ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION

JDF300

Field indicator with FOUNDATION Fieldbus communication

The field indicator JDF300 provides simple and low cost remote indication of a process variable on an easy to read LCD display.

Measurement made easy

JDF300 field indicator

Introduction

The present manual provides information on installing, operating, troubleshooting the field indicator JDF300. Every section of the present manual is specifically dedicated to the specific phase of the field indicator lifecycle starting from its receipt and identification, passing to the installation, to the electrical connections, to the configuration and to the troubleshooting and maintenance operations.

The present manual can be used for JDF300 field indicator.

The new JDF300 Foundation Fieldbus indicator provides remote visibility for up to 8 variables, subscribed from the bus (publisher/subscriber) or directly written by the Host (client/server).
Each individual variable/input to be displayed can be remotely selected through FF protocol or locally selected operating on the housing push button or through the local display menu: such delocalized configuration capabilities saves time and greatly improve productivity.
In addition to its standard function of Field Indicator, the JDF300 is a Link Master device and offers a set of Control Function Blocks improving its calculation capability available for distributed control strategy solutions.

For more information

Further publications for JDF300 are available for free download from:
www.abb.com/measurement

or by scanning this code:

Search for or click on:	
JDF300 field indicator – Datasheet	DS/JDF300-EN
JDF300 field indicator – Operating Instruction	OI/JDF300-EN

Contents

1 Health & Safety

General Safety Information

The Safety section provides an overview of the safety aspects to be observed for operation of JDF300. The device has been constructed in accordance with the state of the art and is operationally safe. It has been tested and left the factory in perfect working conditions. The information in the manual, as well as the applicable documentation and certificates, must be observed and followed in order to maintain this condition throughout the period of operation.

Full compliance with the general safety requirements must be observed during operation of the device. In addition to the general information, the individual sections in the manual contain descriptions of processes or procedural instructions with specific safety information. Only by observing all of the safety information can you reduce to the minimum the risk of hazards for personnel and/or environment. These instructions are intended as an overview and do not contain detailed information on all available models or every conceivable event that may occur during setup, operation, maintenance work and dismantling. For additional information, or in the event of specific problems not covered in detail by these operating instructions, please contact the manufacturer. In addition, ABB declares that the contents of this manual are not part of any prior or existing agreements, commitments or legal relationships; nor are they intended to amend these. All obligations of ABB arise from the conditions of the relevant sales agreement, which also contains the solely binding warranty regulations in full. These contractual warranty provisions are neither extended nor limited by the information provided in this manual.

⚠ CAUTION

Only qualified and authorized specialist personnel should be charged with installation, electrical connection, commissioning and maintenance of the field indicator.

Qualified personnel are persons who have experience in installation, electrical connection, commissioning and operation of the field indicator or similar devices and hold the necessary qualifications such as:

- Training or instruction, i.e., authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures and aggressive media
- Training or instruction in accordance with safety engineering standards regarding maintenance and use of adequate safety systems.

For safety reasons, ABB draws your attention to the fact that only sufficiently insulated tools conforming to DIN EN 60900 may be used. Since the field indicator may form part of a safety chain, we recommend replacing the device immediately if any defects are detected. In case of use in Hazardous Area non sparking tools only must be employed. In addition, you must observe the relevant safety regulations regarding the installation and operation of electrical systems and the relevant standards, regulations, guidelines about explosion protection.

Improper use

It is prohibited to use the device for the following purposes:

- As a climbing aid, e.g., for mounting purposes
- As a support for external loads, e.g., as a support for pipes.
- Adding material, e.g., by painting over the name plate or welding/soldering on parts
- Removing material, e.g., by drilling the housing.

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible as far as these are described in the manual. Approval by ABB must be requested for any activities beyond this scope. Repairs performed by ABB-authorized centers are excluded from this.

Technical limit values

The device is designed for use exclusively within the values stated on the name plates and within the technical limit values specified on the data sheets.

The following technical limit values must be observed:

- The maximum ambient operating temperature may not be exceeded.
- The housing protection type must be observed.
- The supply voltage and power

Warranty provision

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations, releases the manufacturer from any liability for any resulting damage. This makes the manufacturer's warranty null and void.

Use of instructions

⚠ DANGER

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠ WARNING

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠ CAUTION

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word '**NOTICE**' indicates potential damage to material or its surrounding area.

IMPORTANT

This message indicates operator tips or particularly useful information. It does not indicate a dangerous or damaging situation.

Operator liability

The operators must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices.

Qualified personnel

Installation, commissioning, and maintenance of the device may only be performed by trained specialist personnel who have been authorized by the plant operator. The specialist personnel must have read and understood this safety manual and comply with its instructions.

Returning devices

Use the original packaging or suitably secure shipping package if you need to return the device for repair.
According to EU guidelines and other local laws for hazardous materials, the owner of hazardous waste is responsible for its disposal. The owner must observe the proper regulations for shipping purposes. All devices sent back to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Disposal

ABB actively promotes environmental awareness and has an operational management system that meets the requirements of EN ISO 9001:2015, EN ISO 14001:2015 and EN ISO 18001:2015. Our products and solutions are intended to have minimum impact on the environment and people during manufacturing, storage, transport, use and disposal. This includes the environmentally friendly use of natural resources. ABB conducts an open dialog with the public through its publications. This product/solution is manufactured from materials that can be reused by specialist recycling companies.

Information on WEEE Directive 2012/19/EU (Waste Electrical and Electronic Equipment)

This product or solution is subject to the WEEE Directive 2012/19/EU or corresponding national laws. Starting from August 15th 2018, electrical and electronic equipment marked with the crossed-out wheeled bin symbol may not be disposed as unsorted municipal waste. Waste of electrical and electronic equipment (WEEE) shall be treated separately using the national collection framework available to customers for the return, recycling and treatment of WEEE.

Transport and storage

After unpacking the field indicator, check the device for transport damage. Check the packaging material for accessories. During intermediate storage or transport, store the field indicator in the original packaging only.
For information on permissible ambient conditions for storage and transport, see “Technical data”. Although there is no limit on the duration of storage, the warranty conditions stipulated on the order acknowledgment from the supplier still apply.

Safety information for electrical installation

Electrical connections may only be established by authorized specialist personnel in accordance with the electrical circuit diagrams. The electrical connection information in the manual must be observed; otherwise, the applicable protection type may be affected. Ground the measurement system according to requirements.

Safety information for inspection and maintenance

⚠ WARNING

There is no EMC protection or protection against accidental contact when the housing cover is open. There are electric circuits within the housing which are dangerous if touched. Therefore, the auxiliary power must be switched off before opening the housing cover.
Corrective maintenance work may only be performed by trained personnel.

- Before removing the device, remove power supply.
- Check whether hazardous materials have been used in the surroundings before opening the device. Residual amounts of hazardous substances may still be present in the device and could escape when the device is opened.
- Within the scope of operator responsibility, check the measurement-related function as part of a regular inspection.

Cyber security

Disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is operator’s sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be). Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.
ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Communication protocol specific

The FOUNDATION Fieldbus protocol is an unsecured protocol, such as the intended application should be assessed to ensure that these protocols are suitable before implementation.

2 Field indicator overview

Field indicator components overview

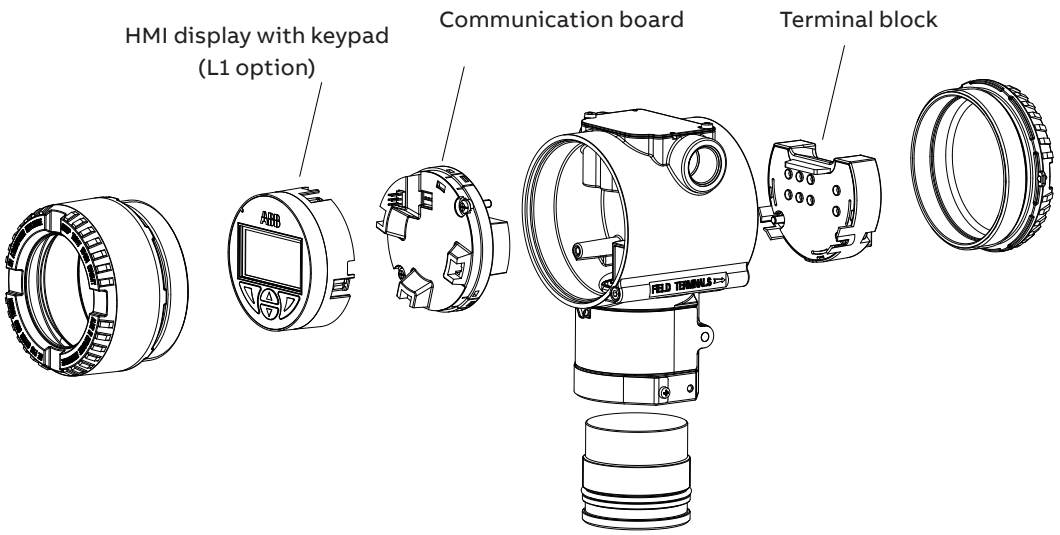


Figure 1 Field Indicator components

3 Product identification

Nameplate

The instrument is identified by the plates shown below.
The Nameplate provides information concerning: product code, output signal, tag and product serial number (see Ref. A).
Please refer to this number when making enquiries.
The Safety Marking plate provides information of Ex protection; it is filled with necessary Ex information only when the indicator is for Hazardous Area installation (see Ref. B).

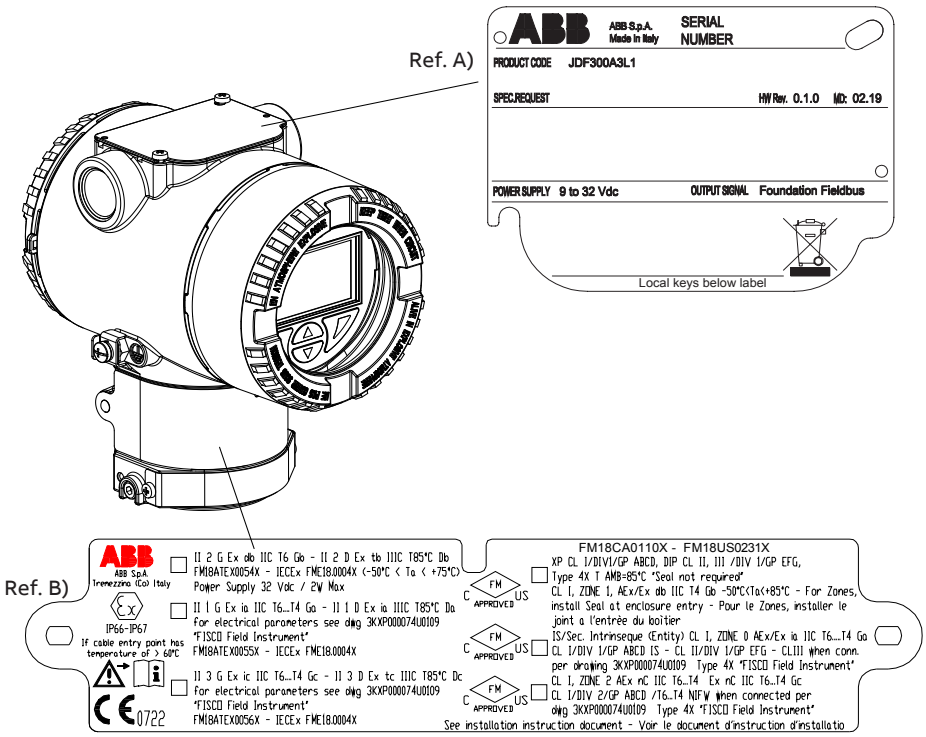


Figure 2 Product identification

JDF300 field indicator is in compliance with EMC 2014/30/EU.
The certification plate (ref.A) shown here is issued by ABB S.p.A, 22016 Tremezzina, Italy, with the numbers:

- FM 18 ATEX 0054X Ex db
- FM 18 ATEX 0055X Ex ia
- FM 18 ATEX 0056X Ex ic
- IECEx FME 18.0004X Exia, Ex db, Ex ic
- FM 18 US 0231X (IS, XP, NI, DIP) US
- FM 18 US 0110X (IS, XP, NI, DIP) CAN

Optional wired-on SST plate (I1)

The JDF300 can be supplied with the optional “Wired on stainless steel plate” (figure 3) which is permanently laser printed with a custom text specified in phase of order. The available space consists in 4 lines with 32 characters per line. The plate will be connected to the field indicator with a stainless steel wire.

Figure 3 4-line layout of the optional wired-on Stainless Steel plate

4 Handling and Storage

The instrument does not require any special precautions during handling although normal good practice should be observed. The instrument does not require any special treatment if stored as dispatched and within the specified ambient conditions. There is no limit to the storage period, although the terms of guarantee remain as agreed with the Company and as given in the order acknowledgement.

Model JDF300	Storage temperature limits
With LCD display	–40 and 85 °C (–40 and 185 °F)

5 Installation

General

Study these installation instructions carefully before proceeding.
Failure to observe the warnings and instructions may cause a malfunction or personal hazard. Before installing the field indicator, check whether the device design meets the requirements of the measuring point from a measurement technology and safety point of view. This applies in respect of:
• Environment corrosion
• Explosion protection certification
• Temperature
• Operating voltage and current
In addition, the relevant directives, regulations, standards, and accident prevention regulations must be observed (e.g., VDE/VDI 3512, DIN 19210, VBG, Elex V, etc.). As far as possible, the setup should be free from critical ambient conditions such as extreme temperatures, vibrations, or shocks.

IMPORTANT

If unfavorable ambient conditions cannot be avoided for reasons relating to building structure, measurement technology, or other issues, product quality may be affected.

IP protection & designation

The field indicator is dust and sand tight and protected against spray water effect as defined by IEC60529 to IP66, IP67 or by NEMA 250 Type 4X.
The first number indicates the protection of the electronics against the entry of foreign bodies, including dust.
“6” means that the housing is dust-proof (i.e., no ingress of dust). The second number indicates the type of protection the integrated electronics have against the effects of temporary immersion in water under standardized water pressure and temporal conditions.

...5 Installation

General installation information

Field indicator factory configuration consideration

The field indicator in your hands has been manufactured to reflect the published specification. According to the user requirements it is possible to customize TAG number and device address.

Hazardous area considerations

The field indicator can be installed in hazardous area only if certified. The certification plate is permanently fixed on the field indicator housing. JDF300 can have the following certifications:

INTRINSIC SAFETY Ex ia:

• ATEX Europe (code E1) approval
II 1 G Ex ia IIC T6...T4 Ga, II 1 D Ex ia IIIC T85 °C Da;
IP66, IP67.
• IECEx (code E8) approval
Ex ia IIC T6...T4 Ga, Ex ia IIIC T85 °C Da; IP66, IP67.

EXPLOSION PROOF:

• ATEX Europe (code E2) approval
II 2 G Ex db IIC T6 Gb Ta=–50 °C to +75 °C,
II 2 D Ex tb IIIC T85 °C Db Ta = –50 °C to +75 °C;
IP66, IP67.
• IECEx (code E9) approval
Ex db IIC T6 Gb Ta=–50 °C to +75 °C,
Ex tb IIIC T85 °C Db Ta = –50 °C to +75 °C; IP66, IP67.

INTRINSIC SAFETY Ex ic:

• ATEX Europe (code E3) type examination
II 3 G Ex ic IIC T6...T4 Gc, II 3 D Ex tc IIIC T85 °C Dc;
IP66, IP67.
• IECEx (code ER) type examination
Ex ic IIC T6...T4 Gc, Ex tc IIIC T85 °C Dc; IP66, IP67.

FM Approvals US (code E6) and
FM Approvals Canada (code E4):

• Explosionproof:
Class I, Division 1, Groups A, B, C, D; T4
• Dust-ignitionproof:
Class II, III Division 1, Groups E, F, G; T4
• Flameproof (US): Class I, Zone 1 AEx db IIC T4 Gb
• Flameproof (Canada): Class I, Zone 1 Ex db IIC T4 Gb
• Intrinsically safe:
Class I, Zone 0 AEx ia IIC T6...T4 Ga (US)
Class I, Zone 0 Ex ia IIC T6...T4 Ga (Canada)
Class I, Division 1, Groups A, B, C, D, T6...T4
Class II, Division 1, Groups E, F, G, T6...T4
Class III
when connected per drawing 3KXP000074U0109
“FISCO Field Instrument”
• Energy limited (US):
Class I, Zone 2 AEx nC IIC T6...T4 Gc
• Energy limited (Canada):
Class I, Zone 2 Ex nC IIC T6...T4 Gc
• Nonincendive: Class I, Division 2, Groups A, B, C, D T6...T4
when connected per drawing 3KXP000074U0109
“FISCO Field Instrument”
• Type 4X, IP66, IP67 for all above markings.

COMBINED ATEX (code EW = E1 + E2 + E3), (code E7 = E1 + E2)

COMBINED IECEx (code EI = E8 + E9 + ER), (code EH = E8 + E9)

COMBINED FM Approvals US and Canada

• Intrinsically safe (code EA)
• Explosionproof, Dust-ignitionproof (code EB)
• Nonincendive (code EC)

COMBINED ATEX, FM and IECEx Approvals (code EN)

⚠ WARNING

Model JDF300 enclosure contains aluminium and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

Installing JDF300 field indicator

The field indicator model JDF300 can be mounted directly a wall using approriate fixing screws (not provided by the manufacturer).

A mounting bracket for pipe mounting (2 in pipe) is also available as an accessory. It is recommended to mount the field indicator to prevent this from being source of possible damage for unskilled operators.

Bracket mounting

Mounting bracket is available as standard please refer to the relevant installation drawing below in mm (inch.):

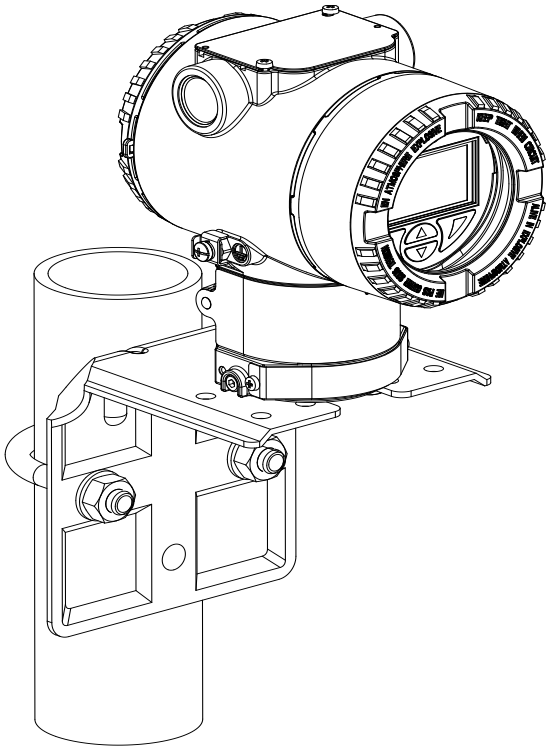


Figure 4 Mounting bracket

Securing the housing cover in flameproof areas

The front face of the field indicator housing features a locking screw (hex-head socket screw) on the top right-end corner (see picture 5).

- Install the cover on the housing by hand- tightening it.
- Turn the locking screw counterclockwise to secure the housing cover. This involves unscrewing the screw until the screw head stops at the housing cover.

IMPORTANT

For Hazardous Areas installations, at least six (6) threads on the cover must be engaged in order to meet flameproof (explosion-proof) requirements.

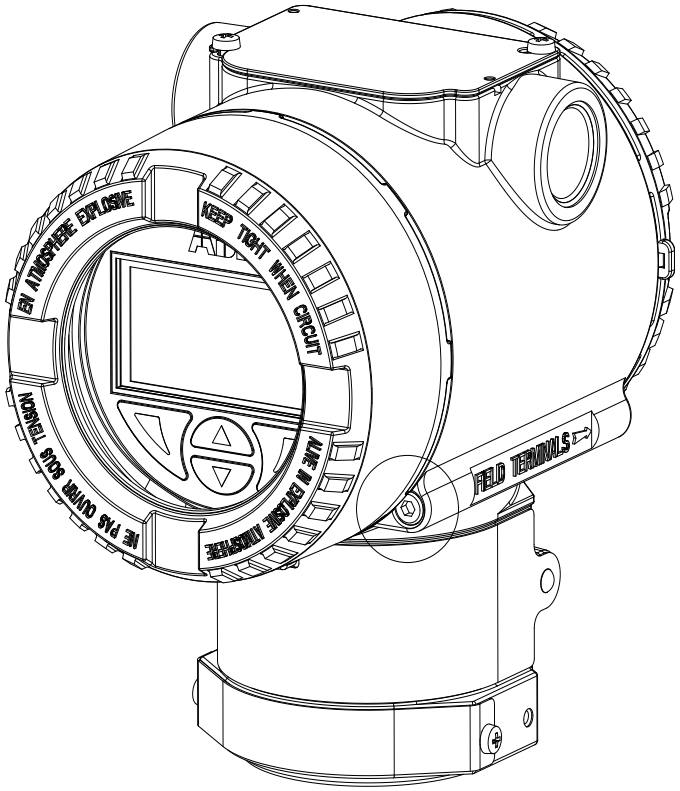


Figure 5 Locking screw position

6 Field indicator wiring

Cable connection

⚠ WARNING

Observe the applicable regulations governing electrical installation. Connections must only be established in a dead-voltage state. JDF300 field indicator has overvoltage/ lightening according to IEC 61326 (higher capacity must be provided at the plant). Check that the existing operating voltage corresponds to the needed voltage.

The same lines are used for both the power supply and output signal. In case the surge protection option is present and the field indicator is installed in a Hazardous area, the field indicator has to be power supplied from a voltage source isolated from mains (galvanic separation). Furthermore the potential equalization for the entire powering cable must be guaranteed since the intrinsic safety circuit of the field indicator is grounded.

Electrical shock can result in death or serious injury. Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock. Do NOT make electrical connections unless the electrical code designation agrees with the classification of the area in which the field indicator is to be installed. Failure to comply with this warning can result in fire or explosion.

To remove the LCD, unscrew the housing cover by turning it. Unplug the LCD by pulling it out gently. On the field indicator housing there are two connection ports for cable glands or conduit fittings. These ports are protected with plastic plugs for transit purpose. The unused port plastic plug must be replaced for Hazardous Area installations with flameproof (explosion proof) protection (see relevant warning). Depending on the design supplied, the electrical connection is established via cable entry, M20 x 1.5 or ½-14 NPT thread. The screw terminals are suitable for wire cross sections up to 2.5 mm2 (AWG 14).

IMPORTANT

With Category 3 field indicators for use in “Zone 2”, a qualified cable gland for this type of protection must be installed by the customer (see the section “Hazardous Area Consideration”).

An M20 x 1.5 or ½-14 NPT thread is located in the electronics housing for this purpose. For field indicators with “Flameproof enclosure” (Ex d) type of protection, the housing cover must be secured using the locking screw. The screw plug that may have been supplied with the field indicator must be sealed at the plant using Molykote DX. The installer assumes responsibility for any other type of sealing medium used. At this point, we wish to draw your attention to the fact that increased force will be required to unscrew the housing cover after an interval of several weeks. This is not caused by the threads, but instead is due solely to the type of gasket.

...6 Field indicator wiring

...Cable connection

The field indicator can be connected in accordance with the following configuration:

- Indicator only, i.e. coupled to the field indicator's terminal block.

Supply requirement

For signal/power connection use twisted, stranded pairs of wiring no 18 to 22 AWG / 0.8 to 0.35 mm2 OD up to 6200 feet (1900 m). Longer loops require larger wire. If a shielded wire is used, the shield should be grounded only at one end, not both ends. In case of wiring at field indicator end, use the terminal located inside the housing marked with the appropriate sign.
The JDF300 Field Indicator is a Bus Powered device with Fieldbus Foundation output. The two wires of the bus have to be connected as in the picture.

IMPORTANT

The JDF300 FF is not Polarity Sensitive.

Note. Avoid routing cables with other electrical cables (with inductive load, etc.) or near large electrical equipment.

Grounding

Field indicator housing should be grounded or earthed in accordance with national and local electrical codes.
Protective grounding terminals (PE) are available outside and/or inside the housing. Both ground terminals are electrically connected and the user can decide which one to use.
The most effective field indicator case grounding method is direct connection to earth ground with impedance equal or less of 5 ohm.

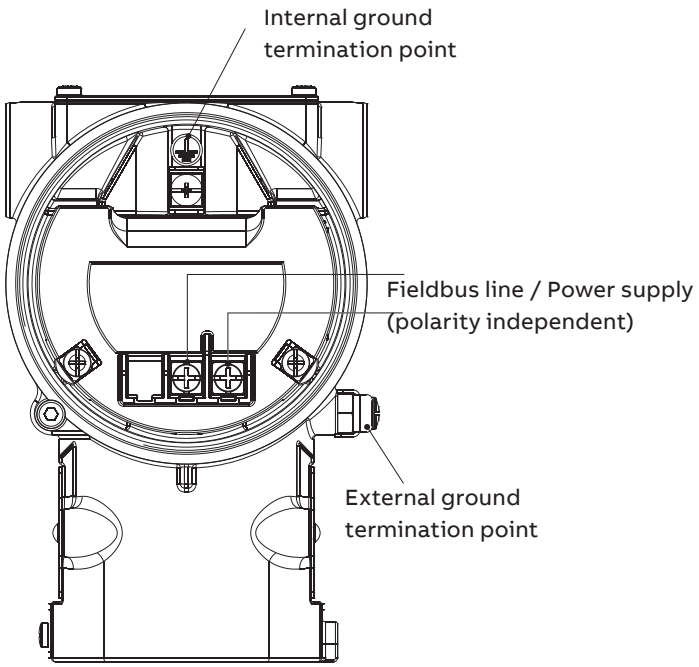


Figure 6 Field indicator grounding

Wiring procedure

Follow these steps to wire the field indicator:

- Remove the temporary plastic cap from one of the two electrical connection ports located at both sides in the upper part of the field indicator housing.
- These connection ports may have a ½ inch internal NPT or M20 threads. Various adaptors and bushings can be fitted to these threads to comply with plant wiring (conduit) standards.
- Remove the housing cover of the "field terminals" side. In an Explosion-Proof/Flame-Proof installation, do not remove the field indicator cover when power is applied to the unit.
- Run the cable through the cable gland and the open port.
- Connect the two bus wires to the + terminal, and the terminal without taking care of their polarity
- Plug and seal the electrical ports. Make sure that when the installation has been completed, the electrical ports are properly sealed against entry of rain and/or corrosive vapors and gases.

⚠ WARNING

Cables, cable glands and unused port plugs must be in accordance with the intended type of protection (e.g. intrinsically safe, explosion proof, etc.) and degree of protection (e.g. IP6x according to IEC EN 60529 or NEMA Type 4x). See also the addendum for "EX SAFETY" ASPECTS AND "IP" PROTECTION.

In particular, for explosion proof installations, remove the red temporary plastic caps and plug the unused openings with a plug certified for explosion containment

- If applicable, install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the field indicator housing.
- Put back the housing cover, turn it to seat O-ring into the housing and then continue to hand tighten until the cover contacts the housing metal-to-metal. In Ex-d (Explosion Proof) installation, lock the cover rotation by turning the set nut (use the 2mm Allen key supplied with the field indicator).

⚠ WARNING

A protective grounding connection is absolutely necessary to insure personnel protection, to protect against surge (in case of installation of this option) and to prevent explosions in potentially explosive environment.Installing/Removing the LCD display.

Integrated lightning protection (optional)

The field indicator housing must be connected using the grounding terminal (PA), by means of a short connection with the equipotential bonding. Equipotential bonding (minimum diameter: 4 mm2 (AWG 12) is required throughout the cable routing area. In case of field indicator with integrated lightning protection (optional), the intrinsically safe circuit is connected to the equipotential bonding for safety reasons.

IMPORTANT

Test voltage withstand capability can no longer be ensured when this protective circuit is used.

7 Electronic Board

Fault protection

The JDF300 FF electronic implements a special circuitry for the fault current protection. Whenever a fatal failure occurs and the current consumption increase over the 20 mA, this circuitry provides to disconnect the device from the bus, in order to preserve the rest of the bus that, otherwise, risks to drop down all the other connected devices.

On board switches

On the electronic unit under the display there are 4 dip switches with the following functionality:

- **Switch 1 and 2** are reserved for future use
- **Switch 3** selects the start mode between COLD and WARM-START UP. When in ON position and COLD start is selected, it means that when a new power cycle is executed the device will be set to a predefined basic configuration.
  Some parameters of the HMITB, RB and MAO blocks are written to a well defined value while all the other function blocks are set to their FF standard default (“Initial Values”).

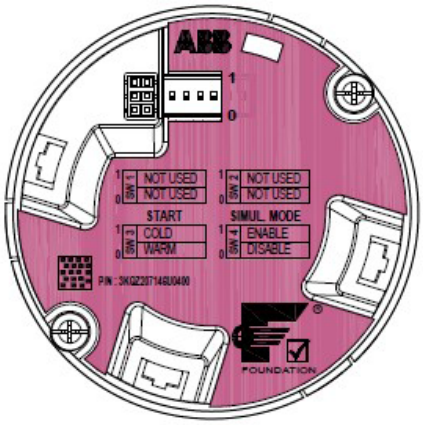


Figure 7 Electronic board view

After the Cold Start the JDF300 is ready to work displaying the value of MAO_IN1 (input 1) with its default Subtag and unit code while the quality status is displayed as textual format. Refer to the Block’s table at the end of this manual to see which parameters are forced to a default value by the Cold Start-up function. They are in Bold/italic/underlined (pink color).

The basic parameters set by the Cold start up are the following:

Cold start-up condition	
MAO_Channel	IN1 (1)
HMITB_IN1_SUBTAG	“Input 1”
HMITB_IN1_Unit	“none”
HMITB_IN_ENABLED	Only IN1 enabled (00000001)
HMITB_SEQUENCE	Disabled (1 – OFF)
HMITB_NUM_STATUS_ENA	Status byte in Text format (1)

Switch 4 selects the simulation mode which is a mandatory requirement for FF devices.
JDF300O can simulate only diagnostic conditions writing the error to be simulated into **“RB_FD_SIMULATE” (index 67)**.
However, this writing has effect only if the HW switch4 has been previously moved in ON position (SIMUL MODE ENABLED).

8 Display

Configuration of the field indicator using the optional integral LCD with keypad (menu-controlled)

The integral LCD is connected on the field indicator electronic board. It can be used to visualize the process measured variables as well as to configure the display.
In addition, diagnostic information is provided. To access the functionality of the LCD an activation procedure needs to be carried out.
The keypad operability doesn't require any activation procedure.

Installing/Removing the LCD display

1 Unscrew the housing cover of the communication board/ LCD side.

IMPORTANT

With an Ex d / Flameproof design, please refer to the section "Securing the housing cover with Ex d".

2 Attach the LCD display. Depending on the mounting position of the field indicator, the LCD display may be attached in four different positions. This enables ± 90 ° or ± 180 ° rotations.

IMPORTANT

Retighten the housing cover until it is hand-tight.

IMPORTANT

If necessary, refer to the section "Securing the housing cover with Ex d".

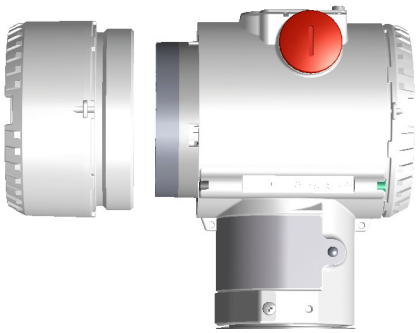


Figure 8 Indicator side view with cover open

Integral Display Rotation

It is possible to mount the display in four different positions rotated clockwise or counterclockwise with 90° steps.
To rotate the LCD, simply open the windowed cover (Hazardous area prescriptions must be respected), pull-out the display housing from the communication board. Reposition the LCD connector according to the new desired position. Push back the LCD module on the communication board. Be sure that the 4 plastic fixing locks are properly in place.

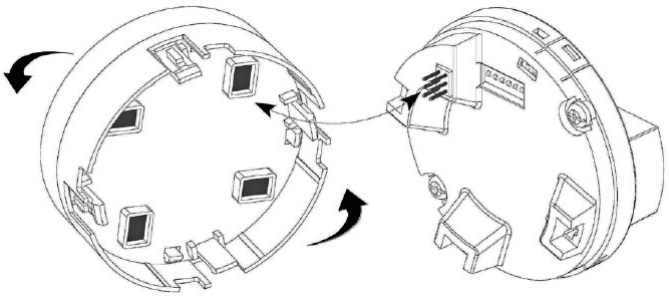
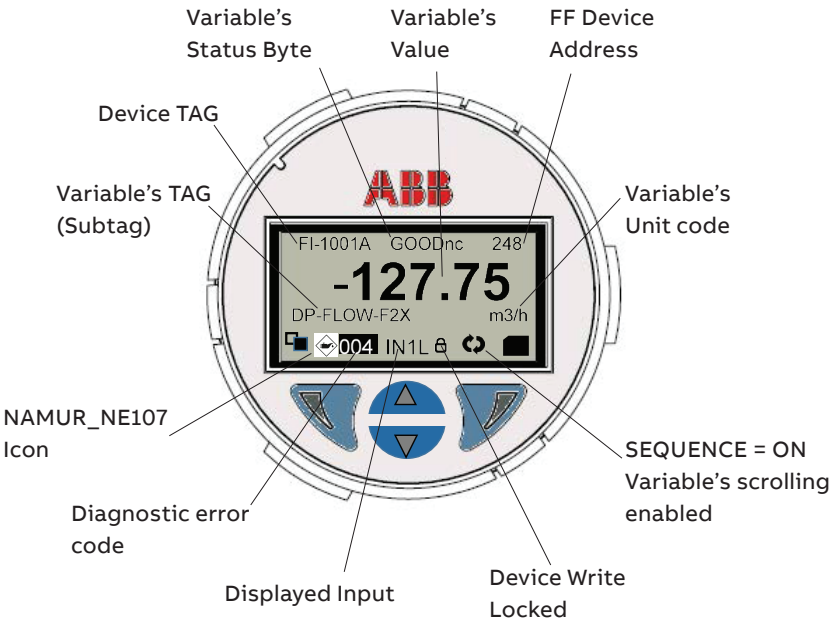


Figure 9 Integral display plug-in

Display Layout

The Display DOT matrix is split in 4 rows each reserved to display different data:



Row 1 displays:

- Device TAG, as a string of 8 characters
- Status Byte displayed as textual or numeric format. The choice between text or decimal number is user selectable from the parameter **"HMITB_NUM_STATUS_ENA" (index 36)**.

When textual format is selected, only the Quality of the Status byte is displayed as:

- "GOODnc"
- "GOODc "
- "BAD "
- "UNCERT"

When the numeric format is selected the code of the Status byte is displayed inside round brakets
i.e: (128) = GOODnc-non specific-not limit.

- Device Address, as detected in the live list of the FF bus.

Row 2 is reserved to the display a number of 5 digit with decimal point plus sign representing the measure received at the selected input of the MAO block..

Row 3 displays:

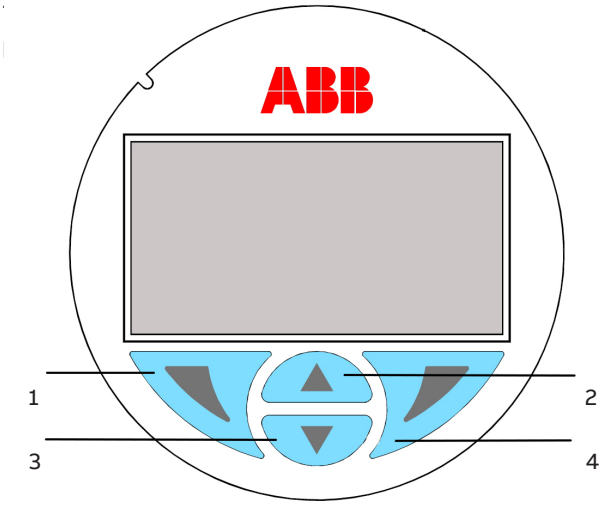
- Variable TAG, as a string of 11 characters to identify the displayed measure.
- Unit code of the displayed measure as a text of 8 characters
- The user can write the Variable TAG and its unit code of each of the 8 MAO Block inputs. Refer to the parameters **"HMITB_INPUT x TAG" and "HMITB_INPUT x Unit" (indexes from 17 to 32)** where x goes from 1 to 8 identifying one of the 8 MAO inputs.

Row 4 displays:

- Diagnostic error code of three digit size plus the NAMUR NE107 classification icon
- The MAO input actually selected with the additional indication if the value in input is coming from a linked source upward block or variable i.e: "INxL" or if it is not linked but directly written to the MAO input i.e: "INxN" where x goes from 1 to 8 depending by the selected input (i.e: IN3L or IN2N)
- The Lock symbol when the JDF300 is write locked.
- The symbol indicating that the Autoscrolling of the enabled inputs is active.

Configuration of the field indicator using the optional integral LCD with keypad (menu-controlled)

The JDF300 Field Indicator is a Dot matrix LCD with a keypad of 4 buttons connected to the electronic board.
Gain access to the display by unscrewing the windowed cover. Please observe the Hazardous area prescription before proceeding with the cover removal.

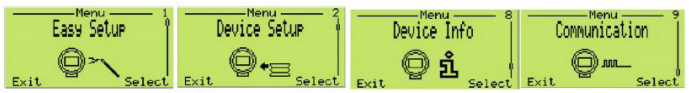


The keys (1) , (4) , (2) and (3) are available for the menu-controlled configuration.
During the normal activity when the indicator is displaying the value of the selected input variable, the buttons (1) and (4), which have a related symbol in the bottom corners of the display, when pressed enable their own function as follows:

- The Button (4) activate the display **local device menu** prompting the menu “Easy Setup”.
- The Button (1) activate the display **local operator menu**.

Local device menu

The local menus allow the review and setting of the most relevant device parameters without to access through the FF protocols. It consists in 4 root menus each with more or less submenus:



1	Language	1	Language	1	Software revision	1	Device revision
2	Contrast	2	Contrast	2	Hardware revision	2	DD revision
3	Auto Scrolling	3	Input Enable	3	HMI software revision	3	PD_TAG
4	Input Selection	4	Auto Scrolling			4	Device Class
		5	Input Selection			5	Device ID
		6	Quality Status Format				

IMPORTANT

For details about above parameters available from the local menus, refer to the Block Mapping tables (sections 9 and 10).

Local menu details

Once the display enter into the local menus, the following details could be taken in account:

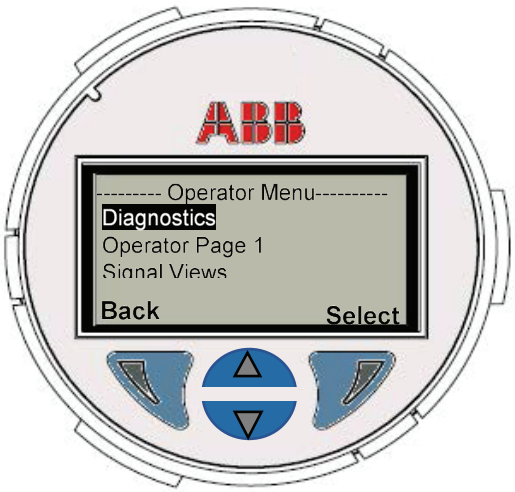
- The menu / submenu name is displayed above in the LCD display.
- The number/line of the currently selected menu item is displayed in the upper right of the LCD display.
- A scroll bar is located on the right edge of the LCD display which shows the relative position of the currently selected menu item within the menu.
- Both of the keys (1) and (4) can have various functions. The meaning of these buttons is displayed below in the LCD display above the respective button.
- You can browse through the menu or select a number within a parameter value using both keys (2) and (3) . The button (4) selects the desired menu item.

Button (1) functionalities	Meaning
Exit	Exit menu
Back	Back one submenu
Cancel	Exit without saving the selected parameter value
Next	Select next position for entering numerical values or letters

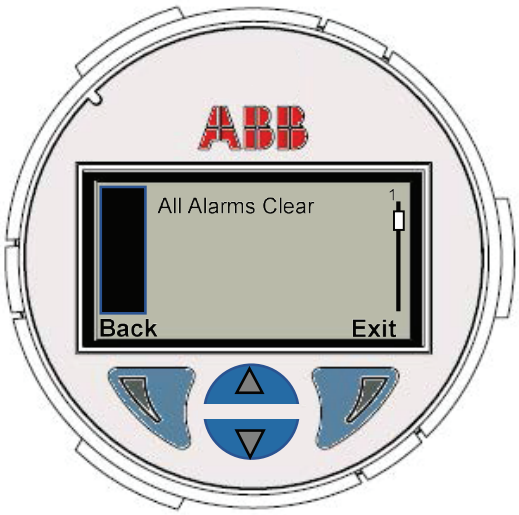
Button (4) functionalities	Meaning
Select	Select submenu/parameter
Edit	Edit parameter
Ok	Save selected parameter and display stored parameter value

Local operator menu

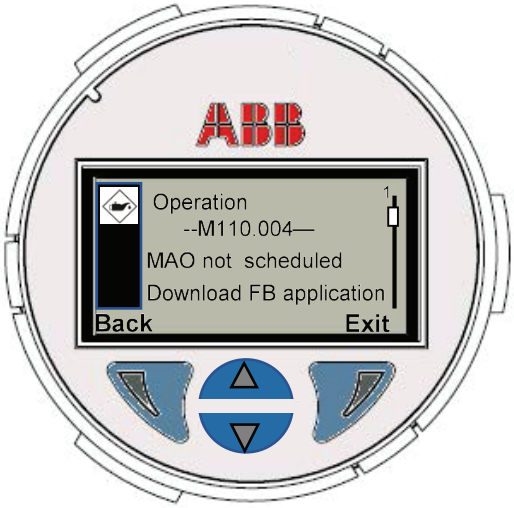
Once pressed the Button 1, the local HMI enter in the local operator menu consisting of three submenus where only the first of the list “Diagnostics” is supported.
Selecting “Diagnostics” it is displayed the device status/health.



When no error are active, it appears the string “All Alarms clear”.



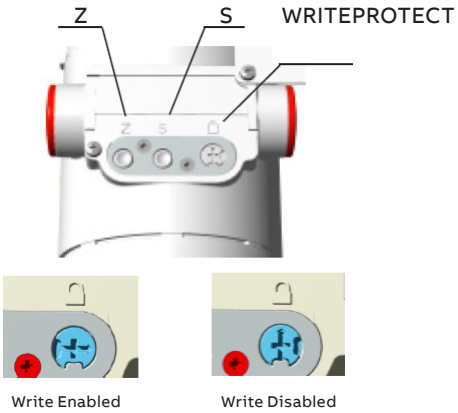
When an error condition is active, corresponding error code is displayed plus a short textual description and a brief suggested action about how it could be fixed.



The error code is the combination of the letter relating its NAMUR NE107 classification (F, M, S, C), its internal priority number and a three digit code.
Its Namur classification correspond at how the error has been mapped in the RB_FD_xx_MAP (Where xx = FAIL; MAINT; OFFSPEC; CHECK)
If more errors are active together, they are displayed into this page according to their priority. They can be visualized by scrolling up/down the screen with the two central buttons and their order is indicated by the bar and number on the right side of the display.

Configuration of the field indicator using the housing push buttons

The Z and S buttons are located under the housing metallic type plate together with the Write Lock & rotation switch.



The Write Lock button
Write locking prevents the configuration data from being overwritten by unauthorized users. If write lock is enabled, the Z and S buttons are disabled.
When the JDF300 is write locked, the lock symbol is displayed in the bottom side of the display.
However, when write lock is enabled it is still possible to read out the configuration data through the HMI local menus or using DD based configuration tools.
Write lock is activated as follows (also refer to the symbols on the plate):

1 First, use a suitable screwdriver to press the switch down fully.

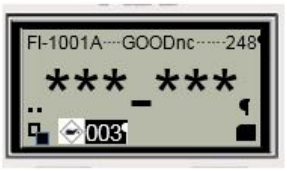
2 Then turn the switch clockwise by 90°.

IMPORTANT

To deactivate the switch, push it down slightly and then turn counter clockwise by 90°.

The Z and S functions
When the JDF300 is used as indicator of more than one variable, the **Z** button is used to locally select the one to be displayed.
By default the **“MAO_CHANNEL”** selects the input 1 but it can be changed selecting any of the 8 inputs of the MAO block.
When it is held down for more than 0.5 seconds, when released the **“MAO_CHANNEL”** is switched to the next valid input.
The next valid input is the next enabled into **“HMITB_INPUT_ENABLED” (index 33)**. Only the inputs enabled into this parameter can be selected and displayed.

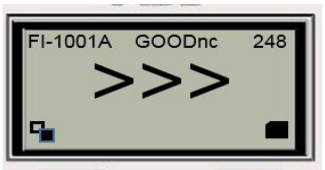
In case no inputs are enabled, the display will appear as follows:



Where the Diagnostic code 003 and the maintenance icon identify the anomalous condition. Refer to the diagnostic section for more info about diagnosis capability of the JDF300.
Below are displayed three images relating the steps occurring when the user press the Z button in order to move from an input to the next one.
At Step 1, when the Z button is released after it has been pressed while the JDF300 displays the IN1 (Linked – IN1L), the JDF300 moves to Step 2. On the display it appears an intermediate view for a couple of seconds having the aim to make evident to the user that the JDF300 is switching to a new input as displayed at Step 3 relating the next valid input IN3 (Not Linked – IN3N).
Together with the input number, it changes also the Variable's TAG and Unit according at what configured in the HMITB for the new input.

Step 1

Step 2



Step 3

IMPORTANT

The L and N letters after the input number, specify if the displayed variable is received from an upward linked block via Pub/ Sub communication (L) or if the value is contained in the INx parameter of the MAO block written via Client/Server communication (N)

Autoscrolling Function

The **S** button is used to enable or disable the Auto scrolling function of the JDF300.
When the **"HMI_IN_SEQUENCE"** is switched to ON via FF communication or through the **S** button, the Autoscrolling function is enabled.

IMPORTANT

While the **"HMI_IN_SEQUENCE"** is enabled (ON), the **Z** button stops its function until the **"HMI_IN_SEQUENCE"** is disabled again.

After the S button is held down for at least 0.5 seconds, when released, it enables or disable the automatic scrolling of the MAO inputs.
If the **"HMI_IN_SEQUENCE"** is disabled (OFF), the **S** button enable the Auto scrolling and its symbol appears in the bottom side of the display.
When the Autoscrolling is enabled, the actual **"MAO_CHANNEL"** remains unchanged for other 6 or 12 seconds after that, according to the **"HMITB_IN_ENABLED"** bits, the **"MAO_CHANNEL"** is written with the number of the next enabled/valid Input.
This condition remains stable for other 6 or 12 seconds after that the same operation above described is repeated again.
After the Input 8 is evaluated and, if necessary, displayed, the next step returns to the Input 1 again.
The two different interval of time of 6 or 12 seconds for the changing of the **"MAO_CHANNEL"** are user selectable. The default interval is 6 seconds when the **"HMITB_SEQUENCE_SPEED"** is set to Fast, while the interval became 12 seconds when **"HMITB_SEQUENCE_SPEED"** is set to Slow.
With the device in this condition, the new pressing of the **S** button writes OFF in the **"HMI_IN_SEQUENCE"** disabling the automatic scrolling. The auto scrolling symbol disappear from the display, the **"MAO_CHANNEL"** remains set to the last input selected before the **"HMI_IN_SEQUENCE"** disabling and the **Z** button returns to execute its normal function.

Squawk Function

The Squawk function is used to make easier the identification of an installed device in the field by enabling a special display behavior.
When the Squawk is enabled writing in the parameter **“HMITB_SQUAWK” (index 37)**, the display of the selected device start to blinks the string “Squawk”.
When Squawk is enabled, on the display it starts to blink the word “Squawk” till when the **“HMITB_SQUAWK”** parameter is disabled again or till when the user, who find the device in the field, push any button of the housing or on the display.
When the Squawk is enabled “once” still writing in the parameter **“HMITB_SQUAWK” (index 37)**, the display of the selected device starts to blink the string “Squawk” for few seconds after that it stops automatically and returns to normally display the selected MAO_Input.

9 Device Application Process (DAP) Blocks

Resource Block (RB)

Overview

This block contains data that is specific to the hardware that is associated with the resource. All data is modelled as Contained, so there are no links to this block. The data is not processed in the way that a function block processes data, so there is no function schematic.
This block contains and manages all the diagnostic info available from the JDF300 in compliance with the NAMUR NE107 recommendations.
The parameters relating the NAMUR NE107 requirements are those with the prefix FD_xxx
Each root error is mapped into one of the four NAMUR NE107 classifications (Failure, Maintenance, Out of Specifications and Function Check) triggering the transmission of the relating Alarm to the hosts.
This parameter set is intended to be the minimum required for the Function Block Application associated with the resource in which it resides. Some parameters that could be in the set, like calibration data and ambient temperature, are more appropriately part of their respective transducer blocks.
The ITK_VER parameter identifies the version of the Interoperability Tester used by the Fieldbus Foundation in certifying the device as interoperable.

RESOURCE Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / OOS	The selectable modes by the operator.
		ACTUAL		The mode the block is currently in.
		PERMITTED	AUTO / OOS	Allowed modes that the target may take on
		NORMAL	AUTO	The common mode for the Actual.
6	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.	
			Bit 1 = Configuration Error	MAO Inputs All disabled
			Bit 3 = Simulate Active	The SW4 of the electronics is in ON position enabling the Simulation.
			Bit 6 = Device Needs Maintenance Soon	NV Mem Burn error
			Bit 11 = Lost NV Data	Electronic memory fail
			Bit 15 = Out of Service	The Resource Block **MODE_BLK_ACTUAL** = Out of Service. **Also the Actual mode of all the Funct.Blocks is forced to OOS**
7	RS_STATE		State machine of the function block application.	
8	TEST_RW		Read/Write test parameter – used only for conformance testing.	
9	DD_RESOURCE		String identifying the tag of the resource, which contains the Device Description for this resource.	
10	MANUFAC_ID		ABB = 0x000320	
11	DEV_TYPE		JDF300 = 0x0008	
12	DEV_REV		0x01	
13	DD_REV		0x01	
14	GRANT_DENY		Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	
15	HARD_TYPES		Bit 1 Scalar Output	The type of Hardware available as channel numbers
16	RESTART		0 Uninitialized	
			1 Run	
			2 Restart resource	
			3 Restart with default	
			4 Restart process	
			5 Special Restart	This function is not supported
			6 Special Operations	See also SPECIAL_OPERATION
17	FEATURES		Used to show supported resource block options	
18	FEATURES_SEL		Used to select resource block options. For the JDF300 they are:	
			Bit 1 Reports Supported	
			Bit 2 Fault State Supported	
			Bit 3 SW Write Lock Supported	
			Bit 4 HW Write Lock Supported	
			Bit 10 Multi-bit Alarm (Bit-Alarm) Support	
19	CYCLE_TYPE		Identifies the block execution methods for this resource	
20	CYCLE_SEL		Bit 1 **Scheduled**	Used to select the block execution methods for this resource.
			Bit 2 Completion of block execution	

...RESOURCE Block Mapping

Idx	Parameter	Description / Range / Selections / Notes		
21	MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.		
22	MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download		
23	NV_CYCLE_TIME	Min. time interval for writing copies of NV parameters to non-volatile memory. Zero means it will be never automatically copied.		
24	FREE_SPACE	Percent of memory available for further configuration. Zero in a preconfigured device		
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks.		
26	SHED_RCAS	Time duration at which to give up on computer writes to function block Rcas locations. Shed from Rcas shall never happen when Shed_Rcas = 0		
27	SHED_ROUT	Time duration at which to give up on computer writes to function block Rout locations. Shed from Rout shall never happen when Shed_Rout = 0		
28	FAULT_STATE	Fault State		
29	SET_FSTATE	Set Fault State		
30	CLR_FSTATE	Clear Fault State		
31	MAX_NOTIFY	Maximum number of unconfirmed alert notify messages possible		
32	LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed		
33	CONFIRM_TIME	The min time between retries of alert report. Retries shall not happen when Confirm_Time = 0		
34	WRITE_LOCK	**1 Unlocked (default)**		
		2 Locked	If set, no writes are allowed except to clear Write_Lock. Block inputs will continue to be updated	
35	UPDATE_EVT	This alert is generated by any change to the static data		
36	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed		
37	ALARM_SUM	The alert status associated to the function block		
38	ACK_OPTION	**0 Auto Ack Disabled (default)**	Selection of whether alarms associated the function block will be automatically acknowledged	
		1 Auto Ack Enabled		
39	WRITE_PRI	Priority of the alarm generated by clearing the write_lock		
40	WRITE_ALM	This alert is generated if the write_lock parameter is cleared		
41	ITK_VER	6		
42	CB_SW_REV	“XX.YY.ZZ” (08.01.01)		
43	CB_HW_REV	“XX.YY.ZZ” (01.00.00)		
44	CAPABILITY_LEV	Not Supported		
45	COMPATIBILITY_REV	0x01		
46	FD_VER	Indicates value of major version of instrument diagnostics specifications (FF-912).		
47	FD_FAIL_ACTIVE	Active error conditions of Failure category	**According to the NAMUR NE107 Categories.** Bit x = 0 – Error Clear Bit x = 1 – Error Active It is a bit-string so that multiple errors of the list below may be shown.	
48	FD_OFFSPEC_ACTIVE	Active error conditions of Out of Specification category		
49	FD_MAINT_ACTIVE	Active error conditions of Maintenance category		
50	FD_CHECK_ACTIVE	Active error conditions of Check Function category.		
51	FD_FAIL_MAP	Errors Mapped as Failure	**Default mapping:**	**Bit 4** Electronic memory fail
52	FD_OFFSPEC_MAP	Errors Mapped as Out of Spec	**Default mapping:**	**none**
53	FD_MAINT_MAP	Errors Mapped as Maintenance:	**Default mapping:**	**Bit 2** MAO not Scheduled **Bit 3** MAO inputs all disabled **Bit 5** NV memory burn error
54	FD_CHECK_MAP	Errors Mapped as Function Check	**Default mapping:**	**Bit 0** Function Check **Bit 1** MAO in OOS
55	FD_FAIL_MASK	Fail error to be masked	**Default no error masked**	
56	FD_OFFSPEC_MASK	Out of Spec errors to be masked		
57	FD_MAINT_MASK	Maintenance errors to be masked		
58	FD_CHECK_MASK	Function Check errors to be masked		

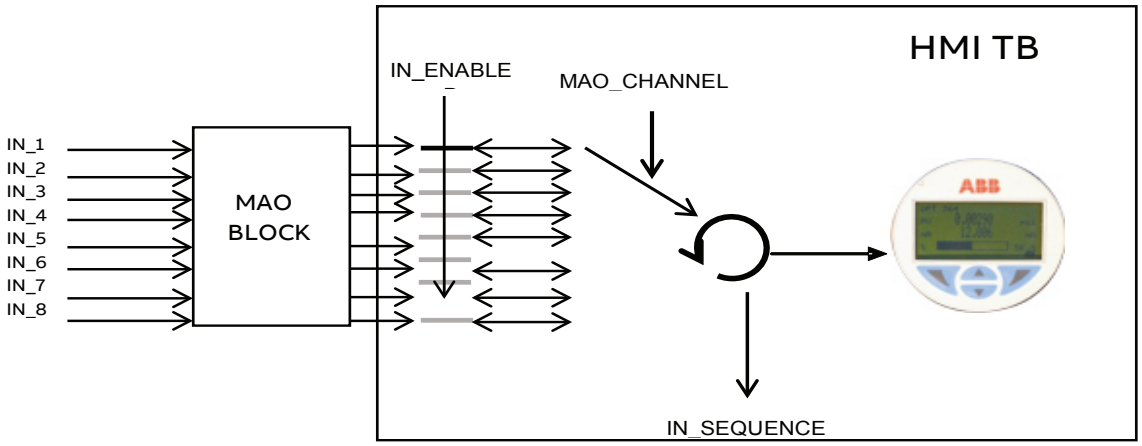
Idx	Parameter	Description / Range / Selections / Notes			
59	FD_FAIL_ALM	Fail Alarm Object			
60	FD_OFFSPEC_ALM	Out of Spec Alarm Object			
61	FD_MAINT_ALM	Maintenance Alarm Object			
62	FD_CHECK_ALM	Function Check Alarm Object			
63	FD_FAIL_PRI	Fail error priority			
64	FD_OFFSPEC_PRI	Out of Spec error priority			
65	FD_MAINT_PRI	Maintenance error priority			
66	FD_CHECK_PRI	Function Check error priority			
67	FD_SIMULATE	**Disabled by default**			The simulation can be enabled only if the SW4 of the electronics is moved to Simulation Enable position
68	FD_RECOMMEN_ACT	Code identifying what should be done to alleviate the anomalous condition. In case of more error conditions detected, this code refers to the most severe/critical 0 is defined as Not Initialized, 1 is defined as No Action Required, all others defined by manufacturer			
69	SPECIAL_RESTART	Bit	11	AR pre-setting	After the selection of one or more blocks of this list is written to SPECIAL_RESTART, then the operation is really executed writing the command “Special Restart” in the RB_RESTART. All the selected Blocks are configured to a pre-defined setting allowing their switching to AUTO Mode. PS: The Function Blocks must have been previously instantiated into a Function Block Application otherwise cannot move out from OOS.
		Bit	12	IS pre-setting	
		Bit	14	PID1 pre-setting	
		Bit	23	PID2 pre-setting	
		Bit	25	CS pre-setting	
		Bit	29	MAO-pre-setting	
		Bit	30	RB pre-setting	
70	SPECIAL_OPERATION		0	Do nothing	No Special Operations available in the JDF300
71	MESSAGE	Message			
72	DESCRIPTOR	Descriptor			
73	INSTALLATION_DATE	Installation date			
74	LOCAL_OPERATIONS		0	disabled	Local operation via PUSH BUTTONS are not allowed
			1	**Enabled (default)**	Local operation via PUSH BUTTONS are allowed
75	DEVICE_SER_NUM	Serial Number of the Field indicator as printed on the main Type Plate (on the housing) **and to be used as final part of the DEV_ID**			

HMI Transducer Block (HMITB)

Overview

The HMI transducer block is a custom block with the task to manage different modalities to visualize the measure and on the display of the JDF300 field indicator.
The HMITB block receives in input the variable selected by the **MAO_Channel**, and takes care to display its Values, Quality Status, subtag, engineering unit in order to give a complete set of info to the user.

Block Diagram



Description

The HMI Transducer Block contains all the parameters allowing the display configuration.
While the Value and Quality Status are received from the selected MAO Input, the Subtag and Engineering unit to display together with the value must to be configured inside this block writing in the **“HMITB_INx_SUBTAG”** and **“HMITB_INx_UNIT CODE”** where x is the number of the input between 1 and 8.
There is also the possibility to enable/disable each of the 8 inputs into **“HMITB_IN_ENABLE”** and only the enabled inputs will be scrolled automatically when the autoscrolling function is active into **“HMITB_IN_SEQUENCE”** In addition, the Quality Status can be displayed as a text or a number according at what set into **“HMITB_NUM_STATUS_ENA”**.

HMI TB Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / OOS	The selectable modes by the operator.
		ACTUAL	//	The mode the block is currently in.
		PERMITTED	AUTO / OOS	Allowed modes that the target may take on
		NORMAL	AUTO	The common mode for the Actual.
6	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.	
			Bit 15 = Out of Service	
7	UPDATE_EVT		This alert is generated by any change to the static data	
8	BLOCK_ALM		The block alarm is used for all configuration, hardware, and connection failure or system problems in the block. The cause of the alert is entered in the sub-code field. The first alert to become active will set the Active Status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the sub-code has changed	
9	TRANSDUCER_DIRECTORY		Directory that specifies the number and starting indices of the transducers in the transducer block	
10	TRANSDUCER_TYPE		Identifies the transducer type.	TN-016 – **65535 = Other**
11	XD_ERROR		Transducer block error sub-code	
12	COLLECTION_DIRECTORY		Directory that specifies the num, starting indices, and the DD items IDs of the data collections in each transd within a transducer block	
13	HMI_CONTRAST		Display Contrast 0 to 100 **Default [50]**	
14	HMI_LANGUAGE		**0: English (default)**	
			1: Deutch	
			2: Francais	
			3: Espanol	
			4: Italiano	
			14: Portuguese	
15	HMI_MODE		5: One Line	FIXED SELECTION
16	HMI_SW_REV		0:	Not Installed
			xxx	Display SW Revision
17	IN1_SUBTAG		**Default string:**	**“Input 1”**
18	IN1_UNIT CODE			“********”
19	IN2_SUBTAG		**Default string:**	**“Input 2”**
20	IN2_UNIT CODE			“********”
21	IN3_SUBTAG		**Default string:**	**“Input 3”**
22	IN3_UNIT CODE			“********”
23	IN4_SUBTAG		**Default string:**	**“Input 4”**
24	IN4_UNIT CODE			“********”
25	IN5_SUBTAG		**Default string:**	**“Input 5”**
26	IN5_UNIT CODE			“********”
27	IN6_SUBTAG		**Default string:**	**“Input 6”**
28	IN6_UNIT CODE			“********”
29	IN7_SUBTAG		**Default string:**	**“Input 7”**
30	IN7_UNIT CODE			“********”

...HMI TB Mapping

Idx	Parameter	Description / Range / Selections / Notes	
31	IN8_SUBTAG	**Default string:** **"Input 7"**	
32	IN8_UNIT CODE	"********"	
33	IN_ENABLED	Each IN has an associated bit in order to enable disable its use Bit 7 = IN8 .....Bit 0 = IN1	Bit x = 0 – Input not used/enabled Bit x = 1 – Input used/enabled **Default = 00000001 = only IN1 enabled**
34	IN_SEQUENCE	**1: OFF (default)**	When IN_SEQUENCE = ON, the MAO Channel must switch to the next ENABLED Inputs evaluating the IN_ENABLED bit corresponding to the channel number
		2: ON	
35	SEQUENCE_SPEED	**1: FAST (default)**	When IN_SEQUENCE = ON, this parameter specify at which rate chance the IN selection. Every 6 seconds when FAST and 12 seconds when SLOW.
		2: SLOW	
36	NUM_STATUS_ENA	**1: OFF (default)**	**Quality Status text view**
		2: ON	Status Byte decimal number view
37	SQUAWK	**1: Disabled (default)**	Squawk = off
		2: Enabled	Squawk blinking
		3: Squawk once	Blink for 2 seconds
38	PWR_ON_COUNT	Number of power cycle	
39	TOT_WORK_TIME	Counter of how much time the device has been powered on expressed in days/hours/mins.	

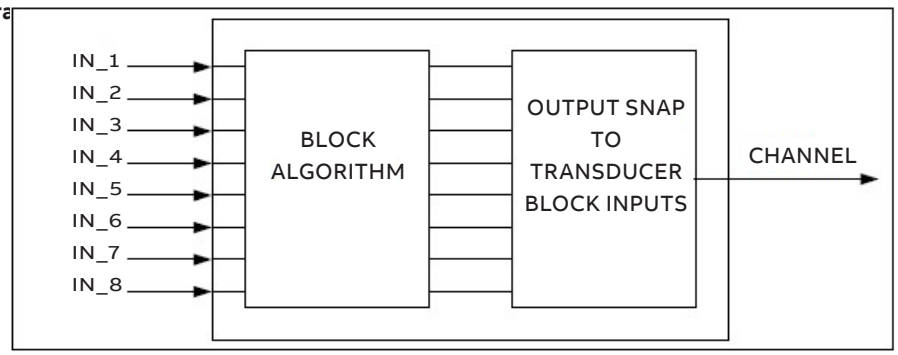
10 Control Application Process (CAP) Blocks

Multiple Analog Output Function Block (MAO)

Overview

The MAO block makes available to the I/O subsystem its eight input parameters IN_1/8.
This function block keeps the fault state features specified for the AO block. It includes option to hold the last value or a preset value when in Fault State, individual preset values for each point, besides a delay time to go into the Fault State.
The actual mode will be LO only due to the resource block (SET_FSTATE parameter). If an input parameter has a bad status, that parameter will be in Fault State, but the mode calculation of the block will not be affected.
The FSTATE_STATUS parameter shows that points are in Fault State.
The MAO block does not support back calculation, or the Cas mode.

Block Diagra



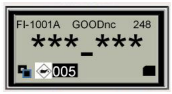
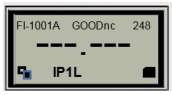
Description

The Channel selects the input to be propagated in output at the connected transducer block.

MAO Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / OOS	The selectable modes by the operator.
		ACTUAL	//	The mode the block is currently in.
		PERMITTED	AUTO / OOS	Allowed modes that the target may take on
		NORMAL	AUTO	The common mode for the Actual.
6	BLOCK_ERR		Bit 0 = Other	MAO Not Scheduled
			Bit 1 = Configuration Error	MAO.Channel = 0 (Uninitialized)
			Bit 15 = Out of Service	
7	CHANNEL		0: Uninitialized	**** Doesn't allow at the MAO to move out from OOS**
			1 - 8:INPUT n selection	**CHANNEL = 1 (default)**
8	IN1		Input 1	Floating Point value + Status
9	IN2		Input 2	
10	IN3		Input 3	
11	IN4		Input 4	
12	IN5		Input 5	
13	IN6		Input 6	
14	IN7		Input 7	
15	IN8		Input 8	
16	MO_OPTS		**All set to 0** (not used in the JDF300)	
17	FSTATE_TIME		**Default = 0** → not used	NOT USED in the JDF300
18	FSTATE_VAL1		**Default = 0** → not used	
19	FSTATE_VAL2		**Default = 0** → not used	
20	FSTATE_VAL3		**Default = 0** → not used	
21	FSTATE_VAL4		**Default = 0** → not used	
22	FSTATE_VAL5		**Default = 0** → not used	
23	FSTATE_VAL6		**Default = 0** → not used	
24	FSTATE_VAL7		**Default = 0** → not used	
25	FSTATE_VAL8		**Default = 0** → not used	
26	FSTATE_STATUS		Not used in the JDF300	
27	UPDATE_EVT		This alert is generated by any change to the static data	
28	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed	

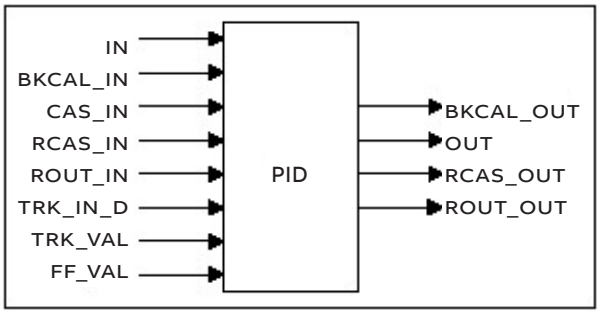
Diagnostic:
Resource Block FD_Diagnostic bits. (Indexes 47, 48, 49, 50):

Bit	Root error	Description	Possible cause	NE 107	Block Error bit setting	HMI code	Suggested action
0	Function Check	HMITB NormalMode = AUTO and HMITB TargetMode NOT = AUTO	HMITB TargetMode = OOS or HMITB TargetMode = MAN	C	HMITB- OOS None set	C002.000	- Set HMITB NormalMode = AUTO. and/or - HMITB TargetMode = AUTO
3	MAO in OOS	MAO.ActualMode = OOS	MAO.TargetMode = OOS	C	MAO-OOS	C090.003	Check the MAO TargetMode and, if not in AUTO, switch to AUTO
4	MAO not Scheduled	MAO.TargetMode = AUTO and MAO.ActualMode = OOS	FBAP not downloaded	M	MAO-Other MAO-OOS	M110.004	Download a FBAP where the MAO is instantiated
5	MAO inputs all disabled	Not even one MAO input enabled. 	HMITB.IN_ENABLED = 0	M	RB-Configuration error	M080.005	Enable at least one input in the HMITB.IN_ENABLED
30	Electronic Memory Fail	Memory data corrupted	Memory failed	F	RB-Lost NV data	F150.030	Electronic should be replaced as soon as possible
31	Electronic NV memory burn fail	Configuration data are not well stored in NV memory	NV memory defect	M	RB-Device needs maint. soon	M130.031	Electronis should be replaced when possible if do not want to re-configure the device at every power cycle
6 - 31	Undefined	-.-	-.-	-.-	-.-	-.-	-.-
-.-		The SW4 of the electronics is in ON position			RB-Simulation Active		Proceed with the simulation of an error bit or return the SW4 to OFF
-.-		The Selected input (MAO_Channel) has been disable into IN_ENABLED. From this picture the MAO_Channel is set to 1 (IN1) but HMITB_IN_ENABLED bit 0 has been cleared. 	The operator has erroneously disabled the input				Enable the selected input into HMITB_IN_ENABLED if it must to be used otherwise select another input with MAO_Channel of those enabled into HMITB_IN_ENABLED

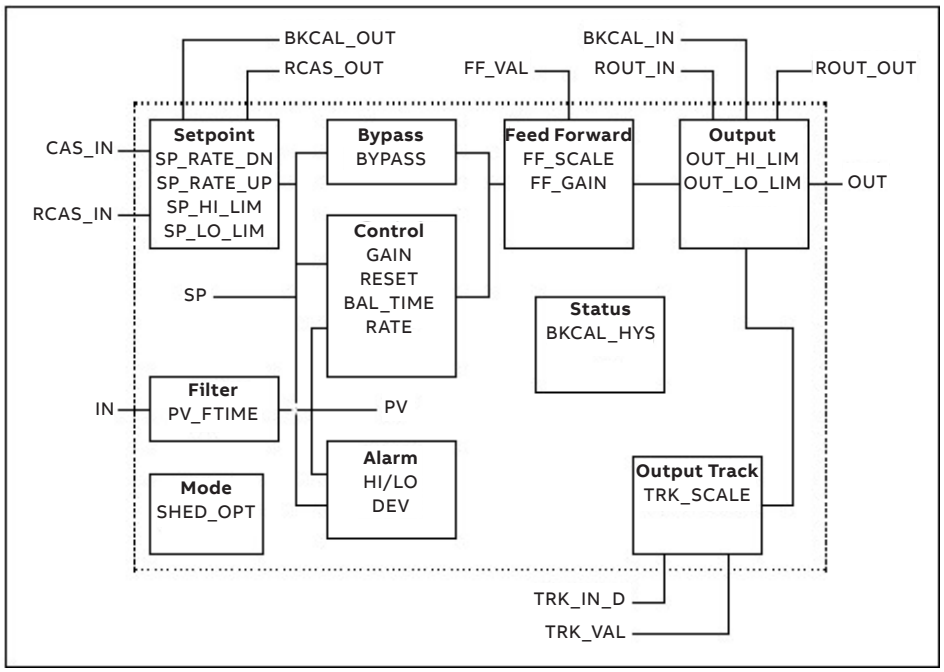
Enhanced-PID Function Block (E-PID)

Overview

The PID block is key to many control schemes and is used almost universally, with the exception of PD, which is used when the process itself does the integration. As long as an error exists, the PID function will integrate the error, which moves the output in a direction to correct the error. PID blocks may be cascaded when the difference in process time constants of a primary and secondary process measurement makes it necessary or desirable.
The PID receives in input the value produced in output from an upstream function block like Analog Input, and provides to apply the algorithm with the Proportional, Integral, Derivative contribute as previously configured.



Block Diagram



Description

The Process Value to be controlled is connected to the IN input. This value is passed through a filter whose time constant is PV_FTIME. The value is then shown as the PV, which is used in conjunction with the SP in the PID algorithm. A PID will not integrate if the limit status of IN is constant. A full PV and DV alarm sub-function is provided. The PV has a status, although it is a Contained parameter. This status is a copy of IN's status unless IN is good and there is a PV or block alarm. The full cascade SP sub-function is used, with rate and absolute limits. There are additional control options which will cause the SP value to track the PV value when the block is in an actual mode of IMan, LO, Man or ROut. Limits do not cause SP-PV tracking.

...Enhanced-PID Function Block (E-PID)

...Description

There is a switch for BYPASS, which is available to the operator if the Bypass Enable control option is true. Bypass is used in secondary cascade controllers that have a bad PV. The Bypass Enable option is necessary because not all cascade control schemes will be stable if BYPASS is true.
BYPASS can only be changed when the block mode is Man or O/S. While it is set, the value of SP, in percent of range, is passed directly to the target output, and the value of OUT is used for BKCAL_OUT. When the mode is changed to Cas, the upstream block is requested to initialize to the value of OUT. When a block is in Cas mode, then on the transition out of bypass, the upstream block is requested to initialize to the PV value, regardless of the "Use PV for BKCAL_OUT" option.
GAIN, RESET, and RATE are the tuning constants for the P, I, and D terms, respectively. Gain is a dimensionless number. RESET and RATE are time constants expressed in seconds. There are existing controllers that are tuned by the inverse value of some or all of them, such as proportional band and repeats per minute. The human interface to these parameters should be able to display the user's preference.
The Direct Acting control option, if true, causes the output to increase when the PV exceeds the SP. If false, the output will decrease when the PV exceeds the SP. It will make the difference between positive and negative feedback, so it must be set properly, and never changed while in an automatic mode. The setting of the option must also be used in calculating the limit state for BKCAL_OUT.
The output supports the feed forward algorithm. The FF_VAL input brings in an external value which is proportional to some disturbance in the control loop. The value is converted to percent of output span using the values of parameter FF_SCALE. This value is multiplied by the FF_GAIN and added to the target output of the PID algorithm. If the status of FF_VAL is Bad, the last usable value will be used, because this prevents bumping the output. When the status returns to good, the block will adjust its integral term to maintain the previous output.
The output supports the track algorithm.
There is an option to use either the SP value after limiting or the PV value for the BKCAL_OUT value.

Equations

The algorithm applied is as in the following formula:

$$OUT = GAIN \cdot \left[(BETA \cdot SP - PV) + \frac{1}{RESET \cdot s}(SP - PV) + \frac{RATE \cdot s}{T1\_RATE \cdot s + 1}(GAMMA \cdot SP - PV) \right] + FF\_VAL$$

Where the **standard variables** are:

GAIN:	Proportional Gain Value
RESET:	Integral action Time constant in seconds
s:	Laplace operator
RATE:	Derivative action time constant in seconds
FF_VAL:	Feed-forward contribution from the feed-forward input
SP:	Setpoint
PV:	Process Variable

And the **enhanced variables** are:

T1_RATE:	Derivative 1st order filter
BETA:	Setpoint weight proportional part [0 to 1]
GAMMA :	Setpoint weight derivative part [0 to 1]

Configuration hints

The minimum configuration for having the PID working and/or moving out from the OOS needs at least the following settings:

- OUT_HI_LIM > OUT_LO_LIM
- SP_HI_LIM > SP_LO_LIM
- BYPASS = OFF
- SHED_OPT = Normal Shed Normal Return
- GAIN > 0

Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / MAN / CAS / RCAS / ROUT / OOS	The selectable modes by the operator.
		ACTUAL		The mode the block is currently in.
		PERMITTED	AUTO / MAN / OOS / IMAN / CAS / RCAS / ROUT / LO	Allowed modes that the target may take on
		NORMAL	AUTO / CAS	The common mode for the Actual.
6	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	PV		The process variable used in block execution, expressed in **PV_SCALE** unit Code	
8	SP		The analog Set Point value of this block, expressed in **PV_SCALE Unit** Code	Acceptable value: **PV_SCALE** +/- 10%
9	OUT		The block output value calculated as a result of the block execution, expressed in **OUT_SCALE unit** code	Writeable only if **MODE_BLK.ACTUAL** = MAN
10	PV_SCALE		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 PV parameter and parameters which have the same scaling as PV.	
11	OUT_SCALE		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	GRANT_DENY		Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	
13	CONTROL_OPTS		Options the user may select to alter the calculation done in a control loop	
			Bit 0	Bypass Enable
			Bit 1	SP-PV Track in Man
			Bit 2	SP-PV Track in ROut
			Bit 3	SP-PV Track in LO or IMan
			Bit 4	SP Track retained target
			Bit 5	Direct Acting
			Bit 6	Track if Bad TRK_IN_D
			Bit 7	Track Enable
			Bit 8	Track in Manual
			Bit 9	Use PV for BKCAL_OUT
			Bit 12	Obey limits if CAS or RCAS
			Bit 13	No out limits in Manual
14	STATUS_OPTS		Options which the user can select for the block processing of status. The available selections are:	
			Bit 0	Initiate Fault State if BAD IN
			Bit 1	Initiate Fault State if BAD CAS_IN
			Bit 2	Use Uncertain as Good
			Bit 5	Target to Manual if BAD IN
			Bit 9	Target AUTO if BAD CAS_IN
			Bit 10	Target to Man if BAD TRK_IN_D
			Bit 11	IFS if BAD TRK_IN_D
15	IN		The Primary Input Value for the block coming from another block. Expressed in **PV_SCALE Unit**	
16	PV_FTIME		0 to 60 seconds	Time constant of a single exponential filter for the PV, expressed in seconds. This is the time necessary for reach the 63% of the variation in input.

...Block Mapping

Idx	Parameter	Description / Range / Selections / Notes	
17	BYPASS	The normal control algorithm may be bypassed trough this parameter. When bypass is set, the set point value (in percent) will be directly transferred to the output.	
		1	OFF
		2	ON
18	CAS_IN	Remote set point value from another block. Expressed in **PV_SCALE Unit** Code	
19	SP_RATE_DN	0 or > 0 Expressed in **PV_SCALE Unit** per seconds	Ramp rate at which downward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero, then the setpoint will be used immediately. For control blocks, rate limiting will apply only in Auto.
20	SP_RATE_UP		Ramp rate at which upward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero, then the setpoint will be used immediately. For control blocks, rate limiting will apply only in Auto.
21	SP_HI_LIM	Acceptable value: **PV_SCALE** +/- 10% Expressed in **PV_SCALE Unit**	The setpoint high limit is the highest setpoint operator entry that can be used for the block.
22	SP_LO_LIM		The setpoint low limit is the lowest setpoint operator entry that can be used for the block.
23	GAIN	0 or > 0	The proportional gain value.
24	RESET	0 or > 0	The integral time constant, expressed in seconds per repeat
25	BAL_TIME	0 or > 0	The specified time for the internal working value of bias to return to operator set bias. Also used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS. Expressed in seconds
26	RATE	0 or > 0	The derivative action time constant expressed in seconds
27	BKCAL_IN	The analog input value from another block's **BKCAL_OUT** output that is used to prevent reset windup and to initialize the control loop. Expressed in **OUT_SCALE Unit** Code	
28	OUT_HI_LIM	Acceptable value: **OUT_SCALE** +/- 10% Expressed in **OUT_SCALE Unit**	Limits the maximum output value.
29	OUT_LO_LIM		Limits the minimum output value.
30	BCAL_HYS	0 to 50% [Default = 0.5%] Expressed as percent of the **OUT_SCALE** span	The amount that the output must change away from its output limit before the limit status is turned off,
31	BKCAL_OUT	Expressed in **PV_SCALE Unit**	The value and status required by an upper block's **BKCAL_IN** so that the upper block may prevent reset windup and provide bumpless transfer to closed loop control.
32	RCAS_IN	Expressed in **PV_SCALE** Unit Used when mode is RCAS	Target setpoint value provided by a supervisory host.
33	ROUT_IN	Expressed in **OUT_SCALE Unit** Used when the mode is ROUT.	Target output value provided by a supervisory host
34	SHED_OPT	Define actions to be taken on remote control device timeout	
35	RCAS_OUT	Expressed in **PV_SCALE Unit**. Used when mode is RCAS.	Block setpoint Value after ramping – provided by a supervisory host for back calculations and to allow action to be taken under limiting conditions or mode change
36	ROUT_OUT	Expressed in **OUT_SCALE Unit**. Used when mode is ROUT.	Block output Value provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change
37	TRK_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point, associated with TRK_VAL.	
38	TRK_IN_D	This discrete input is used to initiate external tracking of the block output to the value specified by TRK_VAL.	
39	TRK_VAL	Expressed in **TRK_SCALE Unit**.	This input is used as the track value when external tracking is enabled by TRK_IN_D.
40	FF_VAL	Expressed in **FF_SCALE Unit**.	The feed forward value and status
41	FF_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with FF_VAL	
42	FF_GAIN	The gain that the feed forward inpt is multiplied by before it is added to the calculated control output.	

Idx	Parameter	Description / Range / Selections / Notes	
43	UPDATE_EVT	This alert is generated by any change to the static data	
44	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed	
45	ALARM_SUM	The summary alarm is used for all process alarm 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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed	
46	ACK_OPTION	Used to set auto acknowledgment of the alarms	
47	ALARM_HYS	Alarm Hysteresis is the amount the PV must return within the alarm limit before the alarm condition clears.	0 or > 0 expressed as percent of the **OUT_SCALE** span (default =[0.5%])
48	HI_HI_PRI	0 - 15	Expressed in **OUT_SCALE unit**.
49	HI_HI_LIM	Critical Limit High producing the High-High Alarm	
50	HI_PRI	0 - 15	
51	HI_LIM	Advisory Limit High producing the High Alarm	
52	LO_PRI	0 - 15	
53	LO_LIM	Advisory Limit Low producing the Low Alarm	
54	LO_LO_PRI	0 - 15	
55	LO_LO_LIM	Critical Limit Low producing the Low-Low Alarm	
56	DV_HI_PRI	0 - 15	
57	DV_HI_LIM	Deviation High Limit producing the Deviation High Alarm	
58	DV_LO_PRI	0 - 15	
59	DV_LO_LIM	Deviation Low Limit producing the Deviation Low Alarm	
60	HI_HI_ALM	High-High Alarm	
61	HI_ALM	High Alarm	
62	LO_ALM	Low Alarm	
63	LO_LO_ALM	Low-Low Alarm	
64	DV_HI_ALM	Deviation High Alarm	
65	DV_LO_ALM	Deviation Low Alarm	
66	T1_RATE	Derivative 1st order filter	
67	BETA	Set-point weight proportional part	
68	GAMMA	Set-point weight derivative part	

Diagnostic

Block_Err	Possible Reasons	OUT Status
Block Configuration error	• SHED_OPT = 0 (uninitialized) • BYPASS = 0 (uninitialized) • OUT_HI_LIM =< OUT_LO_LIM • SP_HI_LIM =< SP_LO_LIM	BAD + Out Of Service **See Note A**
Local Override	MODE_BLK.Actual = Local Override	NO EFFECT
Input Failure/process variable has BAD status	BAD quality Status in input at the PID_IN.	Depends by the STATUS_OPTS
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service

NOTE A: The specific block cannot be switched out from OUT OF SERVICE due to the Configuration Error. The Bad-Configuration Error Status is overridden by the Bad-Out Of Service Status.

OUT Status

The OUT Status can be affected by the setting of the STATUS_OPTS

Troubleshooting

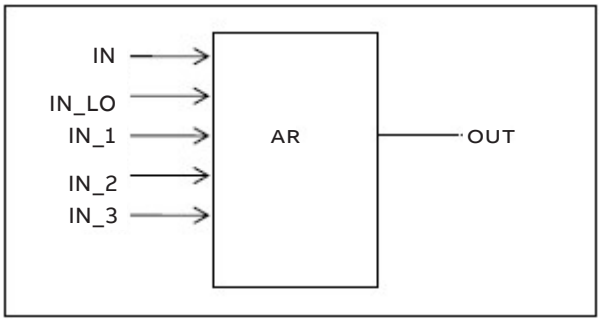
Problem	Possible cause	Solution
The Block cannot be removed from OOS mode	The Target Mode is not set different of OOS	Set the Target Mode to something different from OOS
	The Configuration Error bit is set in the BLOCK_ERR	• Set the OUT_HI_LIM > OUT_LO_LIM • Set the SP_HI_LIM > SP_LO_LIM • Set BYPASS to ON or OFF but different from 0 (uninitialized) • Set SHED_OPT different from 0
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
	The Block is not scheduled	Design the FB Application correctly and download it to the devices
The Block cannot be removed from IMAN mode	Something wrong in the BKCAL_IN	• The Status received in input of the BKCAL_IN is BAD Not Connected. Configure the link with the downstream block • The downstream block is producing a BAD status or Not Invited. Check the reason on the downstream block
The Block cannot be switched in AUTO mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO
	Something wrong in the IN	• The Status received in input of the IN is BAD Not Connected. Configure the link with the upstream block • The upstream block is producing a BAD status or Not Invited. Check the reason on the upstream block
The Block cannot be switched in CAS mode	The Target Mode is not set to CASCADE	Set the Target Mode to CASCADE
	Something wrong in the CAS_IN	• The Status received in input of the CAS_IN is BAD Not Connected. Configure the link of the CAS_IN with another block • The upstream block is producing a BAD status or Not Invited. Check the reason on the upstream block
Block Alarm Not Working (Events not notified)	The FEATURE_SEL has not the Reports bit Set	Set the REPORTS bit in the FEATURE_SEL of the RESOURCE BLOCK
	LIM_NOTIFY value is less of the MAX_NOTIFY value	Set the value of LIM_NOTIFY equal, at least, to the MAX_NOTIFY value

Arithmetic Function Block (AR)

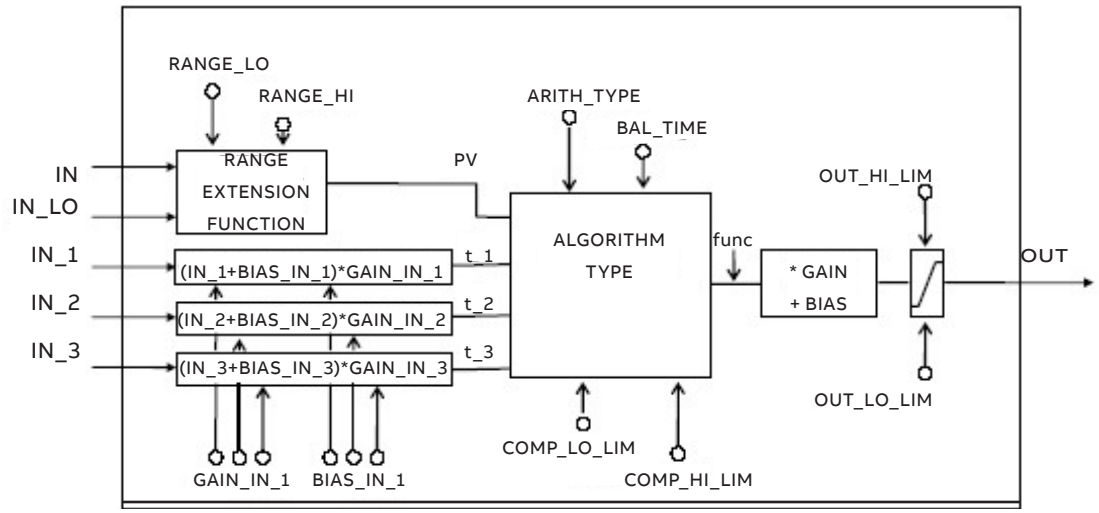
Overview

This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.
The following algorithms are available selectable from ARTH_TYPE:

1. Flow compensation, linear.
2. Flow compensation, square root.
3. Flow compensation, approximate.
4. BTU flow.
5. Traditional Multiply Divide.
6. Average.
7. Traditional Summer.
8. Fourth order polynomial.
9. Simple HTG compensated level.



Block Diagram



Description

The AR block is intended for use in calculating measurements from combinations of signals from sensors.
It is not intended to be used in a control path, so it does not support control status propagation or back calculation. It has no process alarms.
The block has 5 inputs. The first two are dedicated to a range extension function that results in a PV, with status reflecting the input in use.
The remaining three inputs are combined with the PV in a selection of four term math functions that have been found useful in a variety of measurements. The inputs used to form the PV should come from devices with the desired engineering units, so that the PV enters the equation with the right units. Each of the additional inputs has a bias and gain constant.

The bias can be used to correct for absolute temperature or pressure. The gain can be used to normalize terms within a square root function. The output also has gain and bias constants for any further adjustment required. The range extension function has a graduated transfer, controlled by two constants referenced to IN. An internal value, **g**, is zero for IN less than RANGE_LO. It is one when IN is greater than RANGE_HI. It is interpolated from zero to one over the range of RANGE_LO to RANGE_HI. The equation for PV follows:

PV = g * IN + (1-g) * IN_LO

If the status of IN_LO is unusable and IN is usable and greater than RANGE_LO, then g should be set to one. If the status of IN is unusable, and IN_LO is usable and less than RANGE_HI, then **g** should be set to zero. In each case the PV should have a status of Good until the condition no longer applies. Otherwise, the status of IN_LO is used for the PV if **g** is less than 0.5, while IN is used for **g** greater than or equal to 0.5. An optional internal hysteresis may be used to calculate the status switching point.
Six constants are used for the three auxiliary inputs. Each has a BIAS_IN_i and a GAIN_IN_i. The output has a BIAS and a GAIN static constant. For the inputs, the bias is added and the gain is applied to the sum. The result is an internal value called **t_i** in the function equations. The equation for each auxiliary input is the following:

t_i = (IN_i + BIAS_IN_i) * GAIN_IN_i

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

Equations

Algorithm Type	Description	Function
Flow Compensation Linear	Used for density compensation of Volume flow	*OUT = (f * PV * GAIN + BIAS)* Where $f = \frac{t\_1}{t\_2}$ is limited
Flow Compensation Square Root	Usually: - IN_1 is pressure ➔ (t_1) - IN_2 is temperature ➔ (t_2) - IN_3 is the compressibility factor Z ➔ (t_3)	*OUT = (f * PV * GAIN + BIAS)* Where $f = \sqrt{\frac{t\_1}{t\_2 * t\_3}}$ for **Volumetric Flow** is limited For the calculation of the Volumetric Flow **t_3 = Z** The compressibility factor Z can be set writing into the IN_3 a constant value **Z** or can be calculated by a previous block linked in the IN_3. *OUT = (f * PV * GAIN + BIAS)* Where $f = \sqrt{\frac{t\_1 * t\_3}{t\_2}}$ for **Mass Flow** is limited In case it would be necessary produce the Mass Flow, the compressibility factor Z must be set as into the IN_3 as $\frac{1}{Z}$
Flow Compensation Approximate	Both IN_1 and IN_2 would be connected to the same temperature **NOTE:** • The Square Root of the **third power** can be achieved connecting the input to IN and IN_1. • The Square Root of the **fifth power** can be achieved connecting the input to IN, IN_1, IN_3.	*OUT = (f * PV * GAIN + BIAS)* Where $f = \sqrt{t\_1 * t\_2 * t\_3^2}$ is limited
BTU Flow	• IN_1 is the inlet temperature • IN_2 is the outlet temperature	*OUT = (f * PV * GAIN + BIAS)* Where *f* = **t_1 – t_2** is limited
Traditional Multiply Divide		*OUT = (f * PV * GAIN + BIAS)* Where $f = \frac{t\_1}{t\_2}$ **+ t_3** is limited

Algorithm Type	Description	Function
Average		$OUT = \frac{PV + t\_1 + t\_2 + t\_3}{f} * GAIN + BIAS$ Where f = number of inputs used in computation
Traditional Summer		$OUT = (PV + t\_1 + t\_2 + t\_3) * GAIN + BIAS$
Fourth Order Polynomial	All inputs except IN_LO (not used) are linked together	$OUT = (PV + t\_1^2 + t\_2^3 + t\_3^4) * GAIN + BIAS$
Simple HTG Compensated Level	• The PV is the tank base pressure • IN_1 is the top pressure (t_1) • IN_2 is the density correction pressure (t_2) • GAIN is the height of the density tap	$OUT = \frac{PV - t\_1}{PV - t\_2} * GAIN + BIAS$

Configuration hints

The minimum configuration for having the AR working and/or moving out from the OOS needs at least the following settings:

- Set ARITH_TYPE with a valid value. It must be different from 0 and in the range 1 – 9
- If the selected ARITH_TYPE is in the range between 1-5 (limited functions), the output limits COMP_HI_LIM > COMP_LO_LIM
- The BAL_TIME must be greater than the Block Execution Time
- When the ARITH_TYPE = 6 (Average) in case of no inputs available the output will be set to NaN (Not a Number)
- Set the GAIN with value different from 0

Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / MAN / OOS	The selectable modes by the operator.
		ACTUAL		The mode the block is currently in.
		PERMITTED	AUTO / MAN / OOS	Allowed modes that the target may take on
		NORMAL	AUTO	The common mode for the Actual.
6	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	PV		The process variable used in block execution, expressed in **PV_SCALE unit** Code	
8	OUT		The block output value calculated as a result of the block execution, expressed in **OUT_RANGE unit** code	Writeable only if **MODE_BLK.ACTUAL** = MAN
9	PRE_OUT		Expressed in **OUT_RANGE unit** code	Displays what would be the OUT value and status if the mode was Auto or lower.
10	PV_SCALE		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 PV parameter and parameters which have the same scaling as PV.	
11	OUT_RANGE		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 scaling for the output. It has no effect on the block	
12	GRANT_DENY		Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	

Idx	Parameter	Description / Range / Selections / Notes	
13	INPUT_OPTS	Options the user may select to alter the calculation done in a control loop	
		Bit 0 IN Use uncertain as good	
		Bit 1 IN_LO Use uncertain as good	
		Bit 2 IN_1 Use uncertain as good	
		Bit 3 IN_1 Use bad as good	
		Bit 4 IN_2 Use uncertain as good	
		Bit 5 IN_2 Use bad as good	
		Bit 6 IN_3 Use uncertain as good	
		Bit 7 IN_3 Use bad as good	
14	IN	The Primary Input Value for the block coming from another block. Expressed in **PV_SCALE Unit**	
15	IN_LO	Input for the low range transmitter, in a range extension application. Expressed in **PV_SCALE Unit**	
16	IN_1	The Primary Input Value for the block coming from another block. Expressed in **PV_SCALE Unit**	
17	IN_2	The Primary Input Value for the block coming from another block. Expressed in **PV_SCALE Unit**	
18	IN_3	The Primary Input Value for the block coming from another block. Expressed in **PV_SCALE Unit**	
19	RANGE_HI	Constant Value above which the range extension has switched to the high range transmitter Expressed in **PV_SCALE Unit**	
20	RANGE_LO	Constant Value below which the range extension has switched to the low range transmitter Expressed in **PV_SCALE Unit**	
21	BIAS_IN_1	The constant to be added to IN_1	
22	GAIN_IN_1	The constant to be multiplied times (IN_1 + Bias)	
23	BIAS_IN_2	The constant to be added to IN_2	
24	GAIN_IN_2	The constant to be multiplied times (IN_2 + Bias)	
25	BIAS_IN_3	The constant to be added to IN_3	
26	GAIN_IN_3	The constant to be multiplied times (IN_3 + Bias)	
27	COMP_HI_LIM	The high limit imposed on the PV compensation term. Expressed in **PV_SCALE Unit** Code	
28	COMP_LO_LIM	The low limit imposed on the PV compensation term. Expressed in **PV_SCALE Unit** Code	
29	ARTH_TYPE	The identification number of the arithmetic algorithm	
		1 Flow Compensation, Linear	
		2 Flow Compensation, Square Root	
		3 Flow Compensation, Approximate	
		4 BTU Flow	
		5 Traditional Multiple Divide	
		6 Average	
		7 Traditional Summer	
		8 Fourth Order Polynomial	
		9 Simple HTG compensated Level	
30	BAL_TIME	Acceptable value: **OUT_SCALE** +/- 10% Expressed in **OUT_SCALE Unit**	The specified time for the internal working value of bias to return to operator set bias. Also used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS. Expressed in seconds
31	BIAS	Expressed in **OUT_SCALE Unit**	The bias value used in computing the function block output
32	GAIN	0 or > 0	Dimensionless value used by the block algorithm in calculating the block output
33	OUT_HI_LIM	Acceptable value: **OUT_SCALE** +/- 10% Expressed in **OUT_SCALE Unit**	Limits the maximum output value.
34	OUT_LO_LIM		Limits the minimum output value.
35	UPDATE_EVT	This alert is generated by any change to the static data	
36	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed	

Diagnostic

Block_Err	Possible Reasons	OUT Status
Block Configuration error	• ARITH_TYPE = 0 (uninitialized) • GAIN = 0 • if COMP_HI_LIM =< COMP_LO_LIM and ARITH_ TYPE in • the range 1-5 • if BAL_TIME =< macrocycle and different from 0	BAD + Out Of Service **See Note A**
Input Failure/process variable has BAD status	At least one of the inputs used in the Output calculation is not usable**: **For the inputs **IN and IN_LO** usable status are: • GOOD_NC • GOOD_C • UNCERTAIN with INPUT_OPTION = Use uncertain	The worst Status of the used inputs
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service

NOTE A: The specific block cannot be switched out from OUT OF SERVICE due to the Configuration Error. The Bad-Configuration Error Status is overridden by the Bad-Out Of Service Status.

OUT Status

Status of PV depends by the factor **g**. If it is less than 0.5 it will be used the Status of IN_LO otherwise it will use the Status of IN
The inputs with status byte different from GOOD are controlled by the INPUT_OPTS. The status of unused inputs is ignored.
The Status of the OUT will be the same of PV except when the PV is GOOD and the Status of the auxiliary inputs is NOT GOOD and the INPUT_OPTS is not configured to use it. In this case the Status of the OUT is UNCERTAIN.
Otherwise the OUT Status id the worst of the inputs used in the calculation after applying the INPUT_OPTS

Troubleshooting

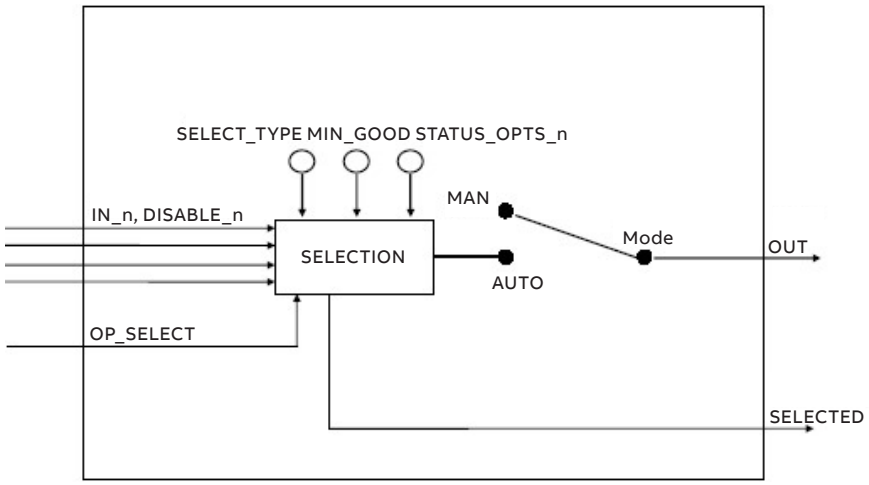
Problem	Possible cause	Solution
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The Configuration Error bit is set in the BLOCK_ERR	• Set the ARITH_TYPE with a valid value. It must be different from 0 and in the range 1 – 9 • Set the GAIN with value different from 0 • Set COMP_HI_LIM > COMP_LO_LIM when ARITH_TYPE in the range 1-5 • Set BAL_TIME > of the Macrocycle IF different from 0
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
	The Block is not scheduled	Design the FB Application correctly and download it to the devices
The OUT Status is BAD	At least one of used inputs have a BAD status	Check the upstream blocks
The OUT Status is UNCERTAIN	At least one of the used inputs have an UNCERTAIN status	Check the upstream blocks
The OUT Status has the Limit bits (0, 1) set to Constant	The Actual Mode is set to MAN	Set the Target Mode to AUTO
Block Alarm Not Working (Events not notified)	The FEATURE_SEL has not the Reports bit Set	Set the REPORTS bit in the FEATURE_SEL of the RESOURCE BLOCK
	LIM_NOTIFY value is less of the MAX_NOTIFY value	Set the value of LIM_NOTIFY equal, at least, to the MAX_NOTIFY value

Input Selector Function Block (IS)

Overview

The signal selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection.
With a combination of parameter configuration options the block can function as a rotary position switch, or a validated priority selection based on the use of the first good parameter and the disable_n parameter. As a switch the block can receive switching information from either the connected inputs or from an operator input. The block also supports the concept of a middle selection. Although the normal configuration for this feature would be with three signals the block should generate an average of the middle two if four signals are configured or the average of two if three are configured and a bad status is passed to one of the inputs.
Logic is provided for handling uncertain and bad signals in conjunction with configured actions. The intended application of this block is to provide control signal selection in the forward path only, therefore, no back calculation support is provided. SELECTED is a second output that indicates which input has been selected by the algorithm.

Block Diagram



Description

This block is intended to be used in a forward path only and is not intended to receive signals from the output of a controller. There is no back calculation support or propagation of control status values. The processing of the block is as follows.

Input processing

If DISABLE_n is true then don't process (ignore) the respective input IN_n.
Process the Use Uncertain as Good status options. Discard (ignore) inputs whose status is BAD.
If there are no inputs left, or fewer than MIN_GOOD inputs, then set the value of SELECTED to zero. Do not do selection processing.

Selection Processing

If OP_SELECT is non-zero, the OP_SELECT value shall determine the selected input, regardless of the SELECT_TYPE selection. Set SELECTED to the number of the input used.
If SELECT_TYPE is First Good, transfer the value of the first remaining input to the output of the block. Set SELECTED to the number of the input used.
If SELECT_TYPE is Minimum, sort the remaining inputs by value. Transfer the lowest value to the output of the block. Set SELECTED to the number of the input with the lowest value.
If SELECT_TYPE is Maximum, sort the remaining inputs by value. Transfer the highest value to the output of the block. Set SELECTED to the number of the input with the highest value.
If SELECT_TYPE is Middle, sort the remaining inputs by value. If there are 3 or 4 values, discard the highest and lowest value. If two values are left, compute their average. Transfer the value to the output
of the block. Set SELECTED to zero if an average was used, else set SELECTED to the number of the input with the middle value.
If SELECT_TYPE is Average compute the average of the remaining inputs and transfer the value to the output of the block. Set SELECTED to the number of inputs used in the average.

Limit Processing

The computations to determine high and low limit conditions for the output can be complex. They should be done to the best of the designer's ability. The limits of OUT should be able to tell a PID to stop integrating if the measurement cannot move.

Equations
With the SELECT_TYPE it is possible select the following algorithms:

Algorithm Type	Description	Function
First Good	Select the first available Input with Good Status	
Minimum	Select the minimum value of the Inputs	
Maximum	Select the maximum value of the Inputs	
Middle	Calculate the middle of three inputs or the average of the two middle inputs if four inputs are defined	
Average	Calculate the average value of the inputs	

Configuration hints

The minimum configuration for having the IS working and/or moving out from the OOS needs at least the following settings:

- Set the SELECT_TYPE with a valid value. It must be different from 0 and in the range 1 – 5

Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / MAN / OOS	The selectable modes by the operator.
		ACTUAL		The mode the block is currently in.
		PERMITTED	AUTO / MAN / OOS	Allowed modes that the target may take on
		NORMAL	AUTO / CAS	The common mode for the Actual.
6	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	OUT		The block output value calculated as a result of the block execution, expressed in **OUT_RANGE unit** code	Writeable only if **MODE_BLK.ACTUAL** = MAN
8	OUT_RANGE		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 scaling for the output. It has no effect on the block	
9	GRANT_DENY		Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	
10	STATUS_OPTS		Options the user may select to alter the calculation done in a control loop	
			Bit 3 Propagate Fault Forward	Enable/Disable the propagation of the Status byte from the PRTB in input at the AI to its Output
			Bit 6 Uncertain if Limited	
			Bit 7 BAD if Limited	
			Bit 8 Uncertain if MAN Mode	
11	IN_1		Input 1 Value and Status	
12	IN_2		Input 2 Value and Status	
13	IN_3		Input 3 Value and Status	
14	IN_4		Input 4 Value and Status	
15	DISABLE_1		0 Use	Parameter to switch off the input 1 from being used
			1 Disable	
16	DISABLE_2		0 Use	Parameter to switch off the input 2 from being used
			1 Disable	
17	DISABLE_3		0 Use	Parameter to switch off the input 3 from being used
			1 Disable	
18	DISABLE_4		0 Use	Parameter to switch off the input 4 from being used
			1 Disable	
19	SEL_TYPE		This parameter specifies the type of selector action	
			1 First Good	
			2 Minimum	
			3 Maximum	
			4 Middle	
			5 Average	
20	MIN_GOOD		0 - 4	If the number of inputs which are good is less than the value of MIN_GOOD then set the out status to bad.
21	SELECTED		0 - 4	An integer indicating which input has been selected
22	OP_SELECTED		0 - 4	An operator settable parameter to force a given input to be used
23	UPDATE_EVT		This alert is generated by any change to the static data	
24	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed.	

Diagnostic

Block_Err	Possible Reasons	OUT Status
Block Configuration error	SELECT_TYPE = 0 (uninitialized)	BAD + Out Of Service **See Note A**
Input Failure/process variable has BAD status	SELECT_TYPE = AVERAGE and at least one IN is BAD	BAD + non specific
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service

NOTE A: The specific block cannot be switched out from OUT OF SERVICE due to the Configuration Error. The Bad-Configuration Error Status is overridden by the Bad-Out Of Service Status.

OUT Status

When in AUTO mode the OUT reflects the Value and Status of the selected input (IN_x).
If there are no inputs used, or the number of inputs with GOOD status is less than the MIN_GOOD value, the OUT status shall be BAD-Non Specific.
The SELECTED output shall have Good(NC) status, unless the block is out of service.
With the STATUS_OPTS it is possible selects the following options:

- **Use Uncertain as Good**: Set the IS_OUT status to Good when the Selected Input Status is Uncertain
- **Uncertain if Manual Mode**: The Status of the IS_OUT is set to Uncertain when the Mode is set to Manual

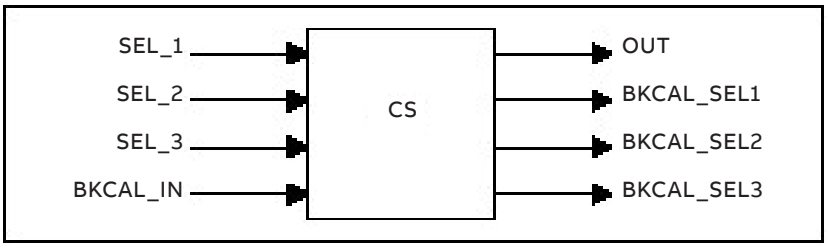
Troubleshooting

Problem	Possible cause	Solution
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The Configuration Error bit is set in the BLOCK_ERR	Set the SELECT_TYPE with a valid value. It must be different from 0 and in the range 1 – 5
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
	The Block is not scheduled	Design the FB Application correctly and download it to the devices
The OUT Status is BAD	All the Inputs have a BAD status	Check the upstream blocks
	The number of inputs with GOOD status is less than the MIN_GOOD value	
	The OP_SELECT is different from 0 and force in output and Input with BAD status	
	The SELECT_TYPE = AVERAGE and at least one Input has Status BAD	
The OUT Status has the Limit bits (0, 1) set to Constant	The Actual Mode is set to MAN	Set the Target Mode to AUTO
	The FEATURE_SEL has not the Reports bit Set	Set the REPORTS bit in the FEATURE_SEL of the RESOURCE BLOCK

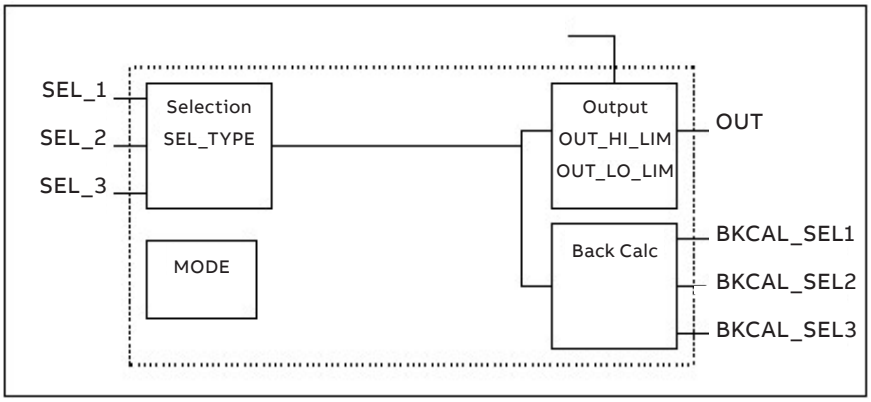
Control Selector Function Block (CS)

Overview

The control selector block is intended to select one of two or three control signals in a manner determined by SEL_TYPE, when the block is in Auto mode. A different block, described in Part 3, is used for selecting a measurement from input or calculation blocks.



Block Diagram



Description

All inputs to the selector block are assumed to have the same scaling as OUT, since any one of them may be selected to be OUT. Three separate BKCAL_SEL_N outputs are available, one for each SEL_N input. The status will indicate those inputs that are not selected. Control blocks that are not selected are limited in one direction only, determined by the type of selector. The value of each BKCAL_SEL_N output is the same as OUT. The limits of back calculation outputs corresponding to deselected inputs will be high for a low selector and low for a high selector, or one of each for a mid selector.

Equations

With the SEL_TYPE it is possible select the following algorithms:

- High
- Low
- Middle

Configuration hints

The minimum configuration for having the CS working and/or moving out from the OOS needs at least the following settings:

- Set the SEL_TYPE with a valid value. It must be different from 0 and in the range 1 – 3

Block Mapping

Idx	Parameter		Description / Range / Selections / Notes	
0	BLOCK_OBJ		In the Block Object data structure, there are different items describing the block characteristics. Execution period, Number of parameters in the block, the DD Revision, Profile Revision, View Objects characteristics and so on	
1	ST_REV		The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value (S – under Storage) in the block is changed.	
2	TAG_DESC		The user description of the intended application of the block	
3	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	TARGET	AUTO / MAN / OOS	The selectable modes by the operator.
		ACTUAL		The mode the block is currently in.
		PERMITTED	AUTO / MAN / OOS	Allowed modes that the target may take on
		NORMAL	AUTO	The common mode for the Actual.
6	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	OUT			
8	OUT_SCALE			
9	GRANT_DENY		Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	
10	STATUS_OPTS		Options which the user can select for the block processing of status. The available selections are:	
			Bit 0 IFS if BAD IN	
			Bit 2 Use Uncertain as Good	
11	SEL_1		First input value to the selector	Expressed in **OUT_SCALE Unit**
12	SEL_2		Second input value to the selector	
13	SEL_3		Third input value to the selector	
14	SEL_TYPE		Options which the user can select for the block processing of status. The available selections are:	
			1 High	
			2 Low	
			3 Middle	
15	BKCAL_IN		The analog input value from another block's **BKCAL_OUT** output that is used to prevent reset windup and to initialize the control loop. Expressed in **OUT_SCALE Unit**	
16	OUT_HI_LIM		Acceptable value: **OUT_SCALE** +/- 10% Expressed in **OUT_SCALE Unit**	Limits the maximum output value.
17	OUT_LO_LIM			Limits the minimum output value.
18	BKCAL_SEL_1		Control selector Value and Status associated with SEL_1 input which is provided to BKCAL_IN of the block connected to SEL_1 in order to prevent reset windup. Expressed in OUT_SCALE Unit	
19	BKCAL_SEL_2		Control selector Value and Status associated with SEL_2 input which is provided to BKCAL_IN of the block connected to SEL_2 in order to prevent reset windup. Expressed in OUT_SCALE Unit	
20	BKCAL_SEL_3		Control selector Value and Status associated with SEL_3 input which is provided to BKCAL_IN of the block connected to SEL_3 in order to prevent reset windup. Expressed in OUT_SCALE Unit	
21	UPDATE_EVT		This alert is generated by any change to the static data	
22	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 parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active Status, if the subcode has changed	

Diagnostic

Block_Err	Possible Reasons	OUT Status
Block Configuration error	SELECT_TYPE = 0 (uninitialized)	BAD + Out Of Service **See Note A**
Input Failure/process variable has BAD status	The value linked in input coming from the upstream blocks has BAD Status.	As Calculated and depending by the STATUS_OPTS
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service

NOTE A: The specific block cannot be switched out from OUT OF SERVICE due to the Configuration Error. The Bad-Configuration Error Status is overridden by the Bad-Out Of Service Status.

OUT Status

The OUT Status of the CS block is the same of the Selected Input exception for:

- If input is Uncertain, the output is Bad unless the STATUS_OPTS is set to Use Uncertain as Good.
- If all the inputs are Bad the CS mode goes to MAN as well as it does the PID. This condition produces the OUT Status to be set to IFS if the STATUS_OPTS is set to IFS if BAD IN.
- If no inputs have been linked or are valid the OUT Status is set to Bad - Configuration Error

Supported STATUS_OPTS:

- IFS if BAD IN
- Use Uncertain as GOOD

Status supported for other output variables:

- If the BKCAL_IN status is NI or IR, this status is transferred to the three BKCAL_SEL_x.
- If the BKCAL_IN status is not normal it is transferred to the selected BKCAL_SEL_x output.
- The BKCAL_SEL_x Status of the deselected inputs is set to Not Selected with the appropriate high or low limit set.
- When the CS is in MAN no inputs are selected. All the BKCAL_SEL_x status are set to Not Invited and Constant limits with the same value of OUT.

Troubleshooting

Problem	Possible cause	Solution
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The Configuration Error bit is set in the BLOCK_ERR	• Set the SEL_TYPE with a valid value. It must be different from 0 and in the range 1 – 3 • Set OUT_HI_LIM > OUT_LO_LIM
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
	The Block is not scheduled	Design the FB Application correctly and download it to the devices
The Block is in MAN mode	The Target Mode is set to MAN	Set the Target Mode to AUTO
	An used input has Bad Status	Check the upstream blocks
	The Selected input has UNCERTAIN Status	Set the STATUS_OPTS to Use Uncertain as Good
The OUT Status is BAD	There are no inputs linked in (OUT Status = BAD Configuration Error)	Review the FB application design
The OUT Status has the Limit bits (0, 1) set to Constant	The Actual Mode is set to MAN	Set the Target Mode to AUTO
Block Alarm Not Working (Events not notified)	The FEATURE_SEL has not the Reports bit Set	Set the REPORTS bit in the FEATURE_SEL of the RESOURCE BLOCK
	LIM_NOTIFY value is less of the MAX_NOTIFY value	Set the value of LIM_NOTIFY equal, at least, to the MAX_NOTIFY value

11 Maintenance

If the field indicator is used as intended under normal operating conditions, no maintenance is required. It is sufficient to check the output signal at regular intervals (in accordance with the operating conditions). If deposits are expected to accumulate, the equipment should be cleaned on a regular basis, in accordance with the operating conditions. Cleaning should ideally be carried out in a workshop.
Repair and maintenance activities may only be performed by authorized customer service personnel.
When replacing or repairing individual components, original spare parts must be used.

NOTICE

The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines). Make sure that the static electricity in your body is discharged when touching electronic components.

⚠ WARNING

No repair is allowed in all JDF300 flameproof joints: threads of enclosure, covers and plugs. Contact the manufacturer for specific flamepath joint details during repair of flameproof Ex d apparatus.

⚠ WARNING

For areas subject to explosive dust atmospheres the painted surface of the JDF300 may store electrostatic charge and become a source of ignition in applications with a low relative humidity < 30% where the painted surface is relatively free of surface contamination such as dirt, dust or oil. Guidance on protection against the risk of ignition due to electrostatic discharge can be found in IEC TS 60079-31-1. Cleaning of the painted surface shall only be done in accordance with the manufacturer's instructions.

⚠ WARNING

Explosion-proof field indicator must be either repaired by the manufacturer or approved by a certified expert following repair work. Observe the relevant safety precautions before, during and after repair work. Only disassemble the field indicator to the extent necessary for cleaning, inspection, repairs, and replacement of damaged components.

Returns and removal

Defective field indicator sent to the repairs department must, wherever possible, be accompanied by your own description of the fault and its underlying cause.

⚠ WARNING

Before removing or disassembling the device, read the instructions in "safety" and electrical connection and perform the steps outlined there in reverse order.

Basic maintenance activities

Essentially maintenance is not required for JDF300 field indicator. Anyway the following items should be checked periodically:

- Check the integrity of the housing and covers (no cracks should be visible).
- Check that there is no tear or corrosion on electrical connection(s).

In case one of the check points above fails, please replace the damaged part with an original spare part.
Please contact your local ABB office for spare parts support information or refer to the spare part list.
The use of non original spare parts makes the warranty void. In case you want ABB to perform the repair, please send back the field indicator to your local ABB office complete with the return form that you find in this manual appendix and include it with the device.

NOTICE

Do not use sharp or pointed tools.

12 Hazardous Area considerations

Ex Safety aspects and IP Protection (Europe)

According to ATEX Directive (European Directive 2014/34/EU of 26 February 2014) and relative European Standards which can assure compliance with Essential Safety Requirements, i.e., EN 60079-0 (General requirements) EN 60079-1 (Flameproof enclosures “d”) EN 60079-11 (Equipment protection by intrinsic safety “i”) EN 60079-26 (Equipment with equipment protection level -EPL- Ga) the JDF300 field indicator has been certified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.

IMPORTANT

The number close to the CE marking of the field indicator safety label identifies the Notified Body which has responsibility for the surveillance of the production.

a) II 1 G Ex ia IIC T6...T4 Ga, II 1 D Ex ia IIIC T85 °C Da; IP66, IP67.
FM Approvals certificate number FM 18 ATEX 0055X.
The meaning of ATEX code is as follows:

- II : Group for surface areas (not mines)
- 1 : Category
- G : Gas (dangerous media)
- D: Dust (dangerous media)

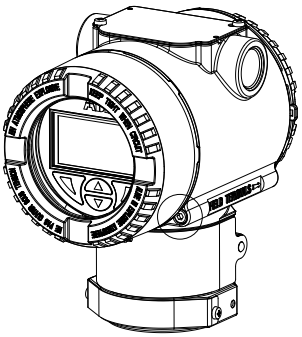
The other marking part refers to the protection type used according to relevant EN standards and is valid also for IECEx as detailed in FM Approvals certificate number IECEx FME 18.0004X:

- Ex ia: Intrinsic safety
- IIC: Gas group
- T4: Temperature class of the field indicator (corresponding to 135°C max) with a Ta from -50°C to +85°C
- T5: Temperature class of the field indicator (corresponding to 100°C max) with a Ta from -50°C to +40°C
- T6: Temperature class of the field indicator (corresponding to 85°C max) with a Ta from -50°C to +40°C
- Ga: Equipment Protection Level
- IIIC: for Dust application
- Da: Equipment Protection Level

About the applications, this field indicator can be used in “Zone 0” (Gas) or “Zone 20” (Dust) classified areas (continuous hazard) as it is shown on the following sketches.
Important. This ATEX Category depends on the application (see below) and also on the intrinsic safety level of the field indicator supply (associated apparatus) which can sometimes suitably be [ib] instead of [ia]. As it is well known, the level of an intrinsic safety system is determined by the lowest level of the various apparatus used, i.e., in the case of [ib] supply, the system takes over this level of protection.

Application for field indicator Ex ia categories Ga and Da

Application with Gas

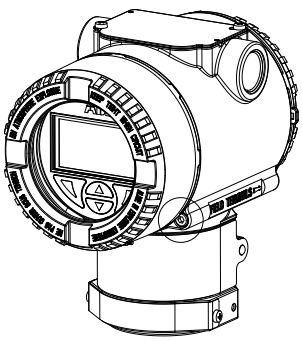


Zone 0

JDF300
Category 1 G Ex ia

Note: the field indicator must be connected to a supply (associated apparatus) certified [Ex ia]

Application with Dust



Zone 20

JDF300
Category 1 D Ex ia; IP6x

Note: the protection is mainly assured by the “IP” degree associated to the low power from supply. This can either be [ia] or [ib] certified [Ex ia]

b) II 2 G Ex db IIC T6 Gb Ta=–50 °C to +75 °C,
II 2 D Ex tb IIIC T85 °C Db Ta = –50 °C to +75 °C;
IP66, IP67.
FM Approvals certificate number FM 18 ATEX 0054X.
The meaning of ATEX code is as follows:

- II: Group for surface areas (not mines)
- 2: Category
- G: Gas (dangerous media)
- D: Dust (dangerous media)

The other marking refers to the protection type used according to relevant EN Standards and is valid also for IECEx as detailed in FM Approvals certificate number IECEx FME 18.0004X:

- Ex db: Explosion proof
- IIC: Gas group
- T6: Temperature class of the field indicator (corresponding to 85°C max) with a Ta from -50°C to +75°C.
- Gb: Equipment Protection Level
- Ex tb: type of protection “tb” means protection by enclosure technique
- IIIC: for Dust application
- Db: Equipment Protection Level

About the applications, this field indicator can be used in Zone “1” (Gas) classified areas (continuous hazard)
About Dust application, JDF300 is suitable for “Zone 21” according to the EN 60079-1 as it is shown on the relevant part of the sketches.

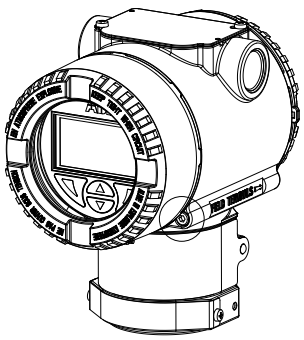
IMPORTANT

IP code

About the degree of protection provided by the enclosure of the field indicator has been certified IP66, IP67 according to EN 60529 standard. The first characteristic numeral indicates the protection of the inside electronics against ingress of solid foreign objects including dusts.
The assigned “6” means an enclosure dust-tight (no ingress of dust).
The second characteristic numeral indicates the protection of the inside electronics against ingress of water.
The assigned “6” refers to degrees of protection against water. Equipment is protected against powerful water jets.
The assigned “7”means an enclosure water-protected against a temporary immersion in water under standardized conditions of pressure and time.

Application for field indicator Ex db categories Gb and Db

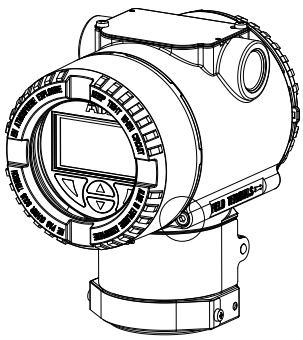
Application with Gas



Zone “1”
Zone “0”

JDF300
Category 2 G Ex db

Application with Dust



Zone “21”
Zone “20”

JDF300
Category 2 D Ex db

...12 Hazardous Area considerations

c) II 3 G Ex ic IIC T6...T4 Gc, II 3 D Ex tc IIIC T85 °C Dc; IP66, IP67.
The meaning of Atex code is as follows :

- II: Group for surface areas (not mines)
- 3: Category
- G: Gas (Dangerous media)

The other marking refers to the protection type used according to relevant EN Standards and is valid also for IECEx as detailed in FM Approvals certificate number IECEx FME 18.0004X:

- Ex ic: “Intrinsically safe” “ic”
- IIC: gas group
- Tx: Temperature class of the field indicator (which corresponds to 135°C max) with a Ta from -50°C to +85°C

as it shown on the following sketch (left side)

- II 3D Ex tc IIIC Tx Dc IP67
- II: Group for surface areas (not mines)
- 3: Category of equipment
- D: Dust (Dangerous media)
- Ex tc: type of protection “tc” means protection by enclosure technique
- IIIC: for Dust application
- Tx: Temperature class of the field indicator
- Dc: Equipment Protection Level
- IP67: degree of protection of field indicator acc. EN60079

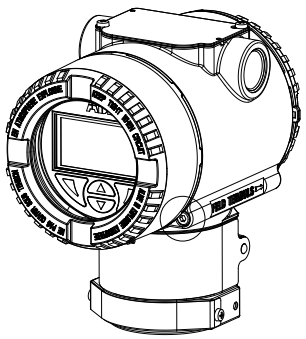
About the applications, this field indicator can be used in Zone 2 (Gas) (unlikely/infrequent hazard).
About Dust application, JDF300 can be used in Zone 22 (unlikely/infrequent hazard) as it shown on the following skecth.

IMPORTANT

Note for field indicator with combined approval
Before installation of the field indicator, the customer should permanent mark his chosen Protection Concept on the safety label. The field indicator can only be used with according to this Protection Concept for the whole life. If two or more types of protection box (on safety label) are permanent marked, the field indicator must be removed from hazardous classified locations. The selected Type of Protection is allowed to be changed only by manufacturer after a new satisfactory assessment.

Application for field indicator Ex ic/tc categories Gc and Dc

Application with Gas

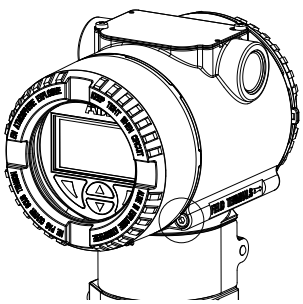


Zone 2

JDF300
Category 3 G Ex ic

Note: the field indicator must be connected to a supply with 42V d.c. max output voltage as above indicated. The Imax of the field indicator is shown in chart “Entities for Ex D and Ex ic”.

Application with Dust



Zone 22

JDF300
Category 3 D Ex tc; IP6x

Note: the protection is mainly assured by the “IP” degree associated to the low power from supply.

13 Requirements for installation and use in US and Canada

General

IMPORTANT

Note for field indicator with combined approval

Before installation of the field indicator, the customer should permanent mark his chosen Protection Concept on the safety label. The field indicator can only be used with according to this Protection Concept for the whole life. If two or more types of protection box (on safety label) are permanent marked, the field indicator must be removed from hazardous classified locations. The selected Type of Protection is allowed to be changed only by manufacturer after a new satisfactory assessment.

Environmental Conditions

JDF300 is designed to be safe under the following conditions:

- Outdoor use
- Altitude up to 2000 m
- Mains supply voltage fluctuation up to ± 10% of the nominal voltage
- No temporary overvoltages occurring on the mains supply
- Pollution degree 2
- Maximum relative humidity 80 % for temperatures up to 31°C decreasing linearly to 50 % relative humidity at 40 °C
- Transient overvoltages up to the levels of Overvoltage Category II

⚠ WARNING

No repair is allowed in all JDF300 flameproof joints: threads of enclosure, covers and plugs. Consult the manufacturer if repair of the flameproof joint is necessary.

Instructions for cleaning

Clean the external enclosure with soft rag and, if it is necessary, use mild cleaning solution and rains with clear water.
If deposits are expected to accumulate, the equipment should be cleaned on a regular basis, in accordance with the operating conditions. Cleaning should ideally be carried out in a workshop.

Insulation for secondary circuits derived from MAINS CIRCUITS of OVERVOLTAGE CATEGORY II up to 300 V

The power supply of the loop must be achieved by a transformer in which the primary windings are separated from the secondary windings by REINFORCED INSULATION, DOUBLE INSULATION or a sceen connected to the PROTECTIVE CONDUCTOR TERMINAL.

Ex Safety aspects and IP Protection (USA)

Applicable standards

According to FM here is the list of Standards which can assure compliance with Essential Safety Requirements

Standard	Description
3810	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, General Requirements
3600 ANSI/ISA 60079-0	Electrical Equipment for use in Hazardous (Classified) Locations, General Requirements
ANSI/ISA 60079-1 3615	Electrical Equipment for use in Hazardous (Classified) Locations, protection by flameproof enclosures “d”
3610 ANSI/ISA 60079-11	Electrical Equipment for use in Hazardous (Classified) Locations, protection by intrinsic safety “i”
3611 ANSI/ISA 60079-15	Electrical Equipment for use in Hazardous (Classified) Locations, protection by intrinsic safety “n”
ANSI/ISA 60079-31	Electrical Equipment for use in Hazardous (Classified) Locations, dust ignition protection by enclosure “t”

Classifications

The field indicator has been certified for the following Class, Divisions and Gas groups, hazardous classified locations, temperature class and types of protection.

- Explosionproof (US) for Class I, Division 1, Groups A, B, C and D, hazardous (classified) locations, Class I Zone 1 AEx db IIC T4 Gb, as Ex db type of protection.
- Dust ignition proof for Class II, III Division 1, Groups E, F and G, hazardous (classified) locations, as Ex tb type of protection.
- NonIncendive for Class I, Division 2, Groups A, B, C and D, in accordance with Nonincendive field wiring requirements for hazardous (classified) locations, as Ex ic type of protection.
- Intrinsically Safe for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F and G in accordance with Entity requirements for hazardous (classified) locations, as Ex ia and Ex iaD type of protection.
- Temperature class T4 to T6 (dependent on the maximum input current and the maximum ambient temperature). See following table for reference.
- Ambient Temperature range -40°C to +85°C (dependent on the maximum input current and the maximum temperature class).
- Type 4X applications Indoors/Outdoors, IP66, IP67.

For a correct installation in field of JDF300 field indicator please see the related control drawing No 3KXP000074U0109.

...13 Requirements for installation and use in US and Canada

Special conditions

Installation cables suitable for specific maximum temperature are indicated in the table here below:

Tamb	Power supply	Cable type
	Type of protection AEx tb and AEx db	
-50°C up to +75°C	Up to 100mA	Cables suitable for a temp of 77°C
	Type of protection AEx nC	
-50°C up to +75°C	Up to 100mA	Cables suitable for a temp of 77°C
-50°C up to +70°C	Up to 160mA	Cables suitable for a temp of 72°C
-50°C up to +40°C	Up to 40mA	All cable can be used

The ambient temperature is not indicated on the label but on this user manual.
The enclosure can be made in aluminium. The installation of the equipment must take this into account with respect of impact and friction sparking for it to be suitable for Group II fro EPL Ga. That is not indicated on the label but only in this user manual.
The final user can chose the level of protection of the equipment when the equipment is with the option E7, EW, E4, E6, EH, EI or EN on the type of code for Hazardous areas certifications. When the selection is made, it is not possible to change it. The same procedure has to apply for all other codes when it is present a multiple choice for the type of protection.

IMPORTANT

When installed with a conduit, a seal shall be installed within 50mm of the enclosure.

Ex Safety aspects and IP Protection (Canada)

Applicable standards

According to FM 18 CA 0110X here is the list of Standards which can assure compliance with Essential Safety Requirements

Standard	Description
CSA 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, General Requirements
CSA 60079-0	Electrical Equipment for use in Hazardous (Classified) Locations, General Requirements
CSA 60079-1	Electrical Equipment for use in Hazardous (Classified) Locations, protection by flameproof enclosures “d”
CSA 60079-11	Electrical Equipment for use in Hazardous (Classified) Locations, protection by intrinsic safety “i”
CSA 60079-15	Electrical Equipment for use in Hazardous (Classified) Locations, protection by intrinsic safety “n”
CSA 60079-31	Electrical Equipment for use in Hazardous (Classified) Locations, dust ignition protection by enclosure “t”

Classifications

The field indicator has been certified for the following Class, Divisions and Gas groups, hazardous classified locations, temperature class and types of protection.

- Explosionproof (Canada) for Class I, Division 1, Groups A, B, C and D, hazardous (classified) locations, Class I Zone 1 Ex db IIC T4 Gb, as Ex db type of protection.
- Dust ignition proof for Class II, III Division 1, Groups E, F and G, hazardous (classified) locations, as Ex tb type of protection.
- NonIncendive for Class I, Division 2, Groups A, B, C and D, in accordance with Nonincendive field wiring requirements for hazardous (classified) locations, as Ex ic type of protection.
- Intrinsically Safe for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F and G in accordance with Entity requirements for hazardous (classified) locations, as Ex ia and Ex iaD type of protection.
- Temperature class T4 to T6 (dependent on the maximum input current and the maximum ambient temperature). See following table for reference.
- Ambient Temperature range -40°C to +85°C (dependent on the maximum input current and the maximum temperature class).
- Type 4X applications Indoors/Outdoors, IP66, IP67.

For a correct installation in field of JDF300 field indicator please see the related control drawing No 3KXP000074U0109.

Special conditions

Installation cables suitable for specific maximum temperature are indicated in the table here below:

Tamb	Power supply	Cable type
	Type of protection AEx tb and AEx db	
-50°C up to +75°C	Up to 100mA	Cables suitable for a temp of 77°C
	Type of protection AEx nC	
-50°C up to +75°C	Up to 100mA	Cables suitable for a temp of 77°C
-50°C up to +70°C	Up to 160mA	Cables suitable for a temp of 72°C
-50°C up to +40°C	Up to 40mA	All cable can be used

The ambient temperature is not indicated on the label but on this user manual.
The enclosure can be made in aluminium. The installation of the equipment must take this into account with respect of impact and friction sparking for it to be suitable dor Group II fro EPL Ga. That is not indicated on the label but only in this user manual.
The final user can chose the level ofprotection of the equipment when the equipment is with the option E5, EJ, EK or EL on the type of code for Hazardous areas certifications. When the selection is made, it is not possible to change it. The same procedure has to apply for all other codes when it is present a multiple choice for the type of protection.

IMPORTANT

When installed with a conduit, a seal shall be installed within 50mm of the enclosure.

FM marking and entities

- Conforms to UL 61010-1, UL 60079-0, UL 60079-1, UL 60079-11, UL 60079-15 and UL 60079-31
- Certified with CSA C22.2.61010-1, CSA C22.2.60079-0, CSA C22.2.60079-11, CSA C22.2.60079-15 and CSA C22.2.60079-31

FM approval	Type of protection	T4/T135	T4/T135	T5/T100	T6/T85
US	Class I, Zone 0 AEx ia IIC T6...T4 Ga Class I, Division 1, Groups A, B, C, D, T6...T4 Class II, Division 1, Groups E, F, G, T6...T4 Class III when connected per drawing 3KXP000074U0109				
Canada	Class I, Zone 0 Ex ia IIC T6...T4 Ga Class I, Division 1, Groups A, B, C, D, T6...T4 Class II, Division 1, Groups E, F, G, T6...T4 Class III when connected per drawing 3KXP000074U0109				
US	Class I, Division 1, Groups A, B, C, D; T4 Class II, III Division 1, Groups E, F, G; T4 Class I, Zone 1 AEx db IIC T4 Gb				
Canada	Class I, Division 1, Groups A, B, C, D; T4 Class II, III Division 1, Groups E, F, G; T4 Class I, Zone 1 Ex db IIC T4 Gb				
US	Class I, Zone 2 AEx nC IIC T6...T4 Gc				
Canada	Class I, Zone 2 Ex nC IIC T6...T4 Gc				
US Canada	Class I, Division 2, Groups A, B, C, D T6...T4 when connected per drawing 3KXP000074U0109 “FISCO Field Instrument”				
Canada	Ex ic IIC T6...T4 Gc When connected per DWG 3KXP000074U0109				

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