Honeywell

Foundation Fieldbus
RMA803 Remote Indicator
User's Guide

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About This Document

This guide provides the details of programming Honeywell RMA803 Remote Indicator for applications involving FOUNDATION Fieldbus protocol. For installation, wiring, and maintenance information, refer to the *RMA803 Remote Indicator User Manual*.

The configuration of your Remote Indicator depends on the mode of operation and the options selected for it with respect to operating controls, displays and mechanical installation.

An RMA803 Remote Indicator can be digitally integrated with:

- Experion PKS, you need to supplement the information in this document with the data and procedures in the Experion PDF Collection.

Release Information

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Foundation Fieldbus RMA803 Remote Indicator User's Guide	34-ST-25-51		
1st Release		1	June 2014
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References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Quick Start Installation Guide, # 34-ST-25-52

HART/DE Option User Manual, Document # 34-ST-25-40

Patent Notice

The Honeywell Remote Indicator family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, see back page or refer to the appropriate Honeywell Solution Support web site:

Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	https://www.honeywellprocess.com/remote-meter-assemblies
Training Classes	www.honeywellprocess.com/en-US/training

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	hfs-tac-support@honeywell.com
Field Product Sales	Honeywell Process Solutions	FP-Sales-Apps@Honeywell.com

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advice or hints for the user, often in terms of performing a task.
	**REFERENCE -EXTERNAL:** Identifies an additional source of information outside of the bookset.
	**REFERENCE - INTERNAL:** Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	**CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING**: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING, Risk of electrical shock**: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Functional earth terminal**: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.

Symbol	Definition
	**Earth Ground**: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Chassis Ground**: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Terms and Acronyms

Term	Definition
Alarm	The detection of a block leaving a particular state and when it returns back to that state.
Analog Input (function block)	One of the standard function blocks define by the Foundation Fieldbus
AP	Absolute Pressure
Application	A software program that interacts with blocks, events and objects. One application may interface with other applications or contain more than one application.
AWG	American Wire Gauge
Block	A logical software unit that makes up one named copy of a block and the associated parameters its block type specifies. It can be a resource block, transducer block or a function block.
Configuration (of a system or device)	A step in system design: selecting functional units, assigning their locations and identifiers, and defining their interconnections.
Device	A physical entity capable of performing one or more specific functions. Examples include Remote Indicators, actuators, controllers, operator interfaces.
DCS	(Distributed Control System)
DD	Device Description
Device Description	Description of FBAPs within a device. Files that describe the software objects in a device, such as function blocks and parameters. The DD binary are created by passing DD source files through a standard tool called a tokenizer.
Device Description Language	A standardized programming language (similar to C) used to write device description source files.
Device Tag	The Physical Device Tag of the device as specified in the Foundation Fieldbus specifications.
DP	Differential Pressure
DTM	Device Type Manager
EDD	Electronic Device Description
EDDL	Electronic Device Description Language
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
Event	An instantaneous occurrence that is significant to scheduling block execution and to the operational (event) view of the application.
Field Device	A fieldbus-compatible device that contains and executes function blocks.

Term	Definition
FDT	Flash Download Tool
FF	Foundation Fieldbus
Foundation Fieldbus	Communications protocol for a digital, serial, two-way system which interconnects industrial field equipment such as sensors, actuators and controllers.
FTA	Field Termination Assembly
Function Block	An executable software object that performs a specific task, such as measurement or control, with inputs and outputs that connect to other function blocks in a standard way.
Function Block Application Process	The part of the device software that executes the blocks (function, transducer, or resource blocks).
Hz	Hertz
IDE	Integrated Development Environment
inH2O	Inches of Water
LGP	In-Line Gauge Pressure
Link Active Scheduler	A device which is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time messages and probes for new devices.
LRL	Lower Range Limit
LRV	Lower Range Value
Macrocycle	The least common multiple of all the loop times on a given link.
mAdc	Milliamperes Direct Current
Manufacturer's Signal Processing	A term used to describe signal processing in a device that is not defined by FF specifications.
MAO	Multiple Analog Output
mmHg	Millimeters of Mercury
mV	Millivolts
Network Management	A part of the software and configuration data in a Foundation Fieldbus device that handles the management of the network.
Network Management Agent	Part of the device software that operates on network management objects.
Network Management Information Base	A collection of objects and parameters comprising configuration, performance and fault-related information for the communication system of a device.
Nm	Newton. Meters
NPT	National Pipe Thread
NVM	Non-Volatile Memory

Term	Definition
Object Dictionary	Definitions and descriptions of network visible objects of a device. There are various object dictionaries within a device. The dictionaries contain objects and their associated parameters which support the application in which they are contained.
Objects	Entities within the FBAP, such as blocks, alert objects, trend objects, parameters, display lists, etc.
OOS	Out Of Service
P	Pressure
Pa	Measured static pressure in PV4 algorithm
Parameters	A value or variable which resides in block objects
Pdp	Measured differential pressure in Pascals in PV4 algorithm
PM	Process Manager
Proportional Integral Derivative control	A standard control algorithm. Also refers to a PID function block.
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
Pu	Static pressure at upstream point
PV	Process Variable
PWA	Printed Wiring Assembly
RFI	Radio Frequency Interference
RMA	Remote Meter Assembly
RTD	Resistance Temperature Detector
Stack	The software component that implement the Foundation Fieldbus communications protocol specifications, including FMS, FAS, DLL, SM and NM.
Status	A coded value that qualifies dynamic variables (parameters) in function blocks. This value is usually passed along with the value from block to block. Status is fully defined in the FF FBAP specifications.
System Management	Provides services that coordinate the operation of various devices in a distributed fieldbus system.
System Management Agent	Part of the device software that operates on system management objects.
System Management Information Base	A collection of objects and parameters comprising configuration and operational information used for control of system management operations.
TAC	Technical Assistance Center
Trim Point	A selected reference point at which a measurement is calibrated.
URL	Upper Range Limit

Term	Definition
URV	Upper Range Value
US	Universal Station
Vac	Volts Alternating Current
Vdc	Volts Direct Current
Virtual Communication Reference	A defined communication endpoint. Fieldbus communications can primarily only take place along an active communications "path" that consists of two VCR endpoints.
Virtual Field Device	A logical grouping of "user layer" functions. Function blocks are grouped into a VFD, and system and network management are grouped into a VFD. For example, to establish communications between a transducer block and a function block, a VCR must be defined at the transducer block and a VCR must be defined at the function block.

Contents

Tables

Figures

1. Introduction

1.1 About the RMA803 Remote Indicator

The Honeywell RMA803 is a Foundation Fieldbus Remote Indicator that provides the following benefits to the user:

Connectivity

The RMA803 can be used with any Foundation Fieldbus device. The values from these Fieldbus devices can be connected to the RMA803 via the MAO function block (for example) and then sent to the LCD display via the LCD Transducer block. The RMA803 can display up to eight (8) values from the devices on the H1 segment.

Mounting

The RMA803 can be connected anywhere along the H1 segment, providing easy access to data from devices that are mounted in inaccessible locations. The LCD module can be rotated in 90 degree increments, allowing the RMA803 to be mounted in any orientation.

Capacity

The RMA803 can display up to eight (8) function block values. The RMA803 will automatically rotate through these values at a user-configurable rate. The user can also step through the values on-demand using the local pushbuttons.

LCD Display formats

The RMA803 provides three user-friendly formats, including bar graph and trend. The scale limits of the bar graph and trend are configured by the user to allow optimum visibility of the process value. The trend format will plot the trend of the selected function block value. The duration of the trend is configured by the user, providing up to 24 hours of history for the selected value.

Custom labeling

The user can enter a custom tag for each screen to provide clear identification of the displayed value. The user can also enter custom units for each screen, or select the units from a predefined list. The length of the custom tag is 14 characters; the length of the custom units label is 8 characters.

Additional calculation and control

The RMA803 provides a robust set of function blocks that can be used to provide additional calculation and control capability.

Backup Link Active Scheduler (LAS)

The RMA803 can also be configured as backup LAS, allowing the Fieldbus devices on the H1 segment to continue operating if the primary LAS fails.

Additional Function Blocks

The RMA803 consists of two Application Software options, which are:

- **Standard Operating Software –** Consists of Resource block, AI block, LCD Transducer block, Diagnostic Transducer block, and MAO (Multiple Analog Output) function block
- **Additional Function Blocks** – Consists of PID block, Signal Characterizer block, Arithmetic block, Input Selector block and Integrator block. Refer to **Section 7.5** for more details.

Note: Additional Function blocks are available post liscensing.

1.2 Features and Options

The RMA803 Foundation Fieldbus Remote Indicator has the following features:

Table 1: Feature and Options

Feature/Option	Standard/Available Options
Communication Protocols	Fieldbus and only Advanced Display
Human-Machine Interface (HMI) Options (Advanced Display)	Advanced Digital Display: 0, 90, 180, & 270 degree viewing position adjustments Standard and custom measurement units available. Up to eight display screens with 3 formats are possible (Large PV or PV with Bar Graph or PV with Trend Graph) Configurable screen rotation timing (4 to 30 sec) Ability to enable/disable screen rotation
	Three-button programming (optional)
	Advanced display languages: East Asian: EN, CH, JP Western: EN, GE, FR, IT, SP, RU, TU
Approvals (See Appendix C for details.)	ATEX, CSA, FM, IECx, NEPSI
Mounting Brackets	Pipe mounting and wall mounting brackets in carbon steel and 316 stainless steel.
# of Devices/ Segments	Entity IS model: 6 devices/segment
Schedule Entries	46 (max)
# of VCRs	50 (max), 50-link objects
Compliance Testing	Tested according to ITK 6.1.1
Software Download	Class-3 of the Common Software Download procedure as per FF-883.

1.3 RMA803 major assembly and electronic housing components

The following illustrations depict the major assembly and electronic housing components.

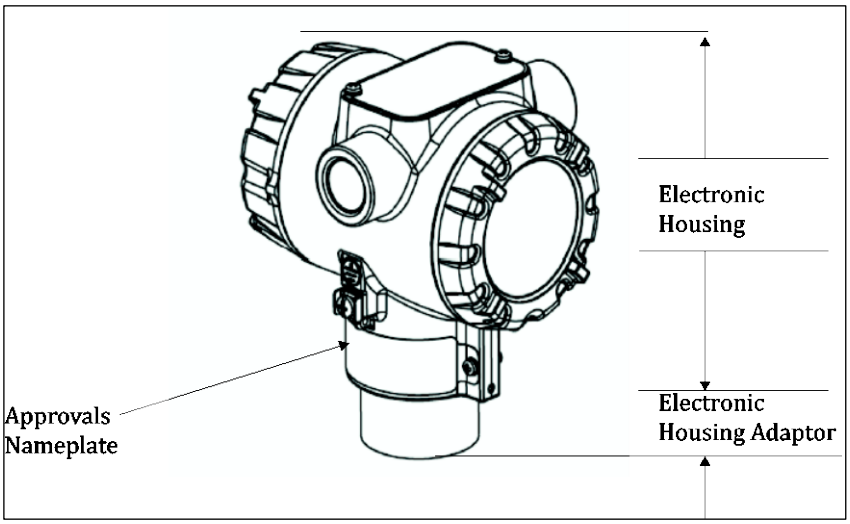

Figure 1: RMA803 Major assemblies

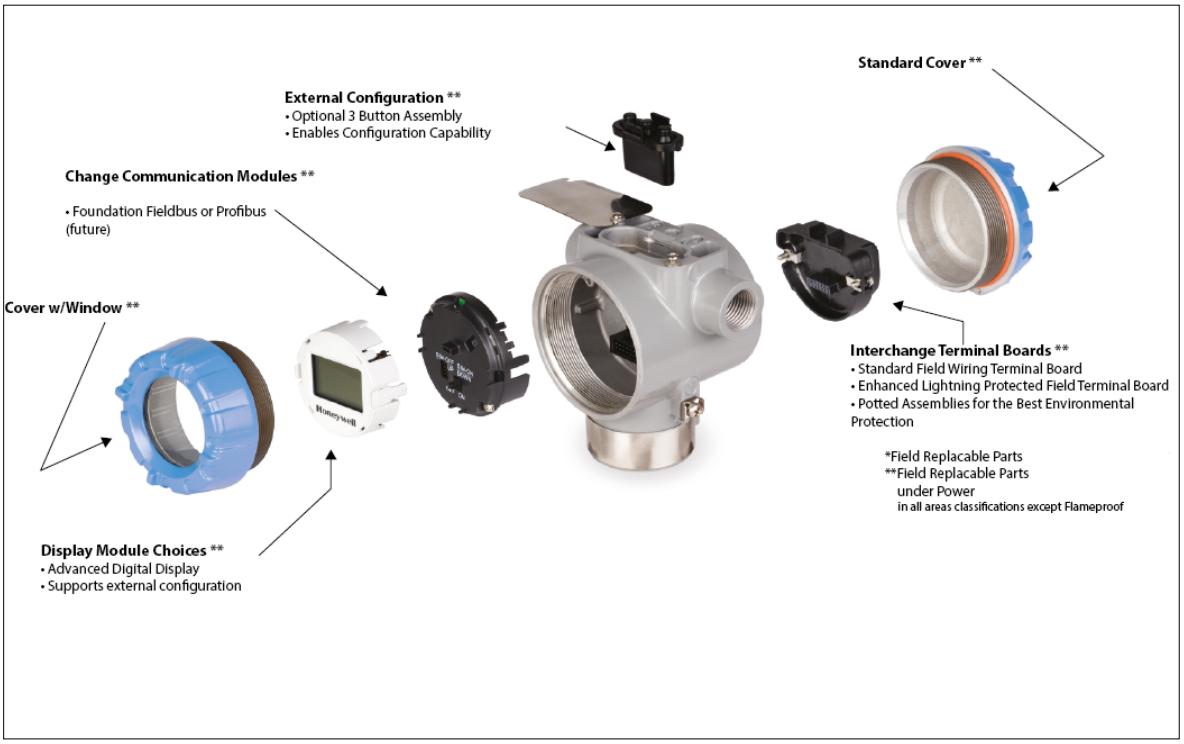

Figure 2: Electronic Housing components

1.4 Features of a Remote Indicator

The Remote Indicator is a configurable intelligent field device which functions as an output and status indicator for any FF device. The core functionalities of the field device include:

- Displaying Process Variable (PV)
- Function Block Application Process (FBAP)
- Device diagnostics

The RMA803 features standard fieldbus function blocks with manufacturer-specific additions for enhanced operation. The Remote Indicator can function as a Link Active Scheduler (LAS) in a Fieldbus network.

It supports the following features:

- Link-master capability
- Supports the following standard function blocks apart from the Resource and Transducer blocks.
  - Input Selector block
  - AI block
  - Integrator block
  - Signal Characterizer block
  - PID with auto tune block
  - Arithmetic block
  - Multiple Analog Output Block
- Function block instantiation is supported by the following blocks
  - Input Selector block
  - PID block
  - Arithmetic block
  - Signal Characterizer block
- Supports the following Transducer blocks
  - LCD Transducer block
  - Diagnostic Transducer block
- Supports class 3 type firmware download through commercial hosts.

DD and EDDL Features

The RMA803 supports DD and EDD file formats, and the data is displayed using the EDDL features in the form of menus, graphs, charts, and pictures.

1.5 RMA803 Remote Indicator Nameplate

The Remote Indicator nameplate mounted on the bottom of the electronics housing (see Figure 1) lists its model number, physical configuration, electronics options, accessories, certifications, and manufacturing specialties.

Figure 3 –Typical RMA803 Nameplate

You can readily identify the series and basic Remote Indicator type from the last digit in the key number. The last digit represents the Foundation Fieldbus.

- 3 = Foundation Fieldbus

For a complete selection breakdown, refer to the appropriate Specification and Model Selection Guide provided as a separate document.

1.6 Safety Certification Information

An "approvals" nameplate is located on the bottom of the Electronics Assembly; see Figure 1 for exact location. The approvals nameplate contains information and service marks that disclose the Remote Indicator compliance information. Refer to Appendix A of this document for safety certification requirements and details.

1.7 Display Options

The RMA803 Foundation Fieldbus Remote Indicator has Advanced Display option.

Table 2: Available Display Characteristics

Advanced Display	• 360° rotation in 90° increments • Three (3) configurable screen formats with configurable rotation interval o Large process variable (PV) o PV with bar graph o PV with trend (1-24 hours, configurable) • Eight (8) screens with 3-30 seconds rotation timing • Standard and custom engineering units • Diagnostic alerts and diagnostic messaging • Multiple language support: o EN, FR, GE, SP, RU, IT & TK o EN, CH (Kanji), JP • Square root output indication • Supports 3-button configuration • Supports messaging and maintenance mode indications of the Remote Indicator

1.8 Optional 3-Button Assembly

The optional 3-Button Assembly provides the following features and capabilities:

• Increment, decrement, and enter key functions.
• With the menu-driven display:
  o Comprehensive on-screen menu for navigation.
  o Display configuration.

2. Getting started

2.1 Verifying the installation

Verifying Remote Indicator installation tasks

After the Remote Indicator is installed and powered up, you can verify communication between the Remote Indicator and the field devices on the network. **Table 3** outlines the steps for identifying and checking the Remote Indicator on a Fieldbus network.

Table 3: Remote Indicator installation verification tasks

Task	Description	Comment
Verify device location	Check that the device is installed in the correct physical location.	
Verify device ID	Match the device ID with the physical location. The device serial number is the PROM ID which is stamped on the Remote Indicator housing nameplate.	
Verify connection with host computer to device	On the operator interface, check and make sure communications are established with the device on the Fieldbus network.	
Verify or assign Device Tag and address	Check that the Device Tag and node address are set. If not, assign the Device Tag and the correct node address. The Device Tag and address can be set and viewed using the Fieldbus device configurator application. Use a Device Tag name (up to 16 characters) that does not contain spaces.	
Configure device	Using a Fieldbus configuration program, create a function block application as part of the device configuration and process control strategy.	
Verify device operation	Bring the network online, verify operation, tune loops, and so on.	

2.2 Verifying communication with the Remote Indicator

On the operator interface, establish communication with the device on the Fieldbus network. If the device is not visible on the network, verify that the device has been installed properly.

Identify the Remote Indicator

Verify the Device ID of the Remote Indicator by checking the device parameters. The parameters contain the following information:

- Device Tag (tag description of the Remote Indicator)
- Device Serial number
- Firmware revision level (revision level of the firmware elements)

Check the Remote Indicator parameters listed in **Table 4** and note down the values to identify the Remote Indicator.

ATTENTION

It is recommended to verify the correct version of the Device Description file is present on the host computer. (Refer to the document on the diskette shipped with the Remote Indicator.) This helps in getting the correct parameter names and its corresponding descriptions, while viewing the device parameters.

Table 4: Remote Indicator parameters

Parameter	To verify
Resource block **DEV_TYPE**	That the Remote Indicator is of the proper device type. For all the RMA803 Remote Indicators, the value is 0005.
Device Tag (Physical device tag name of the Remote Indicator)	The Device Tag is correct. Device Tag name _____
ATTENTION The Device Tag name can be set and viewed using the Fieldbus device configurator application. Use a device tag name (up to eight characters) that does not contain spaces.	
Transducer Block **DEVICE_SN**	Device Serial # _____ The **DEVICE_SN** value, when viewed as a hexadecimal number, is the same number as the first 10 digits of the PROM ID stamped on the Remote Indicator housing nameplate.

ATTENTION

Note that the eight digit serial number in the **DEVICE_SN** parameter does not display the last two digits of the PROM ID stamped on the nameplate of the Remote Indicator housing. The Device ID contains the full 10-digit PROM ID.

2.3 Establishing communication with host systems

The RMA803 Remote Indicator establishes communication with the host systems using a DD or DTM.

Device Description (DD)

DD is a binary file that provides the definition for parameters in the FBAP of the RMA803 Remote Indicator. For example, DD refers to the function blocks that a Remote Indicator contains, and the corresponding parameters in the blocks that are critical to the interoperability of Fieldbus devices. They define the data required to establish communications between different Fieldbus devices from multiple vendors with control system hosts. The DD provides an extended description of each object in the Virtual Field Device (VFD).

The Fieldbus Foundation provides the DD for all standard function blocks and transducer blocks on a CD-ROM. The Fieldbus Foundation also provides this information on its website, www.fieldbus.org.

Enhanced Device Description (EDD)

There are two types of EDDs are available, namely .ff5/.sy5 and .ffo/sym. The.ffo/.sym binary files are generated for the legacy hosts to load the device DD that is generated using latest tokenizer. Few constructs like Images that are supported in .ff5/.sy5 binaries, are not supported in .ffo/.sym binary files.

Device Type Manager (DTM)

DTM is similar to a device driver that enables usage of devices in all the asset management and device configuration software like FDM, with the help of the FDT-DTM technology.

The DTM has the following primary functions:

- Provides a graphic user interface for device configuration.
- Provides device configuration, calibration, and management features for the particular device.

DTM provides functions for accessing device parameters, configuring and operating the devices, calibrating, and diagnosing problems.

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3. Installation and Startup

3.1 Installation Site Evaluation

Evaluate the site selected for the Remote Indicator installation with respect to the process system design specifications and Honeywell's published performance characteristics for your particular model. Some parameters that you may want to include in your site evaluation are:

- Environmental Conditions:
  - Ambient Temperature
  - Relative Humidity
- Potential Noise Sources:
  - Radio Frequency Interference (RFI)
  - Electromagnetic Interference (EMI)
- Vibration Sources
  - Motorized System Devices (e.g., pumps)
  - Valve Cavitation
- Process Parameters
  - Temperature
  - Maximum Pressure Rating

3.2 Display Installation Precautions

Temperature extremes can affect display quality. The display can go blank if the temperature is below -20°C; however, this is only a temporary condition. The display will again be readable when temperatures return to within operable limits.

The display update rate may increase at cold temperature extremes, but as with readability, normal updating resumes when temperatures are within limits for full operability.

3.3 Mounting Remote Indicator

Summary

Remote Indicator models can be attached to a two-inch (50 millimeter) vertical or horizontal pipe using Honeywell's optional pipe mounting bracket. Honeywell's optional wall mounting bracket is also shown below.

Figure 3 shows typical bracket-mounted installations.

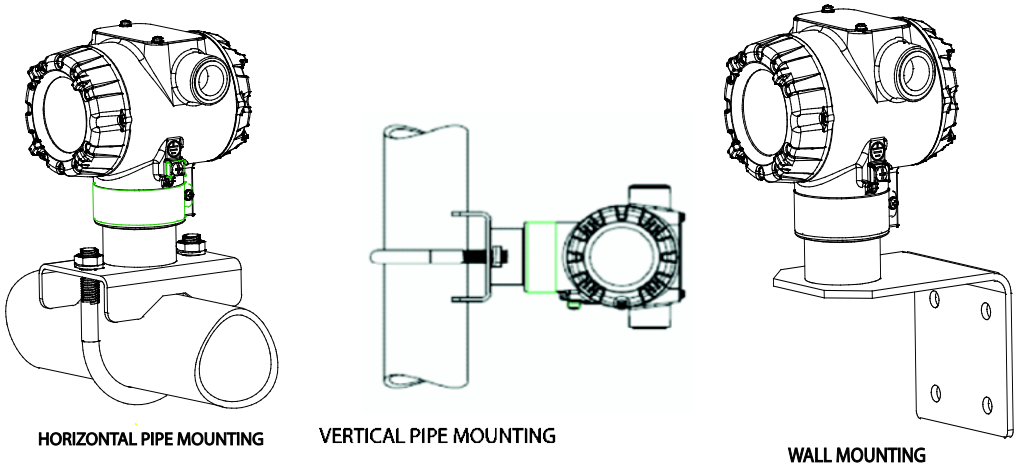


Figure 3: Typical Bracket Mounted Installations

Mounting Dimensions

Refer to Honeywell drawing number 51455045* for detailed electronic housing dimensions. Refer to Honeywell drawing numbers 32306827* for detailed pipe mounting dimensions and 50124813* for detailed wall mounting dimensions. Abbreviated overall dimensions are also shown on the Specification Sheets for the Remote Indicator models. This section assumes that the mounting dimensions have already been taken into account and the mounting area can accommodate the Remote Indicator.

* Honeywell drawings can be supplied on request.

Bracket Mounting Procedure

1. Align the two mounting holes in the Remote Indicator with the two slots in the mounting bracket and assemble the (2) M8 hex cap screws, (2) lockwashers and (2) flat washers provided. Rotate Remote Indicator assembly to the desired position and torque the M8 hex cap screws to 27,0 Nm/20,0 Lb-ft maximum.

Pipe Mount Option: Refer to Figure 4

2. Position the bracket on a 2-inch (50.8 mm) horizontal or vertical pipe, and install a "U" bolt around the pipe and through the holes in the bracket. Secure the bracket with the nuts, flat washers and lock washers provided.
3. Wall Mount Option: Position the bracket on the mounting surface at the desired location and secure the bracket to the mounting surface using the appropriate hardware (Wall mounting hardware requirements to be determined and supplied by the end user).

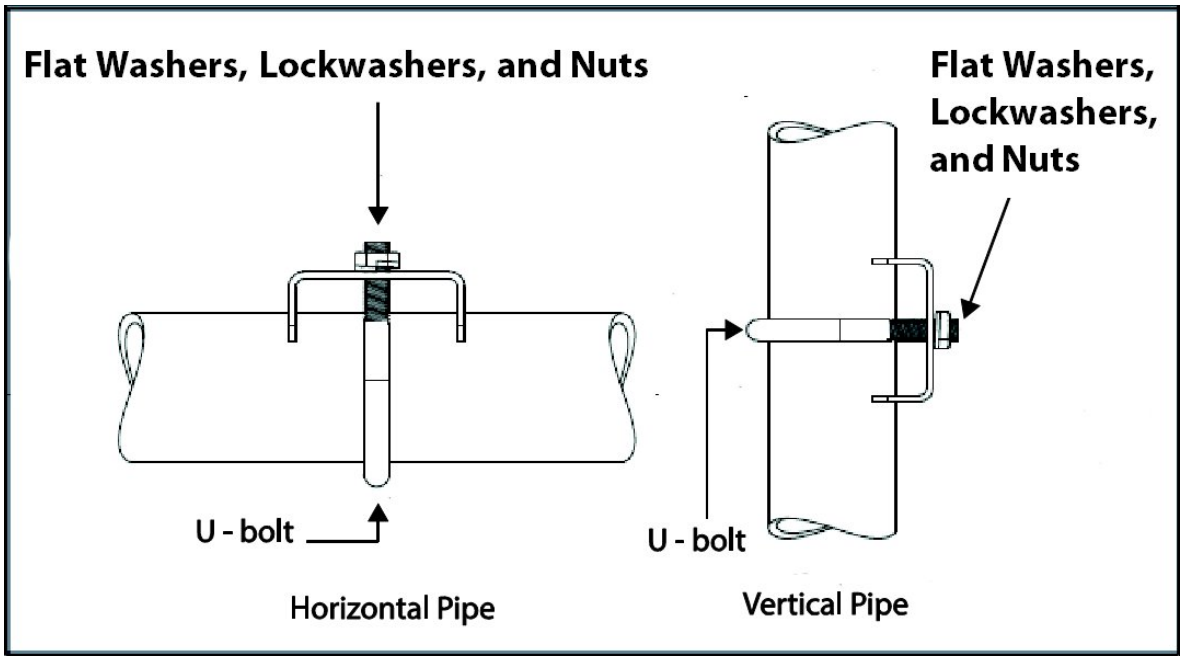


Figure 4: Pipe Mounting Bracket Secured to a Horizontal or Vertical Pipe

3.4 Wiring a Remote Indicator

Overview

The Remote Indicator is designed to operate as part of a Fieldbus Network.

Loop wiring is connected to the Remote Indicator by simply attaching the loop wires to the terminals on the Remote Indicator terminal block in the Electronics Housing shown in Figure 5. Connect the Loop Power wiring shield to earth ground only at the power supply end.

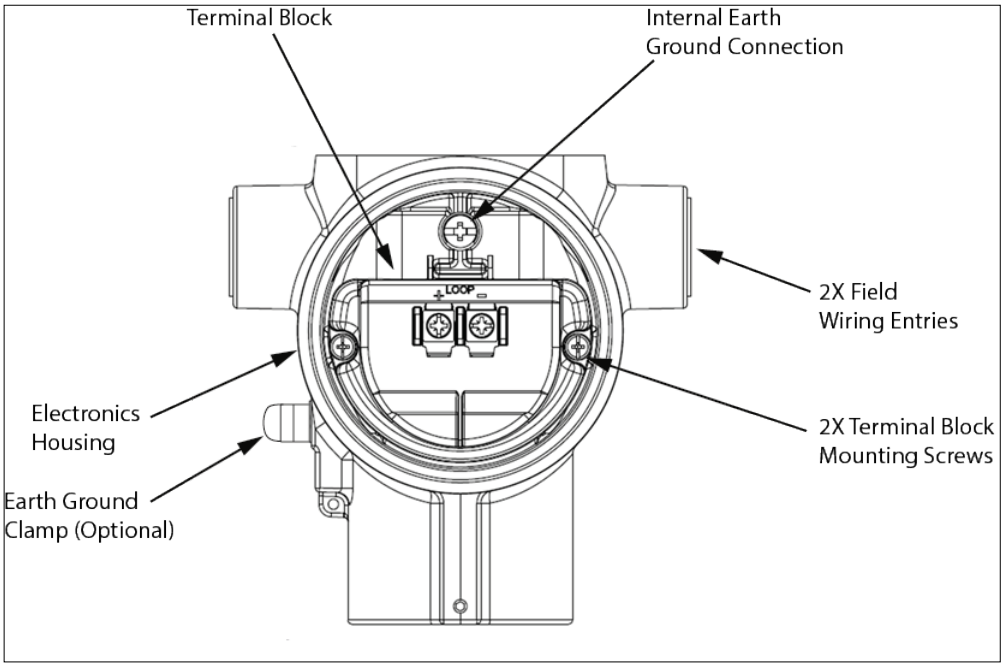


Figure 5: Two Position FF Terminal Block

As shown in Figure 5, each Remote Indicator has an internal ground terminal. Optionally, a ground terminal is also on the outside of the Electronics Housing. While it is not necessary to ground the Remote Indicator for proper operation, doing so tends to minimize the possible effects of noise on the output signal and affords protection against lightning and static discharge. An optional lightning terminal block can be installed in place of the non-lightning terminal block for Remote Indicators that will be installed in an area that is highly susceptible to lightning strikes. For this to be effective the instrument case must be connected to earth ground.

ATTENTION

Wiring must comply with local codes, regulations and ordinances. Grounding may be required to meet various approval body certifications, for example CE conformity. Refer to Appendix A of this document for details.

Wiring Procedure

1. See Figure 5, above, for parts locations. Loosen the end cap lock using a 1.5 mm Allen wrench.
2. Remove the end cap cover from the terminal block end of the Electronics Housing.
3. Feed loop power leads through one end of the conduit entrances on either side of the Electronics Housing. The Remote Indicator accepts up to 16 AWG wire.
4. Plug the unused conduit entrance with a conduit plug appropriate for the environment.

5. Feed both loop powered leads through the Ferrite core, 32301350-001, and then back around and through a second time.
6. Connect both loop power leads to the loop terminals. Torque terminal screws to 0,6 N.m (5.3 lbf.in) to 0.8 N.m (7.0 lbf.in).
   Note. The remote Indicator is not polarity-sensitive.
7. Replace the end cap and secure it in place being careful not to damage the ferrite core or wires.

Fieldbus Network Wiring

For Fieldbus network wiring concepts see application notes such as Relcom Inc. Fieldbus Wiring Guide.

Lightning Protection

If your Remote Indicator includes the optional lightning protection, connect a wire from the Earth Ground Clamp (see Figure 5) to Earth Ground to make the protection effective. Use a size 8 AWG or (8.37mm2) bare or green covered wire for this connection.

Supply Voltage Limiting Requirements

If your Remote Indicator complies with the ATEX 4 directive for self-declared approval per 94/9EC, the power supply has to include a voltage-limiting device. Voltage must be limited such that it does not exceed 9 to 32 V DC. Consult the process design system documentation for specifics.

ATTENTION

FF power Supply along with the Terminators has to be used.

Explosion-Proof Conduit Seal

WARNING

When installed as explosion proof in a Division 1 Hazardous Location, keep covers tight while the Remote Indicator is energized. Disconnect power to the Remote Indicator in the non-hazardous area prior to removing end caps for service.

When installed as non-incendive equipment in a Division 2 hazardous location, disconnect power to the Remote Indicator in the non-hazardous area, or determine that the location is non-hazardous before disconnecting or connecting the Remote Indicator wires.

Remote Indicator installed as explosion proof in Class I, Division 1, Group A Hazardous (classified) locations in accordance with ANSI/NFPA 70, the US National Electrical Code, with 1/2 inch conduit do not require an explosion-proof seal for installation. If 3/4 inch conduit is used, a LISTED explosion proof seal must be installed in the conduit, within 18 inches (457.2 mm) of the Remote Indicator.

4. Operation

4.1 Overview

This section provides the information and processes involved for Fieldbus device operation using the 3-button option.

4.2 Three-Button Operation

The RMA803 optional three-button interface provides a user interface and operation capability without opening the Remote Indicator. Figure 6 shows the location of the three-button option and the labels for each button.

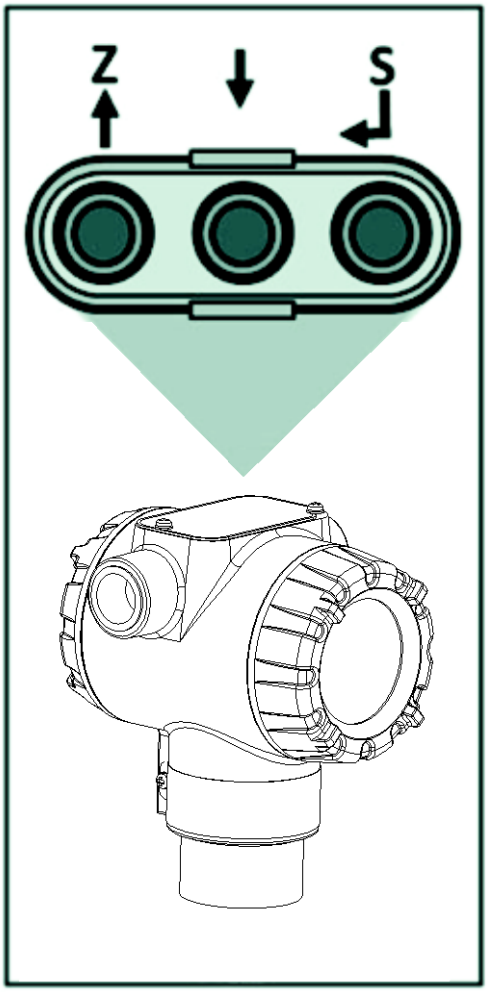


Figure 6: Three-Button Option

Table 5: Three-Button Option Functions

Physical Button	Advanced Display	Action
Left ↑	Increment	Scroll to previous menu item in an active list.
	Move cursor Up	Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Center ↓	Decrement	Scroll to next menu item in an active list.
	Move cursor Down	Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Right ↵	Enter	Call up the Main Menu. Call up a lower-level menu. Select an item for data entry. Confirm a data entry operation Activate the service associated with a selected menu item.

4.3 Menu Navigation

The user must press ↵ button to call up the Main Menu. To exit the Main Menu and return to the PV display screen, select <**EXIT**>.

Use the ↑ and ↓ buttons to scroll through the list of menu items. Press the ↵ button to select an item for data entry or activation. When an item is selected for data entry or activation, the cursor will call up a pop-up to allow editing of the value. No action is taken against a menu item until the ↵ button is pressed.

If a user presses the ↵ button to begin a data entry operation, they must press another button within 10 seconds or the Remote Indicator firmware will assume that the user wants to abort the operation or has walked away from the Remote Indicator. After 10 seconds with no action, the data entry will time out and the original value of the parameter will be preserved.

4.4 Data Entry

Data entry is performed from left to right. Select a character / digit by pressing ↑ or ↓ buttons, and then press ↵ to advance to the next character position to the right. Select the cross-hatch character ▒ to terminate the entry or if the final character is already a space character, just press ↵ again.

All numeric entries are clamped at the low or high limit if needed. You can determine the low and high limit for a parameter by selecting either the ▲ or ▼ character while the cursor is positioned over the left-most digit and press ↵ button. The Display will show the selected limit.

Table 6: Three-Button Data Entry

Screen Symbol	Numeric data entry	Text entry
▲	Display the high limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
▼	Display the low limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
▒	Terminate the numeric entry	Terminate the text entry
0 thru 9, Minus, Decimal	These characters are used to enter numeric values. The minus sign only appears in the left-most digit.	These characters can be used to create custom tags and unit labels
A thru Z, 0 thru 9 special symbols	Not Available	These characters can be used to create custom tags and unit labels

4.5 Editing a Numeric Value

Editing a Numeric Value

Editing of a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process.
2. The Advanced Display will show the current value of the item in a pop-up window in the middle of the screen
3. Press the ↑ or ↓ buttons to select the desired digit, and then press ↵ to advance to the next digit to the right.
4. After the last digit has been entered, press ↵ one more time to write the new value to the Remote Indicator.

Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g., Screen Format, Display Units, etc.).

1. Press ↵ to begin the edit process.
   - The Advanced Display will show the current setting of the item in a pop-up window.
2. Press the ↑ or ↓ buttons to scroll through the list of choices.
3. Press ↵ to make your selection. The new selection will be stored in the Remote Indicator and will be displayed on the lower line, right justified.

The Advanced Display Menus

The Advanced Display menus are organized into three levels, as shown by **Table 7**. There is a <**Return**> menu item at each level that allows the user to return to the previous level.

Table 7: Advanced Display Main Menu Structure

Level 1	Level 2	Level 3
<Exit>	n/a	n/a
Diagnostics	Critical Non-Critical	For details go to the Diagnostics Menu table.
Display Setup	LCD Contrast Common Setup Screen 1 Screen 2 … Screen 8	For details go to the Display Setup Menu table. Note that the Advanced Display supports the configuration of up to 8 different screens. Note that only LCD Contrast, Rotation time, and Rotation Enable are editable parameters. Rest all are read only.
Information	Display Elec Module Model Options	For details go to the Information Menu table.

Table 8: Diagnostics Menu

All Diagnostics menu items are Read Only.

<Return> Return to the Level 1 menu			
Critical	<Return>		
	Active Diags	# #	Shows the number of Critical Diagnostics that are currently active.
	Elec. Module	OK FAULT	FAULT: There is a problem with the Electronics Fieldbus Communication Module.
Non-Critical	<Return>		
	Active Diags	# #	Shows the number of Non-Critical Diagnostics that are currently active.
	Supply Voltage	OK LOW HIGH	OK: Supply voltage is within the specification limit LOW: Supply voltage is below the low specification limit HIGH: Supply voltage is above the high specification limit.
	Elec Module Temp	OK OVER TEMP	OVERTEMP: Electronics temperature is greater than 85 Deg C

Table 9: Display Setup Menus

<Return> Return to the Level 1 menu				
LCD Contrast	<Return>			
	Set Contrast	# #	Adjust the LCD contrast level. Range from 1 to 9. Default: 5	Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to next digit
Common Setup	<Return>			
	Language	English, French, German, Spanish, Russian, Chinese, Japanese, Turkish, and Italian	Shows the selected language. Default: English	Read Only
	Rotation Time	# #	Time duration, in seconds, that each configured screen is shown before moving to the next screen. Range: 3 to 30 seconds Default: 10 seconds	Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to next digit
	Rotation Enable	Yes, No	Option Yes or No enables or disables the screen rotation	Press ↵ to enter menu selection ↑ and ↓ to select Enable or Disable. ↵ to enter and shift to next digit
Screens 1 thru 8	<Return>			
	Screen Format	None PV PV & Bar Graph PV & Trend	Shows the selected format.	Read Only
	Trend Duration	##	Shows the selected Trend duration from the host.	Read Only

Screens 1 thru 8 (continued)	Display Units	**Pressure** inH2O inHg ftH2O mmH2O mmHg psi bar mbar gf/cm2 kgf/cm2 Pa kPa Torr atm inH2O inH2O mmH2O **Temperature** °C °F °R K mV Ohm **Volumetric Flow** CFM gal/min L/min m3/h Mgal/d gal/h L/h **Mass Flow** kg/min kg/h lb/min lb/h **Miscellaneous** mA % pH **Level** m	Shows the selected Display Units.	Read Only

Screens 1 thru 8 (continued)		ft cm in mm yd km mile		
	Custom Units	□□□□□□□□	Shows the selected units.	Read Only
	Decimal	None	Shows the selected decimal value.	Read Only
		X.X		
		X.XX		
		X.XXX		
	Disp Low Limit	#########	Shows the selected low limit.	Read Only
	Disp High Limit	#########	Shows the selected high limit.	
	Custom Tag	□□□□□□□□□□□□	Shows the selected custom tag.	Read Only

Table 10: Information Menus

<Return> Return to the Level 1 menu			
Display	**<Return>**		
	Firmware Version	The firmware version of the Display Module	Read Only
Elec Module	**<Return>**		
	Firmware Version	The firmware version of the Electronics Module	Read Only
	Protocol	The communications protocol of the Remote Indicator: FF: Foundation Fieldbus	Read Only
Model	**<Return>**		
	Model Key	Identifies the type and range of the Remote Indicator	Read Only
Options	**<Return>**		
	Additional FB	Indicates the status of Enabled or Disabled	Read only
	Serial Number	Unique serial number of the Remote indicator	Read only
	License Key	License key to enable optional function block	Write only

The integrated circuits in the Remote Indicator PWA are vulnerable to damage by stray static discharges when removed from the Electronics Housing. Minimize the possibility of static discharge damage when handling the PWA as follows:

Do not touch terminals, connectors, component leads, or circuits when handling the PWA.

When removing or installing the PWA, handle it by its edges or bracket section only. If you need to touch the PWA circuits, be sure you are grounded by staying in contact with a grounded surface or by wearing a grounded wrist strap.

When the PWA is removed from the Remote Indicator, put it in an electrically conductive bag, or wrap it in aluminum foil to protect it.

The following procedure outlines the steps for positioning the write protect and failsafe jumpers on the electronics module. See Figure 7 for the locations of the failsafe and write protect jumpers.

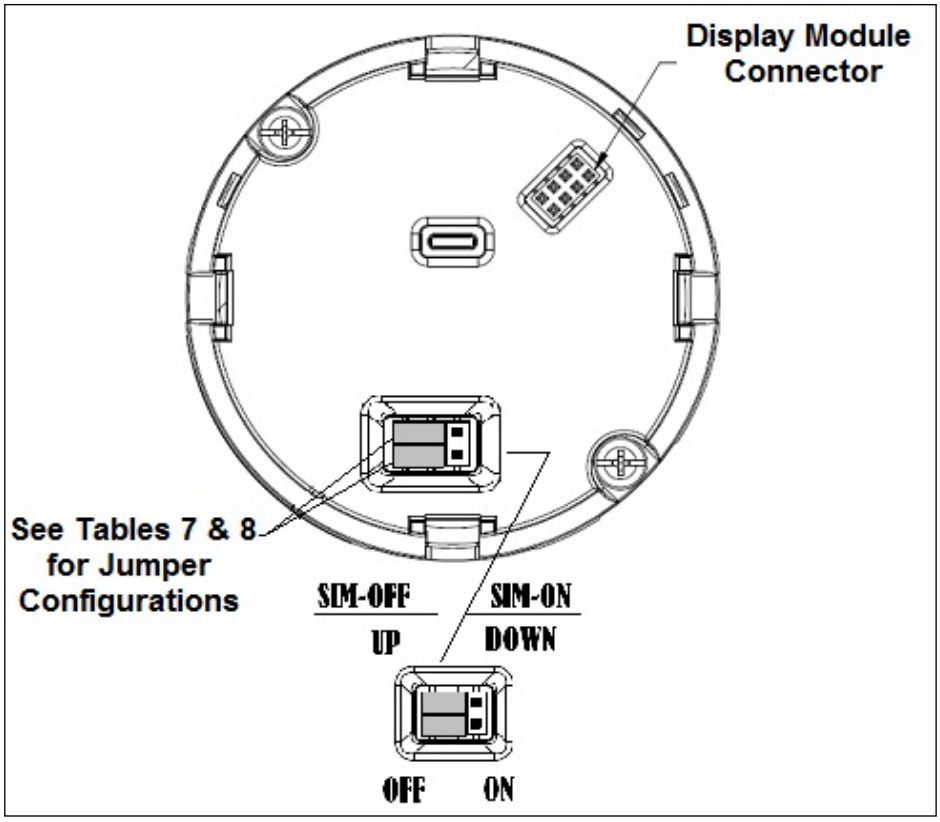
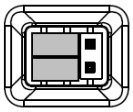
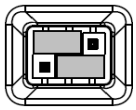
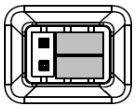


Figure 7: Locating Simulation and Write Protect Jumpers

Table 11: Fieldbus Simulation and Write Protect Jumpers

Image	Description
	Fieldbus Simulation Mode = OFF Write Protect = OFF (Not Protected)
	Fieldbus Simulation Mode = OFF Write Protect = ON (Protected)
	Fieldbus SIM Mode = ON Write Protect = ON (Protected)

1. Turn OFF Remote Indicator power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosion proof and Class 1 Div 2 environments).

2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Remote Indicator housing.

3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the interface connector from the Communication module. Do not discard the connector.

   Set the Failsafe Jumper (top jumper) to the desired position (UP or DOWN).

   If applicable, re-install the Display module as follows:

   - Orient the display as desired.
   - Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.
   - Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

NOTE: Installing a Display Module into a powered Remote Indicator may cause a temporary upset to the loop output value.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90º increments.

5. Restore Indicator power if removed.

4.6 Advanced Displays

As shown in Figure 8, the Advanced Display provides three formats. Figure 8 lists and describes the fields in each of the three Advanced Display formats. Essentially, all three formats provide the same information, but with the following differences:

- Bar Graph. User Configurable 126 segment Bar Graph with range settings. The Bar Graph displays the current value of the configured PV.
- PV Trend. User-configurable display period from one hour to 24 hours. The chart displays minimum, maximum, and average of the configured PV over the selected trend period.

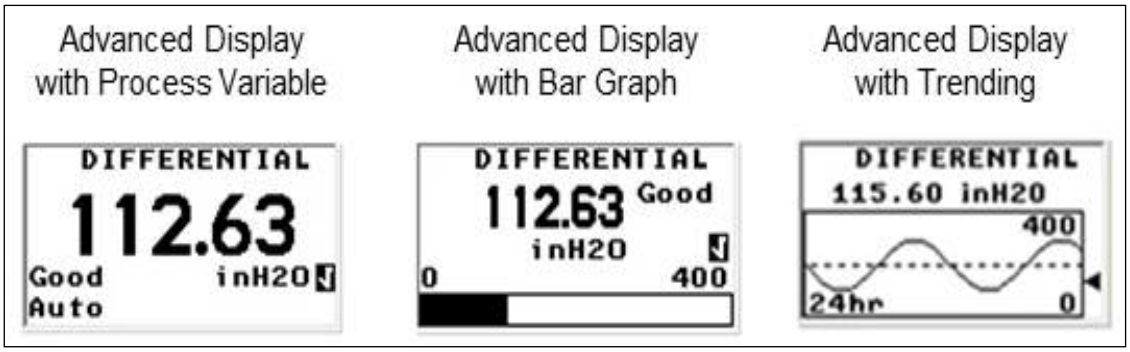


Figure 8: Advanced Display Formats with the Process Variable

Table 11: Advanced Displays with PV Format Display Indications

Display Indicator	What It Means
Diagnostic / Maintenance These indicators are displayed in the upper left corner of the screen when the associated conditions are present in the Remote Indicator.	D Diagnostic condition present This indicator is displayed any time a diagnostic is present in the Remote Indicator, either Critical or Non-Critical. If a Critical Diagnostic is present, the message “Critical Diag” will flash at the top of the screen and the appropriate Diagnostic screen will be inserted into the normal screen rotation.  To determine which Non-Critical diagnostics are active, use the local buttons to call up the Non-Critical diagnostics menu (Main Menu\Diagnostics\Non-Critical). Refer to **Table 10** for details concerning the Non-Critical diagnostics. M Maintenance Mode is active This indicator is set by the Experion DCS. When this Mode is active, a screen with the text “Available for Maintenance” will be inserted into the normal screen rotation to make it easy to identify Remote Indicators that are available for maintenance.
PV Value	User Configurable. This field has 7 characters. Maximum allowable numeric value of 9999999 or -999999. If fractional decimals are configured, the fractional positions will be dropped as required. If the PV exceeds the values above limits, the PV is divided by 1000 and “K” is appended to the result, allowing a maximum value with multiplier of 999999K or -99999K
PV Status:	Good The Remote Indicator is operating normally Bad The Remote Indicator has detected a fault condition. The PV Status field will flash when this condition is present and the PV Value will be displayed on a black background as shown below:  Unc Uncertain (this status is only available for FF Remote Indicators) The PV Value is outside of normal limits.

<table>
<tr><td>PV Function Block Mode</td><td colspan="4">The Function Block Mode is only displayed for Foundation Fieldbus Remote Indicators. The eight possible Modes are shown below.</td></tr>
<tr><td></td><td colspan="2">OOS Out Of Service
Auto Automatic
Man Manual
Cas Cascade</td><td colspan="2">RCas Remote Cascade
Rout Remote Output
IMan Initialization Manual
LO Local Override</td></tr>
<tr><td>Process Variable Tag</td><td colspan="4">User Configurable. This field has 14 characters</td></tr>
<tr><td>PV Units</td><td colspan="4">User Configurable. This field has 8 characters</td></tr>
<tr><td></td><td>Pressure:
inH2O
inHg
ftH2O
mmH2O
mmHg
psi
bar
mbar
gf/cm2
kgf/cm2
Pa
kPa
Torr
atm
inH2O
inH2O
mmH2O</td><td>Level:
m
ft
cm
in
mm
yd
km
mile</td><td>Temperature:
º C
º F
º R
K
mV
ohm</td><td>Mass Flow:
kg/min
kg/h
lb/min
lb/h

Volumetric Flow:
CFM
gal/min
L/min
m3/h
Mgal/d
gal/h
L/h
Miscellaneous:
mA
%
pH</td></tr>
<tr><td>Bar Graph</td><td colspan="4">The limits of the bar graph are user-configurable for each screen.</td></tr>
<tr><td>Trend graph</td><td colspan="4">The limits of the trend graph are user-configurable for each screen.
The amount of time visible on the Trend graph is also configurable.</td></tr>
</table>

Button operation during monitoring

When the operator screens are active on the Advanced Display, the Increment and Decrement buttons (**↑** and **↓)** can be used to move to the next or previous operator screen without waiting for the rotation time to expire. Pressing the Enter button (**↵)** will call up the Main Menu.

5. RMA803 FF Remote Indicator Configuration

ATTENTION

Additional Function blocks are available post liscensing.

5.1 Importing the RMA803 FF Device Description (DD) files

Importing the DD to Experion PKS

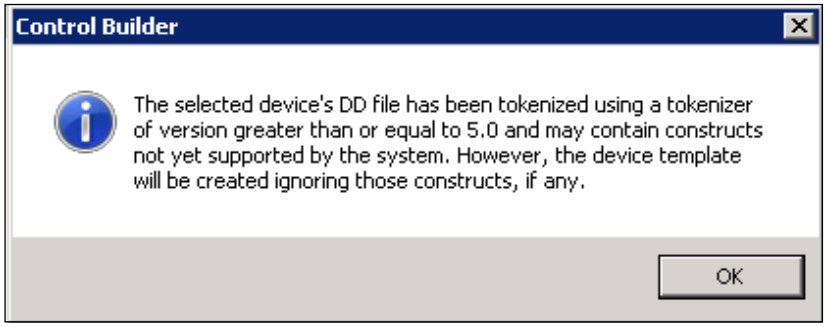
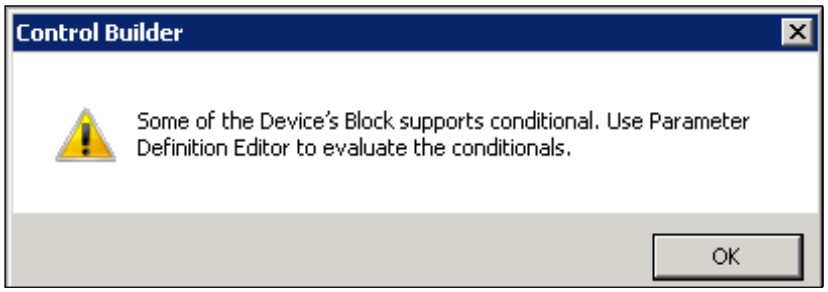
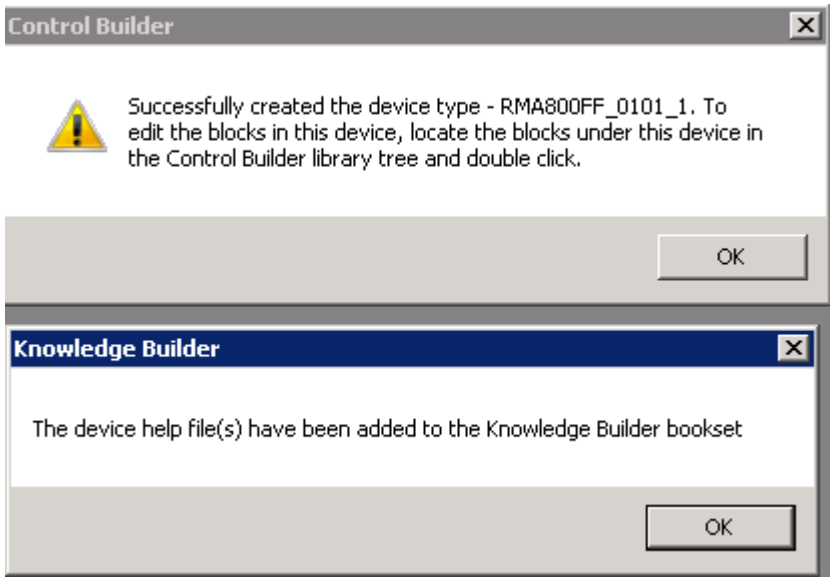
ATTENTION

Experion release compatibility

Experion Release	DD Compatibility
430	Yes
410.4	Yes
400.4 + CP3	Yes
311.3	Yes

The steps in the following procedure are specific to Experion R410 only.

Step	Action
1	From the **Control builder** main screen, click **Fieldbus Device Description Import**  . OR Select **File > New > Type >Fieldbus Device**
2	You can Import the **DD** using one of the following steps: • Choose **Browse**  to locate the folder where you have stored the DD file. • Select the required folder, and click **OK**. • Select the **DD** from the **Device List**, and click **OK**.

Step	Action
2	The following dialog box appears,  Click **OK**
3	Type the **Device Type Name**, and then click **Save As** (only applicable if the same DD version is available and being imported).
4	The following dialog box appears,  Click **OK**.
5	The following dialog box appears,  Click **OK**.

ATTENTION

The device type - **RMA803FF_0101_1** is used as an example.

6 The device is created in the **Library-Containment** window under the folder named **Honeywell**.

7 From the **Library-Containment** window, drag and drop the device into the corresponding FF link on the **Project-Assignment** window.

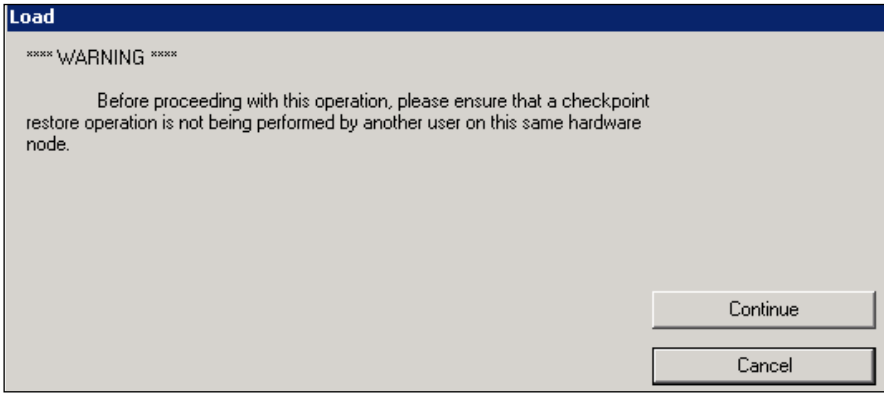
8 You are prompted to name the new function block. If you want to change the name in the destination column, type the new name or if you want to use the default name, click **Finish**.

The device is added on the FF link on the **Project-Assignment** window.

A series of steps for commissioning the device has to be followed in each type of DCS.

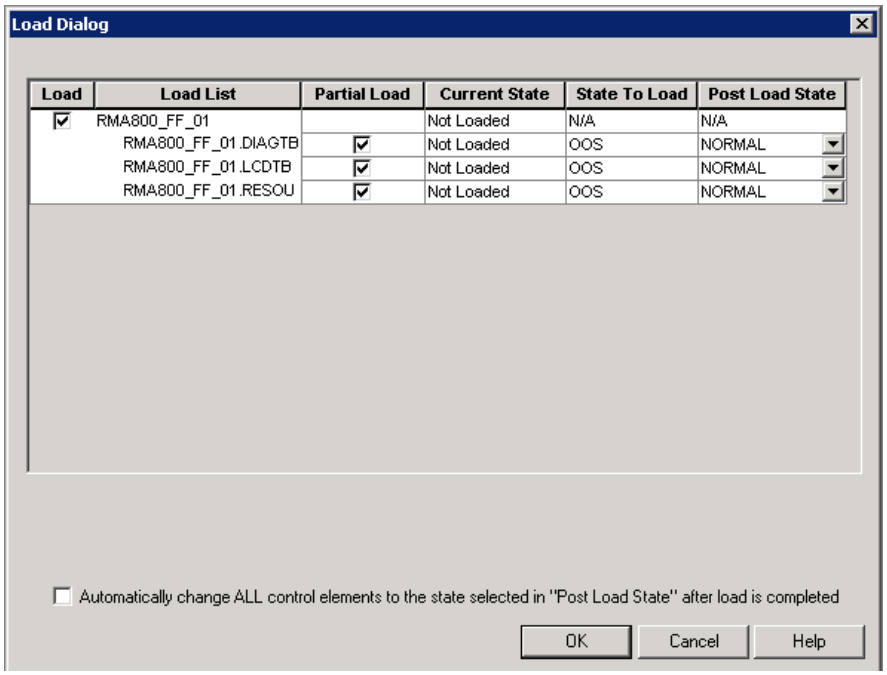
9 Right-click the new device and then click **Load**.

10 The following **WARNING** appears.



Click **Continue**.

11 The following dialog box appears,



Select the **Automatically change ALL control elements to the state selected in "Post Load State" after load is completed** checkbox and click **OK**.

12 On the **Monitoring-Assignment** window, you can notice that device on the **Project-Assignment** window has been loaded to the corresponding FF link.

13 Right-click the device, and then click **Activate >> Selected Item(s) and Content(s)**. The device is commissioned.

ATTENTION

Note that after importing the DD, you have to create control strategies.

Control strategy

A control strategy is an organized approach to define a specific process using detailed information to:

- create control modules in an associated controlled environment
- configure function blocks to enable control applications, and
- runs in a control software infrastructure

To build a control strategy, a Control Module (CM) must be created where function blocks are inserted and connected with other function blocks.

Creating control strategy

For information on creating control strategy, refer to the corresponding DCS document.

5.2 Configuring the function block application process

About the Function Block Application Process (FBAP)

The RMA803 Remote Indicator has one resource block, two transducer blocks, and seven function blocks respectively. The DD-View feature supports all the 9 permanent blocks. The FBAP provides the block related information in a much more organized way. The FBAP defines blocks to represent different types of application functions.

In addition, the blocks have a static revision parameter. The revision level of the static data is associated with the function block. To support tracking changes in static parameter attributes, the associated block's static revision parameter is incremented each time a static parameter attribute value is changed. In addition, the associated block's static revision parameter is incremented, if a static parameter attribute is written but the value is not changed.

The FBAP supports two types of alarms: block alarms and process alarms. A block alarm is generated whenever the **BLOCK_ERR** has an error bit set. The types of block error for all the blocks are shown in **Table 8**. The following alarms are supported by each function block:

Block Alarms

Table 12: Bit mapping of the BLOCK_ERR

Block_ERR Bit	Block Alarms	Description
0	Other	Least significant bit (LSB). **NOTE:** It is not applicable to the Remote Indicator.
1	Block Configuration error	A feature in **FEATURES_SEL** is set that is not supported by features or an execution cycle in **CYCLE_SEL** is set that is not supported by **CYCLE_TYPE**. You get this error if the configuration is not complete.
2	Link Configuration error	If the link is not configured properly.
3	Simulation Active	The jumper or switch that enables simulation within the resource is ON. The individual I/O function blocks disable the simulation.
4	Local Override	The block output is being set to track the value of the track input parameter. **NOTE:** It is not applicable to the Remote Indicator.
5	Device Fault State Set	If the Device Fault State condition is True. **NOTE:** It is not applicable to the Remote Indicator.
6	Device Needs Maintenance Soon	A diagnostic algorithm has found a warning condition. The NV memory is approaching the maximum number of reliable writes. **NOTE:** It is not applicable to the Remote Indicator.

Block_ERR Bit	Block Alarms	Description
7	Output Failure	Output Failure detected by this block/back calculation input has a status of Bad or Device Failure. **NOTE:** It is not applicable to the Remote Indicator.
8	Memory Failure	A diagnostic algorithm has found a failure in memory (includes all types) and the device is still able to communicate that condition.
9	Lost Static data	If the object's static data is Bad, then the object's database is set to its default values.
10	Lost NV data	The NV and static parameters are saved periodically. This alarm occurs, if new data was supposed to be saved to NV at the next NV write cycle, but prevented the write due to power failure.
11	Readback Check failed	This indicates the readback of the actual continuous valve or other actuator position in transducer units has failed.
12	Device needs maintenance now	A diagnostic algorithm has found an invalid condition, but the device is still able to operate and communicate. The NV memory has reached the maximum number of reliable writes. **NOTE:** It is not applicable to the Remote Indicator.
13	Power-up	The resource is performing its first normal execution, after power was applied to the device. It is not an error but generates an alarm that says that normal operation was interrupted and is now being restored. **NOTE:** It is not applicable to the Remote Indicator.
14	Out-of-Service	The actual mode is OOS. No control function blocks are being processed.

Process Alarms

A set of alarms that indicates a process value has exceeded a certain threshold. Process Alarm detection is based on the **OUT** value. The alarm limits can be configured for the following standard alarms:

- High (HI_LIM)
- High High (HI_HI_LIM)
- Deviation High Limit (DEV_HI_LIM)
- Deviation Low Limit (DEV_LO_LIM)
- Low (LO_LIM)
- Low Low (LO_LO_LIM)

When the value **OUT** oscillates, **ALARM_HYS** is used to avoid alarm triggering. The priority of each alarm is set by the following parameters:

- HI_PRI
- HI_HI_PRI
- DV_HI_PRI
- DV_LO_PRI
- LO_PRI
- LO_LO_PRI

The following is the order of priority for alarms.

Table 13: Priority for Alarms

Priority	Description
0	To disable the triggered alarm, the priority of an alarm condition is changed to 0.
1	Alarm condition with a priority 1 is reported to the system, but not reported as an event and alarm
2	Alarm condition with priority of 2 is reported to the system and event, but not reported as an alarm.
3-7	Alarm conditions of priority 3 to 7 are reported as advisory alarms.
8-15	Alarm conditions of priority 8 to 15 are reported as critical alarms.

ATTENTION

Process alarms are not supported by all blocks.

5.3 Resource block

The Resource block is used to describe characteristics of the Fieldbus device such as the device name, manufacturer, and serial number. The block does not contain any input or output parameters. The block contains data that is specific to the hardware associated with the resource. The resource block monitors and controls the general operation of the device hardware. For example, if the resource block is in out of service mode, it affects all the other blocks. The **ITK_VER** parameter is used to identify the version of the Interoperability Tester. The RMA803 Remote Indicator's Revision and Versions, and Model Number can be obtained by executing the methods available in the resource block.

The block modes are used to control major states of the resource:

- The OOS mode stops all function block execution.
- The Actual mode of the function blocks changes to OOS but the target mode does not change.
- The AUTO mode allows normal operation of the resource.

Configuring the Resource block

The Resource block supports scalar input only as **HARD_TYPES**. This parameter is a read-only bit string that indicates the types of hardware that are available for this resource. The **RS_STATE** parameter contains the operational state of the Function Block Application for the data containing that resource block.

RESTART

The **RESTART** parameter allows degrees of initialization of the resource.

Restart	Operation
Run (1)	The passive state of the parameter.
Restart resource (2)	Discards unnecessary alarms, and also discards the resource dynamic values.
Restart with defaults (3)	Resets all configurable function block application objects to their initial value, which is their value before any configuration is done.
Restart processor (4)	Provides a way to press the reset button on the processor associated with the resource.

Execution

CYCLE TYPE

The parameter **CYCLE_TYPE** is a bit string that defines the types of cycles that are available for the resource and supports scheduled and block execution. **CYCLE_SEL** allows the person doing the configuration to indicate that one or more of these execution types can be used by the device. **MIN_CYCLE_T** is the minimum time to execute a cycle; the minimum cycle time supported is 100 ms.

MEMORY

MEMORY_SIZE is the size of the resource for configuration of function blocks; it is represented in kilobytes. **SHED_RCAS** and **SHED_ROUT** set the time limit for loss of communication from a remote device. These constants are used by each function block and are configurable values.

MAX NOTIFY

The **MAX_NOTIFY** parameter value is the maximum number of alert reports that this resource can send without getting a confirmation, and to control alert flooding, adjust the **LIM_NOTIFY** parameter to a lower value. If **LIM_NOTIFY** is set to zero, no alerts are reported. The **CONFIRM_TIME** parameter is the time for the resource to wait for confirmation of receipt of a report before trying again.

FEATURES

The bit strings **FEATURES** and **FEATURE_SEL** determine optional behaviour of the resource. **FEATURES** bit string defines the available features; it is read-only. **FEATURE_SEL** is used to turn on an available feature by configuration.

Reports

If the Reports option is set in the Features bit strings, the Remote Indicator actively sends alerts to host/master. If it is not set, the host/master must poll for alerts.

SOFT W LOCK and HARD W LOCK

There are two types of write locks: Hardware write lock and Software write lock. The software write lock is used to lock the device. The software write lock does not need a jumper. A hardware write lock is provided with a jumper in the device to perform the write lock operation.

If the **WRITE_LOCK** parameter is set, it prevents any external change to the static or non-volatile database in the Function Block Application of the resource. Block connections and calculation results proceeds normally but the configuration is locked. A hard write lock is provided by a jumper in the device as indicated in the **FEATURES** bit string. Clearing **WRITE_LOCK** generates the discrete alert **WRITE_ALM** at the **WRITE_PRI** priority.

If the soft write lock bit is not set as True in the features bit strings, the writing to the parameter **WRITE_LOCK** is rejected by the device. For devices that support hard write lock and have the associated **FEATURE_SEL** attribute enabled, the parameter **WRITE_LOCK** is only an indicator of the state of write-lock. The writing to **WRITE_LOCK** is rejected by the device.

Software write lock

To activate write lock, the soft write lock supported bit in **FEATURE_SEL** must be set, and then set the **WRITE_LOCK** to locked. To deactivate write lock, set the **WRITE_LOCK** to unlocked.

Hardware write lock

To activate write lock, the hard write lock supported bit in **FEATURE_SEL** must be set, and additionally the write lock jumper must be in the correct position as determined by the manufacturer. When this is detected by the device, **WRITE_LOCK** is set to locked. If hard write lock is enabled in **FEATURE_SEL,** the configured value of soft write lock has no impact on device operation. To deactivate write lock, the jumper must be changed as **FEATURE_SEL** is not writeable during write lock. Once the device detects the change in jumper position, the write-lock is disabled and **WRITE_LOCK** is set to 1.

Install Date

When the device is connected to the master/host, the time at which the device is powered up is taken as the install date. It is a read-only parameter.

Field Diagnostics

The Resource block acts as a coordinator for alarms. There are four alarm parameters: Fail alarm, Offspec alarm, Maintenance alarm, and Check alarm. It contains information of device errors that are detected by the Remote Indicator. Based on the error detected, the device provides the recommended actions; it is a read only parameter. It displays the recommended action text for the reported alarms.

Table 14: Diagnostic Definitions

Name	Description
Maintenance	Although the output signal is valid, the wear reserve is nearly exhausted or a function is soon restricted due to operational conditions. For example, build-up of deposits.
Off Specification	Indicates if the device is operating outside its specified range or internal diagnostics indicate deviations from measured or set values due to internal problems in the device or process characteristics.
Check Function	Output signal temporarily invalid due to on-going work on the device.
Failed	Output signal invalid due to malfunction in the field device or its peripherals.

FAILED_ALARMS

Failed alarms indicate a failure within a device that makes the device or some part of the device non-operational. This implies that the device needs repair and must be fixed immediately.

- **FAILED_MAPPED** parameter contains a list of failures in the device which makes the device non-operational that causes an alarm. There are four parameters mapped by default with **FAILED_MAPPED**: Communication board fault, communications board over temperature, low supply voltage, and high supply voltage.
- **FAILED_MASK** parameter masks any of the failed conditions listed in **FAILED_MAPPED**. A bit on means that the condition is masked out from alarming and is not reported.
- **FAILED_PRI** parameter designates the alarming priority of **FAILED_ALM**. The default is 0.
- **FAILED_ACTIVE** parameter displays the alarms that are active.
- **FAILED_ALM** parameter indicates a failure within a device which makes the device non-operational.

MAINT_ALARMS

A maintenance alarm indicates either the device or some part of the device needs maintenance. If the condition is ignored, the device eventually fails.

- **MAINT_MAPPED** parameter contains a list of conditions indicating either the device or some part of the device needs maintenance soon. If the condition is ignored, the device eventually fails. There are four parameters mapped by default with **MAINT_MAPPED**: Communications board fault, communications board over temperature, low supply voltage, and high supply voltage.
- **MAINT_MASK** parameter masks any of the failed conditions listed in **MAINT_MAPPED**. A bit on means that the condition is masked out from alarming and is not reported.
- **MAINT_PRI** designates the alarming priority of the **MAINT_ALM**. The default is 0.
- **MAINT_ACTIVE** parameter displays the alarms that are active.
- **MAINT_ALM** parameter indicates that the device needs maintenance. If the condition is ignored, the device fails.

CHECK_ALARMS

It indicates that the output signal is temporarily invalid due to on-going work on the device.

- **CHECK_MAPPED** parameter contains a list of informative conditions that do not have a direct impact on the device's primary functions.
- **CHECK_MASK** parameter masks any of the failed conditions listed in **CHECK_MAPPED**. A bit on means the condition is masked out from alarming and is not reported.
- **CHECK_PRI** parameter designates the alarming priority of the **CHECK_ALM**. The default is 0.
- **CHECK_ACTIVE** parameter displays the check alarms that are active.
- **CHECK_ALM** parameter indicates check alarms. These conditions do not have a direct impact on the process or device integrity.

OFFSPEC_ALARMS

Indicates if the device is operating outside its specified range or internal diagnostics indicates deviations from measured or set values due to internal problems in the device or process characteristics.

- **OFFSPEC_MAPPED** parameter contains a list of informative conditions that do not have a direct impact on the device's primary functions.
- **OFFSPEC_MASK** parameter masks any of the failed conditions listed in **OFFSPEC_MAPPED**. A bit on means the condition is masked out from alarming and is not reported.
- **OFFSPEC_PRI** parameter designates the alarming priority of the **OFFSPEC_ALM**. The default is 0.
- **OFFSPEC_ACTIVE** parameter displays the offspec alarms that are active.
- **OFFSPEC_ALM** parameter indicates offspec alarms. These conditions do not have a direct impact on the process or device integrity.

RECOMMENDED_ACTION

The **RECOMMENDED_ACTION** parameter displays a text string that give a recommended course of action to take based on which type and which specific event of the alarms is active.

FD_SIMULATE

When simulation is enabled the Field Diagnostics conditions are taken from the Diagnostic Simulate Value, or else the conditions are taken from Diagnostic Value, and the **RECOMMENDED_ACTION** parameter displays the text as ‘Simulation Active’.

ATTENTION

Note that **FD_SIMULATE** can be enabled only if the simulation jumper is enabled in the device. For more information refer section 8.6

MAINTENANCE_MODE

It indicates if the device is available for maintenance. When the resource block is in AUTO mode, **MAINTENANCE_MODE** parameter displays the text as 'Chk with Oper' i.e., the device is in process and is not available for maintenance. When the resource block is in OOS mode, **MAINTENANCE_MODE** parameter displays the text as ‘Avail for Maint' i.e., the device is out of process and is available for maintenance. The same text is displayed in the advanced display.

'Chk with Oper'- Check with operator to determine availability.

‘Avail for Maint'- The device is available for maintenance.

Parameter List

Table 15: Resource block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks.
ALERT_KEY	The identification number of the plant unit.
MODE_BLK	The actual, target, permitted, and normal modes of the block.
BLOCK_ERR	Reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
RS_STATE	Indicates the State of the function block application state machine.
TEST_RW	Read/write test parameter is used only for conformance testing.
DD_RESOURCE	String identifying the tag of the resource, which contains the Device Description for the resource.
MANUFAC_ID	Manufacturer identification number is used by an interface device to locate the DD file for the resource.
DEV_TYPE	Manufacturer model number associated with the resource. It is used by interface devices to locate the DD file for the resource.
DEV_REV	Manufacturer revision number associated with the resource. It is used by an interface device to locate the DD file for the resource.
DD_REV	Revision of the DD associated with the resource. It is used by the interface device to locate the DD file for the resource.
GRANT_DENY	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
HARD_TYPES	The types of hardware available as channel numbers. The supported hardware type is SCALAR_INPUT and SCALAR_OUTPUT.
RESTART	Allows a manual restart to be initiated.
FEATURES	Used to show supported resource block options. The supported features are: REPORT, SOFT_WRITE_LOCK, HARD_WRITE_LOCK, and MULTI_BIT_ALARM.
FEATURE_SEL	Used to select resource block FEATURE_SEL options

Parameter	Description
CYCLE_TYPE	Identifies the block execution methods available for this resource. The supported cycle types are: SCHEDULED, and COMPLETION_OF_BLOCK_EXECUTION.
CYCLE_SEL	Used to select the block execution method for this resource.
MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.
MEMORY_SIZE	Available configuration memory in the empty resource. It must be checked before starting a download.
NV_CYCLE_T	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. Zero implies it is never automatically copied. At the end of NV_CYCLE_T, only those parameters that have changed need to be updated in NVRAM.
FREE_SPACE	Percent of memory available for further configuration. Zero in preconfigured resource.
FREE_TIME	Percent of the block processing time that is free to process additional blocks.
SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas does not happen, if SHED_RCAS = 0.
SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations. Shed from Rout does not happen, if SHED_ROUT = 0.
FAULT_STATE	Condition set by loss of communication to an output block, fault promoted to an output block or a physical contact. When Fault State condition is set, output function blocks perform their FSTATE actions.
SET_FSTATE	Allows the Fault State condition to be manually initiated by selecting Set.
CLR_FSTATE	Writing a Clear to this parameter removes the device fault state if the field condition, if any has cleared.
MAX_NOTIFY	Maximum numbers of unconfirmed notify messages possible.
LIM_NOTIFY	Maximum numbers of unconfirmed alert notify messages allowed.
CONFIRM_ TIME	The time the resource waits for confirmation of receipt of a report before trying again. Retry does not happen when CONFIRM_TIME=0.
WRITE_LOCK	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs continues to be updated.
UPDATE_EVT	This alert is generated by any change to the static data.
BLOCK_ALM	The BLOCK_ALM is used for configuration, hardware, and connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the Active status in the Status attribute. When the Unreported status is cleared by the alert reporting task, another block alert is reported without clearing the Active status, if the subcode has changed.
ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ACK_OPTION	Selection of whether alarms associated with the block is automatically acknowledged.
WRITE_PRI	Priority of the alarm generated by clearing the write lock.

Parameter	Description
WRITE_ALM	This alert is generated if the write lock parameter is cleared.
ITK_VER	Major revision number of the interoperability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus Foundation. The current ITK version is 6.0.1.
FD_VER	A parameter equal to the value of the major version of the Field Diagnostics specification that the device is designed for.
FD_RECOMMEN_ACT	Enumerated list of recommended actions displayed with a device alert.
FD_FAIL_PRI	Designates the alarming priority of the FAIL_ALM. The valid range is 0-15.
FD_FAIL_MAP	Mapped FAIL_ALM alarm conditions, and corresponds bit for bit to the FAIL_ACTIVE. A bit on means that the corresponding alarm condition is Mapped and it is detected. A bit off means the corresponding alarm condition is disabled and is not detected.
FD_FAIL_MASK	Mask of FAIL_ALM. It corresponds to the bit of bit to FAIL_ACTIVE. A bit on means that the condition is masked out from alarming.
FD_FAIL_ACTIVE	Enumerated list of failure conditions within a device.
FD_FAIL_ALM	Alarm indicating a failure within a device which makes the device non-operational.
FD_MAINT_PRI	Designates the alarming priority of the MAINT_ALM. The valid range is 0-15.
FD_MAINT_MAP	Mapped MAINT_ALM alarm conditions and corresponds bit for bit to the MAINT_ACTIVE. A bit on means that the corresponding alarm condition is Mapped and is not detected. A bit off means the corresponding alarm condition is disabled and is not detected.
FD_MAINT_MASK	Mask of MAINT_ALM. It corresponds to the bit of bit to MAINT_ACTIVE. A bit on means that the condition is masked out from alarming.
FD_MAINT_ACTIVE	Enumerated list of maintenance conditions within a device.
FD_MAINT_ALM	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device eventually fails.
FD_OFFSPEC_PRI	Designates the alarming priority of the OFFSPEC_ALM. The valid range is 0-15.
FD_OFFSPEC_MAP	Mapped OFFSPEC_ALM alarm conditions. Corresponds bit for bit to the OFFSPEC_ACTIVE. A bit on implies that the corresponding alarm condition is Mapped and detected. A bit off means the corresponding alarm condition is disabled and is not detected.
FD_OFFSPEC_MASK	Mask of OFFSPEC_ALM. It corresponds to the bit of bit to OFFSPEC_ACTIVE. A bit on implies that the condition is masked out from alarming.
FD_OFFSPEC_ACTIVE	Enumerated list of offspec conditions within a device.
FD_OFFSPEC_ALM	Alarm indicating offspec alarms. These conditions do not have a direct impact on the process or device integrity.
FD_CHECK_PRI	Designates the alarming priority of the CHECK_ALM. The valid range is 0-15.

Parameter	Description
FD_CHECK_MAP	Mapped CHECK_ALM alarm conditions. Corresponds bit for bit to the CHECK_ACTIVE. A bit on means that the corresponding alarm condition is Mapped and is detected. A bit off means the corresponding alarm condition is disabled and is not detected.
FD_CHECK_MASK	Mask of CHECK_ALM. It corresponds to the bit of bit to CHECK_ACTIVE. A bit on means that the condition is masked out from alarming.
FD_CHECK_ACTIVE	Enumerated list of check conditions within a device.
FD_CHECK_ALM	Alarm indicating check alarms. These conditions do not have a direct impact on the process or device integrity.
FD_SIMULATE	When simulation is enabled, the Field Diagnostics conditions are taken from Diagnostic Simulate Value, or else the conditions are taken from Diagnostic Value.
HARDWARE_REV	The hardware revision number of the communications module.
SOFTWARE_REV	The software revision number of the communications module.
MODEL_KEY	The key number of RMA803 Remote Indicator (Example: RMA803).
MOD_PART_1	First part of the Model number information.
MOD_PART_2	Second part of the Model number information.
MOD_PART_3	Third part of the Model number information.
MOD_PART_4	Fourth part of the Model number information.
HW_SIMULATE_JUMPER_STATE	State of Hardware Simulation Jumper (Enabled / Disabled).
INSTALL_DATE	The date and time when the device is installed in the field. The date and time is directly acquired from the FF Host.
MAINTENANCE_MODE	It indicates whether device is ready for maintenance. 'Chk with Oper'- Check with operator to determine availability. ‘Avail for Maint'- The device is available for maintenance.
INSTALL_DATE	The date on which the device was installed.
SERIAL_NO	The serial number of the device.
MAINTENANCE_MODE	Type of maintenance mode.
LICENSE_KEY	The license key details.
OPTIONS_PRESENT_RMA:31	License status of the device.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms (see section 5.2), and discrete alarm for write lock.

5.4 Diagnostic Transducer block

The Diagnostics Transducer block supports the Remote Indicator electronic diagnostics.

ATTENTION

The electronics temperature can be tracked in 8 ways:

- Current Temperature
- Units
- Maximum Temperature
- Minimum Temperature
- Maximum Temperature Accumulated Minutes
- Minimum Temperature Accumulated Minutes
- Maximum Temperature Date
- Minimum Temperature Date

Execution

The block has Device diagnostics. The block is executed as follows:

Device Diagnostics

Electronics Housing Temperature Diagnostics

Electronics housing temperature is the temperature of the electronic housing unit **and** Electronics temperature value is its corresponding value.

Time in Service

The amount of time the device is in operation and is shown in minutes.

Service Life

The average service life of the device under ideal conditions is 27.3 years. But, the service life varies depending on external factors such as temperature. Service life indicates the amount of service life that has been consumed by the device. Service Life is dependent on the temperature of the device only. The Service life is calculated in percentage.

Stress monitor

It is the amount of time the device has been used under stressful conditions. For example, say temperature of the device. The stress monitor is based on the temperature of the device. The Stress monitor is calculated in percentage.

Stress monitor = Amount of time the device was under stressful conditions

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Time in Service of the device

Parameter List

Table 16: Diagnostic Transducer block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks.
ALERT_KEY	The identification number of the plant unit.
MODE	The actual, target, permitted, and normal modes of the block.
BLOCK_ERR	Reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
UPDATE_EVT	This alert is generated by any change to the static data.
BLOCK_ALM	The BLOCK_ALM is used for all configuration, hardware, and connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
EL_TEMP_DIAGNOSTIC	Electronic Temperature Diagnostic parameters.
POWER_TRAC	Power Up Track Data.
OP_VOLTAGE	Operating Voltage.
TIME_IN_SERVICE	Summation of time in minutes that power has been applied to the device since leaving the factory.
SERVICE_LIFE	It is the elapsed Service life of device in percentage.
STRESS_MONITOR	It monitors various diagnostic parameters which are then input into an algorithm to calculate an estimated percent of time that the Remote Indicator has spent in stressful conditions.
HON_RES_1	Reserved for Honeywell use only.
HON_RES_2	Reserved for Honeywell use only.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms (see section 5.2).

5.5 LCD Transducer block

The LCD Transducer block supports Advanced Display. The block is used to configure the advanced display connected to the RMA803 Remote Indicator. The block stores the LCD configurations, and sends these values to the Display while the Remote Indicator is powered up or restarted.

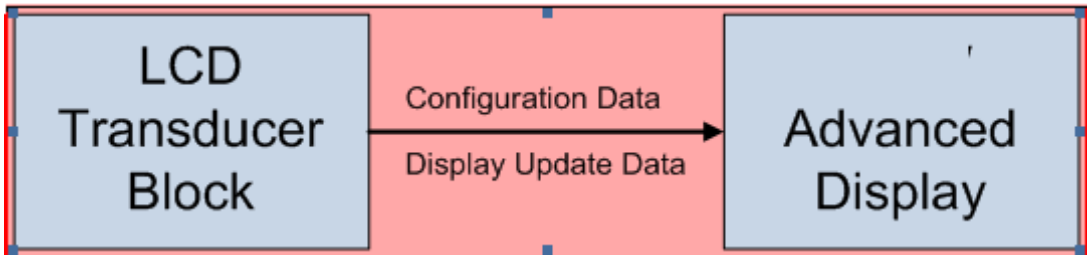


Figure 9: LCD Transducer block

ATTENTION

The initial configuration of LCD transducer is configured to show eight screens.

The Display shows the available set of process variables, and all function block inputs/outputs. In addition, the block reports the current device status and errors. If a function block parameter which is not currently a part of the control strategy is selected, an error does not appear, the PV value shown is 0 and the status of the PV shows Bad and block mode is shown as OOS.

Execution

Advanced Display

The Advanced Display provides three formats, and describes the field in each of the three Advanced Display formats namely, PV, Bar Graph, and PV Trend. Essentially, all three formats provide the same information, but with the following differences:

- **PV**

  It is a user configurable display, and it shows the configured PV.

- **Bar Graph**

  It is a user configurable 126 segment Bar Graph with range settings. The Bar Graph displays the current value of the configured PV.

- **PV Trend**

  It is a user-configurable display period from one hour to 24 hours. The chart displays minimum, maximum, and average of the configured PV over the selected trend period.

The LCD Transducer block supports configuration of up to eight LCD screens on the advanced displays. By default, the Display has a screen configured with default settings.

Remote Indicator Messaging

The RMA803 Remote Indicator messaging is a feature that allows message typed through host (up to 64 alphanumeric characters) which is sent to the Local Display of the RMA803 Remote Indicator. The message is shown on the Display interspersed with the configured screens.

Clear Message

To stop displaying the message, select the Clear Message method. After selecting this option, the device clears the entered Message and it is not shown in the Display.

Table 17 lists the allowed parameters that can be configured using the LCD block.

Table 17: LCD parameters

Block	FF Parameter
PID BLOCK (PID)	SP
	PV
	OUT
	IN
	CAS_IN
	BKCAL_IN
	BKCAL_OUT
	RCAS_IN
	ROUT_IN
	RCAS_OUT
	ROUT_OUT
	FF_VAL
	TRK_VAL
ARITHMETIC FUNCTION BLOCK	OUT
	IN
	IN_LO
	IN_1
	IN_2
	IN_3
INTEGRATOR BLOCK	OUT
	IN_1
	IN_2
SIGNAL CHARACTERIZER BLOCK	OUT_1
	OUT_2
	IN_1
	IN_2
INPUT SELECTOR BLOCK	OUT
	IN_1
	IN_2
	IN_3
	IN_4
	IN_5

Block	FF Parameter
	IN_6
	IN_7
	IN_8
MULTIPLE ANALOG OUTPUT BLOCK	IN_1
	IN_2
	IN_3
	IN_4
	IN_5
	IN_6
	IN_7
	IN_8
AI BLOCK	PV
	OUT
	FIELD_VAL
DIAGTB BLOCK	EL_TEMP VALUE

Parameters List

Table 18: LCD Transducer block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks.
ALERT_KEY	The identification number of the plant unit.
MODE	The actual, target, permitted, and normal modes of the block.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
UPDATE_EVT	This alert is generated by any change to the static data.
BLOCK_ALM	The BLOCK_ALM is used for all configuration, hardware, and connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
DISP_SEQ_TIME	Periodic rotation time of the display screens in seconds. Range 3-30 sec.
LANGUAGE	Language selection for the Display. Supported Languages: English, French, German, Spanish, Russian, Italian, Turkish, Chinese, and Japanese.
DISPLAY_TYPE	Type of Display Connected. Possible Values: No Display Connected, Advanced Display.
LCD_CONTRAST	Contrast of the LCD screen can be controlled by this parameter. Its range is 1-9.
DISP_FW_VER	Version Number of Display Firmware.
BLOCK_TYPE	Block type selection for screen process value. The BLOCK_TYPE is present in all the eight screens: BLOCK_TYPE_1, BLOCK_TYPE_2, BLOCK_TYPE_3, BLOCK_TYPE_4, BLOCK_TYPE_5, BLOCK_TYPE_6, BLOCK_TYPE_7 and BLOCK_TYPE_8
PARAM_INDEX	Parameter selection for screen process value. Parameters need to be chosen based on Block type. The PARAM_INDEX is present in all the eight screens: PARAM_INDEX_1, PARAM_INDEX_2, PARAM_INDEX_3, PARAM_INDEX_4, PARAM_INDEX_5, PARAM_INDEX_6, PARAM_INDEX_7 and PARAM_INDEX_8.

Parameter	Description
UNIT_TYPES	Unit selection for screen process value. Appropriate units need to be selected based on the configured parameter. If desired units are not present, 'custom' may be selected. The UNIT_TYPES is present in all the eight screens: UNIT_TYPES_1, UNIT_TYPES_2, UNIT_TYPES_3, UNIT_TYPES_4, UNIT_TYPES_5, UNIT_TYPES_6, UNIT_TYPES_7 and UNIT_TYPES_8
CUSTOM_UNIT	Character string to represent custom units. This value is used when Unit type of 'custom' is selected. Size: 8 Characters. The CUSTOM_UNIT is present in all the eight screens: CUSTOM_UNIT_1, CUSTOM_UNIT_2, CUSTOM_UNIT_3, and CUSTOM_UNIT_4.
CUSTOM_TAG	Tag to be displayed for the screen. Length: 14 Characters. The CUSTOM_TAG is present in all the eight screens: CUSTOM_TAG_1, CUSTOM_TAG_2, CUSTOM_TAG_3, CUSTOM_TAG_4, CUSTOM_TAG_5, CUSTOM_TAG_6, CUSTOM_TAG_7 and CUSTOM_TAG_8.
DISPLAY_TEMPLATE	Represents the display screen template. Possible Values: a) PV: Regular PV value is displayed b) PV and Trend: PV value followed by a Trend is shown on the display c) PV and Bargraph: PV value followed by a Bargraph is shown on the display d) None: Screen will not be seen. The DISPLAY_TEMPLATE is present in all the eight screens: DISPLAY_TEMPLATE_1, DISPLAY_TEMPLATE_2, DISPLAY_TEMPLATE_3, DISPLAY_TEMPLATE_4, DISPLAY_TEMPLATE_5, DISPLAY_TEMPLATE_6, DISPLAY_TEMPLATE_7 and DISPLAY_TEMPLATE_8
DECIMALS	Number of digits to display after the decimal point. Range: 0 - 3. DECIMALS is present in all the eight screens: DECIMALS_1, DECIMALS_2, DECIMALS_3, DECIMALS_4, DECIMALS_5, DECIMALS_6, DECIMALS_7 and DECIMALS_8
TREND_DURATION	Duration of a trend screen in hours. Its valid range is 1-24. The TREND_DURATION is present in all the eight screens: TREND_DURATION_1, TREND_DURATION_2, TREND_DURATION_3, TREND_DURATION_4, TREND_DURATION_5, TREND_DURATION_6, TREND_DURATION_7 and TREND_DURATION_8.
PV_LOLIM	PV low limit
PV_HILIM	PV high limit
DISPLAY_MESSAGE	A message with a maximum of 64 characters that appears on the advanced display of the Remote Indicator.
SCREEN_ROTATION	Configurable screen rotation timing (4 to 30 sec).

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms (see section 5.2).

Note:

Additional Function blocks (PID block, Signal Characterizer block, Arithmetic block, Input Selector block and Integrator block) are available only for a licensed version.

5.6 Proportional Integral Derivative (PID) block with auto tune

The PID block is the key to many control schemes, and it is commonly used. The PID function integrates the errors. If there is difference in process time constants of a primary process and secondary process measurement, then the block can be cascaded if required. Auto tuning is a feature that tunes the PID constants as per the process automatically.

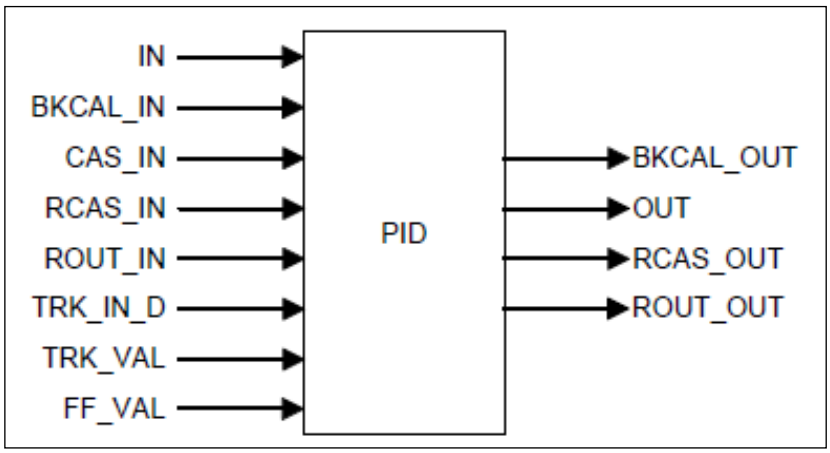


Figure 10: PID block

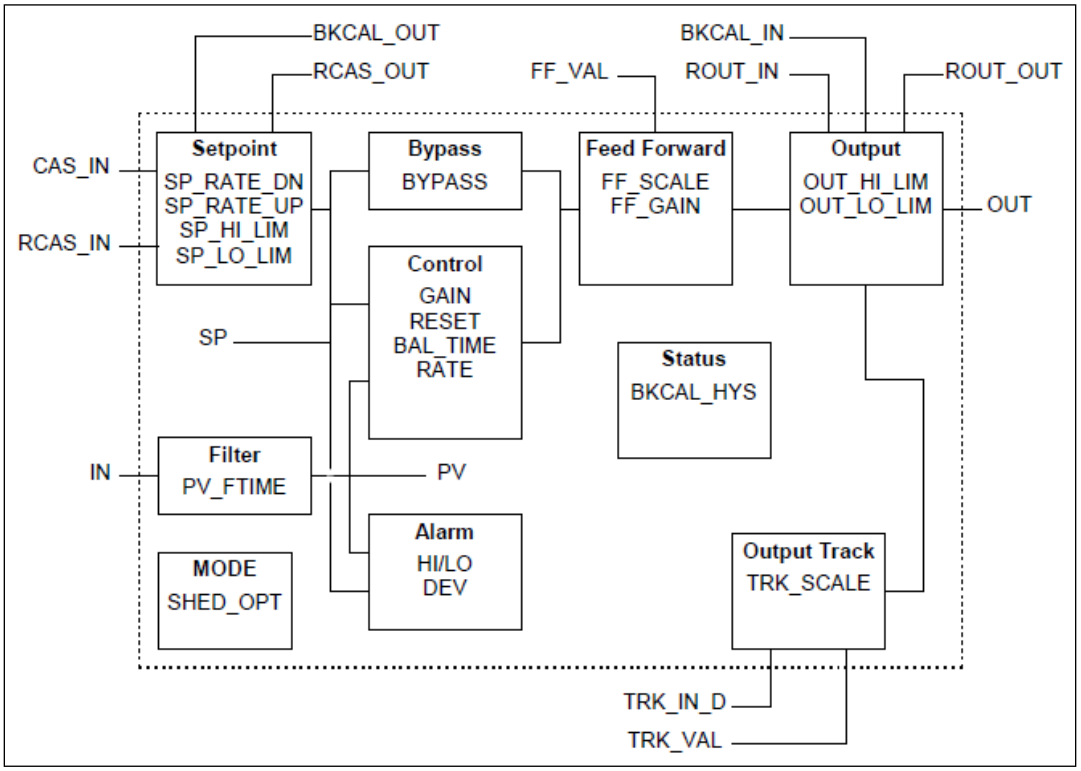


Figure 11: PID block schematic diagram

Execution

The Process Value to be controlled is connected to the **IN** input. The value is passed through a filter, and its time constant is **PV_FTIME**. The value is then shown as the PV, which is used in conjunction with the **SP** in the PID algorithm. A PID does not integrate if the limit status of **IN** input is constant, or if further control action based on the PID error proceeds **IN** input further towards its active status limit. A full PV and DV alarm sub-function is provided. The PV has a status, although it is a contained parameter. This status is a copy of **IN**'s status, unless **IN** is Good and there is a PV or block alarm.

The full cascade **SP** sub-function is used with rate and absolute limits. The block has additional control options which cause the **SP** value to track the PV value. The **SP** value tracks the PV value while the block is in Actual mode of IMan, LO, or ROut, or when the target mode of the block is MAN.

The block provides a switch for **BYPASS**, which is available to the operator if the Bypass Enable control option is set as True. **BYPASS** can be used in secondary cascade controllers that have a Bad PV. The **BYPASS Enable** option is required, so if **BYPASS** is set as True, not all cascade control schemes are stable. **BYPASS** can only be changed when the block mode is in MAN or OOS mode. When **BYPASS** is set, the value of **SP**, in percent of range, is passed directly to the target output, and the value of **OUT** is used for **BKCAL_OUT**. When the mode is changed to Cas, the upstream block is requested to initialize to the value of **OUT**. When a block is in Cas mode, on the transition out of BYPASS, the upstream block is requested to initialize to the PV value, irrespective of the "**Use PV for BKCAL_OUT**" option.

GAIN, **RESET**, and **RATE** are the tuning constants for the **P**, **I**, and **D** terms, respectively. The block provides existing controllers that are tuned by the inverse value of some or all of them, such as proportional band and repeats per minute. The human interface to these parameters must be able to display the user's preference.

BAL_TIME parameter can be used to set the rate at which the **I** term moves towards balancing the difference between the previous integral term and the limited output. The **Direct Acting** control option, if set as True, causes the output to increase when the PV exceeds the **SP**. If set as False, the output decreases when the PV exceeds the **SP**. The **Direct Acting** control option must be set carefully, as it can cause a difference between positive and negative feedback.

ATTENTION

The **Direct Acting** control option can never be changed while in AUTO mode. The setting of the option must also be used in calculating the limit state for **BKCAL_OUT**.

The output supports the feed forward algorithm. The **FF_VAL** input brings in an external value which is proportional to some disturbance in the control loop. The value is converted to percent of output span using the values of parameter **FF_SCALE**.

This value is multiplied by the **FF_GAIN** and added to the target output of the PID algorithm. If the status of **FF_VAL** is Bad, the last usable value is used as this prevents bumping the output. When the status returns to Good, the block adjusts its integral term to maintain the previous output. The output supports the track algorithm. The block provides an option to use either the **SP** value after limiting or the PV value for the **BKCAL_OUT** value.

PID Control block is an algorithm that produces an output signal in response to the measured variable and the setpoint. The PID block allows you to choose either a standard PID control equation (Ideal) or a robust PID equation defined by Honeywell. This selection is defined in the PID_FORM parameter.

The output has three terms, namely Proportional, Integral, and Derivative. The output is adjusted by tuning constants. There are three tuning constants in the ideal PID equation. The robust PID uses four tuning constants:

1. **GAIN** is the tuning constant of the Proportional term.
2. **RESET** is the tuning constant of the Integral.
3. **RATE** is the tuning constant of the Derivative. **RATE** is usually modified by a lag, which is set at some fixed ratio higher than the rate time, to create a rate gain. There is no lag with the rate in this implementation.
4. **OUT_LAG** is the fourth tuning constant used in the robust PID; it adds roll off to the output response. The action is similar to PID with rate gain.

PID Ideal and PID Robust

The ideal equation is a parallel or non-interacting implementation of PID control using three tuning constants. It automatically fixes **OUT_LAG** to 16 times the **RATE** time constant. This produces response characteristics equivalent to the algorithms used in TPS products.

The robust equation is the same parallel implementation of ideal PID control but allows the engineer to set the **OUT_LAG** and effectively change the rate gain.

ALGO_TYPE is a configuration parameter that contains one of three selected algorithm types, A, B, or C.

Where:

- A - **RATE**, **GAIN** and **RESET** all act on the error between set point and measured variable.
- B - **RATE** acts on the measured variable only, **GAIN** and **RESET** use the error.
- C - **RATE** and **GAIN** act on the measured variable only, and **RESET** uses the error.

PID Tuning Parameters

Table lists the valid ranges for the tuning parameters for the PID block. Note that **OUT_LAG** parameter is not configurable when Ideal PID is selected (**PID_FORM** = 1) and can be configured when Robust PID is selected (**PID_FORM** = 2).

The values given for these tuning parameters are valid under the following conditions:

- The values assume that the minimum configurable PID function block execution period (T_s) is 0.125 seconds.
- Algorithm typesetting (A, B, or C) has no effect on the validation of these tuning parameters.

The PID function block rejects all values outside the following ranges:

Table 19: PID Tuning parameters

Parameter	Initial Value	Minimum Value	Maximum Value	Comment
PV_FTIME	0	0	200	Units: seconds.
GAIN	0	.004	250	
GAIN_NLIN	0	.004	250	
RATE (sec.)	0	32 • T_s	7500	The value of ZERO is permitted to turn off rate action.
RESET (sec.)	+INF	2 • T_s	7500	The value of +INF is permitted to turn off reset action. (Some versions of NI configurator program cannot set +/- INF).
OUT_LAG Ideal PID	N/A	N/A	N/A	Fixed for Ideal PID form - not configurable.
Robust PID	0	2 • T_s	7500	Zero permitted which implies no output lag.
BAL_TIME	0	N/A	N/A	Not used in Honeywell Implementation.

Auto tuning

Cycle tuning

The PID block supports the Cycle tuning algorithm. In Cycle tuning, the tuning parameter values are derived from the process response to the resultant action of causing the PV to oscillate about a **SP** value. The tuning method uses the measured ultimate gain and period to produce tuning parameter values, by using the relationship developed by Ziegles Nichols equations. Cycle tuning does not distinguish between process lags and always results in gain based on PV amplitude, and calculates the values of Reset and Rate based on time of the **SP** crossings using a fixed ratio of 4 to 1. Initially, this method does not require a stable process. Cycle tuning is applicable to Three Position Step control, and is used for integrating process.

Auto tuning procedure

There are nine parameters applicable for auto tuning: **AT_TYPE**, **TUNING_CRITERIA, TUNE_REQ, ATI, AT_MODE, AT_ERR, AT_GAIN, AT_RESET, and AT_RATE.**

AT_Type

There are two types of selections, namely Disable and Cycle Tune. When Disable is selected, **AT_MODE** becomes inactive. When Cycle Tune is selected, **AT_MODE** becomes AT Ready.

TUNING_CRITERIA

There are two types of tuning criteria available for selection: Normal and Fast.

- **NORMAL** - Conservative tuning designed to reduce overshoot as compared to FAST.
- **FAST** - Aggressive tuning designed to provide quarter-dampened response.

TUNE_REQ

TUNE_REQ can be turned ON only in the following modes, namely AUTO, CAS, RCAS, and ROUT. The ATI value becomes 1, and **AT_ERROR** shows the status as Run, this shows that auto tuning is in progress.

If **AT_ERROR** shows **OK**, auto tuning is successful. **AT_GAIN**, **AT_REST**, **AT_RATE** gets updated automatically and same values are copied to **GAIN**, **RESET** and **RATE** respectively.

Parameter list

Table 20: PID block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block. The revision value is incremented each time a static parameter value in the block is changed.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
PV	The process variable used in block execution.
SP	It is the target block setpoint value. It is the result of setpoint limiting and setpoint rate of change limiting.
OUT	The block input value and status.
PV_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with PV.
OUT_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by the device.
CONTROL_OPTS	Specify control strategy options. The supported control options for the PID block are Track enable, Track in Manual, SP-PV Track in MAN, SP-PV Track in LO or IMAN, Use PV for BKCAL_OUT, Direct Acting, SP Track retain, SP-PV Track Out, Restrict SP to limits in CAS and RCAS, No output limits in MAN.
STATUS_OPTS	It helps to select options for status handling and processing. The supported status option for the PID block is Target to Manual if Bad IN. IFS if Bad IN, IFS if Bad CAS_IN, Use Uncertain as Good, Target to next permitted mode if Bad CAS_IN, Target to MAN if Bad TRK_IN_D and IFS if Bad TRK_IN_D.
IN	The connection for the PV input from another block.
PV_FTIME	The time constant of the first-order PV filter. It is the time required for a 63 percent change in the IN value.

Parameter	Description
BYPASS	Used to override the calculation of the block. When enabled, the SP is sent directly to the output.
CAS_IN	The remote setpoint value from another block.
SP_RATE_DN	Ramp rate for downward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP-RATE_UP	Ramp rate for upward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP_HI_LIM	The highest SP value allowed.
SP_LO_LIM	The lowest SP value allowed.
GAIN	The proportional gain value. This value cannot = 0.
RESET	The integral action time constant.
BAL_TIME	The specified time for the internal working value of bias to return to the operator set bias. Also used to specify the time constant at which the integral term moves to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS.
RATE	The derivative action time constant.
BKCAL_IN	The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bump less transfer and to pass limit status.
OUT_HI_LIM	The maximum output value allowed.
OUT-LO_LIM	The minimum output value allowed
BKCAL_HYS	The amount the output value must change away from its output limit before limit status is turned off.
BKCAL_OUT	The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bump less transfer of closed loop control.
RCAS_IN	Target setpoint and status that is provided by a supervisory host. Used when mode is RCAS.
ROUT_IN	Target output and status that is provided by a supervisory host. Used when mode is ROUT.
SHED_OPT	Defines action to be taken on remote control device timeout.
RCAS_OUT	Block setpoint and status after ramping, filtering, and limiting that are provided to a supervisory host for back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
ROUT_OUT	Block output that is provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
TRK_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the external tracking value (TRK_VAL).
TRK_IN_D	Discrete input that initiates external tracking.

Parameter	Description
TRK_VAL	The value (after scaling from TRK_SCALE to OUT_SCALE) APPLIED to OUT in LO mode.
FF_VAL	The feedforward control input value and status.
FF_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the feedforward value (FF_VAL).
FF_GAIN	The feedforward gain value. FF_VAL is multiplied by FF_GAIN before it is added to the calculated control output.
UPDATE_EVT	This alert is generated by any changes to the static data.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the active status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task and other block alert may be reported without clearing the Active status, if the subcode has changed.
ALARM_SUM	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
ACK_OPTION	Used to set auto acknowledgment of alarms.
ALARM_HYS	The amount the alarm value must return to within the alarm limit before the associated active alarm condition clears.
HI_HI_PRI	The priority of the HI HI Alarm.
HI_HI-LIM	The setting for the alarm limit used to detect the HI HI alarm condition.
HI_PRI	The priority of the HI alarm.
HI_LIM	The setting for the alarm limit used to detect the HI alarm condition.
LO_PRI	The priority of the LO alarm.
LO_LIM	The setting for the alarm limit used to detect the LO alarm condition.
LO_LO_PRI	The priority of the LO LO alarm.
LO_LO_LIM	The setting for the alarm limit used to detect the LO LO alarm condition.
DV_HI_PRI	The priority of the deviation high alarm.
DV_HI_LIM	The setting for the alarm limit used to detect the deviation high alarm condition.
DV_LO_PRI	The priority of the deviation low alarm.
DV_LO_LIM	The setting for the alarm limit use to detect the deviation low alarm condition.

Parameter	Description
HI_HI_ALM	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
HI_ALM	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_ALM	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_LO_ALM	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_HI_ALM	The DV HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_LO_ALM	The DV LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
PID_FORM	Configuration parameter specifies the IDEAL or ROBUST PID equation to be used: • IDEAL PID (default): Non-interactive form of a three mode control equation that provides Proportional, Integral and Derivative control action. Linear and non-linear gain parameters are available. • ROBUST PID: The same as Ideal PID. Additionally, the equation supports a user-configurable lag filter applied to calculated output value. (See OUT_LAG parameter.) Linear and non-linear gain parameters are available.
ALGO_TYPE	Configuration parameter specifies algorithm type which can be A, B, or C: • Type “A” equation where Proportional, Integral and Derivative act on ERROR. • Type “B” equation where Proportional and Integral act on ERROR and Derivative acts on PV. • Type “C” equation where Integral acts on ERROR and Proportional and Derivative act on PV.
OUT_LAG	Time constant of single exponential LAG filter applied to the OUT parameter (primary output). Units (in seconds). For Ideal PID equation the lag filter is fixed at 1/16 and is not configurable.
GAIN_NLIN	Dimensionless gain factor. When the gain factor is multiplied by absolute value of the error and added to the linear GAIN, the result is a gain response which is proportional to the deviation. The default value is zero resulting in no response due to non-linear gain action.
GAIN_COMP	The composite gain quantity including both linear and non-linear gain parameters. It is a read only parameter.
ERROR_ABS	Absolute value of the difference between PV and working setpoint. Read only parameter.
WSP	Working setpoint. This is the setpoint value after absolute and rate limits have been applied. Deviation alarms are computed on this value. It is a read only parameter.
BLOCK_TEST	An internal Honeywell test parameter.

Parameter	Description
AT_TYPE	Auto Tune Selection supports two types: Disable, Cycle Tune.
TUNING_CRITERIA	Tuning Criteria supports two types: Normal, Fast.
TUNE_REQ	Tuning Request performs auto tuning process.
ATI	Auto Tune Indicator indicates Auto tune ON/OFF.
AT_MODE	Auto Tune Mode supports two options: AT Ready, Inactive • AT Ready indicates block is ready for auto tune • Inactive indicates auto tuning is disabled.
AT_ERROR	Auto Tune Error supports the following errors: Abort, Not ready, OK, and Run.
AT_GAIN	Auto tuned Gain.
AT_RESET	Auto tuned Reset.
AT_RATE	Auto tuned Rate.
LICENSE_STATUS_PID	License status of the function block.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • MAN (Manual) • OOS (Out of Service) • IMan • Cas • RCas • ROut • LO
Alarm Types	The block supports standard block alarms (see section 5.2), in addition to it standard **HI_HI, HI, DV_HI, DV_LO, LO**, and **LO_LO** alarms applied to PV.
Status Handling	Standard, in addition to the following things for the control selector. If Not selected is received at **BKCAL_IN**, the PID algorithm must make necessary adjustments to prevent windup.

5.7 Input Selector block

The Input Selector block performs maximum, minimum, middle, average and ‘first good’ input selection. The Input Selector block provides selection of up to eight inputs and generates an output based on the selected type of input. The block functions as a rotary position switch, or a validated priority selection based on the use of the **first good** parameter and the **disable_n** parameter. As a switch, the block receives switching information from either the connected inputs or from an operator input. The block supports signal status propagation.

The block is used to provide control input selection in the forward path only, and hence no back calculation support is provided. **SELECTED** indicates which input has been selected or the number of inputs selected by the algorithm. The block does not support process alarms.

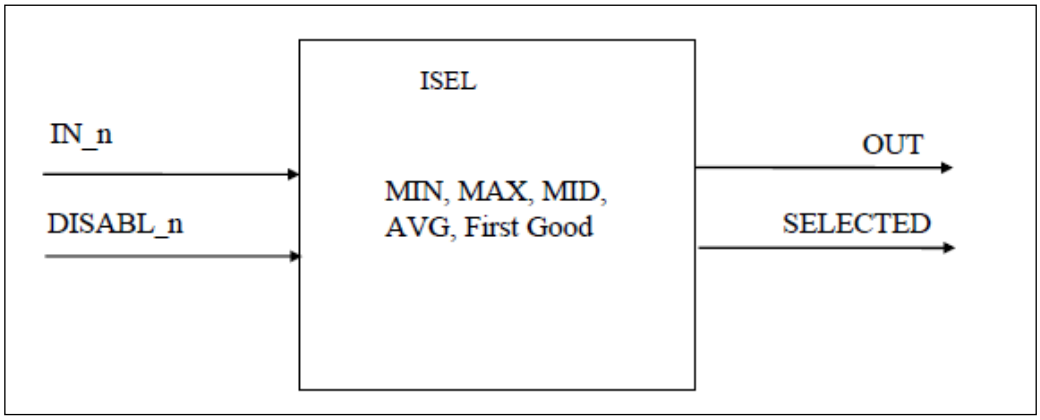


Figure 12: Input Selector block

Execution

Input processing

If **DISABLE_n** is True, the corresponding input **IN_n** is discarded. If there are no inputs left, or if there are inputs fewer than **MIN_GOOD** inputs, then the value of **SELECTED** becomes zero.

Selection Processing

- If **OP_SELECT** is non-zero, the **OP_SELECT** value determines the selected input, irrespective of the **SELECT_TYPE** selection. The value of **SELECTED** is the number of the input used.
- If **SELECT_TYPE** is 'First Good', it transfers the value of the first remaining input to the output of the block. The value of **SELECTED** is the number of the input used.

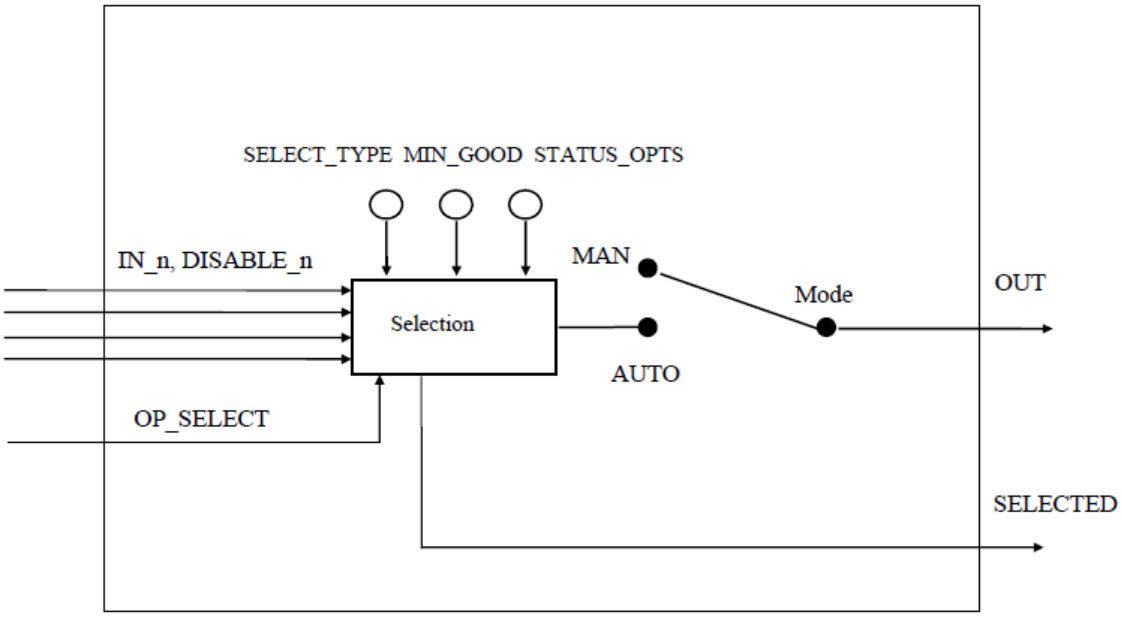


Figure 13 : Input Selector schematic diagram

- If **SELECT_TYPE** is Minimum, it transfers the lowest value to the output of the block. The value of **SELECTED** is the number of the input with the lowest value.
- If **SELECT_TYPE** is Maximum, it transfers the highest value to the output of the block. The value of **SELECTED** is the number of the input with the highest value.
- If **SELECT_TYPE** is Middle, if there are 3 or 4 values, the highest and lowest value is discarded. The average of the remaining two values is computed, and the value is transferred to the output of the block. The value of **SELECTED** becomes zero if an average is used, else the value of **SELECTED** is the number of the input with the middle value.
- If **SELECT_TYPE** is Average, it computes the average of the remaining inputs and transfers the value to the output of the block. The value of **SELECTED** is the number of inputs used in the average.

Parameters List

Table 21: Input Selector block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK	The Actual, Target, Permitted, and Normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
OUT	The block output value and status.
OUT_RANGE	High and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
STATUS_OPTIONS	It helps to select options for status handling and processing. The supported status option for the integrator block is: “Use Uncertain as Good”, “Uncertain if MAN mode.”
IN_1	The block input value and status.
IN_2	The block input value and status.
IN_3	The block input value and status.
IN_4	The block input value and status.
INP_5	The block input value and status.
INP_6	The block input value and status.
INP_7	The block input value and status.
INP_8	The block input value and status.
DISABLE_1	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_2	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_3	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_4	Parameter to switch off the input from being used. 0-Use, 1 -Disable.

Parameter	Description
DISABLE_5	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_6	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_7	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
DISABLE_8	Parameter to switch off the input from being used. 0-Use, 1 -Disable.
SELECT_TYPE	Determines the selector action: First Good, Minimum, Maximum, Middle, and Average.
MIN_GOOD	The minimum number of inputs which are “Good” is less than the value of MIN_GOOD then set the OUT status to “Bad”.
SELECTED	The integer indicating the selected input number.
OP_SELECT	An operator settable parameter to force a given input to be used.
UPDATE_EVT	This alert is generated by any change to the static data.
BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
LICENSE_STATUS_IS	License status of the function block.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • MAN (Manual) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms, (see section 5.2).
Status Handling	During normal operations, the value and status of the selected input is shown by **OUT**. If the number of inputs with Good status is fewer than **MIN_GOOD**, then the output status is Bad. The **SELECTED** output status is Good (NC), until the block is out of service. The block supports two status option: • **Uncertain as Good**: If the selected input status is Uncertain, set the **OUT** status as Good. • **Uncertain, if in Manual mode**: If the block is set to Manual mode, the status of the Output is set to Uncertain.

5.8 Integrator block

The Integrator block integrates a variable as a function of time, and also accumulates the counts from a Pulse Input block. The block is used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, and the integrated or accumulated value is compared to pre-trip and trip settings. When the pre-trip and trip settings are reached, the block generates discrete signals. The integrated value can go up, starting from zero, or go down, starting from the trip value depending on the settings. The block has two flow inputs to calculate and integrate net flow, which can be used to calculate volume or mass variation in vessels or as an optimizing tool for flow ratio control. The block does not support process alarms.

ATTENTION

Alternatively **IN_1** and **IN_2** can be used as pulse inputs coming from other blocks. The same general rules for integration applies for the accumulation of pulses.

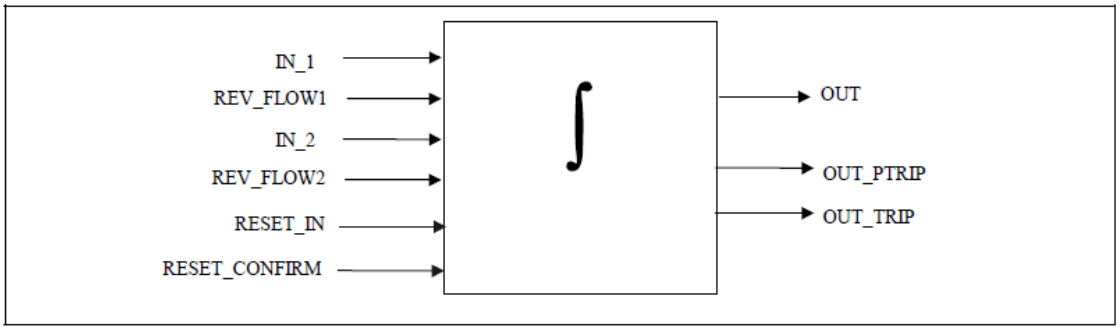


Figure 14: Integrator Block

Execution

The basic function of the Integrator block is to integrate an analog value over time. It can also accumulate the pulses coming from the Pulse Input block or from other Integrator blocks. The block is normally used to totalize flow, giving total mass or volume over a certain time, or totalize power, giving the total energy.

Inputs

The block has two inputs: **IN_1** and **IN_2**. If **IN_2** is not connected (does not have a corresponding link object), calculations for **IN_2** can be avoided. Each input can be configured to receive a measurement per unit of time (rate).

The usage is as follows:

Rate

It is used when the variable connected to the input is a rate, that is Kg/s, w, Gal/hour, and so on. This input can come from the rate output **OUT** of an Analog Input block.

Accum

It is used when the input comes from the **OUT_ACCUM** output of a Pulse Input block, which represents a continuous accumulation of pulse counts from a transducer, or from the output of another Integrator block. The bits corresponding to **IN_1** and **IN_2** can be set to False for **Rate**, or can be set to True for **Accum**.

If the input option is Rate

Each input needs a parameter to define the rate time unit: **IN_1**, **IN_2.** The time unit can be selected in seconds/minutes/hours/days. The second analog input must be converted into the same unit as that of the first input**. IN_2** must be converted into the same units of **IN_1**. This can be done by using the parameter **UNIT_CONV**. For example, if **IN_1** is in seconds and if **IN_2** is in minutes, **IN_2** must be converted to seconds before starting the integration. In this case, the value of **UNIT_CONV** is .0166 (1/60).

To find the mass, volume, or energy increment per block execution, each rate must be multiplied by the block execution time. This increment must be added or subtracted in a register.

The following diagram is an example of the use of two Rate inputs:

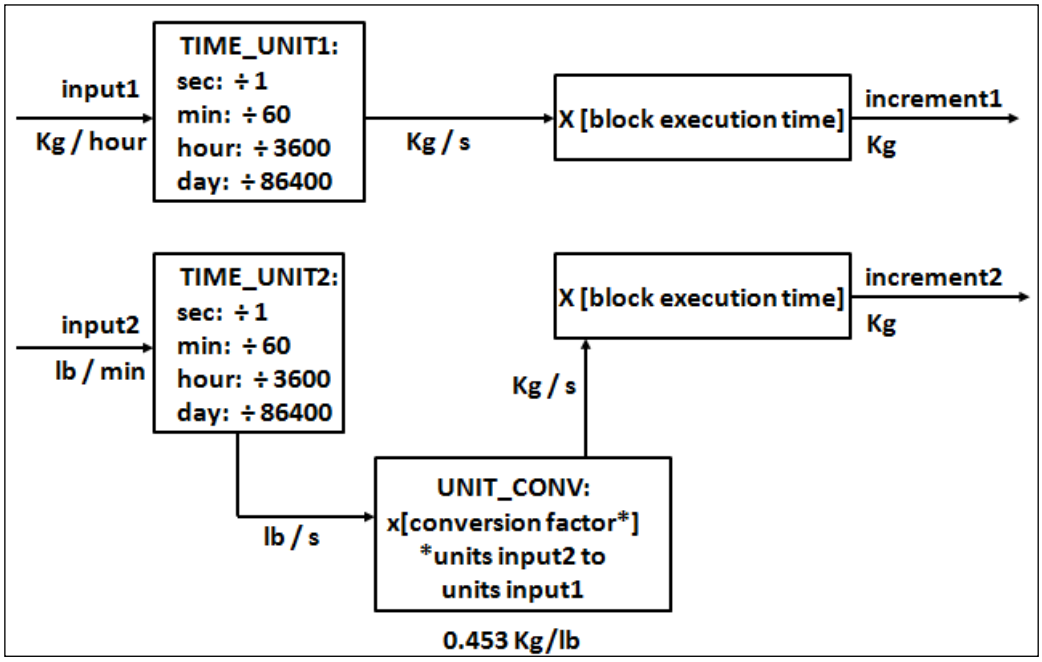


Figure 15: Two Rate Inputs

If the input option is Accum

The Integrator block determines the number of additional counts from the counter input readings from the last execution.

The difference in count is determined as follows:

- If the difference between the reading in one cycle and the reading in the preceding cycle is less than 500,000 or greater than (- 500,000), the difference must be taken as the variation.
- If the difference between the reading in one cycle and the reading in the preceding cycle is greater than or equal to (+500,000), add (-1,000,000), use the result as the variation.
- If the difference between the reading in one cycle and the reading in the preceding cycle is more negative than or equal to (-500,000), add (+1,000,000), use the result as the variation.

The variation of each input must be multiplied by the value, in engineering units, of each pulse given by **PULSE_VAL1** or **PULSE_VAL2**, as appropriate. The result is the increment in engineering units of, for example, mass, volume or energy per block execution.

Net Flow

The Net Flow is calculated by considering the direction of flow. The direction of the flow is calculated by selecting the parameters **REV_FLOW** and **REV_FLOW2**. When the status is set to True for any of these two parameters, the direction of the flow for that input is considered (Increment is negative) to be negative and the net flow is calculated by adding the increments for that cycle of execution.

In order to integrate the difference between the inflow and outflow of a tank, for example, the second one can be assigned to be negative.

The Net Flow direction to be considered in the totalization is defined in **INTEG_OPTS**. The following options are available:

- **FORWARD** = Only positive flows (after application of **REV_FLOWi**) are totalized. The negative values must be treated as zero. **FORWARD** is selected when the bit corresponding to Forward is set to True.
- **REVERSE** = Only negative flows are totalized. The positive values must be treated as zero. The option bit Reverse must be set to True.

Integration of Inputs

There are three internal registers used for the totalization:

- Total = The net increment is added every cycle, irrespective of the status.
- Atotal = The absolute value of the net increment is added every cycle, irrespective of status.
- Rtotal = The absolute value of the net increments with status as Bad (rejects) are added to this register.

The most significant part of Total can be read in the output **OUT**, and of **Rtotal** in **RTOTAL**. **OUT_RANGE** is used only for display of the totals by a host. The high and low range values of **OUT_RANGE** have no effect on the block.

Types of Integration

The value of **OUT** can start from zero and go up or it can start from a Setpoint value (**TOTAL_SP**) and go down. The Reset option can be automatic, periodic, or on demand. This is defined by the enumerated parameter **INTEG_TYPE**:

- **UP_AUTO –** It counts up with automatic reset when **TOTAL_SP** is reached
- **UP_DEM** – It counts up with demand reset, and the block resets only when the operator resets the block.
- **DN_AUTO** – The block is reset when the output becomes zero. The integration starts as **SP** and increments are subtracted from the **SP**.
- **DN_DEM** – The output is calculated even beyond zero till the block is reset. The integration starts from **SP**.
- **PERIODIC –** The integration is done for the assigned period (specified in seconds in **CLOCK_PER**). After that period, the block is reset automatically.
- **DEMAND** – The integration is done (positive or negative depending on the direction of the flow) until the block is reset.
- **PER&DEM** – It is a combination of periodic and demand types. The integration is carried till the end of the specified period and after that period is automatically reset. The block can be reset at any time, before the end of periodic data set.

The first four types indicate use as a batch totalizer with a setpoint **TOTAL_SP**. The count does not stop at **TOTAL_SP** going up or zero going down, as it is important to get the True total of flow. Two outputs, **OUT_TRIP** and **OUT_PTRIP**, are associated with the four types. The next three types indicate that **TOTAL_SP** and the trip outputs are not used. The Periodic type (5) disables reset action based on **RESET_IN**, but has no impact on **OP_CMD_INT**.

The internal registers always add the net increments. Counting down is done by setting **OUT** to the value of **TOTAL_SP** minus the most significant part of Total.

Resetting the totals

The block uses a discrete input **RESET_IN** to reset the internal integration registers. The operator can send a command to reset the same registers by making **OP_CMD_INT** = **RESET**. This is a momentary switch that turns-off when the block is evaluated. The option "Confirm Reset" in **INTEG_OPTS**, if set, prevents another reset from occurring until the value 1 has been written to **RESET_CONFIRM**. This is an input that behaves like a momentary dynamic parameter if it is not connected.

The number of resets is counted in the register **N_RESET**. This counter cannot be written or reset. It provides verification that the total has not been reset since **N_RESET** was last checked. The counter must roll over from 999999 to 0.

The reset always clears the internal registers Total, Atotal, and Rtotal, except that when the option **UP_AUTO** or **DN_AUTO** is selected, a residual value beyond the trip value may be carried to the next integration if the option Carry is set in **INTEG_OPTS**. In this case, **TOTAL_SP** is subtracted from Total, leaving the residual value.

Batch totalizer outputs

When the integration is counting up (type 1 or 2) and the value of **OUT** equals or exceeds a value given by **TOTAL_SP** minus **PRE_TRIP**, the discrete output **OUT_PTRIP** is set. When it equals or exceeds a value given by the parameter **TOTAL_SP**, the discrete output **OUT_TRIP** is set. **OUT_PTRIP** remains set.

When the integration is counting down (type 3 or 4), it starts from a value given by **TOTAL_SP**. When the value of **OUT** is equal to or less than **PRE_TRIP**, the discrete output **OUT_PTRIP** is set. When the count reaches zero, the discrete output **OUT_TRIP** is set. **OUT_PTRIP** remains set. When a reset occurs, the comparisons that set **OUT_PTRIP** and **OUT_TRIP** are no longer True; so they are cleared. **OUT_TRIP** shall remain set for five seconds after an automatic reset (type 1 or 3), if **RESET_CONFIRM** is not connected or the option to "Confirm Reset" in **INTEG_OPTS** is not set.

To determine the amount of **Uncertain** or **Bad** readings, the block integrates the variables with **Bad,** or **Bad** and **Uncertain** status separately. The values used in this second integration are the values with **Good** status, just before the status changed from **Good** to **Bad** or **Good** to **Uncertain**. The ratio of **Good** to total counts determines the output status. Absolute values are used to avoid problems with changing signs.

Integration options

Any or all of the following integration options can be selected:

INTEG_OPTS: 0 (Input1 Accumulate)

When this option is selected, the accumulation of pulses is done instead of the rate input, integration.

INTEG_OPTS: 0 (Input2 Accumulate)

When this option is selected, the accumulation of pulses is done instead of the rate input, integration.

Note:

One input for rate and input for Accumulation can be selected.

INTEG_OPTS: 0 (Flow forward)

When this option is selected, only positive flows is considered for integration. If there is no forward flow inputs (whose value is positive value), and if one inputs is negative (whose value is positive value) the integration continues.

Note:

If both the inputs are negative, then the integration stops.

INTEG_OPTS: 0 (Flow reverse)

When this option is selected, only reverse flows is considered for integration. If there is no reverse flow inputs (whose value is negative), and if one inputs is forward (whose value is positive) the integration continues.

Note:

If both the inputs are forward, then the integration stops.

INTEG_OPTS: 0 (Use uncertain)

When this option is selected, the input (**IN_1/IN_2**) whose status is Uncertain is considered for integration.

INTEG_OPTS: 0 (Use Bad)

When this option is selected, the input (**IN_1/IN_2**) whose status is Bad is considered for integration.

INTEG_OPTS: 0 (Carry)

This option is used only for **UP_AUTO** and **DN_AUTO** kind of integrations only. When this option is selected, the residual value after the integration is added / subtracted from the integral value in the next cycle of integration.

INTEG_OPTS: 0 (Add Zero if Bad)

When this option is selected, if **IN_1/IN_2** is bad, the input value is zero for that input and integration does not happen. Integration stops at the last value.

INTEG_OPTS: 0 (Confirm reset)

This option is to be selected in conjunction with **RESET_CONFIRM.VALUE**. When the value of **RESET_CONFIRM.VALUE** is 1, and “Confirm Reset” is selected, the block gets reset. This is not applicable to **UP_AUTO** and **DN_AUTO** types.

Parameters List

Table 22: Integrator block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks. This data is not checked of processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms.
MODE_BLK	The actual, target, permitted, ad normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take Normal: Most common mode for target.
BLOCK_ERR	The summary of active error conditions associated with the block. The block error for the Integrator function block is Out of service.
TOTAL_SP	The set point for a batch totalization.
OUT	The block output value and status.
OUT_RANGE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
GRAND_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block (not used by the device).
STATUS_OPTS	It helps to select option for status handling and processing. The supported status options for the Integrator block are: “Uncertain if Manual mode.”
IN_1	The block input value and status.
IN_2	The block input value and status.
OUT_TRIP	The first discrete output.
OUT_PTRIP	The second discrete output.
TIME_UNIT1	Converts the rate time, units in seconds.
TIME_UNIT2	Converts the rate time, units in seconds.
UNIT_CONV	Factor to convert the engineering units of IN_2 into the engineering units of IN_1.
PULSE_VAL1	Determines the mass, volume or energy per pulse.
PULSE_VAL2	Determines the mass, volume or energy per pulse.
REV_FLOW1	Indicates reverse flow when “True”; 0-Forward, 1-Reverse
REV_FLOW2	Indicates reverse flow when “True”; 0-Forward, 1-Reverse

Parameter	Description
RESET_IN	Resets the totalizers
STOTAL	Indicates the snapshot of OUT just before a reset
RTOTAL	Indicates the totalization of “Bad” or “Bad” and “Uncertain” inputs, according to INTEG_OPTIONS.
SRTOTAL	The snapshot of RTOTAL just before a reset
SSP	The snapshot of TOTAL_SP.
INTEG_TYPE	Defines the type of counting (up or down) and the type of resetting (demand or periodic)
INTEG_OPTIONS	A bit string to configure the type of input (rate or accumulative) used in each input, the flow direction to be considered in the totalization, the status to be considered in TOTAL and if the totalization residue must be used in the next batch (only when INTEG_TYPE=UP_AUTO or DN_AUTO).
CLOCK_PER	Establishes the period for periodic reset, in hours.
PRE_TRIP	Adjusts the amount of mass, volume or energy that should set OUT_PTRIP when the integration reaches (TOTAL_SP-PRE_TRIP) when counting up of PRE_TRIP when counting down.
N_RESET	Counts the number of resets. It cannot be written or reset.
PCT_INC	Indicates the percentage of inputs with Good status compared to the ones with Bad or Uncertain and Bad status.
GOOD_LIMIT	Sets the limit for PCT_INC. Below this limit OUT receives the status Good
UNCERTAIN_LIMIT	Sets the limit for PCT_INC. Below this limit OUT receives the status Uncertain
OP_CMD_INT	Operator command RESET Resets the totalizer
OUTAGE_LIMIT	The maximum tolerated duration for power failure
RESET_CONFIRM	Momentary discrete value with can be written by a host to enable further resets, if the option “Confirm reset” in INTEG_OPTIONS is chosen.
UPDATE_EVT	This alert is generated by any changes to the static data.
BLOCK_ALM	Used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the active status in the status parameter. As soon as the unreported status is cleared by the alert reporting task other block alerts may be reported without clearing the Active status, if the subcode has changed.
LICENSE_STATUS_IT	License status of the function block.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • MAN (Manual) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms, (see section 5.2).
Status Handling	If an input has status as Uncertain or Bad, then the limit status of the inputs is ignored, as is the sub status. Either Good(C) or Good (NC) is accepted as Good. The increment calculated from an input has an internal status that is either Good or Bad. If the input status is Good(C) or Good (NC), the increment status is Good. If the input status is Uncertain, the increment status is Bad, and the last Good value is used unless the option Use Uncertain is set in **INTEG_OPTS**, and then the increment status is Good and the new value is used. If the input status is Bad, the increment status is Bad, and the last Good value is used unless the option Use Bad is set in **INTEG_OPTS**, and then the increment status is Good and the last Good value is used. The two increments are added together, and the resulting status is the worst of the two. The option Add zero if Bad in **INTEG_OPTS** causes the net increment to be zero if its status is Bad. The percentage of Bad or Uncertain and Bad counts can be determined by calculating the value of PCT_INCL from Rtotal and Atotal. As Atotal is the sum of increments with Good and Bad status, and Rtotal is the sum of increments with Bad status, Atotal minus Rtotal is exactly equal to the total of increments with Good status. If **most significant part** (msp) and Atotal is not zero then the percent of Good values may be calculated as: **PCT_INCL** = 100 * (1 - (msp of Rtotal) / (msp of Atotal)) If Atotal is zero, then PCT_INCL shall be 100 if Rtotal is also zero or 0 if Rtotal is not zero. If the block mode is AUTO, if **PCT_INCL** ≥ **GOOD_LIM**, the status of **OUT** is Good, or else if **PCT_INCL** ≥ **UNCERT_LIM**, the status of **OUT** is Uncertain, or else the status of **OUT** is Bad. If the block mode is Manual, then the status of **OUT**, **OUT_PTRIP**, and **OUT_TRIP** is Good (NC) constant when then status option Uncertain, if MAN is not selected. If this status option is selected and the block mode is manual, then the status of these three outputs is for Uncertain constant, and no limits are applied to the output.

5.9 Arithmetic block

The Arithmetic block is designed for using popular measurement math functions easily. The math algorithm is selected by name and the type of function to be performed. The block is used for calculating measurements from a combination of signals from the sensors. The block must not be used in a control path. The block does not support process alarms.

The Arithmetic block supports the following functions:

- Flow compensation, linear
- Flow compensation, square root
- Flow compensation, approximate
- BTU flow
- Traditional Multiply Divide
- Average
- Traditional Summer
- Fourth order polynomial
- Simple HTG compensated level
- Fourth order Polynomial Based on PV

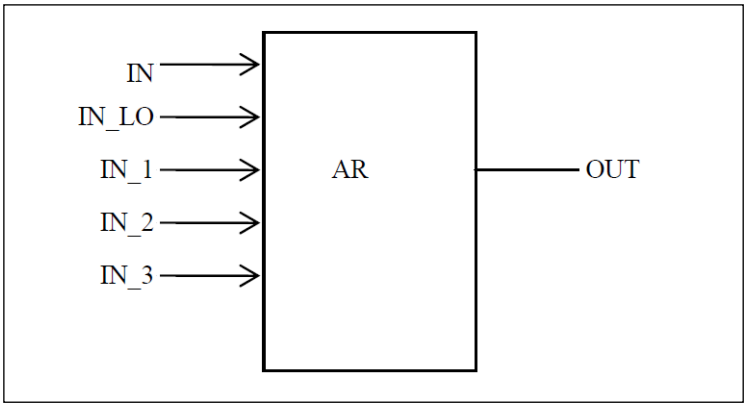


Figure 16: Arithmetic block

Execution

The block has five inputs, namely **IN, IN_LO, IN_1, IN_2,** and **IN_3**. The first two inputs (**IN, IN_LO**) are designed for a range extension function that results in a Process Variable (PV), with the status indicating the input in use.

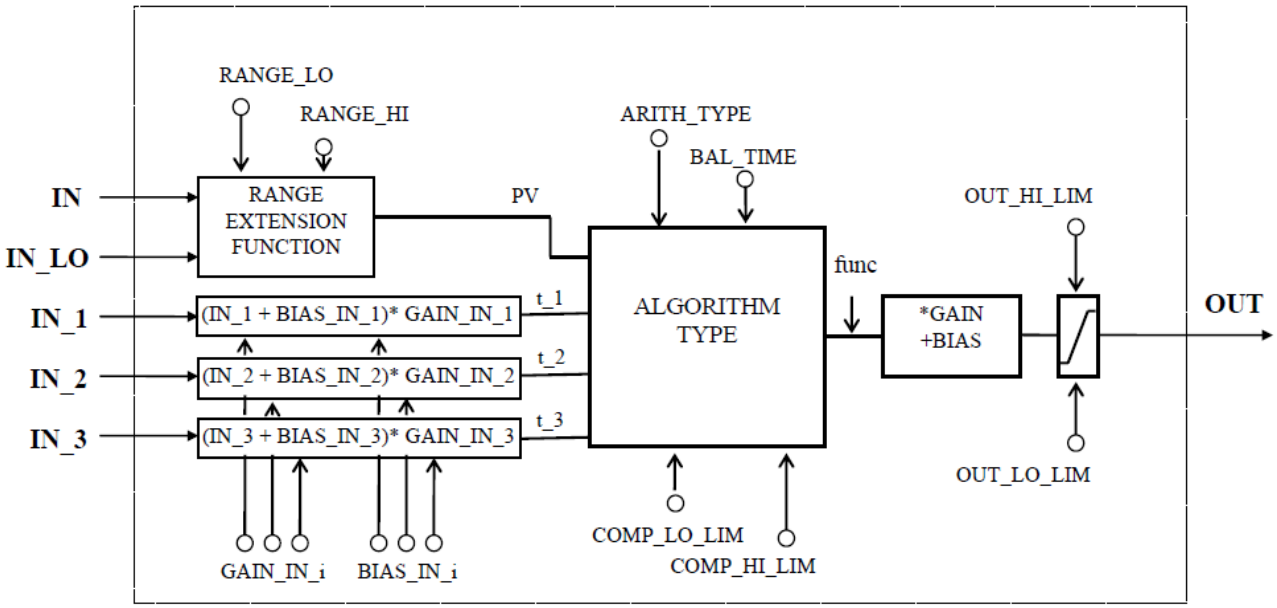


Figure 17: Arithmetic schematic diagram

The remaining three inputs (**IN_1, IN_2, and IN_3**) are combined with the PV in a selection of four term math functions. To ensure that the PV enters the equation with the right units, the inputs used to form the PV must come from devices with the desired engineering units. Each additional input has a bias constant and gain constant. To correct Absolute Pressure, use the bias constant, and to normalize terms within a square root function, use the gain constant.

Calculation of PV

The range extension function has a graduated transfer controlled by two constants referenced to IN. An internal value, g, is zero for IN less than **RANGE_LO**. It is one when IN is greater than **RANGE_HI**. It is interpolated from zero to one over the range of **RANGE_LO** to **RANGE_HI**. The equation for PV follows:

$$PV = g \times IN + (1 - g) \times IN\_LO$$

If the status of **IN_LO** is not usable and **IN** is usable and greater than **RANGE_LO**, then g is set to one. If the status of **IN** is unusable, and **IN_LO** is usable and less than **RANGE_HI**, then g is set to zero.

For three auxiliary inputs, six constants are used, and each input has a **BIAS_IN_i** and a **GAIN_IN_i**. The output has a **BIAS** and a **GAIN** static constant. For the inputs, the bias is added, and the gain is applied to the sum. The result is an internal value called **t_i** in the function equations. The equation for each auxiliary input is the following:

$$t\_i = (IN\_i + BIAS\_IN\_i) \times GAIN\_IN\_i$$

If an auxiliary input is unstable, to assure smooth degradation, the flow compensation functions have limits on the amount of compensation applied to the PV. The internal limited value is f.

The following function types are supported:

1. Flow compensation, linear. Used for density compensation of volume flow.

$$func = f \times PV$$

$$f = \frac{(t\_1)}{(t\_2)} \times [limited]$$

2. Flow compensation, square root. Usually, **IN_1** is pressure, **IN_2** temperature, and IN_3 is the compressibility factor Z.

$$func = f \times PV$$

$$f = \sqrt{\frac{(t\_1)}{(t\_2)}}{(t\_3)} \times [limited]$$

3. Flow compensation, approximate. Both **IN_2** and **IN_3** would be connected to the same temperature.

$$func = f \times PV$$

$$f = \sqrt{(t\_1) \times (t\_2) \times (t\_3) \times (t\_3)} \times [limited]$$

4. BTU flow, where **IN_1** is inlet temperature, and **IN_2** the outlet temperature.

$$func = f \times PV$$

$$f = (t\_1 - t\_2) \times [limited]$$

5. Traditional Multiply Divide

$$func = f \times PV$$

$$f = \frac{(t\_1)}{(t\_2)} + (t\_3) \times [limited]$$

6. Average

$$func = \frac{(PV + (t\_1) + (t\_2) + (t\_3))}{f}$$

f = number of inputs used in computation (unusable inputs are not used).

7. Traditional Summer

$$func = PV + (t\_1) + (t\_2) + (t\_3)$$

8. Fourth order polynomial. All inputs except **IN_LO** (not used) are linked together.

$$func = \mathrm{PV} + (t\_1)^2 + (t\_2)^3 + (t\_3)^4$$

9. Simple HTG compensated level, where PV is the tank base pressure, IN_1 is the top pressure, IN_2 is the density correction pressure, and GAIN is the height of the density tap.

$$func = \frac{(PV - (t\_1))}{(PV - (t\_2))}$$

10. Fourth order polynomial based on PV

$$func = \mathrm{PV} + \mathrm{GAIN\_IN\_1} \times (PV)^2 + \mathrm{GAIN\_IN\_2} \times (PV)^3 + \mathrm{GAIN\_IN\_3} \times (PV)^4$$

After the value of **func** is calculated, it is multiplied by **GAIN**, and then **BIAS** is added to the result. Then, the high and low output limits are applied as per configured range scaling, and **PRE_OUT** is updated with the calculated value. If the mode is AUTO, **PRE_OUT** is copied to **OUT**.

Parameter List

Table 23: Arithmetic block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks. This data is not checked of processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK	The actual, target, permitted, ad normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take Normal: Most common mode for target.
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
PV	It calculates the proportions of IN and IN_LO to for PV.
OUT	The analog output value and status.
PRE_OUT	Displays what would be the OUT value if the mode is AUTO or lower.
PV_SCALE	The high and low scale values, the engineering units’ code, and the number of digits to the right of the decimal point associated with the PV.
OUT_RANGE	The high and low scale values, engineering units code, and number of digits to the tight of the decimal point associated with OUT.
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. (Not used by the device)
INPUT_OPTIONS	Option bit string for handling the status of the auxiliary inputs.
IN	The block input value and status.
IN_LO	Input of the low range Remote Indicator, in a range extension application.
IN_1	The first block input value and status.
IN_2	The second block input value and status.
IN_3	The third block input value and status.
RANGE_HI	Constant value above which the range extension has switch to the high range Remote Indicator.
RANGE_LO	Constant value below which the range extension has switch to the high range Remote Indicator.

Parameter	Description
BIAS_IN_1	The bias value for IN_1.
GAIN_IN_1	The proportional gain (multiplier) value for IN_1.
BIAS_IN_2	The bias value for IN_2.
GAIN_IN_2	The proportional gain (multiplier) value for IN_2.
BIAS_IN_3	The bias value for IN_3.
GAIN_IN_3	The proportional gain (multiplier) value for IN_3.
COMP_HI_LIM	Determines the high limit of the compensation input.
COMP_LO_LIM	Determines the low limit of the compensation input.
ARITH_TYPE	The set of 9 arithmetic functions applied as compensation to or augmentation of the range extended input.
BAL_TIME	Specifies the time for a block value to match an input, output, or calculated value or the time for dissipation of the internal balancing bias.
BIAS	The bias value is used to calculate the output.
GAIN	The gain value is used to calculate the output.
OUT_HI_LIM	The maximum output value allowed.
OUT_LO_LIM	The minimum output value allowed.
UPDATE_EVT	This alert is generated by any changes to the static data.
BLOCK_ALM	Used for all configuration, hardware, connection failure, or system problem in the block. The cause of the alert is entered in the subcode field. The first active alarm sets the active status in the status parameter. When the Unreported status is cleared by the alert reporting test, other block alert may be reported without clearing the Active status, if the subcode has changed.
LICENSE_STATUS_AR	License status of the function block.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • MAN (Manual) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms, (see section 5.2).
Status Handling	The **INPUT_OPTS** bit string controls the use of auxiliary inputs with less than Good status. The status of unused inputs is ignored. The status of the output is the worst of the inputs used in the calculation after applying **INPUT_OPTS**.

5.10 Signal Characterizer block

The Signal Characterizer block describes the input/output relationship for any type of function. The block has two paths, each with an output that is a non-linear function of the corresponding input. The non-linear function is configured based on a single look-up table with 21 arbitrary x-y pairs. To use the block in a control or process signal path, the status of an input is provided to the corresponding output. To use the backward control path, the block provides an option to swap the axes of the function.

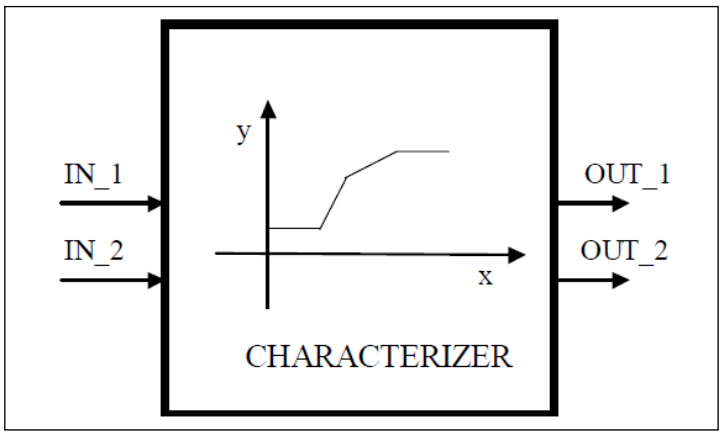


Figure 18: Signal Characterizer Block

The block calculates **OUT_1** from **IN_1** and **OUT_2** from **IN_2** using a curve given by the co-ordinates:

[x1; y1], [x2; y2] ... [x21; y21]

Where,

- x is the Input, and
- y is the Output.

The x-coordinates are given in engineering units of **X_RANGE**. The y-coordinates are given in engineering units of **Y_RANGE.**

Execution

Figure describes the components of the block. The output value is calculated by linear interpolation between two points enclosing the input value. **OUT_1** is associated to **IN_1** and **OUT_2** to **IN_2** by the same curve, but there is no association between **IN_1** and **IN_2** or between **OUT_1** and **OUT_2**.

To derive the output value that corresponds to the input, use the following formula,

$$y = mx + c$$

Where,

- m is the slope of the line.
- c is the y-intercept of the line

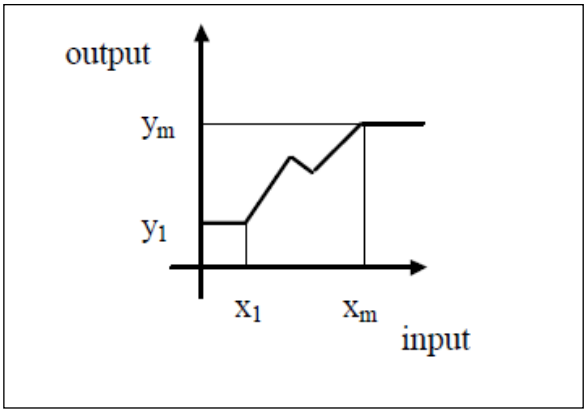


Figure 19: Signal characterizer curve

The values of x must increase sequentially for interpolation to be applicable. If not, a configuration error is set in **BLOCK_ERR**, and the **Actual** mode of the block goes to **Out of Service** mode.

If the curve has m points, m<21, the non-configured points, [xm+1; ym+1], [xm+2; ym+2], ... [x21; y21] is set to +INFINITY to mark them as unused.

Since x1 is the smallest specified value for the input and x_m is the largest, the output is at y1 when the input is smaller than x1, and the output is at y_m when the input is larger than x_m. Since the ends of the y curve act as limits, the **OUT** status is shown when either limit is active.

Backward Control path

A reverse function swaps the interpretation of **IN_2** and **OUT_2** that provides a way to do reverse calculation using the same curve. If the parameter **SWAP_2** is set to True, the block provides:

IN_1 = x and **OUT_1** = y while **IN_2** = y and **OUT_2** = x

If the function is not sequential in y and SWAP_2 is True, **BLOCK_ERR** indicates a configuration error, and the **Actual** mode goes to **Out of Service** mode for x. A function is said to be sequential when y values always increase or decrease when x values increase.

If **SWAP_2** = False, **IN_1** and **IN_2** have the same engineering units defined in **X_RANGE** and **OUT_1** and **OUT_2** use the units defined in **Y_RANGE**.

If **SWAP_2** = True, **OUT _1** and **IN_2** have **Y_RANGE** and **OUT_2** and **IN_1** have **X_RANGE**.

Parameter list

Table 24: Signal Characterizer block parameters

Parameter	Description
ST_REV	The revision level of the static data associated with the function block. The revision value is incremented each time a static parameter value in the block is changed.
TAG_DESC	The use description of the intended application of the block.
STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK	The actual, target, permitted, ad normal modes of the block. Target: The mode to "go to" Actual: The mode the "block is currently in" Permitted: Allowed modes that target may take on Normal: Most common mode for target
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
OUT_1	The block output value and status.
OUT_2	The block output value and status.
X_RANGE	The display scaling of the variable corresponding to the x-axis for display. It has no effect on the block.
Y_RANGE	The display scaling of the variable corresponding to the y-axis for display. It has no effect on the block.
GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. (Not used by the device)
IN_1	The block input value and status.
IN_2	The block input value and status.
SWAP_2	Changes the algorithm in such a way that IN_2 corresponds to "y" and OUT_2 to "x".
CURVE_X	Curve input points. The "x" points of the curve are defined by an array of 21 points.
CURVE_Y	Curve input points. The "y" points of the curve are defined by an array of 21 points.
UPDATE_EVT	This alert is generated by any changes to the static data.
BLOCK _ALM	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active sets the active status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task other block alerts may be reported without clearing the active status, if the subcode has changed.
LICENSE_STATUS_SC	License status of the function block.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • MAN (Manual) • OOS (Out of Service).
Alarm Types	The block supports standard block alarms, (see section 5.2).
Status Handling	**OUT_1** shows the status of **IN_1** and **OUT_2** shows the status of **IN_2**. The sub-status is also passed to the outputs. If one of the curve limits is reached or the input is limited, the appropriate limit must be indicated in the output sub-status. Limits shall be reversed if the curve slope is negative. If **SWAP_2** is set, cascade initialization is controlled by the lower block. When this block is in OOS mode, the cascade to both the lower and upper blocks is broken by Bad status at the outputs. When the block goes to AUTO mode, the lower block can begin cascade initialization with status values that pass through this block to the upper block. The output status signals from the upper block pass through this block to the lower block. The block does not use **STATUS_OPTS**.

5.11 MAO Block

Execution

The MAO block provides its eight input parameters to the I/O subsystem. The output function block acts upon the inputs from another function block and passes its output to the LCD Transducer block. However, if an input has a fault state status, the previous value or a user set value (FSTATE_VAL1 - FSTATE_VAL8) is passed depending on the options (MS_OPTS) that have been enabled.

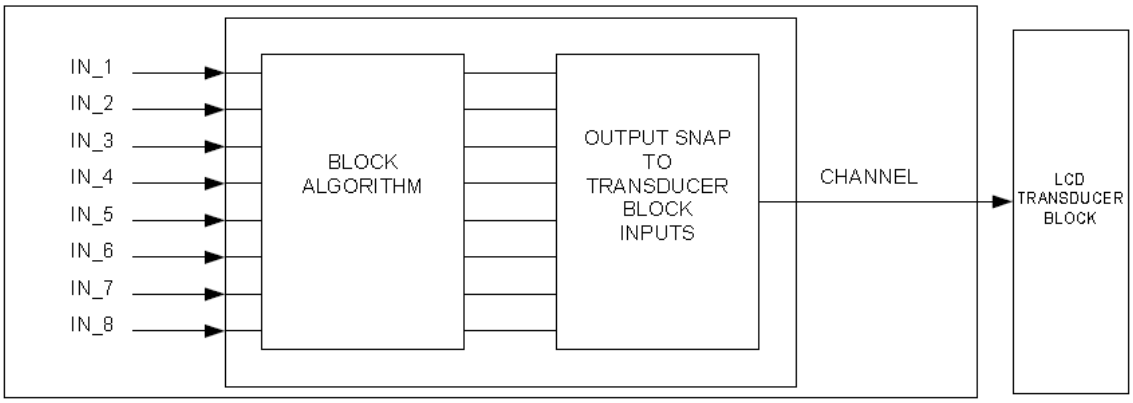


Figure 20: Multiple Analog Output block

Fault State

If Blocks and inputs in the MAO function block are not in the normal state, then MAO function block will update the fault state status. FSTATE_STATUS parameter of MAO function block can be used to confirm inputs in the fault state status. Transition to fault state occurs if the input status stays in the Bad status for longer than the time set using FSTATE_TIME parameter of MAO function block. When the MAO function block is in LO mode, all the inputs transferred to LCD Transducer Block transition to the fault state status.

Fault State Operation

Operation in fault state status is defined by MO_OPTS.

MO_OPTS		Definition
Bit	**Name**	
0	Fault state to value 1	Used when the input 1 is in the fault state
1	Fault state to value 2	Used when the input 2 is in the fault state
2	Fault state to value 3	Used when the input 3 is in the fault state
3	Fault state to value 4	Used when the input 4 is in the fault state
4	Fault state to value 5	Used when the input 5 is in the fault state
5	Fault state to value 6	Used when the input 6 is in the fault state
6	Fault state to value 7	Used when the input 7 is in the fault state
7	Fault state to value 8	Used when the input 8 is in the fault state
8	Use fault state value on restart 1	Used when the input 1 is in the fault state at restart
9	Use fault state value on restart 2	Used when the input 2 is in the fault state at restart
10	Use fault state value on restart 3	Used when the input 3 is in the fault state at restart

11	Use fault state value on restart 4	Used when the input 4 is in the fault state at restart
12	Use fault state value on restart 5	Used when the input 5 is in the fault state at restart
13	Use fault state value on restart 6	Used when the input 6 is in the fault state at restart
14	Use fault state value on restart 7	Used when the input 7 is in the fault state at restart
15	Use fault state value on restart 8	Used when the input 8 is in the fault state at restart

Parameter list

Table 25: MAO block parameters

Parameter	Description/Remarks
ST_REV	The revision level of the static data associated with the function block.
TAG_DESC	The user description of the application of the block.
STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block.
ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
CHANNEL	It is used for accessing LCD Transducer Block of RMA803 device.
IN_1	This is an input1 for the MAO function block.
IN_2	This is an input2 for the MAO function block.
IN_3	This is an input3 for the MAO function block.
IN_4	This is an input4 for the MAO function block
IN_5	This is an input5 for the MAO function block.
IN_6	This is an input6 for the MAO function block.
IN_7	This is an input7 for the MAO function block.
IN_8	This is an input8 for the MAO function block.
MO_OPTS	This is an optional parameter for specifying output operations for the MAO function block. It is mainly used for specifying values to be transferred to LCD Transducer Block in fault state status.

FSTATE_TIME	The delay time(in seconds) the MAO function block takes to set the fault state status if an input becomes Bad and stays in that state fault state.
FSTATE_VAL1	A value transferred as input 1 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL2	A value transferred as input 2 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL3	A value transferred as input 3 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL4	A value transferred as input 4 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL5	A value transferred as input 5 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL6	A value transferred as input 6 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL7	A value transferred as input 7 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_VAL8	A value transferred as input 8 to LCD Transducer Block during fault state condition. Transition will occur if MO_OPT bit is enabled.
FSTATE_STATUS	List of inputs that have transitioned to fault state status.
UPDATE_EVT	Indicates event information when an event update (a change in set values) occurs.
BLOCK_ALM	Indicates alarm information when a block alarm occurs.

Attributes

Supported Modes	The block supports the following modes: • AUTO (Automatic) • LO • O/S.
Alarm Types	Standard block alarm will be supported.
Status Handling	The status values described in the Parameter Formal Model of Part 1 apply.

5.12 Configuring the Remote Indicator using Field Device Manager (FDM) system

The Remote Indicator can be configured through Field Device Manager, by using DTM/DD for R440 release and by using DTM for R430 and R410 release. For more information, refer the FDM manual #EP-FDM-11430, #EP-FDM-11410.

6. RMA803 FF Remote Indicator Operation

6.1 Operational considerations

There are a number of considerations that must be noted when configuring a Remote Indicator to operate in a fieldbus network.

LAS Capability

The Remote Indicator is capable of operating as the Link Active Scheduler (LAS). The LAS is a fieldbus feature which controls traffic on the network, such as controlling token-rotation and coordinating data publishing. This fieldbus function is active in only one device at any given time on a network. Devices which can be designated as the LAS may be an operator station or a field device. The Remote Indicator can be designated as LAS, in the event of a failure of the primary LAS, control in the field could continue.

ATTENTION

Note that the Remote Indicator can be used only as “backup” LAS.

Special Non-volatile parameters and NVM Wear-out

All function block parameters designated as Non-Volatile (NV) in the FF specifications are updated to non-volatile memory (NVM) on a periodic basis. **NV_CYCLE_T** parameter in the resource block specifies this update interval.

To provide predictable restart behavior in the Remote Indicator, the following Non-Volatile parameters are updated to NVM each time they are written over the fieldbus.

- **MODE.TARGET** for all blocks
- **SP.VALUE** for the PID block

Since these are user-written parameters, these additional updates to NVM contribute negligibly to NVM wear out. However, users are cautioned to not construct control configurations where the above parameters are written continuously (via a computer application for example) or at rates greater than the **NV_CYCLE_T** interval. This consideration helps to minimize the possibility of NVM wear-out.

In the case of MODE this must not be a problem. When users wish to provide set-points to the PID block via a computer application, users should use RCAS mode with its corresponding set point value **RCAS_IN**. **RCAS_IN** is updated only at the **NV_CYCLE_T** update rate and this mode supports full shedding functionality and PID initialization necessary for a robust application.

Mode Restricted Writes to Parameters

Some block parameters have restrictions on having write access to them. These are specified in the FF specifications. Writing to certain function block parameters are restricted based on the block’s Target and/ or Actual mode.

6.2 Configuration of the RMA803 Remote Indicator using Handheld (HH)

Figure 21 graphically represents the connection of the RMA803 Remote Indicator to the handheld. Each Remote Indicator includes a configuration database that stores its operating characteristics in a non-volatile memory. The handheld is used to establish and/or change selected operating parameters in a RMA803 Remote Indicator database. The process of viewing and/or changing database parameters is called configuration.

Configuration can be accomplished both online and offline with the Remote Indicator powered up and connected to the handheld. The online configuration immediately changes the Remote Indicator operating parameters. For offline configuration, Remote Indicator operating characteristics are entered into the handheld memory for subsequent downloading to a Remote Indicator.

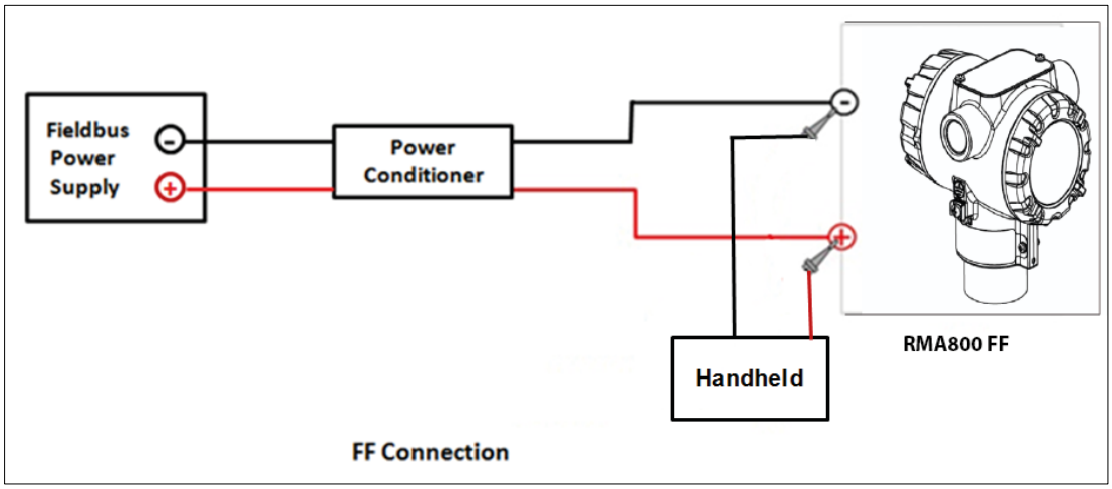


Figure 21: Connecting the Remote Indicator to the handheld

6.3 Performing block instantiation

About block instantiation

A block instance is a copy of an available block in the device. There are totally 10 permanent blocks, and ten instances of 4 functional blocks can be created. Only 4 blocks support instantiation in a device. The Four blocks that support instantiation are Input Selector block, Signal Characterizer block, PID block, and Arithmetic block. A block can be instantiated or deleted.

Before block instantiation, the device checks whether the particular block is supported, and if there is sufficient memory to store the parameters. After Instantiation, the instantiated block must be loaded into the device, and then the strategies can be created.

ATTENTION

Note that ten blocks can be instantiated at a time. For example, you can instantiate 3 Input Selector and 3 Signal Characterizer block, 1 PID Block and 3 Arithmetic block.

Block instantiation using Experion PKS

The following are the steps for performing block instantiation using Experion PKS.

Step	Action
1	From the DD at the **Library-Containment** window, select an instantiation block from the supported blocks, that is Analog Input block, or Input Selector block, or Signal Characterizer block.
2	Drag and drop the required instantiation block into the device on the **Project-Assignment** window.
3	After adding the instantiation block into the device in the **Project-Assignment** window, select the device.
4	Right-click the device, and click **Load**. The instantiated block is loaded into the device.

7. RMA803 FF Remote Indicator Maintenance

7.1 Overview

This section provides information about preventive maintenance and replacing damaged parts. The topics covered in this section are:

- Replacement of damaged parts such as the Remote Indicator Printed Wiring Assembly (PWA).

7.2 Preventive Maintenance Practices and Schedules

The RMA803 Remote Indicator does not require any specific maintenance at regularly scheduled intervals.

7.3 Replacing the Local Display and Communication Electronic Assembly

The Communication module includes a connector to the Display module. This section includes the procedure to replace the Communication module.

The Remote Indicator does not have to be removed from service to replace the Comm Module

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

Refer to Figure 22 for parts locations.

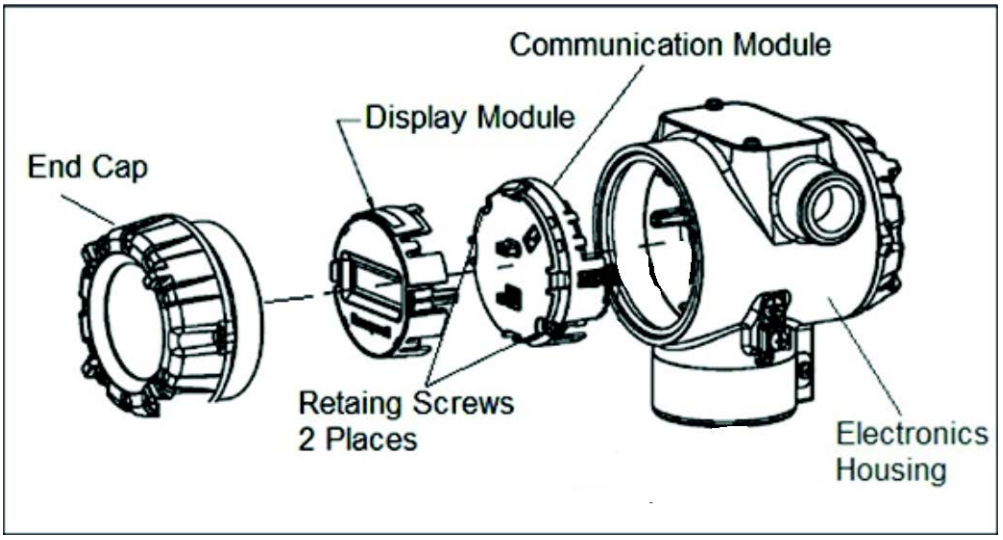


Figure 22: PWA Replacement

1. Turn OFF Remote Indicator power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosionproof and Class 1 Div 2 environments).

    - When removing the Communications Module with power applied, the loop will go to 0V. Likewise, installing a Communications Module into a Remote Indicator with power applied will cause the loop output value to go to 12 ma for several seconds then the loop output value will go to the configured value based on the PV input.
    - Installing a Display Module into a powered Remote Indicator may cause a temporary upset to the loop output value.

2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Remote Indicator housing.
3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.
4. If necessary, unplug the Display interface connector from the Communication module. **Do not discard the connector**.
5. Loosen the two retaining screws, and carefully pull the Communication module from the Electronics compartment.
6. Carefully, insert the Communication module into the Electronics compartment.
7. Tighten the two Communication module retaining screws.
8. Refer to the SmartLine User's Manual to change the FAILSAFE, READ/WRITE, and SIM-OFF/SIM-ON (Fieldbus Only) configuration settings.
9. If applicable, re-install the Display module as follows:

a) Orient the display as desired.

b) Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.

c) Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window.
You can rotate the meter mounting orientation in 90o increments.

10. Apply Parker Super O-ring Lubricant or equivalent to the end cap O-ring before installing the end cap. Reinstall the End Cap and tighten the End Cap locking screw.
11. Installing Optional External Configuration Button Assembly.

a) Loosen (Do Not Remove) both top nameplate screws and pivot nameplate 90°.

b) Align the protrusion on the button assembly with the matching opening in the housing and snap the button assembly into the housing.

c) Rotate the nameplate back to the original position, and tighten the nameplate screws.

(Steps 13 - 16 required for Field Upgrades Only)

12. Loosen the End Cap locking screw and unscrew the End Cap from the Field Wiring side of the Remote Indicator housing.
13. Select the proper Communication/External Configuration upgrade kit label from the label strip provided and adhere to the inside of the Field Wiring compartment End Cap.
14. Apply Parker Super O-ring Lubricant or equivalent to the end cap o-ring before installing the end cap. Reinstall the End Cap and tighten the end cap locking screw
15. Install external upgrade label (i.e. DEVICE MODIFIED…..) provided on outside of housing.
16. Restore power if removed.
17. Check the settings of the Remote Indicator Setup and Display Setup parameters to make sure that the Remote Indicator is configured correctly for your application.
18. If applicable, verify External Button Configuration operation.
    Ready to go.

7.4 Downloading the firmware

About firmware download feature

The download class indicates how the device operation is affected by the download process. There are three types of download classes (1, 2 &3). The Remote Indicator supports only one type of download class as per FOUNDATION Fieldbus specifications. RMA803 REMOTE INDICATOR device FF variant supports download type Class 3 only. A class-3 firmware download is performed, irrespective of whether the device is ON /OFF process.

Class 3

When class 3 download is performed the device prepares for the download and goes out of the link as the memory of the device is re-written with the new firmware. After the restart of the device, the device comes back to the link automatically. However, the device retains the following credentials,

- Retains its original Device ID
- Retains only its System Management **VFD** in its **VFD_LIST**
- Retains its Node Address and **PD** Tag
- Retains its management **VCR** to provide access to the SMIB.

ATTENTION

Note that the Node Address and **PD** Tag does not retain, when the firmware is upgraded from one version to the other.

Recommendations

If firmware upgrade is required for a large number of RMA803 REMOTE INDICATOR devices, the following are the guidelines,

1. **Backup Diagnostics must be done only during the firmware update**. The diagnostics will initialize to zero if this is not done during the firmware update.
2. **Only one device firmware download is allowed in a given H1 Link process**:
   Firmware download to multiple devices must happen one after another in the same link. However, parallel downloads can be performed to devices on different H1 links.
3. **Download firmware to one device type at a time in a H1 link:**
   This reduces the chance for unknown interactions between devices to cause link issues or download failures.
4. **Reduce usage of DTM through tools like FDM in the H1 link:**

This reduces the traffic on the link and therefore reduces the time required for the download to complete.

5. **Parallel Firmware downloads from single CB**
   Firmware downloads to a single FIM should be done from single CB instance. This reduces the chance of initiating multiple downloads to the same H1 link from different users.
6. **FF segment** design (the choice of devices to connect to a FF segment) must consider the maximum current draw of those devices, as well as the potential for inrush current during power-up.

   For reference, the RMA803 REMOTE INDICATOR provides the following:

   - Max current draw (observed during firmware download): 28 mA
   - Normal quiescent current: 18 mA
   - Inrush when powered on: 28 mA

Downloading the File

The firmware file to be downloaded is called as Gendomain file and have the file extension .ffd.

File Name

The file name is constructed as follows:

"Manufacturer ID" + "_" + "Device Type" + "_" + "Domain Name" " + "_" +"Software Name" + "_" +"Software Revision" + "." + "ffd", where:

- **Manufacturer ID** is represented as six hexadecimal digits (leading and trailing zeroes are included).
- **Device Family** is represented as four hexadecimal digits (leading and trailing zeroes are included). For Multidomain devices, Device Family is replaced by Multidomain Family.
- **Device Type** is represented as four hexadecimal digits (leading and trailing zeroes are included).
- Leading "0"s is not suppressed for **Manufacturer ID** and **Device Type**.
- Trailing blanks are stripped from Device Family, Domain Name, Software Name, and Software Revision.
- If **Software Name** or **Software Revision** is composed of all blanks, then the underscore that would have preceded is omitted to prevent names with two adjacent underscores, or from having the underscore character appear directly before the ".ffd".

For example, if the file contains the following header values,

Manufacturer ID = "48574C"

Device Type = "0005"

Domain Name = "DOM01"

Software Name = "FD-SW"

Software Revision = "2-41"

Then the file name would be:

"48574C0005_0005_FD-DOM_FD-SW_2-41.ffd".

ATTENTION

In the RMA803 Remote Indicator, only communication board firmware can be upgraded using the class 3 download. Display boards' firmware upgrade is not possible through FF link in the current release

7.5 Licensing for Function Blocks

Enabling the 'Additional Function blocks' option in device requires user to activate the license. Therefore, the following steps need to be followed in order to activate that option:

If the license is required after the device was originally shipped:

- Retrieve the device unique serial number by going to Device Information Menu
- Place an order with below information
    - Serial number of the device
    - Device Type: Fieldbus Remote Indicator
    - Feature requires license: Additional Function Block (Part Number - 50097037-501)
- The RDC generates and sends a License Key to customer.
- Customer activates the license by writing 'License Key' parameter present in Device Information menu. This can be activated through DD host and Local display.

ATTENTION

Serial number can be found in Device Information menu of DD view and Local display.

To view the activated license:

- For Local Display: Ensure that **Menu>Information>Options>Additional FB** option is enabled.
- For Host: Ensure that **Resource Block>Device Information>Options Present>Additional FB** option is checked/red dot appears.

8. RMA803 FF Remote Indicator Troubleshooting

8.1 Troubleshooting overview

This section contains information to help you identify the faults in devices and the recommended actions to correct them. Troubleshooting is performed to determine the cause of the fault by analyzing the device indications (such as device not visible on network or not able to write values to parameters.)

Device status and faults

The Remote Indicator constantly runs internal background diagnostics to monitor the functions and status of the device operations. When errors and/or faults are detected, they are reported in the status bits of certain block parameters, (for example, **BLOCK_ERR**). The other parameters can be seen by viewing the status descriptions and/or a value, which may help to identify a fault.

Device status and operational faults are identified by viewing key parameter values or status and then interpreting their meaning using the following tables.

ATTENTION

Additional diagnostics are available through supervisory and control applications that monitor and control fieldbus networks. These diagnostics and messages are dependent upon the capabilities of the application and the control system that is used.

8.2 Troubleshooting the Remote Indicator

Device not visible on the network

If a device cannot be seen on the fieldbus network, the device may not be powered up or possibly the supervisory or control program is not able to find (or polling) the node address of that device. See the following table for possible causes and recommended actions.

Symptoms		
Device not visible on the network		
Possible cause	**Things to check**	**Recommended action**
Device may have a node address that is within the “unpolled range” of addresses.	Verify the following settings: • First Unpolled Node • Number of Unpolled Nodes	Set Number of Unpolled Nodes to “0”.
No power to the device.	Measure the DC voltage at the device’s SIGNAL terminals. Voltage must be within the limits.	If no voltage or voltage is out of operating limits, determine the cause and correct it.
Insufficient current to the device.	Measure the DC current to the device. The DC current must be within the limits.	If the current is insufficient, determine the cause and correct it.
More than two or less than two terminators are wired to fieldbus link.	Check to see that only two terminators are present on a link.	Correct, if necessary.
Insufficient signal to the device.	Measure the peak-to-peak signal amplitude. The output must be 0.75 to 1.0 Vp-p. Measure the signal on the + and - SIGNAL terminals and at a frequency of 31.25k Hz.	If the signal amplitude is insufficient, determine the cause and correct it.
Names of parameters are not visible.	Missing or incorrect version of Device Description file on host computer.	Check the path to the Device Description. Load correct version of DD.

Incorrect or non-compatible tools

If non-compatible versions of fieldbus software tools are used, such as Standard Dictionary or Device Description (DD) files, or if you are using the incorrect revision level of device firmware, then device objects or some block objects may not be visible or identified by name. See the following table for the possible causes and recommended actions.

Symptoms		
Device and/or block objects not identified (Unknown). ***Or*** ***Parameters are not visible or identified by name.*** ***Or*** ***Honeywell-defined parameters are not visible.***		
Possible cause	**Things to check**	**Recommended action**
Incorrect Standard Dictionary, Device Description (DD) or Symbols on host computer.	Verify that the Standard Dictionary, the DD or symbols files are correct for the device.	Install the compatible version of Standard Dictionary and DD for the device on the host computer.
Incorrect pathnames to descriptions on host computer.	Check that the pathnames to locations of the Standard Dictionary, and DD files on the host computer are correct.	Make sure that the pathnames of the Standard Dictionary and DD are in the correct location for the fieldbus software application.
Incorrect version of device firmware	Read the following Resource block parameters: • **DEV_REV** (contains the revision level of the resource block). • **DD_REV** (contains the device description of the resource block).	Perform a code download of the correct device firmware. See Section Class 3.

8.3 Troubleshooting blocks

Non-functioning blocks

Device block objects may not be running (executing their function block schedules) or the blocks may be in Out of Service (OOS) mode due to block configuration error. For example, if the PID function block is in OOS mode, the block does not provide updated output values, although the PID block may be running. While troubleshooting a non-functioning block objects, it is recommended to start with the resource block. For example, if the resource block is in OOS mode, all other blocks in the device are also in the OOS mode.

Troubleshooting block configuration errors

The block configuration errors prevent a device block from leaving the OOS mode. The **BLOCK_ERR** parameter (bit 1) shows whether a block configuration error is present. The following section explains the troubleshooting for all the function blocks:

Troubleshooting the Resource block

Table 26: Resource block

Problem cause	Things to check	Recommended action
Resource block mode is OOS mode and is not going to AUTO mode.	Read **MODE_BLOCK.PERMITTED**	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE:** If the mode is set to OOS for maintenance, then do not change the mode to AUTO.
Resource block is not running.	Check **BLOCK_ERR** for errors.	See **Table 12** for details on **BLOCK_ERR**.
Incorrect revision level of the device firmware.	Read **REVISION_ARRAY**	See section 8.2
Block alarms are not reported.	Read **FEATURE_SEL**	**Reports** are not selected in **FEATURE_SEL**. If features do not include Reports then the host must poll for alarms.
	Read **LIM_NOTIFY**	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.
Field diagnostics alarms are not reporting.	Check Field Diagnostics MASK.	If the alarms are MASKED, then the alarms do not report. Unmask the alarms.
	Check Field Diagnostics Priority.	If the priority is zero alarms do not report. For information on how set the priority, see **Table 13**.
	Check Field Diagnostics MAP.	If alarms are not mapped, then Map alarms to any of the Field Diagnostics alarm parameters.

Troubleshooting the Diagnostics Transducer block

Table 27: Diagnostics Transducer block

Problem cause	Things to check	Recommended action
Diagnostic Transducer block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE:** If the mode is set to OOS for maintenance then do not change the mode to AUTO.
Block alarms are not reported.	Read **FEATURE_SEL**	**Reports** are not selected in **FEATURE_SEL**. If features do not include reports then the host must poll for alarms.
	Read **LIM_NOTIFY**	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the LCD Transducer block

Table 28: LCD Transducer block

Problem Cause	Things to check	Recommended Action
LCD Transducer block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE** If the mode is set to OOS for maintenance, then do not change the mode to AUTO.
Writing to display parameters fails.	Check for local display.	Advanced Display is required for **LCD_TB** to work.
		If display is available, remove and reconnect the local display, and check if display powers up.
		If display is not powering up contact Honeywell TAC. **NOTE** If a user goes to menus/sub menus in the display, the parameter change will fail. He must navigate out of the menus.
Writing to some of display parameter in **SCREEN_1**, **SCREEN_2**, **SCREEN_3,** **SCREEN_4,** **SCREEN_5,** **SCREEN_6,** **SCREEN_7,** and **SCREEN_8** fails.	Check **DISPLAY_TYPE**.	If there is No Display, then writing to the parameters fails. Parameters write is supported if Advanced display is connected.
Local display shows Attention as title with some text.	Check the **DISPLAY_MESSAGE** parameters.	Remote Indicator messaging is activated; to clear the message executed the Clear Message method. For more information see section 5.5
Block alarms are not reported.	Read **FEATURE_SEL**.	**Reports** are not selected in **FEATURE_SEL**. If features do not include Reports then the host must poll for alarms.
	Read **LIM_NOTIFY**	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the Proportional Integral Derivative (PID) block

Table 29: PID block

Problem Cause	Things to check	Recommended action
PID block mode is in OOS mode, and does not change to AUTO, CAS, RCAS and ROUT mode.	Read **MODE_BLOCK.PERMITTED**.	Add AUTO, CAS, RCAS and ROUT modes to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE:** If the mode is set to OOS for maintenance then do not change the mode to AUTO.
	Check the License Status parameter value of the block	Check whether License for additional function blocks has been purchased. Otherwise purchase the license and then upgrade.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
PID block mode is in OOS mode with Block configuration Error.	Read parameters: **BYPASS** **SHED_OP**	The default values of these parameters are configuration errors and they must be set to a valid range. See **Table 34**.
	Read **SP_HI_LIM**, **SP_LO_LIM** **OUT_HI_LIM**, **OUT_LO_LIM**	Check that **SP_HI_LIM < SP_LO_LIM**, **OUT_HI_LIM < OUT_LO_LIM**.
PID block is not running.	Read the first element of **BLOCK_TEST**. Number must be increasing indicating that block is running.	If the second element of **BLOCK_TEST** is nonzero, write all zeroes to element.
	If block is not running, check the second element of **BLOCK_TEST**.	
Mode does not change from IM, target mode is MAN, AUTO, or Cas.	No path to process.	Assure that the downstream blocks to at least one AO are all in Cas mode and that the path ends in an AO block. All BKCAL connections must be linked.
Mode does not change from MAN; target mode is MAN, AUTO, or Cas.	Check Input blocks.	The status of IN is Bad, not connected.
Mode does not go to Cas, target mode is Cas.	Check Upstream block.	The upstream block cannot not able to complete cascade initialization for some reason. Assure that **BKCAL_OUT** is connected to **BKCAL_IN** of the upstream block.

Problem Cause	Things to check	Recommended action
Value of output does not make sense	Check Cascade Initialization	Assure that the output can move an actuator.
Block alarms are not reported	Read **FEATURE_SEL**	**Reports** are not selected in **FEATURE_SEL**. If features do not include Reports then the host must poll for alarms.
	Read **LIM_NOTIFY**	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the Input Selector block

Table 30: Input Selector block

Problem Cause	Things to check	Recommended Action
Input Selector block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**.	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE**: If the mode is set to OOS for maintenance then do not change the mode to AUTO.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
	Check the License Status parameter value of the block	Check whether License for additional function blocks has been purchased. Otherwise purchase the license and then upgrade.
Input Selector block mode is in OOS mode with Block configuration Error.	Check **SELECT_TYPE**	**SELECT_TYPE** must be set to a valid value and cannot be left at 0.
Status of output is Bad.	Check Inputs	Make sure at least one input has status as good.
	Check **OP_SELECT**	**OP_SELECT** is not set to 0 (or it is linked to an input that is not used), and it points to an input that is Bad.
	Check **MIN_GOOD**	Make sure that value entered in **MIN_GOOD** is greater or equal to actual number of Good inputs.

Problem Cause	Things to check	Recommended Action
Block alarms are not reported.	Read **FEATURE_SEL.**	Reports are not selected in **FEATURE_SEL**. If features do not include Reports then the host must poll for alarms.
	Read **LIM_NOTIFY**.	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the Integrator block

Table 31: Integrator block

Problem Cause	Things to check	Recommended Action
Integrator block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**.	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK.ACTUAL** of Resource block.	If necessary, set **MODE_BLOCK.TARGET** to AUTO. **NOTE**: If the mode is to OOS for maintenance, then do not change the mode to AUTO.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
	Check the License Status parameter value of the block	Check whether License for additional function blocks has been purchased. Otherwise purchase the license and then upgrade.
Integrator block mode is in OOS mode with Block Configuration Error.	Check **INTEG_TYPE**	**INTEG_TYPE** must not be zero/blank.
	Check **TIME_UNIT 1** and **TIME_UNIT 2**.	**TIME_UNIT1** & **TIME_UNIT 2** must not be zero/blank.
Value of output does not make sense.	Check **TOTAL_SP**.	**TOTAL_SP** must be set to a valid value and cannot be left at 0, if **INTEG_TYPE** is **UP_AUTO**, **DN_AUTO**.
Value of output is going in negative value.	Check **REV_FLOW1** and **REV_FLOW 2**.	For forward flow **REV_FLOW1** and **REV_FLOW 2** must be set as Forward, and for reverse flow **REV_FLOW1** & **REV_FLOW 2** must be set as Reverse.
	Check **INTEG_OPTS** Flow forward and flow reverse	For forward flow in **INTEG_OPTS** flow, forward must be selected and for reverse flow in **INTEG_OPTS** flow, reverse must be selected.
Block alarms are not reported.	Read **FEATURE_SEL**.	**Reports** are not selected in **FEATURE_SEL**. If features do not include Reports, then the host must poll for alarms.
	Read **LIM_NOTIFY**.	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the Arithmetic block

Table 32: Arithmetic block

Problem Cause	Things to check	Recommended Action
Arithmetic block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, set **MODE_BLOCK.TARGET** to AUTO. **NOTE**: If the mode is set to OOS for maintenance, then do not change the mode to AUTO.
Mode does not change from OOS.	Configuration error.	**BLOCK_ERR** shows the Block Configuration Error condition, since **ARITH_TYPE** is not set.
Value of output is incorrect	Error in configuration.	Ensure that engineering units are correct for the computation. If that fails, see section 3.
Block alarms are not reported.	Read **FEATURE_SEL**.	Reports are not selected in **FEATURE_SEL**. If features do not include reports then the host must poll for alarms.
	Read **LIM_NOTIFY**.	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Troubleshooting the Signal Characterizer block

Table 33: Signal Characterizer block

Problem cause	Things to check	Recommended action
Signal characterizer block mode is in OOS and does not change to AUTO mode.	Read **MODE_BLOCK.PERMITTED**.	Add AUTO mode to **MODE_BLOCK.PERMITTED**.
	Read **MODE_BLOCK. ACTUAL** of Resource block.	If necessary, Set **MODE_BLOCK.TARGET** to AUTO. **NOTE**: If the mode is set to OOS for maintenance, then do not change the mode to AUTO.
Mode does not change from OOS	Configuration error.	**BLOCK_ERR** shows the Block Configuration Error condition, due to array configuration errors.
Value of output is incorrect	Error in X or Y array.	See section 3.
Block alarms are not reported.	Read **FEATURE_SEL**	**Reports** are not selected in **FEATURE_SEL**. If features do not include reports then the host must poll for alarms.
	Read **LIM_NOTIFY**	Set **LIM_NOTIFY** to a value higher than zero, but not higher than **MAX_NOTIFY**.

Resolving the block configuration errors

Table 34 lists the parameters of all the blocks that can cause the status bit of Block Configuration Error to be set in their respective **BLOCK_ERR** parameters. The following table provides the initial values and the valid range for the parameters.

ATTENTION

Block configuration errors can only be cleared if the function block is being executed (running). One way of determining block execution is by doing a series of two or three reads of the **BLOCK_TEST** parameter and confirming that the first byte of the parameter is incrementing. This works, if the execute rate is fast relative to the speed of reading **BLOCK_TEST**. A very slowly executing block may not appear to execute as the parameters are updated only when the block executes.

Table 34: Resolving block configuration errors

Parameter	Initial Value	Valid Range	Corrective Action
ALERT_KEY	0	non-zero	Initial Value is a configuration error. Set value to non-zero number.
SIMULATE	1 (disabled)	1-2 (disabled -enabled)	Set value in valid range.
PV_FTIME	0	0-200	Set value to valid range.
ALARM_HYS	0.5 (%)	0-50 (%)	Set value to valid range.
HI_HI_PRI, HI_PRI, LO_LO_PRI, LO_PRI	0	0-15	Set value to valid range.
HI_HI_LIM, HI_LIM	+INF	+INF or within OUT_SCALE range	Set value to valid range.
LO_LIM, LO_LO_LIM	-INF	-INF or within OUT_SCALE range	Set value to valid range.
BYPASS	0	1:OFF, 2:ON	Initial value is a configuration error. Set value in valid range.
SHED_OPT	0	1-8 see Shed Options in the FF specs.)	Initial value is a configuration error. Set value in valid range.
HI_HI_LIM HI_LIM	+INF +INF	PV_SCALE, +INF	Values must be set in rank order. For example, LO_LIM > LO_LO_LIM but < HI_LIM etc.
LO_LIM LO_LO_LIM	-INF -INF	PV_SCALE, -INF	Values must be set in rank order.
OUT_HI_LIM OUT_LO_LIM	100 0	OUT_SCALE +/- 10%	Verify that OUT_HI_LIM > OUT_LO_LIM.
SP_HI_LIM SP_LO_LIM	100 0	PV_SCALE +/- 10%	Verify that SP_HI_LIM > SP_LO_LIM.

8.4 Device Diagnostics

RMA803 FF Remote Indicator memory

The Remote Indicator contains a number of areas of memory. An EEPROM provides a non-volatile memory area for static and non-volatile parameter values. The Remote Indicator also contains areas of RAM and ROM.

Performing diagnostics in the background

Block objects (Resource, Transducer and Function blocks), the communications stack and other device objects, each of them have an allotted area of memory for their corresponding database. Diagnostic routines are performed in the background during device operations that checks the integrity of these individual databases. When a failure is detected, a status bit is set in the **BLOCK_ERR** parameter in the appropriate block object. Diagnostic checks are performed continuously on the device functional databases of the Remote Indicator application shown in **Table 35**.

Table 35: Diagnostics

Device Functional Area	Location
Block object database (DB)	RAM and EEPROM
Communication stack database (DB)	EEPROM
Boot ROM	ROM
Program ROM	ROM
Trend and link object databases (DB)	ROM

BLOCK_ERR parameter

BLOCK_ERR parameter shows diagnostic faults of hardware and software components within the Remote Indicator. Each block object in the Remote Indicator device application contains a **BLOCK_ERR** parameter. **BLOCK_ERR** is actually a bit string, which provides a means to show multiple status or error conditions. A status message identifying the fault can be viewed by accessing the parameter. **Table 12** shows the bit mapping of the **BLOCK_ERR** parameter.

Background Diagnostics Execution, BLOCK_TEST parameter

To verify that block and background diagnostics are executing in a particular block:

View the **BLOCK_TEST** parameter of the block.

- If the first element of the parameter **BLOCK_TEST** is incrementing, the block is executing and the diagnostics are active.
- If the first element value is not increasing, the block is not executing.

8.5 Restoring the Remote Indicator to default settings

Remote Indicator Diagnostics

Remote Indicator faults are grouped into one of these two diagnostic categories and could cause the following results:

1. **Critical and Non-Critical Fault** — Remote Indicator continues to read PVs from other Remote Indicators connected to the RMA803.
2. **Block Configuration Errors** — Incorrect parameter values causes the Remote Indicator to generate a fault, for example, **BLOCK_ERR** or **MODE_BLK** = OOS.

Function Block Faults

Checking the status and values of key block parameters helps in identifying the type of function block fault whether it is critical or non-critical.

ATTENTION

Depending on the fieldbus interface application, device operating status and parameter values may appear as text messages. The text in the table is typical of values or messages seen when using the NI-FBUS configurator.

Critical Fault

In the case of a critical fault due to Memory Failure, NV/Static data loss or the readback check failure, writes to the **RESTART** parameter twice, for the Remote Indicator to fully recover from the fault condition. Therefore:

1. Write “4” or “restart processor” to **RESTART** parameter of resource block.
2. Wait until communication is established.
3. If the fault occurs again, repeat the write to the **RESTART** parameter.
4. If the fault occurs again, replace the Remote Indicator electronics module.

Note that if a ROM error (Memory Failure) occurs in the resource block, it may take up to 10 seconds for the fault to reappear.

8.6 Understanding simulation mode

About simulation mode jumper

If the process is not running, a simulation mode is available in the Remote Indicator which aids in system debug. When simulation mode is enabled, user can simulate Field Diagnostic Alarm from Resource Blocks.

Setting simulation jumper

A hardware jumper on the Communication Module assembly is set to enable or disable the **SIMULATE** parameter. See Figure 23 for jumper location.

Table 36 shows how to set the simulation jumper on the Communication Module assembly.

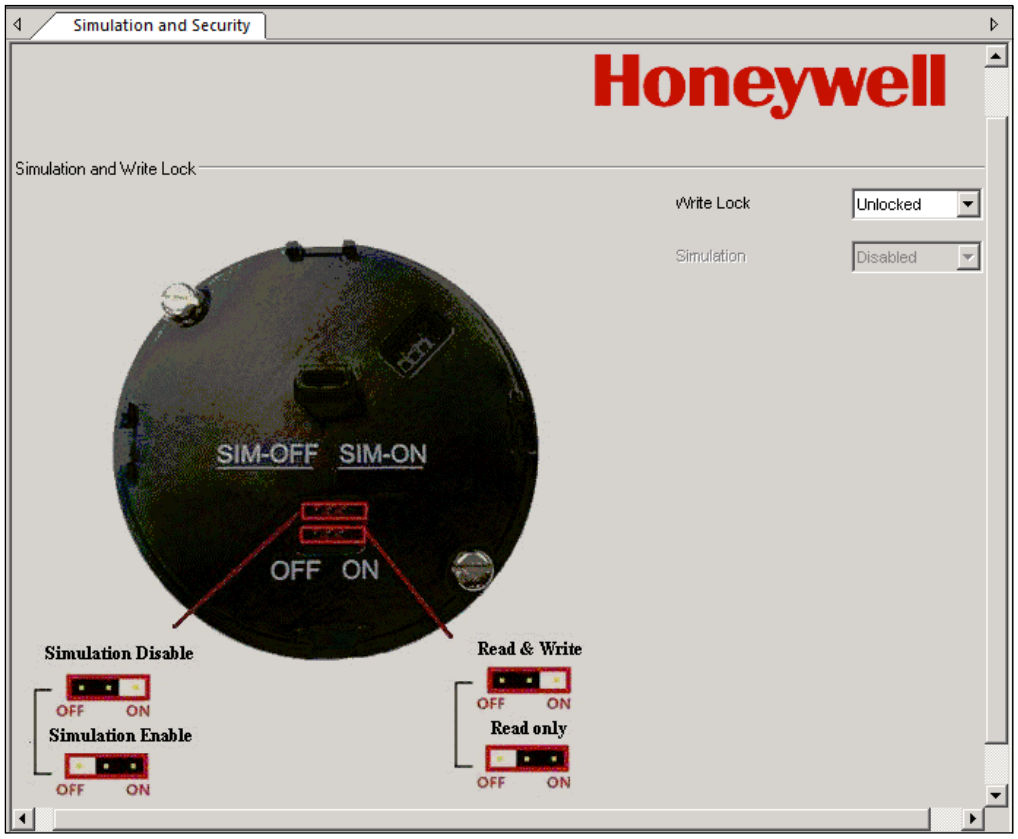
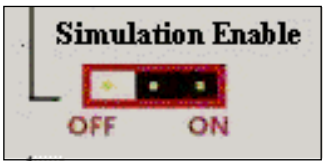


Figure 23: Simulation Write Lock Jumper Location on Comms Module assembly

Table 36: Setting the Simulation Jumper

To	Set the Jumper to:
Disable the **SIMULATE** parameter. (Set Remote Indicator for normal operation.)	"OFF" position on the Transducer board. 
Enable the **SIMULATE** parameter. (For testing or debugging purposes.)	"ON" position on the Transdducer board. 

Enabling simulation mode

The **SIMULATE** parameter is enabled by setting the hardware simulation jumper to the "ON" position.

Simulation mode truth table

Table 37 shows the states of the simulation jumper and **SIMULATE** parameter shows how to activate the simulation mode.

Table 37: Simulation Mode Truth Table

When the Simulation Jumper (HW_SIMULATE_JUMPER_STATE) on Transducer board is set to:	and the SIMULATE Enable_Disable is set to:	
	(Disabled)	(Active)
"OFF" Position	Simulation Disabled	Simulation Disabled
"ON" Position	Simulation Disabled	Simulation Active

8.7 Understanding write protection

The software write lock feature can be enabled, only if the hardware write lock feature is disabled. If the software write lock feature is enabled without disabling the hardware write lock feature, then the software write lock feature gets disabled automatically. If the hardware write lock feature is selected with the hardware jumper being enabled, the selection is rejected. See Figure for jumper location. For more information on write protection, see **Table 38**.

Table 38: Write lock

To	Set the Jumper to:
Disable the Read and Write lock. (In this mode, perform Read and Write operation.)	"OFF" position on the Transducer board. 
Enable the Write lock. (In this mode, read operation can be performed, but the write operation is disabled.)	"ON" position on the Transducer board. 

8.8 Critical Diagnostics Screens

When a Critical Diagnostic is present in the Remote Indicator, the Advanced Display will show the screen pictured in Figure 24. This screen will be inserted into the normal screen rotation and displayed between the user-defined operator screens. A description of the diagnostic conditions is given **Table 39**, along with suggested actions for resolving the problem.

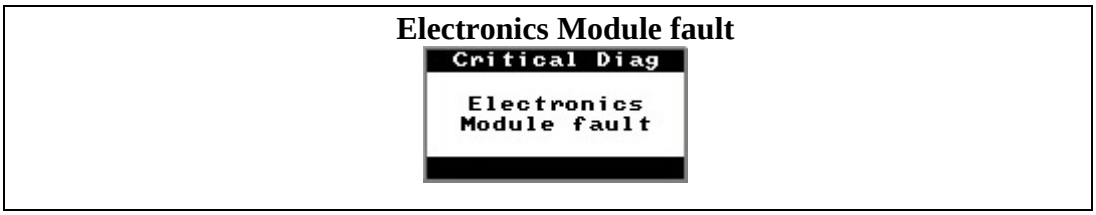


Figure 24: Local Display Fault Diagnostic Conditions

Fault Conditions and Recommended Corrective Actions

Table 39: Fault Conditions and Recommended Corrective Actions.

Condtion	Analysis	Recommended Corrective Action
Electronics Module Fault. A critical failure has been detected on the FF Electronics Module.	Use a FF communicator to read the detailed status information from the Remote Indicator. Refer to the appropriate communicator manual for more information about the possible failure causes.	Cycle power to the Remote Indicator. If the problem continues to occur replace the Electronics Module.

9. Parts List

9.1 Overview

Individually saleable parts for the various Remote IndicatorRemote Indicator models are listed in this section. Some parts are illustrated for identification. Parts are identified and listed in the corresponding tables as follows:

- Individually saleable parts are indicated in each figure by key number callout.

  Table 40 is a summarized list of recommended spare parts.

Table 40: Summary List of Recommended Spare Parts

Part Number	Description	Figure No.				
Electronics Housing Assembly						
50086423-505 50086423-506	FieldBus Electronics Module Without REED Sensor PWA FIeldBus Electronics Module With REED Sensor PWA	Figure 26	5	1	1-2	2-4
50075472-533 50075472-534	FieldBus Terminal Block Assy Without Lightning Protection FieldBus Terminal Block Assy With Lightning Protection	Figure 27	3	1	1	1-2

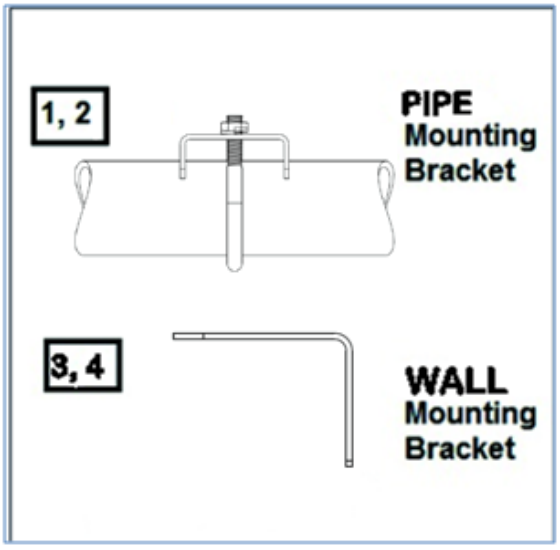


Figure 25: Pipe and Wall Bracket Parts

Table 41: Pipe and Wall Bracket Parts (Refer to Figure 25)

Key No.	Part Number	Description	Quantity Per Unit
1	50090524-501	Carbon Steel Pipe Bracket Mounting kit for all models	1
2	50090524-503	316 Stainless Steel Pipe Bracket Mounting kit for all models	1
3	50092363-501	Carbon Steel Wall Bracket Mounting kit for all models	1
4	50092363-503	316 Stainless Steel Wall Bracket Mounting kit for all models	1

Figure 26: Electronic Housing, Display End

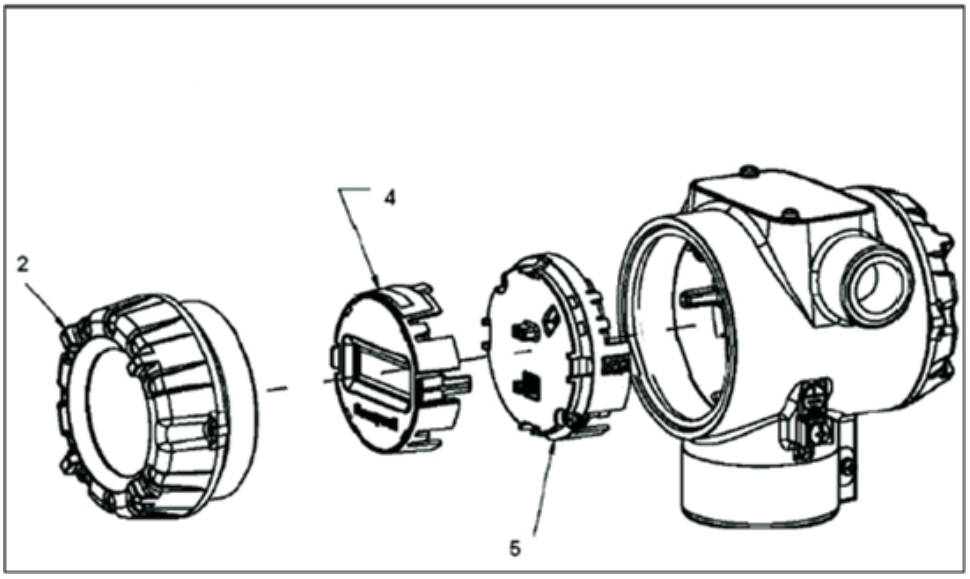


Table 42: Remote Indicator Major Assemblies

(Refer to Figure 27)

Key No.	Part Number	Description	Quantity Per Unit
2	50049832-501 50049832-521	End Cap, Display (Aluminum) End Cap, Display (Stainless Steel)	1 See Fig. 26
3	50075472-533 50075472-534	Terminal Assy FF/PB without Lightning protection Terminal Assy FF/PB with Lightning protection	1
4	50049846-501	Advanced Display	1 See Fig. 26
5	50049849-507 50049849-508	FF Electronics Module Assembly (PWA) without Reed sensor FF Electronics Module Assembly (PWA) with Reed sensor	1 See Fig. 26
6	50049915-501	External Zero, Span & Config Buttons	1
K1	30757503-005	Electronics housing seals kit (includes O-rings)	1

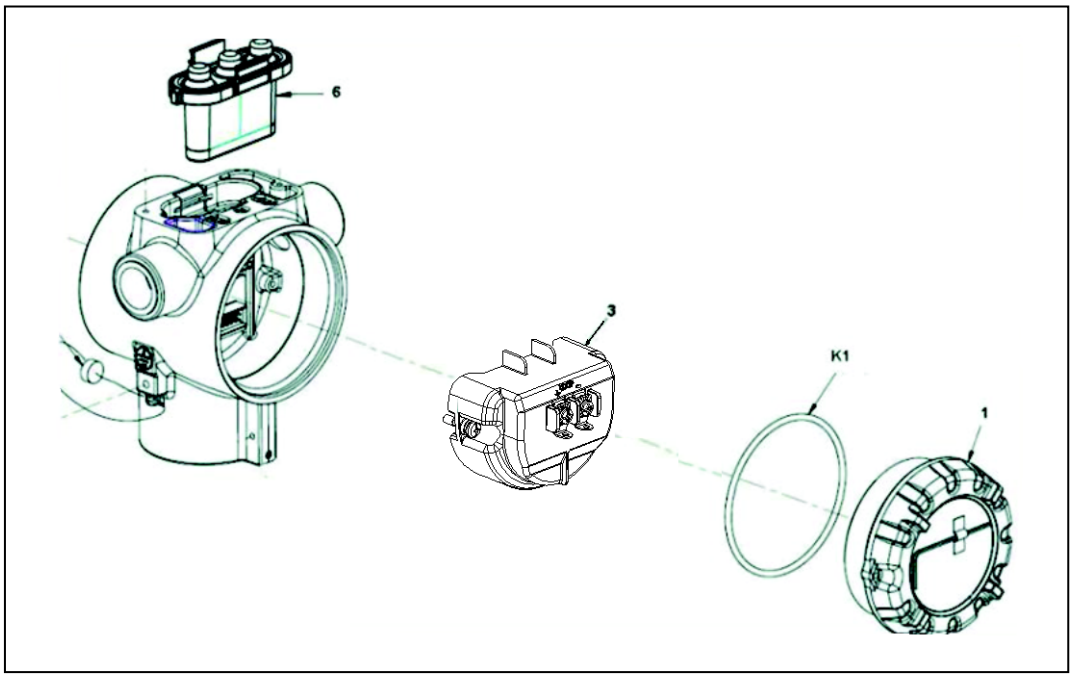


Figure 27: Electronic Housing, Terminal Block End

Appendix A. Product Certifications

A1. European Directive Information (CE Mark)

RMA800 SmartLine Remote Indicator Series EU Declaration of conformity (Document #32302406), can be downloaded here: EU Declaration

Hazardous Locations Certifications

MSG CODE	AGENCY	TYPE OF PROTECTION	Electrical Parameters	Ambient Temperature
A	FM Approvals ™ (USA)	**Explosion proof:** Class I, Division 1, Groups A, B, C, D; T6..T4 **Dust Ignition Proof:** Class II, III, Division 1, Groups E, F, G; T4 Class 1, Zone 1, AEx d IIC T4 Gb Class 2, Zone 21, AEx tb IIIC T 95ºC IP 66 Db	Note 1	T6: -50ºC to +65ºC T4, T5: -50 ºC to 85ºC
		Intrinsically Safe: Class I, II, III, Division 1, Groups A, B, C,D, E, F, G; T4 Class I Zone 0 AEx ia IIC T4 Ga	Note 2	-50 ºC to 70ºC
		Non-Incendive Class I, Division 2, Groups A, B, C, D; T4 Class I Zone 2 AEx nA IIC T4 Gc	Note 1	-50 ºC to 85ºC
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL
		Standards: FM 3600:2018;FM 3611: 2018; ANSI/ UL 60079-0: 2013; ANSI/ UL 60079-1: 2015; FM 3610: 2018; ANSI/ UL 60079-11: 2014; FM 3810: 2018; ANSI/ UL 60079-15: 2013; ANSI/ UL 60079-31 : 2015; FM Class 3615: 2018; FM 3616: 2011		
B	CSA-Canada	**Explosion proof:** CSA 14.2689056 Class I, Division 1, Groups A, B, C, D;T6..T4 **Dust Ignition Proof:** Class II, III, Division 1, Groups E, F, G; T4 Class I Zone 1 Ex db IIC T4 Gb Ex db IIC T4 Gb Zone 21 Ex tb IIIC T 95ºC Db Ex tb IIIC T 95ºC Db	Note 1	T6: -50ºC to +65ºC T4, T5: -50 ºC to 85ºC
		Intrinsically Safe: CSA 14.2689056 Class I, II, III, Division 1, Groups A, B, C, D, E, F, G; T4 Ex ia IIC T4 Ga	Note 2	-50ºC to 70ºC
		Non-Incendive CSA 14.2689056 Class I, Division 2, Groups A, B, C, D; T4 Class I Zone 2 Ex nA IIC T4 Gc Ex nA IIC T4 Gc	Note 1	-50ºC to 85ºC
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL

C	ATEX	**Flame-proof:** II 2 G Ex d IIC T4 Gb II 2 D Ex tb IIIC T 95°C Db	Note 1	-20 °C to 70°C
		Intrinsically Safe: II 2 G Ex ia IIC T4 Ga FISCO Field Device Ex ia IIC T4	Note 2	-50°C to 70°C
		Non-Incendive II 3 G Ex nA IIC T4 Gc	Note 1	-50°C to 70°C
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL
		STANDARDS: EN 60079-0: 2012; EN 60079-1 : 2007; EN 60079-11 : 2011; EN 60079-26 : 2006; EN 60079-31: 2009; EN 60079-15 : 2010; IEC 60529 : 2009 with Corr 3		
D	IECEx	**Flame-proof:** Ex d IIC T4 Gb Ex tb IIIC T 95°C IP 66 Db	Note 1	-20 °C to 70°C
		Intrinsically Safe: Ex ia IIC T4 Ga FISCO Field Device Ex ia IIC T4	Note 2	-50°C to 70°C
		Non-Incendive Ex nA IIC T4 Gc	Note 1	-50°C to 70°C
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL
		STANDARDS: IEC 60079-0: 2011, Edition 6; IEC 60079-1 : 2007-04, Edition 6; IEC 60079-11 : 2011, Edition 6; IEC 60079-15 : 2010, Edition 4 IEC 60079-26 : 2006, Edition 2; IEC 60079-31 : 2008, Edition 1, IEC 60529 : 2009 with Corr 3		
E	SAEx	**Flame-proof:** Ex db IIC T6..T5 Gb Ex tb IIIC T 95°C Db	Note 1	T6: -20°C to 65°C T95°C, T5: -20°C to 85°C
		Intrinsically Safe: Ex ia IIC T4 Ga Ex ic IIC T4 Gc	Note 2	-20°C to 70°C
		Non-Incendive Ex ec IIC T4 Gc	Note 1	--20°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL
		STANDARDS: IEC 60079-0: 2011; IEC 60079-1: 2014; IEC 60079-11: 2011; IEC 60079-7: 2006; IEC 60079-31: 2013		
P	CCoE/ PESO	**Flame-proof:** Ex db IIC T6..T5 Gb	Note 1	T6: -20°C to 65°C T5: -20°C to 85°C
		Intrinsically Safe: Ex ia IIC T4 Ga	Note 2	-20°C to 70°C
		Enclosure: IP66/ IP67	ALL	ALL
		STANDARDS: IEC 60079-0: 2011; IEC 60079-1: 2014; IEC 60079-11: 2011; IEC 60079-7: 2006; IEC 60079-31: 2013		

Notes

1. Operating Parameters:

Voltage= 12 to 42 V Current= 25 mA

2. Intrinsically Safe Entity Parameters

For details see Control Drawing, 50089981.

Marking ATEX Directive

a. General

The following information is provided as part of the labeling of the Remote Indicator:

Name and Address of the manufacturer

The serial number of the Remote Indicator is located on the Meter Body data-plate. The first two digits of the serial number identify the year (02) and the second two digits identify the week of the year (23); for example, 0223xxxxxxxx indicates that the product was manufactured in 2002, in the 23rd week.

b. Apparatus Marked with Multiple Types of Protection

The user must determine the type of protection required for installation the equipment. The user shall then check the box [ ] adjacent to the type of protection used on the equipment certification nameplate. Once a type of protection has been checked on the nameplate, the equipment shall not then be reinstalled using any of the other certification types.

c. WARNINGS and Cautions

Non-Incendive / Non-Sparking (Division 2 and Zone 2 Environments):

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2

Intrinsically Safe (Divisions 1, Zone 1 and Zone 2 Environments):

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

WARNING – DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.

Explosion-Proof (Division 1 and Zone 1 Environments):

WARNING – DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.

WARNING – DO NOT OPEN WHEN ENERGIZED
"OPEN CIRCUIT BEFORE REMOVING COVER"

Flameproof (Division 1 and Zone 1 Environments):

WARNING – DO NOT OPEN WHEN ENERGIZED

General Requirements / Increased Safety (Zone 1):

WARNING – DO NOT OPEN WHEN ENERGIZED

WARNING – OPEN CIRCUIT BEFORE REMOVING COVER

All Protective Measures:

WARNING: FOR CONNECTION IN AMBIENTS ABOVE 60^{O}C USE WIRE RATED 105^{O}C

Conditions of Use “for Ex Equipment”, Hazardous Location Equipment or “Schedule of Limitations”

a. Consult the manufacturer for dimensional information on the flameproof joints for repair.

b. Painted surface of the RMA 800 series may store electrostatic charge and become a source of ignition in applications with a low relative humidity less than approximately30% relative humidity where the painted surface is relatively free of surface contamination such as dirt, dust or oil. Cleaning of the painted surface should only be done with a damp cloth.

c. The ambient temperature range, maximum process temperature and applicable temperature class of the equipment is as follows:

RMA801: T4 for -50˚C < Ta < 85˚C

RMA803: T4 for -20˚C < Ta < 70˚C

d. The RMA800 series enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be considered during installation and use to prevent impact or friction to avoid impact.

e. If a charge-generating mechanism is present, the exposed metallic part on the enclosure is capable of storing a level of electrostatic charge that could become incendive for IIC gases. Therefore, the user/installer shall implement precautions to prevent the buildup of electrostatic charge, e.g. earthing the metallic part. This is particularly important if the equipment is installed in a zone 0 location.

f. On installation, the RMA800 series shall be provided with supply transient protection external to the apparatus such that the voltage at the supply terminals of the RMA800 series does not exceed 140% of the voltage rating of the equipment.

Control Drawing: 50089981

PRE REL							
ISS	REVISION & DATE						APPD
E	8/12/2019 ECN 2019-4515						OJM

RMA 800 Series Remote Meter,
Analog. DE Communications and Foundation Fieldbus

1. Intrinsically safe installation shall be in accordance with
   a. FM (USA): ANSI/NFPA 70, NEC® Articles 504 and 505.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 18.
   c. ATEX: Requirements of EN 60079-14, 12.3 (See also 5.2.4).
   d. IECEx: Requirements of IEC 60079-14, 12.3 (See also 5.2.4).
2. ENTITY approved equipment shall be installed in accordance with the manufacturer's Intrinsic Safety Control Drawing.
3. The Intrinsic Safety ENTITY concept allows the interconnection of two ENTITY Approved Intrinsically safe devices with ENTITY parameters not specifically examined in combination as a system when:
   Uo, Voc, or Vt $\leq$ Ui or Vmax; Io, Isc, or It $\leq$ Ii or Imax; Ca or Co $\geq$ Ci + Ccable, La or Lo $\geq$ Li + Lcable, Po $\leq$ Pi.
   Where two separate barrier channels are required, one dual-channel or two single-channel barriers may be used, where in either case, both channels have been Certified for use together with combined entity parameters that meet the above equations.
4. System Entity Parameters:
   RMA 800 Remote Meter: Vmax Voc or Uo, Imax Isc or Io;
   RMA 800 Remote Meter: Ci + Ccable $\leq$ Control Apparatus Ca,
   RMA 800 Remote Meter: Li + Lcable $\leq$ Control Apparatus La.
5. When the electrical parameters of the cable are unknown, the following values may be used:
   Capacitance: 197pF/m (60 pF/ft)
   Inductance: 0.66µH/m (0.020µH/ft).
6. Control equipment that is connected to Associated Equipment must not use or generate more than 250 V.
7. Associated equipment must be FM, CSA ATEX or IECEx (depending on location) listed. Associated equipment may be installed in a Class I, Division 2 or Zone 2 Hazardous (Classified) location if so approved.
8. Non-Galvanically isolated equipment (grounded Zener Barriers) must be connected to a suitable ground electrode per:
   a. FM (USA): NFPA 70, Article 504 and 505. The resistance of the ground path must be less than 1.0 ohm.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 10.
   c. ATEX: Requirements of EN 60079-14, 12.2.4.
   d. IECEx: Requirements of IEC 60079-14, 12.2.4.
9. Intrinsically Safe DIVISION 1/ Zone 0 WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
10. Division 2/ Zone 2: WARNING: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.
11. NO REVISION OF THIS CONTROL DRAWING IS PERMITTED WITHOUT AUTHORIZATION FROM THE AGENCIES listed.
12. For release approvals see ECO-0103558.

	DRAWN			Honeywell
	CHECKED			CONTROL DRAWING RMA 800 SERIES REMOTE METER DIVISIONS 1 AND 2 / ZONE 0 AND 2
	DEV ENG			
	MFG ENG			
	QA ENG			
	TOLERANCE UNLESS NOTED			A/A4 — 50089981
MASTER FILE TYPE: MS WORD	ANGULAR DIMENSION			SCALE: None — USED ON — SH. 1 OF 3

RMA801, Analog/ DE Communications

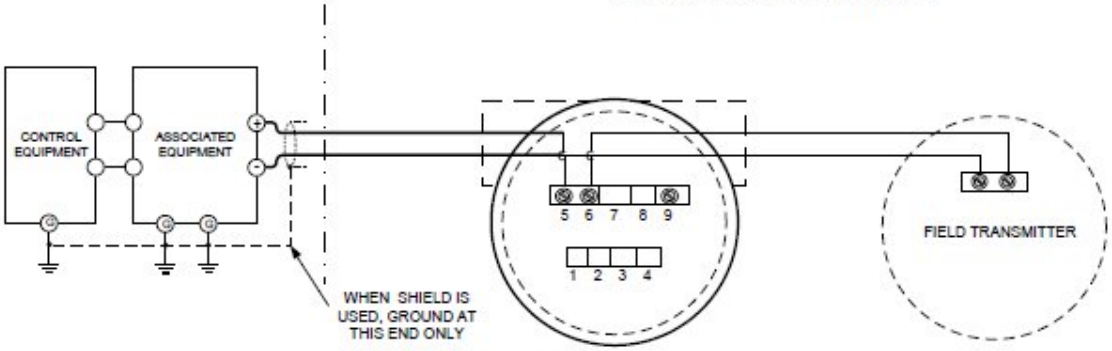
ENTITY PARAMETERS "Ex ia" and Ex ic"	Associated Apparatus
Ui or Vmax ≥6 and ≤ 30V	Uo, Voc or Vt ≥6 and ≤ 30V
Ii or Imax ≤ 225 mA	Io (Isc or It) ≤ 225 mA
Pi or Pmax = 1W	Po ≤ 1 W
Ci= 28.2nF	Ca or Co ≥ C_{cable} + $C_{RMA\ 800}$
Li= 4µH	La or Lo ≥ L_{cable} + $L_{RMA\ 800}$

Note: No Change in Parameters when Terminal 9, DE Communications is connected

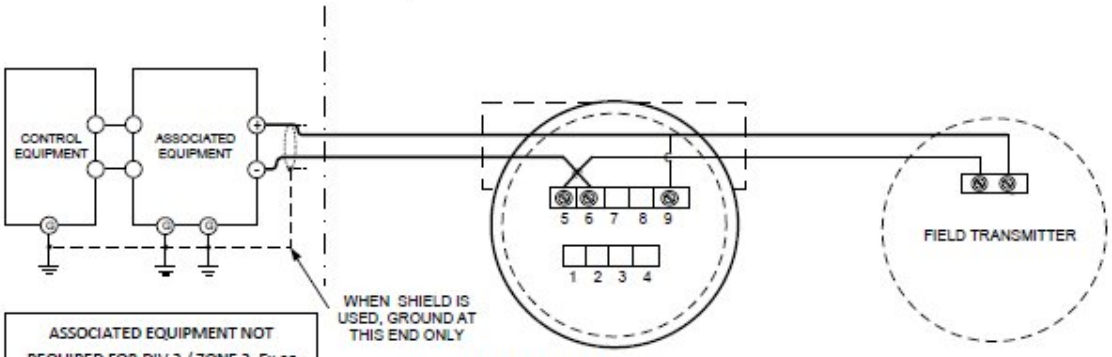
NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION

CLASS I, CLASS II, DIVISION 1, GROUPS A, B, C, D, E, F & G;
ZONE 0 IIC & ZONE 2 IIC,
CLASS I DIVISION 2, GROUPS A, B, C, D;



POSITIVE SIDE OF LOOP



NEGATIVE SIDE OF LOOP

ASSOCIATED EQUIPMENT NOT REQUIRED FOR DIV 2 / ZONE 2 Ex ec or AEx nA INSTALLATIONS
CONTROL EQUIPMENT PARAMETERS WHEN NO ASSOCIATED EQUIPMENT
Umax=Ui= 42V, 25 mA, Po ≤ 1 W

Honeywell	A/A4	50089981	
	SCALE: None	REV E DATE 8/12/19	SH. 2 of 3

RMA803, Foundation Fieldbus

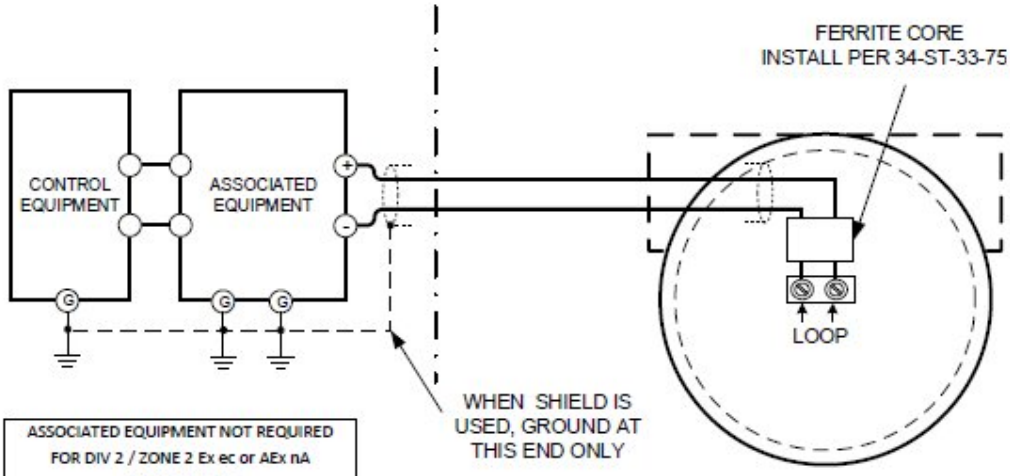
ENTITY PARAMETERS "Ex ia" and Ex ic"	Associated Apparatus
Ui or Vmax ≤ 30V	Uo, Voc or Vt ≤ 30V
Ii or Imax ≤ 180 mA	Io (Isc or It) ≤ 180 mA
Pi or Pmax = 1W	Po ≤ 1 W
Ci= 0 nF	Ca or Co ≥ C_{cable} + $C_{RMA\ 800}$
Li= 9 µH	La or Lo ≥ L_{cable} + $L_{RMA\ 800}$

FISCO Parameters

ENTITY PARAMETERS "Ex ia" and Ex ic"
Ui or Vmax = 17.5V
Ii or Imax ≤ 380 mA
Pi or Pmax ≤ 5.32W
Li = 9 µH
Ci = 0 nF

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, CLASS II, DIVISION 1, GROUPS A, B, C, D, E, F & G;
ZONE 0 IIC & ZONE 2 IIC,
CLASS I DIVISION 2, GROUPS A, B, C, D;



ASSOCIATED EQUIPMENT NOT REQUIRED FOR DIV 2 / ZONE 2 Ex ec or AEx nA INSTALLATIONS
CONTROL EQUIPMENT PARAMETERS WHEN NO ASSOCIATED EQUIPMENT
Umax=Ui= 32V, 28 mA, Po ≤ 1 W

Honeywell	A/A4	50089981		
	SCALE: None	REV E	DATE 8/12/19	SH. 3 of 3

10. INDEX

V

W

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

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