# Technical Information

**TI 01C22T02-01E**

**Model EJA Series
Fieldbus Communication Type**

*DPharp*

FOUNDATION

**YOKOGAWA ◆**

Yokogawa Electric Corporation

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# CONTENTS

# 1.　INTRODUCTION

This manual contains a description of the DPharp EJA Series Differential Pressure/Pressure Transmitter Fieldbus Communication Type. The Fieldbus communication type is based on the same silicon resonant sensing features as that of the BRAIN communication type, which is employed as the measurement principle, and is similar to the BRAIN 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 and that are not contained in the BRAIN communication type instruction manual or other documents.

## ■ Safety Precautions

• 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.

# 2. PART NAMES

This section describes the topics applicable to the Fieldbus communication type.

(1) In the Fieldbus communication type, the CPU assembly comes in two parts, as shown in Figure 2.1.

(2) The Fieldbus communication type has no setting pin (CN4) for burnout. In addition, there is no LCD that displays increases or decreases of the value when zero-point adjustment is performed.

(3) The Fieldbus communication type has a simulation function. A SIMULATE-ENABLE switch is mounted in the EJA amplifier. Refer to Section 6.3, "Simulation Function" for details of the simulation function.
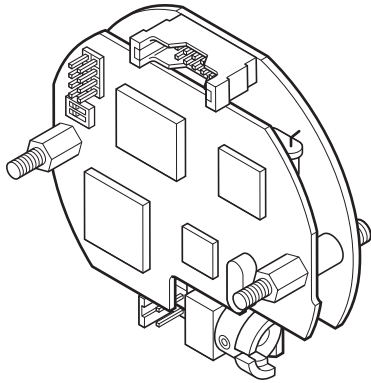


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**Figure 2.1  Diagram of the CPU Assembly**

# 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.

EJA Series 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 two AI 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 EJA

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

**(2)Transducer block**
- Converts sensor output to pressure signals and transfers to AI function block.

**(3)AI1 function block**
- Conditions raw data from the Transducer block.
- Outputs differential pressure signals.
- Carries out scaling, damping and square root extraction.

**(4)AI2 function block**
- Outputs static pressure signals.

**(5)PID function block**
- Performs the PID control computation based on the deviation of the measured value from the setpoint.

## 3.3 Logical Structure of Each Block
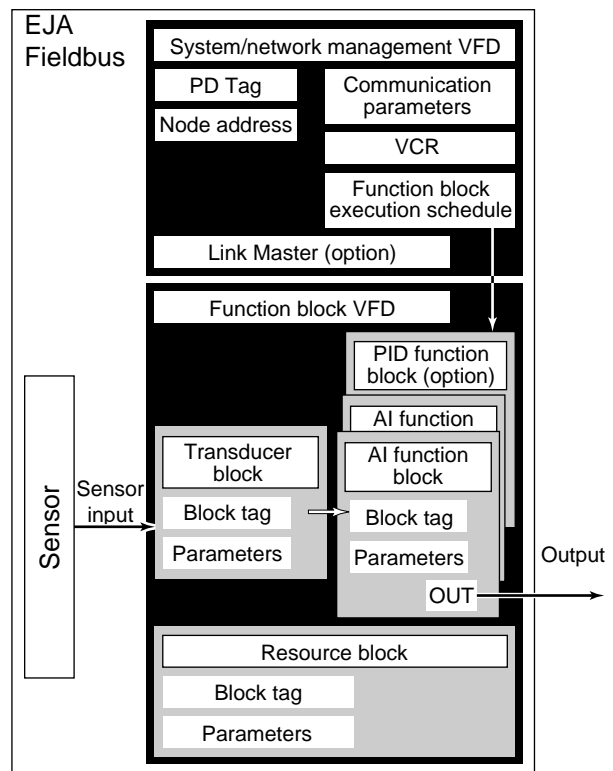


Figure 3.1 Logical Structure of Each Block

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 BRAIN 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 EJA. Two or more EJA 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 (AWG #xx) and cycle period of within 5 cm (2 inches) may be used. Termination processing depends on the type

of device being deployed. For EJA, 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.



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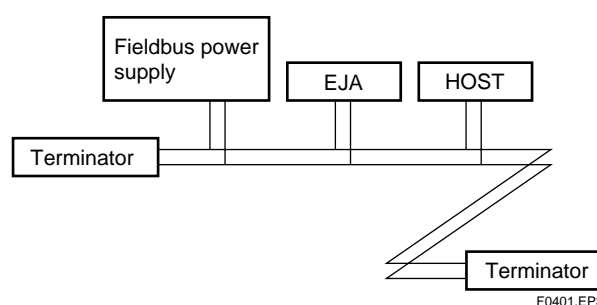
**Figure 4.1 Cabling**

⚠ **NOTE**

No CHECK terminal is used for Fieldbus communication EJA. Do not connect the field indicator and check meter.

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. If the power is turned off within 30 seconds after setting is made, the modified parameters are not saved and the settings 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-Reply-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. EJA address is factory-set to 0xF5. Set this address to be within the range of the BASIC device in Figure 4.2. |

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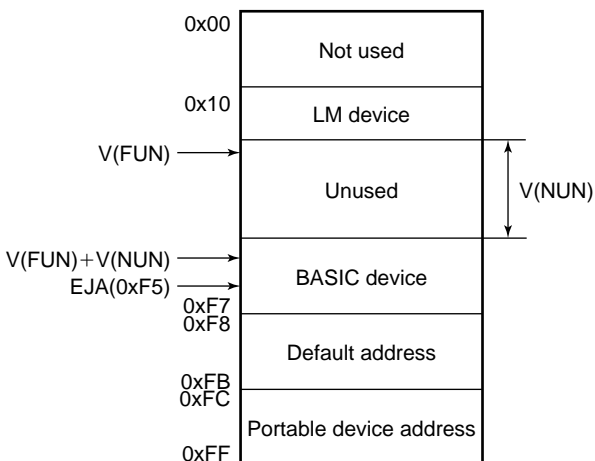


Note 1: LM device: with bus control function (Link Master function)
Note 2: BASIC device: without bus control function

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**Figure 4.2 Available Address Range**

## 4.3 Bus Power ON

Turn on the power of the host and the bus. Where the EJA is equipped with an LCD indicator, first all segments are lit, then the display begins to operate. If the indicator is not lit, check the polarity of the power supply.

Using the host device display function, check that the EJA is in operation on the bus. Unless otherwise specified, the following settings are in effect when shipped from the factory.

PD tag: PT1001
Node address: 245 (hexadecimal F5)
Device ID: 5945430003xxxxxxxx (xxxxxxxx = a total of 8 alphanumeric characters)

If no EJA 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 EJAs are connected at a time with default value, only one EJA will be detected from the host as EJAs have the same initial address. Separately connect each EJA and set a different address for each.

## 4.4 Integration of DD

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

594543\0003
    (594543 is the manufacturer number of Yokogawa Electric Corporation, and 0003 is the EJA device number, respectively.)
If this directory is not found, DD of EJA has not been included. Create the above directory and copy the DD file (0m0n.ffo,0m0n.sym) (m, n is a numeral) (to be supplied separately) into the directory.

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

Off-line configuration is possible by using Capability file (CFF).

## 4.5 Reading the Parameters

To read EJA parameters, select the AI1 block of the EJA from the host screen and read the OUT parameter. The current differential pressure is displayed. Check that MODE_BLOCK of the function block and resource block is set to AUTO, and apply pressure on the Hi side and read the parameter again. A new designated value should be displayed.

## 4.6 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).

## 4.7 Generation of Alarm

If the host is allowed to receive alarms, generation of an alarm can be attempted from EJA. In this case, set the reception of alarms on the host side. EJA's VCR-7 is factory-set for this purpose. For practical purposes, all alarms are placed in a disabled status; for this reason, it is recommended that you first use one of these alarms on a trial basis. Set the value of link object-3 (index 30002) as "0, 299, 0, 6, 0". Refer to section 5.6.1 Link Object for details.

Since the L0_PRI parameter (index 4029) of the AI1 block is set to "0", try setting this value to "3". Select the Write function from the host in operation, specify an index or variable name, and write "3" to it.

The L0_LIM parameter (index 4030) of the AI1 block determines the limit at which the lower bound alarm for the process value is given. In usual cases, a

very small value is set to this limit. Set 10 (meaning 10 kPa) to the limit. Since the differential pressure is almost 0, a lower bound alarm is raised. Check that the alarm can be received at the host. When the alarm is confirmed, transmission of the alarm is suspended.

The above-mentioned items are a description of the simple procedure to be carried out until EJA is connected to Fieldbus. In order to take full advantage of the performance and functionality of the device, it is recommended that it be read together with Chapter 5, which describes how to use the EJA.

Fieldbus is fully dependent upon digital communication protocol and differs in operation from conventional 4 to 20 mA transmission and the BRAIN 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.

# 5.    CONFIGURATION

This chapter contains information on how to adapt the function and performance of the EJA 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 5 when the EJA 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. EJA 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 "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 EJA is 16.5 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 16 to 247 (or hexadecimal 10 to F7) can be set. The device (LM

device) with bus control function (Link Master function) is allocated from a smaller address number (16) side, and other devices (BASIC device) without bus control function allocated from a larger address number (247) side respectively. Place EJA in the range of the BASIC device. When the EJA is used as Link Master, place EJA 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 |

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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.
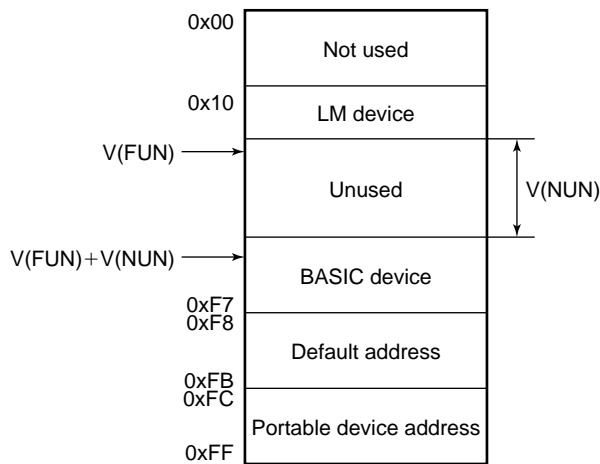


**Figure 5.1  Available Range of Node Addresses**

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 EJA specification values.

**Table 5.2   Operation Parameter Values of the EJA 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 EJA, 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 EJA, 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 EJA, the setting must be a value of 12 or greater. |

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## 5.3  Definition of Combining Function Blocks

The input/output parameters for function blocks are combined. For the EJA, two AI blocks output parameter (OUT) 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 EJA 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 EJA 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 EJA schedule according to the following table. Enclosed values in the table are factory-settings.

**Table 5.3  Execution Schedule of the EJA 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. (32000 = 1 s) |
| 276 (SM) | FB_START_ENTRY.1 | AI1 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (0 = 0 s) |
| 277 (SM) | FB_START_ENTRY.2 | AI2 block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (160000 = 0.5 s) |
| 278 (SM) | FB_START_ENTRY.3 | Not used. |
| 279 (SM) | FB_START_ENTRY.4 | Not used. |

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A maximum of 100 ms is taken for execution of AI block. 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 two AI function blocks of the EJA 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.
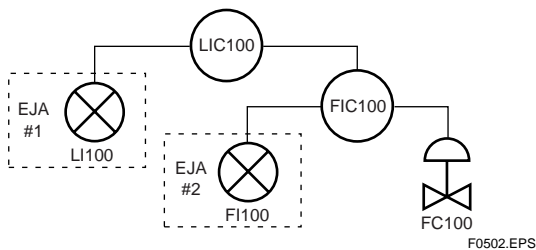


**Figure 5.2  Example of Loop Connecting Function Block of Two EJA with Other Instruments**
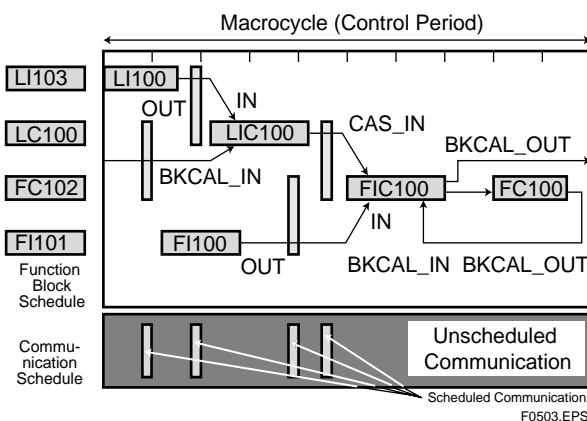


**Figure 5.3  Function Block Schedule and Communication Schedule**

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 EJA. 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. EJA must be transferred to this state when an EJA tag or address is changed.
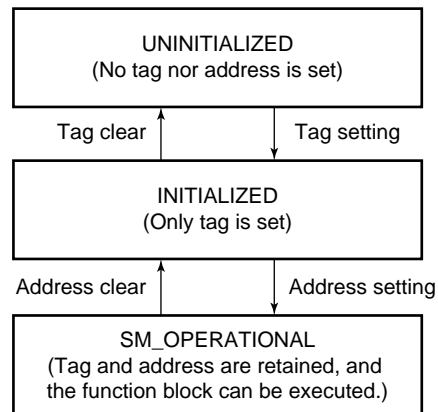


**Figure 5.4  Status Transition by Setting PD Tag and Node Address**

EJA has a PD Tag (PT1001) and node address (245, or hexadecimal F5) 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 EJA is 5945430003xxxxxxxx. (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. EJA has 17 VCRs whose application can be changed, except for the first VCR, which is used for management.

EJA 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 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 5.4. Parameters must be changed together for each VCR because modification for each parameter may cause inconsistent operation.

**Table 5.4  VCR Static Entry**

| Sub-index | Parameter | Description |
|---|---|---|
| 1 | FasArTypeAndRole | Indicates the type and role of communication (VCR). The following 4 types are used for EJA.<br>0x32: Server (Responds to requests from host.)<br>0x44: Source (Transmits alarm or trend.)<br>0x66: Publisher (Sends AI block output to other blocks.)<br>0x76: Subscriber (Receives output of other blocks by PID block.) |
| 2 | FasDllLocalAddr | Sets the local address to specify VCR in EJA. 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.<br>0x2B: Server<br>0x01: Source (Alert)<br>0x03: Source (Trend)<br>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 secounds (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 secounds (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 EJA. |
| 10 | FasDllPublisherTime WindowSize | Not used for EJA. |
| 11 | FasDllPublisher SynchronizaingDlcep | Not used for EJA. |

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| Sub-index | Parameter | Description |
|---|---|---|
| 12 | FasDllSubsriberTime WindowSize | Not used for EJA. |
| 13 | FasDllSubscriber SynchronizationDlcep | Not used for EJA. |
| 14 | FmsVfdId | Sets VFD for EJA 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 EJA, it is automatically set according to specific applications. |

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

**Table 5.5  VCR List**

| Index (SM) | VCR Number | Factory Setting |
|---|---|---|
| 293 | 1 | For system management (Fixed) |
| 294 | 2 | Server (LocalAddr = 0xF3) |
| 295 | 3 | Server (LocalAddr = 0xF4) |
| 296 | 4 | Server (LocalAddr = 0xF7) |
| 297 | 5 | Trend Source (LocalAddr = 0x07, Remote Address=0x111) |
| 298 | 6 | Publisher for AI1 (LocalAddr = 0x20) |
| 299 | 7 | Alert Source (LocalAddr = 0x07, Remote Address=0x110) |
| 300 | 8 | Server (LocalAddr = 0xF9) |
| 301 | 9 | Publisher for AI2 (LocalAddr = 0x21) |
| 302 | 10 | Not used. |
| 303 | 11 | Not used. |
| 304 | 12 | Not used. |
| 305 | 13 | Not used. |
| 306 | 14 | Not used. |
| 307 | 15 | Not used. |
| 308 | 16 | Not used. |
| 309 | 17 | Not used. |

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### 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. EJA has eleven link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 5.6. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

**Table 5.6  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 EJA. 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. |

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Set link objects as shown in Table 5.7.

**Table 5.7  Factory-Settings of Link Objects (example)**

| Index | Link Object # | Factory Settings |
|---|---|---|
| 30000 | 1 | AI1.OUT → VCR#6 |
| 30001 | 2 | Trend → VCR#5 |
| 30002 | 3 | Alert → VCR#7 |
| 30003 | 4 | AI2.OUT → VCR#9 |
| 30004 | 5 | Not used |
| 30005 | 6 | Not used |
| 30006 | 7 | Not used |
| 30007 | 8 | Not used |
| 30008 | 9 | Not used |
| 30009 | 10 | Not used |
| 30010 | 11 | Not used |

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## 5.6.2  Trend Object

It is possible to set the parameter so that the function block automatically transmits Trend. EJA has five Trend objects, four of which are used for Trend in analog mode parameters and one 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. Before writing to a Trend object, it is necessary to release the WRITE_LOCK parameter.

**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. In the EJA, the following three types of trends are possible.<br>7: PV<br>8: OUT<br>19: FIELD_VAL |
| 3 | Sample Type | Specifies how trends are taken. Choose one of the following 2 types:<br>1: Sampled upon execution of a function block.<br>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. |

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

**Table 5.9  Trend Object are Factory-Set**

| Index | Parameters | Factory Settings |
|---|---|---|
| 32000 | TREND_FLT.1 | Not used. |
| 32001 | TREND_FLT.2 | Not used. |
| 32002 | TREND_FLT.3 | Not used. |
| 32003 | TREND_FLT.4 | Not used. |
| 32004 | TREND_DIS.1 | Not used. |

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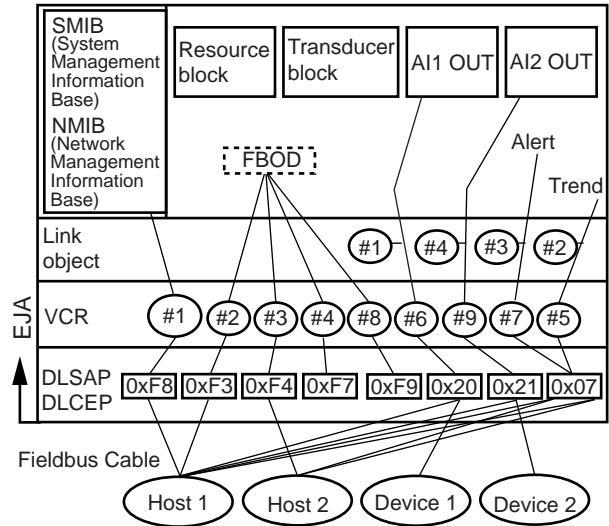


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**Figure 5.5 Example of Default Configuration**

## 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. EJA has four View Objects for each Resource block, Transducer block and AI1.AI2 function block, and each View Object has the parameters listed in Table 5.11 to 5.13.

**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. |

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**Table 5.11 View Object for Resource 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 | RS_STATE | 1 |  | 1 |  |
| 8 | TEST_RW |  |  |  |  |
| 9 | DD_RESOURCE |  |  |  |  |
| 10 | MANUFAC_ID |  |  |  | 4 |

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| Relative Index | Parameter Mnemonic | VIEW 1 | VIEW 2 | VIEW 3 | VIEW 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 | FAIL_SAFE | 1 | | 1 | |
| 29 | SET_FSAFE | | | | |
| 30 | CLR_FSAFE | | | | |
| 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 | WRITE_PRI | | | | |
| 40 | WRITE_ALM | | | | |
| 41 | ITK_VER | | | | 2 |
| 42 | SOFT_REV | | | | |
| 43 | SOFT_DESC | | | | |
| 44 | SIM_ENABLE_MSG | | | | |
| 45 | DEVICE_STATUS_1 | | | 4 | |
| 46 | DEVICE_STATUS_2 | | | 4 | |
| 47 | DEVICE_STATUS_3 | | | 4 | |
| 48 | DEVICE_STATUS_4 | | | 4 | |
| 49 | DEVICE_STATUS_5 | | | 4 | |
| 50 | DEVICE_STATUS_6 | | | 4 | |
| 51 | DEVICE_STATUS_7 | | | 4 | |
| 52 | DEVICE_STATUS_8 | | | 4 | |
| | Totals (# bytes) | 22 | 30 | 54 | 31 |

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**Table 5.12 View Object for Transducer 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 | UPDATE_EVT | | | | |
| 8 | BLOCK_ALM | | | | |
| 9 | TRANSDUCER_ DIRECTORY | | | | |
| 10 | TRANSDUCER_TYPE | 2 | 2 | 2 | 2 |
| 11 | XD_ERROR | 1 | | 1 | 1 |
| 12 | COLLECTION_ DIRECTORY | | | | |
| 13 | PRIMARY_VALUE_ TYPE | | 2 | | 2 |
| 14 | PRIMARY_VALUE | 5 | | 5 | |
| 15 | PRIMARY_VALUE_ RANGE | | | | |
| 16 | CAL_POINT_HI | | 4 | | 4 |
| 17 | CAL_POINT_LO | | 4 | | 4 |
| 18 | CAL_MIN_SPAN | | | | 4 |
| 19 | CAL_UNIT | | | | 2 |
| 20 | SENSOR_TYPE | | | | 2 |
| 21 | SENSOR_RANGE | | | | 11 |
| 22 | SENSOR_SN | | | | |
| 23 | SENSOR_CAL_ METHOD | | | | 1 |
| 24 | SENSOR_CAL_LOC | | | | 32 |
| 25 | SENSOR_CAL_DATE | | | | 6 |
| 26 | SENSOR_CAL_WHO | | | | 32 |
| 27 | SECONDARY_VALUE | 5 | | 5 | |
| 28 | SECONDARY_ VALUE_UNIT | | 2 | | 2 |
| 29 | TERTIARY_VALUE | 5 | | 5 | |
| 30 | TERTIARY_VALUE_ UNIT | | 2 | | 2 |
| 31 | TRIM_PV_ZERO | | | | |
| 32 | TRIM_MODE | | | | 1 |
| 33 | EXT_ZERO_ENABLE | | 1 | | 1 |
| 34 | MODEL | | | | |
| 35 | DISPLAY_MODE | | 1 | | 1 |
| 36 | DISPLAY_CYCLE | | 1 | | 1 |
| 37 | ALARM_SUM | 8 | | 8 | |
| | | | | | |
| | Totals (# bytes) | 34 | 21 | 34 | 116 |

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**Table 5.13 View Object for AI1.AI2 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 | 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 | | | | 1 |
| 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 | | | | |
| | | | | | |
| | Totals (# bytes) | 31 | 26 | 31 | 46 |

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**Table 5.14 Indexes of View for Each Block**

| | VIEW_1 | VIEW_2 | VIEW_3 | VIEW_4 |
|---|---|---|---|---|
| Resourse Block | 40100 | 40101 | 40102 | 40103 |
| Transducer Block | 40200 | 40201 | 40202 | 40203 |
| AI1 Function Block | 40400 | 40401 | 40402 | 40403 |
| AI2 Function Block | 40410 | 40411 | 40412 | 40413 |
| (PID Function Block) | 40800 | 40801 | 40802 | 40803 |

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## 5.6.4 Function Block Parameters

Function block parameters can be read from the host or can be set. For a list of the parameters of blocks held by the EJA, refer to "List of parameters for each block of the EJA" in Appendix 1. For PID/LM function option, refer to Appendix 4&5. The following is a list of important parameters with a guide to how to set them.

### MODE_BLK:

Indicates the three types of function block modes; Out_Of_Service, Manual, and Auto. In Out_Of_Service mode, the AI block does not operate. The Manual mode does not allow values to be updated. The Auto mode causes the measured value to be updated. Under normal circumstances, set the Auto mode to take effect. The Auto mode is the factory default.

### CHANNEL:

This is the parameter of the transducer block to be input to the AI block. AI1 block is assigned differential pressure and AI2 block is assigned static pressure, respectively. Do not change this setting.

### XD_SCALE:

Scale of input from the transducer block. The calibrated range is factory set (from 0% point to 100% point). Usually, the unit is set in kPa. Changing the unit (can be set only in pressure unit) also causes the unit within the transducer block to be automatically changed. (The unit is automatically changed according to the unit selected by AI1.) Unit index which can be set by XD_SCALE is as shown below.

**Table 5.15 Unit Index by XD_SCALE**

| MPa | 1132, 1545 (abs), 1546 (gauge) |
|---|---|
| kPa | 1133, 1547 (abs), 1548 (gauge) |
| hPa | 1136, 1553 (abs), 1554 (gauge) |
| bar | 1137 |
| mbar | 1138 |
| atm | 1140 |
| % | 1342 |

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**L_TYPE:**

Specifies the operation function of the AI block. If set to "Direct", the input delivered to CHANNEL is directly reflected on OUT. If set to "Indirect", scaling by XD_SCALE and OUT_SCALE is carried out and is reflected on OUT. If set to "Indirect SQRT", after scaling by XD_SCALE, the square root is extracted and the value scaled by OUT_SCALE is reflected on OUT.

**PV_FTIME:**

Sets the time constant of the damping function within AI block (primary delay) in seconds.

**OUT_SCALE:**

Sets the range of output (from 0% to 100%). The unit can also be set with ease.

**Alarm Priority:**

Indicates the priority of the process alarm. If a value of 3 or greater is set, an alarm is transmitted. The factory default is 1. Four types of alarm can be set: HI_PRI, HI_HI_PRI, LO_PRI, and LO_LO_PRI.

**Alarm Threshold:**

Sets the threshold at which a process alarm is generated. The factory default setting is a value that does not generate an alarm. Four types of alarm can be set: HI_LIM, HI_HI_LIM, LO_LIM, and LO_LO_LIM.

### 5.6.5 Transducer Block Parameters

The transducer block sets functions specific to the measurement of the differential and normal pressure of the EJA. For a list of the parameters of each block of the EJA, refer to "List of parameters for each block of the EJA" in Appendix 1. The following is a list of important parameters with a guide to how to set them.

**TERTIARY_VALUE:**

Displays the capsule temperature of the EJA.

**TERTIARY_VALUE_UNIT:**

Sets display unit of temperature at EJA. If set to 1001, °C is used, and if set to 1002, °F is used. The factory default setting is °C.

**DISPLAY_MODE:**

Sets the unit to be used for LCD display. If set to 1, actual item unit display set to OUT_SCALE takes effect, and if set to 2, % display takes effect. The factory default setting is 1.

**DISPLAY_CYCLE:**

Sets the cycle of LCD display in units of function block execution cycles. The factory default setting is 1, but if a low temperature environment makes it difficult to view the display, it is recommended that you set a longer display cycle.

# 6. IN-PROCESS OPERATION

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

## 6.1 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.

## 6.2 Generation of Alarm

### 6.2.1 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 in 2-second intervals.



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**Figure 6.1 Error Identification on Indicator**

**Table 6.1 List of Error Messages**

| LCD | Content of Alarms |
|-----|-------------------|
| AL.01 | Capsule module failure. |
| AL.02 | AMP module failure (1). |
| AL.03 | AMP module failure (2). |
| AL.20 | AI1 block is not scheduled. |
| AL.21 | The resource block is in O/S mode. |
| AL.22 | The transducer block is in O/S mode. |
| AL.23 | AI1 or AI2 function block is in O/S mode. |
| AL.41 | The differential pressure is out of the measurement range. An alarm is issued when the differential pressure exceeds the range of LRL–10% to URL+10%. |
| AL.42 | The static pressure is out of the range of the maximum operating pressure. An alarm is issued when the static pressure exceeds 110% of the maximum operating pressure. |
| AL.43 | Temperature is abnormal. An alarm is issued when the temperature is out of the range of –50 to 130°C. |
| AL.61 | Out of the range of the built-in indicator display. |
| AL.62 | All function blocks are in Simulate mode. |
| AL.63 | AI1 function block are in Man mode. |
| AL.64 | Zero-point adjustment is abnormal. An alarm is issued out of the range of LRL–10% to URL+10%. |

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### 6.2.2 Alarms and Events

Following alarm or event can be reported by EJA as an alert if allowed.

**Analog Alerts** (Generated when a process value exceeds threshold)

| | |
|---|---|
| By AI1 Block | Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm |
| By AI2 Block | Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm |

**Discrets Alerts** (Generated when an abnormal condition is detected)

| | |
|---|---|
| By Resource Block | Block Alarm, Write Alarm |
| By Transducer Block | Block Alarm |
| By AI1 Block | Block Alarm |
| By AI2 Block | Block Alarm |

**Update Alerts** (Generated when a important (restorable) parameter is updated)

| | |
|---|---|
| By Resource Block | Update Event |
| By Transducer Block | Update Event |
| By AI1 Block | Update Event |
| By AI2 Block | Update Event |

An alert has following structure:

**Table 6.2 Alert Object**

| Subindex | | | Parameter Name | Explanation |
|---|---|---|---|---|
| Analog Alert | Discrete Alert | Update Alert | | |
| 1 | 1 | 1 | Block Index | Index of block from which alert is generated |
| 2 | 2 | 2 | Alert Key | Alert Key copied from the block |
| 3 | 3 | 3 | Standard Type | Type of the alert |
| 4 | 4 | 4 | Mfr Type | Alert Name identified by manufacturer specific DD |
| 5 | 5 | 5 | Message Type | Reason of alert notification |
| 6 | 6 | 6 | Priority | Priority of the alarm |
| 7 | 7 | 7 | Time Stamp | Time when this alert is first detected |
| 8 | 8 | | Subcode | Enumerated cause of this alert |
| 9 | 9 | | Value | Value of referenced data |
| 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 |

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# 6.3 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.

A SIMULATE_ENABLE switch is mounted in the EJA amplifier. This is to prevent the accidental operation of this function. When this is switched on, simulation is enabled. (See Figure 6.2.) To initiate the same action from a remote terminal, if REMOTE LOOP TEST SWITCH is written to the SIM_ENABLE_MSG parameter (index 1044) of the resource 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 6.3 below.

**Table 6.3  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: Simulation disabled (standard) 2: Simulation started |

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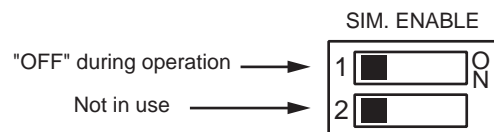When Simulate En/Disable in Table 6.3 above is set to 2, the applicable function block uses the simulation value set in this parameter instead of the data from the transducer block. This setting can be used for propagation of the status to the trailing blocks, generation of a process alarm, and as an operation test for trailing blocks.



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**Figure 6.2 SIMULATE_ENABLE Switch Position**

# 7.    DEVICE STATUS

Device setting status and failures of EJA are indicated by using parameter DEVICE_STATUS_1,
DEVICE_STATUS_2 and DEVICE_STATUS_3 (index 1045, 1046 and 1047) in Resource Block.

**Table 7.1 Contents of DEVICE_STATUS_1 (index 1045)**

| Hexadecimal | Desplay through DD | Description |
|---|---|---|
| 0x80000000 | | |
| 0x40000000 | | |
| 0x20000000 | | |
| 0x10000000 | | |
| 0x08000000 | | |
| 0x04000000 | | |
| 0x02000000 | | |
| 0x01000000 | | |
| 0x00800000 | Sim.enable Jmpr On | SIMULATE_ENABLE switch is ON. |
| 0x00400000 | RB in O/S mode (AL.21) | Resource Block is in O/S mode. |
| 0x00200000 | | |
| 0x00100000 | | |
| 0x00080000 | AMP Module Failure 2 (AL.03) | AMP module failure |
| 0x00040000 | | |
| 0x00020000 | | |
| 0x00010000 | | |
| 0x00008000 | LINK OBJ. 1/17 not open | Link object 1 is not open. |
| 0x00004000 | LINK OBJ. 2 not open | Link object 2 is not open. |
| 0x00002000 | LINK OBJ. 3 not open | Link object 3 is not open. |
| 0x00001000 | LINK OBJ. 4 not open | Link object 4 is not open. |
| 0x00000800 | LINK OBJ. 5 not open | Link object 5 is not open. |
| 0x00000400 | LINK OBJ. 6 not open | Link object 6 is not open. |
| 0x00000200 | LINK OBJ. 7 not open | Link object 7 is not open. |
| 0x00000100 | LINK OBJ. 8 not open | Link object 8 is not open. |
| 0x00000080 | LINK OBJ. 9 not open | Link object 9 is not open. |
| 0x00000040 | LINK OBJ. 10 not open | Link object 10 is not open. |
| 0x00000020 | LINK OBJ. 11 not open | Link object 11 is not open. |
| 0x00000010 | LINK OBJ. 12 not open | Not used for EJA. |
| 0x00000008 | LINK OBJ. 13 not open | Not used for EJA. |
| 0x00000004 | LINK OBJ. 14 not open | Not used for EJA. |
| 0x00000002 | LINK OBJ. 15 not open | Not used for EJA. |
| 0x00000001 | LINK OBJ. 16 not open | Not used for EJA. |

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**Table 7.2 Contents of DEVICE_STATUS_2 (index 1046)**

| Hexadecimal | Desplay through DD | Description |
|---|---|---|
| 0x80000000 | | |
| 0x40000000 | | |
| 0x20000000 | | |
| 0x10000000 | | |
| 0x08000000 | | |
| 0x04000000 | | |
| 0x02000000 | | |
| 0x01000000 | | |
| 0x00800000 | | |
| 0x00400000 | | |
| 0x00200000 | | |
| 0x00100000 | | |
| 0x00080000 | | |
| 0x00040000 | | |
| 0x00020000 | | |
| 0x00010000 | | |
| 0x00008000 | Data is out of LCD display range (AL.61) | Data is out of LCD display range. |
| 0x00004000 | | |
| 0x00002000 | | |
| 0x00001000 | Zero Adjust value is out of normal range (AL.64) | Zero adjustment value is out of range. Alarm is generated when the value is out of LRL -10% to URL +10%. |
| 0x00000800 | | |
| 0x00000400 | Temperalure is out of normal range (AL.43) | Process temperature is out of limit. Alarm is generated when the temperature is out of -50 to 130 degC. |
| 0x00000200 | Static Pressure is out of normal range (AL.42) | Static pressure is out of MWP. Alarm is generated when the static pressure exceeds 110% of MWP. |
| 0x00000100 | Differential Pressure is out of normal range (AL.41) | Differential pressure is out of range. Alarm is generated when the value is out of LRL -10% to URL +10%. |
| 0x00000080 | AMP Module Failure 3 (AL.02) | Amp module failure |
| 0x00000040 | AMP Module Failure 2 (AL.03) | Amp module failure |
| 0x00000020 | AMP Module Failure 1 (AL.02) | Amp module failure |
| 0x00000010 | Capsule Module Failure 3 (AL.01) | Capsule module failure |
| 0x00000008 | | |
| 0x00000004 | | |
| 0x00000002 | Capsule Module Failure 2 (AL.01) | Capsule module failure |
| 0x00000001 | Capsule Module Failure 1 (AL.01) | Capsule module failure |

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**Table 7.3 Contents of DEVICE_STATUS_3 (index 1047)**

| Hexadecimal | Desplay through DD | Description |
|---|---|---|
| 0x80000000 | | |
| 0x40000000 | | |
| 0x20000000 | | |
| 0x10000000 | | |
| 0x08000000 | Transducer Block is in O/S mode (AL.22) | Transducer Block is in O/S mode. |
| 0x04000000 | | |
| 0x02000000 | | |
| 0x01000000 | | |
| 0x00800000 | | |
| 0x00400000 | | |
| 0x00200000 | | |
| 0x00100000 | | |
| 0x00080000 | | |
| 0x00040000 | | |
| 0x00020000 | | |
| 0x00010000 | | |
| 0x00008000 | | |
| 0x00004000 | Simulation is enabled in AI2 Function Block | AI2 Function Block is in Simulation mode. |
| 0x00002000 | AI2 Function Block is in Manual mode | AI2 Function Block is in Manual mode. |
| 0x00001000 | AI2 Function Block is in O/S mode | AI2 Function Block is in O/S mode. |
| 0x00000800 | AI1 Function Block is not scheduled (AL.20) | AI1 Function Block is not scheduled. |
| 0x00000400 | Simulation is enabled in AI1 Function Block (AL.62) | AI1 Function Block is in Simulation mode. |
| 0x00000200 | AI1 Function Block is in Manual mode (AL.63) | AI1 Function Block is in Manual mode. |
| 0x00000100 | AI1 Function Block is in O/S mode (AL.23) | AI1 Function Block is in O/S mode. |
| 0x00000080 | | |
| 0x00000040 | | |
| 0x00000020 | | |
| 0x00000010 | | |
| 0x00000008 | PID Function Block Error 2 | Not used for EJA. |
| 0x00000004 | PID Function Block Error 1 | Not used for EJA. |
| 0x00000002 | PID Function Block is in BYPASS mode | PID Function Block is in BYPASS mode. |
| 0x00000001 | PID Function Block is in O/S mode | PID Function Block is in O/S mode. |

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# 8.    HANDLING CAUTION

This chapter describes important cautions regarding the installation of explosion protected type for FOUNDATION Fieldbus EJA transmitters.

⚠  **CAUTION**

To preserve the safety of explosionproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Please read the following sections very carefully.

## 8.1  Installation of Explosionproof Type Transmitters

### (1)  FM approval

Caution for FM Explosionproof type

Note 1.  Model EJA Series pressure transmitters with optional code /FF15 are applicable for use in hazardous locations:
* Explosionproof for Class I, Division 1, Groups B, C and D.
* Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
* Outdoor hazardous locations, NEMA 4X.
* Temperature Class: T6
* Ambient Temperature: –40 to 60°C
* Supply Voltage: 32V dc max.
* Output current: 15 mA dc

Note 2. Wiring
* All wiring shall comply with National Electrical Code ANSI/NEPA70 and Local Electrical Codes.
* When installed in Division 1, "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

Note 3. Operation
* Keep strictly the "CAUTION" on the nameplate attached on the transmitter.
CAUTION: OPEN CIRCUIT BEFORE REMOVING COVER.
"FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

INSTALL IN ACCORDANCE WITH THE INSTRUCTION MANUAL IM 1C22.
* Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.

Note 4.  Maintenance and Repair
* The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Explosionproof Approval.

### (2)  CSA Certification

Caution for CSA Explosionproof type

Note 1.  Model EJA Series differential pressure transmitter with optional code /CF15 are applicable for use in hazardous locations:
* Explosionproof for Class I, Division 1, Groups B, C and D.
* Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
* Encl "Type 4X"
* Temperature Class:    T6    T5    T4
* Process Temperature: 85°C    100°C    120°C
* Ambient Temperature: –40 to 80°C
* Supply Voltage: 32 V dc max.
* Output current: 15 mA dc

Note 2. Wiring
* All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
* In hazardous location, wiring shall be in conduit as shown in the figure.
* CAUTION: SEAL ALL CONDUITS WITHIN 50 cm OF THE ENCLOSURE.
UN SCELLEMENT DOIT ÊTRE INSTALLÉ À MOINS DE 50 cm DU BÎTIER.
* When installed in Division 2, "SEALS NOT REQUIRED."

Note 3. Operation
* Keep strictly the "CAUTION" on the label attached on the transmitter.

CAUTION: OPEN CIRCUIT BEFORE
REMOVING COVER.
OUVRIR LE CIRCUIT AVANT
D´NLEVER LE COUVERCLE.
* Take care not to generate mechanical spark
when access to the instrument and periph-
eral devices in hazardous location.
Note 4. Maintenance and Repair
* The instrument modification or parts
replacement by other than authorized
representative of Yokogawa Electric
Corporation and Yokogawa Corporation of
America is prohibited and will void
Canadian Standards Explosionproof
Certification.
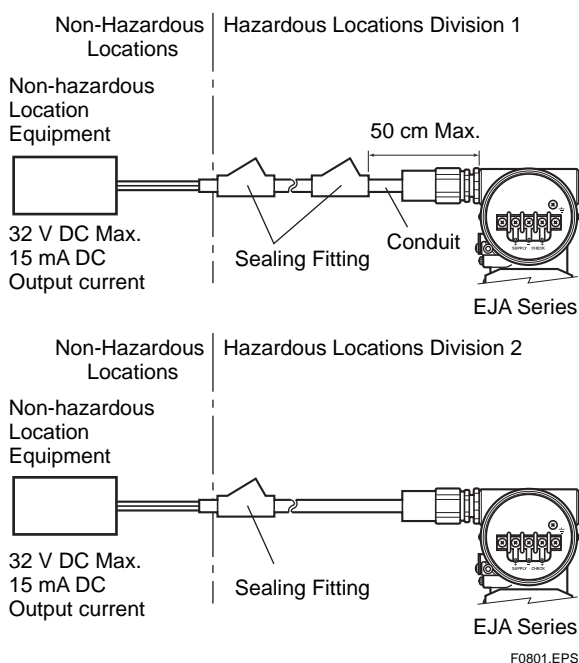
Note 2. Electrical Data
* Supply voltage: 32 V dc max.
Output current: 15 mA dc
Note 3. Installation
* All wiring shall comply with local installa-
tion requirement.
* The cable entry devices shall be of a
certified flameproof type, suitable for the
conditions of use.
Note 4. Operation
* Keep strictly the "CAUTION" on the label
on the transmitter.
CAUTION: WAIT 10 MIN. AFTER
POWER-DISCONNECTION,
BEFORE OPENING THE ENCLO-
SURE.
WHEN AMBIENT TEMP. $\geqq$70°C,
USE HEAT-RESISTING CABLES
$\geqq$90°C.
* Take care not to generate mechanical spark
when access to the instrument and periph-
eral devices in hazardous location.
Note 5. Maintenance and Repair
* The instrument modification or parts
replacement by other than authorized
representative of Yokogawa Electric
Corporation is prohibited and will void
KEMA Flameproof Certification.Mode
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## (3) CENELEC (KEMA)/IEC (KEMA) Certifi-
cation

Caution for CENELEC (KEMA) Flameproof Type
Note 1. Model EJA Series differential pressure
transmitters with optional code /KF5 for
potentially explosive atmospheres:
* Type of Protection and Marking Code: EEx
d IIC T6···T4
Temperature Class:     T6       T5        T4
Maximum Process Temperature:
85°C  100°C  120°C
* Ambient Temperature:
–40 to 80°C(T4 and T5)
–40 to 75°C(T6)

# 9.   GENERAL SPECIFICATIONS

## 9.1  Standard Specifications

**For items other than those described below, refer to each General Specifications.**

**Applicable Model:**
All DPharp EJA series excluding intrinsically safe model.

**Output Signal:**
Digital communication signal based on FOUNDATION Fieldbus protocol.

**Conditions of Communication Line:**
Supply Voltage: 9 to 32 V DC
Supply Current: 16.5 mA (max)

**Power Supply Effect:**
No effect (within the supply voltage of 9 to 32 V DC)

**External Zero Adjustment:**
External zero is continuously adjustable with 0.01% incremental resolution of max span.

**Functional Specifications:**
Functional specifications for Fieldbus communication conform to the standard specifications (H1) of FOUNDATION Fieldbus.
Function Block: Two AI function blocks
              One PID function block (option)
Link Master function (option)

## 9.2  Optional Specifications

| Item | Description | Code |
|---|---|---|
| Factory Mutual (FM) | FM Explosionproof Approval<br>Explosionproof for Class I, Division 1, Groups B, C and D<br>Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G<br>Hazardous (classified) locations, indoors and outdoors (NEMA 4X)<br>Temperature class: T6    Amb. Temp.:–40 to 60°C (–40 to 140°F)<br>Electrical connection: 1/2 NPT female | FF15 |
| CENELEC (KEMA) | CENELEC (KEMA) Flameproof Approval<br>EExd IIC T4, T5 and T6, Amb. Temp.: –40 to 80°C (–40 to 176°F) for T4 and T5,<br>–40 to 75°C (–40 to 167°F) for T6<br>Max. process Temp.: T4; 120°C (248°F), T5; 100°C (212°F), T6; 85°C (185°F)<br>Electrical connection: 1/2 NPT female, Pg 13.5 female and M20 female | KF5 |
| Canadian Standards Association (CSA) | CSA Explosionproof Approval<br>Explosionproof for Class I, Division 1, Groups B, C and D<br>Dustignitionproof for Class II/III, Division 1, Groups E, F and G<br>Temp. Class: T4, T5, T6 Encl Type 4x    Amb. Temp.: –40 to 80°C (–40 to 176°F)<br>Max. Process Temp.: T4; 120°C (248°F), T5; 100°C (212°F), T6; 85°C (185°F)<br>Electrical connection: 1/2 NPT female | CF15 |
| Japanese Industrial Standards (JIS) | JIS Flameproof Approval, Ex do IIC T4X[1]<br>Amb. Temp.: –20 to 60°C, Process Temp.: –20 to 120°C | JF35 |
| PID/LM function | PID control function, Link Master function [2] | LC1 |

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*1: For details of installing JIS approved equipments, refer to General Specifications of each model.
*2: Set as Link Master device when shipped.

**< Settings When Shipped >**

| | |
|---|---|
| Tag Number (PD tag) | 'PT1001' unless otherwise specified in order.<br>(Not engraved on tag plate in such case.) |
| Output Mode (L_TYPE) | 'Indirect' unless otherwise specified in order |
| Calibration Range (XD_SCALE) Lower/Higher Range Value | As specified in order |
| Unit (CAL_UNIT) of Calibration Range | Selected from mmH2O, inH2O, mmHg, inHg, Pa, hPa, kPa, MPa, g/cm2, kg/cm2, bar, mbar, psi, torr, atm<br>(Only one unit can be specified.) |
| Output Scale (OUT_SCALE) Lower/Higher Range Value | '0 to 100%' unless otherwise specified |
| Unit of Output Scale (OUT_SCALE) | As specified in order |
| Damping Time Constant | '2 sec.' |
| Node Address | '0 × F5' unless otherwise specified in order |

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# APPENDIX 1. LIST OF PARAMETERS FOR EACH BLOCK OF THE EJA

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 | 3 | – | Manufacturer's model number associated with the resource-used by interface devices to locate the DD file for the resource. |
| 12 | 1012 | DEV_REV | 1 | – | 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, and 4: Restart processor. |
| 17 | 1017 | FEATURES | Soft write lock supported Report supported | – | Used to show supported resource block options. |

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| Relative Index | Index | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|
| 18 | 1018 | FEATURE_SEL | Soft write lock supported Report supported | AUTO | Used to select resource block options.<br>bit0: Scheduled<br>bit1: Event driven<br>bit2: Manufacturer specified |
| 19 | 1019 | CYCLE_TYPE | Scheduled | – | Identifies the block execution methods available for this resource. |
| 20 | 1020 | CYCLE_SEL | Scheduled | AUTO | Used to select the block execution method for this resource. |
| 21 | 1021 | MIN_CYCLE_T | 3200 (100ms) | – | 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. EJA 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. EJA does not support this. |
| 26 | 1026 | SHED_RCAS | – | AUTO | Time duration at which to give up on computer writes to function block RCas locations. EJA does not support this. |
| 27 | 1027 | SHED_ROUT | – | AUTO | Time duration at which to give up on computer writes to function block ROut locations. EJA 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 | 3 | – | Maximum number of unconfirmed notify messages possible. |
| 32 | 1032 | LIM_NOTIFY | 3 | AUTO | Maximum number of unconfirmed alert notify messages allowed. |
| 33 | 1033 | CONFIRM_TIM | 5000 (ms) | AUTO | The minimum time between retries of alert reports. |
| 34 | 1034 | WRITE_LOCK | Unlocked | 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. |
| 38 | 1038 | ACK_OPTION | 0 | AUTO | |
| 39 | 1039 | WRITE_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 | 4 | – | Version number of interoperability test by Fieldbus Foundation applied to EJA. |
| 42 | 1042 | SOFT_REV | | – | EJA software revision number. |
| 43 | 1043 | SOFT_DESC | | – | Yokogawa internal use. |
| 44 | 1044 | SIM_ENABLE_MSG | Null | AUTO | Software switch for simulation function. |
| 45 | 1045 | DEVICE_STATUS_1 | 0 | – | Device status (VCR setting etc.) |

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| Relative Index | Index | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|
| 46 | 1046 | DEVICE_STATUS_2 | 0 | – | Device status (failure or setting error etc.) |
| 47 | 1047 | DEVICE_STATUS_3 | 0 | – | Device status (function block setting.) |
| 48 | 1048 | DEVICE_STATUS_4 | 0 | – | Not used for EJA. |
| 49 | 1049 | DEVICE_STATUS_5 | 0 | – | Not used for EJA. |
| 50 | 1050 | DEVICE_STATUS_6 | 0 | – | Not used for EJA. |
| 51 | 1051 | DEVICE_STATUS_7 | 0 | – | Not used for EJA. |
| 52 | 1052 | DEVICE_STATUS_8 | 0 | – | Not used for EJA. |

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## A1.2 AI Function Block

| Relative Index | Index AI1 | Index AI2 | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|---|
| 0 | 4000 | 4100 | Block Header | TAG: "AI1" or "AI2" | Block Tag = O/S | Information on this block such as Block Tag, DD Revision, Execution Time etc. |
| 1 | 4001 | 4101 | ST_REV | – | – | The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed. |
| 2 | 4002 | 4102 | TAG_DESC | (blank) | AUTO | The user description of the intended application of the block. |
| 3 | 4003 | 4103 | 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 | 4004 | 4104 | ALERT_KEY | 0 | AUTO | The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. |
| 5 | 4005 | 4105 | MODE_BLK | AUTO | AUTO | The actual, target, permitted, and normal modes of the block. |
| 6 | 4006 | 4106 | 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 | 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 | OUT | – | Value = MAN | The primary analog value calculated as a result of executing the function. |
| 9 | 4009 | 4109 | 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 | XD_SCALE | Specified at the time of order | MAN | 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. Refer to Table 5.15 for the unit available. |
| 11 | 4011 | 4111 | OUT_SCALE | Specified at the time of order | MAN | 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 | 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 | IO_OPTS | 0 | O/S | Options which the user may select to alter input and output block processing |

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| Relative Index | Index AI1 | Index AI2 | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|---|
| 14 | 4014 | 4114 | STATUS_OPTS | 0 | O/S | Options which the user may select in the block processing of status |
| 15 | 4015 | 4115 | CHANNEL | AI1: 1<br>AI2: 2 | 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 | 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 (Ind Sqr Root), using the input range defined by the transducer and the associated output range. |
| 17 | 4017 | 4117 | LOW_CUT | Linear: 0%<br>Square root: 10% | 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 | PV_FTIME | 2sec | AUTO | Time constant of a single exponential filter for the PV, in seconds. |
| 19 | 4019 | 4119 | FIELD_VAL | – | – | Raw value of the field device in percent of thePV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME). |
| 20 | 4020 | 4120 | UPDATE_EVT | – | – | This alert is generated by any change to the static data. |
| 21 | 4021 | 4121 | 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 | 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 | ACK_OPTION | 0 | AUTO | Selection of whether alarms associated with the block will be automatically acknowledged. |
| 24 | 4024 | 4124 | 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 | HI_HI_PRI | 0 | AUTO | Priority of the high high alarm. |
| 26 | 4026 | 4126 | HI_HI_LIM | +INF | AUTO | The setting for high high alarm in engineering units. |
| 27 | 4027 | 4127 | HI_PRI | 0 | AUTO | Priority of the high alarm. |
| 28 | 4028 | 4128 | HI_LIM | +INF | AUTO | The setting for high alarm in engineering units. |
| 29 | 4029 | 4129 | LO_PRI | 0 | AUTO | Priority of the low alarm. |
| 30 | 4030 | 4130 | LO_LIM | –INF | AUTO | The setting for the low alarm in engineering units. |
| 31 | 4031 | 4131 | LO_LO_PRI | 0 | AUTO | Priority of the low low alarm. |
| 32 | 4032 | 4132 | LO_LO_LIM | –INF | AUTO | The setting of the low low alarm in engineering units. |
| 33 | 4033 | 4133 | HI_HI_ALM | – | – | The status for high high alarm and its associated time stamp. |
| 34 | 4034 | 4134 | HI_ALM | – | – | The status for high alarm and its associated time stamp. |
| 35 | 4035 | 4135 | LO_ALM | – | – | The status of the low alarm and its associated time stamp. |
| 36 | 4036 | 4136 | LO_LO_ALM | – | – | The status of the low low alarm and its associated time stamp. |

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## A1.3 Transducer Block

| Relative Index | Index | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|
| 0 | 2000 | Block Header | TAG: "TB" | 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 function block. The revision value will be incremented each time a static parameter value in the block is changed. |
| 2 | 2002 | TAG_DESC | (blank) | AUTO | The user description of the intended application of the block |
| 3 | 2003 | 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 | 2004 | ALERT_KEY | 1 | AUTO | The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. |
| 5 | 2005 | MODE_BLK | AUTO | AUTO | The actual, target, permitted, and normal modes of the block. |
| 6 | 2006 | BLOCK_ERR | – | – | This parameter reflects the error status associated with 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 | 100 (Standard Pressure with Calibration) | – | Identifies transducer. |
| 11 | 2011 | XD_ERROR | – | – | The error code in transducer. 0=No failure 20=Electronics failure 22=I/O failure 21=Mechanical failure |
| 12 | 2012 | 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. |
| 13 | 2013 | PRIMARY_ VALUE_TYPE | 107: differential pressure 108: gauge pressure 109: absolute pressure | O/S | The type of measurement represented by primary value. Followings are available for EJA: 107=differential pressure 108=gauge pressure 109=absolute pressure |
| 14 | 2014 | PRIMARY_ VALUE | – | – | The measured value and status available to the function block. |
| 15 | 2015 | PRIMARY_ VALUE_RANGE | Range of capsule | – | The High and Low 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. |
| 16 | 2016 | CAL_POINT_HI | Max range | O/S | The highest calibrated value. |
| 17 | 2017 | CAL_POINT_LO | 0 | O/S | The lowest calibrated value. |
| 18 | 2018 | CAL_MIN_SPAN | Minimum span of capsule | – | The minimum calibration span value allowed. |
| 19 | 2019 | CAL_UNIT | kPa | – | The engineering unit for the calibrated values. |
| 20 | 2020 | SENSOR_TYPE | Silicon resonant | – | The type of sensor. |
| 21 | 2021 | SENSOR_RANGE | Range of capsule | – | The High and Low range limit values, engineering units code and the number of digits to the right of the decimal point for the sensor. |

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| Relative Index | Index | Parameter Name | Factory Default | Write Mode | Explanation |
|---|---|---|---|---|---|
| 22 | 2022 | SENSOR_SN | Serial No. | – | Serial number. |
| 23 | 2023 | SENSOR_CAL_ METHOD | 103: factory trim standard calibration | O/S | The method of the last sensor calibration.<br>100=volumetric<br>101=static weight<br>102=dynamic weight<br>103=factory trim standard calibration<br>104=user trim standard calibration<br>105=factory trim special calibration<br>106=user trim special calibration<br>255=others |
| 24 | 2024 | SENSOR_CAL_ LOC | – | O/S | Set/indicate the location of the last sensor calibration. |
| 25 | 2025 | SENSOR_CAL_ DATE | – | O/S | Set/indicate the date of the last sensor calibration. |
| 26 | 2026 | SENSOR_CAL_ WHO | – | O/S | Set/indicate the name of the person responsible for the last sensor calibration. |
| 27 | 2027 | SECONDARY_ VALUE | – | – | The secondary value (istatic pressure) of transducer. |
| 28 | 2028 | SECONDARY_ VALUE_UNIT | MPa | – | The engineering unit of secondary value. |
| 29 | 2029 | TERTIARY_ VALUE | – | – | The tertiary value (Temperature) of transducer. |
| 30 | 2030 | TERTIARY_ VALUE_UNIT | C | O/S | The engineering unit of tertiary value. |
| 31 | 2031 | TRIM_PV_ZERO | 0 | O/S | The trim zero of primary value. |
| 32 | 2032 | TRIM_MODE | Trim disable | O/S | Trim disable:     Prohibit zero/span calibration<br>Trim enable:      Enable zero/span calibration<br>Trim data clear: Clear zero/span calibration |
| 33 | 2033 | EXT_ZERO_ ENABLE | Enable | O/S | The permission of external SW for trim zero. |
| 34 | 2034 | MODEL | Model code | – | The model code. |
| 35 | 2035 | DISPLAY_MODE | 1 | O/S | The mode of display. 1=Engineering unit, 2=% display |
| 36 | 2036 | DISPLAY_CYCLE | 1 | O/S | The cycle of display on LCD. |
| 37 | 2037 | ALARM_SUM | Enable | – | The current alert status, unacknowledged status, unreported status and disabled status of the alarms associated with the function block. |
| 38 | 2038 | TEST_1 | – | – | Not used for EJA. |
| 39 | 2039 | TEST_2 | – | – | Not used for EJA. |
| 40 | 2040 | TEST_3 | – | – | Not used for EJA. |
| 41 | 2041 | TEST_4 | – | – | Not used for EJA. |
| 42 | 2042 | TEST_5 | – | – | Not used for EJA. |
| 43 | 2043 | TEST_6 | – | – | Not used for EJA. |
| 44 | 2044 | TEST_7 | – | – | Not used for EJA. |
| 45 | 2045 | TEST_8 | – | – | Not used for EJA. |
| 46 | 2046 | TEST_9 | – | – | Not used for EJA. |
| 47 | 2047 | TEST_10 | – | – | Not used for EJA. |
| 48 | 2048 | TEST_11 | – | – | Not used for EJA. |
| 49 | 2049 | TEST_12 | – | – | Not used for EJA. |
| 50 | 2050 | TEST_13 | – | – | Not used for EJA. |
| 51 | 2051 | TEST_14 | – | – | Not used for EJA. |
| 52 | 2052 | TEST_15 | – | – | Not used for EJA. |
| 53 | 2053 | TEST_16 | – | – | Not used for EJA. |
| 54 | 2054 | TEST_17 | – | – | Not used for EJA. |

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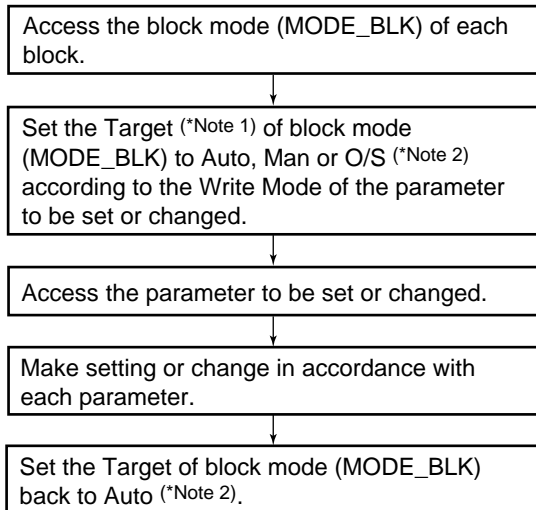# APPENDIX 2.  APPLICATION, SETTING AND CHANGE OF BASIC PARAMETERS

## A2.1 Applications and Selection of Basic Parameters

| Setting Item (applicable parameters) | Summary |
|---|---|
| Tag No. | Sets PD Tag and each block tag.<br>Up to 32 alphanumeric characters can be set for both tags.<br>Refer to "Tag and address" in Section 5.4. |
| Calibration range setup (XD_SCALE) | Sets the range of input from the transducer block corresponding to the 0% and 100% points in operation within the AI1 function block.  The calibrated range (0% and 100%) is the factory default setting.<br>Sets the range unit, input value of the 0% point (lower range limit), input value of the 100% point (higher range limit), and the 4 data at the decimal point. |
| Output scale setup (OUT_SCALE) | Sets the scale of output corresponding to the 0% and 100% points in operation within the AI1 function block. It is possible to set a unit and scale that differs from the calibration range.<br>Sets the range unit, input value of the 0% point (lower bound of output scale), input value of the 100% point (upper bound of output scale), and the 4 data at the decimal point. |
| Scale range and unit of built-in indicator setup (OUT_SCALE) | The range determined with the output scale becomes the scale and unit of the built-in indicator.<br>Note: If a built-in indicator is available, the lower bound and the upper bound of the range (numeric string excluding the decimal point if it is included) may be set in a range from -19999 to 19999. Down to the third decimal position can be set. |
| Output mode setup (L_TYPE) | Selects the operation function of the AI function block.  It may be chosen from among Direct, Indirect, and IndirectSQRT.<br>Direct:           The output of the transducer block is directly output only via filtering without scaling and square root extraction.<br>Indirect:         Output processed by proportion at the AI function block.<br>IndirectSQRT: Output processed by square root extraction at the AI function block. |
| Output signal low cut mode setup (LOW_CUT) | If the output falls below the setting of this parameter, the output is set to Zero.  It can be set individually with Direct, Indirect, and IndirectSQRT. |
| Damping time constant setup (PV_FTIME) | Sets the time constant of the damping (primary delay) function in the AI function block in seconds. |
| Simulation setup (SIMULATE) | Performs simulation of the AI function block.<br>The input value and status for the calibration range can also be set.<br>It is recommended that this parameter be used for loop checks and other purposes.  Refer to "Simulation Function" in Section 6.3. |
| Static pressure | Sets the static pressure to be processed by the AI2 function block. |
| LCD display setup (DISPLAY_MODE, DISPLAY_CYCLE) | Sets the unit to be displayed on the LCD and the display speed.<br>Adjust display speed if a low temperature environment causes a poor LCD display quality. |
| Temperature unit setup (TERTIARY_VALUE_UNIT) | Sets the temperature unit. |
| Range change (while applying actual inputs) (CAL_POINT_HI, CAL_POINT_LO) | Sets the range corresponding to the 0% and 100% points while adding the real input. It is possible to set output to correctly match the user's reference device output. |
| Zero-point adjustment (TRIM_PV_ZERO, EXT_ZERO_ENABLE) | Performs zero-point adjustment.<br>There are two methods for adjustment, (1) using an external zero-point adjustment screw, and (2) by using the parameter of the transducer block. |

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## A2.2 Setting and Change of Basic Parameters

This section describes the procedure taken to set and change the parameters for each block. Obtaining access to each parameter differs depending on the configuration system used. For details, refer to the instruction manual for each configuration system.

Access the block mode (MODE_BLK) of each block.

↓

Set the Target (*Note 1) of block mode (MODE_BLK) to Auto, Man or O/S (*Note 2) according to the Write Mode of the parameter to be set or changed.

↓

Access the parameter to be set or changed.

↓

Make setting or change in accordance with each parameter.

↓

Set the Target of block mode (MODE_BLK) back to Auto (*Note 2).

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### ✋ IMPORTANT

Do not turn the power OFF immediately after parameter setting. Should the power be turned OFF within 30 seconds after setting of parameters, changed parameters are not saved and return to their original values.

Note 1: Block mode consists of the following four modes that are controlled by the universal parameter that displays the running condition of each block.
Target: Sets the operating condition of the block.
Actual: Indicates the current operating condition.
Permit: Indicates the operating condition that the block is allowed to take.
Normal: Indicates the operating condition that the block will
usually take.
Note 2: The following are the operating conditions which the individual blocks will take.

|  | AI Function Block | Transducer Block | Resource Block |
|---|---|---|---|
| Automatic (Auto) | Yes | Yes | Yes |
| Manual (Man) | Yes |  |  |
| Out of Service (O/S) | Yes | Yes | Yes |

TA0202.EPS

Refer to the "List of parameters for each block of the EJA" for details of the Write Mode for each block.

## A2.3 Setting the AI1 Function Block

The AI1 function block outputs the differential pressure signals.

### (1)Setting the calibration range

Access the XD_SCALE parameter.
Set the higher range value to EU at 100% on XD_SCALE.
Set the lower range value to EU at 0% on XD_SCALE.
Set the necessary unit to Units Index.
Set the decimal position of 2 to Decimal Point.

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Example:
To measure 0 to 100kPa,
Set 100 to EU at 100% on XD_SCALE,
Set 0 to EU at 0% on XD_SCALE, and
Set 1133 to Units Index on XD_SCALE (*Note).

Note 1: Each unit is expressed using a 4-digit numeric code. Refer to the table in A1.2 for each unit and the corresponding 4-digit codes.
Note 2: Consider the following precautions when selecting each unit.
• Do not select a unit in gauge for an absolute pressure gauge
(EJA310).
• Do not select the unit in abs for a gauging pressure gauge (EJA430, EJA438).

### (2)Setting the output scale

Access the OUT_SCALE parameter.
Set an output value corresponding to the higher range value to EU at 100% on OUT_SCALE.
Set an output value corresponding to the lower range value to EU at 0% on OUT_SCALE.
Set the necessary unit of output to Units Index.
Set the decimal position to Decimal Point.

FA0203.EPS

Example:
To set the output to 0.00 to 100.00%,
Set 100 to EU at 100% on OUT_SCALE,
Set 0 to EU at 0% on OUT_SCALE,
Set 1342 to Units Index on OUT_SCALE , and
Set 2 to Decimal Point on OUT_SCALE.

**Restrictions imposed when the device is equipped with a built-in indicator.**

When the output mode (L_TYPE) is set as Indirect or IndirectSQRT, the range determined by the output scale corresponds to the scale and unit of the indicator. Set the lower and higher value of the range (numeric string excluding decimal point if the decimal point is included) in a range of −19999 to 19999. Down to the third decimal position can be set. (When the output mode (L_TYPE) is set as Direct, unit determined at XD_SCALE is displayed.)

Pa:      1130, 1541(abs), 1542(gauge)
MPa:    1132, 1545(abs), 1546(gauge)
kPa:     1133, 1547(abs), 1548(gauge)
bar:      1137
mbar:    1138
torr:     1139
atm:     1140
psi:      1141, 1142(abs), 1143(gauge)
$g/cm^2$: 1144, 1155(abs), 1156(gauge)
$kg/cm^2$: 1145, 1157(abs), 1158(gauge)
$inH_2O$: 1146, 1559(abs), 1560(gauge), 1147(4°C),
            1561(abs), 1562(gauge), 1148(6°F),
            1569(abs), 1564(gauge)
$mmH_2O$:1149, 1565(abs), 1566(gauge), 1150(4°C),
            1567(abs), 1568(gauge), 1151(6°F),
            1569(abs), 1576(gauge)
$ftH_2O$: 1152, 1571(abs), 1572(gauge), 1153(4°C),
            1573(abs), 1574(gauge), 1154(6°F),
            1575(abs), 1576(gauge)
inHg:    1155, 1577(abs), 1578(gauge), 1156(0°C),
            1579(abs), 1580(gauge)
mmHg: 1157, 1581(abs), 1582(gauge), 1158(0°C),
            1583(abs), 1584(gauge)
%:        1342

## (3)Setting the output mode

```
Access the L_TYPE parameter.
Set the output mode.
  1: Direct          (Sensor output value)
  2: Indirect        (Linear output value)
  3: IndirectSQRT  (Square root extraction
                        output value)
```
FA0204.EPS

## (4)Setting the output signal Low Cut

Set the low cut value.

```
Access the LOW_CUT parameter.
Set the value subject to LOW_CUT.
```
↓
```
Access the IO_OPTS parameter.
Turn Low cutoff ON.
If Low cutoff is turned OFF, Low cut function is
released.
```
FA0205.EPS

## (5)Setting the damping time constant

```
Access the PV_FTIME parameter.
Set the damping time (in seconds).
```
FA0206.EPS

## (6)Simulation

By optionally setting the input value to the calibration range and status, perform simulation of the AI function block.

```
Access the Simulate Status parameter.
Set the status code.
```
↓
```
Access the Simulate Value parameter.
Set an optional input value.
```
↓
```
Access the Simulate En/Disable parameter.
Set whether Simulation is enabled or disabled.
  2: Enabled
  1: Disabled
```
FA0207.EPS

If simulation is enabled, AI block uses Simulate Status and Simulate Value as the input, and if disabled, the AI block uses Transducer Status and Transducer Value as input.
Refer to Section 6.3 Simulation Function.

## A2.4 Setting the AI2 Function Block

The AI2 function block outputs the static pressure signals.

### (1)Setting the static pressure information

The static pressure range and output range can be set using the same procedure as is used for the AI1 function block. For details of how to set these values, refer to "Setting the AI1 function block" in Appendix 2.3.
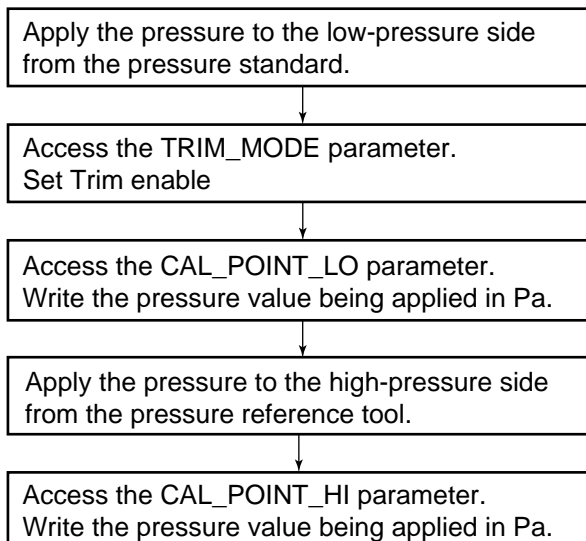
## A2.5 Setting the Transducer Block

To access function specifics of the EJA of the transducer block, the DD (Device Description) for EJA needs to have been installed in the configuration tool used. For integration of DD, refer to "Integration of DD" in Section 4.4.

### (1)Setting the LCD display

Access the DISPLAY_MODE parameter and set the unit of display.
   1: Real item display (Default)
   2: % display

↓

Access the DISPLAY_CYCLE parameter and set display cycle.
The display cycle is 300 mS x (setting).
It defaults to 1, but if the LCD display looks unclear when used in lower temperature environments, increase the value as required.
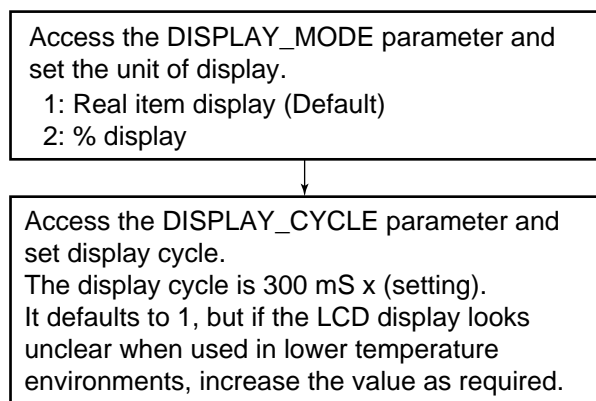
FA0208.EPS

### (2)Setting the unit of temperature

Access the TERTIARY_VALUE parameter.
Set the temperature in the following units:
   1001 = °C
   1002 = °F
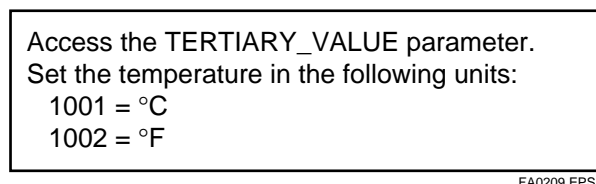
FA0209.EPS

### (3)Range change while applying actual inputs

It is possible to calibrate the sensor by applying the actual inputs to low-pressure and high-pressure points.

Apply the pressure to the low-pressure side from the pressure standard.

↓

Access the TRIM_MODE parameter.
Set Trim enable

↓

Access the CAL_POINT_LO parameter.
Write the pressure value being applied in Pa.

↓

Apply the pressure to the high-pressure side from the pressure reference tool.

↓

Access the CAL_POINT_HI parameter.
Write the pressure value being applied in Pa.

FA0210.EPS

### (4)Zero-point adjustment

Zero-point adjustment can be performed in various ways.
Choose the optimum method in accordance with the circumstances specific to the application employed.

| Adjustment | Summary | |
|---|---|---|
| Zero-point adjustment using setting tool. | (a) Set the current input value to 0%. | Set the input signal to 0% status and adjust 0% output. |
| | (b) Adjust the output to a reference value obtained using other means. | If it is difficult to set input signals such as tank level to 0% status, adjust the output to a reference value obtained using other means. |
| Zero-point adjustment using an external zero-point adjustment screw. | (c) Perform zero-adjustment with the zero-point adjustment screw attached to the transmitter. | |

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(a) Perform the following procedure to set the current output value to 0%.

Set the input pressure to zero.

↓

Access the TRIM_PV_ZERO parameter.
When 0.1 is written, adjustment is performed to set the current input pressure to zero.
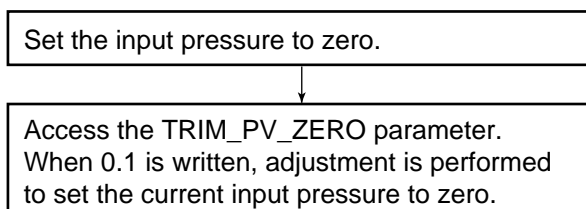
Note: TRIM_PV_ZERO allows only 0 to be executable.

FA0211.EPS

(b) In tank level measurement, if the actual level cannot be brought to zero for zero adjustment, then the output can be adjusted to correspond to the actual level obtained using another measuring instrument such as a sight glass.

Current level: 45%
Current output: 42% (output range value)
Current setting of calibration range: 0 - 100kPa

In order to adjust the current output with the actual level, it is necessary to shift current output so as to indicate the actual correct level with the OUT_SCALE parameter. For details of how to set the OUT_SCALE parameter, refer to "Setting the output scale" in Section A2.3 (2).

(c) Zero-point adjustment using an external zero-adjustment screw

If zero- adjustment by means of adjustment screw is permitted, perform adjustment by turning the screw.

```
┌─────────────────────────────────────────┐
│ Access the EXT_ZERO_ENABLE parameter.    │
│ Write 0 and permit setting beginning with│
│ external zero-point adjustment.          │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Set Auto to the Target parameter in block mode │
│ (MODE_BLK).                              │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Perform zero-point adjustment by using a │
│ standard screwdriver to turn the zero-   │
│ adjustment screw mounted outside the     │
│ equipment case.                          │
└─────────────────────────────────────────┘
```
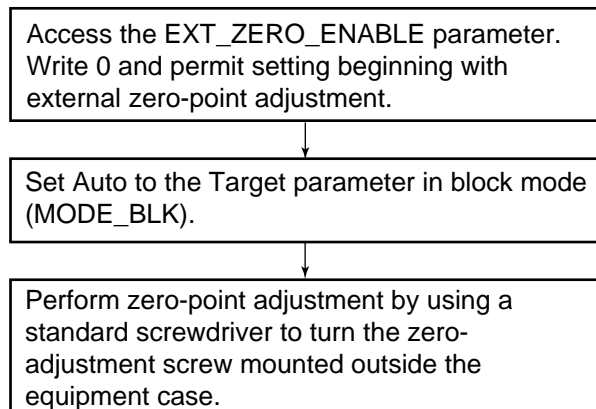
FA0212.EPS

Turning the screw clockwise causes the output value to increase while turning it counterclockwise causes the output to decrease; zero-point can be adjusted with a resolution of 0.001% of URV. The amount of zero-point adjustment changes according to the speed at which the zero- adjustment screw is turned; turn it slowly for fine tuning, or quickly for coarse tuning.

# APPENDIX 3.  OPERATION OF EACH PARAMETER IN FAILURE MODE

- **Following table summarizes the value of EJA parameters when LCD display indicates an Alarm. (1)**

| ALARM Display | Cause of Alarm | Resource Block | Transducer Block | Function Block |
|---|---|---|---|---|
| AL. 01 | Capsule Module Failure | – | BLOCK_ERR=Input Failure | – |
| | | | XD_ERROR= Mechanical Failure | |
| | | | PV. STATUS=BAD: Sensor Failure | PV. STATUS=BAD: Sensor Failure |
| | | | SV. STATUS=BAD: Sensor Failure | OUT. STATUS=BAD: Sensor Failure |
| AL. 02 | AMP Module Failure 1 | – | BLOCK_ERR=Device Needs Maintenance Now | – |
| | | | XD_ERROR=I/O Failure or Electronics Failure | |
| | | | PV. STATUS=BAD: Device Failure | PV. STATUS=BAD: Device Failure |
| | | | SV. STATUS=BAD: Device Failure | OUT. STATUS=BAD: Device Failure |
| AL. 03 | AMP Module Failure 2 | BLOCK_ERR=Lost Static Data or Lost NV Data | – | – |
| | | | – | |
| | | | PV. STATUS=BAD: Non Specific | PV. STATUS=BAD: Non Specific |
| | | | SV. STATUS=BAD: Non Specific | OUT. STATUS=BAD: Non Specific |
| AL. 20 | AI1 Block is not scheduled | – | – | – |
| | | | | PV. STATUS=HOLD |
| | | | | OUT. STATUS=HOLD |
| AL. 21 | Resource Block is in O/S mode | BLOCK_ERR=Out of Service | – | – |
| | | – | PV. STATUS=BAD: Non Specific | PV. STATUS=HOLD |
| | | | SV. STATUS=BAD: Non Specific | OUT. STATUS=BAD: Out of Service |
| AL. 22 | Transducer Block is in O/S mode | – | BLOCK_ERR=Out Of Service | – |
| | | | PV. STATUS=BAD: Out Of Service | PV. STATUS=BAD: Non Specific |
| | | | SV. STATUS=BAD: Out Of Service | OUT. STATUS=BAD: Non Specific |

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- **Following table summarizes the value of EJA parameters when LCD display indicates an Alarm. (2)**

| ALARM Display | Cause of Alarm | Resorce Block | Transducer Block | Function Block |
|---|---|---|---|---|
| AL. 23 | AI1 Function Block is in O/S mode | – | – | BLOCK_ERR=Out Of Service |
| | | | | PV. STATUS=HOLD |
| | | | | OUT. STATUS=BAD: Non Specific |
| AL. 41 | Differential Pressure is out of normal range | – | PV. STATUS= UNCERTAIN: Sensor Conversion not accurate | PV. STATUS= UNCERTAIN: Non Specific |
| | | | SV. STATUS= UNCERTAIN: Non Specific | OUT. STATUS= UNCERTAIN: Non Specific |
| AL. 42 | Static Pressure is out of normal range | – | PV. STATUS= UNCERTAIN: Non Specific | PV. STATUS= UNCERTAIN: Non Specific |
| | | | SV. STATUS= UNCERTAIN: Sensor Conversion not accurate | OUT. STATUS= UNCERTAIN: Non Specific |
| AL. 43 | Fluid temperature is out of normal range | – | PV. STATUS= UNCERTAIN: Non Specific | PV. STATUS= UNCERTAIN: Non Specific |
| | | | SV. STATUS= UNCERTAIN: Non Specific | OUT. STATUS= UNCERTAIN: Non Specific |
| AL. 61 | Data is out of LCD display range | – | – | – |
| AL. 62 | Simulation is enabled in AI1 Function Block | BLOCK_ERR= Simulate Active | – | BLOCK_ERR= Simulate Active |
| AL. 63 | AI1 Function Block is in Manual mode | – | – | OUT. STATUS=HOLD (When "if Man Mode" is not set.) or =Uncertain Substitute (When OUT is changed) |
| AL. 64 | Zero Adjust value is out of normal range | – | PV. STATUS=BAD: Configuration Error | PV. STATUS= BAD: Non Specific (for AI1) |
| | | | – | OUT. STATUS= BAD: Non Specific (for AI1) |

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# APPENDIX 4.  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.

## A4.1 Function Diagram

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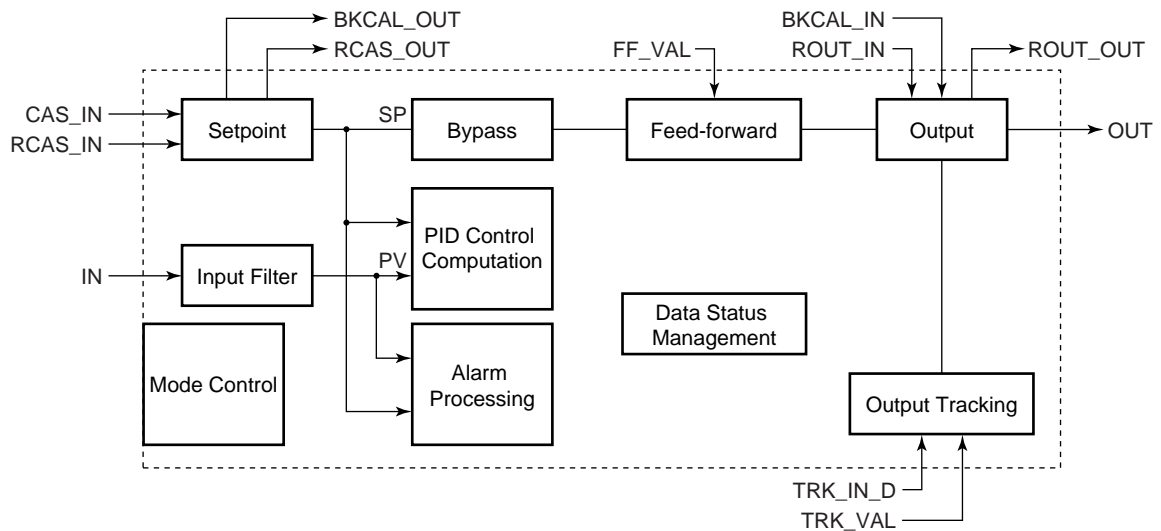


FA0401.EPS

## A4.2  Functions of PID Bock

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. |

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## A4.3 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 | (blank) | | | Same as that for an AI block. |
| 3 | STRATEGY | 0 | | | 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 | MAN | | Upper and lower scale limit values used for scaling of the input (IN) value. |
| 11 | OUT_SCALE | 100 0 1342 1 | MAN | | 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 A4.13 for details. |
| 14 | STATUS_OPTS | 0 | O/S | | See Section A4.15 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 | 0 | | | Proportional gain (= 100 / proportional band) |
| 24 | RESET | +INF | | | 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. |

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| Index | Parameter Name | Default (factory setting) | Write | Valid Range | Description |
|---|---|---|---|---|---|
| 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 A4.17.1 for details. |
| 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 A4.12 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 | 0 | | | 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. |

TA0402-2.EPS

## A4.4 PID Computation Details

For PID control, the PID block in an EJA employs the I-PD control algorithm, which is detailed below.

### A4.4.1 PV-proportional and -derivative Type PID (I-PD) Control Algorithm

The I-PD control algorithm, which is expressed in the basic equation below, 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.

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

Where,

$\Delta MVn$ = change in control output

$\Delta PVn$ = change in measured (controlled) value = PVn - PVn-1

$\Delta T$ = 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.

### A4.4.2 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) |

TA0403.EPS

## A4.5 Control Output

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

### A4.5.1 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, $\Delta MVn$, to the current read-back value of the MV, $MV_{RB}$ (BKCAL_IN). This action can be expressed as:

$$OUT = BKCAL\_IN - \Delta MVn$$

## A4.6 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. |

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## A4.7 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.
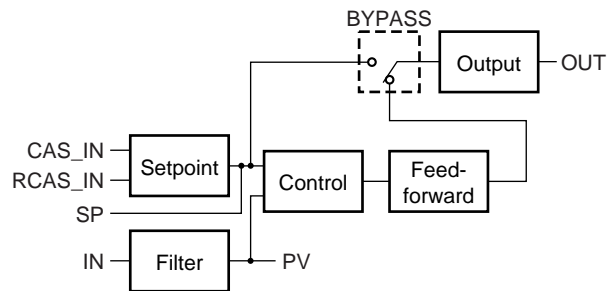


FA0402.EPS

## A4.8 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. See the figure below.



FA0403.EPS

## A4.9 Block Modes

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

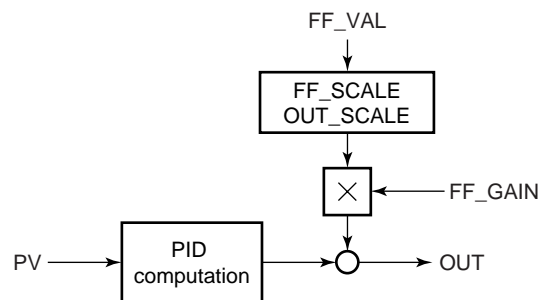| MODE_BLK | Target | Stipulates the target mode to which the PID block transfers. |
|---|---|---|
| | Actual | Indicates the current mode of the PID block. |
| | Permitted | Stipulates all the modes that the PID block can enter. The PID block is prohibited to enter any mode other than those set in this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

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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 A4.14). |
| 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. |

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### A4.9.1 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 A4.14) | **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 |
| 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 A4.17.1 for details) | |

TA0407.EPS

\* 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.

## A4.10 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.

## A4.11 Setpoint Limiters

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

### A4.11.1 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.

### A4.11.2 When PID Block Is in Cas or RCas Mode

By selecting Obey SP Limits if Cas or RCas in CONTROL_OPTS (see Section A4.13), the setpoint high/low limits can be put into force also when the value of MODE_BLK is Cas or RCas.

## A4.12 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.



FA0404.EPS
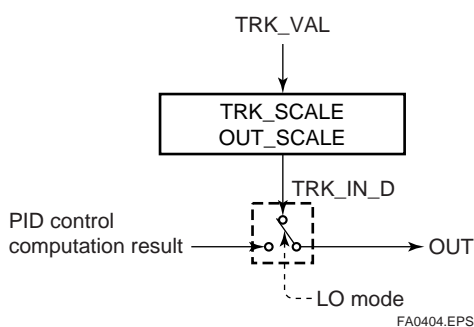
To change the block mode to LO:

(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.

## A4.13 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. |

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## A4.14 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.

## A4.15 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. |

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## A4.16 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.

## A4.17 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.

### A4.17.1 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. |

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*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.
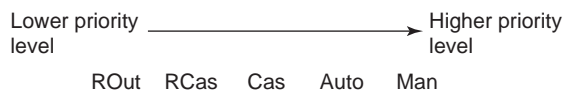


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*2  Only when Auto is set as permitted mode.

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.

## A4.18 Alarms

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

### A4.18.1 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 |
|---|---|
| Input Failure | **IN.status** of the PID block is either of the following: • Bad-Device Failure • Bad-Sensor Failure |
| Out of Service | **MODE_BLK.target** of the PID block is O/S. |

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### A4.18.2 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 |

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## A4.19 Example of Block Connections
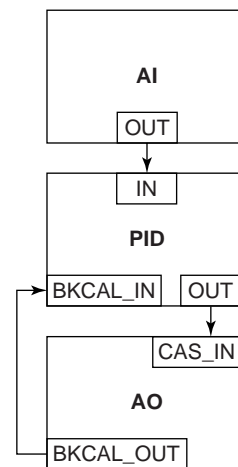


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When configuring a simple PID control loop by combining an EJA transmitter with a fieldbus valve positioner that contains an AO block, follow the procedure below to make the settings of the corresponding fieldbus function blocks:

1. Connect the AI block and PID block of the EJA, 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.

## A4.19.1 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 | |
| | | | | | |
| | Subtotals | 28 | 43 | 53 | 41 |
| | | | | | |

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| Relative Index | Parameter Mnemonic | VIEW 1 | VIEW 2 | VIEW 3 | VIEW 4 |
|---|---|---|---|---|---|
| 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 | | | | |
| | | | | | |
| | | | | | |
| | Subtotals | 15 | 0 | 30 | 63 |
| | Totals | 43 | 43 | 83 | 104 |

TA0413-2.EPS

# APPENDIX 5.  LINK MASTER FUNCTIONS

## A5.1 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.

An EJA 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.

## A5.2 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.
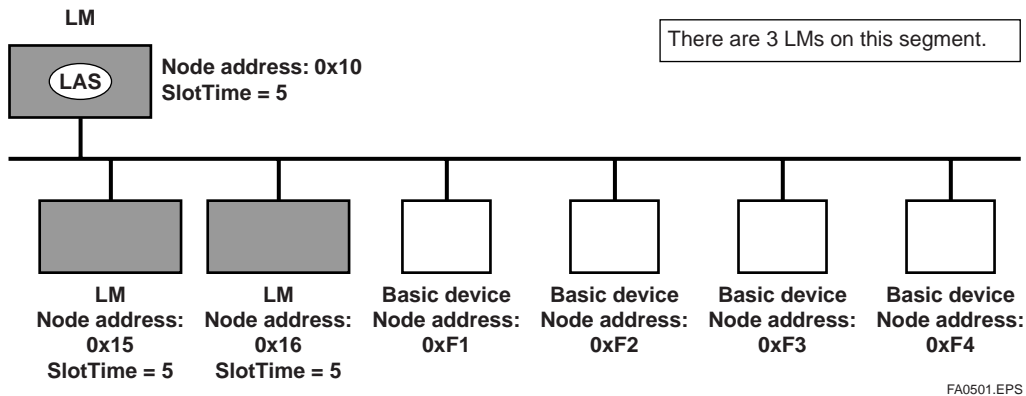


**Figure 1.  Example of Fieldbus configuration-3 LMs on Same Segment**

## A5.3 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.
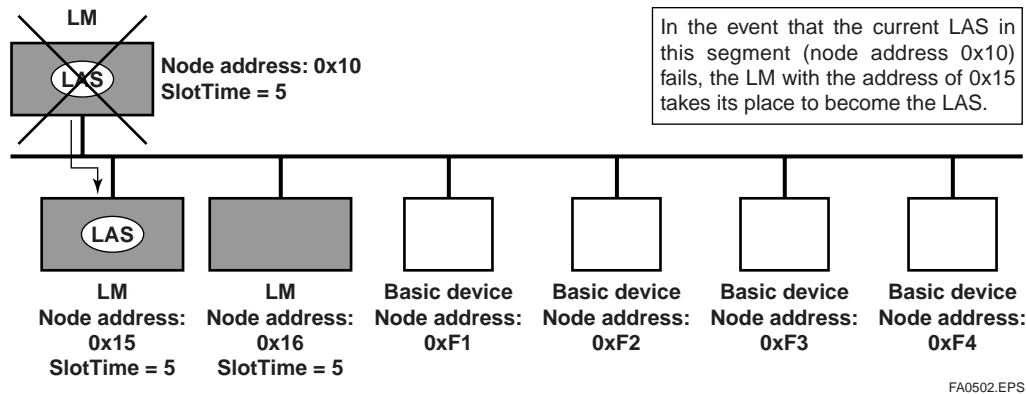


In the event that the current LAS in this segment (node address 0x10) fails, the LM with the address of 0x15 takes its place to become the LAS.

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**Figure 2.  Backup of LAS**

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

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

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



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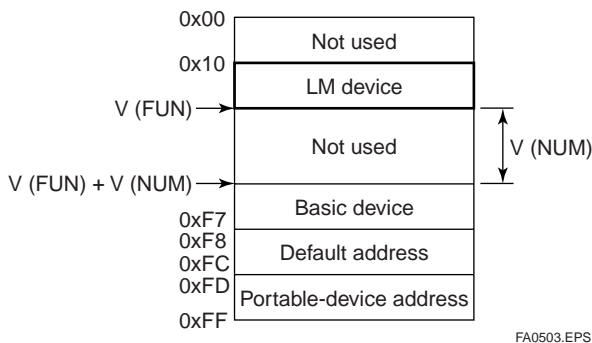
**Figure 3.  Node Address Ranges**

(2) In the LAS settings of the EJA, 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 (EJA Index 361 (SM))**

| Sub-index | Element | EJA | Device 1 | Device 2 | Device 3 | Description |
|---|---|---|---|---|---|---|
| 1 | SlotTime | 4 | 8 | 10 | 20 | Capability value for V(ST) |
| 3 | MaxResponse Delay | 3 | 6 | 3 | 5 | Capability value for V(MRD) |
| 6 | MinInterPdu Delay | 4 | 8 | 12 | 10 | Capability value for V(MID) |

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

**ConfiguredLinkSettingsRecord (EJA Index 369 (SM))**

| Subindex | Element | Setting (Default) | Description |
|---|---|---|---|
| 1 | SlotTime | 20(4095) | V (ST) |
| 3 | MaxResponseDelay | 6(   5) | V (MRD) |
| 6 | MinInterPduDelay | 12(  10) | V (MID) |

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(3) In the LAS settings of the EJA, 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 3.)

**ConfiguredLinkSettingsRecord (EJA Index 369 (SM))**

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

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## A5.4 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.<br>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.<br>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 A5.5. |
| 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. |

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## A5.5 LM Parameters

### A5.5.1 LM Parameter List

The tables below show LM parameters of an EJA transmitter.

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 |
|---|---|---|---|---|---|---|
| 362 | DLME_LINK_MASTER_CAPABILITIES_VARIABLE | | | 0x04 | RW | |
| 363 | 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 | 8 | | |
| | | 8 | LasDatabaseStatusSpduDistributionPeriod | 6000 | | |
| 364 | PRIMARY_LINK_MASTER_FLAG_VARIABLE | | | – | RW | LAS: True = 0xFF; non-LAS: False = 0x00 |
| 365 | LIVE_LIST_STATUS_ARRAY_VARIABLE | | | – | R | |
| 366 | MAX_TOKEN_HOLD_ TIME_ARRAY | 0 | | 0x0000×16, 0x012c×16 | RW | |
| | | 1 | Element1 | 0x012c×5, 0x0000×27 | | |
| | | 2 | Element2 | 0x0000×32 | | |
| | | 3 | Element3 | 0x0000×32 | | |
| | | 4 | Element4 | 0x0000×32 | | |
| | | 5 | Element5 | 0x0000×32 | | |
| | | 6 | Element6 | 0x0000×31  ox012c | | |
| | | 7 | Element7 | 0x012c×32 | | |
| | | 8 | Element8 | 0x02 | | |
| 367 | BOOT_OPERAT_FUNCTIONAL_CLASS | | | | RW | 0x01 (basic device); 0x02 (LM) |
| 368 | CURRENT_LINK_ SETTING_RECORD | 0 | | | R | Settings for LAS |
| | | 1 | SlotTime | | | |
| | | 2 | PerDlpduPhlOverhead | | | |
| | | 3 | MaxResponseDelay | | | |
| | | 4 | FirstUnpolledNodeId | | | |
| | | 5 | ThisLink | | | |
| | | 6 | MinInterPduDelay | | | |
| | | 7 | NumConseeUnpolledNodeId | | | |
| | | 8 | PreambleExtension | | | |
| | | 9 | PostTransGapExtension | | | |
| | | 10 | MaxInterChanSignalSkew | | | |
| | | 11 | TimeSyncClass | | | |
| 369 | 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 | | |

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| Index (SM) | Parameter Name | Sub-parameter Name (Sub Index) | | Default Factory Setting | Access | Remarks |
|---|---|---|---|---|---|---|
| 370 | PLME_BASIC_ CHARACTERISTICS | 0 | | | R | |
| | | 1 | ChannelStatisticsSupported | 0x00 | | |
| | | 2 | MediumAndDataRatesSupported | 0x4900000000000000 | | |
| | | 3 | IecVersion | 1 (0x1) | | |
| | | 4 | NumOfChannels | 1 (0x1) | | |
| | | 5 | PowerMode | 0 (0x0) | | |
| 371 | 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) | | |
| 372 | 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) | | |
| 373 | LINK_SCHEDULE_ACTIVATION_VARIABLE | | | | RW | |
| 374 | LINK_SCHEDULE_LIST_ CHARACTERISTICS_ RECORD | 0 | | | R | |
| | | 1 | NumOfSchedules | 0 | | |
| | | 2 | NumOfSubSchedulesPerSchedule | 1 | | |
| | | 3 | ActiveScheduleVersion | 0 | | |
| | | 4 | ActiveSheduleOdIndex | 0 | | |
| | | 5 | ActiveScheduleStartingTime | 0 | | |
| 375 | DLME_SCHEDULE_ DESCRIPTOR.1 | 0 | | | R | |
| | | 1 | Version | 0 | | |
| | | 2 | MacrocycleDuration | 0 | | |
| | | 3 | TimeResolution | 0 | | |
| 376 | DLME_SCHEDULE_ DESCRIPTOR.2 | 0 | | | R | |
| | | 1 | Version | 0 | | |
| | | 2 | MacrocycleDuration | 0 | | |
| | | 3 | TimeResolution | 0 | | |
| 377 | DOMAIN.1 | | | | | Read/write impossible. Get-OD possible. |
| 378 | DOMAIN.2 | | | | | Read/write impossible. Get-OD possible. |

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## A5.5.2 Descriptions for LM Parameters

The following describes LM parameters of an EJA transmitter.

NOTE: Do not turn off the power to the EJA for 30 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 |

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### (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) |

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### (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.

0x<u>00 00 84</u> 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00

Bit correspondences: <u>0</u> 0 0 0 0 0 0 0 0 0 0

0×00

0 0 0 0 0 <u>1</u> 0 0 0 0 <u>1</u> 0 0...

0×10      0×15

### (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) |

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## (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) |

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## (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 | 0x0403 | IEC 4.3 is supported. |
| 4 | NumOf Channels | 1 | 1 | |
| 5 | Power Mode | 1 | 0 | 0: Bus-powered; 1: Self-powered |

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## (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 |

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## (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. |

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## (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.  (This is fixed to 1 in the Yokogawa communication stacks.) |
| 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. |

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## (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. |

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### (15) Domain

Read/write: impossible; get-OD: possible

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

## A5.6 FAQs

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

A1-1.  Is that EJA running as an LM?  Check that the value of BootOperatFunctionalClass (index 367) 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:

EJA                Other LMs

$V(ST) \times V(TN)$     $<$     $V(ST) \times V(TN)$

**Q2.  How can I make an EJA become the LAS?**

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

LinkScheduleListCharacteristicsRecord (index 374 for an EJA)

- ActiveScheduleVersion (subindex 3)

A2-2.  Make the EJA declare itself as and become the LAS by writing:

- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and

- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 364) in the EJA.

**Q3.  On a segment where an EJA 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 EJA and the capabilities of being the LAS for the device that cannot be connected:
- V(ST), V(MID), V(MRD) of EJA: ConfiguredLinkSettingsRecord (index 369)
- V(ST), V(MID), V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

EJA                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 EJA.