

FI302

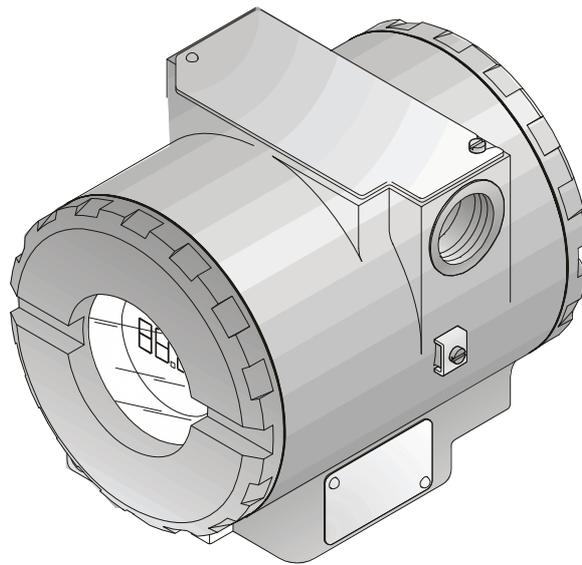
smar
First in Fieldbus

MAR / 10
FI302
VERSION 3



OPERATION & MAINTENANCE
INSTRUCTIONS MANUAL

Triple Channel Fieldbus to Current Converter



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INTRODUCTION

The FI302 is part of Smar's first generation of FOUNDATION FIELDBUS field equipment. It is a converter intended to connect Foundation Fieldbus systems with actuators and positioners for 4 -20 mA control valves. The FI302 produces a 4 -20 mA output proportional to the input received by the Fieldbus network. Its digital technology enables an easy interface between the field and the control room, while offering several types of transference functions and interesting features that reduce installation, operation and maintenance costs.

Foundation Fieldbus is a digital communication system that enables distributing control functions for field equipment and advantageously replaces conventional technology.

Other protocols only disclose maintenance data, as they were not devised for control data. The main Fieldbus goal was to overcome this situation. Closed loop control with a 4 -20 mA performance requires high speed, which means higher power consumption – a feature that is not compatible with intrinsic safety. This fact led to the use of a moderately high communication speed and to devise a system with a minimum communication capability. Using scheduling synchronization, the system controls variable sampling, algorithm execution and communication. The network treatment is optimized and high circuit loop performance is achieved.

Using Foundation Fieldbus Technology with its capability to interconnect several devices, very large projects can be constructed. The function block concept allows the user to easily construct the programming and overview complex control strategies (Smar CD600 users are familiar with this concept, since it was implemented a few years ago). Another advantage is flexibility, as the control strategy may be edited without having to rewire or change any hardware.

The FI302 and the Smar Foundation Fieldbus family have function blocks that avoid the need for separate equipment and facilitate implementing the control strategy. Among these function blocks, the following may be enhanced: PID controller, Input Selector, Arithmetic, Signal Characterizer and Integrator. These built-in blocks improve control, reduce communication, dead-time and costs.

Any Foundation Fieldbus equipment with Master Backup capability may work as a network master and be locally configured using a magnetic screwdriver in several situations. This tool eliminates the need for a configurator in many basic applications.

Read carefully these instructions to get the best result from the FI302.

CAUTION

This manual is compatible with version 3XX. The 3 indicates the software version and the XX indicates the release. The 3XX sign means that this manual is compatible with any release of software version-3

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

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Fieldbus Current Converter Transducer Block – Parameter Description

Description of Parameter Description

Index	Parameter	Manual Section	Valid Range	Default/ Init Value	Unit	Description
1	ST_REV		Positive	0	None	Indicates the level of static data.
2	TAG_DESC			Null	Na	Description of Transducer Block.
3	STRATEGY			0	None	This parameter is not checked and processed by Transducer Block.
4	ALERT_KEY		1 to 255	0	v	Number of identification in the plant.
5	MODE_BLK	3		AUTO	None	Indicates the operation mode of Transducer Block.
6	BLOCK_ERR	5			E	Indicates the status associated with hardware or software in the Transducer.
7	UPDATE_EVT				Na	It is the alert for any static data.
8	BLOCK_ALM				Na	It is used for configuration, hardware and other failures.
9	TRANSDUCER_DIRECTORY			0	None	It is used to select several Transducer Blocks.
10	TRANSDUCER_TYPE			65535	None	Indicates the type of Transducer according to its class.
11	XD_ERROR	5		16	None	It is used to indicate calibration status.
12	COLLECTION_DIRECTORY				None	Specifies the number of transducer index into Transducer Block.
13	FINAL_VALUE	5		0	FVR	It is the current value and status that comes from AO block.
14	FINAL_VALUE_RANGE			4.0 to 20.0 mA	FVR	The High and Low range limit values, the engineering unit code and the number of digits to the right of the decimal point to be used for Final Value.
15	CAL_POINT_HI	4	12.5 to 20.5 mA	20.0	mA	The highest calibrated value.
16	CAL_POINT_LO	4	3.99 to 11.5 mA	4.0	mA	The lowest calibrated value.
17	CAL_MIN_SPAN			1.0	mA	The minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points (high and low) are not too close together.
18	CAL_UNIT			mA	mA	The Device Description engineering units code index for the calibration values.
19	ACT_SN		0 to 2 ³²	0	None	Indicates the actuator serial number.
20	CAL_METHOD			Factory	None	The method of last sensor calibration. ISO defines several standard methods of calibration. This parameter is intended to record that method, or if some other method was used.
21	CAL_LOC			NULL	None	The location of last sensor calibration. This describes the physical location at which the
22	CAL_DATE				None	The date of the last sensor calibration.
23	SENSOR_CAL_WHO			NULL	None	The name of person who is in charge of last calibration.
24	RETURN	5		0	mA	This is the current value that goes to the AO Block.
25	TERMINAL_NUMBER	3	1, 2, 3	0	None	Indicates the input terminal number (1, 2 and 3).
26	BACKUP_RESTORE	5		0	None	This parameter is used to do backup or to restore configuration data.
27	CHARACTERIZATION_TYPE	6		255	None	Indicates the type of characterization curve.

Index	Parameter	Manual Section	Valid Range	Default/ Init Value	Unit	Description
28	CURVE_BYPASS	6	True/False	False	None	Enable and disable the characterization curve.
29	CURVE_LENGTH	6	2 a 8	8	None	Indicates the length of characterization curve.
30	CURVE_X	6		%	%	Input points of characterization curve.
31	CURVE_Y	6		%	%	Output points of characterization curve.
32	FEEDBACK_CAL	4		0	mA	The measured current value used by the calibration method.
33	CAL_CONTROL	4	En/Dis	Disable	None	Enable and disable for calibration process.
34	CAL_POINT_HI_BACKUP			20.0	mA	Indicates the backup for high calibration point.
35	CAL_POINT_LO_BACKUP			4.0	mA	Indicates the last high calibration point.
35	CAL_POINT_HI_FACTORY			20.0	mA	Indicates the last low calibration point.
37	CAL_POINT_LO_FACTORY			4.0	mA	Indicates the low factory calibration point.
38	ORDERING_CODE				None	Indicates information about factory production.

CAPTION

- **AUTO** - Automatic
- **FACTORY** - Standard of factory
- **NULL** - No standard value
- **NONE** - No unit or no value
- **Na** - Non-dimensional parameter
- **E** - Parameter list
- **FVR** - Final_Value_Range,
- **True/False** - Accepts true/false values
- **En/Dis** - Enables/Disables parameter

Display Block Parameters

Index	Parameter	Manual Section	Range/Options	Description
7	BLOCK_TAG_PARAM	3		This is a tag of the block to which the parameter belongs to use up to a maximum of 32 characters.
8	INDEX_RELATIVE	3	0 a 65535	This is the index related to the parameter to be actuated or viewed (1, 2...).
9	SUB_INDEX	6	1 a 255	To visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one.
10	MNEMONIC	6		This is the mnemonic for the parameter identification (maximum of 16 characters). Choose the mnemonic, preferably with no more than 5 characters because, this way, it will not necessary to rotate it on display.
11	INC_DEC	6		It is the increment and decrement in decimal units when the parameter is Float or Float Status time, or integer, when the parameter is in whole units.
12	DECIMAL_POINT_NUMBER	6	0 a 4	This is the number of digits after the decimal point (0 to 3 decimal digits)
13	ACCESS	6	Monit/ Action	The access allows the user to read, in the case of the "Monitoring" option, and to write when "action" option is selected, and then the display will show the increment and decrement arrows.
14	ALPHA_NUM		Mnem/ Value	These parameters include two options: value and mnemonic. In option value it is possible to display data both in the alphanumeric and in the numeric fields, this way, in the case of a data higher than 10000, it will be shown in the alphanumeric field.
63	DISPLAY_REFLESH	3	True/ False	It allows updating the local adjustment tree.

CAPTION

- Monit – Monitoring
- Mnem – Mnemonic

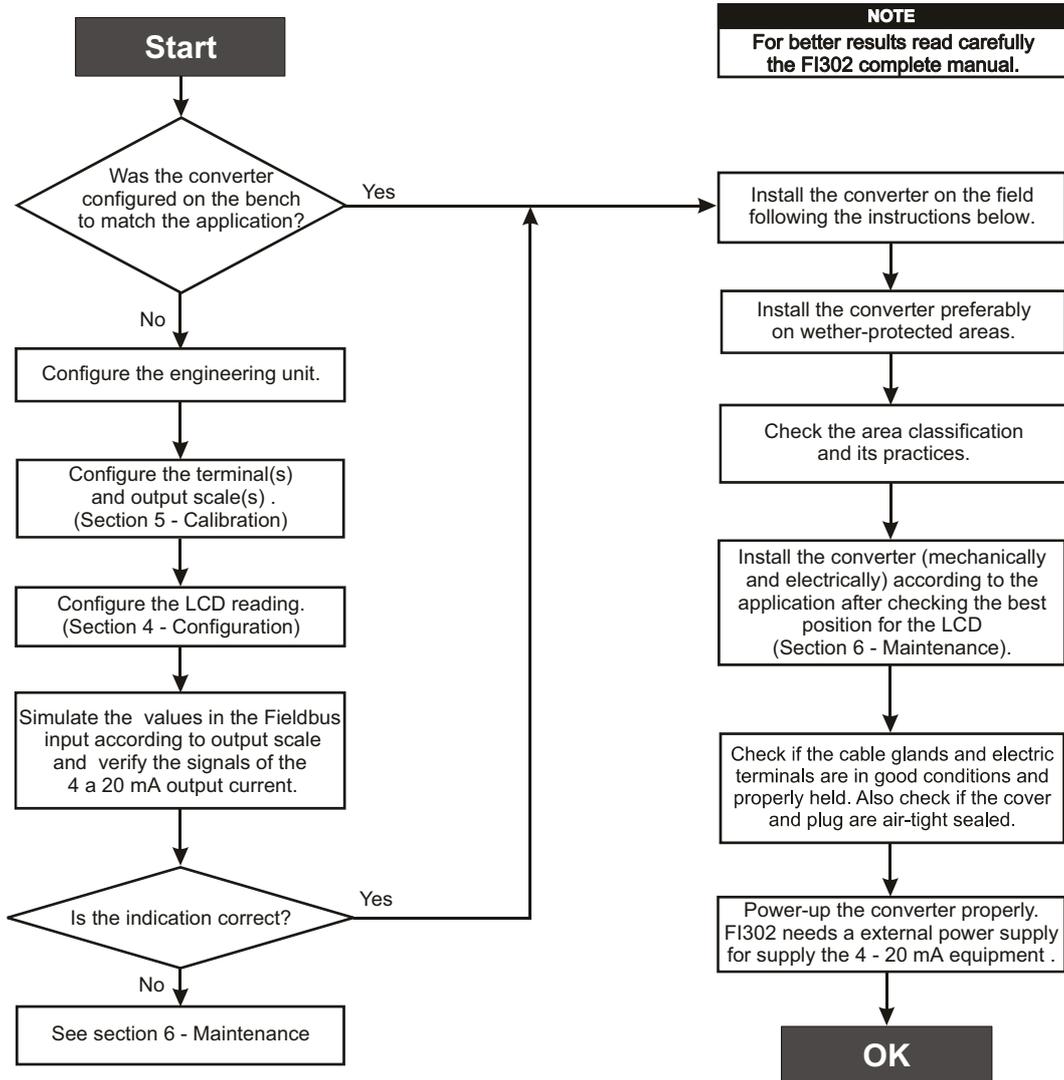
Diagnostic Block Parameters

Index	Parameter	Manual Section	Valid Range	Default/ Init Value	Unit	Description
1	ST_REV			0	Null	-
2	TAG_DESC			Spaces	Na	-
3	STRATEGY			0	Null	-
4	ALERT_KEY		1 a 255	0	Null	-
5	MODE_BLK			O/S	Na	See Mode Parameter.
6	BLOCK_ERR	5			E	
7	EXE_TIME_TAG	5		Spaces	Na	Block tag of the selected block to measure the execution time.
8	MIN_EXE_TIME	5		+INF	ms	Minimum execution time of the selected block.
9	CUR_EXE_TIME	5		0	ms	Current execution time of the selected block.
10	MAX_EXE_TIME			0	ms	Maximum execution time of the selected block.
11	HW_REV	5				Hardware revision.
12	FIRMWARE_REV	5				Firmware revision.
13	DEV_SN	5				Device serial number.
14	MAIN_BOARD_SN					Main board serial number.
15	BEHAVIOR	5	0 - Adapted 1 - Spec	0	E	Select the initial values for parameters, there are two options Adapted and Spec.
16	PUB_SUB_STATUS		0 - bom 1 - ruim		E	Indicate if all external links is good or if at least one is bad.
17	LINK_SELECTION		0 - First 1 - Next 2 - Previous	0	E	Select an external link.
18	LINK_NUMBER					Number of the external link selected.
19	LINK_STATUS					Status of the external link selected (see table below)
20	LINK_RECOVER		0 - No Action 1 - Action	No Action	E	Command a recovery process to the external link selected.
21	BLOCK_ALM				Na	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 subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	SAVING_CONFIG		0 - No save 1 - save	0	E	It indicates if the device is saving the configuration in a non-volatile memory.

CAPTION

- **NULL** - Has no standard value
- **Na** - Non-dimensional parameter
- **E** - Parameter list.
- **ms** - Milisecond

Installation Flowsheet



Section 1

INSTALLATION

General

The converter has a top level performance and for best benefit see that it is adequately installed.

Many factors may affect the converter accuracy, among which environment conditions are the most difficult to control. In order to reduce the effects from temperature, humidity and vibration, install the converter in less aggressive places.

The effects from temperature variation may be minimized by assembling the converter in areas protected from weather changes. If necessary, use thermal insulation against external heat sources.

Humidity is harmful to the electric circuits. In areas with high relative humidity levels, the correct placing of the housing cover o-ring must be assured and hand-tight shut to press the o-ring. The housing cover should not be removed on the field so that its threads are not damaged, as they are not protected by painting.

A flexible sealing material should be applied on the electric connections to avoid humidity. See details on how to connect the FI 302 to Fieldbus.

Mounting

The display may be rotated at 90° to 90° angles for easier visualization. See figure 6.2 on section 6 – Maintenance. To access the display, unlock the locking screw on the display cover by rotating it clockwise. See figure 1.1 to locate the locking screw.

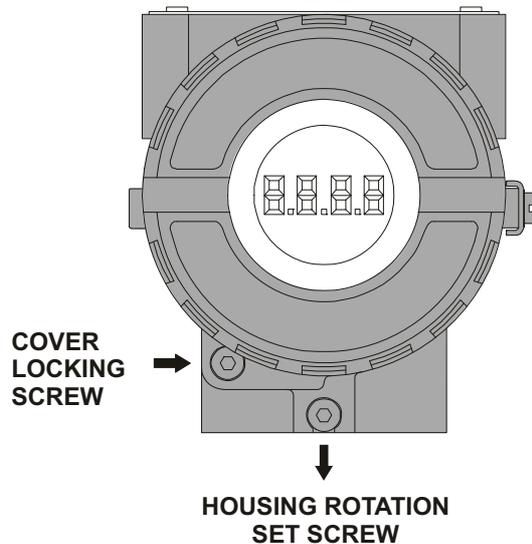


Figure 1.1 - Display lid locking screw

The mounting bracket makes it easier to adjust the converter in several positions, as shown on Figure 1.2 – Mounting Positions and Dimensional Drawing

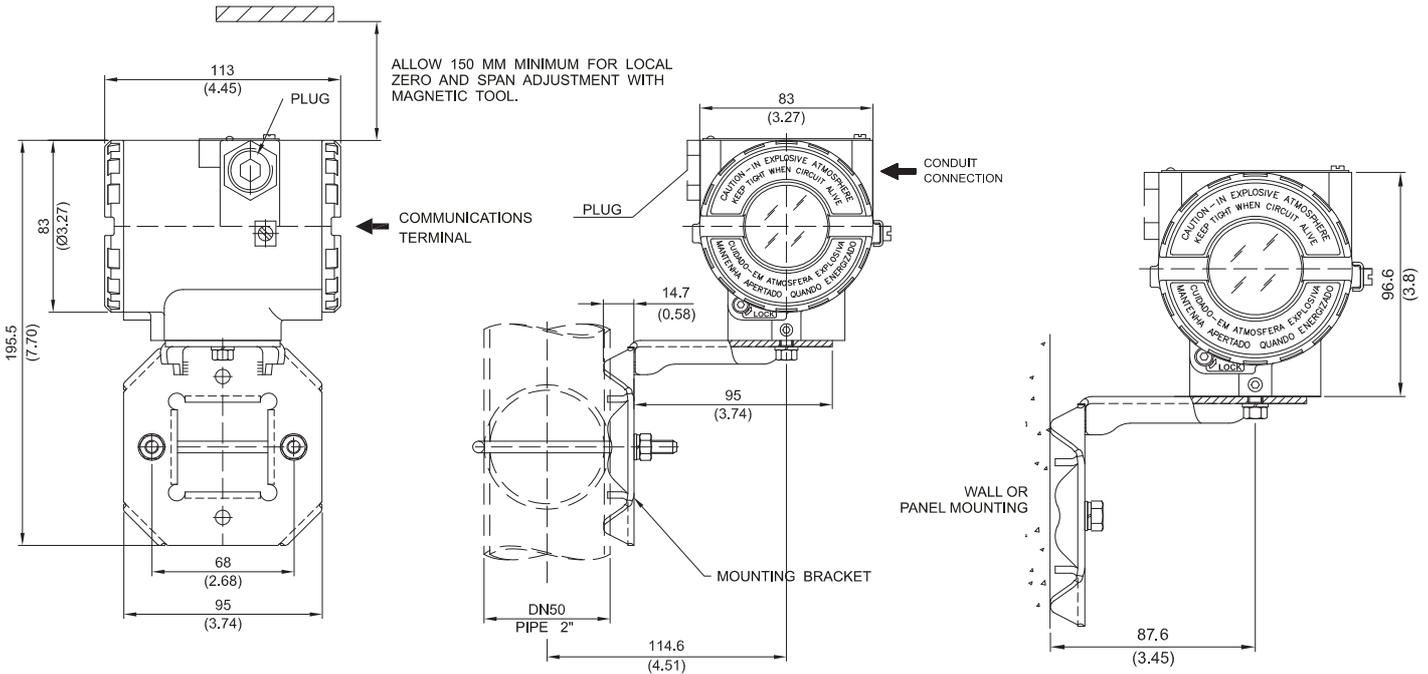


Figure 1.2 = Mounting Positions and Dimensional Drawing.

Electric Connection

Output Connection

To access the terminal block, loosen the cover locking screw to release it. Rotate the cover anti-clockwise and remove it (See Figure 1.3).

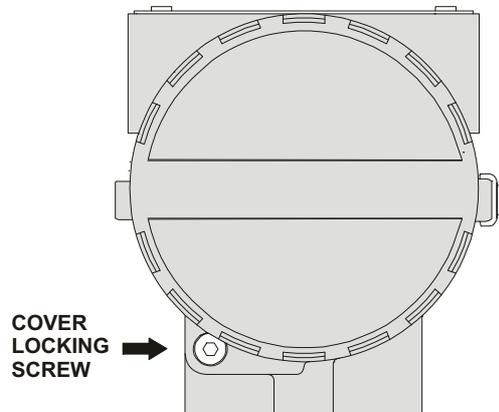


Figure 1.3 – Terminal Block Cover Locking Screw

The housing has two threaded openings where to insert the signal cables of the connection terminal block. The threads allow connecting the wiring conduit or the cable clamp.

For more convenience, there are three ground terminals: one internal and two externals close to the terminal block.

Figure 1.4 shows the three terminals of the converter current output channels, which are marked with numbers 1, 2 and 3. Terminal 4 is the power supply ground common to the loop controlled by the channels. The converter external power supply must be connected to the terminals marked by (+) and (-).

The current output is limited by the power supply voltage on the current loop and by the conditions of the classified area. Refer to the load curve to determine the maximum equipment quantity allowed for the bus.

If power fails, the output will be uncertain and if communication lacks, the output will move to a fixed pre-configured value or to a safety default value.

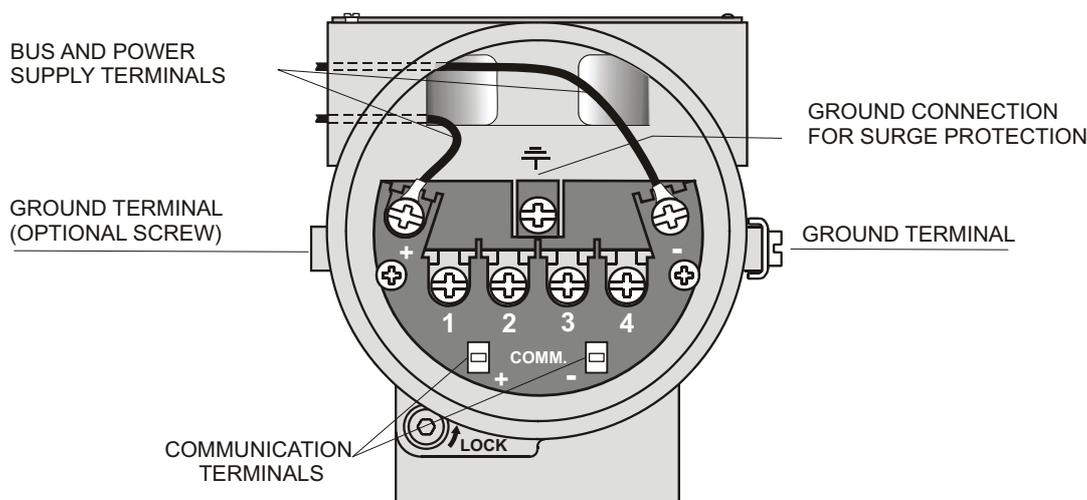


Figure 1.4 – Terminal Block

Connecting the FI302 to the bus

The FI302 may be connected to or removed from a fieldbus network in operation. Take due precaution with this operation and prevent signal cables from touching the shielding, the ground cables or one another. Insert the FI302 on the network with communication speed equal to its own (31,25 kbps), Foundation Fieldbus protocol.

Preparing the FI302 before connecting it to network

The FI302 may be configured on-line or off-line by a fieldbus device like the Smar SYSCON installed on a computer, for instance.

- Then, use the configuration device to attribute a tag to the converter, using the “Assign Tag” option on the menu.
- Download the configuration for the equipment or for the entire network.

NOTE

The Assign Tag may be applied on-line or off-line for specific equipment connected to a Fieldbus network with other equipments.

ATTENTION

To attribute a new Tag to the equipment, the system configuration must be changed. This may bring some inconveniences on the control configuration. For example, the addressees configured on the previous functional blocks and links are deactivated. Therefore, if the tags are modified, the entire configuration must be revised.

In hazardous areas, the number of equipments is limited by the intrinsic safety restrictions. Consult the documents related to the use of equipment for this area.

HAZARDOUS AREAS

In hazardous areas with explosion-proof requirements, the covers must be tightened with at least 8 turns. In order to avoid the penetration of moisture or corrosive gases, tighten the cover until feeling that the sealing ring touches the housing, and tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers with the locking screws.

In hazardous areas with intrinsically safe and explosion-proof equipments, follow the installation procedure and the circuit entity parameters.

The signal cables are accessed via the electric connections on the housing. The wiring conduit threads must be sealed according to the sealing method approved for the area. The standard plug supplied with the Smar converter is not Exd certified. For explosion-proof applications a certified plug should be used. Consult Smar on how to use a certified plug.

The unused electric connection must be sealed with a proper plug and sealing material. Apply flexible sealing (e.g. DC111, Molly-Graph) on the threads to avoid humidity from penetrating. See figure 1.7. Do not use the plastic plug as sealant. Its purpose was only to protect the electric connections during transportation.

The explosion-proof, non-incendive and intrinsic safety Mutual Factory certification is standard for the FI302.

Should other certifications be necessary, refer to the specific certification or standard for installation restrictions.

The FI302 is protected against reverse polarity and may support ± 35 VDC without causing any damage, but it will not work under these conditions. Although the FI302 cannot be affected by polarity, try and keep the polarity in all connections.

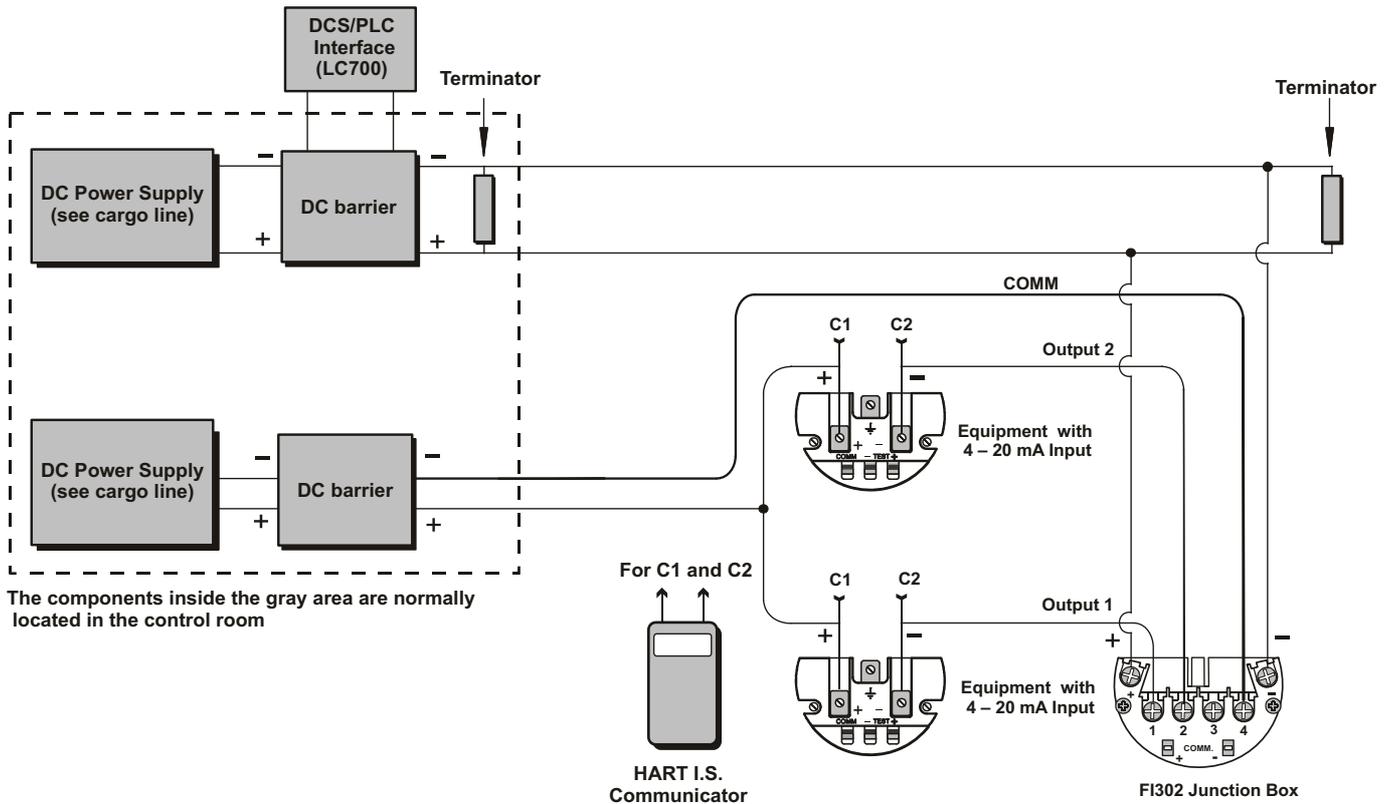


Figure 1.5 – FI302 Output connections for Classified Areas.

The FI302 connection for non-classified areas must follow the diagram on figure 1.6. The three available output channels may be used for that area.

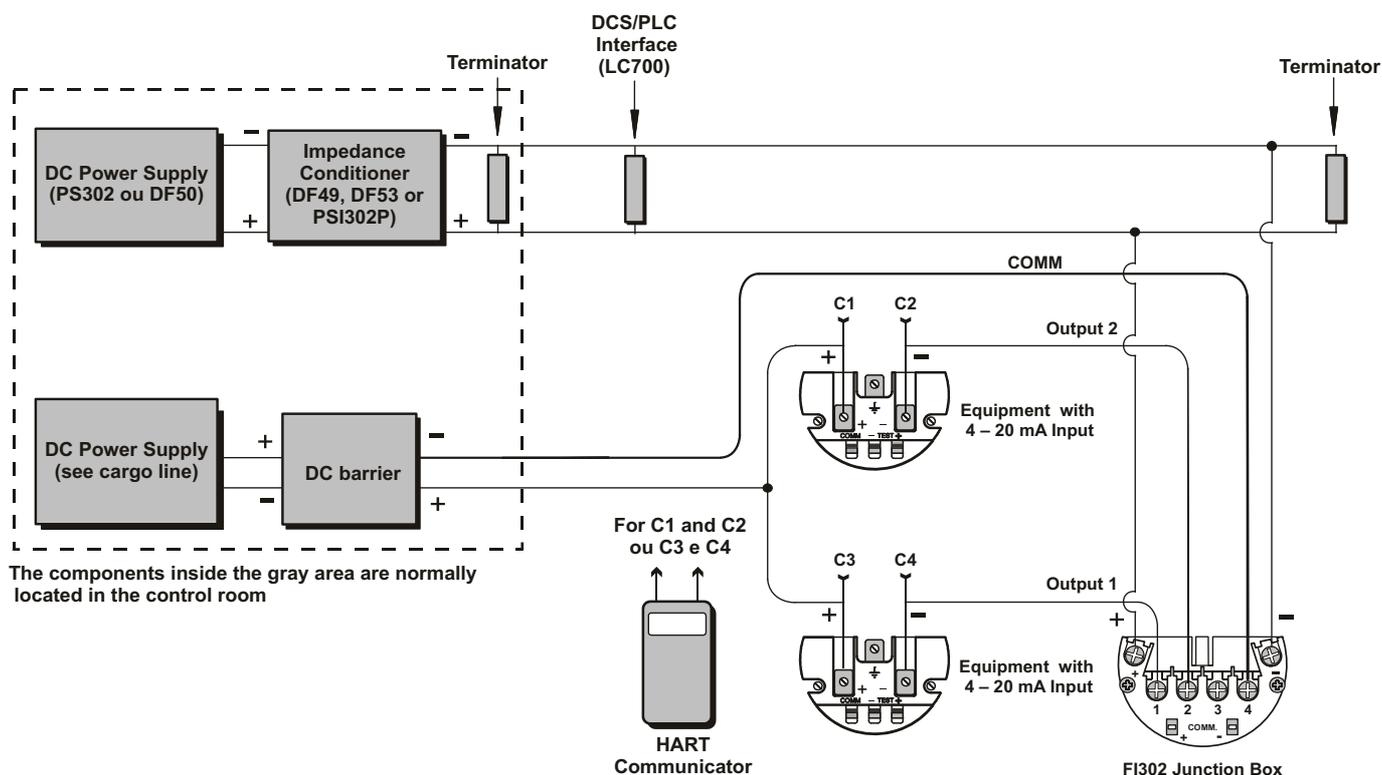


Figure 1.6 – FI302 Output Connections

Figure 1.7 shows a typical fieldbus network with equipments for different functions connected.

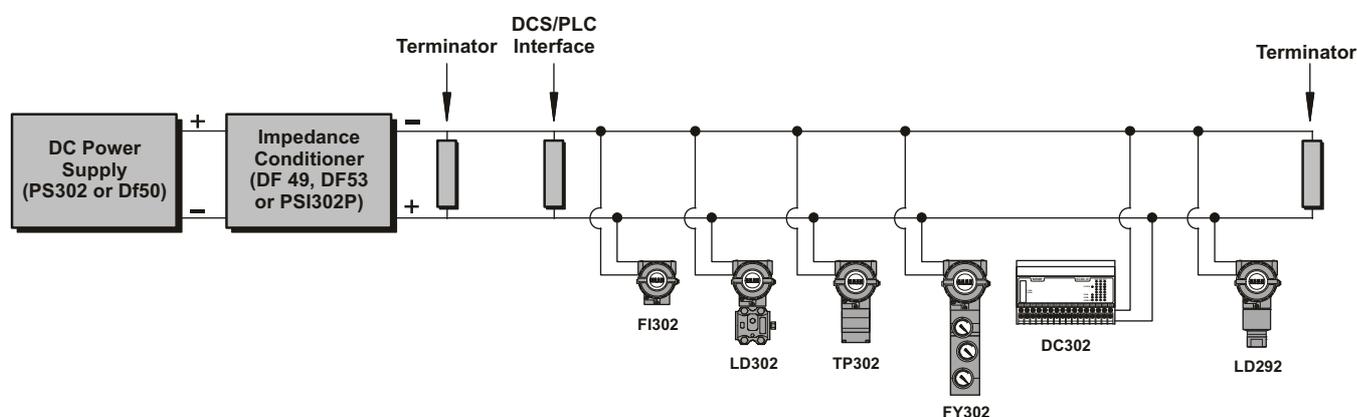


Figure 1.7 – Typical Fieldbus Equipment Network

Power Consumption

The FI302 converter must be properly powered as follows:

- * Minimum 9 V tension;
- * 12 mA Operating Current (I_q)

The power must be supplied regardless of the FI302 position. An independent source should be used to power the 4 – 20 mA equipments connected to the converter output.

Low current consumption equipments should be used for intrinsically safety applications. Choose low resistance cables to reduce voltage drops on the junction box and on each equipment.

Terminator

The terminators are impedances with the same values as the specific bus impedance to avoid signal reflection and, consequently their distortion or loss. Each bus segment must have only two terminators positioned on its ends. Some equipments, especially for power source, output/input, fieldbus test or PC simulation card, etc, include the option for an internal terminator connection. Before connecting a terminator to the bus, check if the equipment already has an internal terminator on one end, and install the other terminator.

Each terminator has a 100 Ohm impedance and the equivalent impedance of both will be 50 Ohm.

The terminator causes a 250- to-500 mV amplitude tension drop on the bus.

Smar has the terminator model BT302.

Cabling

The Foundation Fieldbus protocol works with several types of cable and the best they are, the longer the lengths and the greater the number of equipments to be connected to it. Table 1.1 shows the regular cable types used when installing Foundation Fieldbus equipments and their characteristics.

Pair	Shielding	Twisted	Size	Maximum Length	Type
Single	Yes	Yes	0,75 mm ²	1900 m	A
Multicables	yes	yes	0,32 mm ²	1200 m	B
Multicables	yes	no	0,13 mm ²	400 m	C
Multicables	no	yes	1,25 mm ²	200 m	D

Table 1.1 – Types of Cables.

NOTE

The length of **non-twisted** cables decreases regardless of their diameter and shielding (see D type data). It is recommended not to use these cables, but if you do, do not leave them too close to power cables or noisy equipments.

The Fieldbus Foundation recommends the “A” type cable. Table 1.2 shows its main characteristics for a bus project.

“A” TYPE CABLE	
Characteristic impedance on the 31,25 kHz frequency	100 Ohm ± 20%
Maximum attenuation on the 39 kHz frequency	3 dB/km
Maximum capacitance outbalance for shielding	2 nF/km
Maximum DC resistance per M conductor	22 Ohm/km
Maximum propagation delay change	1,7 us/km
Conductor transversal area	0,75 mm ²

Table 1.2 – “A Type” Cable Characteristics

Total Cable Length

The cable(s) total length vary (ries) according to its/their quality. The total length is the sum of the trunk and the spur lengths. As an example, use the diagram on figure 1.8 and the table 1.3 to determine the total length of a hypothetical bus.

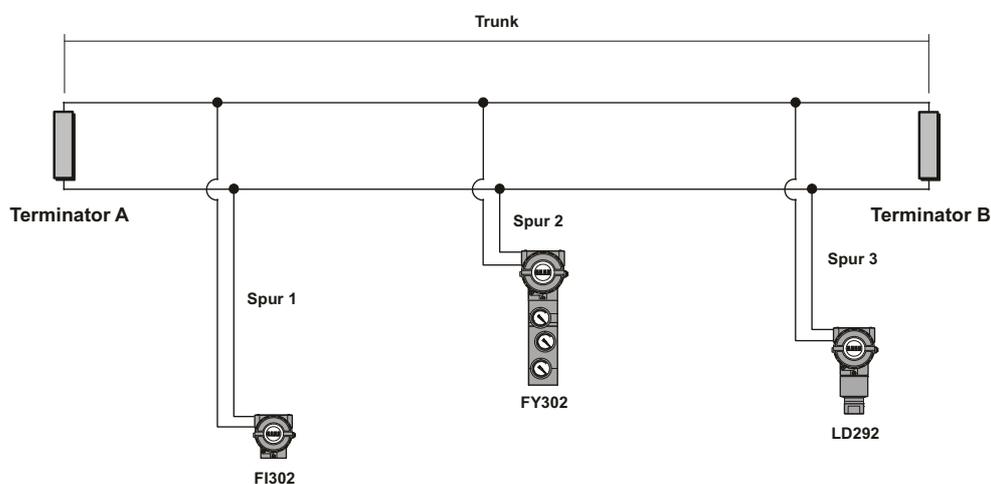


Figure 1.8 – Total Cable Length

Segment A, B	Length
Trunk	240 m
Spur 1	120 m
Spur 2	40 m
Spur 3	80 m
Total	480 m

Table 1.3 – Examples of Total Cable Lengths

The cable types should combine according to the equation below:

$$L1 / L1max + L2 / L2max + \dots < 1$$

Example: the network has the following cables:

L1: is the type 1 cable length

L2: is the type 2 cable length

L1max: is the type 1 maximum cable length (see table 1.1).

L2max: is the type 2 maximum cable length (see table 1.1).

L1 = 1000 m of A type cable

L2 = 100 m of B type cable

1000 / 1900 + 100 / 1200 = 0,61

The hypothetical combination on last example satisfies the above equation: $0,61 < 1$

Cable shielding

Shielding must be used, especially at noisy sites with high EMI/RFI near to the bus. Connect the spur shielding with the trunk shielding. The shielding should cover a minimum 90% cable length to guarantee good protection.

Grounding

The shielding is grounded only at the power supply negative terminal. Do not ground it at the other terminal, in order to avoid a secondary current circulation that could induce noise onto the bus. If the cable is not shielded put it on a tray and ground it only at one end. Do not use shielding as power conductor. Signal cables should NOT be grounded.

Commissioning

This item will explain the commissioning related to the configuration of the converter in the network.

After the project of detail of the plant to conclude and before receiving or to install the devices, it is suggested to begin the configurations in the way offline. After the accomplishment of those procedures it discharges the configuration for the plant.

In Foundation Fieldbus the database configuration is made on user-defined tags with no association with the physical devices. Therefore, the devices must be associated to their respective configurations.

Each device has a unique Device ID with 32 characters as hardware address, and meant to distinguish a device from another. This address is engraved on the circuit board by the manufacturer and cannot be changed. A field device is associated to its configuring system when correlates its configuration tag to the device ID. If the factory tag is identical to the configured tag on the configuring systems they will be automatically associated by the configuring system. Once it is connected to the network, the factory tag may be named, if not done yet.

When all the devices are associated to their respective tags, the configuration may be completely or partially unloaded on the network equipments.

If possible, use the configuring system to simulate the control and the operation. Then, you may start, stop and go through the control strategies and check if the plant is operating normally before the start-up.

Commissioning stages

- Connect the converter (FI302) electrically to the segment, so that the fieldbus will recognize it as an equipment with a non-commissioned tag;
- Use the configuring software to instantiate the newly-connected equipment. This creates ties between the physical equipment in the plant and the databank configuration;
- Unload the equipment internal data on the configuration system and its strategy control on the equipment.

NOTE
The Fieldbus requires that the measuring unit be the same, both on the equipment transducer block and the function blocks, in order not to occur a commissioning error.

Use of non-prefigured equipments

Equipments with non-configured tags are configured during commissioning. To do it, follow the procedure below:

- Connect each adequate equipment to a fieldbus segment. The system will recognize them as non-commissioned equipments;
- Instantiate each equipment on the adequate segment in the configuration software;
- Name a tag for the specific process step where the equipment belongs;
- Unload the configuration on the equipment.

Use of preconfigured equipments

The equipments with preconfigured tags identify themselves automatically with the configuration and save commissioning time. The user must simply install them and check the equipments.

Each preconfigured equipment must be installed on the specific plant site where it was configured for.

Linking Device

The linking device, be it the Smar DFI302 or other interface, addresses all the devices on each network automatically. For every practical purpose, the node address may hidden and is not of interest to most users, whose interaction is based in tags. However, the node address is typically shown on the live list for the use of specialists. As a result, the Foundation Fieldbus devices may be commissioned directly from the control room. Once the device is connected to the network it will be detected in seconds. The devices may be connected or disconnected at any time without disturbing the network.

Error monitoring and detection with Live List

If the device does not appear on the configuring system live list, it most probably was connected to the wrong network or was not commissioned. In this case, it may be located on the live list or another network. Another possibility is that the device cable is not connected or the device is not operating adequately. The live list, thus, is an excellent commissioning tool, as it facilitates checking the cable connection to the field devices. To make sure that a device was not mistaken for another on the same network or that it was installed at the wrong place, the device may be disconnected temporarily from the network, so that the user can check if the right tag disappears from the live list.

For more safety, use the configuration system to obtain detailed ID information from any device connected to the network. This information helps checking the tag, the description, the manufacturer, the type, the version and instrument general condition in order to confirm if it is the right device and if it is working well.

Section 2

FUNCTIONAL DESCRIPTION

Functional Description

See Figure 2.1.

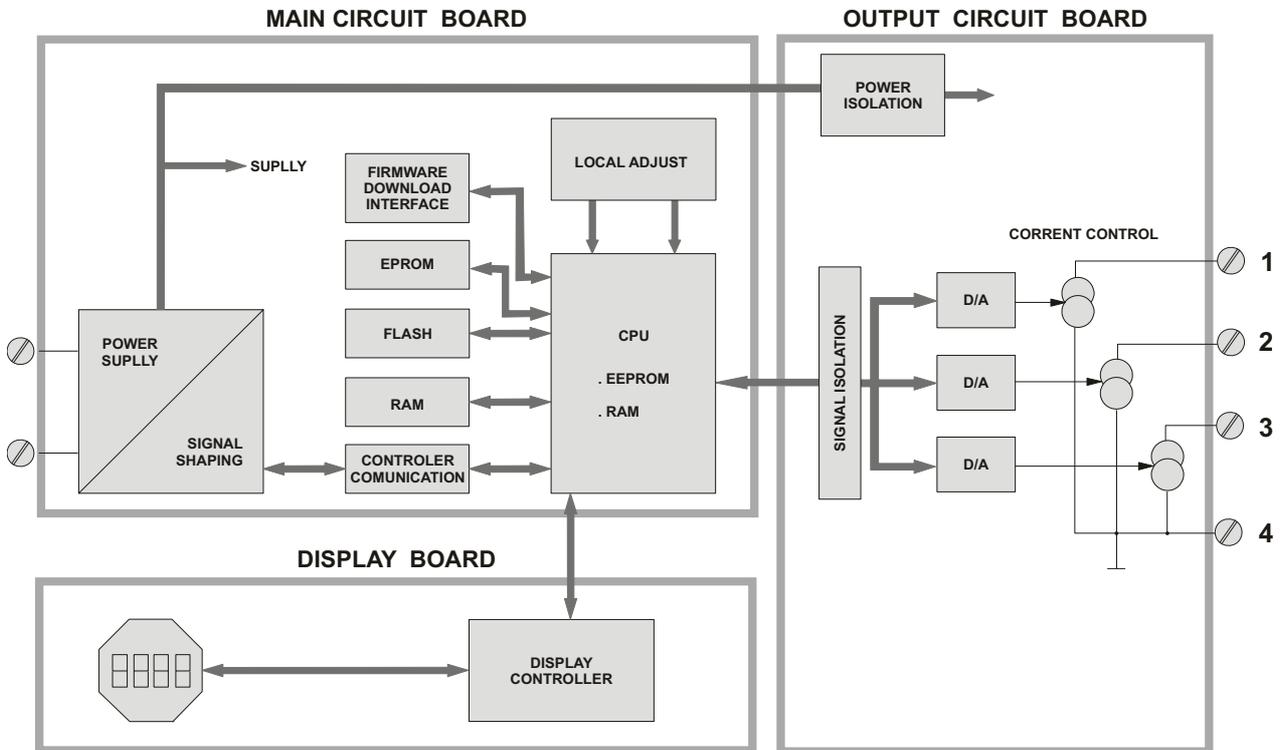


Figure 2.1 – FI302 Block Diagram

D/A

Receives signal from the CPU and converts it to an analogical signal to be used by the current control

Current Control

Controls the channel current according to the data received from the CPU.

Signal Isolator

Isolates the data signal between the output and the CPU.

Central Processing Unit (CPU), RAM and FLASH

THE CPU is the converter intelligent part, and is responsible for the management and operation of the blocks, auto-diagnosis and communication. The program is stored in FLASH. For the temporary storing of data there is a RAM. The RAM data will be lost if energy fails, although the device has a non-volatile EEPROM where the valid data are stored, as for calibration, configuration and identification.

Communication Controller

It controls the line activity, modulates and demodulates communication signals and inserts or delete initial and final delimiters.

Power Supply

Uses energy from the control loop to power the converter circuit.

Power Insulation

The power must be insulated as the output signals sent or received by the output

Signal Conditioner

Prepares the signals from the network or from the communication controller at acceptable levels by the communication controller or the fieldbus network, respectively.

Display Controller

Receives CPU data and controls the Liquid Crystal Display.

Local Adjustment

Two switches may be activated by a magnetic tool without any mechanic or electric contact.

Section 3

OPERATION

Liquid Crystal Display

The liquid crystal display shows up to three variables that may be selected by the user. When two or three variables are chosen, the display will alternate the sampling from both with an interval of approximately 3 seconds.

The LCD is made of a field with 4 1/2 numerical digits, a field with 5 alphanumeric digits and an information field, as shown on Figure 3.1.

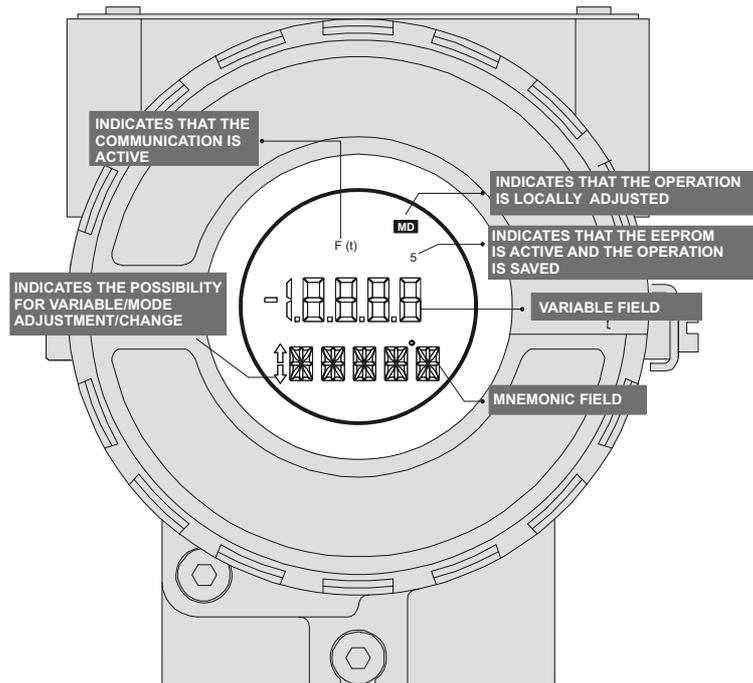


Figure 3.1 - Display

Monitoring

During normal operation, the FI302 is in monitoring mode and the indication alternates between the variables, as configured by the user. See Figure 3.2. The display shows the engineering units, values and parameters simultaneously with most status indicators, depending on the local adjustment configuration.

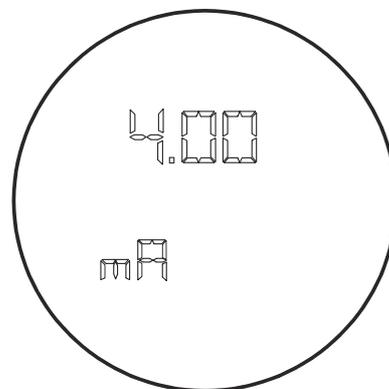


Figure 3.2 – Typical Monitoring Mode displaying the current inferior value, namely 4.0 mA.

The monitoring mode is interrupted when the user makes the local adjustment. The display also shows messages and errors (See Table 3.1).

DISPLAY	DESCRIPTION
Init , FI302 & Version	The FI302 is powered and initiated
Blk OOS	OOS block not configured and link ineffective
bad	Communication or signal failure or bad signal

Table 3.1 – Display Messages and Errors.

Section 4

CONFIGURATION

The **FI302** may be configured by any Foundation Fieldbus configuration tool or by an operational console.

The FI302 has **three output transducer blocks, one resource block, one display block, one diagnostic block and function blocks.**

The function blocks are described in the function block manual, which deals with the parameters of transducer blocks, display block and diagnostic block.

Transducer Block

The transducer block insulates the hardware input/output function block like sensors and actuators. The transducer blocks controls the input and output access through the specific manufacturer implementation.

The connection between the transducer block and function blocks is called channel.

How to Configure a Transducer Block

When instantiating the FI302 on the configuration tool, the transducer block is automatically instantiated.

The Transducer block has an algorithm, an internal parameter group and a channel that connects it to the analogical output function block.

The algorithm describes how the transducer transfers information between the input/output hardware and the other function blocks. The internal parameters, which cannot be linked to other blocks and published on the link via communication, define the user interface for the transducer block. They are divided in Standards that comply with the Foundation Fieldbus standard and those specified by the manufacturer and made according to needs.

Every standard routine (e.g. calibration) follows a step by step method, which defines generally the rules that will help the user.

The transducer, display and diagnostic blocks have several parameters that could be configured. Here will treat of the most usual. The others are similar.

NOTE

The parameters ending with an "n" mean that they are the same for the other groups, and are distinguished by their group number instead of the letter "n".

For the FI302 basic configuration, use the Transducer and Display blocks parameters.

The Transducer Block parameters are configured as follows:

MODE_BLOCK

The **MODE-BLOCK** parameter configures the transducer block mode of operation. There are two options: **Out of Service** or **AUTO** (automatic).

TERMINAL_NUMBER

The **TERMINAL_NUMBER** parameter relates a value for the channel. It starts with 1 to the number 1 transducer and goes up to 3 to the number 3 transducer. The FI302 has 3 current channels and the current value will be sent internally to a specific transducer output from the analogical output function block. The number of the analogical output block (AO) is related to the transducer terminal number (**TERMINAL_NUMBER**). The channels with numbers 1, 2, 3 correspond to the terminal block numbers 1, 2, 3. Select the combinations (1 - 1), (2 - 2), (3 - 3) for the channel and the terminal block number where the output will occur (channel number – terminal block number).

The **TERMINAL_NUMBER** parameter chooses which of the three terminals of the terminal block will supply the output. At least one of them must be chosen or the FI302 will issue the error message "Blk_error".

Display Block

The FI302 display block shows the variable chosen on monitoring mode or the option menu on the local adjustment mode.

The display block is default-configured to make it possible to adjust the Upper Trim (UPPER) and the Lower Trim (LOWER) to monitor the input transducer output and check the Tag.

The options of the FI302 local adjustment tree may be entirely configured by any fieldbus configuration tool. Use them for the configuration, but for certain operations the local adjustment is easier and faster, because it does not depend on network and communication connections. The parameter options to work with the local adjustment are: Mode Block, Output Monitoring, Tag Visualization and Tuning Parameter Adjustments.

Before using the magnetic tool for local adjustment, use the fieldbus configuration tool to prepare the parameters that enable this operation.

How to Configure a Display Block

There are seven parameter groups indexed to the **Block_Tag_Param_n** parameter that may be preconfigured by the user to enable a configuration by local adjustment. If it is not necessary to display this group of tag-indexed parameters, write an invalid tag for the **Block_Tag_Param_n** parameter. With this procedure the equipment does not recognize it as a valid parameter nor the parameters indexed to it.

The Display Block parameters are configured as follows:

MODE_BLOCK

The configuration is identical to the previous transducer block.

BLOCK_TAG_PARAM_n

This is the block tag where the parameter belongs. The FI302 enables inserting up to 7 block tags. Use a maximum of 32 characters.

INDEX_RELATIVE_n

This is the index related to the parameter that will be activated or visualized (0, 1, 2...6). See the Function Block manual to know the required indices, or visualize them on the configuration tool by opening the desired block. The FI302 accepts up to 7 parameter indices, configuring up to 7 parameter in the LCD.

DISPLAY_REFRESH

This parameter updates the new configuration.

CALIBRATION

If necessary, the FI302 adjusts the output channel current. The trim adjustment is used if the indication on the transducer block output is different from the reference standard adopted. Possible causes are:

- The user current meter is different from the plant standard.
- The converter had its original characterization altered by overload or by wear.

American fleet channel output

To analyze the transducer output calibration, measure the channel output current with an accurate meter and compare it with the indication on the FI302. Adjust the trim in case of difference.

The trim may be adjusted in two levels:

Lower Trim: At the range lower level.

Upper Trim: At the range upper level.

These points define the linear output characteristics. The trim adjustments are independent.

The Transducer Block parameters used for the FI302 calibration or current Trim are:

CAL_POINT_HI, CAL_POINT_LO, FEEDBACK_CAL e CAL_CONTROL.

Parameter description:

CAL_POINT_HI

This parameter configures the calibration range upper value.

CAL_POINT_LO

This parameter configures the calibration range lower value.

FEEDBACK_CAL

This is the current measured value used by the calibration method. It is used to apply the current trim. To apply the lower or upper values, write the value read by the amperimeter in the parameter during the calibration of the values. Repeat this operation until the measure is the same as the value read. See figure 5.1.

CAL_CONTROL

It enables and disables the calibration process with options Enable and Disable. After initiating the calibration method, the CAL_CONTROL parameter is used to return to the previous normal operation.

The calibration will be enabled if the AO block output has a valid value and the status is different from "Bad". If "Bad" appears, the message "Calibration Failed" will appear on the XD_ERROR parameter.

Figure 5.1 shows how to connect the converter to calibrate its lower value on 4 mA and its upper value on 20mA.

FI302

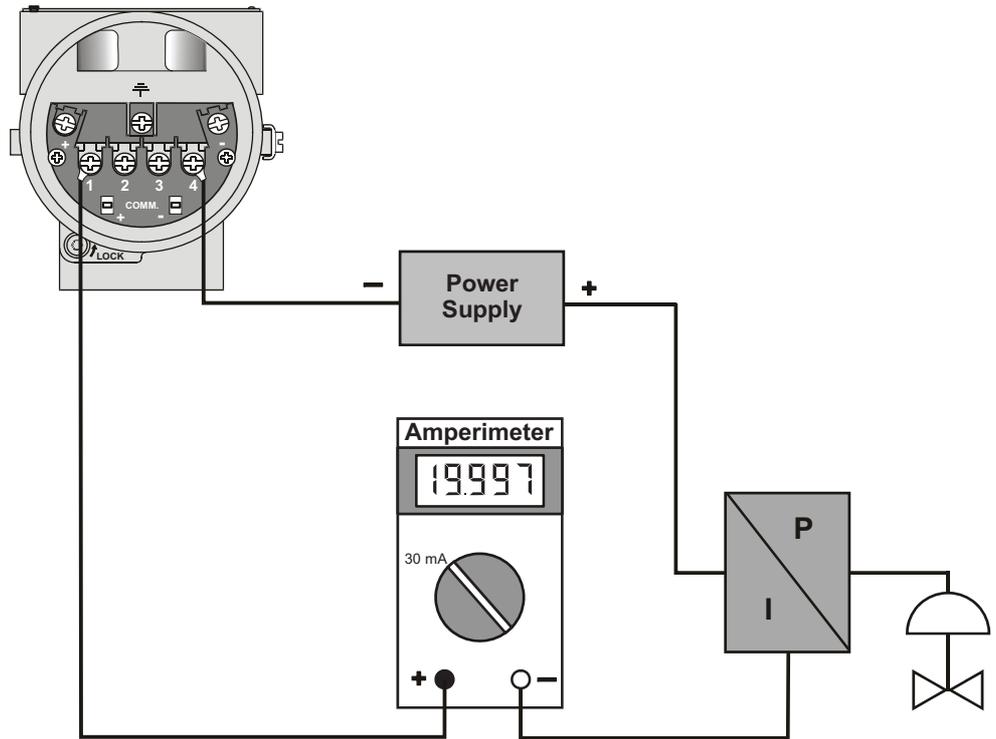


Figure 5.1 – Current Measuring Connection Diagram

There are two ways to apply the trim: use a magnetic tool for one of them and a fieldbus configuration tool, like the Smar SYSCON for the other.

It is possible to calibrate the converter by means of parameters CAL_POINT_LO and CAL-POINT-HI.

Let's take the lower value as an example: write 4 mA or the lower value in parameter CAL_POINT_LO.

Parameter	Value
...BLOCK_ALM	
...TRANSDUCER_DIRECTORY	0
...TRANSDUCER_TYPE	Other
...XD_ERROR	Default value set
...COLLECTION_DIRECTORY	0
...FINAL_VALUE	
...FINAL_VALUE_RANGE	
...CAL_POINT_HI	19
...CAL_POINT_LO	4
...CAL_MIN_SPAN	1
...CAL_UNIT	mA
...ACT_SN	0
...CAL_METHOD	Factory cal standard calibration
...CAL_LOC	
...CAL_DATE	DateTime is not implemented

Figure 5.2 - Calibrating the Cal Point Lo – FI302

Always keep in mind that, simply by writing in this parameter, the trim procedure is initialized. Read the current in the multimeter and write that value in parameter FEEDBACK_CAL. Write in this parameter until it reads 4.0 mA or the lower value readout of the multimeter.

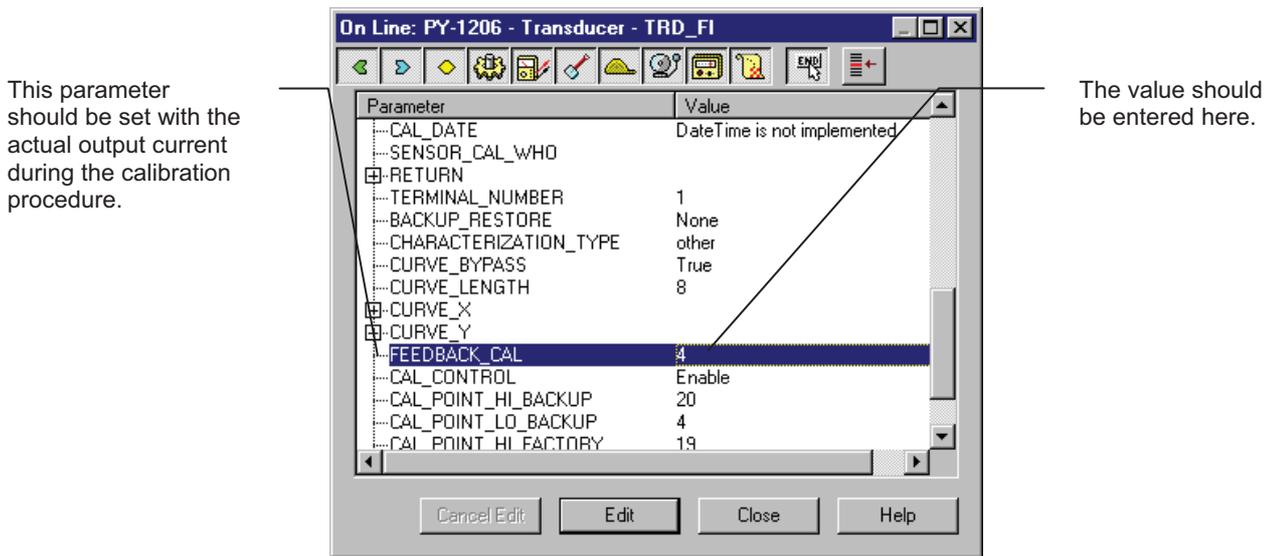


Figure 5.3 - Feedback of Current Lo Value

In order to end the trim procedure, choice DISABLE in the parameter CAL_CONTROL.

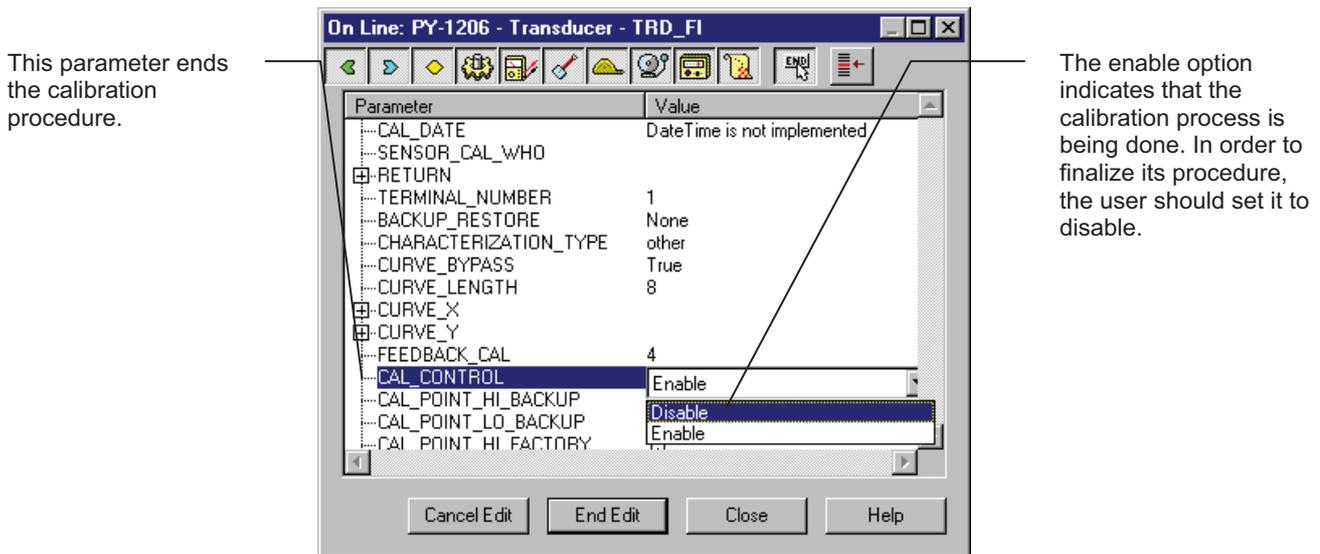
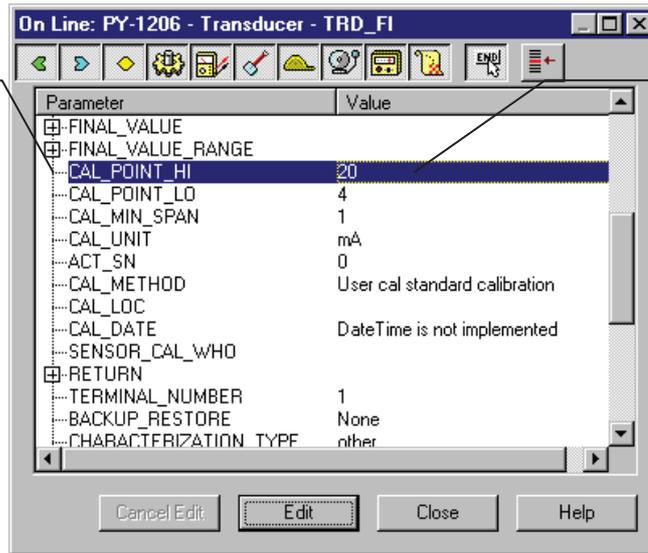


Figure 5.4 - Closing the Calibration Lo Procedure

Let's take the upper value as an example: Write 20 mA in parameter CAL_POINT_HI. Always keep in mind that, simply by writing in this parameter, the trim procedure is initialized.

This parameter indicates where the converter should be when the setpoint is 100%.

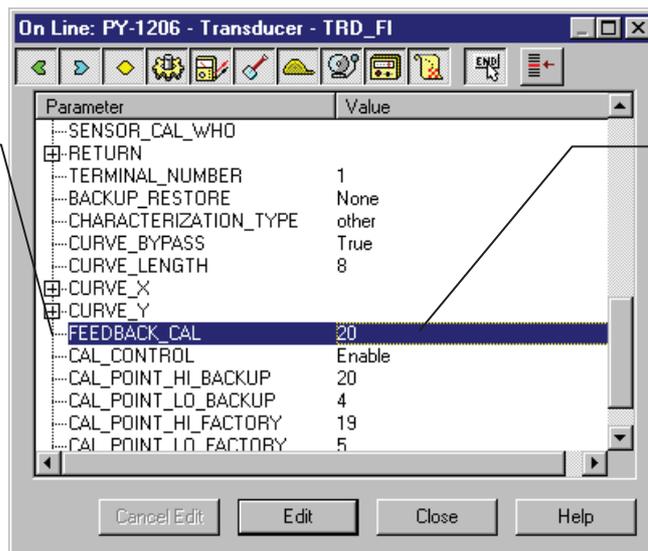


The desired value should be entered.

Figure 5.5 - Calibrating the Cal Point Hi – FI302

Read the current in the multimeter and write that value in parameter FEEDBACK_CAL. Write in this parameter until it reads 20.00 mA or the upper value readout of the multimeter.

This parameter should be set with the actual output current during the calibration procedure.

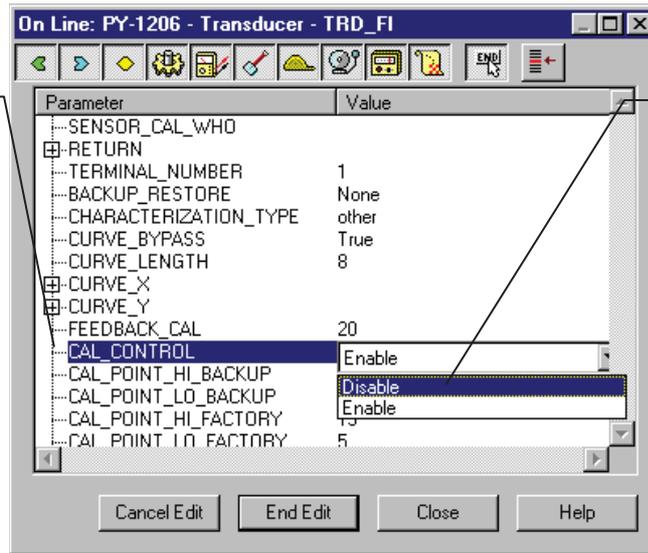


The value should be entered here.

Figure 5.6 - Feedback of Current Hi Value – FI302

In order to end the trim procedure, choice DISABLE in the parameter CAL_CONTROL.

This parameter ends the calibration procedure.

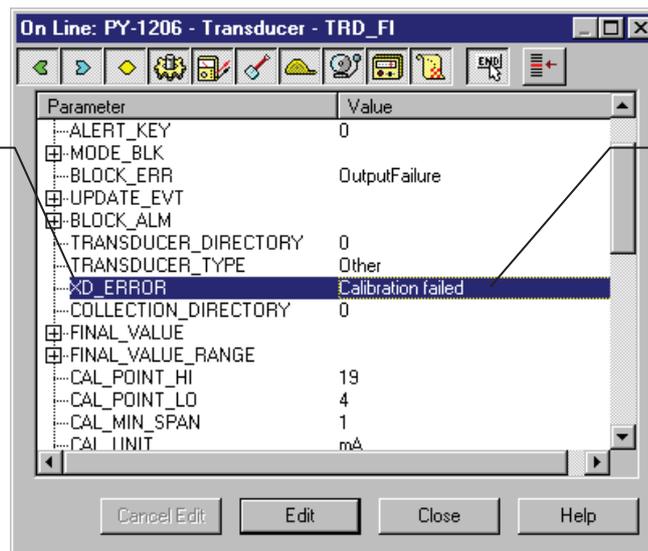


The enable option indicates that the calibration process is being done. In order to finalize its procedure, the user should set it to disable.

Figure 5.7 - Closing the Calibration Hi Procedure

The calibration will be enabled only if the output of AO block has a valid value and status different of "Bad" In this case, the following message can be seen in the parameter XD_ERROR.

This parameter indicates de Error Code Operation associated to calibration procedure.



It indicates that the calibration procedure was not sucessfull.

Figure 5.8- Calibration Error Message – FI302

Section 6

MAINTENANCE

Diagnostic Block – DIAG

This transducer block provides the following characteristics:

- Online measuring time for the functional blocks execution;
- Hardware revision
- Firmware revision
- Equipment serial number
- Main board serial number

The BEHAVIOR parameter defines the initial parameter values that will be used after block instantiation. The Adapted option selects a group of initial values more proper for the parameters, thus avoiding invalid values. The Spec option also allows defining initial values.

Troubleshooting

Physical Inspection

After connecting the FI302 to the network, if it loses communication or slows down. e.g., due to multiple tentative communication, the error may be caused by poor installation procedure, by the configuration or by poor equipment performance.

Causes for communication errors

- Badly fit connections
- Installation problems, repeated equipment addresses, bad configuration, etc.
- Terminator located at the wrong place, with or without terminator
- Power supply with too low or unstable voltage value
- Too long or too many Spurs
- Wrong ground or no ground
- Water infiltration in the equipment due to connections with wrong sealing and/or loose clamps
- Low isolation

After carrying out the procedures for detecting network defects, act as follows:

- Insulate the segment or equipment that causes the problem
- Check if the polarity is correct
- Check if the address is correct
- Check if the network is integrated
- Check if the tension on the converter terminals is at least 9.5 V during communication

Remove the equipment to a bench and test it. If it presents malfunctioning, contact Smar.

Parameters used for Troubleshooting

The FI302 Transducer Block parameters used for troubleshooting are:

BLOCK_ERR, XD_ERROR, FINAL_VALUE, RETURN e BACKUP_RESTORE

Caution messages may appear on the status of the Return parameter or Block Error parameter, in given circumstances such as presented below, in two modes, OOS and AUTO.

BLOCK_ERR

This transducer BLOCK_ERR parameter shows the following errors:

- **Block Configuration** – When XD_SCALE has an improper range or unit;
- **Output Failures** – When the loop current open;
- **Out of Service** – When the block is on out of service mode (OOS)

Limit Conditions for Calibration	
Lower	3.99 < NEW_LOWER < 11.5 mA, otherwise XD_ERROR = 22
Upper	12.5 < NEW_UPPER < 20.01 mA, otherwise XD_ERROR = 22

FINAL_VALUE

The desired current value and the status written by the AO block;

RETURN

Current output value coming from the AO block;

RETURN STATUS

The transducer block **Return Status** indicates the following errors:

- **Bad::NonSpecific:NotLimited** – When the loop current is interrupted;
- **XD_ERROR** – This parameter is used to indicate the calibration status;

BACKUP_RESTORE

This parameter is used as backup or to recover configuration data.

Table 6.1 has the information to determine the converter or network failures.

NOTE
It is recommended not to repair printed circuit boards. Keep spare parts in store or buy them from Smar, if necessary.

Diagnostic	
Sintoma Symptom	Probable Source of Error
No turn on	<p>Converter Fieldbus Connections Check power supply polarity and continuity</p> <p>Power Supply Check power supply output. The voltage at the FI302 terminal block must be between 9 and 32 Vdc</p> <p>Electronic circuit failure Check circuit boards for defects and replace them for spare ones.</p>
No communication	<p>Network Connection Check equipment, power supply and terminator connections.</p> <p>Network equipment impedance Check power supply and terminator impedance.</p> <p>Converter configuration Check the configuration of communication parameters of the converter</p> <p>Network Configuration Check the communication configuration of the network</p> <p>Electronic Circuit Failure Replace the main board and the input board matched pairs.</p>
Incorrect Outputs (the power supply indicated aside is for 4-20 mA equipments)	<p>Output Terminal Connection Check power supply, channels, terminal box polarity and continuity</p> <p>Power Supply Check power supply output. The FI 302 output voltage must be between 3 and 45 Vdc.</p> <p>Load Resistance Must be between 0 and 2000 Ohm. The higher value depends on the output power supply voltage.</p> <p>Calibration Check the converter calibration</p>

Table 6.1 – Failure Diagnostic.

If the failure is not on table 6.1 use the Factory Init. The note below shows how to do it.

NOTE

Use **factory init** as the last option to recover the equipment control when it presents problems related to function blocks or the communication. **Only authorized personnel should do it and the converter must be offline. This procedure will enable the standard configuration values of the plant and disable the equipment configuration.**

To access the letters **S** and **Z** use two magnetic screwdrivers and loosen the screw that holds the identification tag.

Proceed as follows:

Turn off the equipment and insert the magnetic tool handle in the openings **S** and **Z** and leave them there;

Power the equipment;

When the display shows **factory init**, remove the tools and wait for the “**S**” symbol on the right upper corner to unlit, indicating the end of the operation.

After running the **factory init**, download partially the configuration, which characterizes that the equipment is working on the net.

Disassemble Procedure

See Figure 6.1 for guidance on this procedure. Turn off the power supply before disassembling the converter.

Exploded View

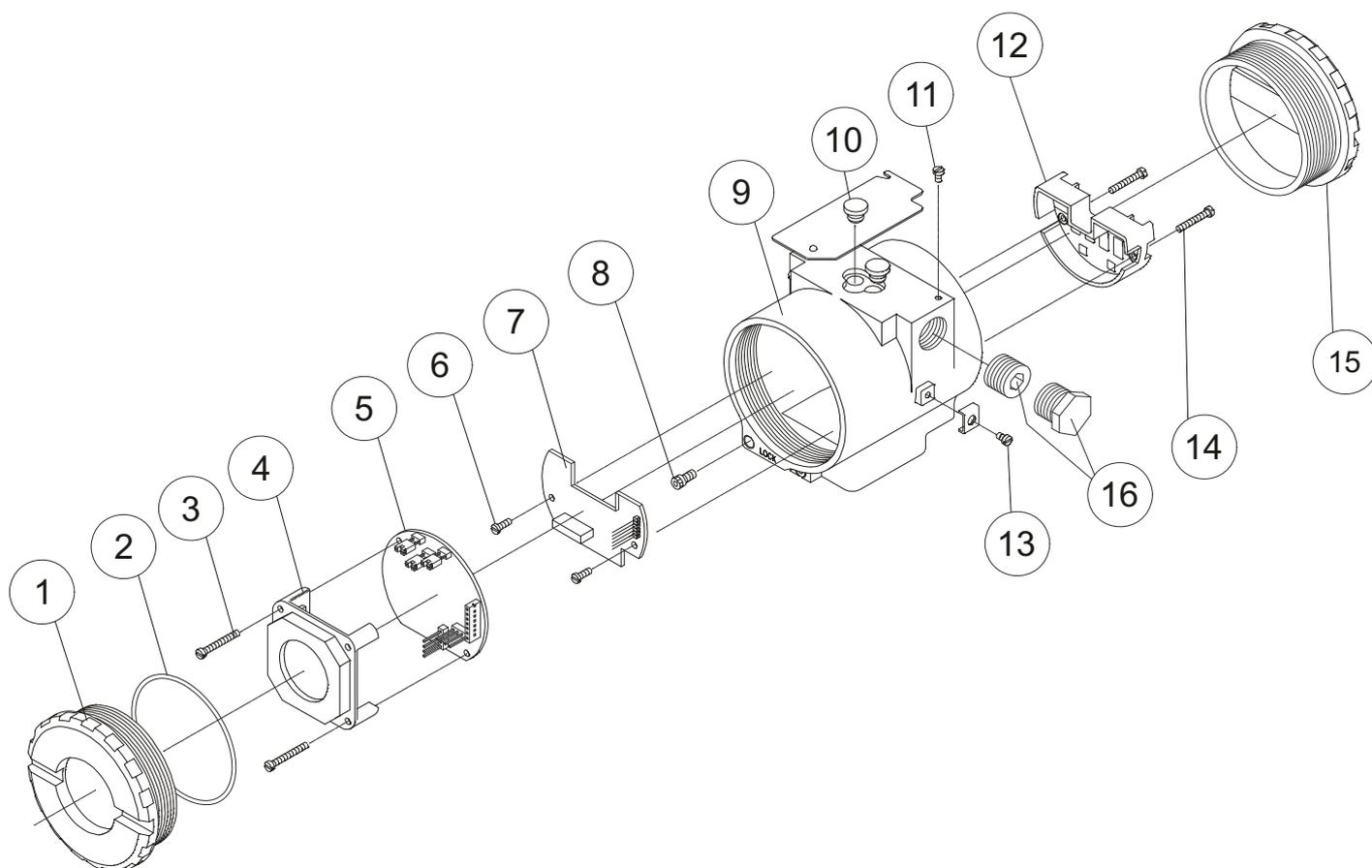


Figure 6.1 – FI302 Exploded View

Electronic Circuit

The main board (5) and output board (7) are matched pairs and must be replaced together should it be needed.

CAUTION

The boards have CMOS components that may be damaged by electrostatic discharges. Follow the right procedure for handling the CMOS components. Store the circuit boards in electrostatic-proof packaging.

Assembly Procedure

See Figure 6.1 for guidance on this procedure.

- Insert the output signal board (7) into the housing (9) and hold it with its screws.
- Insert the main board (5) in the housing, making sure that all the interconnected pins are connected.
- The display may be mounted in any of the 4 possible positions (see Figure 6.2). The “▲” sign indicates the display upper position.
- Hold firmly the main board and the display with their screws (3).
- Fit the cover (1) according to its area description and lock it with the locking screw (8).

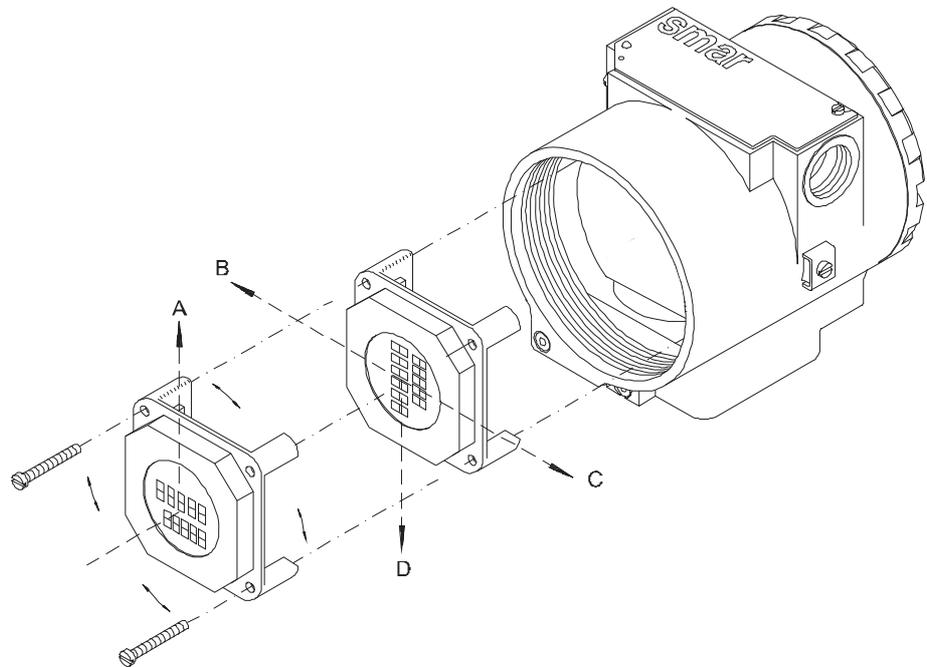


Figure 6.2 – Four Possible Indicator Positions

Interchangeability

The output and the main boards are matched pairs, as the calibration data for the output board is stored in the EEPROM of the main board. If one of the boards is mixed with the other pairs of other boards, you must calibrate them to guarantee precision of the outputs.

Spare Part List

SPARE PART LIST				
DESCRIPTION OF PARTS		POSITION	CODE	CATEGORY (NOTE 4)
Cover Without Window (Included O-ring)	Aluminum	1 e 15	204-0102	
	316 Stainless Steel	1 e 15	204-0105	
Cover With Window (Included O-ring)	Aluminum	1	204-0103	
	316 Stainless Steel	1	204-0106	
Sealing ring (Note 2)	Cover, Buna-N	2	204-0122	B
Aluminum Housing Main Board Screw	Units with indicator	3	304-0118	
	Units without indicator	3	304-0117	
316 Stainless Steel Housing Main Board Screw	Units with indicator	3	204-0118	
	Units without indicator	3	204-0117	
Digital Indicator		4	214-0108	
Main and Output Board		5 e 7	324-0140	A
Output Board Screw	Aluminum Housing	6	314-0125	
	316 Stainless Steel Housing	6	214-0125	
Cover Locking Screw		8	204-0120	
Housing, Aluminum (Note 1)	1/2 - 14 NPT	9	324-0130	
	M20 x 1.5	9	324-0131	
	PG 13.5 DIN	9	324-0132	
Housing, 316 Stainless Steel (Note 1)	1/2 - 14 NPT	9	324-0133	
	M20 x 1.5	9	324-0134	
	PG 13.5 DIN	9	324-0135	
Local Adjustment Protection Cap		10	204-0114	
Identification Plate Screw		11	204-0116	
Terminal Block Insulator		12	314-0123	
External Ground Screw		13	204-0124	
Terminal Block Insulator Screw	Aluminum Housing	14	304-0119	
	316 Stainless Steel Housing	14	204-0119	
Six-Sided Plug 1/2" NPT Internal BR Ex	Bichromated Carbon Steel	16	400-0808	
	Bichromated 304 Stainless Steel	16	400-0809	
Six-Sided Plug 1/2" NPT Internal	Bichromated Carbon Steel	16	400-0583-11	
	Bichromated 304 Stainless Steel	16	400-0583-12	
Six-Sided Plug M20 X 1.5 External BR Ex d	316 Stainless Steel	16	400-0810	
Six-Sided Plug PG13.5 External BR Ex d	316 Stainless Steel	16	400-0811	
Mounting Bracket for 2" Pipe (Note 3)	Carbon Steel	-	214-0801	
	316 Stainless Steel	-	214-0802	
	Carbon Steel Bolts, Nuts, Washers and U-clamp in Stainless Steel	-	214-0803	

NOTE

1. Includes terminal insulator, bolts (cover lock, grounding and terminal insulator), and I.D. plate without certification.
2. Sealing rings in twelve-unit packs
3. Includes U-clamp, nuts, bolts and washers. Spare part list.
4. For category "A" it is recommended to keep in stock 25 parts installed for each set, and for category "B", 50 parts.

Spares

SPARES	
ORDER CODE	DESCRIPTION
SD1	Magnetic Screwdriver for local adjustment
FDI302	Field Equipment Interface

Section 7

ADVANCED CONFIGURATION

The transducer block allows some configurations through of parameters below that alter the out curve in current.

Parameter description

CHARACTERIZATION_TYPE

Indicates the characterization curve type;

CURVE_BYPASS

Enables and disables the characterization curve;

CURVE LENGHT

Indicates the number of points of the characterization curve;

CURVE_X

Characterization curve input points;

CURVE_Y

Characterization curve output points;

Characterization Curve

The transducer block also has a characterization curve, used to give a determined profile to the output. This is useful, for example, when the FI302 controls a valve with a non-linear feature. The characterization curve is applied to the input signal before being converted and sent to the analogical output by the transducer.

The CURVE_BYPASS parameter determines if the curve will be used or not. If the parameter is a true Bypass, the curve is not used and the input value is transmitted directly to the output current conversion routine.

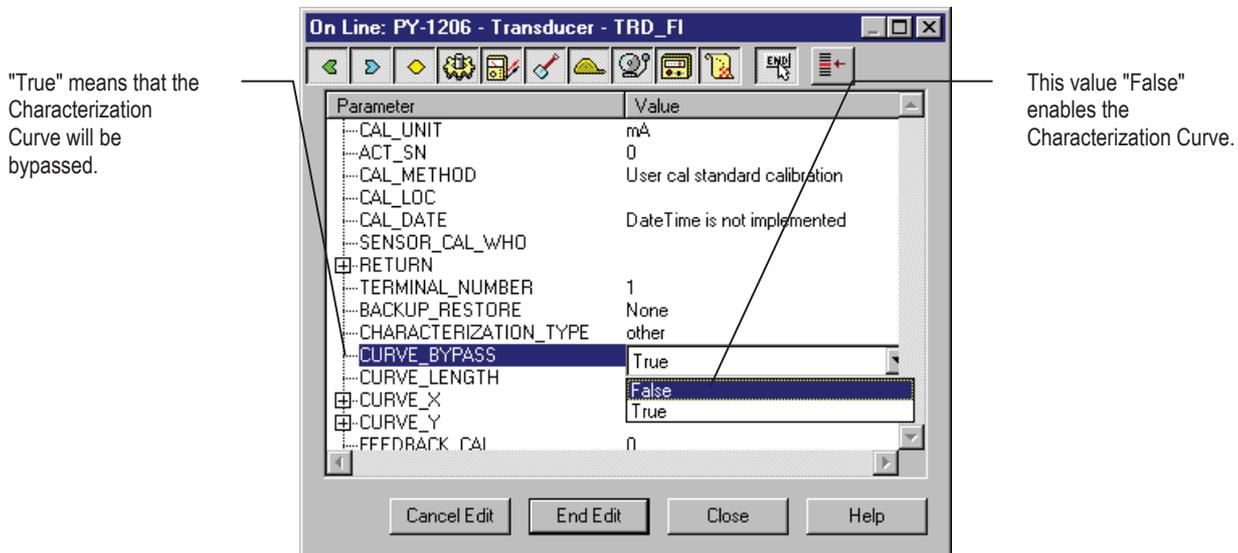


Figure 7.1 - Enabling the Characterization Curve

The characterization curve has 8 points. Each point has two coordinates (**X** and **Y**). These two coordinates define the point location in the **X – Y** space, and the connection of adjacent points with a linear segment forms the characterization curve. Extreme points are extrapolated.

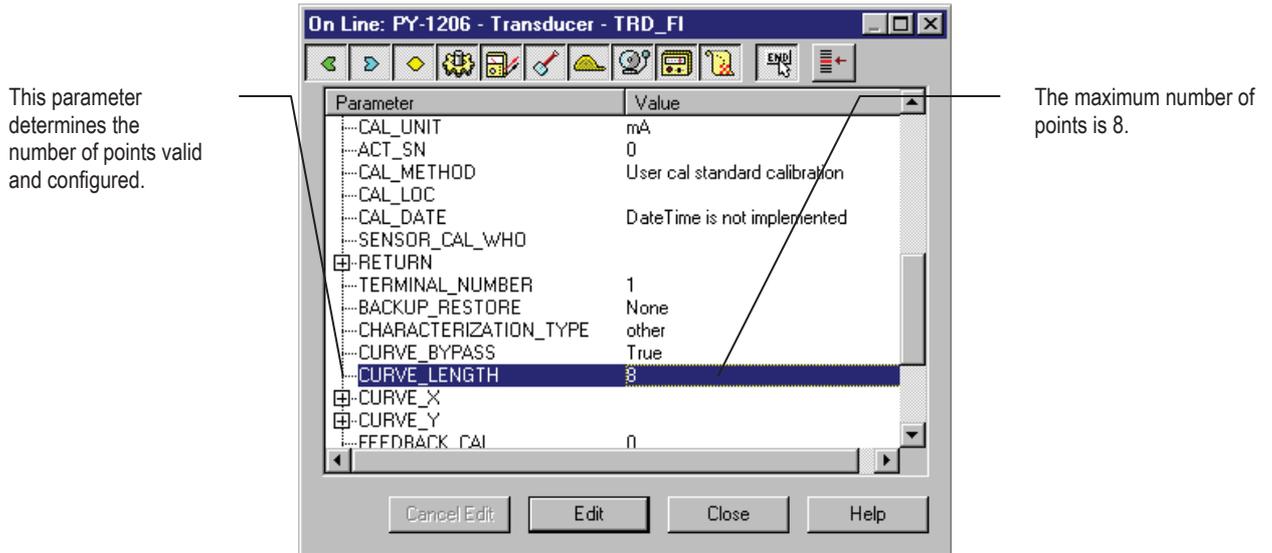


Figure 7.2 - Setting the Characterization Curve Length

These points are numbered from 1 to 8 and are contained in the CURVE_X (abscissas) and CURVE_Y (ordinates) parameters. CURVE_X parameter requires points in crescent order, meaning that the subsequent points must be greater than the preceding ones, or the parameter will not be accepted. CURVE_Y parameter does not require this, and a non-monotonic curve is allowed.

NOTE

When writing on CURVE parameters remember to place the point coordinates in the correct order.

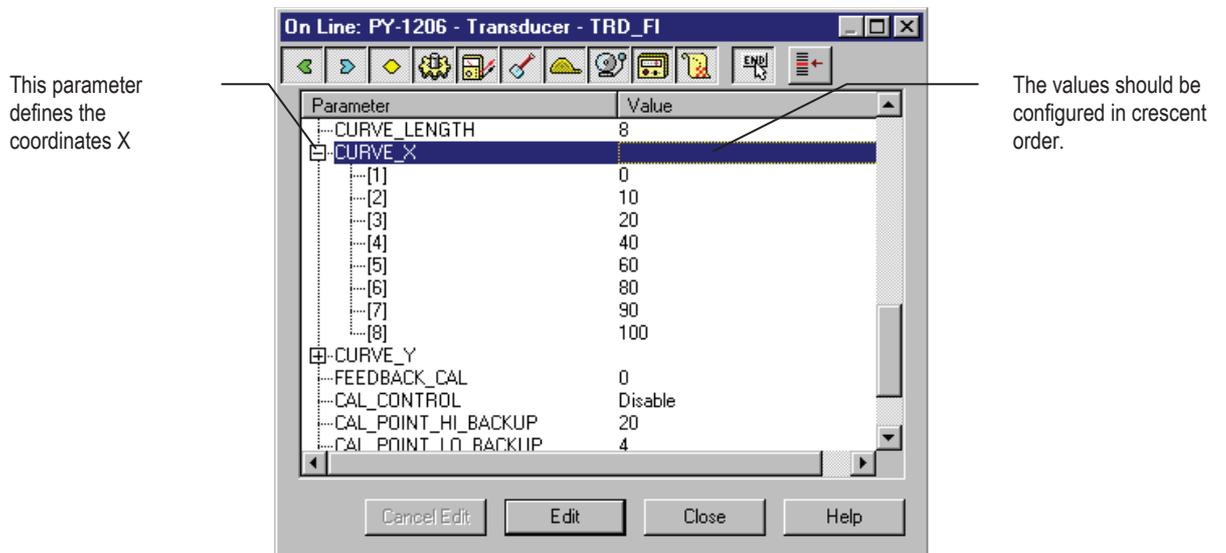


Figure 7.3 - Configuring the Characterization Curve - X points

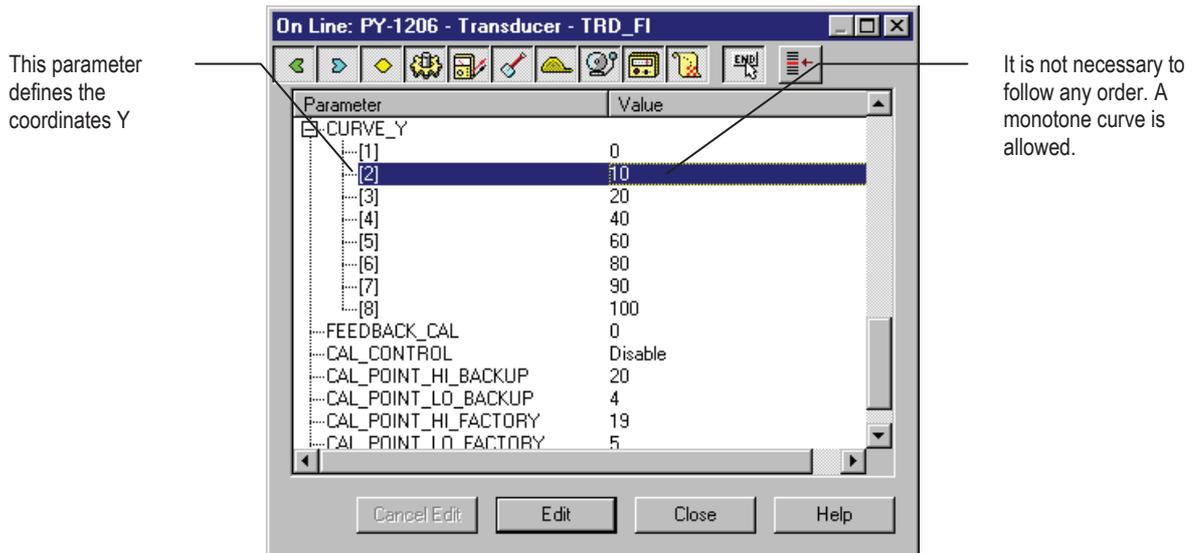


Figure 7.4 - Configuring the Characterization Curve - Y points

The Display Block allows configure up to three variables her they be shown in the digital indicator, or a tree with parameters that can be altered via local adjustment. This configuration is possible through procedures below:

NOTE

The parameters with “n” at its end mean that they are the same for other groups and are differentiated by their group number instead of the letter.

The Display Block parameters are:

SUB_INDEX_n, MNEMONIC_n, INC_DEC_n, DECIMAL_POINT_NUMBER_n e ACCESS_n

SUB_INDEX_n

To visualize a tag choose the relative index equal to zero and the sub index equal to 1

MNEMONIC_n

This mnemonic identifies the parameter (16 characters maximum). Preferably, choose the mnemonic with up to 5 characters because it will be not necessary to rotate it on the display.

INC_DEC_n

It is the increase and the decrease in decimal units when the parameter is Float, Float Status, or Integer when the parameter is expressed in total units;

DECIMAL_POINT_NUMBER_n

Number of digits after the decimal point (0 to 3 decimal digits);

ACCESS_n

On **Monitoring**, the parameter enables only this option and on **Action** the function shows on the display the increment and decrement values.

Definition of Parameters and Values

Block_Tag_Param

This is tag of the block to which the parameter belongs. Use up to a maximum of 32 characters.

Index_Relative

This is the index related to the parameter to be actuated or viewed (0, 1, 2...). Refer to the Function Blocks Manual to know the desired indexes, or visualize them on the SYSCON by opening the desired block.

In case you wish to visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

Sub_Index

This is the mnemonic for the parameter identification (it accepts a maximum of 16 characters in the alphanumeric field of the display). Choose the mnemonic, preferably with no more than 5 characters because, this way, it will not be necessary to rotate it on the display.

Inc_Dec

It is the increment and decrement in decimal units when the parameter is Float or Float Status time, or integer, when the parameter is in whole units.

Decimal_Point_Numb.

This is the number of digits after the decimal point (0 to 3 decimal digits).

Access

The access allows the user to read, in the case of the "Monitoring" option, and to write when "action" option is selected, then the display will show the increment and decrement arrows.

Alpha_Num

These parameters include two options: value and mnemonic. In option value, it is possible to display data both in the alphanumeric and in the numeric fields; this way, in the case of a data higher than 10000, it will be shown in the alphanumeric field.

In option mnemonic, the display may show the data in the numeric field and the mnemonic in the alphanumeric field.

In case you wish to visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

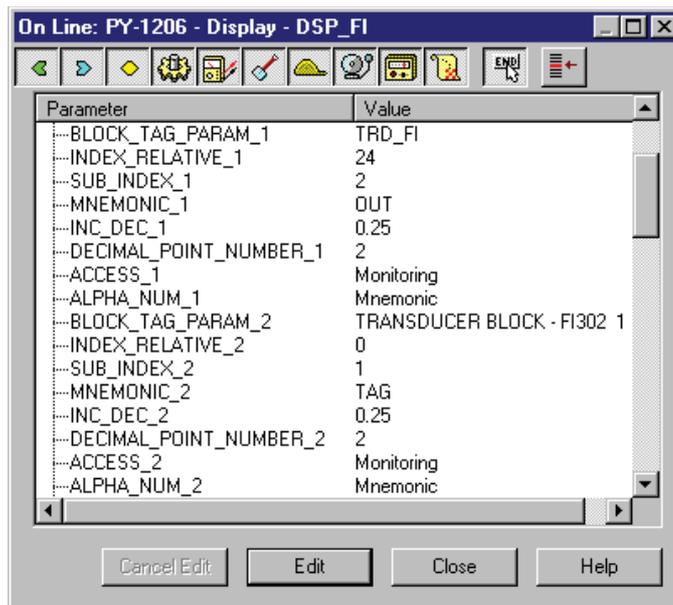


Figure 7.5- Parameters for Local Adjustment Configuration

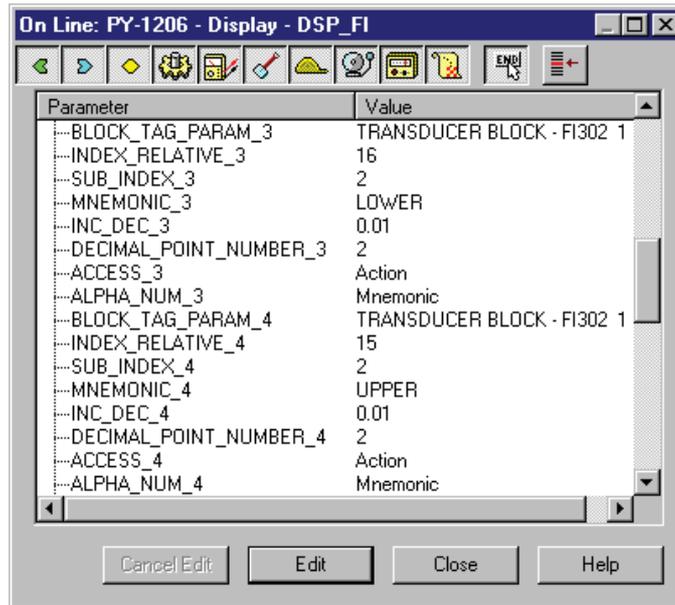


Figure 7.6 - Parameters for Local Adjustment Configuration

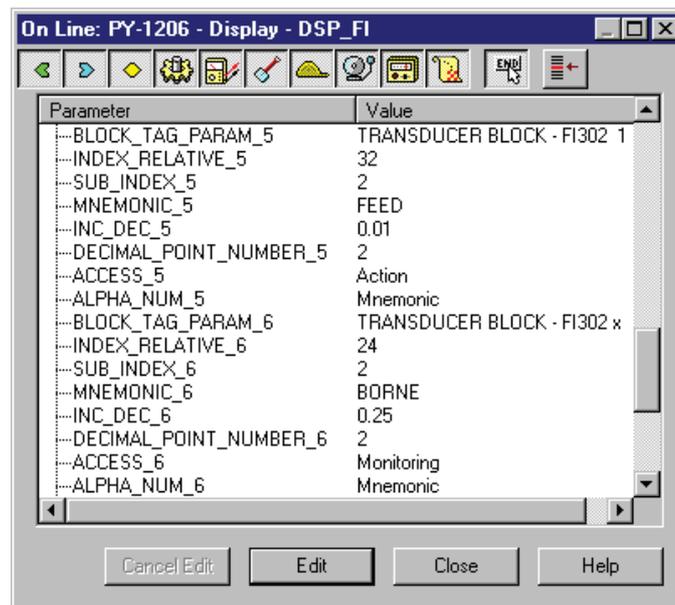


Figure 7.7 - Parameters for Local Adjustment Configuration

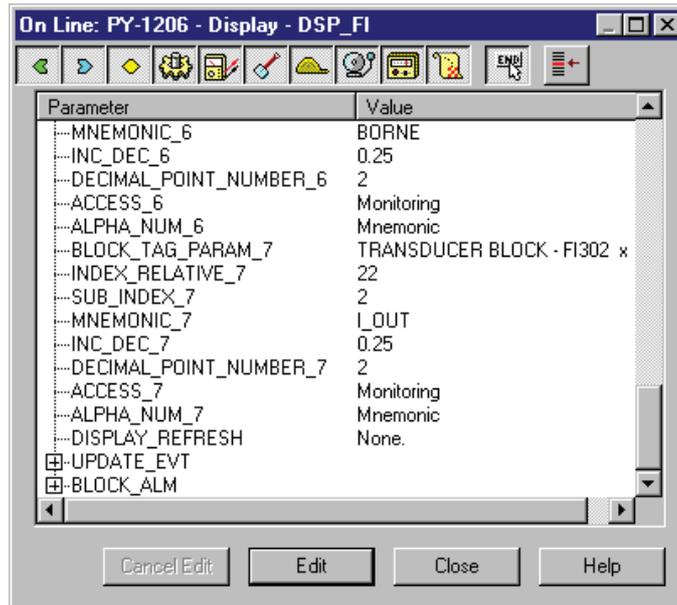


Figure 7.8 - Parameters for Local Adjustment Configuration

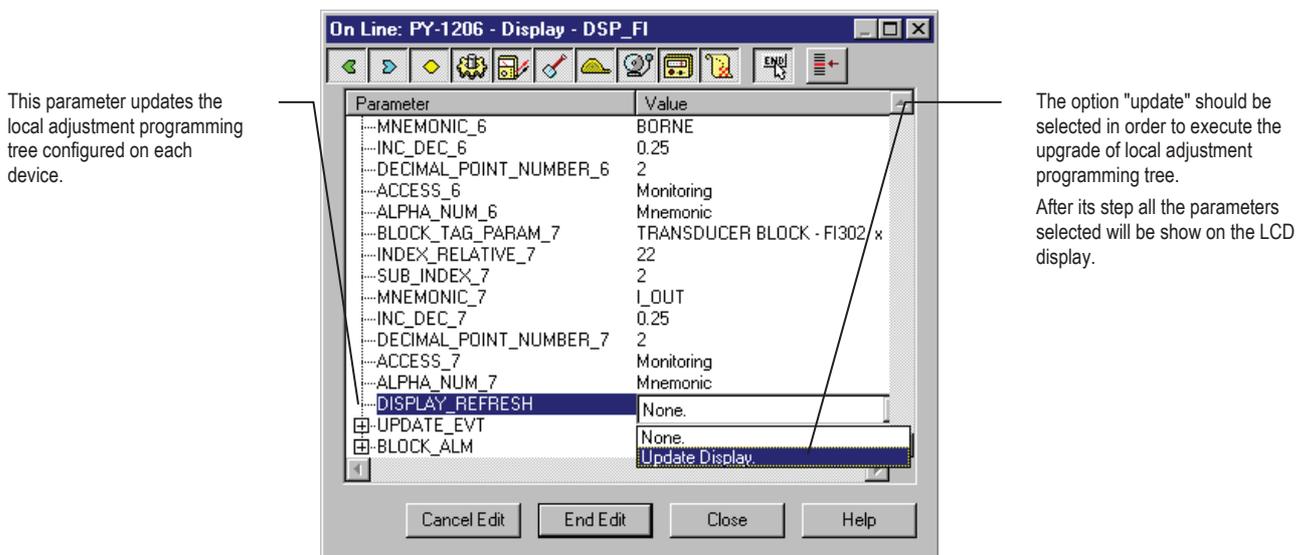


Figure 7.9 - Parameters for Local Adjustment Configuration

Section 8

LOCAL ADJUSTMENT

When using the local adjustment for calibration, configure the display block to show the following parameters: CAL_POINT_HI (UPPER mnemonic), CAL_POINT_LO (LOWER mnemonic) and TAG (TAG mnemonic).

The FI302 has three output transducers, although only the number 1 leaves Smar with factory configuration. To configure the other transducers to work with local adjustment use the configuration tool.

NOTE

The Trim mode is removed from local adjustment automatically if the magnetic tool is not used during approximately 16 seconds.

Under its identification plate, the FI302 has two openings marked with S and Z at their side, giving access to two Reed Switch magnetic tools. They are activated when the magnetic tool is inserted in the orifices by its handle (See Figure 8.1).

The magnetic tool permits adjusting most block parameters.

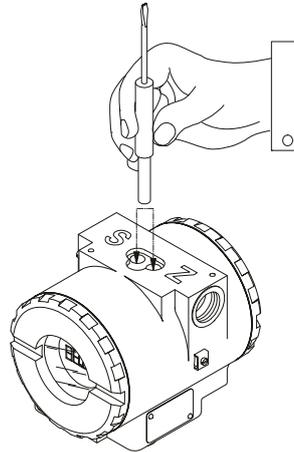


Figure 8.1 – Local Adjustment Orifices.

Jumper Configuration

Jumpers **J1** and **W1** located on top of the main board must be coupled with the main board and the converter must have a display to show the local adjustment options.

Table 8.1 shows the possible actions applied on openings **S** and **Z** when the local adjustment is enabled.

OPENING	ACTION
S	Selects the function shown on the display
Z	Initializes the local adjustment and moves through the available options.

Table 8.1 – Function of the Openings on the Housing

Jumper J1 Connection

If Jumper 1 (see figure 8.2) is connected to the **ON** pins, it will be possible to simulate values and status using the SIMULATE parameter on the functional blocks.

Jumper W1 Connection

If Jumper W1 (see figure 8.2) is connected to **ON**, the display may perform configurations through local adjustment.

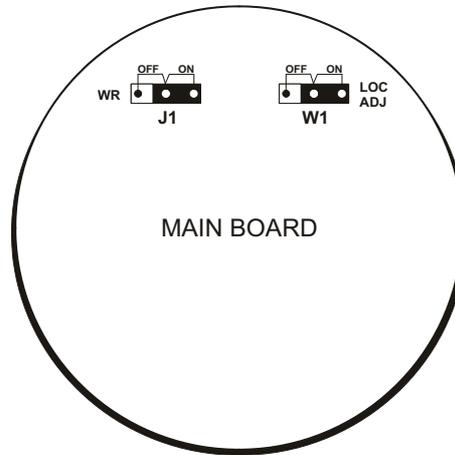
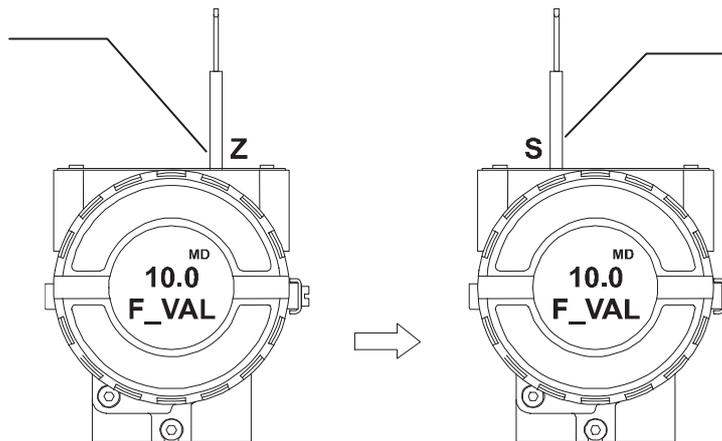


Figure. 8.2 – Jumpers J1 and W1

To calibrate the upper and lower current values by local adjustment follow the step-by-step example below:

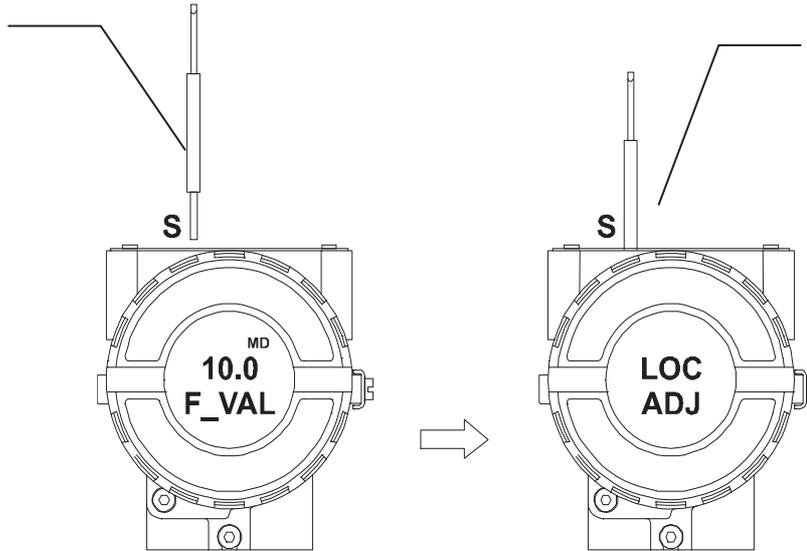
In order to initialize the local adjustment, insert the magnetic. Handle it in orifice **Z** and wait for the letters **MD** to appear.



Insert it again in orifice **S** and wait for 5 secs.

Figure 8.3 – FI302 Step 1

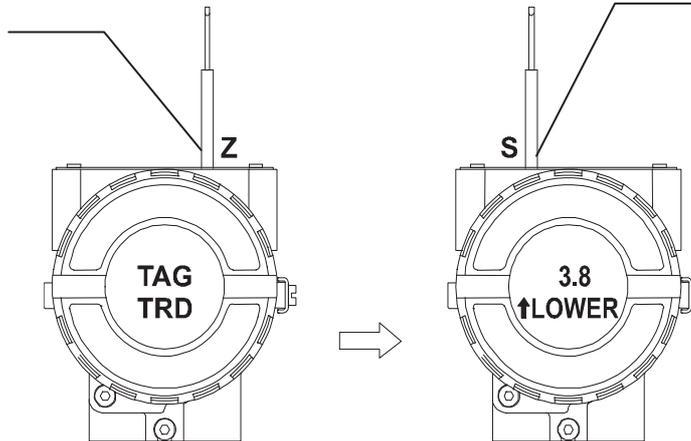
Remove it from opening **S**



Insert it again on opening **S**. The abbreviations **LOC ADJ** will be displayed

Figure 8.4 – FI302 Step 2

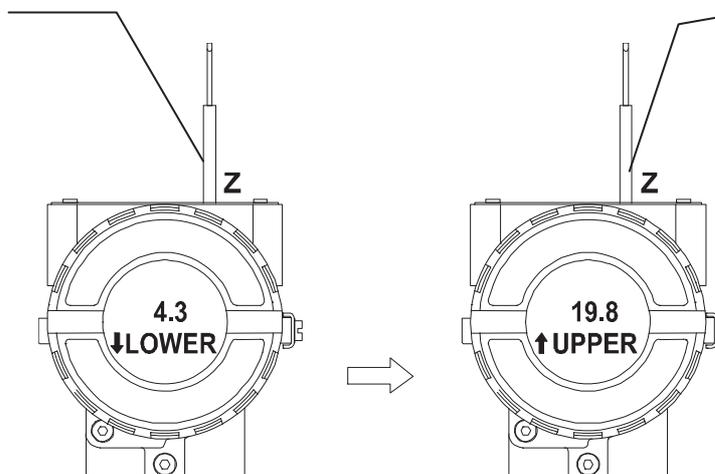
Insert the magnetic tool in the orifice **Z**. If it is the first option to be configured, the option **TAG** and its equivalent mnemonic will be displayed. Otherwise, the last option configured will be displayed. By keeping the tool in the opening, the local adjustment menu will rotate through the options on the local adjustment tree.



The first option on the tree is **LOWER**, with an arrow pointing upwards. An arrow pointing upwards (↑) increments the value and an arrow pointing downwards (↓) decrements the value. This parameter is used to calibrate the lower current value. In order to adjust the lower current value insert the tool in orifice **S**. Leave it there until the display shows 4,00 mA. If the values are different, move to **FEED** parameter and insert the milli-amperimeter current value to correct it.

Figure 8.5 – FI302 step 3

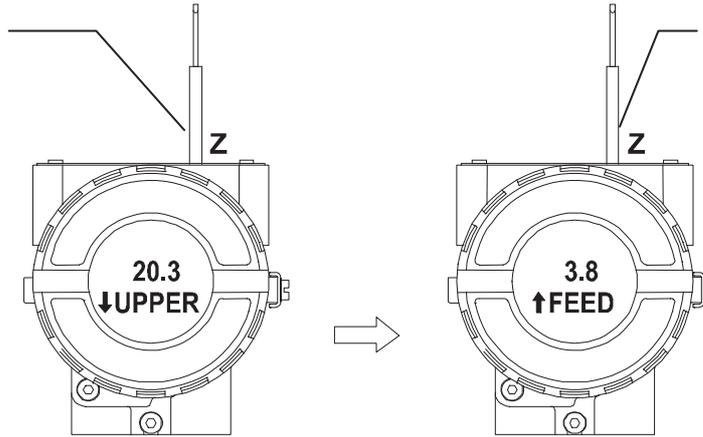
In order to decrement the lower value, insert the magnetic tool in the orifice **Z** to shift the arrow to the downward position. Insert the tool in opening **S** and wait for the lower value to decrement to 4,99 mA. Insert the miliamperimeter in the terminal block output and measure the current. If the values are different, move to the **FEED** parameter and insert the miliamperimeter current value to correct it.



The **UPPER** option is used to calibrate the upper current value. Insert the magnetic tool in the **S** and leave it there until the display indicates 20,00 mA. Insert the miliamperimeter in the output terminal of the terminal block and measure the current. If the values are different, move to the **FEED** parameter and insert the current value read on the meter to correct it.

Figure 8.6 – F302 Step 4

In order to decrement the upper value, insert the magnetic tool in the **Z** to shift the arrow to the downward position. Insert the tool in the **S** and wait for the lower value to decrease to 20,00 mA. Insert the miliamperimeter in the output terminal of the terminal block and measure the current. If the values are different, go to the **FEED** parameter and insert the miliamperimeter current value to correct it.



The FEED option allows the user to correct the current shown on the display, when the current is different from the standard value measured at the output. To implement the correction, read the current shown on the meter and apply this value. This option makes it possible to correct the calibration points on both Upper and Lower currents. An arrow pointing upwards (↑) increments the current.

Figure 8.7 – FI302 Step 5

Insert the magnetic tool in the **S** to shift the arrow downwards and decrement the calibration current according to the measured value. An arrow pointing downwards (↓) will decrement the current value.

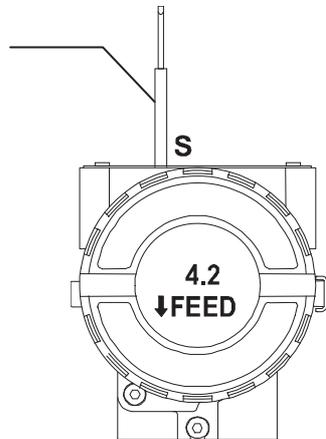


Figure 8.8 – FI302 Step 6

Section 9

TECHNICAL CHARACTERISTICS

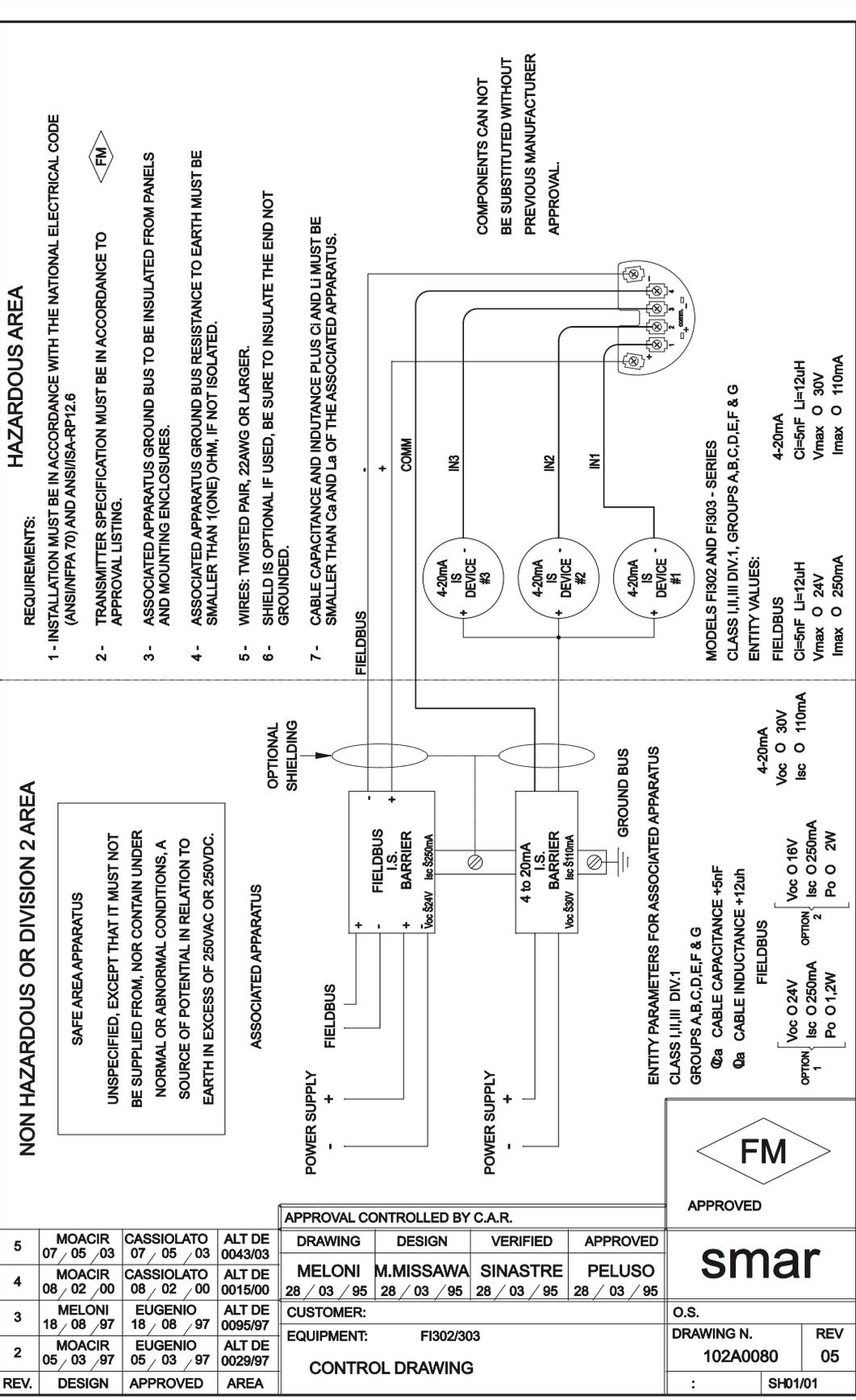
Functional Specification	
Output Signal	Three 4 - 20 mA current output, external supply, common ground.
Input Signal	Fieldbus, digital, voltage mode 31.25 Kbit/s with bus power.
Output Load Limitation	External 3 - 45 Vdc output supply
Power Supply	Bus power. Quiescent current consumption 12 mA
Output Impedance	Non-intrinsic safety: 7.8 KHZ to 39 KHZ impedance must greater or equal to 3 K Ω . With an intrinsic safety, the output impedance should be greater or equal to 400 Ω , on the assumption that exists a power supply barrier of 7.8 KHZ to 39KHz.
Display	4½ digit LCD display
Hazardous Area Certification	Explosion proof, weather proof, intrinsically safe (CENELEC and FM standards)
Temperature Limits	Operation: -40 to 85 °C Storage -40 to 100 °C Display: -20 to 80 °C operation -40 to 85 °C no damage
Humidity Limits	0 a 100% RH.
Operation starting time	Approximately 10 seconds.
Update time	Approximately 0.2 seconds.
Performance Specification	
Accuracy	0.1%.
Ambient Temperature Effect	For a 10° C variation: \pm 0.05%
Output Power Supply Effect	\pm 0.005% V.
Vibration Effect	Complies with SAMA PMC 31.1.
Electro-magnetic interference Effect	Designed to comply with IEC 801 standard
Physical Specification	
Electrical connection	1/2 -14 NPT, Pg 13.5 or M20 x 1.5.
Material of Construction	Injected low copper aluminum and finishing with polyester painting or 316 stainless steel, with Buna N O-rings on cover (NEMA 4X, IP67)
Mounting	With an optional bracket, may be installed on a 2" pipe or on a wall or panel.
Weight	Without display and mounting brackets: 0.80 Kg. Add 0.13 Kg for digital display Add 0.60 Kg for mounting bracket

Ordering Code

MODEL	FIELD BUS CURRENT CONVERTER	
	COD.	Local Display
	0	Without digital indicator
	1	With digital indicator
	COD.	Fixation Bracket
	0	Without Bracket
	1	Carbon Steel Bracket
	2	316 SST Bracket
	COD.	Electric Connection
	0	1/2-14 NPT
	A	M20 x 1.5
	B	Pg 13.5 DIN
	COD.	Optional Items
	H1	316 SST Housing
	A1	316 SST Nuts/Bolts
	ZZ	Special Features: by Specification

FI302	-	1	1	-	0	/	*	Typical model number
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* Leave it blank if not applicable



NON HAZARDOUS OR DIVISION 2 AREA

SAFE AREA APPARATUS
UNSPECIFIED, EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS, A SOURCE OF POTENTIAL IN RELATION TO EARTH IN EXCESS OF 250VAC OR 250VDC.

ASSOCIATED APPARATUS

HAZARDOUS AREA

- REQUIREMENTS:**
- 1 - INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) AND ANSI/ISA-RP12.6
 - 2 - TRANSMITTER SPECIFICATION MUST BE IN ACCORDANCE TO APPROVAL LISTING.
 - 3 - ASSOCIATED APPARATUS GROUND BUS TO BE INSULATED FROM PANELS AND MOUNTING ENCLOSURES.
 - 4 - ASSOCIATED APPARATUS GROUND BUS RESISTANCE TO EARTH MUST BE SMALLER THAN 1(OHMEGA), IF NOT ISOLATED.
 - 5 - WIRES: TWISTED PAIR, 22AWG OR LARGER.
 - 6 - SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED.
 - 7 - CABLE CAPACITANCE AND INDUCTANCE PLUS CI AND LI MUST BE SMALLER THAN Ca AND La OF THE ASSOCIATED APPARATUS.

MODELS F1302 AND F1303 - SERIES
CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G
ENTITY VALUES:
FIELDBUS
Ci=5nF Li=12uH Vmax O 24V Imax O 250mA
4-20mA
Ci=5nF Li=12uH Vmax O 30V Imax O 110mA

ENTITY PARAMETERS FOR ASSOCIATED APPARATUS
CLASS I,II,III DIV.1
GROUPS A,B,C,D,E,F & G
Qa CABLE CAPACITANCE +5nF
Qa CABLE INDUCTANCE +12uH
FIELDBUS
opt1 Voc O 24V Isc O 250mA Po O 1,2W
opt2 Voc O 16V Isc O 250mA Po O 2W
4-20mA
Voc O 30V Isc O 110mA

5	MOACIR 07 / 05 / 03	CASSIOLATO 07 / 05 / 03	ALT DE 0043/03
4	MOACIR 08 / 02 / 00	CASSIOLATO 08 / 02 / 00	ALT DE 0015/00
3	MELONI 18 / 08 / 97	EUGENIO 18 / 08 / 97	ALT DE 0095/97
2	MOACIR 05 / 03 / 97	EUGENIO 05 / 03 / 97	ALT DE 0029/97
REV.	DESIGN	APPROVED	AREA

APPROVAL CONTROLLED BY C.A.R.

DRAWING	DESIGN	VERIFIED	APPROVED
MELONI 28 / 03 / 95	M.MISSAWA 28 / 03 / 95	SINASTRE 28 / 03 / 95	PELUSO 28 / 03 / 95

CUSTOMER:
EQUIPMENT: F1302/303

CONTROL DRAWING

APPROVED

smar

O.S.
DRAWING N. 102A0080 REV 05
: SH01/01

Appendix A

	SRF – Service Request Form		
	Converter from Fieldbus to 4-20mA		
GENERAL DATA			
Model:	FI302 (<input type="checkbox"/>)	FI303 (<input type="checkbox"/>)	
Serial Number:	_____		
TAG:	_____		
How many channels are used in IF?	1 (<input type="checkbox"/>)	2 (<input type="checkbox"/>)	3 (<input type="checkbox"/>)
Configuration:	Magnetic Tool (<input type="checkbox"/>)	PC (<input type="checkbox"/>)	Software: _____ Version: _____ Other: _____
INSTALLATION DATA			
Type/Model/Manufacturer of device connected to the channel 1: _____			
Type/Model/Manufacturer of device connected to the channel 2: _____			
Type/Model/Manufacturer of device connected to the channel 3: _____			
PROCESS DATA			
Hazardous Area Classification:	(<input type="checkbox"/>) Yes, please specify: _____ (<input type="checkbox"/>) No More details: _____		
Types of Interference presents in the area:	Without interference (<input type="checkbox"/>) Temperature (<input type="checkbox"/>) Vibration (<input type="checkbox"/>) Others: _____		
Ambient Temperature:	From _____ °C up to _____ °C		
OCCURRENCE DESCRIPTION			

SERVICE SUGGESTION			
Adjustment (<input type="checkbox"/>)	Cleaning (<input type="checkbox"/>)	Preventive Maintenance (<input type="checkbox"/>)	Update / Up-grade (<input type="checkbox"/>)
Other: _____			
USER INFORMATION			
Company: _____			
Contact: _____			
Title: _____			
Section: _____			
Phone: _____			Extension: _____
E-mail: _____			Date: ____ / ____ / ____
<p>For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on www.smar.com/contactus.asp.</p>			

Returning Materials

Should it be necessary to return the converter to Smar, simply contact your local Smar office informing the defective equipment serial number and dispatch it to our factory.

For easier analysis and faster solution of the problem, the returned material should include the documentation with a description of the failure observed in the field and the circumstances that caused it. Other information, such as the installation site, type of measure taken and the process conditions are also important for a prompt evaluation.

SMAR WARRANTY CERTIFICATE

1. SMAR guarantees its products for a period of 24 (twenty four) months, starting on the day of issuance of the invoice. The guarantee is valid regardless of the day that the product was installed.
2. SMAR products are guaranteed against any defect originating from manufacturing, mounting, whether of a material or manpower nature, provided that the technical analysis reveals the existence of a quality failure liable to be classified under the meaning of the word, duly verified by the technical team within the warranty terms.
3. Exceptions are proven cases of inappropriate use, wrong handling or lack of basic maintenance compliant to the equipment manual provisions. SMAR does not guarantee any defect or damage caused by an uncontrolled situation, including but not limited to negligence, user imprudence or negligence, natural forces, wars or civil unrest, accidents, inadequate transportation or packaging due to the user's responsibility, defects caused by fire, theft or stray shipment, improper electric voltage or power source connection, electric surges, violations, modifications not described on the instructions manual, and/or if the serial number was altered or removed, substitution of parts, adjustments or repairs carried out by non-authorized personnel; inappropriate product use and/or application that cause corrosion, risks or deformation on the product, damages on parts or components, inadequate cleaning with incompatible chemical products, solvent and abrasive products incompatible with construction materials, chemical or electrolytic influences, parts and components susceptible to decay from regular use, use of equipment beyond operational limits (temperature, humidity, etc.) according to the instructions manual. In addition, this Warranty Certificate excludes expenses with transportation, freight, insurance, all of which are the customer's responsibility.
4. For warranty or non-warranty repair, please contact your representative.

Further information about address and contacts can be found on www.smar.com/contactus.asp

5. In cases needing technical assistance at the customer's facilities during the warranty period, the hours effectively worked will not be billed, although SMAR shall be reimbursed from the service technician's transportation, meals and lodging expenses, as well dismounting/mounting costs, if any.
6. The repair and/or substitution of defective parts do not extend, under any circumstance, the original warranty term, unless this extension is granted and communicated in writing by SMAR.
7. No Collaborator, Representative or any third party has the right, on SMAR's behalf, to grant warranty or assume some responsibility for SMAR products. If any warranty would be granted or assumed without SMAR's written consent, it will be declared void beforehand.
8. Cases of Extended Warranty acquisition must be negotiated with and documented by SMAR.
9. If necessary to return the equipment or product for repair or analysis, contact us.
See item 4.
10. In cases of repair or analysis, the customer must fill out the Revision Requisition Form (FSR) included in the instructions manual, which contains details on the failure observed on the field, the circumstances it occurred, in addition to information on the installation site and process conditions. Equipments and products excluded from the warranty clauses must be approved by the client prior to the service execution.
11. In cases of repairs, the client shall be responsible for the proper product packaging and SMAR will not cover any damage occurred in shipment.

12. In cases of repairs under warranty, recall or outside warranty, the client is responsible for the correct packaging and packing and SMAR shall not cover any damage caused during transportation. Service expenses or any costs related to installing and uninstalling the product are the client's sole responsibility and SMAR does not assume any accountability before the buyer.
13. It is the customer's responsibility to clean and decontaminate products and accessories prior to shipping them for repair, and SMAR and its dealer reserve themselves the right to refuse the service in cases not compliant to those conditions. It is the customer's responsibility to tell SMAR and its dealer when the product was utilized in applications that contaminate the equipment with harmful products during its handling and repair. Any other damages, consequences, indemnity claims, expenses and other costs caused by the lack of decontamination will be attributed to the client. Kindly, fill out the Declaration of Decontamination prior to shipping products to SMAR or its dealers, which can be accessed at www.smar.com/doc/declarationofcontamination.pdf and include in the packaging.
14. This warranty certificate is valid only when accompanying the purchase invoice.