MODEL IAMS – INTELLIGENT UNIVERSAL SIGNAL CONDITIONING MODULE

GENERAL DESCRIPTION

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 -20º C to 60º 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)

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

CAUTION: Risk of electric shock.

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 to DIN 46277.
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ORDERING INFORMATION

Unit Part Numbers

<table>
<thead>
<tr>
<th>IAMS</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>No Setpoints</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Dual Setpoints</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>No Analog Outputs</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Analog Output</td>
</tr>
</tbody>
</table>

PGMMOD00 - Programming/Display Module for IAMS
(Requires one to program a unit, or a series of units.)

GENERAL SPECIFICATIONS

1. DISPLAY: See Display/Programming Module
2. POWER:
   AC Power: 21.6 to 253 VAC, 50/60 Hz
   DC Power: 19.2 to 300 VDC,
3. CONSUMPTION: ≤2.5 W
4. FUSE: 400 mA SB/250 VAC
5. ISOLATION: Between input, supply and outputs - 2.3 kVAC/250 VAC
6. INPUTS:
   Current Input:
   Programmable Ranges: 0 to 20 and 4 to 20 mA DC
   Measurement range: -1 to 25 mA
   Input resistance: Nom. 20 Ω ± PTC 50 Ω
   Sensor error detection: 4 to 20 loop break, yes
   Supply Voltage: 16-25 VDC, 20 mA max (Terminal 43 and 44)
   Voltage Input:
   Programmable Ranges: 0 to 1, 0.2 to 1, 0 to 5, 1 to 5, 1 to 10, and 2 to 10 VDC
   Measurement range: -20 mV to 12 VDC
   Input resistance: Nom. 10 MΩ
   Thermocouple Inputs:
   Cold Junction Compensation: via internally mounted sensor < ±1.0 °C
   Sensor Error Detection: All TC types, yes
   Sensor Error Current: When detecting 2 μA, otherwise 0 μA

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MIN. VALUE</th>
<th>MAX. VALUE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>+400 °C</td>
<td>+1820 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>E</td>
<td>-100 °C</td>
<td>+1000 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>J</td>
<td>-100 °C</td>
<td>+1200 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>K</td>
<td>-180 °C</td>
<td>+1372 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>L</td>
<td>-200 °C</td>
<td>+900 °C</td>
<td>DIN 43710</td>
</tr>
<tr>
<td>N</td>
<td>-180 °C</td>
<td>+1300 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>R</td>
<td>-50 °C</td>
<td>+1760 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>S</td>
<td>-50 °C</td>
<td>+1760 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>T</td>
<td>-200 °C</td>
<td>+400 °C</td>
<td>IEC 60584-1</td>
</tr>
<tr>
<td>U</td>
<td>-200 °C</td>
<td>+600 °C</td>
<td>DIN 43710</td>
</tr>
<tr>
<td>W3</td>
<td>0 °C</td>
<td>+2300 °C</td>
<td>ASTM E988-90</td>
</tr>
<tr>
<td>W5</td>
<td>0 °C</td>
<td>+2300 °C</td>
<td>ASTM E988-90</td>
</tr>
<tr>
<td>LR</td>
<td>-200 °C</td>
<td>+800 °C</td>
<td>GOST 3044-84</td>
</tr>
</tbody>
</table>
RTD, Linear Resistance, Potentiometer Inputs

<table>
<thead>
<tr>
<th>INPUT TYPE</th>
<th>MIN. VALUE</th>
<th>MAX. VALUE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td>-200 °C</td>
<td>+850 °C</td>
<td>IEC60751</td>
</tr>
<tr>
<td>Ni00</td>
<td>-60 °C</td>
<td>+250 °C</td>
<td>DIN 43760</td>
</tr>
<tr>
<td>Lin. R</td>
<td>0 Ω</td>
<td>10000 Ω</td>
<td>-</td>
</tr>
<tr>
<td>Potentiometer</td>
<td>10 Ω</td>
<td>100 kΩ</td>
<td>-</td>
</tr>
</tbody>
</table>

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: ≤ 1 sec
Current/Voltage input: ≤ 400 msec

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

<table>
<thead>
<tr>
<th>GENERAL VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Type</td>
</tr>
<tr>
<td>All</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BASIC VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Type</td>
</tr>
<tr>
<td>mA</td>
</tr>
<tr>
<td>Volt</td>
</tr>
<tr>
<td>Pt100</td>
</tr>
<tr>
<td>Lin. R</td>
</tr>
<tr>
<td>Potentiometer</td>
</tr>
<tr>
<td>TC Type: E, J, K, L, N, T, U</td>
</tr>
<tr>
<td>TC Type: B, R, S, W3, W5, LR</td>
</tr>
</tbody>
</table>

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

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 Ω 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 Ω 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 ≤ ±0.5% of span
Extended EMC Immunity: NAMUR NE 21, A criterion, burst ≤ ±1% of span

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 IC
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

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" (3.3 mm) and displays units, line 3 is 0.13" (3.3 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 unauthorized modifications to the configuration. A default password of “2008” allows access to all configuration menus.
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 recommended 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.

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 #28B2029-0A
   - 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.

6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC#SNUB0000.
3.1 POWER WIRING

Supply:

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

3.2 INPUT SIGNAL WIRING

- RTD, 2-wire
- RTD, 3- / 4-wire
- Resistance, 2-wire
- Resistance, 3- / 4-wire
- 2-wire transmitter
- Current
- Voltage
- Potentiometer
- TC

3.3 ANALOG OUTPUT WIRING

- Voltage, 1 V
- Voltage, 10 V
- Current
- Not Used

3.4 SETPOINT OUTPUT WIRING

- Relays

If not using the analog option, pins 11 and 12 must be shorted.
4.0 Reviewing the Front Buttons and Display

**Display**: Total of four lines.

<table>
<thead>
<tr>
<th>Line 1</th>
<th>Line 2</th>
<th>Line 3</th>
<th>Line 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays input signal</td>
<td>Displays input units</td>
<td>Displays output signal</td>
<td>Displays communication and relay status</td>
</tr>
</tbody>
</table>

**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.

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

5.0 Programming the Unit

**Overview**

**Programming Menu**

- **Input Parameters**
- **Setpoint Parameters**
- **Analog Output Parameters**
- **Factory Service Parameters**

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

**Step by Step Programming Instructions:**

**Program 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 application. 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.

**Program 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**

- Press **∧** - displays setpoint 1 and increases the shown setpoint value
- Press **OK** - saves the changed setpoint value and returns to the Display Mode
- Press **∨** - displays setpoint 2 and decreases the shown setpoint value

(Holding for 2 seconds returns to the Display Mode without saving.)

*Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com*
## 5.1 MODULE 1 - SIGNAL INPUT PARAMETERS

### PARAMETER MENU - VOLTAGE, CURRENT AND POTENTIOMETER

<table>
<thead>
<tr>
<th><strong>INPTYPE</strong></th>
<th><strong>URANGE</strong></th>
<th><strong>CONNECT</strong></th>
<th><strong>R 0%</strong></th>
<th><strong>R 100%</strong></th>
<th><strong>UNIT</strong></th>
<th><strong>DEC.P</strong></th>
<th><strong>DISPL.LO</strong></th>
<th><strong>DISPL.HI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Type</td>
<td>Input Range</td>
<td>Wire Connection</td>
<td>Minimum Resistance</td>
<td>Maximum Resistance</td>
<td>Unit Identification</td>
<td>Decimal Point Position</td>
<td>Display Low Value</td>
<td>Display High Value</td>
</tr>
</tbody>
</table>

### INPUT TYPE (IN TYPE)

**VOLT**

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

**VOLTAGE RANGE (URANGE)**

<table>
<thead>
<tr>
<th>2-10</th>
<th>0-1</th>
<th>0-5</th>
<th>0-10</th>
</tr>
</thead>
</table>

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.

**CURRENT RANGE (IRANGE)**

<table>
<thead>
<tr>
<th>4-20</th>
<th>0-20</th>
<th>4-20</th>
</tr>
</thead>
</table>

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.

**MINIMUM RESISTANCE (R 0%)**

Enter the low resistance value.

**MAXIMUM RESISTANCE (R 100%)**

Enter the high resistance value.

### PARAMETER MENU - TEMPERATURE

<table>
<thead>
<tr>
<th><strong>INPTYPE</strong></th>
<th><strong>CONNECT</strong></th>
<th><strong>UNIT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Type</td>
<td>Temperature Sensor</td>
<td>Unit Identification</td>
</tr>
</tbody>
</table>

### INPUT TYPE (VOLT)

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

### INPUT TYPE (CURR)

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

### INPUT TYPE (LIN.R)

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

### UNIT IDENTIFICATION (UNIT)

Select one of the 69 available units as listed below.

### DECIMAL POINT (DEC.P)

Select the appropriate decimal point location.

### DISPLAY LOW (DISPL.LO)

Enter the low display value.

### DISPLAY HIGH (DISPL.HI)

Enter the high display value.
The remaining parameters in this module apply to temperature input type only.

### INPUT TYPE (TEMP)

**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** - Select the appropriate RTD sensor.

**TYPE:** Pt10  Pt20  Pt50  Pt100  Pt200  Pt250  Pt300  Pt400  Pt500  Pt1000

**WIRE CONNECTION:** 2w  3w  4w

### NICKEL SENSORS

- Select the appropriate Nickel sensor.

**TYPE:** Hi50  Ni100  Ni120  Ni1000

**WIRE CONNECTION:** 2w  3w  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

### UNIT IDENTIFICATION (UNIT)

**°C** or **°F**

Select the appropriate unit for the temperature being displayed.

---

**5.2 MODULE 6 - SETPOINT PARAMETERS (REQUIRES SETPOINT OPTION)**

<table>
<thead>
<tr>
<th>PARAMETER MENU - SETPOINT (SET)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RELUN</strong> Relay Assignment</td>
</tr>
<tr>
<td><strong>R1.FUNC</strong> Relay Function</td>
</tr>
<tr>
<td><strong>R1.CONT</strong> Control</td>
</tr>
<tr>
<td><strong>R1.SEP</strong> Setpoint Value</td>
</tr>
<tr>
<td><strong>ACT.DIR</strong> Activation Direction</td>
</tr>
<tr>
<td><strong>R1.HYST</strong> Hysteresis</td>
</tr>
<tr>
<td><strong>ERR.ACT</strong> Error Activation</td>
</tr>
<tr>
<td><strong>ON.DEL</strong> On Delay</td>
</tr>
<tr>
<td><strong>OFF.DEL</strong> Off Delay</td>
</tr>
<tr>
<td><strong>R2.FUNC</strong> Relay 2 repeat R1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARAMETER MENU - WINDOW (WIND)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RELUN</strong> Relay Assignment</td>
</tr>
<tr>
<td><strong>R1.FUNC</strong> Relay Function</td>
</tr>
<tr>
<td><strong>R1.CONT</strong> Control</td>
</tr>
<tr>
<td><strong>R1.SEP.LO</strong> Setpoint Low Value</td>
</tr>
<tr>
<td><strong>R1.SEP.HI</strong> Setpoint High Value</td>
</tr>
<tr>
<td><strong>R1.HYST</strong> Hysteresis</td>
</tr>
<tr>
<td><strong>ERR.ACT</strong> Error Activation</td>
</tr>
<tr>
<td><strong>ON.DEL</strong> On Delay</td>
</tr>
<tr>
<td><strong>OFF.DEL</strong> Off Delay</td>
</tr>
<tr>
<td><strong>R2.FUNC</strong> Relay 2 repeat R1</td>
</tr>
</tbody>
</table>

### RELAY ASSIGNMENT (RELUN)

**DISP**

DISP or PERC

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

### RELAY 1 FUNCTION (R1.FUNC)

**SETP**

SETP  WIND  ERR  POW  OFF

Select the function relay 1 is to perform. 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.**  **N.O. or N.C.**

Select relay 1 operation, normally open or normally closed.

**RELAY 1 SETPOINT VALUE (R1.SEP)**

50.0  -200 to 850.0

Enter the relay 1 setpoint value.

### RELAY 1 HYSTERESIS (R1.HYST)

1.0  0.1 to 262.5

Enter relay 1 hysteresis value.

### RELAY 1 ERROR ACTIVATION (ERR.ACT)

**NONE**

Select relay 1 error mode action.

**RELAY 1 ON DELAY (ON.DEL)**

0  0 to 3600

Enter relay 1 On Delay Time.

**RELAY 1 OFF DELAY (OFF.DEL)**

0  0 to 3600

Enter relay 1 Off Delay Time.

### RELAY 1 FUNCTION (WIND)

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

---

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
RELAY 1 CONTROL (R1.CONT)

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

SETPOINT LOW VALUE (SETP.LO)

Enter the window’s low value.

SETPOINT HIGH VALUE (SETP.HI)

Enter the window’s high value.

RELAY WINDOW HYSTERSIS (R1.HYST)

Set the window’s hysteresis value.

RELAY 1 ERROR ACTIVATION (ERR.ACT)

Select relay 1 error mode action.

RELAY 1 ON DELAY (ON.DEL)

Enter relay 1 On Delay Time.

RELAY 1 OFF DELAY (OFF.DEL)

Enter relay 1 Off Delay Time.

RELAY 1 FUNCTION (ERR)

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

RELAY 1 ERROR ACTIVATION (ERR.ACT)

Select relay 1 error mode action.

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)

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

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

OUTPUT LOW VALUE (OUT.LO) For TEMP only

Enter the value for the output Low Value.

OUTPUT HIGH VALUE (OUT.HI) For TEMP only

Enter the value for the output High Value.
### 5.4 MODULE 9 - ADVANCED PARAMETERS

<table>
<thead>
<tr>
<th><strong>PARAMETER MENU</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM</td>
</tr>
<tr>
<td>Advanced Settings</td>
</tr>
</tbody>
</table>

#### ADVANCED SETTING (ADV.SET)

**MEM**
- **SAVE** or **LOAD**

Select the advanced setting menu to make the desired change.

**ADVANCED SETTING (MEMORY)**

If the advanced setting is selected for memory, the following parameter appears.

**MEMORY SETTING (MEMORY)**

- **SAVE MEMORY**

Select save to save unit set-up to the display module or select load to download saved set-up to the unit.

**ADVANCED SETTING (DISP)**

If the advanced setting is selected for display, the following parameters appear.

**LCD CONTRAST (CONTR.,)**

- **3**

Select the desired Display Contrast.

**LCD BACKLIGHT ADJUSTMENT (LIGHT)**

- **9**

Select the desired Display Backlight.

**TAG NUMBER (TAGNO.,)**

- **A to 9**

Enter a custom 6 character device tag.

**LINE 3 SET UP (LINE 3)**

- **A/OUT**
- **LINE 3**

Select the proper display for Line 3.

**ADVANCED SETTING (CAL)**

If the advanced setting is selected for calibration (applied input scaling), the following parameters appear as selected in the input setup. A temperature example is shown.

**CALIBRATION LOW (CAL.LO)**

- **No** or **YES**

Calibrate the input low to the process value.

**LOW CALIBRATION POINT VALUE (Low Input Signal)**

- **2.0**

- **°C**

- **-200 to 850.0**

Apply the low input signal, then enter the value for the Low Value Point.

**CALIBRATION HIGH (CAL.HI)**

- **No** or **YES**

Calibrate the input high to the process value.

**HIGH CALIBRATION POINT VALUE (High Input Signal)**

- **97.8**

- **°C**

- **-200 to 850.0**

Apply the high input signal, then enter the value for the High Value Point.

**USE PROCESS CALIBRATION VARIABLES (USE.CAL)**

- **YES** or **NO**

Use Process Calibration Variables.

**ADVANCED SETTING (SIM)**

If the advanced setting is selected for simulation, the following parameters appear.

**INPUT SIMULATION (ENR.SIM)**

- **YES** or **No**

Enable Input Simulation.

**INPUT SIMULATION VALUE (°C)**

- **23.0**

- **°C**

- **-200 to 850.0**

Enter the Input Simulation Value, as selected in the input setup.

**RELAY SIMULATION (REL.SIM)**

Use the **V** and **W** to toggle between relay 1 and 2.

**ADVANCED SETTING (PASS)**

If the advanced setting is selected for password, the following parameters appear.

**PASSWORD PROTECTION (EN.PASS)**

- **YES** or **NO**

Enable Password protection.

**ENTER NEW PASSWORD (NEW.PASS)**

- **0000**

- **0000 to 9999**

Enter New Password.

**ENABLE FAST SET (EN.FAST)**

- **YES** or **NO**

Enable fast set functionality of the setpoints.

* Universal code 2008 will allow access to a locked unit.

**ADVANCED SETTING (LANG)**

If the advanced setting is selected for LANGUAGE, the following parameter appears.

**SELECT PROGRAMMING LANGUAGE (LANGUR)**

- **UK**
- **DE**
- **DK**
- **ES**
- **FR**
- **IT**
- **SE**
- **UK**

Set programming language.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
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°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:

<table>
<thead>
<tr>
<th>Range</th>
<th>0 to 60 mV</th>
<th>0 to 100 mV</th>
<th>0 to 200 mV</th>
<th>0 to 300 mV</th>
<th>0 to 500 mV</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5V</td>
<td>±5 mV</td>
<td>±10 mV</td>
<td>±20 mV</td>
<td>0 to 5 mA</td>
<td>0 to 20 mA</td>
</tr>
</tbody>
</table>

3. ZERO/SPAN ADJUSTMENTS: Range Dependent
4. MAX. INPUT SIGNAL:
   - Current Input: 50 mA
   - Voltage Input: 30 V
5. INPUT RESISTANCE:
   - Current: 50 Ω
   - Voltage: 1 MΩ
6. INPUT PROTECTION: Surge suppressor diodes

7. OUTPUT RANGES:
8. MAX. OUTPUT SIGNAL:
   - Current Output: 30 mA
   - Voltage Output: 15 V
9. LOAD RESISTANCE:
   - Current Output: ≤ 500 Ω max.
   - Voltage Output: ≥ 5 KΩ

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAMA</td>
<td>Universal Signal Conditioning</td>
<td>AAMA3535</td>
</tr>
</tbody>
</table>

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.
**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 ≤500 Ω output resistance and the maximum output voltage signal is 15 V with ≥5 KΩ output resistance.

**ZERO AND SPAN**

The AAMA3535 module incorporates two potentiometers for adjusting separate zero and span settings. The module provides a ±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**

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

Note: Blank space = DIP switch OFF.

**WIRING DIAGRAM**

**DIP SWITCH SELECTIONS FOR 0-5 VOLT OUTPUT**

**BLOCK DIAGRAM**

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
### DIP Switch Selections for 0-10 Volt Output

<table>
<thead>
<tr>
<th>Input</th>
<th>DIP Switch 2</th>
<th>DIP Switch 1</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-60 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>0-60 mV</td>
</tr>
<tr>
<td>0-100 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>0-100 mV</td>
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<tr>
<td>0-200 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>0-200 mV</td>
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<tr>
<td>0-300 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
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<tr>
<td>0-500 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
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<tr>
<td>±100 mV</td>
<td>ON ON ON</td>
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<td>±100 mV</td>
</tr>
<tr>
<td>±200 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±200 mV</td>
</tr>
<tr>
<td>±300 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±300 mV</td>
</tr>
<tr>
<td>±500 mV</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±500 mV</td>
</tr>
<tr>
<td>±1 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±1 V</td>
</tr>
<tr>
<td>±2 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±2 V</td>
</tr>
<tr>
<td>±5 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±5 V</td>
</tr>
<tr>
<td>±10 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±10 V</td>
</tr>
<tr>
<td>±20 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>±20 V</td>
</tr>
<tr>
<td>0-5 mA</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>0-5 mA</td>
</tr>
<tr>
<td>0-20 mA</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>0-20 mA</td>
</tr>
<tr>
<td>4-20 mA</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>1-5 V</td>
<td>ON ON ON</td>
<td>ON ON ON</td>
<td>1-5 V</td>
</tr>
</tbody>
</table>

Note: Blank space = DIP switch OFF.

### DIP Switch Selections for ±5 Volt Output

<table>
<thead>
<tr>
<th>Input</th>
<th>DIP Switch 2</th>
<th>DIP Switch 1</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-60 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>0-60 mV</td>
</tr>
<tr>
<td>0-100 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>0-100 mV</td>
</tr>
<tr>
<td>0-200 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>0-200 mV</td>
</tr>
<tr>
<td>0-300 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>0-300 mV</td>
</tr>
<tr>
<td>0-500 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>0-500 mV</td>
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<tr>
<td>±100 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>±100 mV</td>
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<tr>
<td>±200 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>±200 mV</td>
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<tr>
<td>±300 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>±300 mV</td>
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<tr>
<td>±500 mV</td>
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<td>±1 V</td>
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<td>±1 V</td>
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<tr>
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<td>ON ON</td>
<td>ON ON ON</td>
<td>±2 V</td>
</tr>
<tr>
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<td>ON ON</td>
<td>ON ON ON</td>
<td>±5 V</td>
</tr>
<tr>
<td>±10 V</td>
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<td>ON ON ON</td>
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<td>±20 V</td>
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<tr>
<td>±60 mV</td>
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<td>ON ON ON</td>
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<tr>
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<td>ON ON ON</td>
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<tr>
<td>±200 mV</td>
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<td>±200 mV</td>
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<td>ON ON</td>
<td>ON ON ON</td>
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</tr>
<tr>
<td>±500 mV</td>
<td>ON ON</td>
<td>ON ON ON</td>
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</tr>
<tr>
<td>±1 V</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>±1 V</td>
</tr>
<tr>
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<td>ON ON ON</td>
<td>±2 V</td>
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<tr>
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<td>ON ON ON</td>
<td>±5 V</td>
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<td>0-5 mA</td>
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<tr>
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<td>4-20 mA</td>
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<tr>
<td>1-5 V</td>
<td>ON ON</td>
<td>ON ON ON</td>
<td>1-5 V</td>
</tr>
</tbody>
</table>

Note: Blank space = DIP switch OFF.
### DIP SWITCH SELECTIONS FOR 1-5 VOLT OUTPUT

<table>
<thead>
<tr>
<th>Input</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>8</th>
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</tr>
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<tbody>
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<td>0-60 mV</td>
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<td>ON</td>
<td>ON</td>
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<td>ON</td>
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<td>0-300 mV</td>
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Note: Blank space = DIP switch OFF.

### DIP SWITCH SELECTIONS FOR ±10 VOLT OUTPUT

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<td>1-5 V</td>
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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 10 V

Output adjustment of the 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 15 minutes.
3. Set up output adjustment:
   a. Apply lower 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 ±10 V, 4 to 20 mA OR 0 to 20 mA

Output adjustment of ±10 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 15 minutes.
3. Set output adjustment:
   a. Apply lower input range value from calibration source; record output as MV1. If output is 0 to 20 mA, then apply lower input range value PLUS 10% of full scale input (e.g., 2 mA for 0-20 mA range, 5.6 mA for 4-20 mA, 1 V for 0-10 V).
   b. Finally, adjust the zero pot for the nominal full scale output value, plus or minus the adjustment tolerance. The constants are as follows:

<table>
<thead>
<tr>
<th>Input Range</th>
<th>Constant</th>
<th>Adjustment Tolerance</th>
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<tr>
<td>±10 V</td>
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<td>±0.5 mV</td>
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<tr>
<td>0 to 20 mA</td>
<td>0.018</td>
<td>±1.0 µA</td>
</tr>
<tr>
<td>4 to 20 mA</td>
<td>0.016</td>
<td>±1.0 µA</td>
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</table>

b. Apply full scale input from calibration source; record output as MV2.

4. With full scale input value still applied, first calculate the span pot adjustment point “A”:
   a. A = MV2 X constant (MV2-MV1). Adjust the span pot for value “A”, plus or minus the adjustment tolerance. The constants are as follows:

   b. Finally, adjust the zero pot for the nominal full scale output value, plus or minus the adjustment tolerance.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
DESCRIPTION
The Dual Setpoint Module is specifically designed to address the rigorous demands of process control applications. The flexibility of either internal or external alarm set point adjustments and DIN rail mounting, creates many installation possibilities.

The setpoint module accepts either 0(4) to 20 mA or 0 to 10 VDC analog input signals. The input signal level is selected by a series of DIP switches found behind the module’s side door. DIP switch selectable variables include a 1% setpoint hysteresis and normally open/normally closed selectable alarm relay action.

The two digit, thumbwheel switches located on the top of the module allow for easy adjustment of the alarm setpoints. A corresponding yellow LED indicates the status of the relay contact for each setpoint.

Each setpoint has a 0 to 4 second on-delay timer adjustment. This on-delay adjustment is very useful in applications involving turbulence. The time delay will eliminate relay chatter caused by any analog level process signal’s quick fluctuation.

The setpoint module contains a ±2% zero and span adjustment for fine calibration of the setpoint trip points. The zero and span adjustments are found in the same area as the DIP switch adjustments.

The module’s environmental operating temperature range is -20°C to +65°C. The modular high density packaging and mounting saves time and panel space. The modules snap onto standard 35 mm flat DIN rail.

SPECIFICATIONS
1. POWER SUPPLY VOLTAGE: 20 to 30 VDC @ 80 mA
2. INPUT SIGNALS: 0 to 10 VDC, 0 (4) to 20 mA - DIP switches 1 to 4
Max. Allowable Input Signal Level: 13 VDC, 100 mA
3. RESPONSE TIME: 15 msec max.
4. INPUT RESISTANCE:
   - Current: ≤100 Ω
   - Voltage: ≥100 KΩ
5. INPUT PROTECTION: Surge suppressor diodes
6. SETPOINT RANGE: 0 to 10 VDC or 0 (4) to 20 mA
   - Range: 0 to 99% of Input Range
   - Hysteresis: 1% - DIP switches 7 & 8
7. ZERO/SPAN CALIBRATION ADJUSTMENTS: ±2%  0.1 mA, 1.0 mA
8. OUTPUT TYPE: 2 Form C contacts max. rating 3 A @ 250 VAC/DC
   - Contacts: Silver Cadmium Oxide (Ag CdO)
   - Relay Output Time Delay: 0 to 4 seconds
9. ACCURACY: ≤0.5% full scale
10. REPEATABILITY: ≤0.1% full scale
11. OPERATING TEMPERATURE RANGE: -20 to +65°C (-4 to 149°F)
12. TEMPERATURE COEFFICIENT: 100 ppm/K
13. CONSTRUCTION: Case body is green, high impact plastic
14. CONNECTIONS: 14 AWG wire max.
15. MOUNTING: Standard DIN top hat (T) profile rail according to EN50022-35 x 7.5 and 35 x 15.
16. WEIGHT: 7.46 oz (211.37 g)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
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<tbody>
<tr>
<td>AAMR</td>
<td>Dual Setpoint Analog Alarm</td>
<td>AAMR6436</td>
</tr>
</tbody>
</table>

Courteous of Steven Engineering, Inc.- 230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
**INPUT**

The Dual Setpoint Module is capable of accepting both voltage and current process level signals. The module’s analog input circuits are protected by transient suppressor diodes which guard against short circuits and voltage switching transients. Maximum analog input voltage and current is 13 VDC and 100 mA respectively. The analog input circuit is then routed to the threshold setpoint switches where a comparison is made between the external setpoint circuit and the module’s decade switch setpoint circuit. The module’s setpoints always hold (minimum setpoint level) priority over the external analog setpoint signal inputs, Terminals 3, 4, 5 and 6.

**OUTPUT**

**SETPOINTS AND TIME DELAYS**

Each setpoint is capable of a 0 to 4 second on-delay or delay on operate alarm relay output function. This time delay feature is very valuable when monitoring processes that fluctuate momentarily due to such things as wave action about an analog level sensor. The 0 to 4 second time delay eliminates nuisance relay tripping or chattering.

**RELAY SETTINGS (MIN/MAX)**

Each setpoint controls a 3A/250 VAC/DC SPDT mechanical relay. The module’s DIP switch setting (S5 and S6) control the relay’s response as each relay reaches its respective setpoint threshold. The relay action can be inverted by positioning DIP switches S5 and S6 in the ON or OFF position. Relay status is indicated by a yellow LED which is found on the top of the module above each timer potentiometer.

**MIN/MAX DIP SWITCH POSITION RELAY TRUTH TABLE**

<table>
<thead>
<tr>
<th>Position</th>
<th>Relay Setting</th>
<th>Function</th>
</tr>
</thead>
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<tr>
<td>ON</td>
<td>SP1 0-20mA, SP2 0-10V</td>
<td>energized</td>
</tr>
<tr>
<td>OFF</td>
<td>IN 0-10V, IN 0-20mA</td>
<td>de-energized</td>
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<tr>
<td>ON</td>
<td>OUT1 MIN, OUT2 MAX</td>
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<tr>
<td>OFF</td>
<td>HYS1 1%, HYS2 0</td>
<td>de-energized</td>
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</table>

**EXTERNAL ANALOG SETPOINT FUNCTION**

The AAM6436 features an ability to accept up to two external voltage or current setpoint inputs. These external analog inputs are evaluated in the module’s comparator circuit which compares the module’s thumbwheel switches setpoints with the incoming external current or voltage value.

Applying an external voltage or current, [the external analog setpoint inputs must match the analog process input. If the module is configured for 0 to 10 VDC, the external inputs must be 0 to 10 VDC] to Terminals 3 and 4 (setpoint 1) and/or Terminals 5 and 6 (setpoint 2), creates an additive effect to the threshold circuit.

Example: the setpoint module is configured for a 0 to 10 VAC analog input signal, and setpoint 1 thumbwheel switch is set at 60 (60%) which is equivalent to a 6 V relay setpoint. By introducing a 1 VDC signal onto Terminals 3 and 4, the effective alarm threshold is now 70 or 7 VDC.

**MODULE’S POWER SUPPLY**

The module’s power supply input is protected from wiring short circuits and voltage transients by a suppressor diode. Overall module current consumption is less than 80 mA with relays activated.
Typical single module installation with remote setpoint adjustments:

- Current or voltage analog input signal
- External precision current or voltage analog input signal source adjusted by external potentiometers

Typical dual module installation:

- Current input signal (4-20 mA loop)
- Transistor inputs allow daisy-chaining of inputs to monitor current loops
- 20-30 VDC

Typical current loop installation:

- Isolated input monitors loop current with low load and no ground reference
- 24 VDC

WIRING DIAGRAMS

**CONFIGURATION 1**

1. 0 (4)-20 mA analog input signal
2. Relays de-energized below setpoint (max)
3. Terminal 3, 4, 5 and 6 can accept an external mA input for setpoint adjustment
4. No hysteresis on the setpoints

**CONFIGURATION 2**

1. 0 (4)-20 mA analog input signal
2. Relays energized below set point (min)
3. Terminal 3, 4, 5 and 6 can accept an external mA input for setpoint adjustment
4. 1% hysteresis on set point (1)

**CONFIGURATION 3**

1. 0 - 10 VDC analog input signal
2. Relay (1) de-energized below setpoint (max)
3. Terminal 3, 4, 5 and 6 can accept an external voltage for set point adjustment
4. No hysteresis on the setpoints

**CONFIGURATION 4**

1. 0 - 10 VDC analog input signal
2. Relays energized below set point (min)
3. Terminal 3, 4, 5 and 6 can accept an external voltage for setpoint adjustment
4. Both set points 1% hysteresis
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

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No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL AIMI - 0 (4) TO 20 MA PASSIVE LOOP POWERED ISOLATOR

SPECIFICATIONS

1. INPUT RANGE: 0(4) to 20 mA
2. MAXIMUM INPUT CURRENT/VOLTAGE: 50 mA/30 VDC
3. INPUT RESISTANCE@ 20mA: 125-1125 Ω (dependent on load)
4. VOLTAGE DROP AT INPUT: (See Chart at Right)
5. MAXIMUM INPUT FREQUENCY: <75 Hz
6. RESPONSE TIME: 5 msec. max.
7. OUTPUT SIGNAL: 0(4) to 20 mA
   Max. Load Resistance: ≤ 1375 Ω @ 20 mA
8. ISOLATION VOLTAGE: 510 V, 50 Hz, for 1 minute
9. ACCURACY: ≤0.1% of full scale
10. OPERATING TEMPERATURE RANGE: -10 to +70°C
11. TEMPERATURE COEFFICIENT: ≤0.002%/K of the measured value
12. CONSTRUCTION: Case body is green, Polyamide PA
13. MOUNTING: Standard DIN style rail, including top hat (T) profile rail according to EN50022 - 35 ✕ 7.5 and 35 ✕ 15, and G profile rail according to EN50035 - G32.
14. WEIGHT: 2.976 oz (84.37 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 50 022.

VOLTAGE DROP AT INPUT

When using the AIMI0202, ensure that the current-driving voltage of the measuring transducer is sufficient for driving the maximum current of 20 mA, with a power loss of 2.5 V (2.5 V + (20 mA * RLOAD)).

Voltage drop across the input is calculated by determining the load resistance of the output loop, drawing a vertical line to the curve, then horizontally to the 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 2.5 V drops at the module input.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>INPUT</th>
<th>OUTPUT</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIMI</td>
<td>0 (4)-20 mA</td>
<td>0 (4)-20 mA</td>
<td>AIMI0202</td>
</tr>
</tbody>
</table>

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.90</td>
<td>4.47 (113.66)</td>
</tr>
<tr>
<td>0.51 (12.93)</td>
<td></td>
</tr>
</tbody>
</table>
**MODEL AIMR - LOOP POWERED SETPOINT ALARM**

- **LOOP POWERED** - NO EXTERNAL 24 VDC POWER SUPPLY REQUIRED
- **LOW BURDEN ON THE 4 TO 20 mA LOOP** (275 Ω)
- **BI-STABLE RELAY** - REQUIRES NO HOLDING CURRENT
- **CONFIGURABLE RELAY ACTION** - LATCHING OR NON-LATCHING
- **SPDT RELAY CONTACT RATED** 1 A, 125 VAC
- **REPEATABILITY BETTER THAN 0.3%**

**DESCRIPTION**
The Setpoint Module is a primary or redundant industrial process control alarm. The setpoint module features a loop powered threshold monitoring circuit with a bi-stable relay, LED indication of relay status, configurable hysteresis function and relay action. The threshold is set using a 20-turn potentiometer, while the configurable functions are set by moveable jumper settings.

The loop connections are made on the input side of the module through pluggable terminal blocks, terminals #1 and #2, featuring proven gas tight wire clamping technology. Inputs and outputs are physically separated to opposite sides of the module to ensure correct connection of the inputs and outputs. Relay connections are also made through pluggable terminal blocks.

Hysteresis may be set to 0.1 mA or 1.0 mA, depending upon the application. A 0.1 mA setting allows higher precision response for slowly varying signals, while the 1.0 mA setting is useful for applications where the signal has significant overshoot and undershoot (such as tank levels with unstable liquids).

 Relay function may be set in one of two modes: latching or non-latching. Latching mode engages the relay when the input signal crosses the setpoint threshold, and prevents the relay from releasing, when the signal drops below the setpoint threshold. A “RESET” button on the top of the module is used to release the relay when the input signal is below the setpoint. Non-latching mode allows the relay to release when the signal drops below the setpoint threshold.

A combination of through hole and surface mount technology provides stable, low drift performance, even in harsh industrial environments. Rhodium-plated contacts ensure low contact resistance even when low-level signals are switched, while levels up to 1 A and 125 VAC are also accommodated.

The module’s environmental operating temperature range is -20°C to +65°C. The modular high density packaging and mounting saves time and panel space. The modules snap onto standard 35 mm flat DIN rail.

**SPECIFICATIONS**
1. **INPUT SIGNAL:** 4 to 20 mA
2. **VOLTAGE DROP:** 5.5 V
3. **LOOP BURDEN:** 275 Ω
4. **SETPOINT RANGE:** 4 to 20 mA
5. **HYSTERESIS RANGE:** 0.1 mA, 1.0 mA
6. **OUTPUT TYPE:** Form C contacts max. rating 1 A @ 125 VAC, 150 VDC
   - Max. Switching Capacity: 30 W DC, 60 VA AC
   - Mechanical Life: 10⁶ switching cycles
7. **OPERATING TEMPERATURE RANGE:** -20 to +65°C (-4 to 149°F)
8. **TEMPERATURE COEFFICIENT:** ≤0.01%/K
9. **CONSTRUCTION:** Case body is green, high impact plastic.
10. **CONNECTIONS:** 24 - 14 AWG wire
11. **MOUNTING:** Standard DIN Top hat (T) profile rail according to EN50022 - 35 x 7.5 and 35 x 15.
12. **WEIGHT:** 3.25 oz (92.08 g)

**DIMENSIONS “In inches (mm)”**

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIMR</td>
<td>Loop Powered Setpoint Switch</td>
<td>AIMR5306</td>
</tr>
</tbody>
</table>

**REFERENCES**
- Tel +1 (717) 767-6511
- Fax +1 (717) 764-6587
- www.redlion-controls.com
- Bulletin No. AIMR-B
- Drawing No. LP0362
- Revised 8/00

**Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com**
FUNCTIONS

The setpoint value is set with a 20-turn potentiometer on the top of the module. Hysteresis is configured to 0.1 or 1.0 mA by removing the side door and positioning a jumper. The hysteresis (0.1 or 1.0 mA) is centered around the setpoint. To trip the alarm, the signal current must exceed the setpoint plus half the hysteresis setting. To deactivate the alarm, the signal must drop below the setpoint minus half the hysteresis.

Relay function is also configured by removing the side door. As shown on the side door label, when the J2 jumper is in the upper (AUTO) position, the relay is released when the input drops below the setpoint and passes out of the hysteresis range. “RESET” keeps the relay engaged until the RESET button on top of the module is depressed.

Loop connections are made at terminal blocks #1 and #2, with #1 being the positive connection, and #2 being the negative connection. The module will drop approximately 5.5V on the loop, or present a burden of 275 $\Omega$.

Relay connections are positions #5 through #8. Positions #7 and #8 are common to the relay center contact. Two positions enable simple daisy-chaining of a supply voltage for a load from one module to the next. The contacts are rated for 125 VAC or 150 VDC, at 1 A continuous current, maximum. Switching is rated at 30 W DC and 60 VA AC.

Setup Procedure

For setup, keep AIMR in Auto mode. Apply current at desired setpoint value. Turn SP pot clockwise to decrease trip point level. When the Alarm LED comes on, stop turning SP pot. Turn SP pot counterclockwise slightly. Press Reset button and the Alarm LED should turn off. Turn SP pot clockwise very slowly and when the Alarm LED comes on, immediately stop. Lower the current and verify the Alarm LED goes off. Raise the current and the Alarm LED should come on. Move jumper to Reset if desiring Latch mode.

Removal of Loop Power

In Auto mode, the relays will always change to the Alarm State with the removal of loop power. When the loop power is restored, the relays will return to the proper status state. In Reset mode, the relays power up as shown in the chart below.

AIMR Mode Operations With Alarm States

<table>
<thead>
<tr>
<th>Mode</th>
<th>Loop Power</th>
<th>Setpoint</th>
<th>LED</th>
<th>6-7</th>
<th>5-7</th>
<th>Reset Button</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto (Boundary)</td>
<td>Power up</td>
<td>Same as Auto-On</td>
<td>Off</td>
<td>Closed</td>
<td>Open</td>
<td>No affect</td>
</tr>
<tr>
<td>Auto (Boundary)</td>
<td>On</td>
<td>Below</td>
<td>Off</td>
<td>Closed</td>
<td>Open</td>
<td>Momentary reverse</td>
</tr>
<tr>
<td>Auto (Boundary)</td>
<td>On</td>
<td>Above</td>
<td>On</td>
<td>Open</td>
<td>Closed</td>
<td>Momentary reverse</td>
</tr>
<tr>
<td>Auto (Boundary)</td>
<td>On</td>
<td>Above to Below</td>
<td>Off</td>
<td>Closed</td>
<td>Open</td>
<td>No affect</td>
</tr>
<tr>
<td>Auto (Boundary)</td>
<td>Off</td>
<td>N / A</td>
<td>Off</td>
<td>Open</td>
<td>Closed</td>
<td>No affect</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>Power up</td>
<td>Below</td>
<td>On</td>
<td>Open</td>
<td>Closed</td>
<td>Changes to Pwr On / Below</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>Power up</td>
<td>Above</td>
<td>On</td>
<td>Open</td>
<td>Closed</td>
<td>Changes to Pwr On / Above</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>On</td>
<td>Below</td>
<td>Off</td>
<td>Closed</td>
<td>Open</td>
<td>No affect</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>On</td>
<td>Above</td>
<td>On</td>
<td>Open</td>
<td>Closed</td>
<td>Momentary reverse</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>On</td>
<td>Above to Below</td>
<td>On</td>
<td>Closed</td>
<td>Closed</td>
<td>Reverses listed state</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>Off</td>
<td>Previously Below</td>
<td>Off</td>
<td>Open</td>
<td>Closed</td>
<td>No affect</td>
</tr>
<tr>
<td>Reset (Latch)</td>
<td>Off</td>
<td>Previously Above</td>
<td>Off</td>
<td>Open</td>
<td>Closed</td>
<td>No affect</td>
</tr>
</tbody>
</table>

Note: The internal hysteresis jumper settings J1 and J2 create an alarm deadband of 0.1 mA and 1 mA respectively. If the setpoint is 12 mA, a jumper setting of 1 mA would be split to create a deadband of 12.5 mA and 11.5 mA. The process signal must rise above and fall below the 12.5 mA and 11.5 mA to activate or deactivate the alarm relay.
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.

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

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 (non-condensing) 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

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 55082-2

| Electrostatic discharge | EN 61000-4-2 | Level 2; 4 K V contact | Level 3; 8 K V air |
| Electro magnetic 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 K V I/O | Level 3; 2 K V power |
| RF conducted interference | EN 61000-4-6 | Level 3; 10 V/m | 150 KHz - 80 MHz |
| Simulation of cordless telephone | ENV 50204 | Level 3; 10 V/m | 900 MHz + 5 MHz |
| 200 Hz, 50% duty cycle |

Emissions to EN 55081-2

| RF interference | EN 55011 | Enclosure class A |

Refer to EMC Installation Guidelines for additional information.

7. 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


10. WEIGHT: 7.0 oz. (0.20 Kg)

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

WARNING: 3 Phase Fault Detection Modules 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 condition.

DIMENSIONS In inches (mm)

| 3.12 (79.2) | 1.57 (40) |
| 2.90 (73.7) | 3.25 (82.5) |

Released 2/07
Drawing No. LP0376
Bulletin No. APMR-E

UL Recognized Component, File # E137808

Level 3; 10 V/m
Level 3; 8 Kv air
Level 2; 4 K V contact
Level 3; 8 K V air
Level 3; 10 V/m
80 MHz - 1 GHz
Level 4; 2 K V I/O
Level 3; 2 K V power
Level 3; 10 V/m
150 KHz - 80 MHz
900 MHz + 5 MHz
200 Hz, 50% duty cycle

Emissions to EN 55081-2

| RF interference | EN 55011 | Enclosure class A |

Refer to EMC Installation Guidelines for additional information.

7. 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


10. WEIGHT: 7.0 oz. (0.20 Kg)

UL Recognized Component, File # E137808

Level 3; 10 V/m
Level 3; 8 Kv air
Level 2; 4 K V contact
Level 3; 8 K V air
Level 3; 10 V/m
80 MHz - 1 GHz
Level 4; 2 K V I/O
Level 3; 2 K V power
Level 3; 10 V/m
150 KHz - 80 MHz
900 MHz + 5 MHz
200 Hz, 50% duty cycle

Emissions to EN 55081-2

| RF interference | EN 55011 | Enclosure class A |

Refer to EMC Installation Guidelines for additional information.

7. 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


10. WEIGHT: 7.0 oz. (0.20 Kg)
**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. i.e., % temperature rise = (% unbalance 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.

**UNDERSURGE**

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.
   b. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   c. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   d. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

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.

4. 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 # 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)
2. 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.
3. 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.
   b. Under Voltage Delay to minimum (CCW)
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 energizes and the LED glows red. Turn the knob CCW until the relay de-energizes and the LED glows green. This procedure assumes that the line voltages are at an acceptable level when the adjustments are made.
   Note: If the recommended setting is not known, turn the Undervoltage adjustment knob CW until the relay energizes and the LED glows red. Turn the knob CCW until the relay de-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%
7. 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.
8. 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 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 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.

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.

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%.

Note: Insure that the motor is wired for correct rotation.

Note: If the recommended setting is not known, turn the Undervoltage adjustment knob CW until the relay energizes and the LED glows red. Turn the knob CCW until the relay de-energizes and the LED glows green. This procedure assumes that the line voltages are at an acceptable level when the adjustments are made.

Note: NEMA recommends not to operate motors with a phase unbalance greater than 5%.
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.

TROUBLESHOOTING

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

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>AVAILABLE SUPPLY VOLTAGES</th>
</tr>
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<tr>
<td>APMR0096</td>
<td>3 Phase Fault Detection Module</td>
<td>480 VAC</td>
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<tr>
<td>APMR0086</td>
<td></td>
<td>380 VAC</td>
</tr>
<tr>
<td>APMR0016</td>
<td></td>
<td>230 VAC</td>
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</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
DESCRIPTION

RLC relay terminal blocks are only 6.2 mm wide, but provide a complete relay interface with:

- 2 layer double contact with hard gold plating for universal applications from 1 mA to 3 A continuous current
- isolation between input and output of 2 kV rms
- input voltage of 24 VAC/DC
- LED to indicate the switching status
- damping and polarity protection functions by means of bridge rectifiers on the input side

The relay terminal blocks are equipped with the newest development in electromechanical miniature relays. Two versions are available for opposing signal directions. The input and output relays can be differentiated by the LEDs that are arranged on the respective side of the coil.

SPECIFICATIONS

1. COIL SIDE:
   - Input Nominal Voltage: 24 VAC/DC
   - Permissible Range of Nominal Voltage: 0.8 to 1.1
   - Typ. Input Current with Nominal Voltage: 6.5 mA
   - Typ. Operate Time with Nominal Voltage: 5 msec
   - Typ Release Time with Nominal Voltage: 15 msec

2. CONTACT SIDE:
   - Contact Type: Double Contact, Form A
   - Contact Material: AgNi, 5μm hard gold plated
   - Max. Contact Voltage: 250 VAC/ 30 VDC
   - Min. Contact Voltage: 5 V
   - Max. Inrush Current: 5 A
   - Limiting Continuous Current: 3 A
   - Min. Switching Current: 1 mA
   - Max. Power Rating: 72 W

3. ISOLATION VOLTAGE:
   - Winding to Contact: 2 kV, 50 Hz, 1 minute

4. AMBIENT TEMPERATURE RANGE:
   - -20 to +50°C

5. NOMINAL OPERATING MODE:
   - 100% duty cycle

6. MECHANICAL LIFE:
   - 20 million cycles

7. CONSTRUCTION:
   - Case body is green, high impact plastic.

8. CONNECTIONS:
   - 14 AWG max., Torque 5-7 in-lb.

9. MOUNTING:
   - Standard DIN Top hat (T) profile rail according to EN50022
     - 35 x 7.5 and 35 x 15.

10. WEIGHT:
    - 0.704 oz. (19.96 g)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
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<th>PART NUMBER</th>
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<tr>
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<tr>
<td>AVMR</td>
<td>OUTPUT</td>
<td>AVMR4037</td>
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UL Recognized Component,
File #E171375
DESCRIPTION

The Model COS1, Clock Oscillator provides a source of high accuracy clock pulses that can be applied to the input of any RLC Totalizing or Preset Counter to provide precision timing indication and control. Typical uses include exposure control, intervalometer requirements, actuation delay measurement, and many other applications.

The COS1 contains a crystal oscillator clock with a divider chain and a binary controlled selector that allows selection of output pulses in time intervals of 1, 0.1, 0.01 and 0.001 seconds. A divided by 60 (÷60) divider supplies a separate output to provide the same selection in minutes. Time interval selection is accomplished by jumpers which pull “A” and “B” control inputs low as shown in the block diagram. Other control inputs include:

**RESET**: Pulling this input low sets and holds all dividers and registers at zero as long as **RESET** is held low. This input can be connected to the counter reset terminal to provide synchronized timing-start with the counter reset.

**INHIBIT**: Pulling this input low suspends the output of clock pulses without resetting accumulated time. This control input is useful when time must be totaled over separated time segments of machine operation. The **INHIBIT** input of the COS1 should be used instead of the Counter Inhibit Input when this function is needed.

The COS1 is packaged in a convenient Octal 8-pin Plug-in package that mates with UL and CSA rated base mounted or DIN rail mounted socket. The socket (order separately) features clamp-type screw terminals which accept stripped wires without lugs.

SPECIFICATIONS

1. **PRIMARY SUPPLY POWER**: 12 VDC ±15% @ 8 mA. (Power supplied from counter being used, or from Accessory Power Supply in “stand-alone” applications.)
2. **OUTPUT**: Separate NPN Open Collector Transistor outputs for minutes and seconds. Output is a pull-down pulse with a time duration of 20% of the timing increment selected. **V**<sub>OUT</sub> = 1 V @ 10 mA max.
3. **ACCURACY**: 0.01% Absolute timing accuracy.
4. **OPERATING TEMPERATURE RANGE**: 0° to 50°C
5. **WEIGHT**: 3.1 oz (87.9 g)

ORDERING INFORMATION

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<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<tbody>
<tr>
<td>COS1</td>
<td>Plug-in Clock Oscillator</td>
<td>COS10000</td>
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<tr>
<td></td>
<td>Base Mount, 8-pin Octal Socket</td>
<td>SKT10000</td>
</tr>
<tr>
<td></td>
<td>DIN Rail Mount, 8-pin Octal Socket</td>
<td>SKTDIN00</td>
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</table>
MODEL CTD - DC CURRENT TRANSDUCER

- THREE JUMPER SELECTABLE INPUT RANGES
- OUTPUT IS MAGNETICALLY ISOLATED FROM THE INPUT
- INTERNAL POWER REGULATION
- SPLIT-CORE CASE FOR EASY INSTALLATION

GENERAL DESCRIPTION

CTD transducer combines a Hall Effect sensor and a signal conditioner into a single package. This provides higher accuracy, lower wiring costs, easier installation and saves valuable panel space. The CTD has jumper selectable current input ranges and industry standard 4-20 mA output with a split-core case.

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.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

SPECIFICATIONS

1. OUTPUT SIGNAL: 4-20 mA
2. OUTPUT LIMIT: 23 mA
3. ACCURACY: 1.0% FS
4. REPEATABILITY: 1.0% FS
5. RESPONSE TIME: to 90% of step change 100 msec
6. FREQUENCY RANGE: DC
7. POWER SUPPLY: 22 – 26 VAC/VDC
   Power input and output signal are not isolated.
8. POWER CONSUMPTION: 2 VA
9. LOADING: 650Ω max.
10. ISOLATION VOLTAGE: 3 kV (monitored line to output)
11. LINEARITY: 0.75% FS
12. CURRENT RANGES: Three selectable Ranges: 0 – 50 A
    0 – 75 A
    0 – 100 A
13. CASE: UL 94V-0 Flammability rated thermoplastic
14. ENVIRONMENTAL: -4 to 122 °F (-20 to 50 °C)
    0-95% RH, non-condensing

DIMENSIONS

<table>
<thead>
<tr>
<th>Diam.</th>
<th>In</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 0.19</td>
<td>(4.8)</td>
<td></td>
</tr>
<tr>
<td>3.53</td>
<td>(89.7)</td>
<td></td>
</tr>
<tr>
<td>3.04</td>
<td>(77.2)</td>
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<tr>
<td>2.40</td>
<td>(61)</td>
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<tr>
<td>0.45</td>
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<tr>
<td>0.85</td>
<td>(21.7)</td>
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<td>2.25</td>
<td>(57.2)</td>
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</tr>
<tr>
<td>1.18</td>
<td>(30)</td>
<td></td>
</tr>
</tbody>
</table>

0.85
(21.6)
INSTALLATION
Run wire to be monitored through opening in the sensor. Be sure the monitored current flows in the same direction as the arrow on the sensor. The arrow is just above the hinge, with the “+” symbol on the left, the “-” symbol on the right. The CTD transducers work in the same environment as motors, contactors, heaters, pull-boxes, and other electrical enclosures. They can be mounted in any position or hung directly on wires with a wire tie. Just leave at least one inch (25.4 mm) distance between sensor and other magnetic devices.

Split-Core Versions
Press the tab in the direction as shown to open the sensor. After placing the wire in the opening, press the hinged portion firmly downward until a definite click is heard and the tab pops out fully.

KEEP SPLIT-CORE SENSORS CLEAN.
Silicone grease is factory applied on the mating surfaces to prevent rust and improve performance. Be careful not to allow grit or dirt onto the grease in the contact area. Operation can be impaired if the mating surfaces do not have good contact. Check visually before closing.

OUTPUT WIRING
Connect control or monitoring wires to the sensor. Use up to 14 AWG copper wire and tighten terminals to 4 inch-pounds torque.

4-20mA:
The current loop is powered by the CTD Transducer. Maximum loop impedance is 650 Ω.

RANGE SELECT
CTD transducers feature field selectable ranges. The ranges are factory calibrated, eliminating time consuming and inaccurate field setting of zero or span.
1. Determine the normal operating amperage of your monitored circuit.
2. Select the range that is equal to or slightly higher than the normal operating amperage.
3. Place the range jumper in the appropriate position.

TROUBLE SHOOTING
1. Output Signal Too Low
   A. The jumper may be set in a range that is too high for current being monitored. Move jumper to the correct range.
   B. Power supply is inadequate. Check power supply. Make sure it is of sufficient voltage with all loads at maximum. CTD Series draw 2.0 VA.
   C. Output load too high. Check output load, be sure it is no more than 650 Ω.
2. Output Signal is always at maximum
   A. The jumper may be set in a range that is too low for current being monitored. Move jumper to the correct range.
3. Sensor has no output
   A. Polarity is not properly matched. Check and correct wiring polarity
   B. Monitored load is not DC or is not on. Check that the monitored load is DC and that it is actually on.
   C. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTD</td>
<td>DC/DC, Split Case</td>
<td>CTD00000</td>
</tr>
</tbody>
</table>

LIMITED WARRANTY
The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.
No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
**MODEL GCM232 - SERIAL CONVERTER MODULE (RS-232C/20 mA CURRENT LOOP)**

- ALLOWS COMMUNICATIONS BETWEEN RS-232 CONTROL EQUIPMENT AND RLC PRODUCTS WITH 20 mA SERIAL COMMUNICATIONS OPTION
- ISOLATED 20 mA SERIAL COMMUNICATIONS
- FULLY ENCLOSED SCREW-TOGETHER DURABLE PLASTIC CASE

**DESCRIPTION**

The GCM232 Serial Converter Module provides the capability of interfacing Red Lion Controls products with 20 mA current loop serial communications option to most equipment with RS-232 communications. The isolated 20 mA current loop connections in the GCM232 allows multiple modules to be wired into the serial loop. Data format of the RS-232 equipment must be the same as the Red Lion Controls product (Reference the serial communications section of the appropriate manual for more details).

An external +12 VDC power source is required to power the GCM232 module. Some Red Lion Controls products have a +12 VDC output which can be used (Note: Reference appropriate manual to ensure +12 volt output has enough current capability). The external power source and isolated 20 mA serial communications loop connections are made via a 6 position terminal block located inside the module. A 680Ω current limiting resistor is provided to obtain the source current for the Serial Current Loop. Connections for the RS-232 are made via a 25-pin female D-type connector.

**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 28 VDC @ 30 mA max.
   - Power supplies must be Class 2 or SELV rated.
2. **RS-232 VOLTAGES:**
   - **Receive Data Pin 2:** ± 30 VDC<sub>max</sub>, mark condition ≤ 0.8 VDC, space condition ≥ 2.4 VDC.
   - **Transmit Data Pin 3:** mark condition = -10 VDC (typ), space condition = +10 VDC (typ).
3. **20mA CURRENT LOOP:**
   - **SO - Output Transistor Rating:** V<sub>max</sub> = 25 VDC, V<sub>sat</sub> = 1 VDC<sub>max</sub> @ 20 mA.
   - **SI - Input Diode Rating:** VF = 1.25 VDC typ, 1.5 VDC<sub>max</sub> @ 20 mA. (Note: Reverse polarity protection at SI diode)
4. **MAXIMUM CABLE LENGTH:**
   - RS-232 cable: 50 Ft.
   - 20 mA current loop: 4000 Ft.
5. **BAUD RATE:** 9600 max.
6. **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.
   - **Altitude:** Up to 2000 meters
7. **CERTIFICATIONS AND COMPLIANCES:**
   - **SAFETY**
     - IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   - **EMC EMISSIONS:**
     - Meets EN50081-1: Residential, Commercial and Light Industry
     - CISPR 22 Radiated and conducted emissions
   - **EMC IMMUNITY:**
     - Meets EN 50082-2: Industrial Environment.
     - ENV 50140 - Radio-frequency radiated electromagnetic field
     - ENV 50141 - Radio-frequency conducted electromagnetic field
     - EN 61000-4-2 - Electrostatic discharge (ESD)<sup>2</sup>
     - EN 61000-4-4 - Electrical fast transient/burst (EFT)<sup>3</sup>
   - **Notes:**
     - 1. For operation without loss of performance:
       - Install power line filter, RLC #LFIL0000 or equivalent.
       - I/O cables routed in metal conduit connected to earth ground.
     - 2. Anti-static precautions should be observed before handling the device.
     - 3. For operation without loss of performance:
       - Install power line filter, RLC#LFIL0000 or equivalent.
       - Refer to EMC Installation Guidelines section of the manual for additional information.
8. **DIMENSIONS:**
   - 0.99” H x 2.10” W x 4.32” L
   - 25.2 mm H x 53.4 mm W x 109.8 mm L
9. **Shielded cable must be used, connect shield drain wire to earth ground.**

**ORDERING INFORMATION**

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<th>MODEL NO.</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>GCM232</td>
<td>Serial Converter Module RS-232</td>
<td>GCM23201</td>
</tr>
</tbody>
</table>

**CAUTION:**

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

1. 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.

4. 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.

INSTALLATION ENVIRONMENT

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.

Installation

The power and 20 mA current loop connections should be made with 24 gauge, multi-conductor, shielded cable. Wire insulation should be stripped to approximately 1/4 inch (stranded wires should be tinned with solder). Accessing the terminal block is accomplished by removing the four screws and nuts that hold the two halves together. Connect the power and 20 mA loop wires to the appropriate terminal block pins, and route the cable through the groove at the rear of the module.

Install the two screws and saddle washers into the slots at the 25-pin D-connector.

The two halves are placed together, then secured with the four screws and nuts. Refer to figure 1 below for assembly.
TYPICAL POWER AND 20 mA LOOP CONNECTIONS

FIGURE 2

TYPICAL CONNECTION FOR MULTIPLE UNITS

FIGURE 3

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL GCM422 - SERIAL CONVERTER MODULE [RS422/20 mA current loop]

- ALLOWS COMMUNICATIONS BETWEEN RS422 CONTROL EQUIPMENT AND RLC PRODUCTS WITH 20 mA SERIAL COMMUNICATIONS OPTION
- TRANSMIT DISABLE ALLOWS OPERATION ON A TWO-WIRE BUS FOR RS485 COMPATIBILITY
- ISOLATED 20 mA SERIAL COMMUNICATIONS
- FULLY ENCLOSED SCREW TOGETHER DURABLE PLASTIC CASE

DESCRIPTION

The GCM422 Serial Converter Module provides the capability of interfacing Red Lion Controls products, with 20 mA current loop serial communications option, to any equipment with RS-422 communications. The isolated 20 mA current loop connections in the GCM422 allow multiple modules to be wired into the serial loop. Data format of the RS-422 equipment must be the same as the Red Lion Controls product (Reference the serial communications section of the appropriate manual for more details). The GCM422 module can be made to interface with RS-485 equipment by repositioning an internal jumper (which is a removable plug type arrangement). (The user must supply a method of electrically selecting the transmit disable input.)

An external power source is required to power the GCM422 module. Some Red Lion Controls products have a +12 VDC output which can be used. (Note: Reference appropriate manual to ensure +12 VDC output has enough current capability.) The external power source and isolated 20 mA serial communications loop connections are made via a 6 position terminal block located inside the module. A 680Ω current limiting resistor is provided to obtain the source current for the Serial Current Loop. Connections for the RS-422 or RS-485 are made via a 25 pin female D-type connector.

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 @ 50 mA max. Power supplies must be Class 2 or SELV rated.
2. RS-422 VOLTAGES:
   - Differential output voltage (pins 2 & 14): ±5 VDC max. under no load condition.
   - Differential input voltage (pins 3 & 16): ±5 VDC max.
     - mark condition = -0.2 VDC
     - space condition = ±0.2 VDC
   - Common mode input voltage: -7 VDC to +12 VDC.
3. RS-485 TRANSMIT DISABLE INPUT (Pin 4):
   - Active low Vth = 0.8 VDC max.
   - Internally pulled up to +5 VDC through 3.3 KΩ resistor.
4. RS-422 DRIVE CAPACITY: Up to 32 RS-422 receivers connected in parallel.
5. 20 mA CURRENT LOOP:
   - SO - Output Transistor Rating: Vmax = 25 VDC, Vce = 1 VDC @ 20 mA.
   - SI - Input Diode Rating: VF = 1.25 VDC typ, 1.5 VDC max @ 20 mA.
   - (Note: Reverse polarity protection at SI diode)
6. MAXIMUM CABLE LENGTH:
   - RS-422 or RS-485 cable: 4000 Ft. 20 mA current loop: 4000 Ft.
7. BAUD RATE: 9600 Baud max.
8. ENVIRONMENTAL CONDITIONS:
   - Operating Temperature: 0 to 50°C
   - Storage Temperature: -40 to 80°C
   - Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.
   - Altitude: Up to 2000 meters
9. CERTIFICATIONS AND COMPLIANCES:
   - SAFETY
     - IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
   - EMC EMISSIONS:
     - Meets EN50081-1: Residential, Commercial and Light Industry
     - CISPR 22 Radiated and conducted emissions
   - EMC IMMUNITY:
     - Meets EN 50082-2: Industrial Environment:
       - ENV 50140 - Radio-frequency radiated electromagnetic field
       - EN 61000-4-2 - Electrostatic discharge (ESD)
       - EN 61000-4-4 - Electrical fast transient/burst (EFT)
   - Notes:
     - 1. For operation without loss of performance:
        - Install power line filter, RLC#LFIL0000 or equivalent.
     - 2. Anti-static precautions should be observed before handling the device.
     - 3. For operation without loss of performance:
        - Install power line filter, RLC#LFIL0000 or equivalent.
   - Refer to EMC Installation Guidelines section of the manual for additional information.
10. DIMENSIONS:
    - 0.99” (25.2 mm) H x 2.10” (53.4 mm) W x 4.32” (109.8 mm) L
    - 11. Shielded cable must be used, connect shield drain wire to earth ground.

(Note: RS-485 Specifications are the same as RS-422)

ORDERING INFORMATION

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<th>DESCRIPTION</th>
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<tbody>
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<td>Serial Converter Module RS422</td>
<td>GCM42201</td>
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</table>

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

1. 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.

4. 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.

INSTALLATION ENVIRONMENT

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.

INSTALLATION

The power and 20 mA current loop connections should be made with 24 gauge, multi-conductor, shielded cable. Wire insulation should be stripped to approximately 1/4 inch (stranded wires should be tinned with solder). Accessing the terminal block and jumper is accomplished by removing the four screws and nuts that hold the two case halves together. If the jumper needs to be re-positioned, it should be done with NO power applied to the module (module is shipped from factory in the 422 position). Connect the power and 20 mA loop wires to the appropriate terminal block pins. The cable is then routed through the groove at the rear of the module. Install the two screws and saddle washers into the slots at the 25 pin D-connector. Position the two case halves together, and secure with the four screws and nuts. Refer to figure 1 below for assembly.
TYPICAL POWER AND 20 mA LOOP CONNECTIONS

FIGURE 2

TYPICAL CONNECTION FOR MULTIPLE UNITS

FIGURE 3
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.
3. If the RS-422 receive data inputs are not connected, the 20 mA SO output will be indeterminate. Therefore if the receive data input is not connected, the 20 mA SI input loop on the Red Lion Controls product must be wired for the mark condition (current flowing) and must be disconnected from the SO output terminals on the GCM422 Module.
4. Current flowing is a stop bit (mark) and no current flowing is a start bit (space).

FIGURE 4

TYPICAL RS-485 CONNECTIONS

Note: Connect shield drain wire to earth ground.
For RS-485 operation, place the internal jumper in the 485 position. The transmit and receive data lines of the GCM422 module should be wired together. The transmit disable input must be high (+5 VDC) in order to transmit data from the module (Note: This input is internally pulled high).
To receive data from an RS-485 device, the transmit disable input must be low which forces the transmit data output into a high impedance state, effectively disconnecting it from the two-wire bus.
Current flowing is a stop bit (mark) and no current flowing is a start bit (space).

FIGURE 5

TYPICAL RS-485 TO LEGEND CONNECTION

FIGURE 6

TROUBLESHOOTING
For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL GWDN - DEVICENET™ GATEWAY MODULE

DESCRIPTION
The GWDN DeviceNet™ Gateway Module provides the capability of interfacing equipment with RS485/422 serial communications to equipment with DeviceNet™ communications capability.

Four wire RS-422 and two wire RS-485 are supported, as well as standard DeviceNet™ communications capability.

A DIP switch, located on one side of the unit, and accessible from the outside, provides the means to set the DeviceNet™ MacId and the DeviceNet™ baud rate.

There are four LED’s that can be viewed from the front of the converter module. Two green LED’s indicate the receive and transmission of data on the RS485/422 side. A green and a red LED provide a visual indication of the status of the DeviceNet™ communications.

All power to the unit is provided via the DeviceNet™ cable. All connections to the unit 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 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: Power is supplied by the DeviceNet™ cable. Consult DeviceNet™ specification Volumes I and II. Also see DeviceNet™ Specifications on the following page.

2. RS485 VOLTAGES:
   - Differential Output Voltage: ±5 VDC max. under no load
   - Differential Input Voltage: ±5 VDC max.
   - Mark Condition: ≤-0.2 VDC
   - Space Condition: ≥+0.2 VDC


4. MAXIMUM CABLE LENGTH:
   - RS485: 4000 feet
   - DeviceNet: Check DeviceNet™ specification Volumes I and II.

5. RS485 BAUD RATE: 300 min., 19200 max.

6. 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
   - Altitude: Up to 2000 meters

7. CERTIFICATIONS AND COMPLIANCES:
   - Electromagnetic Compatibility
     - Refer to EMC Installation Guidelines section of this bulletin for additional information.

8. CONSTRUCTION: Case body is green, high impact plastic. Installation Category I, Pollution Degree 2.

9. MOUNTING: Standard DIN rail top hat (T) profile rail according to EN50022- 35x7.5 and 35x15

10. WEIGHT: 3.5 OZ. (99.22 G.)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWDN</td>
<td>DeviceNet/RS485 Converter Module</td>
<td>GWDN0000</td>
</tr>
<tr>
<td>CBDN</td>
<td>DeviceNet Mini Receptacle Cable</td>
<td>CBDN1AD6</td>
</tr>
<tr>
<td></td>
<td>DeviceNet Micro Receptacle Cable</td>
<td>CBDN2AD6</td>
</tr>
</tbody>
</table>

DIMENSIONS “In inches (mm)”

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>(229)</td>
</tr>
<tr>
<td>30</td>
<td>(76)</td>
</tr>
<tr>
<td>3.56</td>
<td>(90.0)</td>
</tr>
<tr>
<td>3.76</td>
<td>(96.5)</td>
</tr>
<tr>
<td>3.86</td>
<td>(98)</td>
</tr>
</tbody>
</table>
DeviceNet™ SPECIFICATIONS

POWER SUPPLY
Source: Supplied by DeviceNet™ bus.
   The bus does not power the host.
Voltage: 11 to 25 VDC.
Current: Nominal: 18 mA at 25 VDC.
   Inrush: Test documentation available upon request.

NETWORK SPECIFICS
Compatibility: Group 2 Server Only, not UCMM capable.
Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud.
Bus Interface: Phillips 82C250 or equivalent with mis-wiring protection per
   DeviceNet™ Volume 1 Section 10.2.2.
Node Isolation: Bus powered, isolated node.
Bus Connection: *
   1 V+:
   2 V-:
   3 CAN L:
   4 CAN H:
* Shield: Refer to Appendix A, DeviceNet™ Physical Layer Schematics
   section of Volume I, of the ODVA Specifications Manual.

INSTALLATION INFORMATION
Initial Values (Factory Settings):
   Baud rate: 125 Kbaud
   MacID: 63
Both Mac ID and baud rate are set via DIP switches located on the Gateway
   unit. See the DIP Switch Setting Table below for more details on these switch
   settings.

DIP SWITCH SETTING TABLE

<table>
<thead>
<tr>
<th>SWITCH #</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 6</td>
<td>Mac ID (all off = 0, all on = 63)</td>
</tr>
<tr>
<td>7 off, 8 off</td>
<td>125 K baud</td>
</tr>
<tr>
<td>7 on, 8 off</td>
<td>250 K baud</td>
</tr>
<tr>
<td>7 off, 8 on</td>
<td>500 K baud</td>
</tr>
<tr>
<td>7 on, 8 on</td>
<td>N/A</td>
</tr>
</tbody>
</table>

CONNECTION SIZES
Device Profile: This product conforms to the DeviceNet™ specification
   Volumes I and II of version 2.0.
Device Configuration: No DeviceNet™ configuration is supported.
   However, some Gateway configuration is supported.

<table>
<thead>
<tr>
<th>Message</th>
<th>Produced</th>
<th>Consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit</td>
<td>30 Bytes</td>
<td>30 Bytes</td>
</tr>
</tbody>
</table>

THE DeviceNet™ GATEWAY LED’S
RS485/422 LED’S:
A. TX LED (green), indicates the transmission of data on the RS485/422 data
   lines.
B. RX LED (green), indicates the reception of data on the RS485/422 data
   lines.

DeviceNet™ STATUS LED’S
What to look for:
A. Flashing Red LED;
   This device is the only device on the network (waiting for an
   acknowledgment to its duplicate MacID check), or an I/O connection has
   timed out, or a recoverable error has occurred.
B. Flashing Green LED;
   The device is functioning correctly and is waiting to be commissioned by
   a bus master.
C. Solid Red LED;
   The device has encountered a non-recoverable fault, such as a duplicate
   MacID response, and has removed itself from the bus, or the device is in
   a power up reset state and is attempting to come on line.
D. Solid Green LED;
   The device is on line, functioning correctly and has been commissioned by
   a bus master.

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

GATEWAY DeviceNet ATTRIBUTES
Class ID = 100 decimal (vendor specific)
Instance ID = 1 decimal
The following Attributes are used to configure the RS485/422
   communications side.

A. Attribute ID #1 (Mode Attribute);
   A value of 1 in this attribute will put the Gateway into the Modbus ASCII
   mode. Consult Modbus specifications for the correct use of this protocol. A
   value of 2 in this attribute will put the Gateway into the Modbus RTU mode.
   Consult Modbus specifications for the correct use of this protocol. A value
   of 3 in this attribute will put the Gateway into an open protocol mode. To use
   the open protocol mode, a beginning delimiter value of 1 or 2 must be the
   first character in the command string and an ending delimiter value of 3 must
   be the last character in the command string. Any value in between these
delimiters is allowable and will be transmitted onto the RS485/422 side. The
delimiters, however, will be removed from the transmission and will not
   appear on the RS485/422 side.
   A beginning delimiter of 1 is to be used, if this command string will have a
   response from the RS485/422 side. If no response is detected within the set
   time out period, a time out error will be returned.
   A beginning delimiter value of 2 is used when there will be no response to
   this command string from the device on the RS485/422 side.
   In all modes, the maximum allowable characters that can be transmitted or
   received by the Gateway is 25. This includes the two delimiter characters that
   are used in mode 3.

B. Attribute ID #2 (RS485/422 Protocol Configuration)
   BIT          SETTING
   0 - 3 Baud Rate (300 to 19.2)
   4 Odd/Even Parity (1= Odd)
   5 Enable/Disable Parity (1 = Enable)
   6 7 or 8 Data Bits (1 = 8 Data Bits)
   7 1 or 2 Stop Bits (1 = 2 Stop Bits)
   The following settings are not allowed;
   7 data bits, no parity, and 1 stop bit.
   8 data bits, odd or even parity, and 2 stop bits.
C. Attribute ID#3 (String Terminator Character)
   Used in conjunction with the open protocol mode. The value in this attribute
   will be recognized by the Gateway as the ending character for a response
   from a device on the RS485/422 side.

D. Attribute ID#4 (Response Time out)
   This attribute will determine how long the Gateway unit will wait for a
   response from the RS485/422 side, before issuing a response time out error,
   for a non response from the unit on the RS485/422 side.
   Time Out = Attribute value * 250 msec.
E. Attribute ID #100 (Bridge String Handler)
   This attribute is used as the vehicle by which communications from
   the DeviceNet communications side to the RS485/422 communications side
   is achieved. Also, the reverse of this is true when a response is expected
   from the RS485/422 communications side.
   Unlike most other DeviceNet attributes, attribute #100 is a vendor specific
   attribute and is used solely as the means by which data is transported through
   the Gateway. This attribute is used in conjunction with vendor specific
   service code decimal #50.
   To use attribute #100, set the service code to decimal #50, the class ID to
decimal #100, the Instance ID to #1 and the Attribute ID to decimal #100.
   Construct your string that is to be passed through to the RS485/422 side
   in the manner disguised in section (A) above, Attribute ID #1.

GATEWAY APPLICATION OBJECT:
The Gateway Application Object is the object through which all Gateway
   communications occur. The Application Object acts as the protocol bridge
   between the DeviceNet side of the Gateway and the RS485/422
communications side. This object takes the data stream from the DeviceNet side
and reformats it into a compatible format for the RS485/422 communications side.
This object does the reverse of this for communications from the
RS485/422 side to the DeviceNet communications side. The maximum size of
any one bridge communication message is 30 bytes. This includes data as well
as any control characters needed to format the message.

Vendor Specific Error Responses

<table>
<thead>
<tr>
<th>CODE ERROR #</th>
<th>ERROR CODE MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1F (General Code)</td>
<td>Vendor Specific Error</td>
</tr>
<tr>
<td>1 (Additional Code)</td>
<td>Meter Response Time-out</td>
</tr>
<tr>
<td>2 (Additional Code)</td>
<td>Vendor Service Not Supported</td>
</tr>
<tr>
<td>3 (Additional Code)</td>
<td>Command String Syntax Error</td>
</tr>
</tbody>
</table>

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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.

1. 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.

4. 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.

---

GATEWAY DeviceNet™ OBJECT MODEL

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>OPTIONAL / REQUIRED</th>
<th># OF INSTANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>Message</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>DeviceNet™</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>Connection</td>
<td>Required (Explicit Messaging)</td>
<td>1</td>
</tr>
<tr>
<td>Assembly</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>Application; Gateway</td>
<td>Optional</td>
<td>1</td>
</tr>
</tbody>
</table>

SIDE VIEWS OF THE GATEWAY DEVICE NET™ MODULE

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WARNING: In order to prevent possible bodily injury or equipment damage, it is strongly recommended that all power be removed from the network before plugging or unplugging this device or any other device on the DeviceNet network. Please refer to the ODVA specification Volume 1, Release 2.0, sections 9-3.5.1 to 9-3.5.4 and Appendix C, page C-1, Table C-1, for further information.

**TYPICAL RS-422 CONNECTIONS**

![RS-422 Connections Diagram]

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.

**TYPICAL RS-485 CONNECTIONS**

![RS-485 Connections Diagram]

Notes:
1. Connect shield drain wire to earth ground.
2. The transmit and receive data lines of the GWDN should be wired together.

**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 GWDN 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 GWDN 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 IAMA - UNIVERSAL SIGNAL CONDITIONING MODULE

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 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 EEPROM 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°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 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.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAMA</td>
<td>Linear Universal Signal Conditioning Module</td>
<td>IAMA3535</td>
</tr>
<tr>
<td></td>
<td>Square Root Universal Signal Conditioning Module</td>
<td>IAMA6262</td>
</tr>
</tbody>
</table>

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: 10 Ω
   Voltage: > 100 K
6. INPUT PROTECTION: Surge suppressor diodes
7. MAX OUTPUT CURRENT:
   Current Output: 22 mA
   Voltage Output: 10 mA
8. LOAD RESISTANCE:
   Current Output: ≤ 600 Ω
   Voltage Output: ≥ 1 KΩ
9. 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 KΩ load (10 mA). Factory calibrated for loads of > 1 MΩ.
10. ISOLATION LEVEL INPUT TO OUTPUT: 1.5 kV @ 50/60 Hz, 1 min
11. STEP RESPONSE: To within 99% of full scale: 300 msec
12. ACCURACY (INCLUDING LINEARITY): Factory: ±0.1% of span max. for all ranges except 1 mA, 2 mA, and 20 mA. These ranges are accurate to ±0.2% of span max. All ranges can be field calibrated to 0.1% of span max.
13. RESOLUTION: 0.01% full scale input, 0.01% full scale output

DIMENSIONS

File # E179259
UL Recognized Component, File # E179259
Released 3/07
Drawing No. LP0413
Bulletin No. IAMA-F
14. 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 °C
   Temperature Coefficient: ± 0.01%/°C (100 PPM/°C) max.
   Altitude: Up to 2000 meters

15. CERTIFICATIONS AND COMPLIANCES:
   SAFETY
   UL Recognized Component, File #E179259, UL3101-1, 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 # 01ME11540-072001
   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
   Notes:
   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 1/µs
   Level 3; 2 Kv power²
   RF conducted interference EN 61000-4-6 Level 3; 10 V/µs
   150 KHz - 80 MHz
   900 MHz ± 5 MHz
   Simulation of cordless telephone ENV 50204
   200 Hz, 50% duty cycle
   Emissions to EN 50081-2
   RF interference EN 55011
   Enclosure class A
   Power mains class A

1. Self-recoverable loss of performance during EMI disturbance at 10 V/m:
   Analog output signal deviation less than 5% of full scale.
   For operation without loss of performance:
   Install power line filter, RLC #F1P05000 or equivalent on DC power lines at unit.
   OR
   Install 2 ferrite cores, RLC #FCOR0000 or equivalent, to DC power lines at unit.
2. Criteria A: No loss of performance within the unit’s specifications.
   Refer to EMC Installation Guidelines section of this bulletin for additional information.

16. CONSTRUCTION: Case body is black high impact plastic
17. CONNECTIONS: 14 AWG max.
18. 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.
19. WEIGHT: 4.5 oz. (127.57 g)

**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 IAMA3335 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 IAMA’s 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 E²PROM 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 E²PROM 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 E²PROM 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.

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 ≤600 Ω output resistance and the maximum output voltage signal is 11 V with ≥1 KΩ 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, recalibration 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

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

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

<table>
<thead>
<tr>
<th>OUTPUT RANGE</th>
<th>RANGE DIP SWITCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5 V</td>
<td>3 4 5</td>
</tr>
<tr>
<td>0 - 10 V</td>
<td>0 0 1</td>
</tr>
<tr>
<td>0 - 1 mA</td>
<td>0 1 0</td>
</tr>
<tr>
<td>4 - 20 mA</td>
<td>0 1 1</td>
</tr>
<tr>
<td>0 - 20 mA</td>
<td>1 0 0</td>
</tr>
</tbody>
</table>

Note: DIP switch settings 0 = OFF 1 = ON

### TABLE 3, INPUT RANGE SETTINGS

<table>
<thead>
<tr>
<th>INPUT VOLTAGE</th>
<th>RANGE DIP SWITCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20 mV</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>0 - 50 mV</td>
<td>0 0 0 1</td>
</tr>
<tr>
<td>0 - 100 mV</td>
<td>0 0 1 1</td>
</tr>
<tr>
<td>0 - 200 mV</td>
<td>0 0 1 1</td>
</tr>
<tr>
<td>0 - 500 mV</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>0 - 1 V</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>0 - 2 V</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>1 - 5 V</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>0 - 10 V</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>0 - 20 V</td>
<td>0 1 0 1</td>
</tr>
<tr>
<td>5 - 50 V</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>50 - 100 V</td>
<td>0 1 1 0</td>
</tr>
<tr>
<td>0 - 1 mA</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>0 - 2 mA</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>0 - 5 mA</td>
<td>0 1 1 1</td>
</tr>
<tr>
<td>0 - 10 mA</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>4 - 20 mA</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>0 - 20 mA</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>0 - 50 mA</td>
<td>0 1 0 1</td>
</tr>
<tr>
<td>0 - 100 mA</td>
<td>0 1 0 0</td>
</tr>
</tbody>
</table>

Note: DIP switch settings 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 EEPROM 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 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 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 #28B2029-0A

Line Filters for input power cables: Schaffner # FN610-1/07 (RLC #LFIL0000)
Schaffner # FN670-1.8/07
Corcom #1IV3

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. Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.

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 Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
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.

1.0 INPUT SET-UP USING FACTORY CONFIGURATION

1.1 Remove power.

1.2 Connect signal wires 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

1.3 Set Input Range switches (S1 switches 6 through 10) to the desired Input Range (See Table 3). (0 to 10 VDC range shown).

1.4 Set Input Field/Fact. switch (S1 switch 2) to the off position.

1.5 Apply power to the IAMA.

Solid illumination of Green LED if signal is within the minimum and maximum limits of the selected input range.
Slow blinking of Red LED if signal decreases below minimum limit of selected input range.
Rapid blinking of Red LED if signal increases above maximum limit of selected input range.

1.6 Input set-up complete. Go to Step 3.0 or Step 4.0.

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 E2PROM 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.
2.0 INPUT SCALING USING FIELD CONFIGURATION

2.1 Remove power.

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

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 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

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.
4.0 OUTPUT SCALING USING FIELD CONFIGURATION

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.
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:

1. 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 ensure 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.

4. To remove a module from the rail, insert a screwdriver into the slot while pulling out and pry upwards on the module until it releases from the rail.

5. 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.

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.

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.

2. 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 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 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.
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.

LIMITED WARRANTY
The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.
No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The IAMS3535 Smart Analog to MODBUS Conditioner with Alarms module accepts a wide range of DC analog process signals. There are eighteen different DC analog input ranges which determine the input span and type. The input accepts a maximum of 110 VDC and 110 mA DC.

The IAMS converts an analog input signal into a register format that can be read using ASCII or RTU MODBUS protocol. With the features of gain and offset, the input signal can be scaled to meet process requirements. Additionally, two setpoint values can be entered for dual relay process monitoring alarms.

The IAMS is programmed with Windows® based SFIMS software. The software allows configuration, calibration, and storage of IAMS program files. Additionally, all setup parameters can be interrogated and modified through MODBUS register and coil commands.

The RS485 port allows the IAMS to be multidropped, with Baud rates up to 38400. The CBPRO007 programming cable converts the RS232 port of a PC to RS485, and is terminated with an RJ-11 connector. The bidirectional capability of the CBPRO007 allows it to be used as a permanent interface cable as well as a programming cable.

The IAMS’s two Form A relay alarms can be configured independently for absolute high or low acting with balanced or unbalanced hysteresis. Alarm 2 can also be configured for deviation and band alarms. In these modes, Setpoint 2 tracks Setpoint 1. Adjustable alarm trip delays can be used for delaying output response. The alarms can be programmed for Automatic or Latching. Latched alarms must be reset via serial command. A standby feature suppresses the alarm during power-up until the process stabilizes outside the alarm region. Standby eliminates power-up tripping for low acting alarms. The output relays can also be manually controlled via register commands.

The module’s high density packaging and DIN rail mounting saves time and panel space. The module is equipped with a universal mounting foot for attachment to standard DIN rails, including top hat (T) profile or G profile rail.

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

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAMS</td>
<td>Smart Analog to Modbus Conditioner w/Alarms</td>
<td>IAMS3535</td>
</tr>
<tr>
<td>SFIMS</td>
<td>PC Configuration Software for Windows</td>
<td>SFIMS</td>
</tr>
<tr>
<td>CBPRO</td>
<td>Programming Interface Cable</td>
<td>CBPRO007</td>
</tr>
<tr>
<td>CBJ</td>
<td>Cable RJ11 to Unterminated 7 foot length</td>
<td>CBJ11A07</td>
</tr>
<tr>
<td></td>
<td>Cable RJ11 to RJ11 8 inch jumper</td>
<td>CBJ118D5</td>
</tr>
<tr>
<td></td>
<td>RJ11 to Terminal Adapter</td>
<td>DRRJ11T6</td>
</tr>
</tbody>
</table>

SPECIFICATIONS

1. POWER: 18 to 36 VDC, 3.0 W max. or 24 VAC, ±10%, 50/60 Hz, 4 VA max.
2. INPUT DC RANGES:
   - 0-20 mV, 0-50 mV, 0-100 mV, 0-200 mV, 0-500 mV, 0-1 V, 0-2 V, 0-5 V, 0-10 V, 0-20 V, 0-50 V, 0-100 V, 0-2 mA, 0-5 mA, 0-10 mA, 0-20 mA, 0-50 mA, 0-100 mA
3. MAX. INPUT SIGNAL:
   - Current Input: 110 mA DC
   - Voltage Inputs: Terminal 7: 1 VDC +10%
     Terminal 8: 10 VDC +10%
     Terminal 9: 100 VDC +10%
4. INPUT RESISTANCE:
   - Current: 10 Ohms
   - Voltage: greater than 100 K
5. INPUT PROTECTION: Surge suppressor diode
   - Current Terminal: Protected to 110 mA DC max., 1.1 VDC.
   - 100 V Terminal: Protected to 110 VDC.
   - 1 V & 10 V Terminal: Protected to 100 VDC for one minute.
6. INPUT COMMON MODE REJECTION: 50/60 Hz, 110 dB min.
7. ISOLATION LEVEL: 1.5 kV @ 50/60 Hz, 1 min. between input, RS485 and power supply. 2300 Vrms, 1 min. to relay contacts.
8. SERIAL COMMUNICATIONS:
Type: RS485, MODBUS RTU and ASCII modes
Baud: 300, 600, 1200, 2400, 4800, 9600, 19.2K, and 38.4K
Format: 7/8 bit, odd, even and no parity
Transmit Delay: Programmable. (See Transmit Delay explanation in Step 6)
Transmit Enable (TXEN): (primarily for 20 mA loop converter)
\[ V_{OH} = 10 \text{ VDC max.} \quad V_{OL} = 0.5 \text{ VDC at 5 mA max. current limit} \]

9. A/D CONVERTER:
16 bit resolution

10. ACCURACY (including linearity):
0.1% of span

11. RESOLUTION:
0.002% of span

12. GAIN / OFFSET:
Programmable

13. RELAY OUTPUTS:
Type: 2 Form A N.O. contacts
Rating: 5A @ 30 VDC or 250 VAC max. (resistive)
1/10 HP @ 120 VAC (inductive)
Response Time: 155 msec. max. to close including step response, 153 msec. max. to open.

14. OUTPUT ON DELAY TIME:
Programmable from 0 to 32000 sec, ±0.01% - 1 sec. max.

15. MEMORY:
Nonvolatile E²PROM retains all programmable parameters.

16. 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 °C
Temperature Coefficient: +0.01%/°C (100 PPM °C) max.
Altitude: Up to 2000 meters

17. CERTIFICATIONS AND COMPLIANCE:

SAFETY
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 Certificate # US/5141A/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
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 Vrms
Level 3; 10 V/M
Simulation of cordless telephone ENV 50204 Level 3; 10 V/M
900 MHz ± 5 MHz
200 Hz, 50% duty cycle
Emissions to EN 55011
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 to the module in environments with static levels above 6 KV, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making connections, etc.), typical anti-static precautions should be observed before touching the module.
2. Refer to the EMC Installation Guidelines section of this bulletin for additional information.

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

19. CONNECTIONS:
14 AWG max.

20. 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.

21. WEIGHT:
4.5 oz. (127.57 g)

---

LED FUNCTIONALITY

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>GREEN LED</th>
<th>2 RED LEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Applied</td>
<td>On</td>
<td>———</td>
</tr>
<tr>
<td>Communication Received</td>
<td>Flasching</td>
<td>———</td>
</tr>
<tr>
<td>Respective Alarm</td>
<td>———</td>
<td>On</td>
</tr>
<tr>
<td>Checksum error</td>
<td>Flasching</td>
<td>Flasching</td>
</tr>
<tr>
<td>Calibration</td>
<td>Off</td>
<td>On</td>
</tr>
</tbody>
</table>

MODULE ISOLATION

The IAMS features “4-way” signal isolation. The 4-way isolation is a combination of optical, transformer and relay barriers, providing common mode voltage (CMV) isolation to 1.5 KV for 1 minute between input, RS485, and power supply. Isolation between relay contacts and all other inputs is 2300 Vrms for 1 minute.
EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to Electro-Magnetic 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 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.

![Diagram of IAMS Connector](image)

**STEP 1 WIRING THE MODULE**

**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. When wiring the module, 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. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm), two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm) wires.

**MODULE POWER CONNECTIONS**

Module power is connected to terminals 1 and 2. For best results, the power should be relatively “clean” and within the specified limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off should be avoided. It is recommended that power supplied to the module be protected by a fuse or circuit breaker.

**INPUT CONNECTIONS**

**Current Input**

Wiring for a current input is connected to terminals 10 (+) and 12 (-). Terminal 10 (+): 100 mA

**Voltage Input**

Wiring for a voltage input is connected to terminal 12 (-) and one of the voltage terminals listed below. Terminal 7 (+): 1 VDC max. Terminal 8 (+): 10 VDC max. Terminal 9 (+): 100 VDC max.

**RELAY OUTPUT CONNECTIONS**

There are two Form A output relays. The wiring for Relay 1 is connected between terminals 5 and 6. The wiring for Relay 2 is connected between terminals 3 and 4.

To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contactor. Follow the manufacturer’s instructions for installation.

**DEFAULT SERIAL SETTING CONNECTION**

If the IAMS settings are unknown, or forgotten, they can be reset to the factory defaults by connecting the Serial Default terminal 11 to Input Comm. terminal 12 with a jumper, and then cycling power.

**DEFAULTS:**

- Protocol: RTU
- Address: 247
- Data Bits: 8
- Parity: none
- Baud Rate: 9600

**RS485 SERIAL CONNECTIONS**

There are two RJ-11 connectors located on the bottom for paralleling communications. For single device communications, either connector can be used. When used in conjunction with Red Lion Control Paradigm HMI products, reverse A+ and B- wiring.

![Diagram of RS485 Connections](image)
STEP 2 INSTALLING SFIMS (Software for Intelligent Modules)

Insert the SFIMS diskette into the A: or B: drive. Then Run A:\SETUP (or B:\SETUP) to install RLCPro onto the hard drive. An icon labeled RLCPro will be created under the group RLCPro.

STEP 3 PROGRAMMING - Getting Started

Run RLCPro by double-clicking the icon, or use the start menu.

You will be prompted to select the proper device,

Use the FILE pull-down menu to select a NEW file.

and then the model.

STEP 4 PROGRAMMING THE INPUT

The IAMS receives an analog input, converts it to a raw digital value, and stores this number in the ADC Value (register 40001). This number is scaled into engineering units using the Gain Value (register 40010) and Offset Value (register 40011). The result of this scaling is stored as the Process Value (register 40002). It is also stored in the IEEE 754 Standard 32-bit floating decimal format (register 40003 and 40004). The non-scaled ADC, the scaled Process value, or the Floating point value may be accessed for the purpose of monitoring the input level.

Input Range: Select the desired input range from the pull down menu.

Gain & Offset: The Gain & Offset values are used to scale the input signal into engineering units. The result is stored in the Process Value register. To determine the Gain and Offset for your application, use the Scaling Wizard button.
Filter Response: The Filter Response is a time constant, in tenths of second increments, that is used to stabilize an erratic input. The Process value stabilizes to 99% of the final value within approximately 5 time constants. A value of ‘0’ disables digital filtering.

Filter Band: Filter Band is a value expressed in Process units. When a fluctuating signal remains within the band value, the Digital Filter is active, and therefore stabilizes the Process Value. When a fluctuating signal exceeds the Filter Band value, the Digital Filter is momentarily disabled to allow for a quick response to valid process changes. Once the signal variation is less than the Filter Band value, the Digital Filter is reactivated.

The Scaling Wizard prompts you to enter four values. Simply key in the Minimum and Maximum signal Input Values, and the desired Process Value equivalents. Press the Next button to calculate the new Gain and Offset values.

Note: The Process Values must be between –32000 and +32000. (negative values will be transmitted as 2’s complement)

Once the Next key is pressed, the software will display the new Gain and Offset values. It will also display the exact Process Value result for your input signal. The Process values may be different than those previously entered due to the resolution of the Gain and Offset values. Press the Accept button to have the Gain and Offset values entered into the Input Setup screen. When a download is performed, the Gain and Offset values are written to registers 40010 and 40011 respectively.

STEP 5  PROGRAMMING THE ALARMS

Action: Alarm 1 can be programmed for 5 modes of operation, Alarm 2 has 8 possible modes.

Manual: In Manual mode, the Alarms are forced on and off by writing ‘0’ or ‘1’ to the appropriate MODBUS register (Alarm 1 state = 40024, Alarm 2 state = 40025).

Absolute HI: (with balanced or unbalanced hysteresis) The Alarm energizes when the Process exceeds the Setpoint Limit Value.

Absolute LO: (with balanced or unbalanced hysteresis) The Alarm energizes when the Process falls below the Setpoint Limit Value.

Deviation HI, Deviation LO, Band Outside: In these modes, Alarm 2 “tracks” Alarm/Setpoint 1. (See Setpoint Alarm Figures below.)

Setpoint: The Alarm setpoint, entered in scaled Process units.

Hysteresis: Hysteresis is used to eliminate output chatter. The Hysteresis Amount is the difference between the points that an Alarm will “turn on” and “turn off”. In Unbalanced modes, the alarm turns on at the Setpoint, and turns off at Setpoint-HYS for HI alarms, and Setpoint+HYS for LO alarms. In Balanced modes, the Hysteresis is evenly divided above and below the Setpoint value. (See the Setpoint Alarm Figures below) The software calculates the hysteresis percentage and displays it for you.

Note: The Setpoint, along with the Hysteresis, MUST NOT produce a “trip point” higher than 32,000, or less than -32,000. (See the Setpoint Alarm Figures below)

Reset: The alarms can be programmed for Latched or Automatic. In Automatic mode, an energized alarm turns off by itself once the Process leaves the alarm area. In Latched mode, an energized alarm requires a serial reset. This is done by writing a ‘0’ to the appropriate MODBUS register. (Alarm 1 state = 40024, Alarm 2 state = 40025)

On Delay: The time, in whole second increments, that the alarm will take to energize when the Process Value crosses into an alarm state area.

Enable Standby Delay: Standby prevents nuisance (typically low level) alarms after a power up. After powering up the unit, the Process must stabilize outside the alarm region. Once this has occurred, the standby is disabled, and the alarm responds normally until the next module power up.
**STEP 6  PROGRAMMING THE IAMS COMMS PORT**

The IAMS' serial port must match the device being used to communicate to it.  

**MODBUS Protocol**: RTU or ASCII  
**Unit Address**: 1-247  
**Baud Rate**: 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400  
**Data Bits**: 7 or 8  
**Parity**: odd, even, or none  
**Transmit Delay**: Programmable from 1-255 milliseconds. The Transmit Delay is the time the IAMS will wait to respond to a serial command, UNLESS the values in the table below are larger.

Note: If the Unit Address, Protocol, Baud rate, etc. are changed, and then a download is performed, the unit will now respond to the new settings. Any further attempts to communicate to the module must target the new address, with the new settings.  

The IAMS' serial settings must match the device that it is communicating with. If you do not know or cannot recall the IAMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud, 8 data bits, no parity, with an address of 247.
STEP 7  PC PORT CONFIGURATION

Go to the SETTINGS pull-down menu, and select PC PORT SETTINGS.

The Communications Settings window allows you to set up the software properly to perform a download.

**Connection**: Select the computer port (COMM 1-4) that the IAMS is connected to.

**NOTE**: The following settings must match the IAMS. If you do not know or cannot recall the IAMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud, 8 data bits, No parity, with an address of 247.

**Protocol**: RTU or ASCII
**Unit Address**: 1-247
**Baud Rate**: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400
**Data Bits**: 7 or 8
**Parity**: odd, even, or none

Connect the IAMS to the computer with the CBPRO007 interface cable (or any suitable RS232/RS485 converter). Apply 18-36 VDC to the supply terminals of the IAMS.

Note: The CBPRO007 download cable DOES NOT typically require power. In most cases it will derive its power from the PC. If communications cannot be established, follow the troubleshooting guide. If it is determined that the converter requires power, attach a 12 VDC power supply to the VDC and common terminals of the cable.

STEP 8  DOWNLOADING

Go to the FILE pull-down menu, and select DOWNLOAD.

The following screen prompts you to ensure that the proper file is downloaded to the correct module. Click “OK” to continue.
The IAMS is fully calibrated from the factory. Voltage or Current range calibration is recommended every two years. Internal ADC calibration is not recommended unless the voltage or current values are still incorrect after their calibration. If the ADC calibration is performed, the voltage or current calibration must be performed. Each input range has its own minimum and maximum ADC references (registers 40005 and 40006) which are recalled when the range is selected. This allows independent calibration for the desired range. Calibration may be performed via MODBUS commands, or by using SFIMS software.

Allow the IAMS to warm up for 30 minutes minimum, and follow the manufacturer’s warm-up procedure for the calibration source.

Note: Calibration requires a precision signal source with an accuracy of 0.025%, and must be capable of generating the full span of the range to be calibrated. When using SFIMS for calibration, connect the signal source to the IAMS, select the proper range in the software, and press the Calibrate button. Follow the calibration procedures in the software.

The Scratch Pad category can be used to read or write to the Scratch Pad memory locations (41101-41116). The Scratch Pad locations can be used to store user information.

**Data Format**: Allows registers to be viewed in decimal or hexadecimal format.

**Upload**: The Upload button causes SFIMS software to read the Scratch Pad registers from the module.

**Download**: The Download button causes SFIMS software to write to the Scratch Pad registers in the module.

Note: Downloading new values to the module Scratch Pad locations overwrites the information that is currently stored in those registers.

The View Registers category can be used as a method of diagnostics. Use the IAMS Register Table as a reference of register assignments and data.

**First Register**: This specifies the first, or only, register to be read in a block.

**# of Registers**: This is the length of the block to be read. The module supports block read and write commands up to 16 registers in length.

**Data Format**: Allows registers to be viewed in decimal or hexadecimal format.

**Read**: Clicking the Read button causes SFIMS software to read the selected register from the module.

**Write**: Clicking the Write button causes SFIMS software to write the selected registers to the module.

Note: The Write button overwrites the existing register values, and may change the module setup and operation.
## TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED will not light</td>
<td>Module power</td>
<td>Verify module power connections and level</td>
</tr>
<tr>
<td>Process Value not changing</td>
<td>Input Signal</td>
<td>Check input signal connections and level</td>
</tr>
<tr>
<td>Process Value not changing or incorrect</td>
<td>Incorrect scaling</td>
<td>Check input setup, scaling values, and re-download</td>
</tr>
<tr>
<td>Alarms disabled</td>
<td>Alarm threshold over range*; checksum error; ADC overrange</td>
<td>Adjust alarm Setpoint and Hysteresis to ensure trigger point is within -32,000 - +32,000 (See Alarm setup)</td>
</tr>
<tr>
<td>Process Value stays at 32001 or -32001</td>
<td>Gain/Offset over range* due to:</td>
<td>Check input signal connections and level</td>
</tr>
<tr>
<td></td>
<td>Incorrect input signal</td>
<td>Check Input Setup, and re-download</td>
</tr>
<tr>
<td>Process Value stays at 32002 or -32002</td>
<td>ADC over range* due to:</td>
<td>Check input signal connections and level</td>
</tr>
<tr>
<td></td>
<td>Incorrect input signal</td>
<td>Check Input Setup, and re-download</td>
</tr>
<tr>
<td></td>
<td>Incorrect Input Setup</td>
<td>Perform calibration procedure</td>
</tr>
<tr>
<td>Flashing LEDs, alarms disabled</td>
<td>Parameter checksum*, loss of parameter settings</td>
<td>Re-download SFIMS file (reconfigures each parameter)</td>
</tr>
<tr>
<td>Flashing LEDs, alarms disabled</td>
<td>Calibration checksum*</td>
<td>Perform calibration procedure</td>
</tr>
<tr>
<td>Will not communicate</td>
<td>Incorrect serial settings (IAMS port)</td>
<td>Go to pull down menu SETTINGS, PC PORT SETTINGS</td>
</tr>
<tr>
<td></td>
<td>Incorrect serial settings (computer port)</td>
<td>Try switching A+ and B- lines</td>
</tr>
<tr>
<td></td>
<td>Incorrect wiring</td>
<td>Provide a common connection</td>
</tr>
</tbody>
</table>

**NOTE:** The IAMS’ serial settings must match the device that it is communicating with. If you do not know or cannot recall the IAMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud, 8 data bits, no parity, with an address of 247.

* Can be monitored by accessing coils 9-14, or register 40022.

For further technical assistance, contact technical support.
**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 IAMS 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 IAMS 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**

Untreated waste needed to be pumped up a hill to a treatment center. To prevent undesirable shut downs, a backup pump and a flow transducer were installed in the line. The operator needed the ability to monitor the flow, as well as the ability to change setpoints from the main station, located 4000 feet away. The temperature within the pumping station was not controlled. The IAMS was installed because of the size, operating temperature range, serial communications, and the ability to control the pumps. When the flow is below a certain level, the IAMS switches the Main Pump off, and the Backup Pump on. Operators can monitor the flow and change the setpoints from the main building using a PC acquisition program with a MODBUS driver.
MODBUS SUPPORTED FUNCTION CODES

**FC01: Read Coils**
1. Valid coil addresses are 1-16.
2. Only 16 coils can be requested at one time.
3. Block starting point cannot exceed coil 14.

**FC05: Force Single Coil**
1. Valid write (force) coil addresses are 1-10.
2. <0001> HEX is echoed back that the coil did not change during the request to write to a read only coil.

**FC15: Force Multiple Coils**
1. Valid write (force) coil addresses are 1-10.
2. Block starting point cannot exceed coil 10.
3. If a multiple write includes read only coils, then only the write coils will change.

**FC03: Read Holding Registers**
1. Valid addresses are 40001-40026, 41001-41010, 41101-41116.
2. Only 16 registers can be requested at one time.
3. Block starting point cannot exceed the register boundaries.
4. <8000> HEX is returned in registers beyond the boundaries.
5. Holding registers are a mirror of Input registers.

**FC06: Preset Single Register**
1. Valid write (preset) addresses are 40007-40026, 41101-41116.
2. <8001> HEX is echoed back that the register did not change during the request to write to a read only register.
3. If the write value exceeds the register limit (see Register Table), then that register value changes to its exceeded high or low limit. It is also returned in the response.

**FC16: Preset Multiple Registers**
1. Valid write (preset) register addresses are 40007-40026, 41101-41116.
2. No response is given with an attempt to write to more than 16 registers at a time.
3. Block starting point cannot exceed the read and write boundaries.
4. If a multiple write includes read only registers, then only the write registers will change.
5. If the write value exceeds the register limit (see Register Table), then that register value changes to its exceeded high or low limit.

**FC04: Read Input Registers**
1. Valid addresses are 30001-30026, 31001-31010, 31101-31116.
2. Only 16 registers can be requested at one time.
3. Block starting point cannot exceed the register boundaries.
4. <8000> HEX is returned in registers beyond the boundaries.
5. Input registers are a mirror of Holding registers.

**FC08: Diagnostics**
The following is sent upon FC08 request:
Unit Address, 08 (FC code), 04 (byte count), “Total Comms” count, “Total Good Comms” count, checksum of the string.
“Total Comms” is the total number of messages received that were addressed to the IAMS. “Total Good Comms” is the total messages received by the IAMS with good address, parity and checksum. Both counters are reset to 0 upon response to FC08.

**FC17: Report Slave ID**
The following is sent upon FC17 request:
Unit Address, 17 (FC code), RLC-IAMS3535, 0100 (for code version 1.00), 16 (number of read supported registers), 16 (number of writes supported registers), 16 (number of registers available for GUID/ Scratch pad memory), checksum of the string.

The following is the HEX of the above (with unit address of 247):
\(<F7><11><14><52><4C><43><2D><49><41><D><53><35><33><35><C><01><00><10><00><10><00><10><A><F7>\)

SUPPORTED EXCEPTION CODES

**01: Illegal Function**
Issued whenever the requested function is not implemented in the unit.

**02: Illegal Data Address**
Issued whenever an attempt is made to access a single register or coil that does not exist (outside the implemented space) or to access a block of registers or coils that falls completely outside the implemented space.

**03: Illegal Data Value**
Issued when an attempt is made to read or write more registers or coils than the unit can handle in one request.

**07: Negative Acknowledge**
Issued when a write to coil or register is attempted with an invalid string length.

CHECKSUM ERRORS

1. Issued when a write to coil or register is attempted with an invalid string length.
2. Issued whenever an attempt is made to access a single register or coil that does not exist (outside the implemented space) or to access a block of registers or coils that falls completely outside the implemented space.

CALIBRATION

**ADC (Internal)**
1. Connect the signal source to proper IAMS terminals.
2. Apply 0 V or 0 mA to self calibrate.
3. To start calibration, enter <7777> HEX into Holding register 40026.
4. To start ADC calibration, enter <0001> HEX into Holding register 40026.
5. To end calibration, enter <0000> HEX if not continuing with voltage or current calibration.

Voltage or Current
1. Connect the signal source to proper IAMS terminals.
2. Enter desired range to be calibrated into Holding register 40007.
3. To start calibration, enter <7777> HEX into Holding register 40026.
4. Apply 0 voltage or 0 current and enter <0002> HEX into Holding register 40026.
5. Apply maximum limit of selected range and enter <0003> HEX into Holding register 40026.
6. Repeat all of steps 2, 4, and 5 for each range to be calibrated, changing the source connecting to the proper IAMS terminals as needed.
7. To end calibration, enter <0000> HEX into Holding register 40026.

Issued whenever an attempt is made to read or write more registers or coils than the unit can handle in one request.

 CHECKSUM ERRORS

1. Issued when a write to coil or register is attempted with an invalid string length.
2. Issued whenever an attempt is made to access a single register or coil that does not exist (outside the implemented space) or to access a block of registers or coils that falls completely outside the implemented space.

CALIBRATION

**ADC (Internal)**
1. Connect the signal source to proper IAMS terminals.
2. Apply 0 V or 0 mA to self calibrate.
3. To start calibration, enter <7777> HEX into Holding register 40026.
4. To start ADC calibration, enter <0001> HEX into Holding register 40026.
5. To end calibration, enter <0000> HEX if not continuing with voltage or current calibration.

Voltage or Current
1. Connect the signal source to proper IAMS terminals.
2. Enter desired range to be calibrated into Holding register 40007.
3. To start calibration, enter <7777> HEX into Holding register 40026.
4. Apply 0 voltage or 0 current and enter <0002> HEX into Holding register 40026.
5. Apply maximum limit of selected range and enter <0003> HEX into Holding register 40026.
6. Repeat all of steps 2, 4, and 5 for each range to be calibrated, changing the source connecting to the proper IAMS terminals as needed.
7. To end calibration, enter <0000> HEX into Holding register 40026.
**REGISTER TABLE**

The below limits are shown as Integers or HEX < > values. Read and write functions can be performed in either Integers or HEX as long as the conversion was done correctly. Negative numbers are represented by two's complement.

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT</th>
<th>HIGH LIMIT</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>ADC reading</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>ADC (Analog to Digital Converter) reading of present input level.</td>
</tr>
<tr>
<td>40002</td>
<td>Process Value</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process Value (with gain and offset) of present input level.</td>
</tr>
<tr>
<td>40003</td>
<td>Floating Point LO</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>IEEE Standard 754 Floating Decimal Point, low order of Process Value. (Allows 32 bit accuracy for external monitoring.)</td>
</tr>
<tr>
<td>40004</td>
<td>Floating Point HI</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>IEEE Standard 754 Floating Decimal Point, high order of Process Value. (Allows 32 bit accuracy for external monitoring.)</td>
</tr>
<tr>
<td>40005</td>
<td>Min. ADC Reference</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>ADC reading at minimum input established during calibration.</td>
</tr>
<tr>
<td>40006</td>
<td>Max. ADC Reference</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>ADC reading at maximum input established during calibration.</td>
</tr>
<tr>
<td>40007</td>
<td>Input Range</td>
<td>0</td>
<td>17</td>
<td>Read/Write</td>
<td>See Input Range Table.</td>
</tr>
<tr>
<td>40008</td>
<td>Filter Band</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>See Filter Band explanation.</td>
</tr>
<tr>
<td>40009</td>
<td>Filter Response Time</td>
<td>0</td>
<td>1000</td>
<td>Read/Write</td>
<td>See Filter Response Time explanation (1 = 0.1 second).</td>
</tr>
<tr>
<td>40010</td>
<td>Gain Value</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>See Offset and Gain explanation (1 = 0.001).</td>
</tr>
<tr>
<td>40011</td>
<td>Offset Value</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>See Offset and Gain explanation.</td>
</tr>
<tr>
<td>40012</td>
<td>Alarm 2 Mode</td>
<td>&lt;0000&gt;</td>
<td>&lt;0039&gt;</td>
<td>Read/Write</td>
<td>See Alarm 1 &amp; 2 Mode Register Table.</td>
</tr>
<tr>
<td>40013</td>
<td>Setpoint Value 2</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 setpoint value based on Process Value.</td>
</tr>
<tr>
<td>40014</td>
<td>Alarm 2 Hysteresis</td>
<td>1</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 hysteresis value based on Process Value.</td>
</tr>
<tr>
<td>40015</td>
<td>Alarm 2 Delay</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 delay trip on time (1 = 1 second).</td>
</tr>
<tr>
<td>40016</td>
<td>Alarm 1 Mode</td>
<td>&lt;0000&gt;</td>
<td>&lt;0034&gt;</td>
<td>Read/Write</td>
<td>See Alarm 1 &amp; 2 Mode Register Table.</td>
</tr>
<tr>
<td>40017</td>
<td>Setpoint Value 1</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 setpoint value based on Process Value.</td>
</tr>
<tr>
<td>40018</td>
<td>Alarm 1 Hysteresis</td>
<td>1</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 hysteresis value based on Process Value.</td>
</tr>
<tr>
<td>40019</td>
<td>Alarm 1 Delay</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 delay trip on time (1 = 1 second).</td>
</tr>
<tr>
<td>40020</td>
<td>Transmit Delay</td>
<td>1</td>
<td>255</td>
<td>Read/Write</td>
<td>Delay before serial transmission (1 = 1 msec). See Transmit Delay Explanation.</td>
</tr>
<tr>
<td>40021</td>
<td>Node (Unit) Address</td>
<td>1</td>
<td>247</td>
<td>Read/Write</td>
<td>Node serial IAMS address.</td>
</tr>
<tr>
<td>40022</td>
<td>Error Coils</td>
<td>&lt;0000&gt;</td>
<td>&lt;0003&gt;</td>
<td>Read/Write</td>
<td>Mirror of Coils 9-14. See Coil Table.</td>
</tr>
<tr>
<td>40023</td>
<td>Comm. Coils</td>
<td>&lt;0020&gt;</td>
<td>&lt;0FF&gt;</td>
<td>Read/Write</td>
<td>Mirror of Coils 1-7. See Coil Table and Communication Table.</td>
</tr>
<tr>
<td>40024</td>
<td>Alarm 1 State</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>Alarm 1 state. (1 = on)</td>
</tr>
<tr>
<td>40025</td>
<td>Alarm 2 State</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>Alarm 2 state. (1 = on)</td>
</tr>
<tr>
<td>40026</td>
<td>Factory Calibration</td>
<td>&lt;0000&gt;</td>
<td>&lt;7777&gt;</td>
<td>Read/Write</td>
<td>See Calibration explanation.</td>
</tr>
<tr>
<td>41001-41116</td>
<td>Slave ID</td>
<td>See FC17.</td>
<td>See FC17.</td>
<td>Read Only</td>
<td>IAMS=3535, 0100 (ver. 1.00), 16 reads, 16 writes, 16 scratch. It is possible that the version value is higher.</td>
</tr>
</tbody>
</table>

* For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.

† An attempt to exceed a limit will set the register to its high or low limit value.

**COILS TABLE (COMMUNICATION AND ERRORS)**

<table>
<thead>
<tr>
<th>COIL ADDRESS</th>
<th>COIL NAME</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baud B0</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>2</td>
<td>Baud B1</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>3</td>
<td>Baud B2</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>4</td>
<td>Parity B3</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>5</td>
<td>Parity B4</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>6</td>
<td>Data Bits B5</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>7</td>
<td>Mode B6</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>8</td>
<td>Change B7</td>
<td>Read/Write</td>
<td>&quot;1&quot; = change IAMS communications to above settings.</td>
</tr>
<tr>
<td>9</td>
<td>P. Checksum Error</td>
<td>Read/Write</td>
<td>&quot;1&quot; = Parameter checksum error, disables alarms, causes flashing LEDs.</td>
</tr>
<tr>
<td>10</td>
<td>C. Checksum Error</td>
<td>Read/Write</td>
<td>&quot;1&quot; = Calibration checksum error, disables alarms, causes flashing LEDs.</td>
</tr>
<tr>
<td>11</td>
<td>AL 1 Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Alarm 1 Threshold over range, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>12</td>
<td>AL 2 Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Alarm 2 Threshold over range, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>13</td>
<td>ADC Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = ADC over range, causes Process Value to be ±32002, disables alarms.</td>
</tr>
<tr>
<td>14</td>
<td>G/O Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Gain and Offset over range, causes Process Value to be ±32001.</td>
</tr>
<tr>
<td>15</td>
<td>Not used</td>
<td>Read Only</td>
<td>&quot;0&quot; always.</td>
</tr>
<tr>
<td>16</td>
<td>Not used</td>
<td>Read Only</td>
<td>&quot;0&quot; always.</td>
</tr>
</tbody>
</table>

† An attempt to exceed a limit will set the register to its high or low limit value.

Coils 1-7 mirror register 40023 and Coils 9-14 mirror register 40022.
**INPUT RANGE REGISTER (40007) TABLE**

<table>
<thead>
<tr>
<th>RANGE NUMBER</th>
<th>SPAN/TYP</th>
<th>RANGE NUMBER</th>
<th>SPAN/TYP</th>
<th>RANGE NUMBER</th>
<th>SPAN/TYP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0-20 mV</td>
<td>6</td>
<td>0-2 V</td>
<td>12</td>
<td>0-2 mA</td>
</tr>
<tr>
<td>1</td>
<td>0-50 mV</td>
<td>7</td>
<td>0-5 V</td>
<td>13</td>
<td>0-5 mA</td>
</tr>
<tr>
<td>2</td>
<td>0-100 mV</td>
<td>8</td>
<td>0-10 V</td>
<td>14</td>
<td>0-10 mA</td>
</tr>
<tr>
<td>3</td>
<td>0-200 mV</td>
<td>9</td>
<td>0-20 V</td>
<td>15</td>
<td>0-20 mA</td>
</tr>
<tr>
<td>4</td>
<td>0-500 mV</td>
<td>10</td>
<td>0-50 V</td>
<td>16</td>
<td>0-50 mA</td>
</tr>
<tr>
<td>5</td>
<td>0-1 V</td>
<td>11</td>
<td>0-100 V</td>
<td>17</td>
<td>0-100 mA</td>
</tr>
</tbody>
</table>

**ALARM 1 (40012) & 2 (40016) MODE REGISTER TABLE**

<table>
<thead>
<tr>
<th>Stand By</th>
<th>Latched</th>
<th>Off=Auto</th>
<th>B7</th>
<th>B6</th>
<th>B5</th>
<th>B4</th>
<th>2ndNibble</th>
<th>HEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>off</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>&lt;0&gt;</td>
<td></td>
<td>&lt;0&gt;</td>
</tr>
<tr>
<td>off</td>
<td>on</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>&lt;1&gt;</td>
<td></td>
<td>&lt;1&gt;</td>
</tr>
<tr>
<td>on</td>
<td>off</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>&lt;2&gt;</td>
<td></td>
<td>&lt;2&gt;</td>
</tr>
<tr>
<td>on</td>
<td>on</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>&lt;3&gt;</td>
<td></td>
<td>&lt;3&gt;</td>
</tr>
</tbody>
</table>

Examples:
- Alarm 1 (40016):
  Stand-by off, Latch on = 0 0 0 1  < 1 >
  Absolute Lo, Balanced = 0 0 1 0  < 2 >
- Alarm 2 (40012):
  Stand-by on, Latch off = 0 0 1 0  < 2 >
  Band Outside = 1 0 0 1  < 9 >

See Setpoint Alarm Figures, Page 6, for illustrations of alarm operation.

**COMMUNICATIONS REGISTER (40023) AND COILS 1-8 TABLE**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Parity</th>
<th>Baud</th>
<th>Coil 8 B7*</th>
<th>Coil 7 B6</th>
<th>Coil 6 B5</th>
<th>Coil 5 B4</th>
<th>Coil 4 B3</th>
<th>Coil 3 B2</th>
<th>Coil 2 B1</th>
<th>Coil 1 B0</th>
<th>Coil 8 =0</th>
<th>Coil 8 =1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>300</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>&lt;20&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>600</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>&lt;21&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>1200</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>&lt;22&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>2400</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>&lt;24&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>4800</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>&lt;25&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>9600</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>&lt;26&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>19200</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>&lt;27&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B81,2</td>
<td>38400</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>&lt;29&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>300</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>&lt;2A&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>600</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>&lt;2B&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>1200</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>&lt;2A&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>2400</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>&lt;2B&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>4800</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>&lt;2C&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>9600</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>&lt;2D&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>8E1</td>
<td>19200</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
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* When reading register 40023, B7 will be a 0. When writing (changing IAMS communications to the new setting), change B7 to a 1.
**COMMUNICATIONS REGISTER (40023) AND COILS 1-8 TABLE (continued)**

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<th>Coil 5 ( B4 )</th>
<th>Coil 4 ( B3 )</th>
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* When reading register 40023, \( B7 \) will be a 0. When writing (changing IAMS communications to the new setting), change \( B7 \) to a 1.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL ICM4 - SERIAL CONVERTER MODULE (RS232C/RS485)

DESCRIPTION
The ICM4 Serial Converter Module provides the capability of interfacing equipment with RS485 serial communications to equipment with RS232 communications. Data format of the RS232 and RS485 equipment must be the same.

For full duplex (RS422), the DIP switch on the side of the module must be in the RS422 position. For half duplex (RS485), the DIP switch must be in the RS485 position. In half duplex mode, the RS485 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 RS485 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 RS232 TXD LED flashes when the module is transmitting, and a green RS232 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.

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.
   - Transmit Data Pin: ± 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: ± 0.2 VDC
5. RS485 Drive Disable Time: 4 msec. max.
6. MAXIMUM CABLE LENGTH:
   - RS232: 50 feet
   - RS485: 4000 feet
7. BAUD RATE: 9600 min., 19200 max.
8. CERTIFICATIONS AND COMPLIANCES:
   - SAFETY
     UL Recognized Component, File # E179259, UL3101-1, CSA C22.2 No. 1010-1
     Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
     IECSS CB Scheme Test Certificate # US/5141B/UL,
     CB Scheme Test Report # 01ME1540-0702001
     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
     - Electromagnetic RF fields EN 61000-4-3 Level 3; 8 Kv air
     - Fast transients (burst) EN 61000-4-4 Level 4; 2 Kv I/O
     - RF conducted interference EN 61000-4-6 Level 3; 2 Kv power
     - Simulation of cordless telephone ENV 50204 Level 3; 10 V/m
     - Emissions to EN 50081-1
     - RF interference EN 55022 Enclosure class B
     Refer to EMC Installation Guidelines for additional information.
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
   - 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 make the difference between a successful or a troublesome installation.

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

1. 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.

4. 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.

TYPICAL RS422 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. RS422 polarity: Terminal “A” is negative with respect to Terminal “B” in the mark (logic 1) condition.

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
**TYPICAL RS485 CONNECTIONS**

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 RS232 CONNECTIONS**

- **ICM4**
  - **RS232 DEVICE (25 pin)**
  - RECEIVE DATA ➔ 2 ➔ TRANSMIT DATA
  - TRANSMIT DATA ➔ 3 ➔ RECEIVE DATA
  - SIGNAL COMMON ➔ 7 ➔ SIGNAL COMMON
  - ICM4 connector pin #’s

- **ICM4**
  - **RS232 DEVICE (9 pin)**
  - RECEIVE DATA ➔ 2 ➔ RECEIVE DATA
  - TRANSMIT DATA ➔ 3 ➔ TRANSMIT DATA
  - SIGNAL COMMON ➔ 5 ➔ SIGNAL COMMON
  - ICM4 connector pin #’s

---

**TYPICAL CONNECTION FOR SINGLE UNIT**

**TYPICAL CONNECTION FOR MULTIPLE UNITS**

- **RS232/RS485 CONVERTER**
  - OFFICE COMPUTER (WITH RS232)
  - LGB
  - POWER SUPPLY

- **RS232/RS485 CONVERTER**
  - OFFICE COMPUTER (WITH RS232)
  - TCU/PCU
  - POWER SUPPLY

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Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
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No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

ORDERING INFORMATION

<table>
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<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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</thead>
<tbody>
<tr>
<td>ICM4</td>
<td>RS232/RS485 Converter Module</td>
<td>ICM40030</td>
</tr>
</tbody>
</table>

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 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.

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.

To install the ICM4 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.
DESCRIPTION

The ICM5 Serial Converter Module provides the capability of interfacing equipment with RS485 serial communications to equipment with RS232 communications while providing three way isolation. Data format of the RS232 and RS485 equipment must be the same.

The unit can be configured for full duplex (RS422), or half duplex (RS485) operation. In half duplex mode, the RS485 driver is automatically enabled using the leading edge of the first character that is received on the RS232 side. After the last character is received, the converter waits one character time (at the selected baud rate) to disable the RS485 driver.

An external DC power source (+9 to 26 VDC) is required to power the ICM5. The external power source and RS485 communications connections are made via a 7-position removable terminal block located on the front of the module. A modular RS485 connector is also provided for fast and efficient connection to other Red Lion devices that use a modular connector. The RS232 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 RS232 TXD LED flashes when the module is transmitting, and a green RS232 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. 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: ≥ +0.2 VDC
   - RS485 Drive Capability: Up to 32 RS485 receivers connected in parallel
   - RS485 Drive Disable Time: one character time (at the set baud rate)
4. MAXIMUM CABLE LENGTH:
   - RS232: 50 feet (15.24 m)
   - RS485: 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
   - Altitude: Up to 2000 meters
8. CERTIFICATIONS AND COMPLIANCES:

SAFETY

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 Certificate #US/5141A/UL,
CB Scheme Test Report #01ME11540-0702001
Issued by Underwriters Laboratories, Inc.
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
Electrostatic discharge
EN 61000-4-2 Level 2; 4 Kv contact
EN 61000-4-3 Level 3; 8 Kv air
Electromagnetic RF fields
EN 61000-4-4 Level 4; 2 Kv I/O
Fast transients (burst)
EN 61000-4-6 Level 3; 10 Vrms
RF conducted interference
EN 61000-4-6 Level 3; 2 Kv power
Emissions to EN 50081-1
RF interference
EN 55022 Enclosure class B

Note:
1. 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 green, 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.

1. 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.

4. 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 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
     - Concor #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.
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 RS485 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 KΩ 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.

Switches 8-9 - OFF 4 WIRE / ON 2 WIRE
These switches can be used to internally jumper the A and B lines of the RS485 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 RS485 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 RS485 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 RS232 side. When the RS485 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 allow the use of modern or null-modem cables. All of these switches should be in the DCE or DTE position. No other combinations are valid.
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 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.

**TYPICAL RS485 CONNECTIONS USING RJ-11**

**ORDERING INFORMATION**

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<thead>
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<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<tbody>
<tr>
<td>ICM5</td>
<td>RS232/RS485 Converter Module</td>
<td>ICM50000</td>
</tr>
<tr>
<td>CBJ</td>
<td>6&quot; RJ-11 Jumper Cable</td>
<td>CBJ11BD5</td>
</tr>
</tbody>
</table>

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL IFMA - DIN-RAIL FREQUENCY TO ANALOG CONVERTER

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 x 7.5 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.
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 KΩ pull-down resistor for sensors with current sourcing output. (Max. sensor output current = 24 mA @ 24 V output.)
   - Current Sinking: Internal 3.9 KΩ pull-up resistor for sensors with current sinking output. (Max. sensor current = 3 mA.)

Low Bias: Input trigger levels VIL = 0.25 V, VIH = 0.75 V; for increased sensitivity when used with magnetic pickups.
Hi Bias: Input trigger levels VIL = 2.5 V, VIH = 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. 1KΩ load (10 mA). Factory calibrated for loads greater than 1 MΩ.
   - 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.

DIMENSIONS In inches (mm)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
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<tbody>
<tr>
<td>IFMA</td>
<td>Pulse Rate to Analog Converter</td>
<td>IFMA0035 9 to 32 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IFMA0065 85 to 250 VAC</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.
10. **RESPONSE TIME**: 5 msec +1 period to 10 sec +1 period; user selectable
11. **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.
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**: 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.
     IECCE CB Scheme Test Certificate # UL1683A-176645/USA,
     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
     ENV 50141 - Radio-frequency conducted electromagnetic field
     EN 61000-4-2 - Electrostatic discharge (ESD)
     EN 61000-4-4 - Electrical fast transient/burst (EFT)
     EN 61000-4-8 - Power frequency magnetic field
   - **Notes**: 1. 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.
     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 (e.g., 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
   - **Altitude**: Up to 2000 meters
16. **CONSTRUCTION**: Case body is green, high impact plastic. Installation Category II, Pollution Degree 2
17. **WEIGHT**: 6 oz. (0.17 Kg)

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**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 ±0.1% of full scale for Operating Modes 2, 3, and 4. Operating Mode 1 is accurate to ±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 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).
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.

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
   - 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.

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.

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.
**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 \( V_{IL} = 2.5 \text{ V} \), \( V_{IH} = 3.0 \text{ V} \).

**S3 - OFF:** For increased sensitivity when used with magnetic pickups. Sets the input bias levels to \( V_{IL} = 0.25 \text{ V} \), \( V_{IH} = 0.75 \text{ V} \).

**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**

**DIP SWITCH DESCRIPTION SECTION**

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

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

( ) Indicates Configuration Section
### 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Operating Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 to 5 VDC</td>
</tr>
<tr>
<td>2</td>
<td>0 to 10 VDC</td>
</tr>
<tr>
<td>3</td>
<td>0 to 20 mA</td>
</tr>
<tr>
<td>4</td>
<td>4 to 20 mA</td>
</tr>
</tbody>
</table>

* 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

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 decimal point).

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.
3.0 Input Range Setting Using The Rotary Switch

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.

<table>
<thead>
<tr>
<th>Input Range Frequency</th>
<th>Resolution 6th digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 95.5 Hz</td>
<td>Example: 15,500 Hz</td>
</tr>
</tbody>
</table>

\[
\begin{array}{c|c}
0 & 9550003 \\
0 & 95502 \\
0 & 09551 \\
\end{array}
\]

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 Step 2.2), pauses, and repeats the value.

* If the new Input Range setting is acceptable, this section is complete*. Otherwise, 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

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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5 msec</td>
</tr>
<tr>
<td>1</td>
<td>10 msec</td>
</tr>
<tr>
<td>2</td>
<td>20 msec</td>
</tr>
<tr>
<td>3</td>
<td>50 msec</td>
</tr>
<tr>
<td>4</td>
<td>100 msec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>200 msec</td>
</tr>
<tr>
<td>6</td>
<td>500 msec</td>
</tr>
<tr>
<td>7</td>
<td>1 sec</td>
</tr>
<tr>
<td>8</td>
<td>5 sec (not valid for input range &gt; 3906 Hz)</td>
</tr>
<tr>
<td>9</td>
<td>10 sec (not valid for input range &gt; 3906 Hz)</td>
</tr>
</tbody>
</table>

* 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*. Otherwise, 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.
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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1024 times Input Range period (40 msec min., 10 sec max.)</td>
</tr>
<tr>
<td>1</td>
<td>10 msec (100 Hz)</td>
</tr>
<tr>
<td>2</td>
<td>20 msec (50 Hz)</td>
</tr>
<tr>
<td>3</td>
<td>50 msec (20 Hz)</td>
</tr>
<tr>
<td>4</td>
<td>100 msec (10 Hz)</td>
</tr>
<tr>
<td>5</td>
<td>200 msec (5 Hz)</td>
</tr>
<tr>
<td>6</td>
<td>500 msec (2 Hz)</td>
</tr>
<tr>
<td>7</td>
<td>1 sec (1 Hz)</td>
</tr>
<tr>
<td>8</td>
<td>5 sec (2 Hz)</td>
</tr>
<tr>
<td>9</td>
<td>10 sec (1 Hz)</td>
</tr>
</tbody>
</table>

* 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.

<table>
<thead>
<tr>
<th>Approximate Calibration Increments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROTARY SWITCH</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

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

Analog Output Minimum Value

6.1 Connect a current or volt meter of appropriate accuracy to the desired output pins (voltage or current)

6.2 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown. The Green input LED blinks slowly.

Analog Output Full Scale Value

6.1 Connect a current or volt meter of appropriate accuracy to the desired output pins (voltage or current)

6.2 Place DIP switch 4 to the ON position and DIP switches 5, 6, and 7 as shown. The Green input LED blinks slowly.
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 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 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.

The maximum output of the sensor using the following formula:

\[ \text{Max. Freq.} = \frac{\text{unit/measure} \times \text{pulses/unit}}{\text{seconds/measure}} \]

Set the Input Range with the rotary switch to 420 Hz.

6.0 Calibration (Cont’d)

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.

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.

The maximum output of the sensor using the following formula:

\[ \text{Max. Freq.} = \frac{\text{unit/measure} \times \text{pulses/unit}}{\text{seconds/measure}} \]

Set the Input Range with the rotary switch to 420 Hz.
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 other external input clears a latched trip condition when 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 x 7.5 and 35 x 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 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: (AC version only) +12 VDC ±25% @ 60 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 KΩ pull-down resistor for sensors with current sourcing output. (Max. sensor output current = 24 mA @ 24 V output.)
   Current Sinking: Internal 3.9 KΩ pull-up resistor for sensors with current sinking output. (Max. sensor current = 3 mA.)
   Low Bias: Input trigger levels VIL = 0.25 V, VIH = 0.75 V; for increased sensitivity when used with magnetic pickups.
   Hi Bias: Input trigger levels VIL = 2.5 V, VIH = 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).

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFMR0036</td>
<td>Speed Switch</td>
<td>9 to 32 VDC</td>
</tr>
<tr>
<td>IFMR0066</td>
<td></td>
<td>85 to 250 VAC</td>
</tr>
</tbody>
</table>

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

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

CAUTION: Risk of electric shock.
SPECIFICATIONS (Cont'd)

5. CONTROL INPUTS: Active low (VIL = 0.5 V max.) internally pulled up to 5 VDC through a 100 KΩ resistor (ISNK = 50 µA). 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.

9. 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
   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.
   IEC/CEC CB Scheme Test Certificate #UL1683A-176645/USA,
   CB Scheme Test Report # 97ME50135-042297
   Issued by Underwriters Laboratories, Inc.
   IEC 61010-1, EN 61600-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

   ELECTROMAGNETIC COMPATIBILITY
   Immunity to EN 60082-2
   Electrostatic discharge EN 61000-4-2 Level 2; 4 Kv contact
   Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m²
   Fast transients (burst) EN 61000-4-4 Level 2; 2 Kva I/O
   RF conducted interference EN 61000-4-6 Level 3; 10 V stimuli
   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 (e.g., making adjustments, setting switches, etc.), antistatic 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.
   Altitude: Up to 2000 meters

16. CONSTRUCTION: Case body is black, high impact plastic.

17. WEIGHT: 6 oz. (0.17 Kg)
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 operation 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 input signal. The actual response time is the Minimum Response Time plus 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 undetermined point 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 Offset 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-wire 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:
   - Corcom #1VR3
   - Schaffner # FN610-1.07 (RLC #LFIL0001)
   - Schaffner # FN675-1.07
   - 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.

![Output Wiring Diagram](image-url)
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.

The Model IFMR Speed Switch uses a comparator amplifier connected as a Schmitt trigger circuit to convert the input waveform 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.)

INPUT CIRCUITS, SENSOR CONNECTIONS AND CONFIGURATION SWITCH SET-UP

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

CONFIGURING THE IFMR

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 (½ sec on, ½ 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.

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

( ) Indicates Configuration Section

**INPUT CIRCUITS, SENSOR CONNECTIONS AND CONFIGURATION SWITCH SET-UP**

The Model IFMR Speed Switch uses a comparator amplifier connected as a Schmitt trigger circuit to convert the input waveform 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.)

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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.)

**MAGNETIC PICKUPS**

RECOMMENDED RULES FOR MAGNETIC PICKUP CONNECTIONS

1. Connect the shield to the common Terminal “9” at the input of the IFMR. DO NOT connect the shield at the pickup end. Leave the shield “open” at the pickup and insulate the exposed shield to prevent electrical contact with the frame or case. (Shielded cable, supplied on some RLC magnetic pickups, has open shield on pickup end.)

**SENSORS WITH CURRENT SINK OUTPUT (PNP O.C.)**

**SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.)**

**2-WIRE PROXIMITY SENSORS**

**OLDER STYLE RLC SENSORS WITH -EF OUTPUT**

**INPUT FROM CMOS OR TTL**

**CONFIGURING THE IFMR**

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 (½ sec on, ½ 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**

Operating Mode
Set Trip Frequency Using an Input Signal or Frequency Generator
Set Trip Frequency Using the Rotary Switch
Set Minimum Response Time
Set Relay Trip Point
Set Relay Release Point

**SECTION**

(1.0)
(2.0)
(3.0)
(4.0)
(5.0)
(6.0)

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

( ) Indicates Configuration Section

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
1.0 Operating Mode

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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Operating Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OVERSPEED trip, automatic Release upon return to normal</td>
</tr>
<tr>
<td>2</td>
<td>OVERSPEED latched trip, Release only after ALM Reset pulled to Common</td>
</tr>
<tr>
<td>3</td>
<td>UNDERSPEED trip, automatic Release upon return to normal</td>
</tr>
<tr>
<td>4</td>
<td>UNDERSPEED trip, start-up condition* ignored, automatic Release upon return to normal</td>
</tr>
<tr>
<td>5</td>
<td>UNDERSPEED latched trip, Release only after ALM Reset pulled to Common</td>
</tr>
<tr>
<td>6</td>
<td>UNDERSPEED latched trip, start-up condition* ignored, Release only after ALM Reset pulled to Common</td>
</tr>
</tbody>
</table>

* Refers to initial application of power to the IFMR, not the input frequency.

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.

1.6 If existing operating mode setting is your desired requirement, this section is complete*

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

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).

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.

2.5 Press the push-button. The Green input LED blinks the new Trip Frequency setting. This section is complete*

* 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.
3.0 Set Trip Frequency Using The Rotary Switch

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.

<table>
<thead>
<tr>
<th>Trip Frequency</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 5 of 6 digits</td>
<td>6th digit</td>
</tr>
</tbody>
</table>

Example: 95.5 Hz

Example: 15,500 Hz

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 Step
2.2), pauses, and repeats the value.

* 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.

4.0 Set Minimum Response Time

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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5 msec</td>
</tr>
<tr>
<td>1</td>
<td>10 msec</td>
</tr>
<tr>
<td>2</td>
<td>20 msec</td>
</tr>
<tr>
<td>3</td>
<td>50 msec</td>
</tr>
<tr>
<td>4</td>
<td>100 msec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>200 msec</td>
</tr>
<tr>
<td>6</td>
<td>500 msec</td>
</tr>
<tr>
<td>7</td>
<td>1 sec</td>
</tr>
<tr>
<td>8</td>
<td>5 sec (not valid for trip frequency &gt; 3906 Hz)</td>
</tr>
<tr>
<td>9</td>
<td>10 sec (not valid for trip frequency &gt; 3906 Hz)</td>
</tr>
</tbody>
</table>

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.
5.0 Set Relay Trip Point (Offset)

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.

- **Trip Frequency** = 250 Hz
- **Rotary Switch Setting** = 4 (2.00%)  
- **Offset Value** = 250 Hz x 2.00% (0.02) = 5 Hz

**Trip Point:**
- **OVERSPEED** = 250 + 5 = 255 Hz
- **UNDERSPEED** = 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.

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

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)

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.

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

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 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 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.

**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:

\[
\text{Trip Freq.} = \frac{\text{units/measure} \times \text{pulses/unit}}{\text{seconds/measure}}
\]

\[
\text{Trip Freq.} = \frac{2000 \text{ RPM} \times 60 \text{ PPR}}{60 \text{ sec}} = 2000 \text{ Hz}
\]

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**

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:

\[
\text{Trip Freq.} = \frac{\text{RPM} \times \text{PPR}}{60}
\]

\[
\text{Trip Freq.} = \frac{1250 \text{ RPM} \times 1 \text{ PPR}}{60 \text{ sec}} = 20.83 \text{ Hz}
\]

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

**TROUBLESHOOTING**

For further technical assistance, contact technical support at the appropriate company numbers listed.
MODEL IRMA - INTELLIGENT RTD MODULE WITH ANALOG OUTPUT

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.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>INPUT</th>
<th>RANGE</th>
<th>DIPT SWITCH TYPE RANGE</th>
<th>TEMPERATURE &amp; OHMS RANGE</th>
<th>RANGE ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD alpha = 0.00385</td>
<td>-160 to 654°C</td>
<td>-108 to 207°C</td>
<td>-5 to 414°C</td>
<td>194 to 608°C</td>
</tr>
<tr>
<td>RTD alpha = 0.00392</td>
<td>-157 to 640°C</td>
<td>-106 to 203°C</td>
<td>-5 to 406°C</td>
<td>190 to 596°C</td>
</tr>
<tr>
<td>OHMS</td>
<td>35.5 to 331.0 Ω</td>
<td>57.0 to 178.5 Ω</td>
<td>98.0 to 252.0 Ω</td>
<td>173.5 to 316.5 Ω</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRMA</td>
<td>Intelligent RTD Module</td>
<td>IRMA2003</td>
</tr>
</tbody>
</table>

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]
3. OUTPUT: 4 to 20 mA 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).

SERVICE & SUPPORT

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

Open Sensor Detection
The output can be set to 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 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 necessary. 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).
   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.
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
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 (loop-powered). 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

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUTPUT CAL</td>
</tr>
<tr>
<td>2</td>
<td>FIELD CAL</td>
</tr>
<tr>
<td>3</td>
<td>BASIC CAL</td>
</tr>
<tr>
<td>4</td>
<td>385/392</td>
</tr>
<tr>
<td>5</td>
<td>OPEN SEN DN/UP</td>
</tr>
<tr>
<td>6</td>
<td>RTD/OHMS</td>
</tr>
<tr>
<td>7</td>
<td>RANGE</td>
</tr>
</tbody>
</table>

Range switch settings (ON = 1  OFF = 0)

<table>
<thead>
<tr>
<th>RANGE</th>
<th>DIP SWITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RANGE</th>
<th>TEMPERATURE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>385</td>
<td>0</td>
<td>150°C to 606°C</td>
</tr>
<tr>
<td>392</td>
<td>0</td>
<td>150°C to 595°C</td>
</tr>
</tbody>
</table>

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
### 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.

#### Step 1.1

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.

#### Step 1.2

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)

#### Step 1.3

1.3 Set the FIELD CAL switch (#2) ON. [Current goes to 3.6 mA (nominal)]

#### Step 1.4

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.

#### Step 1.5

1.5 Set the OUTPUT CAL switch (#1) ON. [Current stays at 3.6 mA (nominal)]

#### Step 1.6

1.6 Adjust the input resistance up until the output equals 4 mA.

#### Step 1.7

1.7 Set the OUTPUT CAL switch (#1) OFF. [Current increases to 22.3 mA (nominal)]

#### Step 1.8

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.

#### Step 1.9

1.9 Set the OUTPUT CAL switch (#1) ON. [Current decreases to 20.5 mA (nominal)]

#### Step 1.10

1.10 Adjust the input resistance down until the output equals 20 mA.

#### Step 1.11

1.11 Set the OUTPUT CAL switch (#1) OFF.

#### Step 1.12

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

#### Step 1.13

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

---

**RTD temperature to resistance conversion table**

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

---

**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.
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&8), 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)
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.

TROUBLESHOOTING

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

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
**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.

**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.
2. **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 KΩ 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 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
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.

---

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

---

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRMA</td>
<td>Intelligent RTD Module</td>
<td>IRMA3035</td>
</tr>
</tbody>
</table>

---

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
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.

<table>
<thead>
<tr>
<th>INPUT</th>
<th>RANGE</th>
<th>DIP SWITCH</th>
<th>TYPE RANGE</th>
<th>TEMPERATURE</th>
<th>OHMS RANGE</th>
<th>RANGE ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD alpha = 0.00385</td>
<td>0 0 0 0 0</td>
<td>4 6 7 8</td>
<td>-160 to 654°C</td>
<td>±0.61°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 0 0 0 1</td>
<td></td>
<td>-108 to 207°C</td>
<td>±0.24°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 0 0 1 0</td>
<td></td>
<td>-5 to 414°C</td>
<td>±0.31°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 0 0 1 1</td>
<td></td>
<td>194 to 608°C</td>
<td>±0.31°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RTD alpha = 0.00392
| 0 1 0 0 0 | 1 0 1 0 1 | -157 to 840°C | ±0.60°C |
| 1 0 0 1 0 | -106 to 203°C | ±0.23°C | |
| 2 1 0 1 0 | -5 to 406°C | ±0.31°C | |
| 3 1 0 1 1 | 190 to 596°C | ±0.30°C | |

9. CERTIFICATIONS AND COMPLIANCES

9.1 SAFETY
IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use.

9.2 ELECTROMAGNETIC COMPATIBILITY

9.2.1 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/m²
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/m
150 KHz - 80 MHz
Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m

9.2.2 Emission to EN 50081-2
RF interference EN 55011 Enclosure class B

Note:
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 (e.g., 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

10.1 Operating Temperature Range: -25°C to 75°C (-13°F to 167°F)
10.2 Storage Temperature Range: -40 to 85°C (-40°F to 185°F)
10.3 Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from -25°C to 75°C.
10.4 Altitude: Up to 2000 meters

11. MOUNTING
11.1 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.
11.2 CONNECTION: Compression type terminal block

12. CONSTRUCTION
12.1 High impact black plastic case, Installation Category I, Pollution Degree 2.
12.2 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 # 0443162751 (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**

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.

**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**

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

**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.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RANGE</th>
<th>TEMPERATURE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>385</td>
<td>0</td>
<td>150°C to 606°C</td>
</tr>
<tr>
<td>392</td>
<td>0</td>
<td>150°C to 595°C</td>
</tr>
</tbody>
</table>

**TROUBLESHOOTING**

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

## Field Calibration Wiring

### RTD temperature to resistance conversion table

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

### 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.
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)

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. 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)]

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

4. Set the resistance source to 40 ohms and wait 5 seconds.

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

6. Set the resistance source to 60 ohms and wait 5 seconds.

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

8. Set the resistance source to 100 ohms and wait 5 seconds.

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

10. Set the resistance source to 175 ohms and wait 5 seconds.

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

12. Set the resistance source to 250 ohms and wait 5 seconds.

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

14. Set the resistance source to 315 ohms and wait 5 seconds.

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

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

17. Perform a Field Calibration. (See Section 1.0)
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.

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 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.

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.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 83-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL ITMA - INTELLIGENT THERMOCOUPLE MODULE WITH ANALOG OUTPUT

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 x 7.5 and 35 x 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.

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]
3. OUTPUT: 4 to 20 mA Linear output with Temperature or mV 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 + 0.25°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:

<table>
<thead>
<tr>
<th>TC (INPUT)</th>
<th>RANGE</th>
<th>TEMP. &amp; mV RANGE</th>
<th>RANGE ACCURACY</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0</td>
<td>-136 to 111°C</td>
<td>±0.19°C</td>
<td>White (+)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>69 to 575°C</td>
<td>±0.38°C</td>
<td>Yellow (+)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>338 to 800°C</td>
<td>±0.35°C</td>
<td>Blue (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-149 to 862°C</td>
<td>±0.76°C</td>
<td>Red (-)</td>
</tr>
<tr>
<td>K</td>
<td>0</td>
<td>-200 to 541°C</td>
<td>±0.56°C</td>
<td>Yellow (+)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>427 to 1132°C</td>
<td>±0.53°C</td>
<td>Brown (+)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>648 to 1372°C</td>
<td>±0.54°C</td>
<td>Blue (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-192 to 1372°C</td>
<td>±1.17°C</td>
<td>Red (-)</td>
</tr>
<tr>
<td>T</td>
<td>0</td>
<td>-225 to 149°C</td>
<td>±0.28°C</td>
<td>Blue (+)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>74 to 326°C</td>
<td>±0.19°C</td>
<td>White (+)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>68 to 400°C</td>
<td>±0.25°C</td>
<td>Blue (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-200 to 400°C</td>
<td>±0.45°C</td>
<td>Red (-)</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>-111 to 311°C</td>
<td>±0.32°C</td>
<td>Brown (+)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>276 to 609°C</td>
<td>±0.25°C</td>
<td>Blue (+)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>377 to 1000°C</td>
<td>±0.47°C</td>
<td>Violet (+)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-114 to 1000°C</td>
<td>±0.84°C</td>
<td>Brown (+)</td>
</tr>
<tr>
<td>mV</td>
<td>0</td>
<td>-9 to 6 mV</td>
<td>±0.0113 mV</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-9 to 22 mV</td>
<td>±0.0233 mV</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-9 to 63 mV</td>
<td>±0.0540 mV</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-9 to 77 mV</td>
<td>±0.0645 mV</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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

Note: DIP switch settings ON = 1 OFF = 0

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

5. TC BREAK DETECTION: Upscale to 22.5 mA (nominal) or Downscale to 3.5 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.
   Temperature Coefficient: ± 0.01% of input range per °C
   Ice Point Compensation: ± 0.75°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:
   SAFETY
   IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Electrostatic discharge
EN 61000-4-2 Level 2; 4 Kv contact
EN 61000-4-3 Level 3; 8 Kv air

Electromagnetic RF fields
EN 61000-4-3 Level 3; 10 V/m
EN 61000-4-4 Level 4; 2 Kv I/O
EN 61000-4-6 Level 3; 10 V/rms

Fast transients (burst)
EN 61000-4-4 Level 4; 2 Kv I/O
EN 61000-4-6 Level 3; 10 V/rms

RF conducted interference
EN 61000-4-6 150 KHz - 80 MHz

Emissions to EN 50081-2
EN 55011 Radiation immunity

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 E2-PROM. 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.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RANGE</th>
<th>TEMPERATURE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>3</td>
<td>-50°C to 500°C</td>
</tr>
<tr>
<td>K</td>
<td>3</td>
<td>-85°C to 790°C</td>
</tr>
<tr>
<td>T</td>
<td>3</td>
<td>-195°C to 162°C</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>3°C to 602°C</td>
</tr>
</tbody>
</table>

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**
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 (loop-powered). 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**

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUTPUT CAL</td>
</tr>
<tr>
<td>2</td>
<td>FIELD CAL</td>
</tr>
<tr>
<td>3</td>
<td>BASIC CAL</td>
</tr>
<tr>
<td>4</td>
<td>ICE PT EN/DIS</td>
</tr>
<tr>
<td>5</td>
<td>OPEN SEN DN/UP</td>
</tr>
<tr>
<td>6</td>
<td>TC TYPE</td>
</tr>
<tr>
<td>7</td>
<td>RANGE</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>TC TYPE</th>
<th>DIP SWITCH</th>
<th>RANGE</th>
<th>DIP SWITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0 0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>K</td>
<td>0 0 1</td>
<td>1 0</td>
<td>1 0</td>
</tr>
<tr>
<td>T</td>
<td>0 1 0</td>
<td>2 1</td>
<td>2 1</td>
</tr>
<tr>
<td>E</td>
<td>0 1 1</td>
<td>3 1</td>
<td>3 1</td>
</tr>
<tr>
<td>mV</td>
<td>1 1 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
1.11 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)

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.
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 mV/°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. [Current increases to 3.6 mA (nominal) or more]
4.0 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, 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&10), 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)
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.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL ITMA DC - INTELLIGENT THERMOCOUPLER MODULE WITH ANALOG OUTPUT

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: 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 KΩ 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. 600 Ω load (12 VDC) 4 to 20 mA through max. 600 Ω load (12 VDC) 15 mV peak to peak max. ripple across 600 Ω load (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: ± 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 V AC 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 + 0.25°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

DIMENSIONS

<table>
<thead>
<tr>
<th>In inches (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.12 (79.2)</td>
</tr>
<tr>
<td>1.08 (27.5)</td>
</tr>
</tbody>
</table>

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Fax +1 (717) 764-0839
www.redlion.net

Bulletin No. ITMA3-C
Drawing No. LP0405
Released 1/07

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
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:

<table>
<thead>
<tr>
<th>TC (Input)</th>
<th>RANGE</th>
<th>DIP SWITCH</th>
<th>TEMPERATURE &amp; mV RANGE</th>
<th>RANGE ACCURACY</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0</td>
<td>0 0 0 0 0</td>
<td>-136 to 111°C  +0.19°C</td>
<td>White (+) Yellow (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0 0 0 0 1</td>
<td>69 to 575°C   +0.38°C</td>
<td>Yellow (+) Brown (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0 0 0 1 0</td>
<td>338 to 800°C   +0.35°C</td>
<td>Blue (+) Yellow (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0 0 1 1 1</td>
<td>-149 to 862°C   +0.76°C</td>
<td>Violet (+) Brown (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>K</td>
<td>0</td>
<td>0 0 0 0 0</td>
<td>-200 to 541°C   +0.56°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0 0 0 0 0</td>
<td>427 to 1132°C  +0.53°C</td>
<td>Yellow (+) Brown (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0 0 1 1 0</td>
<td>648 to 1537°C  +0.54°C</td>
<td>Blue (+) Yellow (+)</td>
<td>Red (-) Blue (-)</td>
</tr>
<tr>
<td>T</td>
<td>0</td>
<td>0 0 0 1 0</td>
<td>-225 to 149°C   +0.28°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0 0 0 1 0</td>
<td>74 to 326°C    +0.19°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0 0 1 1 0</td>
<td>68 to 400°C    +0.25°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0 1 0 0 0</td>
<td>-119 to 157°C  +0.45°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>0 0 0 0 0</td>
<td>-111 to 311°C  +0.32°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0 0 1 1 0</td>
<td>276 to 609°C    +0.25°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0 1 1 1 0</td>
<td>377 to 1000°C   +0.47°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0 1 1 1 1</td>
<td>-114 to 1000°C  +0.84°C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>mV</td>
<td>0</td>
<td>1 1 1 0 0</td>
<td>-6 to 6 mV   ±0.0113 mV</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>1 1 1 0 1</td>
<td>-9 to 22 mV ±0.0233 mV</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 1 1 1 0</td>
<td>-9 to 63 mV ±0.0540 mV</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1 1 1 1 1</td>
<td>-9 to 77 mV ±0.0645 mV</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Note: DIP switch settings ON = 1 OFF = 0

Accuracy Example:
Type J: Range “0” (-136°C to 111°C)
-136°C - 111°C = ±0.94°C

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 TC Break Detection in the Specifications section. This setting is always active, so changes to the settings 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 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 must 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: Schaffner # FN610-1/07 (RLC #LFIL0000)
   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.

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 (e.g., 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:
   Process 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.

14. WEIGHT: 4.02 oz. (114.0 g)
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 ±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

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

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

<table>
<thead>
<tr>
<th>TC TYPE</th>
<th>DIP SWITCH</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0 0 0</td>
<td>9 10</td>
</tr>
<tr>
<td>K</td>
<td>0 0 1</td>
<td>0 1</td>
</tr>
<tr>
<td>T</td>
<td>0 1 0</td>
<td>2 1</td>
</tr>
<tr>
<td>E</td>
<td>0 1 1</td>
<td>3 1</td>
</tr>
<tr>
<td>mV</td>
<td>1 1 1</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>NOMINAL FACTORY FIELD CALIBRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>J</td>
</tr>
<tr>
<td>K</td>
</tr>
<tr>
<td>T</td>
</tr>
<tr>
<td>E</td>
</tr>
</tbody>
</table>

TROUBLESHOOTING

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

**CALIBRATION PROCEDURES**

**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.

**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.

1.9 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)**

**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 2.14) 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.

2.8 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.
3.0 Ice Point 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)

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 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+ 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 mV/°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]

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)

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. The Basic 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 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&10), TYPE (#6, #7, and #8), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON. The positions of switches #5 thru #10 are not relevant for this calibration procedure.

4.2 Apply power and allow a 30 minute warm-up period. [Output goes to -0.9 mA, 3.4 mA, or -0.5V nominal]

4.3 Using the temperature indicated by the precision thermometer, input an equivalent 1 mV/°C signal to the TC Input terminals and wait 5 seconds.

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

4.5 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]

4.6 Input -9 mV and wait 5 seconds.

4.7 Input 6 mV and wait 5 seconds.

4.8 Input 22 mV and wait 5 seconds.

4.9 Input 41 mV and wait 5 seconds.

4.10 Input 63 mV and wait 5 seconds.

4.11 Input 77 mV and wait 5 seconds.

4.12 Input 77 mV and wait 5 seconds.

4.13 Input 77 mV and wait 5 seconds.

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

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)
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITMA</td>
<td>Intelligent Thermocouple Module</td>
<td>ITMA3035</td>
</tr>
</tbody>
</table>

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 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.

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G 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.

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.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
GENERAL DESCRIPTION

The ITMS4037 Intelligent Temperature to MODBUS™ Conditioner with Alarms accepts a wide range of temperature sensors (thermocouple and RTD elements), and converts the signal into a register format that can be read using either ASCII or RTU MODBUS protocol.

The ITMS allows a choice of either Fahrenheit or Celsius readout with 0.1 or 1 degree of resolution. An offset value can be programmed to scale the input signal to meet most process requirements. Additionally, two setpoint values can be entered for dual relay process monitoring alarms.

The ITMS is programmed with Windows™ based SFIMS software. The software allows configuration, calibration, and storage of ITMS program files. Additionally, all setup parameters can be interrogated and modified through MODBUS register and coil commands.

The RS485 port allows the ITMS to be multidropped, with Baud rates up to 38400. The CBPRO007 programming cable converts the RS232 port of a PC to RS485, and is terminated with an RJ-11 connector. The bidirectional capability of the CBPRO0007 allows it to be used as a permanent interface cable as well as a programming cable.

The ITMS’s two relay alarms can be configured independently for absolute high or low acting with balanced or unbalanced hysteresis. Alarm 2 can also be configured for deviation and band alarms. In these modes, Setpoint 2 tracks Setpoint 1. Adjustable alarm trip delays can be used for delaying output response. The alarms can be programmed for Automatic or Latching. Latched alarms can be reset with a serial command or a user input. A standby feature suppresses the alarm during power-up until the temperature stabilizes outside the alarm region. Standby eliminates power-up tripping for low acting alarms. A user input can be used to set and reset non-latching alarms. The output relays can also be manually controlled with register commands.

The module’s high density packaging and DIN rail mounting saves time and panel space. The module is equipped with a universal mounting foot for attachment to standard DIN rails, including top hat (T) profile or G profile rail.

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

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITMS</td>
<td>Temperature to MODBUS Conditioner w/Alarms</td>
<td>ITMS4037</td>
</tr>
<tr>
<td>SFIMS</td>
<td>PC Configuration Software for Windows</td>
<td>SFIMS</td>
</tr>
<tr>
<td>CBPRO</td>
<td>Programming Interface Cable</td>
<td>CBPRO0007</td>
</tr>
<tr>
<td>CBJ</td>
<td>Cable RJ11 to Uterminated 7 foot length</td>
<td>CBJ11A07</td>
</tr>
<tr>
<td></td>
<td>Cable RJ11 to RJ11 6 inch jumper</td>
<td>CBJ11BD05</td>
</tr>
<tr>
<td></td>
<td>RJ Connector to Terminal Adapter</td>
<td>DRRJ11T6</td>
</tr>
</tbody>
</table>

UL Recognized Component, File # E179259

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

CAUTION: Risk of electric shock.

DIMENSIONS  In inches (mm)

<table>
<thead>
<tr>
<th>3.12 (79.2)</th>
<th>1.08 (27.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.20 REF (106.7)</td>
<td></td>
</tr>
</tbody>
</table>
SPECIFICATIONS
1. POWER: 18-36 VDC, 3.0 W max. or 24 VAC, ±10%, 50/60 Hz, 4 VA max.
2. INPUT:
   Sample Rate: 67 ms (15 Hz)
   Failed Sensor Response: Open or shorted (RTD only) sensor coils indication,
   error code returned in Process Value
   Common Mode Rejection: 50/60 Hz, 110 dB min.
   Overvoltage: 30 VDC
   Response Time: 150 msec. max.
3. THERMOCOUPLE INPUTS:
   Types: T, E, J, K, R, S, B, N, C, linear mV
   Input Impedance: 20 MΩ
   Lead Resistance Effect: 0.22 µV/Ω
   Resolution: 1° or 0.1° for all types

<table>
<thead>
<tr>
<th>TC TYPE</th>
<th>DISPLAY RANGE</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>-200 to +600°C</td>
<td>(+) blue</td>
</tr>
<tr>
<td></td>
<td>-328 to +752°F</td>
<td>(-) red</td>
</tr>
<tr>
<td>E</td>
<td>-200 to +750°C</td>
<td>(+) orange</td>
</tr>
<tr>
<td></td>
<td>-328 to +1382°F</td>
<td>(-) blue</td>
</tr>
<tr>
<td>J</td>
<td>-200 to +760°C</td>
<td>(+) yellow</td>
</tr>
<tr>
<td></td>
<td>-328 to +1400°F</td>
<td>(-) blue</td>
</tr>
<tr>
<td>K</td>
<td>-200 to +1372°C</td>
<td>(+) brown</td>
</tr>
<tr>
<td></td>
<td>-328 to +2502°F</td>
<td>(-) blue</td>
</tr>
<tr>
<td>R</td>
<td>0 to +1768°C</td>
<td>No Standard</td>
</tr>
<tr>
<td></td>
<td>+32 to +3214°F</td>
<td>(-) red</td>
</tr>
<tr>
<td>S</td>
<td>0 to +1768°C</td>
<td>No Standard</td>
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<tr>
<td></td>
<td>+32 to +3214°F</td>
<td>(-) red</td>
</tr>
<tr>
<td>B</td>
<td>0 to +1820°C</td>
<td>No Standard</td>
</tr>
<tr>
<td></td>
<td>+32 to +3214°F</td>
<td>(-) red</td>
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<td>N</td>
<td>-200 to +1300°C</td>
<td>(+) orange</td>
</tr>
<tr>
<td></td>
<td>-328 to +2372°F</td>
<td>(-) blue</td>
</tr>
<tr>
<td>C</td>
<td>0 to +2315°C</td>
<td>No Standard</td>
</tr>
<tr>
<td></td>
<td>+32 to +4199°F</td>
<td>NA</td>
</tr>
</tbody>
</table>

4. RTD INPUTS:
   Type: 2 or 3 wire
   Excitation: 150 µA
   Lead Resistance: 10 Ω max.
   Resolution: 1° or 0.1° for all types

<table>
<thead>
<tr>
<th>RTD TYPE</th>
<th>INPUT TYPE</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>385</td>
<td>100 Ω platinum, Alpha=0.00385</td>
<td>-200 to +800°C -328 to +1472°F</td>
</tr>
<tr>
<td>392</td>
<td>100 Ω platinum, Alpha=0.003919</td>
<td>-200 to +800°C -328 to +1472°F</td>
</tr>
<tr>
<td>672</td>
<td>120 Ω nickel, Alpha=0.00672</td>
<td>-80 to +260°C -112 to +500°F</td>
</tr>
<tr>
<td>Ohms</td>
<td>Linear Resistance</td>
<td>0 to 440 Ω</td>
</tr>
</tbody>
</table>

5. INDICATION ACCURACY: ±(0.3% of span, +1°C), includes NIST conformity, cold junction effect, A/D conversion errors, tempco and linearization conformity at 23°C after 20 minute warm-up.

6. USER INPUT: Internally pulled up to +5 VDC. VIL = 0.78 V max., VIH = 1.8 V min. VOFF = 9 µA max. 30 V max. over voltage continuously.

7. ISOLATION LEVEL: 1.5 KV @ 50/60 Hz, 1 minute (150 V working) between input, RS485 and power supply. 2300 Vrms, 1 minute (300 V working) to relay contacts.

8. SERIAL COMMUNICATIONS:
   Type: RS485; RTU and ASCII MODBUS modes
   Baud: 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400
   Format: 7/8 bit, odd, even and no parity
   Transmit Delay: Programmable. (See Transmit Delay explanation in Step 6)
   Transmit Enable (TXEN): (primarily for 20 mA loop converter) open collector
   VTH = 10 VDC max. VIL = 0.5 VDC at 5 mA max. current limit
   9. A/D CONVERTER: 16 bit resolution

10. RELAY OUTPUTS:
    Type: 1 Form A N.O. contacts, 1 Form C DPDT
    Rating: 5A @ 30 VDC or 250 VAC max. (resistive)
    1/10 HP @ 120 VAC (inductive)
    Response Time: 155 msec. max. to close including step response, 153 msec. max. to open.
    Output On Delay Time: Programmable from 0 to 32000 sec ±0.01% - 1 sec. max.

11. MEMORY: Nonvolatile EEPROM retains all programmable parameters.

12. 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 °C
    Altitude: Up to 2000 meters

13. CERTIFICATIONS AND COMPLIANCE:
    SAFETY
    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.
    CB Scheme Test Certificate # US/5141A/UL, CB Scheme Test Report # 01ME11540-0702001
    Issued by Underwriters Laboratories, Inc.
    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
    Electrostatic discharge EN 61000-4-2 Level 2; 4 KV contact
    Electromagnetic RF fields EN 61000-4-3 Level 3; 8 KV air¹
    Fast transients (burst) EN 61000-4-4 Level 4; 2 KV I/O
    RF conducted interference EN 61000-4-6 Level 3; 2 KV power
    Simulation of cordless telephone ENV 50204 Level 3; 10 V/m 900 MHz ± 5 MHz
    200 Hz, 50% duty cycle

    Emissions to EN 55011
    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 to the unit in environments with static levels above 6 KV, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making connections, etc.), typical anti-static precautions should be observed before touching the module.
    Refer to the EMC Installation Guidelines section of this bulletin for additional information.

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

15. CONNECTIONS: Wire clamping screw terminals.

16. MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50035 - 35 x 7.5 and -35 x 15, and G profile rail according to EN50035 - G32.

17. WEIGHT: 4.5 oz. (127.57 g)
**MODULE ISOLATION**

The ITMS features “4-way” signal isolation. The 4-way isolation is a combination of optical, transformer and relay barriers, providing common mode voltage (CMV) isolation to 1.5 KV for 1 minute between input, RS485, and power supply. Isolation between relay contacts and all other inputs is 2300 Vrms for 1 minute.

**LED FUNCTIONALITY**

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>GREEN LED</th>
<th>2 RED LEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Applied</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Communication Received</td>
<td>Flashing</td>
<td></td>
</tr>
<tr>
<td>Respective Alarm</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>Checksum error</td>
<td>Flashing</td>
<td>Flashing</td>
</tr>
<tr>
<td>Calibration</td>
<td>Off</td>
<td>On</td>
</tr>
</tbody>
</table>

**EMC INSTALLATION GUIDELINES**

Although this module is designed with a high degree of immunity to Electro-Magnetic 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 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 # ZCAT3015-1330A
   - Steward # 28B209-0A0
   Line Filters for input power cables:
   - Schaffner # FN610-1/07 (RLC # LFIL0000)
   - Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   
   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. When wiring the module, 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. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm), two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm) wires.

MODULE POWER CONNECTIONS
AC module power is connected to terminals 1 and 2. DC module power is connected with (+) to terminal 1 and (-) to terminal 2. For best results, the power should be relatively “clean” and within the specified limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off should be avoided. It is recommended that power supplied to the module be protected by a fuse or circuit breaker.

INPUT CONNECTIONS
Thermocouple Input
Thermocouple leads are connected to terminals 11 (+) and 12 (-).

RTD Input
For 3-wire RTD elements, connect the sense leads to terminals 11 and 12. The excitation lead is connected to terminal 10 (EXC).
For 2-wire RTD elements, connect the sense leads to terminals 11 and 12. Install a copper sense lead of the same gauge and length as the RTD leads. Attach one end of the wire at the probe and the other end to terminal 10. Complete lead wire compensation is obtained. This is the preferred method. If a sense wire is not used, then Terminal 11 should be shorted to terminal 10. A temperature offset error will exist. The error may be compensated by programming a temperature offset.

RELAY OUTPUT CONNECTIONS
Relay 1
Relay 1 is a Form A output relay. Wiring is connected between terminal 9 (COMM.) common and terminal 8 (N.O.) the normally open contact.

Relay 2
Relay 2 is a Form C output relay. Wiring is connected between terminal 4 (COMM.) common and either terminal 5 (N.O.), the normally open contact, or terminal 3 (N.C.), the normally closed contact.
To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contacts. Follow the manufacturer’s instructions for installation. Note: Snubber leakage current can cause some high impedance loads to be held ON.

DEFAULT SERIAL SETTING CONNECTION
If the ITMS settings are unknown, or forgotten, they can be reset to the factory defaults by connecting the Serial Default terminal 7 to Input Comm. terminal 12 with a jumper, and then cycling power. Defaults:
- Protocol: RTU
- Address: 247
- Data Bits: 8
- Parity: none
- Baud Rate: 9600

USER INPUT CONNECTION
The user input is activated when terminal 6 is pulled low (connected to Input Comm. terminal 12).

RS485 SERIAL CONNECTIONS
There are two RJ-11 connectors located on the bottom for paralleling communications. For single device communications, either connector can be used. When used in conjunction with Red Lion Control Paradigm HMI products, reverse A+ and B- wiring.

STEP 2 INSTALLING SFIMS (Software for Intelligent Modules)
Insert the SFIMS diskette into the A: or B: drive. Then Run A:\SETUP (or B:\SETUP) to install RLCPro onto the hard drive. An icon labeled RLCPro will be created under the group RLCPro.
STEP 3  PROGRAMMING - Getting Started

Run RLCPro by double-clicking the icon, or use the start menu.

Use the FILE pull-down menu to select a NEW file.

You will be prompted to select the proper device, and then the model.

STEP 4  PROGRAMMING THE INPUT

The ITMS receives a temperature sensor input, converts it to a raw digital value, and stores this number in the ADC Value (register 40001). This number is scaled into degrees, and a programmable Offset Value (register 40012), that can be used for sensor correction, is applied. The result is stored as the Temperature Value (register 40002). It is also stored in the IEEE 754 Standard 32-bit floating decimal format (register 40003 and 40004). The non-scaled ADC, the scaled Process Temperature Value, or the Floating Point Value may be accessed for the purpose of monitoring the input level.

**Input Type**: Select the proper input type from the pull down menu.

**Scale**: Select Fahrenheit or Celsius. In linear millivolt or resistance modes, this has no effect.

**Resolution**: For thermocouple, RTD, or linear resistance modes, low resolution selects whole degrees or ohms. In these same modes, high resolution selects tenth of degrees or ohms. In linear mV mode, low selects hundredths of mV, and high selects thousandths of mV.

**Offset**: The Offset value can be used as a sensor correction value.

**Filter Response**: The Filter Response is a time constant, in tenth of second increments, that is used to stabilize an erratic input. The Process Value stabilizes to 99% of the final value within approximately 5 time constants. A value of ‘0’ disables digital filtering.

**Filter Band**: Filter Band is a value expressed in Temperature (degrees or tenths) units. When a fluctuating signal remains within the band value, the Digital Filter is momentarily disabled to allow for quick response to valid process changes. Once the signal variation is less than the Filter Band value, the Digital Filter is reactivated.

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**STEP 5  PROGRAMMING THE ALARMS**

**Action:** Alarm 1 can be programmed for 5 modes of operation, Alarm 2 has 9 possible modes. See Setpoint Alarm figures for illustration.

**Manual:** In Manual mode, the Alarms are forced on and off by writing ‘0’ or ‘1’ to the appropriate MODBUS register (Alarm 1 state = 40027, Alarm 2 state = 40028). The alarms are configured for this action from the factory. In this mode, the alarms will not respond to their setpoint or hysteresis values.

**Absolute HI:** (with balanced or unbalanced hysteresis) The Alarm energizes when the Temperature Value exceeds the Setpoint Limit Value.

**Absolute LO:** (with balanced or unbalanced hysteresis) The Alarm energizes when the Temperature Value falls below the Setpoint Limit Value.

**Deviation HI, Deviation LO, Band Inside or Outside:** In these modes, Alarm 2 “tracks” Alarm/Setpoint 1.

**Setpoint:** The alarm Setpoint value, entered in degrees. If the ITMS is programmed for mV or resistance modes, then the Setpoint is in mV or Ohms, respectively.

**Hysteresis:** Hysteresis is used to eliminate output chatter. The Hysteresis Amount is the difference between the points where an Alarm will turn on and turn off. In Unbalanced modes, the alarm turns on at the Setpoint, and turns off at Setpoint minus hysteresis for HI alarms, and Setpoint plus hysteresis for LO alarms. In Balanced modes, the hysteresis is evenly divided above and below the Setpoint value. (See the Setpoint Alarm Figures.)

**Trigger Points:** Trigger Points are the Process Values where the alarm state changes. Their values cannot be entered directly, but are shown as a reference in the SFIMS software. The Setpoint Value, Hysteresis Value, and Setpoint Alarm Type determine the trigger points. With Deviation or Band modes, Setpoint 1 and Setpoint 2 are combined to determine the trigger points. Trigger Points cannot be greater than +32000 or less than -32000. If these limits are exceeded, the alarm is disabled and an alarm threshold over range error is set. The Trigger Points can be outside the Temperature Value range for a given sensor type without receiving an error, but the alarm will not change state for that trigger point.

**Reset:** The alarms can be programmed for Automatic or Latched. In Automatic mode, an energized alarm turns off by itself once the Process Value leaves the alarm region. In Latched mode, an energized alarm requires a reset from the User input, or a serial reset command. This is done by writing a ‘0’ to the appropriate MODBUS register. (Alarm 1 state = 40027, Alarm 2 state = 40028)

**On Delay:** The time, in whole second increments, that the alarm will take to energize when the Process Value enters into an alarm region.

**Enable Standby Delay:** Standby prevents nuisance (typically low level) alarms after a power up. After powering up the unit, the temperature must leave the alarm region. Once this has occurred, the standby is disabled, and the alarm responds normally until the next module power up.

**User Input Action:** The User Input can be programmed to Reset, or Set, either Alarm 1, Alarm 2, or both. The User Input is activated when terminal 6 is pulled low. (Connected to the Common terminal 12.)

**User Input Activation:** The User Input can be programmed to respond as a Level (maintained) or Edge (momentary) input. See the User Input Mode Operation Table below.

**Sensor Failure Action:** This setting allows different alarm responses when the temperature sensor fails. The ITMS can be programmed to turn one or both alarms on or off.

### USER INPUT MODE OPERATION

<table>
<thead>
<tr>
<th>INPUT ACTION</th>
<th>INPUT ACTIVATION</th>
<th>AUTOMATIC ALARM</th>
<th>LATCHED ALARM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IN ALARM REGION</td>
<td>OUTSIDE ALARM REGION</td>
</tr>
<tr>
<td>Reset</td>
<td>Edge</td>
<td>Resets and puts the alarm in Standby mode; resets alarm if in Hysteresis band</td>
<td>No action</td>
</tr>
<tr>
<td>Set</td>
<td>Edge</td>
<td>No action</td>
<td>No action</td>
</tr>
<tr>
<td>Reset</td>
<td>Level</td>
<td>Resets alarm while input is active, resumes normal operation when input is inactive; resets alarm if in Hysteresis band</td>
<td>No action</td>
</tr>
<tr>
<td>Set</td>
<td>Level</td>
<td>No action</td>
<td>Sets alarm while input active, resumes normal operation when input is inactive</td>
</tr>
</tbody>
</table>
**SETPOINT ALARM FIGURES**

**STEP 6  PROGRAMMING THE ITMS COMMS PORT**

**MODBUS Protocol:** RTU or ASCII

- **BAUD**
  - RTU: 38400 2 msec., 19200 3 msec., 9600 5 msec., 4800 9 msec., 2400 17 msec., 1200 33 msec., 600 65 msec., 300 129 msec.
  - ASCII: 2 msec., 2 msec., 2.3 msec., 4.6 msec., 9.2 msec., 18.4 msec., 36.7 msec., 73.4 msec.

- **Unit Address:** 1-247
- **Baud Rate:** 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400
- **Data Bits:** 7 or 8
- **Parity:** odd, even, or none
- **Transmit Delay:** Programmable from 1-255 milliseconds. The Transmit Delay is the time the ITMS waits to respond to a serial command, UNLESS the values in the table are larger.

**Communications Diagnostics:** The Communications Diagnostics function can be used to troubleshoot systems that are experiencing communication errors. Press the Read button to retrieve the diagnostics information. The Commands Received and the Commands Processed values are automatically reset when the values are read, and at each unit power-up.

**Commands Received:** The number of messages received that started with the units own address.

**Commands Processed:** The number of “good” messages received. A “good” message is considered one that contained the correct unit address, parity, and checksum (CRC or LRC).
STEP 7  PC PORT CONFIGURATION

Go to the SETTINGS pull-down menu, and select PC PORT SETTINGS.

The Communications Settings window allows you to set up the software properly to perform a download.

**Connection**: Select the computer port (COMM 1-4) that the ITMS is connected to.

**Note**: The following settings must match the ITMS. If you do not know or cannot recall the ITMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud, 8 data bits, No parity, with an address of 247.

**Protocol**: RTU or ASCII

**Unit Address**: 1-247

**Baud Rate**: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400

**Data Bits**: 7 or 8

**Parity**: odd, even, or none

**Note**: The CBPRO007 download cable DOES NOT typically require power. In most cases it will derive its power from the PC. If communications can not be established, follow the troubleshooting guide. If it is determined that the converter requires power, attach a 12 VDC power supply to the VDC and common terminals of the cable.

Connect the ITMS to the computer with the CBPRO007 interface cable (or any suitable RS232/RS485 converter). Apply 18-36 VDC to the supply terminals of the ITMS.

STEP 8  DOWNLOADING

Go to the FILE pull-down menu, and select DOWNLOAD.

The following screen prompts you to ensure that the proper file is downloaded to the correct module. Click “OK” to continue.
**STEP 9  SCRATCH PAD MEMORY**

The Scratch Pad category can be used to read or write to the Scratch Pad memory locations (41101-41116). The Scratch Pad locations can be used to store user information.

**Data Format:** Allows registers to be viewed in decimal or hexadecimal format.

**Upload:** The Upload button causes SFIMS software to read the Scratch Pad registers from the module.

**Download:** The Download button causes SFIMS software to write to the Scratch Pad registers in the module.

*Note:* Downloading new values to the module Scratch Pad locations overwrites the information that is currently stored in those registers.

**STEP 10  VIEW REGISTERS**

The View Registers category can be used as a method of diagnostics. Use the ITMS Register Table as a reference of register assignments and data.

**First Register:** This specifies the first, or only, register to be read in a block.

**# of Registers:** This is the length of the block to be read. The module supports block read and write commands up to 16 registers in length.

**Data Format:** Allows registers to be viewed in decimal or hexadecimal format.

**Read:** Clicking the Read button causes SFIMS software to read the selected register from the module.

**Write:** Clicking the Write button causes SFIMS software to write the selected registers to the module.

*Note:* The Write button overwrites the existing register values, and may change the module setup and operation.

**STEP 11  CALIBRATION**

The ITMS is fully calibrated from the factory. Recalibration is recommended every two years. Each range has its own internal references that are recalled when the range is selected. This allows independent calibration for each range. All calibration settings are stored in the E2PROM. Calibration may be performed by using SFIMS software or MODBUS commands.

RTD and CJ calibrations are dependent on the millivolt calibration and, therefore, must be performed after a millivolt calibration has been completed. RTD or CJ calibration may be performed independently of the millivolt calibration.

**Calibration Type:** This specifies the type of calibration to be performed.

**Cold Junction Calibration:**

- **TC Type:** This selects the type of TC that is being used to calibrate the cold junction.
- **Scale:** This selects the scale in which the Thermometer temperature is entered and the Module temperature is displayed.
- **Thermometer:** Enter the reference thermometer temperature here.
- **Module:** This displays the ITMS process temperature value after a cold junction calibration is completed to verify the accuracy.

**Calibrate:** The Calibrate button initiates the calibration process after the appropriate settings are selected.

*Note:* Millivolt calibration requires a precision voltage source with an accuracy of 0.025% or better. Allow the ITMS to warm up for 30 minutes minimum and follow the manufacturer’s warm-up recommendations for the calibration source. RTD calibration requires a 0.1% precision 300 ohm resistor. CJ calibration should be performed with a TC of known accuracy of types T, E, J, K, C or N only. When using SFIMS for calibration, select the type of calibration to be performed, and press the Calibrate button. Follow the calibration procedures in the software.
**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 ITMS 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 ITMS 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 chemical company wanted to remotely monitor the temperature of several holding tanks. Using the ITMS, the customer was able to receive, interpret, and store the temperature readings via standard thermocouples. To provide a remote display, the customer chose a Red Lion Paradigm HMI (Human Machine Interface). The HMI communicates with the ITMS modules and displays the information graphically, providing an intuitive interface. As an added benefit, the ITMS alarm setpoints can be adjusted from the HMI, while providing reliable local alarm outputs.

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**TROUBLESHOOTING**

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED will not light</td>
<td>Module power</td>
<td>Check module power connections and voltage level</td>
</tr>
<tr>
<td>Process Value not changing</td>
<td>Input signal</td>
<td>Check input signal connections and signal level</td>
</tr>
<tr>
<td>Process Value not changing or incorrect</td>
<td>Incorrect scaling</td>
<td>Check input setup, scaling values, and re-download</td>
</tr>
<tr>
<td>Alarms disabled</td>
<td>Alarm threshold over range*, checksum error, Input over/under range; open or shorted probe*; calculated results over +32000 or -32000; in Calibration Mode</td>
<td>Adjust alarm Setpoint and Hysteresis to ensure trigger point is within -32000 to +32000 (See Alarm setup). For other possible causes, see the remaining remedies</td>
</tr>
<tr>
<td>Process Value stays at 32001 or -32001</td>
<td>Input over or under range* due to: Wrong TC, or RTD Incorrect input type</td>
<td>Check input level Check input type, and re-download</td>
</tr>
<tr>
<td>Process Value stays at 32002</td>
<td>Open TC or RTD*</td>
<td>Check input signal connections and probe</td>
</tr>
<tr>
<td>Process Value stays at -32002</td>
<td>Shorted RTD*</td>
<td>Check input signal connections and probe</td>
</tr>
<tr>
<td>Process Value stays at +32003 or -32003</td>
<td>Calculated Temp. value over +32000 or -32000</td>
<td>Check offset value, Register 40012</td>
</tr>
<tr>
<td>Process Value stays at 32100, Flashing LEDs, alarms disabled</td>
<td>Parameter checksum*, loss of parameter settings Calibration checksum*</td>
<td>Re-download SFIMS file (reconfigures each parameter) Perform calibration procedure</td>
</tr>
<tr>
<td>Will not communicate (Green LED not flashing)</td>
<td>Incorrect serial settings (ITMS port) Incorrect serial settings (computer port) Incorrect wiring</td>
<td>Verify ITMS communications setup Go to pull down menu SETTINGS, PC PORT SETTINGS Try switching A+ and B- lines Provide a common connection</td>
</tr>
</tbody>
</table>

* Can be monitored by accessing coils 9-16, or register 40025.
For further technical assistance, contact technical support.

---

NOTE: The ITMS’ serial settings must match the device that it is communicating with. If you do not know or cannot recall the ITMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud, 8 data bits, no parity, with an address of 247.

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MODBUS INFORMATION

The remaining sections of this bulletin list ITMS Register Format information and MODBUS conformity.

MODBUS SUPPORTED FUNCTION CODES

FC01: Read Coils
1. Valid coil addresses are 1-16.
2. Only 16 coils can be requested at one time.
3. Block starting point can not exceed coil 16.

FC05: Force Single Coil
1. Valid write (force) coil addresses are 1-10.
2. <8001> HEX is echoed back that the coil did not change during the request to write to a read only coil.

FC15: Force Multiple Coils
1. Valid write (force) coil addresses are 1-10.
2. Block starting point can not exceed coil 10.
3. If a multiple write includes read only coils, then only the write coils will change.

FC03: Read Holding Registers
1. Valid addresses are 40001-40099, 41001-41010, 41101-41116.
2. Only 16 registers can be requested at one time.
3. Block starting point can not exceed the register boundaries.
4. <8000> HEX is returned in registers beyond the boundaries.
5. Holding registers are a mirror of Input registers.

FC06: Preset Single Register
1. Valid write (preset) addresses are 40006-40009, 41101-41116.
2. <8001> HEX is echoed back that the register did not change during the request to write to a read only register.
3. If the write value exceeds the register limit (see Register Table), then that register value changes to its exceeded high or low limit. It is also returned in the response.

FC16: Preset Multiple Registers
1. Valid write (force) register addresses are 40006-40009, 41101-41116.
2. No response is given with an attempt to write to more than 16 registers at a time.
3. Block starting point can not exceed the read and write boundaries.
4. If a multiple write includes read only registers, then only the write registers will change.
5. If the write value exceeds the register limit (see Register Table), then that register value changes to its exceeded high or low limit.

FC04: Read Input Registers
1. Valid addresses are 30001-30029, 31001-31010, 31101-31116.
2. Only 16 registers can be requested at one time.
3. Block starting point can not exceed register boundaries.
4. <8000> HEX is returned in registers beyond the boundaries.
5. Input registers are a mirror of holding registers.

FC08: Diagnostics
The following is sent upon FC08 request:
Unit Address, 08 (FC code), 04 (byte count), “Total Comm” 2 byte count, “Total Good Comm” 2 byte count, checksum of the string.
“Total Comm” is the total number of messages received that were addressed to the ITMS. “Total Good Comm” is the total messages received by the ITMS with good address, parity and checksum. Both counters are reset to 0 upon response to FC08.

FC17: Report Slave ID
The following is sent upon FC17 request:
Unit Address, 17 (FC code), RLC-ITMS4037, 0100 (for code version 1.00), 16 (number of read supported registers), 16 (number of writes supported registers), 16 (number of registers available for GUID/Scratch pad memory), checksum of the string.
The following is the HEX of the above (with unit address of 247):
<F7><11><14><52><4C><43><2D><49><54><4D><53><34><30><33><37><01><00><10><00><10><00><10><8D><9F>

SUPPORTED EXCEPTION CODES

01: Illegal Function
Issued whenever the requested function is not implemented in the unit.

02: Illegal Data Address
Issued whenever an attempt is made to access a single register or coil that does not exist (outside the implemented space) or to access a block of registers or coils that falls completely outside the implemented space.

03: Illegal Data Value
Issued when an attempt is made to read or write more registers or coils than the unit can handle in one request.

07: Negative Acknowledge
Issued when a write to a coil or register is attempted with an invalid string length.

CHECKSUM ERRORS
1. Calibration checksum covers the E2 PROM that contains calibration values for all ranges. When a calibration checksum error occurs, coil 10 becomes a 1. (See Coils Table)
2. Parameter checksum covers the E2 PROM that contains the stored Holding register settings. When a parameter checksum error occurs, coil 9 becomes a 1. (See Coils Table)
3. All of the LEDs will flash as long as either error occurs.
4. The alarms are disabled as long as either error occurs.
5. Either error can be cleared or activated manually by writing to the appropriate coil. (This does not correct the reason for the error. It may be necessary to reconfigure or calibrate.)
6. Both checksums are verified at power up.

CALIBRATION
Calibration may be performed by using SFIMS software, or MODBUS commands. Review Calibration explanation in Step 11, before performing these steps.

mV Calibration
1. Connect the signal source to proper ITMS terminals.
2. To set Input Type, enter 9 into register 40009.
3. To start calibration, enter <7777> HEX into register 40029.
4. To start ADC calibration, enter <0001> HEX into register 40029.
5. Apply the appropriate voltage and enter the corresponding <HEX value into register 40029 for each range to be calibrated.
0 mV <0002>, 14 mV <0003>, 28 mV <0004>, 42 mV <0005>, 56 mV <0006>
6. To save the values and end calibration, enter <0000> HEX into register 40029.

CJ Calibration
Note: In this procedure, write functions are performed in HEX and a write to a register is monitored by a read in a different register.
1. Connect the thermocouple probe source to the proper ITMS terminals. (Types T, E, J, K, N and C only).
2. To set Input Type, enter connected TC type into register 40008.
3. To set Scale, enter 1 for °C or 0 for °F into register 40006.
4. To set High Resolution, enter 1 into register 40009.
5. Place an external reference thermometer probe at the end of the ITMS probe. The two probes should be shielded from air movement and allow sufficient time to equalize in temperature. (As an alternative, the ITMS probe may be placed in a calibration bath of known temperature.)
6. To start calibration, enter <7777> HEX into register 40029.
7. To start CJ calibration, enter <0010> HEX into register 40029.
8. Read the Process Temperature Value register 40002 (Read as an Integer).
9. Subtract the external reference reading from the Process Temperature Value register 40002 reading. Adjust the results to hundredths position, drop decimal point, and maintain the results sign. (If the difference is >2.0 degrees, then adjust to -2.0 and remove decimal point yielding a value of -200.)
10. Enter <0011> HEX into register 40029.
11. Add the value from step 9 (maintain the sign) to the value existing in register 40007 (Read as an integer).
12. If necessary, continue to adjust register 40007 value until the Process Temperature Value register 40002 matches the external reference reading.
13. To save the values and end calibration, enter <0000> HEX into register 40029.

RTD Calibration
2. To set Input Type, enter 13 (Integer) or <000D> HEX into register 40008.
3. To start calibration, enter <7777> HEX into register 40029.
4. To start 0 ohm RTD calibration, enter <0015> HEX into register 40029.
5. Apply 0 ohms by shorting terminals 11 & 12 for 10 seconds.
6. To start 300 ohm RTD calibration, enter <0016> HEX into register 40029.
7. Apply 300 ohms by removing short from terminal 11 for 10 seconds.
8. To save the values and end calibration, enter <0000> HEX into register 40029.
## REGISTER TABLE

The below limits are shown as Integers or HEX < > values. Read and write functions can be performed in either Integers or HEX as long as the conversion was done correctly. Negative numbers are represented by two’s complement.

<table>
<thead>
<tr>
<th>REGISTER ADDRESS</th>
<th>REGISTER NAME</th>
<th>LOW LIMIT†</th>
<th>HIGH LIMIT†</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>ADC reading</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>ADC (Analog to Digital Converter) reading of present input level.</td>
</tr>
<tr>
<td>40002</td>
<td>Process Temperature Value</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>Process Value (with scale and offset) of present input level.</td>
</tr>
<tr>
<td>40003</td>
<td>Floating Point LO</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>IEEE Standard 754 Floating Decimal Point, low order of Temperature Value. (Allows 32 bit accuracy for external monitoring.)</td>
</tr>
<tr>
<td>40004</td>
<td>Floating Point HI</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>IEEE Standard 754 Floating Decimal Point, high order of Temperature Value. (Allows 32 bit accuracy for external monitoring.)</td>
</tr>
<tr>
<td>40005</td>
<td>User Input Pin State</td>
<td>N/A</td>
<td>N/A</td>
<td>Read Only</td>
<td>0 = Active, 1 = Inactive.</td>
</tr>
<tr>
<td>40006</td>
<td>Temperature Scale</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = °F, 1 = °C.</td>
</tr>
<tr>
<td>40007</td>
<td>CJ Temp</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>Cold Junction calibration temp (1 = 0.01°C).</td>
</tr>
<tr>
<td>40008</td>
<td>Input Type</td>
<td>0</td>
<td>13</td>
<td>Read/Write</td>
<td>See Input Type Register Table.</td>
</tr>
<tr>
<td>40009</td>
<td>High Resolution</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>0 = 1 degree, 1 = 0.1 degree.</td>
</tr>
<tr>
<td>40100</td>
<td>Filter Band</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>See Filter Band explanation.</td>
</tr>
<tr>
<td>40101</td>
<td>Filter Response Time</td>
<td>0</td>
<td>1000</td>
<td>Read/Write</td>
<td>See Filter Response Time explanation (1 = 0.1 second).</td>
</tr>
<tr>
<td>40102</td>
<td>Offset Value</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>See Offset explanation.</td>
</tr>
<tr>
<td>40103</td>
<td>User Input Action</td>
<td>&lt;0000&gt;</td>
<td>&lt;0015&gt;</td>
<td>Read/Write</td>
<td>See User Input Action Register Table.</td>
</tr>
<tr>
<td>40104</td>
<td>Alarm 2 Action</td>
<td>&lt;0000&gt;</td>
<td>&lt;0038&gt;</td>
<td>Read/Write</td>
<td>See Alarm 1 &amp; 2 Action Register Table.</td>
</tr>
<tr>
<td>40105</td>
<td>Setpoint 2 Value</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 setpoint value based on Process Value.</td>
</tr>
<tr>
<td>40106</td>
<td>Alarm 2 Hysteresis</td>
<td>1</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 hysteresis value based on Process Value.</td>
</tr>
<tr>
<td>40107</td>
<td>Alarm 2 Delay</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 2 delay trip on time (1 = 1 second).</td>
</tr>
<tr>
<td>40108</td>
<td>Alarm 1 Action</td>
<td>&lt;0000&gt;</td>
<td>&lt;0034&gt;</td>
<td>Read/Write</td>
<td>See Alarm 1 &amp; 2 Action Register Table.</td>
</tr>
<tr>
<td>40109</td>
<td>Setpoint 1 Value</td>
<td>-32000</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 setpoint value based on Process Value.</td>
</tr>
<tr>
<td>40110</td>
<td>Alarm 1 Hysteresis</td>
<td>1</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 hysteresis value based on Process Value.</td>
</tr>
<tr>
<td>40111</td>
<td>Alarm 1 Delay</td>
<td>0</td>
<td>32000</td>
<td>Read/Write</td>
<td>Alarm 1 delay trip on time (1 = 1 second).</td>
</tr>
<tr>
<td>40112</td>
<td>Sensor Failure Action</td>
<td>0</td>
<td>3</td>
<td>Read/Write</td>
<td>See Sensor Failure Action For Alarm State Table.</td>
</tr>
<tr>
<td>40113</td>
<td>Transmit Delay</td>
<td>1</td>
<td>255</td>
<td>Read/Write</td>
<td>Delay before serial transmission (1 = 1 msec). See Transmit Delay Explanation.</td>
</tr>
<tr>
<td>40114</td>
<td>Node (Unit) Address</td>
<td>1</td>
<td>247</td>
<td>Read/Write</td>
<td>Node serial ITMS address.</td>
</tr>
<tr>
<td>40115</td>
<td>Error Coils</td>
<td>&lt;0000&gt;</td>
<td>&lt;0003&gt;</td>
<td>Read/Write</td>
<td>Mirror of Coils 9-16. See Coil Table.</td>
</tr>
<tr>
<td>40116</td>
<td>Comm. Coils</td>
<td>&lt;0020&gt;</td>
<td>&lt;00FF&gt;</td>
<td>Read/Write</td>
<td>Mirror of Coils 1-8. See Coil Table and Communications Table.</td>
</tr>
<tr>
<td>40117</td>
<td>Alarm 1 State</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>Alarm 1 state (1 = on).</td>
</tr>
<tr>
<td>40118</td>
<td>Alarm 2 State</td>
<td>0</td>
<td>1</td>
<td>Read/Write</td>
<td>Alarm 2 state (1 = on).</td>
</tr>
<tr>
<td>40119</td>
<td>Factory Calibration</td>
<td>&lt;0000&gt;</td>
<td>&lt;7777&gt;</td>
<td>Read/Write</td>
<td>See MODBUS Calibration explanation.</td>
</tr>
<tr>
<td>41001-41010</td>
<td>Slave ID</td>
<td>See FC17.</td>
<td>See FC17.</td>
<td>Read Only</td>
<td>ITMS-4037, 0100 (ver. 1.00); 16 reads, 16 writes, 16 scratch. The version value could be higher.</td>
</tr>
<tr>
<td>41101-41116</td>
<td>GUID/Scratch</td>
<td>&lt;0000&gt;</td>
<td>&lt;FFFF&gt;</td>
<td>Read/Write</td>
<td>This area is for the user to store any related information. This register area does not affect ITMS operations.</td>
</tr>
</tbody>
</table>

* For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.
† An attempt to exceed a limit will set the register to its high or low limit value.

## COILS TABLE (COMMUNICATION AND ERRORS)

<table>
<thead>
<tr>
<th>COIL ADDRESS</th>
<th>COIL NAME</th>
<th>ACCESS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baud B0</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>2</td>
<td>Baud B1</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>3</td>
<td>Baud B2</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>4</td>
<td>Parity B3</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>5</td>
<td>Parity B4</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>6</td>
<td>Data Bits B5</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>7</td>
<td>Mode B6</td>
<td>Read/Write</td>
<td>See Communication Register and Coils Table.</td>
</tr>
<tr>
<td>8</td>
<td>Change B7</td>
<td>Read/Write</td>
<td>&quot;1&quot; = Change ITMS communications to above settings.</td>
</tr>
<tr>
<td>9</td>
<td>P Checksum Error</td>
<td>Read/Write</td>
<td>&quot;1&quot; = Parameter checksum error, disables alarms, causes flashing LEDs.</td>
</tr>
<tr>
<td>10</td>
<td>C Checksum Error</td>
<td>Read/Write</td>
<td>&quot;1&quot; = Calibration checksum error, disables alarms, causes flashing LEDs.</td>
</tr>
<tr>
<td>11</td>
<td>AL 1 Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Alarm 1 Threshold over range, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>12</td>
<td>AL 2 Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Alarm 2 Threshold over range, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>13</td>
<td>Open Input</td>
<td>Read Only</td>
<td>&quot;1&quot; = Open RTD or TC, causes Process Temp. Value to be 32002, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>14</td>
<td>Over Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Over Range, causes Process Temp. Value to be 32001, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>15</td>
<td>Under Range</td>
<td>Read Only</td>
<td>&quot;1&quot; = Under Range, causes Process Temp. Value to be -32001, disables alarms, causes no LED indication.</td>
</tr>
<tr>
<td>16</td>
<td>Shorted RTD</td>
<td>Read Only</td>
<td>&quot;1&quot; = Shorted RTD, causes Process Temp. Value to be -32002, disables alarms, causes no LED indication.</td>
</tr>
</tbody>
</table>

Coils 1-7 mirror register 40026 and Coils 9-16 mirror register 40025.
**INPUT TYPE REGISTER (40008) TABLE**

<table>
<thead>
<tr>
<th>MODE</th>
<th>TYPE</th>
<th>MODE</th>
<th>TYPE</th>
<th>MODE</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Tc - T</td>
<td>5</td>
<td>Tc - S</td>
<td>10</td>
<td>RTD - 385</td>
</tr>
<tr>
<td>1</td>
<td>Tc - E</td>
<td>6</td>
<td>Tc - B</td>
<td>11</td>
<td>RTD - 392</td>
</tr>
<tr>
<td>2</td>
<td>Tc - J</td>
<td>7</td>
<td>Tc - N</td>
<td>12</td>
<td>RTD - 672</td>
</tr>
<tr>
<td>3</td>
<td>Tc - K</td>
<td>8</td>
<td>Tc - C</td>
<td>13</td>
<td>LIN Ohms</td>
</tr>
<tr>
<td>4</td>
<td>Tc - R</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**USER INPUT ACTION REGISTER (40013) TABLE**

<table>
<thead>
<tr>
<th>MODE</th>
<th>ACTION</th>
<th>ALARM</th>
<th>INPUT ACTIVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0000&gt;</td>
<td>Reset</td>
<td>1</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0001&gt;</td>
<td>Reset</td>
<td>2</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0002&gt;</td>
<td>Reset</td>
<td>1 &amp; 2</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0003&gt;</td>
<td>Set</td>
<td>1</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0004&gt;</td>
<td>Set</td>
<td>2</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0005&gt;</td>
<td>Set</td>
<td>1 &amp; 2</td>
<td>Level (Maintained)</td>
</tr>
<tr>
<td>&lt;0010&gt;</td>
<td>Reset</td>
<td>1</td>
<td>Edge (Momentary)</td>
</tr>
<tr>
<td>&lt;0011&gt;</td>
<td>Reset</td>
<td>2</td>
<td>Edge (Momentary)</td>
</tr>
<tr>
<td>&lt;0012&gt;</td>
<td>Reset</td>
<td>1 &amp; 2</td>
<td>Edge (Momentary)</td>
</tr>
<tr>
<td>&lt;0013&gt;</td>
<td>Set</td>
<td>1</td>
<td>Edge (Momentary)</td>
</tr>
<tr>
<td>&lt;0014&gt;</td>
<td>Set</td>
<td>2</td>
<td>Edge (Momentary)</td>
</tr>
<tr>
<td>&lt;0015&gt;</td>
<td>Set</td>
<td>1 &amp; 2</td>
<td>Edge (Momentary)</td>
</tr>
</tbody>
</table>

**SENSOR FAILURE ACTION REGISTER (40022) TABLE FOR ALARM STATE CONDITION**

<table>
<thead>
<tr>
<th>MODE</th>
<th>ALARM 1</th>
<th>ALARM 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>1</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>2</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>3</td>
<td>On</td>
<td>Off</td>
</tr>
</tbody>
</table>

**ALARM 1 (40018) & 2 (40014) ACTION REGISTER TABLE**

<table>
<thead>
<tr>
<th>Stand By</th>
<th>Latched</th>
<th>OFF=Auto</th>
<th>B7</th>
<th>B6</th>
<th>B5</th>
<th>B4</th>
<th>2nd Nibble HEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>off</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>&lt;0&gt;</td>
</tr>
<tr>
<td>on</td>
<td>off</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>&lt;1&gt;</td>
</tr>
<tr>
<td>on</td>
<td>on</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>&lt;3&gt;</td>
</tr>
</tbody>
</table>

Examples:
- Alarm 1 (40018):
  - Stand-by off, Latch on = 0 0 1 1 <1>
  - Absolute Lo, balanced = 0 0 1 0 <2>
  - Deviation Hi = 5 2 0 1 1 <5>

- Alarm 2 (40014):
  - Stand-by on, Latch off = 0 0 1 0 <2>
  - Band Outside = 0 1 1 1 <7>
  - Band Inside = 8 2 1 0 0 <8>

**COMMUNICATIONS REGISTER (40026) AND COILS 1-8 TABLE**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Parity</th>
<th>Baud</th>
<th>Coil 8 B7*</th>
<th>Coil 7 B6</th>
<th>Coil 6 B5</th>
<th>Coil 5 B4</th>
<th>Coil 4 B3</th>
<th>Coil 3 B2</th>
<th>Coil 2 B1</th>
<th>Coil 1 B0</th>
<th>Coil 8 =0 B7</th>
<th>Coil 8 =1 B7</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTU</td>
<td>B1N.2</td>
<td>300</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>&lt;20&gt;</td>
<td>&lt;21&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B1N.2</td>
<td>600</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>&lt;21&gt;</td>
<td>&lt;22&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B1N.2</td>
<td>1200</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>&lt;23&gt;</td>
<td>&lt;24&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B1N.2</td>
<td>2400</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>&lt;23&gt;</td>
<td>&lt;25&gt;</td>
</tr>
<tr>
<td>RTU</td>
<td>B1N.2</td>
<td>4800</td>
<td>0 / 1</td>
<td>0</td>
<td>1</td>
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* When reading register 40026, B7 will be a 0. When writing (changing ITMS communications to the new setting), change B7 to a 1.
LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
The PAPBH Paradigm PROFIBUS Host Adapter provides a communication channel from a PROFIBUS-DP EN50170 Network to a Paradigm Operator Interface (HMI). The PROFIBUS Network is connected to the PAPBH (Paradigm PROFIBUS Host Adapter) through a 9-pin sub-miniature D-type female connector. The PROFIBUS Network is isolated from the control electronics using high-speed opto-couplers and isolated from the supply with a DC/DC converter. Three LED’s provide status information.

The PAPBH can be base mounted (using the 4 holes provided in the base plate) or DIN rail mounted (using the optional DIN rail mounting kit).

In normal operation the PAPBH is intended to be connected via it’s HMI port to the programming port of the HMI. Database download can still be carried out via a connection from the PC to the PC port of the PAPBH. All connections are made using standard Red Lion Controls programming cables. Configuration is by the PROFIBUS Network Driver installed on the HMI programming port.

On power up the PAPBH polls the HMI for its Station Address and configuration. During start up the PROFIBUS master attempts to parameterize and configure the PAPBH. Following start up, data is exchanged between the PAPBH and the HMI.

**PNO Conformance and GSD file**

The PAPBH has passed the conformance test for PROFIBUS-DP Slave Devices, Certificate No. Z00584. The PNO Identifier for this PROFIBUS device is 0x00FC. The characteristics are described in GSD file PCL00FC.GSD. A disk containing the GSD file and bitmap is included with each PAPBH.

**SPECIFICATIONS**

1. **POWER REQUIREMENTS:** 11 to 30 VDC @ 3.0 W
   Power Up Current: 3 A @ 2 msec
   Must use a Class 2 or SELV rated power supply.
2. **SERIAL PORTS:**
   PC Port: RS232 on an RJ-11 jack.
   HMI Port: RS232 on an RJ-11 jack.
   ProfiBus Port: RS485 on a DB9 connector
3. **PHYSICAL DIMENSIONS:** L = 5.52" (140.2 mm), W = 4.52" (114.8 mm), H = 1.76" (44.7 mm)
4. **CONSTRUCTION:** Steel base plate and cover. Installation Category I, Pollution Degree 2
5. **ENVIRONMENTAL CONDITIONS:**
   Operating Temperature: 0 to 40 °C
   Storage Temperature: -20 to 80 °C
   Operating and Storage Humidity: 80% max. relative humidity (non-condensing) from 0 °C to 40 °C.
   Altitude: Up to 2000 meters

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**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**

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<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<td>PROFIBUS Host Adapter</td>
<td>PAPBH000</td>
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<td></td>
<td>PAPBH DIN Rail Mounting Kit (Includes 4 clips and 8 screws)</td>
<td>PAPBHDIN</td>
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<td></td>
<td>Programming Cable</td>
<td>P890301Z</td>
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**DIMENSIONS In inches (mm)**

- DIN roll
- 4X DIN roll clips (optional)
- 4X mounting holes for panel mounting (Max. size: ¥3 screws)
6. 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

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/m 1
150 KHz - 80 MHz

Emissions to EN 50081-2
RF interference EN 55011 Enclosure class A
Power mains class A

Note:
1. Self-recoverable loss of performance during EMI disturbance at 10 Vrms:
   For operation without loss of performance:
   Install 1 ferrite core RLC #FCOR0000 or equivalent, to power cable at unit.
   I/O cables are routed in metal conduit connected to earth ground.

7. FIELD CONNECTIONS: Removable screw terminal blocks.

8. WEIGHT: 1.25 lb (0.58 kg)

STATUS LED’s

Three LED’s provide status indication and are described in Table 1. The PROFIBUS–DP state machine is indicated by the data, WD and DP LED’s and are described in Table 2.

Table 1
Paradigm PROFIBUS Host Adapter Status LED Description

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<th>NAME</th>
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<tr>
<td>WD</td>
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<td>Watchdog State Machine State</td>
</tr>
<tr>
<td>DP</td>
<td>Red</td>
<td>DP Control State Machine State</td>
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Table 2
Led Indication of Paradigm PROFIBUS Host Adapter State in PROFIBUS-DP Slave State Machine

<table>
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<th>DATA LED (Red)</th>
<th>WD LED (Green)</th>
<th>DP LED (Red)</th>
<th>PARADIGM PROFIBUS HOST ADAPTER STATE</th>
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</thead>
<tbody>
<tr>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>Baud Search state</td>
</tr>
<tr>
<td>OFF</td>
<td>FLASHING</td>
<td>OFF</td>
<td>Baud Control State</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>Waiting for Parameterization Telegram</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>FLASHING</td>
<td>Waiting for Configuration Telegram</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>Data Exchange State</td>
</tr>
</tbody>
</table>

WIRING AND CONNECTIONS

POWER SUPPLY REQUIREMENTS
The Operator Interface requires an 11 to 30 VDC power supply rated at 2.25 W unless otherwise stated on the label.

- The terminal may take as little as 100 mA in certain circumstances, so be sure that the chosen power supply can operate correctly with this load. Large switch-mode supplies tend to need a certain minimum load before they will operate correctly.

- In any case, it is very important that the power supply is mounted correctly if the unit is to operate reliably. A very high proportion of reported problems are caused by incorrect power supply installation, so 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 of cable between the supply and the PAPBH. Ideally, as short a length as is possible should be used.

- The wire used to connect the PAPBH’s power supply should be of at least 22 gauge wire. If a longer cable run is used, you should use a heavier gauge wire. The routing of the cable should be kept away from large contactors, inverters and other devices which may generate significant electrical noise.

RS232 PORT PIN OUT
Both HMI and PC ports are RS-232 ports and have the same pin-out described below. The following illustration and table gives the pin-out of these ports to enable such connections to be made.

<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RTS</td>
</tr>
<tr>
<td>2</td>
<td>Tx</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
<tr>
<td>5</td>
<td>Rx</td>
</tr>
<tr>
<td>6</td>
<td>CTS</td>
</tr>
</tbody>
</table>

The above table denotes the pin names of the RS-232 port. When connecting, the pin name at the port is connected to the opposite of that pin name at the destination device.

PROFIBUS CONNECTION
It is recommended that PROFIBUS plug connector such as Siemens part 6ES7 972 – 0BA00 – 0XA0 be used. If the PAPBH is the last unit on the network, set the terminating resistor switch to the “ON” position.

TROUBLESHOOTING
For further technical assistance, contact technical support at the appropriate company numbers listed.
**INSTALLATION ENVIRONMENT**

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.

**MOUNTING**

The PAPBH can be base mounted or installed using the optional DIN rail mounting kit.

**DIN RAIL MOUNTING**

- "T" style DIN rail
- (4) mounting clips (optional)
- (8) #4 x 5/16" screws (supplied w/ optional mounting clips)

**APPLICATION**

This drawing shows a typical PROFIBUS Application.
**PROFIBUS NETWORK DRIVER APPLICATION NOTE**

**Introduction**
The PAPBH is a gateway that allows a Paradigm Operator Interface access to a PROFIBUS-DP Network. The Host Adapter is connected to the Operator Interface programming port allowing data transfer with Internal Communications Blocks. The PAPBH is auto-configuring for all PROFIBUS properties such as baud rate, but needs a Station Address configured by the Operator Interface. These are set up using the PROFIBUS Network Driver described here.

**Configuration**
The Station Address and Input and Output Data Container Blocks are set in the Configuration Edit dialog from the Select Communications Driver dialog. The Station Address has a default value of 126 and must be in the range 1 to 125 for normal operation.

The Input and Output Data Container Blocks are the data buffers that the PROFIBUS Network writes data to, and reads data from. These correspond to Internal Communications Blocks and as such these must be set up in the Communications Block Table. A maximum of 116 words may be transferred per block. Data flow is described with respect to the PROFIBUS Network - thus Input Data is written to the PROFIBUS Network and Output Data is read from the PROFIBUS Network.

**Example**
This example shows the PROFIBUS Node configured as Station Address 5, Communications Block A as Input Data and Communications Block B as Output Data.

### Driver Configuration

<table>
<thead>
<tr>
<th>PROFIBUS DP-SLAVE CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Station Address</td>
</tr>
<tr>
<td>Input Data Container Block</td>
</tr>
<tr>
<td>Output Data Container Block</td>
</tr>
</tbody>
</table>

### Communication Block Configuration

<table>
<thead>
<tr>
<th>COMMUNICATION BLOCKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEVICE</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
</tbody>
</table>

---

**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at the Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (PL 90-513) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (PL 93-637), as now in effect or as amended hereinafter.

No warranties expressed or implied are created with respect to the Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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DESCRIPTION

The Model PRA1 is a convenient plug-in module that provides voltage and current analog output signals proportional to the pulse-rate (frequency) of the input signal. In typical applications, the PRA1 input is supplied by a machine mounted sensor that generates a signal which has a frequency proportional to machine or process speed. The PRA1 converts the frequency content of this signal to analog form for operating chart recorders, supplying speed control signals, or driving other controls and indicators that require analog input.

The PRA1 develops an internal “constant-area” pulse from the trailing (negative going) edge of each input pulse or waveform cycle. These “Constant-area” pulses are fixed in voltage amplitude and time duration. The PRA1 then takes the average of a train of these pulses to generate an output signal that will deliver either 0 to 1 or 4 to 20 mA, as determined by a set-up switch.

These units are available in five overlapping adjustable range ratings, each rating providing a calibration adjustment to deliver maximum output over an input frequency range of approximately 3.3:1. Since the PRA1 monitors the voltage output and produces a current output signal that will deliver either 0 to 1 or 4 to 20 mA, as determined by a set-up switch.

These units are available in five overlapping adjustable range ratings, each rating providing a calibration adjustment to deliver maximum output over an input frequency range of approximately 3.3:1. Since the PRA1 monitors the voltage output and produces a current output signal that will deliver either 0 to 1 or 4 to 20 mA, as determined by a set-up switch.

The internal filtering supplied for averaging purposes is kept to a minimum in order to provide the fastest practical response time for each range rating. Additional external capacitance can be added to provide more filtering if required.

The plug-in module mates with a heavy duty, CSA approved base mounting socket with pressure clamp screw terminals that accept stripped wires without lugs. Closed back construction allows mounting directly on metal panel without an insulation barrier.

Note: Not recommended for closed loop speed control. Refer to the RLC Catalog for the MDC - Motor Drive Controller.

SPECIFICATIONS

1. PRIMARY SUPPLY VOLTAGE: Available for 115 or 230 VAC ±10%, 50/60 Hz; 2.5 V A (See Ordering Information).
2. SENSOR OUTPUT POWER: +12 VDC ±5% regulated, 60 mA max.
3. SIGNAL INPUT CHARACTERISTICS: See “PRA1 & PRS1 Input Circuits, Sensor Connections & Configuration Switch Set-ups” section.
4. FREQUENCY RANGES AVAILABLE: (See Ordering Information)
5. SIGNAL VOLTAGE OUTPUT: 0 to 10 V DC @ 10 mA max.
6. SIGNAL CURRENT OUTPUT (Selectable):
   0 to 1 mA into load resistance range 0 to 4 KΩ
   4 to 20 mA into load resistance range 0 to 250 Ω.
7. LINEARITY: ±0.25% of full range setting.
8. VOLTAGE/CURRENT OUTPUT TRACKING: Current Signals follow voltage signals within ±3% of full range setting.
9. RESPONSE TIME: See table on next page.
10. OPERATING TEMPERATURE RANGE: 0 to 60°C.
11. WEIGHT: PRA1 - 8 oz (226.8 g); Mating 12-Pin Socket - 2 oz (56.7 g).

DIMENSIONS “In inches (mm)”
**PRA1 APPLICATION CONSIDERATIONS**

**CONNECTIONS & SET-UP ADJUSTMENTS**

![Connection Diagram](image)

**VOLTAGE OUTPUT ADJUSTMENT:**

Only the RANGE ADJUSTMENT is effective when voltage output is used. (Zero Adjustment affects only current output.)

**PROCEDURE**

Apply the maximum input frequency and set the *RANGE ADJUSTMENT to obtain the desired output voltage.

**CURRENT OUTPUT ADJUSTMENTS:**

When current output is used, the ZERO ADJUSTMENT must be set before RANGE ADJUSTMENT setting is attempted.

**PROCEDURE**

1. Select current range (0-1, or 4-20 mA) with switch S4.
2. Connect a milliammeter in series with the current loop circuit from Term 1 to Term 3. CAUTION: DO NOT exceed maximum load resistance specified for the current range.
3. Zero Adjustment:
   - A) 0-1 mA Range - With input signal removed (zero frequency) turn ZERO ADJUST CW until positive current flow is indicated. Then, turn back CCW until the current flow just reaches zero. Stop turning the adjustment at that point.
   - B) 4-20 mA Range - Set ZERO ADJUST until current is 4 mA.
4. Range Adjustment: Apply maximum frequency input signal and set RANGE ADJUSTMENT to get desired output.

* RANGE ADJUSTMENT - Turning CW decreases output at a given frequency (increases range) and turning CCW increases output (decreases range). To calibrate the RANGE ADJUST, apply a known oscillator frequency to the input, or operate the sensor-equipped machine at a known speed and frequency. Then, set the output as required.

**ADJUSTABLE RANGE RATINGS & OVER RANGE OPERATION**

The Transfer Curve (at left) shows the frequency-input/voltage-output relationship for the PRA13021 for both Min. Range (0-1 KHz) and Max. Range (0-3 KHz) adjustment. These curves are typical and apply to all PRA1 ranges.

As shown by these curves, the PRA1 RANGE ADJUSTMENT allows the unit to be calibrated to deliver full scale output for any input frequency from the min. to max. range ratings. As long as the input frequency is equal-to or less-than the full-scale range setting, the PRA1 is operating in its linear region and the output voltage or current will be proportional to input frequency. If the input frequency exceeds the full-scale range setting (over range), the output will flatten out and saturate at some level above 10 V at all higher frequencies.

**CAUTION:** Maximum input frequency for PRA1 modules is 10 KHz. At input frequencies in excess of 10 KHz, the frequency roll-off characteristics of the input circuit will cause signal dropout and result in discontinuous operation.

**OUTPUT RESPONSE & RIPPLE CHARACTERISTICS**

PRA1 Modules are supplied with a minimum amount of output ripple filtering in order to avoid compromising response-time. The data presented below, permits a reasonable estimate of the amount of ripple and the response-time that will be experienced in a particular application. As shown by the curves below, the amount of output ripple depends on the range setting and the input frequency.

Ripple voltage can be reduced by adding external filter capacitance, but ripple-reduction is a trade-off against increased response times. This must be kept in mind, especially if the PRA1 is to be used to supply feedback control signals.

The values of capacitance given in the table are for reference only and do not imply a limit to the amount of capacitance that can be added. For example, an external filter capacitance may be 10 times the reference values shown for a very high degree of ripple reduction, provided that the resulting long response time is acceptable.

**Note:** If large capacitor values are required to achieve a high degree of ripple reduction, tantalum capacitors rated at 35 V or more are recommended. (Proper polarity must be observed. See Connection Drawing above.)

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>FULL SCALE RANGE</th>
<th>RESPONSE TIME</th>
<th>RIPPLE CURVE</th>
<th>EXT CAP (REF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRA1103-1 OR -2 3 KHz 10 KHz 8 msec C 0.047 mfd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRA1302-1 OR -2 1 KHz 3 KHz 10 msec B 0.1 mfd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRA1102-1 OR -2 0.3 KHz 1 KHz 25 msec A 0.22 mfd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRA1301-1 OR -2 100 Hz 300 Hz 75 msec A 0.56 mfd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRA1101-1 OR -2 30 Hz 100 Hz 250 msec A 2.2 mfd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] RESPONSE TIME - Time required for the output to reach 90% of final value when the frequency is instantly changed from 0 to full-scale range frequency.


[3] External Capacitance can be added between terminals 10 and 11 to decrease ripple. Reference values shown in MFD, will reduce ripple approximately 50% and will roughly double response times.

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**PRA1 & PRS1**

**INPUT CIRCUITS, SENSOR CONNECTIONS & CONFIGURATION SWITCH SET-UP**

The Model PRS1 Speed Switch and the Model PRA1 Pulse-Rate to Analog Converter both use the circuit shown on the right. The circuit uses a comparator amplifier connected as a Schmidt trigger circuit to convert the input waveform 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 pull-down resistor for sensors with sourcing output. (Maximum sensor output current is 12 mA @ 12 V output.)

**S2 - ON:** Sets bias of input to trigger at \( V_{IL} = 2.5 \text{ V} \), \( V_{IH} = 3.0 \text{ V} \); for logic level signals.

**OFF:** Sets the bias of input to trigger at \( V_{IL} = 0.25 \text{ V} \), \( V_{IH} = 0.75 \text{ V} \); for increased sensitivity when used with magnetic pickups.

**S3 - ON:** Connects a 3.9 K pull-up resistor for sensors with current sinking output. (Maximum sensor current is 3 mA.)

**OTHER CHARACTERISTICS & SPECIFICATIONS**

**Maximum Operating Frequency:** 10 KHz with maximum pulse width ON and OFF times of 50 µsec.

**Maximum Input Voltage:** Pin 7 (Input) may be driven from an external voltage up to ±90V provided S1 and S3 are “OFF” to disconnect internal load resistors. (Maximum Input Voltage with S1 “ON” is ±16 V)

**Input Impedance:** With S1 and S3 “OFF”, the resistive input impedance exceeds 1 Megohm, as long as Pin 7 voltage is greater than zero and less than +12 V.

**Paralleling With a Counter and/or Rate Indicator Inputs:** The PRS1 and PRA1 can be operated from a common sensor with current sinking output that is also used to drive the input of a Counter or Rate Indicator. Connect Pin 8 to the Common Terminal and Pin 7 to the Input Terminal of the Counter or Rate Indicator; set S1 and S3 “OFF” and S2 “ON”. DO NOT PARALLEL CONNECT THE +12V OUTPUTS (Pin 9) OF PRS1 AND PRA1 UNITS WITH THE +12V OUTPUTS OF COUNTERS, DITAKS, OR OTHER PRS1 OR PRA1 UNITS. These units have regulated supplies that will not load-share. Multiple inputs cannot be operated from sensing switches, 2-wire proximity sensors, or magnetic pickups.

**CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS**

### MAGNETIC PICKUPS

- **PRA1 OR PRS1**
  - Input
  - COM.
  - +12V

### SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.)

### RLC SENSOR MODELS:
- ASTC, LPSC, LSC, RPGC, RGBG, RGBH, RGBQ, HESS, etc.

### SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.)

### 2-WIRE PROXIMITY SENSORS

### OLDER STYLE RLC SENSORS WITH -EF OUTPUT

### A.C. INPUTS FROM INVERTERS, A.C. TACHOMETERS, GENERATORS, ETC.

- **R** - Resistor to limit input current to 5 mA peak
- **C** - Filter cap required when input A.C. has “ringing” characteristics with inverters.

A.C. Power sources exceeding 50 V output should be coupled with an isolation transformer.

**INPUT FROM CMOS OR TTL**

The addition of two external resistors and a capacitor allows the PRS1 to be operated from input signals generated by a switch contact. The external RC network forms a Low-Pass Filter which operates in conjunction with the hysteresis of the input circuit to "De-bounce" the Switch Contact signal.

Use of the Low-Pass RC Filter places a high-speed restriction on the circuit, and it cannot be used at frequencies of more than 200 to 300 cps. However, Switch Contact input is normally limited to low speed operation, so this does not impose a serious restriction.

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PRA1 & PRS1 SENSOR & FREQUENCY RANGE SELECTION

Both the PRA1 Pulse-Rate to Analog Converter and the PRS1 Speed-Switch normally operate from a variable frequency signal supplied by a machine mounted sensor. The sensor signal varies in frequency in direct proportion to machine speed, and may be a sinusoidal, triangular, square, or pulse-type waveform. The sensor arrangement can take a variety of forms such as a Magnetic Pickup or Proximity Sensor detecting passing teeth on a sprocket or gear, a Photo-Electric Scanner viewing passing pulse spleys, a Rotary Pulse Generator coupled to a machine shaft, or a Length Sensor driven by a web or ribbon of material passing through the machine. (See Sensor Section of the catalog for more information on sensors.)

Since both the PRA1 and PRS1 operate from the frequency content of the incoming signal, the response time of both devices is also related to the signal frequency. This gives rise to the cardinal rule of selecting a sensor arrangement:

**WHEN RESPONSE TIME IS IMPORTANT, SELECT A SENSOR ARRANGEMENT & LOCATION THAT WILL PROVIDE A HIGH FREQUENCY OUTPUT AT OPERATING SPEED.**

When a PRA1 or PRS1 application is first contemplated, it seems to be natural to think in terms of applying the sensor to the low speed end of the power drive train. In some cases this may be the only practical location for the sensor, and if fast response is needed from the PRA1 or PRS1, a sensor arrangement capable of delivering a high number of cycles or pulses/revolution (PPR) will be required. In a great number of applications however, generating a higher frequency sensor signal is simply a matter of locating the sensor on a intermediate or high speed shaft such as directly on the drive motor shaft.

Another advantage of moving the sensor location up toward the high speed end of the drive train is that the shaft rotary motion is usually much smoother and more regular. Slow speed shafts will often rotate irregularly due to gear backlash, “stop” in couplings, or slack in chain drives. This irregular motion can have an adverse effect on the resulting output, especially when using the PRS1 to perform a speed switching function near normal running speed.

**SELECTING AN APPROPRIATE SENSOR ARRANGEMENT**

There are no exact rules governing the selection of a sensor arrangement since machine geometry and conditions can vary widely from one application to the next. However, the following generalized criteria will prove useful as guidelines toward selecting the best sensor arrangement. (See Sensor Section of the catalog for more information.)

**ULTRA-LOW SHAFT SPEEDS (10RPM or less)** - Proximity Sensors, Photo-Electric Scanners, or Rotary Pulse Generators, are usually the best selections. In most ultra-low speed applications, it is advisable to provide as many pulses per revolution as possible (high PPR) to get acceptable response times.

**LOW-SHAFT SPEEDS (10-1000 RPM)** - LMPC (Super-Sensitive Magnetic Pickup), Proximity Sensors, Photo-Electric Scanners and RPG’s can usually be applied in this speed range.

**INTERMEDIATE SHAFT SPEEDS (10-1000 RPM)** - Magnetic Pickups, the LMPC, RPG’s and some Proximity Sensors are appropriate at these speeds.

**HIGH-SHAFT SPEEDS (1000 RPM and up)** - Magnetic Pickups, the LMPC and RPG’s are usually the best choices.

**FOR LINEAR SPEEDS ON PAPER WEBS, TEXTILE, RIBBON, STRIP AND WIRE** - The LSC Length Sensor may prove desirable.

**CAUTION:** When selecting a sensor for operation at any speed, make sure the sensor is also capable of delivering an output for the entire speed range up through maximum machine speed.

**DETERMINING SENSOR FREQUENCY OUTPUT & SELECTING THE PROPER FREQUENCY RANGE**

Machine speeds are normally expressed in revolutions/minute (RPM) while the PRA1 and PRS1 have adjustable frequency ranges in cycles/second or Hz. In addition, sensor arrangements usually deliver a number of signal cycles or pulses for each shaft revolution. The following formula provides a convenient way to relate these variables:

\[ \text{FRQ (CPS or Hz)} = \frac{\text{RPM} \times \text{PPR}}{60} \]

**WHERE:**

- **RPM** is the speed of the shaft where the sensor is located in revolutions per minute.
- **PPR** is the number of pulses (or cycles) produced by the sensor for one shaft revolution.

**EXAMPLE 1**

A machine is to be equipped with a PRS1 Speed Switch. A 42-tooth timing belt pulley is available in the power drive train, and an LMPC is to be used to sense passing teeth. The PRS1 set-point is to be adjusted to provide overspeed output when the timing belt pulley reaches 730 RPM. What should the frequency range of the PRS1 be?

\[ \text{FRQ @ set-point} = \frac{730 \text{ RPM} \times 42 \text{ PPR}}{60} = 511 \text{ Hz} \]

**SELECT:** PRS11021 (or -2 for 230 VAC) which has an adjustable range of 100-1000 Hz.

**EXAMPLE 2**

A pulley with 6 spokes operates at 650 RPM maximum machine speed. The spores are to be sensed with a Model RR Retro-Reflective Photo Sensor. The application requires a PRA1 to develop a 4-20 mA signal for a chart recorder (20 mA output at max. speed), and a PRS1 set to 5% of maximum speed for a “zero-speed” switching function. What are the frequency ranges to be used for the PRA1 and PRS1?

\[ \text{FRQ @ max. speed} = \frac{650 \text{ RPM} \times 6 \text{ PPR}}{60} = 65 \text{ Hz} \]

**SELECT:** PRA11011 (adjustable for max. output 30-100 Hz)

\[ \text{FRQ @ “zero-speed”} = \frac{65 \times 5%}{3.2} = 3 \text{ Hz} \]

**SELECT:** PRS10101 (adjustable set-point 1-10 Hz)

**EXAMPLE 3**

The speed of a gravity-powered conveyor is restrained and controlled by a hydraulic brake (pump) which is coupled to a conveyor shaft. A PRA1 is to be used to supply a speed feed-back signal to the hydraulic control circuit, with 0-10 VDC corresponding to a speed range of 0-36 RPM on the conveyor shaft.

**SOLUTION:** Since the PRA1 is in the speed feed back control loop, fast response is important and a high PPR will be needed to minimize delay in output response. By using a 600 PPR Rotary Pulse Generator (RPGB) coupled by 3:1 speed-increasing instrument belt drive, the effective PPR of the conveyor shaft is 3 x 600 or 1800 PPR. The PRA1 input frequency then is:

\[ \text{FRQ} = \frac{36 \text{ RPM (max. speed)} \times 1800 \text{ PPR}}{60} = 1080 \text{ Hz} \]

**SELECT:** PRA13021 (adjustable for max. output, 1-3 KHz)

**Note:** The smoothness of shaft motion can be a factor in this type of application. Direct coupling a high PPR Rotary Pulse Generator to a slow moving shaft that dithers or exhibits rotary oscillation can create false pulses reflected as an output that is erroneously high. A belt drive was chosen here to help dampen vibration effects. Adding some additional mass to the RPG shaft, such as a weighted drive pulley, will increase the inertia and dampen oscillation even further.
The Model PRA2 is a convenient plug-in module that provides voltage and current analog output signals proportional to the pulse-rate (frequency) of the input signal. In typical applications the PRA2 input is supplied by a machine mounted sensor that generates a signal which has a frequency proportional to machine or process speed. The PRA2 converts the frequency content of this signal to analog form for operating chart recorders, supplying speed control signals, or driving other controls and indicators that require analog input.

The PRA2 develops an internal “constant-area” pulse from the negative going edge of each input pulse or waveform cycle. These “Constant-area” pulses are fixed in voltage amplitude and time duration. The PRA2 then takes the average of a train of these pulses to generate an output voltage level proportional to the frequency. Another circuit within the PRA2 monitors the voltage output and produces a current output signal that will deliver either 0 to 1 mA or 4 to 20 mA, as determined by a set-up switch.

This unit is available with five overlapping adjustable range ratings, each rating providing a calibration adjustment to deliver maximum output over an input frequency range of approximately 3:3:1. Since the PRA2 develops an output by averaging pulses, an inherent response time is involved (See response table, next page). The minimum response time is fixed for each range rating. It is longest for the lowest range rating and decreases as the frequency range rating increases. Response time must be considered, when using the PRA2 to provide closed-loop speed feedback signals, to avoid stability problems. For speed feedback applications it is usually advisable to select a high frequency range coupled with an appropriate sensor arrangement that delivers a high pulse rate.

The internal output filtering supplied for averaging purposes is kept to a minimum to provide the fastest practical response time for each range rating. Extra external capacitance can be added to provide more filtering if required.
APPLICATION CONSIDERATIONS

CONNECTIONS & SET-UP ADJUSTMENTS

VOLTAGE OUTPUT ADJUSTMENT:

Only the RANGE ADJUSTMENT is effective when voltage output is used. (Zero Adjustment affects only current output.)

PROCEDURE
1. Set AC power switch to proper position.
2. Connect voltmeter to Terminals 10 & 12.
3. Set the Range Switches for desired max. input frequency.
4. Apply the maximum input frequency and turn the *RANGE ADJUSTMENT to obtain the desired output voltage.

CURRENT OUTPUT ADJUSTMENTS:

When current output is used, the ZERO ADJUSTMENT must be set before RANGE ADJUSTMENT setting is attempted.

PROCEDURE
1. Set AC power switch to proper position.
2. Select current range with switch SW2-6 (OFF 0-1 mA / ON 4-20 mA).
3. Connect a milliammeter in series with the current loop circuit from Term 1 to Term 2. CAUTION: DO NOT exceed maximum load resistance specified for the current range.
4. Set the Range Switches for desired max. input frequency.
5. Zero Adjustment:
   A) 0-1 mA Range - With input signal removed (zero frequency) turn ZERO ADJUST CW until positive current flow is indicated. Then, turn back CCW until the current flow just reaches zero. Stop turning the adjustment at that point.
   B) 4-20 mA Range - Set ZERO ADJUST until current is 4 mA.
6. *Range Adjustment: Apply maximum frequency input signal and set RANGE ADJUSTMENT to get desired output.

* RANGE ADJUSTMENT - Turning CW decreases output at a given frequency (increases range) and turning CCW increases output (decreases range).

ADJUSTABLE RANGE RATINGS & OVER RANGE OPERATION

Frequency Range

<table>
<thead>
<tr>
<th>RANGE</th>
<th>FULL SCALE ADJUSTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 Hz to 100 Hz</td>
</tr>
<tr>
<td>2</td>
<td>100 Hz to 300 Hz</td>
</tr>
<tr>
<td>3</td>
<td>300 Hz to 1 kHz</td>
</tr>
<tr>
<td>4</td>
<td>1 kHz to 3 kHz</td>
</tr>
<tr>
<td>5</td>
<td>3 kHz to 10 kHz</td>
</tr>
</tbody>
</table>

SW1

SW2

Frequency Curves

The Transfer Curve (at right) shows the frequency-input/voltage-output relationship for the PRA2, Range #4 for both Min. Range (0-1 KHz) and Max. Range (0-3 KHz) adjustment. These curves are typical and apply to all PRA2 ranges.

As shown by these curves, the PRA2 RANGE ADJUSTMENT allows the unit to be calibrated to deliver full scale output for any input frequency from the min. to max. range ratings. As long as the input frequency is equal to or less than the full-scale range setting, the PRA2 is operating in its linear region and the output voltage or current will be proportional to input frequency. If the input frequency exceeds the full-scale range setting (over range), the output will flatten out and saturate at some level above 10 V at all higher frequencies.

CAUTION: Maximum input frequency for PRA2 modules is 10 KHz. At input frequencies in excess of 10 KHz, the frequency roll-off characteristics of the input circuit will cause signal dropout and result in discontinuous operation.

OUTPUT RESPONSE & RIPPLE CHARACTERISTICS

PRA2 Modules are supplied with a minimum amount of output ripple filtering in order to avoid compromising response-time. The data presented below, permits a reasonable estimate of the amount of ripple and the response-time that will be experienced in a particular application. As shown by the curves below, the amount of output ripple depends on the range setting and the input frequency.

Ripple voltage can be reduced by adding external filter capacitance, but ripple-reduction is a trade-off against increased response times. This must be kept in mind, especially if the PRA2 is to be used to supply feedback control signals.

The values of capacitance given in the table are for reference only and do not imply a limit to the amount of capacitance that can be added. For example, an external filter capacitance may be 10 times the reference values shown for a very high degree of ripple reduction, provided that the resulting long response time is acceptable.

<table>
<thead>
<tr>
<th>RANGE</th>
<th>FULL SCALE RANGE ADJUSTMENT</th>
<th>RESPONSE TIME</th>
<th>RIPPLE CURVE</th>
<th>EXT CAP (REF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 Hz to 100 Hz</td>
<td>250 msec</td>
<td>A</td>
<td>2.2 mfd</td>
</tr>
<tr>
<td>2</td>
<td>100 Hz to 300 Hz</td>
<td>75 msec</td>
<td>A</td>
<td>0.56 mfd</td>
</tr>
<tr>
<td>3</td>
<td>0.3 KHz to 1 KHz</td>
<td>25 msec</td>
<td>A</td>
<td>0.22 mfd</td>
</tr>
<tr>
<td>4</td>
<td>1 KHz to 3 KHz</td>
<td>10 msec</td>
<td>B</td>
<td>0.1 mfd</td>
</tr>
<tr>
<td>5</td>
<td>3 KHz to 10 KHz</td>
<td>8 msec</td>
<td>C</td>
<td>0.047 mfd</td>
</tr>
</tbody>
</table>

Note: If large capacitor values are required to achieve a high degree of ripple reduction, tantalum capacitors rated at 35 V or more are recommended. (Proper polarity must be observed. See Connection Drawing above.)

[1] RESPONSE TIME - Time required for the output to reach 90% of final value when the frequency is instantly changed from 0 to full-scale range frequency.
[3] External Capacitance can be added between terminals 10 and 11 to decrease ripple. Reference values shown in MFD, will reduce ripple approximately 50% and will roughly double response times.
The Model PRA2 Pulse-Rate to Analog Converter uses the circuit shown on the right. The circuit uses a comparator amplifier connected as a Schmidt trigger circuit to convert the input waveform 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:

SW1-5 - ON: Connects a 3.9 K pull-up resistor for sensors with current sinking output. (Maximum sensor current is 3 mA.)

SW2-5 - ON: Connects a 1 K pull-down resistor for sensors with sourcing output. (Maximum sensor output current is 12 mA @ 12 V output.)

SW1-6 - ON: Sets bias of input to trigger at VIL = 2.5 V, VIH = 3.0 V; for logic level signals.
OFF: Sets the bias of input to trigger at VIL = 0.25 V, VIH = 0.75 V; for increased sensitivity when used with magnetic pickups.

SW2-6 - ON: 4-20 mA Output
OFF: 0-1 mA Output

OTHER CHARACTERISTICS & SPECIFICATIONS

Maximum Operating Frequency: 10 Khz with minimum pulse width ON and OFF times of 50 μsec.

Maximum Input Voltage: Pin 7 (Input) may be driven from an external voltage up to ±90V provided SW2-5 and SW1-5 are “OFF” to disconnect internal load resistors. (Maximum Input Voltage with SW2-5 “ON” is ±24 V)

Input Impedance: With SW2-5 and SW1-5 “OFF”, the resistive input impedance exceeds 1 Megohm, as long as Pin 7 voltage is greater than zero and less than +12 V.

Paralleling With a Counter and/or Rate Indicator Inputs: The PRA2 can be operated from a common sensor with current sinking output that is also used to drive the input of a Counter or Rate Indicator. Connect Pin 8 to the Common Terminal and Pin 7 to the Input Terminal of the Counter or Rate Indicator; set SW2-5 and SW1-5 “OFF” and SW1-6 “ON”. DO NOT PARALLEL CONNECT THE +12V OUTPUT (Pin 9) OF PRA2 UNITS WITH THE +12V OUTPUTS OF COUNTERS, DITAKS, OR OTHER PRS1, PRA1, OR PRA2 UNITS. These units have regulated supplies that will not load-share. Multiple inputs cannot be operated from sensing switches, 2-wire proximity sensors, or magnetic pickups.

CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS

MAGNETIC PICKUPS

SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.)

SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.)

2-WIRE PROXIMITY SENSORS

A.C. INPUTS FROM INVERTERS, A.C. TACHOMETERS GENERATORS, ETC.

OLDER STYLE RLC SENSORS WITH -EF OUTPUT

Paralleling With a Counter and/or Rate Indicator Inputs: The PRA2 can be operated from a common sensor with current sinking output that is also used to drive the input of a Counter or Rate Indicator. Connect Pin 8 to the Common Terminal and Pin 7 to the Input Terminal of the Counter or Rate Indicator; set SW2-5 and SW1-5 “OFF” and SW1-6 “ON”. DO NOT PARALLEL CONNECT THE +12V OUTPUT (Pin 9) OF PRA2 UNITS WITH THE +12V OUTPUTS OF COUNTERS, DITAKS, OR OTHER PRS1, PRA1, OR PRA2 UNITS. These units have regulated supplies that will not load-share. Multiple inputs cannot be operated from sensing switches, 2-wire proximity sensors, or magnetic pickups.

CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS

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SENSOR & FREQUENCY RANGE SELECTION

The PRA2 Pulse-Rate to Analog Converter normally operates from a variable frequency signal supplied by a machine mounted sensor. The sensor signal varies in frequency in direct proportion to machine speed, and may be a sinusoidal, triangular, square, or pulse-type waveform. The sensor arrangement can take a variety of forms such as a Magnetic Pickup or Proximity Sensor detecting passing teeth on a sprocket or gear, a Photo-Electric Scanner viewing passing pulley spokes, a Rotary Pulse Generator coupled to a machine shaft, or a Length Sensor driven by a web or ribbon of material passing through the machine. (See Sensor Section of the catalog for more information on sensors.)

Since the PRA2 operates from the frequency content of the incoming signal, the response time of this device is also related to the signal frequency. This gives rise to the cardinal rule of selecting a sensor arrangement:

**WHEN RESPONSE TIME IS IMPORTANT, SELECT A SENSOR ARRANGEMENT & LOCATION THAT WILL PROVIDE A HIGH FREQUENCY OUTPUT AT OPERATING SPEED.**

When a PRA2 application is first contemplated, it seems to be natural to think in terms of applying the sensor to the low speed end of the power drive train. In some cases this may be the only practical location for the sensor, and if fast response is needed from the PRA2, a sensor arrangement capable of delivering a high number of cycles or pulses/revolution (PPR) will be required. In a great number of applications however, generating a higher frequency sensor signal is simply a matter of locating the sensor on an intermediate or high speed shaft such as directly on the drive motor shaft.

Another advantage of moving the sensor location up toward the high speed end of the drive train is that the shaft rotary motion is usually much smoother and more regular. Slow speed shafts will often rotate irregularly due to gear backlash, "slop" in couplings, or slack in chain drives.

**SELECTING AN APPROPRIATE SENSOR ARRANGEMENT**

There are no exact rules governing the selection of a sensor arrangement since machine geometry and conditions can vary widely from one application to the next. However, the following generalized criteria will prove useful as guidelines toward selecting the best sensor arrangement. (See Sensor Section of the catalog for more information.)

**ULTRA-LOW SHAFT SPEEDS (10RPM or less)** - Proximity Sensors, Magnetic Pickups, Photo-Electric Scanners, or Rotary Pulse Generators are usually the best selections. In most ultra-low speed applications, it is advisable to provide as many pulses per revolution as possible (high PPR) to get acceptable response times.

**LOW-SHAFT SPEEDS (10-100RPM)** - LMPC (Super-Sensitive Magnetic Pickup), Proximity Sensors, Photo-Electric Scanners and RPG’s can usually be applied in this speed range.

**INTERMEDIATE SHAFT SPEEDS (10-1000RPM)** - Magnetic Pickups, the LMPC, RPG’s and some Proximity Sensors are appropriate at these speeds.

**HIGH-SHAFT SPEEDS (1000RPM and up)** - Magnetic Pickups, the LMPC and RPG’s are usually the best choices.

**FOR LINEAR SPEEDS ON PAPER WEBS, TEXTILE, RIBBON, STRIP AND WIRE** - The LSC Length Sensor may prove desirable.

**CAUTION:** When selecting a sensor for operation at any speed, make sure the sensor is also capable of delivering an output for the entire speed range up through maximum machine speed.

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DETERMINING SENSOR FREQUENCY OUTPUT & SELECTING THE PROPER FREQUENCY RANGE

Machine speeds are normally expressed in revolutions/minute (RPM) while the PRA2 has adjustable frequency ranges in cycles/second or Hz. In addition, sensor arrangements usually deliver a number of signal cycles or pulses for each shaft revolution. The following formula provides a convenient way to relate these variables:

\[
\text{FRQ (CPS or Hz)} = \frac{\text{RPM} \times \text{PPR}}{60}
\]

**WHERE:**

- RPM is the speed of the shaft where the sensor is located in revolutions per minute.
- PPR is the number of pulses (or cycles) produced by the sensor for one shaft revolution.

**EXAMPLE 1**

A pulley with 6 spokes operates at 650 RPM maximum machine speed. The spokes are to be sensed with a Model RR Retro-Reflective Photo Sensor. The application requires a PRA2 to develop a 4-20 mA signal for a chart recorder (20 mA output at max. speed). What is the frequency range to be used for the PRA2?

\[
\text{FRQ @ max. speed} = \frac{650 \text{ RPM} \times 6 \text{ PPR}}{60} = 65 \text{ Hz}
\]

**SELECT:** Range 1 (adjustable for max. output 30 to 100 Hz)

**EXAMPLE 2**

The speed of a gravity-powered conveyor is restrained and controlled by a hydraulic brake (pump) which is coupled to a conveyor shaft. A PRA2 is to be used to supply a speed feed-back signal to the hydraulic control circuit, with 0-10 VDC corresponding to a speed range of 0-36 RPM on the conveyor shaft.

**SOLUTION:** Since the PRA2 is in the speed feed back control loop, fast response is important and a high PPR will be needed to minimize delay in output response. By using a 600 PPR Rotary Pulse Generator (RPGB) coupled by 3:1 speed-increasing instrument belt drive, the effective PPR of the conveyor shaft is 3 x 600 or 1800 PPR. The PRA2 input frequency then is:

\[
\text{FRQ} = \frac{36 \text{ RPM (max. speed)} \times 1800 \text{ PPR}}{60} = 1080 \text{ Hz}
\]

**SELECT:** Range 4 (adjustable for max. output, 1 to 3 KHz)

**Note:** The smoothness of shaft motion can be a factor in this type of application. Direct coupling a high PPR Rotary Pulse Generator to a slow moving shaft that dithers or exhibits rotary oscillation can create false pulses reflected as an output that is erroneously high. A belt drive was chosen here to help dampen vibration effects. Adding some additional mass to the RPG shaft, such as a weighted drive pulley, will increase the inertia and dampen oscillation even further.

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**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL PRS1 - PLUG-IN SPEED SWITCH

DESCRIPTION

The PRS1 is a versatile, reliable and economical solution to most machine speed switching problems. It is not affected by overspeeding and will operate in either direction of rotation.

The heart of the PRS1 is a solid-state CMOS logic circuit, that continuously measures the elapsed time between successive trailing edges (negative going) of an incoming pulse train or waveform. It compares this time with an adjustable set-point reference and determines if the period of the waveform is longer (underspeed) or shorter (overspeed) than the set-point reference.

The internal relay is energized during "normal" operation and can be set to de-energize on either under or overspeed by a programming switch. The unit can be connected for simple over or underspeed detection or for latch/trip-off operation in a machine STOP/START circuit.

The PRS1 features built-in hysteresis (differential between pick-up and drop-out) of 5% of set-point speed. This prevents the output relay from chattering when operating at or near the set-point speed. The set-point control is a 20-turn screwdriver adjustment accessible at the top of the unit with a 10:1 adjustment range. An L.E.D. indicates when the relay is energized. A built-in +12 VDC regulated power supply, furnished power for the internal circuit and for external sensor excitation.

The plug-in module mates with a heavy duty, CSA approved base mounting socket with pressure clamp screw terminals that accept stripped wires without lugs. Closed back construction allows mounting directly on metal panel without an insulation barrier.

SPECIFICATIONS

1. PRIMARY SUPPLY VOLTAGE: Available for 115 or 230 VAC ±10%, 50/60 Hz; 2.5 VA (See Ordering Information).
2. SENSOR OUTPUT POWER: +12 VDC ±5% regulated, 60 mA max.
3. SIGNAL INPUT CHARACTERISTICS: See "PRA1 & PRS1 Input Circuits, Sensor Connections & Configuration Switch Set-ups" section.
4. FREQUENCY RANGES AVAILABLE: Available in 5 ranges, each range providing a relay pick-up or drop-out adjustment span of 10:1. (See Ordering Information)
5. RELAY CONTACT OUTPUT: FORM “C” (SPDT) contacts max. rating 5 amps @ 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.
6. RELAY LIFE EXPECTANCY: 100,000 cycles at max. rating. (As load level decreases, life expectancy increases.)
7. RESPONSE TIME: Response time is equivalent to the period of set-point frequency, plus 5 msec for relay pickup or plus 3 msec for relay dropout.
8. OPERATING TEMPERATURE RANGE: 0 to 60°C.
9. WEIGHT: PRS1 PLUG-IN MODULE - 8 oz (226.8 g).

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. Then a speed switch may be installed to help prevent the machine from entering the unsafe speed condition.

DIMENSIONS “In inches (mm)”

[Diagram of the dimensions and relay connections, showing various input configurations and set-point adjustments.]
**PRS1 APPLICATIONS**

The following guidelines and considerations will help assure the best performance when applying the PRS1 Speed Switch.

1. **SENSOR AND FREQUENCY RANGE SELECTION**

   (See “PRA1 & PRS1 Sensor & Frequency Range Selection” section.)

2. **RESPONSE TIME**

   The PRS1 has an internal adjustable timer whose “time-out” period is determined by the set-point adjustment. In operation, this timer is reset (retriggered) at the start of each signal cycle and the internal logic circuitry monitors whether the signal cycle concludes before time-out occurs (overspeed) or if time-out occurs before conclusion of the signal cycle (underspeed). This operating scheme results in an inherent delay in output switching response which is insignificant at moderate and higher frequencies, but can be appreciable at low frequencies. For example, with the PRS10011 (Range 0.1 to 1 Hz), the underspeed output will not occur until 10 sec after the initiation of the last signal cycle. Overspeed response is directly related to the period of the signal frequency and will be faster, depending on the amount of overspeed.

   The inherent delay at low frequencies can be an advantage when the PRS1 is applied as a zero-speed switch. However, for fast response, a higher frequency unit with an appropriate sensor arrangement should be used. This can often be accomplished simply by moving the sensor to a higher speed shaft, or by going directly to the drive motor shaft with an ARCJ Ring Sensor Kit. (See Sensor Section of the RLC Catalog.)

**OPERAting MODES**

**MODE A:**

LOW SPEED OPERATE, OVERSPEED

Internal relay is energized at all speeds below the set-point speed, and de-energizes when speed exceeds the set-point speed. Relay again energizes when speed drops approximately 5% below the set-point speed.

**MODE B:**

HIGH SPEED OPERATE, UNDERSPEED DROPOUT

Internal relay is de-energized at all speeds below the set-point speed, and energizes when the speed exceeds the set-point. The relay again de-energizes when the speed drops approximately 5% below the set-point.

**MODE C:**

LATCH, HIGH SPEED OPERATE, UNDERSPEED DROPOUT

Pushing the Start button energizes the internal relay and starts the machine. When operating speed is reached, the relay stays latched with the Start button released. If the machine speed drops below the set-point, the relay unlatches, sounding the alarm and stopping the machine.

**MODE D:**

LATCH, LOW SPEED OPERATE, OVERSPEED DROPOUT

Pushing the Start button energizes and latches the relay and starts the machine. The relay stays latched as long as machine operates below set-point speed. If the machine exceeds the set-point speed, the relay unlatches, sounding the alarm and stopping the machine.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>A.C. POWER</th>
<th>PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRS1</td>
<td>Speed Switch</td>
<td>115VAC</td>
<td>PRS10011 PRS10101 PRS11011 PRS11021 PRS11031</td>
</tr>
<tr>
<td>—</td>
<td>Socket, 12-Pin</td>
<td>230VAC</td>
<td>PRS10012 PRS10102 PRS11012 PRS11022 PRS11032</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2300200</td>
</tr>
</tbody>
</table>

Note: The PRS1 has built-in hysteresis of 5% of set-point speed, i.e. underspeed output occurs at 95% of the overspeed set-point. This allows a set-point near running speed provided shaft motion is reasonably smooth.

3. **ERRATIC OR IRREGULAR SHAFT MOTION**

Since the PRS1 operates by timing each successive signal cycle, relay chatter can be experienced when the set-point speed is adjusted close to the running speed and the motion of the sensor shaft is irregular. For example, if a sensor detects teeth of the driven sprocket in a chain drive with a good deal of chain slack, the period between adjacent signal cycles can vary as much as 2:1 as the driven sprocket alternately overhauls and takes up slack. This does not present a problem if the set-point is adjusted at 5 or 10% of running speed, but if the set-point is to be 90% of running speed, the PRS1 output will chatter as the chain picks up and gives out slack. Again, the solution to this problem is to locate the sensor at a point in the drive train where the motion is smooth.

4. **OVERSPEED OPERATION AND HI-FREQUENCY SENSOR DROPOUT**

All ranges of PRS1 units can be operated in the overspeed condition up through 10 KHz without experiencing operational discontinuities. However, when subject to higher input signal frequencies (12 to 15 KHz), signal roll-off will occur in the input circuit and the output will transfer to underspeed as if the signal had dropped to zero frequency. Sensor signal drop-out at high frequencies will also cause a false underspeed output. Caution is advised when selecting proximity, photo-electric, and other sensors that have limited high frequency ratings, to ensure that their maximum output frequency limit is not exceeded at maximum machine speed.
The Model PRS1 Speed Switch and the Model PRA1 Pulse-Rate to Analog Converter both use the circuit shown on the right. The circuit uses a comparator amplifier connected as a Schmidt trigger circuit to convert the input waveform 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 pull-down resistor for sensors with sourcing output. (Maximum sensor output current is 12 mA at 12 V output.)

S2 - ON: Sets bias of input to trigger at VIL = 2.5 V, VIH = 3.0 V; for logic level signals. OFF: Sets the bias of input to trigger at VIL = 0.25 V, VIH = 0.75 V; for increased sensitivity when used with magnetic pickups.

S3 - ON: Connects a 3.9 K pull-up resistor for sensors with current sinking output. (Maximum sensor current is 3 mA.)

OTHER CHARACTERISTICS & SPECIFICATIONS

Maximum Operating Frequency: 10 KHz with maximum pulse width ON and OFF times of 50 µsec.

Maximum Input Voltage: Pin 7 (Input) may be driven from an external voltage up to ±90V provided S1 and S3 are "OFF" to disconnect internal load resistors. (Maximum Input Voltage with S1 "ON" is ±16 V)

Input Impedance: With S1 and S3 "OFF", the resistive input impedance exceeds 1 Megohm, as long as Pin 7 voltage is greater than zero and less than +12 V.

Paralleling With a Counter and/or Rate Indicator Inputs: The PRS1 and PRA1 can be operated from a common sensor with current sinking output that is also used to drive the input of a Counter or Rate Indicator. Connect Pin 8 to the Common Terminal and Pin 7 to the Input Terminal of the Counter or Rate Indicator; set S1 and S3 "OFF" and S2 "ON". DO NOT PARALLEL CONNECT THE +12V OUTPUTS (Pin 9) OF PRS1 AND PRA1 UNITS WITH THE +12V OUTPUTS OF COUNTERS, DITAKS, OR OTHER PRS1 OR PRA1 UNITS. These units have regulated supplies that will not load-share. Multiple inputs cannot be operated from sensing switches, 2-wire proximity sensors, or magnetic pickups.

CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS

MAGNETIC PICKUPS

SENSORS WITH CURRENT SINK OUTPUT (NPN O.C.)

SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.)

2-WIRE PROXIMITY SENSORS

OLDER STYLE RLC SENSORS WITH -EF OUTPUT

A.C. INPUTS FROM INVERTERS, A.C. TACHOMETERS GENERATORS, ETC.

INPUT FROM CMOS OR TTL

A.C. Power sources exceeding 50 V output should be coupled with an isolation transformer. Use of the Low-Pass RC Filter places a high-speed restriction on the circuit, and it cannot be used at frequencies of more than 200 to 300 cps. However, Switch Contact input is normally limited to low speed operation, so this does not impose a serious restriction.

The addition of two external resistors and a capacitor allows the PRS1 to be operated from input signals generated by a switch contact. The external RC network forms a Low-Pass Filter which operates in conjunction with the hysteresis of the input circuit to “De-bounce” the Switch Contact signal.

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Paralleling With a Counter and/or Rate Indicator Inputs: The PRS1 and PRA1 can be operated from a common sensor with current sinking output that is also used to drive the input of a Counter or Rate Indicator. Connect Pin 8 to the Common Terminal and Pin 7 to the Input Terminal of the Counter or Rate Indicator; set S1 and S3 "OFF" and S2 "ON". DO NOT PARALLEL CONNECT THE +12V OUTPUTS (Pin 9) OF PRS1 AND PRA1 UNITS WITH THE +12V OUTPUTS OF COUNTERS, DITAKS, OR OTHER PRS1 OR PRA1 UNITS. These units have regulated supplies that will not load-share. Multiple inputs cannot be operated from sensing switches, 2-wire proximity sensors, or magnetic pickups.
PRA1 & PRS1 SENSOR & FREQUENCY RANGE SELECTION

Both the PRA1 Pulse-Rate to Analog Converter and the PRS1 Speed-Switch normally operate from a variable frequency signal supplied by a machine mounted sensor. The sensor signal varies in frequency in direct proportion to machine speed, and may be a sinusoidal, triangular, square, or pulse-type waveform. The sensor arrangement can take a variety of forms such as a Magnetic Pickup or Proximity Sensor detecting passing teeth on a sprocket or gear, a Photo-Electric Scanner viewing passing pulley spokes, a Rotary Pulse Generator coupled to a machine shaft, or a Length Sensor driven by a web or ribbon of material passing through the machine. (See Sensor Section of the catalog for more information on sensors.)

Since both the PRA1 and PRS1 operate from the frequency content of the incoming signal, the response time of both devices is also related to the signal frequency. This gives rise to the cardinal rule of selecting a sensor arrangement:

WHEN RESPONSE TIME IS IMPORTANT, SELECT A SENSOR ARRANGEMENT & LOCATION THAT WILL PROVIDE A HIGH FREQUENCY OUTPUT AT OPERATING SPEED.

When a PRA1 or PRS1 application is first contemplated, it seems to be natural to think in terms of applying the sensor to the low speed end of the power drive train. In some cases this may be the only practical location for the sensor, and if fast response is needed from the PRA1 or PRS1, a sensor arrangement capable of delivering a high number of cycles or pulses/revolution (PPR) will be required. In a great number of applications however, generating a higher frequency sensor signal is simply a matter of locating the sensor on a intermediate or high speed shaft such as directly on the drive motor shaft.

Another advantage of moving the sensor location up toward the high speed end of the drive train is that the shaft rotary motion is usually much smoother and more regular. Slow speed shafts will often rotate irregularly due to gear backlash, “slop” in couplings, or slack in chain drives. This irregular motion can have an adverse effect on the resulting output, especially when using the PRS1 to perform a speed switching function near normal running speed.

SELECTING AN APPROPRIATE SENSOR ARRANGEMENT

There are no exact rules governing the selection of a sensor arrangement since machine geometry and conditions can vary widely from one application to the next. However, the following generalized criteria will prove useful as guidelines toward selecting the best sensor arrangement. (See Sensor Section of the catalog for more information.)

ULTRA-LOW SHAFT SPEEDS (10RPM or less) - Proximity Sensors, Photo-Electric Scanners, or Rotary Pulse Generators, are usually the best selections. In most ultra-low speed applications, it is advisable to provide as many pulses per revolution as possible (high PPR) to get acceptable response times.

LOW-SHAFT SPEEDS (10-100RPM) - LMPC (Super-Sensitive Magnetic Pickup), Proximity Sensors, Photo-Electric Scanners and RPG’s can usually be applied in this speed range.

INTERMEDIATE SHAFT SPEEDS (10-1000RPM) - Magnetic Pickups, the LMPC, RPG’s and some Proximity Sensors are appropriate at these speeds.

HIGH-SHAFT SPEEDS (1000RPM and up) - Magnetic Pickups, the LMPC and RPG’s are usually the best choices.

FOR LINEAR SPEEDS ON PAPER WEBS, TEXTILE, RIBBON, STRIP AND WIRE - The LSC Length Sensor may prove desirable.

CAUTION: When selecting a sensor for operation at any speed, make sure the sensor is also capable of delivering an output for the entire speed range up through maximum machine speed.

DETERMINING SENSOR FREQUENCY OUTPUT & SELECTING THE PROPER FREQUENCY RANGE

Machine speeds are normally expressed in revolutions/minute (RPM) while the PRA1 and PRS1 have adjustable frequency ranges in cycles/second or Hz. In addition, sensor arrangements usually deliver a number of signal cycles or pulses for each shaft revolution. The following formula provides a convenient way to relate these variables:

$$\text{FRQ (CPS or Hz)} = \frac{\text{RPM} \times \text{PPR}}{60}$$

WHERE:

RPM is the speed of the shaft where the sensor is located in revolutions per minute.

PPR is the number of pulses (or cycles) produced by the sensor for one shaft revolution.

EXAMPLE 1

A machine is to be equipped with a PRS1 Speed Switch. A 42-tooth timing belt pulley is available in the power drive train, and an LMPC is to be used to sense passing teeth. The PRS1 set-point is to be adjusted to provide overspeed output when the timing belt pulley reaches 730 RPM. What should the frequency range of the PRS1 be?

$$\text{FRQ @ set-point} = \frac{730 \text{ RPM} \times 42 \text{ PPR}}{60} = 511 \text{ Hz}$$

SELECT: PRS11021 (or -2 for 230 VAC) which has an adjustable range of 100-1000 Hz.

EXAMPLE 2

A pulley with 6 spokes operates at 650 RPM maximum machine speed. The spokes are to be sensed with a Model RR Retro-Reflective Photo Sensor. The application requires a PRA1 to develop a 4-20 mA signal for a chart recorder (20 mA output at max. speed), and a PRS1 set to 5% of maximum speed for a “zero-speed” switching function. What are the frequency ranges to be used for the PRA1 and PRS1?

$$\text{FRQ @ max. speed} = \frac{650 \text{ RPM} \times 6 \text{ PPR}}{60} = 65 \text{ Hz}$$

SELECT: PRA11011 (adjustable for max. output 30-100 Hz)

$$\text{FRQ @ “zero-speed”} = 65 \times 5\% = 3.2 \text{ Hz}$$

SELECT: PRS10101 (adjustable set-point 1-10 Hz)

EXAMPLE 3

The speed of a gravity-powered conveyor is restrained and controlled by a hydraulic brake (pump) which is coupled to a conveyor shaft. A PRA1 is to be used to supply a speed feed-back signal to the hydraulic control circuit, with 0-10 VDC corresponding to a speed range of 0-36 RPM on the conveyor shaft.

SOLUTION: Since the PRA1 is in the speed feed back control loop, fast response is important and a high PPR will be needed to minimize delay in output response. By using a 600 PPR Rotary Pulse Generator (RPGB) coupled by 3:1 speed-increasing instrument belt drive, the effective PPR of the conveyor shaft is 3 x 600 or 1800 PPR. The PRA1 input frequency then is:

$$\text{FRQ} = \frac{36 \text{ RPM (max. speed)} \times 1800 \text{ PPR}}{60} = 1080 \text{ Hz}$$

SELECT: PRA13021 (adjustable for max. output 1-3 KHz)

Note: The RR Photo Sensor output is limited to 5 mA max. Therefore, its output NPN Transistor is connected as a current sink output driving both PRA1 and PRS1 in parallel, and using only the pull-up resistor in the PRA1 as a load (S3 of PRA1 is ON, S3 of PRS1 is OFF). See “PRA1 & PRS1 Input Circuits, Sensor Connections & Configuration Switch Set-ups” section for more information.
MODEL PSDR6 - SIGNAL CONDITIONER 650 mA POWER SUPPLY

DESCRIPTION

The compact PSDR power supplies are industrial input voltage supplies with primary switched-mode regulator technology. They feature low output ripple and tight nominal voltage tolerance. The output is electronically protected against overloads and short circuits.

The modules snap onto standard 35 mm flat DIN rails, and use removable terminal blocks for easy wiring.

SPECIFICATIONS

1. **POWER REQUIREMENTS:**
   - Input Voltage: 120 to 230 VAC or 100 to 250 VDC
   - Input Voltage Range: 85 to 264 VAC or 90 to 350 VDC
   - Current Consumption at nominal input voltage: 0.2/0.4 A (230/120 VAC)

2. **FREQUENCY:** 47 to 63 Hz

3. **POWER FACTOR:** >0.5

4. **MAINS BUFFERING:** >30 msec (120 VAC); >100 msec (230 VAC)

5. **SURGE VOLTAGE PROTECTION:** Varistor

6. **POWER OUTPUT:** 24 VDC -0% ±3% @ 650 mA

7. **ENVIRONMENTAL CONDITIONS:**
   - Operating Temperature Range: -25 to 50°C
   - Storage Temperature: -40 to 85°C
   - Humidity, no moisture condensation: 95 % at 25°C
   - Vibration in acc. with IEC 68-2-6: 10 Hz -150 Hz, 0.15 mm or 2 g
   - Shock in acc. with IEC 68-2-27: 30 g for 18 msec in 3 directions
   - Contamination in acc. with EN 50178: 2

8. **STANDARDS AND CERTIFICATIONS**
   - UL Listed, File # E171375
   - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards

   **ELECTRICAL SAFETY**
   - Electrical Safety: EN 60950 / VDE 0805
   - Electronic equipment for use in electrical power installations and their assembly into electrical power installations: UL 508 listed
   - Reliable isolation: EN 50178 / VDE 0160
   - Protection against electric shock (reliable isolation): VDE 0105-410 / DIN 57100-410
   - In compliance with the EMC guideline 89/336/EEC

   **POWER PERFORMANCE**
   - EFFICIENCY: 3% @ 650 mA
   - POWER FACTOR: >0.5
   - FREQUENCY: 47 to 63 Hz

   **MECHANICAL SAFETY**
   - The devices have been tested for shock resistance in accordance with IEC 68 part 2-27 and for vibrations in accordance with IEC 68 part 2-6.
   - Protection type IP 20

   **CONSTRUCTION**
   - The modules snap onto standard 35 mm flat DIN rails, and use removable terminal blocks for easy wiring.

   **INSTALLATION POSITION**
   - On horizontal mounting rail NS 35

   **INSULATION VOLTAGE**
   - Input/output 3 kV (4 kV routine test)

   **DIMENSIONS**
   - In inches (mm)

   **MOUNTING**
   - Standard DIN rail top hat (T) profile rail according to EN50022 - 35 X 7.5 and 35 X 15. Can be mounted in rows with vertical spacing > 10 cm or horizontally with no space.

   **CONSTRUCTION**
   - Case body is green, high impact plastic. IP20 touch safe. Protection Class II.

   **MTBF** (Mean Time Between Failure): >500000 h acc. To IEC 1709 (SN 29500)

   **EFFICIENCY:** > 80 %

   **WEIGHT:** 4.93 oz (140 g)
RAIL MOUNTING

The power supply unit can be snapped onto all mounting rails in accordance with EN 50022-35.

CABLE CONNECTION

The device is equipped with COMBICON plug connectors. This easy-to-assemble connection method allows devices to be exchanged easily and the electrical connection to be visibly isolated.

Connecting Cables:

- Cable cross sections from 0.2 - 2.5 mm² rigid (solid)/flexible (stranded) (AWG 24-14) may be used.
- To maintain UL, please use copper cable rated for an operating temperature of 75°C/170°F.

For Reliable And Touch-proof Contacts:

- Strip the connection ends (8 mm - See Figure)

  8 mm (0.32”)

  ![Diagram](image)

Input: The 120 to 230 VAC resp. 100 to 250 VDC connection is made by the screw connections “L(+)” and “N(-)” (torque 0.5 Nm) on the COMBICON plug connection. The power o.k. control lamp signals that the device is functioning.

Output: The 24 VDC connection is made by the screw connections “+” and “-” (torque 0.5 Nm) on the COMBICON plug connection.

PROTECTION

The device must be installed in accordance with the specifications of EN 60950.

It must be possible to switch off the device using a suitable disconnecting device outside the power supply. For example, primary side line protection could be used.

In case of DC applications it is necessary to connect in series an adequate fuse.

On The Secondary Side: The device is electronically protected against short circuits and idling. In the event of an error, the output voltage is limited to max 33 V ± 5 %.

REDUNDANCY MODE

This device can only be switched in parallel for redundancy operation.

If a fault occurs in the primary circuit of device No.1, device No.2 automatically takes control of the entire power supply without interruption and vice versa.

CHARACTERISTIC CURVES

Thermal Behavior

The device supplies the rated current I_N of 650 mA with an ambient temperature up to 60°C.

Short Circuit and Overload Behavior

The output of the device is electronically protected against overload and short circuiting.

With an ambient temperature lower than 30°C, higher output currents than I_N are supplied constantly:

<table>
<thead>
<tr>
<th>INPUT VOLTAGE U_\text{IN}</th>
<th>MAX. OUTPUT CURRENT WITH T_{\text{AMB}} &lt; 30°C (CONSTANTLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 VAC</td>
<td>typ. 0.95 A</td>
</tr>
<tr>
<td>230 VAC</td>
<td>typ. 1.20 A</td>
</tr>
<tr>
<td>110 VAC</td>
<td>typ. 0.80 A</td>
</tr>
<tr>
<td>220 VDC</td>
<td>typ. 1.00 A</td>
</tr>
</tbody>
</table>

In the case of a considerable overload resp. short circuit, the operating point follows the curve depicted above. After the device has shut down, it will attempt to switch on again until the short circuit on the secondary side has been eliminated.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>INPUT</th>
<th>OUTPUT</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSDR6</td>
<td>120 - 230 VAC</td>
<td>24 VDC</td>
<td>PSDR60000</td>
</tr>
</tbody>
</table>

Caution: Danger! Never work on live equipment!

Caution: When the device is opened, a dangerous voltage may remain at the electrolytic capacitors for up to 2 minutes after shutdown!

The installation must be performed by a specialist in accordance with the requirements of EN 60950.

For vertical installations we recommend a minimum spacing of 10 cm (3.937 in.) between other modules and this power supply to ensure sufficient convection.

No minimum spacing is required for horizontal alignment.

The mains feed line must have an appropriate fixing or strain relief outside of the device.

The supply-side installation and the connection via screw terminal blocks must be done in a way that ensures protection against electric shock.

ORDERING INFORMATION

<table>
<thead>
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<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSDR6</td>
<td>120 - 230 VAC</td>
<td>24 VDC</td>
<td>PSDR60000</td>
</tr>
</tbody>
</table>

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Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
DESCRIPTION
PSDR power supplies are compact, linear and highly regulated. Well suited for use with all signal conditioning products. They feature low output ripple and tight (±4%) nominal voltage tolerance.

Single isolated output power supply versions are available for galvanic separation. The power supply outputs are fused. The PSDR features a universal foot for easy installation via universal DIN rail mounting.

MODEL PSDR12 - SIGNAL CONDITIONER 100 mA POWER SUPPLY

SPECIFICATIONS
1. POWER REQUIREMENTS:
   120 V AC, 70 mA ±10%
   220 V AC, 35 mA ±10%
2. POWER OUTPUT: 24 VDC ±4% @ 100 mA max.
3. FUSE: Fine fuse 125 mA (5 x 20 mm), medium-blow.
4. ISOLATION VOLTAGE:
   Input to Output: 4 kV, 50 Hz, 1 minute
5. OPERATING TEMPERATURE RANGE: 0 to 40°C
6. CONSTRUCTION: Case body is green, high impact plastic.
7. CONNECTIONS: 14 AWG max.
8. MOUNTING: Standard DIN style rail, 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.
9. WEIGHT: 10.3 oz (292.11 g)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>INPUT</th>
<th>OUTPUT</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSDR12</td>
<td>220 VAC</td>
<td>24 VDC</td>
<td>PSDR1210</td>
</tr>
<tr>
<td></td>
<td>120 VAC</td>
<td>24 VDC</td>
<td>PSDR1200</td>
</tr>
</tbody>
</table>

DIMENSIONS “In inches (mm)”
MODEL PSDR - 1 A POWER SUPPLY

DESCRIPTION

PSDR power supplies are compact, linear and highly regulated. They are well suited for use with all signal conditioning products. They feature low output ripple and tight (±1%) nominal voltage tolerance.

The PSDR1300 power supply is fused on both the input and output with 1 A (5 × 20 mm) fuses. Slow-blow fuses are used on the input to accommodate start-up current, and fast-blow fuses on the output for fast response to overloads to ensure safe operation and limit damage to loads if a fault would occur. An LED on the output provides visual indication of power and fuse condition.

Preferred mounting is horizontal (horizontal rail orientation on a vertical panel) for optimum convection airflow through the cooling fins and ventilation slots in the case.

Installation is simplified over open frame supplies: there are no holes to drill or brackets to mount. The power supply is simply snapped onto a standard DIN rail.

SPECIFICATIONS

1. INPUT POWER REQUIREMENTS: 120 VAC, +6/-10%
   Max. Input Power: 55 VA
2. POWER OUTPUT: 24 VDC ±1% @ 1 A DC max.
   Ripple: <20 mV pk-pk
3. FUSE:
   Input fuse: Fine fuse 1 A (5 × 20 mm), slow blow.
   Output Fuse: 1 A (5 × 20 mm) fast blow.
4. ISOLATION VOLTAGE:
   Input to Output: 4 kV, 50 Hz, 1 minute
5. OPERATING TEMPERATURE RANGE: 0° to 60°C
6. CONSTRUCTION: Case body is green, high impact plastic.
7. SPACING BETWEEN SUPPLIES: >10 mm / 0.4 inches
8. CONNECTIONS: 14 AWG max.
9. MOUNTING: Standard DIN Top hat (T) profile rail according to EN50022 - 35 × 7.5 and 35 × 15.
10. WEIGHT: 2.62 lb (1.19 Kg)

UL Recognized Component, File #E171378

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>INPUT</th>
<th>OUTPUT</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSDR</td>
<td>120 VAC</td>
<td>24 VDC</td>
<td>PSDR1300</td>
</tr>
</tbody>
</table>

DIMENSIONS In inches (mm)

DERATING CURVE

BLOCK DIAGRAM
**DESCRIPTION**

Cub Counters and Ditak Tachometers are basically self-powered devices and do not have built-in capability for powering electronic sensors or accepting high level sensor outputs. The PSMA provides a convenient plug-in answer to those applications requiring electronic sensors or accessories for pulse input to Cub Counters or Ditak Tachometers.

The PSMA is available in 115 V AC and 230 V AC primary power input versions, and delivers regulated D.C. voltage for sensors and accessories. The signal conditioning amplifier can accept NPN or PNP Open Collector Inputs, or 2-Wire Proximity Sensor Inputs.

The signal conditioning amplifier supplies two separate outputs, one for direct drive to the H.S. Input of Cub Counters, and the other for direct drive input to the PSM Input of the Ditak 5 or Input to the Ditak 6 or 7. A “pulse stretcher” is used in the circuit that provides the output drive to Cub Counters (Terminal 4). This stretcher allows the PSM to accept 50 µsec input pulses, standard on some Red Lion Controls’ sensors and accessories, and expand it to the 100 µsec pulse, as required by the Cub Counters. The Ditak output (Terminal 8) is not pulse stretched, allowing this output to continue functioning to the full 10 KHz limit of the Ditak.

**SPECIFICATIONS**

1. **POWER SOURCE**: 2 versions, for 115 VAC ±10% 50/60 Hz, or 230 VAC ±10% 50/60 Hz. (See Ordering Information.)
2. **POWER OUTPUT TO SENSORS OR ACCESSORIES**: 12 VDC regulated ±5%, 100 mA max.
3. **INPUT SIGNAL**: (Terminal 3) NPN Open Collector (sink), PNP Open Collector (source), or 2-wire Input. Built-in 3.3 K resistor (Terminal 5) can be jumper connected for pull-up, pull-down, or left unconnected as required. Input Schmitt trigger levels as shown on BLOCK DIAGRAM.
4. **OUTPUTS**: (Terminal 4) Bi-polar drive to H.S. Input of Cub Counters supplies 100 µsec negative going logic pulse (switches from +3 to 0 volts) in response to a trailing (negative going) edge of the input pulse. This output will drive up to 3 Cub Counters in parallel. (Terminal 8) NPN Loaded Collector to drive PSM-input of Ditak 5 and Input of Ditak 6. The output voltage on this terminal is in phase with the input signal going into Terminal 3. The high level of this voltage will be clamped to 6.2V by the zener diode in the Ditak. This output can drive up to 3 Ditak units. For Cub 4 products, use the Ditak output of the PSMA.
5. **OPERATING FREQUENCY**: 0 to 5000 cps with Cub Counters; 0 to 10,000 cps with Ditaks.

---

**NOTES**

1. Inputs and Outputs are referenced to COMMON, on Terminal 2.
2. This Power Supply is regulated and cannot be parallel connected with +12 V outputs from other Red Lion Controls counters or tachometers.
IMPORTANT PRODUCT OBsolescence Notice

The time has come to discontinue a few of our older products due to part availability. The recommended alternative product will offer the customer a better solution than the existing product. Certain products have no listed replacements due to technological advancements. The actual discontinuation date is controlled by raw material inventories and future sales. If you have a customer using any of these products, please contact and advise them of the situation. As always, Red Lion will assist the customer as much as possible in the changeover process.

<table>
<thead>
<tr>
<th>DISCONTINUED PART/MODEL NUMBERS</th>
<th>DESCRIPTION</th>
<th>STATUS</th>
<th>ALTERNATIVE PRODUCT OFFERINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFCx0000</td>
<td>Current to Frequency Converter</td>
<td>Discontinued as parts are depleted.</td>
<td>None</td>
</tr>
<tr>
<td>CL1000x0</td>
<td>2 x 20 Operator Interface</td>
<td>Discontinued as parts are depleted.</td>
<td>CL2000x0</td>
</tr>
<tr>
<td>CUBID001</td>
<td>CUB2 DC Current Meter, 5 VDC</td>
<td>Discontinued as parts are depleted</td>
<td>None</td>
</tr>
<tr>
<td>CUBID002</td>
<td>CUB2 DC Current Meter, 7 to 28 VDC</td>
<td>Discontinued as parts are depleted</td>
<td>CUB40000</td>
</tr>
<tr>
<td>CUBVD001</td>
<td>CUB2 DC Volt Meter, 5 VDC</td>
<td>Discontinued as parts are depleted</td>
<td>None</td>
</tr>
<tr>
<td>CUBVD002</td>
<td>CUB2 DC Volt Meter, 7 to 28 VDC</td>
<td>Discontinued as parts are depleted</td>
<td>CUB4Y000</td>
</tr>
<tr>
<td>CX1000x0</td>
<td>2 x 20 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G305x000</td>
</tr>
<tr>
<td>CX1500x0</td>
<td>2 x 40 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G305x000</td>
</tr>
<tr>
<td>GL3000x0</td>
<td>256 x 128 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G306C000</td>
</tr>
<tr>
<td>GL300T0x0</td>
<td>256 x 128 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G306C000</td>
</tr>
<tr>
<td>GL3500x0</td>
<td>256 x 128 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G306C000</td>
</tr>
<tr>
<td>LPP000000</td>
<td>Loop Powered Process Meter</td>
<td>Discontinued as parts are depleted</td>
<td>CUB4LP00</td>
</tr>
<tr>
<td>VFCx0000</td>
<td>Voltage to Frequency Converter</td>
<td>Discontinued as parts are depleted</td>
<td>None</td>
</tr>
<tr>
<td>VX500S00</td>
<td>640 x 480 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G308C000</td>
</tr>
<tr>
<td>VX500TS00</td>
<td>640 x 480 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G308C000</td>
</tr>
<tr>
<td>VX550S00</td>
<td>640 x 480 Operator Interface</td>
<td>Discontinued as parts are depleted</td>
<td>G308C000</td>
</tr>
</tbody>
</table>
The Voltage/Current to Frequency Converter is a plug-in module which converts either 0 to 10 VDC or 4 to 20 mA analog input signals (specify when ordering) to a frequency output. In typical applications, a process is monitored by a transducer providing an analog output that is converted to a frequency by the module and then totaled by an electronic counter. The Models VFC and CFC provide this conversion process with linearity to within 1% of full scale output. Zero and Span potentiometers are accessible at the top of the module and provide fine tuning of the frequency outputs. A low end Output Inhibit adjustment is accessible at the top of the module to disable the output frequencies up to 10% of full scale, which prevents totaling false counts during process start-up or other abnormal conditions. Three full scale frequencies are simultaneously available: 10 KHz, 1 KHz, and 100 Hz. These frequency outputs are NPN Open Collector transistors and easily interface to most counters and totalizers. The modules may be operated from either 115 or 230 VAC (specify when ordering) or from DC supplies from +9 to +16 VDC.

The VFC and CFC Models are packaged in a convenient 8-pin octal plug-in case that mates with a UL and CSA rated base mounted or DIN rail mounted socket. The socket (ordered separately) features clamp type screw terminals which accept stripped wires without lugs.

**SPECIFICATIONS**

1. **POWER:**
   - AC: 115 or 230 VAC ±10%, 50/60 Hz, 2.0 VA (See Ordering Information).
   - DC: +9 to +16 VDC @ 45 mA max.
2. **INPUT:**
   - Model VFC: 0 to 10 VDC, Impedance greater than 600 KΩ.
   - Model CFC: 4 to 20 mA, 30 Ω Impedance,
     - burden less than 600 mV @ 20 mA
   - Protection: 100% of full scale input
   - Common Mode Rejection: 120 dB, 0-60 Hz
   - Normal Mode Rejection: 35 dB @ 50/60 Hz
3. **ACCURACY:**
   - Linearity: within 1% of full scale
   - Zero Drift: 0.06% per °C of full scale
   - Span Drift: 0.04% per °C of output frequency
   - Linearity over power input of +9 to +16 VDC = within 2% of full scale.
4. **OUTPUTS:** All outputs NPN Open Collector transistor, $I_{SNK} = 10$ mA max., $V_{OH} = 30$ VDC max., $V_{SAT} = 1$ V @ 10 mA.
   - Terminal 3: 0-10 KHz, 50/50 duty cycle
   - Terminal 4: 0-1 KHz, 80% high/20% low duty cycle
   - Terminal 5: 0-100 Hz, 80% high/20% low duty cycle
5. **OPERATING TEMPERATURE:** 0°C to +60°C
6. **STORAGE TEMPERATURE:** -40°C to +80°C
7. **WEIGHT:** Module - 8.0 oz. (227 g)

**DIMENSIONS** In inches (mm)

- 15 TURN SCREWDRIVER ADJUSTMENTS ACCESSIBLE THROUGH TOP
- ZERO ADJUSTMENT
- SPAN ADJUSTMENT
- OUTPUT INHIBIT
- 2.38" (60.5)
- 1.75" (+4.5)
- 4.30" (109.0)
- SEALED HEIGHT ABOVE SOCKET

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFC</td>
<td>Voltage to Frequency Converter, 115 VAC</td>
<td>VFC10000</td>
</tr>
<tr>
<td></td>
<td>Voltage to Frequency Converter, 230 VAC</td>
<td>VFC20000</td>
</tr>
<tr>
<td>CFC</td>
<td>Current to Frequency Converter, 115 VAC</td>
<td>CFC10000</td>
</tr>
<tr>
<td></td>
<td>Current to Frequency Converter, 230 VAC</td>
<td>CFC20000</td>
</tr>
<tr>
<td></td>
<td>Base Mount, 8-Pin Octal Socket</td>
<td>SKT10000</td>
</tr>
<tr>
<td></td>
<td>Din Rail Mount, 8-Pin Octal Socket</td>
<td>SKTDIN00</td>
</tr>
</tbody>
</table>
**RECOMMENDED CALIBRATION PROCEDURE**

1. Apply V AC or VDC to the module as per the actual application.
2. Apply 100 mV for Model VFC or 4.16 mA for Model CFC to “Signal Input” (Terminal 8) and “Common” (Terminal 2).
3. Adjust “ZERO” potentiometer to obtain 100 Hz at Terminal 3 (a frequency counter and an appropriate pull-up resistor to DC are required, $V_{OH} = 30$ VDC, $I_{SNK} = 10$ mA maximum).
4. Apply 10.00 VDC for Model VFC or 20.00 mA for Model CFC to “Signal Input” (Terminal 8) and adjust the “SPAN” potentiometer to obtain 10,000 Hz at Terminal 3. Re-apply Model VFC voltages or Model CFC currents to Terminal 8 for additional “ZERO” and “SPAN” readjustments if required.
5. The “OUTPUT INHIBIT” potentiometer may be adjusted for up to 10% of full scale output during this procedure or adjusted in the actual application.

Note: Frequency outputs at Terminal 4 (1 KHz) and 5 (100 Hz) are divided down internally from the 10 KHz output.

Before commencing with calibration procedure, ensure Output Inhibit pot is rotated fully counter clockwise, otherwise the frequency output may be inhibited during zero calibration.

Although Models VFC and CFC are factory calibrated, periodic calibration is recommended as part of a regular maintenance program or whenever accuracy is questionable.

**TOTALIZE THE NUMBER OF GALLONS FLOWING THROUGH A PIPELINE**

A pipeline is moving material at a known rate of 10 gallons per minute as detected by a flowmeter that generates a linearized 4 to 20 mA analog output. This signal is applied to a Model CFC Current to Frequency Converter Module that provides a 0 to 1000 Hz output on Terminal 4 proportional to the analog 4 to 20 mA input. A Gemini 1000 is then set up for totalization of gallons to 10ths accuracy.

A Gemini Scale Multiplier of 0.01 divides the 1 KHz CFC full scale output to 10 Hz, which corresponds to 10 gallons/minutes maximum rate. Therefore, 10 Hz x 60 seconds/minute = 600 counts/minute for 10 gallons/minute flow rate. The Gemini scale factor is calculated for a display in gallons as $10 ÷ 600 = 0.0167$. To read gallons to 10ths, the 10 gallons is multiplied by 10 for $100 ÷ 600 = 0.1667$ scale factor and the Gemini decimal point is set to the right of the second digit.

Note: A +0.02% accumulation error occurs due to the 4 decimal place scale factor limitation.

**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (PL. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (PL. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
MODEL PSDR - 24 V POWER SUPPLIES @ 1, 2, OR 4 A

DESCRIPTION
The compact PSDR power supplies are industrial input voltage supplies with primary switched-mode regulator technology. They feature low output ripple and adjusted output voltage from 22.5 to 28.5 VDC. The output is electronically protected against overloads and short circuits.

MODULES SNAP ONTO STANDARD 35 MM FLAT DIN RAILS AND USE REMOVABLE TERMINAL BLOCKS FOR EASY WIRING.

SPECIFICATIONS
1. POWER REQUIREMENTS:
Input Voltage Range: 85 to 264 V AC or 90 to 350 VDC
Current Consumption at nominal input voltage:
PSDR0100: 0.2 A @ 230 V AC, 0.4 A @ 120 V AC
PSDR0200: 0.4 A @ 230 V AC, 0.8 A @ 120 V AC
PSDR0400: 0.8 A @ 230 V AC, 1.3 A @ 120 V AC
2. FREQUENCY: 45 to 65 Hz
3. INPUT RECOMMENDED BACKUP FUSE:
Power Circuit Breaker: 6 A or 10 A
Characteristic: B (EN 60898)
4. FREQUENCY: 45 to 65 Hz
5. INPUT RECOMMENDED BACKUP FUSE:
Power Circuit Breaker: 6 A or 10 A
Characteristic: B (EN 60898)
6. EFFICIENCY AT 230 VAC AND NOMINAL VALUES: > 80 %
7. ENVIRONMENTAL CONDITIONS:
Operating Temperature Range: -25 to 60°C
Storage Temperature: -40 to 85°C
Humidity, no moisture condensation: 95 % at 25°C
Vibration in acc. with IEC 68-2-6: < 15 Hz, amplitude ±2.5 mm;
15 Hz - 150 Hz, 2.3 g
Shock in all directions acc. with IEC 68-2-27: 30 g
Contamination in acc. with EN 50178: Degree of pollution 2
8. STANDARDS AND CERTIFICATIONS:

**In conformance with EMC guideline 89/336/EEC**

EMC (Electromagnetic compatibility)

<table>
<thead>
<tr>
<th>Immunity in accordance with EN 61000-6-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge of static electricity (ESD)</td>
</tr>
<tr>
<td>EN 61000-4-2</td>
</tr>
<tr>
<td>Contact discharge: 8 kV</td>
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<tr>
<td>Discharge in air: 8 kV</td>
</tr>
<tr>
<td>Housing Level 3</td>
</tr>
<tr>
<td>Fast transients (Burst)</td>
</tr>
<tr>
<td>EN 61000-4-4</td>
</tr>
<tr>
<td>Input: 4 kV (Level 4)</td>
</tr>
<tr>
<td>Output: 2 kV (Level 3)</td>
</tr>
<tr>
<td>Signal: 1 kV (Level 2)</td>
</tr>
<tr>
<td>Surge voltage capacities (Surge)</td>
</tr>
<tr>
<td>EN 61000-4-5</td>
</tr>
<tr>
<td>Input: 4 kV / 2 kV (Level 4)</td>
</tr>
<tr>
<td>Output: 0.5 kV / 0.5 kV (Level 1)</td>
</tr>
<tr>
<td>Signal: 0.5 kV (Level 1)</td>
</tr>
<tr>
<td>Conducted disturbance</td>
</tr>
<tr>
<td>EN 61000-4-6</td>
</tr>
<tr>
<td>I/O/S: Level 3</td>
</tr>
<tr>
<td>Frequency: 0.15-80 MHz / 10 V</td>
</tr>
<tr>
<td>Voltage dips</td>
</tr>
<tr>
<td>EN 61000-4-11</td>
</tr>
<tr>
<td>Input: see mains buffering</td>
</tr>
<tr>
<td>&gt; 20 ms</td>
</tr>
<tr>
<td>Frequency: 900 MHz, 1800 MHz</td>
</tr>
<tr>
<td>Field intensity: 20 V/m</td>
</tr>
<tr>
<td>Simulation mobile phones</td>
</tr>
<tr>
<td>ENV 50204</td>
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Noise emission according to EN 50081-2

**EN 55011 (EN 55022) Class B 5)**

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<tr>
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</tr>
</tbody>
</table>

9. ISOLATION VOLTAGE: Input/Output 3 kVAC
10. INSTALLATION POSITION: On horizontal mounting rail according to EN 50022-35
11. CONNECTIONS: 24 to 14 AWG max. Torque 4.5 to 5.3 inch-lbs (0.5-0.6 Nm).
12. MOUNTING: Standard DIN rail top hat (T) profile rail according to DIN VDE 0106-101
13. CONSTRUCTION: Case body is black, high impact plastic. IP20 touch safe. Protection Class II.
14. MTBF (Mean Time Between Failure): >500000 h in acc. with IEC 1709 (SN 29500)
15. WEIGHT:
- PSDR0100: 7.4 oz. (210 g)
- PSDR0200: 8.8 oz. (250 g)
- PSDR0400: 14.1 oz. (400 g)
CONNECTION AND OPERATION INSTRUCTIONS

Caution: Danger! Never work on live equipment!
Caution: When the device is opened, a dangerous voltage may remain at the electrolytic capacitors for up to 2 minutes after shutdown!

The installation must be performed by a specialist in accordance with the requirements of EN 60950.

For vertical installations we recommend a minimum spacing of 5 cm (1.97 in.) between other modules and this power supply to ensure sufficient convection.

No minimum spacing is required for horizontal alignment.

The mains feed line must have an appropriate fixing or strain relief outside of the device.

The supply-side installation and the connection via screw terminal blocks must be done in a way that ensures protection against electric shock.

PROTECTION
The device must be installed in accordance with the specifications of EN 60950.

It must be possible to switch off the device using a suitable disconnecting device outside the power supply. For example, primary side line protection could be used.

In case of DC applications it is necessary to connect in series an adequate fuse.

RAIL MOUNTING
The power supply unit can be snapped onto all mounting rails in accordance with EN 50022-35. Installation should be made horizontally (input terminal blocks below).

CABLE CONNECTION
The device is equipped with COMBICON plug connectors.

This easy-to-assemble connection method allows devices to be exchanged easily and the electrical connection to be visibly isolated.

Connecting Cables:
Cable cross sections from 0.2 to 2.5 mm² rigid (solid)/flexible (stranded) (AWG 24-14) may be used.

To maintain UL, use copper cable rated for an operating temperature of 75°C/170°F.

For Reliable And Touch-proof Contacts:
Strip the connection ends (7 mm - See Figure). 7 mm (0.28")

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>OUTPUT</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSDR1</td>
<td>24 VDC @ 1A</td>
<td>PSDR0100</td>
</tr>
<tr>
<td>PSDR2</td>
<td>24 VDC @ 2A</td>
<td>PSDR0200</td>
</tr>
<tr>
<td>PSDR4</td>
<td>24 VDC @ 4A</td>
<td>PSDR0400</td>
</tr>
</tbody>
</table>

INPUT

The input connection is made by the screw connections "L(+)" and "N(-)") (torque 0.5 Nm) on the COMBICON plug connection.

For function monitoring, there is the active DC OK switching output and the DC OK LED.

The 24 VDC signal is measured between the "DC OK" and "-" connection terminal blocks and can be loaded with 20 mA maximum. This signal output indicates that the output voltage has fallen below 21.5 VDC when "active high" changes to "low".

The DC OK signal is isolated from the power output.

OUTPUT

The 24 VDC connection is made by the screw connections "+" and "-" (torque 0.5 Nm) on the COMBICON plug connection. At the time of delivery, the output voltage is 24 VDC. The output voltage can be set from 22.5 to 28.5 VDC on the potentiometer.

The device is electronically protected against short circuits and idling. In the event of an error, the output voltage is limited to max 35 VDC.

Function Monitoring
For function monitoring, there is the active DC OK switching output and the DC OK LED.

The 24 VDC connection is made by the screw connections "+" and "-" (torque 0.5 Nm) on the COMBICON plug connection. At the time of delivery, the output voltage is 24 VDC. The output voltage can be set from 22.5 to 28.5 VDC on the potentiometer.

The device is electronically protected against short circuits and idling. In the event of an error, the output voltage is limited to max 35 VDC.

Output Characteristic Curve
The device functions following the U-I characteristic curve. Under load, the operating point follows this curve. In the event of a short circuit or overload, the output current is limited to IBOOST. The secondary voltage is reduced until the short circuit on the secondary side has been remedied.

<table>
<thead>
<tr>
<th>STATUS 1</th>
<th>STATUS 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>U = 0 V</td>
<td>U = 0 V</td>
</tr>
<tr>
<td>U = +24 V</td>
<td>U = +24 V</td>
</tr>
<tr>
<td>(in reference to &quot;-&quot;)</td>
<td>(in reference to &quot;-&quot;)</td>
</tr>
<tr>
<td>Normal operation of the power supply.</td>
<td>Normal operation of the power supply.</td>
</tr>
<tr>
<td>UOUT &gt; 21.5 V</td>
<td>UOUT &gt; 21.5 V</td>
</tr>
<tr>
<td>Secondary consumer</td>
<td>Secondary consumer</td>
</tr>
<tr>
<td>Short-circuit or overload</td>
<td>Short-circuit or overload</td>
</tr>
<tr>
<td>No mains voltage or device faulty</td>
<td>No mains voltage or device faulty</td>
</tr>
</tbody>
</table>

Thermal Behavior
In the case of ambient temperatures above +60°C, the output capacity has to be reduced by 2.5% per Kelvin increase in temperature.

From +70°C or a thermal overload, the device reduces the output power for its own protection, and returns to normal operation when it has cooled down.
**RJ ADAPTERS & CABLES**

### DRRJ11T6 and DRRJ45T8 Connector to Terminal Adapters

**DESCRIPTION**

These adapters convert modular RJ-style connectors to terminal block connectors, providing a rugged means by which standard shielded cabling can be used in lieu of flat, unshielded cable. The DRRJ11T6 can be used with RJ-11 or RJ-12 cables, while the DRRJ45T8 can be used with RJ-45 connectors. The adapters are designed to mount on any standard DIN rail.

Each screw-terminal accepts wire in size from 26 to 14 AWG (0.14 to 2.5 mm solid; 0.14 to 1.5 mm stranded). Terminal numbers for the screw-terminals correspond directly to the terminal pin out of the RJ connector. There is an extra terminal on each block labeled “S” for the connection of shields.

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRRJ</td>
<td>RJ-11/12 Connector to Terminal Adapter</td>
<td>DRRJ11T6</td>
</tr>
<tr>
<td></td>
<td>RJ-45 Connector to Terminal Adapter</td>
<td>DRRJ45T8</td>
</tr>
<tr>
<td></td>
<td>RJ-45 Parallel Connector</td>
<td>DRRJ45P6</td>
</tr>
<tr>
<td>CBJ</td>
<td>RJ-11 to RJ-11 6&quot; Jumper Cable</td>
<td>CBJ11BD5</td>
</tr>
<tr>
<td>CBL</td>
<td>RJ-12 to RJ-12 1&quot; Cable</td>
<td>CBLRLC01</td>
</tr>
<tr>
<td></td>
<td>RJ-12 to RJ-12 10&quot; Cable</td>
<td>CBLRLC02</td>
</tr>
<tr>
<td></td>
<td>RJ-45 to RJ-45 1&quot; Cable</td>
<td>CBLRLC03</td>
</tr>
<tr>
<td></td>
<td>RJ-45 to RJ-45 10&quot; Cable</td>
<td>CBLRLC04</td>
</tr>
<tr>
<td></td>
<td>RJ-45 to RJ-45 6&quot; Jumper Cable</td>
<td>CBLRLC07</td>
</tr>
</tbody>
</table>

### APPLICATION EXAMPLES

#### RS485 via RJ-11 connector and DRRJ11T6

**Product Examples:** DLC, IAMS, ITMS, and PAX.

A Red Lion Controls device with an RS485 RJ-11 port is connected to the DRRJ11T6 adapter using the CBJ11BD5 cable. The terminal block is then wired to run the RS485 MODBUS serial information to another device.

#### RS232 via RJ-12 connector and DRRJ11T6

**Product Examples:** G3, Modular Controller, and Paradigm (CL, CX, GL, TX, and VX)

A Red Lion Controls device with an RS232 RJ-12 port is connected to the DRRJ11T6 adapter using the CBLRLC01 or CBLRLC02 cable. The terminal block is then wired to run the RS232 serial information to another device.

---

**RJ-11 DIMENSIONS In inches (mm)**

![Diagram of RJ-11 dimensions](image)

**RJ-12 (RS485 MODBUS)**

![Diagram of RJ-12 RS485 MODBUS](image)

**RJ-12 (RS232)**

![Diagram of RJ-12 RS232](image)

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**Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com**
**Limited Warranty**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

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**APPLICATION EXAMPLES**

**RS422/RS485/DH485 via RJ-45 connector and DRRJ45T8**

Product Examples: G3 and Modular Controller

A Red Lion Controls device with an RS422/RS485/DH485 port via RJ-45 is connected to the DRRJ45T8 adapter using the CBLRLC03 or CBLRLC04 cable. The terminal block is then wired to run the RS422/RS485/DH485 serial information to another device.

---

**DRRJ45P6 - RJ45 Parallel Connector**

**DESCRIPTION**

The DRRJ45P6 allows Red Lion products that utilize an RJ45-RS485 port to be quickly multi-dropped, saving wiring time. All six of the connectors on the DRRJ45P6 are wired in parallel, allowing products such as the G3 operator panel and the Modular Controller to be easily connected for multi-drop applications.

**APPLICATION EXAMPLE**

G3 operator panel connected to two Modular Controller masters.

The 10' long CBLRLC04 connects the G3, which is mounted on the door of the enclosure, to the DRRJ45P6, which is located on the DIN rail next to the Modular Controllers. The 1' long CBLRLC03 cables are used to jumper from the DRRJ45P6 to the Modular Controllers.

---

**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter. No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
VCM - VOLTAGE CONVERTER MODULES
Converts AC/DC voltages to an acceptable signal input for many RLC counters and accessories and provides input/output voltage isolation.

TCM - TRIAC CONVERTER MODULE
Accepts unloaded, high off-state leakage triac output from sensors and programmable controllers.

LCM - LOGIC CONVERTER MODULE
Interfaces with CMOS, TTL, and other logic circuits up to +28 VDC, at speeds to 50 KHz. Allows Cub Counters to share sensor outputs with other series counters.

These miniature sized modules are completely encapsulated in PVC, which provides protection against oil, water, dirt, and mechanical damage. They can be quickly and easily mounted to most surfaces by using the self-stick adhesive pad.

VCM - VOLTAGE CONVERTER MODULES
These modules provide a convenient way to adapt RLC Counters to most any machine control voltage signal. They also make it easy to upgrade electromechanical counter installations with RLC Counters.

VCM's are available in two input voltage ranges that cover the spectrum from 4-270 V. The non-polarized input of these modules will accept A.C. (50/60 Hz) or D.C. voltages at input cycles up to 30 Hz. The output uses MOSFET technology that is compatible with either the L.S. Count or Remote Reset inputs of RLC Counters. Electrical isolation between input and output is achieved by means of an internal opto-isolator rated at 2300 Vrms.

**SPECIFICATIONS**

1. **INPUT:**
   - VCM1 = 4 to 50 V AC/DC, 50/60 Hz
   - VCM2 = 50 to 270 V AC/DC, 50/60 Hz

2. **OUTPUT:**
   - Solid state DC contact closure
   - Output rating: 30 VDC at 100mA max
   - Output Isolation: 2300 VRMS
   - Off State Leakage: 1µA max

3. **FREQUENCY:** Max output frequency 30 Hz

4. **ENVIRONMENT:** 0-50°C

**DIMENSIONS FOR VCM, TCM, & LCM In inches (mm)**

- **OUTPUT LEADS:** 6” (150mm) Long, 22GA Stranded, 300V Insulation
- **INPUT LEADS:** 6” (150mm) Long, 22GA. VCM and TCM Leads have 600V Insulation. LCM has 3 Leads with 300V Insulation. (For color codes see specific model.)
**TCM - TRIAC CONVERTER MODULE**

The TCM is a specialized version of the VCM. It is specifically designed to operate with photo-electric sensors and programmable controllers that have 115 VAC Triac outputs. Due to protective suppression circuits connected in parallel with Triacs, these outputs have a high OFF-State Leakage current, which, if unloaded, is sufficient to keep a VCM in the ON condition continuously.

The TCM incorporates a current bias that offsets output leakage currents up to 4 mA and allows the application of RLC Counters to most unloaded Triac outputs. These modules are available for operation with 115 VAC ±10% 50/60 Hz only. They operate at count rates up to 10 cps, and also provide input/output electrical isolation. Connections for the TCM are the same as those for the VCM.

Note: VCM's can be used with Triac outputs that are also driving substantial loads, since the load will shunt the leakage current away from the VCM input.

---

**SPECIFICATIONS**

1. **INPUT:** 115 VAC ± 10% (50/60 Hz) at 5mA min
2. **FREQUENCY:** 10 Hz max output
3. **OUTPUT:** Solid state DC contact closure
   - Output rating: 30 VDC at 100mA
   - Output Isolation: 2300 VRMS
   - Off State Leakage: 1 µA max
4. **ENVIRONMENT:** 0-50° C

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**TYPICAL CONNECTION EXAMPLE FOR VCM & TCM**

(Shown with optional VCM for Control Voltage Remote Reset)

Consult Connections and Configurations set up information in counter instruction literature for wiring. Reference switch and contact input information.

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**LCM - CONVERTER MODULE**

The LCM adapts CUB* Counters to practically any type of logic and sensor output, and to any count signal voltage from +3 to +28 VDC. The module accepts input count pulses from NPN Open-Collector Transistor outputs, Bipolar outputs, or sourcing outputs such as Emitter-Follower or PNP Open-Collector Transistors (Sourcing outputs must be externally loaded with a load of 10 Kohms or less). The LCM output is a Bipolar drive that is compatible with either the Low-Speed or High-Speed Counter inputs as well as the Remote Reset input** of the CUB Counters. The output is inverted with respect to the input which causes the CUB Counter to increment on the leading (positive going) edge of a count pulse. Power for operation of the LCM can be normally obtained from the existing D.C. power supply used to operate the sensor or other logic circuity. When count pulse signals are generated by switch contacts the LCM output can be applied to the L.S. input of the CUB to de-bounce these pulses. Minimum pulse width when driving the L.S. input is 10 msec and maximum count rate is 50 cps.

* LCM intended for use with CUB1,2,3, and 7.
** When used to operate Remote Reset input, the LCM will reset counter when input to LCM goes high due to signal inversion.

---

**SPECIFICATIONS**

1. **POWER:** 5 to 28 VDC, 8 mA max
2. **INPUT:** $V_{IH} = +2.5$ to 28 VDC, 500 µA max source
   $V_{IL} = +1.0$ VDC, 50 µA max sink
3. **OUTPUT:** Bipolar 3 VDC with 1 mA sink/source (output should not be connected to voltage levels above 3.5 VDC)
4. **FREQUENCY:** MAX input/output frequency = 50 Khz (see counter input for frequency limitations)
5. **ENVIRONMENT:** 0-50° C

---

*Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com*
TYPICAL INPUTS TO LCM

CMOS OR TTL

5 TO 28VDC SUPPLY

INPUT

BLUE
ORANGE
BLACK

NPN OPEN COLLECTOR
(SINK OUTPUT)

5 TO 28VDC SUPPLY

SENSOR OR LOGIC CIRCUIT

INPUT

BLUE
ORANGE
BLACK

PNP OPEN COLLECTOR
(SOURCE OUTPUT)

5 TO 28VDC SUPPLY

SENSOR OR LOGIC CIRCUIT

INPUT

BLUE
ORANGE
BLACK

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>INPUT VOLTAGE</th>
<th>OUTPUT WIRE COLOR</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCM</td>
<td>Voltage Converter Module</td>
<td>4 - 50 V AC/DC</td>
<td>yellow</td>
<td>VCM10000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 - 270 V AC/DC</td>
<td>white</td>
<td>VCM20000</td>
</tr>
<tr>
<td>TCM</td>
<td>Triac Converter Module</td>
<td>115 VAC ±10%</td>
<td>white/green trace</td>
<td>TCM10000</td>
</tr>
<tr>
<td>LCM</td>
<td>Logic Converter Module</td>
<td>+3 to +28 VDC (signal)</td>
<td>white</td>
<td>LCM10000</td>
</tr>
</tbody>
</table>

+5 to +28 VDC (supply)
```markdown
## LIMITED WARRANTY

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The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.
```
GENERAL DESCRIPTION
CTR Series transducers combine a current transformer and a signal conditioner into a single package. This provides higher accuracy, lower wiring costs, easier installation and saves valuable panel space.

The CTR Series transducers are available in 4-20 mA output only. The CTR Series provides a “True RMS” output on distorted waveforms found on VFD or SCR outputs, and on linear loads in “noisy” power environments. Select the CTR Series for variable speed or SCR controlled loads.

The current waveform of a typical linear load is a pure sine wave. In VFD and SCR applications, however, output waveforms are rough approximations of a sine wave. There are numerous spikes and dips in each cycle. CTR transducers use a mathematical algorithm called “True RMS”, that integrates the actual waveform over time. The output is the amperage component of the true power (heating value) of the AC current waveform. True RMS is the only way to accurately measure distorted AC waveforms.

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.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

SPECIFICATIONS
1. OUTPUT SIGNAL: 4 to 20 mA DC, loop-powered, True RMS
2. OUTPUT LIMIT: 23 mA
3. FREQUENCY RANGE: 10-400 Hz (All Waveforms)
4. RESPONSE TIME: to 90% of step change 600 msec
5. ACCURACY: 0.8% FS
6. POWER SUPPLY: 24 VDC Nominal, 40 VDC Max.
7. INPUT RANGES: (Jumper Selectable)

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Continuous</td>
</tr>
<tr>
<td>CTR05</td>
<td>10 A</td>
<td>80 A</td>
</tr>
<tr>
<td></td>
<td>20 A</td>
<td>110 A</td>
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<td></td>
<td>50 A</td>
<td>175 A</td>
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<td></td>
<td>100 A</td>
<td>200 A</td>
</tr>
<tr>
<td></td>
<td>150 A</td>
<td>300 A</td>
</tr>
<tr>
<td></td>
<td>200 A</td>
<td>400 A</td>
</tr>
<tr>
<td>CTR2</td>
<td>10 A</td>
<td>80 A</td>
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<tr>
<td></td>
<td>150 A</td>
<td>300 A</td>
</tr>
<tr>
<td></td>
<td>200 A</td>
<td>400 A</td>
</tr>
</tbody>
</table>

8. ISOLATION VOLTAGE: 3 kV
9. CASE: UL 94V-0 Flammability rated thermoplastic
10. ENVIRONMENTAL: -4 to 122 °F (-20 to 50 °C)
    0-95% RH, non-condensing
11. TORQUE RATINGS: 9 in-lbs
12. LISTING: UL 508 Industrial Control Equipment, CSA C22.2 No. 14-M95, and CE Certified.
INSTALLATION

Run wire to be monitored through opening in the sensor. Be sure the monitored current flows in the same direction as the arrow on the sensor. The CTR Series transducers work in the same environment as motors, contactors, heaters, pull-boxes, and other electrical enclosures. They can be mounted in any position or hung directly on wires with a wire tie. Just leave at least one inch (25.4 mm) distance between sensor and other magnetic devices.

Split-Core Versions

Press the tab in the direction as shown to open the sensor. After placing the wire in the opening, press the hinged portion firmly downward until a definite click is heard and the tab pops out fully.

KEEP SPLIT-CORE SENSORS CLEAN.

Silicone grease is factory applied on the mating surfaces to prevent rust and improve performance. Be careful not to allow grit or dirt onto the grease in the contact area. Operation can be impaired if the mating surfaces do not have good contact. Check visually before closing.

OUTPUT WIRING

Connect control or monitoring wires to the sensor. Use up to 14 AWG copper wire and tighten terminals to 9 inch-pounds torque. Be sure the output load or loop power requirements are met (see diagram).

Connection Notes:
- Captive screw terminals.
- 14-22 AWG solid or stranded.
- Observe Polarity
- See label for ranges & jumper positions

Loop Voltage Requirements:

\[ V_L = 12V + (R_L \times 20 \text{ mA}) \]

Where: \( V_L = \text{Min. Loop voltage} \)
\( R_L = \text{Loop Resistance} \)

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<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTR</td>
<td>50 A/4-20 mA, Split Case</td>
<td>CTR050000</td>
</tr>
<tr>
<td></td>
<td>200 A/4-20 mA, Split Case</td>
<td>CTR200000</td>
</tr>
</tbody>
</table>

TROUBLE SHOOTING

1. Sensor Has No Output

   A. Power supply is not properly sized. Check power supply voltage and current rating.
   B. Polarity is not properly matched. Check and correct wiring polarity.
   C. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.

2. Output Signal Too Low

   A. The jumper may be set in a range that is too high for current being monitored. Move jumper to the correct range.
   B. Output load too high. Check output load, be sure that \( V_L \) does not exceed 40 VDC.
   C. Monitored current is below minimum required. Loop the monitored wire several times through the aperture until the “sensed” current rises above minimum. Sensed Amps = (Actual Amps) x (Number of Loops). Count loops on the inside of the aperture.

3. Output Signal Is Always At 4mA

   A. Monitored load is not AC or is not on. Check that the monitored load is AC and that it is actually on.

4. Output Signal Is Always At 20mA

   A. The jumper may be set in a range that is too low for current being monitored. Move jumper to the correct range.

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Fax +65 6743-3360

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Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
MODEL CTS - AC CURRENT OPERATED SWITCH

- UNIVERSAL OUTPUT
- SELF-POWERED
- EASILY ADJUSTABLE SETPOINT
- FIXED OR SPLIT-CORE CASE

GENERAL DESCRIPTION
CTS Series Transducers are self-powered, solid-state current-operated switches that trigger when the current level sensed through the aperture exceeds the adjusted setpoint. The solid state output contacts can switch AC or DC; this “universal” output makes them well suited for application in automation systems.

CTS Series Current Operated Switches combine a current transformer, signal conditioner and limit alarm into a single package for use in status monitoring or proof of operation applications. Offering an extended setpoint range of 1-150 A and universal, solid-state outputs, the self-powered CTS can be tailored to provide accurate and dependable digital indication of over-current conditions across a broad range of applications. Available in solid-core enclosure styles or in a split-core case to maximize ease of installation.

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.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

SPECIFICATIONS
1. POWER SUPPLY: None - self powered
2. OUTPUT: Magnetically isolated solid-state switch
3. OUTPUT RATING: 0.15A, 240 VAC/VDC
4. OFF STATE LEAKAGE: <10 µA
5. RESPONSE TIME: 120 msec
6. HYSTERESIS: Approx 5% of Setpoint
7. OVERLOAD:

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>CONTINUOUS</th>
<th>6 SEC</th>
<th>1 SEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTSF</td>
<td>1-150 A</td>
<td>150 A</td>
<td>400 A</td>
<td>1000 A</td>
</tr>
<tr>
<td>CTSS</td>
<td>1.5-150 A</td>
<td>150 A</td>
<td>400 A</td>
<td>1000 A</td>
</tr>
<tr>
<td>CTSG</td>
<td>1.5 A</td>
<td>250 A</td>
<td>400 A</td>
<td>1000 A</td>
</tr>
</tbody>
</table>

8. SET POINT RANGES: Fixed-Core (CTSF): 1-150 A
   Split-Core (CTSS): 1.5-150 A
   Fixed-Core Go/No Go (CTSG): 1.5

9. SETPOINT ADJUST: 4 Turn potentiometer (CTSS)
   15 Turn Potentiometer (CTSF)

10. FREQUENCY RANGE: 6-100 Hz
11. ISOLATION VOLTAGE: UL Listed to 1,270 VAC. Tested to 5,000 VAC
12. CASE: UL 94V-0 Flammability rated thermoplastic
13. ENVIRONMENTAL: -58 to 149 °F (-50 to 65 °C)
   0-95% RH, non-condensing
14. TORQUE RATINGS: 5 in-lbs
15. LISTING: UL 508 Industrial Control Equipment, CSA C22.2 No. 14-M95, and CE Certified.

DIMENSIONS In inches (mm)

SPLIT-CORE

DIMENSIONS In inches (mm)

FIXED-CORE
INSTALLATION

Run wire to be monitored through opening in the sensor. The CTS Series transducers work in the same environment as motors, contactors, heaters, pull-boxes, and other electrical enclosures. They can be mounted in any position or hung directly on wires with a wire tie. Just leave at least one inch (25.4 mm) distance between sensor and other magnetic devices.

Split-Core Versions

Press the tab in the direction as shown to open the sensor. After placing the wire in the opening, press the hinged portion firmly downward until a definite click is heard and the tab pops out fully.

KEEP SPLIT-CORE SENSORS CLEAN.

Silicone grease is factory applied on the mating surfaces to prevent rust and improve performance. Be careful not to allow grit or dirt onto the grease in the contact area. Operation can be impaired if the mating surfaces do not have good contact. Check visually before closing.

OUTPUT WIRING

Connect control or monitoring wires to the sensor. Use up to 14 AWG copper wire and tighten terminals to 5 inch-pounds torque. Be sure the output load does not exceed the switch rating.

CAUTION: Incandescent lamps can have “Cold Filament Inrush” current of up to 10 times their rated amperage. Use caution when switching lamps.

SETPOINT ADJUSTMENT

CTS Series SETPOINT is adjusted with a 4-turn potentiometer (CTSS) or a 15-turn potentiometer (CTSF). The pot is shipped factory set to the lowest setpoint, fully clockwise (CW). Turning the pot counter-clockwise (CCW) will increase the setpoint. The pot has a slip-clutch to prevent damage at either end of its rotation. To determine where the adjustment is, turn the pot all the way CW. This will return it to the minimum setpoint.

Adjustment Notes:
1. Output contacts are solid-state. Check output status by applying voltage to the contacts and reading the voltage drop across the contacts. An Ohmmeter set on “Continuity” will give misleading results.
2. It is recommended that the setpoint be adjusted to allow for voltage variations of 10-15%.

Typical Adjustment
1. Turn the pot to minimum setpoint (4 or 15 turns CW).
2. Have normal operating current running through the sensor. The output should be tripped since the pot is at its minimum setpoint. For units with LED, it should be flashing fast (2 to 3 times per second).
3. Turn the pot CCW until the unit un-trips. This is indicated by the slow flashing of the LED (once every 2 to 3 seconds), or by the changing of the output switch status.
4. Now turn the pot CW slowly until the unit trips again.

It is now set at the current level being monitored.
A. To Set UNDERLOAD - Turn the pot about 1/8 turn further CW.
B. To Set OVERLOAD - Turn the pot about 1/8 turn further CCW.

TROUBLE SHOOTING

1. Sensor Is Always Tripped
   A. The setpoint may be too low. Turn pot CCW to increase setpoint.
   B. Switch has been overloaded and contacts are burned out. Check the output load, remembering to include inrush on inductive loads (coils, motors, ballasts).

2. Sensor Will Not Trip
   A. The setpoint may be too high. Turn pot CW to decrease setpoint.
   B. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.
   C. Monitored current is below minimum required. Loop the monitored wire several times through the aperture until the “sensed” current rises above minimum. Sensed Amps = (Actual Amps) x (Number of Loops). Count loops on the inside of the aperture.
   D. Switch has been overloaded and contacts are burned out. Check the output load, remembering to include inrush on inductive loads (coils, motors, ballasts).

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTS</td>
<td>1.5-150 A Split-Core Current Switch</td>
<td>CTS00000</td>
</tr>
<tr>
<td></td>
<td>1-150 A Fixed-Core Current Switch</td>
<td>CTSS0000</td>
</tr>
<tr>
<td></td>
<td>1.5 A Fixed-Core Go-No Go Current Switch</td>
<td>CTS00000</td>
</tr>
</tbody>
</table>

LIMITED WARRANTY

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MODEL CTL - AVERAGE RESPONDING AC CURRENT TRANSDUCERS

- AVERAGE RESPONDING OUTPUT: 0-10 VDC or 4-20 mA
- JUMPER SELECTABLE RANGES
- OUTPUT IS MAGNETICALLY ISOLATED FROM THE INPUT
- SPLIT-CORE AND FIXED-CORE CASES

GENERAL DESCRIPTION

CTL Series transducers combine a current transformer and a signal conditioner into a single package. This provides higher accuracy, lower wiring costs, easier installation and saves valuable panel space.

The CTL Series transducers have jumper selected current input ranges and industry standard 0-10 VDC or 4-20 mA outputs. The CTL Series is designed for application on “linear” or sinusoidal AC loads. Available in a split-core or solid-core case. Select the CTL Series for constant speed loads or On/Off loads.

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.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

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

SPECIFICATIONS

1. OUTPUT SIGNAL: 0-10 VDC 4-20 mA
2. OUTPUT LIMIT: 15 VDC 40 mA
3. FREQUENCY RANGE: 50-60 Hz 20-100 Hz
4. RESPONSE TIME: 100 msec 300 msec
5. ACCURACY: 1.0% FS 0.5% FS
6. POWER SUPPLY: Self-powered 24 VDC Nominal, 40 VDC max.
7. INPUT RANGES: (Jumper Selectable)

<table>
<thead>
<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>MAXIMUM</th>
</tr>
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<tbody>
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<td></td>
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<tr>
<td>CTL1</td>
<td>2 A</td>
<td>80 A</td>
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<tr>
<td></td>
<td>5 A</td>
<td>100 A</td>
</tr>
<tr>
<td>CTL5</td>
<td>10 A</td>
<td>80 A</td>
</tr>
<tr>
<td></td>
<td>20 A</td>
<td>110 A</td>
</tr>
<tr>
<td></td>
<td>50 A</td>
<td>175 A</td>
</tr>
<tr>
<td>CTL2</td>
<td>100 A</td>
<td>200 A</td>
</tr>
<tr>
<td></td>
<td>150 A</td>
<td>300 A</td>
</tr>
<tr>
<td></td>
<td>200 A</td>
<td>400 A</td>
</tr>
</tbody>
</table>

8. ISOLATION VOLTAGE: 3 kV
9. CASE: UL 94V-0 Flammability rated thermoplastic
10. ENVIRONMENTAL: -4 to 122 °F (-20 to 50 °C)
    0-95% RH, non-condensing
11. TORQUE RATINGS: 7 in-lbs on Fixed-core models; 9 in-lbs on Split-core models.
12. LISTING: UL 508 Industrial Control Equipment, CSA C22.2 No. 14-M95, and CE Certified.

DIMENSIONS In inches (mm)

<table>
<thead>
<tr>
<th>SPLIT-CORE</th>
<th>FIXED-CORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.04 (77.2)</td>
<td>3.03 (77.0)</td>
</tr>
<tr>
<td>3.53 (89.7)</td>
<td>0.93 (23.6)</td>
</tr>
<tr>
<td>Ø 0.19 (4.8)</td>
<td>Ø 0.74 (19)</td>
</tr>
<tr>
<td>2.25 (57.2)</td>
<td>2.26 (56.0)</td>
</tr>
<tr>
<td>0.85 (21.6)</td>
<td>0.85 (21.6)</td>
</tr>
<tr>
<td>0.85 (21.6)</td>
<td>0.85 (21.6)</td>
</tr>
<tr>
<td>0.85 (21.6)</td>
<td>0.85 (21.6)</td>
</tr>
<tr>
<td>2.18 (55.4)</td>
<td>2.18 (55.4)</td>
</tr>
<tr>
<td>3.50 (88.9)</td>
<td>3.50 (88.9)</td>
</tr>
</tbody>
</table>

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
**INSTALLATION**

Run wire to be monitored through opening in the sensor. Be sure the monitored current flows in the same direction as the arrow on the sensor. TheCTL Series transducers work in the same environment as motors, contactors, heaters, pull-boxes, and other electrical enclosures. They can be mounted in any position or hung directly on wires with a wire tie. Just leave at least one inch (25.4 mm) distance between sensor and other magnetic devices.

**Split-Core Versions**

Press the tab in the direction as shown to open the sensor. After placing the wire in the opening, press the hinged portion firmly downward until a definite click is heard and the tab pops out fully.

**KEEP SPLIT-CORE SENSORS CLEAN.**

Silicone grease is factory applied on the mating surfaces to prevent rust and improve performance. Be careful not to allow grit or dirt onto the grease in the contact area. Operation can be impaired if the mating surfaces do not have good contact. Check visually before closing.

**OUTPUT WIRING**

Connect control or monitoring wires to the sensor. Use up to 14 AWG copper wire and tighten terminals to 7 inch-pounds torque for solid-core models and 9 inch-pounds torque for split-core models. Be sure the output load or loop power requirements are met (see diagram).

**POWER SUPPLY**

![Power Supply Graph]

**RANGE SELECT**

CTL series transducers feature field selectable ranges. The ranges are factory calibrated, eliminating time consuming and inaccurate field setting of zero or span.

1. Determine the normal operating amperage of your monitored circuit.
2. Select the range that is equal to or slightly higher than the normal operating amperage.
3. Place the range jumper in the appropriate position.

**TROUBLE SHOOTING**

**0-10 VDC OUTPUT MODELS**

1. **Sensor Has No Output**
   - A. Polarity is not properly matched. Check and correct wiring polarity.
   - B. Monitored load is not AC or is not on. Check that the monitored load is AC and that it is actually on.
   - C. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.

2. **Output Signal Too Low**
   - A. The jumper may be set in a range that is too high for current being monitored. Move jumper to the correct range.
   - B. Output load too low. Check output load, be sure that it is at least 100KΩ and preferably 1 MΩ.
   - C. Monitored current is below minimum required. Loop the monitored wire several times through the aperture until the “sensed” current rises above minimum. Sensed Amps = (Actual Amps) x (Number of Loops). Count loops on the inside of the aperture.

3. **Output Signal Is Always At Maximum**
   - A. The jumper may be set in a range that is too low for current being monitored. Move jumper to the correct range.

**4-20 mA OUTPUT MODELS**

1. **Sensor Has No Output**
   - A. Power supply is not properly sized. Check power supply voltage and current rating.
   - B. Polarity is not properly matched. Check and correct wiring polarity.
   - C. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.

2. **Output Signal Too Low**
   - A. The jumper may be set in a range that is too high for current being monitored. Move jumper to the correct range.
   - B. The load current is not sinusoidal.
   - C. Monitored current is below minimum required. Loop the monitored wire several times through the aperture until the “sensed” current rises above minimum. Sensed Amps = (Actual Amps) x (Number of Loops). Count loops on the inside of the aperture.

3. **Sensor Is Always At 4 mA**
   - A. Monitored load is not AC or is not on. Check that the monitored load is AC and that it is actually on.

4. **Output Signal Is Always At 20 mA**
   - A. The jumper may be set in a range that is too low for current being monitored. Move jumper to the correct range.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL0501F</td>
<td>50 A / 10 VDC, Fixed Case</td>
<td></td>
</tr>
<tr>
<td>CTL0502F</td>
<td>50 A / 4-20 mA, Fixed Case</td>
<td></td>
</tr>
<tr>
<td>CTL2001F</td>
<td>200 A / 10 VDC, Fixed Case</td>
<td></td>
</tr>
<tr>
<td>CTL2002F</td>
<td>200 A / 4-20 mA, Fixed Case</td>
<td></td>
</tr>
<tr>
<td>CTL0052S</td>
<td>5 A / 4-20 mA, Split Case</td>
<td></td>
</tr>
<tr>
<td>CTL0502S</td>
<td>50 A / 4-20 mA, Split Case</td>
<td></td>
</tr>
<tr>
<td>CTL2002S</td>
<td>200 A / 4-20 mA, Split Case</td>
<td></td>
</tr>
</tbody>
</table>
MODEL CTD - DC CURRENT TRANSUDER

- THREE JUMPER SELECTABLE INPUT RANGES
- OUTPUT IS MAGNETICALLY ISOLATED FROM THE INPUT
- INTERNAL POWER REGULATION
- SPLIT-CORE CASE FOR EASY INSTALLATION

GENERAL DESCRIPTION

CTD transducer combines a Hall Effect sensor and a signal conditioner into a single package. This provides higher accuracy, lower wiring costs, easier installation and saves valuable panel space. The CTD has jumper selectable current input ranges and industry standard 4-20 mA output with a split-core case.

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.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

SPECIFICATIONS

1. OUTPUT SIGNAL: 4-20 mA
2. OUTPUT LIMIT: 23 mA
3. ACCURACY: 1.0% FS
4. REPEATABILITY: 1.0% FS
5. RESPONSE TIME: to 90% of step change 100 msec
6. FREQUENCY RANGE: DC
7. POWER SUPPLY: 22 – 26 VAC/VDC
   - Power input and output signal are not isolated.
8. POWER CONSUMPTION: 2 VA
9. LOADING: 650Ω max.
10. ISOLATION VOLTAGE: 3 kV (monitored line to output)
11. LINEARITY: 0.75% FS
12. CURRENT RANGES: Three selectable Ranges: 0 – 50 A
    - 0 – 75 A
    - 0 – 100 A
13. CASE: UL 94V-0 Flammability rated thermoplastic
14. ENVIRONMENTAL: -4 to 122 °F (-20 to 50 °C)
    - 0-95% RH, non-condensing

DIMENSIONS In inches (mm)

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Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
INSTALLATION
Run wire to be monitored through opening in the sensor. Be sure the monitored current flows in the same direction as the arrow on the sensor. The arrow is just above the hinge, with the “+” symbol on the left, the “-” symbol on the right. The CTD transducers work in the same environment as motors, contactors, heaters, pull-boxes, and other electrical enclosures. They can be mounted in any position or hung directly on wires with a wire tie. Just leave at least one inch (25.4 mm) distance between sensor and other magnetic devices.

Split-Core Versions
Press the tab in the direction as shown to open the sensor. After placing the wire in the opening, press the hinged portion firmly downward until a definite click is heard and the tab pops out fully.

KEEP SPLIT-CORE SENSORS CLEAN.
Silicone grease is factory applied on the mating surfaces to prevent rust and improve performance. Be careful not to allow grit or dirt onto the grease in the contact area. Operation can be impaired if the mating surfaces do not have good contact. Check visually before closing.

OUTPUT WIRING
Connect control or monitoring wires to the sensor. Use up to 14 AWG copper wire and tighten terminals to 4 inch-pounds torque.

4-20mA:
The current loop is powered by the CTD Transducer. Maximum loop impedance is 650 Ω.

LIMITED WARRANTY
The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company’s liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company’s option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products. The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter. No warranties expressed or implied are created with respect to The Company’s products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>CTD</td>
<td>DC/DC, Split Case</td>
<td>CTD00000</td>
</tr>
</tbody>
</table>

RANGE SELECT
CTD transducers feature field selectable ranges. The ranges are factory calibrated, eliminating time consuming and inaccurate field setting of zero or span.

1. Determine the normal operating amperage of your monitored circuit.
2. Select the range that is equal to or slightly higher than the normal operating amperage.
3. Place the range jumper in the appropriate position.

TROUBLE SHOOTING

1. Output Signal Too Low
   A. The jumper may be set in a range that is too high for current being monitored. Move jumper to the correct range.
   B. Power supply is inadequate. Check power supply. Make sure it is of sufficient voltage with all loads at maximum. CTD Series draw 2.0 VA.
   C. Output load too high. Check output load, be sure it is no more than 650 Ω.

2. Output Signal is always at maximum
   A. The jumper may be set in a range that is too low for current being monitored. Move jumper to the correct range.

3. Sensor has no output
   A. Polarity is not properly matched. Check and correct wiring polarity
   B. Monitored load is not DC or is not on. Check that the monitored load is DC and that it is actually on.
   C. Split Core models: The core contact area may be dirty. Open the sensor and clean the contact area.

CONTACT AREA CLEAN!
To Open
Press Tab
Toward Hinge.