its span position.

Table 4



TROUBLESHOOTING GUIDE

ELECTRICAL TROUBLESHOOTING

Electrical troubleshooting can be performed using the five test points that are located on the motor connector side of the lower board (see figure 3). The black test point labeled COM is used for the common connection for the voltage meter or oscilloscope. The functions and valid range of the remaining five red test points are shown in the table below.

Test Point	Function	Range
SPEED	The value from potentiometer R59 for the speed of the actuator.	0 to 5 volts should be read at this test point. See Figure 4
POSITION	The position of the actuator based on the linear potentiometer located underneath the lower board.	A value of 1.57 to 4.49 volts should be read at this test point.
SET POINT	The set point command.	1) If 4 to 20ma is selected, then 0.8 volts to 4 volts is the expected value. See Figure 5. 2) If 0 to 5 v is selected then, 0 to 5 volts is the expected value. 3) If 0 to 10v is selected, then 0 to 5 volts is the expected value.
CUR. LIM.	The current limit value	Factory set for system calibration.

Table 5

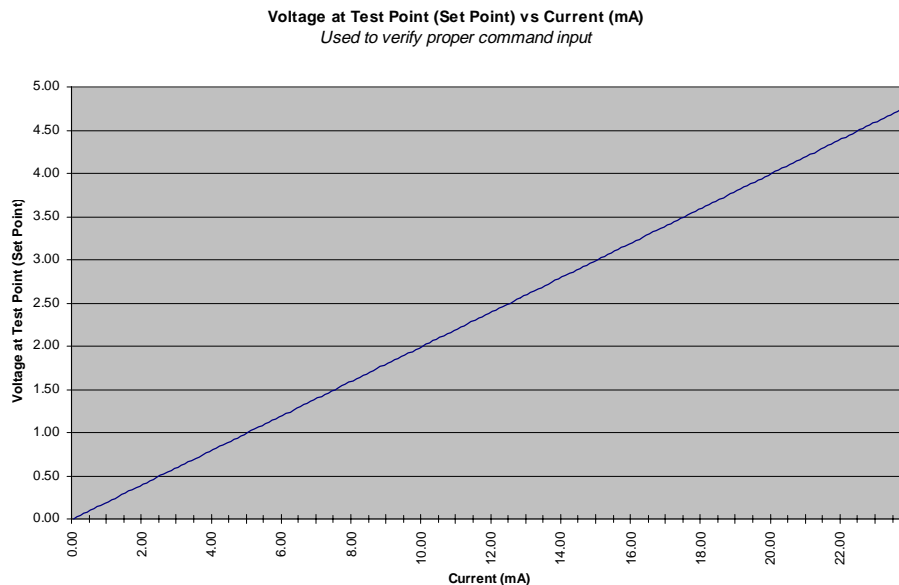


Figure 5

INSTALLATION DIMENSIONS

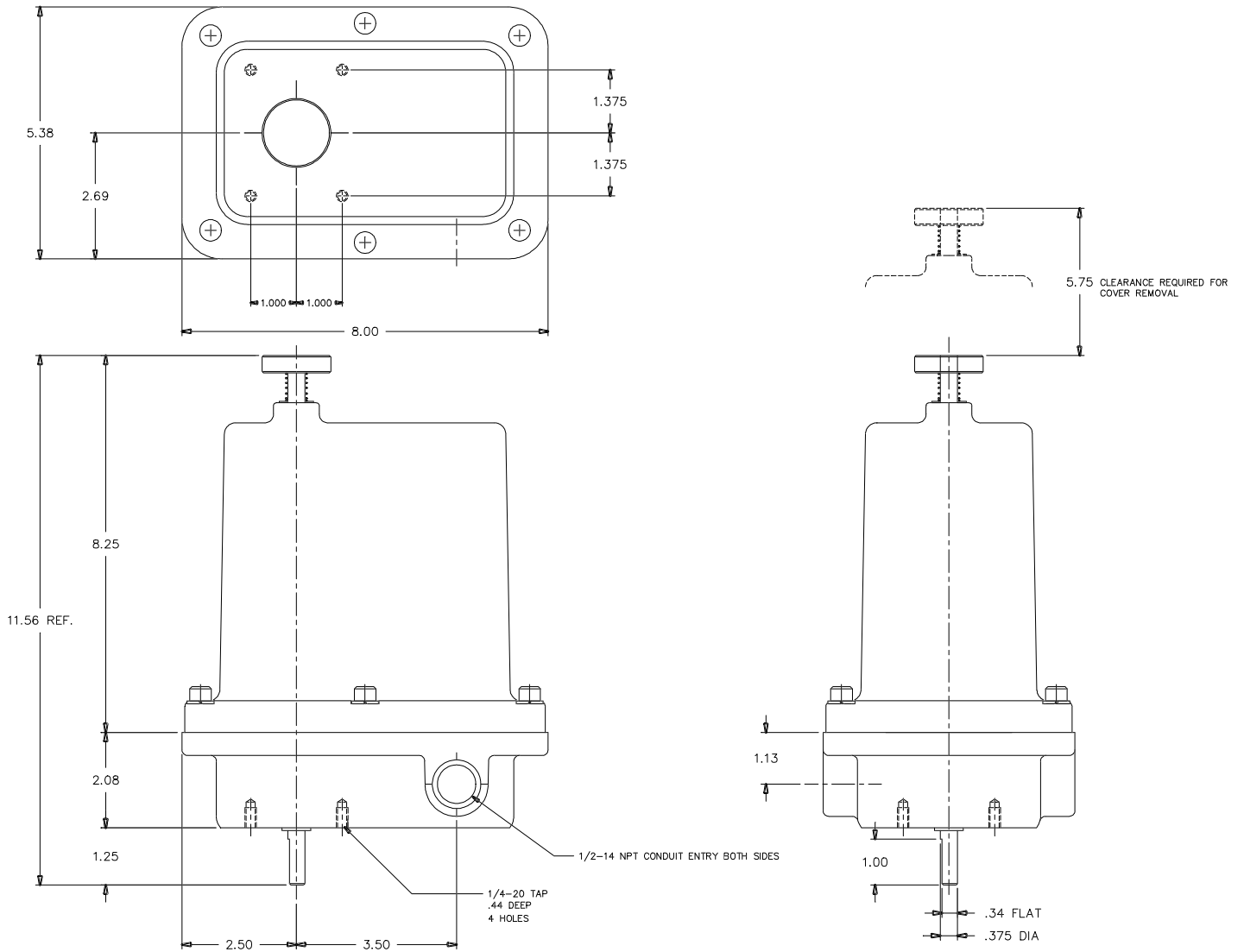


Figure 6

JORDAN CONTROLS, INC.
5607 West Douglas Avenue
Milwaukee, Wisconsin 53218
Phone: (414) 461-9200
FAX: (414) 461-1024
E-Mail: jordan@jordancontrols.com
www.jordancontrols.com
IM-0614 5/00

The dimensions in this manual are subject to change without notice and should not be used for preparation of drawings or fabrication of installation mounting. Current installation dimension drawings are available upon request.

