

REMOTE MOUNT SOLENOID DRIVER (4-20 mA Input Version)

Part No.:

PCB Board - RSD-PCB-4-20MA-x

DIN Rail Mount – RSD-DR-4-20MA-x

Packaged Driver (board installed in housing assembly)

Available with no cable - RSD-SMB-4-20MA-x-00

Available with 3 connectors – RSD-SMB-4-20MA-x-01

IP65 rated, with cable - 5 ft. (1.5m)

- RSD-SMB-4-20MA-x-IP5-1.5M

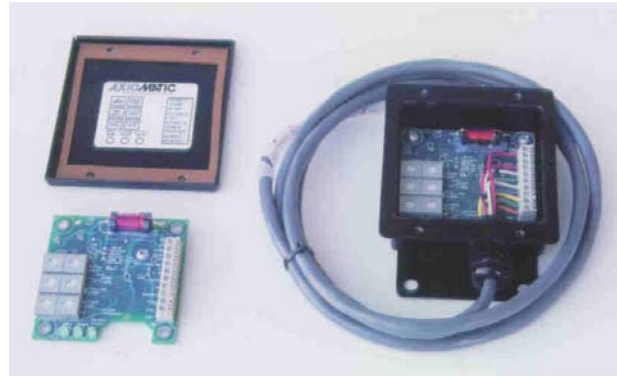
IP67 rated, with cable - 5 ft. (1.5m)

- RSD-SMB-4-20MA-x-IP7-1.5M

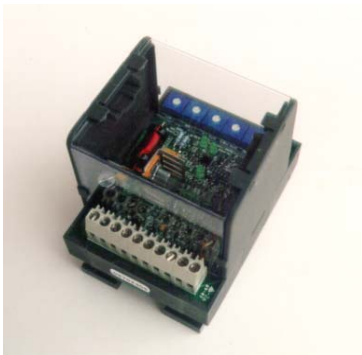
Where x = maximum current output

(2A, 1.2A, 800mA, 600mA or 400mA)

y = 1.5 or custom cable lengths (meters)



Application: Accurate control of hydraulic and pneumatic proportional solenoid valves used in mobile equipment and industrial processes.



Description: The Remote Mount Solenoid Driver simplifies control of proportional solenoids by supplying a current proportional to a 4-20 mA input signal. It accepts power supply voltages from 9 to 28 VDC. This linear solenoid driver utilizes high frequency switching output (PWM) to provide a DC current output. The options for current output include 2 A, 1.2 A, 800 mA, 600 mA or 400 mA. A current sensing circuit maintains output current regardless of changes in input voltage and coil resistance. The user can adjust maximum and minimum current. Ramp time, dither frequency and amplitude can also be adjusted to match the application. A system of LED's indicates output power level, input level and power on/off. The unit is available as a stand alone PCB Board, DIN rail mount version for control cabinets or as a Packaged Driver enclosed in an IP65 or IP67 rated metal housing with cable provided. It is designed for remote mounting. Other models are available including a DIN 43650 coil mount version, a version that accepts 0-10 V as well as a version that accepts 0-5 VDC, 0-20 mA or 10K potentiometer control inputs.

Features:

- Stand alone PCB Board, DIN rail mount version or enclosed in a metal housing (3 connectors or cable optional)
- Current sensing circuit maintains output current regardless of changes in input voltage and coil resistance
- Maximum current adjustment does not affect minimum current setting
- Broad range of supply voltages (9 to 28 VDC) with no degradation in performance
- Modern technology utilizing high frequency switching output (PWM)
- Energy efficient design (no heat sink is required)
- Accepts a 4-20 mA signal input (0-5 VDC, 0-10 VDC, potentiometer and 0-20 mA versions available)
- Options for current output include 2 A, 1.2 A, 800 mA, 600 mA or 400 mA
- LED indication of output power level, input level and power on/off
- Electronic limiting circuit means no internal fuses
- Short circuit proof (in case of solenoid failure or miswiring) and reverse polarity protection provided
- CE certified for EMC
- UL and cUL versions on request
- Metal box version carries IP67 rating
- Integral filter eliminates electrical noise generation

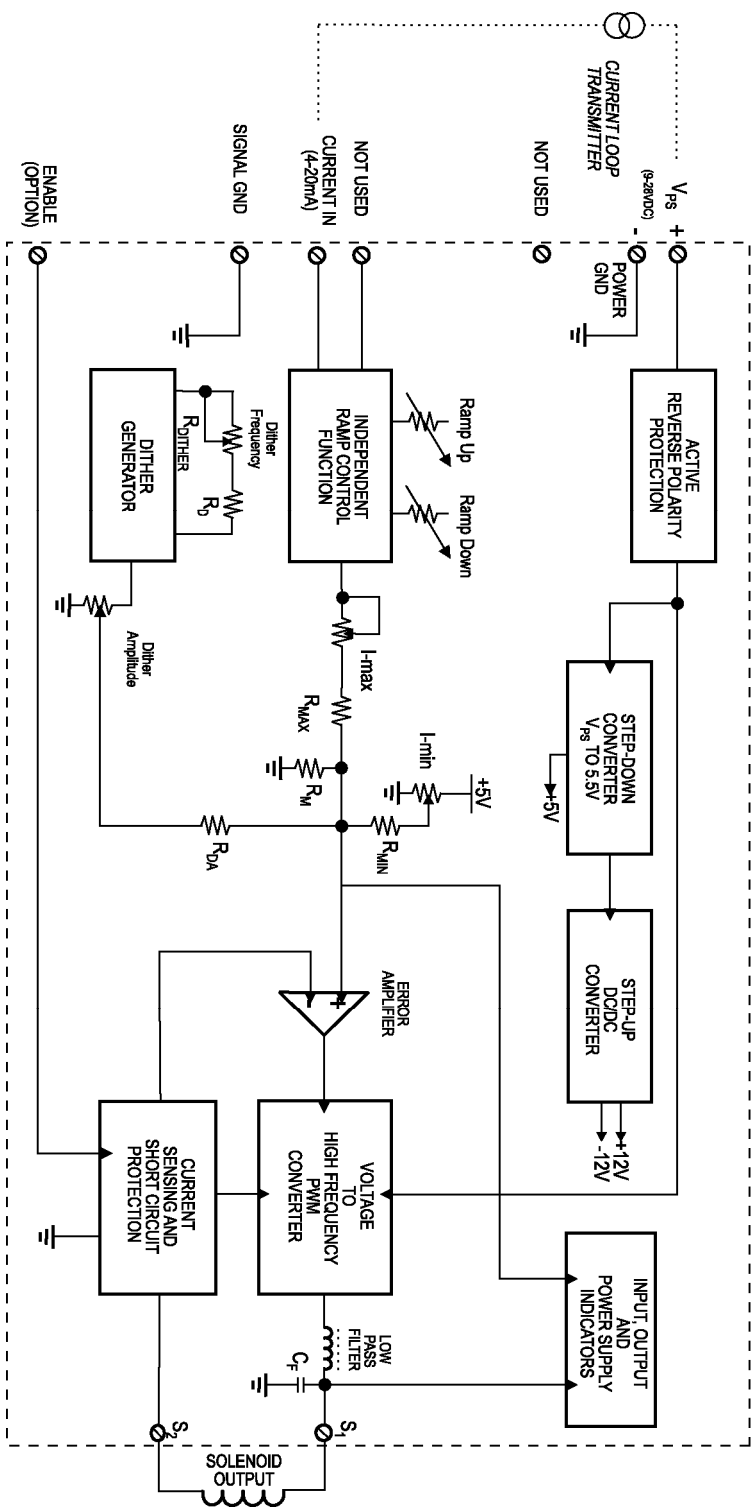
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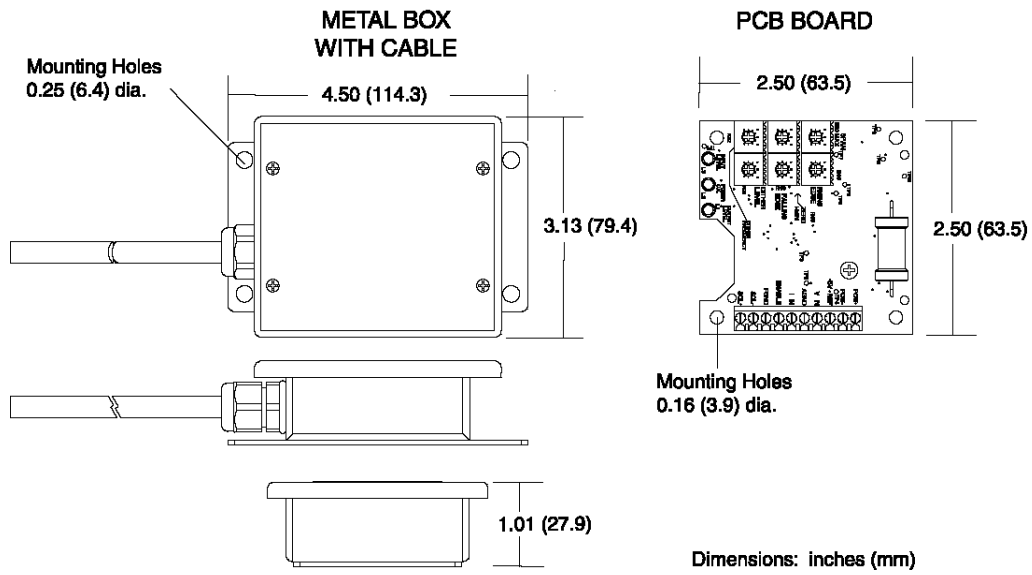
BLOCK DIAGRAM (4-20mA Remote Mount Solenoid Driver)



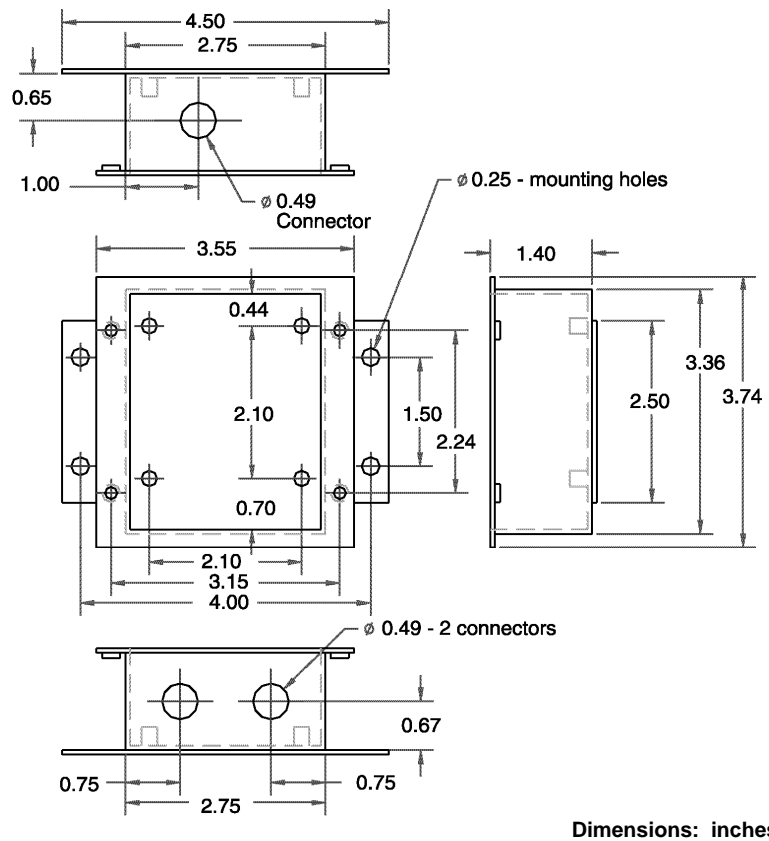
Technical Specifications: All specifications typical at nominal input voltage and 25°C unless otherwise specified.

General Specifications

Quiescent current	13.7 mA @ 12VDC 10 mA @ 24VDC
Operating conditions	-40 to +85 degrees C (-40 to 185°F) 0 to 85% relative humidity
Storage temperature	-50 to +125 degrees C (-58 to 257°F)
Electromagnetic compatibility (EMC)	Emission EN 50081-2 Immunity EN 50082-2
Approvals	CE (Packaged Driver) The PCB Board is sold as a component.
Protection - Packaged Driver	IP65 with nitrile lid gasket and cable installed IP67 with nitrile lid gasket and cable installed
Protection – DIN Rail Mount	IP00 Circuit board is conformally coated.
Electrical connection - PCB Board, DIN rail mount - Packaged Driver (no cable)	10 screw terminals accept 16-20 AWG wire for the power conductors and 18-24 AWG wire for the signal conductors
Electrical connection - Packaged Driver with cable	Unterminated cable - 5 ft. (1.5m) standard length (A DIN 43650 coil mount version is also available.)
Electrical connection - Packaged Driver with connectors	<i>Solenoid</i> - Brad Harrison 45360-001 nano-change receptacle (3-pole male) <i>Signal Input</i> - Brad Harrison 45360-001 nano-change receptacle (3-pole male) <i>Power Input</i> – Brad Harrison 8R4E06A18A120 micro-change single keyway receptacle (4-pole male) <i>Mating plug with cable assemblies are available.</i> <i>Contact manufacturer.</i>
Cable clamp (grommet) size Max. cable diameter	PG9 screw type 5.00 to 7.92 mm (0.200 to 0.312 in.)
Wire size - cable in IP65 rated Driver Wire size - cable in IP67 rated Driver	9 insulated wires AWG 20 plus drain wire 1 twisted quad AWG 18 (1.0 mm ²) and 5 insulated wires AWG 24 (0.25 mm ²) + drain wire
Dimensions - PCB Board	63.5 x 20.3 x 63.5 mm (W x D x H) 2.5 x 0.8 x 2.5 inches
Dimensions – DIN Rail Mount	90.0 x 68.0 x 70.0 mm 3.54 x 2.67 x 2.75 inches (W x L x H excluding foot)
Dimensions - Packaged Driver with cable	114.3 x 27.9 x 79.4 mm 4.50 x 1.01 x 3.13 inches (W x D x H excluding grommet and cable)
Dimensions - Packaged Driver with connectors	114.3 x 39.0 x 110.64 mm 4.50 x 1.53 x 4.35 inches (W x D x H including mounting plate and connectors)
Weight	PCB Board 0.10 lbs. (0.045 kg) DIN Rail Mount 0.30 lbs. (0.136 kg) Packaged Driver with Cables (1.5m) 1.25 lbs. (0.567 kg) Packaged Driver with Connectors 1.10 lbs. (0.499 kg)



METAL BOX WITH CONNECTORS



Electrical Specifications

Operating voltage (power supply)	9 to 28 VDC power supply range
Control input signal options	4-20 mA current signal (max. 30 mA) (0-10 V and 0-5 VDC/0-20 mA/10K potentiometer control inputs versions available) Refer to Notes below for proper installation.
Input resistance	33 Ohms
Range of maximum output current	2 A (1.2 A, 800 mA, 600 mA and 400 mA models)
Solenoid resistance selection (nominal)	Nominal resistance of solenoid coil should comply to: $R_{coil} \leq (V_{powersupply} - 1.5 V) / I_{max}$.

Note 1: For proper operation, match the power supply voltage with rating of solenoid coil. Operating the driver with a supply voltage lower than the solenoid rated voltage may result in reduced maximum current output.

Note 2: Since the output is filtered (not switched), no external protection diodes are necessary.

Note 3: The maximum current output of the driver should not exceed the current rating of the solenoid coil.

Note 4: **WARNING:** The control input and the +5V reference lines (5V model) should never be connected to the power supply input line. This will damage the controller.

Adjustments

Torque rating of trim pots	5.0 oz-in. max.
Minimum current setting	0 to 0.5 A (for 2 A output model) 0 to 0.3 A (for 1.2 A output model) 0 to 150 mA (for 800 mA output model) 0 to 150 mA (for 600 mA output model) 0 to 100 mA (for 400 mA output model)
Maximum current setting	0.6 to 2.0 A (for 2 A output model) 0.36 to 1.2 A (for 1.2 A output model) 300 to 800 mA (for 800 mA output model) 180 to 600 mA (for 600 mA output model) 120 to 400 mA (for 400 mA output model)
Current ramp time	0.01 - 5 sec. independent
Dither amplitude	0 to 10% of rated maximum current
Dither waveform	Triangular
Current dither frequency	70 to 350 Hz ($\pm 10\%$ of full scale)

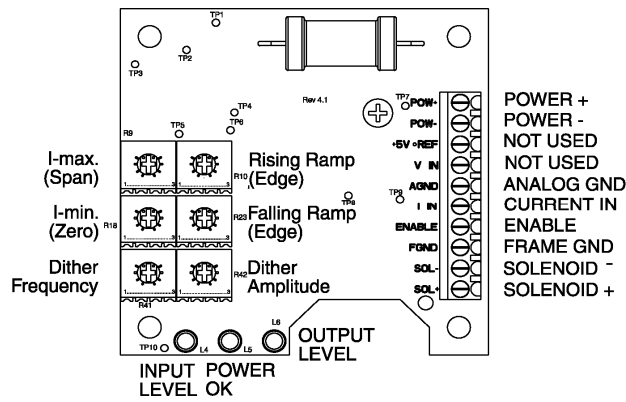
Mounting Instructions and Wiring Connections: For stand alone PCB Boards:

Mounting the PCB board

- The board will accommodate #6 size mounting screws (not supplied).

Connecting to the screw terminals on the board

- Use a cable to connect to the PCB board with each wire stripped to 6.5 mm (1/4 inch) and the shield (jacket) stripped to permit splaying of the wires in the screw terminals without tension. The exposed ground shield wire should have a heat shrink placed around the wire as a precautionary measure.
- Reference the label (included with the board) for the pin out connections of the screw terminals.
- To connect the cable to the board, loosen each screw terminal, insert the pre-tinned wire and tighten with a jeweller's sized screwdriver. **Take care to position the ground shield wire away from the PCB Board.**



For Packaged Drivers with/without cable (Metal Box):

Mounting the housing

Mount the housing using four #10-32 bolts or screws.

Connecting to the screw terminals on the board

For models where no cable is provided connect a cable as follows. For a cable specification, refer to the technical specification section.

- To access the screw terminals, loosen the four screws on the lid using a Phillips #1 screwdriver. Remove the lid.
- Use a 0.200 to 0.312 inch diameter solid round shielded cable to connect to the remote mount solenoid driver. Each wire should be stripped to 6.5 mm (1/4 inch) and the shield (jacket) stripped to a minimum of 57 mm (2-1/4 inches). Exposed ground shield wire should have a heat shrink placed around the wire as a precautionary measure.
- Remove the clamp nut on the Heyco PG9 grommet using an adjustable wrench.
- Slide the clamp nut over the cable. Insert the cable into the grommet, allowing for the stripped minimum of 2 1/4 inches to be available inside the housing. Tighten the clamp nut securely attaching the cable to the housing assembly.
- Reference the label (found on the inside of the lid) for the pin out connections of the screw terminals.
- To connect the cable to the board, loosen each screw terminal, insert the pre-tinned wire and tighten with a jeweller's sized screwdriver. **Take care to position the ground shield wire away from the PCB Board.**
- Replace the lid and gasket. Replace and tighten the four 4-40 Phillips flat head screws.

Connecting the cable

WARNING: The control input and the +5V reference lines (5V model) should never be connected to the power supply input line. This will damage the controller.

4 to 20 mA Control	
(IP65 Rated Metal Box with Cable)	(IP67 Rated Metal Box with Cable)
Power (+) — Red	Power (+) — Red
Power (-) — Black	Power (-) — Black
Not Connected — Red/black stripe	Not Connected — Yellow/red stripe
Not Connected — White/black stripe	Not Connected — Yellow
(-) 4-20 mA Signal — Green/black stripe	(-) 4-20 mA Signal — Yellow/black stripe
(+) 4-20 mA Signal — White	(+) 4-20 mA Signal — Yellow/blue stripe
Enable — Blue	Enable — Purple
Frame Ground — Drain Wire	Frame Ground — Drain Wire
Valve — Green	Valve — Orange/black stripe
Valve — Orange	Valve — Orange/red stripe

For models where the cable is supplied, connect the cable to the solenoid coil, power supply and input signal, as follows.

For 4-20 mA Control:
 Turn ramp screws fully counterclockwise to eliminate ramping.
 Use I-Min. screw to set up minimum speed with minimum control input.
 Use I-Max. screw to set maximum speed with 100% of control input.

Enable:
 When Enable is connected to the -ve power supply, the unit will be disabled. When Enable is left open or connected to the +ve power supply, the unit is enabled.

Refer to page 2 (block diagram) for an alternative method of connecting a current loop transmitter to provide a current control signal input. In this method, the current loop transmitter receives power from the power supply powering the amplifier. The transmitter is connected to the amplifier's +power supply input wire and the +4 to 20mA input wire. This method does not use the – 4 to 20mA input signal wire connection.

For Packaged Drivers with three connectors (Metal Box):

Mounting the housing

Mount the housing using four #10-32 bolts or screws.

Connector Pin Out:

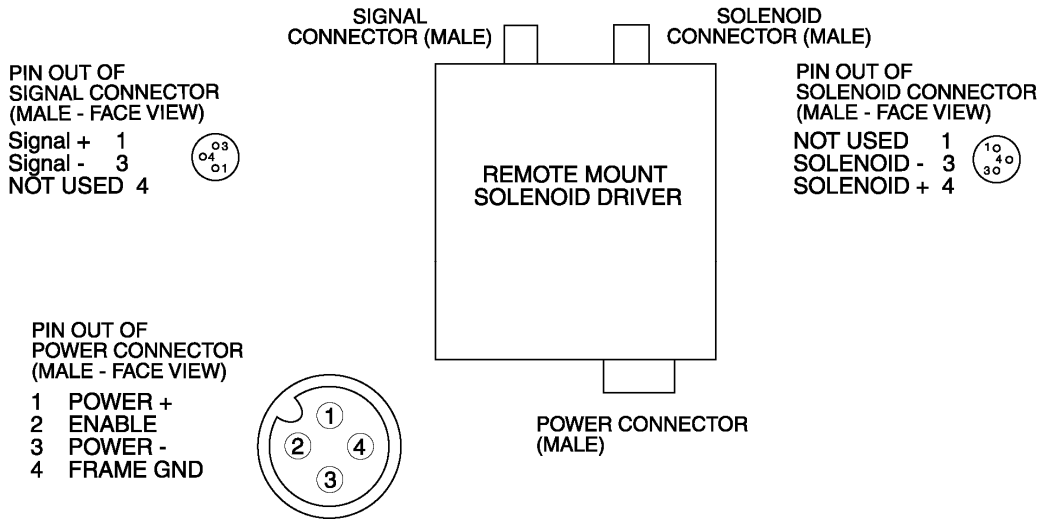
For 4-20 mA Control:

Turn ramp trim pot fully counterclockwise to eliminate ramping.
 Use I-Min. trim pot to set minimum speed with minimum control input.
 Use I-Max. trim pot to set maximum speed with 100% of control input.

Enable:

When Enable is connected to the -ve power supply or Analog GND screw terminal, the unit will be disabled.
 When Enable is left open or connected to the +ve power supply, the unit is enabled.

Mating plug and cable assemblies are available. Contact the manufacturer. The pin out shown below is for the three male connectors mounted in the metal box.



For DIN Rail Mount Drivers:

Mounting the housing

The DIN Rail Mount Driver has a universal foot for mounting on the DIN rail.

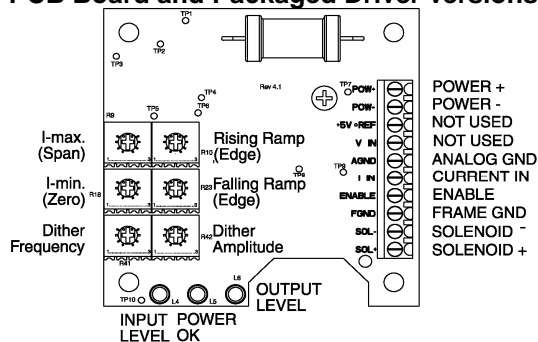
Connecting to the screw terminals on the board

- Use 16-20 AWG wire for the power conductors and 18-24 AWG wire for the signal conductors in a solid round shielded cable to connect to the remote mount solenoid driver. Each wire should be stripped to 6.5 mm (1/4 inch) and the shield (jacket) stripped to a minimum of 57 mm (2-1/4 inches). Exposed ground shield wire should have a heat shrink placed around the wire as a precautionary measure.
- Reference the label for the pin out connections of the screw terminals.
- To connect the cable, loosen each screw terminal, insert the pre-tinned wire and tighten with a jeweller's sized screwdriver. **Take care to position the ground shield wire away from the PCB Board.**

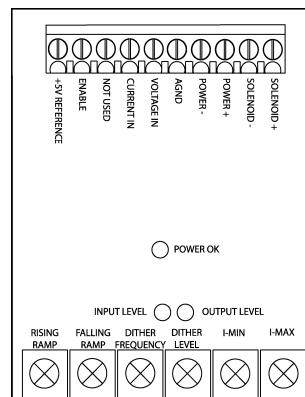
Enable: When Enable is connected to the -ve power supply, the unit will be disabled. When Enable is left open or connected to the +ve power supply, the unit is enabled.

Adjustment Details: Adjustments are accessible by loosening the four screws on the lid of the housing and removing the lid. Ensure that the unit is connected to an operating proportional valve. Use a Phillips #1 screwdriver to make adjustments to the trim pots. The torque rating for the trim pots is 5.0 oz-in. max.

PCB Board and Packaged Driver versions



DIN Rail Mount version



The following settings represent a typical set up. Trim pots are single turn.

Trim Pot Adjustments	Range of Adjustment	Factory Setting
Zero - Minimum Current Setting (I-min.)	0 to 0.5 A (for 2 A output) 0 to 0.3 A (for 1.2 A output) 0 to 150 mA (for 800 mA output) 0 to 150 mA (for 600 mA output) 0 to 100 mA (for 400 mA output)	0% (CCW)
Span - Maximum Current Setting (I-max.)	0.6 to 2.0 A* (for 2 A output) 0.36 to 1.2 A (for 1.2 A output) 300 to 800 mA (for 800 mA output) 180 to 600 mA (for 600 mA output) 120 to 400 mA (for 400 mA output)	100% (CW)
Ramp Time (Rising/Falling Edge)	0.01 to 5 seconds independent	min.(0.01 seconds) (CCW)**
Dither Level (Amplitude)	0 to 10% of rated max. current	0% (CCW)
Dither Frequency	70 to 350 Hz ($\pm 10\%$)	minimum (CCW)

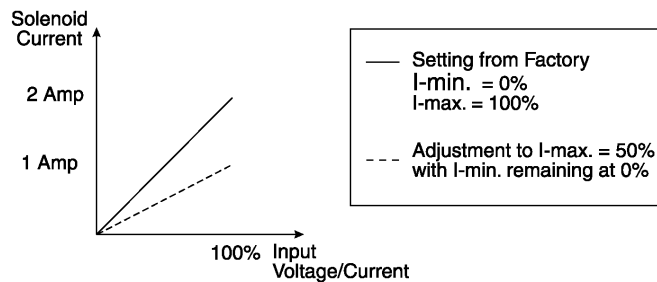
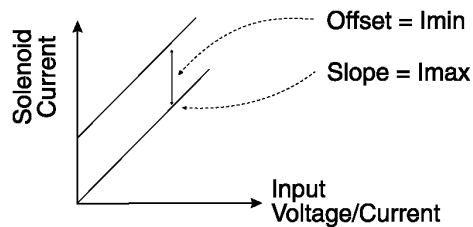
CW = clockwise, CCW = counterclockwise

*NOTE 1: Range of maximum output current is 2A (maximum output current = minimum current setting + maximum current setting).

**NOTE 2: To eliminate ramping, turn the trim pots fully counterclockwise.

Adjusting the minimum current will shift the maximum current setting, as shown.

Adjusting the maximum current (I-max.) does not affect the minimum current (I-min.) setting.



Setting the Minimum Current (I-min.)

- Set the minimum current before setting the maximum current. Apply minimum input (4 mA).
- The factory setting for the I-min. trim pot is set at 0 or fully counterclockwise (CCW).
- If the desired minimum current is greater than 0, adjust the trim pot clockwise (CW) until the desired current is achieved.

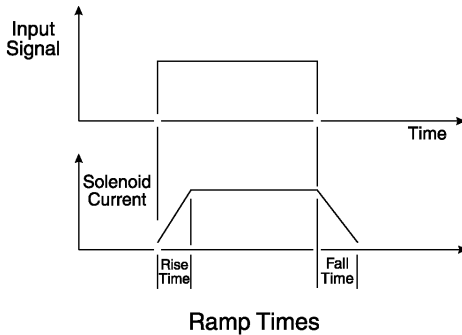
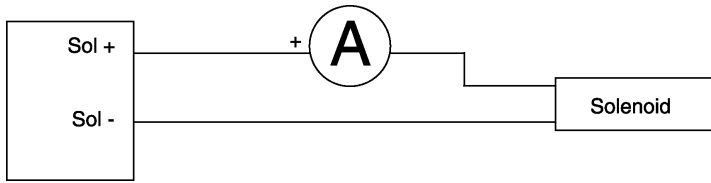
The minimum current setting can be used to take into account the mechanical valve deadband and provide desired offsets from zero to allow full control within the functional range of the specific valve.

Setting the Maximum Current (I-max.)

- Apply maximum control (20 mA).
- The factory setting for the I-max. trim pot is 100% or fully CW.
- Turn the trim pot CCW to adjust the current setting downwards to the desired maximum.

The maximum current setting is adjusted to meet the customer's working pressure or flow range to the full scale signal input range. This provides maximum control for a specific application.

Current output should be measured by an ammeter set up in series with the driver and the load. Connect the Solenoid + output to the + terminal on the Ammeter and the Ammeter to the Solenoid. Connect the Solenoid - output to the Solenoid.



Setting the Ramp Times

- The factory setting for ramp times is the minimum (0.01 seconds) or fully CCW.
 - **If the ramp time settings are not needed, leave the setting at the minimum value.**
 - To change the ramps, adjust the trim pot CW to increase the time.
 - Note that rising and falling ramp times are independent.
- Ramp times are application dependent. They limit the rate of change or how fast the operation happens. Note that if the input signal is not applied long enough for the ramp time set, the desired solenoid current will not be reached.

Setting the Dither Amplitude

- The factory setting for dither amplitude is 0% (CCW).
- To adjust, turn the trim pot CW until small changes in the input signal register similar changes in current output.
- Choose the smallest effective dither amplitude.

Dither amplitude is adjustable from 0 to 10% of the rated maximum current. Dither amplitude and frequency are dependent on the specific valve. The effects of static friction on the operation of the solenoid are reduced by the application of a small AC current. The hysteresis and repeatability of the valve are improved by this practice. The optimum dither amplitude is attained when small input signal changes register similar changes in current output (pressure or flow through the valve).

Setting the Dither Frequency

- The factory setting for dither frequency is the minimum or 0% (CCW).
 - To adjust dither frequency, turn the trim pot CW until the desired frequency is set.
 - The dither frequency rating for a particular valve is available from the valve manufacturer.
- Measure the superimposed dither by attaching a digital multimeter (with a frequency setting) to the Test Point located next to the INPUT LEVEL LED and to the Analog GND screw terminal.

Ordering Part Numbers:

PCB Board - RSD-PCB-4-20MA-x

DIN Rail Mount – RSD-DR-4-20MA-x

Packaged Driver (board installed in metal box)

Available with no cable - RSD-SMB-4-20MA-x-00

Available with 3 connectors – RSD-SMB-4-20MA-x-01

Contact the manufacturer for mating plug and cable assemblies.

IP65 rated and available with cable - 5 ft. (1.5m) - RSD-SMB-4-20MA-x-IP5-1.5M

IP67 rated and available with cable - 5 ft. (1.5m) - RSD-SMB-4-20MA-x-IP7-1.5M

Where x = maximum current output (2A, 1.2A, 800MA, 600MA or 400MA)

y = 1.5 or custom cable lengths (meters)

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process as described on www.axiomatic.com/service.html.

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