



Sentry Process Monitor



Up to four programmable 10A
SPST alarm relay outputs

Up to four programmable
process inputs

Four digit LCD display

Advanced microprocessor
retains programmed values
even with power interruption

AC input 90-250 VAC

+24V for sensor operation

Programmable scale and
offset

Mix and match input types for
unique applications

The Sentry Process Monitor is designed to provide the greatest flexibility to the process engineer, facility technician, or instrumentation personnel to monitor almost any process or combination of processes.

Each input of the Sentry Process Monitor can be configured by means of a plug-in module for 4-20ma, 0-10 or 0-5 volt, proximity sensor, speed, rate, or thermocouple input.

Each input can be scaled to select units meaningful to the particular application.

Each output can be assigned to an input so that multiple setpoints can be derived from one sensor input.

The Sentry Process Monitor is designed to be a stand-alone economical means of quick process monitoring.



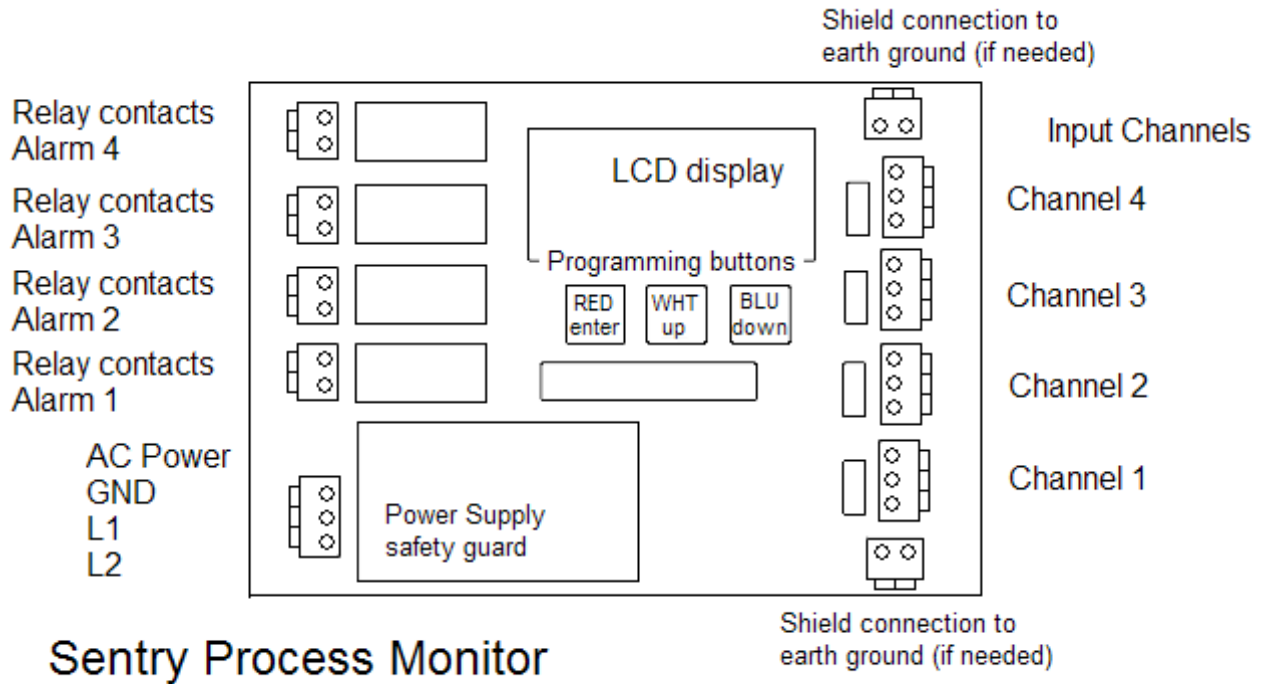
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Caution

The Sentry Process Monitor is used in conjunction with sensors and other devices. Total system performance is dependent upon these components as well as the programming and scale factors. Since there are so many programming options, each application needs to be tested during installation to make sure that the Sentry Process Monitor works with all application conditions. This testing is essential. In addition, the Sentry Process Monitor should not be used as a sole element in any safety, critical process, or life dependent application. These applications should always be designed with redundancy.



Sentry Process Monitor

Specifications:

Input Voltage: 90-250VAC

Output Voltage (sensors): +24VDC

Output Relays: SPST 10A NO

Accuracy : +/- 1% (scale and offset can often be used to recalibrate to better specs)

Analog Measurements:

0-20mA

0-5V

0-10V

Digital Measurements

Logic input

Rate or Speed (equivalent to 6-1000 rpm)

Temperature Measurements

K type thermocouple (-100 to +1000 F)

Read in degrees F (use scaling for degrees C)

Installation

Because the Sentry Process Monitor can be configured in a variety of ways and because the possible connection to hazardous voltages, the Sentry Process Monitor should only be installed by qualified personnel and in accordance with all applicable building and wiring codes and regulations. In addition, the Sentry Process Monitor should not be as a sole element in a critical, safety, or life dependent application. Such applications should always be designed with redundancy to account for equipment failure, misapplication, or operator error.

Warning

Improper installation can result in hazardous voltages and / or machinery operation. Installation should only be performed by qualified personnel and in accordance with all safety and regulatory procedures.

Power Wiring

The earth ground should not be left disconnected. This connection is passed along to the sensor input side of the Sentry Process Monitor. It can be used for sensor shield connection (if required) to reduce electrical noise that may interfere with proper signal transmission. If this connection is inadvertently wired to L1 or L2 of the input power, damage to equipment and electrical shock to personnel can result.

It is a good practice to use a contactor or other device to remove power until a manual reset in the event of power loss. The connection of pumps, motors, or other active devices to the alarm relays can result in a safety hazard if power is returned unexpectedly or if power returns intermittently.

Enclosure integrity

The Sentry Process Monitor has a water and dust tight enclosure. However, the installation of conduit fittings can reduce the effectiveness of the enclosure. If it is desired to retain the water and dust protection, electrical fittings need to be selected and installed to accomplish this. Allowing water or other material to enter the Sentry Process Monitor can result in equipment failure and even danger to personnel. Condensation cycles need to be avoided to prevent equipment damage.

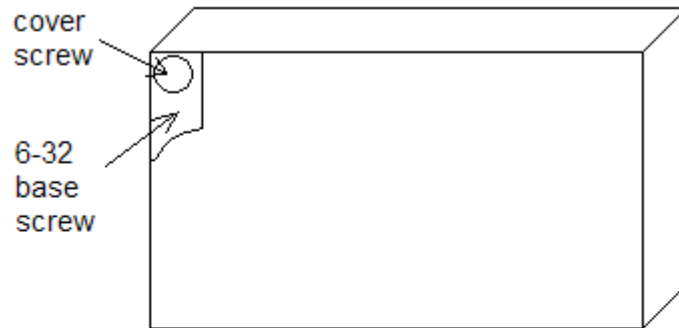
The plastic of the enclosure is subject to breakage with larger size drills. For this reason it is recommended that conduit holes be bored out with a conical rasp, reamer, or step drill to insure that the correct hole size is obtained with a minimum risk of damage to the enclosure.

Power supply safety shield

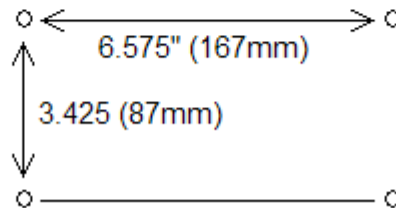
The clear plastic shield over the power supply should not be removed. It prevents operators from contacting the input voltage and removal could result in electrical shock. This cover should not be removed. If the cover is missing or broken, the unit should be returned for repair.

Enclosure cover

The Sentry Process Monitor is shipped with a clear plastic enclosure cover. This should only be removed for programming and installation purposes. The cover allows the display values to be observed, but protects the electronics from foreign objects which could cause damage. Personnel are also protected from exposure to electrical shock by keeping the enclosure cover installed. A missing or broken cover should be replaced to insure safety and protect the equipment from damage.



Mounting Hole Pattern



An aluminum mounting kit is available (with screws) - see appendix

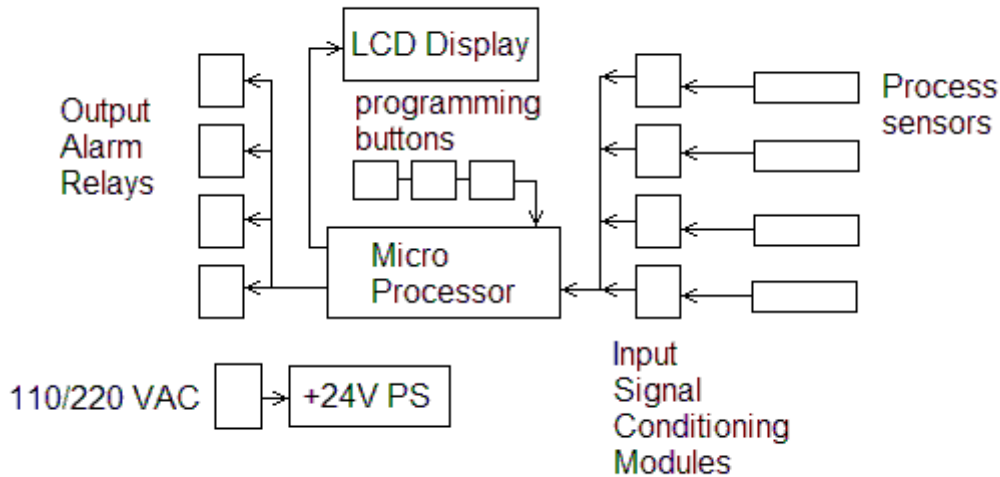
Theory of Operation

The Sentry Process Monitor operates by measuring up to four input signals, calculating the measurements with programmed setpoints, and then operating up to four output alarm relays if needed. The Sentry Process Monitor can be powered from 90-250VAC and supplies +24VDC for sensor operation.

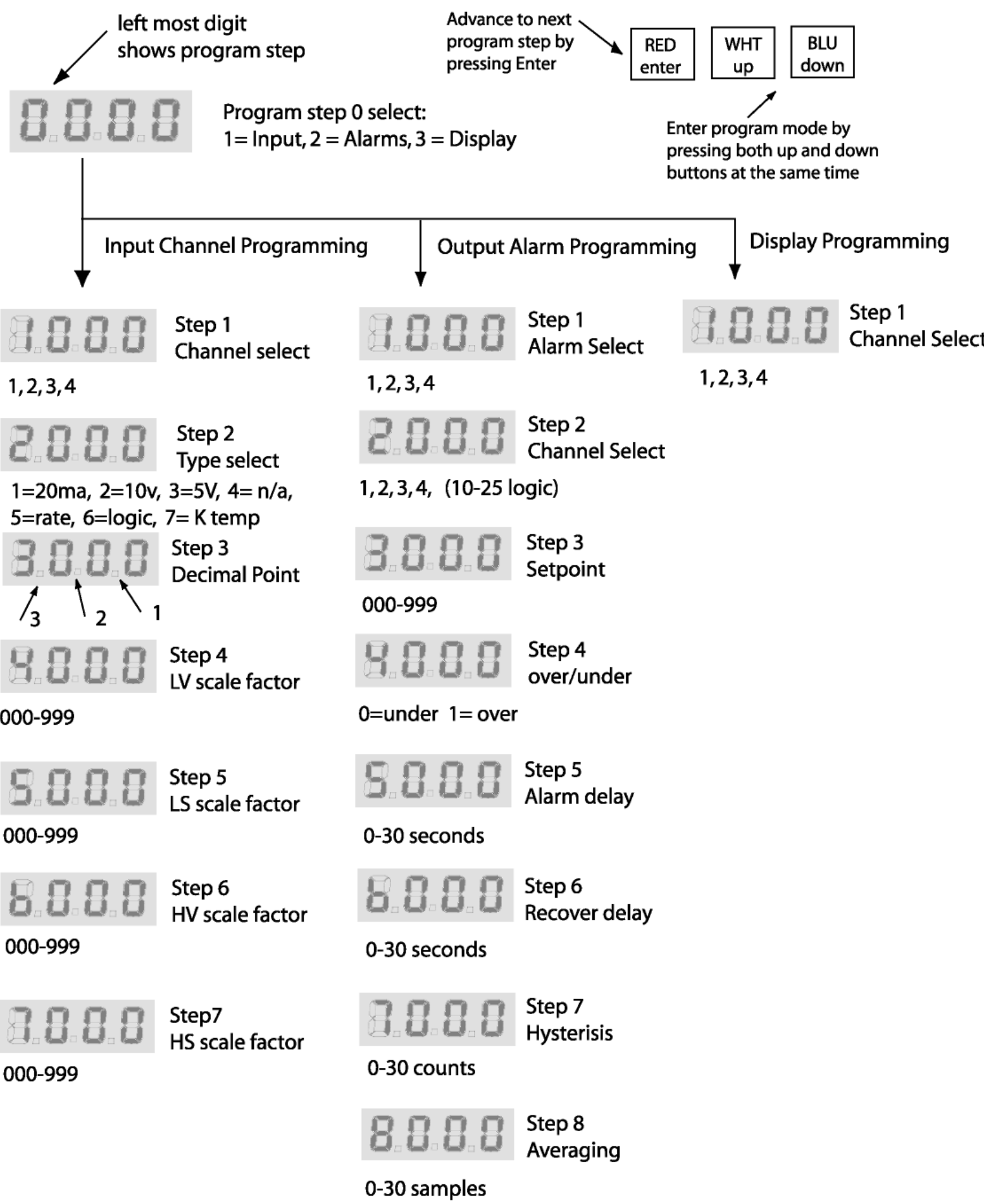
Because the Sentry Process Monitor can receive so many different types of inputs, each input channel requires an input module to both protect the microprocessor from hazardous voltages as well as convert the input signal to a form compatible with the microprocessor.

Programming is the key to configuring the Sentry Process Monitor. There are three main programming options, Inputs, Outputs, and selecting which input channel is displayed. The programming flow chart more fully describes this feature.

Any alarm can be assigned to any input by programming. This allows for the option of having multiple setpoints for one input source. Each alarm relay has an LED to indicate when the relay has been operated.



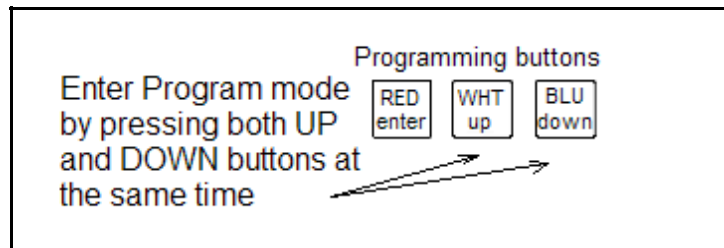
With the exception of the speed inputs which are measured as they occur, the Sentry Process Monitor makes measurements of input channel conditions about every half second. An averaging option exists in software to allow the measurements to be smoothed out over time. Programming options provide for selection of alarm delay and recovery options that allow each alarm channel to be selected for a specific operate and release condition.



Programming

The programming mode can be entered into at any point the unit is powered up. Care should be taken if the unit is connected to an existing process that interruption of the monitoring process does not cause a problem with the process.

The program mode is entered by pressing both the white (up) and blue (down) buttons at the same time. The display will show all zeros and the blue or white buttons can be pressed to select options 1 (input channel programming), 2 (output alarm programming), or 3 (display selection programming). Pressing the red (enter) button accepts the selected value and moves to the next program state.



Input Channel Programming

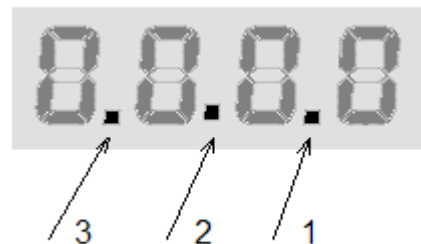
Once the input channel program option has been selected, the next programming option is to select which input channel will be programmed. There can be up to four input channels. Programming unequipped input channels could result in undetermined conditions. It is best to leave unused inputs in a zero state.

The next program step is to select the type of input to be configured to the channel. It is important to make sure that the input type is compatible with the input module that will be used with the input channel. For example, a 4-20ma input module will not give an accurate reading for a channel that has 0-5V or other type selected.

| Input Channel Types | | |
|---------------------|--------------------|---------------------------------------|
| 1 = 0-20ma | 4 = reserved | 7 = Temperature (K type thermocouple) |
| 2 = 0-5V | 5 = Speed or rate | |
| 3 = 0-10V | 6 = Logic or state | |

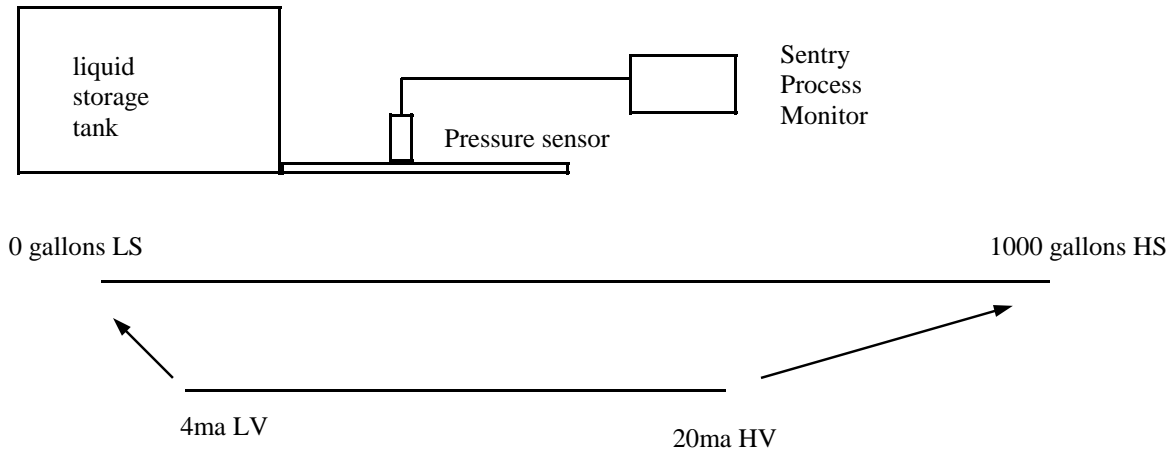
Decimal Points

Because the measured sensor signal (process variable) is scaled, the display needs to know where to put a decimal point. This is selected for the ease of use of the operator or installer to aid in seeing the scaled process value displayed in terms meaningful to the application.



Scaling

One of the more difficult programming concepts is scale. The Sentry Process Monitor can translate a sensor output into values that are meaningful to the application. For example a 4-20ma output sensor may measure pressure. This sensor could be installed in a tank to measure the height of a liquid. This height would represent the inventory volume of the liquid.



| | |
|----|-----|
| LV | 040 |
| LS | 000 |
| HV | 200 |
| HS | 999 |

Since this method of scaling also includes offset information, four numbers are needed instead of just a gain percentage.

Using these numbers tells the Sentry Process Monitor to move the low signal (4ma) to zero and scale the high signal (20ma) to 999.

Scaling is available on the 0-20mA, 0-10V, 0-5V, and rate or speed inputs. However, scaling is not available on the logic or “state” type inputs.

Calibration

Scaling can also be used to calibrate a system. If a particular application can be operated with a test process amount of material, any measured difference can be input into the Sentry Process Monitor as a scale value. This can help achieve much more accurate measurements as well as compensate for any changes in sensor performance over time.

If no scaling is desired, programming LV=LS and HV=HS will assure that there is no scale applied. (I.e. LS=LV=010 and HS=HV=020)

Scaling—cont.

The key to understanding scaling is that it translates the voltage or current of the sensor into units that are more meaningful to the application. It can help to see the different voltage and current input ranges

| | Current Loop | 0-5V | 0-10V |
|-----------|--------------|------|-------|
| Max. Low | 000 | 000 | 000 |
| Max. High | 200 | 500 | 999 |

The first step is to identify the type of output of the sensor to be used. For example, a current output sensor can be 0-20ma, 4-20ma, 20-4ma, 20-0ma, or any other current output as long as the range is within 0-20ma. A voltage output sensor can vary anywhere in its allowable range.

CAUTION: Using a wrong input module or connecting a higher than allowed current or voltage can damage the unit.

Example 1
Temperature sensor
with a 4-20ma output
Where 4ma = -100C
and 20ma = 500C

In this example we bring the low value up from 4ma to 8. This allows us to program a positive value for “LS”. When 4ma is encountered, -100 will still be displayed. Since the scale is linear over the range, programming does not have to be at the extreme limits.

| | |
|----|-----|
| LV | 080 |
| LS | 050 |
| HV | 200 |
| HS | 500 |

To have the display read in degrees F
The following programming values
can be used for this example

| | |
|----|-----|
| LV | 080 |
| LS | 122 |
| HV | 200 |
| HS | 932 |

LS, LV, HS, HV should all be kept positive

Example 2
Temperature sensor
with a 4-20ma output
Where 4ma = 500C
and 20ma = -100C

This example could be called a 20-4ma version of the sensor used in example 1. The display would read -100 when 20ma was given by the sensor instead of 4ma as in the previous example.

This provision allows sensors to be configured as needed for the application. For example two different sensors are not needed in a tank level application one to determine how empty the tank is and another to determine how full.

| | |
|----|-----|
| LV | 000 |
| LS | 500 |
| HV | 160 |
| HS | 050 |

Output Alarm Programming

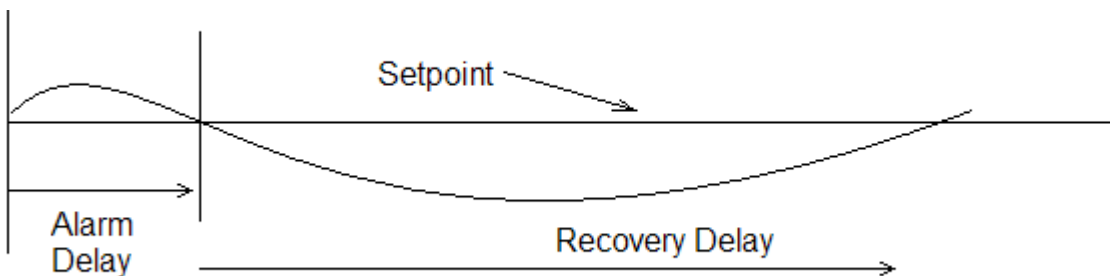
Once the output alarm program option has been selected, the next programming option is to select which output alarm will be programmed. There can be up to four output alarms. Programming unequipped output alarms should result in no undetermined conditions since there are no relays to operate.

Input channel assignment

Once the output alarm has been selected, the next program step is to select which input channel is going to supply the measurement value to be monitored. The assignment of input channel allows for multiple alarms to be configured from just one input.

Setpoint Programming

A value is selected (using the up and down buttons) against which the assigned input will be compared.



Over / Under programming

The next selection is to decide if the output alarm relay should operate if the measured value is over or under the selected setpoint value. A “1” is selected if an over condition and a “0” is selected for an under condition.

Alarm Delay Programming

The next value to be selected is the alarm delay. Some process operations require a tolerance of brief alarm conditions such as the start up of pump, motor, or other mechanical processes. A delay of from 0-30 seconds can be selected to accommodate brief alarm conditions without actually operating the alarm relay.

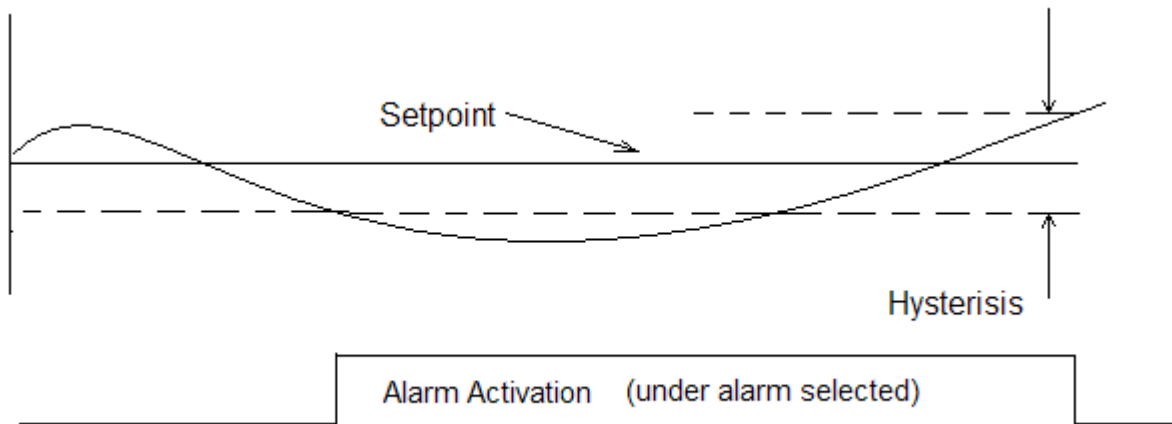
Recovery Delay Programming

Similar to the alarm delay, the recovery delay can be selected from 0-30 seconds to establish the time before a “return to normal” condition is accepted.

WARNING - Extreme care needs to be taken when selecting these values so that operation of machinery will not occur that might cause harm to personnel

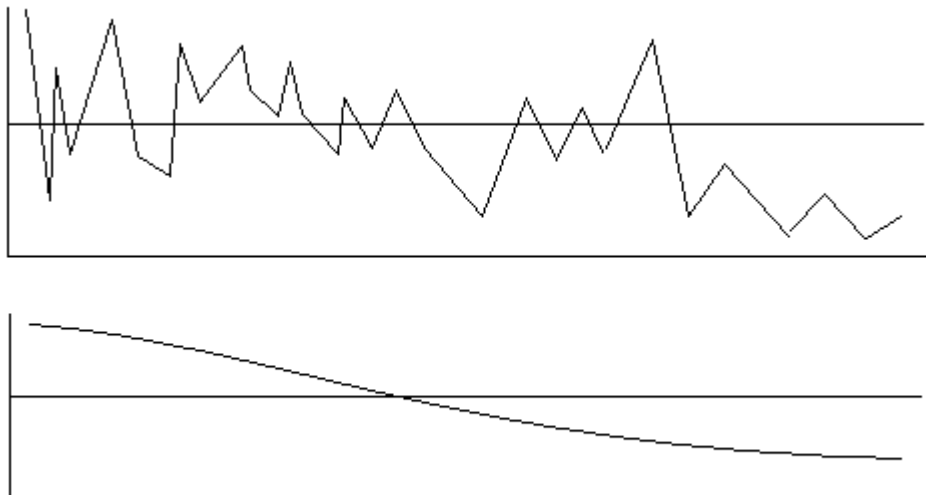
Hysterisis Programming

Hysterisis is the amount above and below the setpoint that the input has to change before the output alarm relay will be effected. It can be selected from 0-30. A value of thirty means that an input condition has to reach the setpoint plus (or minus) thirty units before the alarm condition can be removed. This is useful in cases where the input can very close to the setpoint to avoid relay “chatter”.



Averaging

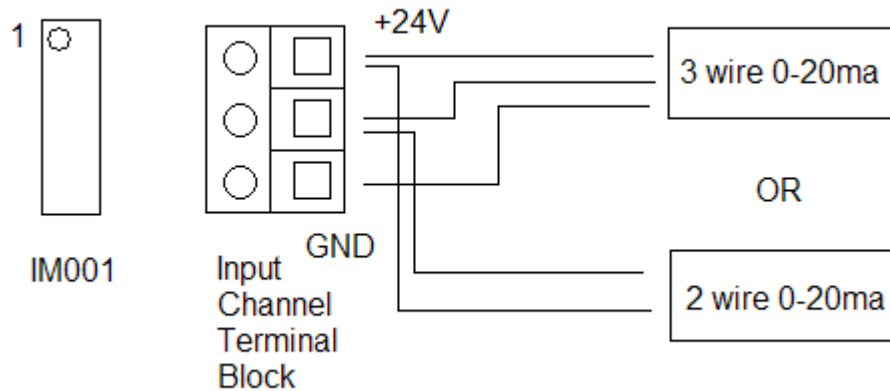
The output alarm can be programmed to average the measured input value from 0-30 samples. This is a rolling average of the last x number of measurements. This can be useful to make erratic measurements more consistent. However, it does slow down the ability to respond to sudden input changes.



Wiring

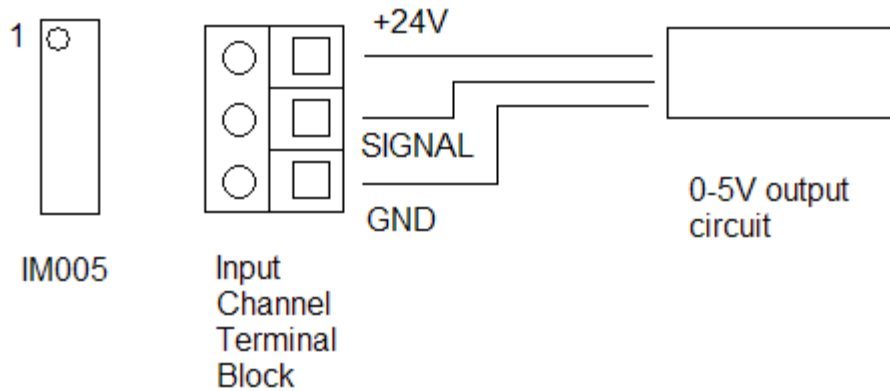
Current Loop

Current loop sensors and other devices can be monitored using the IM001 input module. 0-20ma, 4-20ma, 20-0ma, 20-4ma, two wire and three wire (current sourcing) devices can all be used with the IM001. The scaling portion of input channel programming provides for signal inversion or offset.



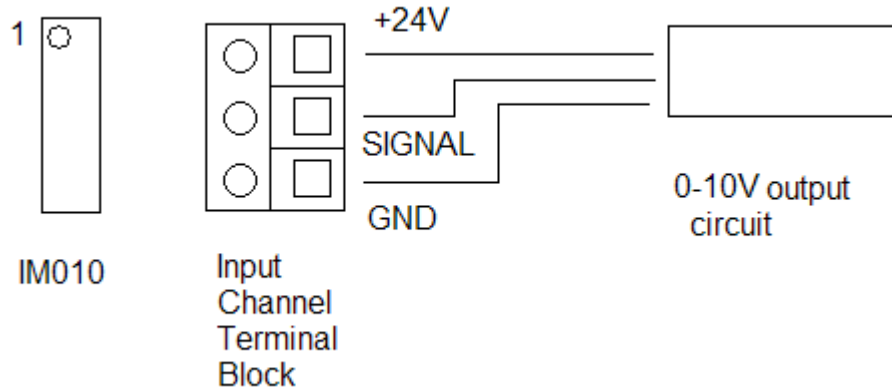
0-5V

Devices that provide a 0-5V output signal can be used with the IM005 input module. Care should be taken not to exceed the input voltage to prevent damage to the Sentry Process Monitor.



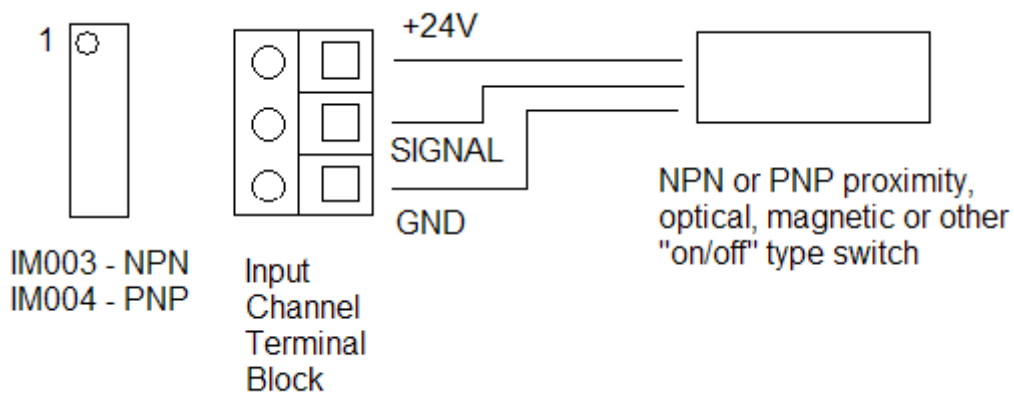
0-10V

Devices that supply a 0-10V output require the IM010 input module. This has a different scaling resistor network than the IM005. Care must also be taken to insure that the input voltage is not exceeded to avoid damage to the Sentry Process Monitor.



Speed / Logic

Both the speed and logic inputs are either high or low and can operate from a variety of switch type devices such as inductive proximity sensors, optical beam detectors, magnetic reed switches, etc. The IM003 is used for NPN or open collector type switches and the IM004 is used for PNP type switches.

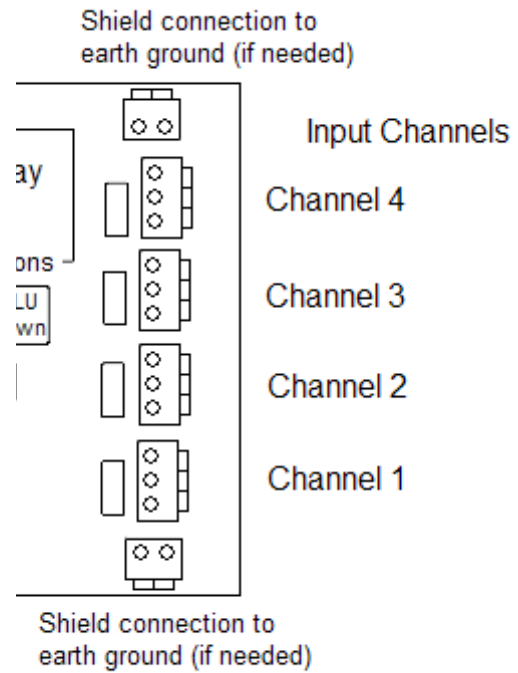


Sensor Shield Wiring

Most applications do not need to make use of an earth ground connection to shield wires for the sensor cables, However, if this type of connection is required, it is available above and below the channel input terminal blocks.

There is no provision for connection of AC voltage to any of the terminals on the right side of the Sentry Process Monitor. Such connections will cause damage to the unit and possibly cause exposure of hazardous voltages to personnel.

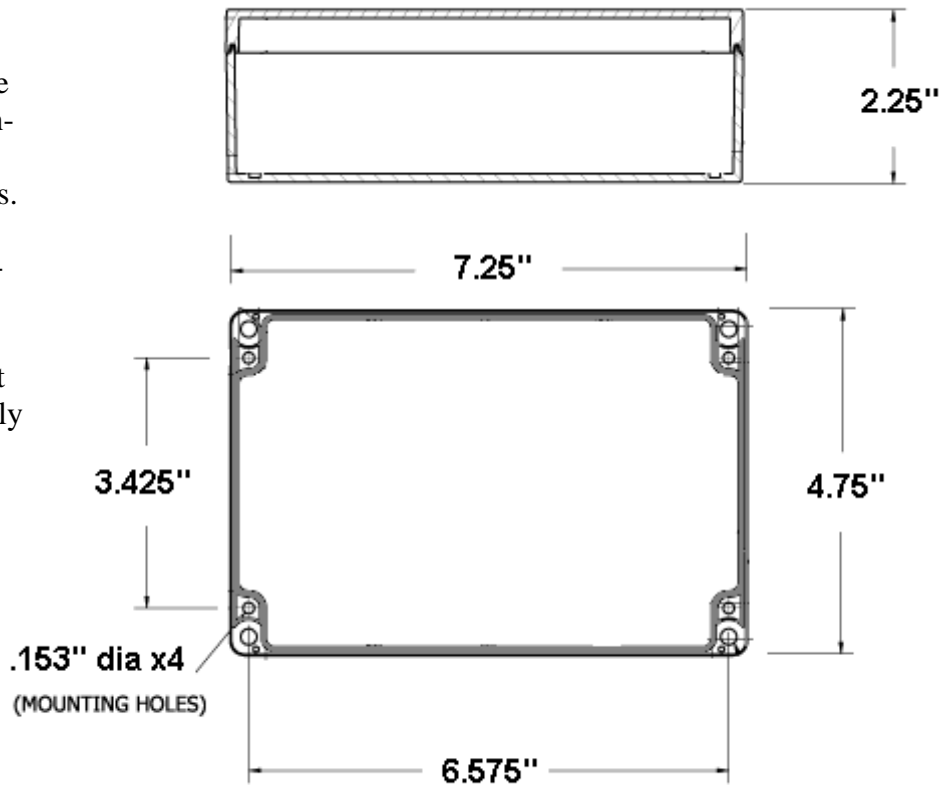
Care should be taken in wiring not to put wrong DC voltages to input channel terminal block pins as this also can result in equipment failure.



Enclosure dimensions

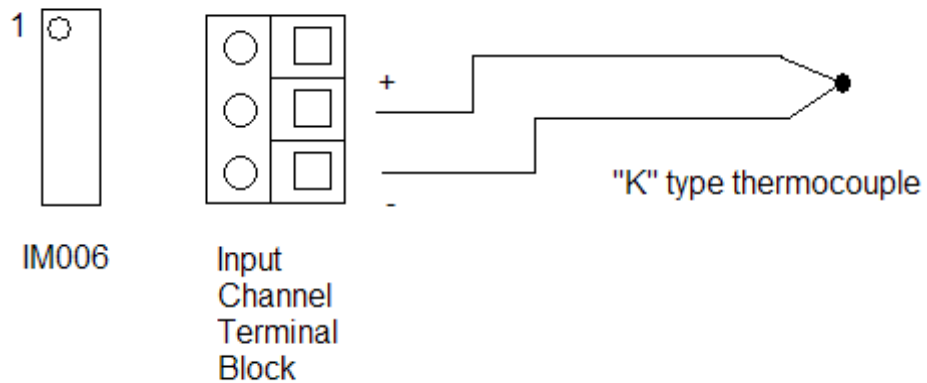
Consideration should be given to the final dimensions including conduit fittings and cable glands.

A mounting kit is available with a bracket to provide for installation where it is preferred not to mount the unit directly to equipment.



Temperature Measurement

The Sentry Process Monitor can accept a “K” type thermocouple for measuring temperature. The range is from –100 degrees to +1000 degrees F. Measurement in degrees C can be achieved by using the scaling function in input channel programming.



If the sensing end of the thermocouple is pinched between the fingers, the temperature displayed should rise over room temperature. If the temperature decreases, the input wires should be switched.

The default display of temperature is in degrees F. This can be changed to degrees C (or other standard) by using the scaling option in the Input Channel programming section

| | |
|----|-----|
| LV | 032 |
| LS | 000 |
| HV | 212 |
| HS | 100 |

Using the Logic function

An output alarm can be assigned a logic function. In this state an alarm will operate if a combination of input conditions exists. These conditions are based on proximity or other switch type inputs giving either a zero or one condition. Input channels that have not be configured as a logic input are automatically considered to be a “zero” value.

| | CH4 | CH3 | CH2 | CH1 |
|----|-----|-----|-----|-----|
| 10 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 1 |
| 12 | 0 | 0 | 1 | 0 |
| 13 | 0 | 0 | 1 | 1 |
| 14 | 0 | 1 | 0 | 0 |
| 15 | 0 | 1 | 0 | 1 |
| 16 | 0 | 1 | 1 | 0 |
| 17 | 0 | 1 | 1 | 1 |
| 18 | 1 | 0 | 0 | 0 |
| 19 | 1 | 0 | 0 | 1 |
| 20 | 1 | 0 | 1 | 0 |
| 21 | 1 | 0 | 1 | 1 |
| 22 | 1 | 1 | 0 | 0 |
| 23 | 1 | 1 | 0 | 1 |
| 24 | 1 | 1 | 1 | 0 |
| 25 | 1 | 1 | 1 | 1 |

For example;

If an output alarm channel select of “17” was selected and input channels 1,2, and 3 were set to type 6 (logic), then a one on all three of these inputs would produce an alarm on that output.

This feature allows a digital input such as a shut door condition to be included in the types of processes monitored by the Sentry Process Monitor.

Scale and averaging are not available for logic channels.

Part Numbers

Sentry Process Monitor SPM—X—Y

X = Number of input channels (1-4)

Y = Number of output alarm channels (1-4)

Input Modules

Current Loop input module SPM-IM001

NPN prox input module SPM-IM003

PNP prox input module SPM-IM004

0-5V input module SPM-IM005

“K” type thermocouple input module SPM-IM006

0-10V input module SPM-IM010

Accessories

Mounting kit with hardware SPM-MTGK

PG7 cable gland (.5” dia. mtg. hole) .12-.26 cable dia. SPM-CG7

PG11 cable gland (.75” dia. mtg. hole) .2-.39 cable dia. SPM-CG11

Miniature “K” type thermocouple panel jack

Standard “K” type thermocouple panel jack

Replacement enclosure