User's Manual

YTA Series

YTA610 and YTA710 Temperature Transmitters Fieldbus Communication

IM 01C50T02-02EN

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 01C50T02-02EN
2nd Edition

YTA610 and YTA710
Temperature Transmitters Fieldbus Communication

IM 01C50T02-02EN 2nd Edition

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1. Introduction

This manual contains a description of the YTA610 and YTA710 Temperature Transmitters Fieldbus Communication Type. The Fieldbus communication type is based on the same dual sensor input features as that of the HART communication type and is similar to the HART communication type in terms of basic performance and operation. This manual describes only those topics that are required for operation of the Fieldbus communication type. Refer to the user's manual "YTA610 and YTA710 Temperature Transmitters [Hardware]" (IM 01C50G01-01EN) for topics common to other communication types.

■ Regarding This Manual

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instrument.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- The following safety symbol marks are used in this Manual:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

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.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

■ For Safe Use of Product

For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety. Please give your attention to the followings.

(a) Installation

- The instrument must be installed by an expert engineer or a skilled personnel. The procedures described about INSTALLATION are not permitted for operators.
- In case of high process temperature, care should be taken not to burn yourself because the surface of the case reaches a high temperature.
- All installation shall comply with local installation requirement and local electrical code.

(b) Wiring

- The instrument must be installed by an expert engineer or a skilled personnel. The procedures described about WIRING are not permitted for operators.
- Please confirm that voltages between the power supply and the instrument before connecting the power cables and that the cables are not powered before connecting.

(c) Maintenance

- Please do not carry out except being written to a maintenance descriptions. When these procedures are needed, please contact nearest YOKOGAWA office.
- Care should be taken to prevent the build up of drift, dust or other material on the display glass and name plate. In case of its maintenance, soft and dry cloth is used.

(d) Modification

- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.

(e) Product Disposal

- The instrument should be disposed of in accordance with local and national legislation/ regulations.

(f) Authorized Representative in EEA

- In relation to the CE Marking, The authorized representative for this product in the EEA (European Economic Area) is:
  Yokogawa Europe B.V.
  Euroweg 2, 3825 HD Amersfoort,The Netherlands

■ Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
- In case of problems, the customer should contact the Yokogawa representative from which the instrument was purchased, or the nearest Yokogawa office.
- If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- Responsible party for repair cost for the problems shall be determined by Yokogawa based on our investigation.
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Failure or damage due to improper handling, use or storage which is out of design conditions.
  - Use of the product in question in a location not conforming to the standards specified by Yokogawa, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except Yokogawa or an approved representative of Yokogawa.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/ lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

■ ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB
All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

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Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

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2. Part Names

Refer to the individual instruction manuals for detailed descriptions of the parts. This section describes the topics applicable to the Fieldbus communication type.

(1) In the Fieldbus communication type, the amplifier assembly consists of two boards, as shown in Figure 2.1.
(2) In other communication types, there's the pin switch which is used for selecting the direction of hardware burnout at the position of 'SW1' on the amplifier assembly, while Fieldbus communication type does not have this pin.
(3) The Fieldbus communication type has a simulation function. A SIMULATE-ENABLE switch is mounted at 'SW1' on the amplifier. Refer to Section 7.3, “Simulation Function” for details of the simulation function.

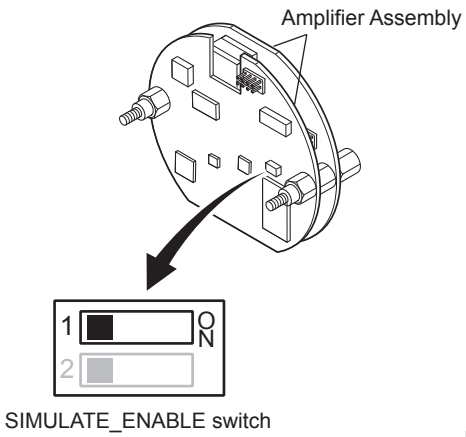


Figure 2.1 Diagram of the Amplifier Assembly

3. About Fieldbus

3.1 Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement in implementation technologies for process control systems and is widely employed by numerous field devices.

YTA Fieldbus communication type employs the specification standardized by The Fieldbus Foundation, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Fieldbus comes with software consisting of four AI function blocks and four DI function blocks, providing the means to implement a flexible instrumentation system.

For information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to “Fieldbus Technical Information” (TI 38K3A01-01E).

3.2 Internal Structure of YTA

The YTA contains two virtual field devices (VFD) that share the following functions.

3.2.1 System/network Management VFD

- Sets node addresses and Phisical Device tags (PD Tag) necessary for communication.
- Controls the execution of function blocks.
- Manages operation parameters and communication resources (Virtual Communication Relationship: VCR).

3.2.2 Function Block VFD

(1) Resource block (RS)

- Manages the status of YTA hardware.
- Automatically informs the host of any detected faults or other problems.

(2) SENSOR transducer block

- Accepts inputs from sensors and transfers to AI and DI function block.

(3) LCD transducer block

- Controls the display of the integral indicator.

(4) Maintenance transducer block

- Define below parameters.
  Device information, Software download, and Log etc.

(5) AI function block

- Outputs signals from SENSOR transducer block.
- Carries out scaling damping, etc.

(6) DI function block

- Limit switch for temperature.

3.3 Logical Structure of Each Block

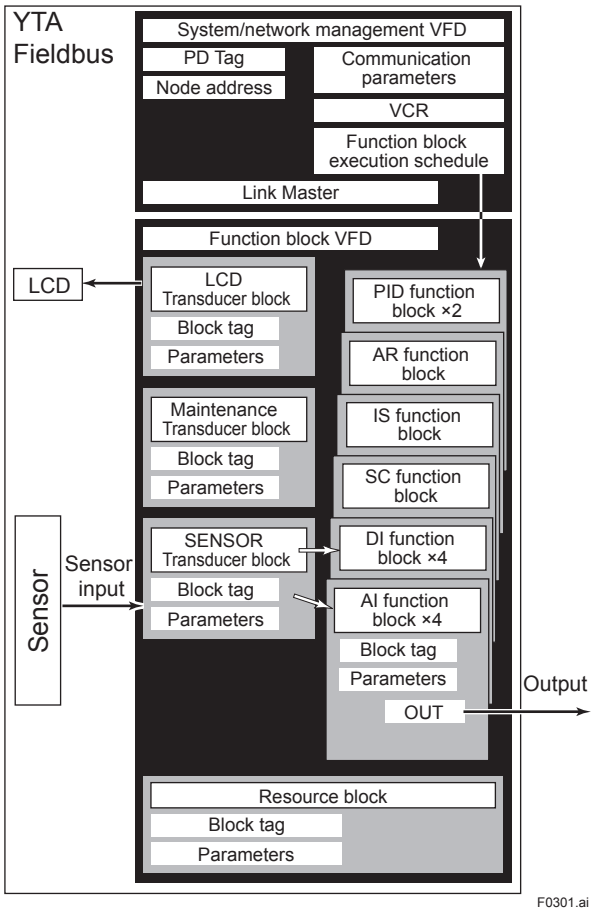


Figure 3.1 Logical Structure of Each Block

Setting of various parameters, node addresses, and PD Tags shown in Figure 3.1 is required before starting operation.

3.4 Wiring System Configuration

The number of devices that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exhibited.

4. Getting Started

Fieldbus is fully dependent upon digital communication protocol and differs in operation from conventional 4 to 20 mA transmission and the HART communication protocol. It is recommended that novice users use field devices in accordance with the procedures described in this section. The procedures assume that field devices will be set up on a bench or an instrument shop.

4.1 Connection of Devices

The following instruments are required for use with Fieldbus devices:

- **Power supply:**

  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.

- **Terminator:**

  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices:**

  Connect Fieldbus communication type YTA. Two or more YTA devices or other devices can be connected.

- **Host:**

  Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes. For operation of the host, refer to the instruction manual for each host. No details of the host are explained in the rest of this material.

- **Cable:**

  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K3A01-01E) for details of instrumentation cabling. If the total length of the cable is in a range of 2 to 3 meters for laboratory or other experimental use, the following simplified cable (a twisted pair wire with a cross section of 0.9 mm^2 or more and cycle period of within 5 cm (2 inches) may be used. Termination processing depends on the type of device being deployed. For YTA, use an M4 screw terminal claw. Some hosts require a connector.

Refer to Yokogawa when making arrangements to purchase the recommended equipment.

Connect the devices as shown in Figure 4.1. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

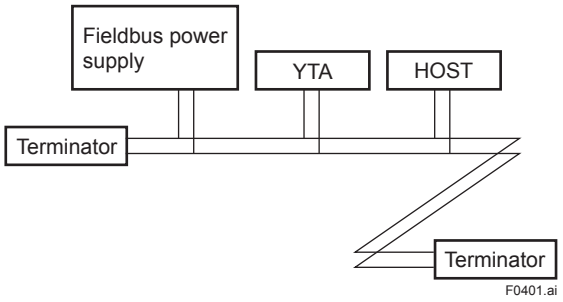


Figure 4.1 Cabling

NOTE

No CHECK terminal is used for Fieldbus communication YTA. Do not connect the field indicator and check meter. Use the instrument with the short-bar being installed between (-) terminal and the CHECK terminal.

Before using a Fieldbus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed in operation. Disconnect the relevant control loop from the bus if necessary.

IMPORTANT

Connecting a Fieldbus configuration tool to a loop with its existing host may cause communication data scrambles resulting in a functional disorder or a system failure.

4.2 Host Setting

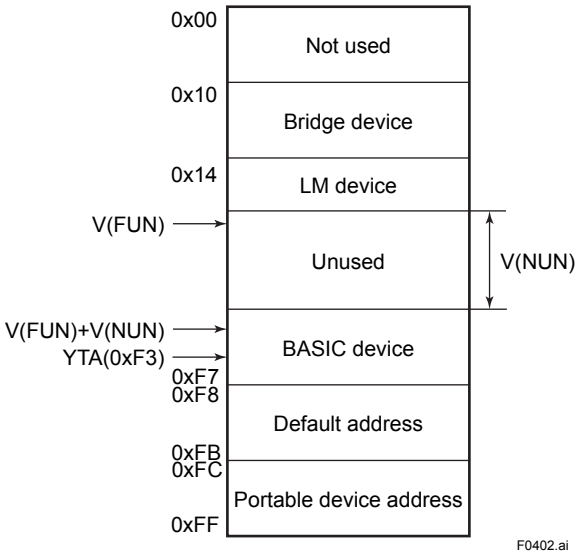
To activate Fieldbus, the following settings are required for the host.

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to EEPROM, the redundant processing is executed for the improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original values.

Table 4.1 Operation Parameters

Symbol	Parameter	Description and Settings
V (ST)	Slot-Time	Set 4 or greater value.
V (MID)	Minimum-Inter-PDU-Delay	Set 4 or greater value.
V (MRD)	Maximum-Response-Delay	Set so that V (MRD) × V (ST) is 12 or greater
V (FUN)	First-Unpolled-Node	Indicate the address next to the address range used by the host. Set 0x15 or greater.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range. YTA address is factory-set to 0xF3. Set this address to be within the range of the BASIC device in Figure 4.2.



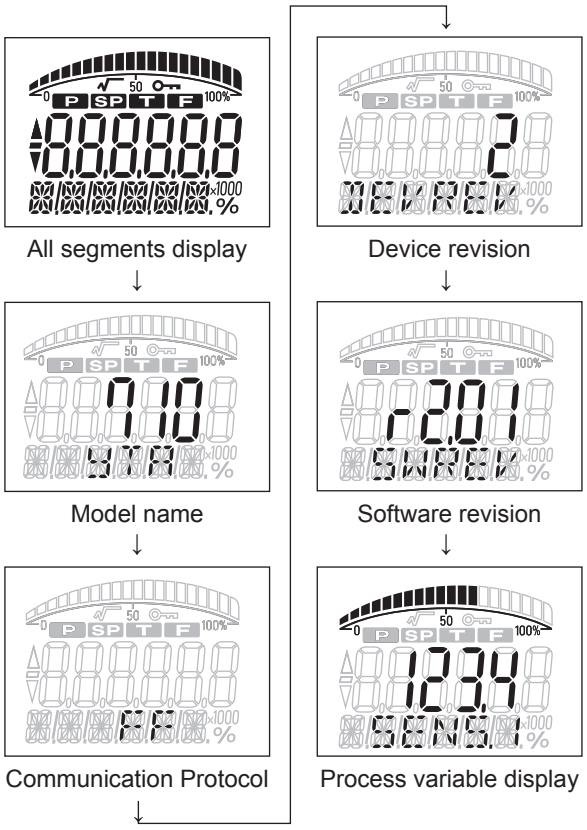
Note 1: Bridge device: A linking device which brings data from one or more H1 networks.
Note 2: LM device: with bus control function (Link Master function)
Note 3: BASIC device: without bus control function

Figure 4.2 Available Address Range

4.3 Bus Power ON

4.3.1 Integral Indicator Display When Powering On

Turn on the power of the host and the bus.
For models with the integral indicator code “D”, the display shows all segments in the LCD and then changes to the displays shown below sequentially.



4.3.2 Confirming that Transmitter is Operating Properly

Turn on the power of the host and the bus. If the indicator is not lit, check the polarity of the power supply.
The device information, including PD tag, Node address, and Device ID, is described on the sheet attached to the transmitter. The device information is given in duplicate on this sheet.

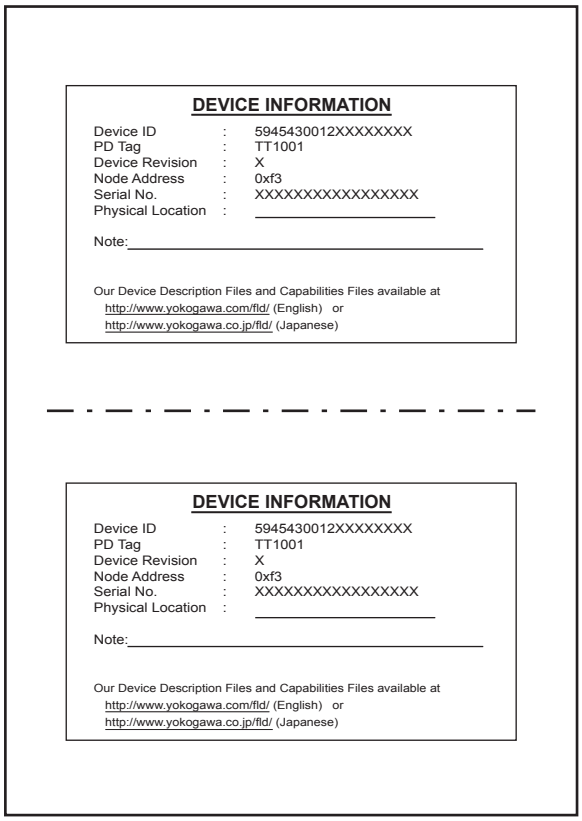


Figure 4.3 Device Information Sheet Attached to YTA

If no transmitter is detected, check the available address range and the polarity of the power supply. If the node address and PD tag are not specified when ordering, default value is factory set. If two or more transmitters are connected at a time with default value, only one transmitter will be detected from the host as transmitters have the same initial address. Separately connect each transmitter and set a different address for each.

4.4 Integration of DD

If the host supports DD (Device Description), the DD of the YTA needs to be installed. Check if host has the following directory under its default DD directory.

594543\0012 or 594543\0014
(594543 is the manufacturer number of Yokogawa Electric Corporation, 0014 is the YTA610 device number, and 0012 is the YTA710 device number, respectively.)

If this directory is not found, DD of YTA has not been included. Create the above directory and copy the DD file (0m0n.ffo,0m0n.sym) (m, n is a numeral) into the directory. If you do not have the DD or capabilities files, you can download them from our web site. Visit the following web site.

http://www.yokogawa.com/fld

Once the DD is installed in the directory, the name and attribute of all parameters of the YTA are displayed.

4.5 Set the parameters using DTM

When configure the parameters using FieldMate, use the DTM (Device Type Manager) shown in the Table 4.2.

Table 4.2 DTM

Name	Model Name	Device Type	Device Revision
YTA610 DTM	YTA610	0x0014	1
YTA710 DTM	YTA710	0x0012	2

4.6 Reading the Parameters

To read YTA parameters, select the AI1 block of the YTA from the host screen and read the OUT parameter. The current temperature which is assign to AI1 block is displayed. Sensor 1 input is assigned to AI1 block upon shipment. Check that actual of MODE_BLOCK of the function block and resource block is set to Auto, and increase the temperature measured by Sensor1 and read the parameter again. A new designated value should be displayed.

4.7 Continuous Record of Values

If the host has a function of continuously recording the indications, use this function to list the indications (values). Depending on the host being used, it may be necessary to set the schedule of Publish (the function that transmits the indication on a periodic basis).

4.8 Generation of Alarm

Generation of an alarm can be attempted from the transmitter. Block alarm, Output limit alarm, and Update alarm are informed to the host. When generating alarm, a Link Object and a VCR Static Entry need to be set. For details of Link Object and VCR Static Entry, refer to section 5.6.1 Link object and section 5.5.1 VCR Setting.

5. Configuration

This chapter contains information on how to adapt the function and performance of the YTA to suit specific applications. Because two or more devices are connected to Fieldbus, settings including the requirements of all devices need to be determined. Practically, the following steps must be taken.

(1) Network design

Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2) Network definition

Determines the tag and node addresses for all devices.

(3) Definition of combining function blocks

Determines the method for combination between each function block.

(4) Setting tags and addresses

Sets the PD Tag and node addresses one by one for each device.

(5) Communication setting

Sets the link between communication parameters and function blocks.

(6) Block setting

Sets the parameters for function blocks.

The following section describes each step of the procedure in the order given. Using a dedicated configuration tool allows the procedure to be significantly simplified. This section describes the procedure to be assigned for a host which has relatively simple functions. Refer to Appendix 6 when the YTA is used as Link Master.

5.1 Network Design

Select the devices to be connected to the Fieldbus network. The following instruments are necessary for operation of Fieldbus.

- **Power supply**

  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.

- **Terminator**

  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices**

  Connect the field devices necessary for instrumentation. YTA has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.

- **Host**

  Used for accessing field devices. A minimum of one device with bus control function is needed.

- **Cable**

  Used for connecting devices. Refer to TI 38K3A01-01E “Fieldbus Technical Information” for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required.

First, check the capacity of the power supply. The power supply capacity must be greater than the sum of the maximum current consumed by all devices to be connected to Fieldbus. The maximum current consumed (power supply voltage 9 V to 32 V) for YTA is 15 mA. The cable must have the spur in a minimum length with terminators installed at both ends of the trunk.

5.2 Network Definition

Before connection of devices with Fieldbus, define the Fieldbus network. Allocate PD Tag and node addresses to all devices (excluding such passive devices as terminators).

The PD Tag is the same as the conventional one used for the device. Up to 32 alphanumeric characters may be used for definition. Use a hyphen as a delimiter as required.

The node address is used to specify devices for communication purposes. Because data is too long for a PD Tag, the host uses the node address in place of the PD Tag for communication. A range of 20 to 247 (or hexadecimal 14 to F7) can be set. The device (LM device) with bus control function (Link Master function) is allocated from a smaller address number (20) side, and other devices (BASIC device) without bus control function allocated from a larger address number (247) side respectively. Place YTA in the range of the BASIC device. When the YTA is used as Link Master, place YTA in the range of LM device. Set the range of addresses to be used to the LM device. Set the following parameters.

Table 5.1 Parameters for Setting Address Range

Symbol	Parameters	Description
V (FUN)	First-Unpolled-Node	Indicates the address next to the address range used for the host or other LM device.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range.

The devices within the address range written as “Unused” in Figure 5.1 cannot be used on a Fieldbus. For other address ranges, the range is periodically checked to identify when a new device is mounted. Care must be taken not to allow the address range to become wider, which can lead to exhaustive consumption of Fieldbus communication performance.

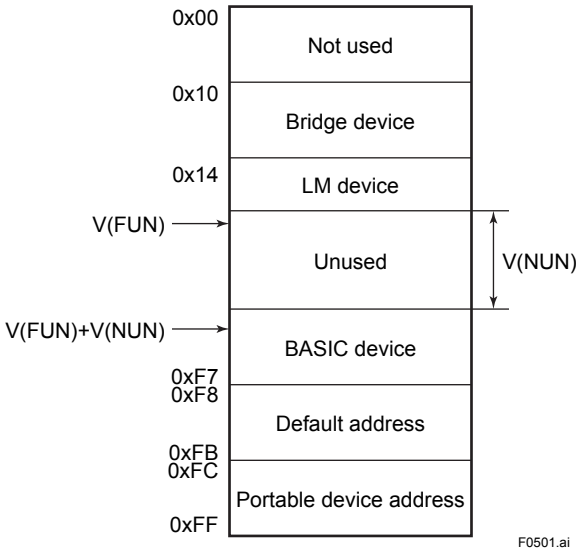


Figure 5.1 Available Range of Node Addresses

To ensure stable operation of Fieldbus, determine the operation parameters and set them to the LM devices. While the parameters in Table 5.2 are to be set, the worst-case value of all the devices to be connected to the same Fieldbus must be used. Refer to the specification of each device for details. Table 5.2 lists YTA specification values.

Table 5.2 Operation Parameter Values of the YTA to be Set to LM Devices

Symbol	Parameters	Description and Settings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of thje device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For YTA, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For YTA, set a value of 4 or greater.
V (MRD)	Maximum-Reply-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) × V (ST) is the maximum value of the specification for all devices. For YTA, the setting must be a value of 12 or greater.

5.3 Definition of Combining Function Blocks

The input/output parameters for function blocks are combined. For the YTA, four AI blocks output parameter (OUT), four DI blocks output parameter (OUT_D) and PID block are subject to combination. They are combined with the input of the control block as necessary. Practically, setting is written to the YTA link object with reference to “Block setting” in Section 5.6 for details. It is also possible to read values from the host at proper intervals instead of connecting the YTA block output to other blocks.

The combined blocks need to be executed synchronously with other blocks on the communications schedule. In this case, change the YTA schedule according to the following table. Enclosed values in the table are factory-settings.

Table 5.3 Execution Schedule of the YTA Function Blocks

Index	Parameters	Setting (Enclosed is factory-setting)
269 (SM)	MACROCYCLE_ DURATION	Cycle (MACROCYCLE) period of control or measurement. Unit is 1/32 ms. (16000 = 0.5 s)
351 (SM)	FB_START_ENTRY.1	AI1 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (0 = 0 s)
352 to 380 (SM)	FB_START_ENTRY.2 to FB_START_ENTRY.30	Not used.

Table 5.4 shows maximum execution time of YTA function blocks.

Table 5.4 Execution Time of YTA Function Block

Function Block	Execution time (ms)
AI	30
DI	30
SC	30
IS	30
AR	30
PID	45

For scheduling of communications for combination with the next function block, the execution is so arranged as to start after a lapse of longer than 100 ms. In no case should function blocks of the YTA be executed at the same time (execution time is overlapped).

Figure 5.3 shows an example of schedule based on the loop shown in Figure 5.2.

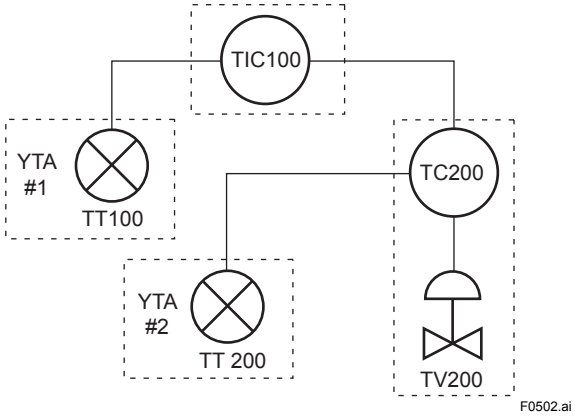


Figure 5.2 Example of Loop Connecting Function Block of Two YTA with Other Instruments

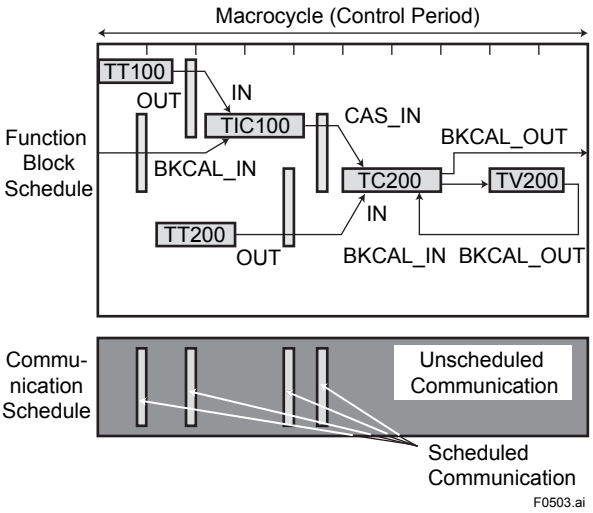


Figure 5.3 Function Block Schedule and Communication Schedule

When the control period (macrocycle) is set to more than 4 seconds, set the following interval to be more than 1% of the control period.

- Interval between “end of block execution” and “start of sending CD from LAS”
- Interval between “end of block execution” and “start of the next block execution”

5.4 Setting of Tags and Addresses

This section describes the steps in the procedure to set PD Tags and node addresses in the YTA. There are three states of Fieldbus devices as shown in Figure 5.4, and if the state is other than the lowest SM_OPERATIONAL state, no function block is executed. YTA must be transferred to this state when an YTA tag or address is changed.

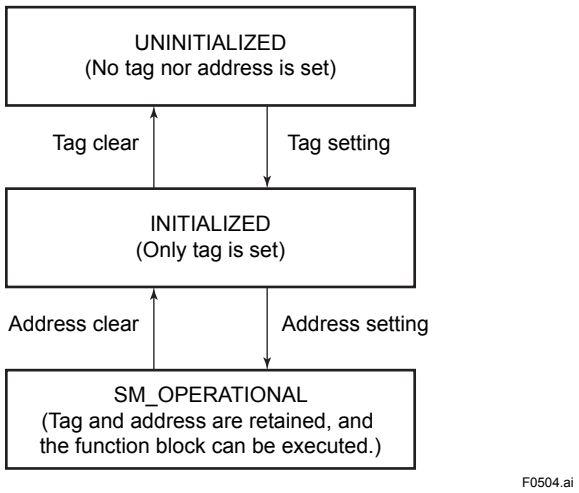


Figure 5.4 Status Transition by Setting PD Tag and Node Address

YTA has a PD Tag (TT1001) and node address (243, or hexadecimal 0xF3) that are set upon shipment from the factory unless otherwise specified. To change only the node address, clear the address once and then set a new node address. To set the PD Tag, first clear the node address and clear the PD Tag, then set the PD Tag and node address again.

Devices whose node address was cleared will await the default address (randomly chosen from a range of 248 to 251, or from hexadecimal F8 to FB). At the same time, it is necessary to specify the device ID in order to correctly specify the device. The device ID of the YTA610 is 5945430014xxxxxxxx and YTA710 is 5945430012xxxxxxxx. (The xxxxxxxx at the end of the above device ID is a total of 8 alphanumeric characters.)

5.5 Communication Setting

To set the communication function, it is necessary to change the database residing in SM-VFD.

5.5.1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. YTA has 38 VCRs whose application can be changed, except for the first VCR, which is used for management.

YTA has VCRs of four types:

Server(QUB) VCR
: A Server responds to requests from a host. This communication needs data exchange. This type of communication is called QUB (Queued User-triggered Bidirectional) VCR.

Source (QUU) VCR
: A Source multicasts alarms or trends to other devices. This type of communication is called QUU (Queued User-triggered Unidirectional) VCR.

Publisher (BNU) VCR
: A Publisher multicasts AI block and DI block output to another function block(s). This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

Subscriber (BNU) VCR
: A Subscriber receives output of another function block(s) by PID block.

A Server VCR is capable to respond to requests from a Client (QUB) VCR after the Client initiates connection to the Server successfully. A Source VCR transmits data without established connection. A Sink (QUU) VCR on another device can receive it if the Sink is configured so. A Publisher VCR transmits data when LAS requests so. An explicit connection is established from Subscriber (BNU) VCR(s) so that a Subscriber knows the format of published data.

Each VCR has the parameters listed in Table 5.5. Parameters must be changed together for each VCR because modification for each parameter may cause inconsistent operation.

Table 5.5 VCR Static Entry

Sub-index	Parameter	Description
1	FasArTypeAndRole	Indicates the type and role of communication (VCR). The following 4 types are used for YTA. 0x32: Server (Responds to requests from host.) 0x44: Source (Transmits alarm or trend.) 0x66: Publisher (Sends AI block output to other blocks.) 0x76: Subscriber (Receives output of other blocks by PID block.)
2	FasDllLocalAddr	Sets the local address to specify VCR in YTA. A range of 20 to F7 in hexadecimal.
3	FasDllConfigured RemoteAddr	Sets the node address of the called party for communication and the address (DLSAP or DLCEP) used to specify VCR in that address. For DLSAP or DLCEP, a range of 20 to F7 in hexadecimal is used. Addresses in Subindex 2 and 3 need to be set to the same contents of the VCR as the called party (local and remote are reversed).
4	FasDllSDAP	Specifies the quality of communication. Usually, one of the following types is set. 0x2B: Server 0x01: Source (Alert) 0x03: Source (Trend) 0x91: Publisher/Subscriber
5	FasDllMaxConfirm DelayOnConnect	To establish connection for communication, a maximum wait time for the called party's response is set in ms. Typical value is 60 seconds (60000).
6	FasDllMaxConfirm DelayOnData	For request of data, a maximum wait time for the called party's response is set in ms. Typical value is 60 seconds (60000).
7	FasDllMaxDlsduSize	Specifies maximum DL Service Data unit Size (DLSDU). Set 256 for Server and Trend VCR, and 64 for other VCRs.
8	FasDllResidual ActivitySupported	Specifies whether connection is monitored. Set TRUE (0xff) for Server. This parameter is not used for other communication.
9	FasDllTimelinessClass	Not used for YTA.
10	FasDllPublisherTime WindowSize	Not used for YTA.
11	FasDllPublisher SynchronizaingDlcep	Not used for YTA.
12	FasDllSubsriberTime WindowSize	Not used for YTA.
13	FasDllSubscriber SynchronizationDlcep	Not used for YTA.
14	FmsVfdId	Sets VFD for YTA to be used. 0x1: System/network management VFD 0x1234: Function block VFD
15	FmsMaxOutstanding ServiceCalling	Set 0 to Server. It is not used for other applications.
16	FmsMaxOutstanding ServiceCalled	Set 1 to Server. It is not used for other applications.
17	FmsFeatures Supported	Indicates the type of services in the application layer. In the YTA, it is automatically set according to specific applications.

VCRs are factory-set as shown in the table below.

Table 5.6 VCR List

Index (SM)	VCR Number	Factory Setting
402	1	For system management (Fixed)
403	2	Server (LocalAddr = 0xF3)
404	3	Server (LocalAddr = 0xF4)
405	4	Server (LocalAddr = 0xF7)
406	5	Trend Source (LocalAddr = 0x07, Remote Address=0x111)
407	6	Publisher for AI1 (LocalAddr = 0x20)
408	7	Alert Source (LocalAddr = 0x07, Remote Address=0x110)
409	8	Server (LocalAddr = 0xF9)
410 to 439	9 to 38	Not used

5.5.2 Function Block Execution Control

According to the instructions given in Section 5.3, set the execution cycle of the function blocks and schedule of execution.

5.6 Block Setting

Set the parameter for function block VFD.

5.6.1 Link Object

Link object combines the data voluntarily sent by the function block with VCR. YTA has 45 link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 5.7.

Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 5.7 Link Object Parameters

Sub-index	Parameters	Description
1	LocalIndex	Sets the index of function block parameters to be combined; set “0” for Trend and Alert.
2	VcrNumber	Sets the index of VCR to be combined. If set to “0”, this link object is not used.
3	RemoteIndex	Not used in YTA.Set to “0”.
4	ServiceOperation	Set one of the following. Set only one each for link object for Alert or Trend. 0: Undefined 2: Publisher 3: Subscriber 6: Alert 7: Trend
5	StaleCountLimit	Set the maximum number of consecutive stale input values which may be received before the input status is set to BAD. To avoid the unnecessary mode transition caused when the data is not correctly received by subscriber, set this parameter to “2” or more.

45 Link objects are not factory-set.

5.6.2 Trend Object

It is possible to set the parameter so that the function block automatically transmits Trend. YTA has ten Trend objects, six of which are used for Trend in analog mode parameters and four is used for Trend in discrete mode parameter. A single Trend object specifies the trend of one parameter.

Each Trend object has the parameters listed in Table 5.8. The first four parameters are the items to be set.

Table 5.8 Parameters for Trend Objects

Sub-index	Parameters	Description
1	Block Index	Sets the leading index of the function block that takes a trend.
2	Parameter Relative Index	Sets the index of parameters taking a trend by a value relative to the beginning of the function block.
3	Sample Type	Specifies how trends are taken. Choose one of the following 2 types: 1: Sampled upon execution of a function block. 2: The average value is sampled.
4	Sample Interval	Specifies sampling intervals in units of 1/32 ms. Set the integer multiple of the function block execution cycle.
5	Last Update	The last sampling time.
6 to 21	List of Status	Status part of a sampled parameter.
21 to 37	List of Samples	Data part of a sampled parameter.

Five trend objects are factory-set as shown Table 5.9.

Table 5.9 Trend Object are Factory-Set

Index	Parameters	Factory Settings
32000 to 32005	TREND_FLT.1 to TREND_FLT.6	Not used.
32006 to 32010	TREND_DIS.1 to TREND_DIS.4	Not used.

5.6.3 View Object

This is the object to form groups of parameters in a block. One of advantage brought by forming groups of parameters is the reduction of load for data transaction. YTA has four View Objects for each Resource block, Transducer block and each function block, and each View Object has the parameters listed in Table 5.11 to 5.16.

Table 5.10 Purpose of Each View Object

	Description
VIEW_1	Set of dynamic parameters required by operator for plant operation. (PV, SV, OUT, Mode etc.)
VIEW_2	Set of static parameters which need to be shown to plant operator at once. (Range etc.)
VIEW_3	Set of all the dynamic parameters.
VIEW_4	Set of static parameters for configuration or maintenance.

Table 5.11 View Object of Resource Block

Relative Index	Parameter	VIEW			
		1	2	3	4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				2
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED ROUT		4		
28	FAULT STATE	1		1	
29	SET_FSTATE				
30	CLR_FSTATE				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRIRE_PRI				1
40	WRITE_ALM				
41	ITK_VER				2
42	COMPATIBILITY_REV				
43	CAPABILITY_LEV				
44	FD_VER				2
45	FD_FAIL_ACTIVE	4		4	
46	FD_OFFSPEC_ACTIVE	4		4	
47	FD_MAINT_ACTIVE	4		4	
48	FD CHECK_ACTIVE	4		4	
49	FD_FAIL_MAP				4
50	FD_OFFSPEC_MAP				4
51	FD_MAINT_MAP				4
52	FD_CHECK_MAP				4
53	FD_FAIL_MASK				4
54	FD_OFFSPEC_MASK				4
55	FD_MAINT_MASK				4
56	FD_CHECK_MASK				4
57	FD_FAIL_ALM				
58	FD_OFFSPEC_ALM				
59	FD_MAINT_ALM				
60	FD_CHECK_ALM				
61	FD_FAIL_PRI				1
62	FD_OFFSPEC_PRI				1
63	FD_MAINT_PRI				1
64	FD_CHECK_PRI				1
65	FD_SIMULATE			9	
66	FD_RECOMMEN_ACT	2		2	
67	FD_EXTENDED_ACTIVE_1				
68	FD_EXTENDED_ACTIVE_2				
69	FD_EXTENDED_ACTIVE_3				
70	FD_EXTENDED_ACTIVE_4				
71	FD_EXTENDED_ACTIVE_5				
72	FD_EXTENDED_ACTIVE_6				
73	FD_EXTENDED_ACTIVE_7				
74	FD_EXTENDED_ACTIVE_8				
75	FD_EXTENDED_MAP_1				
76	FD_EXTENDED_MAP_2				
77	FD_EXTENDED_MAP_3				
78	FD_EXTENDED_MAP_4				
79	FD_EXTENDED_MAP_5				
80	FD_EXTENDED_MAP_6				
81	FD_EXTENDED_MAP_7				
82	FD_EXTENDED_MAP_8				
83	DEVICE_CONDITION_ACTIVE_1				
84	DEVICE_CONDITION_ACTIVE_2				
85	DEVICE_CONDITION_ACTIVE_3				
86	DEVICE_CONDITION_ACTIVE_4				
87	DEVICE_CONDITION_ACTIVE_5				
88	DEVICE_CONDITION_ACTIVE_6				
89	DEVICE_CONDITION_ACTIVE_7				
90	DEVICE_CONDITION_ACTIVE_8				
91	SOFTWARE_REV				
92	WRITE_LOCK_LEVEL				
	Total in byre	40	30	49	69

Table 5.12 View Object of SENSOR Transducer Block

Relative Index	Parameter	VIEW						
		1	2	3	4-1	4-2	4-3	4-4
1	ST_REV	2	2	2	2	2	2	2
2	TAG_DESC							
3	STRATEGY				2			
4	ALERT_KEY				1			
5	MODE_BLK	4		4				
6	BLOCK_ERR	2		2				
7	UPDATE_EVT							
8	BLOCK_ALM							
9	TRANSDUCER_DIRECTORY							
10	TRANSDUCER_TYPE	2	2	2	2			
11	TRANSDUCER_TYPE_VER	2	2	2	2			
12	XD_ERROR	1		1				
13	COLLECTION_DIRECTORY							
14	PRIMARY_VALUE_TYPE_1		2					
15	PRIMARY_VALUE_1	5		5				
16	PRIMARY_VALUE_RANGE_1				11			
17	CAL_POINT_HI_1		4					
18	CAL_POINT_LO_1		4					
19	CAL_MIN_SPAN_1				4			
20	CAL_VALUE_1	5		5				
21	CAL_UNIT_1				2			
22	XD_OPTS		4					
23	SENSOR_TYPE_1				2			
24	SENSOR_RANGE_1				11			
25	SENSOR_SN_1				32			
26	SENSOR_CAL_METHOD_1				1			
27	SENSOR_CAL_LOC_1					32		
28	SENSOR_CAL_DATE_1					7		
29	SENSOR_CAL_WHO_1					32		
30	SENSOR_CONNECTION_1					1		
31	PRIMARY_VALUE_TYPE_2		2					
32	PRIMARY_VALUE_2	5		5				
33	PRIMARY_VALUE_RANGE_2					11		
34	CAL_POINT_HI_2		4					
35	CAL_POINT_LO_2		4					
36	CAL_MIN_SPAN_2					4		
37	CAL_VALUE_2	5		5				
38	CAL_UNIT_2					2		
39	SENSOR_TYPE_2					2		
40	SENSOR_RANGE_2						11	
41	SENSOR_SN_2						32	
42	SENSOR_CAL_METHOD_2						1	
43	SENSOR_CAL_LOC_2						32	
44	SENSOR_CAL_DATE_2						7	
45	SENSOR_CAL_WHO_2							32
46	SENSOR_CONNECTION_2							1
47	CAL_POINT_RESET					1		
48	CONSTANT_CJC_TEMP					4		
49	CONSTANT_CJC_UNIT					2		
50	CJC_SELECT					1		
51	SENSOR1_DAMP		4					
52	WIRING_RESISTANCE_1					4		
53	SENSOR1_MATCH_ICE_A							
54	SENSOR1_MATCH_ICE_B							
55	SENSOR1_MATCH_ICE_C							
56	SENSOR1_MATCH_ICE_R0							

Relative Index	Parameter	VIEW						
		1	2	3	4-1	4-2	4-3	4-4
57	SENSOR1_MATCH_CVD_ALPHA							
58	SENSOR1_MATCH_CVD_DELTA							
59	SENSOR1_MATCH_CVD_BETA							
60	SENSOR1_MATCH_CVD_R0							
61	SENSOR2_DAMP		4					
62	WIRING_RESISTANCE_2							4
63	SENSOR2_MATCH_IEC_A							
64	SENSOR2_MATCH_IEC_A							
65	SENSOR2_MATCH_IEC_A							
66	SENSOR2_MATCH_IEC_R0							
67	SENSOR2_MATCH_CVD_ALPHA							
68	SENSOR2_MATCH_CVD_DELTA							
69	SENSOR2_MATCH_CVD_BETA							
70	SENSOR2_MATCH_CVD_R0							
71	SENSOR1_VALUE	5		5				
72	SENSOR1_UNIT				2			
73	SENSOR1_TERMINAL_VALUE	5		5				
74	SENSOR1_TERMINAL_UNIT				2			
75	TERMINAL_VALUE	5		5				
76	TERMINAL_UNIT				2			
77	TERMINAL_DAMP		4					
78	SENSOR2_VALUE	5		5				
79	SENSOR2_UNIT				2			
80	SENSOR2_TERMINAL_VALUE	5		5				
81	SENSOR2_TERMINAL_UNIT				2			
82	SENSOR1_SENSOR2_VALUE	5		5				
83	SENSOR1_SENSOR2_UNIT				2			
84	SENSOR2_SENSOR1_VALUE	5		5				
85	SENSOR2_SENSOR1_UNIT				2			
86	AVERAGE_VALUE	5		5				
87	AVERAGE_UNIT				2			
88	BACKUP_VALUE	5		5				
89	BACKUP_UNIT				2			
90	SENSOR_RECOVER							
91	BACKUP_STATE			1				
92	LIMSW_1_VALUE_D	2		2				
93	LIMSW_1_TARGET		1					
94	LIMSW_1_SETPOINT		4					
95	LIMSW_1_ACT_DIRECTION				1			
96	LIMSW_1_HYSTERESIS				4			
97	LIMSW_1_UNIT							
98	LIMSW_2_VALUE_D	2		2				
99	LIMSW_2_TARGET		2					
100	LIMSW_2_SETPOINT		4					
101	LIMSW_2_ACT_DIRECTION				1			
102	LIMSW_2_HYSTERESIS				4			
103	LIMSW_2_UNIT							
104	LIMSW_3_VALUE_D	2		2				
105	LIMSW_3_TARGET		1					
106	LIMSW_3_SETPOINT		4					
107	LIMSW_3_ACT_DIRECTION				1			
108	LIMSW_3_HYSTERESIS				4			
109	LIMSW_3_UNIT							
110	LIMSW_4_VALUE_D	2		2				
111	LIMSW_4_TARGET		1					
112	LIMSW_4_SETPOINT		4					
113	LIMSW_4_ACT_DIRECTION				1			

Relative Index	Parameter	VIEW						
		1	2	3	4-1	4-2	4-3	4-4
114	LIMSW_4_HYSTERESIS				4			
115	LIMSW_4_UNIT							
116	SENSOR1_RP23							
117	SENSOR1_RC1							
118	SENSOR1_RC2							
119	SENSOR1_RC3							
120	SENSOR1_RC4							
121	SENSOR2_RP43							
122	SENSOR2_RC3							
123	SENSOR2_RC4							
124*1	SENSOR1_TC_SHORT_THR							
125*1	SENSOR2_TC_SHORT_THR							
126*1	SENSOR1_RTD_CORR_THR							
127*1	SENSOR2_RTD_CORR_THR							
128	DRIFT_UNIT							
129	DRIFT_THR							
130*1	SENSOR1_TEMP_CYCLE							
131*1	SENSOR2_TEMP_CYCLE							
132*1	TEMP_CYCLE_UNIT							
133*1	UPPER_TEMP_CYCLE_THR							
134*1	LOWER_TEMP_CYCLE_THR							
135*1	CYCLE_COUNT_THR							
136*1	CYCLE_COUNT_RESET							
137	TC_ELECTRIC_1_25							
138	TC_ELECTRIC_26_50							
139	TC_TEMPERATURE_1_25							
140	TC_TEMPERATURE_26_50							
141	TC_VALID_POINT							
142	EXTRA_SPEC							
143	SENSOR_STATUS_MASK_1							
144	SENSOR_STATUS_MASK_2							
145	SENSOR_STATUS_MASK_3							
146	SENSOR_STATUS_MASK_4							
147	SENSOR_STATUS_MASK_5							
148	SENSOR_STATUS_MASK_6							
149	SENSOR_STATUS_MASK_7							
150	SENSOR_STATUS_MASK_8							
	Total in byre	86	62	36	72	105	85	29

*1: Applicable only for YTA710.

Table 5.13 View Object of LCD Transducer Block

Relative Index	Parameter	VIEW			
		1	2	3	4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_DIRECTORY				
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1		1	
13	COLLECTION_DIRECTORY				
14	DISP_OUT_1				1
15	DISP_OUT_2				
16	INFO_SEL				1
17	BAR_GRAPH_SELECT				1
18	DISPLAY_CYCLE				1
19	SQUAWK			1	
	Total in byre	13	6	14	13

Table 5.14 View Object of Maintenance Transducer Block

Relative Index	Parameter	VIEW			
		1	2	3	4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_DIRECTORY				
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1		1	
13	COLLECTION_DIRECTORY				
15	DEVICE_SN				32
16	SPECIAL_ORDER_ID				32
17	MANUFAC_DATE				32
18	MS_CODE1				
19	MS_CODE2				
20	MS_CODE3				
21	SOFTWARE_DESC				
22	SIM_ENABLE_MSG			32	
23	SOFTDL_PROTECT				1
24	SOFTDL_ERROR			2	
25	SOFTDL_COUNT				
26	SOFTDL_ACT_AREA				
27	CAPABILITY_CONFIG				
28	SI_CONTROL_CODES				1
46	MODEL				
47	MODULE_SN				
48	OPERATE_TIME				
49	OPERATE_SERVICE				
50	TWO_SENSOR_IS				1
51	SENSOR_MATCHING_IS				1
52	ACCURATE_CJC_IS				1
53	REVERSE_CALC_IS				1
54	SOFTDL_IS				1
55	SENSOR1_MAX				
56	SENSOR1_MIN				
57	SENSOR1_LOG_CLEAR				
58	SENSOR2_MAX				
59	SENSOR2_MIN				
60	SENSOR2_LOG_CLEAR				
61	SENSOR2_MIN				
62	TERMINAL_MIN				
78	FD_EXTENDED_LOG_NO				
79	FD_EXTENDED_LOG_TIME				
80	FD_EXTENDED_1_LOG				
81	FD_EXTENDED_2_LOG				
82	FD_EXTENDED_3_LOG				
83	FD_EXTENDED_4_LOG				
84	FD_EXTENDED_5_LOG				
85	FD_EXTENDED_6_LOG				
86	FD_EXTENDED_7_LOG				
87	FD_EXTENDED_8_LOG				
	Total in byre	13	6	47	107

Table 5.15 View Object of AI Function Block

Relative Index	Parameter	VIEW			
		1	2	3	4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	OUT	5		5	
9	SIMULATE				
10	XD_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	L_TYPE				2
17	LOW_CUT				4
18	PV_FTIME				4
19	FIELD_VAL	5		5	
20	UPDATE_EVT				
21	BLOCK_ALM				
22	ALARM_SUM	8		8	
23	ACK_OPTION				2
24	ALARM_HYS				4
25	HI_HI_PRI				1
26	HI_HI_LIM				4
27	HI_PRI				1
28	HI_LIM				4
29	LO_PRI				1
30	LO_LIM				4
31	LO_LO_PRI				1
32	LO_LO_LIM				4
33	HI_HI_ALM				
34	HI_ALM				
35	LO_ALM				
36	LO_LO_ALM				
37	BLOCK_ERR_DESC_1				
	Total in byre	31	26	31	46

Table 5.16 View Object of DI Function Block

Relative Index	Parameter	VIEW			
		1	2	3	4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV_D	2		2	
8	OUT_D	2		2	
9	SIMULATE_D				
10	XD_STATE		2		
11	OUT_STATE		2		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	PV_FTIME				4
17	FIELD_VAL_D	2		2	
18	UPDATE_EVT				
19	BLOCK_ALM				
20	ALARM_SUM|ALARM_SUM_DI	8		8	
21	ACK_OPTION|ACK_OPTION_DI				2
22	DISC_PRI				1
23	DISC_LIM				1
24	DISC_ALM				
	Total in byre	22	8	22	19

Table 5.17 Indexes of View for Each Block

Function Block	VIEW			
	1	2	3	4
Resource Block	40100	40101	40102	40103
SENSOR Transducer Block	40200	40201	40202	40203 to 40206
LCD Transducer Block	40250	40251	40252	40252
Maintenance Transducer Block	40300	40301	40302	40303
AI1 Function Block	40400	40401	40402	40403
AI2 Function Block	40410	40411	40412	40413
AI3 Function Block	40420	40421	40422	40423
AI4 Function Block	40430	40431	40432	40433
DI1 Function Block	40600	40601	40602	40603
DI2 Function Block	40610	40611	40612	40613
DI3 Function Block	40620	40621	40622	40623
DI4 Function Block	40630	40631	40632	40633
PID1 Function Block	40800	40801	40802	40803
PID2 Function Block	40810	40811	40812	40813
SC Function Block	41450	41451	41452	41453
IS Function Block	41700	41701	41702	41703
AR Function Block	41750	41751	41752	41753

6. Explanation of Basic Items

6.1 Outline

This chapter describes the SENSOR transducer block, the LCD transducer block, and the AI function block and explains basic parameter settings. Refer to Appendixes for other function blocks, LM function, software download function.

6.2 Setting and Changing Parameters for the Whole Process

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for an improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original values.

Block mode

Many parameters require a change of the block mode of the function block to O/S (Out of Service) when their data is changed. To change the block mode of the function block, its MODE_BLK needs to be changed. The MODE_BLK is comprised of the four sub-parameters below:

(1) Target (Target mode):
Sets the operating condition of the block.
(2) Actual (Actual mode):
Indicates the current operating condition.
(3) Permit (Permitted mode):
Indicates the operating condition that the block is allowed to take.
(4) Normal (Normal mode):
Indicates the operating condition that the block will usually take.

6.3 SENSOR Transducer Block (STB)

The SENSOR transducer block is in between the sensor and the function blocks. The transducer block makes settings for the temperature transmitter-specific functions of the YTA, such as the temperature input. See Appendix 1 for a list of all parameters of the YTA; this section describes only the settings for important parameters.

6.3.1 Functional Block

Figure 6.1 presents the main functional block of the SENSOR transducer. Process values are transferred to the AI block via 9 channels and limit switch values are transferred to the DI block via 4 channels.

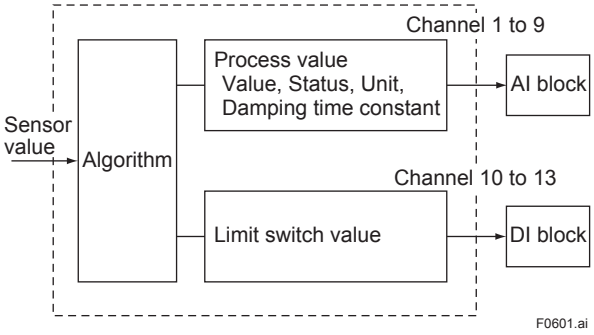


Figure 6.1 SENSOR Transducer Block

6.3.2 Block Mode

The Block modes permitted for the SENSOR transducer block are Automatic (Auto), Manual (MAN), and Out of Service (O/S). The mode must be set to Auto under normal operating conditions, and to O/S when making changes to an important parameter. For parameters that can only be changed in the Auto and O/S modes, refer to the parameter list for the SENSOR Transducer block in Appendix A1.2.

6.3.3 Parameters of SENSOR Transducer Block

NOTE

The YTA DD/DTM menu is shown in parentheses.
(M): Method

The SENSOR transducer block makes settings for the temperature transmitter-specific functions of the YTA, such as the temperature input and display settings. See Appendix 1 for a list of all parameters of the YTA; this section describes only the settings for important parameters.

- **Mode Setting Parameter**

MODE_BLK
Supports O/S, MAN, and Auto modes. In the O/S mode, the transducer block does not function, as implied by the mode name “Out of Service.”

- **Parameters Related to Sensor Input**

The number “2” enclosed in parentheses appearing in the following parameter names and descriptions indicates that the preceding number “1” should be read as “2” for the cases of sensor 2, respectively.

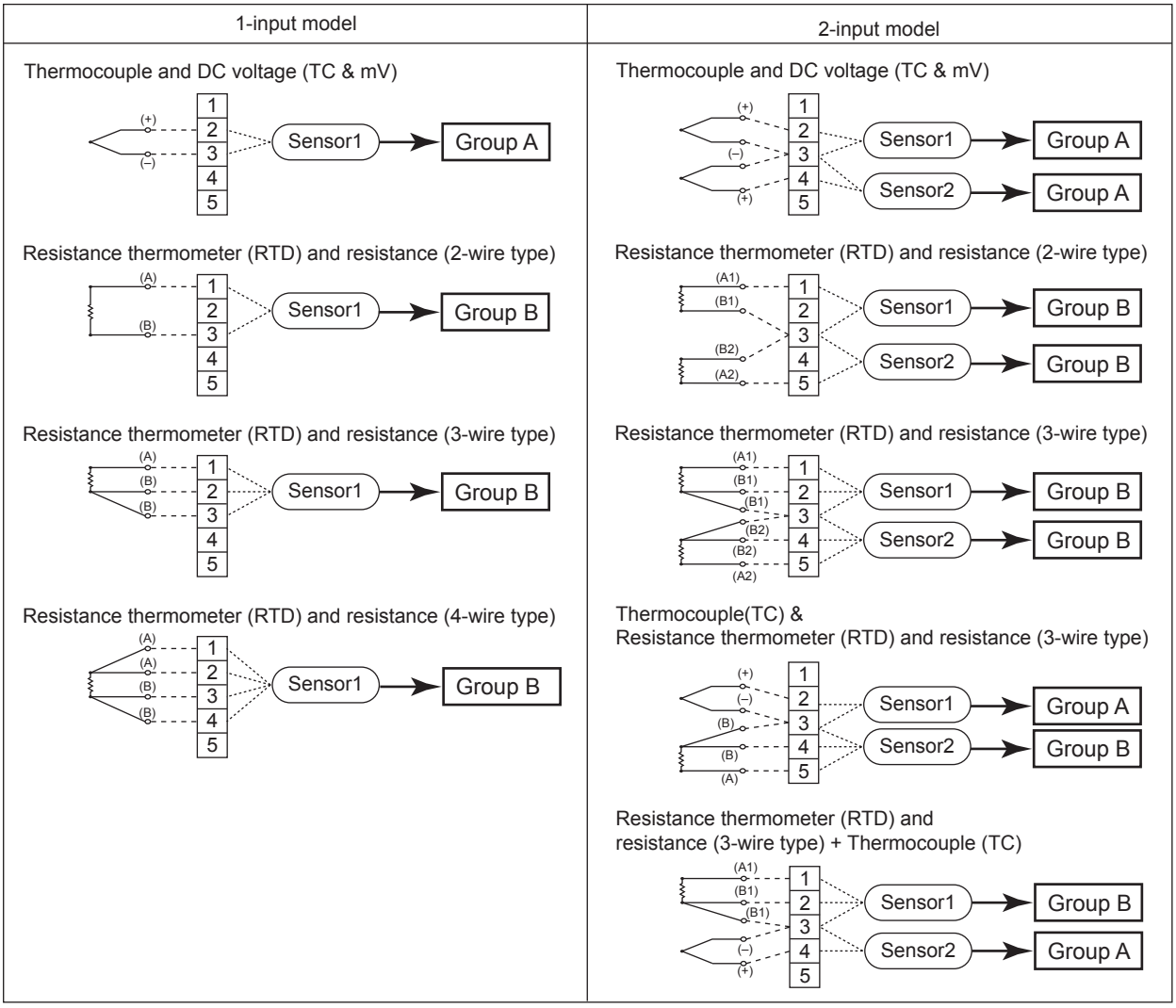
SENSOR_TYPE_1 (2)
(Device Configuration → YTA_STB → Basic Setup → Sensor1(2) Basic → Sensor1(2) Probe Setup(M))
Shows and stipulates the type of sensor connected to sensor input 1 (or 2). The following sensors can be connected.

- Thermocouple:
  Types B, E, J, K, N, R, S, T, and C (IEC60584), Types L and U (DIN43710), and Types W3 (ASTM E988)
  TC User Table
- 2-/3-/4-wire RTD:
  Pt100, Pt200, Pt500, PT1000 (IEC60751)
  JPt100 (JIS), Ni120*1, Cu (SAMA RC21-4)
  SENSOR_MATCH (PT)
- 2-/3-/4-wire resistance input
- 2-wire DC mV input
- Non-Connection

*1: Applicable only for YTA610.

IMPORTANT

Whenever 4-wire input is specified for Sensor 1, set ‘Non Connection’ for Sensor 2.
4-wire input cannot be used as Sensor 2.
If you change the sensor type or number of sensor wires, please check the setting of the AI UNIT definitely.



Group A
Type B (IEC60584)
Type E (IEC60584)
Type J (IEC60584)
Type K (IEC60584)
Type N (IEC60584)
Type R (IEC60584)
Type S (IEC60584)
Type T (IEC60584)
Type C (IEC60584)
Type W3 (ASTM E988)
Type L (DIN43710)
Type U (DIN43710)
Pt100 (IEC60751)
Pt200 (IEC60751)
Pt500 (IEC60751)
Pt1000 (IEC60751)
Pt100 (JIS C 1604-81)
Cu10 (SAMA RC21-4)
Ni120*1
Ohm
mV
TC User Table

Group B
Type B (IEC60584)
Type E (IEC60584)
Type J (IEC60584)
Type K (IEC60584)
Type N (IEC60584)
Type R (IEC60584)
Type S (IEC60584)
Type T (IEC60584)
Type C (IEC60584)
Type W3 (ASTM E988)
Type L (DIN43710)
Type U (DIN43710)
Pt100 (IEC60751)
Pt200 (IEC60751)
Pt500 (IEC60751)
Pt1000 (IEC60751)
Pt100 (JIS C 1604-81)
Cu10 (SAMA RC21-4)
Ni120*1
Ohm
Sensor Maching
“Calibrated RTD CVD Coeff”
mV

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*1: Applicable only for YTA610.

Figure 6.2 Wire connection and sensor type

Table 6.1 Sensor type and measurement range

Sensor Type		Standard	Measurement Range		Minimum Span
			°C	°F	
T/C	B	IEC60584	100 to 300 300 to 1820	212 to 572 572 to 3308	25°C (45°F)
	E		-200 to -50 -50 to 1000	-328 to -58 -58 to 1832	
	J		-200 to -50 -50 to 1200	-328 to -58 -58 to 2192	
	K		-200 to -50 -50 to 1372	-328 to -58 -58 to 2502	
	N		-200 to -50 -50 to 1300	-328 to -58 -58 to 2372	
	R		-50 to 0 0 to 600 600 to 1768	-58 to 32 32 to 1112 1112 to 3214	
	S		-50 to 0 0 to 600 600 to 1768	-58 to 32 32 to 1112 1112 to 3214	
	T		-200 to -50 -50 to 400	-328 to -58 -58 to 752	
	C		0 to 400 400 to 1400 1400 to 2000 2000 to 2300	32 to 752 752 to 2552 2552 to 3632 3632 to 4172	
	W3	ASTM E988	0 to 400 400 to 1400 1400 to 2000 2000 to 2300	32 to 752 752 to 2552 2552 to 3632 3632 to 4172	
	L	DIN43710	-200 to -50 -50 to 900	-328 to -58 -58 to 1652	
	U		-200 to -50 -50 to 600	-328 to -58 -58 to 1112	
RTD	Pt100	IEC60751	-200 to 850	-328 to 1562	10°C (18°F)
	Pt200		-200 to 850	-328 to 1562	
	Pt500		-200 to 850	-328 to 1562	
	Pt1000		-200 to 300	-328 to 572	
	JPt100	—	-200 to 500	-328 to 932	
	Cu10	SAMA RC21-4	-70 to 150	-94 to 302	
	Ni120*1	—	-70 to 320	-94 to 608	
mV		—	-10 to 120 [mV]		3 mV
ohm		—	0 to 2000 [Ω]		20 Ω

*1: Applicable only for YTA610.

SENSOR_CONNECTION_1 (2)
(Sensor1 Probe Setup(M) → SENSOR_ CONNECTION_1(2))
Indicates and stipulates the number of wires connected to sensor input 1 (or 2). This setting only valid for RTD and resistance input.

WIRING_RESISTANCE_1(2)
(Sensor1 Probe Setup(M) → WIRING_ RESISTANCE_1(2))
Wiring resistance of the 2-wire resistance input, the input resistance minus this value is used as the temperature value.

PRIMARY_VALUE_1 (2)
(Device Configuration → STB → Basic Setup → Sensor1(2) Basic → Primary Val Range 1(2))
Indicates the value and status of the input from sensor 1(2). The unit set in PRIMARY_VALUE_ RANGE_1(2) applies to the unit of the value.

NOTE

If an input exceeds the range shown in PRIMARY_VALUE_RANGE_1(2), the value up to 120% of the range will be output for upper limit side, and -20% of the range will be output for lower limit side. In this case, the accuracy of the input exceeding the range shall not be guaranteed.

SENSOR1(2)_VALUE
(Device Configuration → STB → Basic Setup → Sensor1(2) Basic → Sensor 1(2))
Indicates the value and status of the Sensor1(2). The unit is set in SENSOR1(2)_UNIT, and the damping time constant in SENSOR1(2)_DAMP.

TERMINAL_VALUE
(Process Variables → STB → Sensor Value → Sensor1(2) → Terminal)
Indicates the value and status of the terminal board temperature. The unit of temperature is set in TERMINAL_UNIT, and the damping time constant in TERMINAL_DAMP.

AVERAGE_VALUE
(Process Variables → STB → Sensor Value → Diff. Average → Average)
Indicates the value and status of the average of 2 inputs when 2 sensors are connected. The unit of temperature is set in AVERAGE_UNIT. When there is no connection to sensor 2 input, the status of AVERAGE_VALUE is Bad and the value is undefined.

BACKUP_VALUE
(Process Variables → STB → Sensor Value → Backup → Backup)
When 2 sensors are connected, this parameter normally shows the value input from sensor 1, and in case of sensor 1 failure (when the backup action becomes active), shows the value input from sensor 2. The unit and damping time constant follow the respective settings for the input currently selected. If you want to switch back to select sensor 1 input while the backup action is active after the sensor 1 input recovers, set 1 (Enable) in SENSOR_ RECOVER. Because this data is not retained, set 1(Enable) in the parameter every switch back. When there is no connection to sensor 2 input, the status of BACKUP_VALUE is Bad and the value is undefined.

NOTE

Sensor Type: Any type available but two sensors should be same type.

- **Parameters Related to Limit Switches**

Parameters whose names begin with “LIMSW” store the settings for limit switch signals output to DI function blocks. The SENSOR transducer block has 4 limit switches numbered from 1 to 4, and these parameters determine the specifications of the respective switches. In the following parameter names and descriptions, read the number “1” as “2,” “3,” or “4” according to the intended limit switch number.

LIMSW_1_VALUE_D
(Device Configuration → STB → Detailed Setup → Limit Switch → Switch1 → Limsw 1)
Indicates the value and status of limit switch 1.

LIMSW_1_TARGET
(Limsw 1 → LIMSW_1_TARGET)
Stipulates the value that should be compared with the threshold. LIMSW_1_SETPOINT. SENSOR1_VALUE, SENSOR1_TERMINAL_VALUE, TERMINAL_VALUE, SENSOR2_VALUE, SENSOR2_TERMINAL_VALUE, SENSOR1_SENSOR2_VALUE, SENSOR2_SENSOR1_VALUE, AVERAGE_VALUE, and BACKUP_VALUE can be chosen.

LIMSW_1_SETPOINT
(Limsw 1 → LIMSW_1_SETPOINT)
Stipulates the threshold of switching on limit switch 1.

LIMSW_1_ACT_DIRECTION
(Limsw 1 → LIMSW_1_ACT_DIRECTION)
Stipulates whether limit switch 1 should work as a high limit switch or low limit switch.

LIMSW_1_HYSTERESIS
(Limsw 1 → LIMSW_1_HYSTERESIS)
Stipulates the hysteresis of limit switch 1.

- **Sensor Trim**

(Device Diagnostics → STB → Calibration → Sensor1(2) → Sensor1(2) Trim (M))
Each YTA transmitter is factory-characterized based on the standard sensor curve, and uses this information to produce a process variable output. The sensor trim function is used to make an adjustment to the internal interpretation of the input signal and the factory characterization in the transmitter. (See Figure 6.3) Since the factory characterization is kept even after applying the trim operation, it is possible to recover factory characterization.

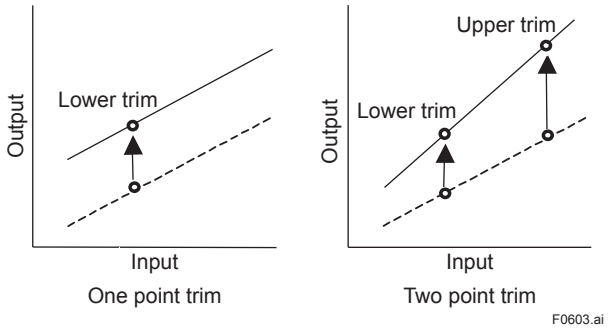
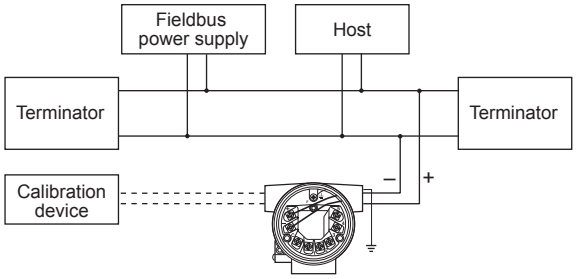


Figure 6.3 Trim function images

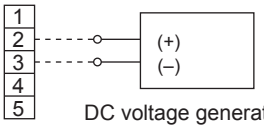
Before performing the sensor trim, complete the configuration of the sensor input.

a) Connect the calibration device to the transmitter and warm-up for 3 minutes.

a. Wiring of power supply and output



b. Example of wiring of thermocouple or DC voltage input (1-input type)



c. Example of wiring of thermometer resistor 4-wire type (1-input type)

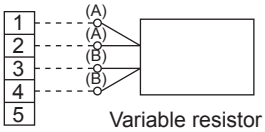


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Figure 6.4 Example of wiring for calibration equipment

b) Apply lower input to Sensor1.
Execute the method of Sensor1 Trim.
c) Select the Lower trim only or the Lower & Upper Trim.
d) Sensor1 temperature is displayed. If the value is OK, press OK. If the display value is different from the expected value, enter the expected value.
Example: In case of the temperature of the Sensor1 indicates the 1°C and expected temperature is 0°C, enter 0°C.
e) Next carry out the Upper trim. Apply Upper range value to Sensor1.
f) Carry out the Upper Trim same as the Lower Trim procedures.

NOTE

"reset Sensor1 Trim" can reset the user's trim adjustment to the initial calibrated values.

- **BLOCK_ERR**

(Device Diagnostics → STB → STB Alerts → BLOCK_ERR)
BLOCK_ERR presents the cause of an error in the block. The SENSOR transducer block checks the following causes and sets the relevant bits.

BLOCK_ERR

Error	Cause
Other	All errors occurred in SENSOR transducer block except O/S.
Out of Service	MODE_BLK Target is O/S

- **XD_ERROR**

(Device Diagnostics → STB → STB Alerts → XD_ERROR)
XD_ERROR is a parameter that contains codes for the most significant errors that can occur in the SENSOR transducer block. The errors of XD_ERROR supported by transmitter and their causes are presented in the table 6.2. When multiple errors occur and their error codes are different, the error with a larger code value is stored first.

Table 6.2 List of XD_ERROR

Value	Error	Cause	Alarm Description	Resource Block BLOCK_ERR
0				
17	General error	Other errors that cannot be classified below.	Temp NV Warning S1 Corrosion*1 S2 Corrosion*1 S1 Signal Error S2 Signal Error Backup Sns1 Fail Backup Sns2 Fail Sensor Drift S1 Over Temp Cycl*1 S2 Over Temp Cycl*1 S1 Temp Low S1 Temp High S2 Temp Low S2 Temp High Amb Temp Low Amb Temp High	
19	Configuration error	An error occurred during configuration or a configuration error has been detected.	Illegal Sensor1 Config Illegal Sensor2 Config	
20	Electronics Failure	An electronics component has failed.	CPU Fail AD Conv Fail Main Rvrs Cal Fail Temp Rvrs Cal Fail Temp Voltage Fail Int Comm Fail Term Sns Fail	Device Needs Maintenance Now
22	I/O Failure	An I/O failure has occurred.	Sensor1 Failure Sensor2 Failure Sensor1 Short*1 Sensor2 Short*1	Device Needs Maintenance Now
23	Data Integrity Error	There was an error in checksum or failed to check after the data writing.	Sensor NV Fail Temp NV Fail Comm NV Fail	Device Needs Maintenance Now

*1: Applicable only for YTA710.

● Parameters Related to CJC

For thermocouple input, the terminal temperature measured by an internal sensor is used for Cold Junction Compensation function. In YTA, constant value set by users can be used for the compensation function in place of the measured terminal temperature. If the constant value is set to “0”, compensation will not be applied.

CJC_SELECT
(Device Configuration → STB → Basic Setup → CJC → CJC Type Setup(M))
Selects whether the terminal board temperature or user-set constant (CONSTANT_CJC_TEMP) is to be used for cold junction compensation (CJC) for the sensor1 input.
0=Internal CJC, 1=Constant CJC

CONSTANT_CJC_TEMP
(CJC Type Setup(M) → CONSTANT_CJC_TEMP)
User-set constant for CJC temperature for the sensor1 input. Setting 0 in this parameter disables CJC.

CONSTANT_CJC_UNIT
(CJC Type Setup(M) → CONSTANT_CJC_UNIT)
User-set constant unit for CJC for the sensor1 input.

● Parameters Related to TC User Table

This function enables users to calculate temperature by creating their own table for TC sensors for the conversion between temperature and electromotive force.
Specifications
- Number of tables: 1 (common for Sensor1 and Sensor2)
- Sensor type: TC User Table (TC only)
- Input items: Temperature and electromotive force
- Number of inputs: 5 to 50 points Input the values of temperature and electromotive force in ascending order from the top of the table. This function determines the end of the table as being where the value of either temperature or electromotive force is not in ascending order.
- Measuring range: −10 to 120 mV
- How to input: Only from DTM, using FieldMate as a setting tool

- Procedure to set up the function

From menu bar of the DTM works window, click “Device” → “Additional Functions” → “TC User Table”
Set the valid points and unit and fill in the Temperature and Electromotive force table.

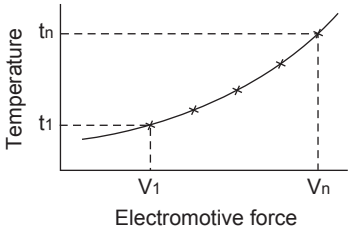
TC_ELECTRIC_1_25

TC_ELECTRIC_26_50

TC_TEMPERATURE_1_25

TC_TEMPERATURE_26_50

TC_VALID_POINT



No.	Temp.	Electro. force
1	t1	V1
.	.	.
.	.	.
.	.	.
n	tn	Vn

Note: Interpolating between valid points in the quadratic equation.

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Figure 6.5 TC user’s table

NOTE

When the TC user table is set incorrectly, inverse operation alarm may be generated.

- **Alarm**

This function enables users to mask the YTA specific alarms individually.
See “DEVICE_CONDITION_ACTIVE_2 or 3” for the cause of alarm.

Mask parameter	Alarm mask	Default setting	Remarks
Sensor_STATUS_MASK_1	CPU Fail Sensor NV Fail Temp NV Fail AD Conv Fail Main Rvrs Cal Fail Temp Rvrs Cal Fail Temp Voltage Fail Comm NV Fail	No mask	Mask not available (Read only)
Sensor_STATUS_MASK_2	Temp NV Warning Int Comm Fail	No mask	Mask not available (Read only)
Sensor_STATUS_MASK_3	Sensor1 Failure Sensor2 Failure	No mask	
	Sensor1 Short*1 Sensor2 Short*1 S1 Corrosion*1 S2 Corrosion*1	Mask	
	S1 Signal Error S2 Signal Error	No mask	
Sensor_STATUS_MASK_4	Term Sns Fail Backup Sns1 Fail Backup Sns2 Fail	No mask	
	Sensor Drift S1 Over Temp Cycl*1 S2 Over Temp Cycl*1	Mask	
Sensor_STATUS_MASK_5	S1 Temp Low S1 Temp High S2 Temp Low S2 Temp High Amb Temp low Amb Temp High	No mask	
Sensor_STATUS_MASK_6	Not used		
Sensor_STATUS_MASK_7	Illegal Sensor1 Config Illegal Sensor2 Config	No mask	
Sensor_STATUS_MASK_7	Not used		

*1: Applicable only for YTA710.
Note: Alarms which masked by” SENSOR_STATUS_1 to 8” do not out to “FD_EXTENDED_ACTIVE_1 to 8”.

Parameter setting:
SENSOR_STATUS_MASK_n
(Device Diagnostics → STB → Diagnostics → SENSOR_STATUS_MASK)

● Parameters Related to Diagnostics Function

The YTA has the following diagnostic functions.

Sensor Failure

This function detects any disconnection at TC, mV, RTD, and ohm sensors. When the current is applied and the resistance of a sensor is above the threshold, the function outputs a disconnection alarm.
Parameter setting: Not necessary
Alarm output: When the resistance is above the threshold, the function outputs the alarm of Sensor1 Failure or Sensor2 Failure.

Terminal Failure

This function detects any disconnection at CJC. When it detects that the resistance of CJC is above the threshold, the function outputs an alarm.
Parameter setting: Not necessary
Alarm output: When the resistance is above the threshold, the function outputs the alarm.

TC Short (only for YTA710)

This function detects any short circuit at TC sensors. When the current is applied and the resistance of a sensor is below the threshold, the function outputs the Short alarm.
Parameter setting:

SENSOR1_TC_SHORT_THR

SENSOR2_TC_SHORT_THR
(Device Diagnostics → STB → Diagnostics → Diagnostics Threshold)

Diagnostic results are displayed below. Please refer to the following parameters.

SENSOR1_RP23

SENSOR2_RP43
(Device Diagnostics → STB → Diagnostics → Sensor1(2) Diag)

Alarm output: When the resistance is below the threshold, the function outputs the alarm of Sensor1 short or Sensor2 short.

NOTE

Some alarms are masked by initial setting. Please set “SENSOR_STATUS_MASK1 to 8” of SENSOR Transducer Block properly to use diagnostics functions.

RTD Short (only for 3-wire and 4-wire, only for YTA710)

This function detects any short circuit at the sensor during the RTD or Ohm measurement. When the resistance is below the threshold, the function outputs a short circuit alarm.
Parameter setting: Not necessary
Alarm output: When the resistance is below the threshold (5Ω fixed), the function outputs the alarm of Sensor1 short or Sensor2 short.
Diagnostic results are displayed below. Please refer to the following parameters.

Table 6.3 Measurements points

	Sensor1	Seneor2
3-wire	SENSOR1_RC2, SENSOR1_RC3	SENSOR2_RC3, SENSOR2_RC4
4-wire	SENSOR1_RC1, SENSOR1_RC2, SENSOR1_RC3, SENSOR1_RC4	

(Device Diagnostics → STB → Diagnostics → Sensor1(2) Diag)

NOTE

- Some alarms are masked by initial setting. Please set “SENSOR_STATUS_MASK1 to 8” of SENSOR Transducer Block properly to use diagnostics functions.
- In case of 3 wire RTD or ohm connection, if actual connection and connection setting is imbalance, unforeseen alarm may be generated.

RTD Corrosion (only for YTA710)

This function detects any corrosion at the terminals and along the measurement cables. When the resistance is above the threshold, the function outputs a corrosion alarm.
Parameter setting:

SENSOR1_RTD_CORR_THR

SENSOR2_RTD_CORR_THR
(Device Diagnostics → STB → Diagnostics → Diagnostics Threshold)

Alarm output: When the resistance is above the threshold, the function outputs the alarm of S1 Corrosion or S2 Corrosion.

NOTE

Some alarms are masked by initial setting. Please set “SENSOR_STATUS_MASK1 to 8” of SENSOR Transducer Block properly to use diagnostics functions.

Sensor Drift

When the difference between Sensor1 and Sensor2 temperatures become larger than the threshold, this function outputs an alarm. This indicates that there is some problem at either Sensor1 or Sensor2. The function can be enabled when Sensor type is set to TC and RTD.

Parameter setting:

DRIFT_UNIT

DRIFT_THR

(Device Diagnostics → STB → Diagnostics → Diagnostics Threshold)

Alarm output: When the temperature difference is larger than the threshold, the function outputs the alarm of Sensor Drift.

NOTE

Some alarms are masked by initial setting. Please set “SENSOR_STATUS_MASK1 to 8” of SENSOR Transducer Block properly to use diagnostics functions.

Temperature Cycle Diagnostics (only for YTA710)

This function displays the number of temperature fluctuations that may cause failure of the sensor. The function is enabled only when Sensor type is set to TC or RTD, and indicates how many times the temperature alternately hits (or crosses) the upper and lower limits. When the number of times exceeds the threshold, an alarm will be issued. When the threshold is set to 0 or a larger value than the upper limit is set to the lower limit, the function is not enabled.

Parameter setting:

(Device Diagnostics → STB → Diagnostics → Temp Cycle Diag Threshold)

TEMP_CYCLE_UNIT

UPPER_TEMP_CYCLE_THR

LOWER_TEMP_CYCLE_THR

CYCLE_COUNT_THR

Parameter reset:

(Device Diagnostics → STB → Diagnostics → Temp Cycle Diag → Reset Cycle Count (M))

CYCLE_COUNT_RESET

Monitoring:

(Device Diagnostics → STB → Diagnostics → Temp Cycle Diag)

SENSOR1_TEMP_CYCLE

SENSOR2_TEMP_CYCLE

NOTE

Some alarms are masked by initial setting. Please set “SENSOR_STATUS_MASK1 to 8” of SENSOR Transducer Block properly to use diagnostics functions.

Sensor Diagnostics Information

Information obtained by the sensor diagnostics are displayed in the parameters below. You can take advantage of the preventive maintenance of the sensor by obtaining this information periodically.

Table 6.4 Sensor1 diagnostics information

Parameter	Sensor type		
	TC	RTD 3-wire	RTD 4-wire
SENSOR1_RP23 (Resistance between terminal 2 and 3)	✓	0.0	0.0
SENSOR1_RC1 (Resistance between sensor cable and terminal connection to terminal1)	0.0	0.0	✓
SENSOR1_RC2 (Resistance between sensor cable and terminal connection to terminal2)	0.0	✓	✓
SENSOR1_RC3 (Resistance between sensor cable and terminal connection to terminal3)	0.0	✓	✓
SENSOR1_RC4 (Resistance between sensor cable and terminal connection to terminal4)	0.0	0.0	✓

✓: Display sensor diagnostics information (resistance).

Table 6.5 Sensor2 diagnostics information

Parameter	Sensor type	
	TC	RTD 3-wire
SENSOR2_RP43 (Resistance between terminal 2 and 3)	✓	0.0
SENSOR2_RC3 (Resistance between sensor cable and terminal connection to terminal3)	0.0	✓
SENSOR2_RC4 (Resistance between sensor cable and terminal connection to terminal4)	0.0	✓

✓: Display sensor diagnostics information (resistance).

- **Parameters Related to Sensor Matching function**

(Device Configuration → STB → Basic Setup → Sensor1(2) Matching
→ Sensor1(2) Match Setup (M))
This function is available only when optional specification /CM1 is specified. Significant temperature measurement accuracy improvement can be obtained using a temperature sensor that is matched to a transmitter.
Applicable sensors: Pt100, Pt200, Pt500, and Pt1000
The properties of the RTD sensor for the YTA comply with the standard specified in IEC60751. Although their variations are within the range allowed by the standard, they may cause measurement errors. The Sensor Matching function improves the precision of temperature measurement by programming the Callendar-Van Dusen constants, specific numbers defined for each RTD sensor, into the transmitter.
The following relation exists between the resistance (Rt) of a RTD sensor and the temperature (t) at that time.
$Rt=R0\{1+\alpha(1+0.01\delta)t - \alpha\delta/104t2 - \alpha\beta/108(t -100)t3\}$
where: Rt=Resistance (ohms) at Temperature t (°C)
R0=Sensor -specific constant (Resistance at t=0°C)
α (alpha)=Sensor-specific constant
δ (delta)=Sensor-specific constant
β (beta)=Sensor-specific constant
(0 at t>0°C)
Although the sensor curve is standardized, the exact values for R0, α, δ and β are specific to each RTD sensor and are obtained by testing each individual sensor at various temperatures. These constants are known as Callender-van Dusen constants. Generally, the constants R0, A, B, and C are also used as the characteristic coefficients of the RTD instead of R0, α, δ and β. These are derived from IEC Standard Curve and the relationship is described as followings;
$Rt = R0 \{1 + At - Bt2 + C (t -100) t3\}$
where: Rt=Resistance (ohms) at Temperature t (°C)
R0 = Sensor-specific constant
(Resistance at t=0°C)
A = Sensor-specific constant
B = Sensor-specific constant
C =Sensor-specific constant
(0 at t > 0°C)

These two equations are equivalent.
If you input A, B, and C values, α, δ, and β will be updated automatically.
If you input α, δ, and β values, A, B, and C will be updated automatically.

IMPORTANT

Note the following restrictions when inputting values for the R0, α, δ, β, A, B, and C constants in the YTA.

- Values must be normalized ones with an exponential part determined for respective constants (see the table below).
- Values must be rounded off so that they have the digits after the decimal point determined for respective constants (see the table below).
- Values with three digits after the decimal point may be changed to values with four digits after the decimal point, which are equivalent to the original value when rounded off.
  Example: +3.809 E-3 → +3.8089 E-3

Item	Decimal point	Exponent	Example	Initial setting
R_0	2	non	+100.05	+100
A	3	E-3 (10^{-3})	+3.908 E-3	+3.9083 E-3
B	3	E-7 (10^{-7})	-5.802 E-7	-5.7749 E-7
C	3	E-12 (10^{-12})	-0 E-12	-4.183 E-12
α	3	E-3 (10^{-3})	+3.850 E-3	+3.8505 E3
δ	3	E0 (10^{0})	+1.507 E0	+1.4998 E0
β	3	E-1 (10^{-1})	+0 E-1	+1.0862 E1

IMPORTANT

This function is effective only when “Sensor Match” (Pt only) is set to the sensor type.

NOTE

Input either of (A, B, C) or (α, δ, β)

Parameter setting:
(Device Configuration → STB → Basic Setup → Sensor1 Matching → Sensor1 Match Setup(M))

SENSOR1_MATCH_IEC_A
Value of the factor A

SENSOR1_MATCH_IEC_B
Value of the factor B

SENSOR1_MATCH_IEC_C
Value of the factor C

SENSOR1_MATCH_IEC_R0
Value of the factor R0

SENSOR1_MATCH_CVD_ALPHA
Value of the factor alpha

SENSOR1_MATCH_CVD_DELTA
Value of the factor delta

SENSOR1_MATCH_CVD_BETA
Value of the factor beta

SENSOR1_MATCH_CVD_R0
Value of the factor R0

NOTE

When the coefficient of sensor matching is set incorrectly, inverse calcuration alarm may be generated.

6.4 LCD Transducer Block (LTB)

6.4.1 Outline of the Functions

The LCD transducer block controls alarms and measured values that are displayed on the integral indicator. It displays not only OUT signals from the AI blocks, but also I/O signals of the Installed blocks on the integral indicator.

6.4.2 Block Mode

The Block modes permitted for the LCD transducer block are Automatic (Auto) and Out of Service (O/S). Settings can be changed in the AUTO mode for this block, except the Block tag parameter.

6.4.3 Display Contents of the Integral Indicator

The components of the integral indicator are the bar graph, the title field, the center field for numerical values, the lower text field, and auxiliary characters. The contents and meanings of these components are as follows:

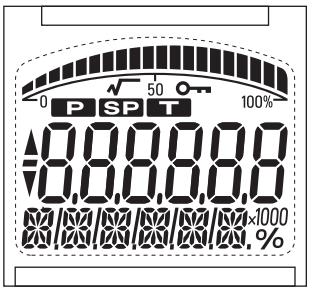

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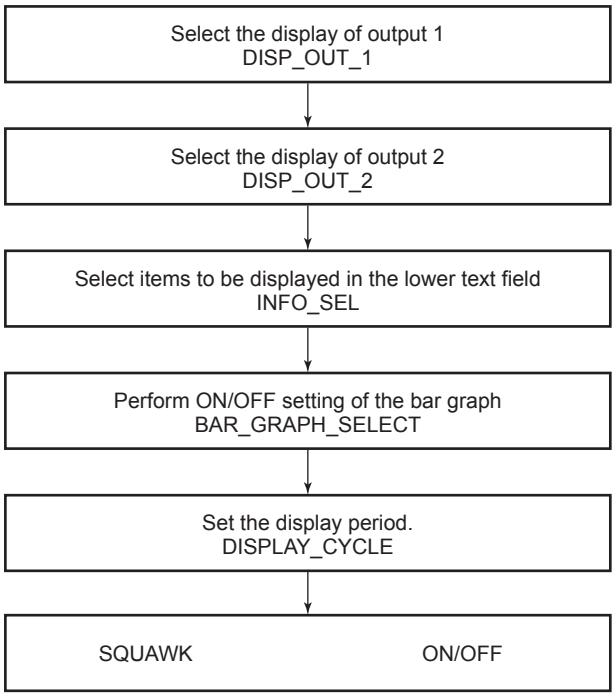
Figure 6.6 Screen Display of the Integral Indicator

Component name	Contents	
Bar graph	Shows the value displayed in the center field for numerical values scaled in terms of percentage.	
Center field for numerical values	Shows process values. While the alarm is on, the alarm number alternates with the displayed value here.	
Lower text field	Displays sensor type, tag, parameter, unit, status, and number of wires.	
Auxiliary characters	%	Flashes when the center field for numerical values displays a % value.
	Key mark	Flashes when Write Protect is selected.

6.4.4 Procedure to Set the Built-in Display

(Device Configuration → LTB → Display Setup)



DISP_OUT 1(2)

Number	Output
1	AI1
2	AI2
3	AI3
4	AI4
5	Sensor1
6	Sensor1-Terminal
7	Terminal
8	Sensor2
9	Sensor2-Terminal
10	Sensor1-Sensor2
11	Sensor2-Sensor1
12	Average
13	Backup
14	Not used (for output2)

DISPLAY_CYCLE

Number	Display cycle
1	HIGH (1200 ms)
2	MID (2400 ms)
3	LOW (3600 ms)

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Figure 6.7 Procedures to Set the Built-in Display

Table 6.6 Process parameters to be displayed on LCD

Process value displayed in center field	Process value name displayed in lower text field
PRIMARY_VALUE_1	SENS.1
PRIMARY_VALUE_2	SENS.2
TERMINAL_VALUE	TERM
SENSOR1_TERMINAL_VALUE	S.1-TER
SENSOR2_TERMINAL_VALUE	S.2-TER
SENSOR1_SENSOR2_VALUE	S.1-S.2
SENSOR2_SENSOR1_VALUE	S.2-S.1
AVERAGE_VALUE	AVG
BACKUP_VALUE	BACKUP
AI1.OUT	AI1.OUT
AI2.OUT	AI2.OUT
AI3.OUT	AI3.OUT
AI4.OUT	AI4.OUT

Table 6.7 Unit to be displayed on LCD

Unit	Unit displayed in lower text field
K	K
degC	C
degR	F
degF	R
mV	mV
Ω	Ohm
mA	mA
%	%
No unit	NO.UNIT

Table 6.8 Sensor type to be displayed

Sensor type	Displayed in lower text field
mV	mV
Resistance	Ohm
Pt100	Pt 100
JPt100	JPt00
Pt200	Pt200
Pt500	Pt500
Pt1000	Pt1000
Cu10	Cu10
Ni120*1	Ni120*1
Type B	TYPE.B
Type E	TYPE.E
Type J	TYPE.J
Type K	TYPE.K
Type N	TYPE.N
Type R	TYPE.R
Type S	TYPE.S
Type T	TYPE.T
Type L	TYPE.L
Type U	TYPE.U
W3	TYPE.W3
Type C	TYPE.C
Sensor matching	S.MATCH
User table	USR.TBL
No sensor	NO.CNCT

*1: Applicable only for YTA610.

Table 6.9 Number of wires to be displayed on LCD

Number of wires	Display in lower text field	Display in center field
2 wires	S1.WIRE or S2.WIRE	2
3 wires	S1.WIRE or S2.WIRE	3
4 wires	S1.WIRE or S2.WIRE	4
Unknown	S1.WIRE or S2.WIRE	-

6.5 Maintenance Transducer Block (MTB)

6.5.1 Logging Functions

The YTA series have the capability to store the data useful for diagnosis of the problems.

(1) Alarm log

Up to eight alarm histories are stored in the transmitter memory, and can be seen using the following parameters.

FD_EXTENDED_n_LOG n:1 to 8
(Device Diagnostics → MTB → FD ExtActive Log)

(2) Max/Min log

Minimum value and Maximum value of the Process variables are stored in the transmitter memory and can be checked.

a) Parameters:
(Device Diagnostics → MTB → Sensor MAX/MIN Log)

SENSOR1_MAX (MIN)

SENSOR2_MAX (MIN)

TERMINAL_MAX (MIN)

b) To clear the logged data for Process variables except Term variables, select **SENSOR1(2)_LOG_CLEAR**.

NOTE

These values may become big by disconnection of the sensor, etc. Please reset in this case.

(3) Operation Time

(Device Diagnostics → MTB → Device Information)
Transmitter's operation time from the first power-on is counted. Call up the OPERATE_TIME display to check the time.

6.6 AI Function Block

The AI function block is a unit of the software and executed according to the system schedule. During execution, it incorporates data from the SENSOR transducer block. After execution, it updates analog outputs and processes newly generated alarms. AI function blocks can provide a discrete output which shows the status of LO, LO_LO, HI, or HI_HI. In terms of function, there is no difference between the four AI function blocks provided in YTA.

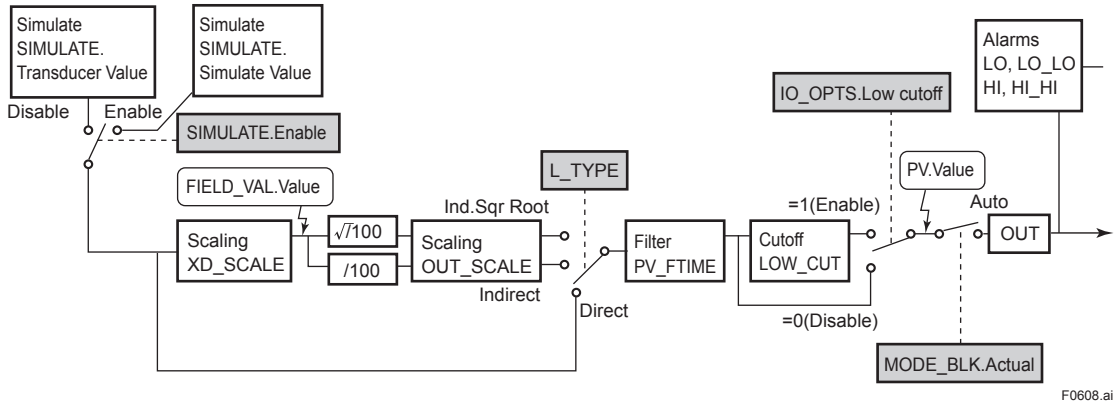


Figure 6.8 Diagram of the AI Function Block

6.6.1 Function Blocks

The AI function block, via the Channel, incorporates analog signals from the SENSOR transducer block, performs scaling processing, filtering, low-cut, and alarm processing before outputting. It has the function to generate a discrete output.

6.6.2 Block Mode

The Block modes permitted for the AI function block are Automatic (Auto), Manual (Man), and Out of Service (O/S). When the Block mode of RB (Resource Block) is Out of Service (O/S), Actual is Out of Service (O/S) even if Automatic (Auto) or Manual (Man) is written to Target.

6.6.3 IO_OPTS

IO_OPTS is a parameter used to select whether options regarding input and output signals should be enabled or disabled. In the case of the AI function block, the only available option is “Low cutoff”. When enabling the low cut function for outputs, set this option.

6.6.4 STATUS_OPT

STATUS_OPT is a parameter to select options regarding the status of signals. The AI function block offers four options: Propagate Fault Forward, Uncertain if Limited, BAD if Limited, and Uncertain if Man mode.

Propagate Fault Forward

If the status from the sensor is Bad, Device failure or Bad, Sensor failure, propagate it to OUT without generating an alarm. The use of these sub-statuses in OUT is determined by this option. Through this option, the user may determine whether alarming (sending of an alert) will be done by the block or propagated downstream for alarming.

Uncertain if Man mode

When the “Uncertain if Man” is enabled and the Actual mode is Man, the OUT signal status should be “Uncertain”.

Uncertain if Limited

Set the output status of an input or calculation block to uncertain if the measured or calculated value is limited.

Bad if Limited

Set the output status to Bad if the sensor is at a high or low limit.

NOTE

Bad if limited has priority over Uncertain if limited.

6.6.5 Basic Parameters of the AI Block

- **CHANNEL**

Select the input to the AI block from the transducer. The table below shows the input value depending on the setting of CHANNEL. Set CHANNEL according to the value you want to input to the AI block.

Table 6.10 Input Selected by CHANNEL Setting (AI)

CHANNEL Setting	Input Selected
1	Sensor1
2	Sensor1-Terminal
3	Terminal
4	Sensor2
5	Sensor2-Terminal
6	Sensor1-Sensor2
7	Sensor2-Sensor1
8	Average
9	Backup

- **BLOCK_ERR**

BLOCK_ERR presents the cause of an error in the block. The SENSOR transducer block checks the following causes and sets the relevant bits.
BLOCK_ERR

Error	Cause
Block Configuration Error	Process variable unit and XD_SCALE unit does not match in type
Simulate Active	SIMULATE is enable.
Input Failure/ process variable has BAD status	Quality of PV variable is BAD status. (Device Failure or Sensor Failure)
Out of Service	MODE_BLK Target is O/S.

- **XD_SCALE**

Stipulates the range of the input from the transducer. The customer-specified range (or 0-100 if the range was not specified when ordering) is set before the YTA is shipped from the factory.
If the unit of the input temperature value is set as mV or ohm in the transducer block and the unit of XD_SCALE is set as a unit of temperature (e.g., °C), or vice versa, the status becomes Uncertain or Bad. It is recommended to set the same unit for the transducer block and AI blocks.

- **L_TYPE**

Stipulates the calculation in the AI block.
Setting L_TYPE to:

- "Direct" puts the value that is input to CHANNEL, in OUT as is.
- "Indirect" performs scaling of the input value based on XD_SCALE and OUT_SCALE and puts the scaled value in OUT.
- "IndirectSQRT" performs scaling of the input value based on XD_SCALE, extracts the square root of the scaled value, performs scaling of the square root, and then puts the scaled value in OUT.

- **PV_FTIME**

Stipulates the time constant (in seconds) of the first-order lag filter inside the AI block.

- **OUT_SCALE**

Stipulates the range of OUT (by setting the upper and lower range limits). The unit can also be set freely. The customer specified scale (or 0-100% if the scale was not specified when ordaring) is set before the YTA is shipped from the factory.

- **Alarm Priorities: HI_HI_PRI, HI_PRI, LO_PRI, and LO_LO_PRI**

These parameters determine the respective priority levels of the four types of process alarms: HI_HI_ALM, HI_ALM, LO_ALM, and LO_LO_ALM. Only the alarms whose priority level is set to 3 or higher will be transmitted upon occurrence.
Factory default of these parameters are 0 (Disable).

- **Alarm Thresholds: HI_HI_LIM, HI_LIM, LO_LIM, and LO_LO_LIM**

These parameters determine the respective thresholds for the four types of process alarms: HI_HI_ALM, HI_ALM, LO_ALM, and LO_LO_ALM. Before the YTA is shipped from the factory, these parameters are set to values such that no alarm will occur.

IMPORTANT

If SENSOR Transducer Block and AI Function Block setting is imbalance, "Block Configuration Error "is generated in AI Function Block. Please verify below.

- XD_SCALE setting of AI Function Block.
- Mismatch of sensor type unit and AI unit.

6.7 DI Function Block

Parameters of function blocks can be read and written from a host computer. See Appendix 1 for a list of all parameters of the YTA. This section describes only the settings for important parameters of each DI block.

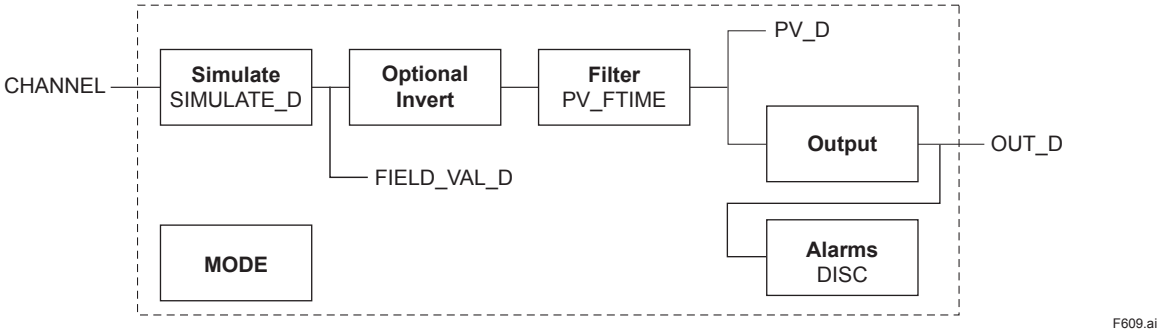


Figure 6.9 Diagram of the D1 Function Block

- **MODE_BLK**

Supports O/S, Auto, and Manual modes. The DI block does not function in the O/S mode, does not update the measured value in the Manual mode, and updates the measured value in the Auto mode. Normally, set the mode to Auto. Before the YTA is shipped from the factory, all the DI blocks are set to O/S mode.

- **CHANNEL**

Selects the input to the DI block from the transducer. The table below shows the input value depending on the setting of CHANNEL. Set CHANNEL according to the value you want to input to the DI block.

Table 6.11 Input Selected by CHANNEL Setting (DI)

CHANNEL Setting	Input Selected
10	Limit switch 1
11	Limit switch 2
12	Limit switch 3
13	Limit switch 4

- **PV_FTIME**

Stipulates the delay time (in seconds) of changing the output value after a change of the value inside the DI block.

- **DISC_PRI**

Determines the priority level of the discrete alarm on the block's output (OUT_D). The alarm will be transmitted upon occurrence only when the DISC_PRI is set at 3 or higher. This parameter is set to 1 before the YTA is shipped from the factory.

- **DISC_LIM**

Setpoint of the discrete alarm; when the value of OUT_D agrees with the value set in DISC_LIM, the discrete alarm is generated.

7. In-Process Operation

This chapter describes the procedure performed when changing the operation of the function block of the transmitter in process.

7.1 Mode Transition

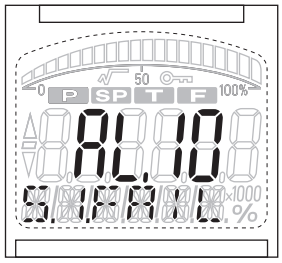
When the function block mode is changed to Out_Of_Service, the function block pauses and a block alarm is issued.

When the function block mode is changed to Manual, the function block suspends updating of output values. In this case alone, it is possible to write a value to the OUT parameter of the block for output. Note that no parameter status can be changed.

7.2 Generation of Alarm

7.2.1 Indication of Alarm

When the self-diagnostics function indicates that a device is faulty, an alarm (device alarm) is issued from the resource block. When an error (block error) is detected in each function block or an error in the process value (process alarm) is detected, an alarm is issued from each block. If an LCD indicator is installed, the error number is displayed as AL.XX. If two or more alarms are issued, multiple error numbers are displayed.
For details of Alarm, refer to Section 7.2.4.



F0701.ai

Figure 7.1 Error Identification on Indicator

7.2.2 Alarms and Events

The following alarms or events can be reported by the transmitter if Link object and VCR static entry are set.

Analog Alerts (Generated when a process value exceeds threshold)
By AI Block Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm

Discrete Alerts (Generated when an abnormal condition is detected)
By Resource Block Block Alarm, Write Alarm
By Transducer Block Block Alarm
By AI, SC, IT, IS, AR and PID Blocks Block Alarm

Update Alerts (Generated when an important (restorable) parameter is updated)
By Resource Block Update Event
By Transducer Block Update Event
By AI, SC, IT, IS, AR and PID Blocks Update Event

Field Diagnostic Alerts (Generated when an abnormal condition in field device is detected)
By Resource Block Check Alarm, Failure Alarm, Maintenance Alarm, and off specification Alarm.

An alert has following structure:

Table 7.1 Alert Object

Subindex				Parameter Name	Explanation
Analog Alert	Discrete Alert	Update Alert	Field Diagnostic Alert		
1	1	1	1	Block Index	Index of block from which alert is generated
2	2	2	2	Alert Key	Alert Key copied from the block
3	3	3	3	Standard Type	Type of the alert
4	4	4	4	Mfr Type	Alert Name identified by manufacturer specific DD
5	5	5	5	Message Type	Reason of alert notification
6	6	6	6	Priority	Priority of the alarm
7	7	7	7	Time Stamp	Time when this alert is first detected
8	8		8	Subcode	Enumerated cause of this alert
9	9		9	Value	Value of referenced data
10	10		10	Relative Index	Relative index of referenced data
		8		Static Revision	Value of static revision (ST_REV) of the block
11	11	9		Unit Index	Unit code of referenced data
			11	Source Block Index	Relative index of the block that triggered the alert

7.2.3 Standard categories for NAMUR NE-107 instrument diagnostics alarms

The following standard categories of instrument diagnostics are defined for the NAMUR NE-107.

F (Failed):
An alarm category that indicates a failure has occurred in the instrument or in its peripheral devices.

C (Check Function):
An alarm category that indicates that a detected failure is a temporary event.

S (Off Specification):
An alarm category that indicates that the detected failure was caused by the instrument being used outside of its range or because a discrepancy has occurred between the set value and measured value. The alarm was caused either by the instrument or process state.

M (Maintenance):
An alarm category for a detected failure that has a low level of urgency but is a failure that could develop into a problem causing restrictions in instrument functionality in some environments.

7.2.4 Alarm Handling

Details of alarm handling (see Figure 7.2) are as below.

(1) FD_EXTENDED_ACTIVE_n
Generated alarms will be displayed here. After reflecting the mask in "SENSOR_STATUS_ MASK_1 to 8", YTA specific alarms will be aggregated and displayed in "FD_EXTENDED_ ACTIVE_2" and "FD_EXTENDED_ACTIVE_3". The allocation of alarms is the same as the "DEVICE_CONDITION_ACTIVE_n" of Table 7.3 to Table 7.9.

(2) FD_EXTENDED_MAP_n
User can mask the alarms of "FD EXTENDED ACTIVE n". The allocation of alarms is the same as the "DEVICE_CONDITION_ACTIVE_n" of Table 7.3 to Table 7.9.

(3) DEVICE_CONDITION_ACTIVE_n
The results that reflect the mask in "FD_ EXTENDED_MAP_n" display to "FD_EXTENDED_ ACTIVE_n". Refer to the Table 7.3 to Table 7.9 with respect to the allocation of alarms.

(4) FD_SIMULATE.DIAGNOSTIC_VALUE
The results that aggregate "DEVICE CONDITION ACTIVE n" will be displayed here. These are aggregated according to the description of "FD_*_ ACTIVE No.". User cannot change the settings for aggregation. Indication of contents are same as Indication of "FD_*_ ACTIVE" of Table 7.2.

(5) FD_FAIL_MAP, FD_OFFSPEC_MAP, FD_ MAINT_MAP, FD_CHECK_MAP
User can classify "FD_SIMULATE.DIAGNOSTIC_ VALUE" to F, S, M, or C. Initial settings will be indicated NE-107 default category in table 7.2. Indication of contents are same as Indication of "FD_*_ ACTIVE" of Table 7.2.

(6) FD_FAIL_ACTIVE, FD_OFFSPEC_ACTIVE, FD_MAINT_ACTIVE, FD_CHECK_ACTIVE
The results that are classified by "FD_FAIL_MAP", "FD_OFFSPEC_MAP", "FD_MAINT_MAP, and "FD_CHECK _MAP" will be displayed here.

(7) FD_FAIL_MASK, FD_OFFSPEC_MASK , FD_MAINT_MASK, FD_CHECK_MASK
User can mask the "FD_FAIL_MASK", "FD_ OFFSPEC_MASK", "FD_MAINT_MASK", and "FD_CHECK_MASK". Indication of contents are same as Indication of "FD_*_ ACTIVE" of Table 7.2.

(8) FD_FAIL_PRI, FD_OFFSPEC_PRI, FD_ MAINT_PRI, FD_CHECK_PRI
Set the priorities that indicate in "FD_FAIL_ PRI", "FD_OFFSPEC_ PRI", "FD_MAINT_ PRI", and "FD_CHECK_ PRI".

(9) FD_FAIL_ALM, FD_OFFSPEC_ALM, FD_ MAINT_ALM, FD_CHECK_ALM
Display the alarms that generate according to the settings of above (7) and (8).

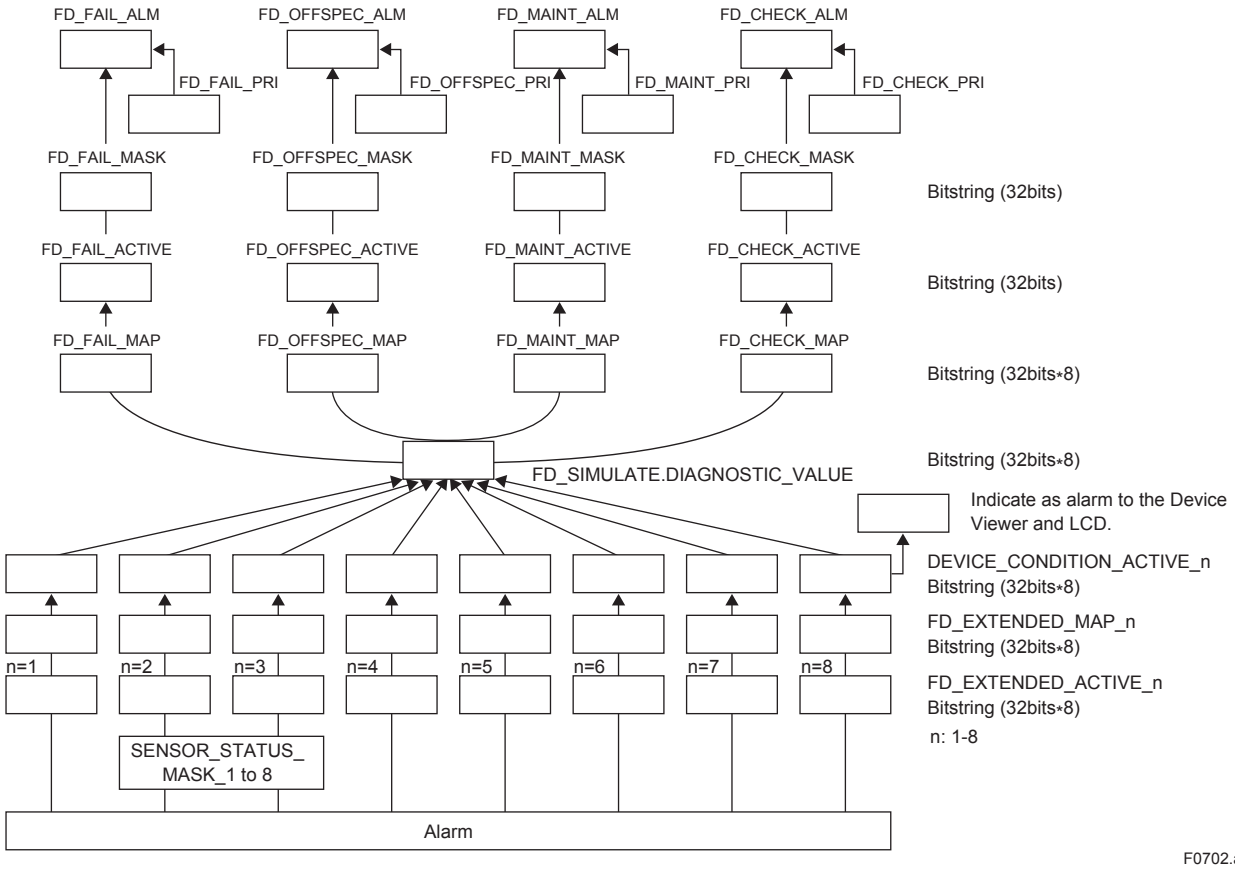


Figure 7.2 Alarm handling overview

Table 7.2 Field Diagnostic Alert

No.	NE-107 default category	Indication of FD_*_ ACTIVE	Indication of FD_ RECOMMEN_ACT	Action
31	F	Electronics failure	Repair electronics	Replace electrical parts e.g. amplifier. Or contact sales office or service center.
30	F	Sensor/Actuator failure	Repair Sensor/Actuator	Replace mechanics e.g. sensor or actuator. Or contact sales office or service center.
29	F	Failure which requires investigation	Investigate failure	Perform reconfiguration, cleaning, wiring/ connector or electrical board check. If alarm still persists, contact sales office or service center.
26	F	Operated at the backup side	Repair primary side	Repair primary sensor before backup sensor fails.
24	C	Firmware update error	Retry updating firmware	Retry firmware update. Check cause of the failure if alarm persists.
23	C	Communication configuration error	Configure communication correctly	Correct configuration of communication.
22	C	Non operating state	Wait for a while	Wait for a while. Check cause of the failure if alarm persists.
21	C	Calibration warning	Check calibration	Investigate cause of failure and recalibrate device.
20	C	Instrument configuration error	Configure device correctly	Correct configuration relating to sensor or actuator.
19	C	Function restricted	Confirm the state	Check if this is the right state.
18	C	Simulation mode	Confirm the state	Check if this is the right state.
17	C	Manual mode	Confirm the state	Check if this is the right state.
16	C	Function Block notification	Check Function Block status	Check condition of function blocks. In order to avoid alarm from unused function blocks, configure RESORCE.FD_EXTENDED_ MAP_n parameter.
13	S	Sensor value/Actuator value out of specification	Check specification	Check specification of sensor and actuator. Or process conditions may be temporarily non-conforming.
12	S	Environment out of specification	Check environment	Check environment specifications of sensor and actuator. Or process environment may be temporarily non-conforming.
9	M	Temporal decrease of value quality	Check process or peripherals	Check process and peripherals conditions.
8	M	Deteriorate estimation by counter	Check deterioration	Check if maintenance is required.
7	M	Deteriorate estimation by anomaly detection	Check deterioration	Check if maintenance is required.
6	M	Backup Sensor Failure	Repair sensor1	Repair sensor1 before backup sensor fails.
3	C	Optional function configuration error	Check optional configuration	Check configuration of optional functions.
2	-	Alarm related information	Confirm information	Check the alarm related information.
1	-	Process alarm	Check process	Check process conditions.
0	-	Condition Check	CHECK	CHECK

7.2.5 Field Diagnostics

(1) Alarm Indications

Faults found as a result of self-diagnostics by the YTA are identified as alarms. Alarms are abnormalities in the physical device, such as a hardware failure or communication error and problems in the parameter settings or abnormal operation status of the device, such as the active state of the bypass action and simulation mode, in order to alert the user. The user can check the alarms currently occurring in a YTA with either of the following:

- Value (bit statuses) in DEVICE_CONDITION_ACTIVE_1 to 8 of the resource block
- Alarm code displayed on the LCD

(2) Checking with LCD

For the YTA with integral indicator, when an alarm occurs, the corresponding alarm No. is displayed on the LCD. The following shows the alarm No, cause, and action for each of the alarms.

Table 7.3 Contents of DEVICE_CONDITION_ACTIVE_1

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_1	FD_*_ ACTIVE No.*1
Write Unlocked	Writing to parameters is Unlocked.	Change the RB Write Lock (RB. WRITE_LOCK) to Locked or turn on the hardware write lock switch, depending on RB Feature Selection (RB.FEATURE_SEL).	-	Mask	2
Hard Write Lock SW OFF	Hardware write lock switch is OFF.	Turn on the hardware write lock switch.	-	Mask	2
Write Locked	Writing to parameters is locked.	Change the RB Write Lock (RB. WRITE_LOCK) to Not Locked or turn off the hardware write lock switch, depending on RB Feature Selection (RB.FEATURE_SEL).	-	Mask	2
Hard Write Lock SW ON	Hardware write lock switch is ON.	Turn off the hardware write lock switch.	-	Mask	2
Abnormal Boot Process	Abnormal boot processing was detected at the starting.	Check the cables, power and MTB Software download error (MTB. SOFTDL_ERROR).	-	No mask	29
SoftDL Failure	Software download has failed.		-	No mask	24
SoftDL Incomplete	Software download is incomplete.	Check the cables, power supply and MTB Software download error (MTB.SOFTDL_ERROR).	-	No mask	24
Simulation Switch ON	Software or hardware simulation switch is ON.	Delete the value of MTB Sim Enable Message (MTB.SIM_ ENABLE_MSG) or turn off the hardware simulation switch.	-	Mask	2
RB in O/S mode	Resource Block is in O/S mode.(AL-110)	Change the RB Block Mode.Target (RB.MODE_BLK.Target) to Auto mode.	AL.110	Mask	16
Simulation Switch OFF	Software or hardware simulation switch is OFF.	Write REMOTE LOOP TEST SWITCH on MTB Sim Enable Message (MTB.SIM_ENABLE_ MSG) or turn on the hardware simulation switch.	-	Mask	2
Amp EEPROM Failure	Amplifier EEPROM failed.	Replace electrical parts such as the amplifier. Or replace the device.	AL.01	No mask	31

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.4 Contents of DEVICE_CONDITION_ACTIVE_2

Description	Cause	Action	Alarm No.	Initial Setting of FD_EXTENDED_MAP_2	FD_*_ACTIVE No.*1
CPU Fail	CPU is failed.	Replace the device. Or contact sales or service center.	AL.00	No mask	31
Sensor NV Fail	Sensor non-volatile memory is failed.		AL.01	No mask	31
Temp NV Fail	Temp assy non-volatile memory is failed.		AL.02	No mask	31
AD Conv Fail	AD converter is failed.		AL.03	No mask	31
Main Rvrs Cal Fail	Main assy reverse calculation is failed.		AL.04	No mask	31
Temp Rvrs Cal Fail	Temp assy reverse calculation is failed.		AL.05	No mask	31
Temp Voltage Fail	Temp assy voltage is failed.		AL.06	No mask	31
Comm NV Fail	Communication non-volatile memory is failed.		AL.07	No mask	31
Temp NV Warning	Temp non-volatile memory is warning.		AL.08	No mask	9
Int Comm Fail	Internal communication is failed.		AL.09	No mask	31
Sensor1 Failure*2	Sensor1 is disconnected.	Check sensor for damage and connection.	AL.10	No mask	30
Sensor2 Failure*2	Sensor2 is disconnected.		AL.11	No mask	30
Sensor1 Short*2	Sensor1 is shorted.		AL.12	No mask	30
Sensor2 Short*2	Sensor2 is shorted.		AL.13	No mask	30
S1 Corrosion	Sensor1 has been corroded.		AL.14	No mask	9
S2 Corrosion	Sensor2 has been corroded.		AL.15	No mask	9
S1 Signal Error	The input of sensor1 is out of measurable range.	Check sensor type and connection.	AL.20	No mask	13
S2 Signal Error	The input of sensor2 is out of measurable range.		AL.21	No mask	13
Term Sns Fail	Terminal block temperature is abnormal.	Contact our service personnel.	AL.22	No mask	12
Backup Sns1 Fail	The sensor1 side has failed, while sensor backup is working. So the input of sensor2 is enabled.	Implement the restoration process after replace sensor1.	AL.23	No mask	6
Backup Sns2 Fail	The sensor2 side has failed, while sensor backup is working.	Implement the restoration process after replace sensor2.	AL.24	No mask	6
Sensor Drift	Difference of temperature between 2sensors is over the threshold.	Check sensor fail.	AL.25	No mask	9
S1 Over Temp Cycl*2	Temperature cycle count of sensor1 is over the threshold.	Check sensor deterioration.	AL.26	No mask	9
S2 Over Temp Cycl*2	Temperature cycle count of sensor2 is over the threshold.	Check sensor type and connection.	AL.27	No mask	9

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.
*2: Applicable only for YTA710.

Table 7.5 Contents of DEVICE_CONDITION_ACTIVE_3

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_3	FD_*_ ACTIVE No.*1
S1 Temp Low	Measured temperature of sensor1 is too low.	Check sensor setting.	AL.40	No mask	13
S1 Temp High	Measured temperature of sensor1 is too high.		AL.41	No mask	13
S2 Temp Low	Measured temperature of sensor2 is too low.		AL.42	No mask	13
S2 Temp High	Measured temperature of sensor2 is too high.		AL.43	No mask	13
Amb Temp Low	Ambient temperature is too low.	Use a heater to raise the ambient temperature, or reset to a higher level.	AL.44	No mask	12
Amb Temp High	Ambient temperature is too high.	Take enough distance from the source of heat, or reset to a lower level.	AL.45	No mask	12
Illegal Sensor1 Config	There is incorrect item in setting of Sensor1.	Check sensor setting.	AL.61	No mask	20
Illegal Sensor2 Config	There is incorrect item in setting of Sensor2.		AL.62	No mask	20

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.6 Contents of DEVICE_CONDITION_ACTIVE_4

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_4	FD_*_ ACTIVE No.*1
No FB Scheduled	No Function Block is scheduled.	Check the LAS communication or Schedule Function Block.	AL.100	No mask	22
AI1 Hi Hi Alarm	High High Alarm has occurred.	Check the AI1 Output.Value (AI1. OUT.VALUE) and configuration of AI1 Hi Hi Lim (AI1 HI_HI_LIM), AI1 Hi Hi Pri (AI1 HI_HI_PRI).	AL.101	Mask	1
AI1 Lo Lo Alarm	Low Low Alarm has occurred.	Check the AI1 Output.Value (AI1. OUT.VALUE) and configuration of AI1 Lo Lo Lim(AI1 LO_LO_LIM), AI1 Lo Lo Pri(AI1 LO_LO_PRI).	AL.101	Mask	1
AI2 Hi Hi Alarm	High High Alarm has occurred.	Check the AI2 Output.Value (AI2. OUT.VALUE) and configuration of AI2 Hi Hi Lim (AI12HI_HI_LIM), AI2 Hi Hi Pri (AI2 HI_HI_PRI).	AL.102	Mask	1
AI2 Lo Lo Alarm	Low Low Alarm has occurred.	Check the AI2 Output.Value (AI1. OUT.VALUE) and configuration of AI2 Lo Lo Lim(AI2 LO_LO_LIM), AI1 Lo Lo Pri(AI1 LO_LO_PRI).	AL.102	Mask	1
AI3 Hi Hi Alarm	High High Alarm has occurred.	Check the AI3 Output.Value(AI3. OUT.VALUE) and configuration of AI3 Hi Hi Lim(AI3 HI_HI_LIM), AI3 Hi Hi Pri(AI3 HI_HI_PRI).	AL.103	Mask	1
AI3 Lo Lo Alarm	Low Low Alarm has occurred.	Check the AI3 Output.Value(AI3. OUT.VALUE) and configuration of AI3 Lo Lo Lim(AI3 LO_LO_LIM), AI3 Lo Lo Pri(AI3 LO_LO_PRI).	AL.103	Mask	1
AI4 Hi Hi Alarm	High High Alarm has occurred.	Check the AI4 Output.Value(AI4. OUT.VALUE) and configuration of AI4 Hi Hi Lim(AI4 HI_HI_LIM), AI4 Hi Hi Pri(AI4 HI_HI_PRI).	AL.104	Mask	1

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_4	FD_*_ ACTIVE No.*1
AI4 Lo Lo Alarm	Low Low Alarm has occurred.	Check the AI4 Output.Value(AI4. OUT.VALUE) and configuration of AI4 Lo Lo Lim(AI4 LO_LO_LIM), AI4 Lo Lo Pri(AI4 LO_LO_PRI).	AL.104	Mask	1
PID1 Hi Hi Alarm	High High Alarm has occurred.	Check the PID1 Output.Value(PID1. OUT.VALUE) and configuration of PID1 Hi Hi Lim(PID1 HI_HI_LIM), PID1 Hi Hi Pri(PID1 HI_HI_PRI).	AL.105	Mask	1
PID1 Lo Lo Alarm	Low Low Alarm has occurred.	Check the PID1 Output.Value(PID1. OUT.VALUE) and configuration of PID1 Lo Lo Lim(PID1 LO_LO_LIM), PID1 Lo Lo Pri(PID1 LO_LO_PRI).	AL.105	Mask	1
PID2 Hi Hi Alarm	High High Alarm has occurred.	Check the PID2 Output.Value(PID2. OUT.VALUE) and configuration of PID2 Hi Hi Lim(PID2 HI_HI_LIM), PID2 Hi Hi Pri(PID2 HI_HI_PRI).	AL.106	Mask	1
PIDI2 Lo Lo Alarm	Low Low Alarm has occurred.	Check the PID2 Output.Value(PID2. OUT.VALUE) and configuration of PID2 Lo Lo Lim(PID2 LO_LO_LIM), PID Lo Lo Pri(PID2 LO_LO_PRI).	AL.106	Mask	1
RS in O/S Mode	Resource Block is in O/S mode.	Change the RS Block Mode.Target (RB.MODE_BLK.Target) to Auto mode.	AL.110	Mask	16
STB in O/S Mode	Sensor Transducer Block is in O/S mode.	Change the STB Block Mode.Target (STB.MODE_BLK.Target) to Auto mode.	AL.111	Mask	16
LTB in O/S Mode	LCD Transducer Block is in O/S mode.	Change the LCD Block Mode. Target (STB.MODE_BLK.Target) to Auto mode.	AL.112	Mask	16
MTB in O/S Mode	Maintenance Transducer Block is in O/S mode.	Change the MTB Block Mode. Target (STB.MODE_BLK.Target) to Auto mode.	AL.113	Mask	16
AI1 in O/S Mode	AI1 Block is in O/S mode.	Change the AI1 Block Mode.Target (AI1.MODE_BLK.Target) to Auto or other mode.	AL.114	Mask	16
AI2 in O/S Mode	AI2 Block is in O/S mode.	Change the AI2 Block Mode.Target (AI2.MODE_BLK.Target) to Auto or other mode.	AL.115	Mask	16
AI3 in O/S Mode	AI3 Block is in O/S mode.	Change the AI3 Block Mode.Target (AI3.MODE_BLK.Target) to Auto or other mode.	AL.116	Mask	16
AI4 in O/S Mode	AI4 Block is in O/S mode.	Change the AI4 Block Mode.Target (AI4.MODE_BLK.Target) to Auto or other mode.	AL.117	Mask	16
AI1 Not Scheduled	AI1 Block is not scheduled.	Schedule AI1 Block.	AL.118	Mask	16
AI2 Not Scheduled	AI2 Block is not scheduled.	Schedule AI2 Block.	AL.119	Mask	16
AI3 Not Scheduled	AI3 Block is not scheduled.	Schedule AI3 Block.	AL.120	Mask	16
AI4 Not Scheduled	AI4 Block is not scheduled.	Schedule AI4 Block.	AL.121	Mask	16
STB in Man Mode	Sensor Transducer Block is in MAN mode.	Change the STB Block Mode. Target(STB.MODE_BLK.Target) to Auto mode.	AL.122	Mask	17

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.7 Contents of DEVICE_CONDITION_ACTIVE_6

Description	Cause	Action	Alarm No.	Initial Setting of FD_EXTENDED_MAP_6	FD_*_ACTIVE No.*1
DI1 in O/S Mode	DI1 Block is in O/S mode.	Change the DI1 Block Mode.Target (DI1.MODE_BLK.Target) to Auto or other mode.	AL.130	Mask	16
DI1 in MAN Mode	DI1 Block is in Man mode.	Change the DI1 Block Mode.Target (DI1.MODE_BLK.Target) to Auto or other mode.	AL.130	Mask	17
DI1 Not Scheduled	DI1 Block is not scheduled.	Schedule DI1 Function Block.	AL.130	Mask	16
DI1 Simulate Active	DI1 Block is in simulation mode.	Change the DI1 Simulation En/Disable (DI1.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.130	Mask	18
DI2 in O/S Mode	DI2 Block is in O/S mode.	Change the DI2 Block Mode.Target (DI2.MODE_BLK.Target) to Auto or other mode.	AL.131	Mask	16
DI2 in MAN Mode	DI2 Block is in Man mode.	Change the DI2 Block Mode.Target (DI2.MODE_BLK.Target) to Auto or other mode.	AL.131	Mask	17
DI2 Not Scheduled	DI2 Block is not scheduled.	Schedule DI2 Function Block.	AL.131	Mask	16
DI2 Simulate Active	DI2 Block is in simulation mode.	Change the DI2 Simulation En/Disable (DI2.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.131	Mask	18
DI3 in O/S Mode	DI3 Block is in O/S mode.	Change the DI3 Block Mode.Target (DI3.MODE_BLK.Target) to Auto or other mode.	AL.132	Mask	16
DI3 in MAN Mode	DI3 Block is in Man mode.	Change the DI3 Block Mode.Target (DI3.MODE_BLK.Target) to Auto or other mode.	AL.132	Mask	17
DI3 Not Scheduled	DI3 Block is not scheduled.	Schedule DI3 Function Block.	AL.132	Mask	16
DI3 Simulate Active	DI3 Block is in simulation mode.	Change the DI3 Simulation En/Disable (DI3.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.132	Mask	18
DI4 in O/S Mode	DI4 Block is in O/S mode.	Change the DI4 Block Mode.Target (DI4.MODE_BLK.Target) to Auto or other mode.	AL.133	Mask	16
DI4 in MAN Mode	DI4 Block is in Man mode.	Change the DI4 Block Mode.Target (DI4.MODE_BLK.Target) to Auto or other mode.	AL.133	Mask	17
DI4 Not Scheduled	DI4 Block is not scheduled.	Schedule DI4 Function Block.	AL.133	Mask	16
DI4 Simulate Active	DI4 Block is in simulation mode.	Change the DI4 Simulation En/Disable (DI4.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.133	Mask	18
PID1 in O/S Mode	PID1 Block is in O/S mode.	Change the PID1 Block Mode. Target (PID1.MODE_BLK.Target) to Auto or other mode.	AL.134	Mask	16
PID1 in MAN Mode	PID1 Block is in Man mode.	Change the PID1 Block Mode. Target (PID1.MODE_BLK.Target) to Auto or other mode.	AL.134	Mask	17
PID1 Not Scheduled	PID1 Block is not scheduled.	PID1 Block is not scheduled.	AL.134	Mask	16
PID1 in Bypass Mode	PID1 Block is in Bypass mode.	PID1 Block is in Bypass mode.	AL.134	Mask	19
PID2 in O/S Mode	PID2 Block is in O/S mode.	Change the PID2 Block Mode. Target (PID2.MODE_BLK.Target) to Auto or other mode.	AL.135	Mask	16

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_6	FD_*_ ACTIVE No.*1
PID2 in MAN Mode	PID2 Block is in Man mode.	Change the PID2 Block Mode. Target PID2.MODE_BLK.Target) to Auto or other mode.	AL.135	Mask	17
PID2 Not Scheduled	PID2 Block is not scheduled.	PID2 Block is not scheduled.	AL.135	Mask	16
PID2 in Bypass Mode	PID2 Block is in Bypass mode.	PID2 Block is in Bypass mode.	AL.135	Mask	19
SC in O/S Mode	SC Block is in O/S mode.	Change the SC Block Mode.Target (SC.MODE_BLK.Target) to Auto or other mode.	AL.136	Mask	16
SC in MAN Mode	SC Block is in Man mode.	Change the SC Block Mode.Target (SC.MODE_BLK.Target) to Auto or other mode.	AL.136	Mask	17
SC Not Scheduled	SC Block is not scheduled.	Schedule SC Function Block.	AL.136	Mask	16
IS in O/S Mode	IS Block is in O/S mode.	Change the IS Block Mode.Target (SC.MODE_BLK.Target) to Auto or other mode.	AL.137	Mask	16
IS in MAN Mode	IS Block is in Man mode.	Change the IS Block Mode.Target (SC.MODE_BLK.Target) to Auto or other mode.	AL.137	Mask	17
IS Not Scheduled	IS Block is not scheduled.	Schedule IS Function Block.	AL.137	Mask	16

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.8 Contents of DEVICE_CONDITION_ACTIVE_7

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_7	FD_*_ ACTIVE No.*1
AR in O/S Mode	AR Block is in O/S mode.	Change the AR Block Mode.Target (AR.MODE_BLK.Target) to Auto or other mode.	AL.138	Mask	16
AR in MAN Mode	AR Block is in Man mode.	Change the AR Block Mode.Target (AR.MODE_BLK.Target) to Auto or other mode.	AL.138	Mask	17
AR Not Scheduled	AR Block is not scheduled.	Schedule AR Function Block.	AL.138	Mask	16

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.9 Contents of DEVICE_CONDITION_ACTIVE_8

Description	Cause	Action	Alarm No.	Initial Setting of FD_ EXTENDED_ MAP_8	FD_*_ ACTIVE No.*1
AI1 Simulate Active	AI1 Block is in simulation mode.	Change the AI1 Simulation En/Disable (AI1.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.150	Mask	18
AI2 Simulate Active	AI2 Block is in simulation mode.	Change the AI2 Simulation En/Disable (AI2.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.151	Mask	18
AI3 Simulate Active	AI3 Block is in simulation mode.	Change the AI3 Simulation En/Disable (AI3.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.152	Mask	18
AI4 Simulate Active	AI4 Block is in simulation mode.	Change the AI4 Simulation En/Disable (AI4.SIMULATE. SIMULATE_ENABLE) to Disabled.	AL.153	Mask	18
AI1 in MAN Mode	AI1 Block is in Man mode.	Change the AI1 Block Mode.Target (AI1.MODE_BLK.Target) to Auto or other mode.	AL.154	Mask	17
AI2 in MAN Mode	AI2 Block is in Man mode.	Change the AI2 Block Mode.Target (AI2.MODE_BLK.Target) to Auto or other mode.	AL.155	Mask	17
AI3 in MAN Mode	AI3 Block is in Man mode.	Change the AI3 Block Mode.Target (AI3.MODE_BLK.Target) to Auto or other mode.	AL.156	Mask	17
AI4 in MAN Mode	AI4 Block is in Man mode.	Change the AI4 Block Mode.Target (AI4.MODE_BLK.Target) to Auto or other mode.	AL.157	Mask	17

1: Contents of DEVICE_CONDITION_ACTIVE are aggregated to FD_*_ACTIVE (indicates FAIL, OFF_SPEC, MAINT or CHECK). See table 7.2.

Table 7.10 Troubleshooting When Actual in MODE_BLK of a Function Block Cannot Change from O/S

Presumed Cause	Remedy
The target mode of the function block in question is not set.	Set the target mode of the block to Auto.
The actual mode of the resource block is O/S.	Set the target mode of the resource block to Auto.
Function block execution schedule is not set correctly.	Set up the schedule using a configuration tool or the like.

7.3 Simulation Function

The simulation function simulates the input of a function block and lets it operate as if the data was received from the transducer block. It is possible to conduct testing for the downstream function blocks or alarm processes.

7.3.1 Simulate Enable

(1) Setting by Hardware Switch

A SIMULATE_ENABLE switch is mounted in the transmitter amplifier. This is to prevent the accidental operation of this function. When this is switched on, simulation is enabled. (See Figure 7.2.)

(2) Setting by Local Parameter Setting

By setting the 'Simulation' parameter of local parameter setting ON, simulation is enabled. Since the data is held in non-volatile memory, even when the power is turned off, the simulation mode is retained.

(3) Setting by Parameters

To initiate the same action from a remote terminal, if REMOTE LOOP TEST SWITCH is written to the SIM_ENABLE_MSG parameter (index 3022) of the MTB block, the resulting action is the same as is taken when the above switch is on. Note that this parameter value is lost when the power is turned OFF. In simulation enabled status, an alarm is generated from the resource block, and other device alarms will be masked; for this reason the simulation must be disabled immediately after using this function.

The SIMULATE parameter of AI block consists of the elements listed in Table 7.11 below.

Table 7.11 SIMULATE Parameter

Sub-index	Parameters	Description
1	Simulate Status	Sets the data status to be simulated.
2	Simulate Value	Sets the value of the data to be simulated.
3	Transducer Status	Displays the data status from the transducer block. It cannot be changed.
4	Transducer Value	Displays the data value from the transducer block.It cannot be changed.
5	Simulate En/Disable	Controls the simulation function of this block. 1: Disable 2: Active

When Simulate En/Disable in Table 7.11 above is set to 2, the applicable function block uses the simulation value set in this parameter instead of the data from the transducer block. This setting can be used for propagation of the status to the trailing blocks, generation of a process alarm, and as an operation test for trailing blocks.

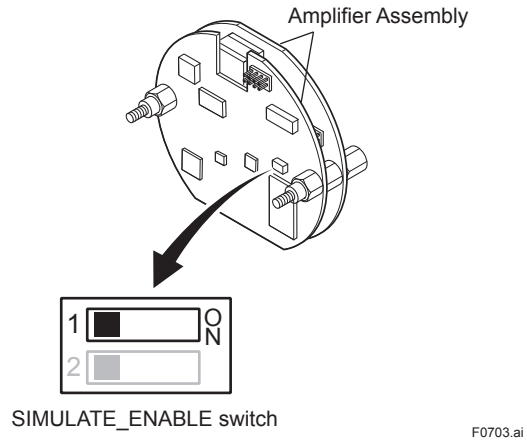


Figure 7.3 SIMULATE_ENABLE Switch Position

FD_SIMULATE parameters of the Resource block are shown in Table 7.12.

Table 7.12 FD_SIMULATION parameters

Sub-index	Parameter	Description
1	Diagnostic Simulate Value	Set the alarm bit to simulate. If "Sub-index3: Enable" is set to Disable, this displays the value of the "Sub-index2: Diagnostic Value".
2	Diagnostic Value	This displays the diagnostic state of the real state of the equipment.
3	Enable	This controls the simulation function. 1: Simulation disabled (initial setting) 2: Simulation active

In state of "SIMULATE_ENABLE switch" on or simulation function is active by "SIM_ENABLE_ MSG" of Resource block, then set the Sub-index 3 "Enable" to "2: Simulation active" you can generate an alarm bit which you set in "Diagnostic Simulate Value" . Using this function you can verify whether the diagnostics alarm of instrument generate normally.

7.4 Write lock (Write-protect) function

The transmitter is provided with a write lock (write-protect) function to restrict write operations to blocks and prevent inadvertent writing of parameter data. To enable this function, use the write lock switch (Hard W Lock), the WRITE_LOCK (index 1034) (Soft W Lock) or Local Write Lock (LPS W Lock).

The CPU assembly of the transmitter is provided with a write lock switch (switch 2 in Figure 7.4). Setting switch 2 to On activates the write lock function, to prevent changes to block parameters of WRITE_LOCK_LEVEL (index 1092). Table 7.13 shows how WRITE_LOCK_LEVEL relates to the block targeted by write lock. In the factory default setting, WRITE_LOCK_LEVEL is “2” (preventing writing to the transducer block, resource block and function block). To enable the switch lock function, set "Hard W Lock” (bit 4) of FEATURE_SEL (index 1018) to “1” (On). (The factory default for “Hard W Lock” (bit 4) is “0” (Off).

Table 7.13 Relationship between WRITE_LOCK_ LEVEL and block targeted by write lock

WRITE_LOCK_ LEVEL (index 1092)	Block targeted by Write lock
C (TB)	All parameters for the transducer block and FEATURE_SEL and WRITE_LOCK_LEVEL parameter settings for FEATURE_SEL
B (TB+RB)	All parameters for the transducer block and resource block
A (ALL FBAP)	All function block parameters in addition to WRITE_LOCK_LEVEL “1”
AA (MIB+ALL FBAP)	MIB and VCR in addition to WRITE_LOCK_LEVEL “2”

When the write lock switch is disabled, set 2 (enabled) for WRITE_LOCK (index 1034) of the resource block to enable the write lock function. To enable the write lock function using the WRITE_ LOCK setting, FEATURE_SEL (index 1018) of the resource block must be returned to its factory default. (In the factory default setting, “Hard W Lock” (bit 4) is “0” (Off) and “Soft W Lock” (bit 3) is “1” (On).

To enable the write lock function using the Local parameter setting (HW.LOCK), FEATURE_SEL of the resource block must be “Hard W Lock” (bit 4) is “1” (On) .

Table 7.14 FEATURE_SEL, write lock switch WRITE_LOCK and Local Write Lock parameter relationship

FEATURE_SEL (index 1018)		Write lock switch	Local Write Lock	WRITE_ LOCK (index 1034)
Hard W Lock (bit4)	Soft W Lock (bit3)			
0 (OFF)	0 (OFF)	Disabled	Disable	Unavailable (“1” (Write lock disabled))
	1 (ON)			1 (Write lock disabled) (Factory default)
				2 (Write lock enabled)
1 (ON)	0 (OFF)	Enabled	Enable	Unavailable (depends on write lock switch and Local Write Lock)

* When “Hard W Lock” and “Soft W Lock” are both 1 (On), the “Hard W Lock” setting takes precedence and “Soft W Lock” is automatically set to 0 (Off).

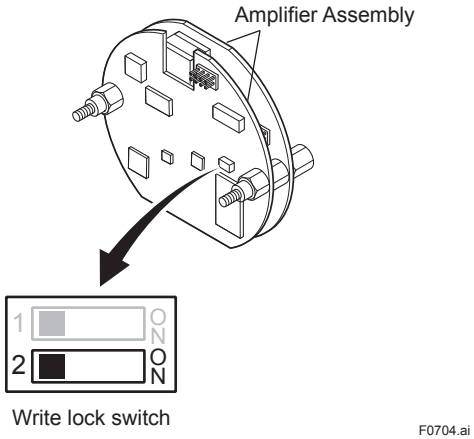


Figure 7.4 Write lock Switch

Appendix 1. List of Parameters for Each Block of the YTA

Note: The Write Mode column contains the modes in which each parameter is write enabled.
O/S: Write enabled in O/S mode.
Man: Write enabled in Man mode and O/S mode.
Auto: Write enabled in Auto mode, Man mode, and O/S mode

A1.1 Resource Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	1000	Block Header	TAG: “RS”	Block Tag =O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	1001	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	1002	TAG_DESC	Null	AUTO	The user description of the intended application of the block.
3	1003	STRATEGY	0	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	1004	ALERT_KEY	0	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	1005	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	1006	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.
7	1007	RS_STATE	—	—	State of the resource block state machine.
8	1008	TEST_RW	Null	AUTO	Read/write test parameter-used only for conformance testing and simulation.
9	1009	DD_RESOURCE	Null	—	String identifying the tag of the resource which contains the Device Description for this resource.
10	1010	MANUFAC_ID	0x00594543	—	Manufacturer identification number-used by an interface device to locate the DD file for the resource.
11	1011	DEV_TYPE	12	—	Manufacturer’s model number associated with the resource-used by interface devices to locate the DD file for the resource.
12	1012	DEV_REV	2	—	Manufacturer revision number associated with the resource-used by an interface device to locate the DD file for the resource.
13	1013	DD_REV	1	—	Revision of the DD associated with the resource used by an interface device to locate the DD file for the resource.
14	1014	GRANT_DENY	0	AUTO	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
15	1015	HARD_TYPES	Scalar input	—	The types of hardware available as channel numbers. bit0: Scalar input bit1: Scalar output bit2: Discrete input bit3: Discrete output
16	1016	RESTART	—	—	Allows a manual restart to be initiated. Several degrees of restart are possible. They are 1: Run, 2: Restart resource, 3: Restart with defaults defined in FF specification*1, and 4: Restart processor.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
17	1017	FEATURES	Reports Fault state Soft W Lock Hard W Lock Multi_bit Alarm support	—	Used to show supported resource block options.
18	1018	FEATURE_SEL	Report Fault state Soft W Lock Hard W Lock	AUTO	Used to select resource block options.
19	1019	CYCLE_TYPE	Scheduled	—	Identifies the block execution methods available for this resource. bit0: Scheduled bit1: Event driven bit2: Manufacturer specified
20	1020	CYCLE_SEL	Scheduled	AUTO	Used to select the block execution method for this resource.
21	1021	MIN_CYCLE_T	3200 (100 ms)	—	Time duration of the shortest cycle interval of which the resource is capable.
22	1022	MEMORY_SIZE	0	—	Available configuration memory in the empty resource. To be checked before attempting a download.
23	1023	NV_CYCLE_T	0	—	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
24	1024	FREE_SPACE	0	—	Percent of memory available for further configuration. YTA has zero which means a preconfigured resource.
25	1025	FREE_TIME	0	—	Percent of the block processing time that is free to process additional blocks. YTA does not support this.
26	1026	SHED_RCAS	640000 (20 S)	AUTO	Time duration at which to give up on computer writes to function block RCas locations. YTA does not support this.
27	1027	SHED ROUT	640000 (20 S)	AUTO	Time duration at which to give up on computer writes to function block ROut locations. YTA does not support this.
28	1028	FAULT STATE	1	—	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fail-safe condition is set, Then output function blocks will perform their FSAFE actions.
29	1029	SET_FSTATE	1	AUTO	Allows the fail-safe condition to be manually initiated by selecting Set.
30	1030	CLR_FSTATE	1	AUTO	Writing a Clear to this parameter will clear the device fail-safe state if the field condition, if any, has cleared.
31	1031	MAX_NOTIFY	4	—	Maximum number of unconfirmed notify messages possible.
32	1032	LIM_NOTIFY	4	AUTO	Maximum number of unconfirmed alert notify messages allowed.
33	1033	CONFIRM_TIME	640000 (2 S)	AUTO	The minimum time between retries of alert reports.
34	1034	WRITE_LOCK	1(Not locked)	AUTO	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated
35	1035	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
36	1036	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 will set 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.
37	1037	ALARM_SUM	Enable	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
38	1038	ACK_OPTION	0xFFFF	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
39	1039	WRIRE_PRI	0	AUTO	Priority of the alarm generated by clearing the write lock.
40	1040	WRITE_ALM	—	—	This alert is generated if the write lock parameter is cleared.
41	1041	ITK_VER	6	—	Version number of interoperability test by Fieldbus Foundation applied to YTA.
42	1042	COMPATIBILITY_REV	2	—	Indicates the smallest Rev value compatible with device DevRev.
43	1043	CAPABILITY_LEV	0x00	—	Indicates the capability level of instrument interior.
44	1044	FD_VER	0	—	Indicates value of major version of instrument diagnostics specifications.
45	1045	FD_FAIL_ACTIVE	0	—	A parameter that corresponds to ”Failed” in the NAMUR NE- 107 category.
46	1046	FD_OFFSPEC_ACTIVE	0	—	A parameter that corresponds to ”Off Specification” in the NAMUR NE-107 category.
47	1047	FD_MAINT_ACTIVE	0	—	A parameter that corresponds to ”Maintenance” in the NAMUR NE-107 category.
48	1048	FD CHECK_ACTIVE	0	—	A parameter that corresponds to ”Check Function” in the NAMUR NE-107 category.
49	1049	FD_FAIL_MAP	0xFC000000	AUTO	Specifies the bit assigned to FD_FAIL_ACTIVE, a parameter for indicating ”Failed,” a 32-bit alarm listed in FD_SIMULATE. Diagnostic Value.
50	1050	FD_OFFSPEC_MAP	0x00003800	AUTO	Specifies the bit assigned to FD_OFFSPEC_ACTIVE, a parameter for indicating ”Off Specification,” a 32-bit alarm listed in FD_SIMULATE. Diagnostic Value.
51	1051	FD_MAINT_MAP	0x000003E0	AUTO	Specifies the bit assigned to FD_MAINT_ACTIVE, a parameter for indicating ”Maintenance,” a 32-bit alarm listed in FD_SIMULATE. Diagnostic Value.
52	1052	FD_CHECK_MAP	0x01FF8008	AUTO	Specifies the bit assigned to FD_CHECK_ACTIVE, a parameter for indicating ”Check Function,” a 32-bit alarm listed in FD_SIMULATE. Diagnostic Value.
53	1053	FD_FAIL_MASK	0xFFFFFFFF	AUTO	Specifies the bit that notifies the host of 32-bit ”Failed” alarms listed in FD_FAIL_ACTIVE.
54	1054	FD_OFFSPEC_MASK	0xFFFFFFFF	AUTO	Specifies the bit that notifies the host of 32-bit ”Off Specification” alarms listed in FD_OFFSPEC_ ACTIVE.
55	1055	FD_MAINT_MASK	0xFFFFFFFF	AUTO	A parameter that specifies the bit that notifies the host of 32-bit ”Maintenance” alarms listed in FD_MAINT_ ACTIVE. A parameter set by the user.
56	1056	FD_CHECK_MASK	0xFFFFFFFF	AUTO	Specifies the bit that notifies the host of 32-bit ”Check Function”alarms listed in FD_CHECK_ACTIVE.
57	1057	FD_FAIL_ALM		AUTO	Indicates alarm information for alarms categorized under ”Failed.”
58	1058	FD_OFFSPEC_ALM		AUTO	Indicates alarm information for alarms categorized under ”Off Specification.”
59	1059	FD_MAINT_ALM		AUTO	Indicates alarm information for alarms categorized under ”Maintenance”.
60	1060	FD_CHECK_ALM		AUTO	Indicates alarm information for alarms categorized under ”Check Function”.
61	1061	FD_FAIL_PRI	0	AUTO	Indicates the FD_FAIL_ALM priority for an alarm.
62	1062	FD_OFFSPEC_PRI	0	AUTO	Indicates the FD_OFFSPEC_ALM priority for an alarm.
63	1063	FD_MAINT_PRI	0	AUTO	Indicates theFD_MAINT_ALM priority for an alarm.
64	1064	FD_CHECK_PRI	0	AUTO	Indicates the FD_CHECK_ALM priority for an alarm.
65	1065	FD_SIMULATE		AUTO	A parameter for simulating an alarm.
66	1066	FD_RECOMMEN_ACT	0	—	Indicates procedures for handling essential alarms.
67	1067	FD_EXTENDED_ ACTIVE_1	0	—	A parameter serving as a starting point for alarms.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
68	1068	FD_EXTENDED_ ACTIVE_2	0	—	A parameter serving as a starting point for alarms.
69	1069	FD_EXTENDED_ ACTIVE_3	0	—	
70	1070	FD_EXTENDED_ ACTIVE_4	0	—	
71	1071	FD_EXTENDED_ ACTIVE_5	0	—	
72	1072	FD_EXTENDED_ ACTIVE_6	0	—	
73	1073	FD_EXTENDED_ ACTIVE_7	0	—	
74	1074	FD_EXTENDED_ ACTIVE_8	0	—	
75	1075	FD_EXTENDED_MAP_1	0x07080000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_1 to DEVICE CONDITION_ ACTIVE_1.
76	1076	FD_EXTENDED_MAP_2	0xFFC0FFFC	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_2 to DEVICE CONDITION_ ACTIVE_2.
77	1077	FD_EXTENDED_MAP_3	0xFCFF0000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_3 to DEVICE CONDITION_ ACTIVE_3.
78	1078	FD_EXTENDED_MAP_4	0x80000000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_4 to DEVICE CONDITION_ ACTIVE_4.
79	1079	FD_EXTENDED_MAP_5	0x00000000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_5 to DEVICE CONDITION_ ACTIVE_5.
80	1080	FD_EXTENDED_MAP_6	0x00000000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_6 to DEVICE CONDITION_ ACTIVE_6.
81	1081	FD_EXTENDED_MAP_7	0x00000000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_7 to DEVICE CONDITION_ ACTIVE_7.
82	1082	FD_EXTENDED_MAP_8	0x00000000	AUTO	A parameter set by the user as a mask from FD_ EXTENDED_ACTIVE_8 to DEVICE CONDITION_ ACTIVE_8.
83	1083	DEVICE_CONDITION_ ACTIVE_1	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_1” display to “FD_EXTENDED_ACTIVE_1”.
84	1084	DEVICE_CONDITION_ ACTIVE_2	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_2” display to “FD_EXTENDED_ACTIVE_2”.
85	1085	DEVICE_CONDITION_ ACTIVE_3	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_3” display to “FD_EXTENDED_ACTIVE_3”.
86	1086	DEVICE_CONDITION_ ACTIVE_4	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_4” display to “FD_EXTENDED_ACTIVE_4”.
87	1087	DEVICE_CONDITION_ ACTIVE_5	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_5” display to “FD_EXTENDED_ACTIVE_5”.
88	1088	DEVICE_CONDITION_ ACTIVE_6	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_6” display to “FD_EXTENDED_ACTIVE_6”.
89	1089	DEVICE_CONDITION_ ACTIVE_7	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_7” display to “FD_EXTENDED_ACTIVE_7”.
90	1090	DEVICE_CONDITION_ ACTIVE_8	0x00000000	—	The results that reflect the mask in “FD_EXTENDED_ MAP_8” display to “FD_EXTENDED_ACTIVE_8”.
91	1091	SOFTWARE_REV	R1.02	—	Transmitter software revision number.
92	1092	WRITE_LOCK_LEVEL	2	AUTO	Specify blocks that activate Write Lock.

A1.2 SENSOR Transducer Block (STB)

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	2000	Block Header	TAG: “STB”	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	2001	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	2002	TAG_DESC	Null	AUTO	The user description of the intended application of the block.
3	2003	STRATEGY	1		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	2004	ALERT_KEY	1		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	2005	MODE_BLK	AUTO		The actual, target, permitted, and normal modes of the block.
6	2006	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.
7	2007	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
8	2008	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 will set the Active status in the Status attribute.
9	2009	TRANSDUCER_ DIRECTORY	—	—	A directory that specifies the number and starting indices of the transducers.
10	2010	TRANSDUCER_TYPE	104	—	Identifies transducer.
11	2011	TRANSDUCER_TYPE_ VER	0x0200		Transducer type version
12	2012	XD_ERROR	—	—	Stores the error prioritized at the highest level from among the errors that are currently occurring in the SENSOR transducer block.
13	2013	COLLECTION_ DIRECTORY	—	—	A directory that specifies the number, starting indices, and DD Item Ids of the data collections in each transducer within a transducer block.
14	2014	PRIMARY_VALUE_ TYPE_1	104	MAN	Defines the type of primary value 1 (sensor1 input). The following can be chosen for a YTA transmitter: 104 = Process temperature 105 = Non process temperature 112 = mV 200 = ohm
15	2015	PRIMARY_VALUE_1	—	—	Shows the value and status of the input from sensor 1.
16	2016	PRIMARY_VALUE_ RANGE_1	Sensor range	—	The upper and lower range limit values, engineering units code and the number of digits to the right of the decimal point to be used to display the primary value.
17	2017	CAL_POINT_HI_1	100.0	O/S	Upper value for calibrations of sensor 1 input.
18	2018	CAL_POINT_LO_1	0.0	O/S	Lower value for calibrations of sensor 1 input.
19	2019	CAL_MIN_SPAN_1	10	—	Minimum calibration span for sensor 1 input.
20	2020	CAL_VALUE_1	—	—	Calibration value of sensor1
21	2021	CAL_UNIT_1	mV or ohm	—	Unit of calibration value for sensor 1. Set to “mV” for a thermocouple or mV input, or to “ohm” for an RTD or resistance input.
22	2022	XD_OPTS			
23	2023	SENSOR_TYPE_1	As specified by the customer before shipment	MAN	Type of sensor1.
24	2024	SENSOR_RANGE_1	Range of sensor	—	Range of sensor1.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
25	2025	SENSOR_SN_1	0000000001	—	Serial number of sensor1.
26	2026	SENSOR_CAL_METHOD_1	103	AUTO	Calibration method for sensor1: 103 = Factory trim standard calibration 104 = User trim standard calibration
27	2027	SENSOR_CAL_LOC_1	YOKOGAWA	AUTO	Shows and is used to record the location where sensor1 was calibrated.
28	2028	SENSOR_CAL_DATE_1	—	AUTO	Shows and is used to record the date when sensor1 was calibrated.
29	2029	SENSOR_CAL_WHO_1	—	AUTO	Shows and is used to record the person who calibrated sensor1.
30	2030	SENSOR_CONNECTION_1	As specified by the customer before shipment	O/S	Number of connection wires of sensor1. Valid for RTD and resistance only.
31	2031	PRIMARY_VALUE_TYPE_2	104	MAN	Defines the type of primary value 2 (sensor2 input). The following can be chosen for a YTA transmitter: 104 = Process temperature 105 = Non process temperature 112 = mV 200 = ohm
32	2032	PRIMARY_VALUE_2	—	—	Shows the value and status of the input from sensor 2.
33	2033	PRIMARY_VALUE_RANGE_2	Sensor range	—	The upper and lower range limit values, engineering units code and the number of digits to the right of the decimal point to be used to display the primary value.
34	2034	CAL_POINT_HI_2	100.0	O/S	Upper value for calibrations of sensor2 input.
35	2035	CAL_POINT_LO_2	0.0	O/S	Lower value for calibrations of sensor2 input.
36	2036	CAL_MIN_SPAN_2	10	—	Minimum calibration span for sensor2 input.
37	2037	CAL_VALUE_2	—	—	Calibration value of sensor2
38	2038	CAL_UNIT_2	mV or ohm	—	Unit of calibration value for sensor 1. Set to “mV” for a thermocouple or mV input, or to “ohm” for an RTD or resistance input.
39	2039	SENSOR_TYPE_2	As specified by the customer before shipment	MAN	Type of sensor2.
40	2040	SENSOR_RANGE_2	Range of sensor	—	Range of sensor2.
41	2041	SENSOR_SN_2	0000000001	—	Serial number of sensor2.
42	2042	SENSOR_CAL_METHOD_2	103	AUTO	Calibration method for sensor2: 103 = Factory trim standard calibration 104 = User trim standard calibration
43	2043	SENSOR_CAL_LOC_2	YOKOGAWA	AUTO	Shows and is used to record the location where sensor2 was calibrated.
44	2044	SENSOR_CAL_DATE_2	—	AUTO	Shows and is used to record the date when sensor2 was calibrated.
45	2045	SENSOR_CAL_WHO_2	—	AUTO	Shows and is used to record the person who calibrated sensor2.
46	2046	SENSOR_CONNECTION_2	As specified by the customer before shipment	O/S	Number of connection wires of sensor2. Valid for RTD and resistance only.
47	2047	CAL_POINT_RESET	0	O/S	Reset user calibration.
48	2048	CONSTANT_CJC_TEMP	—	O/S	User-set constant for CJC for the sensor1 input. Setting 0 in this parameter disables RJC. Valid only when CJC_SELECT_1 is set to 1.
49	2049	CONSTANT_CJC_UNIT	—	O/S	User-set constant unit for CJC for the sensor1 input. Setting 0 in this parameter disables RJC. Valid only when CJC_SELECT_1 is set to 1.
50	2050	CJC_SELECT	0	O/S	Selects whether the terminal board temperature or user-set constant (CONSTANT_CJC_TEMP_1) is to be used for cold junction compensation (CJC) for the sensor1 input. Valid for Thermocouple input only. 0=Internal CJC 1=Constant CJC
51	2051	SENSOR1_DAMP	2	O/S	Damping time constant for sensor1

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
52	2052	WIRING_RESISTANCE_1	0	O/S	Wiring resistance of the sensor1 input. For a 2-wire resistance input, the input resistance minus this value is used as the temperature value.
53	2053	SENSOR1_MATCH_ IEC_A	0	O/S	Value of the factor A used in the sensor matching function for the sensor1 input
54	2054	SENSOR1_MATCH_ IEC_B	0	O/S	Value of the factor B used in the sensor matching function for the sensor1 input
55	2055	SENSOR1_MATCH_ IEC_C	0	O/S	Value of the factor C used in the sensor matching function for the sensor1 input
56	2056	SENSOR1_MATCH_IEC_ R0	0	O/S	Value of the factor R0 used in the sensor matching function for the sensor1 input
57	2057	SENSOR1_MATCH_ CVD_ALPHA	0	O/S	Value of the factor alpha used in the sensor matching function for the sensor1 input
58	2058	SENSOR1_MATCH_ CVD_DELTA	0	O/S	Value of the factor delta used in the sensor matching function for the sensor1 input
59	2059	SENSOR1_MATCH_ CVD_BETA	0	O/S	Value of the factor beta used in the sensor matching function for the sensor1 input
60	2060	SENSOR1_MATCH_ CVD_R0	0	O/S	Value of the factor R0 used in the sensor matching function for the sensor1 input
61	2061	SENSOR2_DAMP	2	O/S	Damping time constant for sensor1
62	2062	WIRING_RESISTANCE_2	0	O/S	Wiring resistance of the sensor1 input. For a 2-wire resistance input, the input resistance minus this value is used as the temperature value.
63	2063	SENSOR2_MATCH_ IEC_A	0	O/S	Value of the factor A used in the sensor matching function for the sensor2 input
64	2064	SENSOR2_MATCH_ IEC_B	0	O/S	Value of the factor B used in the sensor matching function for the sensor2 input
65	2065	SENSOR2_MATCH_ IEC_C	0	O/S	Value of the factor C used in the sensor matching function for the sensor2 input
66	2066	SENSOR2_MATCH_IEC_ R0	0	O/S	Value of the factor R0 used in the sensor matching function for the sensor2 input
67	2067	SENSOR2_MATCH_ CVD_ALPHA	0	O/S	Value of the factor alpha used in the sensor matching function for the sensor2 input
68	2068	SENSOR2_MATCH_ CVD_DELTA	0	O/S	Value of the factor delta used in the sensor matching function for the sensor2 input
69	2069	SENSOR2_MATCH_ CVD_BETA	0	O/S	Value of the factor beta used in the sensor matching function for the sensor2 input
70	2070	SENSOR2_MATCH_ CVD_R0	0	O/S	Value of the factor A used in the sensor matching function for the sensor1 input
71	2071	SENSOR1_VALUE	—	—	Indicate the status and value of the sensor1.
72	2072	SENSOR1_UNIT	—	—	Unit of the sensor1 value
73	2073	SENSOR1_TERMINAL_ VALUE	—	—	Indicate the status and value of the sensor1 - terminal.
74	2074	SENSOR1_TERMINAL_ UNIT	—	—	Unit of the value of sensor1 - terminal
75	2075	TERMINAL_VALUE	—	—	Indicate the status and value of the terminal.
76	2076	TERMINAL_UNIT	—	—	Unit of the terminal value
77	2077	TERMINAL_DAMP	2	O/S	Damping time constant for terminal
78	2078	SENSOR2_VALUE	—	—	Indicate the status and value of the sensor2.
79	2079	SENSOR2_UNIT	—	—	Unit of the sensor2 value
80	2080	SENSOR2_TERMINAL_ VALUE	—	—	Indicate the status and value of the sensor2 - terminal.
81	2081	SENSOR2_TERMINAL_ UNIT	—	—	Unit of the value of the ensor2 - terminal
82	2082	SENSOR1_SENSOR2_ VALUE	—	—	Indicate the status and value of the sensor1 – sensor2
83	2083	SENSOR1_SENSOR2_ UNIT	—	—	Unit of the t value of the sensor1 – sensor2
84	2084	SENSOR2_SENSOR1_ VALUE	—	—	Indicate the status and value of the sensor2 – sensor1

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
85	2085	SENSOR2_SENSOR1_ UNIT	—	—	Unit of the t value of the sensor2 – sensor1
86	2086	AVERAGE_VALUE	—	—	Indicate the status and value of the average.
87	2087	AVERAGE_UNIT	—	—	Unit of the average value
88	2088	BACKUP_VALUE	—	—	Indicate the status and value of the sensor1 input normally, and the status and value of sensor2 in case of sensor1 failure.
89	2089	BACKUP_UNIT	—	—	Unit of the backup value
90	2090	SENSOR_RECOVER	0	O/S	Setting 1 in this parameter switches the value to be output from the sensor 2 input back to the sensor 1 input: 0 = DISABLE 1 = ENABLE
91	2091	BACKUP_STATE	—	—	
92	2092	LIMSW_1_VALUE_D	—	—	Indicate the value and status of limit swich1
93	2093	LIMSW_1_TARGET	3	O/S	Value to be monitored by limit switch1: 1 = Sensor1 2 = Sensor1 - Terminal 3 = Terminal 4 = Sensor2 5 = Sensor2 - Terminal 6 = Sensor1 - Sensor2 7 = Sensor2 - Sensor1 8 = Average 9 = Backup
94	2094	LIMSW_1_SETPOINT	0	O/S	Threshold of switching on limit switch1
95	2095	LIMSW_1_ACT_ DIRECTION	1	O/S	Type of limit switch1: 0 = HI LIMIT (high-limit switch) 1 = LO LIMIT (low-limit switch)
96	2096	LIMSW_1_HYSTERESIS	0	O/S	Hysteresis of limit switch1. Input of only a positive number is valid.
97	2097	LIMSW_1_UNIT	°C (1001)	O/S	Unit of LIMSW_1_SETPOINT and LIMSW_1_ HYSTERESIS
98	2098	LIMSW_2_VALUE_D	—	—	Indicate the value and status of limit swich2
99	2099	LIMSW_2_TARGET	3	O/S	Value to be monitored by limit switch2: 1 = Sensor1 2 = Sensor1 - Terminal 3 = Terminal 4 = Sensor2 5 = Sensor2 - Terminal 6 = Sensor1 - Sensor2 7 = Sensor2 - Sensor1 8 = Average 9 = Backup
100	2100	LIMSW_2_SETPOINT	0	O/S	Threshold of switching on limit switch2
101	2101	LIMSW_2_ACT_ DIRECTION	1	O/S	Type of limit switch2: 0 = HI LIMIT (high-limit switch) 1 = LO LIMIT (low-limit switch)
102	2102	LIMSW_2_HYSTERESIS	0	O/S	Hysteresis of limit switch2. Input of only a positive number is valid.
103	2103	LIMSW_2_UNIT	°C (1001)	O/S	Unit of LIMSW_2_SETPOINT and LIMSW_2_ HYSTERESIS
104	2104	LIMSW_3_VALUE_D	—	—	Indicate the value and status of limit swich3
105	2105	LIMSW_3_TARGET	3	O/S	Value to be monitored by limit switch3: 1 = Sensor1 2 = Sensor1 - Terminal 3 = Terminal 4 = Sensor2 5 = Sensor2 - Terminal 6 = Sensor1 - Sensor2 7 = Sensor2 - Sensor1 8 = Average 9 = Backup

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
106	2106	LIMSW_3_SETPOINT	0	O/S	Threshold of switching on limit switch3
107	2107	LIMSW_3_ACT_ DIRECTION	1	O/S	Type of limit switch3: 0 = HI LIMIT (high-limit switch) 1 = LO LIMIT (low-limit switch)
108	2108	LIMSW_3_HYSTERESIS	0	O/S	Hysteresis of limit switch3. Input of only a positive number is valid.
109	2109	LIMSW_3_UNIT	°C (1001)	O/S	Unit of LIMSW_3_SETPOINT and LIMSW_3_ HYSTERESIS
110	2110	LIMSW_4_VALUE_D	—	—	Indicate the value and status of limit swich4
111	2111	LIMSW_4_TARGET	3	O/S	Value to be monitored by limit switch4: 1 = Sensor1 2 = Sensor1 - Terminal 3 = Terminal 4 = Sensor2 5 = Sensor2 - Terminal 6 = Sensor1 - Sensor2 7 = Sensor2 - Sensor1 8 = Average 9 = Backup
112	2112	LIMSW_4_SETPOINT	0	O/S	Threshold of switching on limit switch4
113	2113	LIMSW_4_ACT_ DIRECTION	1	O/S	Type of limit switch4: 0 = HI LIMIT (high-limit switch) 1 = LO LIMIT (low-limit switch)
114	2114	LIMSW_4_HYSTERESIS	0	O/S	Hysteresis of limit switch4. Input of only a positive number is valid.
115	2115	LIMSW_4_UNIT	°C (1001)	O/S	Unit of LIMSW_4_SETPOINT and LIMSW_4_ HYSTERESIS
116	2116	SENSOR1_RP23	—	—	The registration of Sensor1 Pin2-3
117	2117	SENSOR1_RC1	—	—	The registration of Sensor1 RC1
118	2118	SENSOR1_RC2	—	—	The registration of Sensor1 RC2
119	2119	SENSOR1_RC3	—	—	The registration of Sensor1 RC3
120	2120	SENSOR1_RC4	—	—	The registration of Sensor1 RC4
121	2121	SENSOR2_RP43	—	—	The registration of Sensor2 Pin4-3
122	2122	SENSOR2_RC3	—	—	The registration of Sensor2 RC3
123	2123	SENSOR2_RC4	—	—	The registration of Sensor2 RC4
124	2124	SENSOR1_TC_SHORT_ THR	0	AUTO	The Hysteresis of the Sensor1 TC short.
125	2125	SENSOR2_TC_SHORT_ THR	0	AUTO	The Hysteresis of the Sensor2 TC short.
126	2126	SENSOR1_RTD_CORR_ THR	50	AUTO	The Hysteresis of the Sensor1 RTD Corrosion.
127	2127	SENSOR2_RTD_CORR_ THR	50	AUTO	The Hysteresis of the Sensor2 RTD Corrosion.
128	2128	DRIFT_UNIT	°C (1001)	AUTO	Unit of the drift
129	2129	DRIFT_THR	0	AUTO	The threshold of the drift
130	2130	SENSOR1_TEMP_ CYCLE	—	—	Sensor1 temperature cycle
131	2131	SENSOR2_TEMP_ CYCLE	—	—	Sensor2 temperature cycle
132	2132	TEMP_CYCLE_UNIT	°C (1001)	AUTO	The Unit of temperature cycle
133	2133	UPPER_TEMP_CYCLE_ THR	2000	AUTO	The threshold of the upper temperature of temperature cycle
134	2134	LOWER_TEMP_CYCLE_ THR	-273.15	AUTO	The threshold of the lower temperature of temperature cycle
135	2135	CYCLE_COUNT_THR	0	AUTO	The threshold of the cycle count
136	2136	CYCLE_COUNT_RESET	0	AUTO	Reset the count of the temperature cycle.
137	2137	TC_ELECTRIC_1_25		O/S	Configuration of TC user table from DTM
138	2138	TC_ELECTRIC_26_50	0.0	O/S	Configuration of TC user table from DTM
139	2139	TC_ TEMPERATURE_1_25		O/S	Configuration of TC user table from DTM

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
140	2140	TC_ TEMPERATURE_26_50	0.0	O/S	Configuration of TC user table from DTM
141	2141	TC_VALID_POINT	25	O/S	Configuration of TC user table from DTM
142	2142	EXTRA_SPEC			Show the extra specification
143	2143	SENSOR_STATUS_ MASK_1	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_1.
144	2144	SENSOR_STATUS_ MASK_2	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_2.
145	2145	SENSOR_STATUS_ MASK_3	0x3C	AUTO	Mask the FD_EXTENDED_ACTIVE_3.
146	2146	SENSOR_STATUS_ MASK_4	0x38	AUTO	Mask the FD_EXTENDED_ACTIVE_4.
147	2147	SENSOR_STATUS_ MASK_5	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_5.
148	2148	SENSOR_STATUS_ MASK_6	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_6.
149	2149	SENSOR_STATUS_ MASK_7	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_7.
150	2150	SENSOR_STATUS_ MASK_8	0x00	AUTO	Mask the FD_EXTENDED_ACTIVE_8.

A1.3 LCD Transducer Block (LTB)

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	2500	Block Header	TAG: “LTB”	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	2501	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	2502	TAG_DESC	Null	AUTO	The user description of the intended application of the block.
3	2503	STRATEGY	0	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	2504	ALERT_KEY	0	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	2505	MODE_BLK	—	AUTO	The actual, target, permitted, and normal modes of the block.
6	2506	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.
7	2507	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
8	2508	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 will set the Active status in the Status attribute.
9	2509	TRANSDUCER_ DIRECTORY	—	—	A directory that specifies the number and starting indices of the transducers.
10	2510	TRANSDUCER_TYPE	0x8050	—	Identify transducer.
11	2511	TRANSDUCER_TYPE_ VER	—	—	Transducer type version
12	2512	XD_ERROR	—	—	Stores the error prioritized at the highest level from among the errors that are currently occurring in the transducer block.
13	2513	COLLECTION_ DIRECTORY	—	—	A directory that specifies the number, starting indices, and DD Item Ids of the data collections in each transducer within a transducer block.
14	2514	DISP_OUT_1	1 (AI1)	AUTO	Select the display of the output information on the LCD
15	2515	DISP_OUT_2	14 (Not used)	AUTO	Select the display of the second output information on the LCD.
16	2516	INFO_SEL	0x03	AUTO	Selection of items to be displayed Bit0=1:TAG ON Bit1=1:PARAMETER ON Bit2=1:UNIT ON Bit3=1:STATUS ON
17	2517	BAR_GRAPH_SELECT	1 (ON)	AUTO	Selection of bar graph indicator
18	2518	DISPLAY_CYCLE	1 (MID)	AUTO	Duration of display cycle. (Time unit: 1=400 ms)
19	2519	SQUAWK	0(OFF)	AUTO	Identify the transmitter by displaying the particular pattern on LCD.

A1.4 Maintenance Transducer Block (MTB)

Relative Index	Index	Parameter	Factory Default	Write Mode	Explanation
0	3000	Block Header	TAG: “MTB”	Block Tag =O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	3001	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	3002	TAG_DESC	Null	AUTO	The user description of the intended application of the block.
3	3003	STRATEGY	0	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	3004	ALERT_KEY	0	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	3005	MODE_BLK	—	AUTO	The actual, target, permitted, and normal modes of the block.
6	3006	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.
7	3007	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
8	3008	BLOCK_ALM	—	AUTO	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 will set the Active status in the Status attribute.
9	3009	TRANSDUCER_ DIRECTORY	—	—	A directory that specifies the number and starting indices of the transducers.
10	3010	TRANSDUCER_TYPE	0x8060	—	Identify transducer.
11	3011	TRANSDUCER_TYPE_ VER	0x0001	—	Transducer type version
12	3012	XD_ERROR	—	—	Stores the error prioritized at the highest level from among the errors that are currently occurring in the transducer block.
13	3013	COLLECTION_ DIRECTORY	—	—	A directory that specifies the number, starting indices, and DD Item Ids of the data collections in each transducer within a transducer block.
15	3015	DEVICE_SN	—	—	The nameplate of the device
16	3016	SPECIAL_ORDER_ID	—	—	The identification number of special order
17	3017	MANUFAC_DATE	—	—	The manufacture date of the device
18	3018	MS_CODE1	—	—	The model suffix codes of the device
19	3019	MS_CODE2	—	—	The model suffix codes of the device
20	3020	MS_CODE3	—	—	The model suffix codes of the device
21	3021	SOFTWARE_DESC	MTB_VAL_SOFT_ DESC	AUTO	Software description
22	3022	SIM_ENABLE_MSG	DISABLE		Simulate enable message
23	3023	SOFTDL_PROTECT	1		Protection of Software Download
24	3024	SOFTDL_ERROR	0		Activate error code
25	3025	SOFTDL_COUNT	0	—	Number of times when the software was downloaded.
26	3026	SOFTDL_ACT_AREA	0	—	The activated FlashROM.
27	3027	CAPABILITY_CONFIG	0	—	Capability configuration.
46	3046	MODEL	—		The model code
47	3047	MODULE_SN	0000000001		Module serial number
48	3048	OPERATE_TIME	00000D 00:00		The operating time of the device.
55	3055	SENSOR1_MAX	0	—	The max value of Sensor1

Relative Index	Index	Parameter	Factory Default	Write Mode	Explanation
56	3056	SENSOR1_MIN	0	—	The min value of Sensor1
57	3057	SENSOR1_LOG_CLEAR	0	AUTO	Clear the value log of Sensor1
58	3058	SENSOR2_MAX	0	—	The max value of Sensor2
59	3059	SENSOR2_MIN	0	—	The min value of Sensor2
60	3060	SENSOR2_LOG_CLEAR	0	AUTO	Clear the value log of Sensor2
61	3061	TERMINAL MAX	0	—	The max value of terminal
62	3062	TERMINAL_MIN	0	—	The min value of Sensor2
78	3078	FD_EXTENDED_LOG_ NO	0	—	FD EXTENDED LOG will be displayed after writing a number into this parameter. The smaller number is displayed the latest log. If the illegal number was written, this parameter returns to an error.
79	3079	FD_EXTENDED_LOG_ TIME	00000D 00:00	—	Show the time of log
80	3080	FD_EXTENDED_1_LOG	0x00000000	—	Show the log of FD EXTENDED 1
81	3081	FD_EXTENDED_2_LOG	0x00000000	—	Show the log of FD EXTENDED 2
82	3082	FD_EXTENDED_3_LOG	0x00000000	—	Show the log of FD EXTENDED 3
83	3083	FD_EXTENDED_4_LOG	0x00000000	—	Show the log of FD EXTENDED 4
84	3084	FD_EXTENDED_5_LOG	0x00000000	—	Show the log of FD EXTENDED 5
85	3085	FD_EXTENDED_6_LOG	0x00000000	—	Show the log of FD EXTENDED 6
86	3086	FD_EXTENDED_7_LOG	0x00000000	—	Show the log of FD EXTENDED 7
87	3087	FD_EXTENDED_8_LOG	0x00000000	—	Show the log of FD EXTENDED 8

A1.5 AI Function Block

Relative Index	Index				Parameter	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3	AI4				
0	4000	4100	4200	4300	Block Header	TAG: "AI1", "AI2", "AI3" or "AI4"	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc. The value for "Period of Execution" should be larger than "Execution Time."
1	4001	4101	4201	4301	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	4002	4102	4202	4302	TAG_DESC		AUTO	The user description of the intended application of the block.
3	4003	4103	4203	4303	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	4004	4104	4204	4304	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	4005	4105	4205	4305	MODE_BLK	AI1: Auto AI2, AI3, AI4: O/S	AUTO	The actual, target, permitted, and normal modes of the block.
6	4006	4106	4206	4306	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.
7	4007	4107	4207	4307	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..
8	4008	4108	4208	4308	OUT	—	Value = Man	The primary analog value calculated as a result of executing the function.
9	4009	4109	4209	4309	SIMULATE	Disable	AUTO	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
10	4010	4110	4210	4310	XD_SCALE	Specified at the time of order	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.
11	4011	4111	4211	4311	OUT_SCALE	0 - 100	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
12	4012	4112	4212	4312	GRANT_DENY	0	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	4013	4113	4213	4313	IO_OPTS	0	O/S	Options which the user may select to alter input and output block processing
14	4014	4114	4214	4314	STATUS_ OPTS	0	O/S	Options which the user may select in the block processing of status
15	4015	4115	4215	4315	CHANNEL	AI1: Sensor1 AI2, AI3, AI4: Terminal	O/S	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.
16	4016	4116	4216	4316	L_TYPE	Specified at the time of order	MAN	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (IndSqr Root), using the input range defined by the transducer and the associated output range.

Relative Index	Index				Parameter	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3	AI4				
17	4017	4117	4217	4317	LOW_CUT	0%	AUTO	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero for a flow sensor.
18	4018	4118	4218	4318	PV_FTIME	0sec	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	4019	4119	4219	4319	FIELD_VAL	—	—	Raw value of the field device in percent of the PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_ FTIME).
20	4020	4120	4220	4320	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
21	4021	4121	4221	4321	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 will set 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.
22	4022	4122	4222	4322	ALARM_SUM	Enable	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	4023	4123	4223	4323	ACK_OPTION	0xFFFF	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	4024	4124	4224	4324	ALARM_HYS	0.5%	AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span.
25	4025	4125	4225	4325	HI_HI_PRI	0	AUTO	Priority of the high high alarm.
26	4026	4126	4226	4326	HI_HI_LIM	+INF	AUTO	The setting for high high alarm in engineering units.
27	4027	4127	4227	4327	HI_PRI	0	AUTO	Priority of the high alarm.
28	4028	4128	4228	4328	HI_LIM	+INF	AUTO	The setting for high alarm in engineering units.
29	4029	4129	4229	4329	LO_PRI	0	AUTO	Priority of the low alarm.
30	4030	4130	4230	4330	LO_LIM	−INF	AUTO	The setting for the low alarm in engineering units.
31	4031	4131	4231	4331	LO_LO_PRI	0	AUTO	Priority of the low low alarm.
32	4032	4132	4232	4332	LO_LO_LIM	−INF	AUTO	The setting of the low low alarm in engineering units.
33	4033	4133	4233	4333	HI_HI_ALM	—	—	The status for high high alarm and its associated time stamp.
34	4034	4134	4234	4334	HI_ALM	—	—	The status for high alarm and its associated time stamp.
35	4035	4135	4235	4335	LO_ALM	—	—	The status of the low alarm and its associated time stamp.
36	4036	4136	4236	4336	LO_LO_ALM	—	—	The status of the low low alarm and its associated time stamp.
37	4037	4137	4237	4337	BLOCK_ERR_ DESC_1	—	—	Selection of alarm to output it from OUT_D

A1.6 DI Function Block

Relative Index	Index				Parameter	Factory Default	Write Mode	Explanation
	DI1	DI2	DI3	DI4				
0	6000	6100	6200	6300	BLOCK HEADER		Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc. The value for “Period of Execution” should be larger than “Execution Time.”
1	6001	6101	6201	6301	ST_REV	0	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	6002	6102	6202	6302	TAG_DESC		AUTO	The user description of the intended application of the block.
3	6003	6103	6203	6303	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	6004	6104	6204	6304	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	6005	6105	6205	6305	MODE_BLK	O/S	AUTO	The actual, target, permitted, and normal modes of the block.
6	6006	6106	6206	6306	BLOCK_ERR	O/S	—	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.
7	6007	6107	6207	6307	PV_D	—	—	Either the primary discrete 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.
8	6008	6108	6208	6308	OUT_D	—	MAN	The primary analog value calculated as a result of executing the function.
9	6009	6109	6209	6309	SIMULATE_D	disabled	—	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
10	6010	6110	6210	6310	XD_STATE	0	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.
11	6011	6111	6211	6311	OUT_STATE	0	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
12	6012	6112	6212	6312	GRANT_DENY	0	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	6013	6113	6213	6313	IO_OPTS	0	O/S	Options which the user may select to alter input and output block processing
14	6014	6114	6214	6314	STATUS_OPTS	0	O/S	Options which the user may select in the block processing of status
15	6015	6115	6215	6315	CHANNEL	10	O/S	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer tobe used going to or from the physical world.
16	6016	6116	6216	6316	PV_FTIME	0	MAN	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (IndSqr Root), using the input range defined by the transducer and the associated output range.

Relative Index	Index				Parameter	Factory Default	Write Mode	Explanation
	DI1	DI2	DI3	DI4				
17	6017	6117	6217	6317	FIELD_VAL_D	—	—	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero for a flow sensor.
18	6018	6118	6218	6318	UPDATE_EVT	—	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	6019	6119	6219	6319	BLOCK_ALM	—	—	Raw value of the field device in percent of the PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_ FTIME).
20	6020	6120	6220	6320	ALARM_ SUM|ALARM_ SUM_DI	0	—	This alert is generated by any change to the static data.
21	6021	6121	6221	6321	ACK_ OPTION|ACK_ OPTION_DI	0	—	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 will set 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.
22	6022	6122	6222	6322	DISC_PRI	0	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	6023	6123	6223	6323	DISC_LIM	0	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	6024	6124	6224	6324	DISC_ALM		AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span.

A1.7 Unit and Code

Unit	Code
K	1000
°C	1001
°F	1002
°R	1003
mV	1243
ohm	1281

Appendix 2. Signal Characterizer (SC) Block

The Signal Characterizer (SC) block is used to convert the values of input signals according to a line-segment function. The line-segment function is created using 21 points of the X/Y coordinates specified by the user. This function block can also be used as a transmission line for control signals and supports backward control.

Application

The Signal Characterizer block is primarily used if you wish for one of the following reasons to correct signals using the coordinates rather than a computational expression:

- The computational expression for correction in relation to input signals is complex
- The relationship between input signals and the signals after correction is only empirically known

A2.1 Schematic Diagram of Signal Characterizer Block

The following shows the schematic diagram of the Signal Characterizer block.

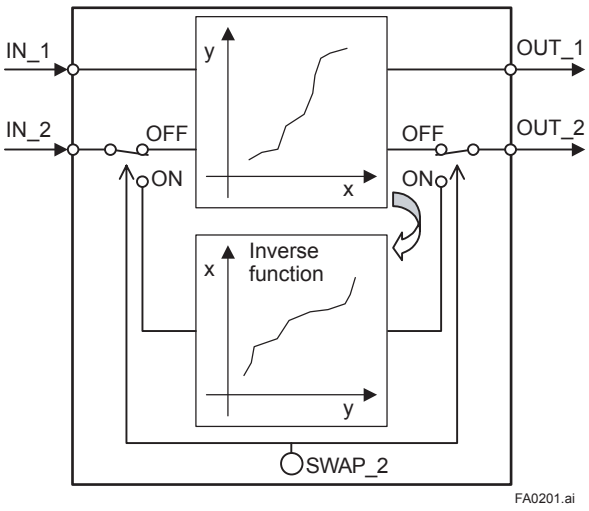


Figure A2.1 Signal Characterizer Block

Input/Output Parameters

Input	IN_1	Inputs a signal desired to be corrected using a line-segment function. (It is substituted for X of the line-segment function.)
	IN_2	Inputs a signal desired to be corrected using a line-segment function. (If SWAP_2 = off, it is substituted for X of the line-segment function.) (If SWAP_2 = on, it is substituted for Y of the line-segment function.)
Output	OUT_1	Outputs the result of the IN_1 input that has been corrected using the line-segment function. (The function block outputs the value of Y corresponding to IN_1.)
	OUT_2	Outputs the result of the IN_2 input that has been corrected using the line-segment function. The output can also be approximated using the inverse function of the specified line-segment function. (This is used for backward control.) (If SWAP_2 = off, the value of Y corresponding to X of IN_1 is output.) (If SWAP_2 = on, the value of X corresponding to Y of IN_1 is output.)
Others	CURVE_X	The points of the curve determining inputs and outputs. The x points of the curve are defined by an array of 1 to 21 points with a monotone increase. "+INFINITY" is configured for unused point(s).
	CURVE_Y	The points of the curve determining inputs and outputs. The y points of the curve are defined by an array of 1 to 21 points. If SWAP_2 = on, the elements of the curve are defined with a monotone increase or decrease. "+INFINITY" is configured for unused point(s).
	SWAP_2	Selector switch used to specify if an inverse function is used for the line-segment approximation of IN_2 to OUT_2. The setting of SWAP_2 = on (which uses the inverse function) is used for backward control.

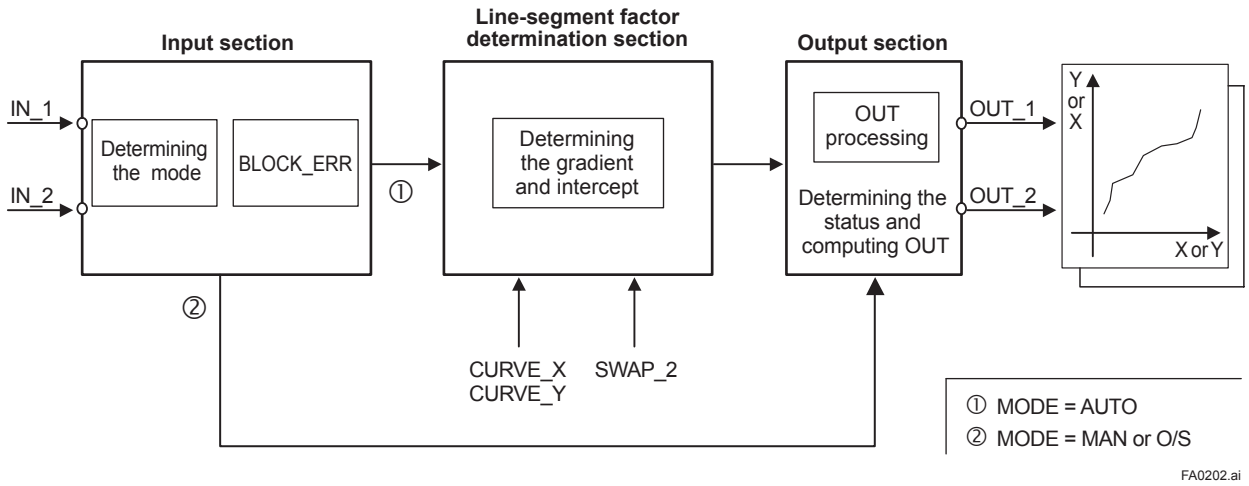


Figure A2.2 Overview of the Signal Characterizer Block

The following describes the Signal Characterizer block, dividing its functions into three sections:

- Input section: Determines the mode and judges BLOCK_ERR.
- Line-segment factor determination section: Determines the gradient and intercept for OUT_1 and OUT_2 based on CURVE_X, CURVE_Y, and SWAP_2 at shift ①.
- Output section: Multiplies the input values in IN_1 and IN_2 by the gradient and adds the intercept to them before outputting the results. Alternatively, it outputs a limit value.

A2.2 Input Section

The input section determines the mode and judges BLOCK_ERR.

A2.2.1 Determining the Mode

The following describes operations of the Signal Characterizer block.

Supported Mode	Rules
O/S (Out of Service)	• System-stopped status • Configuration change
Man	• If you do not want to output the value and the status from IN, you can manually transmit the value to OUT.
Auto	• Automatic system operation status

A2.2.2 Judging BLOCK_ERR

BLOCK_ERR indicates the cause of an error in the function block. If the cause of an error indicated by BLOCK_ERR occurs, the following configuration error is generated.

Name	Description
Block Configuration Error	1) "–INFINITY" has been configured for CURVE_X and CURVE_Y. 2) "+INFINITY" has been configured for X1 of CURVE_X. 3) "+INFINITY" has been configured for Y1 of CURVE_Y. 4) A value of the array of CURVE_X does not increase in a monotone manner. 5) A configuration error when SWAP_2 is on • A value of the array of CURVE_Y does not increase or decrease in a monotone manner. 6) The value of SWAP_2 is any value other than 1 or 2.

The mode changes to O/S if a block configuration error occurs.

A2.3 Line-segment Factor Determination Section

When the mode is AUTO and no bit in BLOCK_ERR is set, the "gradient" and "intercept" of a line passing through two points that are considered line-segment approximation values are determined.

A2.3.1 Conditions for Configuring Valid Coefficients (CURVE_X, CURVE_Y)

No write error is generated with respect to the settings in CURVE_X and CURVE_Y. However, a configuration error occurs in the following cases:

1. "+INFINITY" has been configured for X1 or Y1.
2. "–INFINITY" has been configured for each X or Y.
3. The values of CURVE_X are not increasing in a monotone manner (X1 < X2 < ... < X20 < X21). (If SWAP_2 is off, it is acceptable if the values of CURVE_Y do not increase or decrease in a monotone manner.)
4. The values of CURVE_Y are not increasing or decreasing in a monotone manner when SWAP_2 is on.

If a configuration error occurs, the Block Configuration Error bit in BLOCK_ERR is set, causing the mode to change to O/S.

Example of the case where SWAP_2 is off:

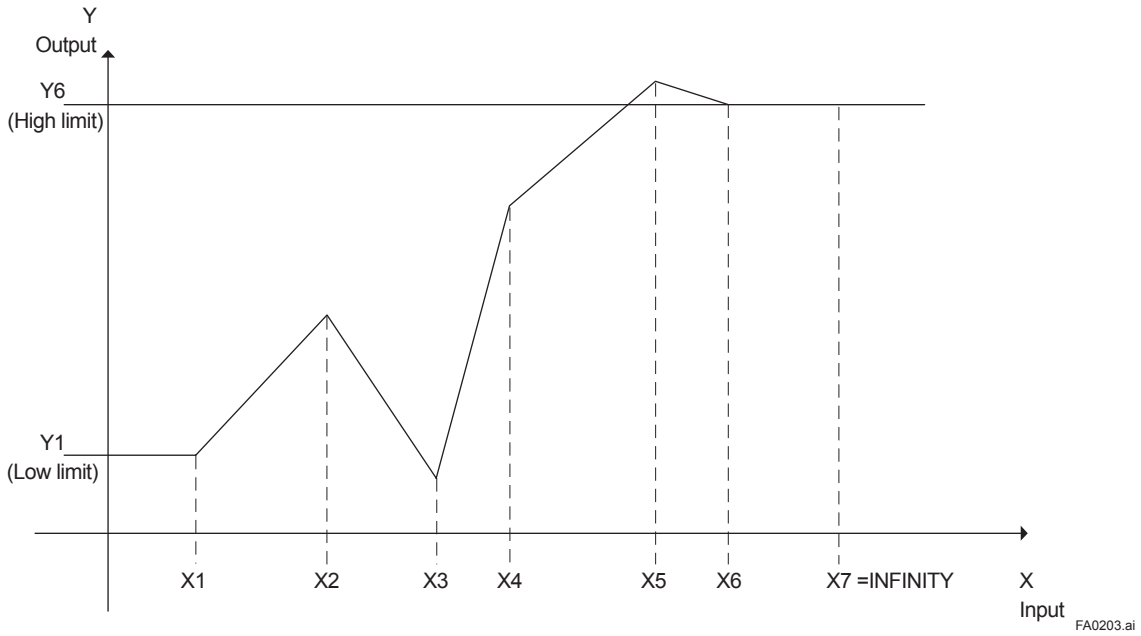


Figure A2.3 Example of Curve (SWAP_2 = off)

The range of CURVE_X: X1 to X6 (X7 and above are invalid because "+INFINITY" has been configured for X7*1.)

The X1 to X6 values always increase in a monotone manner (X1 < X2 < X3 < X4 < X5 < X6).

If an input value is smaller than X1, it is set to Y1.

If an input value is larger than X6, it is set to Y6.

The range of CURVE_Y: Y1 to Y6

It is acceptable if the Y1 to Y6 values do not increase in a monotone manner.

However, if the setting of SWAP_2 is changed from off to on, the values of CURVE_Y must increase or decrease in a monotone manner. Thus, if a value of CURVE_Y does not increase or decrease in a monotone manner in this setting, the mode changes to O/S, causing the Block Configuration Error bit in BLOCK_ERR to be set.

*1: For any points of the curve that are not used, configure "+INFINITY" for all of them.

Example of the case where SWAP_2 is on (monotone increase):

The input range of IN_1 is always in CURVE_X. The following shows the input/output graph of the IN_1 values.

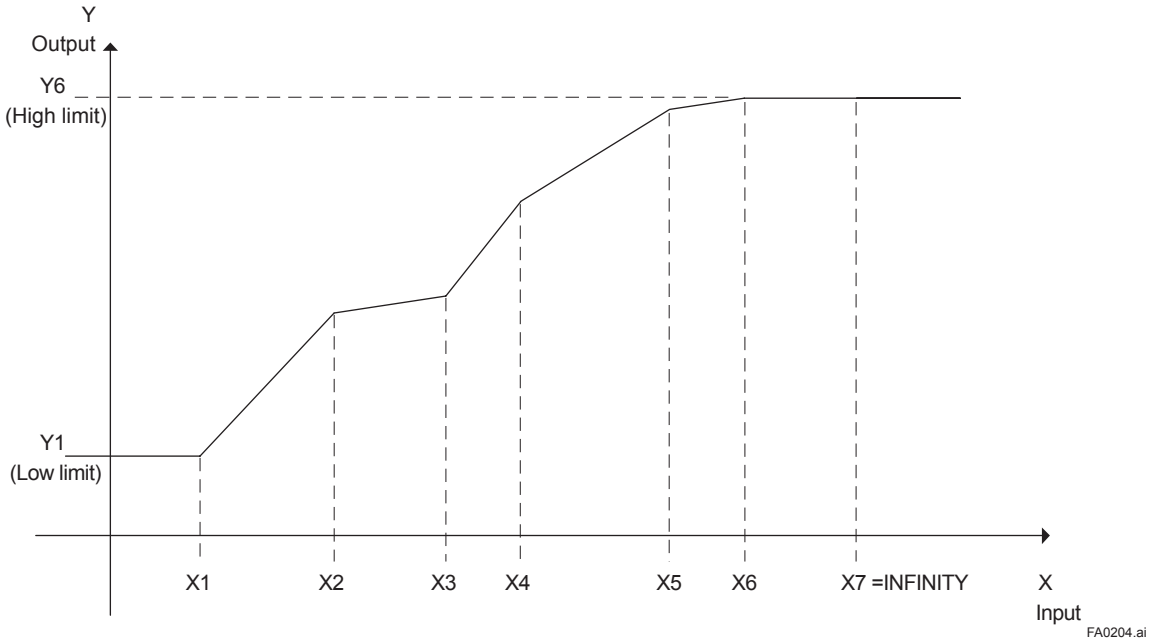


Figure A2.4 Example of Curve for IN_1 (SWAP_2 = on)

The input range of IN_2 is always in CURVE_Y. The following shows the input/output graph of the IN_2 values.

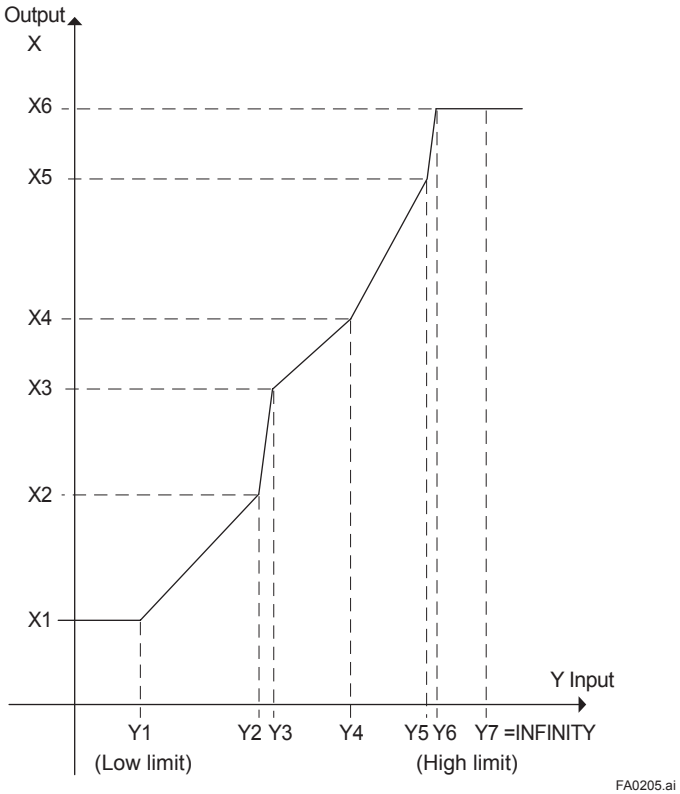


Figure A2.5 Example of Curve for IN_2 (SWAP_2 = on)

When SWAP_2 is on, the array elements of CURVE_Y must be configured for a monotone increase or decrease. (Y1 < Y2 < Y3 < Y4 < Y5 < Y6 or Y6 < Y5 < Y4 < Y3 < Y2 < Y1)

A2.4 List of Signal Characterizer Block Parameters

Relative Index	Parameter	Write Mode	Valid Range	Initial Value	View				Description / Remarks
					1	2	3	4	
0	BLOCK_ HEADER	Block Tag=O/S		TAG: "SC"					Information relating to this function block, such as block tag, DD revision, and execution time
1	ST_REV	- - - - -			2	2	2	2	The revision level of the set parameters associated with the Signal Characterizer block
2	TAG_DESC			Null					Stores comments describing tag information.
3	STRATEGY			1				2	The strategy field can be used by the high-level system to identify function blocks.
4	ALERT_KEY		1-255	1				1	Key information used to identify the location at which an alert has occurred
5	MODE_BLK				4		4		Mode of the Signal Characterizer block. O/S, Man, and Auto are supported.
6	BLOCK_ERR				2		2		Indicates the error status of the Signal Characterizer block in bit strings.
7	OUT_1	MAN			5		5		Outputs the result of the value of IN_1 corrected using a line-segment function.
8	OUT_2	MAN			5		5		Outputs the result of the value of IN_2 corrected using a line-segment function. It is also possible to approximate the result using the inverse function of the specified line-segment function. (This is used for backward control.)
9	X_RANGE					11			The engineering unit of variables corresponding to the x-axis for display
10	Y_RANGE					11			The engineering unit of variables corresponding to the y-axis for display
11	GRANT_DENY					2			The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before being executed. After the operations are complete, the DENY parameter is checked for the setting of any bit relating to the corresponding operation. If no bit is set, it is evident that the operations have been executed successfully.
12	IN_1				5		5		Input a signal to be corrected using a line-segment function.
13	IN_2				5		5		Input a signal to be corrected using a line-segment function.
14	SWAP_2		0:Initialized 1:No swap 2:Swap					1	Selector switch used to apply the inverse function to line-segment approximation of IN_2 to OUT_2
15	CURVE_X								Curve input points that determine inputs and outputs. The "x" points of the curve are defined by an array of 1 to 21 points with a monotone increase.
16	CURVE_Y								Curve input points that determine inputs and outputs. The "y" points of the curve are defined by an array of 1 to 21 points. If SWAP_2 is on, the elements of the curve must be defined with a monotone increase or decrease.
17	UPDATE_EVT								Indicates event information if an update event occurs.
18	BLOCK_ALM								Indicates alarm information if a block alarm occurs.

A2.5 Application Example

A2.5.1 Input Compensation

The following is an application example of pH compensation made by performing feedback control.

The pH is a value representing the degree of acidity or alkalinity and ranges from 0 to 14. pH 7 indicates neutral, a value smaller than 7 represents acidity, and a value larger than 7 denotes alkalinity. It is very difficult to control pH with a quickly changing reaction rate at a point near 7.

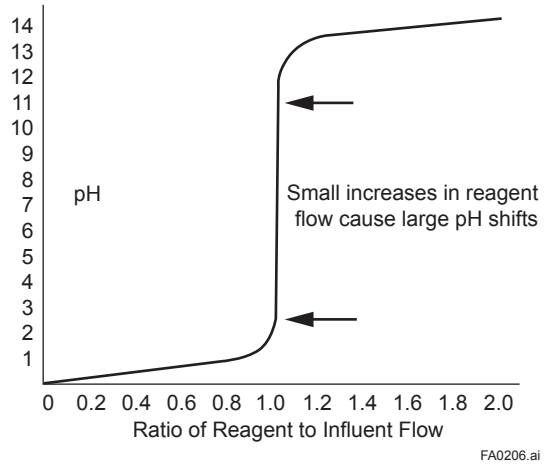


Figure A2.6 pH and Reagent Flow

To control this pH, the input is regulated using line-segment approximation, gain, and input compensation.

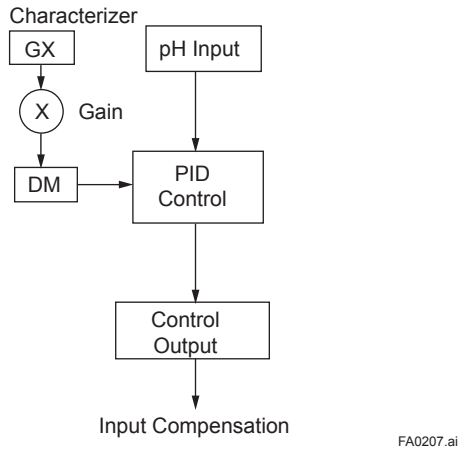


Figure A2.7 Input Compensation

The following shows the approximation-value graph of GX Output that is approximation-value output and GX Input that is pH input. pH with a quickly changing reaction rate can be controlled at a point near neutral 7 according to the following graph.

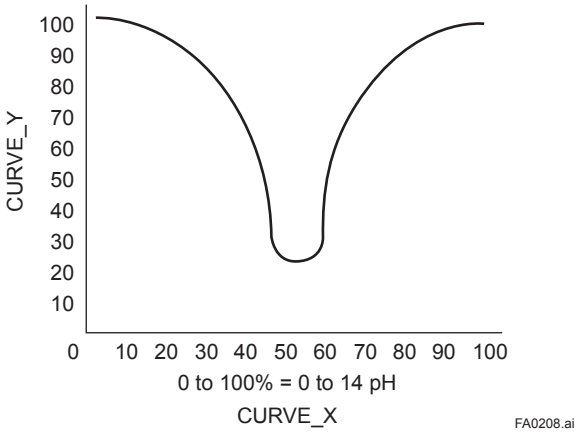


Figure A2.8 Approximation Curve

A2.5.2 Calorie Flow Compensation

AI_1: Inlet temperature, AI_2: Outlet temperature, AI_3: Flow rate
SC: Corrects the inlet and outlet temperatures.
AR: Calculates a calorie flow rate on the basis of the difference between the corrected inlet and outlet temperatures.

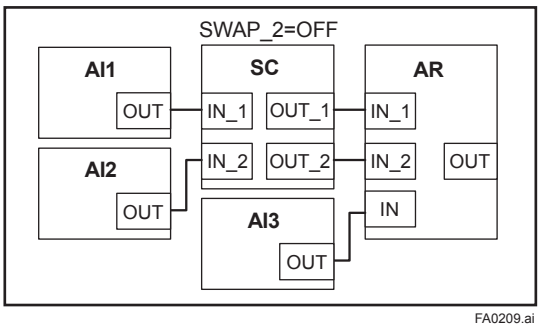


Figure A2.9 Calorie Flow Rate Compensation (SWAP_2 = Off)

A2.5.3 Backward Control

SC: The controlled variable output from PID is converted into an information quantity that can be interpreted by AO, and backward information from AO is converted into an information quantity that can be interpreted by PID before being transmitted to the PID.

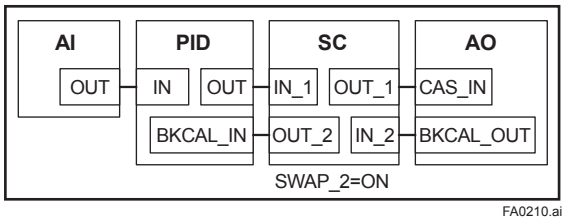


Figure A2.10 Backward Control (SWAP_2 = On)

To enable backward control (which inverts the X and Y axes), the line-segment function must be set so that the elements of the curve increase in a monotone manner.(As shown in Figure A2.11) If they do not increase in a monotone manner, the mode changes to O/S, disabling calculation.

No.	CURVE_X	CURVE_Y
1	5	5
2	10	10
3	15	11
4	20	20
5	25	25
6	30	26
7	35	30
8	40	40
9	45	45
10	50	50
11	51	51
12	52	54
13	53	59
14	54	66
15	55	75
16	65	80
17	75	81
18	80	85
19	85	86
20	90	90
21	95	95

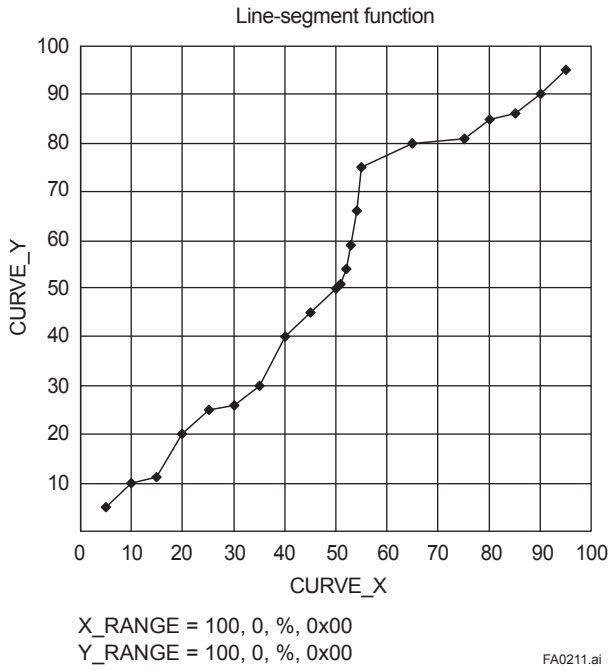


Figure A2.11 Setting Example of a Line-segment Function

Appendix 3. Input Selector (IS) Block

The function of the Input Selector (IS) block is to automatically select one signal from multiple input signals using a specified selection method.

The IS block is used for selective control in which one measured quantity is selected from multiple measured quantities to be transmitted to the controller as a controlled variable. This feature is primarily used for temperature control systems.

A3.1 Input Selector Function Block Schematic

The following shows the Input Selector function block schematic.

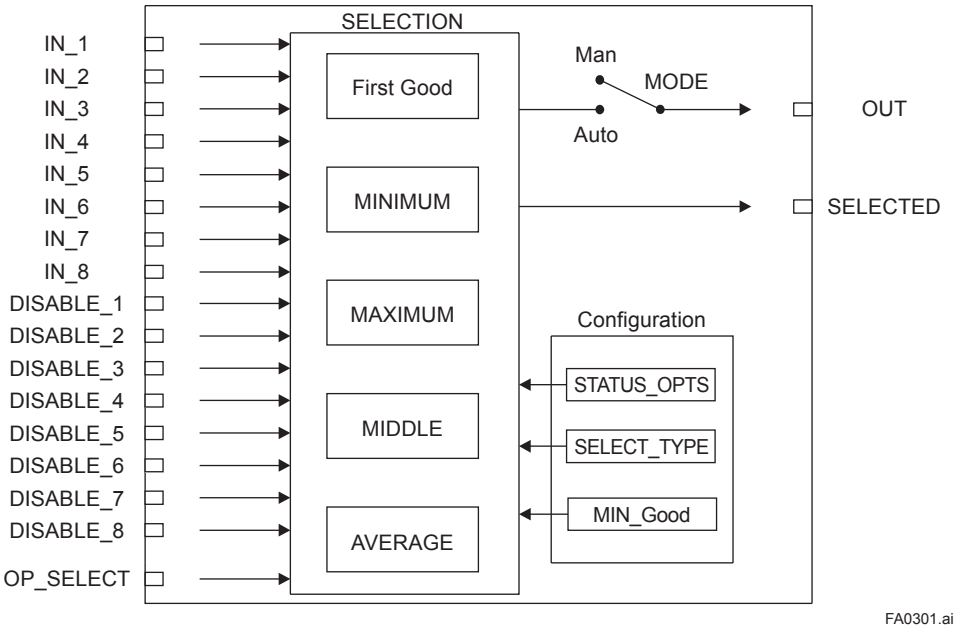


Figure A3.1 IS Block

Input Parameters (Input Terms)

IN_1 : Block input 1
IN_2 : Block input 2
IN_3 : Block input 3
IN_4 : Block input 4
IN_5 : Block input 5
IN_6 : Block input 6
IN_7 : Block input 7
IN_8 : Block input 8
DISABLE_1 : Selector switch 1 to disable input 1 from being selected
DISABLE_2 : Selector switch 2 to disable input 2 from being selected
DISABLE_3 : Selector switch 3 to disable input 3 from being selected
DISABLE_4 : Selector switch 4 to disable input 4 from being selected
DISABLE_5 : Selector switch 5 to disable input 5 from being selected
DISABLE_6 : Selector switch 6 to disable input 6 from being selected
DISABLE_7 : Selector switch 7 to disable input 7 from being selected
DISABLE_8 : Selector switch 8 to disable input 8 from being selected
OP_SELECT : A parameter which can be set by an operator to forcibly employ the input of the selected number

Output Parameters (Computation or Selection Results)

OUT : Block output
SELECTED : Indicates the input number selected using the alternatives.

Other Parameters

OUT_RANGE : Sets the OUT range.
STATUS_OPTS : Option used to specify the handling of various statuses.
SELECT_TYPE : Determines the input selection algorithm.
MIN_GOOD : Parameter specifying the minimum required number of inputs with “good” status. If the number of inputs that are “good” is less than the value of MIN_GOOD, input selection is canceled.

Mode

O/S : Allows configuration change, but disables input value output.
Man : Allows internal processing, but the output value may vary depending on the definition of usage conditions.
Auto : Outputs the input value.

The Input Selector (IS) block offers a maximum of eight input alternatives and generates the output according to the configured action. This block generally receives inputs from the Analog Input (AI) function block. The function of the IS block is to select a maximum, minimum, middle, average, “first good,” or “latched good” signal. The block combines parameter configuration (DISABLE_n) and option (“first good”) to give priority to alternative(s) or to function as a rotary position switch. When used as a rotary position switch, the block can receive operator inputs or switch information from connected inputs.

The IS block supports the concept of middle selection. This function outputs the average of two middle signals if even multiple valid signals are configured or a middle signal if odd multiple valid signals are configured. Application of the block is to supply a selected control signal in the forward path.

The SELECTED parameter is the 2nd output indicating which input has been selected using the algorithm.

A3.2 Input Section

A3.2.1 Mode Handling

The Input Selector block's operations are determined by the mode (parameter name: MODE_BLK). The following describes operations in each mode.

Supported Mode	Role
O/S (Out of Service)	· System-stopped status. · Allows you to make changes to configuration.
Man	· If you do not want to output the value and status from IN or if the value or status thus output is not preferable, you can manually transmit the value to OUT.
Auto	· Automatic system operation status.

Valid Input

When the following conditions are satisfied, the value of IN_n becomes valid.

1) The QUALITY in each status of IN_n is either Good (NC), Good (C), or Uncertain*1, 3.
2) The values of DISABLE_n corresponding to each IN_n are OFF and the QUALITY in the status of which is either Good (NC), Good (C), or Uncertain*1, 2.
3) The number of inputs that are "good" is greater than the value of MIN_GOOD*4.

Note:

*1: Uncertain is applicable when "Use Uncertain as Good" is selected in the STATUS_OPTS parameter.

*2: If the status of DISABLE_n is Bad or Uncertain, its quality is lower so that the status of IN_n is also defined as lower quality. When DISABLE_n is ON, the value of IN_n becomes invalid. For the priority of DISABLE_n is higher than that of IN_n.

Status in SELECT_TYPE except OP_SELECT

QUALITY of DISABLE / IN Status	IN
Good (NC)	Valid
Good (C)	Valid
Uncertain*1	Valid
Uncertain	Invalid
Bad	Invalid

Condition: The number of inputs that are "good" is greater than the value of MIN_GOOD.

*3: Priority of IN_n when the same value is input.

Priority 1:Highest 8:Lowest	Input
1	IN_1
2	IN_2
3	IN_3
4	IN_4
5	IN_5
6	IN_6
7	IN_7
8	IN_8

*4: Refer to A3.2.2 for the details of MIN_GOOD.

A3.2.2 MIN_GOOD Handling

If there is no selectable input or if the number of selectable inputs is less than the value of MIN_GOOD, SELECTED becomes “0.”

A case where the number of valid INs is less than the value of MIN_GOOD:

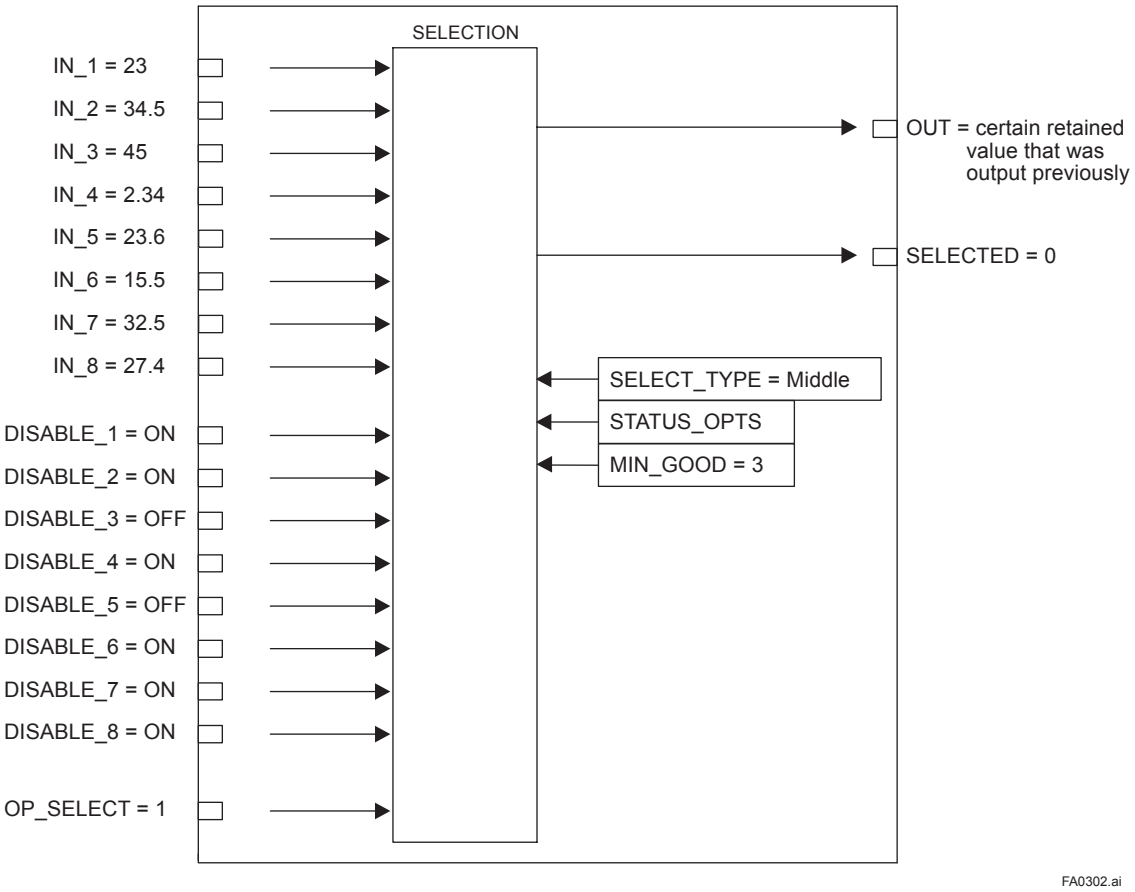


Figure A3.2 Example (1)

This example restricts the valid inputs using DISABLE_n, and the inputs are enabled only at DISABLE_3 and DISABLE_5. Because the effective number of MIN_Good is 3, the input specified by OP_SELECT will not be output.

A3.3 Selection

The following processing is performed after completing input processing. If the number of valid inputs is less than the value of MIN_Good, no input selection is made.

A3.3.1 OP_SELECT Handling

When a value other than “0” (that is, 1 to 8) is selected for OP_SELECT:

The IS block selects the input of the number specified by OP_SELECT regardless of the setting of SELECT_TYPE, propagates the value of that input to OUT, and transmits the input number to SELECTED.

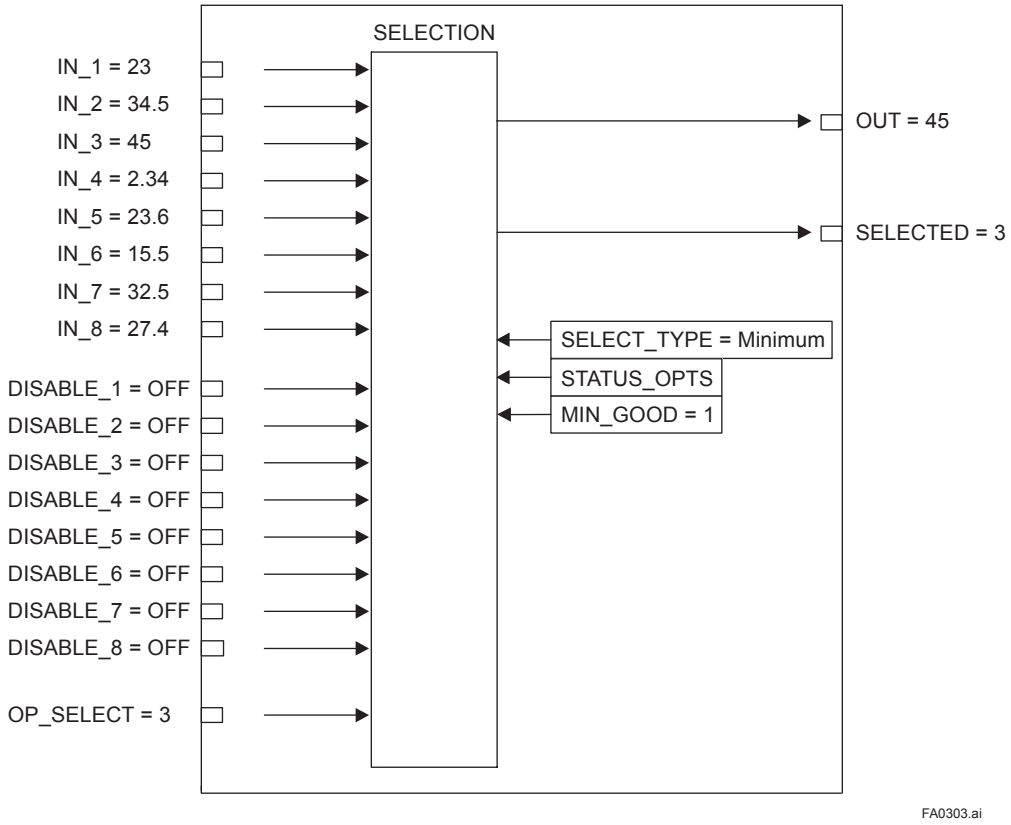


Figure A3.3 Example (2)

In the above example, SELECT_TYPE is set to Minimum. However, because OP_SELECT specifies the value and number of IN_3, the value and number of this specified IN are transmitted to OUT and SELECTED.

* Note: Even if the IN specified by OP_SELECT is an invalid input (the corresponding DISABLE parameter is ON or the IN’s status is “bad”), the value and status of that IN are transmitted to OUT.

A3.3.2 SELECTION Handling

If the value of OP_SELECT is “0,” input selection using SELECT_TYPE is enabled.

When SELECT TYPE is “first good”

The IS block selects the input with the smallest input number among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.

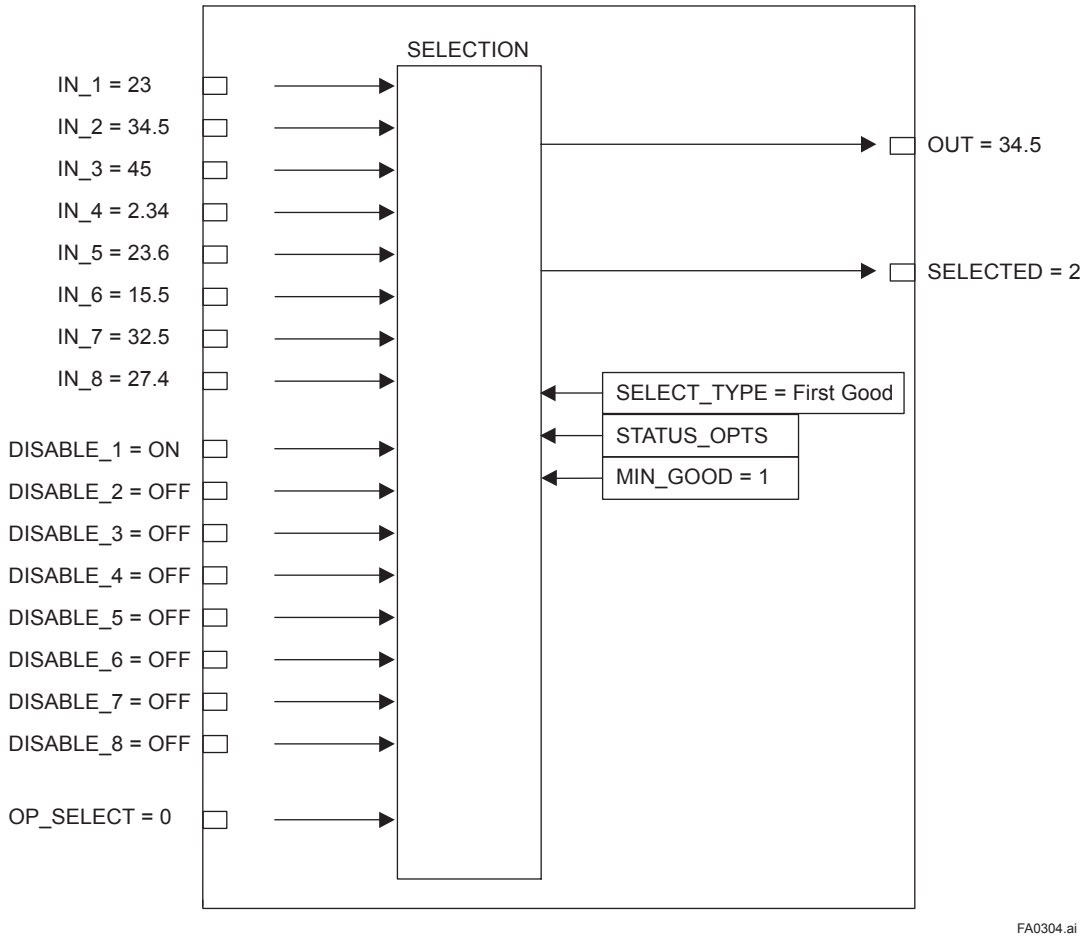


Figure A3.4 Example (3)

Because DISABLE_1 is ON, IN_1 is disabled, and IN_2 is selected for output. If DISABLE_1 is turned OFF, the output changes from IN_2 to IN_1. That is, the valid IN with the smaller input number is always selected for output.

When SELECT TYPE is “Minimum”

The IS block selects the input with the minimum value among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.

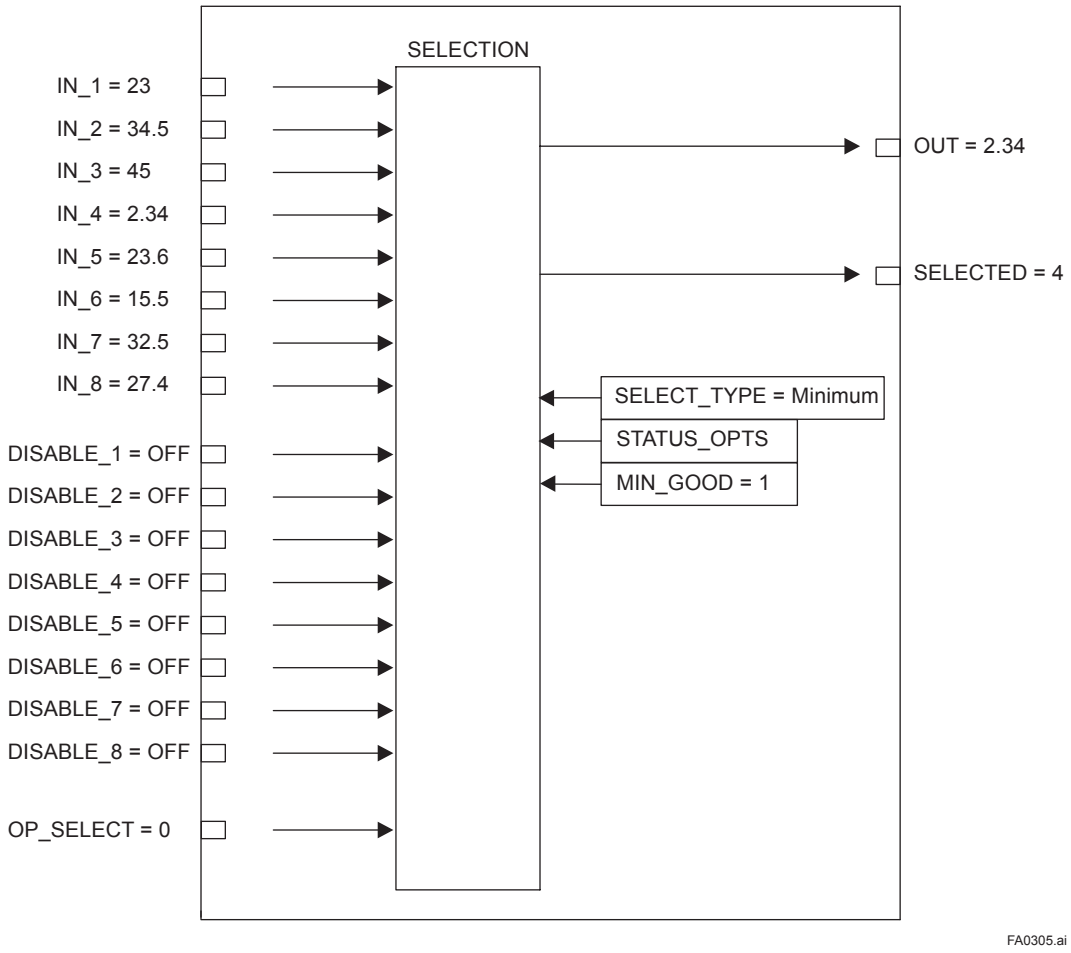


Figure A3.5 Example (4)

When SELECT TYPE is “Maximum”

The IS block selects the input with the maximum value among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.

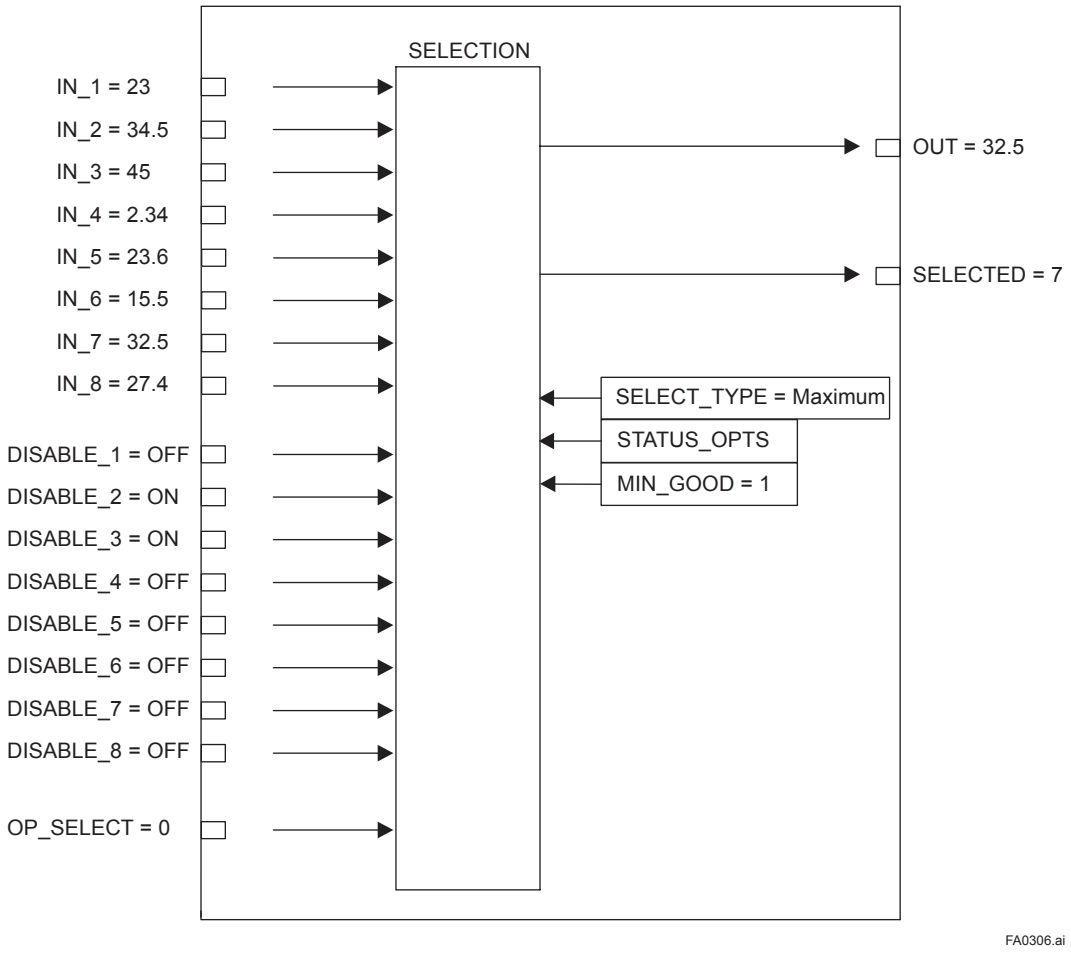


Figure A3.6 Example (5)

Because DISABLE_2 and DISABLE_3 are ON, IN_2 and IN_3 are disabled, and the IN with the maximum value among the remaining IN_n is selected for output. In the above example, since IN_7 has the maximum value among the remaining valid INs, it is output.

When SELECT TYPE is “Middle”

If there is more than one valid input and the number of such input is an odd number, the value of the middle input will be transmitted to OUT. If there is an even number of valid inputs, the average of the middle two inputs is transmitted to OUT. If the average is used for OUT, the block transmits “0” to SELECTED, while it transmits the number of the input used for the middle for other cases. If the number of valid inputs is 1, it is irrelevant to selection by “Middle” selector action. The following shows an example of selection by “Middle” selector action.

If there is an even number of valid inputs:

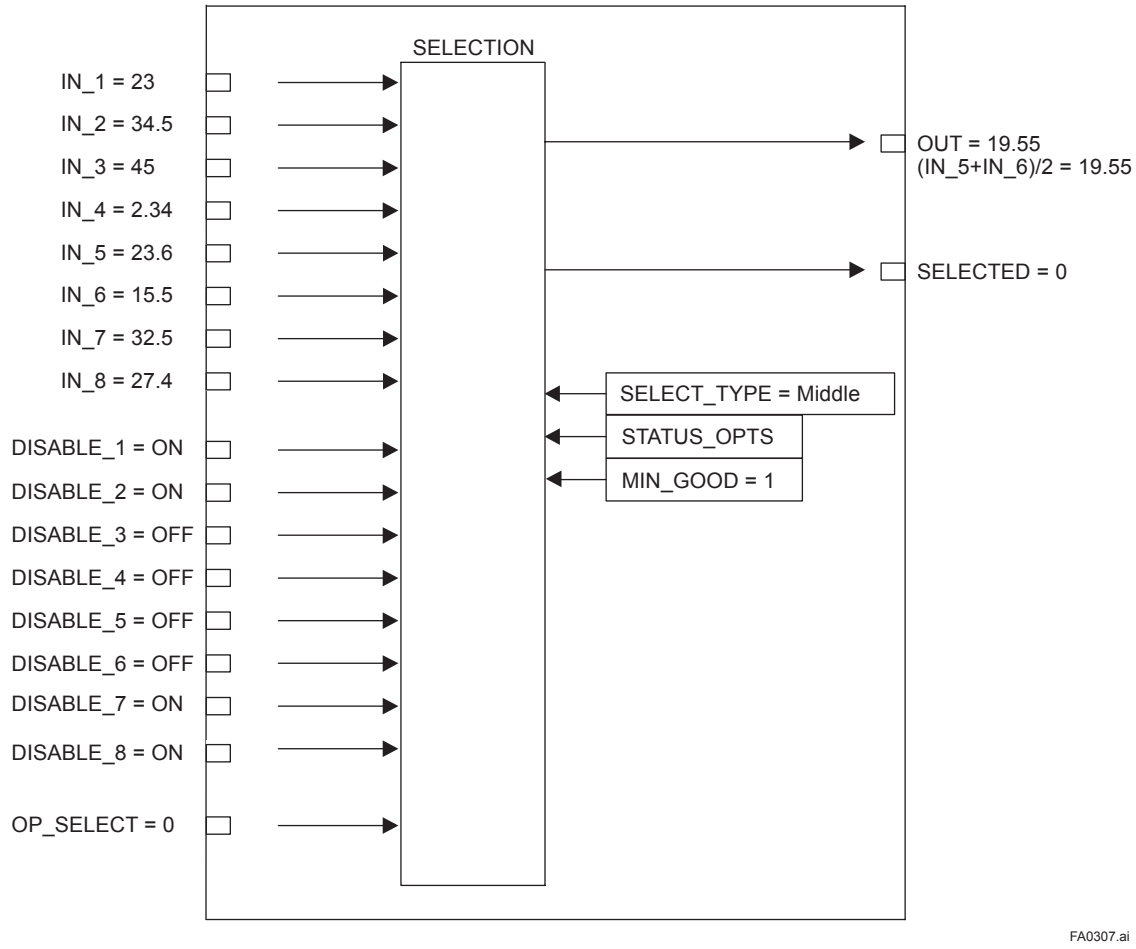


Figure A3.7 Example (6)

Because DISABLE_1, DISABLE_2, DISABLE_7, and DISABLE_8 are ON, the corresponding IN_1, IN_2, IN_7, and IN_8 are disabled and the remaining four INs are enabled. Furthermore, because IN_3 has the maximum value and IN_4 has the minimum value among the valid INs, they are not selected and the average of IN_5 and IN_6 inputs is output. When the average is selected for OUT, SELECTED is set to “0.”

If there is an odd number of valid inputs:

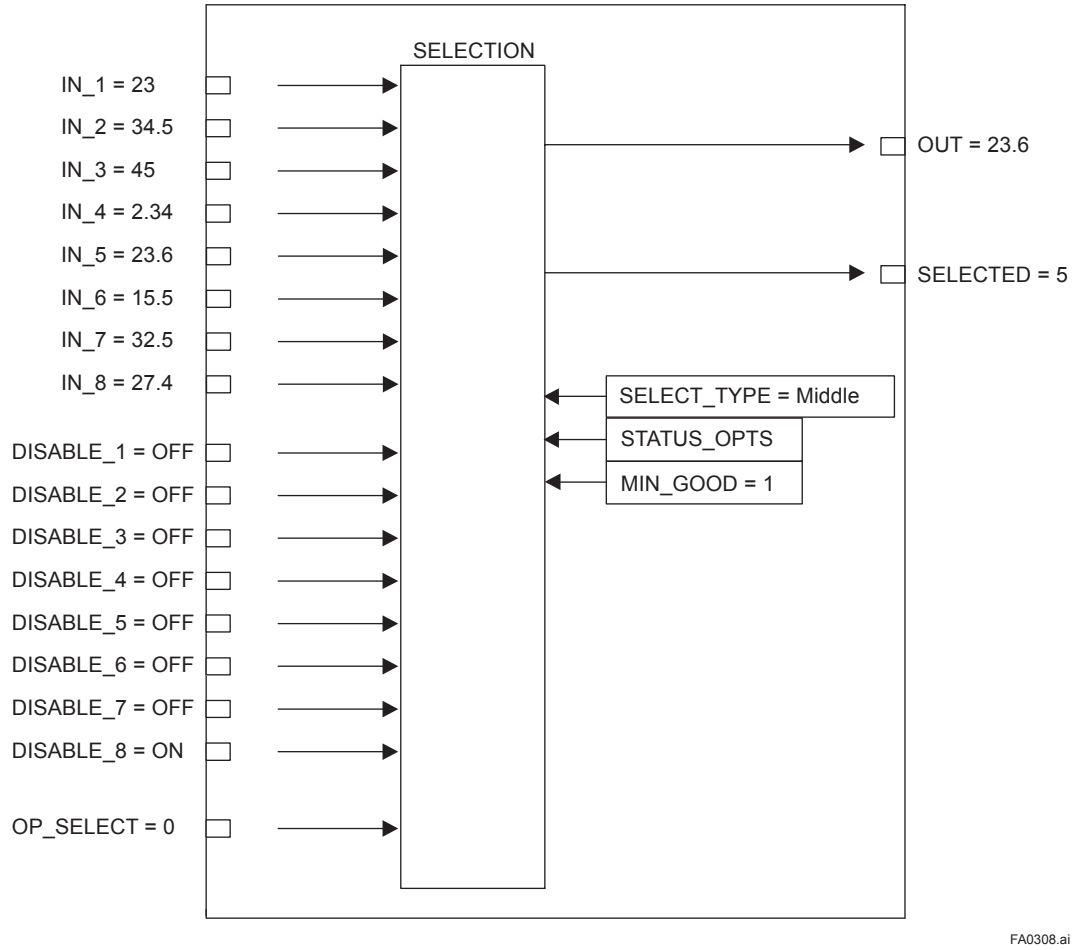


Figure A3.8 Example (7)

If the number of valid INs is an odd multiple, the IN with the middle value will be output. In the above example, the IN_5 input having the middle value is output.

When SELECT TYPE is “Average”

The block calculates the average of the valid inputs and transmits it to OUT. The number of inputs used to calculate its value is indicated in SELECTED.

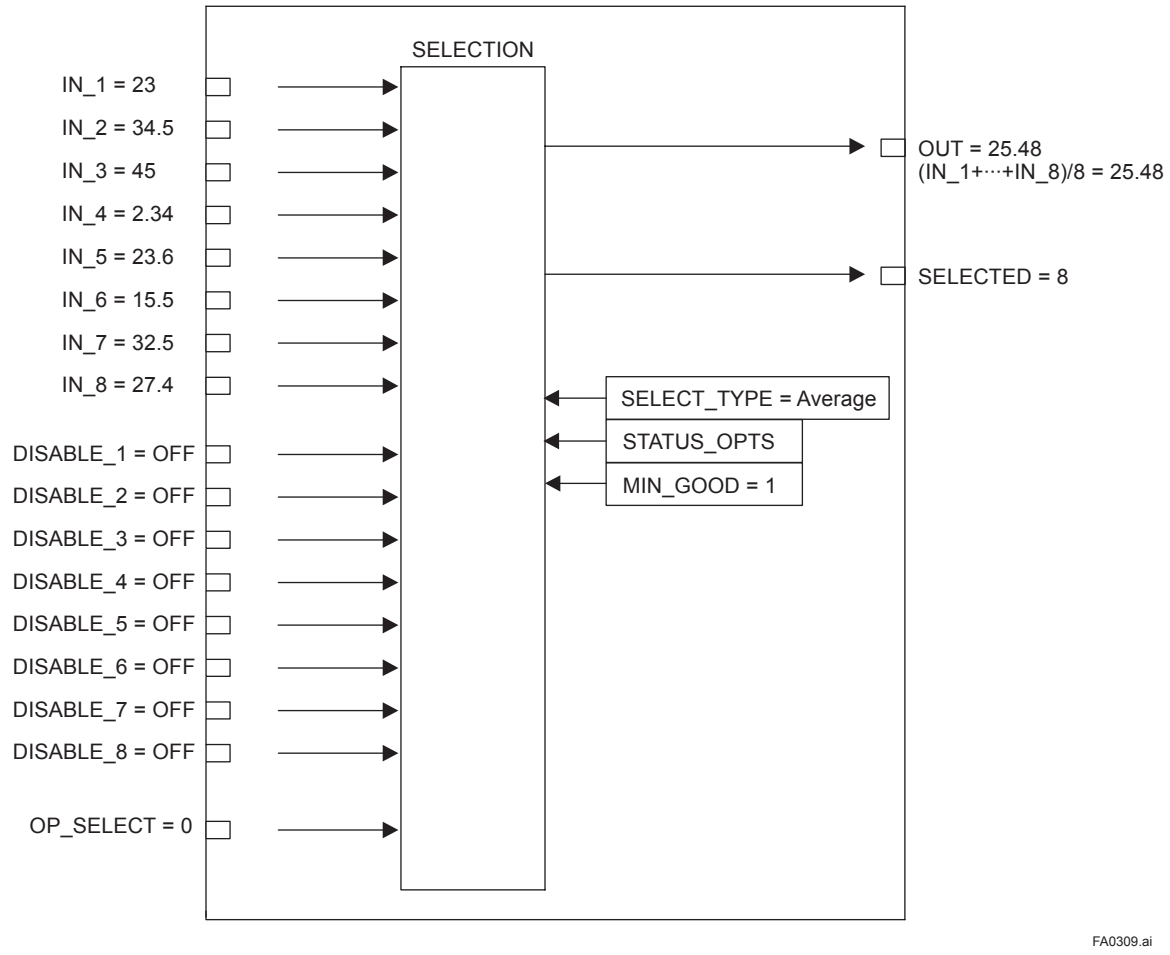


Figure A3.9 Example (8)

When SELECT TYPE is “Latched Good”

The valid input with the smaller input number is selected as an output and is held until it becomes invalid. When it becomes invalid, the next valid input will be selected as an output regardless of the magnitude of the value. Even if an input with the input number smaller than that of the currently selected input recovers, the current selection is held.

Assuming that IN_2 is the valid input with the smallest input number, the order of input selection is IN_2 → IN_3 → ...→ IN_8 → IN_1 → ....

If the power is turned OFF and then ON with SELECT TYPE set to “Latched Good,” input selection starts with the IN that was selected before the power was turned OFF.

A3.4 Output Processing

A3.4.1 Handling of SELECTED

For the value output to SELECTED when OP_SELECT has been selected (that is, not “0”), the number specified by OP_SELECT will be stored as is.

However, “0” is stored in the SELECTED in the following cases:

1. If there is no valid input;
2. If the value of MIN_GOOD is greater than the number of valid inputs;
3. If the input status is “bad” or “uncertain” when the value of OP_SELECT is anything other than “0” (with the exception of the case where the “Uncertain as good” bit in STATUS_OPTS is set.);
4. If the value of OP_SELECT is greater than 8, which is the maximum number of inputs;
5. If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is zero.

As long as there is one valid input, even an invalid input can be selected for OP_SELECT.

If the number of valid inputs is greater than the value of MIN_GOOD, the number of the input (including an invalid input) specified by OP_SELECT will be stored in SELECTED. Therefore, even if an invalid input is selected, SELECTED does not become zero.

If no input is selected for OP_SELECT, the output of SELECTED will depend on SELECT_TYPE.

The Table A3.1 shows the value of SELECTED according to the number of valid inputs and SELECT_TYPE.

Table A3.1 Value of SELECTED According to Inputs

<table>
<tr><th rowspan="2">Valid Inputs</th><th colspan="4">Value of SELECTED</th></tr>
<tr><th>SELECT_TYPE = First Good</th><th>SELECT_TYPE = MINIMUM, MAXIMUM, or Latched Good</th><th>SELECT_TYPE = MIDDLE</th><th>SELECT_TYPE = AVERAGE</th></tr>
<tr><td>None</td><td>0 (zero)</td><td>0 (zero)</td><td>0 (zero)</td><td>0 (zero)</td></tr>
<tr><td>1</td><td rowspan="3"># of IN with a smaller value</td><td rowspan="3"># of selected IN</td><td># of selected IN</td><td>1</td></tr>
<tr><td>Multiple INs (Even # of INs)</td><td>0 (the average is taken)</td><td rowspan="2"># of valid INs (the average is taken)</td></tr>
<tr><td>Multiple INs (Odd # of INs)</td><td># of IN with the middle value</td></tr>
</table>

Table A3.2 Value of SELECTED According to the Mode

O/S	MAN	AUTO
0	0	0 to 8

A3.4.2 OUT Processing

OUT is an output parameter used to send the value selected in the IS block to another function block.

The following describes OUT processing.

Table A3.3 Block Mode and Value

MODE		Value
O/S		· The previous value is output. (At startup, the initial value is used). · Writable (the operator may change the value.)
Man		
Auto	Value specified by MIN_Good > the number of valid inputs	· The previous value is output. · Not writable
	If there is no valid input	
	If the input status is “bad” or “uncertain” when the value of OP_SELECT is anything other than “0” (with the exception of the case where the “Uncertain as good” bit in STATUS_OPTS is set)	
	If the value of OP_SELECT is greater than 8, which is the maximum number of inputs	· Zero · Not writable
	If OP_SELECT is enabled	· The value of the selected input is output. · Not writable
	If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is “0”	· The previous value is output. · Not writable
	If SELECT_TYPE is “First Good”	· The value of a valid input with the smallest input number is output. · Not writable
	If SELECT_TYPE is “MINIMUM”	· The minimum value among the values of the valid inputs is output. · Not writable
	If SELECT_TYPE is “MAXIMUM”	· The maximum value among the values of the valid inputs is output. · Not writable
	If SELECT_TYPE is “MIDDLE” (There is an even multiple number of valid inputs.)	· Because two inputs are positioned in the middle of the values of even multiple valid inputs, the average of the values of these two inputs is output. · Not writable
	If SELECT_TYPE is “MIDDLE” (There is an odd multiple number of valid inputs.)	· The value of the input positioned in the middle of the values of odd multiple valid inputs is output. · Not writable
	If SELECT_TYPE is “AVERAGE”	· The value obtained by dividing the added value of the values of valid inputs by the number of these inputs is output. · Not writable
	If SELECT_TYPE is “Latched Good”	· The value of a valid input with the smallest input number is output. · Not writable

Table A3.4 Condition and Mode

Condition (Listed in priority sequence)	Mode
If the Actual is in O/S	O/S
If the “Uncertain if Man mode” bit in STATUS_OPTS is set and the Actual is in Man	Man
If the “Uncertain if Man mode” bit in STATUS_OPTS is not set and the Actual is in Man	Man
Values specified by MIN_Good > the number of valid inputs	Aute
If there is no valid input	Aute
If the input status is “bad” or “uncertain” when the value of OP_SELECT is anything other than “0” (with the exception of the case where the “Uncertain as good” bit in STATUS_OPTS is set)	Aute
If the value of OP_SELECT is greater than 8, which is the maximum number of inputs	Aute
If OP_SELECT has selected IN whose status is “bad” or “uncertain” (See the item “Transition of Sub-status in the Case Where OP_SELECT is Selected.”)	Aute
If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is “0”	Aute

A3.4.3 STATUS_OPTS

Bit	Description
Use Uncertain as Good	Causes all inputs (OP_SELECT, IN_n, and DISABLE_n) the status of which is “uncertain,” to be handled as “good” (NC) status inputs and the others to be handled as ”bad” status inputs.
Uncertain if Man mode	When the mode is Man, the status of OUT is interpreted as “uncertain.” (This does not apply to SELECTED.)

A3.5 List of Input Selector Block Parameters

Relative Index	Parameter	Write Mode	Valid Range	Initial Value	View				Description / Remarks
					1	2	3	4	
0	BLOCK_ HEADER	Block Tag=O/S		TAG: “IS”					Information relating to this function block, such as block tag, DD revision, and execution time.
1	ST_REV		-----	-----	2	2	2	2	Indicates the revision level of the set parameters associated with the IS block. If a setting is modified, this revision is updated. It is used to check for parameter changes, etc.
2	TAG_DESC			Null					A universal parameter that stores comments describing tag information.
3	STRATEGY			1				2	A universal parameter intended for use by the high-level system to identify function blocks.
4	ALERT_KEY		1-255	1				1	Key information used to identify the location where an alert has occurred. Generally, this parameter is used by the high-level system to identify specific areas in a plant that are under the control of specific operators, to distinguish necessary alarms only. This is one of the universal parameters.
5	MODE_BLK				4		4		A universal parameter representing the operation status of the IS block. It consists of the Actual, Target, Permit, and Normal modes.
6	BLOCK_ ERR		-----	-----	2		2		Indicates the error status relating to the Input Selector function block. The bit used by this function block is as follows: Bit 15: O/S mode.
7	OUT	MAN		0	5		5		Block output.
8	OUT_ RANGE					11			Set the range of OUT.
9	GRANT_ DENY			0		2			The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before any of them are executed. After the operations are complete, the DENY parameter is checked to find out if any bit corresponding to the relevant operation has been set. If no bit is set, it is evident that the operations have been executed successfully.
10	STATUS_ OPTS	O/S	“Use Uncertain as good” and “Uncertain if Manual” only	0				2	A user-selectable option available for status handling in the block.
11	IN_1			0	5		5		Input 1
12	IN_2			0	5		5		Input 2
13	IN_3			0	5		5		Input 3
14	IN_4			0	5		5		Input 4
15	DISABLE_1		0, 1	0	2		2		Selector switch to disable input 1 from being selected.
16	DISABLE_2		0, 1	0	2		2		Selector switch to disable input 2 from being selected.
17	DISABLE_3		0, 1	0	2		2		Selector switch to disable input 3 from being selected.
18	DISABLE_4		0, 1	0	2		2		Selector switch to disable input 4 from being selected.
19	SELECT_ TYPE		1-6	0				1	Specifies the input selection algorithm.

Relative Index	Parameter	Write Mode	Valid Range	Initial Value	View				Description / Remarks
					1	2	3	4	
20	MIN_GOOD		0-8	0				1	Parameter specifying the minimum required number of inputs with “good” status If the number of inputs with “good” status is less than the value of MIN_GOOD, input selection is canceled.
21	SELECTED		0-8	0	2		2		Indicates the number of the selected input. However, it indicates the number of inputs used to calculate the average if SELECT_TYPE = Average. If no input is selectable or if there are multiple inputs, it becomes “0” (none).
22	OP_ SELECT		0-8	0	2		2		A parameter to forcibly employ the input of a selected number (Operator-settable).
23	UPDATE_ EVT		-----	-----					Indicates event information if an update event (setting change) occurs.
24	BLOCK_ ALM		-----	-----					Indicates alarm information if a block alarm occurs.
25	IN_5			0	5		5		Input 5
26	IN_6			0	5		5		Input 6
27	IN_7			0	5		5		Input 7
28	IN_8			0	5		5		Input 8
29	DISABLE_5		0, 1	0	2		2		Selector switch to disable input 5 from being selected.
30	DISABLE_6		0, 1	0	2		2		Selector switch to disable input 6 from being selected.
31	DISABLE_7		0, 1	0	2		2		Selector switch to disable input 7 from being selected.
32	DISABLE_8		0, 1	0	2		2		Selector switch to disable input 8 from being selected.

A3.6 Application Example

The following describes the temperature control system of a fixed bed-type reactor. In this case, there are instances where the point showing the maximum temperature changes due to catalytic deterioration, raw material flow, etc. Therefore, a large number of measurement points are provided, and the maximum value obtained among these measurement points is input to the controller to control reactor temperature.

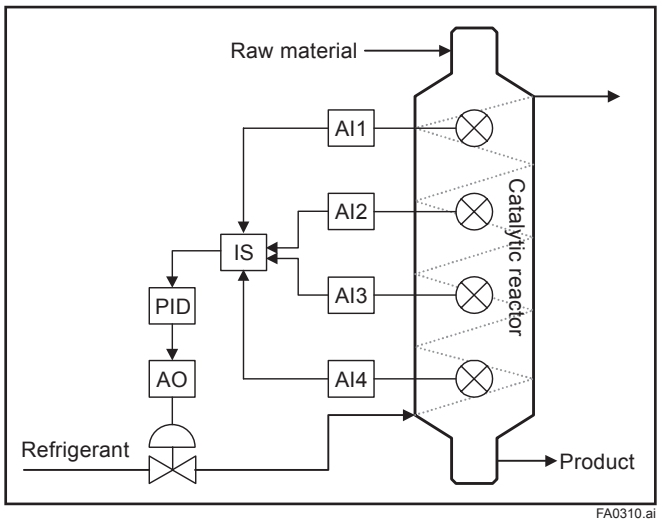


Figure A3.10 Temperature Control System of a Fixed Bed-type Reactor

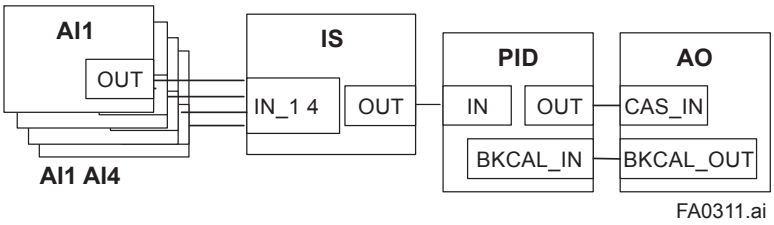


Figure A3.11 Example of Scheduling

AI1: Temperature 1, AI2: Temperature 2, AI3: Temperature 3, AI4: Temperature 4
IS: SELECT_TYPE = MAX

Basic operations and work sequence:

1. The IS block obtains values and status information from AI.
2. The block selects the AI information using the alternatives.
3. The block displays and outputs the information selected by SELECTED.

Appendix 4. Arithmetic (AR) Block

The Arithmetic (AR) block switches two main inputs of different measurement ranges seamlessly and combines the result with three auxiliary inputs through the selected compensation function (10 types) to calculate the output.

A4.1 Arithmetic Function Block Schematic

The diagram below shows the Arithmetic block schematic.

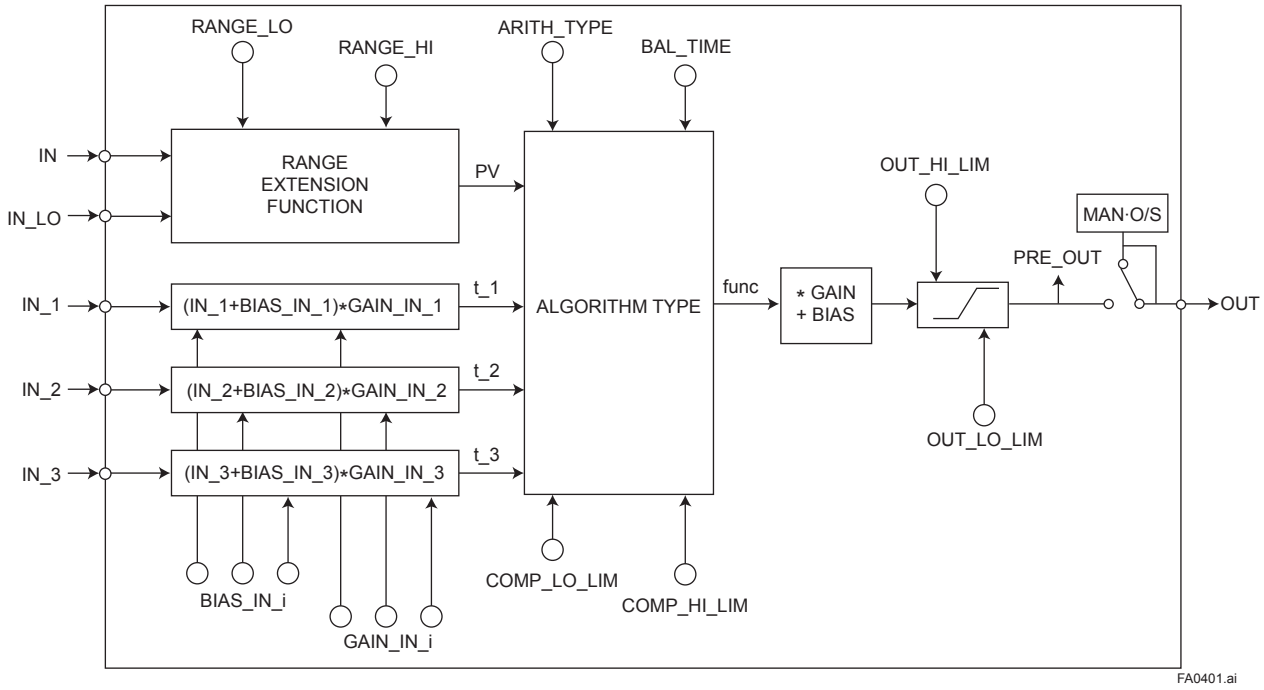


Figure A4.1 AR Block

The Arithmetic block is divided into three sections:

- Input section: Makes a go/no-go decision on the use of an input value, switches the range, and determines the PV status.
- Computation section: Makes calculations through ARITH_TYPE.
- Output section: Applies gain multiplication and bias addition to the calculated result to perform limitation processing for output.

* The range extension function compensates the IN and IN_LO input values when two devices with different ranges are connected, to make smooth input switching.

A4.2 Input Section

There are five inputs: IN and IN_LO main inputs and IN_1, IN_2, and IN_3 auxiliary inputs.

IN and IN_LO are intended to connect devices with different measurement ranges and allow the use of switching a measurement range by selecting the measuring device. However, because there are slight differences between IN and IN_LO values even when the same item is measured, instantaneous switching causes abrupt changes in the output.

To prevent this phenomenon, the Arithmetic block uses a function known as range extension to compensate the IN and IN_LO values between RANGE_HI and RANGE_LO. This enables the input to be switched smoothly. The result of the range extension function is substituted into PV to be used for calculations.

A4.2.1 Main Inputs

The range extension function determines the PV value in the following order:

1. If IN ≥ RANGE_HI → PV = IN
2. If IN ≤ RANGE_LO → PV = IN_LO
3. If RANGE_HI > IN > RANGE_LO → PV = g × IN + (1- g) × IN_LO

g = (IN - RANGE_LO) / (RANGE_HI - RANGE_LO)

RANGE_HI and RANGE_LO are threshold values for switching two main inputs seamlessly.

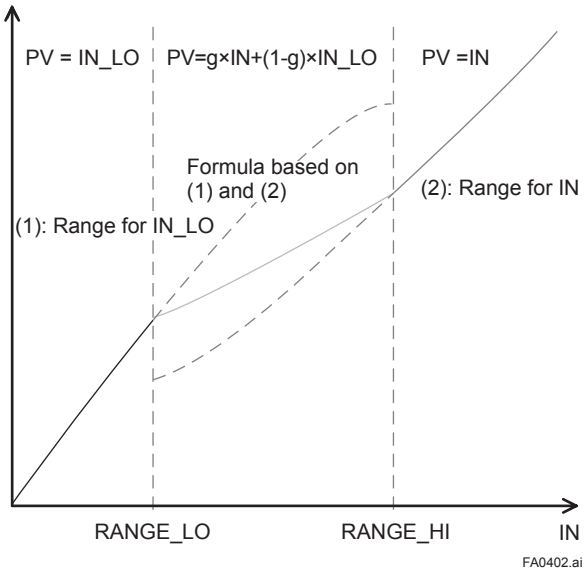


Figure A4.2 Range Extension Function and PV

PV is a parameter with status information, and PV status is determined by the value of "g."

If "g" < 0.5 → The status of IN_LO is used.

If "g" ≥ 0.5 → The status of IN is used.

Determination of the status is made with a hysteresis of 10% provided for 0.5.

If RANGE_LO > RANGE_HI, the statuses of PV and OUT are "Bad. Configuration Error." Then "Configuration Error" is output to BLOCK_ERR.

If there is only one main input, the input is incorporated into the computation section as is, not taking into account RANGE_HI and RANGE_LO.

Example:

Assuming that

RANGE_LO	20
RANGE_HI	300

the following are established:

IN = 310, IN_LO = 20
→ PV = 310

IN = 230, IN_LO = 20
→ g = (230 - 20) / (300 - 20) = 0.75
PV = 0.75 × 230 + (1 - 0.75) × 20 = 177.5

IN = 90, IN_LO = 20
→ g = (90 - 20) / (300 - 20) = 0.25
PV = 0.25 × 230 + (1 + 0.25) × 20 = 37.5

IN = 19, IN_LO = 10
→ PV = 10

A4.2.2 Auxiliary Inputs

There are bias and gain parameters for the IN_1, IN_2, and IN_3 auxiliary inputs. The following shows the equation using them.

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

The bias parameter is used for calculating absolute temperature or absolute pressure, while the gain parameter is used for normalization of square root extraction.

A4.2.3 INPUT_OPTS

INPUT_OPTS has an option that handles an input with “uncertain” or “bad” status as a “good” status input.

Bit	Function
0	Handles IN as a “good” status input if its status is “uncertain.”
1	Handles IN_LO as a “good” status input if its status is “uncertain.”
2	Handles IN_1 as a “good” status input if its status is “uncertain.”
3	Handles IN_1 as a “good” status input if its status is “bad.”
4	Handles IN_2 as a “good” status input if its status is “uncertain.”
5	Handles IN_2 as a “good” status input if its status is “bad.”
6	Handles IN_3 as a “good” status input if its status is “uncertain.”
7	Handles IN_3 as a “good” status input if its status is “bad.”
8 to 15	Reserved

There are options called “IN Use uncertain” and “IN_LO Use uncertain” for the IN and IN_LO inputs. When these options are valid, IN and IN_LO are internally interpreted as “good” IN and IN_LO even if their statuses are “uncertain.” (There is no option for “bad” status.)

For the IN_1, IN_2, and IN_3 auxiliary inputs, there are options known as “IN_i Use uncertain” and “IN_i Use bad.” If these options are valid, an IN_i with “uncertain” or “bad” status is internally interpreted as a “good” IN_i.

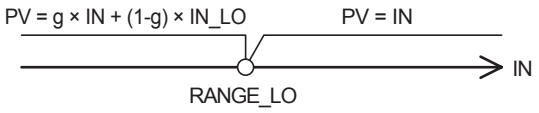
* The exception is that if the input status is “Bad. Not Connected,” INPUT_OPTS does not apply and the input is considered “bad” as is.

A4.2.4 Relationship between the Main Inputs and PV

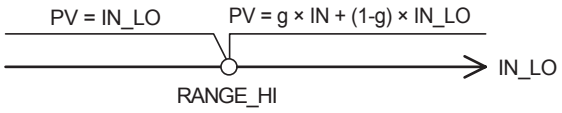
The value and PV status are determined by the statuses of two main inputs, INPUT_OPTS, and RANGE_LO and RANGE_HI.

- If the statuses of two main inputs are both “good” or anything other than “good”
  See A4.2.1, Main Inputs.
- If only one of two main inputs has “good” status after application of INPUT_OPTS, the PV value is determined as follows:
  - If the status of IN is “good” and that of “IN_LO” is anything other than “good”
    IN > RANGE_LO → PV = IN
    IN ≤ RANGE_LO → See A4.2.1.
  - If the status of IN is anything other than “good” and that of “IN_LO” is “good”
    IN_LO < RANGE_HI → PV = IN_LO
    IN_LO ≥ RANGE_H → See A4.2.1.

If the status of IN is “good” and that of “IN_LO” is anything other than “good”



If the status of IN is anything other than “good” and that of “IN_LO” is “good”



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A4.3 Computation Section

A4.3.1 Computing Equations

This subsection shows computing equations used in the computation section:

1) Flow compensation (linear)
   func = PV × f
   f = (t_1 / t_2)

2) Flow compensation (square root)
   func = PV × f
   f = sqrt(t_1 / t_2 / t_3)

3) Flow compensation (approximate expression)
   func = PV × f
   f = sqrt(t_1 × t_2 × t_3 × t_3)

4) Quantity of heat calculation
   func = PV × f
   f = (t_1 - t_2)

5) Multiplication and division
   func = PV × f
   f = ((t_1 / t_2) + t_3)

6) Average calculation
   func = (PV + t_1 + t_2 + t_3) / N
   where N: number of inputs

7) Summation
   func = PV + t_1 + t_2 + t_3

8) Polynomial computation
   func = PV + t_1^2 + t_2^3 + t_3^4

9) HTG-level compensation
   func = (PV - t_1) / (PV - t_2)

10) Polynomial computation
    func = PV + GAIN_IN_1 × PV^2 + GAIN_IN_2 × PV^3 + GAIN_IN_3 × PV^4

* Precaution for computation
Division by "0": If a value is divided by "0," the calculation result is interpreted as 10^{37} and, depending with core, a plus sign is added to it.
Negative square root: The square root of an absolute value is extracted and a minus sign is added to it.

A4.3.2 Compensated Values

In computing equations 1) to 5) in A4.3.1, the value "f" is restricted by the COMP_HI_LIM or COMP_LO_LIM parameter. In this case, the value "f" is treated as follows:

If "f" > COMP_HI_LIM, f = COMP_HI_LIM

If "f" < COMP_LO_LIM, f = COMP_LO_LIM

A4.3.3 Average Calculation

In computing equation 6) in A4.3.1, the average of input value is calculated. Here, it is necessary to obtain the number of inputs, N. For this, determination is made to see if the sub-status of each input is "Not Connected." Note that the main inputs may be accepted if IN or IN_LO is not in "Not Connected" sub-status. In this case, the number of inputs that are not in "Not Connected" sub-status is regarded as "N."

A4.4 Output Section

After executing the computing equation, the block applies a gain to the calculated result and then adds a bias to it.

It then substitutes the result into PRE_OUT and if the mode is in AUTO, the value of PRE_OUT is taken as OUT.

PRE_OUT = func × gain + bias
where func: result of computing equation execution
OUT = PRE_OUT (when the mode is in AUTO)

Next, the block performs limitation processing (OUT_HI_LIM, OUT_LOW_LIM). This processing is described as follows with respect to the value of PRE_OUT.

If PRE_OUT > OUT_HI_LIM:
PRE_OUT = OUT_HI_LIM
The "high limited" processing is applied to the status of PRE_OUT.

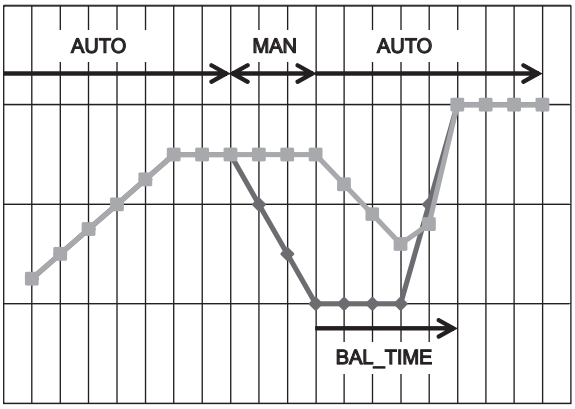
If PRE_OUT < OUT_LO_LIM:
PRE_OUT = OUT_LO_LIM
The "low limited" processing is applied to the status of PRE_OUT.

A4.4.1 Mode Handling

Mode	Output
Auto	OUT = PRE_OUT
MAN	For OUT, the OUT value in the Auto mode just before change to MAN or O/S is retained.
O/S	

In the Manual mode (including O/S), the value of OUT in the Auto mode just before a change to the Manual mode is held or the value written to OUT is output.

If the mode is switched from Manual to Auto, the value of OUT that is linearly changed with respect to the value of PRE_OUT for time set by BAL_TIME is output. The PRE_OUT always indicates the results of calculation. After elapse of BAL_TIME, OUT = PRE_OUT is established. Note that if the value of BAL_TIME is changed during linear change of the OUT value, it is not reflected. The value of BAL_TIME will be reflected only after the mode is changed the next time.



Case of BAL_TIME = 5 seconds

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The value of OUT is represented by the following equation.

$$yn = yn - 1 + (xn - yn - 1) / (\alpha - n)$$
$$\alpha = (T / tc) + 1$$

*: The value of T/tc truncates digits to the right of the decimal point.

where y: OUT

x: PRE_OUT
tc: period of execution
T: BAL_TIME
n: period

A4.4.2 Status Handling

The setting of INPUT_OPTS is applied to the input status. When INPUT_OPTS is applied, there are cases where the PV status becomes “good” even if the status of main inputs is “uncertain” or the status of auxiliary inputs is “uncertain” or “bad.”

The PV status is classified by the following:

- If the statuses of two main inputs are both “good” or anything other than “good”: See A4.2.1, Main Inputs.
- If only one of the statuses of two main inputs is “good”:
  - If the status of IN is “good” and that of “IN_LO” is anything other than “good”
    IN > RANGE_LO
    → The status of IN applies.
    IN ≤ RANGE_LO
    → See A4.2.1, Main Inputs
  - If the status of IN is anything other than “good” and that of “IN_LO” is “good”
    IN_LO < RANGE_H
    → The status of IN_LO applies.
    IN_LO ≥ RANGE_HI
    → See A4.2.1, Main Inputs

The exception is that if RANGE_LO > RANGE_HI, the PV status is made “Bad. Configuration Error.”

The input status irrelevant to the computing equation selected by ARITH_TYPE will be ignored and does not affect other statuses. The statuses of outputs (OUT.Status and PRE_OUT.Status) are interpreted as the status of the worst input among the statuses of PV and auxiliary inputs (IN_1, IN_2, and IN_3) to which INPUT_OPTS has been applied.

Example:

		Case 1	Case 2	Case 3
PV		Good		
IN_1		Unceriain		
IN_2		Bad		
IN_3		Bad		
INPUT_OPTS	**IN_1**	Handled as a “good” input if its status is “uncertain.”	No option	
	IN_2	Handled as a “good” input if its status is “bad.”		No option
	IN_3	No option		
ARITH_TYPE		1) Flow compensation (linear) in A4.3.1, “Computing Equations”		
OUT.Status		Good	Uncertain	Bad

A4.5 List of the Arithmetic Block Parameters

Relative Index	Parameter	Write Mode	Valid Range	Initial Value	View 1	View 2	View 3	View 4	Description / Remarks
0	BLOCK_ HEADER	O/S		TAG="AR"					Information relating to this function block, such as block tag, DD revision, and execution time.
1	ST_REV			0	2	2	2	2	Indicates the revision level of the set parameters associated with the Arithmetic block. If a setting is modified, this revision is updated. It is used to check for parameter changes, etc.
2	TAG_DESC			Null					A universal parameter that stores comments describing tag information.
3	STRATEGY			1				2	A universal parameter intended for use by a high-level system to identify function blocks.
4	ALERT_KEY		1-255	1				1	Key information used to identify the location at which an alert has occurred. Generally, this parameter is used by a high-level system to identify specific areas in a plant that are under the control of specific operators, to separate necessary alerts only. This is one of the universal parameters.
5	MODE_BLK			AUTO	4		4		A universal parameter representing the operation status of the Arithmetic block. It consists of the Actual, Target, Permit, and Normal modes.
6	BLOCK_ ERR			0	2		2		Indicates the error status relating to the Arithmetic block. The bit used by this function block is as follows: Bit 1: Block Configuration Error Bit 15: O/S mode
7	PV			0	5		5		The result of a range extension function is substituted into this. When viewed from the computing equation, PV is the main input.
8	OUT	MAN		0	5		5		Block output.
9	PRE_OUT			0	5		5		Always indicates the calculation result. The value is substituted into OUT in Auto mode.
10	PV_SCALE	O/S				11			Indicates PV scaling (for making a memo).
11	OUT_ RANGE					11			Output scaling for the host (for making a memo).
12	GRANT_ DENY			0		2			The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before any of them are executed. After the operations are complete, the DENY parameter is checked to find out if any bit corresponding to the relevant operation has been set. If no bit has been set, it is evident that the operations have been executed successfully.
13	INPUT_ OPTS			0				2	Determines whether an input is used as a "good" input when the input status is "bad" or "uncertain." Bit 0: Handles IN as "good" input if its status is "uncertain." Bit 1: Handles IN_LO as "good" input if its status is "uncertain." Bit 2: Handles IN_1 as "good" input if its status is "uncertain." Bit 3: Handles IN_1 as "good" input if its status is "bad." Bit 4: Handles IN_2 as "good" input if its status is "uncertain." Bit 5: Handles IN_2 as "good" input if its status is "bad." Bit 6: Handles IN_3 as "good" input if its status is "uncertain." Bit 7: Handles IN_3 as "good" input if its status is "bad." Bit 8 to 15: Reserved
14	IN			0			5		Input block.
15	IN_LO			0			5		Input for a low-range transmitter. This is used for the range extension function.
16	IN_1			0			5		Auxiliary input 1
17	IN_2			0			5		Auxiliary input 2
18	IN_3			0			5		Auxiliary input 3
19	RANGE_HI			0				4	High limit for switching to a high-range transmitter by the range extension function.
20	RANGE_LO			0				4	Low limit for switching to a low-range transmitter by the range extension function.

Relative Index	Parameter	Write Mode	Valid Range	Initial Value	View 1	View 2	View 3	View 4	Description / Remarks
21	BIAS_IN_1			0				4	IN_1 bias
22	GAIN_IN_1			0				4	IN_1 gain
23	BIAS_IN_2			0				4	IN_2 bias
24	GAIN_IN_2			0				4	IN_2 gain
25	BIAS_IN_3			0				4	IN_3 bias
26	GAIN_IN_3			0				4	IN_3 gain
27	COMP_HI_LIM			+INF				4	High limit of compensation factor f.
28	COMP_LO_LIM			-INF				4	Low limit of compensation factor f.
29	ARITH_TYPE	1 to 10		0x01				1	Computation algorithm identification no.

Value	Selection Name	Description
1	Flow compensation, linear	Flow compensation (linear)
2	Flow compensation, square root	Flow compensation (square root)
3	Flow compensation, approximate	Flow compensation (approximate expression)
4	BTU flow (*)	Quantity of heat calculation
5	Traditional Multiply Divide	Multiplication and division
6	Average	Average calculation
7	Traditional summer	Summation
8	Fourth order Polynomial, Type 1	4th-order (auxiliary input) polynomial computation
9	HTG level compensation (*)	HTG-level compensation
10	Fourth order Polynomial, Type 2	4th-order (main input) polynomial computation

* BTU stands for British thermal unit.
HTG stands for hydrostatic tank gauging.

30	BAL_TIME	More than 0		0				4	Time taken to return to the set value.
31	BIAS			0				4	Bias value used to calculate the output.
32	GAIN			1				4	Gain value used to calculate the output.
33	OUT_HI_LIM			+INF				4	Maximum output value.
34	OUT_LO_LIM			-INF				4	Minimum output value.
35	UPDATE_EVT								Indicates event information if an update event (setting change) occurs.
36	BLOCK_ALM								Indicates alarm information if a block alarm occurs.

Appendix 5. PID Block

A PID block performs the PID control computation based on the deviation of the measured value (PV) from the setpoint (SV), and is generally used for constant-setpoint and cascaded-setpoint control.

A5.1 Function Diagram

The figure below depicts the function diagram of a PID block.

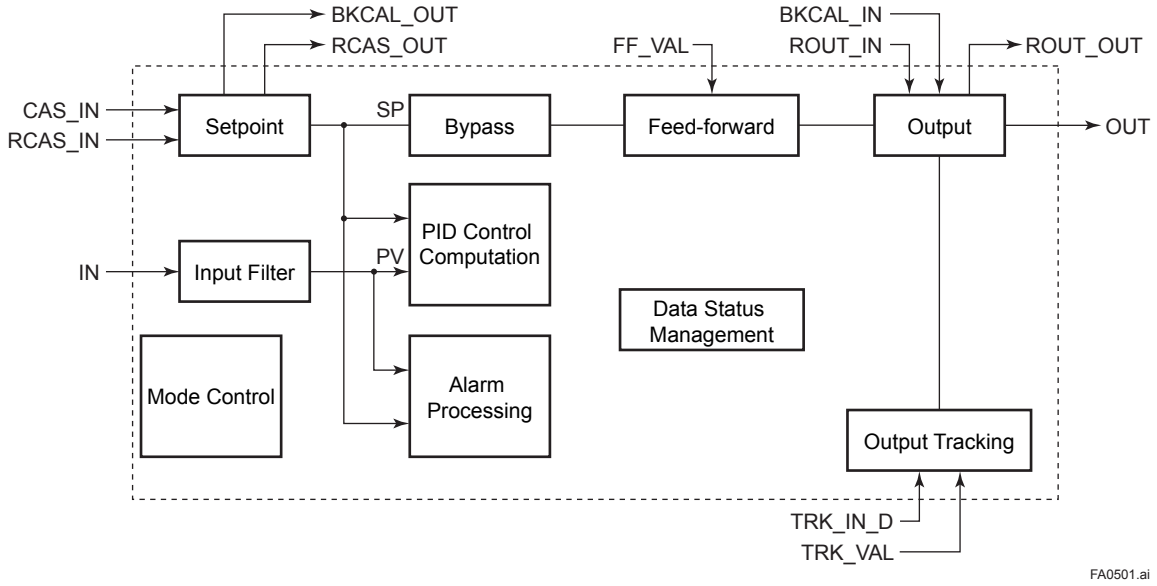


Figure A5.1 PID Block

A5.2 Functions of PID Block

The table below shows the functions provided in a PID block.

Function	Description
PID control computation	Computes the control output in accordance with the PID control algorithm.
Control output	Converts the change in control output ΔMV to the manipulated value MV that is to be actually output.
Switching of direction of control action	Switches over the direction of control action between direct and reverse, i.e., the direction of changes in the control output depending on the changes in the deviation.
Control action bypass	When the bypass is on, the value of the SP is scaled to the range of the OUT and output as the OUT.
Feed-forward	Adds the value of the FF_VAL (input to the PID block) to the output from the PID computation.
Measured-value tracking	Equalizes the setpoint SP to the measured value PV.
Setpoint limiters	Limit the value of setpoint SP within the preset upper and lower levels as well as limit the rate of change when the PID block is in Auto mode.
External-output tracking	Performs the scaling of the value of TRK_VAL to the range of the OUT and outputs it as the OUT.
Mode change	Changes the block mode between 8 modes: O/S, IMan, LO, Man, Auto, Cas, RCas, ROut.
Bumpless transfer	Prevents a sudden change in the control output OUT at changes in block mode and at switching of the connection from the control output OUT to the cascaded secondary function block.
Initialization and manual fallback	Changes the block mode to IMan and suspends the control action when the specified condition is met.
Manual fallback	Changes the block mode to Man and aborts the control action.
Auto fallback	Changes the block mode to Auto when it is Cas, and continues the control action with the setpoint set by the operator.
Mode shedding upon computer failure	Changes the block mode in accordance with the SHED_OPT setting upon a computer failure.
Alarm processing	Generates block alarms and process alarms, and performs event updates.

A5.3 Parameters of PID Block

NOTE: In the table below, the Write column shows the modes in which the respective parameters can be written. A blank in the Write column indicates that the corresponding parameter can be written in all modes of the PID block. A dash (-) indicates that the corresponding parameter cannot be written in any mode.

Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
0	Block Header	TAG: "PID"	Block Tag = O/S		Same as that for an AI block.
1	ST_REV		—		Same as that for an AI block.
2	TAG_DESC	Null			Same as that for an AI block.
3	STRATEGY	1			Same as that for an AI block.
4	ALERT_KEY	1		1 to 255	Same as that for an AI block.
5	MODE_BLK				
6	BLOCK_ERR		—		Same as that for an AI block.
7	PV		—		Measured value; the non-dimensional value that is converted from the input (IN) value based on the PV_SCALE values and filtered.
8	SP	0	AUTO	PV_SCALE ±10%	Setpoint
9	OUT		MAN		Output
10	PV_SCALE	100 0 1133 1	O/S		Upper and lower scale limit values used for scaling of the input (IN) value.
11	OUT_SCALE	100 0 1342 1	O/S		Upper and lower scale limit values used for scaling of the control output (OUT) value to the values in the engineering unit.
12	GRANT_DENY	0	AUTO		Same as that for an AI block.
13	CONTROL_ OPTS	0	O/S		Setting for control action. See Section A5.13 for details.
14	STATUS_OPTS	0	O/S		See Section A5.15 for details.
15	IN	0			Controlled-value input.
16	PV_FTIME	2	AUTO	Non-negative	Time constant (in seconds) of the first-order lag filter applied to IN.
17	BYPASS	1 (off)	MAN	1, 2	Whether to bypass the control computation. 1 (off): Do not bypass. 2 (on): Bypass.
18	CAS_IN	0			Cascade setpoint
19	SP_RATE_DN	+INF		Positive	Rate-of-decrease limit for setpoint (SP).
20	SP_RATE_UP	-INF		Positive	Rate-of-increase limit for setpoint (SP).
21	SP_HI_LIM	100		PV_SCALE ±10%	Upper limit for setpoint (SP).
22	SP_LO_LIM	0		PV_SCALE ±10%	Lower limit for setpoint (SP).
23	GAIN	1			Proportional gain (= 100 / proportional band).
24	RESET	10			Integration time (seconds).
25	BAL_TIME	0		Positive	Unused
26	RATE	0		Positive	Derivative time (seconds).
27	BKCAL_IN	0			Read-back of control output.
28	OUT_HI_LIM	100		OUT_SCALE ±10%	Upper limit for control output (OUT).
29	OUT_LO_LIM	0		OUT_SCALE ±10%	Lower limit for control output (OUT).
30	BKCAL_HYS	0.5 (%)		0 to 50%	Hysteresis for release from a limit for OUT.status.
31	BKCAL_OUT	0	—		Read-back value to be sent to the BKCAL_IN in the upper block.
32	RCAS_IN	0			Remote setpoint set from a computer, etc.
33	ROUT_IN	0			Remote control output value set from a computer, etc.
34	SHED_OPT	0			Action to be performed in the event of mode shedding. SHED_OPT defines the changes to be made to MODE. BLK.target and MODE.BLK.actual when the value of RCAS_IN.status or ROUT_IN.status becomes Bad if MODE_BLK.actual = RCas or ROut. See Section A5.17.1 for details.

Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
35	RCAS_OUT	0	—		Remote setpoint sent to a computer, etc.
36	ROUT_OUT	0	—		Remote control output value.
37	TRK_SCALE	100 0 1342 1	MAN		Upper and lower scale limits used to convert the output tracking value (TRK_VAL) to non-dimensional.
38	TRK_IN_D	0			Switch for output tracking. See Section A5.12 for details.
39	TRK_VAL	0			Output tracking value (TRK_VAL). When MODE_BLK.actual = LO, the value scaled from the TRK_VAL value is set in OUT.
40	FF_VAL	0			Feedforward input value. The FF_VAL value is scaled to a value with the same scale as for OUT, multiplied by the FF_GAIN value, and then added to the output of the PID computation.
41	FF_SCALE	100 0 1342 1	MAN		Scale limits used for converting the FF_VAL value to a non-dimensional value.
42	FF_GAIN	0	MAN		Gain for FF_VAL.
43	UPDATE_EVT		—		Same as that for an AI block.
44	BLOCK_ALM		—		Same as that for an AI block.
45	ALARM_SUM	Enable			Same as that for an AI block.
46	ACK_OPTION	0xFFFF			Same as that for an AI block.
47	ALARM_HYS	0.5%		0 to 50%	Hysteresis for alarm detection and resetting to prevent each alarm from occurring and recovering repeatedly within a short time.
48	HI_HI_PRI	0		0 to 15	Priority order of HI_HI_ALM alarm.
49	HI_HI_LIM	+INF		PV_SCALE	Setting for HI_HI_ALM alarm.
50	HI_PRI	0		0 to 15	Priority order of HI_ALM alarm.
51	HI_LIM	+INF		PV_SCALE	Setting for HI_ALM alarm.
52	LO_PRI	0		0 to 15	Priority order of LO_ALM alarm.
53	LO_LIM	-INF		PV_SCALE	Setting for LO_ALM alarm.
54	LO_LO_PRI	0		0 to 15	Priority order of LO_LO_ALM alarm.
55	LO_LO_LIM	-INF		PV_SCALE	Setting for LO_LO_ALM alarm.
56	DV_HI_PRI	0		0 to 15	Priority order of DV_HI_ALM alarm.
57	DV_HI_LIM	+INF			Setting for DV_HI_ALM alarm.
58	DV_LO_PRI	0		0 to 15	Priority order of DV_LO_ALM alarm.
59	DV_LO_LIM	-INF			Setting for DV_LO_ALM alarm.
60	HI_HI_ALM	—	—		Alarm that is generated when the PV value has exceeded the HI_HI_LIM value and whose priority order* is defined in HI_HI_PRI. * Priority order: Only one alarm is generated at a time. When two or more alarms occur at the same time, the alarm having the highest priority order is generated. When the PV value has decreased below [HI_HI_LIM - ALM_HYS], HI_HI_ALM is reset.
61	HI_ALM	—	—		As above
62	LO_ALM	—	—		As above Reset when the PV value has increased above [LO_LIM + ALM_HYS].
63	LO_LO_ALM	—	—		As above
64	DV_HI_ALM	—	—		Alarm that is generated when the value of [PV - SP] has exceeded the DV_HI_LIM value. Other features are the same as HI_HI_ALM.
65	DV_LO_ALM	—	—		Alarm that is generated when the value of [PV - SP] has decreased below the DV_LO_LIM value. Other features are the same as LO_LO_ALM.

A5.4 PID Computation Details

A5.4.1 PV-proportional and -derivative Type PID (I-PD) Control Algorithm

For PID control, the PID block employs the PV-proportional and PV-derivative type PID control algorithm (referred to as the I-PD control algorithm) in Auto and RCas mode. The I-PD control algorithm ensures control stability against sudden changes in the setpoint, such as when the user enters a new setpoint value. At the same time, the I-PD algorithm ensures excellent controllability by performing proportional, integral, and derivative control actions in response to changes of characteristics in the controlled process, changes in load, and occurrences of disturbances.

In Cas mode, PV derivative type PID control algorithm (referred to as the PI-D control algorithm) is employed in order to obtain better performance against the changes in the setpoint. The algorithm is automatically switched by the block according to the mode. A basic form of each algorithm is expressed in the equation below.

I-PD Control Algorithm (in Auto / RCas mode)

$$\Delta MVn = K\{\Delta PVn + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\}$$

PI-D Control Algorithm (in Cas mode)

$$\Delta MVn = K\{\Delta(PVn - SPn) + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\}$$

Where,

- ΔMVn = change in control output
- ΔPVn = change in measured (controlled) value = PVn - PVn-1
- ΔT = control period = period_of_execution in Block Header
- K = proportional gain = GAIN (= 100/ proportional band)
- Ti = integral time = RESET
- Td = derivative time = RATE

The subscripts, n and n-1, represent the time of sampling such that PVn and PVn-1 denote the PV value sampled most recently and the PV value sampled at the preceding control period, respectively.

A5.4.2 PID Control Parameters

The table below shows the PID control parameters.

Parameter	Description	Valid Range
GAIN	Proportional gain	0.05 to 20
RESET	Integral time	0.1 to 10,000 (seconds)
RATE	Derivative time	0 to infinity (seconds)

A5.5 Control Output

The final control output value, OUT, is computed based on the change in control output ΔMVn, which is calculated at each control period in accordance with the aforementioned algorithm. The PID block in an EJX performs the velocity type output action for the control output.

A5.5.1 Velocity Type Output Action

The PID block determines the value of the new control output OUT by adding the change in control output calculated in the current control period, ΔMVn, to the current read-back value of the MV, MV_{RB} (BKCAL_IN).

This action can be expressed as:

ΔMVn' = ΔMVn * (OUT_SCALE. EU100 – OUT_SCALE. EU_0) / (PV_SCALE. EU_100 – PV_SCALE. EU_0)

(Direct Acting is False in CONTROL_OPTS)
OUT = BKCAL_IN – ΔMVn'
(Direct Acting is True in CONTROL_OPTS)
OUT = BKCAL_IN + ΔMVn'

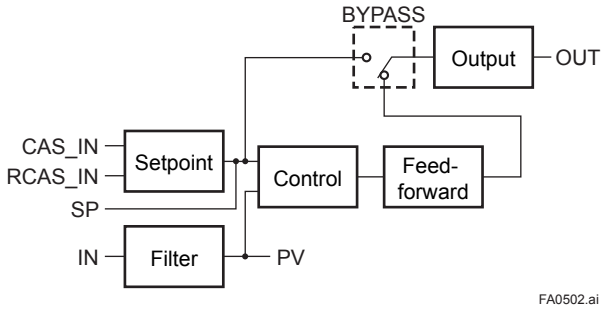
A5.6 Direction of Control Action

The direction of the control action is determined by the Direct Acting setting in CONTROL_OPTS.

Value of Direct Acting	Resulting Action
True	The output increases when the input PV is greater than the setpoint SP.
False	The output decreases when the input PV is greater than the setpoint SP.

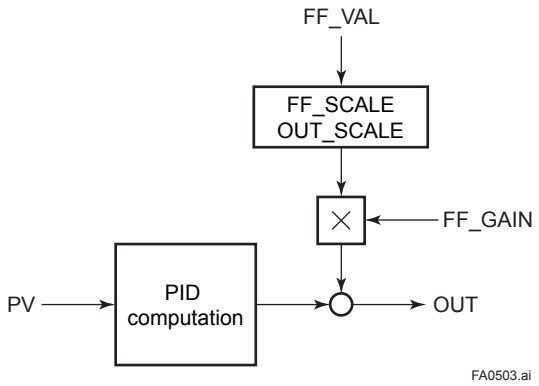
A5.7 Control Action Bypass

The PID control computation can be bypassed so as to set the SP value in the control output OUT as shown below. Setting BYPASS to “On” bypasses the PID control computation.



A5.8 Feed-forward

Feed-forward is an action to add a compensation output signal FF_VAL to the output of the PID control computation, and is typically used for feed-forward control. The figure below illustrates the action.



A5.9 Block Modes

The block mode is set in the parameter MODE-BLK.

MODE_ BLK	Target	Stipulates the target mode to which the PID block transfers.
	Actual	Indicates the current mode of the PID block.
	Permitted	Stipulates all the modes that the PID block can enter. The PID block is prohibited to enter any mode other than those set in this element.
	Normal	Stipulates the mode in which the PID block normally resides.

There are eight modes for a PID block as shown below.

Block Mode	Description
ROut	Remote output mode, in which the PID block outputs the value set in ROUT_IN.
RCas	Remote cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set via the remote cascade connection, such as from a computer, and outputs the computed result.
Cas	Cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set from another fieldbus function block, and outputs the computed result.
Auto	The PID block carries out automatic control and outputs the result computed by the PID control computation.
Man	Manual mode, in which the PID block outputs the value set by the user manually.
LO	The PID block outputs the value set in TRK_ VAL.
IMan	Initialization and manual mode, in which the control action is suspended. The PID block enters this mode when the specified condition is met (see Section A5.14).
O/S	Out of service mode, in which neither the control computation nor action is carried out, and the output is kept at the value that was output before the PID block entered into O/S mode.

A5.9.1 Mode Transitions

Transition Destination Mode	Condition	NOT Conditions
O/S	1. If O/S is set in **MODE_ BLK.target** (or if O/S is set in **target** inside the resource block).	
IMan	2. If the specified condition is met (see Section A5.14).	**NOT** if condition 1 is met.
LO	3. If Track Enable is specified in **CONTROL_OPTS** and the value of **TRK_IN_D** is true.	**NOT** if either or both of conditions 1 and 2 are met.
Man	4. If Man is set in **MODE_ BLK.target** or if **IN.status** (input status) is Bad.	**NOT** if any one or more of conditions 1 to 3 are met.
Auto*	5. If Auto is set in **MODE_ BLK.target** **- AND -** if **IN.status** (input status) is not Bad.	**NOT** if any one or more of conditions 1 to 3 are met.
Cas* **	6. If Cas is set in **MODE_ BLK.target** **- AND -** if neither **IN.status** (input status) nor **CAS_IN.status** is Bad.	**NOT** if any one or more of conditions 1 to 3 are met.

Transition Destination Mode	Condition	NOT Conditions
RCas* **	7. If RCas is set in **MODE_BLK.target** **- AND -** if neither **IN.status** (input status) nor **RCAS_IN.status** is Bad.	**NOT** if any one or more of conditions 1 to 3 are met.
ROut* **	8. If ROut is set in **MODE_BLK.target** **- AND -** if **ROUT_IN.status** (input status) is not Bad.	**NOT** if any one or more of conditions 1 to 3 are met.
In accordance with the **SHED_OPT** setting	9. If **RCAS_IN.status** or **ROUT_IN.status** is Bad (indicating a computer failure; see Section A5.17.1 for details).	

* To activate mode transitions to Auto, Cas, RCas, and ROut, the respective target modes must be set beforehand to MODE_BLK.permitted.

** A transition to Cas, RCas, or ROut requires that initialization of the cascade connection has been completed.

A5.10 Bumpless Transfer

Prevents a sudden change in the control output OUT at changes in block mode (MODE_BLK) and at switching of the connection from the control output OUT to the cascaded secondary function block. The action to perform a bumpless transfer differs depending on the MODE_BLK values.

A5.11 Setpoint Limiters

Active setpoint limiters that limit the changes in the SP value, differ depending on the block mode as follows.

A5.11.1 When PID Block Is in Auto Mode

When the value of MODE_BLK is Auto, the four types of limiters are in force: high limit, low limit, rate-of-increase limit, and rate-of-decrease limit.

Setpoint High/Low Limits

- A value larger than the value of SP_HI_LIM cannot be set for SP.
- A value smaller than the value of SP_LO_LIM cannot be set for SP.

Setpoint Rate Limits

The setpoint rate limits are used to restrict the magnitude of changes in the SP value so as to change the SP value gradually towards a new setpoint.

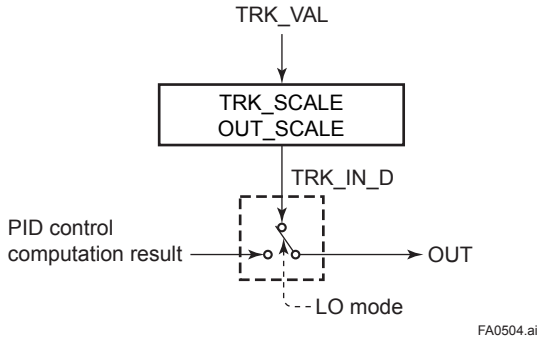
- An increase of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_UP.
- A decrease of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_DOWN.

A5.11.2 When PID Block Is in Cas or RCas Mode

By selecting Obey SP Limits if Cas or RCas in CONTROL_OPTS (see Section A5.13), the setpoint high/low limits can be put into force also when the value of MODE_BLK is Cas or RCas.

A5.12 External-output Tracking

External tracking is an action of outputting the value of the remote output TRK_VAL set from outside the PID block, as illustrated in the figure below. External tracking is performed when the block mode is LO.



To change the block mode to LO:

(1) Select Track Enable in CONTROL_OPTS.
(2) Set TRK_IN_D to true.

However, to change the block mode from Man to LO, Track in Manual must also be specified in CONTROL_OPTS.

A5.13 Measured-value Tracking

Measured-value tracking, also referred to as SP-PV tracking, is an action to equalize the setpoint SP to the measured value PV when the block mode (MODE_BLK.actual) is Man in order to prevent a sudden change in control output from being caused by a mode change to Auto.

While a cascade primary control block is performing the automatic or cascade control (in the Auto or Cas mode), when the mode of its secondary control block is changed from Cas to Auto, the cascade connection is opened and the control action of the primary block stops. The SP of the secondary controller can be equalized to its cascade input signal CAS_IN also in this case.

The settings for measured-value tracking are made in the parameter CONTROL_OPTS, as shown in the table below.

Options in CONTROL_OPTS	Description
Bypass Enable	This parameter allows BYPASS to be set.
SP-PV Track in Man	Equalizes SP to PV when **MODE_BLK.target** is set to Man.
SP-PV Track in ROut	Equalizes SP to PV when **MODE_BLK.target** is set to ROut.
SP-PV Track in LO or IMan	Equalizes SP to PV when actual is set to LO or IMAN.
SP-PV Track retained Target	Equalizes SP to RCAS_IN when **MODE_BLK.target** is set to RCas, and to CAS_IN when **MODE_BLK.target** is set to Cas when the actual mode of the block is IMan, LO, Man or ROut.
Direct Acting	Set the PID block to a direct acting controller.
Track Enable	This enables the external tracking function. The value in TRK_VAL will replace the value of OUT if TRK_IN_D becomes true and the target mode is not Man.
Track in Manual	This enables TRK_VAL to replace the value of OUT when the target mode is Man and TRK_IN_D is true. The actual mode will then be LO.
Use PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT, instead of the value of SP.
Obey SP limits if Cas or RCas	Puts the setpoint high/low limits in force in the Cas or RCas mode.
No OUT limits in Manual	Disables the high/low limits for OUT in the Man mode.

A5.14 Initialization and Manual Fallback (IMan)

Initialization and manual fallback denotes a set of actions in which a PID block changes mode to IMan (initialization and manual) and suspends the control action. Initialization and manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- The quality component of BKCAL_IN.status is Bad.
  - OR -
- The quality component of BKCAL_IN.status is Good (c)
  - AND -
  The sub-status component of BKCAL_IN.status is FSA, LO, NI, or IR.

The user cannot manually change the mode to IMan. A mode transition to IMan occurs only when the condition above is met.

A5.15 Manual Fallback

Manual fallback denotes an action in which a PID block changes mode to Man and suspends the control action. Manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- IN.status is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met, Target to Manual if BAD IN must be specified beforehand in STATUS_OPTS.

The table below shows the options in STATUS_OPTS.

Options in STATUS_OPTS	Description
IFS if BAD IN	Sets the sub-status component of **OUT.status** to IFS if **IN.status** is Bad except when PID control bypass is on.
IFS if BAD CAS IN	Sets the sub-status component of **OUT.status** to IFS if **CAS_IN.status** is Bad.
Use Uncertain as Good	Does not regard **IN** as being in Bad status when **IN.status** is Uncertain (to prevent mode transitions from being affected when it is Uncertain).
Target to Manual if BAD IN	Automatically changes the value of **MODE_BLK.target** to MAN when **IN** falls into Bad status.
Target to next permitted mode if BAD CAS IN	Automatically changes the value of **MODE_BLK.target** to Auto (or to Man if Auto is not set in Permitted) when **CAS_IN** falls into Bad status.

A5.16 Auto Fallback

Auto fallback denotes an action in which a PID block changes mode from Cas to Auto and continues automatic PID control with the user-set setpoint. Auto fallback takes place automatically when the following condition is met:

- IN.status (data status of IN) is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met:

- Target to next permitted mode if BAD CAS IN must be previously specified in STATUS_OPTS.
  - AND -
- Auto must be previously set in MODE_BLK.permitted.

A5.17 Mode Shedding upon Computer Failure

When the data status of RCAS_IN or ROUT_IN, which is the setting received from a computer as the setpoint SP, falls to Bad while the PID block is running in the RCas or ROut mode, the mode shedding occurs in accordance with the settings in SHED_OPT.
If the RCAS_IN data is not renewed within the time specified by SHED_RCAS in resource block, the data status of RCAS_IN falls to Bad.

A5.17.1 SHED_OPT

The SHED_OPT setting stipulates the specifications of mode shedding as shown below. Only one can be set.

Available Setting for SHED_OPT	Actions upon Computer Failure
Normal shed, normal return	Sets **MODE_BLK.actual** to Cas*1, and leaves **MODE_BLK.target** unchanged.
Normal shed, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Cas*1.
Shed to Auto, normal return	Sets **MODE_BLK.actual** to Auto*2, and leaves **MODE_BLK.target** unchanged.
Shed to Auto, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Auto*2.
Shed to Manual, normal return	Sets **MODE_BLK.actual** to Man, and leaves **MODE_BLK.target** unchanged.
Shed to Manual, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Man.
Shed to retained target, normal return	If Cas is in **MODE_BLK.target**, sets **MODE_BLK.actual** to Cas*1, and leaves **MODE_BLK.target** unchanged. If Cas is not set in **MODE_BLK.target**, sets **MODE_BLK.actual** to Auto*2, and leaves **MODE_BLK.target** unchanged.
Shed to retained target, no return	If Cas is set in **MODE_BLK.target**, sets both **MODE_BLK.actual** and **MODE_BLK.target** to Cas*1. If Cas is not set in **MODE_BLK.target**, sets **MODE_BLK.actual** to Auto*2, and **MODE_BLK.target** to Cas.

*1 The modes to which a PID block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below. In fact, if Normal shed, normal return is set for SHED_OPT, detection of a computer failure causes MODE_BLK.actual to change to Cas, Auto, or MAN, whichever is set in MODE_BLK.permitted and has the lowest priority level.

FA0505.ai

*2 Only when Auto is set as permitted mode.

NOTE: If a control block is connected as a cascade primary block of the PID block in question, a mode transition of the PID block to Cas occurs in the following sequence due to initialization of the cascade connection: RCas or ROut → Auto → Cas.

A5.18 Alarms

There are two kinds of alarms generated by a PID block: block and process alarms.

A5.18.1 Block Alarm (BLOCK_ALM)

The block alarm BLOCK_ALM is generated upon occurrence of either of the following errors (values set in BLOCK_ERR) and notifies the content of BLOCK_ERR.

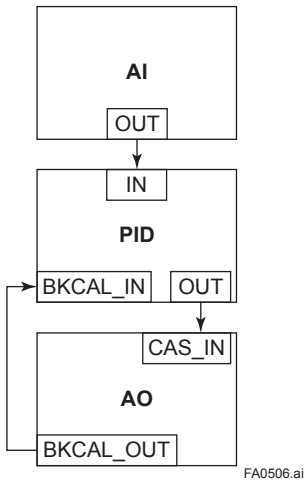
Value of BLOCK_ERR	Condition
Local Override	**MODE_BLK** actual of PID block is LO.
Input Failure	The status of PV is Bad. (The status of IN is Bad, or the status of IN is Uncertain and “Use Uncertain as Good” is false in STATUS_OPTS.)
Out of Service	**MODE_BLK.target** of the PID block is O/S.

A5.18.2 Process Alarms

There are six types of process alarms. Only one process alarm can be generated at the same time, and the process alarm having the highest priority level from among those occurring at the same time is generated. The priority level is set for each process alarm type.

Process Alarm	Cause of Occurrence	Parameter Containing Priority Level Setting
HI_HI_ALM	Occurs when the PV increases above the HI_HI_LIM value.	HI_HI_PRI
HI_ALM	Occurs when the PV increases above HI_LIM value.	HI_PRI
LO_ALM	Occurs when the PV decreases below the LO_LIM value.	LO_PRI
LO_LO_ ALM	Occurs when the PV decreases below the LO_LO_LIM value.	LO_LO_LIM
DV_HI_ALM	Occurs when the value of [PV - SP] increases above the DV_HI_LIM value.	DV_HI_PRI
DV_LO_ ALM	Occurs when the value of [PV - SP] decreases below the DV_LO_LIM value.	DV_LO_PRI

A5.19 Example of Block Connections



When configuring a simple PID control loop by combining an EJX transmitter with a fieldbus valve positioner that contains an AO block, follow the procedure below to make the settings of the corresponding fieldbus function blocks:

1. Connect the AI block and PID block of the EJX, and the AO block of the valve positioner as shown above.
2. Set MODE_BLK.target of the PID block to O/S, and then set GAIN, RESET, and RATE to appropriate values.
3. Check that the value of MODE_BLK.actual of the AI block is Auto.
4. Set MODE_BLK.target of the AO block to CAS|AUTO (meaning "Cas and Auto").
5. Check that the value of BKCAL_IN.status of the PID block is not Bad.
6. Check that the value of IN.status of the PID block is not Bad.
7. Check that Auto is set in MODE_BLK.permitted of the PID block.
8. Set MODE_BLK.target of the PID block to Auto.

When finishing all steps in order, the PID block and AO block exchange the respective information and initialize the cascade connection. Consequently, the value of MODE_BLK.actual of the PID block changes to Auto and automatic PID control starts.

A5.20 View Object for PID Function Block

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4
21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				
63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
	Totals	43	43	83	104

Appendix 6. Link Master Functions

A6.1 Link Active Scheduler

A link active scheduler (LAS) is a deterministic, centralized bus scheduler that can control communications on an H1 fieldbus segment. There is only one LAS on an H1 fieldbus segment.

The transmitter supports the following LAS functions.

- PN transmission: Identifies a fieldbus device newly connected to the same fieldbus segment. PN is short for Probe Node.
- PT transmission: Passes a token governing the right to transmit, to a fieldbus device on the same segment. PT is short for Pass Token.
- CD transmission: Carry out a scheduled transmission to a fieldbus device on the same segment. CD is short for Compel Data.
- Time synchronization: Periodically transmits the time data to all fieldbus devices on the segment and returns the time data in response to a request from a device.
- Live list equalization: Sends the live list data to link masters on the same segment.
- LAS transfer: Transfers the right to be the LAS on the segment to another link master.

A6.2 Link Master

A link master (LM) is any device containing a link active scheduler. There must be at least one LM on a segment. When the LAS on a segment has failed, another LM on the same segment starts working as the LAS.

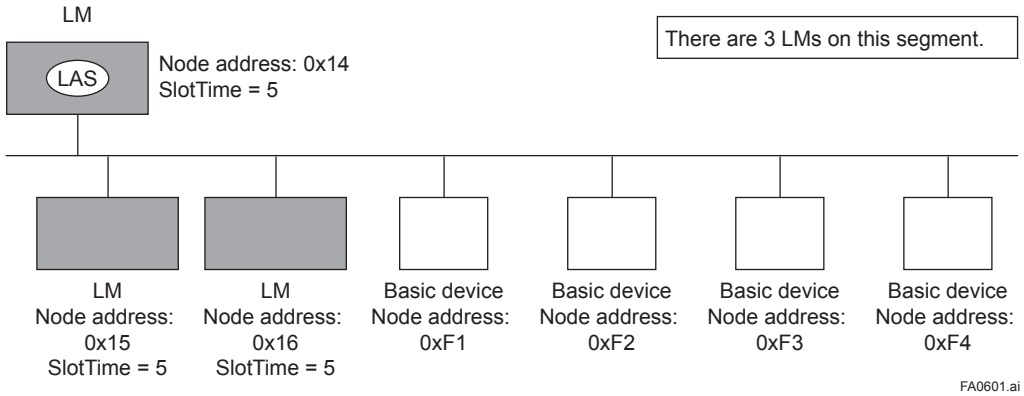


Figure A6.1 Example of Fieldbus configuration-3 LMs on Same Segment

A6.3 Transfer of LAS

There are two procedures for an LM to become the LAS:

- If the LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, judges that there is no LAS on the segment, in such a case as when the segment has started up or when the current LAS has failed, the LM declares itself as the LAS, then becomes the LAS. (With this procedure, an LM backs up the LAS as shown in the following figure.)
- The LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, requests the LAS on the same segment to transfer the right of being the LAS, then becomes the LAS.

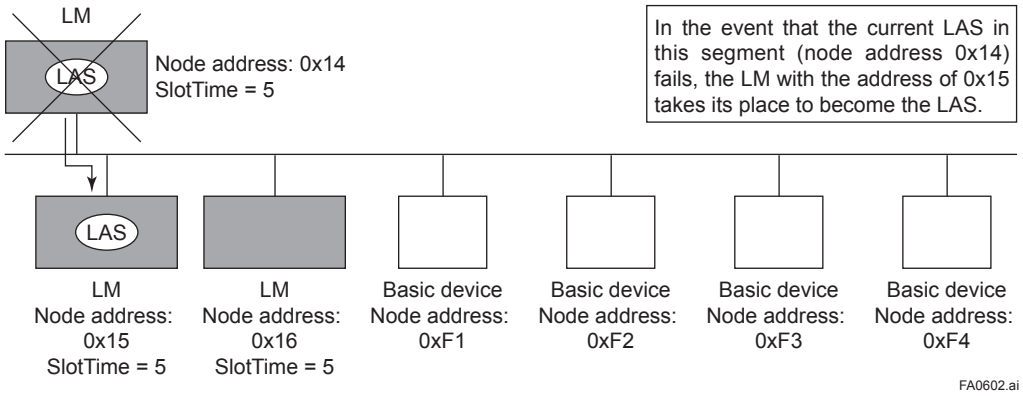


Figure A6.2 Backup of LAS

To set up the transmitter as a device that is capable of backing up the LAS, follow the procedure below.

NOTE: When changing the settings in the transmitter, add the transmitter to the segment in which an LAS is running. After making changes to the settings, do not turn off the power to the transmitter for at least 30 seconds.

(1) Set the node address of the transmitter. In general, use an address from 0x10 to [V(FUN) - 1].

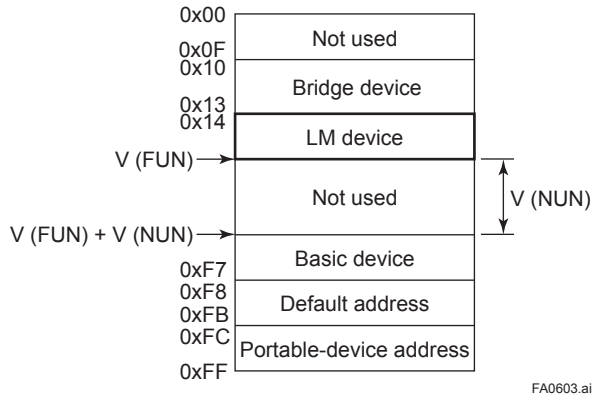


Figure A6.3 Node Address Ranges

(2) In the LAS settings of the transmitter, set the values of V(ST), V(MRD), and V(MID) to the same as the respective lowest capability values in all the devices within the segment. An example is shown below.

DlmeBasicInfo (Index 374 (SM))

Subindex	Element	EJX	Device 1	Device 2	Device 3	Description
1	SlotTime	4	8	10	20	Capability value for V(ST)
3	MaxResponseDelay	3	6	3	5	Capability value for V(MRD)
6	MinInterPduDelay	4	8	12	10	Capability value for V(MID)

In this case, set SlotTime, MaxResponseTime, and MinInterPduDelay as follows:

ConfiguredLinkSettingsRecord (Index 385 (SM))

Subindex	Element	Setting (Default)	Description
1	SlotTime	20 (4095)	V (ST)
3	MaxResponseDelay	6 (5)	V (MRD)
6	MinInterPduDelay	12 (12)	V (MID)

(3) In the LAS settings of the transmitter, set the values of V(FUN) and V(NUN) so that they include the node addresses of all nodes within the same segment. (See also Figure A6.3.)

ConfiguredLinkSettingsRecord (Index 385 (SM))

Subindex	Element	Default Value	Description
4	FirstUnpolledNodeId	0x25	V (FUN)
7	NumConsecUnpolledNodeId	0xBA	V (NUN)

A6.4 LM Functions

No.	Function	Description
1	LM initialization	When a fieldbus segment starts, the LM with the smallest [V(ST) × V(TN)] value within the segment becomes the LAS. At all times, each LM is checking whether or not a carrier is on the segment.
2	Startup of other nodes (PN and Node Activation SPDU transmissions)	Transmits a PN (Probe Node) message, and Node Activation SPDU message to devices which return a new PR (Probe Response) message.
3	PT transmission (including final bit monitoring)	Passes a PT (Pass Token) message to devices included in the live list sequentially, and monitors the RT (Return Token) and final bit returned in reply to the PT.
4	CD transmission	Transmits a CD (Compel Data) message at the scheduled times.
5	Time synchronization	Supports periodic TD (Time Distribution) transmissions and transmissions of a reply to a CT (Compel Time).
6	Domain download server	Sets the schedule data. The schedule data can be equalized only when the Domain Download command is carried out from outside the LM in question. (The version of the schedule is usually monitored, but no action takes place, even when it changes.)
7	Live list equalization	Transmits SPDU messages to LMs to equalize live lists.
8	LAS transfer	Transfers the right of being the LAS to another LM.
9	Reading/writing of NMIB for LM	See Section A6.5.
10	Round Trip Delay Reply (RR) Reply to DLPDU	Not yet supported in the current version.
11	Long address	Not yet supported in the current version.

A6.5 LM Parameters

A6.5.1 LM Parameter List

The tables below show LM parameters.

Meanings of Access column entries: RW = read/write possible; R = read only

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
283	PLME_BASIC_ CHARACTERISTICS	0		R	
		1 ChannelStatisticsSupported	0x00		
		2 MediumAndDataRatesSupported	0x4900000000000000		
		3 IecVersion	1 (0x1)		
		4 NumOfChannels	1 (0x1)		
		5 PowerMode	0 (0x0)		
284	CHANNEL_STATES	0		R	
		1 channel-1	0 (0x0)		
		2 channel-2	128 (0x80)		
		3 channel-3	128 (0x80)		
		4 channel-4	128 (0x80)		
		5 channel-5	128 (0x80)		
		6 channel-6	128 (0x80)		
		7 channel-7	128 (0x80)		
		8 channel-8	128 (0x80)		
285	PLME_BASIC_INFO	0		R	
		1 InterfaceMode	0 (0x0)		
		2 LoopBackMode	0 (0x0)		
		3 XmitEnabled	1 (0x1)		
		4 RcvEnabled	1 (0x1)		
		5 PreferredReceiveChannel	1 (0x1)		
		6 MediaTypeSelected	73 (0x49)		
		7 ReceiveSelect	1 (0x1)		
286	DLME_LINK_MASTER_CAPABILITIES_VARIABLE		0x04	RW	
287	DLME_LINK_ MASTER_INFO_ RECORD	0		RW	
		1 MaxSchedulingOverhead	0		
		2 DefMinTokenDelegTime	100		
		3 DefTokenHoldTime	300		
		4 TargetTokenRotTime	4096		
		5 LinkMaintTokHoldTime	400		
		6 TimeDistributionPeriod	5000		
		7 MaximumInactivityToClaimLasDelay	2		
		8 LasDatabaseStatusSpduDistributionPeriod	6000		
288	PRIMARY_LINK_MASTER_FLAG_VARIABLE		0	RW	LAS: True = 0xFF; non-LAS: False = 0x00
289	LIVE_LIST_STATUS_ARRAY_VARIABLE		0	R	
290	MAX_TOKEN_ HOLD_TIME_ ARRAY	0		RW	
		1 Element1	0x0000(x16), 0x012C(x16)		
		2 Element2	0x012C(x5), 0x0000(x27)		
		3 Element3	0x0000(x32)		
		4 Element4	0x0000(x32)		
		5 Element5	0x0000(x32)		
		6 Element6	0x0000(x32)		
		7 Element7	0x0000(x31), 0x012C(x1)		
		8 Element8	0x012C(x32)		
291	BOOT_OPERAT_FUNCTIONAL_CLASS		Specified at the time of order	RW	0x01 (basic device); 0x02 (LM)

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
292	CURRENT_LINK_ SETTING_RECORD	0		R	Settings for LAS
		1 SlotTime	0		
		2 PerDlpduPhlOverhead	0		
		3 MaxResponseDelay	0		
		4 FirstUnpolledNodeId	0		
		5 ThisLink	0		
		6 MinInterPduDelay	0		
		7 NumConseeUnpolledNodeId	0		
		8 PreambleExtension	0		
		9 PostTransGapExtension	0		
		10 MaxInterChanSignalSkew	0		
		11 TimeSyncClass	0		
293	CONFIGURED_ LINK_SETTING_ RECORD	0		RW	
		1 SlotTime	4095		
		2 PerDlpduPhlOverhead	4		
		3 MaxResponseDelay	5		
		4 FirstUnpolledNodeId	37		
		5 ThisLink	0		
		6 MinInterPduDelay	12		
		7 NumConseeUnpolledNodeId	186		
		8 PreambleExtension	2		
		9 PostTransGapExtension	1		
		10 MaxInterChanSignalSkew	0		
		11 TimeSyncClass	4		
294	LINK_SCHEDULE_ACTIVATION_VARIABLE		0 (0x0)	RW	
295	LINK_ SCHEDULE_LIST_ CHARACTERISTICS_ RECORD	0		R	
		1 NumOfSchedules	2		
		2 NumOfSubSchedulesPerSchedule	5		
		3 ActiveScheduleVersion	0		
		4 ActiveSheduleOdIndex	0		
		5 ActiveScheduleStartingTime	0		
296	DLME_SCHEDULE_ DESCRIPTOR.1	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
297	DLME_SCHEDULE_ DESCRIPTOR.2	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
298	DOMAIN.1				Read/write impossible. Get-OD possible.
299	DOMAIN.2				Read/write impossible. Get-OD possible.

A6.5.2 Descriptions for LM Parameters

The following describes LM parameters of the transmitter.

NOTE: Do not turn off the power to the transmitter for 60 seconds after making a change to its parameter settings.

(1) DlmeLinkMasterCapabilitiesVariable

Bit Position	Meaning	Description	Value
B3: 0x04	LAS Schedule in Non-volatile Memory	Whether the LAS schedule can (=1) or cannot (=0) be saved to the non-volatile memory	1
B2: 0x02	Last Values Record Supported	Whether to support (=1) or not to support (=0) LastValuesRecord.	0
B1: 0x01	Link Master Statistics Record Supported	Whether to support (=1) or not to support (=0) DlmeLinkMasterStatisticsRecord.	0

(2) DlmeLinkMasterInfoRecord

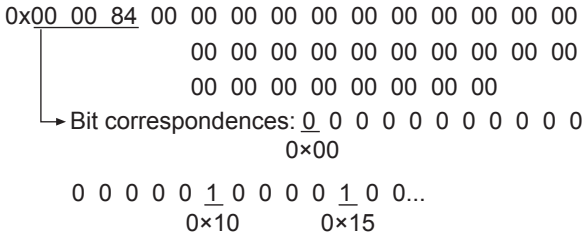
Sub-index	Element	Size [bytes]	Descrip-tion
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod	2	V(LDDP)

(3) PrimaryLinkMasterFlagVariable

Explicitly declares the LAS. Writing “true” (0xFF) to this parameter in a device causes that device to attempt to become the LAS. However, a request of writing “true” to this parameter in a device is rejected if the value of the same parameter in any other device that has a smaller node address within the same segment is true.

(4) LiveListStatusArrayVariable

A 32-byte variable, in which each bit represents the status of whether a device on the same segment is live or not. The leading bit corresponds to the device address 0x00, and final bit to 0xFF. The value of LiveListStatusArrayVariable in the case where devices having the addresses 0x10 and 0x15 in the fieldbus segment is shown below.



(5) MaxTokenHoldTimeArray

An 8 (64 byte array variable, in which each set of 2 bytes represents the delegation time (set as an octet time) assigned to a device. The delegation time denotes a time period that is given to a device by means of a PT message sent from the LAS within each token circulation cycle.

The leading 2 bytes correspond to the device address 0x00, and the final 2 bytes to the device address 0xFF. Specify the subindex to access this parameter.

(6) BootOperatFunctionalClass

Writing 1 to this parameter in a device and restarting the device causes the device to start as a basic device. On the contrary, writing 2 to this parameter and restarting the device causes the device to start as an LM.

(7) CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord

CurrentLinkSettingRecord indicates the bus parameter settings currently used. ConfiguredLinkSettingsRecord indicates the bus parameter settings to be used when the device becomes the LAS. Thus, when a device is the LAS, its CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord have the same values.

Sub-index	Element	Size [bytes]	Descrip-tion
1	SlotTime	2	V(ST)
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	V(MRD)
4	FirstUnpolledNodeId	1	V(FUN)
5	ThisLink	2	V(TL)
6	MinInterPduDelay	1	V(MID)
7	NumConsecUnpolledNodeId	1	V(NUN)
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)
11	TimeSyncClass	1	V(TSC)

(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	Indicates the capability value for V(MRD) of the device.
4	ThisNode	1	V(TN), node address
5	ThisLink	2	V(TL), link-id
6	MinInterPduDelay	1	Indicates the capability value for V(MID) of the device.
7	TimeSyncClass	1	Indicates the capability value for V(TSC) of the device.
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)

(9) PlmeBasicCharacteristics

Sub-index	Element	Size [bytes]	Value	Description
1	Channel Statistics Supported	1	0	Statistics data are not supported.
2	Medium AndData Rates Supported	8	0x49 00 00 00 00 00 00 00	Wire medium, voltage mode, and 31.25 kbps are supported.
3	IceVersion	2	1	IEC Physical Layer Entity Version
4	NumOf Channels	1	1	
5	Power Mode	1	0	0: Bus-powered; 1: Self-powered

(10) ChannelStates

Sub-index	Element	Size [bytes]	Value	Description
1	Channel 1	1	0x00	In Use, No Bad since last read, No Silent since last read, No Jabber since last read, Tx Good, Rx Good
2	Channel 2	1	0x80	Unused
3	Channel 3	1	0x80	Unused
4	Channel 4	1	0x80	Unused
5	Channel 5	1	0x80	Unused
6	Channel 6	1	0x80	Unused
7	Channel 7	1	0x80	Unused
8	Channel 8	1	0x80	Unused

(11) PlmeBasicInfo

Sub-index	Element	Size [bytes]	Value	Description
1	InterfaceMode	1	0	0: Half duplex; 1: Full duplex
2	LoopBackMode	1	0	0: Disabled; 1: MAU; 2: MDS
3	XmitEnabled	1	0x01	Channel 1 is enabled.
4	RcvEnebled	1	0x01	Channel 1 is enabled.
5	PreferredReceive Channel	1	0x01	Channel 1 is used for reception.
6	MediaType Selected	1	0x49	Wire medium, voltage mode, and 31.25 kbps are selected.
7	ReceiveSelect	1	0x01	Channel 1 is used for reception.

(12) LinkScheduleActivationVariable

Writing the version number of an LAS schedule, which has already been downloaded to the domain, to this parameter causes the corresponding schedule to be executed. On the other hand, writing 0 to this parameter stops execution of the active schedule.

(13) LinkScheduleListCharacteristicsRecord

Sub-index	Element	Size [bytes]	Description
1	NumOf Schedules	1	Indicates the total number of LAS schedules that have been downloaded to the domain.
2	NumOfSub SchedulesPer Schedule	1	Indicates the maximum number of sub-schedules an LAS schedule can contain.
3	ActiveSchedule Version	2	Indicates the version number of the schedule currently executed.
4	ActiveSchedule OdIndex	2	Indicates the index number of the domain that stores the schedule currently executed.
5	ActiveSchedule StaringTime	6	Indicates the time when the current schedule began being executed.

(14) DlmeScheduleDescriptor

This parameter exists for the same number as the total number of domains, and each describes the LAS schedule downloaded to the corresponding domain. For the domain to which a schedule has not yet been downloaded, the values in this parameter are all zeros.

Sub-index	Element	Size [bytes]	Description
1	Version	2	Indicates the version number of the LAS schedule downloaded to the corresponding domain.
2	Macrocycle Duration	4	Indicates the macro cycle of the LAS schedule downloaded to the corresponding domain.
3	TimeResolution	2	Indicates the time resolution that is required to execute the LAS schedule downloaded to the corresponding domain.

(15) Domain

Read/write: impossible; get-OD: possible

Carrying out the GenericDomainDownload command from a host writes an LAS schedule to Domain.

CAUTION

When downloading a LAS schedule to transmitter, maximum allowable linkages between devices are 25.

A6.6 FAQs

Q1. When the LAS stops, the transmitter does not back it up by becoming the LAS. Why?

A1-1. Is that transmitter running as an LM? Check that the value of BootOperatFunctionalClass (index 383) is 2 (indicating that it is an LM).

A1-2. Check the values of V(ST) and V(TN) in all LMs on the segment and confirm that the following condition is met:

Transmitter V(ST)×V(TN) < Other LMs V(ST)×V(TN)

Q2. How can I make the transmitter become the LAS?

A2-1. Check that the version numbers of the active schedules in the current LAS and the transmitter are the same by reading:

LinkScheduleListCharacteristicsRecord (index 295 for the transmitter)

- ActiveScheduleVersion (subindex 3)

A2-2. Make the transmitter declare itself as and become the LAS by writing:
- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and
- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 288) in the transmitter.

Q3. On a segment where the transmitter works as the LAS, another device cannot be connected. How come?

A3-1. Check the following bus parameters that indicate the bus parameter as being the LAS for the transmitter and the capabilities of being the LAS for the device that cannot be connected:
- V(ST), V(MID), V(MRD) of the transmitter: ConfiguredLinkSettingsRecord (index 385)
- V(ST), V(MID), V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

Transmitter		Problematic Device
V(ST)	>	V(ST)
V(MID)	>	V(MID)
V(MRD)	>	V(MRD)

A3-2. Check the node address of the problematic device is not included in the V(FUN)+V(NUN) of the transmitter.

Q4. Communication with the LAS and the transmitter does not start.

The LAS does not exist or is not identified in the fieldbus network, or the transmitter is not able to establish communication with the LAS.

A4-1. Check that the LAS is connected on the network. When using the transmitter as the LAS, follow the steps described in section A6.3.

A4-2. Adjust the parameters of the LAS to that of the transmitter. Refer to section 5.2 for details.

LAS		Transmitter
V(ST)	>	V(ST) 4 or above
V(MID)	>	V(MID) 4 or above
V(MRD)	>	V(MRD) 12 or above

A4-3. Check that the correct Node Address is used for the transmitter. Refer to section 5.2 for details.
Confirm that the Node Address of transmitter should be out of the parameters of the LAS of V (FUN) ~ V (FUN)+V (NUN)
Confirm that the Node Address is not within the default address (0xF8 to 0xFB).

Appendix 7. Software Download

A7.1 Benefits of Software Download

This function enables you to download software to field devices via a FOUNDATION Fieldbus to update their software. Typical uses are to add new features such as function blocks and diagnostics to existing devices, and to optimize existing field devices for your plant.

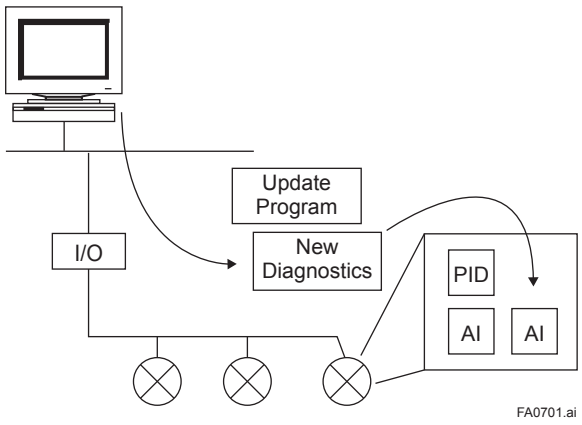


Figure A7.1 Concept of Software Downloading

A7.2 Specifications

Steady-state current: Max. 15 mA

Current Draw (Steady-state): 15mA (max)

Current Draw (Software Download state):
24mA (max)

Current during FlashROM blanking time:
Max. 24 mA additional to steady-state current

Based on Fieldbus Foundation Specification
Download class: Class 1

NOTE

Class 1 devices can continue the specified measurement and/or control actions even while software is being downloaded to them. Upon completion of a download, however, the devices will be reset internally to make the new, downloaded software take effect, and this will halt fieldbus communication and function block executions for about one minute.

A7.3 Preparations for Software Downloading

For software downloading, you need to prepare the following:

- Software download tool
- Software for downloading file for each of the target field devices

For the software download tool, use only a program developped for that purpose. For details, see the software's User's Manual. For information about updates of software binary files for field devices and how to obtain them, visit the following web site.

http://www.yokogawa.com/fld/fld-top-en.htm

CAUTION

Do not hook up the software download tool to a fieldbus segment while the plant is in operation, as it may temporarily disturb the communication. Always connect the tool before starting operation.

NOTE

The download tool can not execute downloading during other system connects to the system/ network management VFD of the device.

A7.4 Software Download Sequence

The flowchart below outlines the software download procedure. Although the time taken for the entire procedure varies depending on the size of the field bus device's software, it generally take about 20 minutes where there is a one-to-one connection between a fieldbus device and download tool, and longer when multiple field devices are connected to the fieldbus.

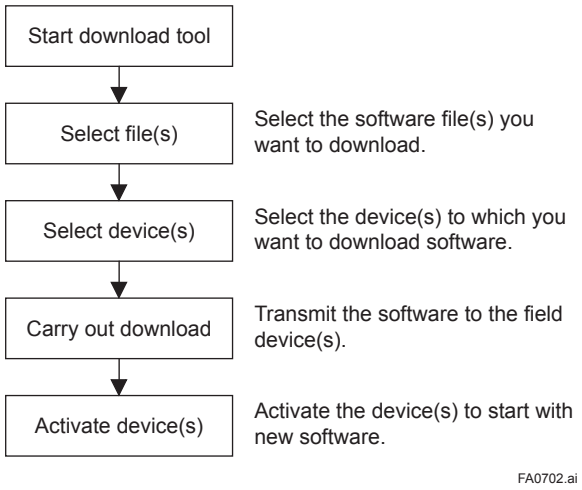


Figure A7.2 Flow of Software Download Procedure

CAUTION

Carrying out a software download leaves the PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device, but may reset other parameters to the defaults (except a minor update that does not change the number of parameters). Hence, where necessary, save the parameters using an engineering tool, parameter setting utility, or the like before carrying out a software download, and then reconfigure the field device(s) after the download. For details, see Section A7.6.

CAUTION

The current dissipation of the target field device increases transitorily immediately after a download due to erasing of the FlashROM's contents. Use a fieldbus power supply which has sufficient capacity to cover such increases in feed current.

CAUTION

Upon completion of the activation, the target fieldbus device performs resetting internally, which temporarily halts fieldbus communication and function block executions. Be especially careful about a valve positioner; the output air pressure will fall to the minimum level (i.e., zero).

CAUTION

Do not turn off the power to a field device or disconnect the download tool during a download or activation. The device may fail as a result.

NOTE

Be careful about the noise on the fieldbus link. If the fieldbus is noisy, the downloading may take a very long time or fail.

A7.5 Download Files

Download files have the following filenames (with the filename extension of ".ffd"). Take care to choose the correct download file for the target field device:

"594543" + device family + "_" + device type + "_" + domain name + "_" + software name + "_" + software revision + ".ffd"

For example, the name of the download file for an YTA may have the following name:

594543000C_0012_YTA_ORIGINAL_R101.ffd

Refer to A7.11(3) DOMAIN_HEADER about each keyword of the file name.

The device type is "0012" for an YTA710 temperature transmitter.

The software name is "ORIGINAL" or "UPDATE." The former indicates an original file and the latter an update file. Whenever performing a download to update the device revision, obtain the original file. In general, an addition to the parameters or blocks requires a device revision update.

A7.6 Steps after Activating a Field Device

When the communication with a field device has recovered after activating the device, check using the download tool that the software revision of the field device has been updated accordingly. The value of SOFT_REV of the resource block indicates the software revision.

The PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device will remain unchanged after a software download. However, after a software update which causes an addition to the block parameters or blocks, or to the system/network management VFD parameters, some parameters may be reset to the defaults, thus requiring parameter setup and engineering again. For details, see the table below.

Also note that a change in the number of parameters or blocks requires the DD and capabilities files corresponding to the new software revision.

Table A7.1 Actions after Software Update

Contents of Software Update	Action
Does not change the number of parameters.	Re-setup of parameters not needed.
Adds a block parameter.	Setup of the added parameter needed.
Adds a block.	Reengineering and setup of the added block's parameters needed.
Changes the number of system/network management VFD parameters.	Reengineering needed.

A7.7 Troubleshooting

For information on the download tool's error messages, see also the software's User's Manual.

Table A7.2 Problems after Software Update

Symptom	Cause	Remedy
An error occurs before starting a download, disabling the download.	The selected download file is not for the selected field device.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
An error occurs after starting a download, disabling the download.	You attempted to update the device revision by downloading a file which is not an original file.	Check SOFTDWN_ERROR in the resource block and obtain the original file.
	The selected field device does not support software downloading.	Check whether the option code /EE is included in the model and suffix codes of the device.
	The voltage on the fieldbus segment falls below the specified limit (9 volts).	Check the capacity of the field bus power supply used and the voltage at the terminal.
	There was an error in a checksum or the number of transmission bytes.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
	The download tool does not allow download with same software revision.	Check the setting of the download tool.
The download takes far longer than expected or fails frequently.	The fieldbus segment is noisy.	Check the noise level on the fieldbus segment.
An error occurs after activation.	Transient error caused by the internal resetting of the field device.	Check whether communication with the field device has recovered after a while.
The new software does not work after the activation.	The file of the current revision was downloaded.	Obtain the correct file.
	Failure of the memory in field device, etc.	Check SOFTDWN_ERROR in the resource block, and re-try downloading. If fails, place a service call.

A7.8 Maintenance Transducer Block's Parameters Relating to Software Download

Table A7.3 Additional Parameters of Maintenance Transducer Block

Relative Index	Index	Parameter Name	Default (Factory Set)	Write Mode	Description
23	3023	SOFTDWN_PROTECT	0x01		Defines whether to accept software downloads. 0x01: Unprotected 0x02: Protected
24	3024	SOFTDWN_ERROR	0	—	Indicates an error during a software download. See Table A7.4.
25	3025	SOFTDWN_COUNT	0	—	Indicates the number of times the internal FlashROM was erased.
26	3026	SOFTDWN_ACT_AREA	0	—	Indicates the ROM number of the currently working FlashROM. 0: FlashROM #0 working 1: FlashROM #1 working

Table A7.4 Download Error Codes

Error Code	Description
0	No error
32768	Unsupported header version (not 1)
32769	Abnormal header size (not 44)
32770	Abnormal manufacturer ID (not 0x594543)
32771	Device family error (not RB.DEV_TYPE)
32772	Device revision error (less than RB.DEV_REV)
32773	File revision error (not 3)
32774	File type error (not 0 or 1)
32775	Abnormal number of modules (9 and over)
32776	Abnormal number of EEPROM data tuning (11 and over)
32777	Abnormal module size of program (less than 13 bytes or 655373 bytes and over)
32778	Abnormal data size of EEPROM (under 13 bytes or (A area size + 13byte) and over)
32779	Module type error (except 0 and 1)
32780	Module address error (less than 32768 (0x8000) or 786432 (0xC0000)and over)
32781	Module CRC error
32782	Abnormal block size (Block size of downloaded EEPRPM data is under the existing block size)
32783	Block ID error (There is no existing Block in downloaded EEPROM data)
32784	Abnormal module ID which tunes EEPROM data (except 1 and 2)
32785	Abnormal EEPROM block ID which tunes EEPROM data
32786	Offset error from the beginning of the block which tunes EEPROM data
32787	Abnormal data size which tunes EEPPROM data
32788	EEPROM data tuning type error (except 1 to 3)
32789	File CRC error
32790	File endcode error (first 1 byte of endcode is not 0x00)
32791	Verification error during external SerialFlashROM writing
32792	Access error of external SerialFlashROM
32793	Timeout of the external SerialFlashROM access
32794	Generic initiate download sequence error
32705	Generic download segment error
32796	Generic terminate download sequence.error
32797	State error during activation (except DWNLD_NOT_READY, DWNLD_ READY, and DWNLD_OK)
32798	Succeeded process error during activation (FlashROM failure, EEPRPM failure)

A7.9 System/Network Management VFD Parameters Relating to Software Download

Table A7.5 System/Network Management VFD Parameters

Write Mode: R/W = read/write; R = read only

Index (SM)	Parameter Name	Sub Index	Sub-parameter Name	Default (Factory Set)	Write Mode	Remarks
310	DWNLD_ PROPERTY	0			R	
		1	Download Class	1	R	
		2	Write Rsp Returned For ACTIVATE	1	R	
		3	Write Rsp Returned For PREPARE	1	R	
		4	Reserved	0	—	
		5	ReadyForDwnld Delay Secs	300	R	
		6	Activation Delay Secs	60	R	
313	DOMAIN_ DESCRIPTOR	0			R/W	Read/write-permitted only for sub-index 1
		1	Command	3	R/W	
		2	State	1	R	
		3	Error Code	0	R	
		4	Download Domain Index	440	R	
		5	Download Domain Header Index	420	R	
		6	Activated Domain Header Index	430	R	
		7	Domain Name	(Device name)	R	
314	DOWNLOAD_ DOMAIN_ HEADER	0				
		1	Header Version Number	1	R	
		2	Header Size	0	R	
		3	Manufacturer ID	0x594543	R	
		4	Device Family	(DEV_TYPE of RB)	R	
		5	Device Type	(DEV_TYPE of RB)	R	
		6	Device Revision	(DEV_REV of RB)	R	
		7	DD Revision	(DD_REV of RB)	R	
		8	Software Revision	(SOFT_REV of RB)	R	
		9	Software Name	ORIGINAL	R	
		10	Domain Name	(Device name)	R	
315	ACTIVATED_ DOMAIN_ HEADER	0				
		1	Header Version Number	1	R	
		2	Header Size	44	R	
		3	Manufacturer ID	0x594543	R	
		4	Device Family	(DEV_TYPE of RB)	R	
		5	Device Type	(DEV_TYPE of RB)	R	
		6	Device Revision	(DEV_REV of RB)	R	
		7	DD Revision	(DD_REV of RB)	R	
		8	Software Revision	(SOFT_REV of RB)	R	
		9	Software Name	ORIGINAL	R	
		10	Domain Name	(Device name)	R	
316	DOWNLOAD_ DOMAIN					Read/write: prohibited Get-OD: permitted

A7.10 Comments on System/Network Management VFD Parameters Relating to Software Download

IMPORTANT

Do not turn off the power to a field device immediately after changing parameter settings. Data writing actions to the EEPROM are dual redandant to ensure reliability. If the power is turned off within 60 seconds after setup, the parameters may revert to the previous settings.

(1) DWNLD_PROPERTY

Sub Index	Element	Size (Bytes)	Description
1	Download Class	1	Indicates the download class. 1: Class 1
2	Write Rsp Returned For ACTIVATE	1	Indicates whether a write response is returned to the ACTIVATE command. 1: Write Response Returned
3	Write Rsp Returned For PREPARE	1	Indicates whether a write response is returned to the PREPARE command. 1: Write Response Returned
4	Reserved	1	(Reserved)
5	ReadyForDwnld Delay Secs	2	Indicates the maximum delay after receipt of the PREPARE_FOR_DWNLD command to proceed to transition from DWNLD_NOT_READY to DWNLD_READY.
6	Activation Delay Secs	2	Indicates the maximum delay after receipt of the ACTIVATE command to proceed to transition from DWNLD_OK to DWNLD_NOT_READY.

(2) DOMAIN_DESCRIPTOR

Sub Index	Element	Size (Bytes)	Description
1	Command	1	Reads/writes software download commands. 1: PREPARE_FOR_DWNLD (instruction of download preparation) 2: ACTIVATE (activation instruction) 3: CANCEL_DWNLD (instruction of download cancellation)
2	State	1	Indicates the current download status. 1: DWNLD_NOT_READY (download not ready) 2: DWNLD_PREPARING (download under preparation) 3: DWNLD_READY (ready for download) 4: DWNLD_OK (download complete) 5: DOWNLOADING (download underway) 6: CHECKSUM_FAIL (not used in this product) 7: FMS_DOWNLOAD_FAIL (failure during download) 8: DWNLD_INCOMPLETE (download error detected at restart) 9: VCR_FAIL (not used in this product) 10: OTHER (download error other than 6 and 7 detected)
3	Error Code	2	Indicates the error during a download and activation. 0: success, configuration retained (download successfully completed) 32768 - 65535: Download error (See Table A7.4 for error codes.)
4	Download Domain Index	4	Indicates the index number of the domain for software downloading.
5	Download Domain Header Index	4	Indicates the index number of the domain header to which the download is performing.
6	Activated Domain Header Index	4	Indicates the index numbers of the domain header currently running.
7	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

(3) DOMAIN_HEADER

Sub Index	Element	Size (Bytes)	Description
1	Header Version Number	2	Indicates the version number of the header.
2	Header Size	2	Indicates the header size.
3	Manufacturer ID	6	Indicates the value of resource block's MANUFAC_ID (manufacturer ID) as character string data.
4	Device Family	4	Indicates the device family. With this product, Device Family indicates the value of resource block's DEV_TYPE as character string data.
5	Device Type	4	Indicates the value of resource block's DEV_TYPE as character string data.
6	Device Revision	1	Indicates the value of resource block's DEV_REV.
7	DD Revision	1	Indicates the value of resource block's DD_REV.
8	Software Revision	8	Indicates the value of resource block's SOFT_REV.
9	Software Name	8	Indicates the attribute of the binary file. With this product, Software Name indicates either of the following: "ORIGINAL" followed by one space: Original file "UPDATE" followed by two spaces: Update file
10	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

Revision Information

- Title : YTA610 and YTA710 Temperature Transmitters
  Fieldbus Communication
- Manual No. : IM 01C50T02-02EN

Edition	Date	Page	Revised Item
1st	June 2016	—	New publication.
2nd	Oct. 2016	—	Add YTA610.
		—	Incorporate Manual Change 16-045 (delete Ni120 sensor for YTA710)
		—	Add note for difference between YTA610 and YTA710
		—	YTA710_STATUS_MASK→SENSOR_STATUS_MASK
		—	YTA710_STB→STB
		3-1	Revised Figure 3.1
		5-3	Revised Table 5.3
		5-4	Revised number of VCR from 35 to 38
		5-5	Revised Table 5.6
		6-6	Revised Figure 6.4
		6-7	Change the alarm description of Table 6.2
		6-8	Change the description of alarm
		6-16	Add Note
		6-18	“OUT_SCALE”: Change description
		7-2	Add “7.2.4 Alarm Handling”
		A1-4	Index 1083 to 1090: Revised explanation
		A6-8	Q2: Revised index number
		A7-4	A7.8: Resource Block→Maintenance Transducer Block