



Foundation Fieldbus

Communication Module

Technical Manual

(For Actuators with Software Above Rev.3.2)

FFMNL-SI-20250421



www.ontracactuators.com

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1. Introduction

Product Introduction.

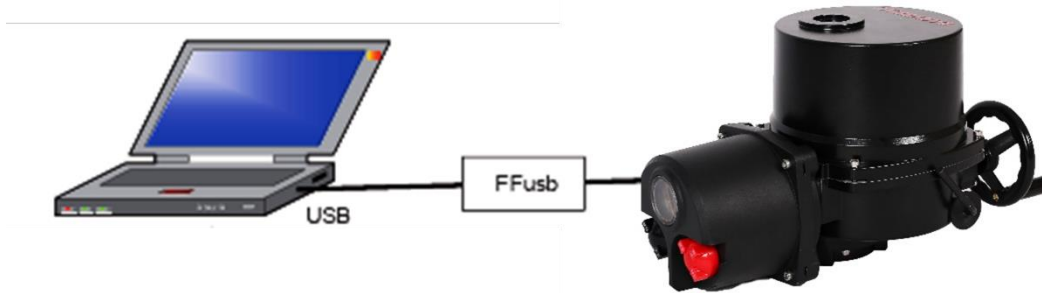


Figure 1-1. Connection of the Ontrac Actuator the Host PC

Ontrac is renowned for its extensive suite of software and automation solutions, including the Multitrac and Easytrac actuator series. These actuators are designed for seamless integration with a variety of standard communication and control mechanisms, which includes the Foundation Fieldbus (FF). The Foundation Fieldbus Module (FFM) serves as a network interface, it collects operational data from the actuator and conveys critical commands from the master. This bi-directional communication capability enables the actuator to receive precise commands and configurations and transmit comprehensive status and diagnostics information.

The Ontrac FFM acts as a slave device on the FF network, ensuring communication between the device and the Master. The configuration of each slave device is facilitated through software, which assumes the role of the master in this configuration. Ontrac's commitment to compliance and industry standards is exemplified by the latest FFM card, which adheres strictly to the IEC 61158-2

standard for H1, 31.25 kbit/s networks utilizing 2-wire communication. This compliance empowers the system with unparalleled flexibility, optimizing the performance of the actuators to meet diverse needs of sophisticated control systems.

2. Operation, Storage and Safety Conditions.



If any function that is not stated in this specification or other Ontrac documentation specification is sent to the actuator through the FFM, the actuator may not operate properly, or it may execute unintended movements. Please exercise due caution by not sending any function or address not specified by Ontrac.

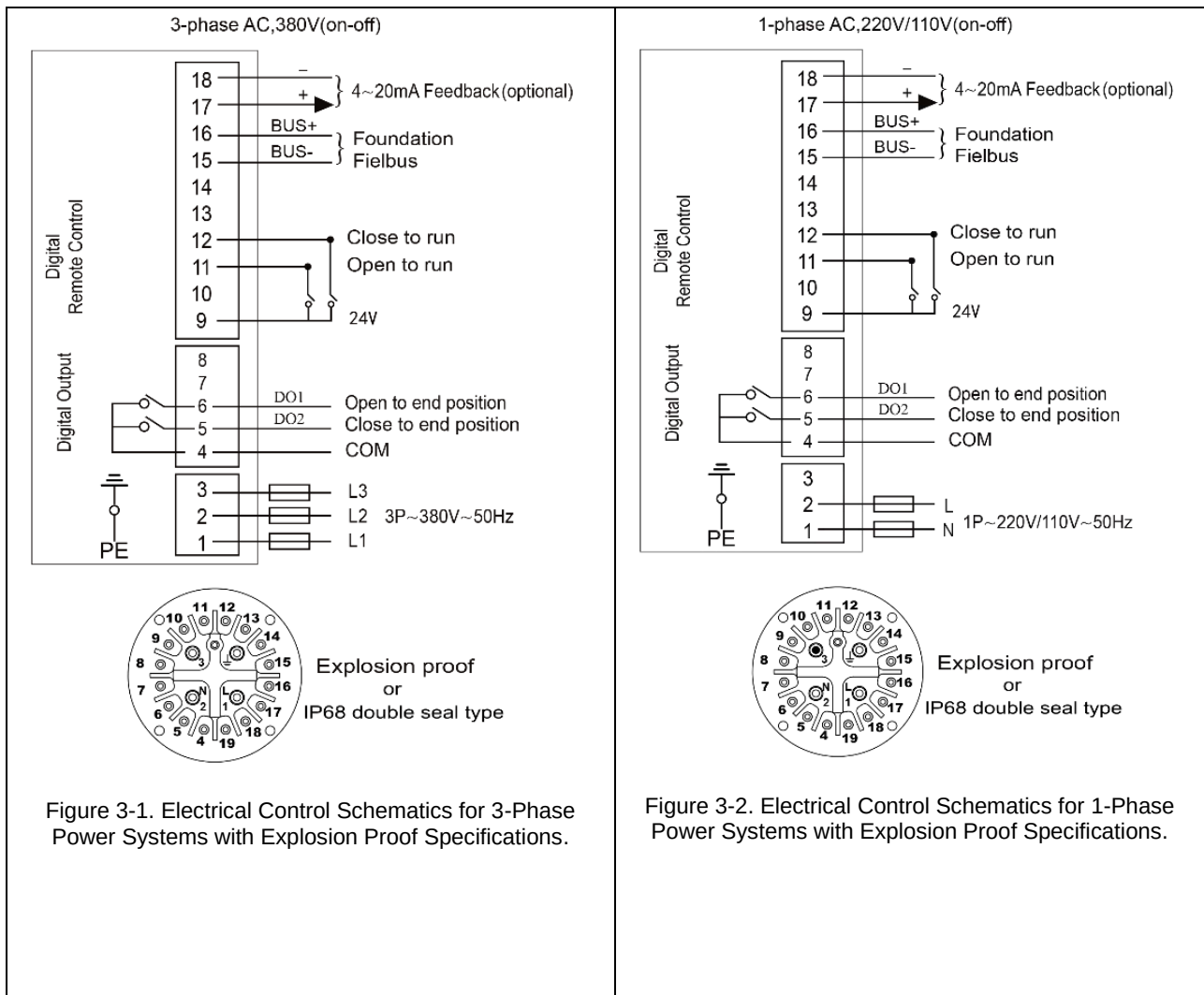
The module is designed to work and to be stored in the same environment as the actuator. If the actuator containing the FFM, or the FFM is used or stored in a place or conditions that are outside the parameters specified by the manufacturer and without sufficient shielding measures, the actuator may malfunction if sufficient actions are not taken. The FFM should also not be allowed to operate in the following environment.

1. Where large current or high magnetic field is generated.
2. Where arc discharge occurs due to welding, etc.
3. Where electric noise generates due to electrostatic, etc.
4. Where the actuator housing the FFM may be exposed to radiation.

3. Setup and Installation

General Installation Information.

The FF module is designed to integrate with actuators through an adapter plate that is built into the actuator housing. The communication module is plugged directly into the adapter plate, which is equipped with an actuator interface and a bus power interface.



Communication Features.

Feature	Specification
Communication protocol:	Foundation Fieldbus
Electrical interface	IEC 61158-2, 2 wire communication.
Bus type	Point to point, Bus to spur, Daisy chain, Tree.
Signal voltage	0.75V _{ss} - 1V _{ss}
Data rate	31.25 kbit/sec
Data transmission method	Digital Bit Synchronization
Coding Technique.	Manchester encoding
Cable Type.	Shielded Twisted Pair
Topology	Line, Tree, Star, Compound.
Number of devices per segment	Up to 32 units
Cable Type.	Shielded Twisted Pair
Addressing capability	
Bus length	Less than 1900 Meters.
Electrical power	Bus powered. Max. voltage 32 V Min. voltage 9 V Rated current $I_n = 19 \text{ mA}$ Fault current $I_{\max} = 24 \text{ mA}$
Device capacitance	Tantalum Capacitor.
Device inductance	Chip Inductors.
Operating Temperature	-40°C~85°C.
EMC protections	Cable Shielding.

Device type.	Supports full range of Ontrac brand actuators with Modbus communication.
Device replacement	Return to factory for replacement.
ITK version	Support ITK6.1.1.

4. Network Configuration.

FF Communication Model (OSI)

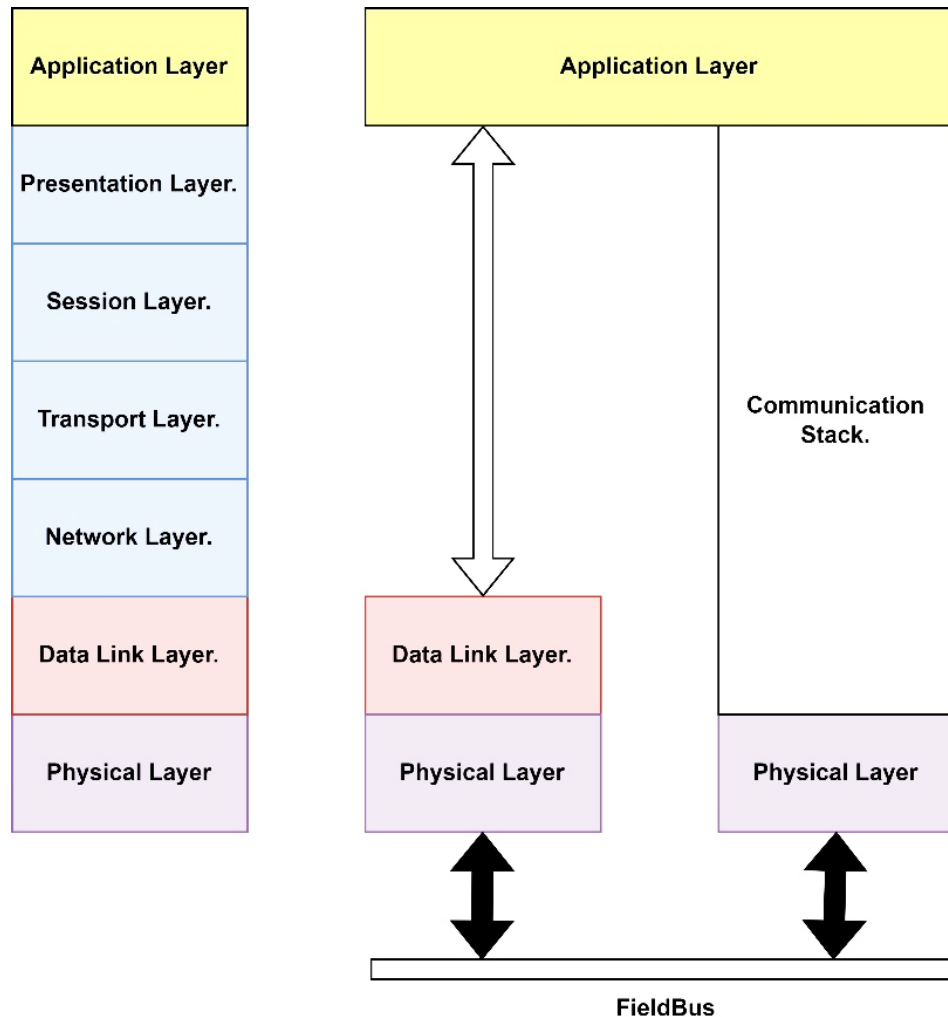


Figure 4-1 communications model diagram.

The architecture of FF fieldbus is developed with reference to the Open System Interconnection (OSI) protocol of the International Organization for Standardization (ISO). There are seven layers in the OSI, and FF implements three of them: the physical layer, the data link layer, and the application layer.

The application layer is the uppermost layer in communication and the one used by users. The layer consists of three main components: function blocks, transformation blocks, and resource blocks. The application layer provides function blocks and device descriptions that allow the host system to communicate with the device without special programming.

Network Topology.

FF devices support various network topology wiring methods, as shown in Figure 4-2. Figure 4-3 shows the bus connection of the foundational fieldbus. Both ends of the bus need to be connected to the terminal matching resistor to ensure signal quality. The maximum length of the bus is 1900 meters, which can be extended to 10 kilometers by using repeaters. The bus communication is fixed at 31.25 kbit/second, and the devices can be powered directly from the fieldbus and operate on wiring previously used for 4 - 20 mA devices.

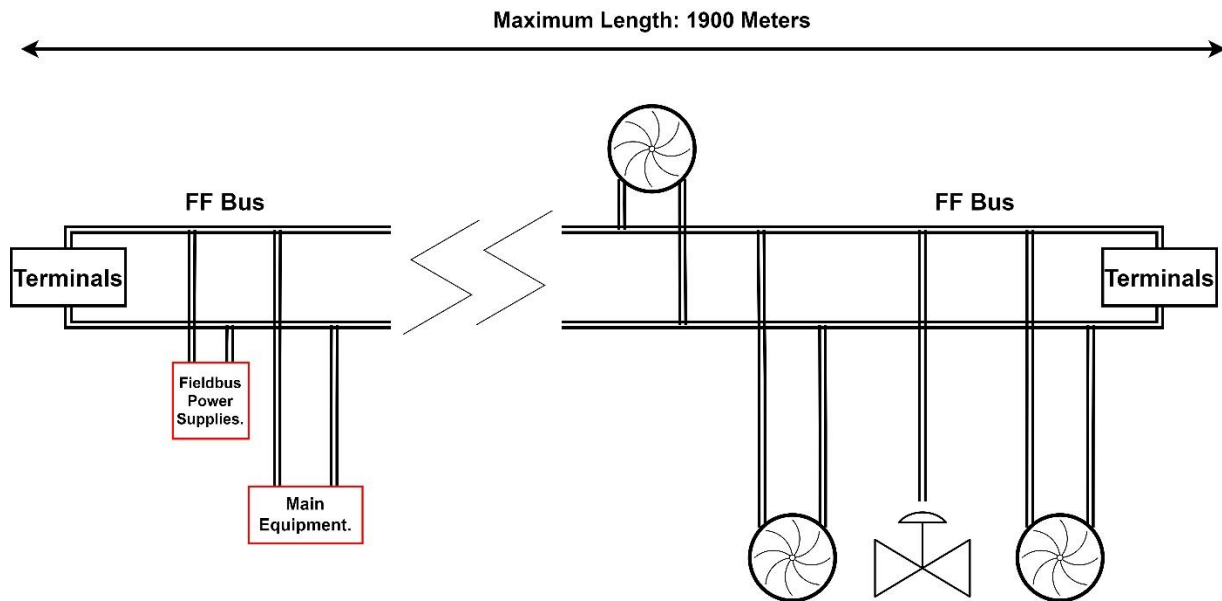


Figure 4-2 Fieldbus diagram.

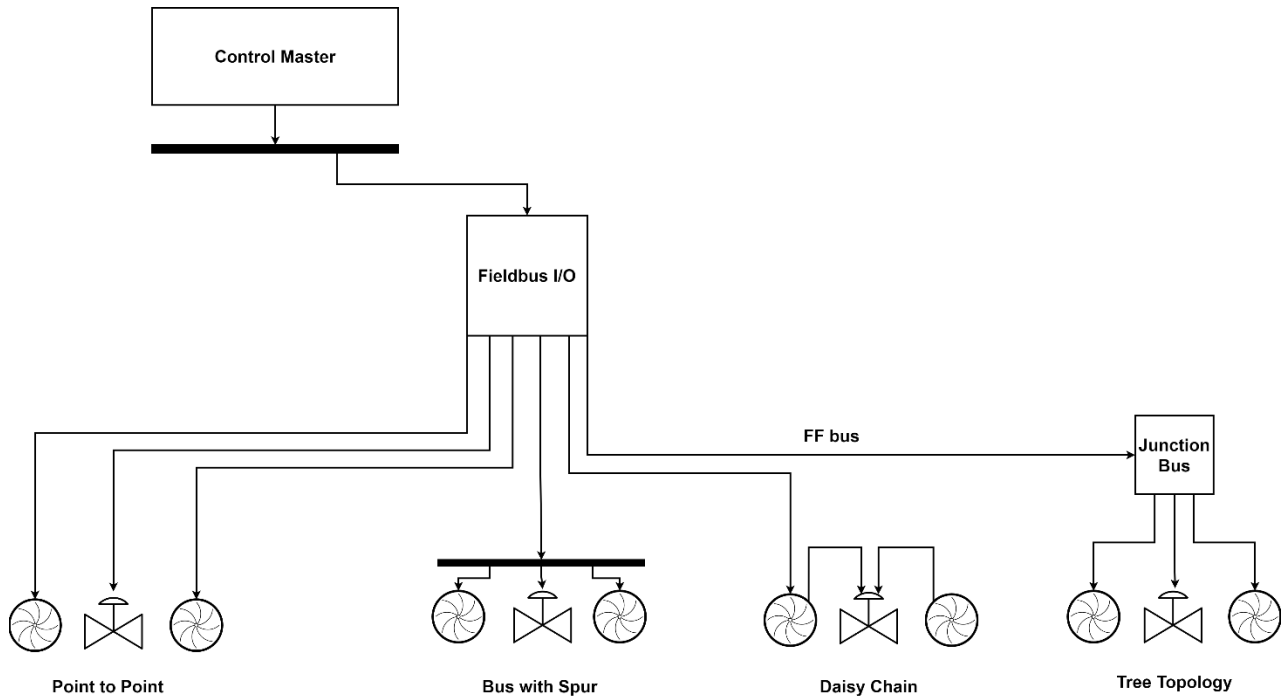


Figure 4-3 Industrial Fieldbus Network Configuration with Control Master, Fieldbus I/O, Actuators, Sensors, and Junction Bus

Bus with Branches (Spurs): The Bus with Branches topology extends the main bus to each device and adds branches to connect other devices where needed. Each device on the main line can communicate directly with the other devices, while the devices on the branches can communicate through the devices connected to the main line. This topology allows for larger scale systems and provides some fault tolerance.

Point-to-point topology: This topology consists of segments of only two devices. The segment can be entirely in the field (operating independently from the device and the host device, e.g., transmitters and valves), or it can be connected to the host system (for control or monitoring) of the field device (transmitter). Simple point-to-point (host and one device per bus segment) may not be used often because it has only one measurement or control device (e.g., 4-20 mA) per bus segment. Therefore, it does not utilize the multi-device capability of each bus segment.

Daisy Chain: With this topology, fieldbus cables are routed from one device to another on the segment and interconnected at the terminals of each fieldbus device. Installations using this topology should use connectors to disconnect individual devices without interrupting the continuity of the entire segment.

Tree topology: In the tree structure of the network, any two nodes do not generate a loop between each pathway to support bidirectional transmission, this structure is characterized by easy to expand, flexible, low cost, easy to promote, suitable for primary and secondary or hierarchical network system. Tree structure is an extension of the bus structure, it is in the bus-type network plus the formation of branches, the transmission medium can have more than one branch, but does not form a closed loop, tree network is a hierarchical network, its structure can be symmetrical, fixed contact, with a certain degree of fault-tolerance, generally a branch and node failures do not affect the work of the other branch node, any node to send out the information can be spread across the entire transmission medium. , is a broadcast network.

Bus cable

Various types are useable for fieldbus. The table in Figure 6.1-1 contains the types of cable identified by the IEC/ISA Physical Layer Standard.

The preferred fieldbus cable is specified in the IEC/ISA Physical Layer Standard, Clause 22.7.2 for conformance testing, and it is referred to as type "A" fieldbus cable. (This cable will probably be used in new installations.)

Other types of cables can be used for fieldbus wiring. The alternate preferred fieldbus cable is a multiple twisted pair cable with an overall shield, hereafter referred to as Type "B" fieldbus cable. (This cable will probably be used in both new and retrofit installations where multiple fieldbuses are run in the same area of the user's plant.)

A less preferred fieldbus cable is a single or multiple, twisted pair cable without any shield, hereafter referred to as Type 'C' fieldbus cable. The least preferred fieldbus cable is a multiple conductor cable without twisted pairs, but with overall shield, hereafter referred to as Type "D" fieldbus cable. Types "C" and "D" cables will mainly be used in retrofit applications. They will have some limitations in fieldbus distance as compared to Type "A" and 'B.' This may preclude the use of Type "C" and "D" cables in certain applications.

Table 4-1 Comparison Table of Fieldbus Cable Types with Descriptions, Sizes, and Maximum Transmission Lengths

Type	Cable Description	Size	Max Length
Type A	Shielded twisted pair	#18 AWG(0.8mm ²)	1900 m (6232ft.)
Type B	Multi-twisted pair with shield	#22 AWG(0.32mm ²)	1200 m (3936ft.)
Type C	Multi-twisted pair without shield	#26 AWG(0.13mm ²)	400 m (1312ft.)
Type D	Multi-core without twisted pairs and having an overall shield	#16 AWG(1.25mm ²)	200 m (656ft.)

Ground screen polarity.

Fieldbus devices must not ground any of the wires of the twisted pair at any point in the network. Fieldbus signals are applied and stored in different ways throughout the network, and grounding any one wire will cause all devices on that bus to lose communication during the time the wire is grounded.

Shielding: According to standards of practice, the shielding of fieldbus cables is normally grounded at only one point along the length of the cable and should not be used as a power conductor.

5. Power Supply and Network Configuration.

Overview of the FF Bus

Foundation Fieldbus is based on the IEC 61158-2, and it also complies with ISA-SP50 recommendations, ensuring its broad applicability and industry acceptance. Fieldbus power conditioners (hereinafter referred to as Bus Power) are used in Foundation Fieldbus control systems to provide power to bus-powered devices. The active impedance control of the bus power supply significantly increases the load carrying capacity compared to simple passive solutions and provides a uniform impedance characteristic which, in combination with the termination matchers, reproduces the bus signals perfectly. The bus power supply panel has two LEDs for power indication and overcurrent indication for easy maintenance. The bus power supply provides an optional internal termination matcher that can be used when bus power redundancy is not utilized. The bus power supply can support power redundancy, which can further improve system reliability when two bus power supply redundant connections are used.

According to the referenced Fieldbus Foundation Physical Layer Profile specification, power supplies are designated as the following types:

- **131 Non-IS** type power supply Used to power the I.S barrier. The output voltage depends on the rating.
- **132 Non-IS** type power supply Not used to power the I.S. barrier. Output voltage is 32 VDC max.

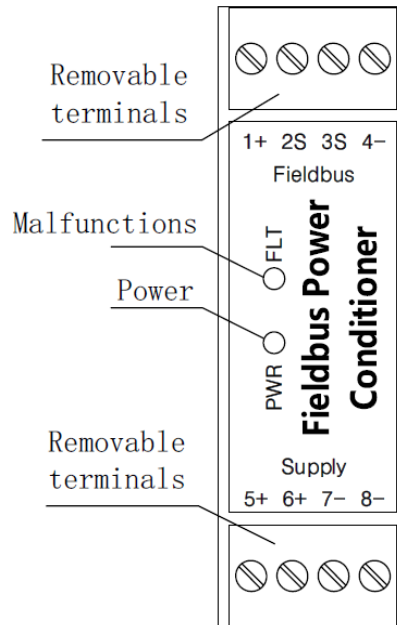


Figure 5-1 Bus Power Panel Schematic

Terminals

Fieldbus Terminal Matchers (hereinafter referred to as bus terminals) are used in conjunction with bus power supplies and are installed at the end of the bus to realize the impedance matching function of signals and to complete the conversion of current signals to voltage signals at the same time. A terminator is an impedance matching module used at or near each end of a transmission line. Two (and only two) terminators are required per bus segment. Terminators prevent distortion and signal loss and are usually purchased and installed as pre-assembled sealed modules. The user/installer does not need to care for or assemble separate resistors and capacitors. Various mechanical and electrical configurations incorporate terminals into terminal blocks, I.S. barriers, power supplies, fieldbus interface cards, etc.

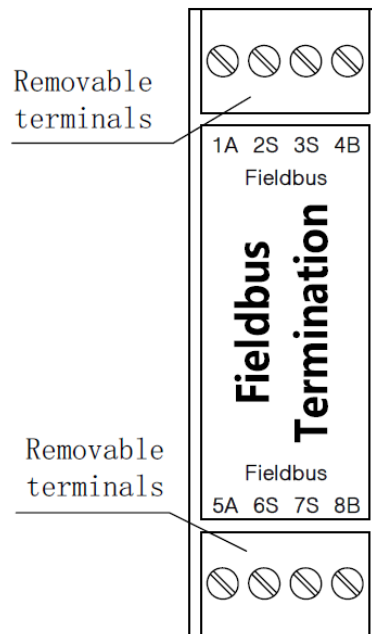


Figure 5-2 Bus Terminal Panel Schematic.

Power Supply Strategy

Product Power Source: Bus-powered

Typical Current Requirement: 10-30 mA of current at 9 to 32 volts. Any device or wiring assembly with a minimum required voltage of less than 2 volts should be bus-powered.

Total Current Draw: Must not exceed the rating of the FOUNDATION fieldbus power supply.

FOUNDATION Fieldbus Power Supply Current Rating: Must be considered in the network/segment design with the following factors:

- Maximum total device quiescent current.
- Primary branch circuit short-circuit fault (i.e., ~50 mA additional current consumption)
- Current consumption of wiring elements
- Test devices (typically 12 mA per device)

Limitation on Number of Devices: The number of bus-powered (two-wire) devices on a segment is limited by factors such as:

- Zoning requirements.
- Current consumption per device.
- Current consumption of cabling components.
- Location of device on network/segment (i.e., voltage drop).
- FOUNDATION Location of the fieldbus power supply.
- Resistance of each cable segment (i.e. cable characteristics).
- Minimum operating voltage per device.
- Additional current consumption due to one branch circuit short circuit fault (~40 mA).
- Inrush current due to powering up the entire segment at once.
- Bandwidth of the segment.
- FOUNDATION Output voltage of the fieldbus power supply.

Notes:

Current experience suggests that these calculations may not be necessary for all segments if good quality cables are used, and the guidelines given in this document are followed.

6. Device Configuration and Operation.

The FF protocol leverages standardized 'Function Blocks' and Device Descriptions for device control. These Function Blocks are associated with various automation functions such as discrete input (DI), discrete output (DO), analog input (AI), analog output (AO), and Proportional/Integral/Derivative (PID) controls. Each Foundation Fieldbus device is configured with a Resource Block, detailing overall device parameters, and at least one Transducer Block.

Configuration Software.

The configuration of Foundation Fieldbus Modules (FFM) utilizes NI-FBUS software from National Instruments, available in various versions with distinct capabilities and licensing requirements. The NI-FBUS Communications Manager (CM), also known as COMM SW, is free and includes drivers for NI-FBUS interface hardware and APIs for accessing FF H1 networks. It is compatible with LabVIEW, Lookout, NI OPC Server, and programming environments like Microsoft Visual C++, and Visual Basic, enabling the development of custom FF applications. The LabVIEW API uniquely offers "set node address" and "set tag" functions.

The CM version supporting High-Speed Ethernet (HSE) requires a purchase. The NI-FBUS Configurator, a graphical tool for FF network configuration in both online and offline modes, is not free and needs activation for online functionalities. It offers an intuitive interface for device detection, tag configuration, function block linkages, and more.

Similarly, the NI-FBUS Monitor, a standalone application for monitoring, debugging, and analyzing Fieldbus data packets on H1 networks, is not free and requires activation. From July 2010 onwards, NI-FBUS Monitor 4.0, and later versions are compatible with the USB-8486 for troubleshooting Fieldbus networks in industrial settings. It is important to note that the purchase of the USB-8486 Device does not include the NI-FBUS Configurator or NI-FBUS Monitor.

Resource blocks.

The Resource Block (RB) in Foundation Fieldbus (FF) systems is a mandatory component in every FF device, it uniquely identifies the device with details such as the device name, manufacturer, serial number, device type, and revision level. The RB also provides important information about the device's memory capacity, computation time, available features, and its current operational state (e.g., Initializing, Standby, On-line, Failed). While the RB offers comprehensive information about the device's identity and status, it does not include specifics about the device's functional capabilities, which are defined in other function blocks within the FF system. The following points should be noted at design time:

- Users cannot make changes.
- Parameters can be changed by the user. (This section DO-AO).
- There is only one RB in a device.
- In a FOUNDATION device, the RB is the only mandatory block.
- The RB contains the ID and general information about the entire resource or resource status (no actual details of the device functionality are included).

RB contains the ID and general information related to the status of the entire resource or resources (no actual details about device functionality).

0001050312-M0313-70262986 : RESOURCE (RB2)

Apply Values

RESOURCE (RB2)

☒ Periodic Updates

2 (sec)

OOS

Auto

Process

Tuning

Options

Alarms

Diagnostics

Others

Parameter	Value	Type & Extensions	Help
● TAG_DESC		232 (max len = 32)	The user description of the intended application of the block.
● MODE_BLK — TARGET — ACTUAL — PERMITTED — NORMAL	Auto Auto Auto OOS Auto	200 200 200 200	The actual, target, permitted, and normal modes of the block. This is the mode requested by the operator. Only one mode from those allowed by the permitted mode parameter may be requested. This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution. Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement. This is the mode which the block should be set to during normal operating conditions.
● RS_STATE	Online	200	State of the function block application state machine.
● TEST_RW/ — VALUE_1 — VALUE_2 — VALUE_3 — VALUE_4 — VALUE_5 — VALUE_6 — VALUE_7 — VALUE_8 — VALUE_9 — VALUE_10 — VALUE_11 — VALUE_12 — VALUE_13 — VALUE_14 — VALUE_15	FALSE 0 0 0 0 0 0 0 0 0 01/01/00 00:00:00 (MM/DD/YY) 01/01/1984 00:00:00 (MM/DD/YY) 0:00:00:00 (DD:HH:MM:SS) 0x0000 01/01/1972 00:00:00 (MM/DD/YY)	200 200 200 200 200 200 200 200 200 200 200 (max len = 32) 200 (max len = 32) 200 200 (max len = 2)	Read/write test parameter - used only for conformance testing.
● HARD_TYPES	Scalar Input Scalar Output Discrete	200	The types of hardware available as channel numbers.
● MIN_CYCLE_T	0 1/32 ms	200	Time duration of the shortest cycle interval of which the resource is capable.
● NV_CYCLE_T	0 1/32 ms	200	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
● WRITE_LOCK	Not Locked	200	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.

Figure 6-1 Resource Block

Table 6-1 Definitions of Parameter Names and Their Clarifications for Fieldbus System Configuration and Diagnostics

Parameter name	Clarification
MODE_BLK	block mode (computing)
TARGET	Operator-modified modes (only one mode is supported at the same time)
ACTUAL	Actual block pattern
PERMITTED	Application Requirements Model
NORMAL	Normal operation mode
BLOCK_ERR	Error status of the hardware or configuration associated with the block
TEST_RW	Read/Write Test Parameters
MANUFAC_ID	Manufacturer Identification Number
DEV_TYPE	Resource-related manufacturer models

DEV_REV	Resource-related manufacturer's revision number
DD_REV	DD Revision No. related to resources
FREE_SPACE	Percentage of remaining configurable memory
FREE_TIME	Percentage of processing time for free processing of additional blocks.

This block displays some basic information on the hardware, making it easy to view and correct errors and expand functionality.

0001050312-M0313-70262986 : RESOURCE (RB2)

Apply Values

RESOURCE (RB2)

Periodic Updates: 2 (sec)

OOS Auto

Process | Tuning | Options | Alarms | Diagnostics | Others

Parameter	Value	Type & Extensions	Help
● TAG_DESC		32 (max len = 32)	The user description of the intended application of the block.
● MODE_BLK			The actual, target, permitted, and normal modes of the block.
- TARGET	Auto	000	This is the mode requested by the operator. Only one mode from those allowed by the permitted mode parameter may be requested.
- ACTUAL	Auto	000	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution.
- PERMITTED	Auto OOS	000	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement.
- NORMAL	Auto	000	This is the mode which the block should be set to during normal operating conditions.
● RS_STATE	Online	000	State of the function block: application state machine.
● TEST_RW			Read/write test parameter - used only for conformance testing.
- VALUE_1	FALSE	000	
- VALUE_2	0	000	
- VALUE_3	0	000	
- VALUE_4	0	000	
- VALUE_5	0	000	
- VALUE_6	0	000	
- VALUE_7	0	000	
- VALUE_8	0	000	
- VALUE_9	0	000	
- VALUE_10	0	000	
- VALUE_11	01/01/00 00:00:00 (MM/DD/YY)	000 (max len = 32)	
- VALUE_12	01/01/1984 00:00:00 (MM/DD/YY)	000 (max len = 32)	
- VALUE_13	0:00:00:00 (DD:HH:MM:SS)	000	
- VALUE_14	0x0000	000 (max len = 2)	
- VALUE_15	01/01/1972 00:00:00 (MM/DD/YY)	000	
● HARD_TYPES	Scalar Input Scalar Output Discrete	000	The types of hardware available as channel numbers.
● MIN_CYCLE_T	0 1/32 ms	000	Time duration of the shortest cycle interval of which the resource is capable.
● NV_CYCLE_T	0 1/32 ms	000	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
● WRITE_LOCK	Not Locked	000	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.

Figure 6-2 Screenshot of FF Configuration Software Displaying Parameters for Operational Modes, System State, and Hardware Configuration.

Parameter name	Descriptions
ST_REV	Function block static data revision value (increases with number of parameter modifications)
CYCLE_SEL	Selection of the method of execution of the block
MEMORY_SIZE	Empty resources available configuration space
UPDATE_EVT	Static data change alarm
BLOCK_ALM	Alarms for configuration, hardware, connection failures or system problems in the block
ALARM_SUM	Current alarm status of the function block
WRITE_ALM	Write lock parameter changed alarm

Table 6-2 Table of Fieldbus Function Block Parameters with Descriptions for System Status, Memory, and Alarms Management

This block is responsible for the false alarm function of the communication module, it includes some hardware, software configuration, alarm visualization of specific parameters and the enabling or not of the alarm function, and of course some basic configuration of the alarm function. This book only lists and explains the meaning of some of the more important parameters that may be used.

Transformation blocks

The transform block (TB) contains information such as calibration date and sensor type. Field devices require at least one transform block to make the device useful. the TB connects the FB with read sensors and command output hardware (where parameterization, calibration, and diagnostics are performed by the local device). Some devices have multiple TBs, where a dedicated TB is used for diagnostics, multiple measurements, or to manage the local display of the device. Diagnostic coverage is all in the device's TB.

Modbus Transformer Block (MTB): The transformer block provides each of analogue inputs/outputs and digital inputs/outputs that parameterize the process data.

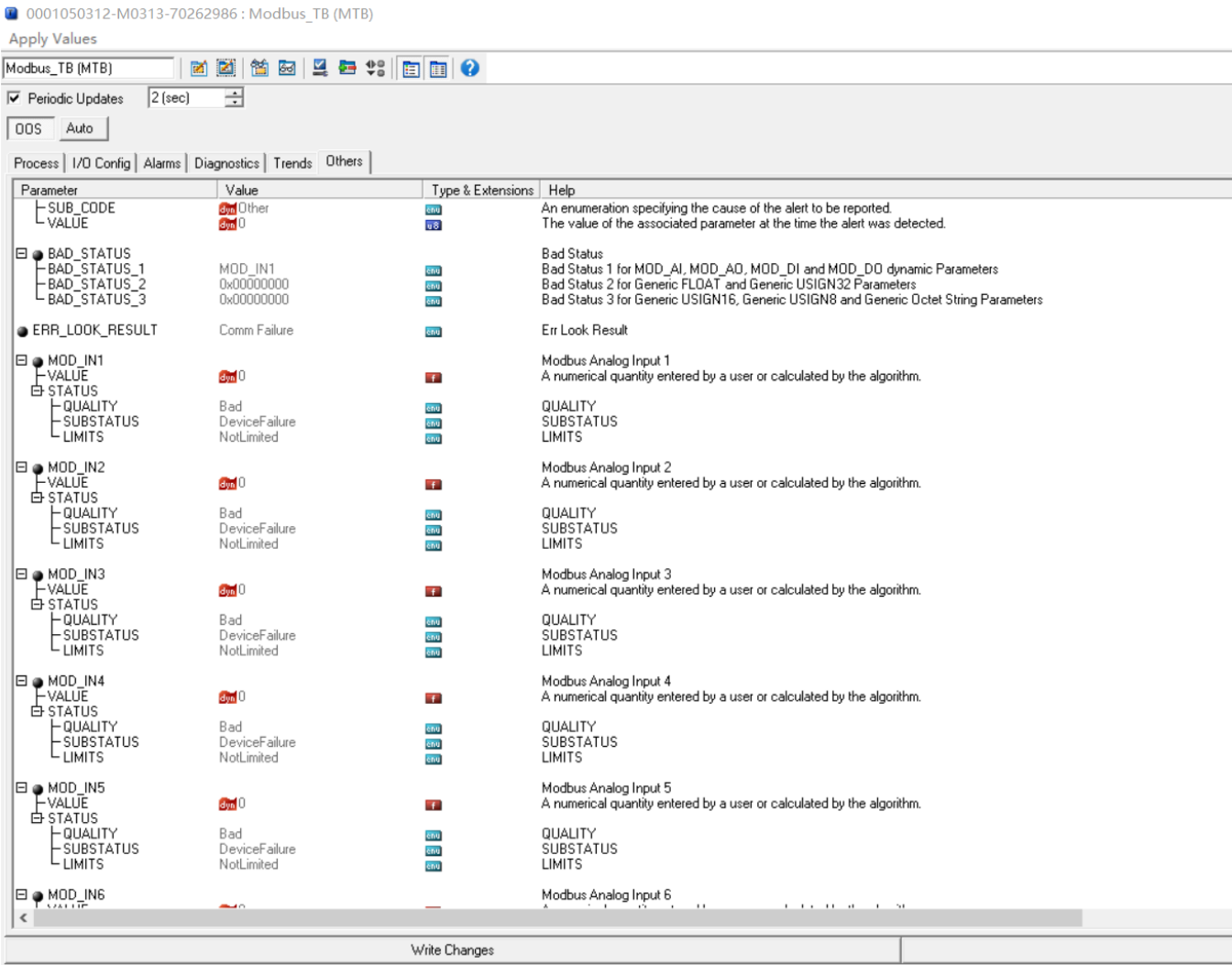


Figure 6-3 Screenshot of FF Configuration Software Displaying Parameters, Status, and Diagnostics for System Monitoring and Troubleshooting.

Function blocks.

Function Blocks (FBs) shall be used within a user-defined Function Block application to provide the various functions (e.g., inputs, outputs, signal selection, and other control actions) required by the control system. In other words, function blocks are control strategies. FB are built into Foundation devices as needed to implement the desired control functions. Some FBs can be built into devices,

and some can be instantiated (preferably at the factory). The factory instantiation option should be used as it will reduce confusion and configuration efforts. Depending on the DCS (host) manufacturer's policy, some specific device parameters may not be shown. In the case of diagnostics, this may reduce device functionality. The manufacturer's device manual should be consulted for optimal configuration. Not all available FB types may not yet be included in the current ITK scale marks. However, not all FBs are required. Some FBs are only required when Control in the Field (CIF) is applied. It is then necessary to make the correct selection to meet the requirements when specifying the function blocks to be included for use in the various field device types.

The Easytrac function blocks are as follows:

- Analog modules: AI (analog input module), AO (analog output module)
- Switching modules: DI (Digital Input Module), DO (Digital Output Module)

Each communication module provides four variables: AI/01-AI/04, DI/01-DI/04.

DO1: Digital Outputs – Regulated Control Run Enable.

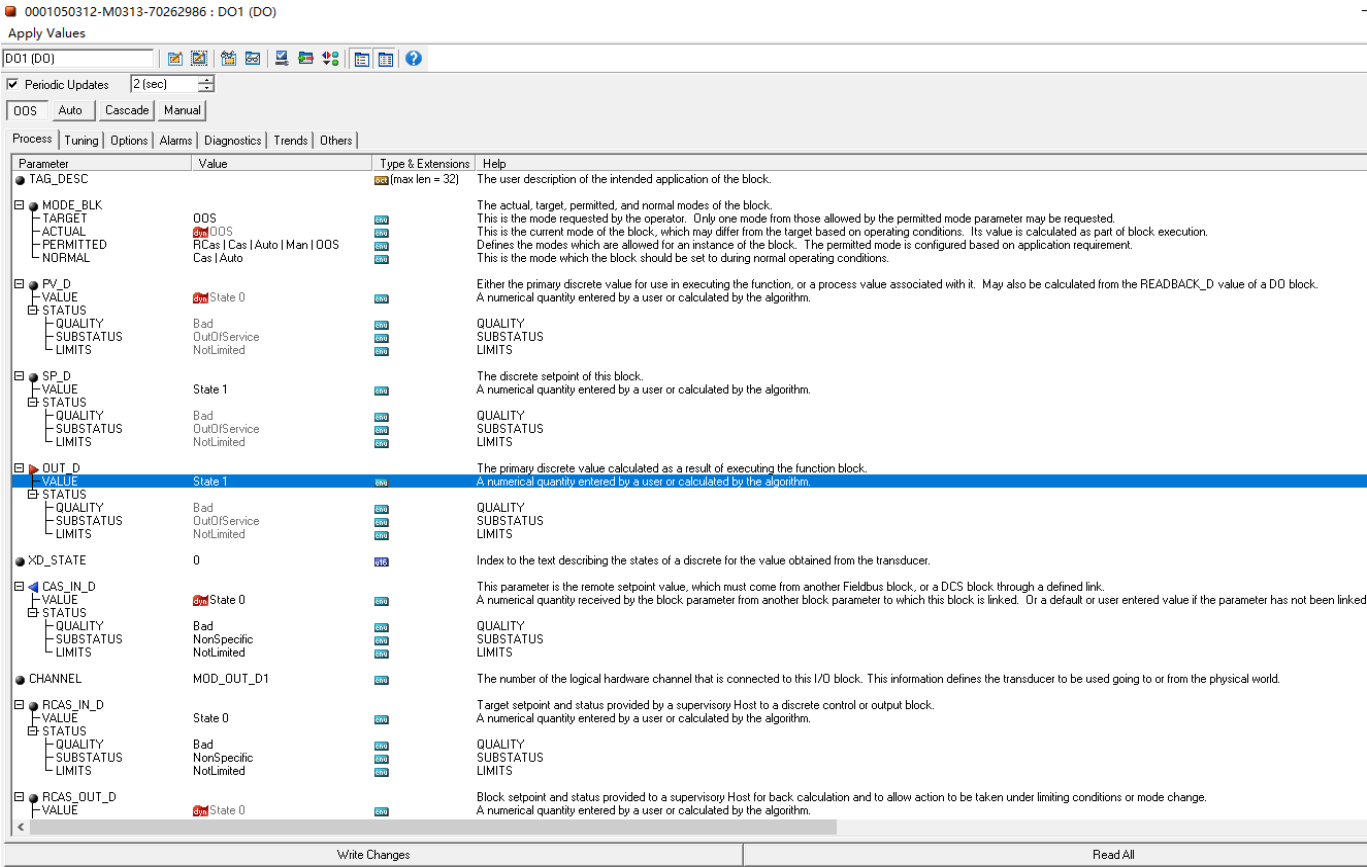


Figure 6-4 DO1

AO1 can be enabled by changing the value of DO1. The value output from AO1 is valid and the actuator moves only when DO1 is 1 (State1).

Parameter name	Descriptions	Clarification
	Adjustment, Control, Run, Enable.	0—Control stops
ModulateStart		1—Control open

DO2: Digital Outputs - Switch Control Run Enable

Figure 6-5 DO2

AO2 can be enabled by changing the value of DO2. The value of the AO2 output is valid and the actuator moves only when DO2 is 1 (State1).

Parameter name	Descriptions	Clarification
OnOffStart	Switch, Control, Run, Enable.	0—Control stops.
		1—Control open

AO1: Analog output regulates the valve position value.

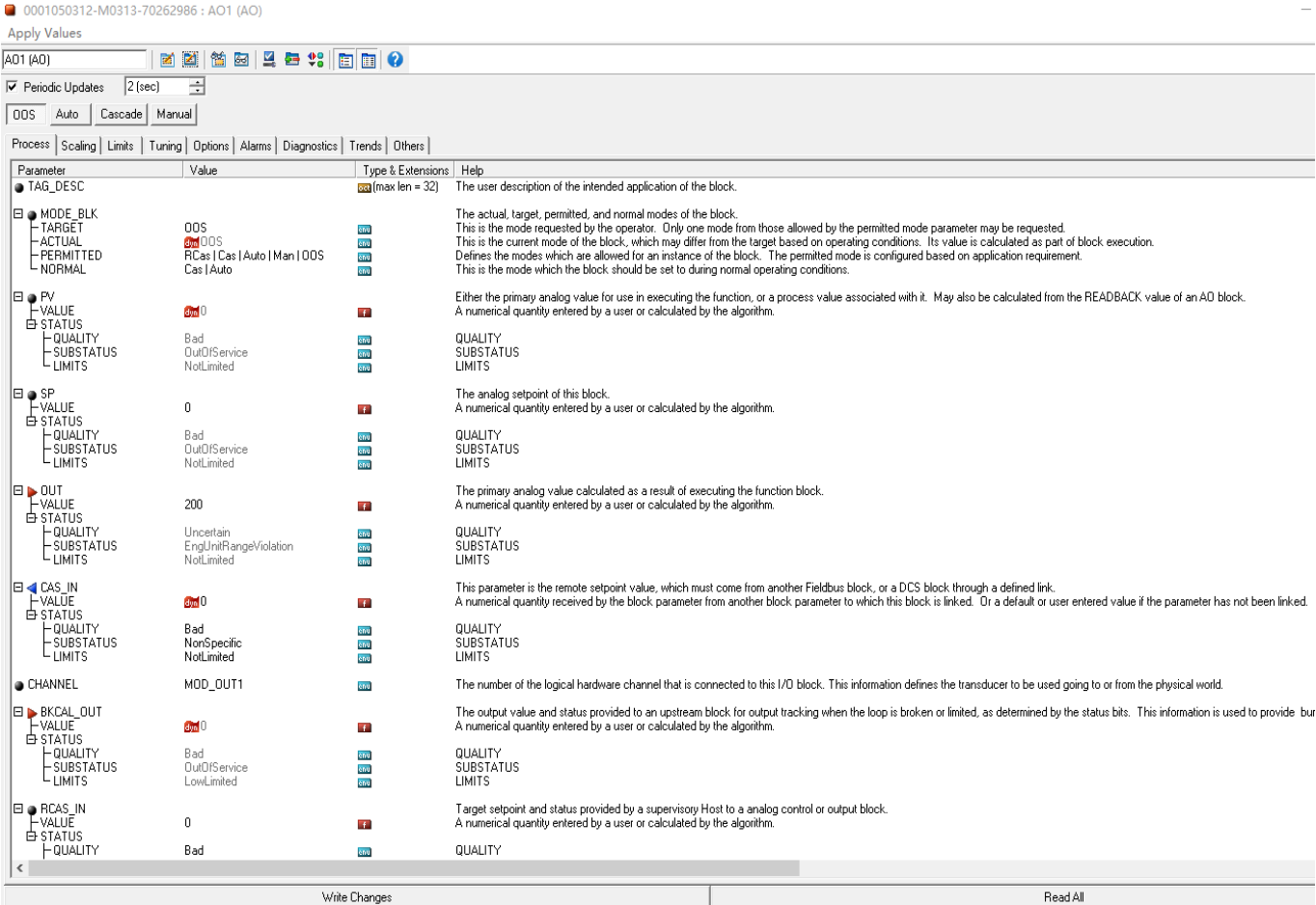


Figure 6-6 AO1

If DO1 is 1 (State1), the actuator can be controlled by changing the value of AO1.

Parameter name	Descriptions	Clarification
ModBusPermilTarget	Modbus Setting Valve Position.	0—1000

AO2: Analog Output Switching Valve Position.

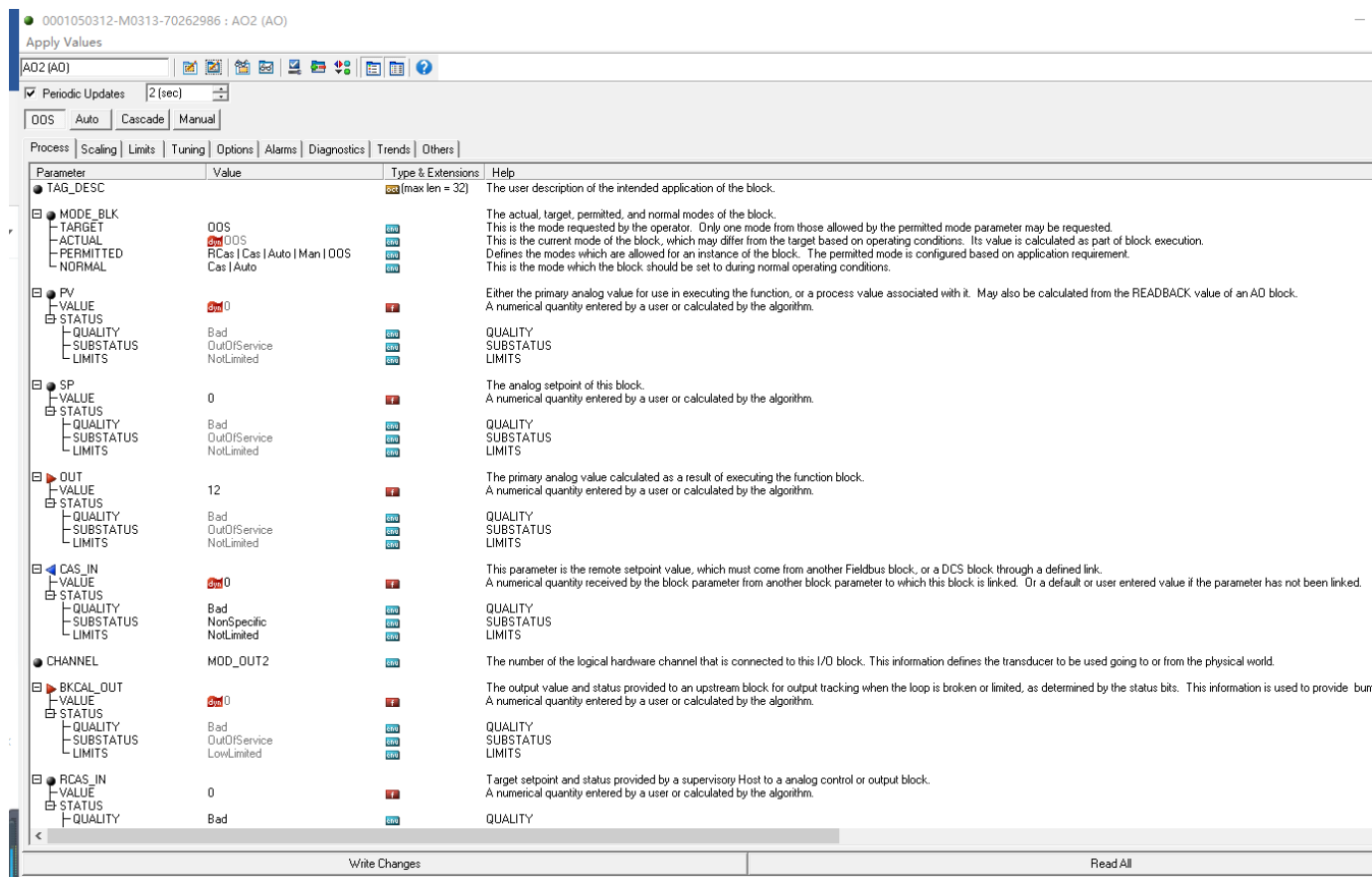


Figure 6-7 AO2

If DO2 is 1 (State1), the actuator can be controlled by changing the value of AO2.

Table 6-3. Control Parameters: Definitions and Values for Operation Modes

Parameter name	Descriptions	Clarification
ModBusOnOffTarget	Modbus switching control byte.	3—Open direction operation to maximum valve position.
		12—Off direction operation to minimum valve position.
		192—inactivity.

AI

AI1

AI1 is the Analog Input Thousandths Valve Level, AI1 will display the real time valve level value of the actuator. The range is 0 -1000.

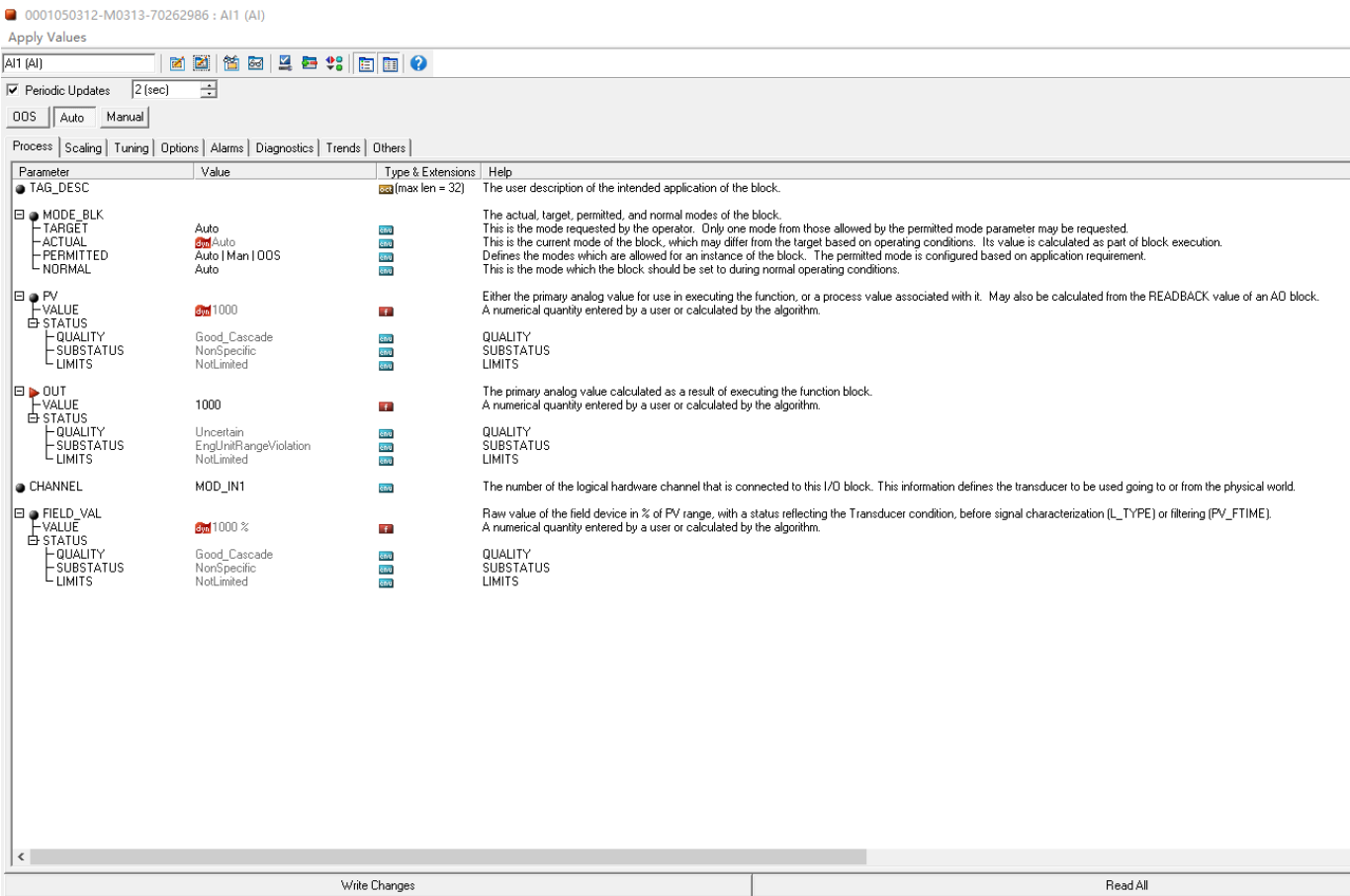


Figure 6-8 AI1

AI2

AI2 is alarm information feedback, through the value of AI2, you can see the current device alarm information.

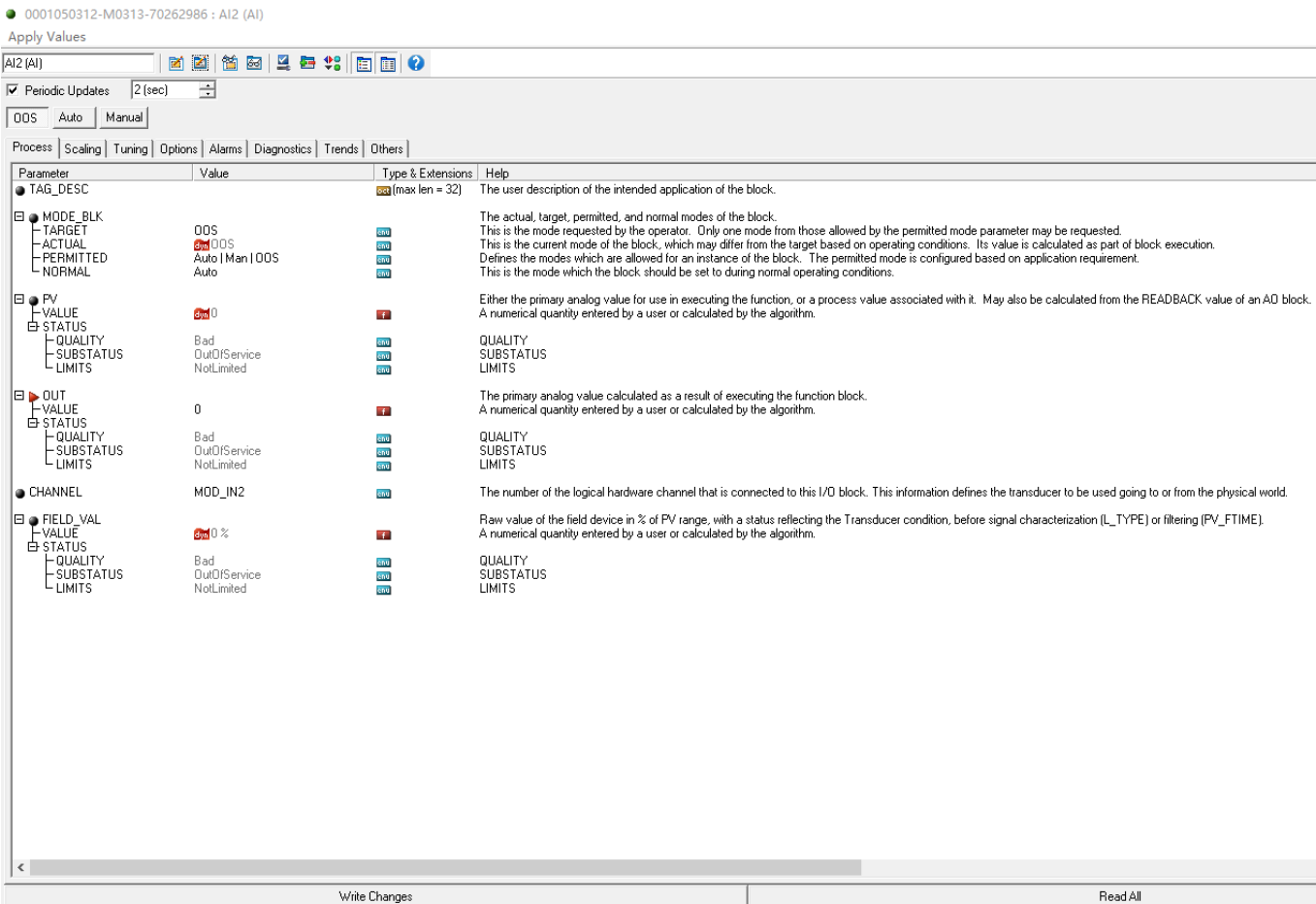


Figure 6-9 AI2

The 16-bit unsigned binary number returned by the device status is explained below:

The value of AI2 is a decimal number, so you can check the device alarm information against the decimal number in the following table.

Table 6-4. Device Alarm Information Decoding Table with Bit Number, Value, and Status Clarification for Actuator Diagnostics.

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
			Reservations				Reservations								
Bit number		Bit value (binary)			Complete value(10-bit)				Clarification						

11	1	2048	Setpoint Current over 20mA
14		16384	Fully open in place switch
15		32768	Fully closed in place switch
16		65536	Handwheels

AI3

AI3 is the current device status feedback, you can know the current device status by the value of

AI3!

0001050312-M0313-70262986 : AI3 (AI)

Apply Values

AI3 (AI)

Periodic Updates: 2 (sec)

OOS | Auto | Manual

Process | Scaling | Tuning | Options | Alarms | Diagnostics | Trends | Others

Parameter	Value	Type & Extensions	Help
● TAG_DESC		32 (max len = 32)	The user description of the intended application of the block.
● MODE_BLK			The actual, target, permitted, and normal modes of the block.
● TARGET	Auto	32	This is the mode requested by the operator. Only one mode from those allowed by the permitted mode parameter may be requested.
● ACTUAL	Auto	32	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution.
● PERMITTED	Auto Man OOS	32	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement.
● NORMAL	Auto	32	This is the mode which the block should be set to during normal operating conditions.
● PV			Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
● VALUE	0	16	A numerical quantity entered by a user or calculated by the algorithm.
● STATUS			
● QUALITY	Bad	32	QUALITY
● SUBSTATUS	DeviceFailure	32	SUBSTATUS
● LIMITS	NotLimited	32	LIMITS
● OUT			The primary analog value calculated as a result of executing the function block.
● VALUE	0	16	A numerical quantity entered by a user or calculated by the algorithm.
● STATUS			
● QUALITY	Bad	32	QUALITY
● SUBSTATUS	DeviceFailure	32	SUBSTATUS
● LIMITS	NotLimited	32	LIMITS
● CHANNEL	MOD_IN3	32	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
● FIELD_VAL			Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).
● VALUE	0 %	16	A numerical quantity entered by a user or calculated by the algorithm.
● STATUS			
● QUALITY	Bad	32	QUALITY
● SUBSTATUS	DeviceFailure	32	SUBSTATUS
● LIMITS	NotLimited	32	LIMITS

Write Changes | Read All

Figure 6-10 AI3

The 16-bit unsigned binary number returned by the device status is explained below:

The value of AI3 is a decimal number, so you can check the device status against the decimal number in the following table.

Table 6-5. 16-bit Device Status Binary Number Breakdown with Hexadecimal Values and Clarifications for Fault Diagnostics

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reservations															

Bit number	Bit value (binary)	Complete value (10-bit)	Complete value (hex)	Clarification
0	1	1	0x0001	STATUS_BIT_LOCAL_OP
1		2	0x0002	STATUS_BIT_DISC_DIR
2		4	0x0004	STATUS_BIT_TORQUE_D _OP
3		8	0x0008	STATUS_BIT_TORQUE_D _CL
4		16	0x0010	STATUS_BIT_ACT_OPEN
5		32	0x0020	STATUS_BIT_ACT_CLOS E
6		64	0x0040	STATUS_BIT_TEMPERAT URE
7		128	0x0080	STATUS_BIT_END_POS
8		256	0x0100	STATUS_BIT_OS_OP

AI4

The value of AI4 is the fault information of the actuator. This parameter returns a 16-bit unsigned integer, and the fault information is identified according to the return value against the actuator manual.

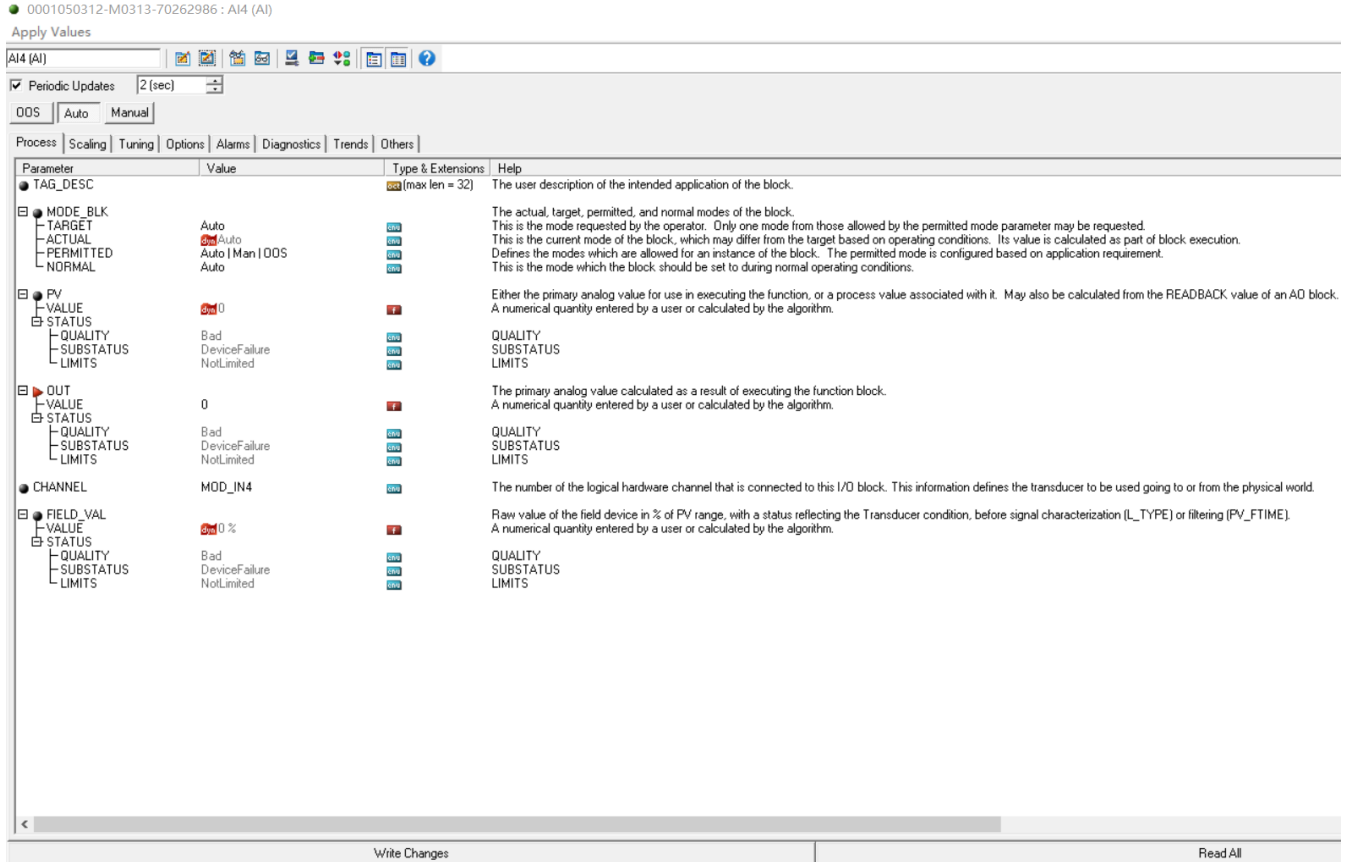


Figure 6-11 AI4.

The 16-bit unsigned binary number returned by the fault message is explained below:

The value of AI4 is a decimal number and can be used to quickly pinpoint the fault against the decimal number in the table below.

Table 6-6 Bitwise Fault Message Structure for Motor Diagnostics with Decimal Value Correspondence and Descriptions

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reservations															Reservations

Bit number	Bit value (binary)	Complete value (10-bit)	Clarification
1	1	2	Motor Temperature Fault
2		4	Electr Temperature Fault
3		8	End Position Fault
4		16	Torque Open Overload Fault

5		32	Torque Open Overload Fault
6		64	Open Block
7		128	Close Block
8		256	Motor Line Connect Error
9		512	Phase Loss
10		1024	Encoder Loss

Note: Both the output values (AO, DO) and input values (AI) set in the function block can be viewed in the MTB block, but cannot be modified in the MTB.

7. Troubleshooting and Support

Malfunction of Communications.

The communication process can be viewed through the FF field debugging software to check the communication between FF and the actuator, in which there are two important parameter values. Through the BAD_STATUS parameter you can check the communication of each input and output value channel in the FF function block, and through the ERR_LOOK_RESULT parameter, you can check the communication between the FF module and the actuator as well as the communication situation on the bus.

Table 7-1. BAD_STATUS Parameter Description. If communication fails, the corresponding bit is set to 1, otherwise it is 0.

Bit	Parameter	Bit	Parameter
0	MOD_IN1	16	MOD_IN_D1
1	MOD_IN2	17	MOD_IN_D2
2	MOD_IN3	18	MOD_IN_D3
3	MOD_IN4	19	MOD_IN_D4

4	MOD_IN5	20	MOD_IN_D5
5	MOD_IN6	21	MOD_IN_D6
6	MOD_IN7	22	MOD_IN_D7
7	MOD_IN8	23	MOD_IN_D8
8	MOD_OUT1	24	MOD_OUT_D 1
9	MOD_OUT2	25	MOD_OUT_D 2
10	MOD_OUT3	26	MOD_OUT_D 3
11	MOD_OUT4	27	MOD_OUT_D 4
12	MOD_OUT5	28	MOD_OUT_D 5
13	MOD_OUT6	29	MOD_OUT_D 6
14	MOD_OUT7	30	MOD_OUT_D 7
15	MOD_OUT8	31	MOD_OUT_D 8

ERR_LOOK_RESULT Parameter Description

ERR_LOOK_RESULT parameter provides the function of querying the negative response data of input/output parameters, users can query the response value of each input/output data and read the ERR_LOOK_RESULT parameter to get the communication response data of the parameter. 0 means no error, 0x01 - 0x0B are Modbus standard negative response data, 0xFF means master-slave communication failure. ERR_LOOK_RESULT, 0 means there is no error, 0x01 - 0x0B is the negative response data of Modbus standard, and 0xFF means master-slave communication failure.

ERR_LOOK_RESULT.

Table 7-2. ERR_LOOK_RESULT Parameter Codes for Fieldbus Communication Error Identification and Troubleshooting.

Numerical value	Parameter Description
0x00	OK
0x01	Illegal Function

0x02	Illegal Data Address
0x03	Illegal Data Value
0x04	Slave Device Failure
0x05	Acknowledge
0x06	Slave Device Busy
0x08	Memory Parity Error
0x0A	Gateway Path Unavailable
0x0B	Gateway Target Device Failed to Respond
0xFE	Function Code Mismatch
0xFF	Communication Failure

Contact Information for Support

Please contact the Ontrac Technical Support team through the support page on the website (www.ontracactuators.com) for further assistance. The support agent will request information about the actuator and provide the necessary assistance.