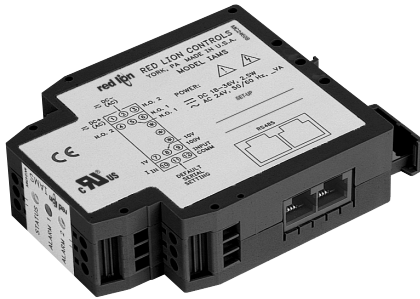


MODEL IAMS - INTELLIGENT ANALOG TO MODBUS CONDITIONER W/ ALARMS



- ANALOG TO MODBUS CONVERSION
- 18 DIFFERENT DC ANALOG INPUT RANGES
- PROCESSOR BASED SCALING
- PC CONFIGURATION SOFTWARE
- DUAL SETPOINT RELAY ALARMS
- FOUR WAY SIGNAL ISOLATION



UL Recognized Component,
 File # E179259



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.



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



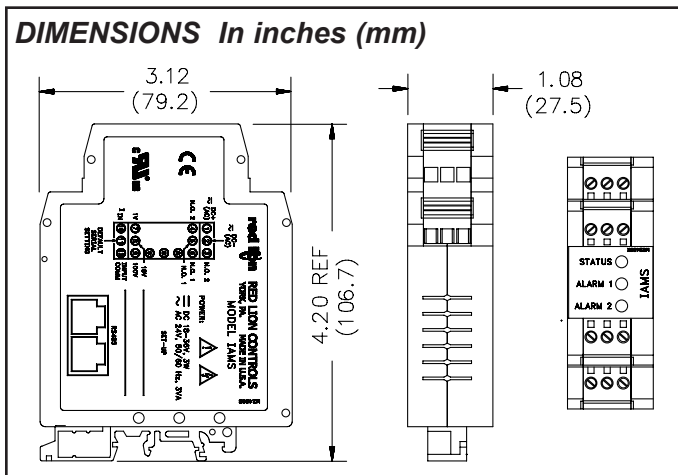
CAUTION: Risk of electric shock.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IAMS	Smart Analog to Modbus Conditioner w/Alarms	IAMS3535
SFIMS	PC Configuration Software for Windows	SFIMS
CBPRO	Programming Interface Cable	CBPRO007
CBJ	Cable RJ11 to Unterminated 7 foot length	CBJ11A07
	Cable RJ11 to RJ11 6 inch jumper	CBJ11BD5
-	RJ11 to Terminal Adapter	DRRJ11T6

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, 0-1V, 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)
 $V_{OH} = 10$ VDC max. $V_{OL} = 0.5$ VDC @ 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.
 IECCE 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 ¹
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/M 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 KV I/O Level 3; 2 KV power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
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
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Notes:

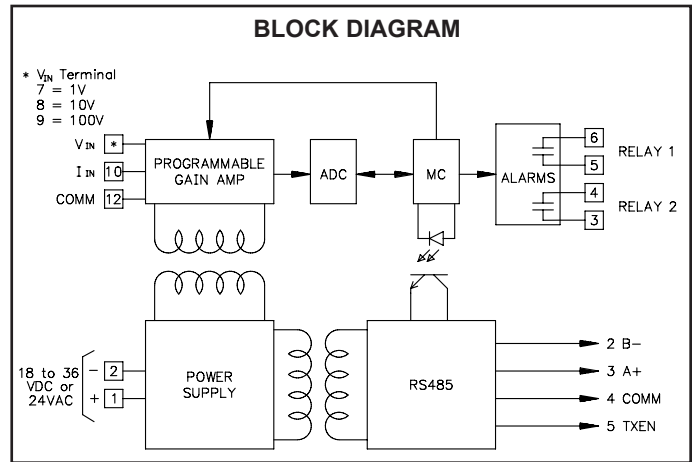
- This device was designed for installation in an enclosure. To avoid electrostatic discharge to the module in environments with static levels above 6 KV, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making connections, etc.), typical anti-static precautions should be observed before touching the module.
 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)



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.

LED FUNCTIONALITY

CONDITION	GREEN LED	2 RED LEDS
Power Applied	On	—
Communication Received	Flashing	—
Respective Alarm	—	On
Checksum error	Flashing	Flashing
Calibration	Off	On

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.

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

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

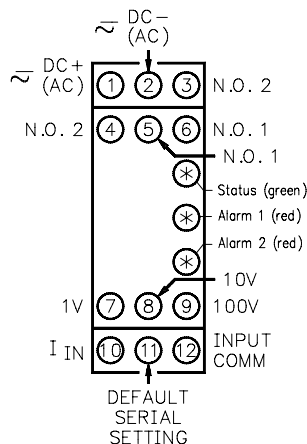
Voltage Input

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.

Note: Snubber leakage current can cause some high impedance loads to be held ON.

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.

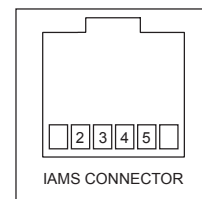
DEFAULTS:

Protocol: RTU Data Bits: 8
 Address: 247 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.

RJ11	IAMS
1	Not used
2	B-
3	A+
4	COMM
5	TXEN
6	Not used

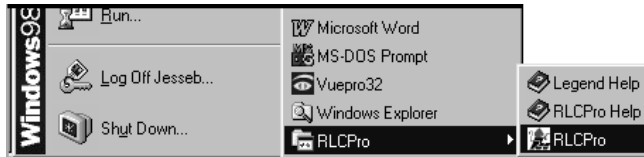


STEP 2 INSTALLING SFIMS (Software for Intelligent Modules)

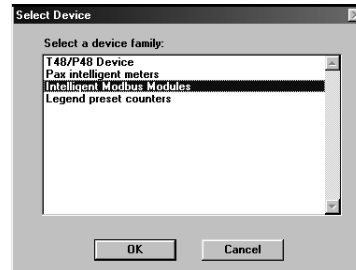
Insert the SFIMS diskette into the A: or B: drive. Then Run A:\SETUP (or B:\SETUP) to install RLCPro onto the hard drive. An icon labeled RLCPro will be created under the group RLCPro.



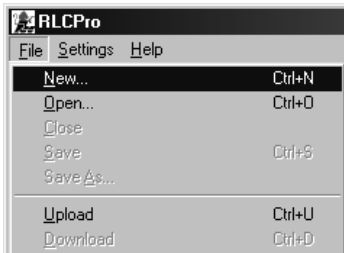
STEP 3 PROGRAMMING - Getting Started



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

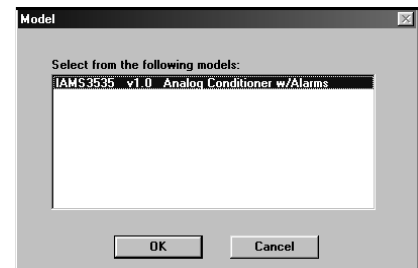


You will be prompted to select the proper device,



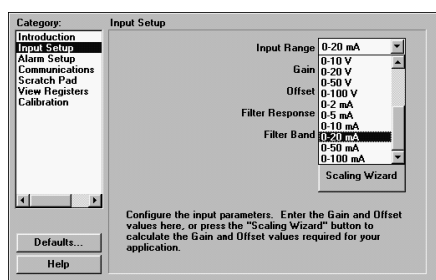
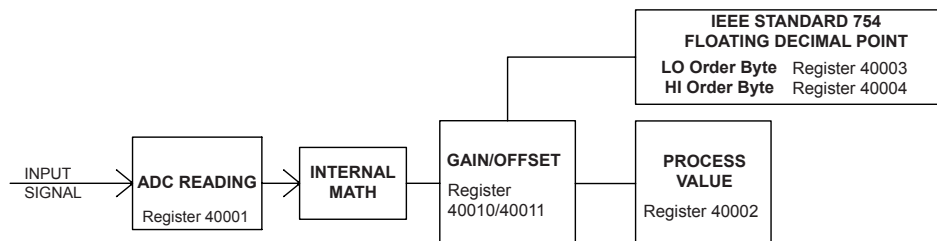
Use the FILE pull-down menu to select a NEW file.

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 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.

Scaling Points

Enter the minimum and maximum Input signal and desired scaled Process values for your application.

Input and Process Scaling Values

	Input	Process
Minimum	4.000	0
Maximum	20.000	1500

Enter the Process value (+/-32000) that corresponds to the 20.000 mAmps Input value.

Press NEXT to calculate the new Gain and Offset values for the Input and Process values or CANCEL to exit the Scaling Wizard and retain the existing Gain and Offset values.

Help < Back Next > Cancel

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)

Scaling - Gain and Offset Values

New Gain and Offset values have been calculated for the given Input signal range and scaled Process values.

Calculated Gain and Offset Values

	Input	Process
Gain	0.094	4.000
Offset	-380	-4

NOTE: Input and Process values are only used to calculate the Gain and Offset settings, and are not part of the IAMS data. The Input and Process values are neither saved in the unit nor in a file and will be discarded upon exit from the Scaling Wizard.

Press ACCEPT to save the new Gain and Offset values. CANCEL to retain the old values, or BACK to change the Input/Process values.

Help < Back Accept > Cancel

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.

Category: Input Setup

Introduction
Input Setup
Alarm Setup
Communications
Scratch Pad
View Registers
Calibration

Input Range: 0-20 mA
Gain: 1.000
Offset: 0
Filter Response: 0.0
Filter Band: 0

Scaling Wizard

Configure the input parameters. Enter the Gain and Offset values here, or press the "Scaling Wizard" button to calculate the Gain and Offset values required for your application.

Defaults... Help

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 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.

STEP 5 PROGRAMMING THE ALARMS

Category: Alarm Setup

Introduction
Input Setup
Alarm Setup
Alarm #1
Alarm #2
Communications
Scratch Pad
View Registers
Calibration

Alarm #1 Action: manual
Setpoint: manual
Hysteresis: absolute HI (balanced)
absolute LO (balanced)
absolute HI (unbalanced)
absolute LO (unbalanced)
Trigger Points: Off 0, On 0
Reset: manual
On Delay: 0
Enable standby delay

Select an alarm and configure the alarm settings.

Defaults... Help

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.)

Category: Alarm Setup

Introduction
Input Setup
Alarm Setup
Alarm #1
Alarm #2
Communications
Scratch Pad
View Registers
Calibration

Alarm #1 Action: absolute LO [balanced]
Setpoint: 500
Hysteresis: 1
Trigger Points: Off 500.5, On 499.5
Reset: automatic
On Delay: latched
Enable standby delay

Select an alarm and configure the alarm settings.

Defaults... Help

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)

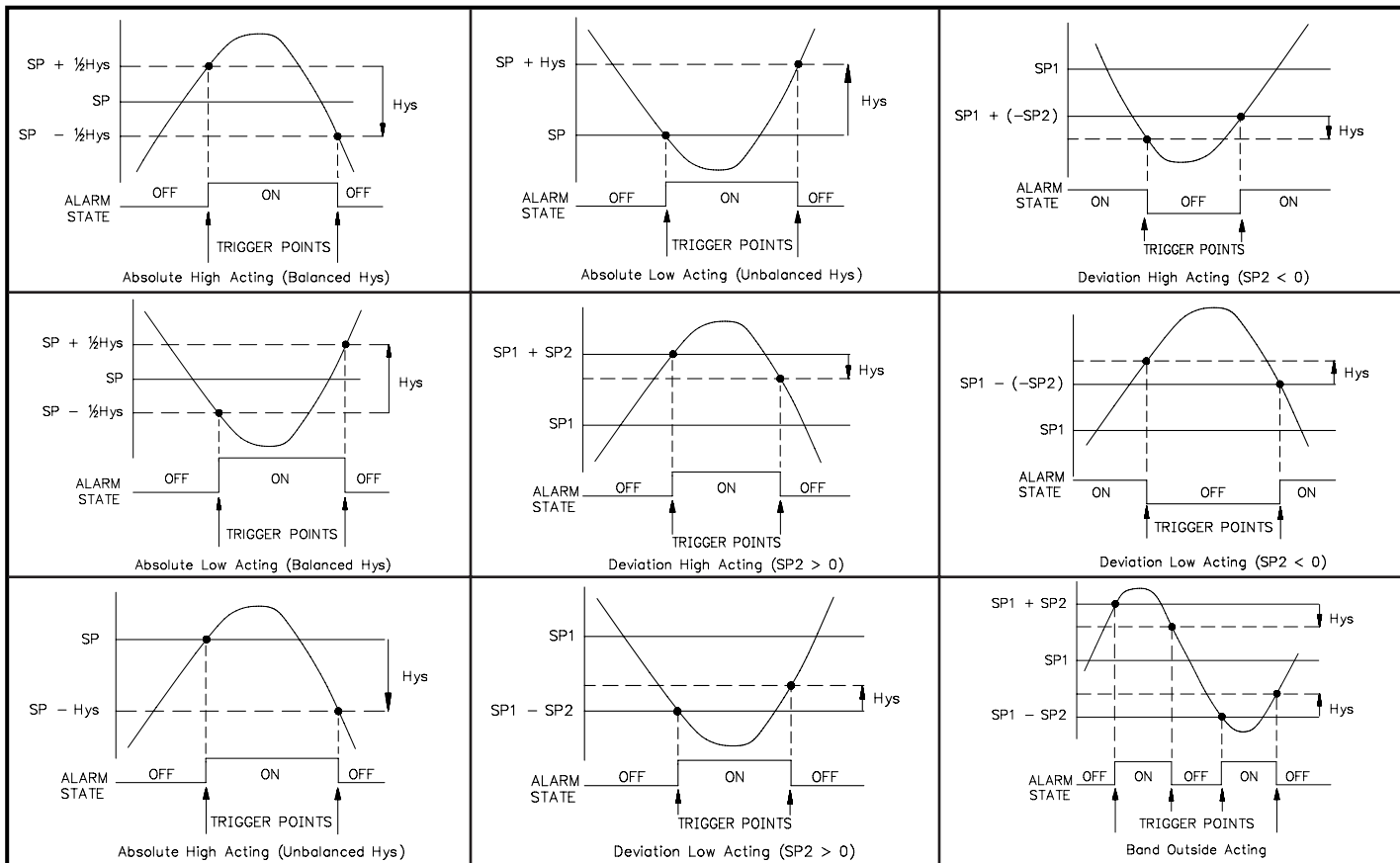
Reset: The alarms can be programmed for Latched or Automatic. In Automatic mode, an energized alarm turns off by itself once the Process leaves the alarm area. In Latched mode, an energized alarm requires a serial reset. This is done by writing a '0' to the appropriate MODBUS register. (Alarm 1 state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

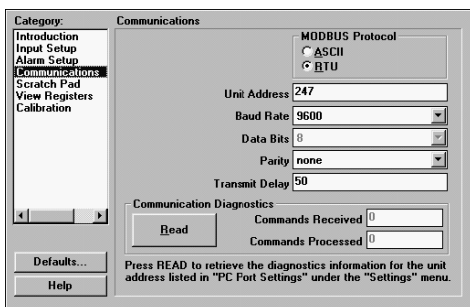
Enable standby delay

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.

SETPOINT ALARM FIGURES



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.

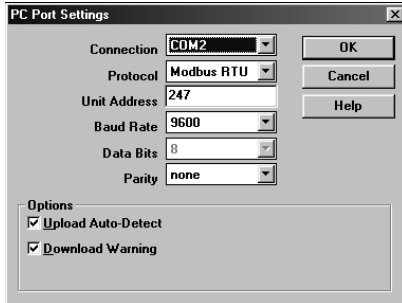
The IAMS' serial settings must match the device that it is communicating with. If you do not know or cannot recall the IAMS settings, they can be reset back to factory defaults. Simply jumper the Serial Default terminal to Common, and cycle power. The serial settings will default to RTU mode, 9600 baud,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

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

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

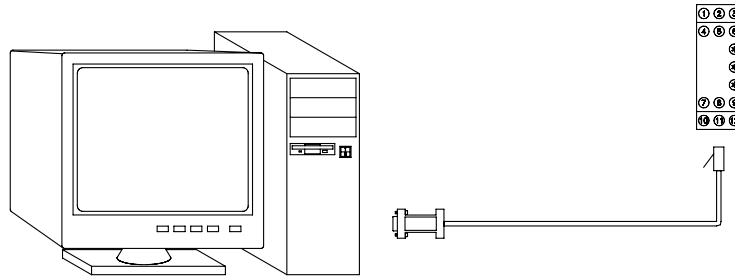
Unit Address: 1-247

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.



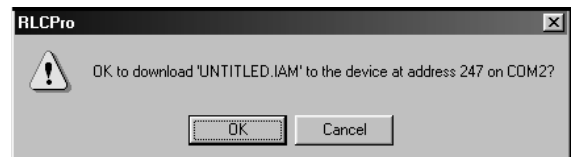
Note: The CBPRO007 download cable DOES NOT typically require power. In most cases it will derive its power from the PC. If communications can not be established, follow the troubleshooting guide. If it is determined that the converter requires power, attach a 12 VDC power supply to the VDC and common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

STEP 8 DOWNLOADING

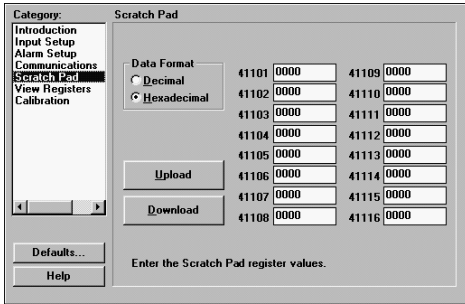


Go to the FILE pull-down menu, and select DOWNLOAD.

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.

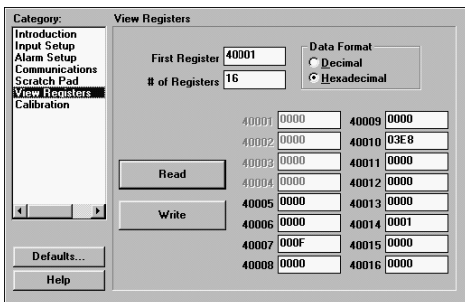
Data Format: Allows registers to be viewed in decimal or hexadecimal format.

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 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.

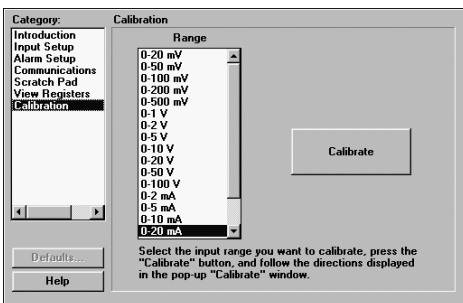
Data Format: Allows registers to be viewed in decimal or hexadecimal format.

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.

STEP 11 CALIBRATION



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.

TROUBLESHOOTING

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

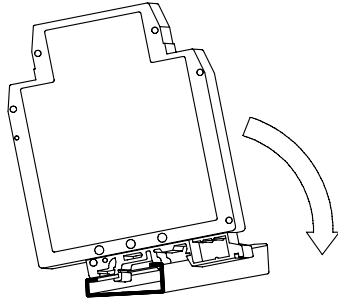
* Can be monitored by accessing coils 9-14, or register 40022.
For further technical assistance, contact technical support.

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.

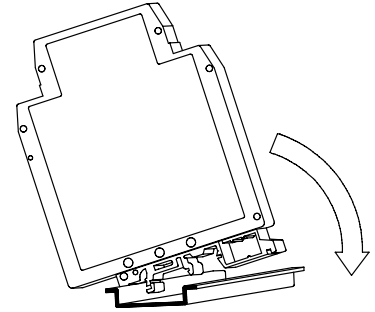
G Rail Installation

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

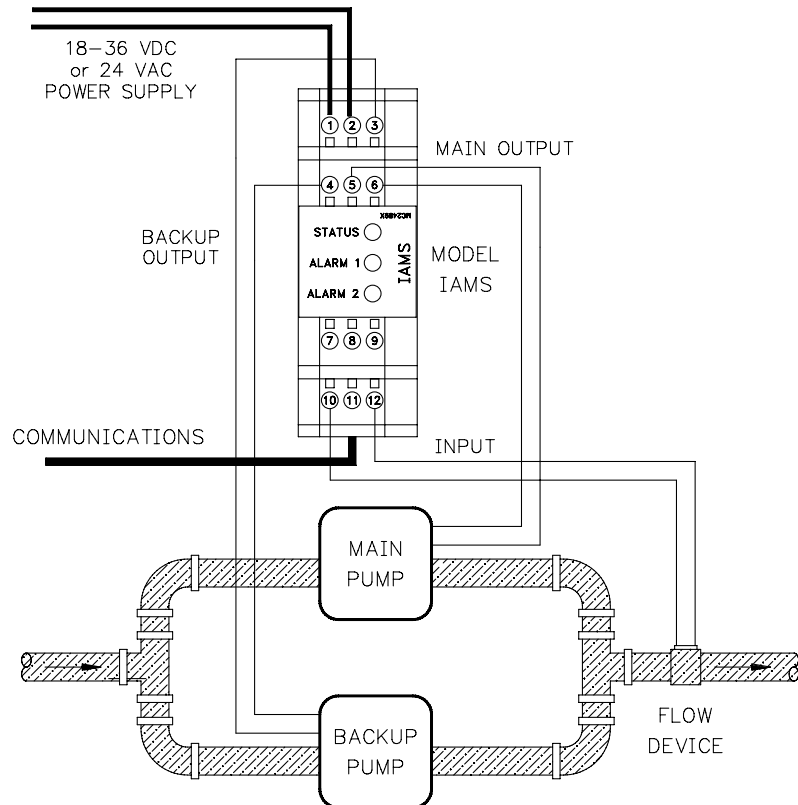
To install the IAMS on a “T” style rail, angle the module so that the top groove of the “foot” is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the “foot”, and pry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

The remaining sections of this bulletin list IAMS 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 14.

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 40001-40026, 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 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 (force) 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 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 30001-30026, 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 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><4D><53><33><35><33><33><35><01><00><00><10><00><10><00><10><A5><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. 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 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 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.

REGISTER ADDRESS *	REGISTER NAME	LOW LIMIT†	HIGH LIMIT†	ACCESS	COMMENTS
40001	ADC reading	N/A	N/A	Read Only	ADC (Analog to Digital Converter) reading of present input level.
40002	Process Value	N/A	N/A	Read Only	Process Value (with gain and offset) of present input level.
40003	Floating Point LO	N/A	N/A	Read Only	IEEE Standard 754 Floating Decimal Point, low order of Process Value. (Allows 32 bit accuracy for external monitoring.)
40004	Floating Point HI	N/A	N/A	Read Only	IEEE Standard 754 Floating Decimal Point, high order of Process Value. (Allows 32 bit accuracy for external monitoring.)
40005	Min. ADC Reference	N/A	N/A	Read Only	ADC reading at minimum input established during calibration.
40006	Max. ADC Reference	N/A	N/A	Read Only	ADC reading at maximum input established during calibration.
40007	Input Range	0	17	Read/Write	See Input Range Register Table.
40008	Filter Band	0	32000	Read/Write	See Filter Band explanation.
40009	Filter Response Time	0	1000	Read/Write	See Filter Response Time explanation (1 = 0.1 second).
40010	Gain Value	-32000	32000	Read/Write	See Offset and Gain explanation (1 = 0.001).
40011	Offset Value	-32000	32000	Read/Write	See Offset and Gain explanation.
40012	Alarm 2 Mode	<0000>	<0039>	Read/Write	See Alarm 1 & 2 Mode Register Table.
40013	Setpoint 2 Value	-32000	32000	Read/Write	Alarm 2 setpoint value based on Process Value.
40014	Alarm 2 Hysteresis	1	32000	Read/Write	Alarm 2 hysteresis value based on Process Value.
40015	Alarm 2 Delay	0	32000	Read/Write	Alarm 2 delay trip on time (1 = 1 second).
40016	Alarm 1 Mode	<0000>	<0034>	Read/Write	See Alarm 1 & 2 Mode Register Table.
40017	Setpoint 1 Value	-32000	32000	Read/Write	Alarm 1 setpoint value based on Process Value.
40018	Alarm 1 Hysteresis	1	32000	Read/Write	Alarm 1 hysteresis value based on Process Value.
40019	Alarm 1 Delay	0	32000	Read/Write	Alarm 1 delay trip on time (1 = 1 second).
40020	Transmit Delay	1	255	Read/Write	Delay before serial transmission (1 = 1 msec). See Transmit Delay Explanation.
40021	Node (Unit) Address	1	247	Read/Write	Node serial IAMS address.
40022	Error Coils	<0000>	<0003>	Read/Write	Mirror of Coils 9-14. See Coil Table.
40023	Comm. Coils	<0020>	<00FF>	Read/Write	Mirror of Coils 1-7. See Coil Table and Communication Table.
40024	Alarm 1 State	0	1	Read/Write	Alarm 1 state. (1 = on)
40025	Alarm 2 State	0	1	Read/Write	Alarm 2 state. (1 = on)
40026	Factory Calibration	<0000>	<7777>	Read/Write	See Calibration explanation.
41001- 41010	Slave ID	See FC17.	See FC17.	Read Only	IAMS-3535, 0100 (ver. 1.00), 16 reads, 16 writes, 16 scratch. It is possible that the version value is higher.
41101- 41116	GUID/Scratch	<0000>	<FFFF>	Read/Write	This area is for the user to store any related information. This register area does not affect IAMS operations.

* 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)

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

Coils 1-7 mirror register 40023 and Coils 9-14 mirror register 40022.

INPUT RANGE REGISTER (4007) TABLE

RANGE NUMBER	SPAN/TYPE	RANGE NUMBER	SPAN/TYPE	RANGE NUMBER	SPAN/TYPE
0	0-20 mV	6	0-2 V	12	0-2 mA
1	0-50 mV	7	0-5 V	13	0-5 mA
2	0-100 mV	8	0-10 V	14	0-10 mA
3	0-200 mV	9	0-20 V	15	0-20 mA
4	0-500 mV	10	0-50 V	16	0-50 mA
5	0-1 V	11	0-100 V	17	0-100 mA

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

Stand By	Latched Off=Auto	B7	B6	B5	B4	2nd Nibble HEX
off	off	0	0	0	0	<0 >
off	on	0	0	0	1	<1 >
on	off	0	0	1	0	<2 >
on	on	0	0	1	1	<3 >

Examples:

Alarm 1 (40016):

Stand-by off, Latch on = 0 0 0 1 <1 >
 Absolute Lo, Balanced = 0 0 1 0 <2 >
<12>

Alarm 2 (40012):

Stand-by on, Latch off = 0 0 1 0 <2 >
 Band Outside = 1 0 0 1 <9 >
<29>

ACTION	MODE	ALARMS	B3	B2	B1	B0	1st Nibble HEX
Manual	0	1 2	0	0	0	0	< 0>
Absolute Hi, balanced	1	1 2	0	0	0	1	< 1>
Absolute Lo, balanced	2	1 2	0	0	1	0	< 2>
Absolute Hi, unbalanced	3	1 2	0	0	1	1	< 3>
Absolute Lo, unbalanced	4	1 2	0	1	0	0	< 4>
Deviation Hi	5	2	0	1	0	1	< 5>
Deviation Lo	6	2	0	1	1	0	< 6>
Band Outside	9	2	1	0	0	1	< 9>

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

COMMUNICATIONS REGISTER (40023) AND COILS 1-8 TABLE

Mode	Parity	Baud	Coil 8 B7*	Coil 7 B6	Coil 6 B5	Coil 5 B4	Coil 4 B3	Coil 3 B2	Coil 2 B1	Coil 1 B0	Coil 8 =0 HEX	Coil 8 =1 HEX
RTU	8N1,2	300	0 / 1	0	1	0	0	0	0	0	<20>	<A0>
RTU	8N1,2	600	0 / 1	0	1	0	0	0	0	1	<21>	<A1>
RTU	8N1,2	1200	0 / 1	0	1	0	0	0	1	0	<22>	<A2>
RTU	8N1,2	2400	0 / 1	0	1	0	0	0	1	1	<23>	<A3>
RTU	8N1,2	4800	0 / 1	0	1	0	0	1	0	0	<24>	<A4>
RTU	8N1,2	9600	0 / 1	0	1	0	0	1	0	1	<25>	<A5>
RTU	8N1,2	19200	0 / 1	0	1	0	0	1	1	0	<26>	<A6>
RTU	8N1,2	38400	0 / 1	0	1	0	0	1	1	1	<27>	<A7>
RTU	8E1	300	0 / 1	0	1	0	1	0	0	0	<28>	<A8>
RTU	8E1	600	0 / 1	0	1	0	1	0	0	1	<29>	<A9>
RTU	8E1	1200	0 / 1	0	1	0	1	0	1	0	<2A>	<AA>
RTU	8E1	2400	0 / 1	0	1	0	1	0	1	1	<2B>	<AB>
RTU	8E1	4800	0 / 1	0	1	0	1	1	0	0	<2C>	<AC>
RTU	8E1	9600	0 / 1	0	1	0	1	1	0	1	<2D>	<AD>
RTU	8E1	19200	0 / 1	0	1	0	1	1	1	0	<2E>	<AE>
RTU	8E1	38400	0 / 1	0	1	0	1	1	1	1	<2F>	<AF>
RTU	8O1	300	0 / 1	0	1	1	1	0	0	0	<38>	<B8>
RTU	8O1	600	0 / 1	0	1	1	1	0	0	1	<39>	<B9>
RTU	8O1	1200	0 / 1	0	1	1	1	0	1	0	<3A>	<BA>
RTU	8O1	2400	0 / 1	0	1	1	1	0	1	1	<3B>	<BB>
RTU	8O1	4800	0 / 1	0	1	1	1	1	0	0	<3C>	<BC>
RTU	8O1	9600	0 / 1	0	1	1	1	1	0	1	<3D>	<BD>
RTU	8O1	19200	0 / 1	0	1	1	1	1	1	0	<3E>	<BE>
RTU	8O1	38400	0 / 1	0	1	1	1	1	1	1	<3F>	<BF>

* 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)

Mode	Parity	Baud	Coil 8 B7 *	Coil 7 B6	Coil 6 B5	Coil 5 B4	Coil 4 B3	Coil 3 B2	Coil 2 B1	Coil 1 B0	Coil 8 =0 HEX	Coil 8 =1 HEX
ASCII	7N2	300	0 / 1	1	0	0	0	0	0	0	<40>	<C0>
ASCII	7N2	600	0 / 1	1	0	0	0	0	0	1	<41>	<C1>
ASCII	7N2	1200	0 / 1	1	0	0	0	0	1	0	<42>	<C2>
ASCII	7N2	2400	0 / 1	1	0	0	0	0	1	1	<43>	<C3>
ASCII	7N2	4800	0 / 1	1	0	0	0	1	0	0	<44>	<C4>
ASCII	7N2	9600	0 / 1	1	0	0	0	1	0	1	<45>	<C5>
ASCII	7N2	19200	0 / 1	1	0	0	0	1	1	0	<46>	<C6>
ASCII	7N2	38400	0 / 1	1	0	0	0	1	1	1	<47>	<C7>
ASCII	7E1	300	0 / 1	1	0	0	1	0	0	0	<48>	<C8>
ASCII	7E1	600	0 / 1	1	0	0	1	0	0	1	<49>	<C9>
ASCII	7E1	1200	0 / 1	1	0	0	1	0	1	0	<4A>	<CA>
ASCII	7E1	2400	0 / 1	1	0	0	1	0	1	1	<4B>	<CB>
ASCII	7E1	4800	0 / 1	1	0	0	1	1	0	0	<4C>	<CC>
ASCII	7E1	9600	0 / 1	1	0	0	1	1	0	1	<4D>	<CD>
ASCII	7E1	19200	0 / 1	1	0	0	1	1	1	0	<4E>	<CE>
ASCII	7E1	38400	0 / 1	1	0	0	1	1	1	1	<4F>	<CF>
ASCII	7O1	300	0 / 1	1	0	1	1	0	0	0	<58>	<D8>
ASCII	7O1	600	0 / 1	1	0	1	1	0	0	1	<59>	<D9>
ASCII	7O1	1200	0 / 1	1	0	1	1	0	1	0	<5A>	<DA>
ASCII	7O1	2400	0 / 1	1	0	1	1	0	1	1	<5B>	<DB>
ASCII	7O1	4800	0 / 1	1	0	1	1	1	0	0	<5C>	<DC>
ASCII	7O1	9600	0 / 1	1	0	1	1	1	0	1	<5D>	<DD>
ASCII	7O1	19200	0 / 1	1	0	1	1	1	1	0	<5E>	<DE>
ASCII	7O1	38400	0 / 1	1	0	1	1	1	1	1	<5F>	<DF>
ASCII	8N1	300	0 / 1	1	1	0	0	0	0	0	<60>	<E0>
ASCII	8N1	600	0 / 1	1	1	0	0	0	0	1	<61>	<E1>
ASCII	8N1	1200	0 / 1	1	1	0	0	0	1	0	<62>	<E2>
ASCII	8N1	2400	0 / 1	1	1	0	0	0	1	1	<63>	<E3>
ASCII	8N1	4800	0 / 1	1	1	0	0	1	0	0	<64>	<E4>
ASCII	8N1	9600	0 / 1	1	1	0	0	1	0	1	<65>	<E5>
ASCII	8N1	19200	0 / 1	1	1	0	0	1	1	0	<66>	<E6>
ASCII	8N1	38400	0 / 1	1	1	0	0	1	1	1	<67>	<E7>
ASCII	8E1	300	0 / 1	1	1	0	1	0	0	0	<68>	<E8>
ASCII	8E1	600	0 / 1	1	1	0	1	0	0	1	<69>	<E9>
ASCII	8E1	1200	0 / 1	1	1	0	1	0	1	0	<6A>	<EA>
ASCII	8E1	2400	0 / 1	1	1	0	1	0	1	1	<6B>	<EB>
ASCII	8E1	4800	0 / 1	1	1	0	1	1	0	0	<6C>	<EC>
ASCII	8E1	9600	0 / 1	1	1	0	1	1	0	1	<6D>	<ED>
ASCII	8E1	19200	0 / 1	1	1	0	1	1	1	0	<6E>	<EE>
ASCII	8E1	38400	0 / 1	1	1	0	1	1	1	1	<6F>	<EF>
ASCII	8O1	300	0 / 1	1	1	1	1	0	0	0	<78>	<F8>
ASCII	8O1	600	0 / 1	1	1	1	1	0	0	1	<79>	<F9>
ASCII	8O1	1200	0 / 1	1	1	1	1	0	1	0	<7A>	<FA>
ASCII	8O1	2400	0 / 1	1	1	1	1	0	1	1	<7B>	<FB>
ASCII	8O1	4800	0 / 1	1	1	1	1	1	0	0	<7C>	<FC>
ASCII	8O1	9600	0 / 1	1	1	1	1	1	0	1	<7D>	<FD>
ASCII	8O1	19200	0 / 1	1	1	1	1	1	1	0	<7E>	<FE>
ASCII	8O1	38400	0 / 1	1	1	1	1	1	1	1	<7F>	<FF>

* When reading register 40023, B7 will be a 0. When writing (changing IAMS communications to the new setting), change B7 to a 1.

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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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