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B873-002 and B875-002 Analog Input

6

Purpose

The purpose of this chapter is to describe the B873-002 and B875-002 analog input modules.

What's in this Chapter?

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B873-002 and B875-002

B873-002 and B875-002 Modules

The B873-002 and B875-002 are analog input modules that can be used with 984 programmable controllers. The only difference between the two modules is that the B873-002 has four input channels and the B875-002 has eight input channels.

The module can be set to produce a data value in the standard range (0000 to 4096) or the elevated range (4095 to 8192). It accepts inputs of 1.0 to 5.0 V or 4 to 20 mA. (Refer to *B873-002 and B875-002 Field Connections, page 93*).

Converting Analog Data

The input is converted to a numerical value, ranging from 0001 to 4095 or 4096 to 8191. Values of 0000, 4095, 4096, or 8192 indicate invalid data and a possible problem. (Refer to the *Data Value Reference Chart, page 91*). The value is directly proportional to the input signal. For example, an input voltage of 3.0 V causes the module to send a value of 2048 (standard). Or the input could be 12 mA, which would produce a value of 6144 (elevated). (Refer to *Input to Data Value Conversion, page 90*).

NOTE: No voltage or current on an input channel produces a data value of 0000 (standard) or 4095 (elevated).

The PLC polls the module and places the values into designated (3x) input registers.

Each time the module is powered up, it:

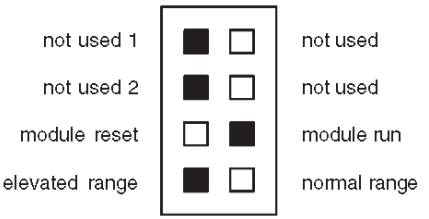
1. performs diagnostic tests
2. resets the input latches
3. presents a value of 0000 to the controller for each channel; this value is present for approximately 3 s after power up
4. starts converting the inputs according to the schedule found in the *B873-002 and B875-002 Throughput Rate, page 92*

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B873-002 and B875-002 Switch Settings and Indicators

Switch Settings

There is a DIP switch located at the rear of the module. Switches 1 and 2 are not used. Switch 3 can be set to either module reset or module run. It must set to the module run position for the module to operate. Switch 4 is used to set which data value range the module will produce. Select either normal range or elevated range. Make sure you set Switch 3 and 4 before inserting the module into the housing. Refer to the figure below for a key to setting the DIP switch.



black box indicates switch in down position

Indicators

The Active, Over Range, Under Range indicators are located on the front panel of the module. The Over Range and Under Range indicators are shared by all of the module's input channels. The module's status can be determined by referring to the table below.

The following table gives the Indicator readings for the B873-002 and B875-002 modules:

Indicator	State	Condition
Active	on blinking off	The module is communicating properly and PLC is running The module failed the powerup reference test The module failed the internal diagnostic test/PLC is not in Run mode/communication from PLC to module has failed
Over Range	off on or flickering	All input are within the valid input range One or more inputs have exceeded the valid input range
Under Range	off on or flickering	All input are within the valid input range One or more inputs have dropped below the valid input range

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B873-002 and B875-002 Installation

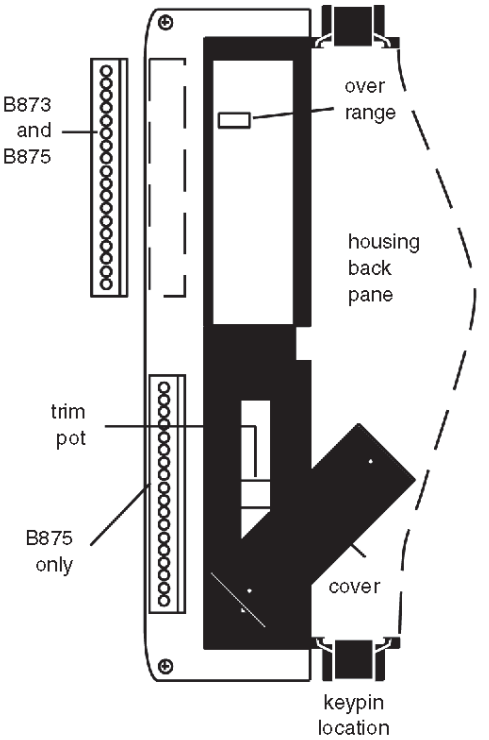
Installing the Module

Remove the module from the box and check for damage. If damage is found, contact your salesman or distributor for correct return procedure.

Set switch three to the module run position, and switch four to the data range selected for input - either standard or eevated - before inserting the module into the housing. (Refer to *Switch Settings, page 85*).

Module Characteristics

The following figure shows the 873 / 875 module, at pre-installation.



Included with the module is an analog connector set (Part# AS-8533-001 for B873-002 and Part# AS-8533-002 for B875-002).

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The connector set consists of two mounting screws, a wire duct, and either one (B873-002) or two (B875-002) field wiring connectors. Each connector has eighteen recessed slotted screw terminals and can accept various wire gauges, but 16 to 20 gauge is recommended for the field side wiring.

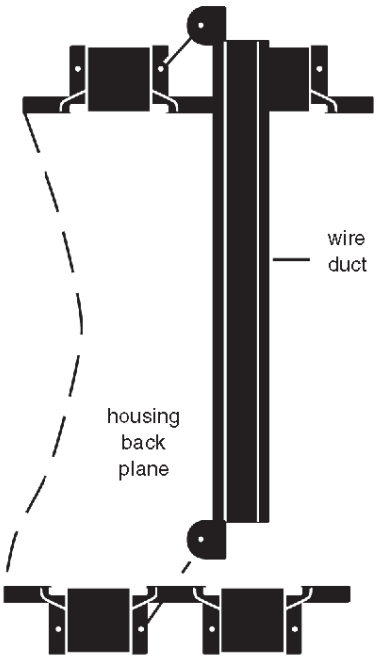
NOTE: The wiring connections can only be made with an 1/8 inch blade screwdriver.

The connector plugs into the module with the field wiring to the left. The removable connector permits module removal and replacement without disturbing the wiring. Refer to the diagram for the terminal numbering for the terminal functions.

The wire duct protects the connections to the analog input module from being damaged or loosened when the module to its immediate left is removed.

Installing the Wire Duct

The following is the wire duct installation diagram, for the B873/B875 module.



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Steps to Installation

The following table lists the steps for installing the B873/B875 module:

Step	Action
1	Turn off the power to the housing.
2	Determine which slot will be used for the analog module.* If there is a duct present, and it is different from the one provided in the connector set, then it must be removed.This is accomplished by removing the two screws located on the top and bottom of the housing and then pulling the duct out.
3	If there is a module to the left of this slot, it must be removed until installation of the duct is complete.
4	Insert the wire duct between the two slots with the screw holes to the left. (Refer to the installation diagram.)
5	Using the two 1/4 inch slotted screws provided in the package, secure the wire duct to the housing.
6	Re-install the module(s) and complete the wiring connections. *The wire duct can not be installed for the left-most slot of the housing. Therefore the use of this slot for the analog module is not recommended.

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B873-002 and B875-002 Calibration

Required Tools

Calibration is recommended at 12 month intervals for operation at or below 405 C (1045 F) and at 6 month intervals between 405 and 605 C (1045 and 1405 F).

The following tools are needed to calibrate a B873-002 or B875-002 module in a running system:

1.	A programmer
2.	A precision voltmeter
3.	An Analog DC Voltage/Current
4.	A 1/4 inch Phillips screwdriver
5.	A 1/8 inch standard screwdriver
6.	An adhesive for the trim pot adjusting screw (e.g. Locktight Glyptol)

Calibration Adjustments

To achieve full accuracy of the module, allow it to warm up for one hour with a valid input present at the channel to be used for the calibration. Without warm up, the accuracy of the data values will be +/-%2 counts.

Steps to Calibration

The adjustments can be made using a voltage or current source. Use steps 5a through 10a for voltage or steps 5b through 10b for current.

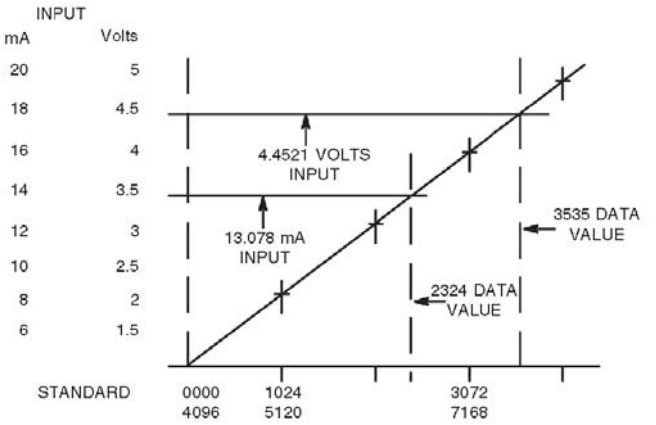
1.	Remove trim pot access cover, located on the front panel.
2.	Open module handle to expose connector(s) and terminal(s).
3.	Unplug field wiring connector(s).
4.	Set up Programmer to monitor the register for the channel used for calibration.
Method using a voltage source:	
5a.	Connect the positive lead of the voltage source to the channel's input + terminal and the negative lead to the channel's input - terminal.
6a.	Set voltage source to output 1.00048 volts.
7a.	While monitoring the register, adjust the top trim pot until the value toggles between 0000 and 0001 (Standard) or 4095 and 4096 (Elevated).
8a.	Use an adhesive to secure the adjusting screw on the trimmer.
9a.	Set voltage source to output 4.99951 volts.
10a.	While monitoring the register, adjust the bottom trim pot until the value toggles between 4095 and 4096 (Standard) or 8191 and 8192 (Elevated).
Method using a current source:*	

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5b.	Connect the positive lead of the current source to the channel's input + terminal and the negative lead to the channel's input - terminal.
6b.	Set current source to output 4.002 mA.
7b.	While monitoring the register, adjust the top trim pot until the value toggles between 0000 and 0001 (Standard) or 4095 and 4096 (Elevated).
8b.	Use an adhesive to secure the adjusting screw on the trimmer.
9b.	Set current source to output 19.998mA.
10b.	While monitoring the register, adjust the bottom trim pot until the value toggles between 4095 and 4096 (Standard) or 8191 and 8192 (Elevated).
11.	Disconnect input source.
12.	Re-connect field wiring.
13.	Close module handle.
14.	Replace trim pot access cover.
* To use this method, a jumper must be connected between the Current Sense terminal and the Input + terminal of the channel to be calibrated.	

Input to Data Value Conversion

The following figure shows the Input to Data Value Conversion chart.



Calculation for determining Data Value (refer to the figure above and the table below):

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Voltage:

(Input Voltage - 1) X 1024

Example: (Refer to Graph)

(4.4521V - 1) X 1024

3.4521 X 1024 = 3534.9504 (Add 4096 for Elevated Value)

Data Value = 3535 Standard 7631 Elevated

(Rounded to the nearest whole number)

Current:

(Input Current - 4) X 256

Example: (Refer to Graph)

(13.078mA - 4) X 256

9.078 X 256 = 2323.968 (Add 4096 for Elevated Value)

Data Value = 2324 Standard 6420 Elevated

(Rounded to the nearest whole number)

Data Value Reference Chart

The following is the Data Reference Chart for the B873-200 & B875-200 Modules.

Standard	Elevated	Input Voltage, Current, or Condition
0000	0000	1. First three seconds after power up 2. During failure recovery
0000	4095	Under range
0000	OFF	1.0000V or 4 mA
4095	4096	4.999V or 19.995 mA
4095	8192	Over range

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B873-002 and B875-002 Throughput Rate

Update Interval

Update Interval:*

B873-	4 Channels	400 ms
B875-	8 Channels	710 ms
Out of Range		220 ms per channel

All registers are updated every 400 or 710 ms, as long as the inputs on all of the channels are within the valid range. 220 ms is added to the update interval for each channel either under or over range. The input is considered under range when the voltage is at -3 V or below. This keeps unused channels from adding time to the update interval.

NOTE: The over range indicator will be on or flickering, if the input on any channel is between .999 and -2.999 V or below 4 mA; but the 220 ms time will not be added to the update interval.

Update Interval Example

On an eight channel module, 2 channels are under range. All the registers assigned to the module will be updated every 1150 ms, until the inputs on the out of range channels return to the valid range. When they do, the update interval will return to 710 ms.

Update Interval =

(400 or 710) + (out of range channels X 220)

Using the example above:

(710) + (2 X 220) = 1150 ms

If one channel returned to the valid range, the update interval would reduce to 930 ms.

NOTE: As long as the channel is out of range, the register assigned to it will either have data of 0000 (4095 elevated), under range, or 4096 (8192 elevated), over range. (Refer to the data value reference chart)

* The update interval is the amount of time necessary to update the data for all the registers assigned to the module.

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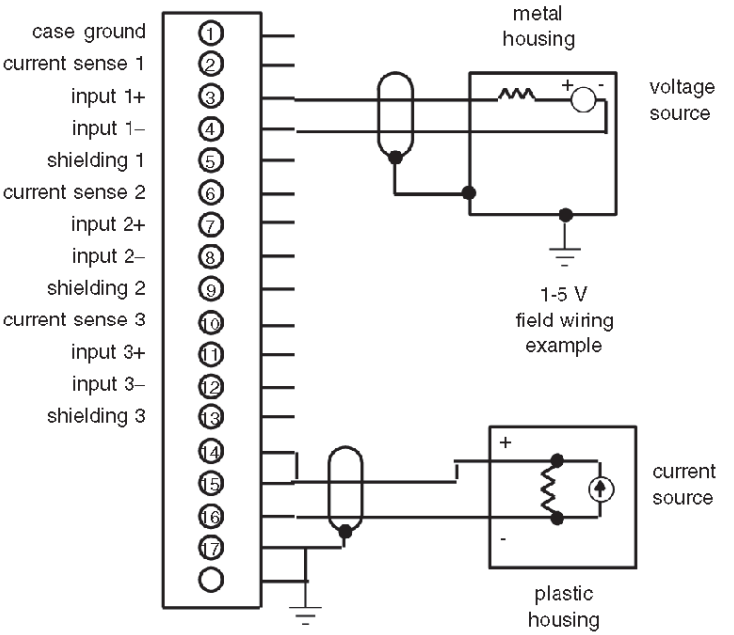
B873-002 and B875-002 Field Connections

User Connections

User connections are made to a standard screw terminal strip; and the rigid wiring system permits module insertion or removal without disturbing the wiring.

B873-002 Terminal Numbering and Wire Connections

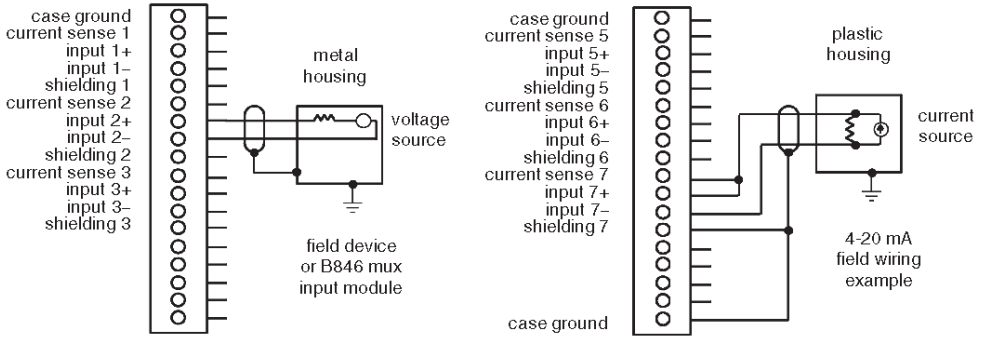
B873-002 terminal numbering and corresponding input functions are presented below.



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B875-002 Terminal Numbering and Wire Connections

B875-002 terminal numbering and corresponding output functions are presented below.



NOTE: If a user has a process where the over-range or under-range detection is immaterial, the unused voltage or current terminal, including the shields, on the field connector should be jumpered to case ground.

If over-range or under-range detection is important to your process, and this detection is causing throughput problems with the unused channels (because they float or spike outside the range), then the unused voltage or current channels at the field connector, should be connected in parallel, to a valid Input channel. As long as the valid channel stays within range, the tied channels will also stay within range.

For current, 4 to 20 ma operation, the valid Input is the only Input requiring the 250 Ω resistor to be in the circuit.

Case ground is effective when the H8XX housing is connected to earth ground.

The shield cannot be connected, both ends, to the device and the module. The exception to this is where the device shield is part of the device input circuit, and is not connected internally to device case ground.

NOTE: Any module run-time diagnostic failure will result in a 0000 value being returned to the controller, regardless of selected range.

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B873-002 and B875-002 Specifications

Module Specifications

The following table gives specifications for the B873-002 and B875-002 input modules.

Description	Analog input 4 - 20 mA, 1 - 5 Vdc
Number of Channels	4, (B873-002) 8, (B875-002)
Operating Range Voltage/Current	1 - 5 Vdc / 4 - 20 mA
Impedance Voltage Current	 0.5 MΩ per input 1 MΩ differentially
Resolution	12 bit
Filter	-3 dB @ 18 Hz Rolloff -20 dB per decade
Linearity	+.05% of full scale @ 25 °C (77 °F)
Protection	240 Vac RMS
Common Mode Range Rejection	 0 Vac to 30 Vac RMS > -86 dB @ 60 Hz
Isolation Channel to Channel Input to Case Module	 250 Vac RMS 500 Vac RMS for one minute 1500 Vac RMS for one minute 300 Vac RMS continuous
Accuracy Overall At 25 °C (77 °F) Offset Drift Gain Drift	 7 mV or 19.7 µA +/-0.488 mV or +/-1.95 µA @ 1.2207 mV +/-30 µV or +/-0.12 µA per °C +/-16.7 µV or +/-0.07 µA per °F +/-15 ppm per °C
Repeatability	Over a twenty-four hour period, with a constant voltage and at a constant operating temperature, the input data value will be within +/-2 counts.
Power Required +5 V +4.3 V -5 V	 300 mA 300 mA 0 mA

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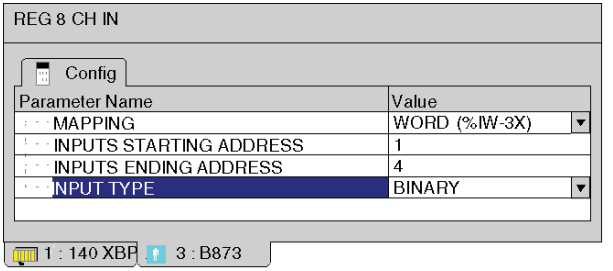
Data Format	
0000	Power Up On diagnostic failure or during failure recovery Under range - standard
4095	Under range - elevated
0000 to 4095	Valid - standard range
4096 to 8191	Valid - elevated range
4096	Over range - standard
8192	Over range - elevated
Throughput Rates	
Update Interval	4 channels 400 ms 8 channels 710 ms (Including diagnostics)
Out of Range	220 ms for each channel in under or over range condition (Refer to throughput section)
Terminal Connector	AS-8533-001 (B873-002) AS-8533-002 (B875-002)
Reference Type	B873-002 Mapped as 4 registers input 3x B875-002 Mapped as 8 registers input 3x
Input Type	BIN/BCD

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B873-002 Parameter Configuration

Parameter and Default Values

Parameter configuration window



Module configuration

Parameter Name	Default Value	Value (Options Available)
Mapping	WORD (%IW-3X)	-
Inputs Starting Address	1	-
Inputs Ending Address	4	-
Input Type	BINARY	BCD

Mapping parameter references

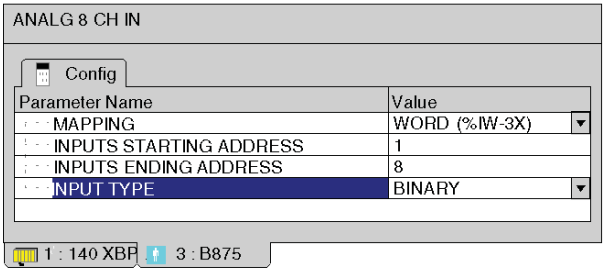
	Modsoft, Concept, ProWORX	Unity
Reference Type	Mapped as 4 registers input 3x	Mapped as 4 words input %IWx
Input Type	BIN/BCD	BIN/BCD

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B875-002 Parameter Configuration

Parameter and Default Values

Parameter configuration window



Module configuration

Parameter Name	Default Value	Value (Options Available)
Mapping	WORD (%IW-3X)	-
Inputs Starting Address	1	-
Inputs Ending Address	8	-
Input Type	BINARY	BCD

Mapping parameter references

	Modsoft, Concept, ProWORX	Unity
Reference Type	Mapped as 8 registers input 3x	Mapped as 8 words input %IWx
Input Type	BIN/BCD	BIN/BCD

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