SIGNAL CONDITIONERS



The Trusted Source for Innovative Control Solutions

QUICK Specs

		Signal Conditioners						
		FREQUEN	CY INPUT	ANALOG	INPUT			
		IFMA	IFMR	AFCM	IAMS			
D	escription	Frequency to Analog Converter	Speed Switch	Analog to Frequency Converter	Universal Conversion Module			
D (Heigl	limensions ht)x(Width)	79 mm (H) x 28 mm (W) x 107 mm(D)	79 mm (H) x 28 mm (W) x 107 mm(D)	93 mm (H) x 6.2 mm (W) x 93 mm(D)	109 mm (H) x 24 mm (W) x 104 mm(D)			
	Input	Programmable to accept a variety of sensors 25 KHz Max.	Programmable to accept a variety of sensors 25 KHz Max.	0 to 10 mA, 0 to 20 mA, 2 to 10 mA 4 to 20 mA, 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC and 2 to 10 VDC	DC Current, DC Voltage, Process, RTD, Thermocouple, Linear Resistance and Potentiometer			
	Outputs	0 to 5 VDC, 0 to 10 VDC, 0 to 20 mA or 4 to 20 mA	Single Form C Relay	0 to 50 Hz, 0 to 100 Hz, 0 to 250 Hz, 0 to 500 Hz, 0 to 1KHz, 0 to 2.5 KHz, 0 to 5 KHz and 0 to 10 KHz	Setpoint - Dual Form "A" Relay Output Analog - 0 to 20 mA, 4 to 20 mA, 0 to 5 VDC, 0 to 10 VDC or the reverse of each			
Othe	r Features/ Options	Low Frequency Cut-out, Overrange Indication, 3 Way Isolation	Hysteresis and Offset	3 Way Isolation	3 Way Isolation			
Pov	wer Source	85 to 250 VAC	85 to 250 VAC	19.2 to 30 VDC	21.6 to 253 VAC or 19.2 to 300 VDC			
Recommended Applications		Converts a Frequency Input to an Analog Current or Voltage	Provides a Contact Ouput at a Setpoint Speed, Overspeed, Underspeed, or Zero Speed	Used to Isolate and Convert Various Analog Signals to Frequencies Signals	Used to Isolate and Convert Various Analog Signals to Standard Control Signals			
Pa	ge Number	Page 755	Page 763	Page 771	Page 774			

QUICK Specs

		Signal Conditioners							
			ANALOG	INPUT					
		IAMA	IAMA6	AAMA	AIMI				
De	escription	DC Current, DC Voltage and Process Converter	DC Current, DC Voltage and Process Converter	Universal Conversion Module	Loop Powered Isolator				
Di (Height	mensions t) x (Width)	79 mm (H) x 28 mm (W) x 107 mm(D)	93 mm (H) x 6 mm (W) x 102 mm(D)	99 mm (H) x 18 mm (W) x 115 mm (D)	79 mm (H) x 25 mm (W) x 93 mm(D)				
	Input	0 to 500 mV 0 to 100 VDC or 0 to 100 mA DC	0 to 5 VDC, 0 to 10 VDC, 0 to 20 mA or 4 to 20 mA	0 to 500 mV, 0 to 20 VDC, 0 to 20 mA, +/- 500 mV, or +/- 20 VDC	0 to 20 mA or 4 to 20 mA				
	Outputs	0 to 5 VDC, 0 to 10 VDC, 0 to 1 mA DC, 0 to 20 mA or 4 to 20 mA	0 to 5 VDC, 0 to 10 VDC, 0 to 20 mA or 4 to 20 mA	0 to 10 VDC, +/-10 VDC, or 4 to 20 mA	0 to 20 mA				
Other	Features/ Options	3 Way Isolation, Linear or Square Root Extraction	3 Way Isolation	3 Way Isolation, Accepts Positive and Negative Signals	2 Way Isolation				
Pow	er Source	11 to 36 VDC, 24 VAC	19.2 to 30 VDC	18 to 30 VDC	Loop Powered				
Reco App	mmended olications	Used to Isolate and Convert Various Analog Signals to Standard Control Signals	Used to Isolate and Convert Various Analog Signals to Standard Control Signals	Used to Isolate and Convert Various Analog Signals to Standard Control Signals	Provides Ground Potential Isolation of Analog Control Circuits				
Pag	e Number	Page 784	Page 792	Page 795	Page 773				

QUICK Specs

		nditioners			
	ANALOG	À INPUT	СОММИИ	ICATION	
	IRMA	ITMA	ICM4/5	ICM8	
Description	RTD to Analog Converter	Thermocouple to Analog Converter	Serial Converter Modules	Serial to Ethernet Converter for Red Lion Products	
Dimensions (Height)x(Width)	Model Dependent	Model Dependent	79 mm (H) x 25 mm (W) x 98 mm (D)	135 mm (H) x 45 mm (W) x 106 mm (D)	
Input	2, 3, or 4 Wire RTD 100 Ohm Platinum (385 or 392) or Resistance	J, K, T, E, or mV	RS232, RS485	Protocols - RS232, RS485, and Ethernet	
Outputs	4 to 20 mA or mV	4 to 20 mA or mV	RS232, RS485	Protocols - RS232, RS485, and Ethernet	
Other Features/ Options	2 Way Isolation, Sensor Break Detection	2 Way Isolation, Sensor Break Detection	N/A	N/A	
Power Source	12 to 42 VDC 9 to 32 VDC, Loop Powered	12 to 42 VDC 9 to 32 VDC, Loop Powered	9 to 32 VDC	24 VDC	
Recommended Applications	Used to Convert an RTD Input to a 4 to 20 mA Output	Used to Convert a Thermocouple Input to a 4 to 20 mA Output	Used to Convert Serial Communications	Used to enable Red Lion Products to Communication via Ethernet	
Page Number	Page 804	Page 816	Page 829/833	Page 837	

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QUICK Specs							
	Signal Co	nditioners					
	COMMUNICATION GCM	F A U L T APMR					
Description	Serial Converter Modules	3 Phase Fault Detection Module					
Dimensions (Height)x (Width)	25 mm (H) x 54 mm (W) x 110 mm (D) w/socket	79 mm (H) x 40 mm (W) x 85 mm (D)					
Input	Serial 20 mA Current Loop						
Outputs	RS232, (GCM232) RS422/485, (GCM422)	SPDT 10A Relay					
Other Features/ Options	N/A	N/A					
Power Source	9 to 28 VDC (GCM232) 9 to 26 VDC (GCM422)	230VAC 380VAC 480VAC					
Recommended Applications	Used to Convert 20 mA Current Loop to RS232 or RS422/485	Protect Against Phase Loss, Unbalance, Under Voltage and Phase Reversal in 3 Phase Equipment					
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MODEL IFMA - DIN-RAIL FREQUENCY TO ANALOG CONVERTER



- SIMPLE ON-LINE RANGE SETTING (Using Actual Input Signal or Signal Generator)
- USER SETTABLE FULL SCALE FREQUENCY FROM 1 Hz to 25 KHz
- FOUR OUTPUT OPERATING RANGES (0 to 5 V, 0 to 10 V, 0 to 20 mA, and 4 to 20 mA)
- PROGRAMMABLE INPUT CIRCUIT ACCEPTS OUTPUTS FROM A VARIETY OF SENSORS
- 85 to 250 VAC and 9 to 32 VDC POWERED VERSIONS AVAILABLE
- LOW FREQUENCY CUT-OUT AND OVERRANGE INDICATION
- 3-WAY ELECTRICAL ISOLATION (POWER/INPUT/OUTPUT)
- INPUT AND OUTPUT INDICATION LEDs
- UL Recognized Component, File # E137808

DESCRIPTION

The Model IFMA accepts a frequency input, and outputs an analog voltage or current in proportion to the input frequency, with 0.1% accuracy. The full scale input frequency can be set to any value from 1 Hz to 25 KHz, either with a frequency source, or digitally with the on-board rotary switch and push-button.

The IFMA utilizes a seven position DIP switch, a rotary switch, a push-button and two indication LEDs to accomplish input circuit configuration, operational parameter set-up, and Input/Output indication. The input circuitry is DIP switch selectable for a variety of sources.

The indication LEDs are used during normal operation to display the input and output status of the IFMA. These LEDs are also used to provide visual feedback to the user of the existing parameter settings during parameter set-up.

The IFMA operates in one of four output modes. The programmable minimum and maximum response times provide optimal response at any input frequency.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat profile rail according to EN 50 022 - 35 x7.5 and 35 x 15, and G profile rail according to EN 50 035 - G 32.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

SPECIFICATIONS

1. POWER:

- **AC Operation**: 85 to 250 VAC, 48 to 62 Hz; 6.5 VA **DC Operation**: 9 to 32 VDC; 2.5 W
 - **Power Up Current**: Ip = 600 mA for 50 msec. max.
- 2. SENSOR POWER: (AC version only) +12 VDC ±25% @ 60 mA max.
- 3. OPERATING FREQUENCY RANGE:
- From 0 Hz to 25 KHz; user selectable.
- SIGNAL INPUT: DIP switch selectable to accept signals from a variety of sources, including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups, and all standard RLC sensors.
 - **Current Sourcing**: Internal 1 K Ω pull-down resistor for sensors with current sourcing output. (Max. sensor output current = 24 mA @ 24 V output.)
 - **Current Sinking**: Internal 3.9 K Ω pull-up resistor for sensors with current sinking output. (*Max. sensor current* = 3 mA.)



Low Bias: Input trigger levels $V_{IL} = 0.25$ V, $V_{IH} = 0.75$ V; for increased sensitivity when used with magnetic pickups. **Hi Bias**: Input trigger levels $V_{II} = 2.5$ V, $V_{III} = 3.0$ V; for logic level signals.

Hi Bias: Input trigger levels $V_{II} = 2.5$ V, $V_{IH} = 3.0$ V; for logic level signals. **Max. Input Signal**: ±90 V; 2.75 mA max. (With both Current Sourcing and Current Sinking resistors switched off.)

- 5. SIGNAL VOLTAGE OUTPUT (Selectable): 0 to 5 VDC @ 10 mA max.
- 0 to 10 VDC @ 10 mA max. 6. SIGNAL CURRENT OUTPUT (Selectable): 0 to 20 mA @ 10 VDC min.
- 4 to 20 mA@ 10 VDC min.
- 7. OUTPUT COMPLIANCE:
- **Voltage**: 10 V across a min. 1K Ω load (10 mA). Factory calibrated for loads greater than 1 M Ω .
- Current: 20 mA through a max. 500Ω load (10 VDC).
- 8. ACCURACY: ±0.1% of full scale range (±0.2% for 0 to 5 VDC range).
- 9. RESOLUTION:

Voltage : 3.5 mV min. Current: 5 µA min.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES					
		9 to 32 VDC	85 to 250 VAC				
IFMA	Pulse Rate to Analog Converter	IFMA0035	IFMA0065				
For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.							

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SPECIFICATIONS (Cont'd)

- RESPONSE TIME: 5 msec +1 period to 10 sec +1 period; user selectable
 INPUT IMPEDANCE: 33 KΩ min. with the sink and source DIP switches in the OFF position (See Block Diagram).
- 12. INPUT AND POWER CONNECTIONS: Screw in terminal blocks.
- ISOLATION BREAKDOWN VOLTAGE (Dielectric Withstand): 2200 V between power & input, and power & output; 500 V between input & output for 1 minute.

14. CERTIFICATIONS AND COMPLIANCES:

SAFETY

- UL Recognized Component, File #E137808, UL508, CSA C22.2 No. 14 Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
- IECEE CB Scheme Test Report # 97ME50135-042297
 - Issued by Underwriters Laboratories, Inc.
 - IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

EMC EMISSIONS

- Meets EN 50081-2: Industrial Environment.
- CISPR 11 Radiated and conducted emissions

EMC IMMUNITY

- Meets EN 50082-2: Industrial Environment.
 - ENV 50140 Radio-frequency radiated electromagnetic field ¹ ENV 50141 - Radio-frequency conducted electromagnetic field EN 61000-4-2 - Electrostatic discharge (ESD) ²

EN 61000-4-4 - Electrical fast transient/burst (EFT)

EN 61000-4-8 - Power frequency magnetic field

1. For operation without loss of performance:

Notes:

- Unit is mounted on a rail in a metal enclosure (Buckeye SM7013-0 or equivalent) and I/O cables are routed in metal conduit connected to earth ground.
- 2. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches, etc.) typical anti-static precautions should be observed before touching the unit.

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

- 15. ENVIRONMENTAL CONDITIONS:
 - Operating Temperature: 0 to 50°C

Storage Temperature: -40 to 80°C

- Operating and Storage Humidity: 85% max. (non-condensing) from 0°C to 50°C.
- Vibration according to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 3 g's.
- Shock according to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions. Altitude: Up to 2000 meters
- 16. **CONSTRUCTION**: Case body is black, high impact plastic. Installation Category II, Pollution Degree 2
- 17. WEIGHT: 6 oz. (0.17 Kg)



OVERVIEW

The Model IFMA continuously monitors a frequency input and outputs a voltage or current signal in proportion to the input signal. The output is accurate to $\pm 0.1\%$ of full scale for Operating Modes 2, 3, and 4. Operating Mode 1 is accurate to $\pm 0.2\%$ of full scale. The green Input LED blinks at the rate of the input frequency. At about 100 Hz, the Input LED will appear to be solid on. At very low frequencies, the Input LED blinks slowly and may also appear to be solid on. A loss of signal may also cause the Input LED to remain on, depending on the DIP switch set-up. In this case, the red LED also turns on.

The Minimum Response Time parameter sets the minimum update time of the output. The actual response time is the Minimum Response Time plus up to one full period of the input signal. The IFMA counts the negative edges occurring during the update time period, and computes the average frequency value for that time. This action filters out any high frequency jitter that may be present in the input signal. The longer the Minimum Response Time, the more filtering occurs.

The Maximum Response Time parameter sets the Low Frequency Cut-out response time for the unit. If a new edge is not detected within the time specified by the Maximum Response Time setting, the unit sets the output to the existing Low Frequency Cut-out Value setting depending on the selected range and calibration setting.

The unit also indicates Low Frequency Cut-out by turning ON the output LED. The Maximum Response Time can be set shorter than the Minimum Response Time. In this case, as long as the input signal period is shorter than the Maximum Response Time, the unit continues to indicate the input frequency at its output. But, if the input period at any time exceeds the Maximum Response Time, the unit immediately takes the output to the Low Frequency Cut-out Value, regardless of the Minimum Response Time setting.

The IFMA is calibrated at the factory for all of the selected ranges. However, the user can adjust the minimum calibration to any value less than the Full Scale value, and the Full Scale value to any value greater than the minimum value. If the minimum and full scale values are brought closer together, the accuracy of the unit decreases proportionate to the decreased range of the unit (See Calibration).

H

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. The unit becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful installation or troublesome installation.

Listed below are some EMC guidelines for successful installation in an industrial environment.

- Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- 3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
 - Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

POWER AND OUTPUT CONNECTIONS

AC Power

Primary AC power is connected to terminals 10 and 12 (labeled AC). For best results, the AC Power should be relatively "clean" and within the specified variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

DC Power

The DC power is connected to terminals 10 and 12. The DC plus (+) power is connected to terminal 10 and the minus (-) is connected to terminal 12.

It is recommended that separate supplies be used for sensor power and unit power. Using the same supply for both will negate isolation between input and power.

Current Output

When using Operating Mode 3 or 4, the output device is connected to terminals 1(I+) and 3 (I-).

Voltage Output

When using Operating Mode 1 or 2, the output device is connected to terminals 4 (V+) and 6 (V-).

- *Note:* Although signals are present at voltage and current outputs at the same time, only the selected mode is in calibration at any one time.
 - Example: Operating Mode 2 is selected. The voltage level present at the voltage terminals is in calibration, but the signal appearing at the current terminals does not conform to either of the current output modes.



INPUT CIRCUITS, SENSOR CONNECTIONS AND CONFIGURATION SWITCH SET-UP

The Model IFMA uses a comparator amplifier connected as a Schmidt trigger circuit to convert the input wave form into the pulse form required for proper circuit operation. Three set-up switches are used to configure the input circuit to accept signals from a wide variety of sources, as follows:

S1 - ON: Connects a 1 KΩ pull-down resistor for sensors with sourcing outputs. (Maximum sensor output current is 24 mA @ 24 VDC output.)

- S2 ON: For logic level signals. Sets the input bias levels to V_{IL} = 2.5 V, V_{IH} = 3.0 V.
 - OFF: For increased sensitivity when used with magnetic pickups. Sets the input bias levels to $V_{IL} = 0.25$ V, $V_{IH} = 0.75$ V.
- S3 ON: Connects a 3.9 KΩ pull-up resistor for sensors with current sinking output. (Max. sensor current = 3 mA.)

CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS

Note: Separate power supplies must be used for sensor power and input power to maintain the isolation breakdown voltage specification. If isolation between power and input is not needed, then a single supply can be used for both unit and sensor power.





CONFIGURING THE IFMA

To begin set-up, place DIP switch 4 to the on (up) position. DIP switches 5, 6, and 7 access unit configuration settings. Upon entry to a set-up parameter, the Input LED blinks the current numerical value of a setting at a 1 Hz rate. A setting of "1" is indicated by one blink ($\frac{1}{2}$ sec on, $\frac{1}{2}$ sec off), through a setting of "9", which is indicated by nine blinks. A setting of "0" is indicated by a single short flash (40 msec on, 1 sec off). The decimal point position is the last number blinked. After the entire value is indicated, the IFMA pauses two seconds and repeats the value.

During entry of a new value, if the Mode switch (S4) or any of the CFG DIP switch positions are changed before the push button is pressed, the IFMA aborts the entry process and retains the previous setting.

DIP SWITCH	DESCRIPTION	SECTION
	Operating Mode	(1.0)
	Input Range Setting Using an Input Signal or Frequency Generator	(2.0)
	Input Range Setting Using the Rotary Switch	(3.0)
	Minimum Response Time	(4.0)
	Maximum Response Time (Low Frequency Cut-Out Setting)	(5.0)
	Analog Output Minimum Value	(6.0)
	Analog Output Full Scale Value	(6.0)

Note: To return to normal operation, place DIP switch 4 in the down (RUN) position.

() Indicates Configuration Section

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OUTPUT INDICATION

Over range on the output : The Output LED (red) turns on and the Output is "clamped" at the maximum level.

Low Frequency Cut-Out : The Output LED (red) turns on to indicate the input frequency is below the Zero Frequency setting.Invalid Entry during Set-up : The Input LED (green) and the Output LED (red) alternately blink until a valid entry is made.

FACTORY SETTINGS						
Parameter	Setting	Value				
Operating Mode	4	4 to 20 mA				
Input Range	10.000	10 KHz				
Minimum Response	0	5 msec				
Maximum Response	0	1024 times Input Range Period (102 msec, 9.8 Hz)				

1.0 Operating Mode (Analog Output)







1.1 Place DIP switch 4 to the ON (up) position and DIP switches 5, 6, and 7 as shown.

1.2 Green input LED blinks the Setting corresponding to the Operating Mode shown below, pauses and repeats the value.

Setting	Operating Mode
1	0 to 5 VDC
2	0 to 10 VDC
3	0 to 20 mA
4	4 to 20 mA

- Factory calibration values are restored when the Operating Mode is changed.
- If existing operating mode setting is your desired requirement, this section is complete*. Otherwise, continue with Step 1.3.
- 1.3 Press the push-button. The Green input LED blinks rapidly to indicate the Operating mode setting is now accessed.
- 1.4 Turn the rotary switch to the selected numerical value for the output desired (see the list in Step 1.2).
- 1.5 Press the push-button. The Green input LED blinks value entered, pauses, and repeats the new Operation setting.
- ◆ If the new Operating mode setting is acceptable, this section is complete*.
- ◆ If the new Operating mode setting is not the desired setting, repeat from Step 1.3.
- ◆ If the Red output LED blinks, the rotary switch numerical value is invalid. Repeat Steps 1.4 and 1.5.
- * Section complete; place DIP switch 4 to the Down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

2.0 On-Line Input Range Setting Using Actual Input Signal Or Frequency Generator



METHOD

2.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.2.2 The Green input LED blinks the existing Input Range setting as shown in the examples below. Six full digits of numerical information blink with a short pause between digits and a longer pause before repeating. The first five digits are the existing input range setting of the frequency magnitude. The sixth digit is the frequency resolution (the number of digits to the right of the



- ◆ If the existing Input Range setting is your desired requirement, this section is complete*. Otherwise, continue with Step 2.3.
- 2.3 Apply the maximum input signal.
- 2.4 Press the push-button. The Green input LED blinks rapidly. The acquisition process takes two seconds plus one period of the input signal.
- If the new input range setting is valid, the Green input LED turns on solid. Continue to Step 2.5.
 If Red output LED blinks, the new input range setting is invalid, outside the acceptable 1 Hz to 25 KHz range. Repeat Steps 2.3 and 2.4.
- 2.5 Press the push-button. The Green input LED blinks the new Input Range setting. This section is complete*. Verify the Input Range setting as shown in Step 2.2.
- * Section complete; place DIP switch 4 to the Down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

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Step 3.2





ALTERNATIVE METHOD IF INPUT SIGNAL IS NOT AVAILABLE

- 3.1 Place DIP switch 4 to the ON(up) position and DIP switches 5, 6, and 7 as shown.
- 3.2 The Green input LED blinks the existing Input Range setting, pauses and repeats. Six full digits of numerical information blink with a short pause between digits and a longer pause at the end, before repeating. The first five digits are the existing input range setting magnitude. The sixth digit is the frequency resolution (the number of digits to the right of the decimal point).
- ◆ If the existing Input Range setting is your desired requirement, this section is complete*. Otherwise, continue with Step 3.3.

3.3 Determine the Input Range frequency and record in the space provided below.

Resolution

6th digit





- 3.4 Press the push-button. The Green input LED blinks rapidly. Input Range setting is now accessed.
- 3.5 Turn the rotary switch to the first selected numerical value. Press the push-button. The Green input LED continues to blink rapidly. First of six digits is entered.
- 3.6 Turn the rotary switch to the second selected numerical value. Press the push-button. The Green input LED continues to blink rapidly. Second of six digits is entered.
- 3.7 Repeat Step 3.6 three more times, then go to Step 3.8. This enters a total of five of the required six numerical digits.
- 3.8 Turn the rotary switch to the selected numerical value for resolution requirement. Press the push-button. The Green input LED blinks the new Input Range setting (as described in <u>Step 2.2</u>), pauses, and repeats the value.
- ◆ If the new Input Range setting is acceptable, this section is complete*.
- ◆ If the new Input Range setting is not the desired setting, repeat Steps 3.4, through 3.8.
- ◆ If the Red output LED blinks, the numerical value entered is invalid. Repeat Steps 3.3 through 3.8.
- * Section complete; place DIP switch 4 to the Down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

4.0 Minimum Response Time Setting



Step 4.4

Setting '2

Selected

4.1 Position DIP switch 4 to the ON(up) position and DIP switches 5, 6, and 7 as shown.

4.2 The Green input LED blinks the corresponding Minimum Response Time Setting (see following list), pauses and repeats.

Setting	Time	Setting	Time
0	5 msec	5	200 msec
1	10 msec	6	500 msec
2	20 msec	7	1 sec
3	50 msec	8	5 sec (not valid for input range > 3906 Hz)
4	100 msec	9	10 sec (not valid for input range > 3906 Hz)

- ◆ If the existing Minimum Response Time setting is your desired requirement, this section is complete*. Otherwise, continue with Step 4.3.
- 4.3 Press the push-button. The Green input LED blinks rapidly. Minimum Response Time setting is now accessed.
- 4.4 Turn the rotary switch to the selected numerical value for Minimum Response Time desired (see list in Step 4.2).
- 4.5 Press the push-button. The Green input LED blinks the value entered, pauses, and repeats the new Minimum Response Time setting.
- ◆ If the new Minimum Response Time setting is acceptable, this section is complete*.
- ◆ If the new Minimum Response Time setting is not acceptable, repeat from step 4.3.
- ◆ If the Red output LED blinks, the rotary switch numerical value is invalid. Repeat Steps 4.4 and 4.5.
- * Section complete; place DIP switch 4 to the Down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

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5.0 Maximum Response Time Setting (Low Frequency Cut-Out Setting)



5.1 Place DIP switch 4 to the ON (up) position and DIP switches 5, 6, and 7 as shown.5.2 The Green input LED blinks the corresponding Maximum Response Time Setting (see following list), pauses and repeats.

Setting	Time	Setting	Time
0	1024 times Input Range period (40 msec min., 10 sec max.)	5	200 msec (5 Hz)
1	10 msec (100 Hz)	6	500 msec (2 Hz)
2	20 msec (50 Hz)	7	1 sec (1 Hz)
3	50 msec (20 Hz)	8	5 sec (.2 Hz)
4	100 msec (10 Hz)	9	10 sec (.1 Hz)

- If the existing Maximum Response Time setting is your desired requirement, this section is complete*. Otherwise, continue with Step 5.3.
- 5.3 Press the push-button. The Green input LED blinks rapidly. Maximum Response Time setting is now accessed.
- 5.4 Turn the rotary switch to the selected numerical value for Maximum Response Time desired. (see list in Step 5.2)
- 5.5 Press the push-button. The Green input LED blinks the value entered, pauses, and repeats the new Maximum Response Time setting.
- ◆ If the new Maximum Response Time setting is acceptable, this section is complete*.
- ◆ If the new Maximum Response Time setting is not acceptable, repeat from Step 5.3.
- If the Red output LED blinks, the rotary switch numerical value is invalid. Repeat Steps 5.4 and 5.5.
- * Section complete; place DIP switch 4 to the Down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

6.0 Calibration

The IFMA is factory calibrated for all operating modes. These settings are permanently stored in the unit's configuration memory. The IFMA automatically selects the proper calibration setting for the selected Operation mode.

The Minimum and Full Scale output values established at the factory can be changed using the calibration routines. The Minimum output value can be adjusted to any value less than the Full Scale output value, and the Full Scale value can be adjusted to any value greater than the Minimum value.

Changing the factory calibration settings does affect the accuracy of the unit. Specified accuracy for modes 2, 3, and 4 holds until the factory calibration range has been halved. This does not apply to mode 1, since it already uses only half of the IFMA's output range. When increasing the output range, the new calibration settings can not exceed the factory Full Scale value by more than 10%. The 0 to 5 VDC range can be doubled.

The IFMA can store user calibration settings for only one mode at a time. If calibration is changed for one operating mode, and the user then selects a different operating mode, the unit reverts to factory calibration settings. Calibration steps can be combined (added) to obtain a total calibration change. This is done by repeated push-button entries of the same value, or different values, before saving the change. The calibration steps as shown in the table at right are approximations. A current or volt meter should be connected to the appropriate output pins to verify the actual calibration setting.

Approximate Calibration Increments

ROTARY SWITCH	VOLTAGE	CURRENT
1	3 mV	5 µA
2	5 mV	10 µA
3	10 mV	25 µA
4	25 mV	50 µA
5	50 mV	100 µA
6	100 mV	200 µA
7	200 mV	400 µA
8	400 mV	800 µA

Calibration Direction

The default direction for calibration changes is up (increasing values) on entry to either calibration routine. This direction can be toggled from within the routine with the following steps:

- 1. Enter the calibration routine you wish to change (Minimum or Full Scale).
- 2. Press the push-button. The Green input LED blinks rapidly.
- 3. Turn the rotary switch to position 9. Press the push-button.
- 4. The Output LED indicates the direction of calibration:

OFF = Increasing Value ON = Decreasing Value



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6.0 Calibration (Cont'd)



Step 6.4



- 6.3 Press the push-button to enable the rotary switch. The Green input LED now blinks at a faster rate, indicating that calibration values are accessible.
- 6.4 Turn rotary switch to appropriate numerical setting for calibration (see list in Step 6.0), while monitoring the output signal. Press the push-button. Calibration is raised or lowered by this approximate value, depending on calibration direction.
- If this setting meets your requirements, go to step 6.5. If more calibration is required, repeat step 6.4 until the calibration meets your requirements.
- If you overshoot your desired value, reverse calibration direction as shown in 6.0 and continue calibration until the value meets your requirements.

6.5 Turn the rotary switch to 0 and press the push-button. This saves the new user calibration setting.

- ◆ If you want to return to factory calibration, exit Calibration and then re-enter. Turn rotary switch to 0 and press push-button twice. This reloads the factory calibration setting for the selected mode of operation.
- When calibrating the Minimum output value, if the red output LED blinks while in the down direction, the requested calibration setting is beyond the output's absolute minimum value. The calibration setting is held at the absolute minimum value. Reverse calibration direction and repeat from step 6.4.
- When calibrating Full Scale, if the red output LED blinks while in the up direction, the requested calibration setting is beyond the output's absolute maximum value. The calibration setting is held at the maximum value. Reverse calibration direction and repeat from step 6.4.
- If an attempt is made to calibrate the Full Scale value lower than the Minimum value, or conversely, the Minimum value higher than the Full Scale value, the red output LED blinks, and the IFMA sets the two values equal. Reverse calibration direction and repeat from step 6.4.

Calibration Example (Scaling):

A customer using the 0 to 10 VDC output range of the IFMA wants the Minimum value to be at 1 VDC. To do this, connect a voltmeter to the output of the IFMA to monitor the output voltage. Access Configuration Mode by placing DIP switch 4 to the ON (up) position. Access Analog Output Minimum value by placing DIP switches 5 and 7 up, and DIP switch 6 down. Press the push-button to enable changes to the calibration value. Turn the rotary switch to position 8 and press the push-button. The voltmeter should reflect an increase of about 400 mV. With the rotary switch still at position 8, press the push-button again. The voltmeter should now read approximately 800 mV. Turn the rotary switch to a position lower than 8 to effect a smaller change in calibration. Continue adjusting the rotary switch and pressing the push-button until 1 VDC is displayed on the voltmeter. Turn the rotary switch to position 0 and press the push-button. This action saves the new calibration setting for the Minimum value.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the IFMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out and away from the rail.





T Rail Installation

To install the IFMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.

APPLICATION

A customer needs a unit to output a signal to a chart recorder for a flow rate system. There is an existing APLR rate indicator receiving an input from a PSAC inductive proximity sensor. The IFMA Frequency to Analog Converter is connected in parallel with the APLR to output the signal to the chart recorder.

The flow rate is measured in gal/min. and needs to be converted to a 0 to 10 VDC signal. The Operating Mode of the IFMA is set for a 0 to 10 VDC output signal. The PSAC measures 48 pulses/gal. with a maximum flow rate of 525 gal/min. The Maximum Response Time is set to setting '9' (10 sec). The chart recorder will record 0 VDC at 0.125 gal/min, and 10 VDC at 525 gal/min.

The Input Range can be set one of two ways. By entering the calculated maximum frequency with the rotary switch, or by applying the maximum frequency signal of the process to the input of the IFMA. To set the input with the rotary switch, first determine the maximum frequency generated by the maximum output of the sensor using the following formula:



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MODEL IFMR - DIN-RAIL SPEED SWITCH



- SIMPLE ON-LINE TRIP FREQUENCY SETTING (USING ACTUAL INPUT SIGNAL OR FREQUENCY GENERATOR)
- USER SETTABLE TRIP FREQUENCY FROM 0.1 Hz to 25 KHz
- OVER-SPEED, UNDER-SPEED, AND ZERO-SPEED DETECTION
- RELAY LATCHING, ALARM OVERRIDE, AND ALARM RESET FUNCTIONS
- PROGRAMMABLE INPUT CIRCUIT ACCEPTS OUTPUTS FROM A VARIETY OF SENSORS
- HYSTERESIS AND OFFSET FUNCTIONS AVAILABLE
- 85 to 250 VAC and 9 to 32 VDC VERSIONS AVAILABLE
- INPUT AND RELAY STATUS INDICATION LED'S



DESCRIPTION

The Model IFMR accepts a frequency input, and controls a single relay (SPDT) based on the value of the input frequency. The Trip frequency can be set to any value from 0.1 Hz to 25 KHz. The IFMR can be set to trip on overspeed, or underspeed (including zero speed). Offset and hysteresis values can be incorporated into the trip setting to eliminate output chatter. LED indicators for both the Input signal and the Relay status are provided. Two separate input connections for external push-buttons are also provided. One external input overrides the trip detection function, and holds the relay in the release state as long as the input is pulled to common.

The IFMR utilizes a seven position DIP switch, a rotary switch, a push-button and two indication LEDs to accomplish input circuit configuration, operational parameter set-up, input signal, and relay status indication. The input circuitry is DIP switch selectable for a variety of sources.

The indication LEDs are used during normal operation to display the input signal and relay status of the IFMR. These LEDs are also used to provide visual feedback to the user of the current parameter settings during parameter set-up.





The IFMR operates in one of six output modes, as selected by the user. The programmable Minimum Response Time provides optimum response vs. input filtering for any input frequency. The offset and hysteresis settings provide flexible adjustment of the relay trip and release points.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat profile rail according to EN 50 022 - 35×7.5 and 35×15 , and G profile rail according to EN 50 035 - G32.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



WARNING: SPEED SWITCHES MUST NEVER BE USED AS PRIMARY PROTECTION AGAINST HAZARDOUS OPERATING CONDITIONS. Machinery must first be made safe by inherent design, or the installation of guards, shields, or other devices to protect personnel in the event of a hazardous machine speed condition. The

protect personnel in the event of a hazardous machine speed condition. The speed switch may be installed to help prevent the machine from entering the unsafe speed.

SPECIFICATIONS

- 1. POWER:
 - AC Powered Versions: 85 to 250 VAC; 48 to 62 Hz; 5.5 VA DC Powered Versions: 9 to 32 VDC; 2.0 W
 - Power Up Current: Ip = 600 mA for 50 msec max.
- 2. SENSOR POWER: $(A\hat{C} \text{ version only}) + 12 \text{ VDC} \pm 25\% @ 60 \text{ mA max}.$
- 3. OPERATING FREQUENCY RANGE: 0 Hz to 25 KHz
- 4. SIGNAL INPUT: DIP switch selectable to accept signals from a variety of sources, including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups, and all standard RLC sensors.
 - **Current Sourcing**: Internal 1 K Ω pull-down resistor for sensors with current sourcing output. (Max. sensor output current = 24 mA @ 24 V output.) **Current Sinking**: Internal 3.9 K Ω pull-up resistor for sensors with current
 - sinking output. (Max. sensor current = 3 mA.)
 - **Low Bias**: Input trigger levers $V_{IL} = 0.25$ V, $V_{IH} = 0.75$ V; for increased sensitivity when used with magnetic pickups.
 - **Hi Bias**: Input trigger levels $V_{IL} = 2.5 \text{ V}$, $V_{IH} = 3.0 \text{ V}$; for logic level signals. **Max. Input Signal**: $\pm 90 \text{ V}$; 2.75 mA mass (with both Current Sourcing and Current Sinking resistors switched off).

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES			
		9 to 32 VDC	85 to 250 VAC		
IFMR	Speed Switch	IFMR0036	IFMR0066		

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SPECIFICATIONS (Cont'd)

- 5. **CONTROL INPUTS:** Active low ($V_{IL} = 0.5 \text{ V max.}$) internally pulled up to 5 VDC through a 100 K Ω resistor ($I_{SNK} = 50 \mu A$). Response Time = 1 msec. **Alarm Reset:** Unlatches the relay when pulled to common while the input frequency is in the release region.
 - Alarm Override: Causes the IFMR to unconditionally release the relay when pulled to common.
- 6. RELAY CONTACT OUTPUT: FORM "C" (SPDT) contacts max. rating. 5 A @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load). The operate time is 5 msec nominal and the release time is 3 msec nominal.
- 7. **RELAY LIFE EXPECTANCY:** 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)
- 8. ACCURACY: ±0.1% of the trip frequency setting.
- INPUT IMPEDANCE: 33 KΩ min. with the sink and source DIP switches in the OFF positions. (See Block Diagram)
- 10. **MINIMUM RESPONSE TIME:** From 5 msec. +1 period to 10 sec. +1 period in ten steps (*excluding relay operate time*).
- 11. **HYSTERESIS AND OFFSET:** From 0.25% to 33.33% of Trip Frequency in nine steps. Hysteresis and/or Offset can also be set to 0 (*Disabled*).
- 12. INPUT AND POWER CONNECTIONS: Screw in terminal blocks
- 13. ISOLATION BREAKDOWN VOLTAGE (Dielectric Withstand):
- 2200 V between power & input, and power & output; 500 V between input & output for 1 minute.

14. CERTIFICATIONS AND COMPLIANCES:

SAFETY

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UL Recognized Component, File #E137808, UL508, CSA 22.2 No. 14 Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

IECEE CB Scheme Test Report # 97ME50135-042297 Issued by Underwriters Laboratories, Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact ¹
		Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m ²
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O
		Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m
Emissions to EN 50081-2		
RF interference	EN 55011	Enclosure class A
		Power mains class A

Notes:

1. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches, etc.) typical anti-static precautions should be observed before touching the unit.

2. For operation without loss of performance:

- Unit is mounted on a rail in a metal enclosure (Buckeye SM7013-0 or equivalent) and I/O cables are routed in metal conduit connected to earth ground.
- Refer to the EMC Installation Guidelines section of this bulletin for additional information.

15. ENVIRONMENTAL CONDITIONS:

Operating Temperature: 0 to 50°C

Storage Temperature: -40 to 80°C

- **Operating and Storage Humidity**: 85% max. (non-condensing) from 0°C to 50°C.
- Vibration according to IEC 68-2-6: Operational 5 to 150 Hz in X, Y, Z direction for 1.5 hours, 2 g.
- **Shock according to IEC 68-2-27:** Operational 30 g (10 g relay), 11 msec in 3 directions.

Altitude: Up to 2000 meters

16. **CONSTRUCTION:** Case body is black, high impact plastic. Installation Category II, Pollution Degree 2

17. WEIGHT: 6 oz. (0.17 Kg)



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OVERVIEW

The Model IFMR continuously monitors the input signal and controls an output relay based on the frequency of the input signal, the chosen Operation Mode (Underspeed or Overspeed), and the Trip and Release points the user has selected. The green Input LED blinks at the rate of the input frequency. At about 100 Hz, the Input LED will appear to be solid on. At very low frequencies, the Input LED blinks slowly and may also appear to be solid on. A loss of signal may also cause the Input LED to remain on, depending on the DIP switch setup. In this case, the red Relay LED also turns on. The IFMR indicates the status of the relay with the Relay LED (Red). Whenever the relay is in the Trip state, the IFMR turns ON the Relay LED. In the Release state, the Relay LED is OFF.

For Overspeed detection, when the input frequency (averaged over the Minimum Response Time) exceeds the Trip point, the IFMR trips the relay. With the relay in the Trip condition, the input frequency must fall below the Release point for the relay to release.

For Underspeed detection, the relay trips when the input frequency (averaged over the Minimum Response Time) falls below the Trip point. The relay releases only after the input frequency has exceeded the Release point. Two of the Underspeed operating modes allow the machine or system that supplies the input signal to reach normal operating speed before the IFMR responds to an Underspeed condition. For Zero Speed applications, bear in mind that Zero Speed detection and Underspeed detection are identical.

The Minimum Response Time parameter sets the minimum update time of the output. The actual response time is the Minimum Response Time plus up to one full period of the input signal. The IFMR counts the negative edges occurring during the update time period, and computes the average frequency value for that time. This action filters out any high frequency jitter that may be present in the input signal. The longer the Minimum Response Time, the more filtering occurs.

The Offset value is added to the Trip Frequency to determine the Trip Point for Overspeed operation. For Underspeed operation the Trip point becomes the Trip Frequency minus the Offset value.

If No Hysteresis has been selected, the Trip and Release points are identical, which can lead to cycling or "chattering" of the relay at input frequencies hovering around the Trip point. If Hysteresis is selected, the Release point is set to the Trip point (including Offset) minus the Hysteresis value for Overspeed detection. For Underspeed detection, the Release point is set to the Trip point (including Offset) plus the Hysteresis value.

Two input pins (Alarm Override and Alarm Reset) are provided for the optional connection of push-buttons. The Alarm Override pin causes the IFMR to unconditionally Release the relay, regardless of the input frequency, or the state of the relay, when pulled to common. When the Alarm Override pin is released from common, the operation of the IFMR returns to normal, and the status of the relay is updated based on the input frequency.

The Alarm Reset pin is only active when the IFMR is in one of the Latch operation modes. With the Latch function selected, the relay "latches" into the Trip state whenever a Trip condition is detected. The relay remains latched until the Alarm Reset pin is pulled to common while the input frequency is in the Release region. The Alarm Reset pin is ignored while the input frequency is in the Trip region.

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. The unit becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful installation or a troublesome installation.

Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application.

- Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
- a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
- b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
- c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- 3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components
- 4. In very electrically noisy environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables: Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A Steward #28B2029-0A0

- Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3
- *Note: Reference manufacturer's instructions when installing a line filter.* 5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

POWER AND OUTPUT CONNECTIONS

AC Power

Primary power is connected to terminals 10 and 12 (labeled AC). For best results, the AC Power should be relatively "clean" and within the specified variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

DC Power

The DC power is connected to Terminals 10 and 12. The DC plus (+) is connected to Terminal 10 and the minus (-) is connected to Terminal 12. It is recommended that separate supplies be used for sensor power and unit power. Using the same supply for both will negate isolation between input and power.

Output Wiring

Terminals 1, 2, and 3 are used to connect to the relay output. Terminal 1 is the normally open contact. Terminal 3 is the normally closed contact, and Terminal 2 is the output relay common.



INPUT CIRCUITS, SENSOR CONNECTIONS AND CONFIGURATION SWITCH SET-UP

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The Model IFMR Speed Switch uses a comparator amplifier connected as a Schmidt trigger circuit to convert the input wave form into the pulse form required for proper circuit operation. Three set-up switches are used to configure the input circuit to accept signals from a wide variety of sources, as follows: S1 - ON: Connects a 1 K Ω pull-down resistor for sensors with sourcing outputs. (Maximum sensor output current is 24 mA @ 24 VDC output.)

S2 - ON: For logic level signals, sets the input bias levels to $V_{II} = 2.5 V_{c}$

V_{IH} = 3.0 V.

OFF: For increased sensitivity when used with magnetic pickups, sets the input bias levels to $V_{IL} = 0.25$ V, $V_{IH} = 0.75$ V.

S3 - ON: Connects a 3.9 KΩ pull-up resistor for sensors with current sinking output. (Max. sensor current = 3 mA.)

CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS

Note: Separate power supplies must be used for sensor power and input power to maintain the isolation breakdown voltage specification. If isolation between power and input is not needed, then a single supply can be used for both unit and sensor power.





Upon entry to a set-up parameter, the Input LED blinks the current numerical value of a setting at a 1 Hz rate. A setting of "1" is indicated by one blink ($\frac{1}{2}$ sec off), through a setting of "9", which is indicated by nine blinks. A setting of "0" is indicated by a single short flash (40 msec on, 1 sec off). After the entire value is indicated, the IFMR pauses two seconds and repeats the value.

During entry of a new value, if the Mode switch (S4) or any of the CFG DIP switch positions are changed before the push button is pressed, the IFMR aborts the entry process and retains the previous setting.

To begin set-up, place DIP switch 4 to the on (up) position. DIP switches 5, 6, and 7 access unit configuration settings.

DIP SWITCH	DESCRIPTION	SECTION
	Operating Mode	(1.0)
	Set Trip Frequency Using an Input Signal or Frequency Generator	(2.0)
	Set Trip Frequency Using the Rotary Switch	(3.0)
	Set Minimum Response Time	(4.0)
	Set Relay Trip Point	(5.0)
(ÈÈÙÓ	Set Relay Release Point	(6.0)

Note: To return to normal operation, place DIP switch 4 in the down (RUN) position.

() Indicates Configuration Section

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RELAY INDICATION

Overspeed: The Relay LED (red) turns on to indicate the input signal has exceeded the trip frequency.

Underspeed: The Relay LED (red) turns on to indicate the input signal is below the trip frequency setting.

Invalid Entry during Set-up: The Input LED (green) and the Relay LED (red) alternately blink until a valid entry is made.

1.0 Operating Mode







	FACTORY SETTINGS			
	Setting Parameter			
Operating Mode	1	Low Speed Operation, Trip on Overspeed		
Trip Frequency	10000	10 KHz		
Minimum Response	0	5 msec		
Trip Point Offset	0	None		
Trip Point Hysteresis	1	0.25%		

1.1 Place DIP switch 4 to the ON (up) position and DIP switches 5, 6, and 7 as shown.

 1.2 Green input LED blinks the setting corresponding to the Operating Mode shown below, pauses and repeats the value.

Setting	Operating Mode		
1	OVERSPEED trip, automatic Release upon return to normal		
2	OVERSPEED latched trip, Release only after ALM Reset pulled to Common		
3	UNDERSPEED trip, automatic Release upon return to normal		
4	UNDERSPEED trip, start-up condition* ignored, automatic Release upon return to normal		
5	UNDERSPEED latched trip, Release only after ALM Reset pulled to Common		
6	UNDERSPEED latched trip, start-up condition* ignored, Release only after ALM Reset		
	multiplet to Common		

- 1.3 Press the push-button. The Green input LED blinks rapidly to indicate the Operating mode setting is now accessed.
- 1.4 Turn the rotary switch to the selected numerical value for output desired (see the list in Step 1.2).
- 1.5 Press the push-button. The Green input LED blinks the value entered, pauses, and repeats the new operation setting.
- ◆ If the new Operating mode setting is acceptable, this section is complete*.
- If the new Operating mode setting is not the desired setting, repeat Steps 1.3, 1.4, and 1.5.
- ◆ If Red output LED blinks, the rotary switch numerical value is invalid. Repeat Steps 1.4 and 1.5.
- * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

2.0 On-Line Trip Frequency Setting Using Actual Input Signal or Frequency Generator

Step 2.1



Step 2.2





- 2.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.
- 2.2 Green input LED blinks the existing Trip Frequency setting as shown in the examples below. Six full digits of numerical information blink with a 2 sec. pause between digits and a 4 sec. pause at the end, before repeating. The first five digits are the existing Trip Frequency magnitude. The sixth digit is the frequency resolution (the number of digits to the right of the decimal point).



- If existing Trip Frequency setting is your desired requirement, this section is complete*. Otherwise, continue with Step 2.3.
- 2.3 Apply the desired Trip Frequency to the signal input pin.
- 2.4 Press the push-button. The Green input LED blinks rapidly. The acquisition process takes two seconds plus one period of the input signal.
- If the new Trip Frequency setting is valid, the Green input LED turns on solid. Continue to Step 2.5.
- If Red relay LED blinks, the new Trip Frequency is invalid, outside the acceptable 0.1 Hz to 25 KHz range. Repeat Steps 2.3 and 2.4.
- 2.5 Press the push-button. The Green input LED blinks the new Trip Frequency setting. This section is complete*.
- ◆ To verify Trip Frequency setting, see Step 2.2.
- * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

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- 3.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.
- 3.2 The Green input LED blinks the existing Trip Frequency setting, pauses and repeats. Six full digits of numerical information blink with a 2 sec. pause between digits and a 4 sec. pause at the end, before repeating. The first five digits are the existing Trip Frequency magnitude. The sixth digit is the frequency resolution (the number of digits to the right of the decimal point).
- ◆ If the existing Trip Frequency setting is your desired requirement, this section is complete*. Otherwise, continue with Step 3.3.
- 3.3 Determine the Trip Frequency and record in the space provided below.



- 3.4 Press the push-button. The Green input LED blinks rapidly. Trip Frequency setting is now accessed.
- 3.5 Turn the rotary switch to the first selected numerical value. Press the push-button. The Green input LED continues to blink rapidly. First of six numerical digits is entered.
- 3.6 Turn the rotary switch to the second selected numerical value. Press the push-button. The Green input LED continues to blink rapidly. Second of six numerical digits is entered.
- 3.7 Repeat Step 3.6 three more times then go to Step 3.8. This enters a total of five of the required six numerical digits.
- 3.8 Turn the rotary switch to the selected numerical value for resolution requirement. Press the push-button. The Green input LED blinks the new Trip Frequency setting (as described in <u>Step 2.2</u>), pauses, and repeats the value.
 - Ferrite Suppression Cores for signal and control cables:
- ◆ If the new Trip Frequency setting is acceptable, this section is complete*.
- ◆ If the new Trip Frequency setting is not the desired setting, repeat Steps 3.4, through 3.8.
- If the Red relay LED blinks, the numerical value entered is invalid. Repeat Steps 3.3 through 3.8.
- * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

4.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.

4.2 The Green input LED blinks the existing Minimum Response Time setting (see following list), pauses and repeats.

Setting	Time	Setting	Time
0	5 msec	5	200 msec
1	10 msec	6	500 msec
2	20 msec	7	1 sec
3	50 msec	8	5 sec (not valid for trip frequency > 3906 Hz)
4	100 msec	9	10 sec (not valid for trip frequency > 3906 Hz)

Note: Minimum Response Times do not include the relay's operate response time of 5 msec., or the release response time of 3 msec.

- 4.3 Press the push-button. The Green input LED blinks rapidly. Minimum Response Time setting is now accessed.
- 4.4 Turn the rotary switch to the selected numerical value for Minimum Response Time desired (see list in Step 4.2).
- 4.5 Press the push-button. The Green input LED blinks the value entered, pauses, and repeats the new setting.
- ◆ If the new Minimum Response Time setting is acceptable, this section is complete*.
- If the new Minimum Response Time setting is not the desired setting, repeat Steps 4.3, 4.4, and 4.5.
- If the Red relay LED blinks, the rotary switch numerical value is invalid. Repeat Steps 4.4 and 4.5.
- * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.



Step 4.1



Step 4.2



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Step 5.1



Step 5.2





For Overspeed operation, the Relay Trip point is internally set to the Trip Frequency plus the Offset value. For Underspeed operation, the Relay Trip point is internally set to the Trip Frequency minus the Offset value. The Offset value is equal to the Trip Frequency multiplied by the selected Offset percentage.

Example: The Offset value is calculated as shown below.

=	250 Hz
=	4 (2.00%)
=	250 Hz x 2.00% (0.02) = 5 Hz
=	250 + 5 = 255 Hz
=	250 - 5 = 245 Hz
	= = =

5.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.

5.2 The Green input LED blinks the existing setting (see following list), pauses and repeats.

Setting	Percentage
0	0.00% (NO Offset)
1	0.25% (0.0025)
2	0.50% (0.0050)
3	1.00% (0.0100)
4	2.00% (0.0200)
5	5.00% (0.0500)
6	10.00% (0.1000)
7	20.00% (0.2000)
8	25.00% (0.2500)
9	33.33% (0.3333)

5.3 Press the push-button. The Green input LED blinks rapidly. Trip Point Offset setting is now accessed

- 5.4 Turn the rotary switch to the selected numerical value for Trip Point Offset desired (see list in Step 5.2).
- 5.5 Press the push-button. The Green input LED blinks the value entered, pauses, and repeats the new setting
- ◆ If the new Trip Point Offset setting is acceptable, this section is complete*.
- If the new Trip Point Offset setting is not the desired setting, repeat Steps 5.3, 5.4, and 5.5.
- ◆ If the Red relay LED blinks, the rotary switch numerical value is invalid. Repeat Steps 5.4 and 5.5.
- * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

6.0 Set Relay Release Point (Hysteresis)

|↑||↓||↑| Step 6.1

Step 6.2





For Overspeed operation, the Relay Release point is set to the Relay Trip point minus the Hysteresis value. For Underspeed operation, the Relay Release point is set to the Relay Trip point plus the Hysteresis value. The hysteresis value is calculated by multiplying the hysteresis percentage by the current trip frequency. If No Hysteresis (setting = 0) is selected, the Relay Trip and Release points are identical, which can lead to chattering or cycling of the relay at input frequencies hovering around the Relay Trip point.

Example: Using the Trip Frequency and Offset value as shown in the example above, the hysteresis value is calculated as shown below.

Rotary Switch Setting	=	3 (1.00%)
Hysteresis Value	=	250 Hz x 1.00% (0.01) = 2.5 Hz
Release Point:		
OVERSPEED	=	250 + 5 - 2.5 = 252.5 Hz
UNDERSPEED	=	250 - 5 + 2.5 = 247.5 Hz

6.1 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown.

6.2 The Green input LED blinks the existing setting (see following list), pauses, and repeats.

Setting	Percentage
0	0.00% (NO Hysteresis)
1	0.25% (0.0025)
2	0.50% (0.0050)
3	1.00% (0.0100)
4	2.00% (0.0200)
5	5.00% (0.0500)
6	10.00% (0.1000)
7	20.00% (0.2000)
8	25.00% (0.2500)
9	33.33% (0.3333)

- 6.3 Press the push-button. The Green input LED blinks rapidly. Trip Point Hysteresis setting is now accessed.
- 6.4 Turn the rotary switch to the selected numerical value for Hysteresis desired (see list in Step 6.2).
- 6.5 Press the push-button. The Green input LED blinks the value entered, pauses and repeats the new setting
- ◆ If the new Trip Point Hysteresis setting is acceptable, this section is complete*.
- ◆ If the new Trip Point Hysteresis setting is not the desired setting, repeat Steps 6.3, 6.4, and 6.5. ◆ If the Red relay LED blinks, the rotary switch numerical value is invalid. Repeat Steps 6.4
- and 6.5. * Section complete; place DIP switch 4 to the down position for normal operation, or change DIP switches 5, 6, and 7 for the next Configuration Section.

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the IFMR on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



T Rail Installation

To install the IFMR on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.

TROUBLESHOOTING

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For further technical assistance, contact technical support at the appropriate company numbers listed.

APPLICATION 1

An APLR is connected to an LMPC (logic magnetic pickup) that is sensing the speed of a 60 tooth gear attached to a shaft. The shaft speed



should not exceed 2000 RPM.

The IFMR is placed in parallel with the APLR to activate an alarm when an overspeed condition is detected, and to turn off the alarm when the speed returns to normal. The Mode of Operation is set for Mode #1 (overspeed trip, automatic release upon return to normal).

To set the value of the alarm, either apply the maximum input signal as described in Section 2.0 or determine the Trip Frequency using the following formula:

Set the Trip Frequency with the rotary switch for 2000 Hz.

With Trip point Offset set at 0.00% (No Offset) and Trip Point Hysteresis set at 0.25%; activation of the relay occurs at 2000 Hz, and release occurs at 1995 Hz.

APPLICATION 2

Trip

The IFMR can be used in a speed monitoring system to detect when the system drops below setpoint.

The IFMR is wired to a PSAC (inductive proximity sensor) that is sensing a key way on the shaft of a motor. The motor is turning at 1750 RPM. When the speed of the motor drops below 1250 RPM, the IFMR latches the output until the user resets the output with an external push button.

The mode of operation of the IFMR is set for 5 (UNDERSPEED Latched trip, release only after Alarm Reset pulled to common). Determine the Trip Frequency using the following formula:

Trip Freq. =
$$\frac{\text{RPM x PPR}}{60}$$

$$p \text{ Freq.} = \frac{1250 \text{ RPM x 1 PPR}}{60 \text{ sec.}} = 20.83 \text{ Hz.}$$

Set the Trip Frequency with the rotary switch for 20.83 Hz.

H

MODEL AFCM - Analog to Frequency Converter Module



DESCRIPTION

The configurable analog to frequency converter is used to convert analog standard signals to frequency signals or pulse width modulated (PWM) signals. Input signal ranges are 0 - 20 mA, 4 - 20 mA, 0 - 10 mA, 2 - 10 mA, 0 - 10 V, 2 - 10 V, 0 - 5 V, or 1 - 5 V.

The DIP switches are accessible on the side of the housing and allow the following parameters to be configured:

- Input signal
- Output values
- Output type (frequency or PWM)
- Filter type (for smoothing interferences on the input signal)

- Input over/under range fault detection



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
AFCM	Analog to Frequency Converter Module	AFCM0000

- VOLTAGE/CURRENT TO FREQUENCY CONVERTER
- 3-WAY ISOLATION OF INPUT / OUTPUT SIGNALS
- UNIVERSAL CONVERSION MODULE INPUTS AND OUTPUTS SELECTED VIA DIP SWITCH SETTINGS
- ULTRA SLIM DESIGN ONLY 0.244" WIDE
- 19 to 30 VDC POWER



UL Recognized Component, File # E257265

SAFETY SUMMARY

The device may only be installed and put into operation by qualified personnel. The corresponding national regulations must be observed.



SPECIFICATIONS

INPUT

- 1. INPUT SIGNAL RANGE (Configurable): 0 20 mA, 4 20 mA, 0 10 mA, 2 10 mA, 0 10 V, 2 10 V, 0 5 V, 1 5 V
- 2. MAX. INPUT SIGNAL: Current inputs: 100 mA Voltage inputs: 30 VDC
- INPUT RESISTANCE: Current inputs: 50 Ω, approx. Voltage inputs: 110 KΩ, approx.

OUTPUT

1. OUTPUT SIGNAL RANGE (Configurable):

Frequencies: 0 - 10 kHz, 0 - 5 kHz, 0 - 2.5 kHz, 0 - 1 kHz, 0 - 500 Hz 0 - 250 Hz, 0 - 100 Hz, 0 - 50 Hz

- PWM: 7.8 kHz, 3.9 kHz, 1.9 kHz, 977 Hz, 488 Hz, 244 Hz, 122 Hz, 61 Hz 2. **MIN. LOAD**:
- Frequency: 6 KΩ
- PWM: 2 KΩ
- 3. MAX. LOAD CURRENT: 20 mA
- 4. OUTPUT: NPN open collector transistor
- 5. MAX. SWITCHING VOLTAGE: 30 V
- 6. OVER-RANGE/UNDER-RANGE FAULT DETECTION: Configurable
- 7. OUTPUT PROTECTION: Short circuit and polarity protection

GENERAL DATA

- 1. SUPPLY VOLTAGE: 19.2 30 VDC
- 2. NOMINAL VOLTAGE: 24 VDC
- 3. CURRENT CONSUMPTION: < 10 mA
- 4. POWER CONSUMPTION: < 200 mW
- 5. TRANSMISSION ERROR: < 0.1%
- 6. TEMPERATURE COEFFICIENT (MAX.): < 0.02%/K
- 7. STEP RESPONSE:
- 0% to 99%: < 15 msec + (1/T)
- With Largest Filter: < 1 sec + (1/T)
- 8. TEST VOLTAGE (INPUT / OUTPUT / SUPPLY): 1.5 kV, 50 Hz, 1 min
- 9. AMBIENT TEMPERATURE RANGE:
- Operation: -20 t +65°C (-4 to 148°F) Storage: -40 to +85°C (-4 to 183°F)
- 10. FAULT DETECTION: Red LED under clear cover top

TF

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11. CERTIFICATIONS AND COMPLIANCES:

Conformance With EMC Guideline 89/336/EEC And Low Voltage Directive 73/23/EEC Immunity to Interference According to EN 61000-6-2

Discharge of static electricity (ESD)	EN 61000-4-2	Criterion B ¹
Electromagnetic HF field	EN 61000-4-3	Criterion A ²
Fast transients (Burst)	EN 61000-4-4	Criterion B ¹
Surge voltage capacities (Surge)	EN 61000-4-5	Criterion B ¹
Conducted disturbance	EN 61000-4-6	Criterion A ²
Noise Emission According to EN 61000-6-4		
Noise emission of housing	EN 55011	Class A ³

- ¹ Criterion B: Temporary impairment to operational behavior that is corrected by the device itself.
- ² Criterion A: Normal operating behavior within the defined limits.
- ³ Class A: Area of application; industry.

12. CONNECTIONS:

Wire Gauge: 24-12 AWG

- Stripping length: 0.47" (12 mm)
- 13. CONSTRUCTION: Polybutylenterephthalate PBT, black

INPUT

сомм

- 14. **MOUNTING**: Standard DIN top hat (T) profile rail according to EN50022 35x7.5
- 15. WEIGHT: 2 oz. (54 g)

WIRING CONNECTIONS

Primary power is connected to terminals 7 or 3 (19.2 - 30 VDC) and 8 or 4 (GND 3). For best results, the Power should be relatively "clean" and within the specified variation limits. Drawing power from heavily loaded circuits or from that also circuits power loads that cycle on and off, should be avoided.

The input signal is connected to terminal 1 (In UI) and 2 (GND 1). Connections for the output signal is on terminals 5 (Out f) and 6 (GND 2).





CONFIGURATION

DIP Switch S1

Using DIP switch S1, you can set the input values, and the values for Moving Average Filter and Over sampling.

1	2	3	4	ANALOG IN
				0 – 10V
	ON			1 – 5V
		ON		0 – 5V
	ON	ON		2 – 10V
ON			ON	0 – 20 mA
ON	ON		ON	4 – 20 mA
ON		ON	ON	0 – 10 mA
ON	ON	ON	ON	2 – 10 mA

The moving average filter can group values (1, 2, 4, 6) using moving window averaging to form a new measured value. In moving window averaging, the average of a fixed number of measured values is taken, whereby the oldest value is always dropped and the most recent added.

5	6	MOVING WINDOW AVERAGING
		1 value
ON		2 values
	ON	4 values
ON	ON	6 values

7	8	OVER SAMPLING	
		1 value	
ON		10 values	
	ON	50 values	
ON	ON	100 values	

In order to smooth the measured values, an average can be formed from several measured values (1, 10, 50, 100). This process is called Over sampling. In oversampling, the average is updated every time the selected number of values is reached.

DIP Switch S2

Using DIP switch S2, you can set the output values, the output type and fault detection.

Output Signals Frequency Output:

Variable frequency/period duration T



1	2	3	4	FREQUENCY OUTPUT	
				0 - 10 kHz	
ON				0 - 5 kHz	
	ON			0 – 2.5 kHz	
ON	ON			0 - 1 kHz	
		ON		0 - 500 Hz	
ON		ON		0 - 250 Hz	
	ON	ON		0 - 100 Hz	
ON	ON	ON		0 - 50 Hz	

PWM Output

(Pulse Wide Modulation): Variable pulse to pause ratio/fixed

period duration T



Change can only be read by PWM input meters.

1	2	3	4	PWM OUTPUT
			ON	7.8 KHz
ON			ON	3.9 KHz
	ON		ON	1.9 KHz
ON	ON		ON	977 Hz
		ON	ON	488 Hz
ON		ON	ON	244 Hz
	ON	ON	ON	122 Hz
ON	ON	ON	ON	61 Hz

Fault Detection

5	6	INPUT OVER RANGE	
		Freeze at 100% measuring range end value	
ON		105% measuring range end value	
	ON	110% measuring range end value	
ON	ON	Fault detection OFF (continues past end value)	

7	8	INPUT UNDER RANGE	
		Freeze at 100% measuring range start value	
ON		105% measuring range end value	
	ON	110% measuring range end value	
ON	ON	Fault detection OFF (stops at start value)	

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

T Rail Installation

To install the AFCM on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



MODEL AIMI - 0 (4) to 20 mA passive LOOP POWERED Isolator

CE



SPECIFICATIONS

- 1. INPUT RANGE: 0(4) to 20 mA
- 2. MAXIMUM INPUT CURRENT/VOLTAGE: 40 mA/18 VDC
- 3. VOLTAGE DROP AT INPUT: 1.7 V + (20 mA * RLOAD)
- 4. MAXIMUM INPUT FREQUENCY: <75 Hz
- 5. **RESPONSE TIME:** 5 msec. max.
- 6. OUTPUT SIGNAL: 0(4) to 20 mA
- **Max. Load Resistance**: $\leq 600 \Omega$
- 7. ISOLATION VOLTAGE: 1.5 KV, 50 Hz, for 1 minute
- 8. ACCURACY: ≤0.1% of full scale
- 9. OPERATING TEMPERATURE RANGE: -20 to +65 °C
- 10. TEMPERATURE COEFFICIENT: ≤0.002%/K of the measured value
- 11. CONSTRUCTION: Case body is black, Polyester PBT
- MOUNTING: Standard DIN style rail, including top hat (T) profile rail according to EN50022 - 35 × 7.5.
- 13. WEIGHT: 2 oz (56 g)



DESCRIPTION

The AIMI0202 passive isolator is used for the electrical isolation and processing of analog 0(4) to 20 mA standard current signals. The AIMI0202 provides electrical isolation between the control electronics and process I/O. In addition, interference signals above 75 Hz are effectively suppressed.

Input and output circuit do not require separate auxiliary power. The AIMI0202 obtains power from the input signal. The modules are snapped onto symmetrical DIN rails in accordance with EN 50022.

VOLTAGE DROP AT INPUT

When using the AIMI0202, ensure the voltage supply is sufficient for handling both the voltage drop of the input and the output load voltage drop. The AIMI0202 input resistance will create around a 1.7 V drop.

The following formula calculates the total voltage drop (input and output). Total voltage drop = (1.7 V + (20 mA * RLOAD))

Where:

1.7 V = Input voltage drop

20 mA * RLOAD = Output load voltage drop



WIRING CONNECTIONS

Connect transducer to input (Terminals 1 & 2), observing polarity. A power supply may be required for loop powered transducers.

The energy for the supply on the input side is taken from the analog input signal. Due to the dynamic input resistance, a power loss of approximately 1.7 V drops at the module input. The module's output is self-powered (active), which is also derived from the input signal.



ORDERING INFORMATION

MODEL NO.	INPUT	OUTPUT	PART NUMBER
AIMI	0 (4)-20 mA	0 (4)-20 mA	AIMI0202

MODEL IAMS – INTELLIGENT UNIVERSAL SIGNAL **CONDITIONING MODULE**



UNIVERSAL INPUT, PROCESS, mA DC, VDC, TC, 100 (RTD, POTENTIOMETER, AND LINEAR RESISTANCE

- UNIVERSAL POWER SUPPLY, 21.6 to 253 VAC/ 19.2 to 300 VDC
- 3-WAY ISOLATION (POWER/SIGNAL/OUTPUT)
- CHOOSE SETPOINTS AND/OR ANALOG OUTPUT MODELS
- PROGRAMMING/DISPLAY MODULE (NOT INCLUDED)
- PROGRAMMING AVAILABLE IN SEVEN DIFFERENT LANGUAGES



CE

GENERAL DESCRIPTION

FM

The IAMS - Universal Signal Conditioners unmatched capability provides users the ultimate in flexibility. As a signal conditioner, the unit provides complete isolation and conversion capability to satisfy almost any application. The Universal Input accepts Process, DC Current, DC Voltage, Thermocouples, RTDs, Potentiometers, and Linear Resistance signals allowing the module to be connected to most common sensors. The setpoint model allows dual setpoint control capability through dual Form A relays. The analog model provides a retransmitted analog signal. A third model provides both analog and control capability. The power supply is also universal, accepting 21.6 to 253 VAC/ 19.2 to 300 VDC as its power source. Add the optional programming module and the unit is easily programmed through menu style programming. The module can also be used to provide a display of the process variable when it is not being used for programming.

The IAMS features well over 100 combinations of inputs to outputs configurations. Input specific terminals allow for the various signals and sensors to be connected to the unit while the input ranges and resolutions are adjusted in the input programming loop of the unit. The menu style programming allows the user quick and easy set-up by using the PGMMOD, programming module. The module is required to program the IAMS. However, if you are using more than

one IAMS, only one programming module is required. The module can store programming from one unit and load it to a second unit reducing set-up time for multiple installations. When the programming module is not being used for programming, it can indicate the input parameters, just like a panel meter.

The unit's overall full scale accuracy typically exceeds 0.1 % depending on the range selection and scaling. The microprocessor based design provides ease of field scaling and the onboard E²PROM stores scaling values for future recall. All units come factory precalibrated for all input and output ranges. Factory or custom field scaling can be selected in the Advanced programming loop. The IAMS can be factory recalibrated in the field if desired.

The unit's environmental operating temperature range is -20° C to 60° C. DIN rail mounting saves time and panel space. The units are equipped with mounting feet to attach to top hat profile rail according to EN50022 - 35 x 7.5 and 35 x 15.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



DIMENSIONS In inches (mm)





WARNING

To keep the safety distances, the relay contacts on the devices must not be connected to both hazardous and non-hazardous voltages at the same time

The IAMS devices must be mounted on a DIN rail according INSTALLto DIN 46277



ATION

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ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
	Intelligent Universal Signal Conditioner with Analog Output	IAMS0001
IAMS	Intelligent Universal Signal Conditioner w/Dual Setpoints	IAMS0010
	Intelligent Universal Signal Conditioner w/Analog Output and Dual Setpoints	IAMS0011
	Programming Display Module (Not Included) *	PGMMOD00

* At least one module is required to program a unit or a series of units.

GENERAL SPECIFICATIONS

1. DISPLAY : See Display/ Programming Module		
2. POWER:	TYPE	м
AC Power: 21.6 to 253 VAC, 50/60 Hz	P	
DC Power: 19.2 to 300 VDC,	B	
3. CONSUMPTION: $\leq 2.5 \text{ W}$	E	· ·
4. FUSE: 400 mA SB/250 VAC	J	T .
5. ISOLATION : Between input, supply and outputs - 2.3 kVAC/250 VAC 6. INPUTS:	К	<u> </u>
Current Input:	L	· ·
Programmable Ranges: 0 to 20 and 4 to 20 mA DC	N	·
Input resistance: Nom. 20 Ω + PTC 50 Ω	R	
Sensor error detection: 4 to 20 loop break, yes	S	
Supply Voltage: 16-25 VDC, 20 mA max (Terminal 43 and 44)	т	+
Voltage Input:		+
Programmable Ranges: 0 to 1, 0.2 to 1, 0 to 5, 1 to 5, 1 to 10, and 2 to 10	U	· ·
VDC	W3	
Measurement range: -20 mV to 12 VDC	W5	1
Input resistance: Nom. 10 M Ω		+
Thermocouple Inputs:	LR	
Thermocouple Type: B, E, J, K, L, N, R, S, T, U, W3, W5, and LR Cold Junction Compensation: via internally mounted sensor $<\pm1.0$ °C Sensor Error Detection: All TC types, yes Sensor Error Current: When detecting 2 μ A, otherwise 0 μ A		

TYPE	MIN. VALUE	MAX. VALUE	STANDARD
В	+400 °C	+1820 °C	IEC 60584-1
E	-100 °C	+1000 °C	IEC 60584-1
J	-100 °C	+1200 °C	IEC 60584-1
К	-180 °C	+1372 °C	IEC 60584-1
L	-200 °C	+900 °C	DIN 43710
N	-180 °C	+1300 °C	IEC 60584-1
R	-50 °C	+1760 °C	IEC 60584-1
S	-50 °C	+1760 °C	IEC 60584-1
Т	-200 °C	+400 °C	IEC 60584-1
U	-200 °C	+600 °C	DIN 43710
W3	0 °C	+2300 °C	ASTM E988-90
W5	0 °C	+2300 °C	ASTM E988-90
LR	-200 °C	+800 °C	GOST 3044-84

Η

RTD, Linear Resistance, Potentiometer Inputs

RTD Types: Pt10, Pt20, Pt50, Pt100, Pt200, Pt250, Pt300, Pt400, Pt500, Pt1000, Ni50, Ni100, Ni120, and Ni1000

INPUT TYPE	NPUT TYPE MIN. VALUE MAX. VALUE		STANDARD
Pt100	Pt100 -200 °C +850 °C		IEC60751
Ni100	-60 °C	+250 °C	DIN 43760
Lin. R 0 Ω		10000 Ω	-
Potentiometer	10 Ω	100 kΩ	-

Cable Resistance per wire: RTD, 50 Ω max. Sensor Current: RTD, Nom. 0.2 mA Sensor Error Detection: RTD, yes

Short Circuit Detection: RTD, < 15 Ω 7. STEP RESPONSE TIME: (0 to 90% or 100 to 10%) Temperature input: \leq 1 sec

Current/Voltage input: ≤ 400 msec

8. ACCURACY: The greater of the general and basic values.

GENERAL VALUES			
Input Type	Absolute Accuracy	Temperature Coefficient	
All	$\leq \pm 0.1\%$ of span	$\leq \pm 0.1\%$ of span/°C	

BASIC VALUES		
Input Type	Basic Accuracy	Temperature Coefficient
mA	$\leq \pm 4 \ \mu A$	$\leq \pm 0.4 \ \mu A/^{\circ}C$
Volt	$\leq \pm 20 \ \mu V$	$\leq \pm 2 \ \mu V/^{\circ}C$
Pt100	$\leq \pm 0.2$ °C	$\leq \pm 0.01 \ ^{\circ}C/^{\circ}C$
Lin. R	$\leq \pm 0.1 \ \Omega$	$\leq \pm 0.01 \ \Omega/^{\circ}C$
Potentiometer	$\leq \pm 0.1 \ \Omega$	$\leq \pm 0.01 \ \Omega/^{\circ}C$
TC Type: E, J, K, L, N, T, U	≤±1 °C	$\leq \pm 0.5$ °C/°C
TC Type: B, R, S, W3, W5, LR	≤ ±2 °C	$\leq \pm 0.2 \ ^{\circ}C/^{\circ}C$

9. CALIBRATION TEMPERATURE: 20 to 28 °C

10. RELAY OUTPUTS: Dual Form A. Contacts rated at 2 A AC or 1 A DC Hysteresis: 0.1 to 25 % (1 to 2999 display counts)
On and off delay: 0 to 3600 sec
Sensor Error Detection: Break / Make / Hold
Max. Voltage: 250 Vrms
Max. Current: 2 A AC or 1 ADC
Max. Power: 500 VA

ACCESSORY



Display/ Programming Module

The module easily connects to the front of the IAMS and is used to enter or adjust the programming of the module. For applications that require more than one IAMS, the same programming module can be used to program multiple units. In fact, it can store the configuration from one module and download the same configuration to another module. When the module is not being used for programming, it can provide a display of the process data and status.

Display: LCD display with 4 lines; line 1 is 0.2" (5.5 mm) and displays the input signal, line 2 is 0.13" (3.33 mm) and displays units, line 3 is 0.13" (3.33 mm) and displays analog output or tag number, line 4 shows communication and relay status

Programming Mode: Three push buttons combined with a simple and easily understandable menu structure and help text guides you effortlessly through the configuration steps. The actual configuration/set-up will be explained in the Programming Section.

Password Protection: Programming access may be blocked by assigning a password. The password is saved in the IAMS to guard against unautherized modifications to the configuration. A default password of "2008" allows access to all configuration menus.

11. ANALOG OUTPUT:

Current Output: Signal Range (Span): 0 to 20 mA Programmable Measurement Range: 0 to 20, 4 to 20, 20 to 0, and 20 to 4 mA Load Resistance: 800 \Omega max. Output Compliance: 16 VDC max. Load Stability: = 0.01 % of span, 100 Ω load Sensor Error Detection: 0 / 3.5 mA/ 23 mA / none Output Limitation: For 4 to 20 and 20 to 4 mA signals - 3.8 to 20.5 mA For 0 to 20 and 20 to 0 mA signals - 0 to 20.5 mA Current Limit: = 28 mA Voltage Output: Signal Range: 0 to 10 VDC Programmable Signal Ranges: 0 to 1, 0.2 to 1, 0 to 10, 0 to 5, 1 to 5, 2 to 10, 1 to 0, 1 to 0.2, 5 to 0, 5 to 1, 10 to 0, and 10 to 2 V Load: 500 K Q min 12. ENVIRONMENTAL CONDITIONS: Operating Temperature: -20 to +60 °C Operating and Storage Humidity: 95% relative humidity (non-condensing) 13. CERTIFICATIONS AND COMPLIANCES: ELECTROMAGNETIC COMPATIBILITY: EMC 2004/108/EC Emission and Immunity EN 61326 EMC Immunity Influence $<\pm 0.5\%$ of span Extended EMC Immunity: NAMUR NE 21, $<\pm 1\%$ of span A criterion, burst SAFETY LVD 2006/95/EC EN 61010-1 Factory Mutual Approved, Report #3034432, FM 3600, 3611, 3810, and ISA 82.02.01 FM, applicable in: Class I, Div. 2, Group A, B, C, D Class I, Div. 2, Group IIC Zone 2 Max. ambient temperature for T5 60°C UL Listed, File # E324843, UL508, CSA C22.2 No. 14-M95 LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards Refer to the EMC Installation Guidelines section of this bulletin for additional information. 14. CONSTRUCTION: IP 50/IP20 Touch Safe, case body is black high impact plastic. Pollution Degree 1. 15. CONNECTIONS: High compression cage-clamp terminal block. Use 60/75°C copper conductors only. Wire strip length: 0.3" (7.5 mm) Wire gage: 26 – 14 AWG stranded wire Torque: 4.5 inch-lbs (0.5 N-m) max 16. WEIGHT: 5 oz (145 g) 5.6 oz (160 g) with programming module

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1.0 INSTALLING THE UNIT

The IAMS is designed to mount to a top hat profile DIN rail. The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.



2.0 INSTALLING THE PROGRAMMING MODULE

The PGMMOD, Programming/Display Module is designed to connect to the front of the IAMS. Insert the top of the programming module first, then allow the bottom to lock into the IAMS.

When programming is complete, leave the programming module in place to display the process data or press the release tab on the bottom of the programming module.

3.0 WIRING THE UNIT

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the sides of the unit. All conductors should conform to the unit's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes, and regulations. It is recommend that power supplied to the unit (DC or AC) be protected by a fuse or circuit breaker.

When wiring the unit, compare the numbers on the terminal blocks against those shown in wiring drawings for proper wire position. Insert the wire under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. The unit becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful installation or troublesome installation.

Listed below are some EMC guidelines for successful installation in an industrial environment.

- Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

- 2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables: Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A Steward #28B2029-0A0 Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

- Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
- Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI. Snubber: RLC#SNUB0000.

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3.1 POWER WIRING

Supply: $31 \quad 32 \quad 33$ $0 \quad 0 \quad 0$ $1 \quad 0 \quad 0$

Note: For DC power connections, there are no polarity concerns.

3.2 INPUT SIGNAL WIRING



3.3 ANALOG OUTPUT WIRING



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3.4 SETPOINT OUTPUT WIRING



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H

.0 REVIEWING THE FRONT BUTTONS AND DISPLAY

DISPLAY: Total of four lines.

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Display	Mode

Line 1	Displays input signal
Line 2	Displays input units
Line 3	Displays output signal
Line 4	Displays communication and relay status

Programming Mode

Shows the selected parameter value Shows the selected parameter Shows scrolling help text Shows communication and relay status

PUSH BUTTONS: Configuration of the unit is by the use of the three function keys. These keys are only active in the programming mode.

- increases the numerical value or choose the next selection
- Enters programming mode, OK
- saves the chosen value and proceeds to the next selection
- decreases the numerical value or choose the previous selection

.0 PROGRAMMING THE



Warning: Save all programming changes before entering 9.ADV SETUP. Do this by exiting the Program Mode at the NO SETUP prompt and then reentering.

* If password is enabled.

STEP BY STEP PROGRAMMING INSTRUCTIONS:

PROGRAMMING MODE ENTRY (OK KEY)

A programming module, PGMMOD00 is required to program the unit. The programing mode is entered by pressing the OK key. If the password protection is enabled, entry of the password is required to gain access. If the password protection is disabled, direct access to programming will occur.

MENU ENTRY (ARROW & OK KEYS)

Upon entering the programming mode (set-up), the arrow keys will index between the programming modules. Select the desired module, press the OK key enter the module programming.

PARAMETER SELECTION AND ENTRY (ARROW & OK KEYS)

In each of the Programming Modules are parameters that can be configured to the desired action for a specific appplication. Each parameter has a list of selections or a numeric value that can be entered. The parameters are displayed on line #2 and the selection is on line #1. The arrow keys will move through the selection list or increase or decrease the numeric values. Once the selection or numeric value is set to the desired action, press the OK key to enter the data and move to the next parameter.

PROGRAMMING MODE EXIT (ARROW & OK KEYS)

After completing a programming module loop, the display will return to the set-up position. At this time additional programming modules can be selected for programming or the selection of "NO" can be entered. Entering "NO" will exit the Programming Mode, save any changes, and enable the Display Mode. (If power loss occurs before returning to the display mode, verify recent parameter changes.)

Note: The unit will return to the Display Mode from any menu after 1 minute without a key press or by pressing and holding the OK key for 2 seconds. In these cases, verify recent parameter changes.



FAST SETPOINT MODE

- ∧ displays setpoint 1 and increases the shown setpoint value
- OK saves the changed setpoint value and returns to the Display Mode (Holding for 2 seconds returns to the Display Mode without saving.)
- ✓ displays setpoint 2 and decreases the shown setpoint value

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MODULE 1 - SIGNAL INPUT PARAMETERS 5.1



INPUT TYPE (IN TYPE)



Н

VOLT CURR LIN.R POTM TEMP

Select the appropriate Input Type for the application.

Note: Changing the input parameters may affect the setpoint and/or analog programming.



INPUT TYPE (VOLT)

If input type is selected for voltage, the following parameters appear.

<u>и–1и</u>

2 - 10

VOLTAGE RANGE (U.RANGE) <u>и–1</u>

0.2 - 1

2-10	
U.RANGE	

Select the appropriate Voltage Range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution.

INPUT TYPE (CURR)

0 - 5

1 - 5



If input type is selected for current, the following parameters appear.

CURRENT RANGE (I.RANGE)



0-20 4-20

Select the appropriate Current Range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution.

INPUT TYPE (LIN.R)



If input type is selected for linear resistance, the following parameters appear.

WIRE CONNECTION (CONNEC.) 2W



ЗW

Select the wires the sensor or signals has to connect to the unit.

4W

MINIMUM RESISTANCE (R 0%)

0 R 0%

Enter the low resistance value.

0.0 to 9998

MAXIMUM RESISTANCE (R 100%) 2500 0.0 to 9999 100% Enter the high resistance value.

The next five parameters apply to the voltage, current, linear resistance and potentiometer input types.

UNIT IDENTIFICATION (UNIT)

UNIT	Select one of the 69 available units as listed below			below.
7.				
°C	he	kW	mA	РH
۹F	hPa	kWh	mbar	rpm
2.	Hz	1	mils	s
A	in	1∕h	min	S
bar	in∕h	l∕min	mm	t
CM	in∕min	l/s	mm⁄s	t∕h
ft	in∕s	m	mol	uΑ
ft∕h	ips	m∕h	mPa	um
ft∕min	К	m∕min	mŲ	uS
ft/s	kА	m⁄s	MW	V
9	kэ	m∕s2	MWh	ω
9al∕h	kJ	mЗ	N	Wh
9al∕min	kPa	m3∕h	Ohm	Уd
GW	kV	m3∕min	Pa	

DECIMAL POINT (DEC.P)



1111 111.1 11.11 1.111

Select the appropriate decimal point location.

DISPLAY LOW (DISP.LO)

-199.9 to 999.9



Enter the low display value.



DISPLAY HIGH (DISP.HI)



-199.9 to 999.9

Enter the high display value.

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The remaining parameters in this module apply to temperature input type only.

INPUT TYPE (TEMP)



If input type is selected for temperature, the following parameters appear.

TEMPERATURE SENSOR (SENSOR)

Ni

Pt, Ni, or TC

Select the appropriate temperature sensor.

RTD -Selec	t the appropr	iate RT	D senso	r.		
TYPE:	Pt10	Pt2	:0	Pt50	I	Pt100
	Pt200	Pt2	:50	Pt30	0	
	Pt400	Pt5	00	Pt10	00	
WIRE	CONNECT	TION:	2W	30	4W	

NICKEL SENSORS -Select the appropriate Nickel sensor.			
TYPE: Ni50	Ni1	<i>00</i> ,	
Ni120	Ni1	000	
WIRE CONNECTION:	2W	ZW	4W

THERMOCOUPLE -select the appropriate Thermocouple sensor. TYPE: TC.B TC.E TC.J TC.K TC.L TC.N TC.R TC.S TC.T TC.U TC.W3 TC.W5 TC.Lr Η

UNIT IDENTIFICATION (UNIT)

■F or ■C

Select the appropriate unit for the temperature being displayed.



<u>" C</u> UNIT

RELAY ASSIGNMENT (REL.UN) *

DISP or PERC

Select relay assignment to display units or percent of the input.

* This selection is not valid when programmed for temperature.

RELAY 1 FUNCTION (R1.FUNC)



SETP WIND E R R POW OFF

Select how relay 1 is to function. For SETP the relay is controlled by setpoint one. Select WIND and the relay is controlled by 2 setpoints. For ERR the relay indicates sensor alarm only. Select POW and the relay indicates power status. For OFF the relay is disabled.

RELAY 1 FUNCTION (SETP)



If the relay function is selected for setpoint, the following parameters appear.

RELAY 1 CONTROL (R1.CONT)



N.O. or N.C.

Select relay 1 operation, normally open or normally closed.

RELAY 1 SETPOINT VALUE (R1.SETP)

50.0 R1.SETP

-200 to 850.0

Enter the relay 1 setpoint value.

ACTIVATION DIRECTION (ACT.DIR)

INCR or DECR

Select the direction relay 1 should activate, increasing signal or decreasing signal.

RELAY 1 HYSTERSIS (R1.HYST)

1.0 (

0.1 to 262.5

Enter relay 1 hysteresis value.

RELAY 1 ERROR ACTIVATION (ERR.ACT)



HOLD, CLOS, OPEN, and NONE

Select relay 1 error mode action.

0 to 3600

RELAY 1 ON DELAY (ON.DEL)

0 ON.DEL

Enter relay 1 On Delay Time.

RELAY 1 OFF DELAY (OFF.DEL)

0	Ø to	3600	
OFF.DEL	-		
		-	

Enter relay 1 Off Delay Time.

RELAY 1 FUNCTION (WIND)



If the relay function is selected for window, the following parameters appear.

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RELAY 1 CONTROL (R1.CONT)

OLLW or CLLW

R1_CONT Select relay 1 contact to be open inside the window or closed in the window.

SETPOINT LOW VALUE (SETP.LO)



-200 to 849.9

Enter the window's low value.

SETPOINT HIGH VALUE (SETP.HI)



-199.9 to 850.0

Enter the window's high value.

RELAY WINDOW HYSTERSIS (R1.HYST)



0.1 to 262.5

Set the window's hysteresis value.

RELAY 1 ERROR ACTIVATION (ERR.ACT)



HOLD, CLOS, OPEN, and NONE

Select relay 1 error mode action.

RELAY 1 ON DELAY (ON.DEL)



0 to 3600

Enter relay 1 On Delay Time.

RELAY 1 OFF DELAY (OFF.DEL)

0	0 to 3600
OFF.DEL	
Ento	r rolov 1 Off Dolor

Enter relay 1 Off Delay Time.





If the relay function is selected for error mode, the following parameters appear.

RELAY 1 ERROR ACTIVATION (ERR.ACT)

OPEN	CLOS	OPEN
ERR.ACT		

Select relay 1 error mode action.

The POW and OFF selection have no programming capabilites.

For Relay 2, repeat the steps listed for Relay 1.

5.3 MODULE 8 - ANALOG OUTPUT PARAMETERS (REQUIRES ANALOG OUTPUT OPTION)



ANALOG OUTPUT TYPE (ANA.OUT)



VOLT or CURR

VUL I OF CURP

Select either Voltage or Current output.

OUTPUT RANGE (O.RANGE)



Select the appropriate range based on the analog output type selected.

VOLTAGE -Select the appropriate voltage range.

RANGE: 0-1, 0.2-1, 0-5, 1-5, 1-10, or 2-10 CURRENT -Select the appropriate current range.

RANGE: 0-20, 4-20, 20-0, or 20-4

OUTPUT ERROR (OUT.ERR) For CURR only

23mA

NONE, OmA, 3.5mA, or 23mA

This parameter is only available if the analog output type is selected for current. Select the proper Error action, if needed.

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OUTPUT LOW VALUE (OUT LO) For TEMP only



-200 or 849**.**0

Enter the value for the output Low Value.

OUTPUT HIGH VALUE (OUT.HI) For TEMP only



-199 or 850.0

Enter the value for the output High Value.

OUT.LO



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MODEL IAMA - UNIVERSAL SIGNAL CONDITIONING module



- 3-WAY ISOLATION OF ANALOG SIGNALS
- UNIVERSAL CONVERSION MODULE INPUTS AND OUTPUTS SELECTED VIA DIP SWITCH SETTINGS
- OVER 100 INPUT AND OUTPUT ANALOG CONVERSION COMBINATIONS
- CHOOSE LINEAR OR SQUARE ROOT EXTRACTION MODEL
- ALL RANGES ARE FACTORY PRECALIBRATED. CUSTOM FIELD CALIBRATION IS AVAILABLE FOR ALL RANGES WHILE MAINTAINING THE FACTORY CALIBRATION FOR FUTURE USE
- 11 to 36 VDC AND 24 VAC MODULE POWER



SAFETY SUMMARY

UL Recognized Component, File # E179259

GENERAL DESCRIPTION

The IAMA – Universal Signal Conditioning Module Series can isolate and convert over 100 combinations of analog signal ranges. The IAMA3535 converts and transmits signals linearly proportional to the input, while the IAMA6262 transmits the scaled square root of the input signal. This allows the IAMA6262 to provide a signal that is linear to flow rate in applications utilizing a differential pressure transducer.

DIP switch range selection eliminates the need to order and stock different modules for each input and output signal range, and allows quick and convenient setup for over 100 standard signal conversions. By utilizing the Field mode of calibration, the user can customize the input and output scaling for odd applications, including reversal of the output relative to the input.

In addition to the conversion capabilities, the IAMA modules feature optically isolated Input/Output signal circuits and transformer isolated Power to Input, Power to Output circuits.

The modules' overall full scale accuracy typically exceed 0.05% depending upon range selection and scaling. The microprocessor based design provides ease of field scaling and the onboard E^2 PROM stores scaling values for future recall. Both models come factory precalibrated for all input and output ranges. Factory or custom field scaling can be selected by a simple mode switch change. The IAMA can be factory recalibrated in the field if desired.

The modules' environmental operating temperature range is -20° C to $+65^{\circ}$ C. DIN rail mounting saves time and panel space. The units are equipped with universal mounting feet for attachment to standard DIN style rails, including top hat profile rail according to EN50022 - 35x7.5 and 35×15 and G profile rail according to EN50035-G32.



All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IAMA	Linear Universal Signal Conditioning Module	IAMA3535
	Square Root Universal Signal Conditioning Module	IAMA6262

SPECIFICATIONS

- 1. POWER: 11 to 36 VDC, 3 W max. or 24 VAC, ±10%, 50/60 Hz, 4.8 VA max.
- 2. INPUT/OUTPUT RANGES: See Tables 2 and 3
- 3. ZERO/SPAN ADJUSTMENTS: Digital (DIP Switch Transition)
- 4. MAX INPUT SIGNAL:
- Current Input: 110 mA DC, 1.1 VDC

Voltage Inputs: Terminal 7-	1 VDC +10%
Terminal 8-	10 VDC +10%
Terminal 9-	100 VDC +10%

- 5. INPUT RESISTANCE:
- Current: 10Ω
- Voltage: > 100 K
- 6. INPUT PROTECTION: Surge suppressor diodes
- 7. OUTPUT: Self-powered (Active)
- 8. MAX OUTPUT CURRENT:
- Current Output: 22 mA
- Voltage Output: 10 mA
- 9. LOAD RESISTANCE: Current Output: ≤ 600 Ω
- **Voltage Output**: $\geq 1 \text{ K}\Omega$
- 10. OUTPUT COMPLIANCE:
- Current: 4 to 20 mA, 0 to 20 mA: 12 V min (≤ 600 Ω) 0 to 1 mA: 10 V min (≤10 KΩ)
- **Voltage**: 10 VDC across a min. 1 K Ω load (10 mA). Factory calibrated for loads of > 1 M Ω .
- 11. ISOLATION LEVEL INPUT TO OUTPUT: 1.5 kV @ 50/60 Hz, 1 min
- 12. STEP RESPONSE: To within 99% of full scale: 300 msec
- ACCURACY (INCLUDING LINEARITY): Factory: ±0.1% of span max. for all ranges except 1 mA, 2 mA, and 20 mV. These ranges are accurate to ±0.2% of span max. All ranges can be field calibrated to 0.1% of span max.
- 14. RESOLUTION: 0.01% full scale input, 0.01% full scale output
- 15. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: -20 to +65 °C

Storage Temperature Range: -40 to +85 °C

Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from -20 to +65 $^{\circ}\mathrm{C}$

Temperature Coefficient: ± 0.01%/°C (100 PPM/°C) max. **Vibration to IEC 68-2-6**: Operational 5 to 150 Hz, 2 g. **Shock to IEC 68-2-27**: Operational 30 g

Altitude: Up to 2000 meters

16. CERTIFICATIONS AND COMPLIANCES:

CE Approved

EN 61326-1 Immunity to Industrial Locations Emission CISPR 11 Class A

IEC/EN 61010-1

- UL Recognized Component: File #E179259
- Refer to EMC Installation Guidelines section of this bulletin for additional information.
- 17. CONSTRUCTION: Case body is black high impact plastic

18. CONNECTIONS: 14 AWG max

 MOUNTING: Standard DIN top hat (T) profile rail according to EN50022 - 35x7.5 and 35 x 15 and G profile rail according to EN50035-G32.

20. WEIGHT: 4.5 oz. (127.57 g)

BLOCK DIAGRAM



* Terminal number is dependent on max. input voltage.

MODULE ISOLATION

IAMA modules feature "3-Way" Signal Isolation. The 3-Way isolation is a combination of optical and transformer isolation. The optical isolation provides common mode voltage (CMV) isolation up to 1.5 kV between the sensor input and the process signal output. The IAMA's power is isolated from the sensor signal input and the process signal output by a DC/DC transformer isolation circuit.

OVERVIEW

The IAMA3535 continuously monitors a voltage or current input and provides a linearly proportional voltage or current output, while the IAMA6262 transmits the scaled square root of the input signal. This allows the IAMA6262 to provide a signal that is linear to flow rate in applications utilizing a differential pressure transducer. Both units have two modes of operation known as Factory and Field modes. Factory mode is used when the default input and output ranges are suitable. Field mode can be independently selected for both the input and output, and allows the user to custom calibrate, or scale the signal. If Factory mode is selected, the IAMAS use factory presets for the selected input or output range. If Field mode is selected, the IAMAs can be custom scaled within a selected input or output range. Field mode also allows the IAMA to reverse its output in relation to its input.

The units are factory precalibrated for minimum and full scale for all input and output ranges. The factory calibration values are permanently stored in E^2 PROM and should not be changed in the field, unless unacceptable error or a factory checksum error occurs. See Factory Recalibration for details. Field scaling is achieved by applying minimum and full scale values from a calibration source and storing the values by a single DIP switch transition. Field scaling is available for all input and output ranges and the values are permanently stored in E^2 PROM until reprogramming occurs.

After field scaling, the IAMAs can be changed between Factory and Field modes for a particular range, which restores the respective setting. The Factory and Field E^2 PROM locations contain the same calibration values when the

IAMA is received from the factory. Therefore, until the IAMA is field scaled, factory and field modes perform identically. See SCALING PROCEDURE for detailed instructions on field programming the IAMA.

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The units can be scaled to any minimum scale and full scale values within the extent of the selected range. The closer together the minimum and full scale values are to each other, the less accurate the signal will be. For example, if the 0 to 1 V input range is selected, and the unit is scaled for 0 to 0.5 V, the signal has the same resolution as the 0 to 1 V range. Since this resolution will be two times the percentage of span for 0.5 V, more accuracy can be achieved by using the 0 to 0.5 V range.

The input may exceed the full scale value for the selected range by 10% of span, but the IAMA will not update the output beyond 10% over range.

The red and green LED's indicate the status of the modules during scaling and normal operation. Table 1, LED Indications, details the LED indications for various unit conditions.

The IAMA – Signal Conditioning Module Series is designed for use in industrial environments. Suppressor diodes protect both input and output circuits from wiring errors and transient high voltage conditions.

INPUTS

The IAMAs accept a full range of process signal inputs and isolate and convert these signals to common industrial control signals. The input signal combinations are configured by making specific DIP switch selections on the 10 position DIP switch.

OUTPUTS

As with the input choices, the process signal output of the modules is DIP switch selectable. A 1 position DIP switch is used to select between the 1 mA/20 mA output ranges. The maximum output current signal is 22 mA with $\leq 600 \Omega$ output resistance and the maximum output voltage signal is 11 V with $\geq 1 K\Omega$ output resistance.

ZERO AND SPAN

The input zero and span are set by first applying the minimum value then transitioning S1-2 to store that value. Next, the full scale value is applied and the DIP switch transition stores the value. The output scaling is performed in a similar manner but the output is driven to the desired minimum and full scale values by the calibration source applied to the input. S1-1 is used to store the minimum and full scale output values.

The span is defined by: span = (full scale - minimum scale).

ILLEGAL RANGE SELECTIONS AND CHANGES

The ranges should only be selected before power is applied. If an invalid input or output range is selected when power is applied the output is set to approximately 0 VDC and the red LED indicates the error according to Table 1. Power must be removed and valid ranges selected for the IAMA to operate properly.

If S1 switches 3 through 10 are changed while the IAMA is operating, the red LED indicates a range change according to Table 1, LED Indications and the output goes to the previously stored range minimum scale value. Normal operation will be resumed if the switches are placed back in the previous positions or power is removed and restored.

CHECKSUM ERRORS

A checksum is performed every time power is applied to the IAMA. If a checksum error occurs, the LEDs will indicate where the error occurred according to Table 1, LED Indications. Operation with a checksum error is not recommended but can be done in critical situations. If an error occurs, re-calibration of the field or factory ranges to be used must be performed.

If a field checksum error occurs, the IAMA will operate only in factory mode. If a factory checksum occurs, the IAMA will operate only in a previously calibrated field mode. Do not perform a field scaling until the factory checksum is cleared. Since a checksum error is a high priority LED indication, the LEDs will indicate the error until it is cleared. This will exclude other LED information.

TABLE 1, LED INDICATIONS

CONDITION	GREEN LED	RED LED
Normal Operation	On	Off
Scaling Mode	Alternate with Red	Alternate with Green
Under Range	Off	Slow Flash (0.8 sec rate)
Over Range	Off	Fast Flash (0.4 sec rate)
Illegal Range Change	Off	On
Invalid Range	Off	On
Factory Checksum	Off	On, short off
Field Checksum	On, short off	Off
User Factory Calibration	Fast Flash for 2 sec	Off

GETTING STARTED

One method for the Input (1 or 2 below) should be configured, and one method for the Output (3 or 4 below) should be configured.

- 1. FACTORY preprogrammed settings for the Input, see Section 1.0
- 2. FIELD scaling method for the Input, see Section 2.0
- 3. FACTORY preprogrammed setting for the Output, see Section 3.0

4. FIELD scaling method for the Output, see Section 4.0

Note: The ranges should only be changed while power is removed from the IAMA.

TABLE 2, OUTPUT RANGE SETTINGS

	OUTPUT	RANGE DIP SWITCHES									
	RANGE	3	4	5							
VOLTAGE	0 - 5 V	0	0	0							
OUTPUTS	0 - 10 V	0	0	1							
	0 - 1 mA	0	1	0							
CURRENT	4 - 20 mA	0	1	1							
0011010	0 - 20 mA	1	0	0							

Note: DIP switch settings 0 = OFF 1 = ON

TABLE 3, INPUT RANGE SETTINGS

	DANCE	R/	ANGE	DIP SV	итсн	ES
	RANGE	6	7	8	9	10
	0 - 20 mV	0	0	0	0	0
	0 - 50 mV	0	0	0	0	1
	0 - 100 mV	0	0	0	1	0
	0 - 200 mV	0	0	0	1	1
	0 - 500 mV	0	0	1	0	0
	0 - 1 V	0	0	1	0	1
	0 - 2 V	0	0	1	1	0
VOLIAGE	1 - 5 V	0	0	1	1	1
	0 - 5 V	0	1	0	0	0
	0 - 10 V	0	1	0	0	1
	0 - 20 V	0	1	0	1	0
	0 - 50 V	0	1	0	1	1
	0 - 100 V	0	1	1	0	0
	0 - 1 mA	0	1	1	0	1
	0 - 2 mA	0	1	1	1	0
	0 - 5 mA	0	1	1	1	1
INPUT	0 - 10 mA	1	0	0	0	0
CURRENT	4 - 20 mA	1	0	0	0	1
	0 - 20 mA	1	0	0	1	0
	0 - 50 mA	1	0	0	1	1
	0 - 100 mA	1	0	1	0	0

Note: DIP switch settings 0 = OFF

ttings 0 = OFF 1 = ON

FIELD OR FACTORY MODE SELECTION

SELECTING FIELD MODE (2 Methods):

- 1. Scale the input or output according to SCALING PROCEDURE 2.0 or 4.0
- 2. Before applying power, set the input or output (or both) field/factory switch to the up (field) position. Field calibration values will be restored upon power-up. If the IAMA has not been previously field calibrated, the E²PROM will contain the factory calibration values which will be restored.

SELECTING FACTORY MODE (2 Methods):

1. Before applying power to the IAMA set the input or output (or both) field/

factory switch to the down (factory) position. Factory calibration values will be restored upon power-up.

2. While power is applied to the IAMA and it is operating in the field input and/ or output mode, set the desired field/factory switch(s) to the down (factory) position. The factory calibration values will be restored.

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

- 1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
- 2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
- 3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. Long cable runs are more susceptible to EMI pickup than short cable runs.
- 5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:

Fair-Rite part number 0443167251 (RLC part number FCOR0000) Line Filters for input power cables:

Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)

- 6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
 - a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
 - b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used. RLC part numbers: Snubber: SNUB0000

Varistor: ILS11500 or ILS23000

7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

VisitRLC's website athttp://www.redlion.net/Support/InstallationConsiderations. html for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed. Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.

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POWER AND OUTPUT CONNECTIONS

Power

Primary power is connected to terminals 2 and 3 (labeled VDC- and VDC+). For best results, the Power should be relatively "clean" and within the specified variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

Current Output

Wiring for a current output is connected to terminals 1 (IOUT-) and 4 (IOUT+). DIP switch S2 should be set for the desired full scale output current. (20 mA = ON; 1 mA = OFF).

Voltage Output

Wiring for a voltage output is connected to terminals 5 (Vout-) and 6 (Vout+).

- *Note:* Although signals are present at voltage and current outputs at the same time, only the selected range is in calibration at any one time.
- Example: A 0 to 10 VDC output is selected. The voltage level present at the voltage output terminals is in calibration, but the signal appearing at the current output terminals does not conform to any of the current output ranges.

INPUT CONNECTIONS Current Input

Wiring for a current input is connected to terminals 10 (IIN) and 12 (INPUT COMMON).

Voltage Input

Wiring for a voltage input is connected to terminal 12 (INPUT COMMON) and one of the three available voltage terminals listed below, depending on maximum input voltage.

> Terminal 7: 1 VDC max. Terminal 8: 10 VDC max. Terminal 9: 100 VDC max.





SCALING PROCEDURE

The accuracy of the IAMA is dependent on the accuracy of the calibration source and the voltage or current meter used in the scaling process.

If an out of range (see Table 1 for LED indications) or illegal (full scale less than minimum scale) scaling is attempted, the factory calibration values will be stored in place of the field values. This will prohibit erroneous operation of the IAMA. The scaling procedure will have to be repeated.

The final storage of the zero and full scale values to E^2PROM is not done until the last transition of the mode/calibration DIP switches (S1-1 or S1-2). Therefore, the scaling can be aborted any time before the full scale value is saved. This is accomplished by cycling power to the IAMA. The IAMA will restore the factory or previous field scaling values at power up depending on the setting of the DIP switches. See Mode Selection for more detailed instructions for selecting factory and field modes at power up. See Table 2 and 3 for the input and output range DIP switch settings.

1.0 INPUT SET-UP USING FACTORY CONFIGURATION



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2.0 INPUT SCALING USING FIELD CONFIGURATION

Step 2.3

Step 2.4

Step 2.6

Step 2.8

Step 2.10

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GREEN

RED

LED



red lipn



2.2 Connect signal source to the correct input terminals based on the maximum signal input.

Terminal 7: max. signal input 1 VDC Terminal 8: max. signal input 10 VDC Terminal 9: max. signal input 100 VDC Terminal 10: max. signal input 100 mA Terminal 12: signal common

- 2.3 Set Input Range switches (S1 switches 6 through 10) to the desired input range (See Table 3). Select the lowest possible range that will support the desired maximum signal. Example: if the desired span is 20 mV to 85 mV, the best range selection is 0 to 100 mV. The 0 to 200 mV will also suffice, but the accuracy will be reduced. (0 to 10 VDC range shown).
- 2.4 Set Input Field/Fact. switch (S1 switch 2) to the off position.
- 2.5 Apply power to the IAMA and allow a warm up period of five minutes. Follow the manufacturer's warm up procedure for the calibration source.
- 2.6 Set Input Field/Fact. switch (S1 switch 2) to the on position. *The Red and Green LEDs will alternately blink.*
- 2.7 Apply desired minimum scale signal.

2.8 Set Input Field/Fact. switch (S1 switch 2) to the off position. The Red and Green LEDs will alternately blink. If the signal is equal or below the minimum limit of the selected range, the Red LED

If the signal is equal or below the minimum limit of the selected range, the Red LED blinks slowly and the Green LED turns off. Removing power aborts scaling, begin at Step 2.1.

2.9 Apply maximum scale input.

The Red and Green LEDs will alternately blink.

- 2.10 Set Input Field/Fact. switch (S1 switch 2) to the on position.
 - Red LED extinguishes and Green LED becomes solid. Your scaled values are now saved and recalled if the Input Field/Fact. switch (S1 switch 2) is in the on position when power is applied.
 - Red LED will blink slowly if signal is equal to or below minimum limit and blinks rapidly if signal increases above maximum limit.
- 2.11 Input scaling complete. Go to Step 3.0 or Step 4.0.

3.0 OUTPUT SET-UP USING FACTORY CONFIGURATION



Step 3.3

- 3.1 Remove power.
- 3.2 For voltage output values, go to Step 3.4
- For current output values, continue at Step 3.3
- 3.3 Set 20 mA/1 mA switch (S2) to desired full scale output. (20 mA on; 1 mA off)
- 3.4 Set Output Field/Fact. switch (S1 switch 1) to the off position.
- 3.5 Set Output Range switches (S1 switches 3, 4, and 5) to the desired Output Range (See Table 2). (4 to 20 mA range shown)

3.6 Connect external device to appropriate IAMA output terminals. Terminal 6: + Voltage

- Terminal 5: Voltage Terminal 4: + Current
- Terminal 1: Current
- 3.7 Apply power to the IAMA and allow a warm up period of five minutes. Output set-up complete.

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4.0 OUTPUT SCALING USING FIELD CONFIGURATION





Step 4.12



4.1 Remove power.

- 4.2 For voltage output scaling, go to Step 4.4. For current output scaling, continue at Step 4.3.
- 4.3 Set 20 mA/1 mA switch (S2) to desired full scale output. (20 mA - on; 1 mA - off)
- 4.4 Set Output Field/Fact. switch (S1 switch 1) to the off position.
- 4.5 Set Output Range switches (S1 switches 3, 4, and 5) to the desired Output Range (See Table 2). Select the lowest possible range that will support the desired full scale output. Example: if the desired span is 1 V to 4 V, the best range selection is 0 to 5 V. (0 to 5 VDC range shown)
- 4.6 Connect volt or current meter to appropriate IAMA output terminals.
 - Terminal 6: + Voltage Terminal 5: - Voltage Terminal 4: + Current
 - Terminal 1: Current
- 4.7 An input signal is required to complete output scaling. If previous scaled input is used (completed in Step 2.0), Input Field/Fact. switch (S1 switch 2) and Input Range switches (S1 switches 6 through 10) must remain in the same positions. If another signal source is used, set Input Field/Fact. switch (S1 switch 2) to off position and Input Range switches (S1 switches 6 through 10) to the desired input range (See Table 3).
- 4.8 Connect input signal source to the correct input terminals based on the maximum signal input.
 - Terminal 7: max. signal input 1 VDC Terminal 8: max. signal input 10 VDC Terminal 9: max. signal input 100 VDC Terminal 10: max. signal input 100 mA Terminal 12: signal common
- 4.9 Apply power to the IAMA and allow a warm up period of five minutes.
- 4.10 Set Output Field/Fact. switch (S1 switch 1) to the on position.
- The Red and Green LEDs will alternately blink.
- If Red LED blinks slowly, increase signal until Red and Green LEDs alternately blink.
- 4.11 Adjust the input signal until the desired * minimum output level is displayed on the volt or current meter.
 - The Red and Green LEDs will alternately blink.
- 4.12 Set Output Field/Fact. switch (S1 switch 1) to the off position. The Red and Green LEDs alternately blink.
 - If the signal is equal to or below the minimum limit of the selected range, the Red LED blinks slowly and the Green LED turns off. Removing power aborts scaling. Start over at Step 4.1.
- 4.13 Adjust the input signal until the desired * maximum output level is displayed on the volt or current meter.
- 4.14 Set Output Field/Fact. switch (S1 switch 1) to the on position.
- Red LED extinguishes and Green LED becomes solid. Your scaled values are now saved and will be recalled if the Output Field/Fact. switch (S1 switch 1) is in the on position when power is applied.
- 4.15 Output scaling is complete.
- * If the minimum output is higher than the maximum output the module reverses its output behaviour accordingly.

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RECALIBRATING FACTORY STORED VALUES



WARNING: Read the complete procedure at least once before attempting to recalibrate the factory values. This procedure should only be performed due to factory checksum error or unacceptable error. This procedure should be performed by qualified technicians using accurate calibration equipment.

The following list outlines conditions that are unique to factory recalibration:

- Unlike the field scaling procedures, there are no software under and over range indications while performing a factory recalibration. Therefore, care must be taken to insure the selected range extents are not exceeded. The minimum scale and full scale calibration values must be set to the extents of the range being calibrated.
 - For example: If the Input Range DIP switches are set for the 4-20 mA range, minimum scale must be set at 4 mA, and full scale must be set at 20 mA.
- 2. At least one input calibration must be completed before calibrating any output range. When calibrating the input voltage range, it is recommended that a range above 1 V be used to provide better accuracy.
- 3. If multiple input or output ranges are to be calibrated, DO NOT REMOVE POWER TO CHANGE THE RANGE. Place the appropriate Field/Fact. DIP switch; S1-1 for outputs, and S1-2 for inputs to the down position, and set the remaining DIP switches for the range to be calibrated. *Note: Be sure to change the terminal wiring to match the Input or Output range DIP switch settings before performing the calibration procedure. Set calibration source to 0 V or 0 mA before changing wiring.*

INPUT RECALIBRATION

- 1. To enter the factory calibration mode, set switches S1-1 and S1-2 down, S1-3 through S1-5 up, and S1-6 through S1-10 down.
- Connect a signal source to the correct input terminals based on the maximum signal input to be calibrated. If an output range will be calibrated after the input range is calibrated, connect a voltage or current meter to the appropriate output terminals at this time.
- 3. Apply power to the IAMA. After the version number indication, the green LED will flash rapidly for 2 seconds indicating the factory calibration mode has been entered. Allow the IAMA to warm up for 5 minutes minimum and follow the manufacturer's warm up procedure for the calibration source.
- 4. Set the Input Range DIP switches to the desired input range according to Table 3.
- 5. Complete Steps 2.6 through 2.10 of Input Scaling Using Field Configuration. *Note: There will be no over or under range indication of the LED's during this procedure, so use care not to exceed the range extents.*
- 6. If an output is to be calibrated, continue from #2 of Output Recalibration below. If no further input or output calibration is to be completed, return S1-1 and S1-2 to the down position and remove power from the IAMA. Apply power and check for accurate operation of the newly calibrated range or ranges.

OUTPUT RECALIBRATION

- 1. Complete 1 through 5 of the input recalibration procedure for at least one range.
- 2. For current output, set 20 mA/1 mA switch (S2) to desired full scale output. (20 mA on; 1 mA off)
- 3. Set Output Field/Fact. switch (S1 switch 1) to the off position.
- 4. Set the Output Range DIP switches to the desired output range according to Table 2.
- 5. Complete Steps 4.10 through 4.14 of Output Scaling Using Field Configuration. *Note: There will be no over or under range indication of the LED's during this procedure, so use care not to exceed the range extents.*
- 6. If no further calibration is to be completed, return S1-1 and S1-2 to the down position and remove power from the IAMA. Apply power and check for accurate operation of the newly calibrated range or ranges.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the IAMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out and away from the rail.



T Rail Installation

To install the IAMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



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APPLICATION

Cost efficiency measurements of a printing company included the reduction of bulk stock of the various inks used in their printing processes. The company currently had various ink flow and level devices with different current and voltage outputs and wanted to record these measurements into a control room PC. Several IAMA Universal Signal Conditioning Modules were the answer. The IAMA's universal input allowed for easy signal conditioning of the various output signals to the required PC's Bus Board 0 to 10 VDC input signal. The factory calibration settings of the IAMA could be used with the devices in which the flow and level pressure was linear to the signal. The IAMA could also be scaled utilizing the field calibration method with the devices where pressure affected the signal slope specifications. In this case, the IAMA's re-transmitted 0 to 10 VDC output was field calibrated, negating the expense and time required to rewrite the PC's software parameters. In addition to accepting multiple signal types and field calibration features, the IAMA also provides the necessary electrical isolation between the control room PC and the hazards of the printing floor electrical noise.

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MODEL IAMA - CONFIGURABLE 3-WAY ISOLATING AMPLIFIER



- 3-WAY ISOLATION OF ANALOG SIGNALS
- UNIVERSAL CONVERSION MODULE INPUTS AND OUTPUTS SELECTED VIA DIP SWITCH SETTINGS
- OVER 35 INPUT AND OUTPUT ANALOG CONVERSION COMBINATIONS
- ULTRA SLIM DESIGN ONLY 0.244" WIDE
- 19 to 30 VDC POWER



PROCESS CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 31ZN CLASS 1, DIV 2 GROUPS A, B, C, D T5 CE

GENERAL DESCRIPTION

The IAMA can isolate and convert over 35 combinations of analog signal ranges. The IAMA converts and transmits signals linearly proportional to the input. DIP switch range selection eliminates the need to order and stock different modules for each input and output signal range, and allows quick and convenient setup for over 35 standard signal conversions. In addition to the conversion capabilities, the IAMA modules feature optically isolated Input/ Output signal circuits and isolated Power to Input, Power to Output circuits. The modules' overall full scale accuracy typically exceed 0.04%. DIN rail mounting saves time and panel space. The units are equipped with universal mounting feet for attachment to standard top hat profile rail according to EN50022 - 35x7.5.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IAMA	Configurable 3-Way Isolating Amplifier	IAMA0006

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



SPECIFICATIONS

- 1. POWER: 19.2 to 30 V DC, 450 mW max.
- 2. INPUT / OUTPUT RANGES: See table 1
- 3. SPAN ADJUSTMENT: Potentiometer, located below transparent top cover.
- 4. MAX INPUT SIGNAL: Current: 50 mA
- Voltage: 30 V 5. **INPUT RESISTANCE**: Current: Approx. 50 Ω
- Voltage: Approx. 100 k Ω
- 6. OUTPUT: Self-powered (Active)
- 7. MAX OUTPUT SIGNAL: Current: 28 mA/12.5 V Voltage: 12.5 V/22 mA
- 8. LOAD RESISTANCE:
- Current: 500 Ω max. Voltage: 10 k Ω min
- 9. OUTPUT COMPLIANCE:
 - Current: 12.5 V max (500 Ω). Ripple: < 20 mV
- Voltage: 22 mA (10 kΩ). Ripple: < 20 mV 10. **TRANSMISSION ERROR**: The transmission error without adjustment is <0.4%. Using the potentiometer,
- the error can be adjusted to < 0.1%. 11. TEMPERATURE COEFFICIENT:
- Max.: < 0.01%/K Typ.: < 0.002%/K
- 12. CUT-OFF FREQUENCY: 100 Hz
- 13. STEP RESPONSE (FROM 10 to 90 %): 3.5 msec
- 14. TEST VOLTAGE (Input/Output/Supply): 1.5 kV, 50 Hz, 1 min.
- 15. ENVIRONMENTAL CONDITIONS:
 Operating Temperature Range: -20°C to 65°C (-4°F to 149°F)

Storage Temperature Range: -40°C to +85°C (-40°F to 149°F)

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16. TESTS/APPROVALS:

CE c**M**us

PROCESS CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 31ZN

Class I Div 2 Groups A, B, C, D T5

A) This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non- hazardous locations only.

- B) Warning explosion hazard substitution of components may impair suitability for Class 1, Division 2.
- C) Warning explosion hazard do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

17. CERTIFICATIONS AND COMPLIANCES:

Conformance With EMC Guideline 2004/108/EC And Low Voltage Directive 2006/95/EC Immunity to Interference According to EN 61000-6-2¹

Discharge of static electricity (ESD)	EN 61000-4-2	Criterion B ²
Electromagnetic HF field	EN 61000-4-3	Criterion A ³
Fast transients (Burst)	EN 61000-4-4	Criterion B ²
Surge voltage capacities (Surge)	EN 61000-4-5	Criterion B ²
Conducted disturbance	EN 61000-4-6	Criterion A ³
Noise Emission According to EN 50081-2		
Noise emission of housing	EN 55011 ⁴	Class A ⁵

¹ EN 61000 corresponds to IEC 1000

² Criterion B: Temporary impairment to operational behavior that is corrected by the device itself.

³ Criterion A: Normal operating behavior within the defined limits.

⁴ EN 55011 corresponds to CISPR11

⁵ Class A: Area of application industry.

18. CONNECTIONS: 12 AWG max., Stripping length: 0.47" (12 mm)

19. CONSTRUCTION: Polybutylenterephthalate PBT, black

20. **MOUNTING**: Standard DIN top hat (T) profile rail according to EN50022 - 35x7.5

21. WEIGHT: 2 oz. (54 g)

BLOCK DIAGRAM



INPUTS

The IAMA accepts a full range of process signal inputs and isolates and converts these signals to common industrial control signals. The input signal combinations are configured by making specific DIP switch selections on the 6 and 2 position DIP switches.

OUTPUTS

As with the input choices, the process signal output of the modules is DIP switch selectable. The maximum output current signal is 28 mA with =500 Ω output resistance and the maximum output voltage signal is 12.5 V with =10 K Ω output resistance. The transmission error without adjustment is < 0.4%. Using the potentiometer, the error can be adjusted to < 0.1%.

TABLE 1 - CONFIGURATION

BAN	CES				DIP SW	TCHES			
KAN	GES			OUTPL	JT (S2)			INPU	T (S1)
IN	OUT	1	2	3	4	5	6	1	2
0 –10 V	0 – 20 mA	off	off	off	off	off	off	off	off
	4 - 20 mA	off	off	off	off	off	ON	off	off
	0 – 10 V	ON	off	ON	off	off	off	off	off
	2 – 10 V	ON	off	ON	off	off	ON	off	off
	0 – 5 V	ON	ON	off	off	off	off	off	off
	1 – 5 V	ON	ON	off	off	off	ON	off	off
2 – 10 V	0 – 20 mA	off	off	off	ON	ON	off	off	off
	4 - 20 mA	off	off	off	off	off	off	off	off
	0 – 10 V	ON	off	ON	ON	ON	off	off	off
	2 – 10 V	ON	off	ON	off	off	off	off	off
	0 – 5 V	ON	ON	off	ON	ON	off	off	off
	1 – 5 V	ON	ON	off	off	off	off	off	off
0 – 5 V	0 – 20 mA	off	off	off	off	off	off	ON	off
	4 - 20 mA	off	off	off	off	off	ON	ON	off
	0 – 10 V	ON	off	ON	off	off	off	ON	off
	2 – 10 V	ON	off	ON	off	off	ON	ON	off
	0 – 5 V	ON	ON	off	off	off	off	ON	off
	1 – 5 V	ON	ON	off	off	off	ON	ON	off
1 – 5 V	0 – 20 mA	off	off	off	ON	ON	off	ON	off
	4 - 20 mA	off	off	off	off	off	off	ON	off
	0 – 10 V	ON	off	ON	ON	ON	off	ON	off
	2 – 10 V	ON	off	ON	off	off	off	ON	off
	0 – 5 V	ON	ON	off	ON	ON	off	ON	off
	1 – 5 V	ON	ON	off	off	off	off	ON	off
0 – 20 mA	0 – 20 mA	off	off	off	off	off	off	off	ON
	4 - 20 mA	off	off	off	off	off	ON	off	ON
	0 – 10 V	ON	off	ON	off	off	off	off	ON
	2 – 10 V	ON	off	ON	off	off	ON	off	ON
	0 – 5 V	ON	ON	off	off	off	off	off	ON
	1 – 5 V	ON	ON	off	off	off	ON	off	ON
4 - 20 mA	0 – 20 mA	off	off	off	ON	ON	off	off	ON
	4 - 20 mA	off	off	off	off	off	off	off	ON
	0 – 10 V	ON	off	ON	ON	ON	off	off	ON
	2 – 10 V	ON	off	ON	off	off	off	off	ON
	0 – 5 V	ON	ON	off	ON	ON	off	off	ON
	1 – 5 V	ON	ON	off	off	off	off	off	ON

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WIRING CONNECTIONS

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Primary power is connected to terminals 7 or 3 (19.2 – 30 VDC) and 8 or 4 (GND 3). For best results, the power should be relatively "clean" and within the specified variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

The input signal is connected to pins 1 (In U,I) and 2 (GND 1). Connections for the output signal are made on pins 5 (Out U,I) and 6 (GND 2).



INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

T Rail Installation

To install the IAMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.





MODEL AAMA - UNIVERSAL SIGNAL CONDITIONING module



- 3-WAY ISOLATION OF ANALOG SIGNALS
- UNIVERSAL CONVERSION MODULE INPUTS AND OUTPUTS CAN BE SELECTED VIA DIP SWITCH SETTINGS
- OVER 100 INPUT AND OUTPUT ANALOG CONVERSION COMBINATIONS
- 18 to 30 VDC MODULE POWER

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DESCRIPTION

The AAMA3535 Universal Signal Conditioning Module can isolate and convert over 100 combinations of industry standard analog signal ranges. The universal DIP switch selection feature eliminates the need to order and stock different modules for each input and output signal.

In addition to the conversion capabilities, the AAMA3535 module features an optically isolated Input/Output signal circuit and a transformer (galvanically) isolated Power to Input, Power to Output circuit.

The AAMA3535 module meets the stringent IEC 801 Standard for surge suppression, noise emission and noise immunity. The module is also CE marked for European applications.

The module's overall full scale accuracy can exceed 0.005% depending upon range selection and calibration. A hybrid SMD calibration circuit stores all range and amplification settings. The hybrid circuit maintains a very high accuracy and low drift output signal.

The module's environmental operating temperature range is -20° C to $+65^{\circ}$ C. The modular high density packaging and mounting saves time and panel space. The modules snap onto standard 35 mm flat DIN rail, and uses removable terminal blocks for easy module wiring.

SPECIFICATIONS

1. POWER SUPPLY VOLTAGE: 18 to 30 VDC @ 60 mA

2. INPUT RANGES:

0 to 60 mV	0 to 100 mV	0 to 200 mV	0 to 300 mV	0 to 500 mV
0 to 1 V	0 to 5 V	0 to 10 V	0 to 20 V	±100 mV
±200 mV	±300 mV	±500 mV	±1 V	±2 V
±5 V	±10 V	±20 V	0 to 5 mA	0 to 20 mA
4 to 20 mA	1 to 5 V			

- 3. ZERO/SPAN ADJUSTMENTS: Range Dependent
- 4. MAX. INPUT SIGNAL:
- Current Input: 50 mA Voltage Input: 30 V
- 5. INPUT RESISTANCE:
- Current: 50Ω
- Voltage: 1 MΩ
- 6. **INPUT PROTECTION:** Surge suppressor diodes 7. **OUTPUT RANGES:** Self-powered (Active)

	1	. ,	
0 to 5 V	±5 V	0 to 10 V	±10 V
0 to 20 mA	4 to 20 mA	1 to 5 V	

8. MAX. OUTPUT SIGNAL: Current Output: 30 mA Voltage Output: 15 V

9. LOAD RESISTANCE: Current Output: $\leq 500 \ \Omega \ max$.

Voltage Output: $\geq 5 \text{ K}\Omega$



- 10. ISOLATION LEVEL INPUT/OUTPUT: 1.5 kV @ 50 Hz, 1 minute Opto Isolation
- 11. POWER TO INPUT/OUTPUT: 1.0 kV @ 50 Hz, 1 minute Transformer DC/DC
- 12. MAX. INPUT FREQUENCY: 30 Hz
- 13. RESPONSE TIME: 0.034 sec. max.
- 14. **OVERALL FULL SCALE ACCURACY:** 0.1% to 0.05% Dependent on Calibration Source
- 15. OPERATING TEMPERATURE RANGE: -20 to +65°C (-4 to 145°F)
- 16. TEMPERATURE COEFFICIENT: 100 ppm/K
- 17. CONSTRUCTION: Case body is green, high impact plastic
- 18. CONNECTIONS: 14 AWG wire max.
- 19. **MOUNTING:** Standard DIN Top hat (T) profile rail according to EN50022 35 x 7.5 and 35 x 15
- 20. WEIGHT: 3.76 oz (106.59 g)

ORDERING INFORMATION

MODEL NO	DESCRIPTION	PART NUMBER
AAMA	Universal Signal Conditioning	AAMA3535

The AAMA3535 module is ordered nonconfigured, allowing the user the flexibility to select their input and output signals by setting the appropriate DIP switch combination.

1-717-767-6511



MODULE ISOLATION

AAMA3535 modules feature "3-Way" Signal Isolation. The 3-Way isolation is a combination of optical and transformer isolation. The optical isolation provides common mode voltage (CMV) isolation up to 1.0 kV between the sensor input and the process signal output. The module's power is isolated from the sensor signal input and the process signal output by a DC/DC transformer isolation circuit.

SURGE AND SHORT CIRCUIT PROTECTION

The Signal Conditioning Module is designed for use in industrial environments. Stringent IEC testing has shown that the modules pass the IEC 801.2 (Electrostatic Discharge) and IEC 801.4 (Electrical Fast Transient/Burst) tests. Suppressor diodes protect both input and output circuits from wiring errors.



INPUTS

The AAMA3535 module accepts a full range of process signal inputs and will isolate and/or convert these signals to common industrial control signals. The input and output signal combinations are configured by making specific DIP switch selections. The DIP switches can be easily accessed by pushing the side tabs and sliding the module up in the case.

OUTPUTS

As with the input choices, the process signal outputs of the module are DIP switch selectable. The maximum output current signal is 30 mA with \leq 500 Ω output resistance and the maximum output voltage signal is 15 V with \geq 5 K Ω output resistance.



ZERO AND SPAN

The AAMA3535 module incorporates two potentiometers for adjusting separate zero and span settings. The module provides a $\pm 5\%$ zero and span fine calibration adjustment. To use this calibration feature, the zero point should be set first, by adjusting the potentiometer labeled ZERO. Adjusting the Zero reference will proportionally offset the output range. After the Zero has been set, adjusting the SPAN potentiometer will change the signal gain.

INPUT/OUTPUT DIP SWITCH SELECTION TABLES DIP SWITCH SELECTIONS FOR 0-5 VOLT OUTPUT

		DIP SWITCH 2											D	IP SV	/ІТСН	1			
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV			ON			ON						ON				ON	ON	ON	0-60 mV
0-100 mV			ON			ON						ON					ON		0-100 mV
0-200 mV			ON			ON							ON				ON		0-200 mV
0-300 mV			ON			ON							ON			ON		ON	0-300 mV
0-500 mV			ON			ON						ON				ON			0-500 mV
0-1 V			ON			ON							ON			ON			0-1 V
0-2 V			ON			ON								ON		ON			0-2 V
0-5 V			ON			ON							ON						0-5 V
0-10 V			ON			ON								ON					0-10 V
0-20 V			ON			ON									ON				0-20 V
± 60 mV		ON		ON			ON					ON				ON	ON	ON	± 60 mV
±100 mV		ON		ON			ON					ON					ON		±100 mV
±200 mV		ON		ON			ON						ON				ON		±200 mV
±300 mV		ON		ON			ON						ON			ON		ON	±300 mV
±500 mV		ON		ON			ON					ON				ON			±500 mV
±1 V		ON		ON			ON						ON			ON			±1 V
±2 V		ON		ON			ON							ON		ON			±2 V
±5 V		ON		ON			ON						ON						±5 V
±10 V		ON		ON			ON							ON					±10 V
±20 V		ON		ON			ON								ON				±20 V
0-5 mA			ON			ON					ON			ON		ON	ON	ON	0-5 mA
0-20 mA			ON			ON					ON		ON			ON			0-20 mA
4-20 mA								ON			ON		ON			ON			4-20 mA
1-5 V								ON					ON						1-5 V

Note: Blank space = DIP switch OFF.

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DIP SWITCH SELECTIONS FOR 0-10 VOLT OUTPUT

				D	IP SW	/ітсн	2						D	IP SW	/ітсн	1			
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV			ON		ON	ON						ON				ON	ON	ON	0-60 mV
0-100 mV			ON		ON	ON						ON					ON		0-100 mV
0-200 mV			ON		ON	ON							ON				ON		0-200 mV
0-300 mV			ON		ON	ON							ON			ON		ON	0-300 mV
0-500 mV			ON		ON	ON						ON				ON			0-500 mV
0-1 V			ON		ON	ON							ON			ON			0-1 V
0-2 V			ON		ON	ON								ON		ON			0-2 V
0-5 V			ON		ON	ON							ON						0-5 V
0-10 V			ON		ON	ON								ON					0-10 V
0-20 V			ON		ON	ON									ON				0-20 V
± 60 mV		ON		ON	ON		ON					ON				ON	ON	ON	± 60 mV
±100 mV		ON		ON	ON		ON					ON					ON		±100 mV
±200 mV		ON		ON	ON		ON						ON				ON		±200 mV
±300 mV		ON		ON	ON		ON						ON			ON		ON	±300 mV
±500 mV		ON		ON	ON		ON					ON				ON			±500 mV
±1 V		ON		ON	ON		ON						ON			ON			±1 V
±2 V		ON		ON	ON		ON							ON		ON			±2 V
±5 V		ON		ON	ON		ON						ON						±5 V
±10 V		ON		ON	ON		ON							ON					±10 V
±20 V		ON		ON	ON		ON								ON				±20 V
0-5 mA			ON		ON	ON					ON			ON		ON	ON	ON	0-5 mA
0-20 mA			ON		ON	ON					ON		ON			ON			0-20 mA
4-20 mA					ON			ON			ON		ON			ON			4-20 mA
1-5 V					ON			ON					ON						1-5 V

Note: Blank space = DIP switch OFF.

DIP SWITCH SELECTIONS FOR ±5 VOLT OUTPUT

	DIP SWITCH 2											DIP SWITCH 1							
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV	ON		ON					ON	ON	ON		ON				ON	ON	ON	0-60 mV
0-100 mV	ON		ON					ON	ON	ON		ON					ON		0-100 mV
0-200 mV	ON		ON					ON	ON	ON			ON				ON		0-200 mV
0-300 mV	ON		ON					ON	ON	ON			ON			ON		ON	0-300 mV
0-500 mV	ON		ON					ON	ON	ON		ON				ON			0-500 mV
0-1 V	ON		ON					ON	ON	ON			ON			ON			0-1 V
0-2 V	ON		ON					ON	ON	ON				ON		ON			0-2 V
0-5 V	ON		ON					ON	ON	ON			ON						0-5 V
0-10 V	ON		ON					ON	ON	ON				ON					0-10 V
0-20 V	ON		ON					ON	ON	ON					ON				0-20 V
± 60 mV			ON			ON						ON				ON	ON	ON	± 60 mV
±100 mV			ON			ON						ON					ON		±100 mV
±200 mV		Ì	ON			ON							ON				ON		±200 mV
±300 mV			ON			ON							ON			ON		ON	±300 mV
±500 mV			ON			ON						ON				ON			±500 mV
±1 V			ON			ON							ON			ON			±1 V
±2 V			ON			ON								ON		ON			±2 V
±5 V			ON			ON							ON						±5 V
±10 V			ON			ON								ON					±10 V
±20 V			ON			ON									ON				±20 V
0-5 mA	ON		ON					ON	ON	ON	ON			ON		ON	ON	ON	0-5 mA
0-20 mA	ON		ON					ON	ON	ON	ON		ON			ON			0-20 mA
4-20 mA	ON							ON	ON		ON		ON			ON			4-20 mA
1-5 V	ON							ON	ON				ON						1-5 V

Note: Blank space = DIP switch OFF.

DIP SWITCH SELECTIONS FOR 1-5 VOLT OUTPUT

		DIP SWITCH 2									DIP SWITCH 1								
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV	ON			ON								ON				ON	ON	ON	0-60 mV
0-100 mV	ON			ON								ON					ON		0-100 mV
0-200 mV	ON			ON									ON				ON		0-200 mV
0-300 mV	ON			ON									ON			ON		ON	0-300 mV
0-500 mV	ON			ON								ON				ON			0-500 mV
0-1 V	ON			ON									ON			ON			0-1 V
0-2 V	ON			ON										ON		ON			0-2 V
0-5 V	ON			ON									ON						0-5 V
0-10 V	ON			ON										ON					0-10 V
0-20 V	ON			ON											ON				0-20 V
0-5 mA	ON			ON							ON			ON		ON	ON	ON	0-5 mA
0-20 mA	ON			ON							ON		ON			ON			0-20 mA
4-20 mA			ON			ON					ON		ON			ON			4-20 mA
1-5 V			ON			ON							ON						1-5 V

Note: Blank space = DIP switch OFF.

DIP SWITCH SELECTIONS FOR ± 10 VOLT OUTPUT

		DIP SWITCH 2									DIP SWITCH 1								
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV	ON		ON		ON			ON	ON	ON		ON				ON	ON	ON	0-60 mV
0-100 mV	ON		ON		ON			ON	ON	ON		ON					ON		0-100 mV
0-200 mV	ON		ON		ON			ON	ON	ON			ON				ON		0-200 mV
0-300 mV	ON		ON		ON			ON	ON	ON			ON			ON		ON	0-300 mV
0-500 mV	ON		ON		ON			ON	ON	ON		ON				ON			0-500 mV
0-1 V	ON		ON		ON			ON	ON	ON			ON			ON			0-1 V
0-2 V	ON		ON		ON			ON	ON	ON				ON		ON			0-2 V
0-5 V	ON		ON		ON			ON	ON	ON			ON						0-5 V
0-10 V	ON		ON		ON			ON	ON	ON				ON					0-10 V
0-20 V	ON		ON		ON			ON	ON	ON					ON				0-20 V
± 60 mV			ON		ON	ON						ON				ON	ON	ON	± 60 mV
±100 mV			ON		ON	ON						ON					ON		±100 mV
±200 mV			ON		ON	ON							ON				ON		±200 mV
±300 mV			ON		ON	ON							ON			ON		ON	±300 mV
±500 mV			ON		ON	ON						ON				ON			±500 mV
±1 V			ON		ON	ON							ON			ON			±1 V
±2 V			ON		ON	ON								ON		ON			±2 V
±5 V			ON		ON	ON							ON						±5 V
±10 V			ON		ON	ON								ON					±10 V
±20 V			ON		ON	ON									ON				±20 V
0-5 mA	ON		ON		ON			ON	ON	ON	ON	ĺ	ĺ	ON		ON	ON	ON	0-5 mA
0-20 mA	ON		ON		ON			ON	ON	ON	ON	ĺ	ON	ĺ		ON			0-20 mA
4-20 mA	ON				ON			ON	ON		ON		ON			ON			4-20 mA
1-5 V	ON				ON			ON	ON				ON						1-5 V

Note: Blank space = DIP switch OFF.

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DIP	SWITCH	SELECTIONS	FOR 0-20	mA OU	ΓΡυτ
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		DIP SWITCH 2									DIP SWITCH 1								
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV			ON		ON	ON						ON				ON	ON	ON	0-60 mV
0-100 mV			ON		ON	ON						ON					ON		0-100 mV
0-200 mV			ON		ON	ON							ON				ON		0-200 mV
0-300 mV			ON		ON	ON							ON			ON		ON	0-300 mV
0-500 mV			ON		ON	ON						ON				ON			0-500 mV
0-1 V			ON		ON	ON							ON			ON			0-1 V
0-2 V			ON		ON	ON								ON		ON			0-2 V
0-5 V			ON		ON	ON							ON						0-5 V
0-10 V			ON		ON	ON								ON					0-10 V
0-20 V			ON		ON	ON									ON				0-20 V
± 60 mV		ON		ON	ON		ON					ON				ON	ON	ON	± 60 mV
±100 mV		ON		ON	ON		ON					ON					ON		±100 mV
±200 mV		ON		ON	ON		ON						ON				ON		±200 mV
±300 mV		ON		ON	ON		ON						ON			ON		ON	±300 mV
±500 mV		ON		ON	ON		ON					ON				ON			±500 mV
±1 V		ON		ON	ON		ON						ON			ON			±1 V
±2 V		ON		ON	ON		ON							ON		ON			±2 V
±5 V		ON		ON	ON		ON						ON						±5 V
±10 V		ON		ON	ON		ON							ON					±10 V
±20 V		ON		ON	ON		ON								ON				±20 V
0-5 mA			ON		ON	ON					ON			ON		ON	ON	ON	0-5 mA
0-20 mA			ON		ON	ON					ON		ON			ON			0-20 mA
4-20 mA					ON			ON			ON		ON			ON			4-20 mA
1-5 V					ON			ON					ON						1-5 V

Note: Blank space = DIP switch OFF.

DIP SWITCH SELECTIONS FOR 4-20 mA OUTPUT

		DIP SWITCH 2									DIP SWITCH 1								
Input	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	Input
0-60 mV	ON			ON	ON							ON				ON	ON	ON	0-60 mV
0-100 mV	ON			ON	ON							ON					ON		0-100 mV
0-200 mV	ON			ON	ON								ON				ON		0-200 mV
0-300 mV	ON			ON	ON								ON			ON		ON	0-300 mV
0-500 mV	ON			ON	ON							ON				ON			0-500 mV
0-1 V	ON			ON	ON								ON			ON			0-1 V
0-2 V	ON			ON	ON									ON		ON			0-2 V
0-5 V	ON			ON	ON								ON						0-5 V
0-10 V	ON			ON	ON									ON					0-10 V
0-20 V	ON			ON	ON										ON				0-20 V
0-5 mA	ON			ON	ON						ON			ON		ON	ON	ON	0-5 mA
0-20 mA	ON			ON	ON						ON		ON			ON			0-20 mA
4-20 mA			ON		ON	ON					ON		ON			ON			4-20 mA
1-5 V			ON		ON	ON							ON						1-5 V

Note: Blank space = DIP switch OFF.

CALIBRATION PROCEDURE

Module accuracy is dependent upon your calibration reference. The higher your calibration source accuracy, the lower the overall signal conditioner conversion error.

CALIBRATION OF MODULES WITH 0 to 5 V, 0 to 10 V

- Output adjustment of the 0 to 5 V or 0 to 10 V range:
- 1. Set DIP switches as shown in the DIP switch selection Tables.
- 2. Apply power, and let the unit stabilize for 5 minutes.
- 3. Set up output adjustment:
- a. Apply low scale input range value; adjust zero pot for 0 V, ± 0.5 mV.
- b. Finally, apply full scale input from calibration source; adjust span pot for full scale ± 0.5 mV.

CALIBRATION OF MODULES WITH ±5 V, ±10 V, 1 to 5 V, 4 to 20 mA OR 0 to 20 mA

- Output adjustment of ± 5 V, ± 10 V, 1 to 5 V, 4 to 20 mA or 0 to 20 mA ranges:
- 1. Set DIP switches as shown in the DIP switch selection Tables.
- 2. Apply power, and let the unit stabilize for 5 minutes.

3. Set up output adjustment:

- a. Apply low scale input range value from calibration source; record output as MV1. (If using 0 to 20 mA output range, apply 2 mA for low scale input value.)
- b. Apply full scale input from calibration source; record output as MV2.
- 4. With full scale input value still applied:
 - a. First calculate the span pot adjustment point "A" using the formula: A=MV2 X constant/ (MV2-MV1). Adjust the span pot for value "A", plus or minus the adjustment tolerance. (See below table for constant and tolerance.)
 - b. Finally, adjust the zero pot for the nominal full scale output value, plus or minus the adjustment tolerance.

The Constants and Adjustment Tolerances are as follows:

01	onstants and Aujustment Tolerances are as fonows.									
	INPUT RANGE	CONSTANT	ADJUSTMENT TOLERANCE							
	±5 V	10 V	±0.5 mV							
	±10 V	20 V	±0.5 mV							
	1 to 5 V	4 V	±1 mV							
	0 to 20 mA	18 mA	±1 μA							
	4 to 20 mA	16 mA	±1 μA							

MODEL APMR - 3 PHASE FAULT DETECTION DIN RAIL MODULE



DESCRIPTION

The APMR protects three phase equipment, mostly motors, from destructive line conditions. Specifically it detects Phase Reversal, Phase Loss, Phase Unbalance and Low Voltage. All of these conditions, except for Phase Reversal, produce excessive heating of motor windings, causing immediate or cumulative damage to the motor. Phase Reversal will cause a motor to operate in the reverse intended direction, possibly damaging machinery.

There are three models available; 230 VAC, 380 VAC, and 480 VAC. The 230 VAC model is used with 208, 220, 230, and 240 VAC rated equipment. The 380 VAC model is used with 380 and 415 VAC (European) equipment. The 480 VAC model is used with 440, 460, and 480 VAC rated equipment. The electrical connection is three wire Delta or WYE configurations (no neutral connection required).

The output is SPDT relay and LED. The relay is typically connected in series with a motor contactor coil to inhibit motor start or to disconnect the motor in the presence of a fault condition. The relay automatically resets when the fault clears. The relay is typically used in a latching configuration so the motor has to be restarted after the fault is cleared. The LED illuminates green when all conditions are normal - no fault. When the LED is green, the relay is energized. When a fault occurs, the LED turns red and the relay is de-energized. If phase loss occurs on L1 or L3 the LED turns-off and the relay is de-energized.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



- PROTECTS AGAINST PHASE LOSS, UNBALANCE, UNDER VOLTAGE, AND PHASE REVERSAL
- AVAILABLE IN 230, 380, OR 480 VAC
- LOW COST
- DIN RAIL MOUNTABLE
- INRUSH UNDER VOLTAGE DELAY



UL Recognized Component, File # E137808

SPECIFICATIONS

1. POWER:

230 VAC: 185 min to 264 max, 3 VA (Typ)⇒Nominal is 185 to 240, 48 to 62 Hz. **380 VAC**: 320 min to 457 max, 3 VA (Typ)⇒Nominal is 320 to 415, 48 to 62 Hz. **480 VAC**: 380 min to 528 max, 3 VA (Typ)⇒Nominal is 380 to 480, 48 to 62 Hz.

2. OUTPUT: SPDT 10 A @ 240 VAC (resistive load); 1/2 HP @ 240 VAC Response Time: Phase Reversal: Not greater than 120 msec

Low Voltage: 0.1 to 20 sec, user adjustable **Phase Loss and Unbalance**: Not greater than 100 ms

- 3. **TEMPERATURE COEFFICIENTS:** Unbalance: ±0.5% Over temperature range
- Undervoltage: ±200 PPM/°C
- 4. ENVIRONMENTAL CONDITIONS: Operating Temperature: 0 to 55°C Storage Temperature: -40 to 80°C

Operating and Storage Humidity: 85% max. relative humidity (noncondensing) from 0°C to 50°C.

- Altitude: Up to 2000 meters
- 5. ISOLATION BREAKDOWN RATING: 3000 V

6. CERTIFICATIONS AND COMPLIANCES:

SAFETY

UL Recognized Component, File # E137808, UL 508, CSA C22.2 No. 14 Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc. IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact
		Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O
		Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz - 80 MHz
Simulation of cordless telephone	ENV 50204	Level 3; 10 V/m
-		$900 \text{ MHz} \pm 5 \text{ MHz}$
		200 Hz, 50% duty cycle
Emissions to EN 50081-2		
RF interference	EN 55011	Enclosure class A

Refer to EMC Installation Guidelines for additional information.

- MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 - 35 X 7.5 and 35 X 15, and G profile rail according to EN50035 - G32.
- 8. **CONNECTION:** Compression type terminal block
- 9. **CONSTRUCTION:** High impact black plastic case. Installation Category II, Pollution Degree 2.

10. WEIGHT: 7.0 oz. (0.20 Kg)

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FUNCTION DESCRIPTIONS

PHASE UNBALANCE

Unbalance occurs in 3 phase systems when single phase loads are added without regard to voltage effects on the remaining phases. This unbalance in phase voltage causes excessive motor current producing temperatures in excess of specifications. The relationship between voltage unbalance and percentage of temperature rise is approximately the square of the percent voltage unbalance times two. ie., - % temperature rise = (% unbalance² X 2).

Therefore, a 4% voltage unbalance will result in approximately a 32% increase in winding temperature. The effect of temperature rise is immediate failure of winding insulation if unbalance is severe as with single phasing. If unbalance is slight, gradual winding degradation will result in premature insulation failure. The APMR will detect slight unbalances that thermal and magnetic devices usually miss.

PHASE LOSS

Phase Loss is an extreme case of unbalance known as "single phasing" where a total loss of one of the phases occurs. During this condition the motor will continue to run and the full current is drawn from the remaining phases. Unless the motor is lightly loaded motor failure will occur. The APMR will detect Phase Loss even with regenerated voltages present.

PHASE REVERSAL

Reversing any two of the three phases will cause a motor to rotate opposite the intended direction causing damage to machinery. Reversal can occur during maintenance of distribution systems. The APMR will detect Phase Reversal regardless of load conditions.

UNDERVOLTAGE

Undervoltage can occur during Brownouts, excessive system loading and motor startups. An undervoltage **Time Delay** is provided with the undervoltage detection to eliminate false tripping during startups when a motor draws many times its operating current.

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

- 1. The unit should be mounted in a metal enclosure, that is properly connected to protective earth.
 - a. If the bezel is exposed to high Electro-Static Discharge (ESD) levels, above 4 Kv, it should be connected to protective earth. This can be done by making sure the metal bezel makes proper contact to the panel cut-out or connecting the bezel screw with a spade terminal and wire to protective earth.
- 2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables: Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A Steward #28B2029-0A0 Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN610-1707 (KEC #LF1E0000) Schaffner # FN670-1.8/07 Corcom #1VB3 Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the number on the label to identify the position number with the proper function. Strip wire, leaving approximately 1/4" (6mm) of bare wire exposed. Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.





SETUP

- 1. Adjust the dials on the APMR to the following settings:
- a. Under Voltage to minimum
 - (CCW)b. Under Voltage Delay to minimum (CCW)
 - c. % Unbalanced to maximum (CW)
 - Connect input wire from the fused 3 phase line voltage to Terminals 7 (L1), 9 (L2), and 11 (L3). In Wye systems, connection to neutral wire is not required. Do not wire output contacts until Step 9.
 - TURN POWER ON. When the internal relay energizes, and the Red LED glows green, the phase sequence is correct and the voltages on all three phases are above the minimum under voltage setting.
 - a. If the internal output relay does not energize, and the LED stays red, TURN POWER OFF and swap any two (2) of the three (3) input wires. This corrects the phase sequence if the monitor was connected in reverse rotation. *Note: Insure that the motor is wired for correct rotation.*
 - 4. Select the proper under voltage trip point. (This is the dial marked Under Voltage.) The under voltage setting should be the same as the minimum operating voltage for the equipment to be protected.
 - Note: If the recommended setting is not known, turn the Undervoltage adjustment knob CW until the relay de-energizes and the LED glows red. Turn the knob CCW until the relay energizes and the LED glows green. This procedure assumes that the line voltages are at an acceptable level when the adjustments are made.

5. Set the Under Voltage Delay to the desired value. This is the maximum time period that an under voltage condition can exist before de-energizing the internal relay. The exact value of the delay depends on the type of equipment being protected and the quality of the available three phase power. A setting too low, will cause unnecessary interruptions due to momentary dips in the line voltage. On the other hand, if the time delay is too long, damage to the equipment can occur before a legitimate under voltage condition is detected. Three phase motors have a starting current that is many times higher than the normal full load current but lasts for only a few seconds. Setting the delay slightly longer than the duration of this inrush period will prevent the APMR from being tripped due to a low voltage condition caused by the starting current.

Note: The under voltage delay applies only to under voltage conditions. Exceeding the phase unbalance trip setting or a phase loss will de-energize the relay instantly regardless of the delay setting.

6. Phase Unbalance setting. Maximum permissible unbalance and phase voltages that most three phase powered equipment can tolerate are very seldom specified. In most locations, three phase voltages typically are not perfectly balanced. Use your own discretion when setting this value. Too low of a setting (CCW) can cause unnecessary tripping. Too high of a setting (CW) does not provide adequate protection.

An alternative procedure is to turn the Unbalance adjustment CCW until the relay de-energizes and the LED turns red. Turn the knob CW until the relay energizes and the LED turns green.

- Note: This procedure assumes that the line voltages are sufficiently balanced when the adjustments are made. % Voltage Unbalance is defined by NEMA as: [(Maximum Deviation From Average Voltage/Average Voltage) X 100] where Average Voltage = (L1 + L2 + L3)/3.
- Note: NEMA recommends not to operate motors with a phase unbalance greater than 5%.
- When the phase sequence is correct and the line voltages are within preset limits, the internal relay of the APMR will energize. The LED indicator glows green to show a normal condition.
- TURN POWER OFF. Refer to the wiring diagram for proper output contact connections.
- 9. After proper connections are made, TURN POWER ON. The internal relay energizes allowing the monitored load to become active.

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 .

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the APMR on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



T Rail Installation

To install the APMR on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.





APPLICATION

A waste water treatment plant had just completed a costly repair program, reconditioning several

motors used in their pumping process. The necessity to rebuild was the direct result of unbalanced and low voltage supply lines causing excessive heating to the motor windings. The continual operation below acceptable levels of power supply lead to the failure of the motor windings. The APMR (3 phase fault detector) was included in the repair program. This upgrade to the system will automatically shut down the motors if an undesirable power supply condition is detected. Not only is this a safeguard against unbalance or low voltage, it will also detect phase loss or reversal. An alarm will also trigger in the control room, alerting the operators of the shut down action.

L1

L2

L3



TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES							
		480 VAC	380 VAC	230 VAC					
APMR 3 Phase Fault Detection Module APMR0096 APMR0086 APMR001									
For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.									

MODEL IRMA - INTELLIGENT RTD MODULE WITH ANALOG OUTPUT



- USER PROGRAMMABLE INPUT (RTD alpha=0.00385 (DIN 43760), alpha=0.00392, or resistance)
- 12 to 42 VDC LOOP POWERED (4 to 20 mA Output)
- MICROPROCESSOR CONTROLLED
- SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)
- RTD BREAK DETECTION
- MOUNTS ON "T" AND "G" STYLE DIN RAILS
- 2-WAY ELECTRICAL ISOLATION (INPUT/OUTPUT & POWER)
- HIGH-DENSITY PACKAGING (22.5 mm wide)
- WIDE OPERATING TEMPERATURE RANGE

DESCRIPTION

The IRMA accepts a 2, 3, or 4 wire RTD or resistance input and converts it into a 4 to 20 mA current output. The 4 to 20 mA output is linearly proportional to the temperature or the resistance input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The IRMA is loop-powered which means that the same two wires are carrying both the power and the output signal. The unit controls the output current draw from 4 to 20 mA in direct proportion to the input while consuming less than 4 mA for operation. The conversion to a current output signal makes the IRMA less susceptible to noise interference and allows accurate transmission over long distances. Two-Way isolation allows the use of grounded RTD's which can provide additional noise reduction benefits.

The IRMA uses an eight position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output current for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35 X 7.5 and 35 X 15, and G profile according to EN 50 035 - G 32.





CAUTION: Risk of Danger. Read complete instructions prior to installation and operation of the unit.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IRMA	Intelligent RTD Module	IRMA2003

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

SPECIFICATIONS

- 1. POWER: 12 to 42 VDC *(Loop powered). The power supply must have a 30 mA min. capacity.
- [* Min. voltage must be increased to include the drop across any current display indicator]
- 2. INPUT: RTD 2, 3, or 4 wire, 100 ohm platinum, alpha=0.00385 (DIN 43760), alpha=0.00392, or resistance [selectable via DIP switch] Excitation: 0.170 mA nominal

Lead resistance: Less than 0.5°C with 15 ohms max. per lead Note: There is no lead compensation for 2 wire input. Field calibration should be accomplished with equivalent series resistance.

- 3. OUTPUT: 4 to 20 mÅ Linear output with Temperature or resistance input. Ripple: Less than 15 mV peak-to-peak max., across 250Ω load resistor (up to 120 Hz frequencies).
- 4. RANGE & ACCURACY: (12 Bit resolution)
- Accuracy: ± (0.075% Range + 0.1°C [Conformity]) at 23°C after 20 min. warm-up, conforming to ITS-90.

Note: RTD conformity does not apply to resistance input.

Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Range Accuracy:

INPUT	RANGE	DIP SWITCH TYPE RANGE 4 6 7 8	TEMPERATURE & OHMS RANGE	RANGE ACCURACY
	0	0000	-160 to 654°C	± 0.61°C
PTD alpha = 0.00385	1	0001	-108 to 207°C	± 0.24°C
	2	0010	-5 to 414°C	± 0.31°C
	3	0011	194 to 608°C	± 0.31°C
	0	1000	-157 to 640°C	± 0.60°C
BTD alpha = 0.00202	1	1001	-106 to 203°C	± 0.23°C
RTD alpha = 0.00392	2	1010	-5 to 406°C	± 0.31°C
	3	1011	190 to 596°C	± 0.30°C
	0	0100	35.5 to 331.0 Ω	± 0.222 Ω
OLIME	1	0101	57.0 to 178.5 Ω	± 0.091 Ω
Опіміз	2	0110	98.0 to 252.0 Ω	± 0.116 Ω
	3	0111	173.5 to 316.5 Ω	\pm 0.107 Ω

Note: DIP switch settings

ON = IOFF = 0

www.redlion.net

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

SPECIFICATIONS (Cont'd)

- SENSOR BREAK DETECTION: Upscale to 22.5 mA (nominal) or Downscale to 3.6 mA (nominal) [selectable via DIP switch]
- 6. RESPONSE TIME: 400 msec (to within 99% of final value w/step input; typically, response is limited to response time of probe.)
- 7. DIELECTRIC WITHSTAND VOLTAGE: 1500 VAC for 1 minute Working Voltage: 50 VAC from input to output.
- 8. CERTIFICATIONS AND COMPLIANCES:

SAFETY

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1. ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact ¹
		Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3: 10 V/m ²
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O
		Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m
Emissions to EN 50081-2		
RF interference	EN 55011	Enclosure class A

Notes:

- 1. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure, (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the device.
- 2. Self-recoverable loss of performance during EMI disturbance at 10 V/m: Analog output signal may deviate during EMI disturbance.

FUNCTION DESCRIPTIONS

Open Sensor Detection

The output can be set to go Upscale or Downscale for the detection of an open sensor. The Upscale setting makes the output go to 22.5 mA (nominal). The Downscale setting makes the output go to 3.5 mA (nominal). This setting is always active, so changes in the setting are effective immediately.

Calibration Malfunction

If the unit has scaling problems (current remains at 3.5 mA nominal), check the voltage between the RTD- Input (-) and TEST pad (+) [located next to the DIP switches on the side of the unit]. For normal operation the voltage is 0 V (nominal). If the voltage is +3 V(nominal), a problem occurred storing information in the E²PROM. When this happens, perform a Basic Calibration and then a Field Calibration. Turn off power for 5 seconds. Turn on power and check the voltage between the TEST pad (+) and RTD- Input (-). If the voltage is still +3 V(nominal), contact the factory.

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. For the purpose of EMC testing, both input and output lines on the unit were connected with 25 feet (8 m) of cable. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

- 1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).

For operation without loss of performance:

Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent). I/O and power cables are routed in metal conduit connected to earth ground.

9. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: -25°C to 75°C (-13°F to 167°F) Storage Temperature Range: -40°C to 85°C (-40°F to 185°F) Vibration according to IEC 68-2-6: Operational 5 to 150 Hz in X, Y, Z direction for 1.5 hours, 2 g's. Shock according to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions

Temperature Coefficient: $\pm 0.01\%$ of input range per °C Altitude: Up to 2000 meters.

- 10. MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 -35 x 7.5 and 35 x 15, and G profile rail according to EN50035 - G32.
- 11. CONNECTION: Compression type terminal block
- 12. CONSTRUCTION: High impact green plastic case
- 13. WEIGHT: 2.7 oz (76.54 g)



- b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
- c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- 3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A

Steward #28B2029-0A0

- Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3
- Note: Reference manufacturer's instructions when installing a line filter.
- 5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.



INPUT AND POWER/OUTPUT CONNECTIONS INPUT

12 to 42 VDC

Power Supply

When connecting the RTD or resistance device, be certain that the connections are clean and tight. Attach the device to terminals #2 and #3. Install a copper sense lead of the same gauge as those used to connect the device. Attach one end of the wire at the probe where the lead connected to terminal #2 is attached and the other end to terminal #1. This configuration will provide complete lead wire compensation. If a sense wire is not utilized, then Terminal #1 should be shorted to terminal #2. To avoid errors due to lead wire resistance, field calibration should be performed with a series resistance equal to the total lead resistance in the system. Always refer to the probe manufacturer's recommendations for mounting, temperature range, shielding, etc.



POWER/OUTPUT

The unit has the power and current output sharing the same two wires (looppowered). Connect DC power to terminals #4 and #5, observing the correct polarity, with a current meter/indicator connected in between so that the output current can be monitored. Be certain that the DC power is relatively "clean" and within the 12 to 42 VDC range at the terminals. The current meter voltage drop must be included in the power supply considerations.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH		DESCRIPTION
1	OUTPUT CAL	Output Calibration
2	FIELD CAL	Field Calibration
3	BASIC CAL	Basic Calibration
4	385/392	Select RTD alpha - 0.00392 (ON) / 0.00385 (OFF)
5	OPEN SEN DN/UP	Open Sensor Detection - Upscale (ON) / Downscale (OFF)
6	RTD/OHMS	Select Input Type - Ohms (ON) / RTD (OFF)
7 8	RANGE	Sensor Range - 2 switch combination setting

Range switch settings (ON = 1 OFF = 0)

RANGE	DIP SWITCH				
	7	8			
0	0	0			
1	0	1			
2	1	0			
3	1	1			

FACTORY SETTINGS

The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type 385 RTD in range 0. The IRMA should be calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for each RTD type.

TYPE	RANGE	TEMPERATURE RANGE
385	0	150°C to 606°C
392	0	150°C to 595°C

1.0 Field Calibration

Allow a 30 minute warm-up period before starting Field Calibration. Field Calibration scales the 4 to 20 mA output to a temperature or resistance input. This procedure assigns an input value to 4 mA and an input value to 20 mA. The microprocessor handles configuring the output so it is linear to the temperature or resistance input. The Field Calibration procedure is described below.

Note: The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.11) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

RTD temperature to resistance conversion table

Temperature °C	alpha 0.00385 ohms	alpha 0.00392 ohms	Temperature °C	alpha 0.00385 ohms	alpha 0.00392 ohms
-160	35.53	34.38	300	212.03	214.08
-150	39.71	38.64	350	229.69	232.07
-100	60.25	59.55	400	247.05	249.77
-50	80.30	79.96	410	250.49	253.28
0	100.00	100.00	450	264.13	267.18
50	119.40	119.75	500	280.92	284.30
100	138.5	139.20	550	297.42	301.13
150	157.33	158.36	590	310.41	314.38
190	172.17	173.48	600	313.63	317.66
200	175.85	177.23	640	326.38	330.68
250	194.09	195.80	650	329.54	333.90

Field Calibration with an Accurate Adjustable Resistance Source 1.1 Connect an Adjustable Resistance Source with an accuracy of 0.03% to the RTD input terminals using a third sense wire.

For 2 wire sensors short terminal #1 to terminal #2.

- 1.2 Set the Type and Range for the RTD or resistance used in your application (DIP switches #4, #6, #7 and #8). (RTD alpha=0.00385, Range 0 shown)
- 1.3 Set the FIELD CAL switch (#2) ON. [Current goes to 3.6 mA (nominal)]
- 1.4 Set the resistance source to the desired resistance for the 4 mA output. For 2 wire sensors add the system lead resistance to the desired value.
- 1.5 Set the OUTPUT CAL switch (#1) ON. [Current stays at 3.6 mA (nominal)]
- 1.6 Adjust the input resistance up until the output equals 4 mA.
- 1.7 Set the OUTPUT CAL switch (#1) OFF. [Current increases to 22.3 mA (nominal)]
- 1.8 Set the resistance source to the desired resistance for the 20 mA output. For 2 wire sensors add the system lead resistance to the desired value.
- 1.9 Set the OUTPUT CAL switch (#1) ON. [Current decreases to 20.5 mA (nominal)]
- 1.10 Adjust the input resistance down until the output equals 20 mA.
- 1.11 Set the OUTPUT CAL switch (#1) OFF.
- 1.12 Set the FIELD CAL switch (#2) OFF.
- 1.13 Disconnect the resistance source from the IRMA and connect the actual sensor to be used in the application.



Η



2.0 Basic Calibration (Factory Calibration)





The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input circuitry. The Basic Calibration should be performed only if a condition exists as described in the "Calibration Malfunction" section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

Note: To abort this calibration and reset to the previous settings, set the BASIC CAL switch OFF prior to the final setting of the OUTPUT CAL switch (Step 2.15) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.

- 2.1 Connect an Adjustable Resistance Source with an accuracy of 0.03% to the RTD input terminals using a third sense wire. Set the RANGE (#7), TYPE (#4), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 2.2 Apply power and allow a 30 minute warm-up period. [Current goes to 3.5 mA (nominal)]
- 2.3 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.4 Set the resistance source to 40 ohms and wait 5 seconds.
- 2.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.6 Set the resistance source to 60 ohms and wait 5 seconds.
- 2.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.8 Set the resistance source to 100 ohms wait 5 seconds.
- 2.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.10 Set the resistance source to 175 ohms and wait 5 seconds.
- 2.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.12 Set the resistance source to 250 ohms and wait 5 seconds.
- 2.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.14 Set the resistance source to 315 ohms and wait 5 seconds.
- 2.15 Set the OUTPUT CAL switch (#1) ON and then OFF.

2.16 Set the BASIC CAL switch (#3) OFF. [Current increases to 3.6 mA (nominal) or more]

2.17 Perform a Field Calibration. (See Section 1.0)

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the IRMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



APPLICATION

An aluminum manufacturer had the requirement to heat soak aluminum ingots before they were to advance into their hot roll mill. The system is being controlled by a PLC that allows the material to move to the next of twelve zones as soon as the aluminum ingot reaches the soak temperature. An IRMA, RTD Loop powered signal conditioner was used to transmit each zone temperature, measured by an RTD sensor, to the PLC. Because the heat soak procedure was accomplished in an eighty foot furnace tunnel, a relatively long wire run was required to connect each RTD with the PLC. The IRMA transmitter converts and linearizes the RTD signal into a 4 to 20 mA signal that can be run long distances to connect to the PLC.

T Rail Installation

To install the IRMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.





TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

MODEL IRMA DC - INTELLIGENT RTD MODULE WITH ANALOG OUTPUT



- USER PROGRAMMABLE INPUT (RTD alpha = 0.00385 (DIN 43760), alpha = 0.00392, or resistance)
- MICROPROCESSOR CONTROLLED
- SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)
- RTD BREAK DETECTION
- MOUNTS ON "T" AND "G" STYLE DIN RAILS
- 3-WAY ELECTRICAL ISOLATION (POWER/INPUT/OUTPUT)
- MULTIPLE ANALOG OUTPUTS (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC)

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- WIDE OPERATING TEMPERATURE RANGE (-25°C to 75°C)
- LED INDICATION (POWER & MEMORY ERROR)
- 9 to 32 VDC POWERED

DESCRIPTION

The IRMA accepts an RTD or resistance input and converts it into a voltage or current output. The output is linearly proportional to the temperature or resistance input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The IRMA is DC powered. The DC power input is isolated from the signal input and analog output. The unit scales the analog output proportionally to the RTD or resistance input signal. The analog output may be configured for one of the following: 0 to 20 mA, 4 to 20 mA, or 0 to 10 VDC. Making the signal conversion with the IRMA to a current output signal, makes the signal less susceptible to noise interference and allows accurate transmission over long distances. The 3-Way isolation allows the use of grounded RTD's which can provide additional noise reduction benefits.

The IRMA uses an eight position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35×7.5 and 35×15 , and (G) profile according to EN 50 035 - G 32.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IRMA	Intelligent RTD Module	IRMA3035

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



CAUTION: Read complete instructions prior to installation and operation of the unit.

SPECIFICATIONS

- 1. **POWER**: 9 to 32 VDC; 1.75 W. 200 mA max. current. The power supply must have 400 mA for 200 msec. surge capacity.
- INPUT: RTD 2, 3, or 4 wire, 100 ohm platinum, alpha = 0.00385 (DIN 43760), alpha = 0.00392, or resistance [selectable via DIP switches].
 Excitation: 0.170 mA nominal

Lead resistance: Less than 0.5°C with 15 ohms max. per lead

Note: There is no lead compensation for 2 wire input. Field calibration should be performed with equivalent series resistance.

- 3. **OUTPUT:** All output signals scaled linearly using temperature or resistance input. Unit is shipped set for the 4 to 20 mA output. 4 to 20 mA or 0 to 20 mA selected via internal jumper.
 - Voltage Output Compliance:

0 to 10 VDC across min. 1 K Ω load (10 mA)

20 mV peak to peak max. ripple (for frequencies up to 120 Hz) Current Output Compliance:

- 0 to 20 mA through max. 600Ω load (12 VDC)
- 4 to 20 mA through max. 600Ω load (12 VDC)
- 15 mV peak to peak max. ripple across 600Ω load (for frequencies up to 120 Hz)
- 4. **RTD BREAK DETECTION**: Nominal values shown in the following order: (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC).

Upscale: 22.9 mA, 22.5 mA, and 11.5 VDC **Downscale**: -0.5 mA, 3.5 mA, and -0.4 VDC

- 5. **RESPONSE TIME**: 400 msec. (to within 99% of final value w/step input; typically, response is limited to response time of probe.)
- 6. TEMPERATURE EFFECTS:
- **Temperature Coefficient**: ± 0.025% of input range per °C
- DIELECTRIC WITHSTAND VOLTAGE: 1500 VAC for 1 minute Working Voltage: 50 VAC

Power input to Signal input, Power input to Signal output, & Signal input to Signal output.

8. RANGE & ACCURACY: (12 Bit resolution)

Accuracy: ± (0.075% Range + 0.1°C [Conformity]) at 23°C after 45 min. warm-up, conforming to ITS-90.

Note: RTD Conformity does not apply to resistance input. For best accuracy, calibration should be performed under operating conditions.

Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Range Accuracy

INPUT	RANGE	DIP SWITCH TYPE RANGE 4 6 7 8	TEMPERATURE & OHMS RANGE	RANGE ACCURACY
	0	0 0 0 0	-160 to 654°C	± 0.61°C
RTD alpha = 0.00385	1	0001	-108 to 207°C	± 0.24°C
	2	0010	-5 to 414°C	± 0.31°C
	3	0011	194 to 608°C	± 0.31°C
	0	1000	-157 to 640°C	± 0.60°C
BTD alpha = 0.00202	1	1001	-106 to 203°C	± 0.23°C
RTD alpha = 0.00392	2	1010	-5 to 406°C	± 0.31°C
	3	1011	190 to 596°C	± 0.30°C
	0	0100	35.5 to 331.0 Ω	± 0.222 Ω
	1	0101	57.0 to 178.5 Ω	± 0.091 Ω
	2	0110	98.0 to 252.0 Ω	± 0.116 Ω
	3	0111	173.5 to 316.5 Ω	± 0.107 Ω

Note: DIP switch settings ON = 1OFF = 0

Accuracy Example:	Range	Conformity		Total Error
-160°C to 654°C	(±0.61°C +	• ±0.1°C)	=	±0.71°C

9. CERTIFICATIONS AND COMPLIANCES:

SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1. ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

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Electrostatic discharge	EN 61000-4-2	Level 2; 4 kV contact
		Level 3; 8 kV air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m ²
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 kV I/O
		Level 3; 2 kV power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz – 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m
Emission to EN 50081-2		
RF interference	EN 55011	Enclosure class B

Notes

- 1. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the unit.
- 2. Self-recoverable loss of performance during EMI disturbance at 10 V/m: Analog output signal may deviate during EMI disturbance.

For operation without loss of performance:

Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent) I/O and power cables are routed in metal conduit connected to earth ground. Refer to the EMC Installation Guidelines section of this bulletin for

additional information.

10. ENVIRONMENTAL CONDITIONS:

- Operating Temperature Range: -25°C to 75°C (-13°F to 167°F) Storage Temperature Range: -40 to 85°C (-40°F to 185°F)
- Operating and Storage Humidity: 85% max. relative humidity (noncondensing) from -25°C to 75°C.

Altitude: Up to 2000 meters

- 11. MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 , and G profile rail according to EN50035 - G32.
- 12. CONNECTION: Compression type terminal block
- 13. CONSTRUCTION: High impact black plastic case, Installation Category I, Pollution Degree 2.

14. WEIGHT: 4.02 oz. (114.0 g)



FUNCTION DESCRIPTIONS **Open Sensor Detection**

The output can be set to go Upscale or Downscale for the detection of an open sensor. The nominal values for each output range are listed under RTD Break Detection in the Specifications section. This setting is always active, so changes to the setting are effective immediately.

Unit Malfunction

If the unit has scaling problems (output remains at -0.5 mA, 3.5 mA, or -0.5 VDC nominal), check the ERROR LED on the front of the unit. An E²PROM problem is indicated when the ERROR LED is on. If the ERROR LED is on, perform a Basic Calibration followed by a Field Calibration. Turn the power off for 5 seconds. Turn power on and check if the ERROR LED is on. If the LED is on, contact the factory.

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment

- 1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- 3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

Note: Reference manufacturer's instructions when installing a line filter.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.

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INPUT AND POWER/OUTPUT CONNECTIONS INPUT

When connecting the RTD or resistance device, be certain that the connections are clean and tight. Attach the device to terminals #8 and #9. Install a copper sense lead of the same gauge as those used to connect the device. Attach one end of the wire at the probe where the lead connected to terminal #8 is attached and the other end to terminal #7. This configuration will provide complete lead wire compensation. If a sense wire is not utilized, then Terminal #7 should be shorted to terminal #8. To avoid errors due to lead wire resistance, field calibration should be performed with a series resistance equal to the total lead resistance in the system. Always refer to the probe manufacturer's recommendations for mounting, temperature range, shielding, etc.



OUTPUT

Connect the output signal wires to the desired output terminals. For voltage output, use terminals #4 and #6; for current output, use terminals #1 and #3 observing proper polarity. Only one output may be used at a time. The unit is factory set for a 4 to 20 mA output. The voltage output will track the current output linearly within ±2.5% deviation of range endpoints.

To select 0 to 20 mA, output you must open the case and cut the wire jumper. The jumper is located to the left side of the board as shown in the drawing.

Remove this side of the unit case.





FACTORY SETTINGS The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type 385 RTD in range 0. The IRMA should be Field calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for each RTD

type.

NOMINAL FACTORY FIELD CALIBRATION				
TYPE	RANGE	TEMPERATURE RANGE		
385	0	150°C to 606°C		
392	0	150°C to 595°C		

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

POWER

Connect DC power to terminals #10 and #12 observing proper polarity. Be certain DC power is within the 9 to 32 VDC specifications.

POWER LED

The IRMA has a green LED located on the front to indicate that power is applied to the unit.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH	LABEL	DESCRIPTION
1	OUTPUT CAL	Output Calibration
2	FIELD CAL	Field Calibration
3	BASIC CAL	Basic Calibration
4	385/392	RTD Type
5	OPEN SEN UP/DN	Open Sensor Detection - Upscale (ON) / Downscale (OFF)
6	RTD/OHMS	Select Input Type - Ohms (ON) / RTD (OFF)
7	RANGE	Sensor Range - 2 switch combination setting

Range switch settings (ON = 1 OFF = 0)

-						
Г	RANGE	DIP SWITCH				
'		7	8			
	0	0	0			
Г	1	0	1			
Γ	2	1	0			
	3	1	1			



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CALIBRATION PROCEDURES

1.0 Field Calibration

Field Calibration scales the selected output to a temperature or resistance input. This procedure assigns an input value to the low end and an input value to the high end. The microprocessor handles configuring the output so it is linear to the temperature or resistance input. The Field Calibration procedure is described below.

Note: The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.11) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

> MONITORINGINSTRUMENT VOLTAGE METER

RTD temperature to resistance conversion table

Temperature °C	alpha 0.00385	alpha 0.00392	Temperature °C	alpha 0.00385	alpha 0.00392
-160	35.53	34.38	300	212.03	214.08
-150	39.71	38.64	350	229.69	232.07
-100	60.25	59.55	400	247.05	249.77
-50	80.30	79.96	410	250.49	253.28
0	100.00	100.00	450	264.13	267.18
50	119.40	119.75	500	280.92	284.30
100	138.5	139.20	550	297.42	301.13
150	157.33	158.36	590	310.41	314.38
190	172.17	173.48	600	313.63	317.66
200	175.85	177.23	640	326.38	330.68
250	194.09	195.80	650	329.54	333.90

OR CURRENT METER 1) 🗙 🕄 4) 🕱 6 POWER RTD(-ADJUSTABLE ERROR RESISTANCE RTD(+) SOURCE 2 3 4 5 6 7 8 (7) (8) (9) RTD(S) VDC+ 10 🗙 🖸 VDC ON Step 1.2 POWER SUPPLY 9 to 32 VDC 2345678 ON **Field Calibration Wiring** Step 1.3 1 2 3 4 5 6 7 8 ON Step 1.5 1 2 3 4 5 6 7 8 6 ON Step 1.7 MODEL IRMA 2 3 4 5 6 7 8 ON Step 1.9 0

FIELD CAL OUTPUT CAL			ŝ	Ste	p '	1.9)
	1	2	3	4	5	6	
<u> </u>			¥	¥	¥	¥	
,			S	Ste	p 1	.1	1

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Field Calibration with an Accurate Adjustable Resistance Source

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

- 1.1 Connect resistance source to the RTD input terminals using a third sense wire. (For 2 wire sensors, short terminal #7 to terminal #8.)
- 1.2 Set the type and Range for the RTD or resistance used in your application. (DIP switches #4, #6, #7 & #8). (RTD alpha = 0.00385, Range 0 shown). APPLY OPERATING VOLTAGE and allow 45 minute warm-up period.
- 1.3 Set the FIELD CAL switch (#2) ON. [Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.4 Set the input resistance to the value intended to generate the analog low endpoint (For 2 wire sensors, add the system lead resistance to the desired value.)
- 1.5 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.6 Adjust the input signal up until the analog output equals desired low value.[0 mA, 4 mA, or 0 V]
- 1.7 Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 1.8 Set the input resistance to the value intended to generate the analog high endpoint. (For 2 wire sensors, add the system lead resistance to the desired value.)
- 1.9 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 1.10 Adjust the input signal down until the output equals desired high value. [20 mA, 20 mA, or 10 V]
- 1.11 Set the OUTPUT CAL switch (#1) OFF.

1.12 Set the FIELD CAL switch (#2) OFF.

1.13 Disconnect the resistance source from the IRMA and connect the actual sensor to be used in the application.

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2.0 Basic Calibration



The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input. The Basic Calibration should be performed only if a condition exists as described in the "Unit Malfunction" section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

Note: To abort this calibration and reset to the previous settings, set the BASIC CAL switch(#3) OFF prior to the final setting of the OUTPUT CAL switch (#1) (Step 4.17) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

- 2.1 Connect an adjustable resistance source with an accuracy of 0.03% to the RTD input terminals using a third sense wire. Set the RANGE (#7& #8), TYPE (#4), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 2.2 Apply operating power and allow a 45 minute warm-up period. [Current goes to -0.9 mA, 3.4 mA, or -0.5 V(nominal)]
- 2.3 Set the OUTPUT CAL switch (#1) ON and then OFF.

ON

- Set the resistance source to 40 ohms and wait 5 seconds. 2.4
- 2.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.6 Set the resistance source to 60 ohms and wait 5 seconds.
- 2.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.8 Set the resistance source to 100 ohms wait 5 seconds.
- 2.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.10 Set the resistance source to 175 ohms and wait 5 seconds.
- 2.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.12 Set the resistance source to 250 ohms and wait 5 seconds.
- 2.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.14 Set the resistance source to 315 ohms and wait 5 seconds.
- 2.15 Set the OUTPUT CAL switch (#1) ON and then OFF.

2.16 Set the BASIC CAL switch (#3) OFF. [Current increases to 3.6 mA (nominal) or more]



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INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the IRMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



To install the IRMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.

T Rail Installation



APPLICATION

The temperature of certain industrial plastics is critical for melt flow of an injection molding process. Different plastic grades and the complexity of the mold determine required temperatures for efficient material flow. The master control room monitors the temperature of the melt flow of each injection mold machine. They will determine whether the operator may start the process on his machine or override the injection molding process. The injection molding machines are located throughout the plant, posing an RTD signal loss problem from long cable runs. The IRMA DC powered unit is mounted at the machine and uses the local 24 VDC for power. The signal loss problem is solved using the 4 to 20 mA analog output for the long cable run to the master control room.





DESCRIPTION

The ITMA accepts a thermocouple or millivolt input and converts it into a 4 to 20 mA current output. The 4 to 20 mA output is linearly proportional to the temperature or the millivolt input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The ITMA is loop-powered which means that the same two wires are carrying both the power and the output signal. The unit controls the output current draw from 4 to 20 mA in direct proportion to the input change while consuming less than 4 mA for power. The conversion to a current output signal makes the ITMA less susceptible to noise interference and allows accurate transmission over long distances. The 2-Way isolation allows the use of grounded thermocouples which can provide additional noise reduction benefits.

The ITMA uses a ten position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output current for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35×7.5 and 35×15 , and G profile according to EN 50 035 - G 32.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ITMA	Intelligent Thermocouple Module	ITMA2003

USER PROGRAMMABLE INPUT (Thermocouple types J, K, T, & E, or millivolt) 12 to 42 VDC LOOP POWERED (4 to 20 mA Output) MICROPROCESSOR CONTROLLED SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal) THERMOCOUPLE BREAK DETECTION MOUNTS ON "T" AND "G" STYLE DIN RAILS

2-WAY ELECTRICAL ISOLATION (INPUT/OUTPUT & POWER)

HIGH-DENSITY PACKAGING (22.5 mm wide)

WIDE OPERATING TEMPERATURE RANGE



CAUTION: Read complete Instructions prior to installation and operation of the unit.

SPECIFICATIONS

- 1. **POWER:** 12 to 42 VDC *(Loop powered). The power supply must have a 30 mA min. capacity.
 - [* Min. voltage must be increased to include the drop across any current display indicator]
- 2. INPUT: J, K, T, E, mV [selectable via DIP switch]
- OUTPUT: Loop powered (passive), 4 to 20 mA Linear output Ripple: Less than 15 mV peak-to-peak max., across 250Ω load resistor (up to 120 Hz frequencies).
- 4. RANGE & ACCURACY: (12 Bit resolution)
 - Accuracy: \pm (0.075% Range + 0.25°C [Conformity] + 0.50°C [Ice Point]) at 23°C after 20 min. warm-up, conforming to ITS-90.
 - Note: TC Conformity and Ice Point do not apply to mV input.
 - Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Thermocouple Accuracy for each type and the corresponding ranges:

тс	RANGE	DIP SWITCH				H	TEMPERATURE	RANGE	WIRE COLOR	
(INPUT)		6	РЕ 7	8	9	3E 10	& mV RANGE	ACCURACY	ANSI	BS1843
	0	0	0	0	0	0	-136 to 111°C	± 0.19°C		Yellow (+) Blue (-)
	1	0	0	0	0	1	69 to 575°C	± 0.38°C	White (+)	
J	2	0	0	0	1	0	338 to 800°C	± 0.35°C	Red (-)	
	3	0	0	0	1	1	-149 to 862°C	$\pm 0.76^{\circ}C$		
	0	0	0	1	0	0	-200 to 541°C	± 0.56°C		Brown (+) Blue (-)
ĸ	1	0	0	1	0	1	427 to 1132°C	± 0.53°C	Yellow (+)	
r.	2	0	0	1	1	0	648 to 1372°C	$\pm 0.54^{\circ}C$	Red (-)	
	3	0	0	1	1	1	-192 to 1372°C	± 1.17°C		
	0	0	1	0	0	0	-225 to 149°C	± 0.28°C		White (+) Blue (-)
т –	1	0	1	0	0	1	74 to 326°C	± 0.19°C	Blue (+)	
'	2	0	1	0	1	0	68 to 400°C	± 0.25°C	Red (-)	
	3	0	1	0	1	1	-200 to 400°C	$\pm 0.45^{\circ}C$		
	0	0	1	1	0	0	-111 to 311°C	± 0.32°C		Brown (+) Blue (-)
_	1	0	1	1	0	1	276 to 609°C	± 0.25°C	Violet (+)	
	2	0	1	1	1	0	377 to 1000°C	± 0.47°C	Red (-)	
	3	0	1	1	1	1	-114 to 1000°C	$\pm 0.84^{\circ}C$		
	0	1	1	1	0	0	-9 to 6 mV	\pm 0.0113 mV		NI/A
m)/	1	1	1	1	0	1	-9 to 22 mV	± 0.0233 mV	NI/A	
IIIV	2	1	1	1	1	0	-9 to 63 mV	± 0.0540 mV	IN/A	IN/A
	3	1	1	1	1	1	-9 to 77 mV	\pm 0.0645 mV		

Note: DIP switch settings ON = 1 OFF

Accuracy Example:
Type "J" Range "0"
-136°C to 111°C

Range	Conformity		Ice Point	Total Error
(±0.19°C +	±0.25°C	+	$\pm 0.50^{\circ}C$) =	±0.94°C

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- 5. TC BREAK DETECTION: Upscale to 22.5 mA (nominal) or Downscale to 3.6 mA (nominal) [selectable via DIP switch]
- 6. RESPONSE TIME: 400 msec (to within 99% of final value w/step input; typically, response is limited to response time of probe.)
- 7. ENVIRONMENTAL CONDITIONS: Operating Temperature Range: -25°C to 75°C (-13°F to 167°F) Storage Temperature Range: -40°C to 85°C (-40°F to 185°F) Operating and Storage Humidity: 85% max. (non-condensing) from -25°C to 75°C Vibration to IEC 68-2-6: Operational 5-150 Hz, 2 g

Shock to IEC 68-2-27: Operational 30 g

Temperature Coefficient: $\pm 0.01\%$ of input range per °C Ice Point Compensation: $\pm 0.75^{\circ}$ C for a 50°C change in temperature

Altitude: Up to 2000 meters.

8. DIELECTRIC WITHSTAND VOLTAGE: 1500 VAC for 1 minute, at 50 VAC working volts, from Input to Output

9. CERTIFICATIONS AND COMPLIANCES:

CE Approved

EN 61326-1 Immunity to Industrial Locations Emission CISPR 11 Class A

IEC/EN 61010-1

- Refer to the EMC Installation Guidelines section of this bulletin for additional information.
- 10 MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 , and G profile rail according to EN50035 - G32.
- 11. CONNECTION: Compression type terminal block
- 12. CONSTRUCTION: High impact black plastic case. Installation Category I, Pollution Degree 2.
- 13. WEIGHT: 2.7 oz (76.54 g)



FUNCTION DESCRIPTIONS

Open Sensor Detection

The output can be set to go Upscale or Downscale for the detection of an open sensor. The Upscale setting makes the output go to 22.5 mA (nominal). The Downscale setting makes the output go to 3.5 mA (nominal). This setting is always active, so changes in the setting are effective immediately.

Ice Point Compensation

The Ice Point Compensation for the thermocouple sensors can be enabled (DIP Switch OFF) or disabled (DIP Switch ON). The mV sensor input is not affected by this setting. Generally, the Ice Point Compensation is always enabled.

Calibration Malfunction

If the unit has scaling problems (current remains at 3.5 mA nominal), check the voltage between the TC- Input (-) and TEST pad (+) [located next to the DIP switches on the side of the unit]. For normal operation the voltage is -1.77 V (nominal). If the voltage is +1.23 V(nominal), a problem occurred storing information in the E²PROM. When this happens, perform a Basic Calibration and then a Field Calibration. Turn off power for 5 seconds. Turn on power and check the voltage between the TEST pad (+) and TC- Input (-). If the voltage is still +1.23 V(nominal), contact the factory.

FACTORY SETTINGS

The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type J thermocouple in range 3. The ITMA should be Field calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for the given thermocouple types.

Η

TYPE	RANGE	TEMPERATURE RANGE
J	3	-50°C to 500°C
K	3	-85°C to 790°C
Т	3	-195°C to 162°C
E	3	3°C to 602°C

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.



EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

- 1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
- 2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness
 - a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
- 3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. Long cable runs are more susceptible to EMI pickup than short cable runs.

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5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:

Fair-Rite part number 0443167251 (RLC part number FCOR0000) Line Filters for input power cables:

Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)

- 6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
 - a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
 - b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used. RLC part numbers: Snubber: SNUB0000

Varistor: ILS11500 or ILS23000

7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

VisitRLC'swebsiteathttp://www.redlion.net/Support/InstallationConsiderations. html for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

INPUT AND POWER/OUTPUT CONNECTIONS

Input

When connecting the thermocouple, be certain that the connections are clean and tight. The negative thermocouple lead is connected to Terminal #2 (TC-) and the positive lead is connected to Terminal #1 (TC+). If the thermocouple probe cannot be connected directly to the module, thermocouple wire or thermocouple extension-grade wire must be used to extend the connection points (copper wire does not work). Always refer to the thermocouple manufacturer's recommendations for mounting, temperature range, shielding, etc.

Power/Output

The unit has the power and current output sharing the same two wires (looppowered). Connect DC power to terminals #4 and #5, observing the correct polarity, with a current meter/indicator connected in between so that the output current can be monitored. Be certain that the DC power is relatively "clean" and within the 12 to 42 VDC range at the terminals. The current meter voltage drop must be included in power supply considerations.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH		DESCRIPTION	
1	OUTPUT CAL	Output Calibration	
2	FIELD CAL	Field Calibration	
3	BASIC CAL	Basic Calibration	
4	ICE PT EN/DIS	Ice Point Compensation - Disabled (ON) / Enabled (OFF)	
5	OPEN SEN DN/ UP	Open Sensor Detection - Upscale (ON) / Downscale (OFF)	
6			
7	TC TYPE	combination setting	
8			
9	BANCE	Sensor Range - 2 switch combination setting	
10	RANGE		

TC Type and Range switch settings (ON = 1 OFF = 0)

	DIP SWITCH				
ICTIPE	6	7	8		
J	0	0	0		
K	0	0	1		
Т	0	1	0		
E	0	1	1		
mV	1	1	1		

DANCE	DIP SWITCH			
RANGE	9	10		
0	0	0		
1	0	1		
2	1	0		
3	1	1		

CALIBRATION PROCEDURES

1.0 Field Calibration



Field Calibration scales the 4 to 20 mA output to a temperature or mV input. This procedure assigns an input value to 4 mA and an input value to 20 mA. The microprocessor handles configuring the output so it is linear to the temperature or mV input. The Field Calibration procedure is described below.

Note: Allow a 30 minute warm-up period before calibrating. The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.13) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

Field Calibration with a Thermocouple Calibrator

- 1.1 Enable the Ice Point Compensation on the Thermocouple Calibrator and set it to the Thermocouple type being used in your application.
- 1.2 Connect the thermocouple wire as selected in step 1 to the TC input terminals of the ITMA and the thermocouple calibrator.
- 1.3 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 1.4 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10). (TC type "J", Range 0 shown)
- 1.5 Set the FIELD CAL switch (#2) ON. [Current goes to 3.6 mA (nominal)]
- 1.6 Apply the input signal for the 4 mA output.
- 1.7 Set the OUTPUT CAL switch (#1) ON. [Current stays at 3.6 mA (nominal)]
- 1.8 Adjust the input signal up until the output equals 4 mA.
- 1.9 Set the OUTPUT CAL switch (#1) OFF. [Current increases to 22.3 mA (nominal)] 1.10 Apply the input signal for the 20 mA output.
- 1.10 hppiy the input signal for the 20 hill output.

1.11 Set the OUTPUT CAL switch (#1) ON. [Current decreases to 20.5 mA (nominal)] 1.12 Adjust the input signal down until the output equals 20 mA.

- 1.13 Set the OUTPUT CAL switch (#1) OFF.
- 1.14 Set the FIELD CAL switch (#2) OFF.
- 1.15 Disconnect the thermocouple calibrator from the ITMA and connect the actual sensor to be used in the application.

2.0 Field Calibration With an Accurate Adjustable Millivolt Source: (Alternate Method)

Step 2.14



DIP SWITCH SETTINGS

0

This calibration procedure can be used to assign the high and low input values if a thermocouple calibrator is not available.

- Note: To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 2.12) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.
- 2.1 Connect the accurate Adjustable Millivolt Source to the TC input terminals.
- 2.2 Set the ICE PT EN/DIS switch (#4) ON to disable Ice Point Compensation.
- 2.3 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10).(TC type "J", Range 0 shown)
- 2.4 Set the FIELD CAL switch (#2) ON.[Current goes to 3.6 mA (nominal)]
- 2.5 Apply the input signal (mV equivalent for the thermocouple temperature) for the 4 mA output.
- 2.6 Set the OUTPUT CAL switch (#1) ON. [Current stays at 3.6 mA (nominal)]
- 2.7 Adjust the input signal up until the output equals 4 mA.
- 2.8 Set the OUTPUT CAL switch (#1) OFF. [Current increases to 22.3 mA (nominal)]2.9 Apply the input signal (millivolt equivalent for the thermocouple temperature) for the 20 mA output.

2.10 Set the OUTPUT CAL switch (#1) ON. [Current decreases to 20.5 mA (nominal)] 2.11 Adjust the input signal down until the output equals 20 mA.

- 2.12 Set the OUTPUT CAL switch (#1) OFF.
- 2.13 Set the FIELD CAL switch (#2) OFF.
- 2.14 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 2.15 Disconnect millivolt source from the ITMA and connect the actual sensor to be used in the application.

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ON

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3.0 Ice Point Calibration





820

The Ice Point Calibration should only be performed with an ambient temperature between 21°C and 29°C. This Calibration was performed on the unit at the factory during the Basic Calibration and generally does not need to be done again. The Ice Point Compensation can be adjusted through this calibration. The Ice Point Calibration procedure is described below.

Note: Calibration can be aborted by setting the BASIC CAL switch OFF prior to the setting of the OUTPUT CAL switch OFF. (Step 3.6)

- 3.1 Connect a precision mV source with an accuracy of 0.02% to Terminal #1 TC+ Input and Terminal #2 TC- Input. Set the OUTPUT CAL switch (#1) and ICE PT EN/DIS switch (#4) OFF. Set the BASIC CAL (#3) and FIELD CAL (#2) switches ON. The positions of switches #5 thru #10 are not relevant for this calibration procedure.
- 3.2 Connect a precision thermometer (accuracy of 0.1°C) to the unused terminal (#3) beside the TC Input terminals.
- 3.3 Apply power and allow a 30 minute warm-up period. [Current goes to 3.5 mA (nominal)]
- 3.4 Using the temperature indicated by the precision thermometer, input an equivalent $1 \text{ mV/}^{\circ}\text{C}$ signal to the TC Input terminals and wait 5 seconds.

3.5 Set the OUTPUT CAL switch (#1) ON and then OFF.

TON

Ton

T ON

Тоn

1 2 3 4 5 6 7 8 9 10

Step 3.5

1 2 3 4 5 6 7 8 9 10

Step 3.6

3.6 Set the BASIC CAL switch (#3) and FIELD CAL switch (#2) OFF. [Current increases to 3.6 mA (nominal) or more]

H
4.0 Basic Calibration



Basic Calibration Wiring





Step 4.18

ON

ON

The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input, and the Ice Point Compensation. The Basic Calibration should be performed only if a condition exists as described in the "Calibration Malfunction" section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

- Note: To abort this calibration and reset to the previous settings, set the BASIC CAL switch OFF prior to the final setting of the OUTPUT CAL switch (Step 4.17) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.
- 4.1 Connect a precision mV source with an accuracy of 0.02% to Terminal #1 (TC+ Input) and Terminal #2 (TC- Input). Set the ICE PT EN/DIS switch (#4), RANGE (#9
), TYPE (#6, #7, and #8), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 4.2 Apply power and allow a 30 minute warm-up period. [Current goes to 3.5 mA (nominal)]
- 4.3 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.4 Input -9 mV and wait 5 seconds.
- 4.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.6 Input 6 mV and wait 5 seconds.
- 4.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.8 Input 22 mV and wait 5 seconds.
- 4.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.10 Input 41mV and wait 5 seconds
- 4.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.12 Input 63 mV and wait 5 seconds.
- 4.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.14 Input 77 mV and wait 5 seconds.
- 4.15 Set the OUTPUT CAL switch (#1) ON and then OFF.

4.16 Ice Point Calibration.

- a. If ice point calibration is not desired, go to step 4.17.
- b. To Enable ice point calibration, set the FIELD CAL switch (#2) ON.
 - 1. Connect a precision thermometer (accuracy of 0.1°C) to the unused terminal beside the TC Input terminals.
- 2. Allow 5 minutes for the temperature to equalize.
- 3. Using the temperature indicated by the precision thermometer, input an equivalent 1 mV/°C signal to the TC Input terminals.

4.17 Set the OUTPUT CAL switch (#1) ON and then OFF.

- 4.18 Set the BASIC CAL switch (#3) and FIELD CAL switch (#2) OFF. [Current increases to 3.6 mA (nominal) or more]
- 4.19 Perform a Field Calibration. (See Section 1.0)

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to $EN50022 - 35 \times 7.5$ and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the ITMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.





To install the ITMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



APPLICATION

A meat processing plant needs to keep daily records of the process area temperature. FDA regulations require the temperature to be 22°C at all times. The ITMA can be used for this application, with the added benefit of being DIN rail mounted to save space.

The ITMA will sense the process area temperature, and transmit a 4 to 20 mA output to a chart recorder. The processing plant uses a "J" type thermocouple with a range of -136°C to 111°C. The ITMA is field calibrated to output 4 mA at 0°C and 20 mA at 44°C. See Section 1.0 for the Field Calibration procedure.

The ITMA output receives its power from a PSDR1200 Signal Conditioning Power Supply with a +24 VDC output.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

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MODEL ITMA DC - INTELLIGENT THERMOCOUPLE MODULE WITH ANALOG OUTPUT



- USER PROGRAMMABLE INPUT (Thermocouple types J, K, T, & E, or millivolt)
- MICROPROCESSOR CONTROLLED
- SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)
- THERMOCOUPLE BREAK DETECTION
- MOUNTS ON "T" AND "G" STYLE DIN RAILS
- 3-WAY ELECTRICAL ISOLATION (POWER/INPUT/OUTPUT)
- MULTIPLE ANALOG OUTPUTS (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC)
- WIDE OPERATING TEMPERATURE RANGE (-25°C to 75°C)
- POWER & MEMORY ERROR INDICATION
- 9 to 32 VDC POWERED

DESCRIPTION

The ITMA accepts a thermocouple or millivolt input and converts it into a voltage or current output. The voltage or current output is linearly proportional to the temperature or millivolt input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The ITMA is DC powered. The DC power input is isolated from the signal input and analog output. The unit scales the analog output proportionally to the thermocouple or millivolt input signal. The analog output may be configured for one of the following: 0 to 20 mA, 4 to 20 mA, or 0 to 10 VDC. Making the signal conversion with the ITMA to a current output signal, makes the signal less susceptible to noise interference and allows accurate transmission over long distances. The 3-Way isolation allows the use of grounded thermocouples which can provide additional noise reduction benefits.

The ITMA uses a ten position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35×7.5 and 35×15 , and (G) profile according to EN 50 035 - G 32.



SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



CAUTION: Read complete instructions prior to installation and operation of the unit.

SPECIFICATIONS

- 1. **POWER**: 9 to 32 VDC; 1.75 W The power supply must have 300 mA for 200 msec. surge capacity.
- 2. INPUT: J, K, T, E, mV [selectable via DIP switch]
- 3. **OUTPUT**: Self-powered (active); All output signals scaled linearly using temperature or mV input. Unit is shipped set for 4 to 20 mA output. 4 to 20 mA or 0 to 20 mA selected via internal jumper.
 - Voltage Output Compliance:
 - 0 to 10 VDC across min 1 K Ω load (10 mA)
 - 20 mV peak to peak max. ripple (for frequencies up to 120 Hz)
 - Current Output Compliance:
 - 0 to 20 mA through max. 600Ω load (12 VDC)
 - 4 to 20 mA through max. $600\Omega \log d (12 \text{ VDC})$ 15 mV peak to peak max. ripple across $600\Omega \log d$ (for freq. up to 120 Hz)
- 4. TC BREAK DETECTION: Nominal values shown in the following order: (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC).
- **Upscale**: 22.9 mA, 22.5 mA, and 11.5 VDC **Downscale**: -0.5 mA, 3.5 mA, and -0.4 VDC
- 5. **RESPONSE TIME**: 400 msec (to within 99% of final value w/step input;
- typically, response is limited to response time of probe.) 6. **TEMPERATURE EFFECTS**:
- **Temperature Coefficient**: $\pm 0.025\%$ of input range per °C **Ice Point Compensation**: ± 0.75 °C for a 50°C change in temperature
- 7. DIELECTRIC WITHSTAND VOLTAGE: 1500 VAC for 1 minute Working Voltage: 50 VAC
- Power input to Signal input, Power input to Signal output, & Signal input to Signal output.
- RANGE & ACCURACY: (12 Bit resolution)
 Accuracy: ± (0.075% Range + 0.25°C [Conformity] + 0.50°C [Ice Point]) at 23°C after 20 min. warm-up, conforming to ITS-90. Note: TC Conformity and Ice Point do not apply to mV input

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Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Thermocoup	le /	Accuracy	for	each	type	and	the	corres	nonding	ranges.
i nei mocoup		iccuracy	101	cucii	· , p ·		une	corres	ponung	ranges.

TC RANGE TYPE		DIP SWITCH		TEMPERATURE	RANGE	WIRE COLOR			
(INPUT)	NANOL	6 7	8	9	10	& mV RANGE	ACCURACY	ANSI	BS1843
	0	00	0	0	0	-136 to 111°C	± 0.19°C		
	1	0 0	0	0	1	69 to 575°C	± 0.38°C	White (+)	Yellow (+)
J	2	0 0	0	1	0	338 to 800°C	± 0.35°C	Red (-)	Blue (-)
	3	00	0	1	1	-149 to 862°C	± 0.76°C		
	0	0 0	1	0	0	-200 to 541°C	± 0.56°C		
ĸ	1	0 0	1	0	1	427 to 1132°C	± 0.53°C	Yellow (+)	Brown (+)
ĸ	2	0 0	1	1	0	648 to 1372°C	± 0.54°C	Red (-)	Blue (-)
	3	00	1	1	1	-192 to 1372°C	± 1.17°C		
	0	0 1	0	0	0	-225 to 149°C	± 0.28°C		White (+) Blue (-)
т	1	0 1	0	0	1	74 to 326°C	± 0.19°C	Blue (+)	
'	2	0 1	0	1	0	68 to 400°C	± 0.25°C	Red (-)	
	3	0 1	0	1	1	-200 to 400°C	± 0.45°C		
	0	0 1	1	0	0	-111 to 311°C	± 0.32°C		
E	1	0 1	1	0	1	276 to 609°C	± 0.25°C	Violet (+)	Brown (+)
E	2	0 1	1	1	0	377 to 1000°C	± 0.47°C	Red (-)	Blue (-)
	3	0 1	1	1	1	-114 to 1000°C	± 0.84°C		
	0	1 1	1	0	0	-9 to 6 mV	\pm 0.0113 mV		
m\/	1	1 1	1	0	1	-9 to 22 mV	\pm 0.0233 mV		
IIIV	2	1 1	1	1	0	-9 to 63 mV	± 0.0540 mV		I N/A
	3	1 1	1	1	1	-9 to 77 mV	\pm 0.0645 mV		
Note: DIP switch settings $ON = 1$ OFF = 0									

Accuracy Example:

nple: Range Conformity

(±0.19°C +

Type "J" Range "0" -136°C to 111°C

9. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: -25°C to 75°C (-13°F to 167°F) Storage Temperature Range: -40 to 85°C (-40°F to 185°F) Operating and Storage Humidity: 85% max. relative humidity (noncondensing) from -25°C to 75°C.

±0.25°C

Ice Point

 $+ \pm 0.50^{\circ}C$) =

Total Error

±0.94°C

Vibration to IEC 68-2-6: Operational 5-150 Hz, 2 g

Shock to IEC 68-2-27: Operational 30 g

Altitude: Up to 2000 meters

- MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 -35 × 7.5 and -35 × 15, and G profile rail according to EN50035 - G32.
- 11. CONNECTION: Compression type terminal block
- 12. CONSTRUCTION: High impact black plastic case

13. CERTIFICATIONS AND COMPLIANCES:

CE Approved

EN 61326-1 Immunity to Industrial Locations Emission CISPR 11 Class B IEC/EN 61010-1

RoHS Compliant

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

14. WEIGHT: 4.02 oz. (114.0 g)



FUNCTION DESCRIPTIONS Open Sensor Detection

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The output can be set to go Upscale or Downscale for the detection of an open sensor. The nominal values for each output range are listed under TC Break Detection in the Specifications section. This setting is always active, so changes to the setting are effective immediately.

Ice Point Compensation

The Ice Point Compensation for the thermocouple sensors can be enabled (DIP Switch OFF) or disabled (DIP Switch ON). The mV sensor input is not affected by this setting. Generally, the Ice Point Compensation is always enabled.

Unit Malfunction

If the unit has scaling problems (output remains at -0.5 mA, 3.5 mA, or -0.5 VDC nominal), check the ERROR LED on the front of the unit. An E^2PROM problem is indicated when the ERROR LED is on. If the ERROR LED is on, perform a Basic Calibration followed by a Field Calibration. Turn the power off for 5 seconds. Turn power on and check if the ERROR LED is on. If the LED is on, contact the factory.

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

- 1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
- 2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
- 3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors, feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 4. Long cable runs are more susceptible to EMI pickup than short cable runs.
- 5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:

Fair-Rite part number 0443167251 (RLC part number FCOR0000) Line Filters for input power cables:

Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)

- 6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is normally installed across the load, the contacts or both. The most effective location is across the load.
 - a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
 - b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used. RLC part numbers: Snubber: SNUB0000

Varistor: ILS11500 or ILS23000

7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

VisitRLC's website at http://www.redlion.net/Support/InstallationConsiderations. html for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

WIRING CONNECTIONS

All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.



INPUT, OUTPUT, AND POWER CONNECTIONS

INPUT

Ensure thermocouple wire ends are stripped and clean. Connect positive thermocouple lead to terminal #7 (TC+). Connect negative thermocouple lead to terminal #8 (TC-). If the thermocouple probe cannot be connected directly to the module, thermocouple wire or thermocouple extension-grade wire must be used to extend the connection (copper wire does not work). Always refer to the thermocouple manufacturer's recommendations for: mounting, temperature range, shielding, etc.



OUTPUT

Connect the output signal wires to the desired output terminals. For voltage output, use terminals #4 and #6; for current output, use terminals #1 and #3 observing proper polarity. Only one output may be used at a time. The unit is factory set for a 4 to 20 mA output. The voltage output will track the current output nominally within a $\pm 2.5\%$ deviation range.

To select 0 to 20 mA, output you must open the case and cut the wire jumper. The jumper is located to the left side of the board as shown in the drawing.

POWER

Connect DC power to terminals #10 and #12 observing proper polarity. Be certain DC power is within the 9 to 32 VDC specifications.

POWER LED

The ITMA has a green LED located on the front to indicate that power is applied to the unit.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH	LABEL	DESCRIPTION		
1	OUTPUT CAL	Output Calibration		
2	FIELD CAL	Field Calibration		
3	BASIC CAL	Basic Calibration		
4	ICE PT DIS/EN	Ice Point Compensation - Disabled (ON) / Enabled (OFF)		
5	OPEN SEN UP/DN	Open Sensor Detection - Upscale (ON) / Downscale (OFF)		
6				
7	TC TYPE	Thermocouple Type - 3 switch		
8		combination setting		
9	DANCE	Sensor Range - 2 switch		
10	RANGE	combination setting		

TC Type and Range switch settings (ON = 1 OFF = 0)

DIP SWITCH тс TYPE 6 7 8 J 0 0 0 Κ 0 0 1 Т 0 1 0 Е 0 1 1 mV 1 1 1

DANCE	DIP SWITCH				
RANGE	9	10			
0	0	0			
1	0	1			
2	1	0			
3	1	1			

FACTORY SETTINGS

The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type J thermocouple in range 3. The ITMA should be Field calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for the given thermocouple types.

NOMINAL FACTORY FIELD CALIBRATION					
TYPE	RANGE	TEMPERATURE RANGE			
J	3	-50°C to 500°C			
K	3	-85°C to 790°C			
Т	3	-195°C to 162°C			
E	3	3°C to 602°C			

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

Η

CALIBRATION PROCEDURES

ON

1.0 Field Calibration



POWER SUPPLY

9 to 32 VDC

Field Calibration Wiring

MODEL ITMA

CH SETTINGS OFF = 0

0

9-32 VDC

0

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

Allow a 30 minute warm-up period before starting Field Calibration. Field Calibration scales the voltage or current output to a temperature or mV input. This procedure assigns an input value to analog output low and an input value to analog output high. The microprocessor handles configuring the output so it is linear to the temperature or mV input. The Field Calibration procedure is described below.

Note: The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch(#2) OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.13) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

Field Calibration with a Thermocouple Calibrator

- 1.1 Enable the Ice Point Compensation on the Thermocouple Calibrator and set it to the Thermocouple type being used in your application.
- 1.2 Connect the thermocouple wire as selected in step 1 to the TC input terminals of the ITMA and the thermocouple calibrator.
- 1.3 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 1.4 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10). (TC type "J", Range 0 shown)
- 1.5 Set the FIELD CAL switch (#2) ON. [Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.6 Apply the input signal for the analog output low value.
- 1.7 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.8 Adjust the input signal up until the output equals desired low value.
- Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 1.10 Apply the input signal for the analog output high value.
- 1.11 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 1.12 Adjust the input signal down until the output equals desired high value.
- 1.13 Set the OUTPUT CAL switch (#1) OFF.
- 1.14 Set the FIELD CAL switch (#2) OFF.
- 1.15 Disconnect the thermocouple calibrator from the ITMA and connect the actual sensor to be used in the application.

2.0 Field Calibration With an Accurate Adjustable Millivolt Source: (Alternate Method)

ON

2 3 4 5 6 7 8 9 10

Step 1.14

VOLTAGE METER OR CURRENT METER $\bigcirc \boxtimes \odot$ 4) 🕱 6 V. POWER ERROR (ADJUSTABLE тс MILLIVOLT 788 TC+ SOURCE VDC+ $0 \otimes 2$ VDC POWER SUPPLY

Field Calibration Wiring

9 to 32 VDC



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Ļ		Į		¥	¥	¥	¥	V	U	Î	ON	
			S	tep	o 2	2.4						
1	2	3	4	5	6	7	8	9	10			
Ť	Î	Ţ	ſ	¥	¥	¥	¥	¥	₽	Î	ON	
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Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

This calibration procedure can be used to assign the high and low input values if a thermocouple calibrator is not available.

- Note: To abort this calibration and reset to the previous settings, set the FIELD CAL switch(#2) OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 2.12) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.
- 2.1 Connect the accurate Adjustable Millivolt Source to the TC input terminals.
- 2.2 Set the ICE PT EN/DIS switch (#4) ON to disable Ice Point Compensation.
- 2.3 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10).(TC type "J", Range 0 shown)
- 2.4 Set the FIELD CAL switch (#2) ON.[Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 2.5 Apply the input signal (mV equivalent for the thermocouple temperature) for the analog output low value.
- 2.6 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 2.7 Adjust the input signal up until the output equals desired low value.
- Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 2.9 Apply the input signal (millivolt equivalent for the thermocouple temperature) for the analog output high value.
- 2.10 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 2.11 Adjust the input signal down until the output equals desired high value.
- 2.12 Set the OUTPUT CAL switch (#1) OFF.
- 2.13 Set the FIELD CAL switch (#2) OFF.
- 2.14 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 2.15 Disconnect millivolt source from the ITMA and connect the actual sensor to be used in the application.

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H

3.0 Ice Point Calibration



4.0 Basic Calibration



Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

Н

The Ice Point Calibration should only be performed with an ambient temperature between 21°C and 29°C. This Calibration was performed on the unit at the factory during the Basic Calibration and generally does not need to be done again. The Ice Point Compensation can be adjusted through this calibration. The Ice Point Calibration procedure is described below.

Note: Calibration can be aborted by setting the BASIC CAL switch(#3) OFF prior to the setting of the OUTPUT CAL switch OFF. (Step 3.6)

- 3.1 Connect a precision mV source with an accuracy of 0.02% to Terminal #7 TC+ Input and Terminal #8 TC- Input. Set the OUTPUT CAL switch (#1) and ICE PT EN/DIS switch (#4) OFF. Set the BASIC CAL (#3) and FIELD CAL (#2) switches ON. The positions of switches #5 thru #10 are not relevant for this calibration procedure.
- 3.2 Connect a precision thermometer (accuracy of 0.1°C) to the unused terminal (#9) beside the TC Input terminals.
- 3.3 Apply power and allow a 30 minute warm-up period. [Output goes to -0.9 mA, 3.4 mA, or -0.5V nominal]
- 3.4 Using the temperature indicated by the precision thermometer, input an equivalent $1 \text{ mV/}^{\circ}\text{C}$ signal to the TC Input terminals and wait 5 seconds.
- 3.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 3.6 Set the BASIC CAL switch (#3) and FIELD CAL switch (#2) OFF. [Output increases to -0.8 mA, 3.5 mA, or -0.38 V nominal, or more]

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input, and the Ice Point Compensation. The Basic Calibration should be performed only if a condition exists as described in the "Unit Malfunction" section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

- Note: To abort this calibration and reset to the previous settings, set the BASIC CAL switch(#3) OFF prior to the final setting of the OUTPUT CAL switch (Step 4.17) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.
- 4.1 Connect a precision mV source with an accuracy of 0.02% to Terminal #7 (TC+ Input) and Terminal #8 (TC- Input). Set the ICE PT EN/DIS switch (#4), RANGE (#9
), TYPE (#6, #7, and #8), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 4.2 Apply power and allow a 30 minute warm-up period. [Output goes to -0.9 mA, 3.4 mA, or -0.5 V nominal]
- 4.3 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.4 Input -9 mV and wait 5 seconds.
 - 4.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.6 Input 6 mV and wait 5 seconds.
- 4.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.8 Input 22 mV and wait 5 seconds.
- 4.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.10 Input 41mV and wait 5 seconds.
- 4.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.12 Input 63 mV and wait 5 seconds.
- 4.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.14 Input 77 mV and wait 5 seconds.
- 4.15 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.16 Ice Point Calibration.
 - a. If ice point calibration is not desired, go to step 4.17.
 - b. To Enable ice point calibration, set the FIELD CAL switch (#2) ON.
 - 1. Connect a precision thermometer (accuracy of 0.1°C) to the unused terminal beside the TC Input terminals.
 - 2. Allow 5 minutes for the temperature to equalize.
 - 3. Using the temperature indicated by the precision thermometer, input an equivalent 1 mV/°C signal to the TC Input terminals.
- 4.17 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 4.18 Set the BASIC CAL switch (#3) and FIELD CAL switch (#2) OFF. [Output increases to -0.8 mA, 3.5 mA, or -0.4 V nominal, or more]
- 4.19 Perform a Field Calibration. (See Section 1.0)

1-717-767-6511

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the ITMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



To install the ITMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.

T Rail Installation



APPLICATION

828

The temperature of certain industrial plastics is critical for melt flow of an injection molding process. Different plastic grades and the complexity of the mold determine required temperatures for efficient material flow. The master control room monitors the temperature of the melt flow of each injection mold machine. They will determine whether the operator may start the process on his machine or override the injection molding process. The injection molding machines are located throughout the plant, posing a thermocouple signal loss problem from long cable runs. The ITMA DC powered unit is mounted at the machine and uses the local 24 VDC for power. The signal loss problem is solved using the 4 to 20 mA analog output for the long cable run to the master control room.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ITMA	Intelligent Thermocouple Module	ITMA3035

MODEL ICM4 - SERIAL CONVERTER MODULE (RS-232C/RS-485)



ALLOWS COMMUNICATIONS BETWEEN RS-232 CONTROL EQUIPMENT AND PRODUCTS WITH RS-485 SERIAL COMMUNICATIONS

- WIDE DC INPUT POWER RANGE (+9 to 32 VDC)
- HALF DUPLEX (RS-485) AND FULL DUPLEX (RS-422)
- LED INDICATION FOR RXD, TXD, and POWER
- UNIVERSAL MOUNTING FOOT FOR DIN RAIL INSTALLATION



UL Recognized Component, File # E179259 CE

DESCRIPTION

The ICM4 Serial Converter Module provides the capability of interfacing equipment with RS-485 serial communications to equipment with RS-232 communications. Data format of the RS-232 and RS-485 equipment must be the same.

For full duplex (RS-422), the DIP switch on the side of the module must be in the RS-422 position. For half duplex (RS-485), the DIP switch must be in the RS-485 position. In half duplex mode, the RS-485 driver is enabled using the leading edge of the first character transmitted (RXD input). After the last character transmits, the converter waits one character time (at 9600 baud) to disable the RS-485 driver.

There are 3 LED's that can be viewed from the front of the converter module. A green power LED indicates power is on, a red RS-232 TXD LED flashes when the module is transmitting, and a green RS-232 RXD LED flashes when the module is receiving.

An external DC power source (+9 to 32 VDC) is required to power the ICM4. The external power source and serial communications connections are made via a 12 position removable terminal block located on the front of the module.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat profile rail according to EN50022 - 35 x 7.5 and 35 x 15, and G profile rail according to EN50035 - G32.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



DIMENSIONS In inches (mm)

3.76 (95.5) 3.86 (98)

SPECIFICATIONS

- 1. **POWER**: +9 to 32 VDC @ 75 mA maximum. Above 26 VDC, derate max. operating temperature to 40 °C. Power supply must be Class 2 or SELV rated.
- 2. RS232 VOLTAGES: Receive Data Pin: ± 30 VDC max. Mark Condition: ≤ 0.8 VDC Space Condition: ≥ 2.4 VDC Transmit Data Pin: Mark Condition: −8 VDC (typ.)
 - Space Condition: +8 VDC (typ.)
- 3. RS485 VOLTAGES:

Differential Output Voltage: ± 5 VDC max. under no load

Differential Input Voltage: ± 5 VDC max.

- Mark Condition: ≤ -0.2 VDC
- **Space Condition**: $\geq +0.2$ VDC

RS485 Drive Capability: Up to 32 RS-485 receivers connected in parallel. **RS485 Drive Disable Time**: 4 msec. max.

4. MAXIMUM CABLE LENGTH:

RS232: 50 feet **RS485**: 4000 feet

- **KS485**: 4000 feet
- 5. BAUD RATE: 9600 min., 19200 max.
 6. CERTIFICATIONS AND COMPLIANCES:

SAFETY

UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 1010-1

Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

- IECEE CB Scheme Test Certificate # US/5141B/UL, CB Scheme Test Report # 01ME11540-0702001
 - Issued by Underwriters Laboratories, Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Infinumity to Env 50002-2		
Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact
		Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O
		Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz - 80 MHz
Simulation of cordless telephone	ENV 50204	Level 3; 10 V/m
		$900 \text{ MHz} \pm 5 \text{ MHz}$
		200 Hz, 50% duty cycle
Emissions to EN 50081-1		
RF interference	EN 55022	Enclosure class B

Refer to EMC Installation Guidelines for additional information.

1-717-767-6511

SPECIFICATIONS (Cont'd)

7. ENVIRONMENTAL CONDITIONS

- **Operating Temperature Range:** 0 to 50 °C. Derate max. operating temperature to 40 °C above 26 VDC. **Storage Temperature:** -40 to + 75 °C
- Operating and Storage Humidity: 85% max.relative humidity (non-condensing) from 0 to 50 °C
- Vibration according to IEC 68-2-6: Operational 5 to 150 Hz in X, Y, Z direction for 1.5 hours, 2 g's.
- Shock according to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions Altitude: Up to 2000 meters
- 8. **CONSTRUCTION**: Case body is black, high impact plastic. Installation Category I, Pollution Degree 2.
- 9. **MOUNTING**: Standard DIN rail top hat (T) profile rail according to EN50022- 35 X 7.5 and 35 X 15

10. WEIGHT: 3.2 oz. (90.7 g)

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

- DC power to the unit should be relatively clean and within the specified limits. Connecting power to the unit from circuits that power inductive loads that cycle on and off, such as contactors, relays, motors, etc., should be avoided. This will reduce the chance of noise spikes entering the DC power connection and affecting the unit.
- 2. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the unit to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 3. Never run Signal cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- Signal cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection.
 - Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal cables: Fair-Rite # 0443167251 (RLC #FCOR0000) TDK # ZCAT3035-1330A Steward #28B2029-0A0

Line Filters for input power cables:

- Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3
- *Note: Reference manufacturer's instructions when installing a line filter.* 6. Long cable runs are more susceptible to EMI pickup than short cable runs.
- Therefore, keep cable runs as short as possible.

SIDE VIEW OF ICM4



TYPICAL RS-422 CONNECTIONS



Notes:

- 1. Connect shield drain wire to earth ground.
- 2. Place DIP switch on the side of the ICM4 in the 422 position.
- 3. RS-422 polarity: Terminal "A" is negative with respect to Terminal "B" in the mark (logic 1) condition.

TYPICAL RS-485 CONNECTIONS



Notes:

- 1. Connect shield drain wire to earth ground.
- 2. Place DIP switch on the side of the ICM4 in the 485 position.
- 3. The transmit and receive data lines of the ICM4 should be wired together.

TYPICAL RS-232 CONNECTIONS



TYPICAL CONNECTION FOR SINGLE UNIT



TYPICAL CONNECTION FOR MULTIPLE UNITS



INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35 x 7.5 and 35 x 15. The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the ICM4 on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ICM4	RS-232/RS-485 Converter Module	ICM40030

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

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MODEL ICM5 – THREE WAY ISOLATED SERIAL CONVERTER MODULE (RS-232C/RS-485)



- 9 PIN D-SUB CONNECTOR FOR RS-232 CONNECTION
- SWITCHABLE TERMINATION AND BIASING RESISTORS
- MODULAR RJ JACK OR SCREW TERMINAL FOR RS-485
 CONNECTION

- ALLOWS COMMUNICATIONS BETWEEN RS-232 CONTROL EQUIPMENT AND PRODUCTS WITH RS-422/RS-485 SERIAL COMMUNICATIONS
- THREE WAY ISOLATION PROTECTS SERIAL EQUIPMENT FROM GROUND LOOPS (1000 VDC)
- AUTOMATIC RS-485 DRIVER CONTROL
- DIP SWITCH SELECTABLE BAUD RATES 9600, 19200, 38400, 57600, 115200
- WIDE DC INPUT POWER RANGE (+9 to 26 VDC)
- HALF DUPLEX (RS-485) AND FULL DUPLEX (RS-422)
- LED INDICATION FOR RXD, TXD, and POWER
- UNIVERSAL MOUNTING FOOT FOR DIN RAIL INSTALLATION
 - SELECTABLE DTE & DCE OPERATION WORKS WITH ANY RS-232 CABLE



UL Recognized Component, File # E179259

DESCRIPTION

The ICM5 Serial Converter Module provides the capability of interfacing equipment with RS-485 serial communications to equipment with RS-232 communications while providing three way isolation. Data format of the RS-232 and RS-485 equipment must be the same.

The unit can be configured for full duplex (RS-422), or half duplex (RS-485) operation. In half duplex mode, the RS-485 driver is automatically enabled using the leading edge of the first character that is received on the RS-232 side. After the last character is received, the converter waits one character time (at the selected baud rate) to disable the RS-485 driver.

An external DC power source (+9 to 26 VDC) is required to power the ICM5. The external power source and RS-485 communications connections are made via a 7-position removable terminal block located on the front of the module. A modular RS-485 connector is also provided for fast and efficient connection to other Red Lion devices that use a modular connector. The RS-232 connection is provided via a standard D-SUB 9-pin male connector. The ICM5 can be configured for DTE or DCE operation, allowing the use of modem or null-modem cables.

There are 3 LEDs that can be viewed from the front of the converter module. A green power LED indicates power is on, a red RS-232 TXD LED flashes when the module is transmitting, and a green RS-232 RXD LED flashes when the module is receiving.



The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat profile rail according to EN 50 022 - 35x7.5 and 35x15, and G profile rail according to EN 50 035 - G32.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



SPECIFICATIONS

- 1. **POWER**: +9 to 26 VDC @ 125 mA maximum. 85 mA typical Power Supply must be Class 2 or SELV rated.
- 2. RS-232 VOLTAGES:
 - Receive Data Pin: ± 30 VDC max. Mark Condition: ≤ 0.8 VDC Space Condition: ≥ 2.4 VDC Transmit Data Pin:
 - Mark Condition: -8 VDC (typ.) Space Condition: +8 VDC (typ.)
- 3. RS-485 VOLTAGES:

Differential Output Voltage: ± 5 VDC max. under no load

- **Differential Input Voltage**: ± 5 VDC max.
- Mark Condition: ≤ -0.2 VDC
- Space Condition: $\geq +0.2$ VDC

RS-485 Drive Capability: Up to 32 RS-485 receivers connected in parallel RS-485 Drive Disable Time: one character time (at the set baud rate) 4. MAXIMUM CABLE LENGTH:

- **RS-232**: 50 feet (15.24 m) **RS-485**: 4000 feet (1219.2 m)
- 5. **BAUD RATE**: 9600 min., 115200 max.
- 6. ISOLATION: 1000 VDC
- 7. ENVIRONMENTAL CONDITIONS:
- Operating Temperature Range: 0 to 50°C. Storage Temperature: -40 to + 75°C Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0 to 50°C

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Vibration according to IEC 68-2-6: Operational 5 to 150 Hz in X, Y, Z direction for 1.5 hours, 2 g's.

Shock according to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions. Altitude: Up to 2000 meters

8. CERTIFICATIONS AND COMPLIANCES:

SAFETY

Н

UL Recognized Component, File #E179259, UL3101-1, CSA 22.2 No. 1010-1 Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

IECEE CB Scheme Test Report #01ME11540-0702001

Issued by Underwriters Laboratories, Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact ¹
		Level 3; 8 Kv air ¹
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m
		80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O
		Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms
		150 KHz - 80 MHz
Emissions to EN 50081-1		
RF interference	EN 55022	Enclosure class B
		Power mains class B

Note:

 This device was designed for installation in an enclosure. To avoid electrostatic discharge to the unit in environments with static levels above 4 Kv, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure, (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the unit.

Refer to EMC Installation Guidelines for additional information.

9. **CONSTRUCTION**: Case body is black, high impact plastic. Installation Category I, Pollution Degree 2.

- 10. **MOUNTING:** Standard DIN rail top hat (T) profile rail according to EN50022- 35 X 7.5 and 35 X 15
- 11. WEIGHT: 3.3 oz. (93.6 g)



EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

- DC power to the unit should be relatively clean and within the specified limits. Connecting power to the unit from circuits that power inductive loads that cycle on and off, such as contactors, relays, motors, etc., should be avoided. This will reduce the chance of noise spikes entering the DC power connection and affecting the unit.
- 2. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the unit to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when
 - the noise source frequency is above 1 MHz.c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

- 3. Never run Signal cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- Signal cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection.

Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal cables: Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A Steward #28B2029-0A0

Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000) Schaffner # FN670-1.8/07 Corcom #1VR3

Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

www.redlion.net

Note: Reference manufacturer's instructions when installing a line filter.



DIP SWITCH SETTINGS

Top Bank of 10 Switches

Switches 1-5 - BAUD

Select the appropriate baud rate. This adjusts the time delay for the automatic RS-485 driver controller. Only one of the baud switches should be in the ON position.

Switches 6-7 - PULL UP / PULL DOWN

These switches connect 4.7 K Ω biasing resistors to the A and B lines of the 485 receiver. To minimize loading of the network, these should only be used if no other device in the system provides biasing.

DEFAULT SETTINGS

BAUD RATE 9600

2 WIRE \ RS-485

NO TERMINATION

NO PULL-UP OR PULL DOWN

DCE

Switches 8-9 - OFF 4 WIRE / ON 2 WIRE

These switches can be used to internally jumper the A and B lines of the RS-485 driver and receiver together. This allows 2-wire operation without the use of external jumper wires. To use the RJ-11 connector, the ICM5 must be in 2-wire mode. Both switches should be in the same position.

Switch 10 - 120 Ω TERMINATION

This switch connects a 120 Ω resistor across the A and B lines of the RS-485 receiver. The use of the resistor prevents signal reflection, or echoing, at high baud rates, over long distances. This should only be turned on if the ICM5 is the first, or last, device in a multi-drop network that is experiencing reflection due to long cable distances.

Bottom Bank of 7 Switches

Switches 1-2 - OFF 422 / ON 485

These switches enable and disable the automatic RS-485 driver control. In the 422 position, the driver is always enabled, allowing 4-wire full duplex operation. In the 485 position, the driver is enabled as soon as characters are received on the RS-232 side. When the RS-485 driver has transmitted the last character, it waits one character time (at the selected baud rate), and then enters a high-impedance state. The receiver is also enabled and disabled in a similar fashion to prevent transmitted characters from being echoed back. This allows 2-wire, half-duplex operation, without the use of handshake lines. Both switches should be in the same position.

Switch 3 - N/C

No Connection

Switches 4-7 - OFF DCE / ON DTE

These switches configure the RS-232 port to act as a DCE or DTE device. With all of the switches in the DCE position, pin 2 of the DB-9 connector is the RS-232 receiver, and pin 3 is the RS-232 transmitter. DTE configures pin 2 as the transmitter, and pin 3 as the receiver. These switches allow the use of modem or null-modem cables. All of these switches should be in the DCE or DTE position. No other combinations are valid.



TYPICAL RS-422 CONNECTIONS



Notes:

1. Connect shield (drain wire) to earth ground.

2. RS-422 polarity: Terminal "A" is negative with respect to Terminal "B" in the mark (logic 1) condition.



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Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com



INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35×7.5 and 35×15 . The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

G Rail Installation

To install the ICM5 on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



T Rail Installation

To install the ICM5 on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ICM5	RS-232/RS-485 Converter Module	ICM50000
CBJ	6" RJ-11 Jumper Cable	CBJ11BD5

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

MODEL ICM8 – ETHERNET GATEWAY



ETHERNET GATEWAY FOR RED LION PANEL METERS PROGRAMMABLE VIA CRIMSON SOFTWARE USB PROGRAMMING PORT

EXTENSIVE ETHERNET DRIVER LIST ALLOWS EASY DATA MAPPING TO PLCs, PCs, AND SCADA SYSTEMS

10 BASE-T/100 BASE-TX ETHERNET

Η

GENERAL DESCRIPTION

The ICM8 is designed to act as an ethernet gateway offering multiple protocol conversion for Red Lion panel meters. With two serial ports (one RS232 and one RS485) and a 10 Base-T/100 Ethernet Port, the unit performs protocol conversion, allowing Red Lion panel meters to communicate seamlessly to the ethernet network. Programming the unit can be accomplished via the RS232 or the USB Port using Crimson Software. It is important to note that this device is designed to function with Red Lion panel meters and will not offer protocol conversion if a Red Lion Product is not connected to at least one of the serial ports.

The ICM8'S DIN rail mounting saves time and panel space and snaps easily onto standard top hat (T) profile DIN rail.

SOFTWARE

The ICM8 is programmed with Windows[®] compatible Crimson software. The software is an easy to use graphical interface which can be purchased as part of a kit that includes a manual and cables, or downloaded free of charge from www.redlion.net.



SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



SPECIFICATIONS

- 1. **POWER:** 24 VDC ± 10% 200 mA max. Must use a Class 2 or SELV rated power supply.
- 2. COMMUNICATIONS:
- **USB/PG Port**: Adheres to USB specification 1.1. Device only using Type B connection.

Serial Ports: Format and Baud Rates for each port are individually software programmable up to 115,200 baud.

- RS232/PG Port: RS232 port via RJ12
- COMMS Ports: RS485 port via RJ11
- Ethernet Port: 10 BASE-T / 100 BASE-TX
- 3. LEDs:

STS - Status LED indicates condition of ICM8.

- TX/RX Transmit/Receive LEDs show serial activity.
- Ethernet Link and activity LEDs.
- 4. MEMORY:
- On-board User Memory: 4 Mbytes of non-volatile Flash memory. On-board SDRAM: 2 Mbytes

5. CERTIFICATIONS AND COMPLIANCES:

SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion B ³
		4 kV contact discharge
		8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A
		10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B
		2 kV power
		1 kV signal
Surge	EN 61000-4-5	Criterion A
		1kV L-L,2 kV
		L&N-E power
RF conducted interference	EN 61000-4-6	Criterion A
		3 V/rms
Emissions:		
Emissions	EN 55011	Class A

Notes:

- 1. Criterion A: Normal operation within specified limits.
- 2. Criterion B: Temporary loss of performance from which the unit self-recovers.
- 3. This device was designed for installation in an enclosure. To avoid electrostatic discharge to the unit in environments with static levels above 4 kV precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the unit.

6. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: 0 to 50°C Storage Temperature Range: -30 to +70°C Operating and Storage Humidity: 80% max relative humidity, non-condensing, from 0 to 50°C Altitude: Up to 2000 meters

- CONSTRUCTION: Case body is black high impact plastic and stainless steel. Installation Category I, Pollution Degree 2.
- POWER CONNECTION: Removable wire clamp screw terminal block. Wire Gage Capacity: 24 AWG to 12 AWG Torque: 4.45 to 5.34 in/lb (0.5 to 0.6 N-m)
- 9. **MOUNTING**: Snaps onto standard DIN style top hat (T) profile mounting rails according to EN50022 -35 x 7.5 and -35 x 15.
- 10. WEIGHT: 12.3 oz (348g)

HARDWARE



Figure 1 - Attach ICM8 To DIN Rail

POWER SUPPLY REQUIREMENTS

It is very important that the power supply is mounted correctly if the unit is to operate reliably. Please take care to observe the following points:

- The power supply must be mounted close to the unit, with usually not more than 6 feet (1.8 m) of cable between the supply and the ICM8. Ideally, the shortest length possible should be used.
- The wire used to connect the ICM8's power supply should be at least 22-gage wire. If a longer cable run is used, a heavier gage wire should be used. The routing of the cable should be kept away from large contactors, inverters, and other devices which may generate significant electrical noise.
- A power supply with a Class 2 or SELV rating is to be used. A Class 2 or SELV power supply provides isolation to accessible circuits from hazardous voltage levels generated by a mains power supply due to single faults. SELV is an acronym for "safety extra-low voltage." Safety extralow voltage circuits shall exhibit voltages safe to touch both under normal operating conditions and after a single fault, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

- To reduce the chance of noise spikes entering the unit via the power lines, connections should be made to a clean source. Connecting to circuits that also power loads such as contactors, relays, motors, solenoids etc. should be avoided.
- 2. The unit should be mounted in a metal enclosure, which is properly connected to protective earth.
- 3. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
 - c. Connect the shield to common of the Data Station and leave the other end of the shield unconnected and insulated from earth ground.

WIRING POWER CONNECTION

- 4. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run through metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
- 6. In extremely high EMI environments, the use of external EMI suppression devices is effective. The following EMI suppression devices (or equivalent) are recommended:
 - Ferrite Suppression Cores for signal and control cables:

Fair-Rite part number 0443167251 (RLC part number FCOR0000) TDK part number ZCAT3035-1330A

- Steward part number 28B2029-0A0
- Line Filters for input power cables:
- Schaffner part number FN2010-1/07 (RLC part number LFIL0000) Schaffner part number FN670-1.8/07

Corcom part number 1 VR3

Visit RLC's web site at www.redlion.net for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.



PROGRAMMING PORTS



COMMUNICATION PORTS







PORT 3 - ETHERNET CONNECTION





TROUBLESHOOTING

- 1. This module is designed to operate with Red Lion panel meters only. Please make sure a Red Lion product is connected to either one of the two serial ports for the gateway to be active.
- 2. The Ethernet port is equipped with data LEDs. If they are blinking, the converter is active and the data is available at the port. Please verify the receiving equipment is properly programmed.
- 3. If for any reason you have trouble operating, connecting, or simply have questions concerning your new ICM8, contact Red Lion's technical support. For contact information, refer to the back page of this bulletin for phone and fax numbers.

EMAIL: techsupport@redlion.net Web Site: http://www.redlion.net

COMMUNICATING WITH THE ICM8

CONFIGURING THE ICM8

The ICM8 is configured using Crimson software. Crimson is available as a free download from Red Lion's website, or it can be ordered on CD. Updates to Crimson for new features and drivers are posted on the website as they become available. Crimson software can configure the ICM8 through the RS232/PG port or USB/PG port. The USB/PG port is connected using a standard USB cable with a Type B connector.

The driver needed to use the USB port will be installed with Crimson. The RS232/PG port uses a programming cable made by Red Lion to connect to the DB9 COM port of your computer. If making your own cable, refer to the "ICM8 Port Pin Outs" for wiring information.

ETHERNET COMMUNICATIONS

Ethernet communications can be established at either 10 BASE-T or 100 BASE-TX. The Crimson manual contains additional information on Ethernet communications.

RS232 PORTS

The ICM8 has one RS232 port. The port can be used for programming or communications.



RS485 PORT

The ICM8 has one RS485 port.



Note: All Red Lion devices connect A to A and B to B.

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RECEIVING DEVICE

LEDs STS - STATUS LED

Η

The green Status LED provides information regarding the state of the ICM8. This includes indication of the various stages of the start-up routine (power-up), and any errors that may occur.

Startup Routing

	INDICATION
Rapidly Flashing	ICM8 is currently running the boot loader and/or being flash upgraded by Crimson
Steady	ICM8 is operating properly

USER COMMUNICATION PORTS - TX/RX LEDS

LED	INDICATION
GREEN	Transmitting
RED	Receiving

LED	INDICATION	
YELLOW (Solid)	Link Established	
YELLOW (Flashing)	Network Activity	
GREEN	10 BASE-T Communications	
AMBER	100 BASE-T Communications	

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
ICM8	Communication Gateway	ICM80000
PSDR	DIN Rail Power Supply	PSDRxxxx
SFCRM2	Crimson 2.0 ² , Manual and Download Cable	SFCRM200
CBL	RS-232 Programming Cable	CBLPROG0
	USB Cable	CBLUSB00
	Communications Cables ¹	CBLxxxxx
DR	DIN Rail Mountable Adapter Products ³	DRxxxxxx

¹ Contact your Red Lion distributor or visit our website for complete selection.
 ² Use this part number to purchase Crimson on CD with a printed manual, USB cable, and RS-232 cable. Otherwise, download free of charge from www.redlion.net.
 ³ Red Lion offers RJ modular jack adapters. Refer to the DR literature for complete details.