Operating Instruction
IM/264FF_V2_1

Field IT

2600T Series Pressure Transmitters

Models 264xx – Revision 2

ADDENDUM FOR FOUNDATION™ Fieldbus

Industrial IT enabled

FOUNDATION

ABB

CONTENTS:

IMPORTANT NOTE !!!!

The original FF Drivers specific of the 264xx Revision 2 described in this manual are the following:

0201.ffo	***DD Object File***
0201.sym	***DD Symbol File***
020101.cff	***Capability File***

Where for the DD files the filename in the format "aabb" means:
aa = Device Revision
bb = DD Revision

and for the CFF file the filename in the format "aabbcc" means:
aa = Device Revision
bb = DD Revision
cc = Capability File Revision

- ***The DD revision and Capability File revision reported in the above file names represent the minimum revision valid for the 264 Revision 2.***
- ***Future DD or CFF revisions identified with a greater revision number in the file name will be valid and usable for the same 264 Revision 2.***

Before to put the 264 Revision 2 in communication with any Fieldbus Host, check that the above FF drivers (DD & CFF) have been previously installed.

Future 264 Revisions will be always released with the new specific FF drivers.

In case the Fieldbus Host has already installed the FF drivers of 264 Revision 1, it is necessary to install the new FF drivers for the support of the new 264 Revision 2. In this way old and new revisions of the same device type can work together on the same Host

ACRONYMS

LCD	**L**iquid **C**rystal **D**isplay
H1	Low Speed Fieldbus Segment
FF	**F**oundation **F**ieldbus
LAS	**L**ink **A**ctive **S**cheduler
RB	**R**esource **B**lock
TB	**T**ransducer **B**lock
DD	**D**evice **D**escription
CFF	**C**apability **F**ile **F**ormat
FISCO	**F**ieldbus **IS** **Co**ncept
OOS	**O**ut **O**f **S**ervice
SW	**S**oft**W**are
FM	**F**actory **M**utual
AI	**A**nalog **I**nput block
PID	**P**roportional **I**ntegral **D**erivative block
AR	**Ar**ithmetic
IT	**I**ntegrator **T**otalizer block
CS	**C**ontrol **S**elector block
IS	**I**nput **S**elector block
SC	**S**ignal **C**haracterizer block
TPB	**T**ransducer **P**ressure **B**lock
ADB	**A**dvanced **D**iagnostic Transducer **B**lock
TDB	**T**ransducer **D**isplay **B**lock
PILD	**P**lugged **I**mpulse **L**ine **D**etection
FBAP	**F**unction **B**lock **AP**plication

Preamble

In order to make easier the description, all the variables mentioned in this document are written with the suffix indicating the block within they are mapped i.e. RB, TPB, ADB, TDB, PID, AI, AR, IS, CS, SC, IT

1. – Foundation Fieldbus Definition

FOUNDATION™ Fieldbus is an all-digital, serial, two-way communication system that serves as a Local Area Network (LAN) for factory/plant instrumentation and control devices.
FOUNDATION™ Fieldbus is designed to be compatible with the officially sanctioned SP50 standards project of the ISA (The International Society for Measurement and Control) and the specifications of the IEC (International Electrotechnical Committee
A unique characteristic of FOUNDATION™ Fieldbus is interoperability that ensures its use of a fully specified, standard User Layer based on "Blocks" and Device Description technology.

Detailed information of the Foundation Fieldbus is available from the FF Organization site www.fieldbus.org and/or from the ABB site www.abb.com/fieldbus

2. – Device Introduction

2.1 – General Considerations

The 2600T Pressure Transmitter Series include a complete line of differential, absolute and gauge pressure transmitters used also for level, flow and volume measurement applications.
In addition, 2600T Series offers the most complete line of remote seal forms and wetted materials in the industry; different process and application matching fill fluids cover the widest process temperature range.
The series is covered by multiple agency safety approvals (including ATEX and FM) supported by intrinsically safe and explosion proof designs, for a full compliance to hazardous area requirements.

2.2 – FOUNDATION™ Fieldbus Features

The 2600T-264xx FOUNDATION™ Fieldbus version differs by the traditional 4-20 mA version only in the secondary electronic and in the Terminal block[1]. The transducer with its own primary electronic has to be considered the common part of all the different Transmitter versions (Hart, Profibus, and FF). This feature offers the possibility to replace on the same transmitters different electronics with the plug and play capability.

The 2600T-264xx Foundation Fieldbus Revision 2 implements and is compliant to the communication Protocol FOUNDATION™ Fieldbus specification version 1.6.

The 2600T-264xx FF Revision 2 is registered as a **Link Master Device.**
It can be configured as the LAS backup device of the H1 segment in order to maintain alive the control loop whenever the primary LAS element, typically the controller, fails

The 2600T-264xx FF Revision 2 implements the following **Function Blocks**:

- 1 Enhanced Resource Block
- 2 Enhanced Analog Input Function Blocks
- 1 Enhanced PID Function Block
- 1 Standard Arithmetic Function Block
- 1 Standard Integrator Function Block
- 1 Standard Input Selector Function Block
- 1 Standard Control Selector Function Block
- 1 Standard Signal Characterizer Function Block,
- 1 Enhanced Pressure with Calibration Transducer Block,
- 1 Custom LCD Display Transducer Block,
- 1 Custom Advanced Diagnostic Transducer Block with **"Plugged Input Line Detection"** algorithm.

The 2600T-264xx FF Revision 2 is suitable for the following **physical layer types**:

- Standard-power entimetre, bus-powered, Entity Model I.S.
- Standard-power entimetre, bus-powered, non I.S.
- Low-power entimetre, bus-powered, FISCO I.S.

[1] Anyway the standard Terminal Block, without surge protector, can be used also for the FF application connecting the FF bus cable to the +/- terminals. **The polarity has not consistency.**

2.3 – Registration Details

DEVICE

Model:	2600T Series– Models 264xx
Type:	Pressure Transmitter
Revision:	2.0
Tested Function Blocks:	1xRB(e), 2xAI(e), 1xPID(e), 1xAR(s), 1xIT(s), 1xIS(s),
Other Blocks:	1xSC(s), 1xCS(s), 1xTB Pressure(e), 1xTB Display I, 1xTB Advanced Diagnostic I
Comm. Profile Class:	31PS, 32L
IT Campaign Number:	IT032600

PHYSICAL LAYER

Class:	111, 113, 511

DEVICE DESCRIPTION

Manufacturer ID Num:	0x000320
Device Type:	0x0004
DD Revision:	1.0

CAPABILITY FILE

Filename:	020101.cff

ITK VERSION: 4.6

All the Registration details are available from the Fieldbus Foundation webpage of the specific Device, see the link: http://www.fieldbus.org/ProductsAndServices/DisplayProduct/default.asp?product_id=1102

FF Device Registration Certificate

FOUNDATION

FIELDBUS FOUNDATION

DEVICE REGISTRATION

Presented To:	ABB SACE SpA
Model:	2600T Series Model 264
Device Type:	Pressure Transmitter
ITK_Ver:	4.6
IT Campaign Number:	IT032600
Registration Date:	6/13/2005
DD Revision:	0x01
CFF Revision:	020101.cff

The above device has successfully completed rigorous testing by the Fieldbus Foundation and has received registration and the right to use the FF checkmark logo as specified by MT-045.

Heather Santos
Test Technician

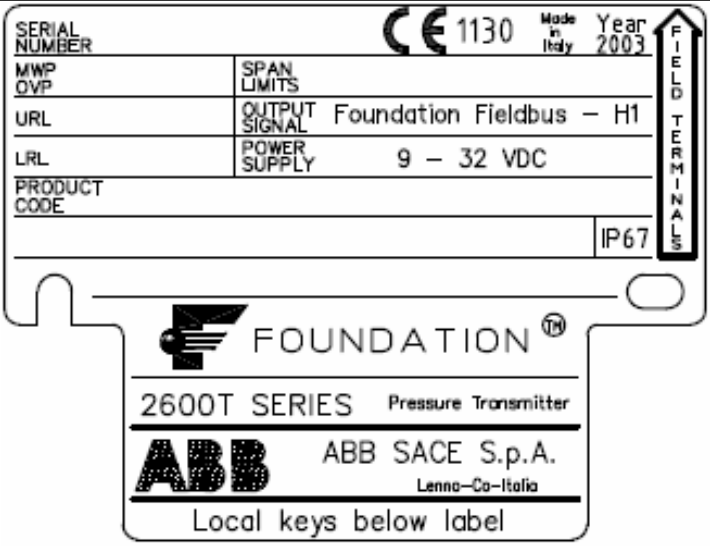
Richard J. Timoney
President

3. – Hardware Characteristics

3.1 – Environmental Protection

The 2600T-264xx FF Pressure Transmitter is an integrated electronic designed for Intrinsically Safety application. The 2600T-264xx Series is compliant and conforms to the ENTITY and FISCO certifications.

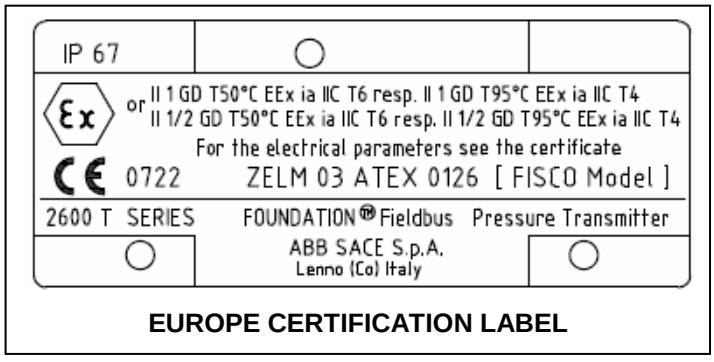
TYPE PLATE:



FOUNDATION™ Fieldbus Type Plate

EUROPE CERTIFICATIONS:

Agency: **ATEX / ZELM**
Certificate N°: ZELM 03 ATEX 0126
Protection Type: II 1 GD T50°C EEx ia IIC T6 resp. II 1 GD T95°C EEx ia IIC T4
Or
II ½ GD T50°C EEx ia IIC T6 resp. II ½ GD T95°C EEx ia IIC T4



EUROPE CERTIFICATION LABEL

The meaning of ATEX code is as follows:

II :	Group for surface areas (not mines)
1 or 2 :	Category
G :	Gas (dangerous media)
D :	Dust (dangerous media)
T50°C:	Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) +40°C for Dust (not Gas) with a dust layer up to 50 mm depth.
T95°C:	As before for Dust for a Ta +85°C

and for Flameproof protection type:

T85°C: Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) +75°C for Dust (not Gas) with a dust layer up to 50 mm depth.

(Note: the number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production)

The other marking refers to the Intrinsic safety protection type used according to relevant EN standards:

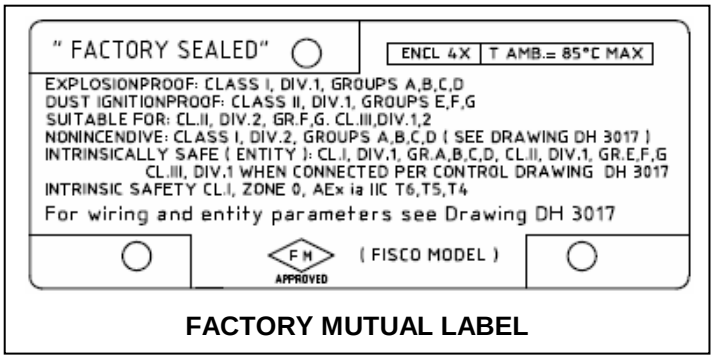
Eex ia : Intrinsic safety, protection level “a”
IIC : Gas group
T6 : Temperature class of the transmitter (which corresponds to 85°C max) with a Ta (ambient temperature) +40°C
T4 : Temperature class of the transmitter (which corresponds to 135°C max) with a Ta (ambient temperature) +85°C

The other marking refers to the Flameproof protection type used according to relevant EN standards:

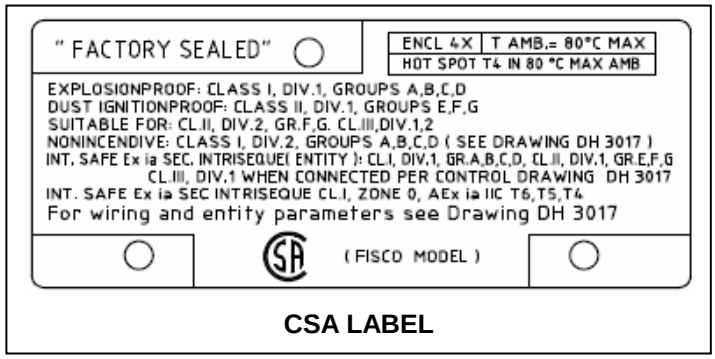
Eex d: Flameproof
IIC : Gas group
T6 : Temperature class of the transmitter (which corresponds to 85°C max) with a Ta (ambient temperature) +75°C

NORTH AMERICA CERTIFICATION:

Agency:	**FM & CSA**	
Certificate N°:	**FM: 3014824**	
	CSA: 1390857	
Protection Type:	Explosionproof:	Class I, Div.1, Groups A, B, C, D
	Dust Initionproof:	Class II, Div.1, Groups E, F, G
	Suitable for:	Class II, Div.2, Groups F, G; Class III, Div.1, 2
	Nonincendive:	Class I Div.2, Groups A, B, C, D
	Intrinsically safe (Entity):	Class I, Div.1 Groups A, B, C, D; Class II, Div.1 Groups E, F, G; Class III, Div.1
	Intrinsically safety:	Class I, Zone 0, AEx ia IIC T6, T5, T4



FACTORY MUTUAL LABEL



CSA LABEL

3.2 – Fault Protection

The 264 electronic implements an especial 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 save the good functionality of the other connected devices that, otherwise, would be switched off due to the missing power available.

3.3 – Hardware Settings

On the electronic unit (behind the Local Display when installed) there are 4 switches, see the Figure 1, with the following functionality:

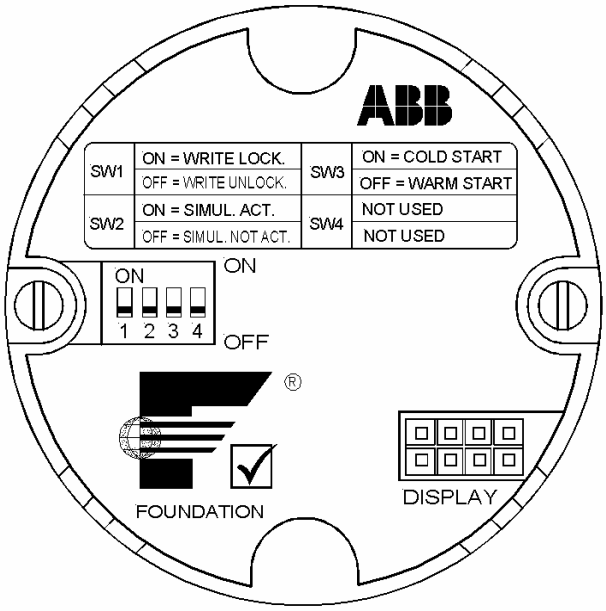


Figure 1: Electronic front view

SW 1 - Write Locking

In ON position enables the Write Locking condition. Any attempt to change the configuration of the device is refused.

The SW1 in ON position enable the Write Locking only if the "HW Write Lock Supported" bit is set in the RB_FEATURE_SEL, see the Resource Block table in section 8 – Device Configuration

SW 2 - Simulation

SW 2 in ON position enables the Simulation.

SW 3 - Cold Start

SW 3 in ON position enables the Cold Start-up. The Cold Start-up feature is available in order to initialise all the parameters requiring a well-defined value, with default values **congruent to the connected sensor type/model**. This operation can be performed setting the Cold Start-up switch 3 in the ON position before to power on the device, Many variables of the AI and TPB are properly set with values strictly related to the connected sensor type.

SW 4 – not used: *(For future use)*

3.4 – Local Indicator

The 2600T-264xx Foundation Fieldbus Pressure Transmitter is available with the LCD local indicator as optionally item see the Figure 2. This indicator is a Dot matrix type with one 5 digit line for the value to be displayed, one 7 characters alphanumeric line for the strings and unit code, plus a 50 segments bar-graph.

It can be optionally installed on the transmitter, with the capability to display:

1. **Variables** produced in output by the TPB and/or Function Blocks in Engineering Value or percentage.
2. **Diagnostic** strings whenever errors or warnings are detected.
3. **Feedback** of the local operations performed acting on the external push buttons.
   For details see the section 3.5 – Local Push Buttons

Figure 2: Integral Local Display

3.4.1 – Variables Indicator

The TDB has 4 variables called TDB_LCD_VALx_SELECTION (where x is from 1 to 4) containing the code of the variable to be displayed selectable from a list of 16 different variables.
Depending by the combination of the TDB_LCD_SELECTION and TDB_LCD_SEQUENCE the indicator can works as

1. Single Variable Indicator
2. Multiple Variable Indicator

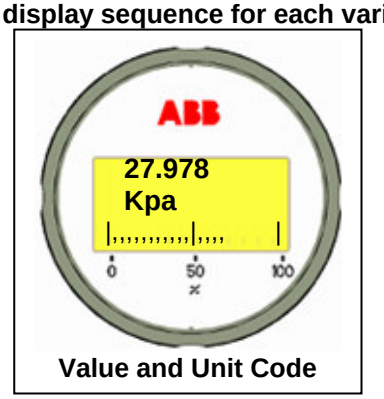
3.4.1.1 Single Variable indicator

When the following variables are set to:

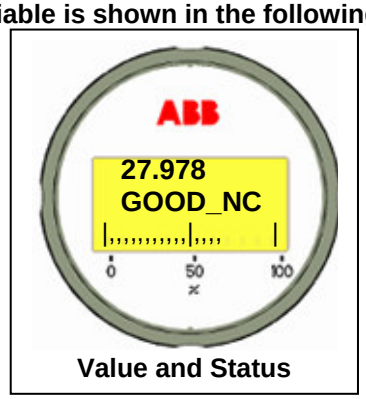
- TDB_LCD_SEQUENCE = ***Disable***
- TDB_LCD_SELECTION = ***1 to 4***

The Indicator displays the variable selected in TDB_VAL**x**_SELECTION where **x** is the number set in the TDB_LCD_SELECTION.

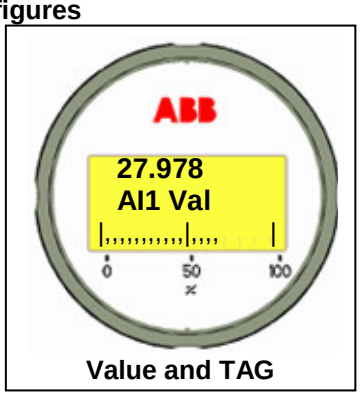
The display sequence for each variable is shown in the following figures



Value and Unit Code



Value and Status



Value and TAG

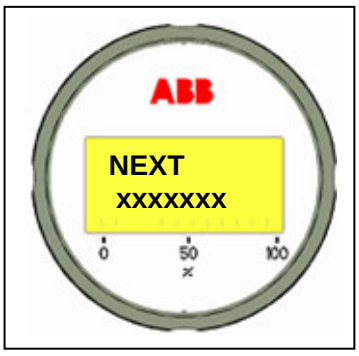
- The first line displays always the Value
- The second line displays in sequence every 3.0 seconds the Status, the TAG and the engineering unit of the selected variable.
- The bargraph in the bottom of the display represent the percentage of the displayed variable accordingly to the relevant configured Scale:
  - OUT_SCALE for the Function Block Outputs
  - SENSOR_RANGE for the TPB Output

3.4.1.2 Multiple Variable indicator

When the following variables are set to:

- TDB_LCD_SEQUENCE = ***Enable***
- TDB_LCD_SELECTION = xxxx (***Don't care)***

The Indicator displays in sequence the variables selected in all the TDB_VAL**x**_SELECTION scrolling them each every 27 seconds.
The sequence of Value Status, Value TAG and Value Unit is repeated 3 times before to display the next variable. The commutation to the next variable is visible by the following displaying:



Where **xxxxxx** represents the TAG of the next variable

☞ The indicator scrolls the 4 variables selected in the TDB_VAL**x**_SELECTION skipping those set to '**Uninitialized**'

3.4.2 – Diagnostic Indicator

Whenever a failure or warning condition is detected within the transmitter, the correspondent string is displayed on the indicator.

There is a different way to display the diagnostic conditions depending by their severity:

1. Error Indicator
2. Warnings Indicator

3.4.2.1 – Error Indicator

The errors in general are conditions that make not usable the variables calculated in the device and produced in output from the transducer or function blocks.
The error conditions have higher priority for the indicator and whenever a failure is detected the correspondent strings blink every 2 seconds independently by any other indicator selection.
For details about the possible Error strings and for which reason they are displayed, refers to the Diagnostic sections within any block description

3.4.2.2 – Warning Indicator

The warnings in general are conditions that allow the use of the variables calculated in the device and produced in output from the transducer or function blocks.
The warning conditions are displayed alternate with the selected variable every 2 seconds.
For details about the possible Warning strings and for which reason they are displayed, refers to the Diagnostic sections within any block description

3.5 – Local Push Buttons

Two push buttons ‘Z’ and ‘S’ are available under the housing’s type plate, see the Figure 3 for different usage:

- **The ‘Z’ button** performs the ‘Zero Alignment’ operation.
  With this operation the TPB_PROCESS_VALUE indication is automatically adjusted to ‘zero’.

  Whenever the user wants to set the measure produced by the transmitter to ‘zero’ (i.e. when the measure is different by ‘zero’ due to the installation position or due to remote seals) the following sequence of operations are required when the user acts with the local push button:

  After the ‘Z’ button is kept pushed for more than 1 second, when released, the ‘Zero Alignment’ operation is executed adjusting to ‘0.0’ value the TPB_PROCESS_VALUE and consequently setting to ‘zero’ (0.0) also the TPB_CAL_POINT_LO as Calibration Point Low, see the also section 9.1.

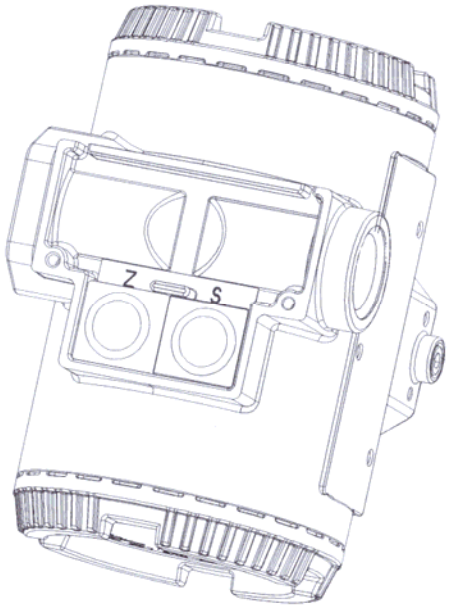


Figure 3: Push Buttons View

As consequence of the above operation, when the ‘Z’ button is released, the feedback on the display is one of the following strings:

When the operation is successfully executed

When the operation is not successfully executed

When the security-locking switch 1 is in ON position (Write Protection).

When the Local operations are disabled
(see TDB_KEY_ENABLED)

➢ **The 'S' button** when kept pressed shown in sequence on the display different information. The display is refreshed every 2 seconds with the following sequence:

1st displaying

2nd displaying

3rd displaying

1st displaying: The copy of the electronic DIP switches position as 0 = Off or 1= ON in this case it is possible to know the DIP switches setting without remove the display.

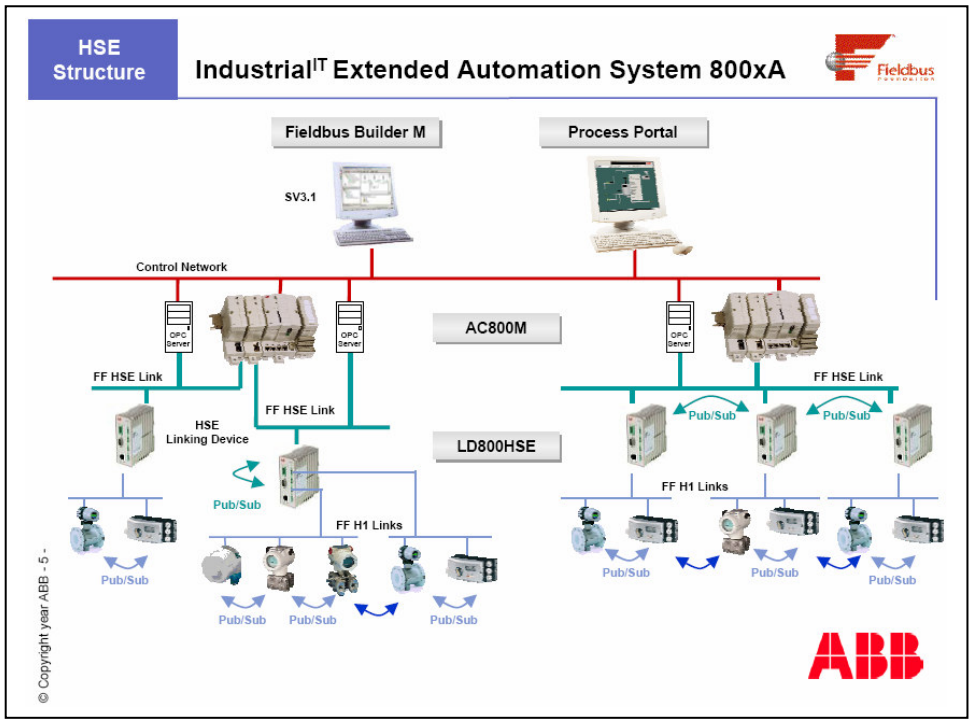
2nd displaying: DEV_REV as in the Resource Block

3rd displaying: DD_REV as in the Resource Block

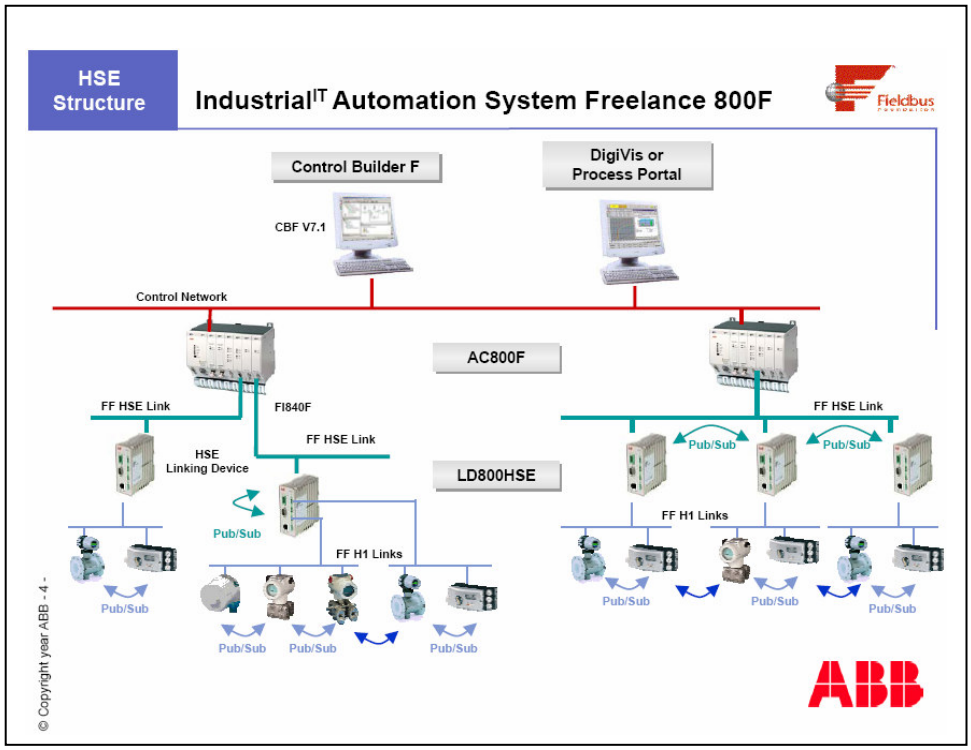
4. – Network Architecture

Simple diagrams of the ABB architecture for Foundation Fieldbus are shown in the following pictures where the different systems are represented:

800xA solution with LD800HSE linking device



800F solution with LD800HSE linking device



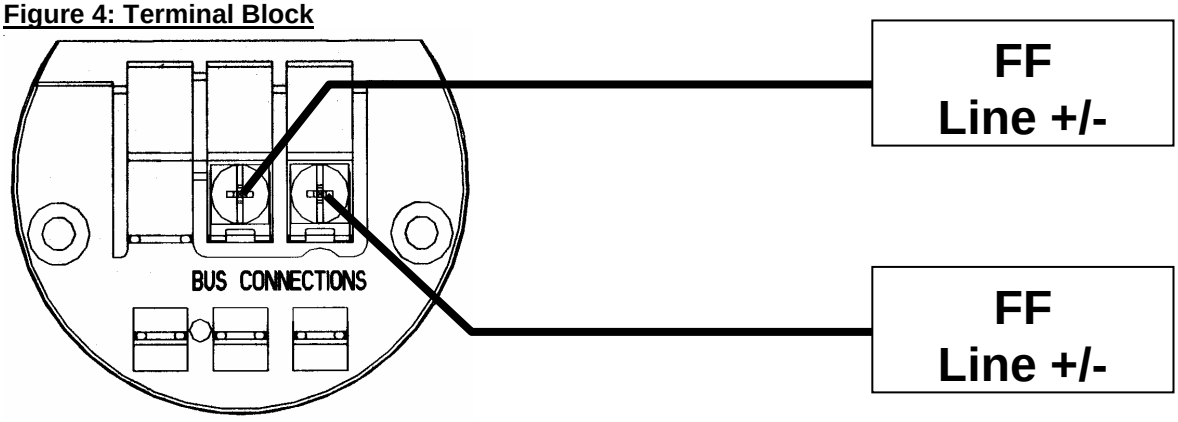
More details are available from the ABB web site www.abb.com/fieldbus

5 – Electrical Connections

The 2600T-264xx FF is a Bus Powered device with FOUNDATION™ Fieldbus output. On the terminal block there are two screws for the bus connection, see the Figure 4.

> ☞ The Polarity has not consistency. The two bus cables can be connected without take care of the polarity.

Figure 4: Terminal Block



If necessary the ground terminal could be also connected. For details about the connections refer to the ***"Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium"*** Application Guide document **ag-140s** and/or the ***"31.25 kbit/s Intrinsically Safe System"*** Application Guide document **ag-163s** available on the Fieldbus Foundation website www.fieldbus.org

The special Fieldbus Connector is also available as optional item for the easy connection of the transmitter to the bus. Below there are the pictures of the two selected models with different plugs.

> **WARNING –** These connectors can be used **ONLY FOR UNCLASSIFIED LOCATIONS**

7/8" PLUG

M12x1 PLUG

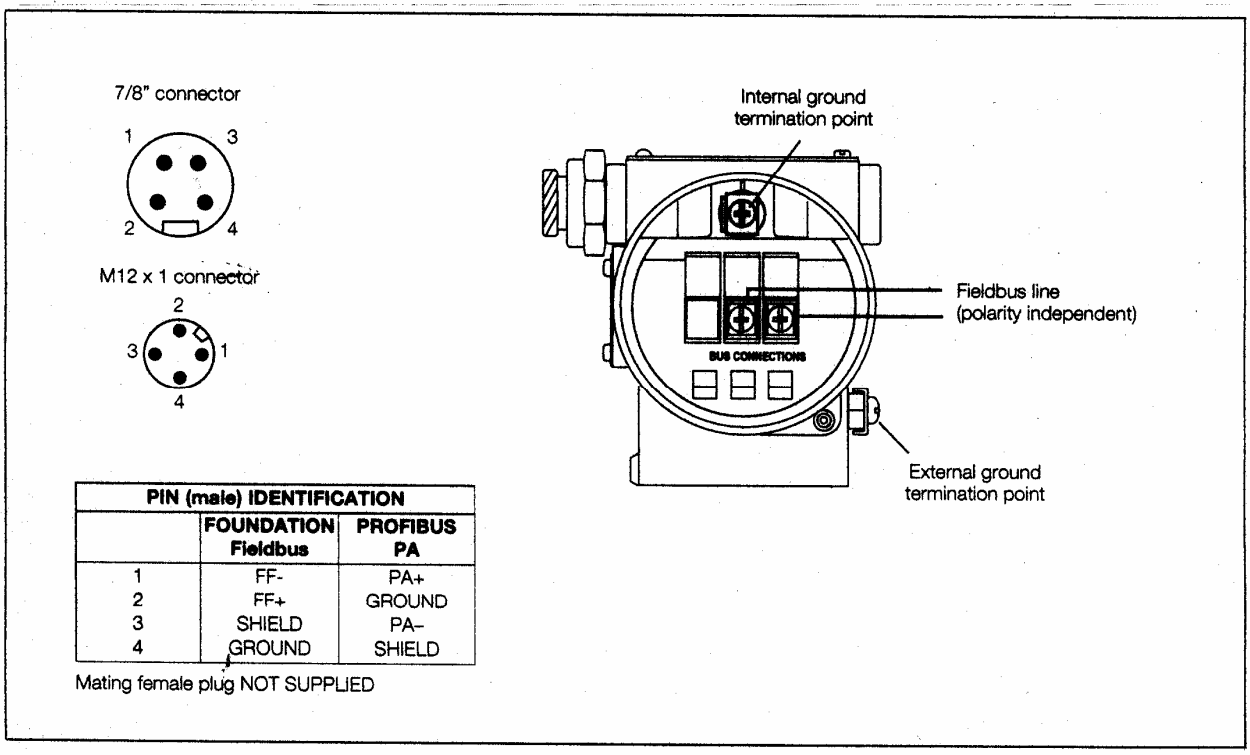
> ☞ The **7/8" PLUG** model is considered the default version for the 264xx - FOUNDATION Fieldbus version.

> ☞ The connector Thread will be in accordance with the selected Housing Model. By default the Housing Thread is **1/2 - 14 NPT**

The picture below shows the pin-out of the two different Fieldbus connector models.

- The Bus lines are polarity independent.
- The GROUND and SHIELD connections must be evaluated depending by the installation rules

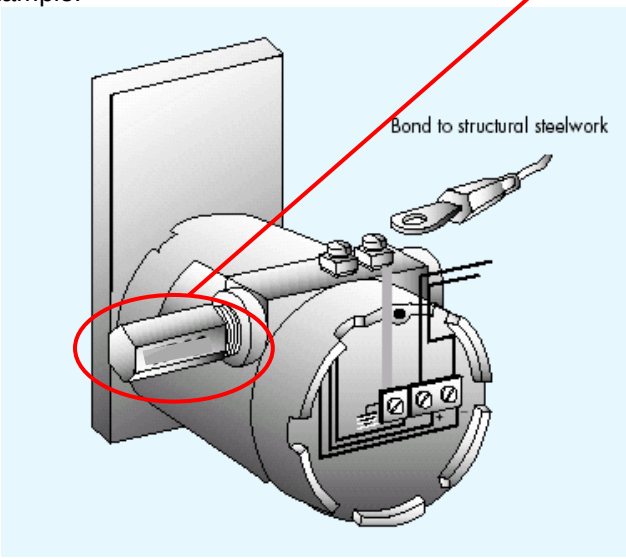
FIELDBUS Versions



PIN (male) IDENTIFICATION		
	FOUNDATION Fieldbus	**PROFIBUS PA**
1	FF-	PA+
2	FF+	GROUND
3	SHIELD	PA–
4	GROUND	SHIELD

Mating female plug NOT SUPPLIED

The Surge Protection is also available as optional item to be connected externally on the device's housing thread, see the picture below as example.



WARNING – The Surge Protection can be used **ONLY FOR UNCLASSIFIED LOCATIONS**

☞ By default the threads of the housing and the relating Surge Protection is **1/2 - 14 NPT**

Technical Note for the connection of the SURGE PROTECTOR and/or FILEDBUS CONNECTOR on the 264 Rev.2

NOTA TECNICA / TECHNICAL NOTE

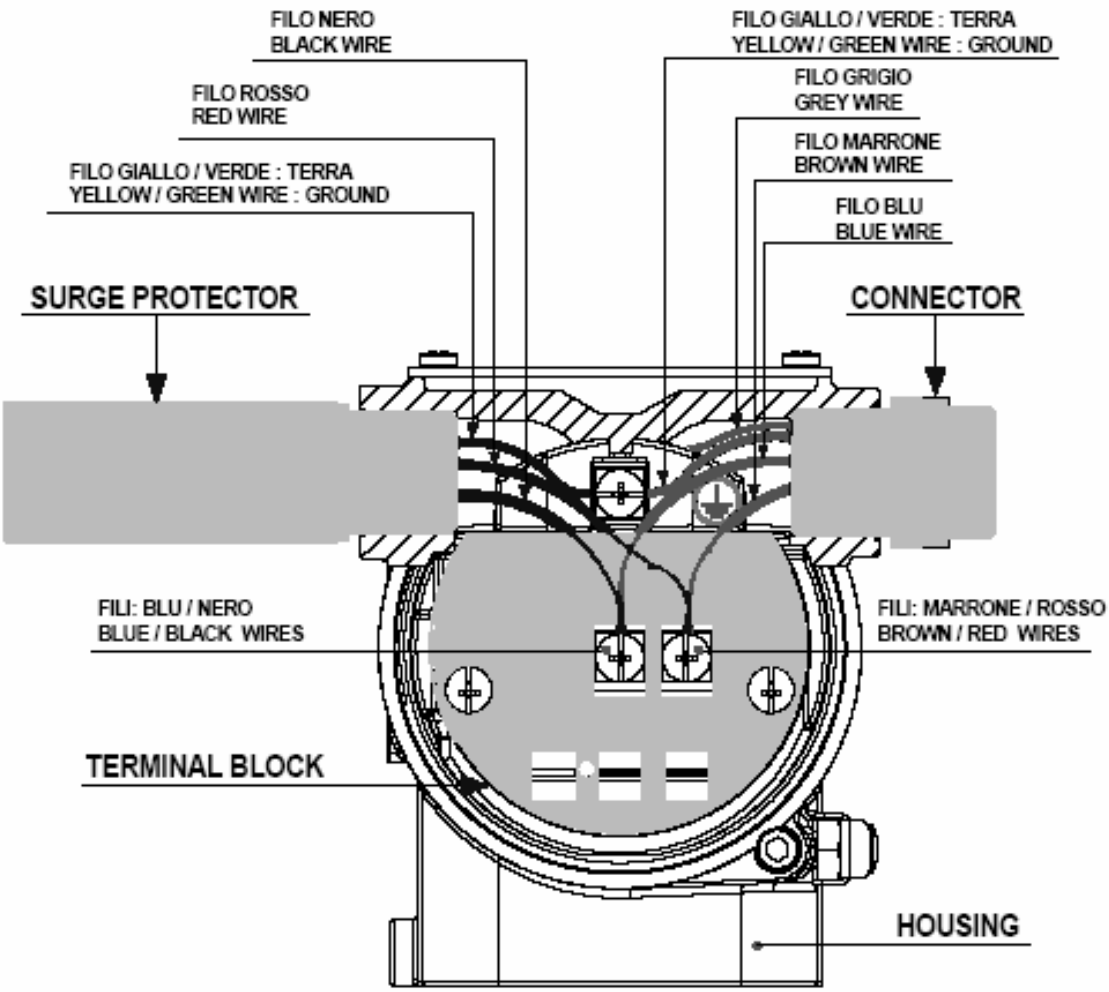


ABB SACE S.p.A.

NOTA : IL COLORE DEI FILI NEL DISEGNO E' PURAMENTE INDICATIVO. LA MORSETTIERA DELLO STRUMENTO NON PREVEDE NESSUNA POLARITA', QUINDI NON E' NECESSARIO SEGUIRE I COLLEGAMENTI INDICATI NEL DISEGNO. SI RACCOMANDA IN OGNI CASO DI MANTENERE LA STESSA COMBINAZIONE DI COLORI DEI FILI E MORSETTI SU TUTTI GLI STRUMENTI DA INSTALLARE. NEL CASO IL CONNETTORE HA 4 FILI IL 4° FILO E' DI COLORE GRIGIO ED E' CONNESSO ALLO SCHERMO DEL CAVO DI RETE.
L' USO DELLO SCHERMO DIPENDE DALLE DIVERSE CONDIZIONI DI INSTALLAZIONE E TOPOLOGIA DELLA RETE. PER DETTAGLI FARE RIFERIMENTO ALLE SPECIFICHE IEC 1158-2, SEZIONE "MEDIUM SPECIFICATION" O AI DOCUMENTI AG140s SCARICABILI DAL SITO www.fieldbus.org
www.fieldbus.org/ProductsAndServices/FFProductCatalog/#Lit

NOTE : THE COLORS OF THE CABLES IN THE DRAWING ARE PURELY INDICATIVE. THE DEVICE IS NOT POLARITY SENSITIVE AND IT IS NOT MANDATORY TO FOLLOW THE SAME WIRING SCHEME AS IT THE DRAWING.
IN CASE A DIFFERENT WIRING SCHEME IS USED, IT IS STRONGLY RECOMMENDED TO APPLY THE SAME WIRING FOR ALL THE TRANSMITTERS TO BE INSTALLED. IN CASE THE CONNECTOR HAS GOT 4 WIRES, THE 4th WIRES IS OF GREY COLOUR AND IS CONNECTED TO THE SHIELD OF THE BUS CABLES.
IT COULD BE USED NOT DEPENDING BY INSTALLATION AND / OR TOPOLOGY CONDITIONS.
FOR DETAILS REFER TO THE SPECIFICATIONS IEC 1158-2 IN THE SECTION "MEDIUM SPECIFICATION" OR TO THE DOCUMENTS AG140s AND AG163s DOWNLOADABLE FROM THE WEBSITE www.fieldbus.org
www.fieldbus.org/ProductsAndServices/FFProductCatalog/#Lit

6. – Initialisation

At the power up, the 2600T-264 FF executes some internal self-test. Both the Hardware and the memory contents are checked before to start the normal operations.
During this phase, on the display all the segments remain lit on for few seconds until the initial testing is complete. After that, depending by the initial testing and by how the TDB has been configured see 3.4.1, on the display appears or the selected variable or the diagnostic string.

By default, the Function Blocks of the 2600T-264 FF are not running, until a Function Block application is not downloaded into the transmitter. For this reason the selected default variable to be displayed is the TPB_PROCESS_VALUE because it is always produced independently by the downloading of the Function Block application.
After the Function Block has been successfully downloaded into the transmitter, the Function Blocks start to be scheduled producing in output the value to be used for the Process Control. After this condition is established, the user can select from the TDB_VALx_SELECTION the preferred variable to be displayed.

☞ By default the 2600T-264 FF starts with the two Analog Input blocks selected to measure:
- AI_1 produces the Pressure Measurement (CHANNEL = 1)
- AI_2 produces the Sensor Temperature (CHANNEL = 2)

7. – Device Addressing

When the 2600T-264 FF Transmitter is connected on a FF bus, the Master has to recognize it with a unique address in the world. For this reason the FF specifications define three different addressing levels that characterize the FF devices:
- The DEV_ID is the unique device identifier
- The PD_TAG is the physical name of the device
- The Node Address is the real node at which the device is connected on the bus. It is automatically set by the Master (Primary LAS) and its default value is **35**.

The most important one with the higher priority is the DEV_ID. This is a string of 32 characters and must identify in a unique way each FF device in the world.
In order to fulfill this requirement the 2600T-264 FF applies the following mechanism:
- The first part of the string is of 10 characters; the Manufacturer Code “000320” and Device Type code “0004”.
- The second part of the string is of 12 characters and represent the device type identification; “_2600T_264__”.
- The third part of the string is of 10 characters and is filled with the TPB_SENSOR_SERIAL_NUMBER read from the transducer database. This number is written at factory configuration stage and it is assigned in a well-defined way just to be sure to have always different numbers.

Finally the DEV_ID appears of 32 characters in this way ‘0003200004_2600T_264__xxxxxxxxxx’, where the entire ‘x’ represents the Serial number.
Whenever an electronics replacement after an electronics failure is necessary, appear clear that the device will be recognized on the network as before of the replacement. This is possible because the transducer, which includes the serial number, remains unchanged and the DEV_ID will be maintained the same as before of the failure.

8. – Device Configuration

The 2600T-264 FF Pressure Transmitter offers a set of variables available trough the FF communication. The Host for configuration and maintenance purposes can access the variables with Read and Write operations each addressed by an Index number. The FF Profile Standard defines the relative index of each variable, but the Start Index of each block is Manufacturer Specific.

In order to allow a full visibility and support of the variables mapped inside the 2600T-264 FF transmitter, it is necessary to import in the Host configuration system the DD files (.sym, and .ffo)
These files together with the Capability file (.cff) are available from the ABB website www.abb.com/instrumentation

The variables contained in the different blocks and available over the FF communication are listed in the following tables where:

idx = Relative Index
PC = Access Type
Note: Some variables can be changed only if the relevant block is in Out of Service.
The RB, E-PID, E-AI, CS are implemented in accordance with the Function Block Part 2 specification Document.
The IS, AR, IT, SC, are implemented in accordance with the Function Block Part 3 specification Document.

For details about the meaning of each single variable refer at the FF Function Block Part 2 (Ref. 2), Part 3 (Ref. 3)

Enhanced-RESOURCE BLOCK

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 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.

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	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	RS_STATE	1	R	State machine of the function block application.
8	TEST_RW	112	R/W	Read/Write test parameter – used only for conformance testing.
9	DD_RESOURCE	32	R	String identifying the tag of the resource, which contains the Device Description for this resource.
10	MANUFAC_ID	4	R	Manufacturer Identification number – used by an interface device to locate the DD file for the resource. **000320 hex for ABB**
11	DEV_TYPE	2	R	Manufacturer's model number associated with the resource – used by interface devices to locate the DD file for the resource.
12	DEV_REV	1	R	Manufacturer's revision number associated with the resource – used by interface devices to locate the DD file for the resource.
13	DD_REV	1	R	Revision of the DD associated with the resource – used by interface devices to locate the DD file for the resource.
14	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
15	HARD_TYPES	2	R	The type of Hardware available as channel numbers. 1 Scalar Inputs (i.e. Analog Input)
16	RESTART	1	R/W	Allows a manual restart to be initiated. More restart are possible, they are: ***STANDARD PART*** 1: Run – Normal state when running 2: Restart Resource 3: Restart with Default – Set the parameters to INITIAL VALUES as defined by the FF specs. 4: Restart Processor – perform a warm start-up ***ENHANCED PART*** 200: Special Restart – Associated with the Special Restart variable index 52 201: Special Operation – Associated with the Special Operation variable index 53
17	FEATURES	2	R	Used to show supported resource block options
18	FEATURES_SEL	2	R/W	Used to select resource block options. For the 264xx they are: Bit 1 – Reports Supported Bit 2 – Fault State Supported Bit 3 – SW Write Lock Supported Bit 4 – HW Write Lock Supported
19	CYCLE_TYPE	2	R	Identifies the block execution methods for this resource
20	CYCLE_SEL	2	R/W	Used to select the block execution methods for this resource. The 2600T-264 supports the following: - **Scheduled**: Blocks are executed depending by the function block schedule. - **Block execution**: A block may be executed by linking to another block completion.
21	MIN_CYCLE_T	4	R	Time duration of the shorted cycle interval of which the resource is capable.
22	MEMORY_SIZE	2	R	Available configuration memory in the empty resource. To be checked before attempting a download
23	NV_CYCLE_TIME	4	R	Minimum time interval for writing copies of NV parameters to non-volatile memory. Zero means it will be never automatically copied.

24	FREE_SPACE	4	R	Percent of memory available for further configuration. Zero in a preconfigured device
25	FREE_TIME	4	R	Percent of the block processing time that is free to process additional blocks.
26	SHED_RCAS	4	R/W	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	4	R/W	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	1	R	Fault State
29	SET_FSTATE	1	R/W	Set Fault State
30	CLR_FSTATE	1	R/W	Clear Fault State
31	MAX_NOTIFY	1	R	Maximum number of unconfirmed alert notify messages possible
32	LIM_NOTIFY	1	R/W	Maximum number of unconfirmed alert notify messages allowed
33	CONFIRM_TIME	4	R/W	The min time between retries of alert report. Retries shall not happen when Confirm_Time = 0
34	WRITE_LOCK	1	R/W	If set, no writes from anywhere 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.		
		1	R/W	Unacknowledged:
		1	R	Update State:
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision: The number of the last increment generating the alert
		2	R	Relative Index: The index of the changed variable generating the alert
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		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode: Cause of the alert
		1	R	Value: The value generating the alert
37	ALARM_SUM	The alert status associated to the function block		
		2	R	Current
		2	R	Unacknowledged
		2	R	Unreported
		2	R/W	Disabled
38	ACK_OPTION	2	R/W	Selection of whether alarms associated the function block will be automatically acknowledged.
39	WRITE_PRI	1	R/W	Priority of the alarm generated by clearing the write_lock
40	WRITE_ALM	This alert is generated if the write_lock parameter is cleared		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		1	R	Value
41	ITK_VER	2	R	Major revision number of the Interoperability test case used in certifying this device as interoperable

ENHANCED PARAMETERS

42	TRANSMITTER_ SERIAL_NUMBER	16	R	Serial Number of the Transmitter as printed on the main Type Plate (on the housing or hockypuck).
43	APPLICATION_ REVISION	8	R	Revisions of part of the transmitter, hardware and firmware, not impacting on the communication protocol or FF registration. Typically are new revisions due for bugfix or improvements of the functionality. The Format is “xx.yy.zz” where: – xx = Device Revision – yy = HW Revision – zz = SW Revision
44	MESSAGE	32	R/W	Reserved for User messages
45	DESCRIPTOR	32	R/W	Reserved for the User definitions
46	INSTALLATION DATE	7	R/W	Reserved for the User setting
47	HW_SWITCH_ SETTING	1	R	It reflects the setting of the Link/Switch position of the electronics. This is useful when is not clear which is the setting of the switches behind the local display. It is not necessary remove the display for looking the switches. They are: – Cold Start-up – Simulation – Write locking
48	DETAILED_RB_ STATUS	2	R	The detailed diagnostic conditions relating the RB are collected in this additional bit-string variable, they are: – Power up – Non Volatile memory failure

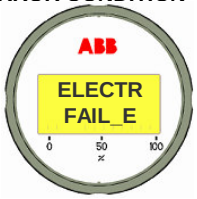
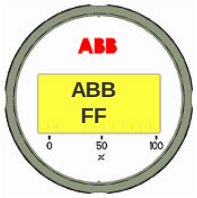
49	DEV_MASK_ERROR	2	R/W	The diagnostic conditions can be masked setting the correspondent bit in this variable. When the diagnostic condition is detected, the associated bit to be communicated via protocol is set or cleared after the AND logic with the correspondent bit in this mask. When the bit in the mask is set, it means that the correspondent diagnostic condition must be masked and nothing will be set in the Block_Err and consequently no Alert_Notify will be issued. Only not fatal errors can be masked, they are: – Power up – Non Volatile memory failure
50	DEV_SIM_ERROR	2	R/W	The diagnostic conditions can be simulated setting the correspondent bit in this variable. They are: – Lost Static Data – Power up – Non Volatile memory failure – Electronics memory data corruption
51	RB_XD_ERROR	1	R	The detailed diagnostic conditions are collected as Code Number to be used as **sub-status** in the Alert_Notify telegrams
52	SPECIAL RESTART	4	R/W	Selection of the Function Blocks to be set with the default pre-configuration. When the Special Restart command is written in the RB_RESTART variable, the device perform a warm start-up and all the function blocks previously selected from the list below are set to the default configuration. The bit set means that the block is set with default values. Bit 1 Resource Block Bit 2 AI Bit 6 CS Bit 8 PID Bit 14 SC Bit 17 IT Bit 19 IS Bit 20 AR
53	SPECIAL OPERATIONS	1	R/W	Selection of the specific device operations to be executed When the Special Operation command is written in the RB_RESTART variable, the device perform a specific operation according to the value previously written in the Special Operation variable. 0 No operation to be executed 1 Reset to Factory Sensor Trimming/Calibration

Supported Modes

- **OOS, AUTO**

Diagnosis

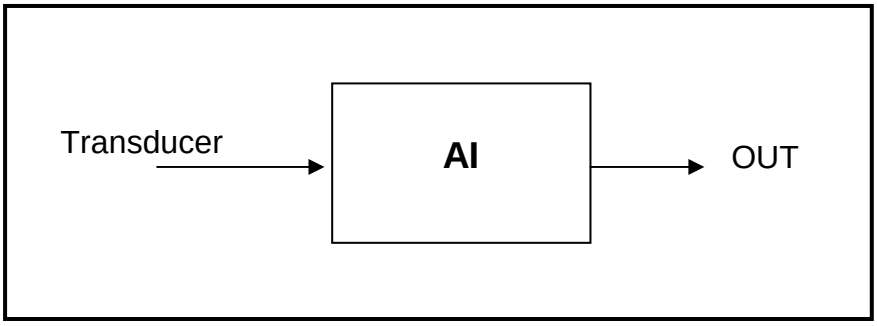
The **RESOURCE BLOCK** supports the following errors:

Conditions	Sub Conditions	Possible Reasons	LCD
Simulate active	**N/A**	The Switch 2 of the electronics has been set in ON position in order to enable the Simulation.	**NORMAL DISPLAY**
Memory failure	**Electronics memory data Corruption**	The database in the NV memory doesn't match its copy database in the RAM. ▪ The RB goes in OOS mode forcing also the other blocks in OOS as well	**ERROR CONDITION** 
	NV Failure	An error has been detected during the periodic R/W access to the electronics NV memory. ▪ After a power cycle the last device configuration could be lost ▪ The RB remains in AUTO mode and the device can continue to work with the data in RAM	**ERROR CONDITION** 
Lost Static Data	**N/A**	▪ The start up procedure was not successfully completed due to NV sensor memory corruption or errors. ▪ The Device_ID read from the Sensor memory is different respect the Device_ID in the electronic memory. ***This typical situation occurs when the electronics replacement is performed without the Cold Start-up procedure.***	**ERROR CONDITION** 
Power up	**N/A**	Each occurrence is counted by a dedicated counter ADB_POWER_ON_CNT *****This bit must be AUTOMATICALLY cleared after 20 seconds***	**POWER UP** 
Out-of-Service	**N/A**	The Actual_Mode is OUT OF SERVICE. ▪ The Actual Mode of all the other blocks is forced to Out of Service too ▪ The selected variables continue to be displayed with BAS Status	**NORMAL DISPLAY** 

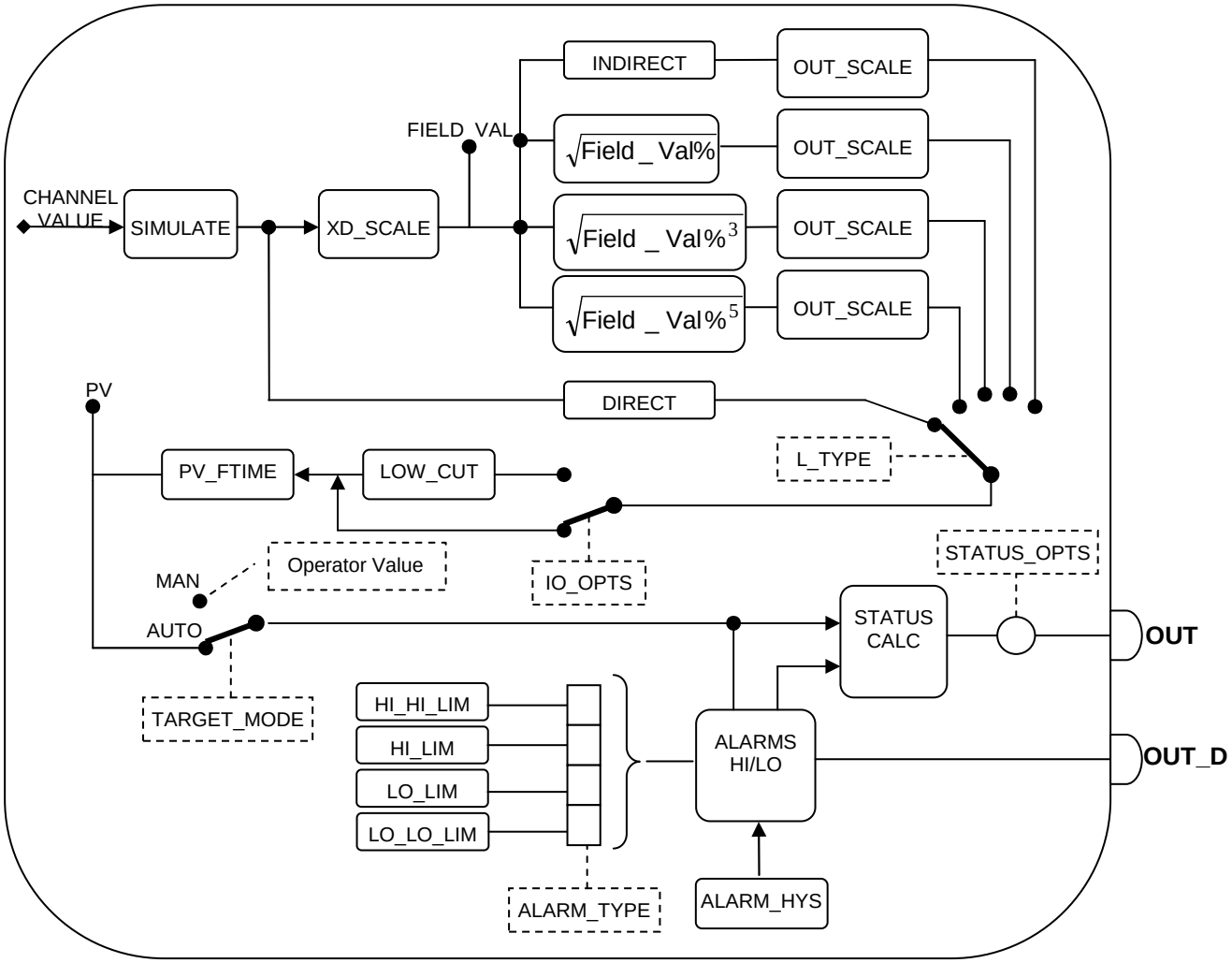
Enhanced-AI FUNCTION BLOCK

Overview

The Analog Input receives in input variables produced in the Transducer Block via the selected CHANNEL. It is possible that some transmitters have more Transducer Blocks or more variables produced within one Transducer Block.
The CHANNEL setting allows the user to select the desired variable to be used in input for the AI.



Block Diagram



Description

Transducer scaling (XD_SCALE) is applied to the value from the channel to produce the FIELD_VAL in percent. The XD_SCALE units code must match the channel units code (if one exists), or the block will remain in O/S mode after being configured. A block alarm for units mismatch will be generated. The OUT_SCALE is normally the same as the transducer, but if L_TYPE is set to Indirect or Ind Sqr Root, OUT_SCALE determines the conversion from FIELD_VAL to the output. PV and OUT always have identical scaling.
OUT_SCALE provides scaling for PV. The PV is always the value that the block will place in OUT if the mode is Auto. If Man is allowed, someone may write a value to the output. The status will prevent any attempt at closed loop control using the Man value, by setting the Limit value to Constant.
The LOW_CUT parameter has a corresponding “Low cutoff” option in the IO_OPTS bit string. If the option bit is true, any calculated output below the low cutoff value will be changed to zero. This is only useful for zero based measurement devices, such as flow.
The PV filter, whose time constant is PV_FTIME, is applied to the PV, and not the FIELD_VAL.

Equations

The Analog Input receive in input the Transduce Block variable Value selected with the CHANNEL. The Input Value is represented as CHANNEL Value in the following formula.

$$FIELD\_VAL = 100 * \frac{CHANNEL\_VALUE - XD\_SCALE\_0\%}{XD\_SCALE\_100\% - XD\_SCALE\_0\%}$$

Depending by the L_TYPE selection the following signal conversions are applied:

Direct	PV = CHANNEL_VALUE
Indirect	This conversion is applied when the XD_SCALE values are different from the OUT_SCALE values PV = FIELD_VAL% * (OUT_SCALE_100% - OUT_SCALE_0%) + OUT_SCALE_0%
Indirect Square Root	IF FIELD_VAL < 0.0 PV = OUT_SCALE 0% ELSE IF FIELD_VAL < LOW_CUT PV = OUT_SCALE 0% ELSE PV = $\sqrt{Field\_Val\%}$ * (OUT_SCALE_100% - OUT_SCALE_0%) + OUT_SCALE_0%
Indirect Square Root of the Third Power	IF FIELD_VAL < 0.0 PV = OUT_SCALE 0% ELSE IF FIELD_VAL < LOW_CUT PV = OUT_SCALE 0% ELSE PV = $\sqrt{Field\_Val\%^3}$ * (OUT_SCALE_100% - OUT_SCALE_0%) + OUT_SCALE_0%
Indirect Square Root of the Fifth Power	IF FIELD_VAL < 0.0 PV = OUT_SCALE 0% ELSE IF FIELD_VAL < LOW_CUT PV = OUT_SCALE 0% ELSE PV = $\sqrt{Field\_Val\%^5}$ * (OUT_SCALE_100% - OUT_SCALE_0%) + OUT_SCALE_0%

Configuration hints

The minimum configuration for having the AI working and/or moving out from the OOS needs at least the following settings:
- CHANNEL different by 0 (uninitialized)
- XD_SCALE = OUT_SCALE
- L_TYPE = Direct

Block Mapping

Idx	Name	byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	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	4	R	The process variable used in block execution, expressed in XD_SCALE unit Code
		1	R	The process variable status
8	OUT	4	R	The block output value calculated as a result of the block execution, expressed in OUT_SCALE unit code. **This variable can be written only when the block is in Man MODE**
		1	R	The block output status
9	SIMULATE	1	R/W	Simulate Transducer Status
		4	R/W	Simulate Transducer Value
		1	R	Current Transducer Status
		4	R	Current Transducer Value
		1	R/W	Simulation Enable/Disable bit
10	XD_SCALE	4	R/W	High Range — All the values are associated with the channel input value
		4	R/W	Low Range — When Channel = 1 or 3 The available unit codes are **Pressure Unit Codes**
		2	R/W	Unit Index — 1130 pascal; 1131 gigapascal; 1132 Megapascal; 1133 Kilopascal; 1134 Millipascal; 1135 Micropascal; 1136 Hectopascal; 1137 bar; 1138 millibar; 1139 Torr (0 deg. C); 1140 Atmosphere; 1141 Psi; 1142 Psia; 1143 Psig; 1144 grams / cm^2; 1145 Kilograms / cm^2; 1146 inches H2O (20 deg. C); 1147 inches H2O (4 deg. C); 1148 inches H2O (68 deg. F); 1149 mm H2O (20 deg. C); 1150 mm H2O (4 deg. C); 1151 mm H2O (68 deg. F); 1152 feet H2O (20 deg. C); 1153 feet H2O (4 deg. C); 1154 feet H2O (68 deg. F); 1155 inches Hg; 1156 inches Hg (0 deg. C); 1157 mm Hg; 1158 mm Hg (0 deg. C)
				When Channel = 2 The available unit codes are Temperature Unit Codes — 1000 Kelvin; 1001 Celsius Degree; 1002 Fahrenheit Degree; 1003 Rankine Degree
		1	R/W	Decimal point
11	OUT_SCALE	4	R/W	High Range — All the values are associated with the OUT. All the units code specified by the FF are available for this Scaling. Refer to the FF specs (Ref. 2) for the complete set of available unit code
		4	R/W	Low Range
		2	R/W	Unit Index
		1	R/W	Decimal point
12	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
13	IO_OPTS	2	R/W	Option which the user can select to alter Input and Output block processing **Only the Low cutoff can be enabled/disabled**
14	STATUS_OPTS	2	R/W	Options which the user can select for the block processing of status. The available selections are: Bit 3 – Propagate Fault Forward; Bit 6 – Uncertain if Limited; Bit 7 – BAD if Limited; Bit 8 – Uncertain if MAN Mode
15	CHANNEL	2	R/W	The CHANNEL value is used to select the measurement value from the I/O block. Channel 0 = Not Initialized; Channel 1 = Pressure; Channel 2 = Sensor Temp.; Channel 3 = Static Press.
16	L_TYPE	1	R/W	Linearisation Type. The selectable ***STANDARD*** types are: 1 Direct; 2 Indirect; 3 Indirect Square Root. The selectable ***ENHANCED*** types are: 4 Indirect Square Root Third Power ($X^{3/2}$); 5 Indirect Square Root Fifth Power ($X^{5/2}$)

17	LOW_CUT	4	R/W	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer falls below this limit, in % of scale. The features may be used to eliminate noise near zero for a flow sensor
18	PV_FTIME	4	R/W	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.
19	FIELD_VAL	4	R	The percent of the value from the Transducer block or from the simulation value, when enabled, before the characterisation (L_TYPE) and Filtering (PV_FTIME).
		1	R	Field Value Status
20	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
21	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 Actve Status, if the subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		1	R	Value
22	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 Actve Status, if the subcode has changed		
		2	R	Current
		2	R	Unacknowledged
		2	R	Unreported
		2	R/W	Disabled
23	ACK_OPTION	2	R/W	Used to set auto acknowledgment of the alarms
24	ALARM_HYS	4	R/W	Amount the PV must return within the alarm limit before the alarm condition clears. Alarm Hysteresis is expressed as percent of the OUT_SCALE span.
25	HI_HI_PRI	1	R/W	Priority of the High High Alarm
26	HI_HI_LIM	4	R/W	The setting of the High High Limit producing the High High Alarm. This value is expressed in OUT_SCALE Unit Code
27	HI_PRI	1	R/W	Priority of the High Alarm
28	HI_LIM	4	R/W	The setting of the High Limit producing the High Alarm. This value is expressed in OUT_SCALE Unit Code
29	LO_PRI	1	R/W	Priority of the Low Alarm
30	LO_LIM	4	R/W	The setting of the Low Limit producing the Low Alarm. This value is expressed in OUT_SCALE Unit Code
31	LO_LO_PRI	1	R/W	Priority of the Low Low Alarm
32	LO_LO_LIM	4	R/W	The setting of the Low-Low Limit producing the Low-Low Alarm. This value is expressed in OUT_SCALE Unit Code
33	HI_HI_ALM	The Critical HIGH Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
34	HI_ALM	The Advisory HIGH Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
35	LO_ALM	The Advisory LOW Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
36	LO_LO_ALM	The Critical LOW Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated

ENHANCED PARAMETERS

37	OUT_D	1	R/W	Digital Output Value set when the measure, OUT float value, over-cross the thresholds selected with the ALARM_TYPE. The ALARM_HYS enter in the calculation for setting and clearing the Digital state in order to avoid continuous changing whenever the Out Float value is around to the ALARM Threshold. Only when the MODE in MANUAL this variable is R/W
		1	R	Digital Output Status
38	ALARM_TYPE	1	R/W	Variable for the selection of the AI limits to be used as threshold for producing the Digital output. More thresholds/limits can be selected together. The correspondent bit set to 0 disable the thresholds, the correspondent bit set to 1 enable the thresholds. They are: Bit 0 – HI_HI_LIM Bit 1 – HI_LIM Bit 2 – LO_LIM Bit 3 – LO_LO_LIM

Supported Modes

- **OOS, MAN, AUTO**

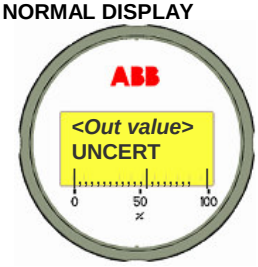
☞ ***When the RB is Out of Service, the Analog Input Block is forced in Out of Service too.***

Diagnosis

The **ANALOG INPUT** supports the following errors:

Conditions	Possible Reasons	effect on the OUT Status	LCD (for AI1 or AI2 OUT)
Block Configuration error	▪ CHANNEL = 0 (uninitialized) ▪ L_TYPE = 0 (uninitialized) ▪ XD_SCALE != OUT_SCALE and LIN_TYPE = DIRECT ▪ XD_SCALE unit code != TB_Primary_Value_Range unit. ▪ The FBAP doesn't include the AI or it has not been correctly downloaded in the transmitter. Execution time = 0	When the Block Configuration Error is set, the AI cannot exit from OOS and the OOS condition is also set in the AI Block Error. In this case the OUT_STATUS = BAD-OOS overrides the BAD-Configuration Error	**ERROR CONDITION** 
Simulate active	The Simulation has been set with the HW switch and the SIMULATE_EN/DIS = Active	The OUT_STATUS is produced as result of the normal calculation within the AI block but starting from a simulated Status instead of the real TB Status	**NORMAL DISPLAY** 
Input Failure/process variable has BAD status	The value in input coming from the TB has BAD Status.	IF STATUS_OPTS-Propagate Fault Forward = Set: ▪ **BAD Sensor Fail** ▪ **BAD Device Fail** Received in input from the TB are produced also as AI OUTPUT Status. All the other BAD status are propagated as: ▪ **BAD-not specific.** IF STATUS_OPTS-Propagate Fault Forward = Clear: All the BAD status are propagated as ▪ **BAD-not specific**	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode is OUT OF SERVICE	The OUT_STATUS is BAD-OOS. In case of concomitance with other conditions because this is the High priority Status condition	**ERROR CONDITION** 

Additional indications **VALID ONLY FOR ANALOG INPUT BLOCKS** are:

Conditions	Description	effect on the OUT Status	LCD
IF OUT_VALUE > OUT_SCALE 100% **OR** **IF OUT_VALUE < OUT_SCALE 0%**	In the normal displaying sequence, the STATUS appears as UNCERTAIN	UNCERTAIN – engineering unit range violation-Not Limited	**NORMAL DISPLAY** 
IF OUT_VALUE > HI_HI_LIM	In the normal displaying sequence, a double arrow UP appears in the top right corner together with the Value	IF ACK_OPTION Bit 2 = Set and HI_HI_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Active Advisory Alarm-Not Limited IF ACK_OPTION Bit 2 = Set and HI_HI_PRI > 7 ➔ OUT Status = GOOD_NC – Active Critical Alarm-Not Limited IF ACK_OPTION Bit 2 = Clear and HI_HI_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Unacknowledged Advisory Alarm-Not Limited IF ACK_OPTION Bit 2 = Clear and HI_HI_PRI > 7 ➔ OUT Status = GOOD_NC – Unacknowledged Critical Alarm-Not Limited	**NORMAL DISPLAY** 
IF OUT_VALUE < LO_LO_LIM	In the normal displaying sequence, a double arrow DOWN appears in the top right corner together with the Value	IF ACK_OPTION Bit 4 = Set and LO_LO_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Active Advisory Alarm-Not Limited IF ACK_OPTION Bit 4 = Set and LO_LO_PRI > 7 ➔ OUT Status = GOOD_NC – Active Critical Alarm-Not Limited IF ACK_OPTION Bit 4 = Clear and LO_LO_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Unacknowledged Advisory Alarm-Not Limited IF ACK_OPTION Bit 4 = Clear and LO_LO_PRI > 7 ➔ OUT Status = GOOD_NC – Unacknowledged Critical Alarm-Not Limited	**NORMAL DISPLAY** 
IF OUT_VALUE < LO_LIM	In the normal displaying sequence, a single arrow DOWN appears in the top right corner together with the Value	IF ACK_OPTION Bit 5 = Set and LO_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Active Advisory Alarm-Not Limited IF ACK_OPTION Bit 5 = Set and LO_PRI > 7 ➔ OUT Status = GOOD_NC – Active Critical Alarm-Not Limited IF ACK_OPTION Bit 5 = Clear and LO_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Unacknowledged Advisory Alarm-Not Limited IF ACK_OPTION Bit 5 = Clear and LO_PRI > 7 ➔ OUT Status = GOOD_NC – Unacknowledged Critical Alarm-Not Limited	**NORMAL DISPLAY** 
IF OUT_VALUE > HI_LIM	In the normal displaying sequence, a single arrow UP appears in the top right corner together with the Value	IF ACK_OPTION Bit 3 = Set and HI_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Active Advisory Alarm-Not Limited IF ACK_OPTION Bit 3 = Set and HI_PRI > 7 ➔ OUT Status = GOOD_NC – Active Critical Alarm-Not Limited IF ACK_OPTION Bit 3 = Clear and HI_PRI >= 3 or <= 7 ➔ OUT Status = GOOD_NC – Unacknowledged Advisory Alarm-Not Limited IF ACK_OPTION Bit 3 = Clear and HI_PRI > 7 ➔ OUT Status = GOOD_NC – Unacknowledged Critical Alarm-Not Limited	**NORMAL DISPLAY** 

OUT Status

The **AI OUT Status byte** supports the following conditions:

		Quality		Substatus				Limits				
Dec	Hex	Gr	Gr	QS	QS	QS	QS	Qu	Qu		STATUS_OPTS	DESCRIPTIONS
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0			
0	00	0	0							= bad		
64	40	0	1							= uncertain		
128	80	1	0							= good (Not Cascade)		
BAD												
0	00	0	0	0	0	0	0	x	x	= non-specific	Propagate Fault Forward = Clear	The value in input at the AI has BAD status
											BAD if Limited = Set	The value in input at the AI has status limit set "low limited" or "high limited" or "constant"
12	0C	0	0	0	0	1	1			= device failure	Propagate Fault Forward = Set	The value in input at the AI has BAD-Device Failure status
16	10	0	0	0	1	0	0			= sensor failure	Propagate Fault Forward = Set	The value in input at the AI has BAD-Sensor Failure status
28	1C	0	0	0	1	1	1			= out of service		The AI-MODE_BLK.ACTUAL = OOS
UNCERTAIN												
64	40	0	1	0	0	0	0			= non-specific		The value in input at the AI has UNCERTAIN status
											UNCERTAIN if Limited = set	The value in input at the AI has status limit set "low limited" or "high limited" or "constant". ***See NOTE A Below***
72	48	0	1	0	0	1	0			= substitute set	UNCERTAIN if Man Mode = set	The MODE_BLK.ACTUAL of the AI = MAN
84	54	0	1	0	1	0	1	X	X	= engineering unit range violation		The OUT Value is outside the OUT_SCALE range values. IF OUT > OUT_SCALE100% OR OUT < OUT_SCALE0% Status = UNCERTAIN – engineering unit range violation-Not limited In case of reverse range, ***See NOTE B*** IF OUT < OUT_SCALE100% OR OUT > OUT_SCALE0% Status = UNCERTAIN – engineering unit range violation-Not limited
GOOD_NC												
128	80	1	0	0	0	0	0			= ok		The value in input at the AI has GOOD_NC status
132	84	1	0	0	0	0	1			= active block alarm	ACK_OPTION = set	When an AI BLOCK_ERR condition is set, **if the AI goes in OOS**, the OUT status cannot be set to GOOD_NC.actve block alarm. ***See NOTE C below***
136	88	1	0	0	0	1	0			= active advisory alarm	ACK_OPTION = set	The OUT_VALUE is outside the limits (HI_HI, HI, LO, LO_LO) and the priority of the limits is between 3 and 7
140	8C	1	0	0	0	1	1			= active critical alarm	ACK_OPTION = set	The OUT_VALUE is outside the limits (HI_HI, HI, LO, LO_LO) and the priority of the limits is between 8 and 15
144	90	1	0	0	1	0	0			= unack block alarm	ACK_OPTION = clear	When an AI BLOCK_ERR condition is set, **if the AI goes in OOS**, the OUT status cannot be set to GOOD_NC.unack block alarm. ***See NOTE C below***
148	94	1	0	0	1	0	1			= unack advisory alarm	ACK_OPTION = clear	The OUT_VALUE is outside the limits (HI_HI, HI, LO, LO_LO) and the priority of the limits is between 3 and 7
152	98	1	0	0	1	1	0			= unack critical alarm	ACK_OPTION = clear	The OUT_VALUE is outside the limits (HI_HI, HI, LO, LO_LO) and the priority of the limits is between 8 and 15

NOTE A: ***When the Transducer Block value goes outside the Range Limits, it should be Limited at the Range Limit high or low, and the Status should be set to GOOD_NC- High Limited or Low Limited.***

NOTE B: ***The XD_SCALE and/or OUT_SCALE can be set with EU0% value greater than EU100% value. In this case the test of the OUT value with the range values is inverted.***

NOTE C: ***This status can be set only if the specific AI Block_Err condition doesn't force the AI to OOS***

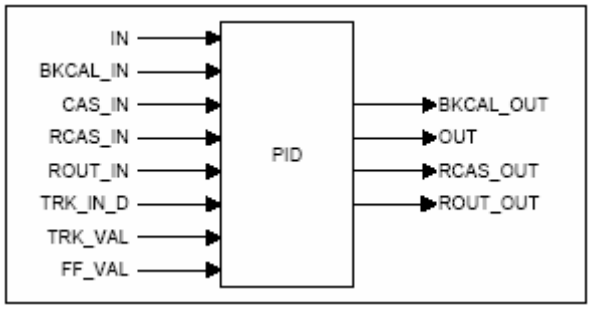
Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
The Block cannot be removed from OOS mode	The Target Mode is set to OOS	Set the Target Mode to something different by OOS
	The Configuration Error bit is set in the BLOCK_ERR	- Set the CHANNEL to a valid value different by 0 - Set L_TYPE = DIRECT → If XD_SCALE = OUT_SCALE - Set LIN_TYPE = INDIRECT or IND.SQ ROOT → if XD_SCALE different by OUT_SCALE - Set XD_SCALE unit = TPB Primary Value Range unit.
	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 switched in AUTO mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO
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
	STATUS_OPTS has the Propagate Fault Forward bit Set	This bit should be cleared for producing the alarm

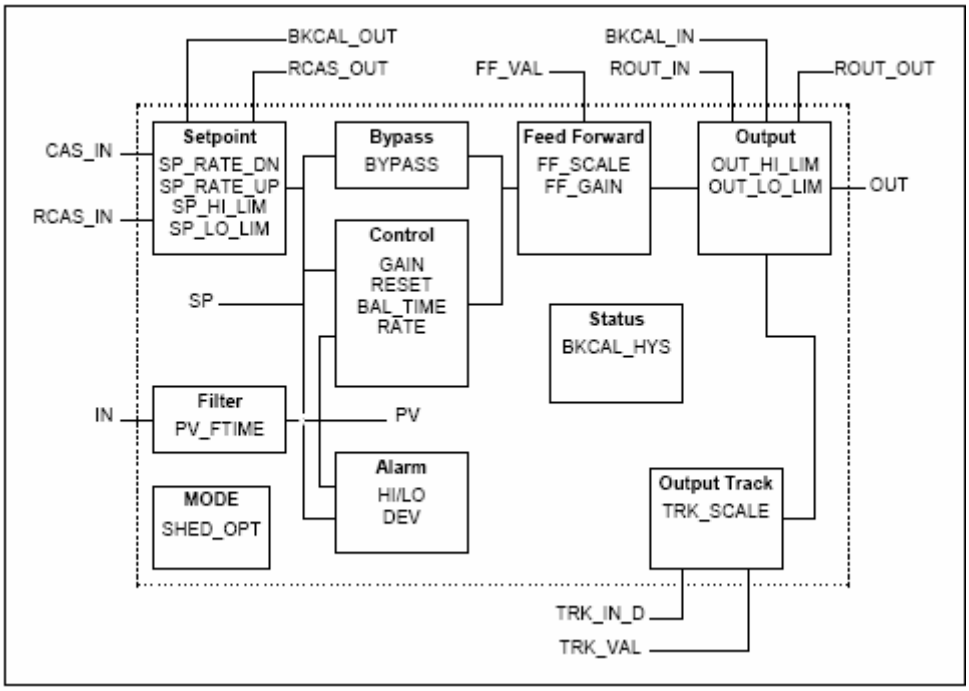
Enhanced-PID FUNCTION BLOCK

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.
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…1]
GAMMA: Setpoint weight derivative part [0…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	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	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	4	R	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R	The process variable status

8	SP	4	R/W	The analog Set Point value of this block, expressed in PV_SCALE Unit Code	
		1	R/W	The analog Set Point status of this block	
9	OUT	4	R	The block output value calculated as a result of the block execution, expressed in OUT_SCALE unit code. **This variable can be written only when the block is in Man MODE**	
		1	R	The block output status	
10	PV_SCALE	4	R/W	High Range	All the values are associated with the PV
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
11	OUT_SCALE	4	R/W	High Range	All the values are associated with the OUT
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
12	GRANT_DENY	1	R/W	Grant	
		1	R/W	Deny	
13	CONTROL_OPTS	2	R/W	Options the user may select to alter the calculation done in a control loop. They are: bit 0 – Bypass enabled 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 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	2	R/W	Options the user can select for block processing of status. They are: bit 0 – Initiate Fault Sate if BAD IN bit 1 – Initiate Fault Sate 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	
15	IN	4	R/W	The Primary Input Value for the block coming from another block. Expressed in PV_SCALE Unit	
		1	R/W	The Primary Input Status	
16	PV_FTIME	4	R/W	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 of IN value.	
17	BYPASS	1	R/W	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.	
18	CAS_IN	4	R/W	Remote set point value from another block. Expressed in PV_SCALE Unit Code	
		1	R/W	Remote set point status from another block	
19	SP_RATE_DN	4	R/W	Ramp rate for downward SP changes. When the ramp rate is set to zero the SP is used immediately. Expressed in PV_SCALE Unit Code per seconds	
20	SP_RATE_UP	4	R/W	Ramp rate for upward SP changes. When the ramp rate is set to zero the SP is used immediately. Expressed in PV_SCALE Unit Code per seconds	
21	SP_HI_LIM	4	R/W	The Highest Set Point value allowed. Expressed in PV_SCALE Unit Code	
22	SP_LO_LIM	4	R/W	The Lowest Set Point value allowed. Expressed in PV_SCALE Unit Code	
23	GAIN	4	R/W	The proportional gain value.	
24	RESET	4	R/W	The integral time constant, in seconds per repeat.	
25	BAL_TIME	4	R/W	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	4	R/W	The derivative action time constant expressed in seconds	
27	BKCAL_IN	4	R/W	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	
		1	R/W	Back Calculation Input Status	
28	OUT_HI_LIM	4	R/W	The max. Output value allowed. Expressed in OUT_SCALE Unit Code	
29	OUT_LO_LIM	4	R/W	The min. Output value allowed. Expressed in OUT_SCALE Unit Code	
30	BKCAL_HYS	4	R	The amount that the output must change away from its output limit before the limit status is turned off. Expressed as percent of the OUT_SCALE span	
31	BKCAL_OUT	4	R	The value required by an upper block's BKCAL_IN so that the upper block may prevent reset windup and provide bumpless transfer to closed control loop. Expressed in PV_SCALE Unit Code	
		1	R	Back Calculation Status	
32	RCAS_IN	4	R/W	Target setpoint value provided by a supervisory host. Used when mode is RCAS. Expressed in PV_SCALE Unit Code.	
		1	R/W	RCAS_IN Status	
33	ROUT_IN	4	R/W	Target output value provided by a supervisory host. Used when the mode is ROUT. Expressed in OUT_SCALE Unit Code	
		1	R/W	ROUT_IN Status	
34	SHED_OPT	1	R/W	Define actions to be taken on remote control device timeout	
35	RCAS_OUT	4	R	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. Used when mode is RCAS. Expressed in PV_SCALE Unit Code	
		1	R	RCAS_OUT Status	
36	ROUT_OUT	4	R	Block output Value provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is ROUT. Expressed in OUT_SCALE Unit Code	
		1	R	ROUT_OUT Status	

37	TRK_SCALE	4	R/W	High Range	All the values are associated with the external tracking value TRK_VAL
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
38	TRK_IN_D	2	R/W	Discrete input used to initiate ext. tracking of the block output to the value specified by TRK_VAL	
39	TRK_VAL	4	R/W	This input is used as track value when external tracking is enabled by TRK_IN_D. Expressed in TRK_SCALE Unit Code.	
		1	R/W	Tracking Status	
40	FF_VAL	4	R/W	The Feed-Forward Control Value. Expressed in FF_SCALE Unit Code	
		1	R/W	The Feed-Forward Control Status	
41	FF_SCALE	4	R/W	High Range	All the values are associated with the feed forward value FF_VAL
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
42	FF_GAIN	4	R/W	The gain that the feed forward input is multiplied by before it is added to the calculated control loop.	
43	UPDATE_EVT	This alert is generated by any change to the static data			
		1	R/W	Unacknowledged	
		1	R	Update State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Static Revision	
		2	R	Relative Index	
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			
		1	R/W	Unacknowledged	
		1	R	Alarm State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Subcode	
		1	R	Value	
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 Actve Status, if the subcode has changed			
		2	R	Current	
		2	R	Unacknowledged	
		2	R	Unreported	
		2	R/W	Disabled	
46	ACK_OPTION	2	R/W	Used to set auto acknowledgment of the alarms	
47	ALARM_HYS	4	R/W	Amount the PV must return within the alarm limit before the alarm condition clears. Alarm Hysteresis is expressed as percent of the OUT_SCALE span.	
48	HI_HI_PRI	1	R/W	Priority of HI_HI_ALM	
49	HI_HI_LIM	4	R/W	The setting of the High-High Limit producing the High-High Alarm. Expressed in OUT_SCALE Unit	
50	HI_PRI	1	R/W	Priority of HI_ALM	
51	HI_LIM	4	R/W	The setting of the High Limit producing the High Alarm, expressed in OUT_SCALE Unit	
52	LO_PRI	1	R/W	Priority of LO_ALM	
53	LO_LIM	4	R/W	The setting of the Low Limit producing the Low Alarm, expressed in OUT_SCALE Unit	
54	LO_LO_PRI	1	R/W	rioritàof LO_LO_ALM	
55	LO_LO_LIM	4	R/W	The setting of the Low-Low Limit producing the Low-Low Alarm, expressed in OUT_SCALE Unit	
56	DV_HI_PRI	1	R/W	The Priority of DV_HI_ALM	
57	DV_HI_LIM	4	R/W	The setting of the Deviation High Limit producing the Deviation High Alarm, expressed in OUT_SCALE Unit	
58	DV_LO_PRI	1	R/W	The Priority of DV_LO_ALM	
59	DV_LO_LIM	4	R/W	The setting of the Deviation Low Limit producing the Deviation Low Alarm, expressed in OUT_SCALE Unit	
60	HI_HI_ALM	High High Alarm data			
		1	R/W	Unacknowledged	
		1	R	Alarm State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Subcode	
		4	R	Value: The date and time of when the alert was generated	
61	HI_ALM	High Alarm data			
		1	R/W	Unacknowledged	
		1	R	Alarm State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Subcode	
		4	R	Value: The date and time of when the alert was generated	

62	LO_ALM	Low Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
3	LO_LO_ALM	Low Low Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
64	DV_HI_ALM	Deviation High Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated
65	DV_LO_ALM	Deviation Low Alarm data		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Subcode
		4	R	Value: The date and time of when the alert was generated

ENHANCED PARAMETERS

66	T1_RATE	4	R/W	Derivative 1st order filter
67	BETA	4	R/W	Set-point weight proportional part
68	GAMMA	4	R/W	Set-point weight derivative part

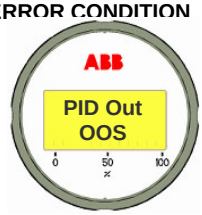
Supported Modes

- **OOS, IMAN, MAN, AUTO, CAS, RCAS, ROUT, LO**

☞ ***When the RB is Out of Service, the PID Blocks forced in Out of Service too.***

Diagnosis

The **PID** supports the following errors:

Conditions	Possible Reasons	effect on the OUT_Status	LCD (for PID OUT)
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**	**ERROR CONDITION** 
Local Override	Actual Mode = Local Override	***NO EFFECT***	**NORMAL DISPLAY**
Input Failure/process variable has BAD status	BAD quality Status in input at the PID_IN.	Depends by the STATUS_OPTS	**NORMAL DISPLAY**
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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 by 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 by 0 (uninitialized) - Set SHED_OPT different by 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
	STATUS_OPTS has the Propagate Fault Forward bit Set	This bit should be cleared for producing the alarm

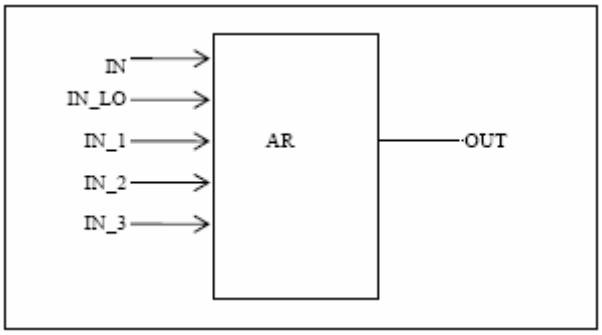
ARITHMETIC FUNCTION BLOCK

Overview

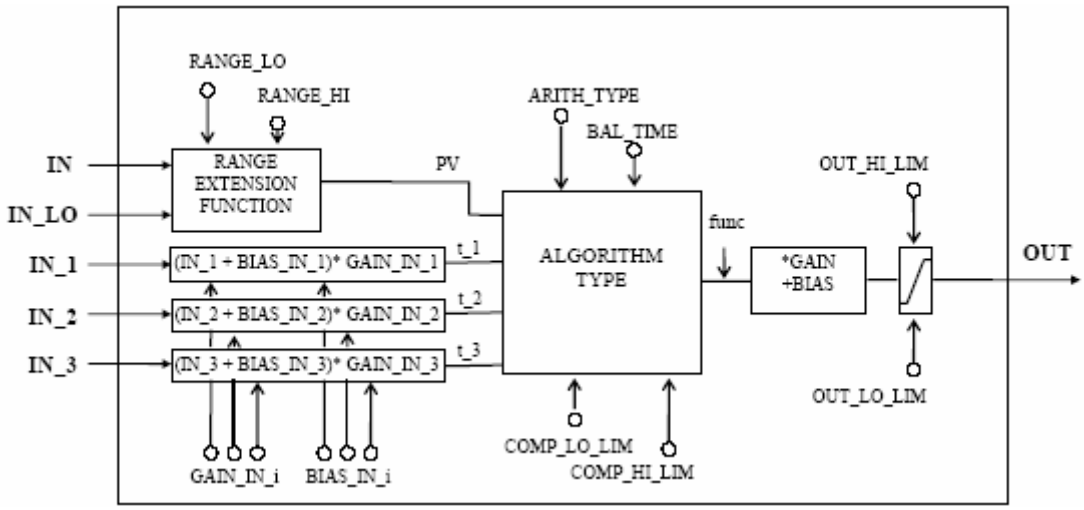
This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.

The following algorithms are available:

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

With the **ARITH_TYPE** it is possible select the following algorithms:

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
Average		***OUT*** = $\frac{PV + t\_1 + t\_2 + t\_3}{f} * GAIN + BIAS$ 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 by 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 by 0

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the hw or sw components associated with a block. It is a bit string, so that multiple errors may be shown.
7	PV	4	R	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R	The process variable status
8	OUT	4	R	The block output value calculated as a result of the block execution, in OUT_SCALE unit code. **This variable can be written only when the block is in Man MODE**
		1	R	The block output status
9	PRE_OUT	4	R	Display what would be the Out Value if the mode was AUTO or lower
		1	R	Display what would be the Out Status if the mode was AUTO or lower
10	PV_SCALE	4	R/W	High Range — All the values are associated with the PV
		4	R/W	Low Range
		2	R/W	Unit Index
		1	R/W	Decimal point
11	OUT_RANGE	4	R/W	High Range — All the values are associated with the OUT
		4	R/W	Low Range
		2	R/W	Unit Index
		1	R/W	Decimal point
12	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
13	INPUT_OPTS	2	R/W	Options the user may select to alter the calculation done in a control loop. Supported are: bit 0 - IN Use uncertain bit 1 - IN LO Use uncertain bit 2 - IN_1 Use uncertain bit 3 - IN_1 Use bad bit 4 - IN_2 Use uncertain bit 5 - IN_2 Use bad bit 6 - IN_3 Use uncertain bit 7 - IN_3 Use bad
14	IN	4	R/W	The Primary Input Value for the block coming from another block, in PV_SCALE Unit
		1	R/W	The Primary Input Status
15	IN_LO	4	R/W	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R/W	The process variable status
16	IN_1	4	R/W	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R/W	The process variable status
17	IN_2	4	R/W	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R/W	The process variable status
18	IN_3	4	R/W	The process variable used in block execution, expressed in PV_SCALE Unit Code
		1	R/W	The process variable status
19	RANGE_HI	4	R/W	Constant Value above which the range extension has switched to the high range transmitter.
20	RANGE_LO	4	R/W	Constant Value below which the range extension has switched to the low range transmitter.
21	BIAS_IN_1	4	R/W	The constant to be added to IN_1
22	GAIN_IN_1	4	R/W	The constant to be multiplied times (IN_1 + Bias)
23	BIAS_IN_2	4	R/W	The constant to be added to IN_2
24	GAIN_IN_2	4	R/W	The constant to be multiplied times (IN_2 + Bias)
25	BIAS_IN_3	4	R/W	The constant to be added to IN_3
26	GAIN_IN_3	4	R/W	The constant to be multiplied times (IN_3 + Bias)
27	COMP_HI_LIM	4	R/W	The Highest Set Point value allowed. Expressed in PV_SCALE Unit Code
28	COMP_LO_LIM	4	R/W	The Lowest Set Point value allowed. Expressed in PV_SCALE Unit Code

29	ARITH_TYPE	1	R/W	**Type of Arithmetic function**: 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	4	R/W	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	4	R/W	The bias Value used in computing the function block output expressed in engineering unit
32	GAIN	4	R/W	Dimensionless Value used by the block algorithm in calculating the block output
33	OUT_HI_LIM	4	R/W	The max. Output value allowed. Expressed in OUT_SCALE Unit Code
34	OUT_LO_LIM	4	R/W	The min. Output value allowed. Expressed in OUT_SCALE Unit Code
35	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
36	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failures 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 subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value

Supported Modes

- **OOS, MAN, AUTO.**

☞ ***When the RB is Out of Service, the Arithmetic Block is forced in Out of Service too.***

Diagnosis

The AR supports the following errors:

Conditions	Possible Reasons	effect on the OUT Status	LCD *(for AR OUT)*
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 by 0	BAD + Out Of Service **See Note A**	**ERROR CONDITION** 
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	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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 by 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

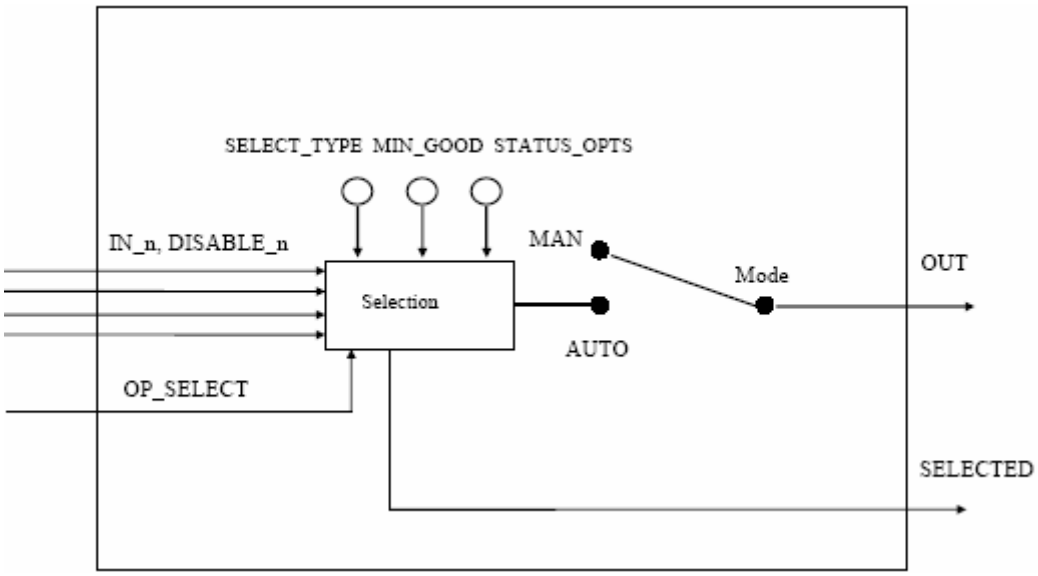
PROBLEM	POSSIBLE CAUSE	SOLUTION
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The Configuration Error bit is set in the BLOCK_ERR	- Set the ARITH_TYPE with a valid value. It must be different by 0 and in the range 1 – 9 - Set the GAIN with value different by 0 - Set COMP_HI_LIM > COMP_LO_LIM when ARITH_TYPE in the range 1-5 - Set BAL_TIME > of the Macrocycle IF different by 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

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:

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 by 0 and in the range 1 – 5

Block Mapping

Idx	Name	Byte	PC	Description	
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.	
2	TAG_DESC	32	R/W	The user description of the intended application of the block	
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.	
		1	R	Actual – The mode the block is currently in.	
		1	R/W	Permitted – Allowed modes that the target may take on	
		1	R/W	Normal – The common mode for the Actual.	
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the hw or sw components associated with a block. It is a bit string, so that multiple errors may be shown.	
7	OUT	4	R	The block output value calculated as a result of the block execution, in OUT_SCALE unit code. **This variable can be written only when the block is in Man MODE**	
		1	R	The block output status	
8	OUT_RANGE	4	R/W	High Range	All the values are associated with the OUT
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
9	GRANT_DENY	1	R/W	Grant	
		1	R/W	Deny	
10	STATUS_OPTS	2	R/W	Options the user may select to alter the calculation done in a control loop. Supported are: bit 8 - Use Uncertain as Good bit 2 - Uncertain if Man Mode	
11	IN_1	4	R/W	Input 1 Value	
		1	R/W	Input 1 Status	
12	IN_2	4	R/W	Input 2 Value	
		1	R/W	Input 2 Status	
13	IN_3	4	R/W	Input 3 Value	
		1	R/W	Input 3 Status	

14	IN_4	4	R/W	Input 4 Value
		1	R/W	Input 4 Status
15	DISABLE_1	2	R/W	Disable of the Input 1 0 = Enabled, 1 = Disabled
16	DISABLE_2	2	R/W	Disable of the Input 2 0 = Enabled, 1 = Disabled
17	DISABLE_3	2	R/W	Disable of the Input 3 0 = Enabled, 1 = Disabled
18	DISABLE_4	2	R/W	Disable of the Input 4 0 = Enabled, 1 = Disabled
19	SELECT_TYPE	1	R/W	**Input Selection Type:** 1. First Good 2. Minimum 3. Maximum 4. Middle 5. Average
20	MIN_GOOD	1	R/W	If the number of the inputs which are GOOD is less than the value of MIN_GOOD then set the Output Status to BAD
21	SELECTED	2	R/W	Code of the Selected Input
22	OP_SELECT	2	R/W	Operator settable parameters to force the selection of the input to be used
23	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
24	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failures 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 subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value

Supported Modes

- **OOS, MAN, AUTO.**

☞ ***When the RB is Out of Service, the Input Selector Block is forced in Out of Service too.***

Diagnosis

The IS supports the following errors:

Conditions	Possible Reasons	effect on the OUT Status	LCD *(for IS OUT)*
Block Configuration error	SELECT_TYPE = 0 (uninitialized)	BAD + Out Of Service **See Note A**	**ERROR CONDITION** 
Input Failure/process variable has BAD status	SELECT_TYPE = AVERAGE and at least one IN is BAD	BAD + non specific	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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

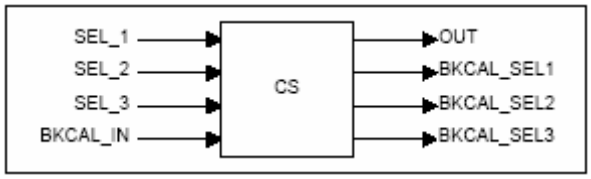
Troubleshooting

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 by 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 by 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
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

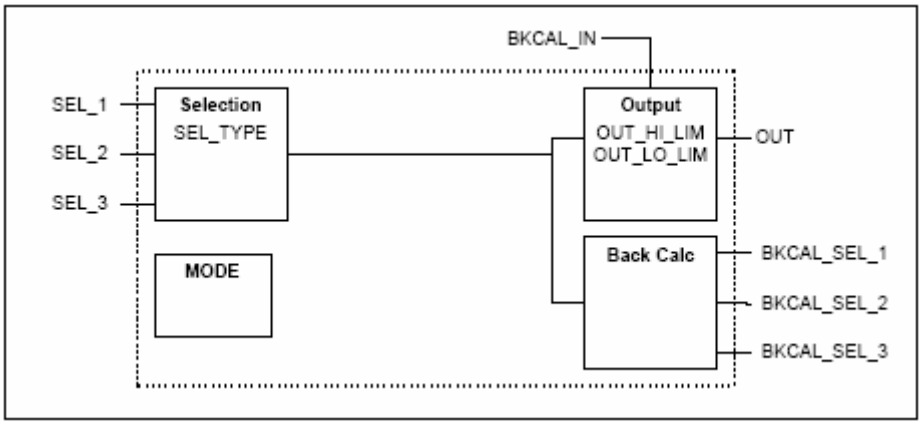
CONTROL SELECTOR FUNCTION BLOCK

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:

1. **High**
2. **Low**
3. **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 by 0 and in the range 1 – 3

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
3	STRATEGY	2	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This info may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the hw or sw components associated with a block. It is a bit string, so that multiple errors may be shown.
7	OUT	4	R	The block output value calculated as a result of the block execution, in OUT_SCALE unit code. **This variable can be written only when the block is in Man MODE**
		1	R	The block output status
8	OUT_SCALE	4	R/W	High Range — All the values are associated with the OUT
		4	R/W	Low Range
		2	R/W	Unit Index
		1	R/W	Decimal point
9	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
10	STATUS_OPTS	2	R/W	Options the user may select to alter the calculation done in a control loop. Supported are: bit 0 – IFS if BAD IN bit 2 – Use Uncertain as GOOD
11	SEL_1	4	R/W	First input Value to the selector
		1	R/W	First input Status to the selector
12	SEL_2	4	R/W	Second input Value to the selector
		1	R/W	Second input Status to the selector
13	SEL_3	4	R/W	Third input Value to the selector
		1	R/W	Third input Status to the selector
14	SEL_TYPE	1	R/W	**Control Selection Type:** 1- High 2- Low 3- Middle
15	BKCAL_IN	4	R/W	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
		1	R/W	Back Calculation Input Status
16	OUT_HI_LIM	4	R/W	The max. Output value allowed. Expressed in OUT_SCALE Unit Code
17	OUT_LO_LIM	4	R/W	The min. Output value allowed. Expressed in OUT_SCALE Unit Code
18	BKCAL_SEL_1	4	R/W	Control selector Value associated with SEL_1 input which is provided to BKCAL_IN of the block connected to SEL_1 in order to prevent reset windup
		1	R/W	Control Selector Status associated with SEL_1
19	BKCAL_SEL_2	4	R/W	Control selector Value associated with SEL_2 input which is provided to BKCAL_IN of the block connected to SEL_2 in order to prevent reset windup
		1	R/W	Control Selector Status associated with SEL_2
20	BKCAL_SEL_3	4	R/W	Control selector Value associated with SEL_3 input which is provided to BKCAL_IN of the block connected to SEL_3 in order to prevent reset windup
		1	R/W	Control Selector Status associated with SEL_3
21	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
22	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failures 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 subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value

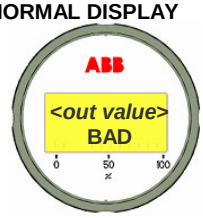
Supported Modes

- **OOS, IMAN, MAN, AUTO.**

☞ ***When the RB is Out of Service, the Control Selector Block is forced in Out of Service too.***

Diagnosis

The CS supports the following errors:

Conditions	Possible Reasons	effect on the OUT Status	LCD *(for CS OUT)*
Block Configuration error	SEL_TYPE = 0 (uninitialized)	BAD + Out Of Service **See Note A**	**ERROR CONDITION** 
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	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode of the AIFB is set to OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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.

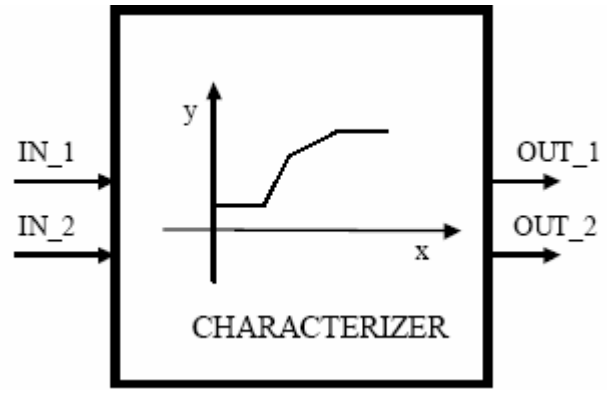
Troubleshooting

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 by 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	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

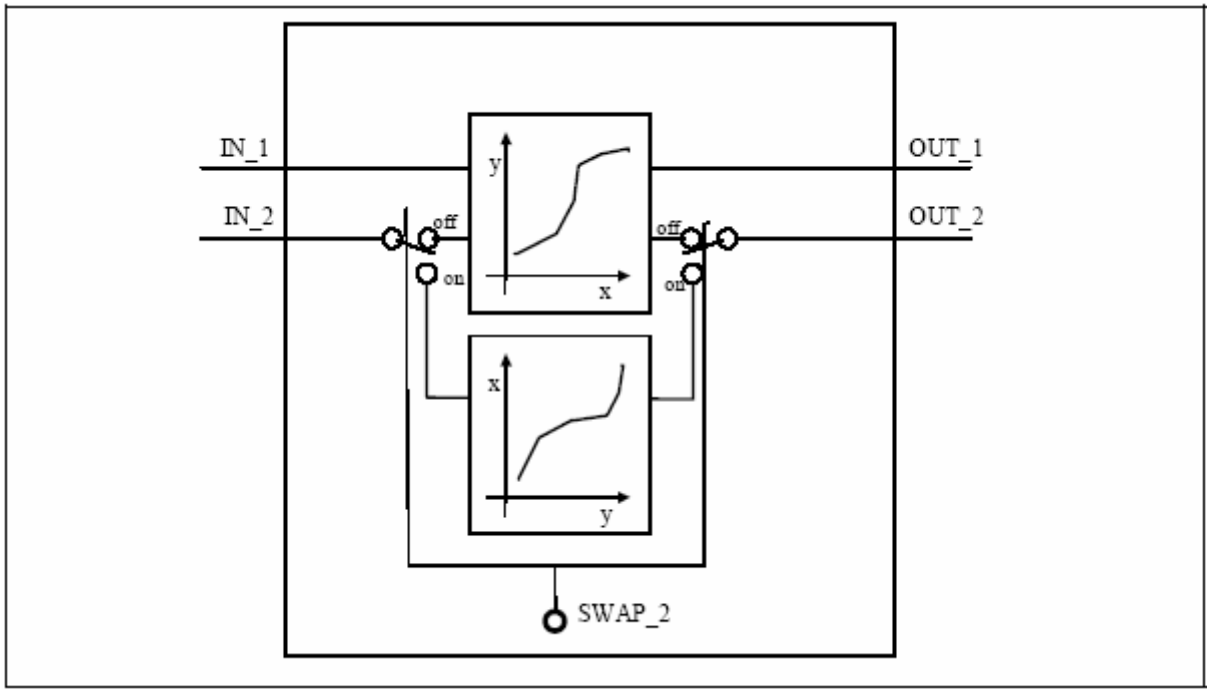
SIGNAL CHARACTERIZER FUNCTION BLOCK

Overview

The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs. The status of an input is copied to the corresponding output, so the block may be used in the control or process signal path. An option can swap the axes of the function for section 2, so that it can be used in the backward control path.



Block Diagram

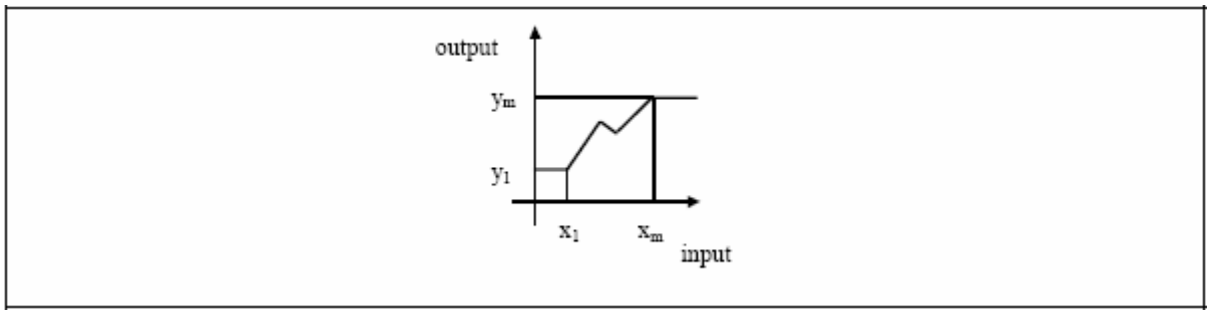


Description

The block calculates OUT_1 from IN_1 and OUT_2 from IN_2 using a curve given by the points:
[x1 ;y1], [x2 ; y2] ... [x21 ; y21] where **x** corresponds to the Input and **y** to the Output. The **x**-coordinates are given in engineering units of X_RANGE. The **y**-coordinates are given in engineering units of Y_RANGE.
The only useful mode is Auto.

Calculation and the curve:
OUT_1 is related to IN_1 and OUT_2 to IN_2 by the same curve, but there is no relation between IN_1 and IN_2 or between OUT_1 and OUT_2.
An output value may be calculated by linear interpolation between two points bracketing the input value.
Values of **x** should increase monotonically, so that interpolation may be possible. If not, a configuration error shall be set in BLOCK_ERR and the actual mode of the block shall go to Out of Service. Write checks may also be implemented, but they may force the order of entry of the **x** terms.

If the curve has m points, m<21, the non-configured points, [xm+1; ym+1], [xm+2; ym+2], ... [x21; y21] shall be set to +INFINITY to mark them as unused.
Since x1 is the smallest specified value for the input and xm is the largest, the output shall be at y1 when the input is smaller than x1 and at ym when the input is larger than xm. Since the ends of the y curve act as limits, the OUT status shall show when either limit is active.



Reversing path 2:
A reverse function swaps the interpretation of IN_2 and OUT_2, which provides a way to do back calculation using the same curve. If the parameter SWAP_2 is set true, the block shall provide:

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

If the function is not monotonic in y and SWAP_2 is true, then BLOCK_ERR shall indicate a configuration error and the actual mode go to Out of Service as above for **x**. A function is called monotonic when **y** values always increase or decrease when **x** values increase, e.g. the function does not present peaks, valleys, or flat spots.
If SWAP_2 = false, IN_1 and IN_2 have the same engineering units defined in X_RANGE and OUT_1 and OUT_2 use the units defined in Y_RANGE.
If SWAP_2 = true, OUT _1 and IN_2 have Y_RANGE and OUT_2 and IN_1 have X_RANGE.

Configuration hints

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

- Set SWAP_2 different by 0
- Set at least one X and Y pairs
- Set the X values monotonically increasing or the Y values monotonically increasing or decreasing

Block Mapping

Idx	Name	Byte	PC	Description	
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.	
2	TAG_DESC	32	R/W	The user description of the intended application of the block	
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.	
		1	R	Actual – The mode the block is currently in.	
		1	R/W	Permitted – Allowed modes that the target may take on	
		1	R/W	Normal – The common mode for the Actual.	
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the hw or sw components associated with a block. It is a bit string, so that multiple errors may be shown.	
7	OUT_1	4	R	The block output 1 value. **This variable can be written only when the block is in Man MODE**	
		1	R	The block output 1 status	
8	OUT_2	4	R	The block output 2 value. **This variable can be written only when the block is in Man MODE**	
		1	R	The block output 2 status	
9	X_RANGE	4	R/W	High Range	All the values are associated with the CURVE_X
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	
10	Y_RANGE	4	R/W	High Range	All the values are associated with the CURVE_Y
		4	R/W	Low Range	
		2	R/W	Unit Index	
		1	R/W	Decimal point	

11	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
12	IN_1	4	R/W	Input 1 Value
		1	R/W	Input 1 Status
13	IN_2	4	R/W	Input 2 Value
		1	R/W	Input 2 Status
14	SWAP_2	1	R/W	1 – No Swap 2 – Swap
15	CURVE_X	84	R/W	21 floating point X values
16	CURVE_Y	84	R/W	21 floating point Y values
17	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
18	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failures 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 subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value

Supported Modes

- **OOS, MAN, AUTO.**

☞ ***When the RB is Out of Service, the Signal Characterizer Block is forced in Out of Service too.***

Diagnosis

The SC supports the following errors:

Conditions	Possible Reasons	effect on the OUT Status	LCD *(for SC OUT1 or SC OUT2)*
Block Configuration error	- SWAP_2 = 0 (uninitialized) - No X, Y point set - SWAP = FALSE and X values do not increase monotonically - SWAP = TRUE and X values do not increase monotonically OR Y values do not increase or decrease monotonically	BAD + Out Of Service **See Note A**	**ERROR CONDITION** 
Input Failure/process variable has BAD status	The value linked in input coming from the upstream blocks has BAD Status.	- The Status of IN_1 is propagated to the OUT_ 1 - The Status of IN_2 is propagated to the OUT_2	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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

OUT_1 shall reflect the status of IN_1 and OUT_2 shall reflect the status of IN_2. The sub-status shall also be passed to the outputs. If one of the curve limits is reached or the input is limited, the appropriate limit should be indicated in the output sub-status. Limits shall be reversed if the curve slope is negative.
If SWAP_2 is set, cascade initialization is controlled by the lower block. When this block is in O/S mode, the cascade to both the lower and upper blocks shall be broken by Bad status at the outputs. When this block goes to Auto mode, the lower block can begin cascade initialization with status values that pass through this block to the upper block. Answering status signals from the upper block pass through this block to the lower block.

- The block does not use STATUS_OPTS.

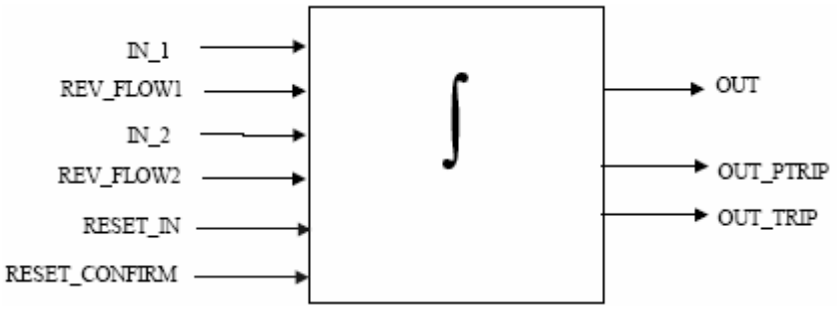
Troubleshooting

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 SWAP_2 different by 0 – Set at least one X, Y pairs – IF SWAP = FALSE set X points with increasing monotonically values – IF SWAP = TRUE set X points with increasing monotonically values and Y points with increasing or decreasing monotonically values
	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	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

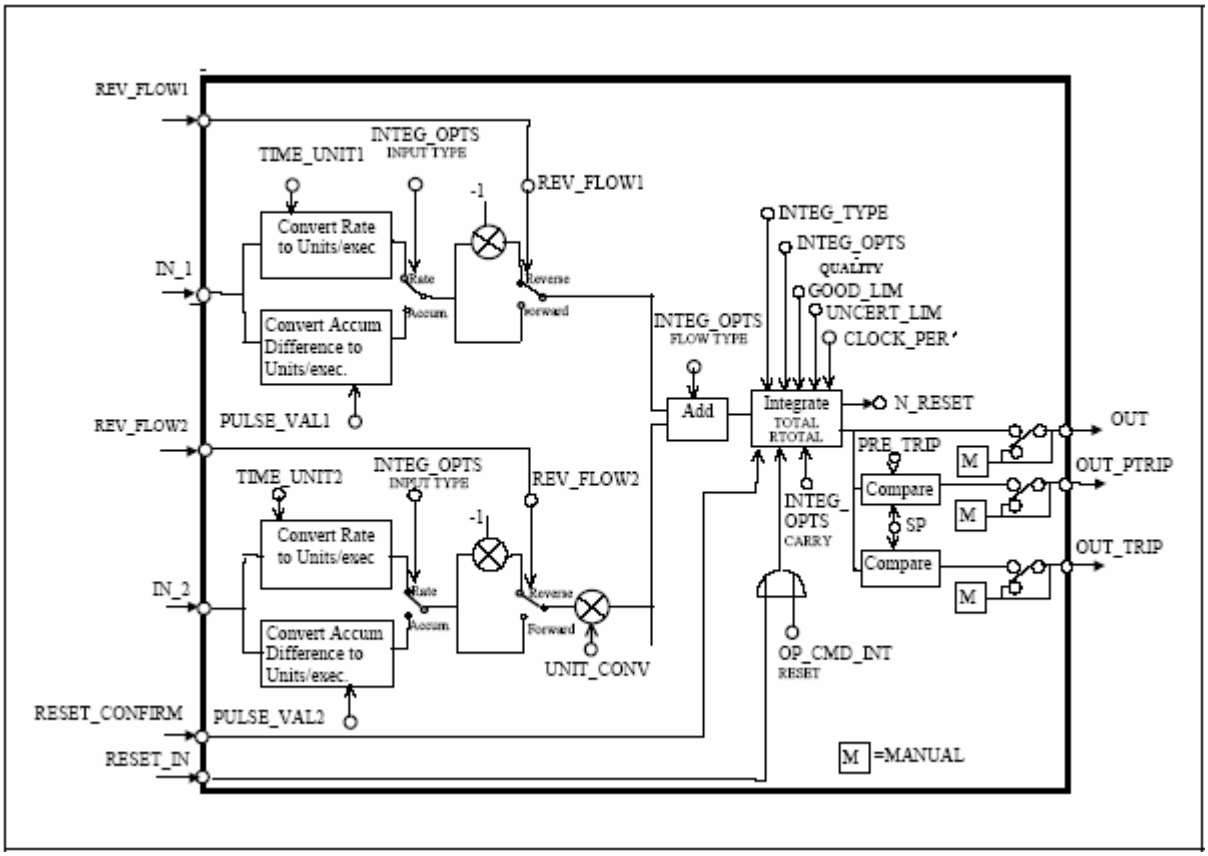
INTEGRATOR FUNCTION BLOCK

Overview

The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block (to be described in another specification). The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached. The integrated value may go up, starting from zero, or down, starting from the trip value. The block has two flow inputs so that it can calculate and integrate net flow. This can be used to calculate volume or mass variation in vessels or as an optimizing tool for flow ratio control.
In order to determine the amount of uncertain or bad readings, the block integrates the variables with bad or bad and uncertain status separately. The values used in this second integration are the values with good status just before they went from good to bad or uncertain.
The ratio of good to total counts determines the output status. Absolute values are used to avoid problems with changing signs.



Block Diagram



Description

The function of this block is in keeping with common industry practice. There is nothing to be tested here concerning the calculation of the integral term. The following description is a guide to the use of the parameters.The basic function of the Integrator block is to integrate an analog value over time. It can also accumulate the pulses coming from Pulse Input blocks or from other Integrator blocks. This block is normally used to totalize flow, giving total mass or volume over a certain time, or totalize power, giving the total energy.

Inputs

The block has two dual purpose inputs, IN_1 and IN_2. If IN_2 is not connected (does not have a corresponding link object) then calculations for IN_2 may be omitted. Each input can receive a measurement per unit of time (rate) or an accumulated number of pulses. The usage is as follows:

Rate - Used when the variable connected to the input is a rate, i.e., Kg/s, w, Gal/hour, etc. This input can come from the rate output OUT of a Pulse Input block or from the output of an Analog Input block.

Accum - Used when the input comes from the OUT_ACCUM output of a Pulse Input block, which represents a continuous accumulation of pulse counts from a transducer, or from the output of another Integrator block.

The input type is configured in the bit string parameter INTEG_OPTS. The bits corresponding to IN_1 and IN_2 can be set false for Rate or true for Accum.

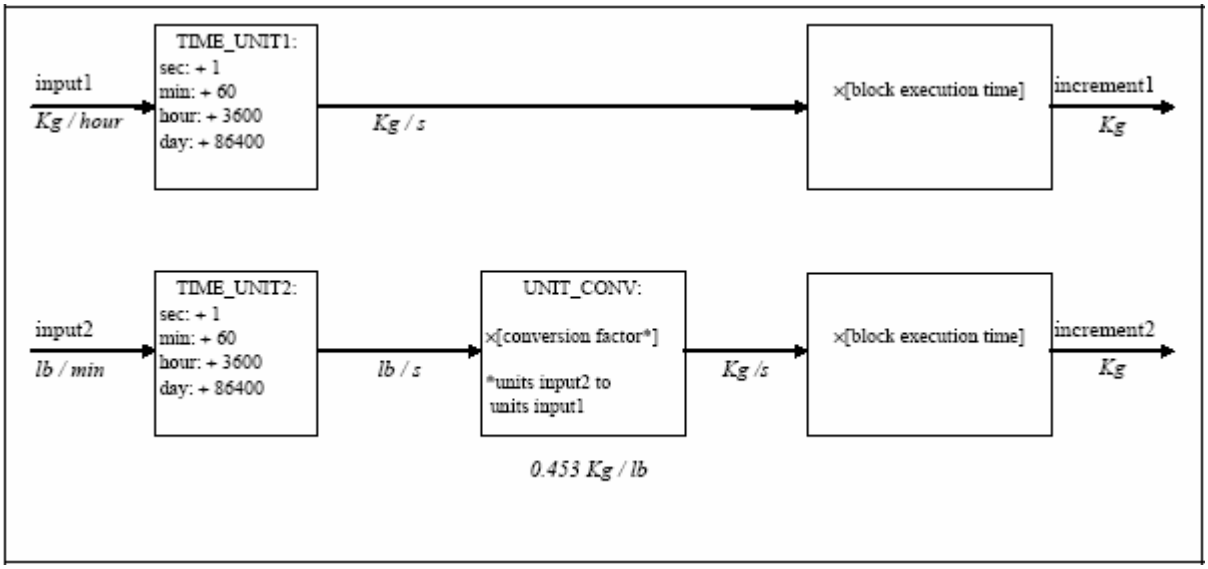
If the input option is Rate:

Each input needs a parameter to define the rate time unit: TIME_UNIT1 or TIME_UNIT2. The time units are used to convert the two rates in units of mass, volume or energy per second

The second analog input may have to be converted into the same units of the first input. This is achieved by a unit conversion factor, given by the parameter UNIT_CONV.

Each rate, multiplied by the block execution time, gives the mass, volume or energy increment per block execution. This increment should be added or subtracted in a register, according to some rules defined below.

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



If the input option is Accum:

A counter input normally comes from a Pulse Input block OUT_ACCUM. It can also be connected to the output of another integrator block. The OUT_ACCUM of the Pulse Input block represents a continuous accumulation of pulses from the flow transducer, while the output OUT of an Integrator represents an integration or accumulation of analog inputs.

The Integrator block should determine the number of additional counts from the counter input readings since the last execution.

As the output ACCUM_OUT of the Pulse Input block wraps up when the counting reaches 999,999 and does not increment or decrement by more than 499,999 per cycle, the difference in counts is determined as follows:

a) If the difference between the reading in one cycle and the reading in the preceding cycle is less than 500,000 or greater than (-500,000), the difference should be taken as the variation.

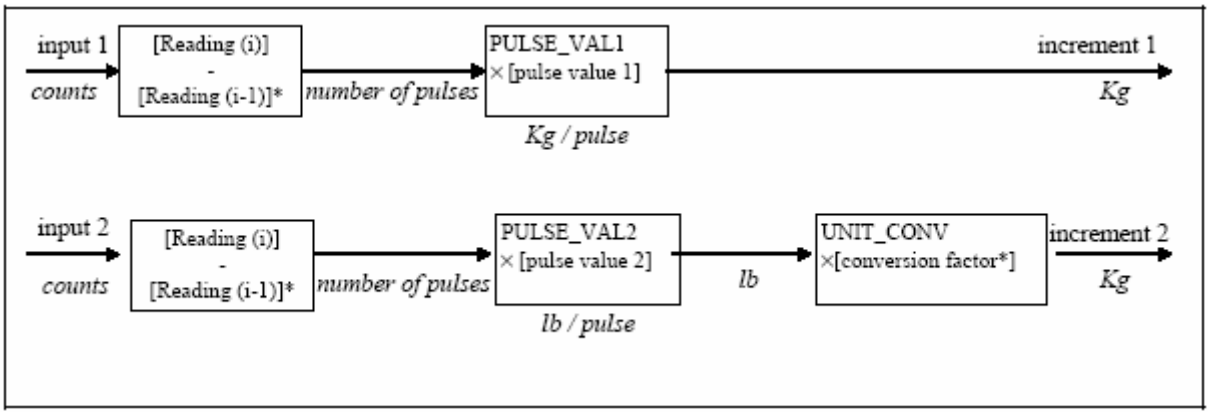
b) If the difference between the reading in one cycle and the reading in the preceding cycle is greater than or equal to (+500,000), add (-1,000,000) and use the result as the variation.

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

If the output OUT of another integrator block is used, that block should be programmed to obey the rules listed above.

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

Example:



Net Flow

In order to discern between forward and reverse flows, the Integrator block considers a negative sign as an indication of reverse flow. Some flowmeters already indicate forward and reverse flows by adding a sign to the measurement value. Others use a separate binary signal. This signal can be connected to the inputs REV_FLOW1 and REV_FLOW2, where True should invert the signal of the corresponding input.

The net flow is obtained by adding the two increments. The net increment should have a positive or negative signal to indicate the net flow direction. In order to integrate the difference between the inflow and outflow of a tank, for example, the second one can be assigned to be negative.

The net flow direction to be considered in the totalization is defined in INTEG_OPTS. The following options are available:

FORWARD = only positive flows (after application of REV_FLOWi) are totalized. The negative values should be treated as zero.

FORWARD is selected when the bit corresponding to Forward is set to true.

REVERSE = only negative flows are totalized. The positive values should be treated as zero. The option bit Reverse should be set to true

TOTAL = both positive and negative values should be totalized. Both option bits Forward and Reverse should be set to true or to false.

Integration of Inputs:

There are three internal registers used for the totalization:

Total = The net increment is added every cycle, regardless of status.

Atotal = The absolute value of the net increment is added every cycle, regardless of status.

Rtotal = The absolute value of the net increments with bad status (rejects) are added to this register.

These internal registers may have greater precision than the standard floating point value. The value of Rtotal requires the same precision as Atotal in order to be able to accumulate floating point fractions so that they are not lost as arithmetic underflow. The value of a register that corresponds to standard floating point is called the most significant part of the register.

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

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

1. UP_AUTO Counts up with automatic reset when TOTAL_SP is reached
2. UP_DEM Counts up with demand reset
3. DN_AUTO Counts down with automatic reset when zero is reached
4. DN_DEM Counts down with demand reset
5. PERIODIC Counts up and is reset periodically according to CLOCK_PER
6. DEMAND Counts up and is reset on demand
7. PER&DEM Counts up and is reset periodically or on demand

The first four types indicate use as a batch totalizer with a setpoint TOTAL_SP. This is not the standard SP because it does not have the structure of SP that is defined in FF-890. The count does not stop at TOTAL_SP going up or zero going down, as it is important to get the true total of flow. Two outputs, OUT_TRIP and OUT_PTRIP, are associated with the four types. See **Batch totalizer outputs** below.
The next three types indicate that TOTAL_SP and the trip outputs are not used. The Periodic type (5) disables operator reset.
The internal registers always add the net increments. Counting down is done by setting OUT to the value of TOTAL_SP minus the most significant part of Total.

Resetting the totals:
The block shall use a discrete input RESET_IN to reset the internal integration registers. The operator can send an operator command to reset the same registers by making OP_CMD_INT = RESET. This is a momentary switch, which shall be turned off when the block is evaluated. Either shall cause reset to occur.
Reset should occur after the totals have been adjusted in the same block evaluation. The block should take a snapshot of the most significant part of Total, Rtotal and TOTAL_SP just prior to the reset and move the values to the registers STOTAL, SRTOTAL and SSP, respectively. The information should be kept until the next reset.
The integrator should reject reset requests for at least 5 seconds after a reset. This is to allow time for other devices to read the snapshot values before they can be overwritten. The option Confirm Reset in INTEG_OPTS, if set, prevents another reset from occurring until the value 1 has been written to RESET_CONFIRM. This is an Input that behaves like a momentary dynamic parameter if it is not connected.
This provides a guarantee that a host has recorded the snapshot values before the next reset can occur.
The number of resets is counted in the register N_RESET. This counter can not be written or reset. It provides verification that the total has not been reset since N_RESET was last checked. The counter should roll over from 999999 to 0.
Reset always clears the internal registers Total, Atotal and Rtotal, except that when the option UP_AUTO or DN_AUTO is selected, a residual value beyond the trip value may be carried to the next integration if the option Carry is set in INTEG_OPTS. In this case, TOTAL_SP is subtracted from Total, leaving the residual value.
The option Generate reset event in INTEG_OPTS shall cause an analog event (DS-75) to be generated at each reset. This messages provides a timestamp and the most significant part of Total just prior to the reset. The Standard Type (4.3) shall be 14, Reset event. The Subcode (4.8) shall be the status byte of OUT. The Value (4.9) shall be the most significant part of Total just prior to the reset. The Unit Index (4.11) shall be the units code of OUT_RANGE.

Batch totalizer outputs:
When the integration is counting up (type 1 or 2) and the value of OUT equals or exceeds a value given by TOTAL_SP minus PRE_TRIP then the discrete output OUT_PTRIP is set. When it equals or exceeds a value given by the parameter TOTAL_SP, the discrete output OUT_TRIP is set. OUT_PTRIP remains set.
When the integration is counting down (type 3 or 4), it starts from a value given by TOTAL_SP. When the value of OUT is equal to or less than PRE_TRIP, the discrete output OUT_PTRIP is set. When the count reaches zero, the discrete output OUT_TRIP is set. OUT_PTRIP remains set.
When a reset occurs, the comparisons that set OUT_PTRIP and OUT_TRIP are no longer true, so they are cleared. OUT_TRIP shall remain set for five seconds after an automatic reset (type 1 or 3) if RESET_CONFIRM is not connected or the option to Confirm Reset in INTEG_OPTS is not set.

Configuration hints

The minimum configuration for having the IT working and/or moving out from the OOS needs at least the following settings:
- Set TIME_UNIT1 different by 0
- Set TIME_UNIT2 different by 0
- Set INTEG_TYPE different by 0

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the hw or sw components associated with a block. It is a bit string, so that multiple errors may be shown.
7	TOTAL_SP	4	R/W	Set Point for a batch UP totalization. When the OUT reaches it, the OUT is reset and the N_RESET is incremented.
8	OUT	4	R	This variable is the most significant part of the internal Total (Total = net increment added every cycle regardless of status). The OUT value is expressed in OUT_RANGE Unit code **This variable can be written only when the block is in Man MODE**
		1	R	The block output status
9	OUT_RANGE	4	R/W	High Range — All the values are associated with the OUT. OUT_RANGE is used only for displaying of the totals (OUT, STOTAL, RTOTAL SRTOTAL) by a host. The high and low range values of OUT_RANGE have no effect on the block
		4	R/W	Low Range
		2	R/W	Unit Index
		1	R/W	Decimal point
10	GRANT_DENY	1	R/W	Grant
		1	R/W	Deny
11	STATUS_OPTS	2	R/W	Options the user may select to alter the calculation done in a control loop. Supported are: bit 8 - Uncertain if Man Mode
12	IN_1	4	R	Input 1. If the input is not set to Accumulate in the INTEG_OPTS it is expressed in unit/sec, unit/min, unit/h or unit/day, if the input is set to Accumulate it is expressed in number of pulses.
		1	R	The Input 1 status
13	IN_2	4	R	Input 2. If the input is not set to Accumulate in the INTEG_OPTS it is expressed in unit/sec, unit/min, unit/h or unit/day, if the input is set to Accumulate it is expressed in number of pulses.
		1	R	The Input 2 status
14	OUT_TRIP	2	R/W	The first discrete output. Set to ON when the TOTAL_SP is reached. This value is set to ON when OUT ≥ TOTAL_SP in UP totalization or OUT ≤ 0 in DOWN totalization. When a reset occurs, OUT_TRIP is no longer true, so it is cleared. It shall remain set for 5 seconds after an automatic reset if RESET_CONFIRM is not connected or if the INTEG_OPTS is not set to Confirm Reset. 0- Off 1- On
15	OUT_PTRIP	2	R/W	The second discrete output. This value is set to ON when OUT ≥ (TOTAL_SP - PRE_TRIP) in UP totalization or OUT ≤ PRE_TRIP in DOWN totalization. When a reset occurs, OUT_PTRIP is no longer true, so it is cleared. 0- Off 1- On
16	TIME_UNIT 1	1	R/W	Time unit of the IN_1. It is used to convert the IN_1 in unit per seconds. 0. Not Initialized 3. hours 1. seconds 4. days 2. minutes
17	TIME_UNIT 2	1	R/W	Time unit of the IN_2. It is used to convert the IN_2 in unit per seconds. 0. Not Initialized 3. hours 1. seconds 4. days 2. minutes
18	UNIT_CONV	4	R/W	Factor to convert the engineering unit of the input 2 into the engineering unit of input 1
19	PULSE_VAL 1	4	R/W	If the input 1 is set to Accumulation this value converts the number of pulses in the engineer unit. It is expressed in unit per pulse
20	PULSE_VAL 2	4	R/W	If the input 2 is set to Accumulation this value converts the number of pulses in the engineer unit. It is expressed in unit per pulse
21	REV_FLOW 1	2	R/W	In order to discern between forward and reverse flows, the Integrator block considers the negative sign as an indication of reverse flow. Some flowmeters already indicate forward and reverse flows by adding a sign to the measurement value. Others use a separate binary signal. This signal can be connected to the inputs REV_FLOW1 for the IN_1, when it is True the IN_1 is inverted. 0: Forward 1: Reverse
22	REV_FLOW 2	2	R/W	Same as REV_FLOW 1 for the IN_2 0: Forward 1: Reverse
23	RESET_IN	2	R/W	External signal used to reset the totalizer 0: OFF 1: Reset

24	STOTAL	4	R	After Reset the block should take a snapshot/copy of the OUT just prior to the reset and move the value to the register STOTAL. The information should be kept until the next reset.
25	RTOTAL	4	R/W	This value is the most significant part of the internal RTOTAL (RTOTAL = The absolute value of the net increments with bad status (rejects) are added to this register).
26	SRTOTAL	4	R	After Reset the block should take a snapshot/copy of the RTOTAL just prior to the reset and move the value to the register SRTOTAL. The information should be kept until the next reset.
27	SSP	4	R	After Reset the block should take a snapshot/copy of the TOTAL_SP just prior to the reset and move the value to the register SSP. The information should be kept until the next reset.
28	INTEG_TYPE	1	R/W	**Integration Type:** 0 – Not Initialized 1 – UP AUTO 2 – UP DEM 3 – DN AUTO 4 – DN DEM 5 – PERIODIC 6 – DEMAND 7 – PER&DEM
29	INTEG_OPTS	2	R/W	**Integration option:** bit 0 – Input 1 Accumulate bit 1 – Input 2 Accumulate bit 2 – Flow Forward bit 3 – Flow Reverse bit 4 – Use Uncertain bit 5 – Use Bad bit 6 – Carry bit 7 – Add zero if Bad bit 8 – Confirm Reset bit 9 – Generate Reset Event
30	CLOCK_PER	4	R/W	Interval time for the periodic reset. It is expressed in seconds.
31	PRE_TRIP	4	R/W	Value used for the OUT_PTRIP setting. It adjusts the amount of mass, volume or energy that should set OUT_PTRIP when the integration reaches (TOTAL_SP - PRE_TRIP) when counting UP or PRE_TRIP when counting DOWN
32	N_RESET	4	R	The number of resets is counted in the register N_RESET. This counter can not be written or reset. It provides verification that the TOTAL has not been reset since N_RESET was last checked. The counter should roll over from 999999 to 0.
33	PCT_INCL	4	R	This value is the percentage of the absolute net increment with good status respect of the absolute net increment regardless of the status.
34	GOOD_LIM	4	R/W	If PCT_INCL ≥ GOOD_LIM and the mode is AUTO the status of the OUT is GOOD_NC otherwise check the other limit.
35	UNCERT_LIM	4	R/W	If PCT_INCL ≥ UNCERT_LIM and the mode is AUTO the status of the OUT is UNCERTAIN otherwise is BAD.
36	OP_CMD_INT	1	R/W	The operator can write a command to reset the registers by making OP_CMD_INT = RESET. 0 - Off 1 - Reset
37	OUTAGE_LIM	4	R/W	The maximum tolerated duration for power failure. This value is used by the host, it is expressed in seconds.
38	RESET_CONFIRM	2	R/W	If the Confirm Reset in the INTEG_OPTS is set, any further reset will be prevented until a logic 1 is not received in input to the RESET_CONFIRM. If it is not connected it acts like a momentary dynamic parameter. This provides a guarantee that a host has recorded the snapshot values before the next reset can occur. 0 - Off 1 - Confirm
39	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
40	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failures 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 subcode has changed		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value

Supported Modes

- **OOS, MAN, AUTO.**

☞ ***When the RB is Out of Service, the Integrator Block is forced in Out of Service too.***

In manual mode, the outputs are disconnected from the algorithm and the user can set the values of OUT, RTOTAL, OUT_TRIP and OUT_PTRIP for test purposes. No integration takes place.
When the block is switched to Auto, the integration starts from the value set manually. Each write to OUT or RTOTAL shall increment the N_RESET counter. In auto mode, the outputs follow the algorithm.

Diagnosis

The IT supports the following errors:

Mnemonic	Possible Reasons	effect on the OUT Status	LCD *(for IT OUT)*
Block Configuration error	▪ TIME_UNIT1 = 0 ▪ TIME_UNIT2 = 0 ▪ INTEG_TYPE = 0 ▪ IF INTEG_OPTS = IN_1 ACCUMULATE o PULSE_VAL1 = 0 ▪ IF INTEG_OPTS = IN_2 ACCUMULATE o PULSE_VAL2 = 0 ▪ IF INTEG_TYPE = PERIODIC o CLOCK_PER = 0	BAD + Out Of Service **See Note A**	**ERROR CONDITION** 
Input Failure/process variable has BAD status	The value linked in input coming from the upstream blocks has BAD Status.	Calculated according the algorithm. See the OUT STATUS section below	**NORMAL DISPLAY** 
Out-of-Service	The Actual_Mode is OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

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

If an input has a status of Uncertain or Bad, it shall be treated as explained below. The limit status of the inputs is ignored, as is the substatus. Either Good(C) or Good(NC) are accepted as good.
The increment calculated from an input has an internal status that is either good or bad. If the input status is Good(C) or Good(NC) the increment status is good. If the input status is Uncertain, the increment status is bad, and the last good value is used unless the option Use Uncertain is set in INTEG_OPTS, and then the increment status is good and the new value is used. If the input status is Bad, the increment status is bad, and the last good value is used unless the option Use Bad is set in INTEG_OPTS, and then the increment status is good and the last good value is used.
The two increments are added together, and the resulting status is the worst of the two.
The option Add zero if bad in INTEG_OPTS causes the net increment to be zero if its status is bad.
The percentage of bad or uncertain and bad counts may be determined by calculating the value of PCT_INCL from Rtotal and Atotal.
Since Atotal is the sum of increments with good and bad status, and Rtotal is the sum of increments with bad status, Atotal minus Rtotal is exactly equal to the total of increments with good status. If msp is used to mean “most significant part” and Atotal is not zero then the percent of good values may be calculated as:
PCT_INCL = 100 * (1 - (msp of Rtotal) / (msp of Atotal))
If Atotal is zero, then PCT_INCL shall be 100 if Rtotal is also zero, or 0 if Rtotal is not zero.
If the block mode is Auto, if PCT_INCL ≥ GOOD_LIM, the status of OUT shall be Good, or else if PCT_INCL ≥ UNCERT_LIM, the status of OUT shall be Uncertain, or else the status of OUT shall be Bad.
If the block mode is Manual, then the status of OUT, OUT_PTRIP, and OUT_TRIP will be Good (NC) constant when then status option Uncertain if Man is not selected. If this status option is selected and the block mode is manual, then the status of these three outputs will be Uncertain constant. No limits are applied to the output.

Troubleshooting

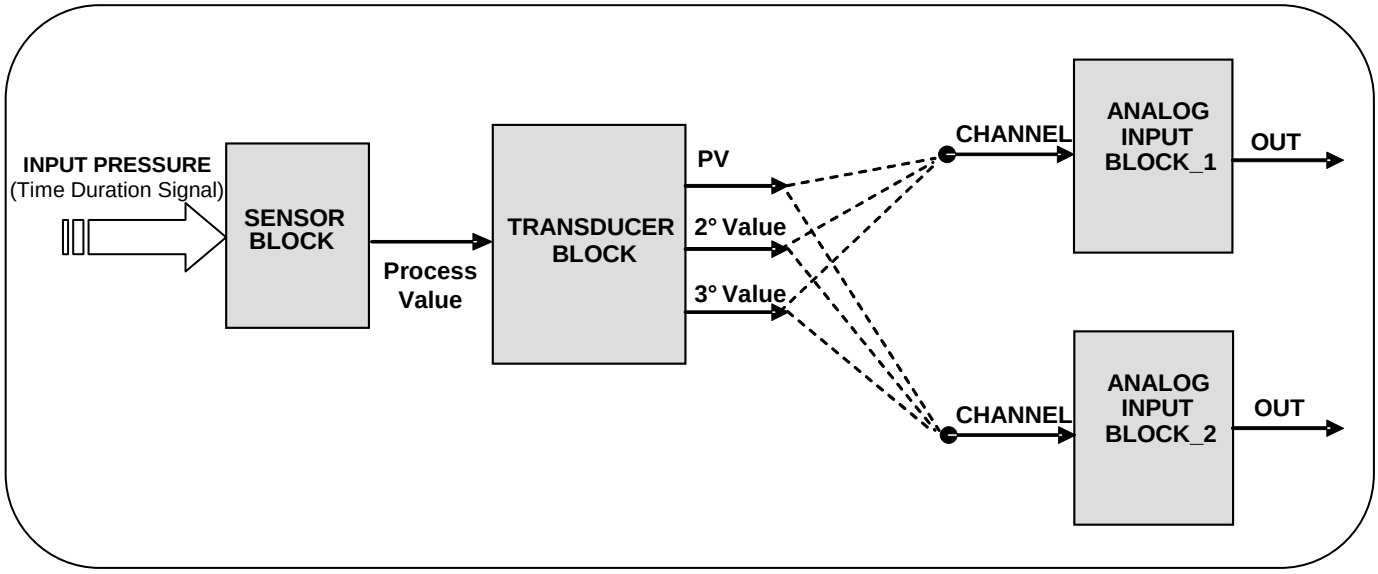
PROBLEM	POSSIBLE CAUSE	SOLUTION
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The Configuration Error bit is set in the BLOCK_ERR	– Set TIME_UNIT1 different by 0 – Set TIME_UNIT2 different by 0 – Set INTEG_TYPE different by 0 in a range between 1 and 7 selecting a valid type – IF INTEG_OPTS = IN_1 ACCUMULATE set PULSE_VAL1 different by 0 – IF INTEG_OPTS = IN_2 ACCUMULATE set PULSE_VAL2 different by 0 – IF INTEG_TYPE = PERIODIC set CLOCK_PER different by 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 is in MAN mode	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

PRESSURE TRANSDUCER BLOCK

Overview

This pressure transducer block is implemented within devices whose primary process sensor has the purpose to measure pressure, or differential pressure.
In addition at the pressure value as primary measurement, there are available auxiliary variables that can be selected trough the Channel as input for the Analog Input blocks, these are the Sensor Temperature and, in case of differential pressure measurement, the Static Pressure identified respectively as secondary and tertiary variable

Block Diagram

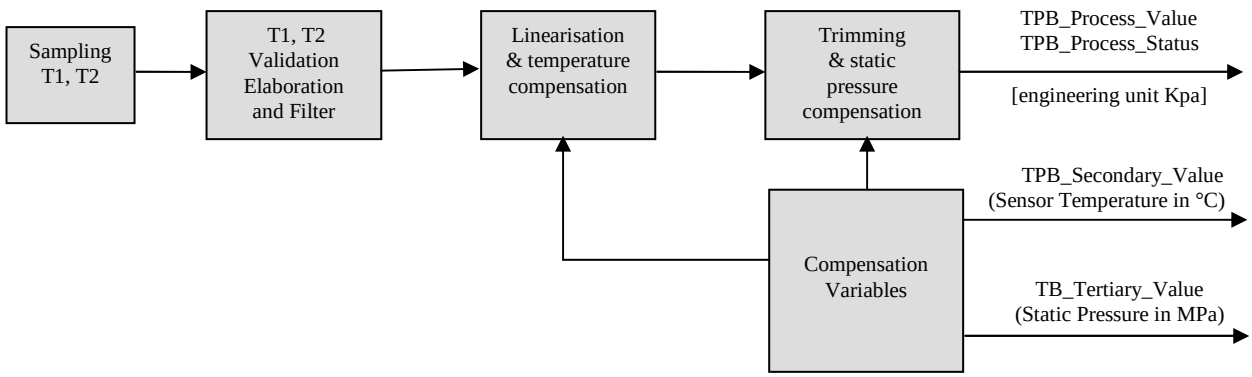


Description

The Sensor Block is a manufacturer device specific algorithm with the purpose to convert the signal representing the measurement in a row format, into a digital format.
Within the Sensor Block of the 264 are collected a set of basic operations as represented in the diagram below:

1- Sampling of the Time Duration Signal (T1, T2)
2- Validation and Elaboration
3- Linearization
4- Calibration and Compensation

The Sensor Block produce in output the TPB_PROCESS_VALUE as compensated and linearizated value to be used as reference for the Calibration of the Sensor, see the section…... and to be used as Input for the Pressure Transducer Block.
The Auxiliary variables are also produced in output from the Sensor Block ready to be linked in input to the AI blocks.



☞ ***Both the two AI Blocks can be selected with the same CHANNEL for receiving in input the same variable from the TPB. The same CHANNEL set for the 2 AI can produce the AI Configuration Error if not properly configured. See the detail in the ANALOG INPUT DIAGNOSIS for Configuration Error description when AI XD_SCALE UNIT is different by TPB PRIMARY VALUE RANGE UNIT***

☞ ***The TPB_PROCESS_VALUE, TPB_SECONDARY_VALUE and TPB_TERTIARY_VALUE, always run independently by the availability of a valid FBAP and by the AI Operating Mode.***
They are computed also when the TPB is in O/S mode but their status will be BAD + OOS.

Block Mapping

Idx	Name	Byte	PC	Description	
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.	
2	TAG_DESC	32	R/W	The user description of the intended application of the block	
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.	
		1	R	Actual – The mode the block is currently in.	
		1	R/W	Permitted – Allowed modes that the target may take on	
		1	R/W	Normal – The common mode for the Actual.	
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the HW or SW components associated with a block. It is a bit string, so that multiple errors may be shown.	
7	UPDATE_EVT	This alert is generated by any change to the static data			
		1	R/W	Unacknowledged	
		1	R	Update State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Static Revision	
		2	R	Relative Index	
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			
		1	R/W	Unacknowledged	
		1	R	Alarm State	
		8	R	Time Stamp: The date and time of when the alert was generated	
		2	R	Sub-code	
		1	R	Value	
9	TRANSDUCER_ DIRECTORY	4	R	Directory that specifies the number and starting indices of the transducers in the transducer block	
10	TRANSDUCER_ TYPE	2	R	Identifies the transducer type. **For the 264 FF it is 100 = Standard Pressure with calibration**	
11	XD_ERROR	1	R	Transducer block error sub-code	
12	COLLECTION_ DIRECTORY	36	R	Directory that specifies the number, starting indices, and the DD items IDs of the data collections in each transducer within a transducer block	
13	PRIMARY_VALUE_ TYPE	2	R/W	Type of measurement representing the primary value. The default measurement type is Differential Pressure. 107. Differential Pressure 108. Gauge Pressure 109. Absolute Pressure	
14	PRIMARY_VALUE	4	R	This is the output value from the TB and input for the AI when CHANNEL = 1. It is represented in the PRIMARY_VALUE_RANGE_UnitIndex	
		1	R	This is the output status from the TB	
15	PRIMARY_VALUE_ RANGE	4	R	High Range	Always set to the Upper Sensor Limit and converted in accordance with the Unit Index changes
		4	R	Low Range	Always set to the Lower Sensor Limit and converted in accordance with the Unit Index changes
		2	R	Unit Index	Updated at every AI_XD_SCALE_Unit_Index changing in order to always keep them equal
		1	R	Decimal point	
16	CAL_POINT_HI	4	R/W	The Highest calibrated value expressed in CAL_UNIT	
17	CAL_POINT_LO	4	R/W	The Lowest calibrated value expressed in CAL_UNIT	
18	CAL_MIN_SPAN	4	R	The Minimum Span to be used between the above calibrations points. Expressed in CAL_UNIT.	

19	CAL_UNIT	2	R/W	Calibration Unit. Only Pressure Units are allowed. See in the Analog Input Function Block Table the XD_SCALE Unit Code the allowed **Code for Pressure**	
20	SENSOR_TYPE	2	R/W	Type of sensor. **The 264 is –121 - Pressure sensor unknown**	
21	SENSOR_RANGE	Range Values representing the Physical Sensor Limits			
		4	R	High Range	Always set to the Upper Sensor Limit
		4	R	Low Range	Always set to the Lower Sensor Limit
		2	R	Unit Index	Always set to the customer order unit code. See in the Analog Input Function Block Table the XD_SCALE Unit Code the allowed **Code for Pressure**
		1	R	Decimal point	
22	SENSOR_SN	32	R	Serial Number of the sensor	
23	SENSOR_CAL_ METHOD	1	R/W	**Calibration Method:** 100 – Volumetric 101 – Static Weigh 102 – Dynamic Weigh 103 – Factory Trim Standard Calibration (default) 104 – User Trim Standard Calibration 105 – Factory Trim Special Calibration 106 – User Trim Special Calibration 255 - Other	
24	SENS_CAL_LOC	32	R/W	The last Location of the Sensor Calibration	
25	SENS_CAL_DATE	7	R/W	The last Date on which the Sensor Calibration was performed	
26	SENS_CAL_WHO	32	R/W	The Name of the person responsible of the last Sensor Calibration	
27	SENS_ISOL_MTL	2	R	**Type of materials for sensor isolator:** 104 Monel 105 Tantalum 119 AISI 316L Stainless Steel 130 Hastelloy C276 236 Monel Gold Plated 339 Monel 400	
28	SENSOR_FILL_ FLUID	2	R	**Type of Fill Fluid used in the sensor:** 1 Silicone Oil 2 Fluorcarbon 7 With Oil (FDA) 50 Inert Oil (Galden) 61 Dibutyl Penthalate	
29	SECONDARY_ VALUE	4	R	Sensor Temperature Value to be linked in input to the AI when the CHANNEL = 2 is selected. It is expressed in SECONDARY_VALUE_UNIT	
		1	R	Sensor Temperature Status	
30	SECONDARY_ VALUE_UNIT	2	R/W	**Sensor Temperature Unit. The allowed units are:** 1000 Kelvin 1001 Celsius Degree 1002 Fahrenheit Degree 1003 Rankine Degree	

ENHANCED PARAMETERS

31	TERTIARY_VALUE	4	R	Static Pressure Value to be linked in input to the AI when the CHANNEL = 3 is selected. It is expressed in TERTIARY_VALUE_UNIT	
		1	R	Static Pressure Status	
32	TERTIARY_VALUE_ UNIT	2	R/W	Static Pressure Unit. Only Pressure unit code are usable, see in the Analog Input Function Block Table the XD_SCALE Unit Code the allowed **Code for Pressure**	
33	CHANNEL_MAP	5	R/W	An optional parameter that aids in the correlation of channels in a device to channels as defined for a plant or process area. Channel 1 = Pressure Channel 2 = Sensor Temp. Channel 3 = Static Press.	
34	PROCESS_ VALUE	4	R	Pressure value used as reference for the Calibration Operation. **See also the section 9**.	
		1	R	Process Value Status	
35	O_RING_MTL_HSP	2	R/W	**Type of materials for the O-ring:** 110 PTFE 111 Viton 112 Buna-N 121 Nitrile Rubber (Perbunan NBR) 136 TFE Glass Filled 233 Perfluoro elastomer 238 EPDM	
36	FLANGE_TYPE_HSP	2	R/W	**Type of Flanges:** 12 Conventional 14 Remote Seal 53 Level Flange Type Flush 54 Level Flange Type Extended 55 Welded Flange 56 Level Sanitary 57 Level Food 58 No Flange, Direct Connection 59 All Welded for Remote Seal 60 Gasketed for Remote Seal 62 Direct Mount Seal (level)	
37	FLANGE_MTL_HSP	2	R/W	**Type of material for the Flange:** 100 Carbon Steel 102 AISI 316 Stainless Steel 103 Hastelloy C 104 Monel 60 AISI 316L Stainless Steel 124 Kynar 130 Hastelloy C276 339 Monel 400	
38	DRAIN_VENT_MTL_ HSP	2	R/W	**Type of material of the Drain Vent:** 103 Hastelloy C 104 Monel 119 AISI 316L Stainless Steel 339 Monel 400 251 None	
39	REM_SEAL_TYPE_ HSP	2	R	**Type of remote seals:** 51 Wafer 55 Off line threated 56 Chemical Tee 57 Button 58 Triclamp & Cherry Burrell 59 Alimentary (Union Nut) 61 Union Connection 62 Aseptic 62 Off line flanged connection 63 Sanitary Flush 64 Sanitary Extended 65 Flush Flanged 66 Extended Flanged 67 Urea Service 69 Pulp & Paper 70 Beverage	

40	REMOTE_SEAL_ FILL_FLUID_HSP	2	R	**Type of Fill fluid for the remote seals:**		59	Ethyl Alcohol
				1	Silicon Oil	60	Propylene Glycol/Water
				2	Inert Oil (Fluorolube)	61	Dibutyl Penthalate
				50	Inert Oil (Galden)	62	Siltherm 800
				51	Glyceryn + H2O	63	Mercury
				54	Santotherm	65	DC97 9120 Pharma B-Grade
				55	Silicone Oil food	66	Marcol 82 (Mineral Oil)
				56	Neobee	67	AN140 (Silicon oil Hi Temp)
				57	Dowtherm	68	Siltherm XLT
				58	Ethyl benzene	253	Special
41	REMOTE_SEAL_ ISOLATOR_HSP	2	R	**Type of remote seals isolator:**		130	Hastelloy C276
				104	Monel	134	AISI 316L TFE Coated
				105	Tantalum	236	Monel Gold Plated
				119	AISI 316L Stainless Steel	334	Hastelloy C276 TFE Coated
42	O_RING_MTL_LSP	2	R/W	**Type of materials for the O-ring:**		121	Nitrile Rubber (Perbunan NBR)
				110	PTFE	137	TFE Glass Filled
				111	Viton	233	Perfluoro elastomer
				112	Buna-N	238	EPDM
43	FLANGE_TYPE_LSP	2	R/W	**Type of Flanges:**		56	Level Sanitary
				12	Conventional	57	Level Food
				14	Remote Seal	58	No Flange, Direct Connection
				53	Level Flange Type Flush	59	All Welded for Remote Seal
				54	Level Flange Type Extended	61	Gasketed for Remote Seal
				55	Welded Flange	62	Direct Mount Seal (level)
44	FLANGE_MTL_LSP	2	R/W	**Type of material for the Flange:**			
				100	Carbon Steel	119	AISI 316L Stainless Steel
				102	AISI 316 Stainless Steel	125	Kynar
				103	Hastelloy C	131	Hastelloy C276
				104	Monel	339	Monel 400
45	DRAIN_VENT_MTL_ LSP	2	R/W	**Type of material of the Drain Vent:**		119	AISI 316L Stainless Steel
				103	Hastelloy C	339	Monel 400
				104	Monel	251	None
46	REM_SEAL_TYPE_ LSP	2	R	**Type of remote seals:**			
				51	Wafer	62	Off line flanged connection
				55	Off line threated	63	Sanitary Flush
				56	Chemical Tee	64	Sanitary Extended
				57	Button	65	Flush Flanged
				58	Triclamp & Cherry Burrell	66	Extended Flanged
				59	Alimentary (Union Nut)	67	Urea Service
				60	Union Connection	69	Pulp & Paper
				61	Aseptic	70	Beverage
47	REMOTE_SEAL_ FILL_FLUID_LSP	2	R	**Type of Fill fluid for the remote seals:**		59	Ethyl Alcohol
				1	Silicon Oil	60	Propylene Glycol/Water
				2	Inert Oil (Fluorolube)	61	Dibutyl Penthalate
				50	Inert Oil (Galden)	62	Siltherm 800
				51	Glyceryn + H2O	63	Mercury
				54	Santotherm	69	DC97 9120 Pharma B-Grade
				55	Silicone Oil food	70	Marcol 82 (Mineral Oil)
				56	Neobee	71	AN140 (Silicon oil Hi Temp)
				57	Dowtherm	72	Siltherm XLT
				58	Ethyl benzene	253	Special
48	REMOTE_SEAL_ ISOLATOR_LSP	2	R	**Type of remote seals isolator:**		130	Hastelloy C276
				104	Monel	135	AISI 316L TFE Coated
				105	Tantalum	237	Monel Gold Plated
				119	AISI 316L Stainless Steel	334	Hastelloy C276 TFE Coated
49	PROCESS_ CONNECTION	1	R				
50	NUMBER_ REMOTE_SEAL	1	R	**Number of remote seals:**			
				1	One Seal		
				2	Two Seals		
				251	None		
51	CALIBRATION_ TYPE	1	R	**Type of Calibration:**		102	Special Temperature
				100	Standard	103	Special Line Pressure and Temp.
				101	Special Line Pressure		
52	PROCEDURE_ TYPE	1	R	**Type of procedure:**		3	Chlorine Cleaning
				1	None	4	Hydrogen Preparation
				2	Oxygen Cleaning	5	Special degreasing
53	HIGH_TEMP_LIM	4	R	Highest allowed sensor temperature limit. It is expressed in SECONDARY_VALUE_UNIT			
54	LOW_TEMP_LIM	4	R	Lowest allowed sensor temperature limit. It is expressed in SECONDARY_VALUE_UNIT			
55	MAX_WORK_ PRESS_UNIT	2	R/W	Maximum working pressure Unit code. Only Pressure unit code are usable. See in the Analog Input Function Block Table the XD_SCALE Unit Code the allowed **Code for Pressure**			
56	MAX_WORK_PRESS	4	R/W	Max allowed working pressure of the sensor.			
57	STATIC_PRESS_ TRIM	4	R/W	Value at which the Static Pressure has been adjusted expressed in MAX_WORK_PRESS_UNIT			

58	MODULE_TYPE	2	R	**Type of sensor module:** 42 Differential Piezo Minden 43 Diff. Absolute Piezo Minden 50 Pressure Capacitive Minden 51 Press.Abs.Capacitive Minden 52 Pressure Piezo Minden 53 Pressure Abs.Piezo Minden		60 Differential Inductive Lenno 61 Diff. Inductive Abs.Lenno 62 Diff. Inductive Gauge Lenno 63 Pressure Inductive Lenno 64 Press.Inductive Abs.Lenno 65 Pressure Capacitive Lenno 66 Press.Capacitive Abs.Lenno	
59	DETAILED_ STATUS	2	R	The detailed diagnostic conditions relating the TPB are collected in this additional bit-string variable, they are: – Sensor Type Incompatible – Sensor database invalid for the electronics – Read Error for Critical data – Read Error for Not Critical data – Pressure sensor not updating – Mechanical Fail – Static Pressure Sensor Failed – Temperature Sensor Failed		– PV out of High sensor limit – PV out of Low sensor limit – Overpressure side High – Overpressure side Low – Over Temperature High – Over Temperature Low – Over Static Pressure – Generic Sensor Fail	
60	ERROR MASK	2	R/W	The diagnostic conditions can be masked setting the correspondent bit in this variable. Only NOT fatal errors can be masked, they are: – Read Error for Not Critical data – Static Pressure Sensor Failed – Temperature Sensor Failed – Sensor NV R/W Failure – PV out of High sensor limit – PV out of Low sensor limit		– Overpressure side High – Overpressure side Low – Over Temperature High – Over Temperature Low – Over Static Pressure	
61	ERROR SIMULATION	2	R/W	The diagnostic conditions can be simulated setting the correspondent bit in this variable: – Sensor Type Incompatible – Sensor database invalid for the electronics – Read Error for Critical data – Read Error for Not Critical data – Pressure sensor not updating – Mechanical Fail – Static Pressure Sensor Failed – Temperature Sensor Failed – Sensor NV R/W Failure		– PV out of High sensor limit – PV out of Low sensor limit – Overpressure side High – Overpressure side Low – Over Temperature High – Over Temperature Low – Over Static Pressure – Generic Sensor Fail	

Supported Modes

- **OOS, AUTO.**

☞ ***When the RB is Out of Service, the Transducer Pressure Block is forced in Out of Service too.***

Diagnosis

The **TPB** supports the following errors:

Conditions	Sub-Conditions	Possible Reason	PRIMARY_VALUE Status	LCD
Other	**Sensor type incompatible**	The Sensor type is an old model or its database is not compatible with the installed electronics.	BAD + Sensor Fail	**ERROR CONDITION** 
	Sensor database invalid for the electronics	The Sensor database is of an old type for the actual electronic	BAD + Sensor Fail	**ERROR CONDITION** 
	Pressure sensor out of High limit	The TPB_PRIMARY_VALUE exceed the TPB_SENSOR_RANGE_high_range	GOOD_NC + High limited	**WARNING CONDITION** 
	Pressure sensor out of Low limit	The TPB_PRIMARY_VALUE exceed the TPB_SENSOR_RANGE_low_range	GOOD_NC + Low limited	**WARNING CONDITION** 
	Overpressure High	An Overrange of pressure on the side + has been detected. Each occurrence is counted in a dedicated counter ADB_OVER_RNG_CNT	GOOD_NC + High limited	**WARNING CONDITION** 
	Overpressure Low	An Overrange of pressure on the side - has been detected. Each occurrence is counted in a dedicated counter ADB_OVER_RNG_CNT	GOOD_NC + Low limited	**WARNING CONDITION** 
	Over Temperature High	A Sensor Temperature Out of the operational limits High has been detected. Each occurrence is counted in a dedicated counter ADB_OVER_TMP_CNT	UNCERTAIN + Sensor Conversion Not Accurate	**WARNING CONDITION** 

	Over Temperature Low	A Sensor Temperature Out of the operational limits Low has been detected. Each occurrence is counted in a dedicated counter ADB_OVER_TMP_CNT	UNCERTAIN + Sensor Conversion Not Accurate	**WARNING CONDITION** 
	Over Static	A Static Pressure Out of the acceptable Working limit has been detected. Each occurrence is counted in a dedicated counter ADB_OVER_STAT_CNT	UNCERTAIN + Sensor Conversion Not Accurate	**WARNING CONDITION** 
Device needs maintenance soon	**Static Pressure Sensor Failed**	The circuitry for the sampling of the Static Pressure is failed/broken. The 264 continue to work but with the latest valid compensation	UNCERTAIN + Sensor Conversion Not Accurate	**WARNING CONDITION** 
	Temperature Sensor Failed	The circuitry for the sampling of the Sensor Temperature is failed/broken. The 264 continue to work but with the latest valid compensation	UNCERTAIN + Sensor Conversion Not Accurate	**WARNING CONDITION** 
Memory failure	**N/A**	An error has been detected during the periodic R/W access to the non-volatile memory of the Sensor. ▪ The 264 continue to work normally, but in case of power cycle the last changes could be lost.	***NO EFFECT***	**WARNING CONDITION** 
Lost Static Data	**CRC Error for <u>Critical data</u> of Sensor EEPROM**	A CRC error in the NV Sensor memory has been detected during the start-up for data that **can impact critically** on the correct production of the Process Variable.	BAD + Sensor Fail	**ERROR CONDITION** 
	CRC Error for Not Critical data of Sensor EEPROM	A CRC error in the NV Sensor memory has been detected during the start-up for data that **have not a critical impact** on the correct production of the Process Variable.	***NO EFFECT***	**WARNING CONDITION** 

Device needs maintenance now	**Pressure sensor not updating**	The Sensor Primary signal is no more available or correctly updated due to electronics failure	BAD + Sensor Fail	**ERROR CONDITION** 
	Mechanical Error	The sensor signal reflects wrong condition due to probably mechanical failure.	BAD + Sensor Fail	**ERROR CONDITION** 
Out-of-Service	**N/A**	The Actual_Mode of the TPB is set to OUT OF SERVICE	BAD + Out Of Service	**ERROR CONDITION** 

OUT Status

The **TPB_PRIMARY_VALUE Status byte** supports the following conditions:

		Quality		Substatus				Limits			
Dec	Hex	Gr	Gr	QS	QS	QS	QS	Qu	Qu		DESCRIPTIONS
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		
0	00	0	0							= bad	
64	40	0	1							= uncertain	
128	80	1	0							= good (Not Cascade)	
							BAD				
12	0C	0	0	0	0	1	1			= device failure	Set as consequence of the CRC Error for Critical data of Sensor EEPROM.
16	10	0	0	0	1	0	0			= sensor failure	Set as consequence of the Device Needs Maintenance Now
28	1C	0	0	0	1	1	1			= out of service	This status is produced when the device is in Out Of Service mode.
							UNCERTAIN				
64	40	0	1	0	0	0	0			= non specific	**Set when the PILD function executed in the ADB detects a plugged line and the PILD status is enabled to affect the TPB status.** ▪ If the calculated TPB status has lower priority of the Uncertain non specific, the Uncertain non specific is produced, if the calculated TPB status has higher priority of the Uncertain non specific, the calculated TPB status is produced
80	50	0	1	0	1	0	0			= sensor conversion not accurate	Set as consequence of the Device Needs Maintenance Soon or in case of Overtemperature and Overstatic The auxiliary values for compensation are not more usable (compensation sensors failed). The OUT will be always produced but with the last valid compensation. This gives an indication of degraded performances of the device
							GOOD_NC				
128	80	1	0	0	0	0	0			= non specific	
132	84	1	0	0	0	0	1			= active block alarm ???	Set when the value is Good and the block has an Active Block alarm.
+1	+01							0	1	= low limited	Set as consequence of the Primary Value out of sensor high limit and/or in case of overpressure plus
+2	+02							1	0	= high limited	Set as consequence of the Primary Value out of sensor low limit and/or in case of overpressure minus
+3	+03							1	1	= constant	

Troubleshooting

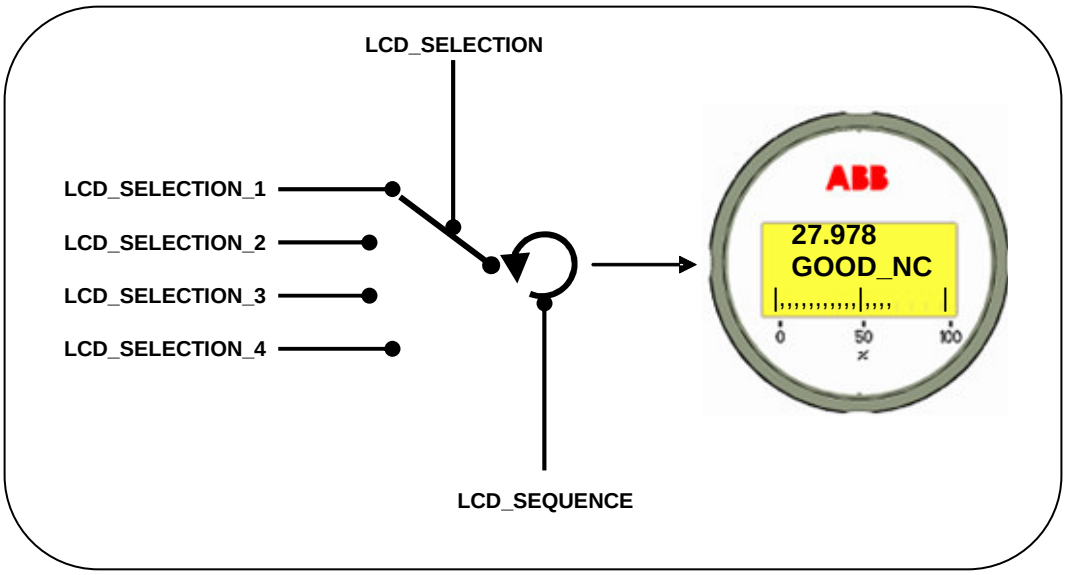
PROBLEM	POSSIBLE CAUSE	SOLUTION
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
The OUT Status is BAD	There is a fatal failure at the sensor level which produces not usable values	For details check the BLOCK_ERR and DETAILED_STATUS variables
The OUT Status is UNCERTAIN	There is a non fatal failure at the sensor level which produces usable values but with decreased performances	For details check the BLOCK_ERR and DETAILED_STATUS variables
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

DISPLAY TRANSDUCER BLOCK

Overview

The display transducer block is an independent block dedicated to the management of the local display and the local operations via push buttons.

Block Diagram



Description

The Display Transducer Block allows the selection of which variables, produced/calculated within the device, must be displayed. It is possible select up to 4 display inputs, each selectable with one variable to be displayed from a list of predefined variables, refer to the section **3.4 – Local Indicator.**
The variables can be optionally selected to be displayed as a single variable or in sequence.
It is also selectable the possibility to display only Error strings or only Warnings strings when diagnostic strings should be displayed, by default all the diagnostic strings are enabled.
From this block is also possible enable or disable the push buttons.

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the HW or SW components associated with a block. It is a bit string, so that multiple errors may be shown.
7	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index

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		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value
9	TRANSDUCER_ DIRECTORY	4	R	Directory that specifies the number and starting indices of the transducers in the transducer block
10	TRANSDUCER_ TYPE	2	R	Identifies the transducer type.
11	XD_ERROR	1	R	Transducer block error sub-code
12	COLLECTION_ DIRECTORY	36	R	Directory that specifies the number, starting indices, and the DD items IDs of the data collections in each transducer within a transducer block
13	LCD_INSTALLATION	1	R	Indication about the installation of the Display on the transmitter: xxx = Installed → (xxx = LCD sw rev) 255 = Not Installed
14	KEY_ENABLE	1	R/W	Local operations enabled/disabled. The Push buttons can be selected as: 100 – Push buttons Enabled 101 – Push buttons Disabled
15	LCD_SELECTION_1	1	R/W	Selection of the 1st variable to be displayed: 0 Uninitialized 100 TPB Process Value 101 TPB Primary Value 102 TPB Secondary Value 103 TPB Tertiary Value 104 AI_1 output value 105 AI_1 output percent 106 AI_2 output value 107 AI_2 output percent 108 PID Out 109 AR Out 110 CS Out 111 IS Out 112 IT Out 113 SC Out 1 114 SC Out 2
16	LCD_SELECTION_2	1	R/W	Selection of the 2nd variable to be displayed. The list is the same of the Selection 1
17	LCD_SELECTION_3	1	R/W	Selection of the 3rd variable to be displayed. The list is the same of the Selection 1
18	LCD_SELECTION_4	1	R/W	Selection of the 4th variable to be displayed. The list is the same of the Selection 1
19	LCD_SEQUENCE	1	R/W	Possibility to display the 4 variables selected with LCD_SELECTION_x in sequence. Each every 5 seconds: 1 – Sequence OFF 2 – Sequence ON
20	LCD_SELECTION	1	R/W	Selection of which of the LCD_SELECTION_x must be displayed. Valid values between 1 & 4.
21	DISABLE WARNINGS	1	R/W	Possibility to enable/disable the displaying of strings representing Warnings 0 - Enable displaying of Warning strings 1 - Disable displaying of Warning strings
22	DISABLE ERRORS	1	R/W	Possibility to enable/disable the displaying of strings representing Errors 0 - Enable displaying of Error strings 1 - Disable displaying of Error strings

Supported Modes

- **OOS, AUTO.**

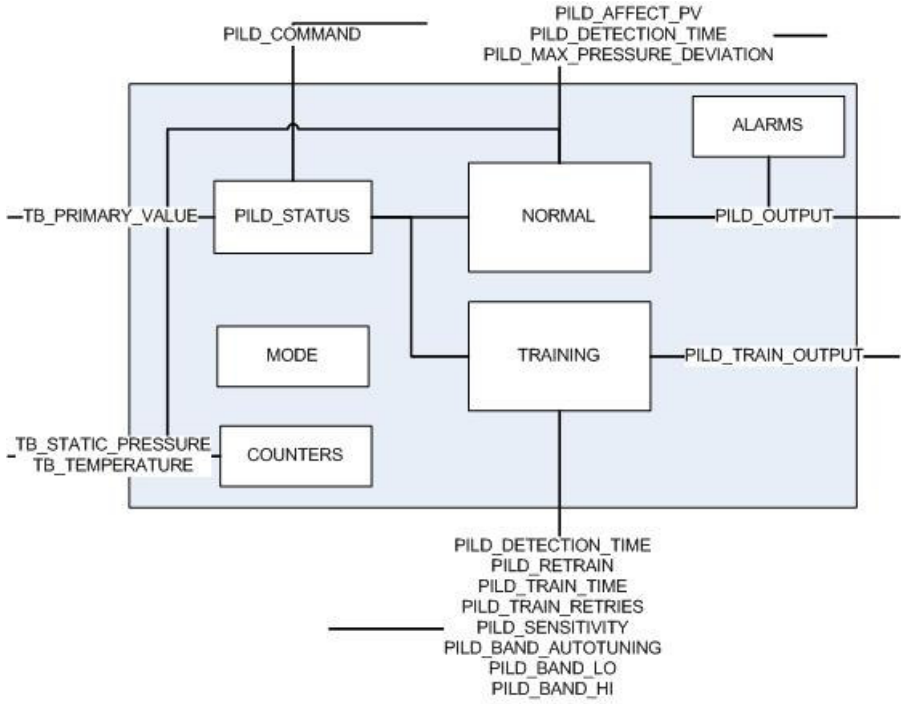
☞ ***The Display Transducer Block is not subject to the RB operating mode. It can be switched in AUTO also when the RB is in OOS***

ADVANCED DIAGNOSTIC TRANSDUCER BLOCK

Overview

The advanced diagnostic transducer block contains all the parameters that related to the device diagnostic and all the parameters related with the PILD algorithm. The goal of this block is to supervise the device and report an alarm under transducer abnormal condition to the control system, modifying the pressure transducer block primary value status and raising an alarm in the BLOCK_ERR.

Block Diagram



Description

The Advanced Diagnostic Transducer Block is divided into two parts:

1. **The PILD algorithm**

   The Plugged Impulse Line Detection (PILD) is a new function for 264 Differential Pressure models, aimed at detecting the blockage of the process connections of the instrument and any type of problem occurring at the sensor internal hydraulic circuit.

   The PILD algorithm is executed in two distinct phases:

   Training Phase:

   The algorithm analyses and learns the process dynamics in term of noises of the primary signal detected when the process is working at its normal conditions, then if the training phase is successfully completed with good result, the ADB is switched in AUTO mode and the PILD monitoring phase get start.

   Until the training is not executed or its result is not good, a configuration error is raised with details like:

   - Process Instable during training
   - Process not available during training
   - Not good process condition for training
   - Training not done

   and the ADB block is remains in OOS.

   Monitoring Phase:

   The algorithms perform a continuous sampling and comparison of the current process noises with what memorized during the training phase. Differences have been experienced being consequences of something bad in process connections to the sensor like dirty, ice and so on which tap/plug the pipe/s partially or totally.

   Whenever a pipe plugging/tapping is detected, an Input Failure error is raised with details like:

   - Line on side H plugged
   - Line on side L plugged

- Both lines H and L plugged
- An undetected line plugged

and the ADB block goes in OOS.

When one of the above conditions has been detected, there is the possibility that the PV in output from the TBP continue to be produced with GOOD status.
In this way the AI block receiving in input the PV from the TPB works normally and the operator could have not evidence of the wrong conditions. For this reason it is possible make a choice in order to decide to affect or not the TPB primary value when the plugging conditions have been detected. This selection is possible with the PILD_AFFECT_PV variable. When it is selected to true, and the Plugging conditions are detected, the GOOD status that would be produced in output for the TPB_ PRIMARY_VARIABLE is forced to Uncertain not specific

The PILD algorithm loses the train every time it is switched off. The algorithm is switched off automatically for every error condition and the block go to OOS, except when the pressure violates the maximum pressure deviation and the retrain is selected.

☞ ***The Variables relevant with the PILD algorithm are in a grey background in the Block Mapping table below***

2. The working conditions limits and the over-range counters

The over-range counters count the times the device is in condition of upper and lower over-range for differential pressure, static pressure and temperature. The FF counters are clearable while a copy of those counters is stored in the Non volatile memory for future statistics. Those parameters will be saved every day.

☞ ***The counters are updated in every block mode included when the ADB is in OOS.***

Block Mapping

Idx	Name	Byte	PC	Description
0	BLOCK_OBJ	62	mix.	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	2	R	The revision level of the Static data associated with the Function Block. The revision level is incremented each time a static parameter value in the block is changed.
2	TAG_DESC	32	R/W	The user description of the intended application of the block
3	STRATEGY	2	R/W	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	1	R/W	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	1	R/W	Target – The selected mode from the operator.
		1	R	Actual – The mode the block is currently in.
		1	R/W	Permitted – Allowed modes that the target may take on
		1	R/W	Normal – The common mode for the Actual.
6	BLOCK_ERR	2	R	This parameter reflects the error status associated with the HW or SW components associated with a block. It is a bit string, so that multiple errors may be shown.
7	UPDATE_EVT	This alert is generated by any change to the static data		
		1	R/W	Unacknowledged
		1	R	Update State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Static Revision
		2	R	Relative Index
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		
		1	R/W	Unacknowledged
		1	R	Alarm State
		8	R	Time Stamp: The date and time of when the alert was generated
		2	R	Sub-code
		1	R	Value
9	TRANSDUCER_ DIRECTORY	4	R	Directory that specifies the number and starting indices of the transducers in the transducer block
10	TRANSDUCER_ TYPE	2	R	Identifies the transducer type.
11	XD_ERROR	1	R	Transducer block error sub-code
12	COLLECTION_ DIRECTORY	36	R	Directory that specifies the number, starting indices, and the DD items IDs of the data collections in each transducer within a transducer block

13	PILD_COMMAND	1	R/W	With this parameter is possible perform the PILD algorithm actions The possible values are: 0 – IDLE - (Default value) 1 – GO_OFF - To switch ON the algorithm 2 – GO_ON - To switch OFF the algorithm 3 – TRAIN - To start the training phase 4 – STOP_TRAINING - To stop the training phase of the algorithm before its natural ending
14	PILD_STATUS	1	R	This parameter shows the actual algorithm status, the possible values are: 0 – OFF - The algorithm is Inactive (Default value) 1 – NORMAL - The algorithm is Active 2 – TRAINING - The algorithm is in training phase
15	PILD_OUTPUT	1	R	This parameter gives information on whether the impulse lines are plugged or not. Its possible values are: Bit 0 – Normal - The process connections are OK and the device is working normally. Lines Not Plugged Bit 1 – Not Valid - When the PILD algorithm is not working like, for example, during the Training phase or if the training phase didn't produce a valid result Bit 2 – Max Pressure Deviation - The pressure value currently detected is too different from what used for the Training. A new Training is necessary for this new process condition Bit 3 – One - One undetected process connection is plugged. It was not possible identify which one Bit 4 – Two - Both the Process connections, high side (+) and low side (-) are plugged Bit 5 – Line H Plugged - The Process connection on the high side (+) is plugged Bit 6 – Line L Plugged - The Process connection on the low side (-) is plugged
16	PILD_AFFECT_PV	1	R/W	This parameter indicates if the PILD algorithm must affect the transducer block primary variable, if the PILD algorithm reveals an abnormal situation it drives the status of TB primary variable to UNCERTAIN status. 0 – False - Doesn't affect primary value status (default value) 1 – True - Affect primary value status
17	PILD_DETECTION_ TIME	1	R/W	This parameter represents the length of the algorithm slot. This is the **time interval (minutes)** over which the algorithm bases the decision on the plugging state of the impulse lines. This parameter is expressed as a time duration value with **range between 1 minute and 30 minutes**, the default value is **5 minutes**
18	PILD_MAX_PRESS_ DEVIATION	1	R/W	This parameter is used in the normal operation checks. It is the maximum allowed deviation of the differential pressure from the mean differential pressure recorded in the training phase. If the deviation is greater, than the PILD output is set to OUTPUT NOT VALID, because the conditions are too different from the training phase. The parameter is expressed in **percent** value of the mean training differential pressure; the default value will be **40%** while the range will be between **20% and 60%**
19	PILD_RETRAINING	1	R/W	This parameter force the algorithm to train status when the process conditions pass the maximum allowed deviation. 0 – False - Doesn't retrain automatically (default value) 1 – True - Retrain automatically
20	PILD_TRAINING_ TIME	1	R/W	This parameter represents the duration of the training period. This parameter is expressed in **time duration (minutes)** value with range between **1 minute and 30 minutes**. The default value is **5 minutes.**
21	PILD_TRAINING_ RETRIES	1	R/W	At the end of the training procedure, there are the training checks on the recorded data. If they fail, the algorithm is allowed to retry the procedure adding a further slot of data. This parameter is the max number of allowed retries. The default value is **2**, while the range is between **0 and 4**
22	PILD_TRAINING_ OUTPUT	1	R	This parameter gives information on the status of the training phase, the values are: Bit 0 – PILD_TRAIN_NOT_DONE - Training not yet executed Bit 1 – PILD_TRAIN_OK - Training correct Bit 2 – PILD_TRAIN_FREQUENCY_TUNING - The training phase is checking the signal frequency for its execution Bit 3 – PILD_TRAIN_BAD_MAX_POWER_DEV - Signal power has passed the maximum allowed deviation - This process condition is considered instable for a good training Bit 4 – PILD_TRAIN_BAD_MAX_PRESSURE_DEV - Pressure has passed the maximum allowed deviation. - This process condition is considered instable for a good training Bit 5 – PILD_TRAIN_BAD_MIN_NOISE - The Noise of the process is too low for allowing a good training Bit 6 – PILD_TRAIN_BAD_MIN_ALFA - There is not a good process condition which could allow an efficient training

23	PILD_SENSITIVITY	1	R/W	Algorithm sensibility is composed by two parameters; the first manages the one-line-plugged condition while the other the two-lines-plugged condition. The parameters can be managed with just one variable that sets up either parameters or leaving them separate 1 – LOWEST - 1% and 99% of Gamma Distribution 2 – VERY LOW - 2% and 98% of Gamma Distribution 3 – LOW - 3% and 97% of Gamma Distribution 4 – MEDIUM - 5% and 95% of Gamma Distribution (default value) 5 – HIGH - 10% and 90% of Gamma Distribution 6 – VERY HIGH - 20% and 80% of Gamma Distribution 7– HIGHEST - 30% and 70% of Gamma Distribution
24	PILD_BAND_ AUTOTUNING	1	R/W	Experience on the PILD algorithm has shown that the frequency band over which the signal power is computed can be auto tuned. This parameter enable the procedure to auto tune the frequency band, it can be enabled or disabled to let the user work manually 0 – False - Doesn't frequency auto tune (default value) 1 - True - Does frequency auto tune
25	PILD_BAND_LOW	1	R/W	Upper bound of the frequency range over which the signal power is computed. It is expressed in **Hz** with default value of **20 Hz** and range between **1 and 20 Hz** (40 for Minden Sensor type, see MODULE_TYPE index 58 in the TBP). This value must be lower than PILD_BAND_HIGH. Writable only if PILD_BAND_AUTOTUNING is set to false
26	PILD_BAND_HIGH	1	R/W	Lower bound of the frequency range over which the signal power is computed. It is expressed in **Hz** with default value of **1 Hz** and range between **1 and 20 Hz** (40 for Minden Sensor type, see MODULE_TYPE index 58 in the TBP). This value must be higher than PILD_BAND_LOW. Writable if PILD_BAND_AUTOTUNING is set to false
27	PWR_ON_CNT	2	R	Power On Counter. This counter represents the number of power on of the device. After a defined number of power-on cycles an alert notification is sent to the Master.
28	PLUS_OVER_RNG _CNT	2	R/W	High side Over-range Counter. Each over-range occurrence on the high/plus side is counted. An operator writing command can clear this counter
29	MINUS_OVER_RNG _CNT	2	R/W	Low side Over-range Counter. Each over-range occurrence on the low/minus side is counted. An operator writing command can clear this counter
30	PLUS_OVER_TEMP _CNT	2	R/W	High Over Sensor Temp. Counter Each time the sensor temperature goes outside the HIGH_TEMP_LIMIT the occurrence is counted. An operator writing command can clear this counter
31	MINUS_OVER_ TEMP_CNT	2	R/W	Low Over Sensor Temp. Counter Each time the sensor temperature goes outside the LOW_TEMP_LIMIT the occurrence is counted. An operator writing command can clear this counter
32	OVER_STAT_CNT	2	R/W	Over Static Press. Counter. Each time the static pressure goes outside the MAX_WORK_PRESS the occurrence is counted. An operator writing command can clear this counter
33	TOT_WORK_HR	6	R	Total Working hours. Total amount of time the transmitter has been switched on
34	PAR_WORK_HR	6	R/W	Partial Working hours. Partial amount of time the transmitter has been switched on. An operator writing command can clear this counter.
35	MAX_SENS_VAL	4	R/W	Maximum Value reached by the Sensor
36	MIN_SENS_VAL	4	R/W	Minimum Value reached by the Sensor
37	MAX_TEMP_VAL	4	R/W	Maximum Temperature Value reached by the Sensor
38	MIN_TEMP_VAL	4	R/W	Minimum Temperature Value reached by the Sensor
39	MAX_WORK_PR	4	R/W	Maximum Static Pressure Value reached by the Sensor
40	DETAILED_STATUS	2	R	The detailed diagnostic conditions relating the ADB are collected in this additional bit-string variable, they are: – Line H plugged – Line L plugged – Both Lines H and L plugged – One undetected Line plugged – Process instable during training phase – Process not available during training phase – Not Good Process condition for Training – Max Power Deviation Exceeded
41	ADB_MASK_ERROR	2	R/W	The diagnostic conditions can be masked setting the correspondent bit in this variable. Only not fatal errors can be masked, they are: – Line H plugged – Line L plugged – Both Lines H and L plugged – One undetected Line plugged – Process instable during training phase – Process not available during training phase – Not Good Process condition for Training – Max Power Deviation Exceeded
42	ADB_SIM_ERROR	2	R/W	The diagnostic conditions can be simulated setting the correspondent bit in this variable. They are: – Line H plugged – Line L plugged – Both Lines H and L plugged – One undetected Line plugged – Process instable during training phase – Process not available during training phase – Not Good Process condition for Training – Max Power Deviation Exceeded

Supported Modes

- **OOS, AUTO.**

☞ ***When the RB is Out of Service, the Advanced Diagnostic Block is forced in Out of Service too.***

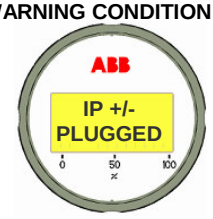
Diagnosis

The **ADB** supports the following errors:

Conditions	Sub-Conditions	Reasons	effect on TPB_PRIMARY_VALUE status	LCD
Block Configuration error	**Process instable during training phase**	The Process was not stable during the Training phase	▪ The Training phase didn't produce good results to be used for the PILD algorithm. ▪ The ADB remain in OOS ▪ There is NO EFFECT on the PRIMARY_VALUE_STATUS of the TPB	**NORMAL DISPLAY**
	Process not available during training phase	The process was not available during the training phase		
	Not Good Process condition for Training	The process conditions had general problems that doesn't guarantee the good training results		
	Training not Done	The Training phase was never done before or the algorithm was switched off.		

Input Failure/process variable has BAD status	**Line + plugged**	The line + is plugged or not in the condition to give good measurement	IF ((PILD_AFFECT_PV=True) && (PV STATUS=GOOD))
			PV_STATUS = UNCERTAIN non specific
			IF ((PILD_AFFECT_PV= True) && (PV_STATUS = BAD))
			PV_STATUS = BAD
			ELSE IF (PILD_AFFECT_PV=False)
			PV_STATUS = as calculated by TPB PRESSURE
				WARNING CONDITION
				 

	Line – plugged	The line - is plugged or not in the condition to give good measurement	IF ((PILD_AFFECT_PV=True) && (PV STATUS=GOOD))
			PV_STATUS = UNCERTAIN non specific
			IF ((PILD_AFFECT_PV= True) && (PV_STATUS = BAD))
			PV_STATUS = BAD
			ELSE IF (PILD_AFFECT_PV=False)
			PV_STATUS = as calculated by TPB PRESSURE
				WARNING CONDITION
				 

	Both Lines + and – plugged	Both the lines + / - are plugged or not in the condition to give good measurement	IF ((PILD_AFFECT_PV=True) && (PV STATUS=GOOD))
			PV_STATUS = UNCERTAIN non specific
			IF ((PILD_AFFECT_PV= True) && (PV_STATUS = BAD))
			PV_STATUS = BAD
			ELSE IF (PILD_AFFECT_PV=False)
			PV_STATUS = as calculated by TPB PRESSURE
				WARNING CONDITION
				 

	One undetected Line plugged	One line, + or -, is plugged. It is not possible detect which one	IF ((PILD_AFFECT_PV=True) && (PV STATUS=GOOD))
			PV_STATUS = UNCERTAIN non specific
			IF ((PILD_AFFECT_PV= True) && (PV_STATUS = BAD))
			PV_STATUS = BAD
			ELSE IF (PILD_AFFECT_PV=False)
			PV_STATUS = as calculated by TPB PRESSURE
				WARNING CONDITION
				 

Out-of-Service	**N/A**	The Actual_Mode of the ADB is OUT OF SERVICE	NO EFFECT ON PV_STATUS	**NORMAL DISPLAY**

OUT Status

The Status of the TPB_PRIMARY_VALUE will be affected by the ADB in accordance with the PILD_AFFECT_PV setting.
In case the PILD_AFFECT_PV is set to true, and a diagnostic PILD condition is active, the TPB_PRIMARY_VALUE status that would be produced as GOOD, will be forced to UNCERTAIN-Non Specific.

Troubleshooting

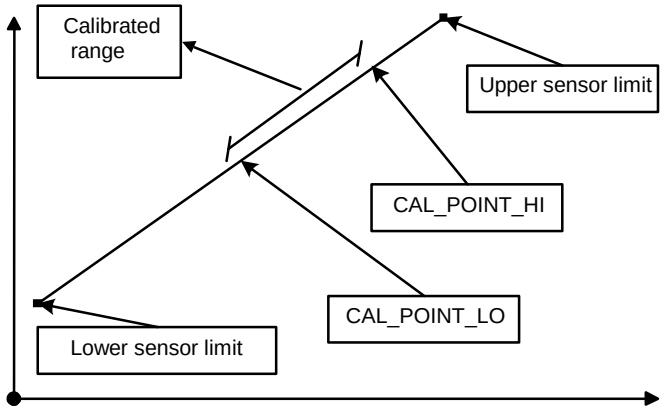
PROBLEM	POSSIBLE CAUSE	SOLUTION
The Block cannot be removed from OOS mode	The Target Mode is not set to AUTO	Set the Target Mode to AUTO and/or remove the OOS
	The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
	The Training phase has been not executed or it didn't produce a valid result	Check the Process conditions and the PILD setting and retry the Training
	A PILD error condition has been detected	Remove the cause of the error e.g. clean the process connection and restart the PILD performing a new training
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

9. Sensor Calibration

The sensor of the 264 can be calibrated in order to adjust and make accurate as much as possible the sensor conversion to a digital pressure value. The operations provided by the transmitters and to be supported by the configuration tools are listed in the table below

Operations	Parameters involved and modified
Zero Alignment	TPB_CAL_POINT_LO
Low Trimming	TPB_CAL_POINT_LO
High Trimming	TPB_CAL_POINT_HI
Reset to Factory Sensor Trimming Condition	TPB_CAL_POINT_LO, TPB_CAL_POINT_HI, TPB_CAL_UNIT
Static Pressure Trimming	TPB_STATIC_PRESS_TRIM

Two points are necessary to perform a sensor calibration. Low sensor calibration point (Zero) and High sensor calibration point (Span). The minimum distance from the two points must be greater than minimum span.
The user makes a calibration procedure writing in the TPB_CAL_POINT_HI and TPB_CAL_POINT_LO the values that the transmitter has to produce as TPB_PROCESS_VALUE matching the current pressure applied in input. These values are expressed in TPB_CAL_UNIT engineering unit code.



9.1 - Zero Alignment

This operation can be executed using the remote configuration tool or the local ‘Z’ push button. With this operation the TPB_PROCESS_VALUE is automatically adjusted to 'zero'. Whenever the user wants to set the measure produced by the transmitter to ‘zero’ (i.e. when the measure is different by ‘zero’ due to the installation position) the following sequence of operations are required when the remote configuration tool is used:

1. Select the desired unit for representing the measure produced by the transmitter writing the right unit code in the TPB_CAL_UNIT. → **Only Pressure Unit Code is allowed**
2. Read the reference value produced by the transmitter from the TPB_PROCESS_VALUE.
3. If the read value is different by ‘zero’, the ‘zero alignment’ operation should be executed: It automatically writes ‘zero’ in the TPB_CAL_POINT_LO and consequently forces the TPB_PROCESS_VALUE to ‘zero’.
4. Read again the TPB_PROCESS_VALUE and check if its value is now ‘zero’.

For details about this operation executed using the local push button ‘Z’, see the section 3.5

9.2 - Low Trimming

This operation can be executed only using the remote configuration tool. With this operation the TPB_PROCESS_VALUE is automatically adjusted, in order to match the real value of the pressure applied in input, in the low part of the working range. The following sequence of operations is required:

1. Apply a reference pressure in input using a reference pressure generator.
2. Select the desired unit for representing the measure produced by the transmitter writing the right unit code in the TPB_CAL_UNIT. → **Only Pressure Unit Code is allowed**
3. Read the reference value produced by the transmitter from the TPB_PROCESS_VALUE.
4. If this value doesn’t match the pressure applied in input, write the right known applied pressure value in the TPB_CAL_POINT_LO and write it in the transmitter. This writing executes an internal algorithm that produces the new correction coefficients.
5. Read again the TPB_PROCESS_VALUE and check if its value has been adjusted for matching the applied pressure.

9.3 - High Trimming

This operation can be executed only using the remote configuration tool. With this operation the TPB_PROCESS_VALUE is automatically adjusted, in order to match the real value of the pressure applied in input, in the high part of the working range. The following sequence of operations is required:

1. Apply a reference pressure in input using a reference pressure generator.
2. Select the desired unit for representing the measure produced by the transmitter writing the right unit code in the TPB_CAL_UNIT. → **Only Pressure Unit Code is allowed**
3. Read the reference value produced by the transmitter from the TPB_PROCESS_VALUE.
4. If this value doesn't match the pressure applied in input, write the right known applied pressure value in the TPB_CAL_POINT_HI and write it in the transmitter. This writing executes an internal algorithm that produces the new correction coefficients.
5. Read again the TPB_PROCESS_VALUE and check if its value has been adjusted for matching the applied pressure.

9.4 - Reset to Factory Sensor Trimming

This operation can be executed only using the remote configuration tool. With this operation the all the parameters involved in the trimming operations are updated with the original values recorded during the final calibration performed in the factory.

This operation is executed selecting the dedicated item "Reset to Factory Sensor Trimming Value" in the RB_RESTART, see the Resource Block.

9.5 - Static Pressure Trimming

This operation can be executed only using the remote configuration tool. With this operation the TPB_TERTIARY_VALUE (Static Pressure) is automatically adjusted, in order to match the known value of Static Pressure applied at the transducer. The following sequence of operations is required:

1. Read the Static Pressure value from the TPB_TERTIARY_VALUE
2. If this value doesn't match the known Static pressure applied in input at the transducer, write the right value in the TPB_STATIC_PRESS_TRIM and write it to the transmitter. This writing executes an internal algorithm that produces the new correction coefficients.
3. Read again the TPB_TERTIARY_VALUE and check if its value has been adjusted for matching the real Static Pressure value.

10. - Commissioning

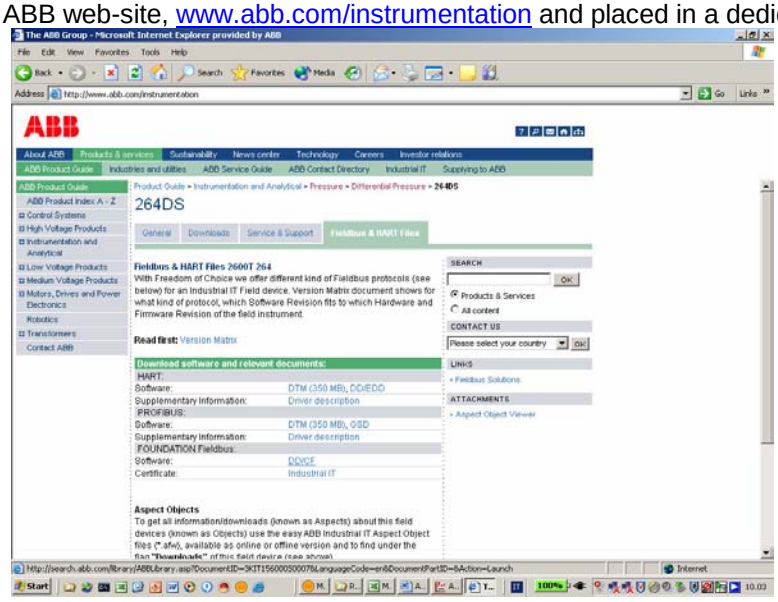
In order to make working the 264 rev.2 with any FF host it is necessary perform some operations as described in the following sections.
The description below is based on the 264 Rev.2 connected to an ABB System but a similar approach is in general valid also for other non ABB hosts. A summary of the required operations is:

- **Off Line Configuration**
  - Importing of the FF device drivers DD&CFF in the host
  - Design of the FF H1 network
  - Design of the FBAP
- **ON Line Configuration**
  - Assignment of the FF device
  - Downloading of the FBAP to the H1 network and devices
  - Device and/or Blocks Configuration

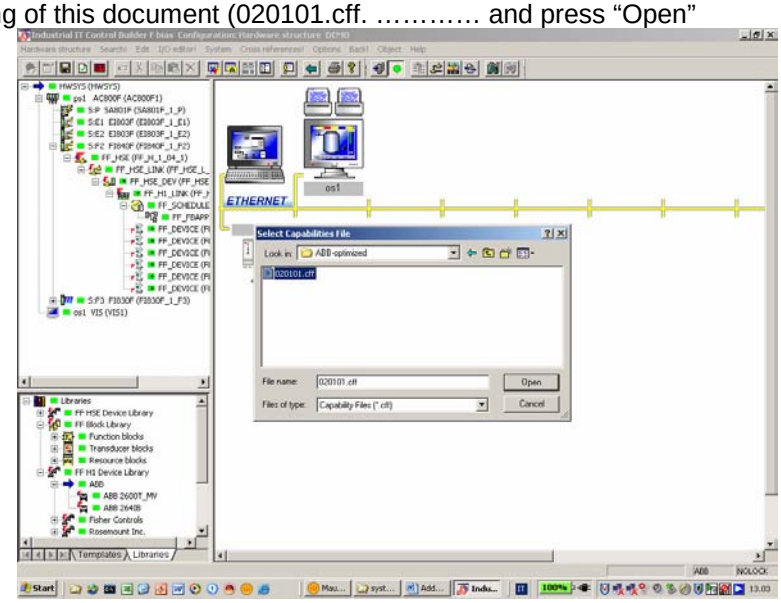
☞ **The first part of the operations is executed in OFF-Line. OFF line means that is not necessary has the real device connected on the FF H1 network to the host.**

10.1 Importing of the FF device drivers DD&CFF in the host

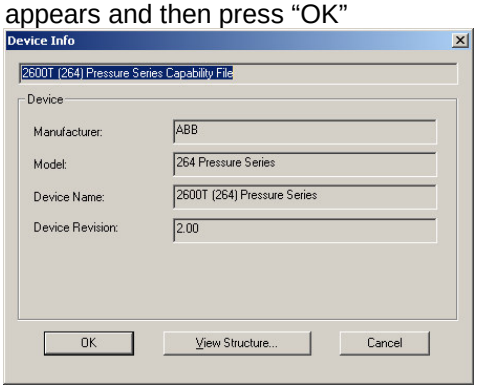
10.1.1 The DD&CFF drivers of the 264 Rev.2 FOUNDATION™ Fieldbus have to be previously downloaded from the ABB web-site, www.abb.com/instrumentation and placed in a dedicate directory



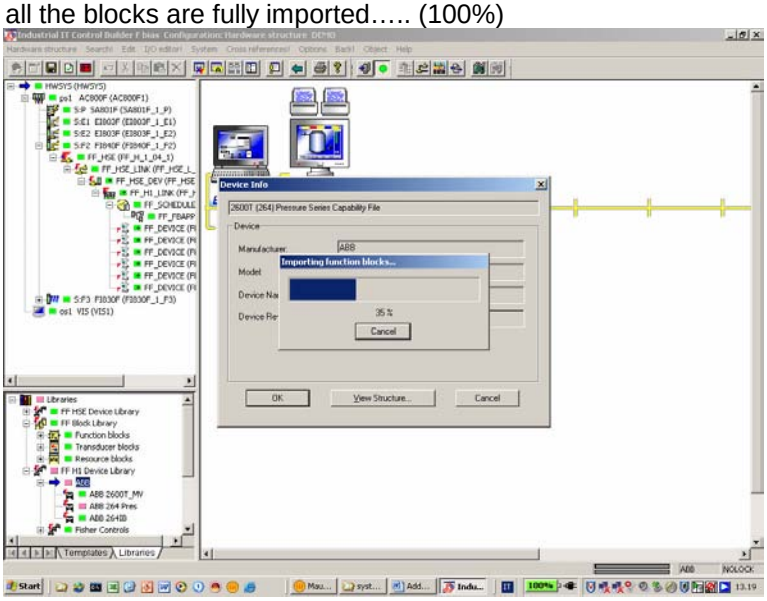
10.1.2 Then select the correct Capability File (CFF) from this directory, refer to the “Important Note” in the beginning of this document (020101.cff. …… and press “Open”



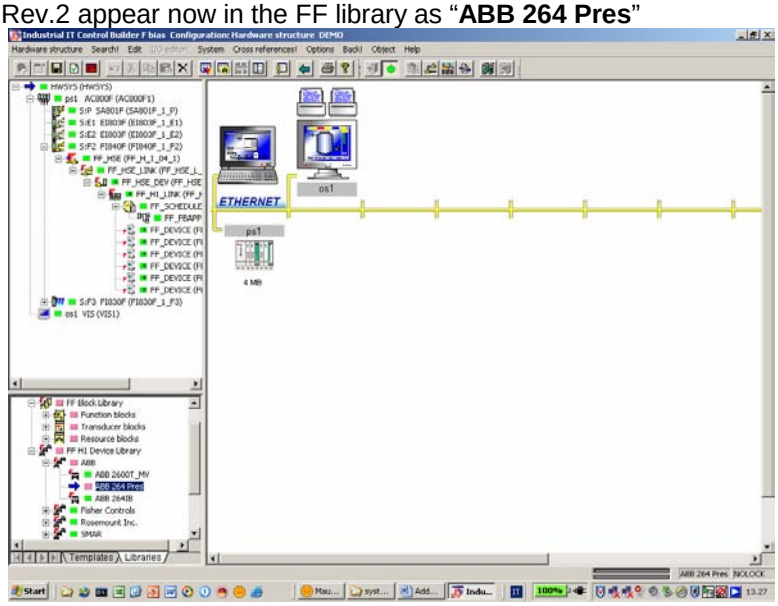
10.1.3 The “Device Info” box appears and then press “OK”



10.1.4 The “Importing Function blocks….” get start.
Wait until all the blocks are fully imported….. (100%)

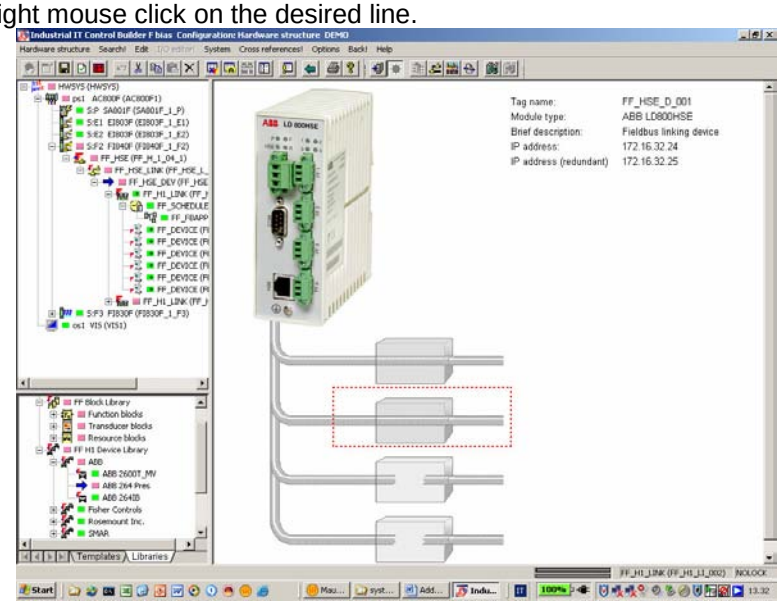


10.1.5 The 264 Rev.2 appear now in the FF library as “**ABB 264 Pres**”

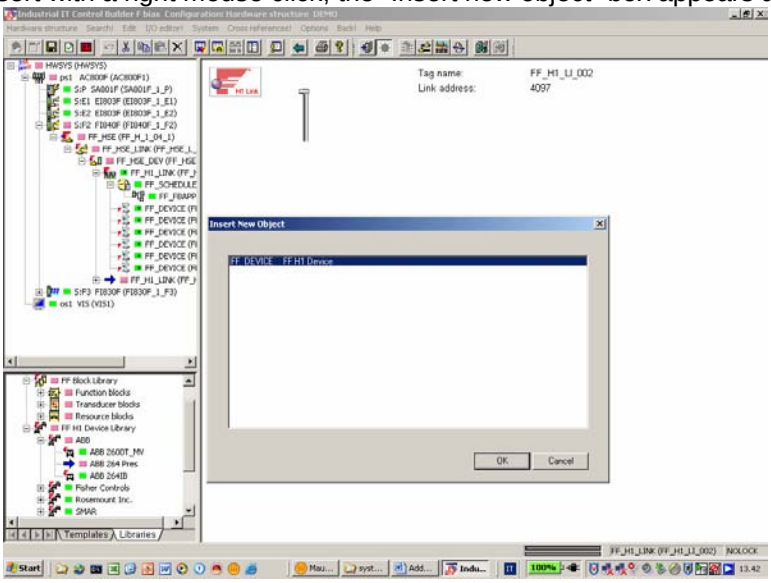


10.2 Design of the FF H1 network

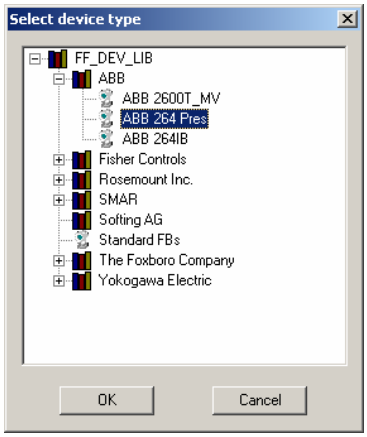
10.2.1 Select one of the four (4) FF H1 segments supported by the ABB Linking Device LD800HSE with a double right mouse click on the desired line.



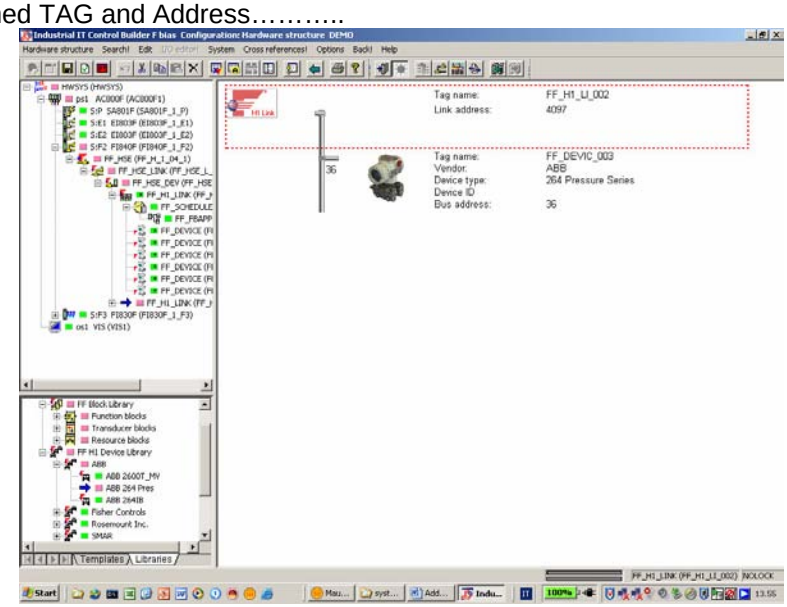
10.2.2 Select Insert with a right mouse click, the “Insert new object” box appears and press “OK”



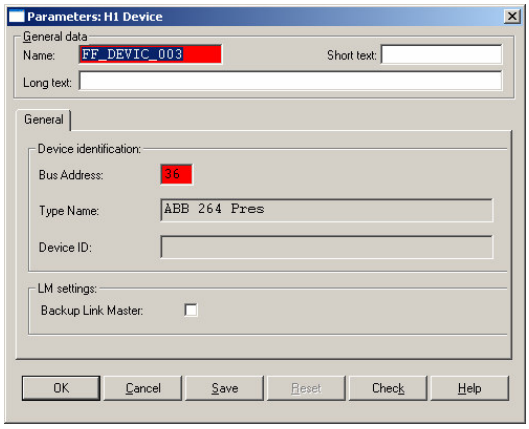
10.2.3 The “Select device type” box appears with a list of manufacturers and device types depending by the drivers imported in the host. Under ABB are available the drivers of the FF ABB devices



10.2.4 Select “ABB 264 Pres” and press OK. The 264 Rev.2 appears now in the H1 segment with predefined TAG and Address…….

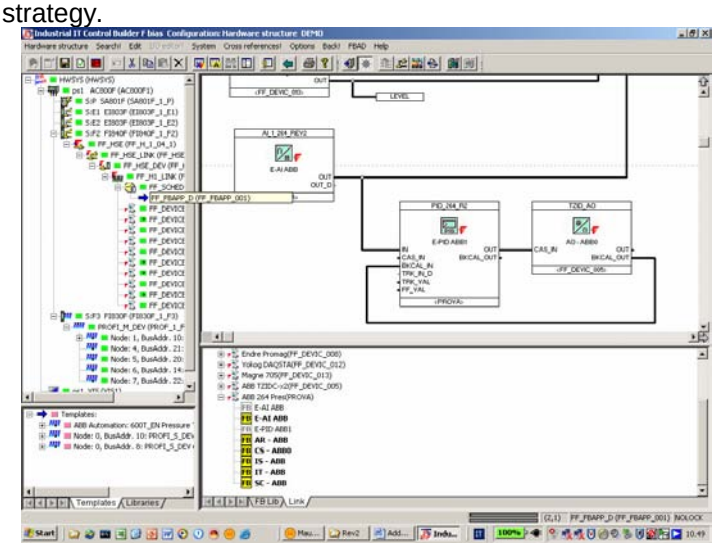


10.2.5 ……parameters that can be changed as desired opening the “Parameters” box of the device with a right mouse click. From this box is also possible select the Backup Link Master function (LAS) of the device.



10.3 Design of the Function Block Application (FBAP)

Select the FF Function Block Application section. In the lower part of the screen appears the list of the selected devices and their function blocks. The yellow colour of the blocks means that they are not yet used and thus available. With a drag and drop of the mouse on these blocks is possible translate them in the box above ready to be, renamed and linked with other blocks of the same or other devices in order to achieve the desired control strategy.

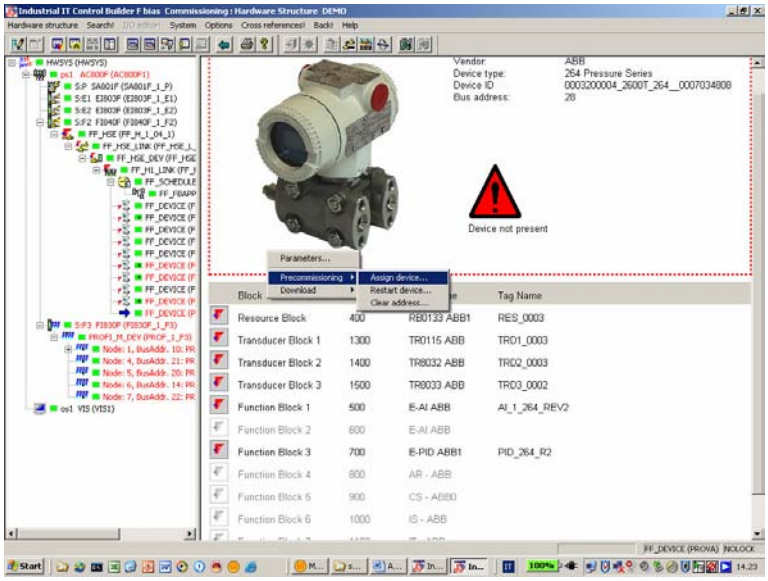


The second part of the operations is executed in ON-Line. ON line means that the real device has to be connected on the FF H1 network to the host.

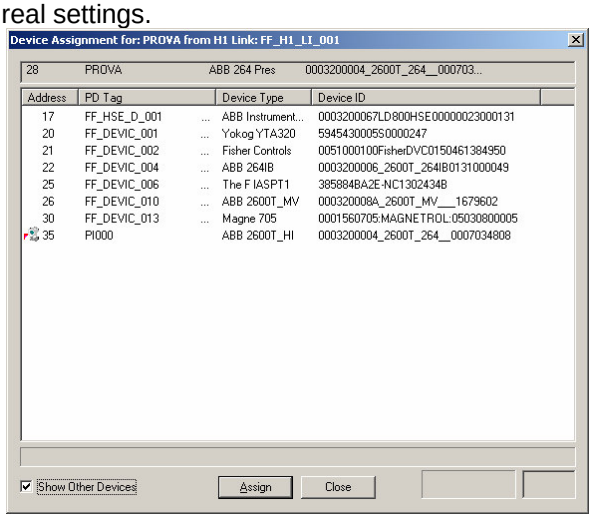
10.4 Assignment of the FF devices

10.4.1 Verify that the 264 Rev.2 appears in the “live List” of the Linking Device.

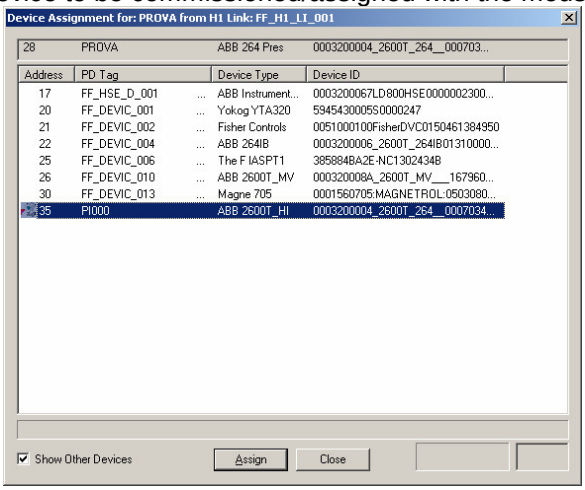
10.4.2 Then with the right mouse click select “Pre-commissioning” and then with the left mouse click select “Assign device”



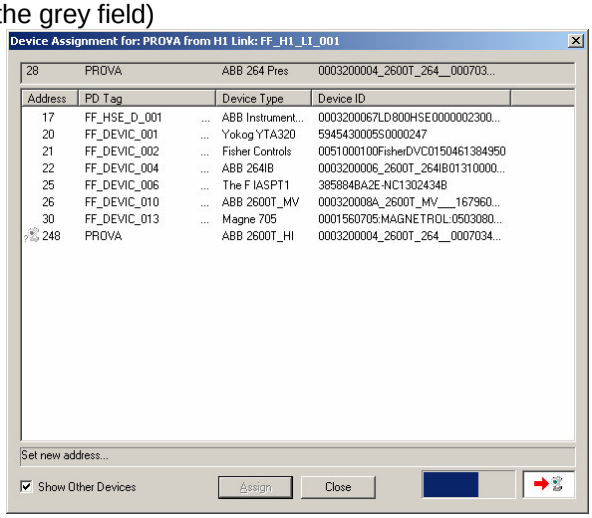
10.4.3 The current configuration of the device appears in the box “Device Assignment for: xxxxx” where, in the grey field is shown the configured/desired settings of the device to be commissioned in term of Address, TAG, Device Type and Device_ID, while in the white field are listed all the devices in the live list with their real settings.



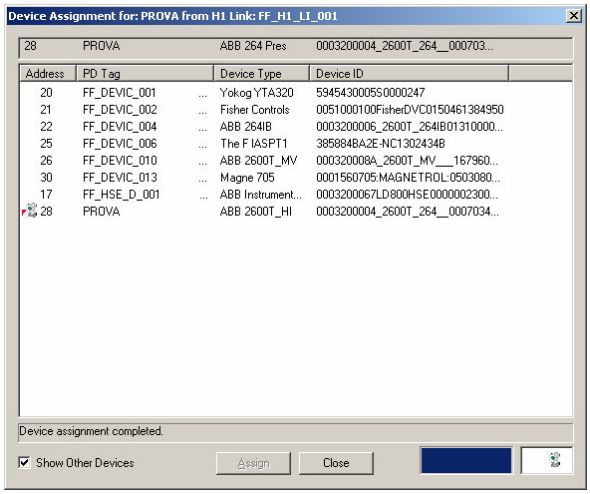
10.4.4 Select the new device to be commissioned/assigned with the mouse and press “Assign”



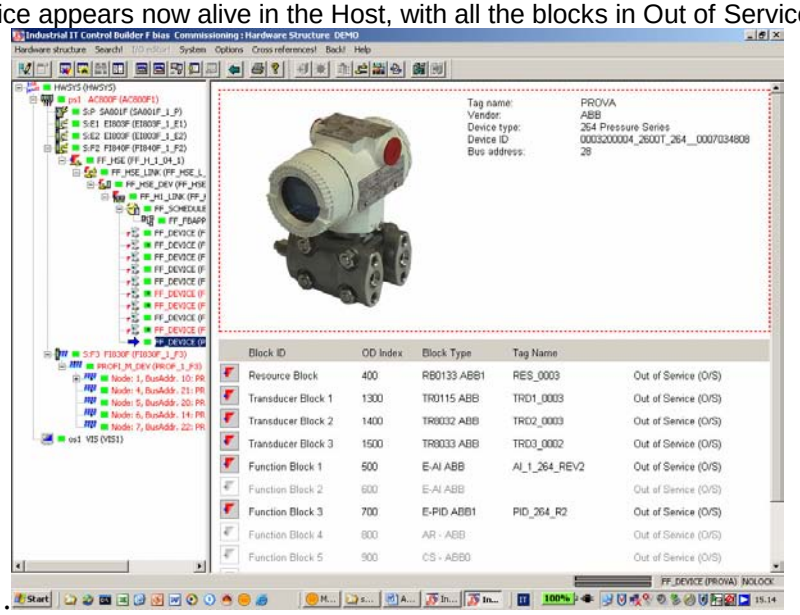
10.4.5 The Assignment get start changing the device Address, and TAG as decided in the configuration…. (What written in the grey field)



10.4.6 Until when the “Device Assignment Completed” appears in the grey filed of the low part of the message box and the Address and TAG of the device match what set in the configuration.

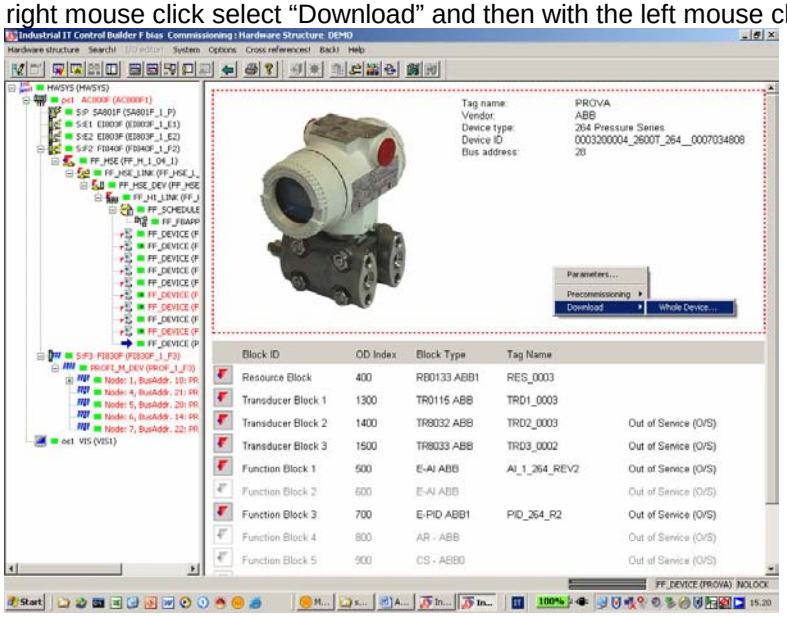


10.4.7 The device appears now alive in the Host, with all the blocks in Out of Service

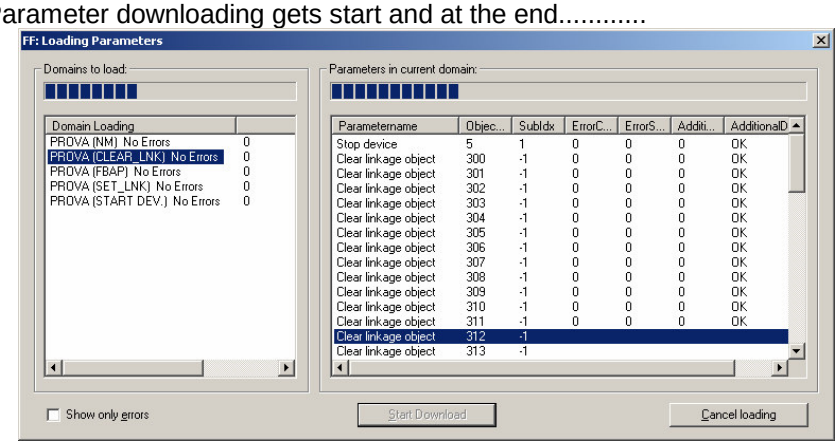


10.5 Downloading of the FBAP into the H1 network and devices

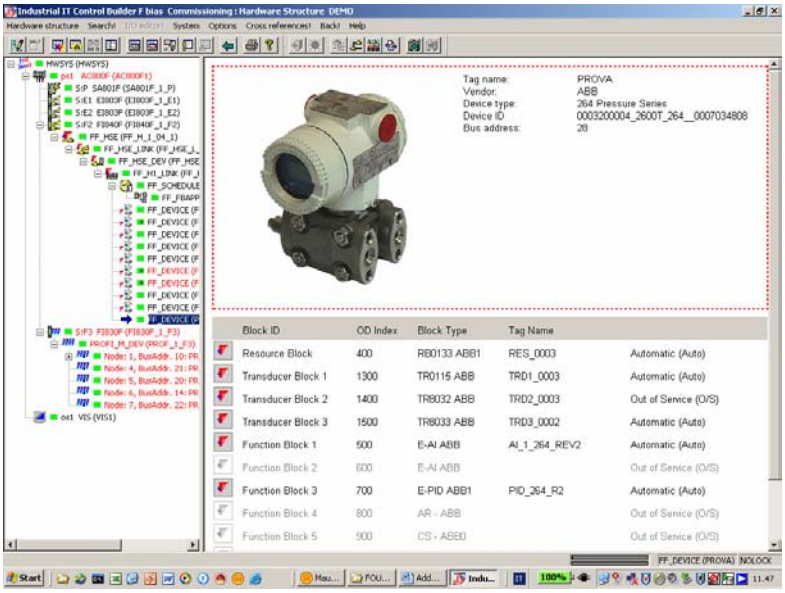
10.5.1 With the right mouse click select “Download” and then with the left mouse click “Whole device”



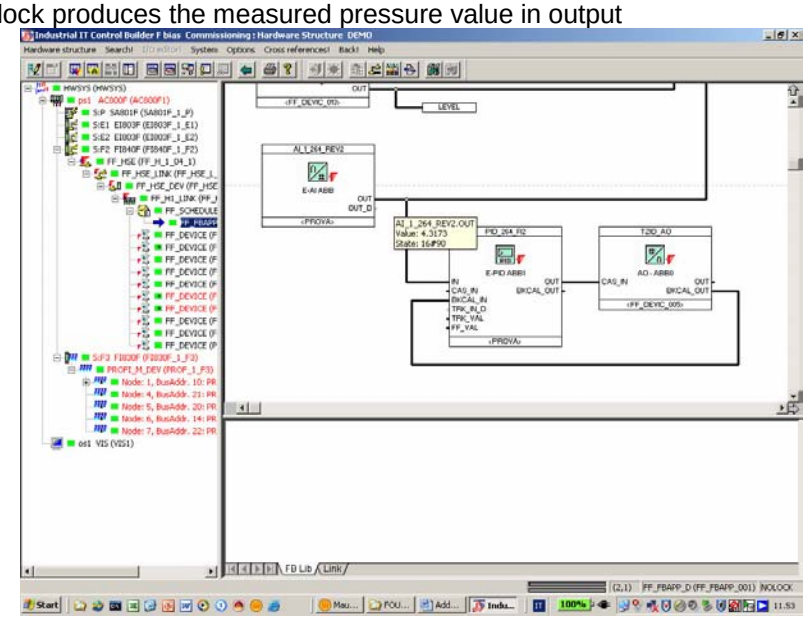
10.5.2 The “FF loading parameter” box appears, Press “Start Download”.
The Parameter downloading gets start and at the end.....



10.5.3 ……the transmitter's blocks used in the FBAP are moved in the AUTO or their Normal Mode.

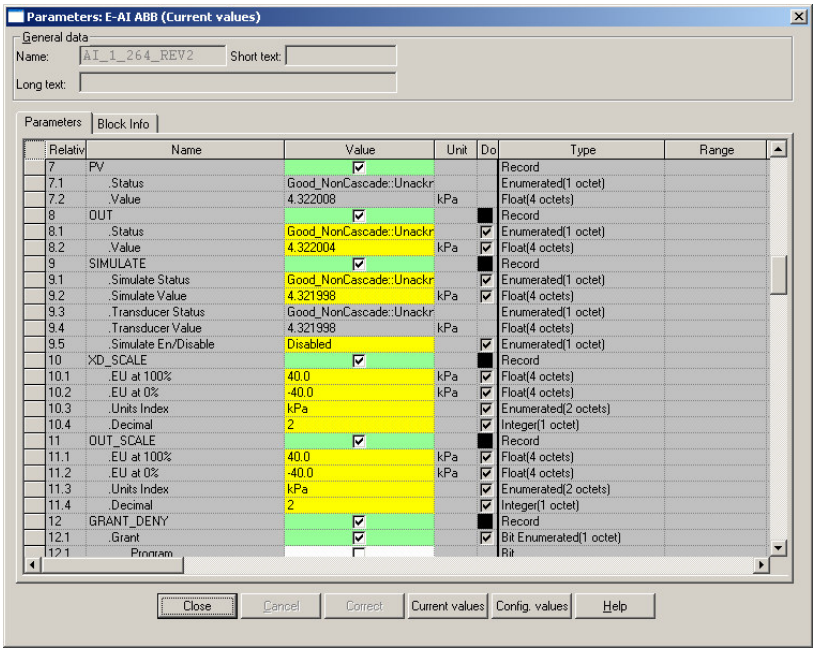


10.5.4 ……and the Function Blocks start to work normally. In the example below the 264 Rev.2 Analog Input block produces the measured pressure value in output

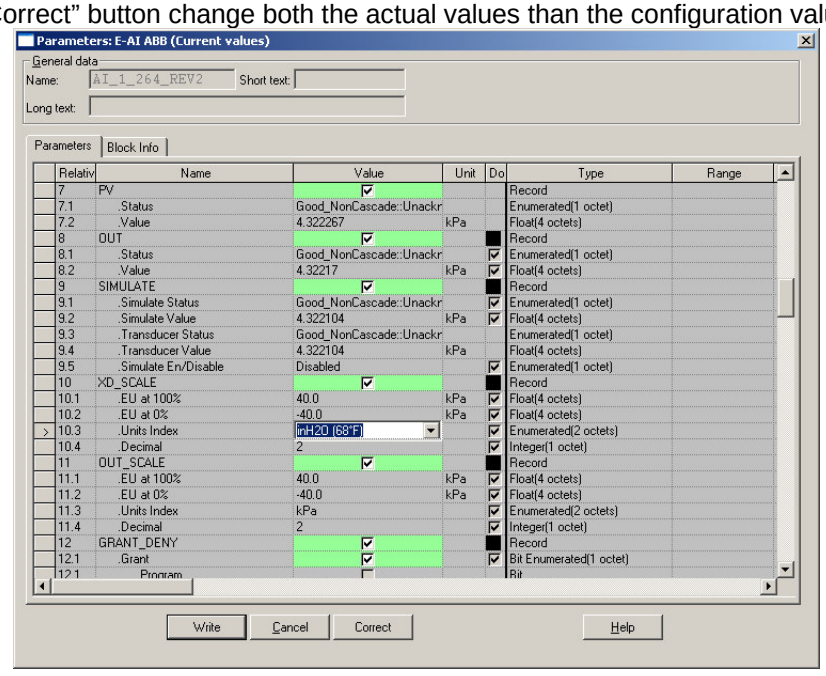


10.6 Device and/or Blocks configuration

10.6.1 Whenever the 264 Rev.2 is in this condition, it is then possible open any of the used blocks for read/write operations.
A double right mouse click, when the cursor is over the desired block, open it and the contained variables are read and shown.



10.6.2 Then variables in white or yellow fields can be changed and written in the device pressing the buttons “Write” or “Correct”.
The “Write” button change only the actual values
The “Correct” button change both the actual values than the configuration values



11. – Summary of the Device Specification Data

Manufacturer	ABB
Device Model	2600T Series Pressure Transmitter – Models 264xx FOUNDATION Fieldbus Revision 2
Device Type	Link Master Device
Measured Variable	Differential, Gauge, Absolute Pressure
Output Signal	Physical layer compliant to the standard IEC 1158-2
Communication speed	31.25 Kbit/second
Electrical Signal	Manchester Code II
Power supply	Bus Powered: 9 - 32 Volts limited to 24 Volts for Intrinsically Safety Entity model or limited to 17.5 for Intrinsically Safety FISCO model
Interface	FOUNDATION™ Fieldbus H1 Compliant with specification V 1.6
Bus Connection	NO Polarity sensitive
Blocks implemented	**Function Blocks:** 2 Enhanced Analog Input, 1 Enhanced PID, 1 stnd AR, 1stnd IS, 1 stnd CS, 1 stnd SC, 1 stnd IT **Other Blocks:** 1 Enhanced Resource Block, 1 Enhanced Pressure with Calibration Transducer Blocks, 1 Custom Display Block, 1 Custom Advanced Diagnostic Block with Pressure Plugging Tap algorithm (PILD)
FB Execution period	AI = 25mS PID = 40 mS AR, IT, IS, SC, CS = 25 mS
LAS functionality	Max = 1 sub-schedule, 96 sequences, 25 elements for sequence
Number of link objects	35
Number of VCRs	35
Quiescent Current	10.5 +/- 0.5 mA
Fault Current limiting	20 mA
FF Registration	IT019000
IS Certificate	ATEX, FM, FISCO See section 3.1 – Environmental protection
Max. Temperature	-40 / +85 °C
Remote Configuration tools	Via tools using DD & CFF Files

12. - Reference -

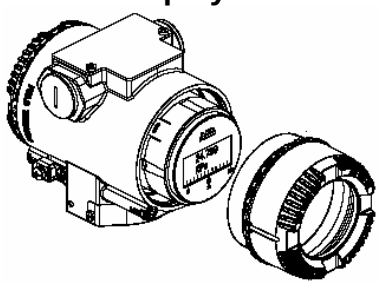
1- Function Block Application Process – Part 1. n° FF-890- Revision 1.6 dated October 8, 2003
2- Function Block Application Process – Part 2. n° FF-891- Revision 1.6 dated October 8, 2003
3- Function Block Application Process – Part 3. n° FF-892- Revision 1.6 dated October 8, 2003
4- Transducer Block Application Process PART 2 n° FF-903 Revision PS 3.0 dated April 21,1998

APPENDIX A

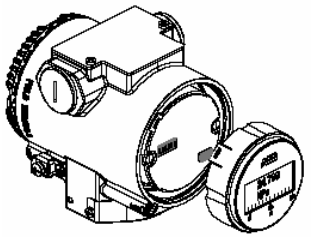
2600T-264 FF Electronics Replacement

☞ **The following steps are necessary for the 264 FF electronics replacement:**

1- Remove the cover of the electronics/display side

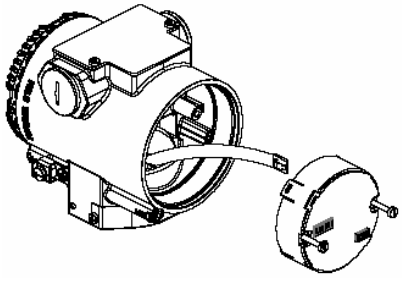


2- Remove the display….. if installed (be carefully with the plastic clips)

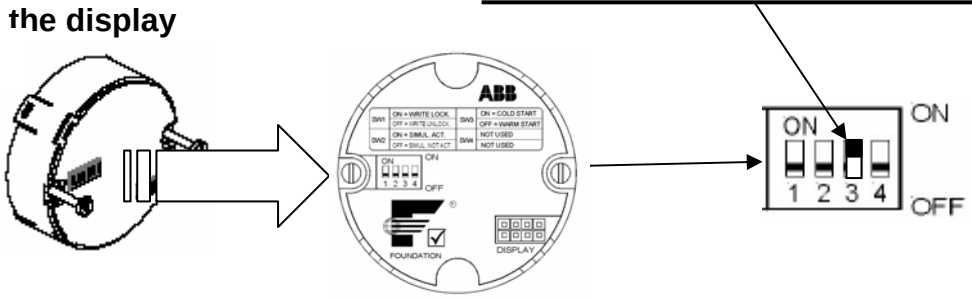


3- Remove the 2 screws of the electronics

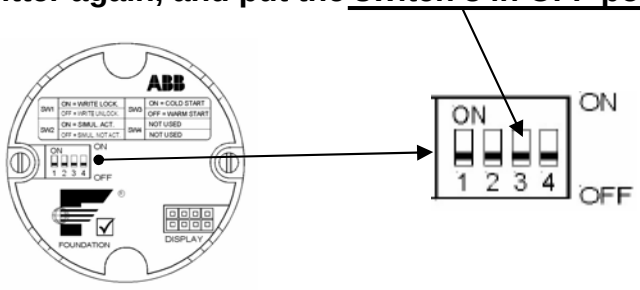
4- Extract the electronics from the housing, (be carefully with the sensor Flat cable connected to the unit), and disconnect the flat cable.



5- Take the new electronics and put the switch 3 (cold Start-up) in ON position…. Do not connect the display



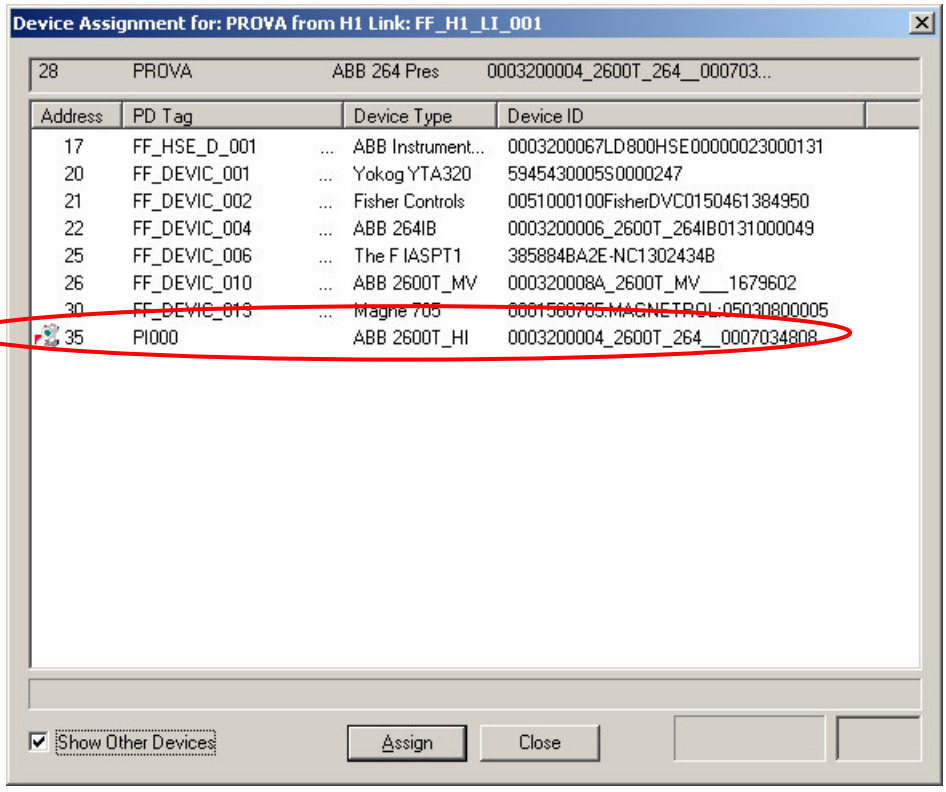
6- **Connect the sensor flat cable to the new electronics and insert it into the housing (be careful with the two in-housing jack connectors)**
7- **Power on the transmitter and keep it powered-on for few seconds (about 10 seconds are enough).**
8- **Power-Off the transmitter again, and put the switch 3 in OFF position**



9- **Fix the electronics with the two screws**
10- **Insert the display, (be carefully with the 8 pins connector). Maybe removing again the electronics from the housing make easier the connection of the display**
11- **Mount the display cover again.**

The operation is completed and the device will be set with default configuration:

PD_TAG = PI000
ADDRESS = 35



The target Mode for all the Blocks is Out Of Service and the 264 must be commissioned again following the procedure described in the section 10

IM/264FF_V2 Rev.1

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Printed in Italy (04.07)

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