FI302

smar

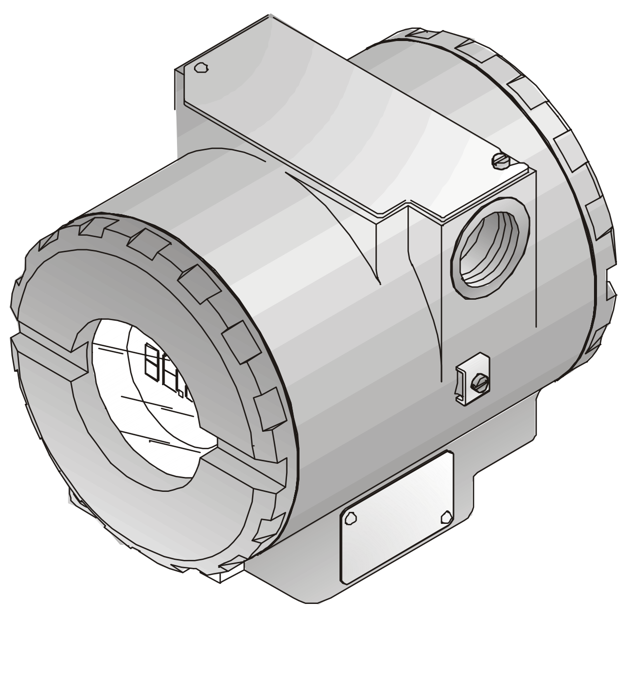
FIRST IN FIELDBUS

OPERATION & MAINTENANCE INSTRUCTIONS MANUAL

TRIPLE CHANNEL

FIELDBUS TO CURRENT

CONVERTER



MAY / 02

FI302

VERSION 3

FOUNDATION

F I 3 0 2 M E

smar

web: www.smar.com

Specifications and information are subject to change without notice.
For the latest updates, please visit the SMAR website above.

BRAZIL
Smar Equipamentos Ind. Ltda.
Rua Dr. Antonio Furlan Jr., 1028
Sertãozinho SP 14170-480
Tel.: +55 16 3946-3510
Fax: +55 16 3946-3554
e-mail: smarinfo@smar.com

CHINA
Smar China Corp.
3 Baishiqiao Road, Suite 30233
Beijing 100873, P.R.C.
Tel.: +86 10 6849-8643
Fax: +86-10-6894-0898
e-mail: info@smar.com.cn

FRANCE
Smar France S. A. R. L.
42, rue du Pavé des Gardes
F-92370 Chaville
Tel.: +33 1 41 15-0220
Fax: +33 1 41 15-0219
e-mail: smar.am@wanadoo.fr

GERMANY
Smar GmbH
Rheingaustrasse 9
55545 Bad Kreuznach
Germany
Tel: + 49 671-794680
Fax: + 49 671-7946829
e-mail: infoservice@smar.de

MEXICO
Smar México
Cerro de las Campanas #3 desp 119
Col. San Andrés Atenco
Tlalnepantla Edo. Del Méx - C.P. 54040
Tel.: +53 78 46 00 al 02
Fax: +53 78 46 03
e-mail: ventas@smar.com

SINGAPORE
Smar Singapore Pte. Ltd.
315 Outram Road
#06-07, Tan Boon Liat Building
Singapore 169074
Tel.: +65 6324-0182
Fax: +65 6324-0183
e-mail: info@smar.com.sg

USA
Smar International Corporation
6001 Stonington Street, Suite 100
Houston, TX 77040
Tel.: +1 713 849-2021
Fax: +1 713 849-2022
e-mail: sales@smar.com

Smar Laboratories Corporation
6001 Stonington Street, Suite 100
Houston, TX 77040
Tel.: +1 713 849-2021
Fax: +1 713 849-2022
e-mail: sales@smar.com

Smar Research Corporation
4250 Veterans Memorial Hwy.
Suite 156
Holbrook , NY 11741
Tel: +1-631-737-3111
Fax: +1-631-737-3892
e-mail: sales@smarresearch.com

Introduction

The **FI302** is of the first generation of Fieldbus devices. It is a converter mainly intended for interface of a Fieldbus system to control valve or other actuators. The **FI302** produces a 4-20 mA output proportional to input received over the Fieldbus network. The digital technology used in the **FI302** enables an easy interface between the field and the control room and several interesting features that reduce considerably the installation, operation and maintenance costs.

The **FI302** is part of Smar's complete 302 line of Fieldbus devices.

Fieldbus is not only a replacement for 4-20 mA or intelligent / smart transmitter protocols, it contains much more. Fieldbus is a complete system enabling distribution of the control function to equipment in the field.

Some of the advantages of bi-directional digital communications are known from existing smart transmitter protocols: Higher accuracy, multi-variable access, remote configuration and diagnostics, and multi-dropping of several devices on a single pair of wires.

Those protocols were not intended to transfer control data, but maintenance information. Therefore they were slow and not efficient enough to be used.

The main requirements for Fieldbus were to overcome these problems. Closed loop control with performance like a 4-20 mA system requires higher speed. Since higher speed means higher power consumption, this clashes with the need for intrinsic safety.
Therefore a moderately high communication speed was selected, and the system was designed to have a minimum of communication overhead. Using scheduling the system controls variable sampling, algorithm execution and communication so as to optimize the usage of the network, not loosing time. Thus, high closed loop performance is achieved.

Using Fieldbus technology, with its capability to interconnect several devices, very large control schemes can be constructed. In order too be user friendly the function block concept was introduced (users of SMAR CD600 should be familiar with this, since it was implemented several years ago). The user may now easily build and overview complex control strategies. Another advantage is added flexibility; the control strategy may be edited without having to rewire or change any hardware.

The **FI302**, like the rest of the 302 family, has several Function Blocks built in, like PID controller, Input Selector and Splitter/Output Selector, eliminating the need for separate control device. This feature reduces communication and by that less dead-time and tighter control, not to mention the reduction in cost.

Other function blocks are also available. They allow flexibility in control strategy implementation.

The need for implementation of Fieldbus in small as well as large systems was considered when developing the entire 302 line of Fieldbus devices. They have the common features of being able to act as a master on the network and be configured locally using a magnetic tool, eliminating the need for a configurator or console in many basic applications.

Get the best result of the FI302 by carefully reading these instructions.

WARNING

This Manual is compatible with version 3.XX, where 3 denote software version and XX software release. The indication 3.XX means that this manual is compatible with any release of software version 3.

Table of Contents

Section 1

Installation

General

The overall accuracy of measurement and control depends on several variables. Although the converter has an outstanding performance, proper installation is essential, in order to maximize its performance.

Among all factors, which may affect converter accuracy, environmental conditions are the most difficult to control. There are, however, ways of reducing the effects of temperature, humidity and vibration.

Locating the converter in areas protected from extreme environmental changes can minimize temperature fluctuation effects.

In warm environments, the converter should be installed to avoid, as much as possible, direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided.

Use of sunshades or heat shields to protect the converter from external heat sources should be considered, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronics cover must be correctly placed. Removal of the electronics cover in the field should be reduced to the minimum necessary, since each time it is removed the circuits are exposed to the humidity. The electronic circuit is protected by a humidity proof coating, but frequent exposures to humidity may affect the protection provided. It is also important to keep the covers tightened in place. Every time they are removed, the threads are exposed to corrosion, since painting cannot protect these parts. Code-approved sealing methods on conduit entering the converter should be employed.

Mounting
Using the bracket, the mounting may be done in several positions, as shown on Figure 1.3 - Dimensional Drawing and Mounting Positions.
For better visibility, the digital indicator may be rotated in steps of 90° (See the section Maintenance Procedures).

Output Wiring
The output is in fact a current link. An external power source is therefore necessary. The **FI302** controls the current in the loop. (See Figure 1.4 - Output Connections). The three channels have a common ground for the external power supply.

The output load is limited by the voltage of the external power supply. Please refer to the load graph to determine the maximum load.

On loss of power the output will be uncertain. If power is maintained, but communication is lost, the output may be pre-configured to freeze or go to a safe value.

Electric Wiring
Access the wiring block by removing the Electrical Connection Cover. This cover can be locked closed by the cover locking screw (See Figure 1.1 - Cover Locking). To release the cover, rotate the locking screw clockwise.

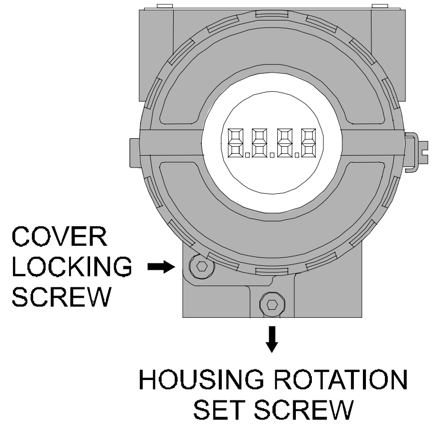


Figure 1.1 - Cover Locking

Cable access to wiring connections is obtained by one of the two conduit outlets. Conduit threads should be sealed by means of code-approved sealing methods. The unused outlet connection should be plugged accordingly.

The wiring block has screws on which terminals type fork or ring can be fastened, see Figure 1.2 - Ground Terminals**.**

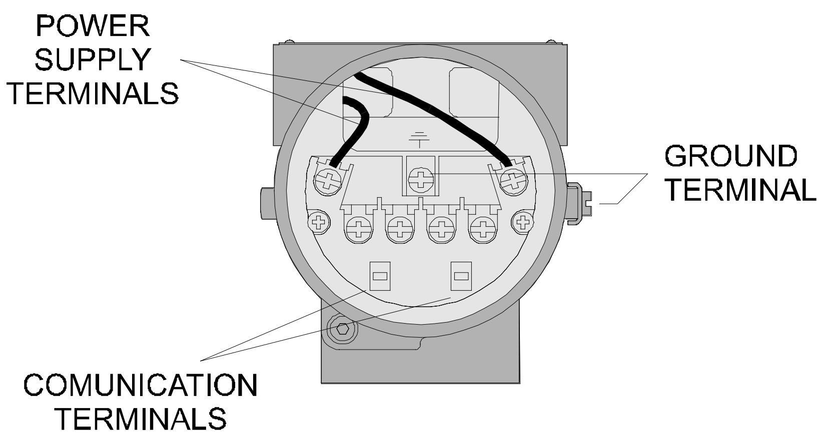


Figure 1.2 - Ground Terminals

For convenience there are three ground terminals: one inside the cover and two externals, located close to the conduit entries.

The **FI302** uses the 31.25 kbit/s voltage mode option for the physical signaling. All other devices on the same bus must use the same signaling. All devices are connected in parallel along the same pair of wires.

Various types of Fieldbus devices may be connected on the same bus.

The **FI302** is powered via the bus. The limit for such devices is 12 for one bus for non-intrinsically safe requirement. In hazardous area, the number of devices may be limited by intrinsically safe restrictions.

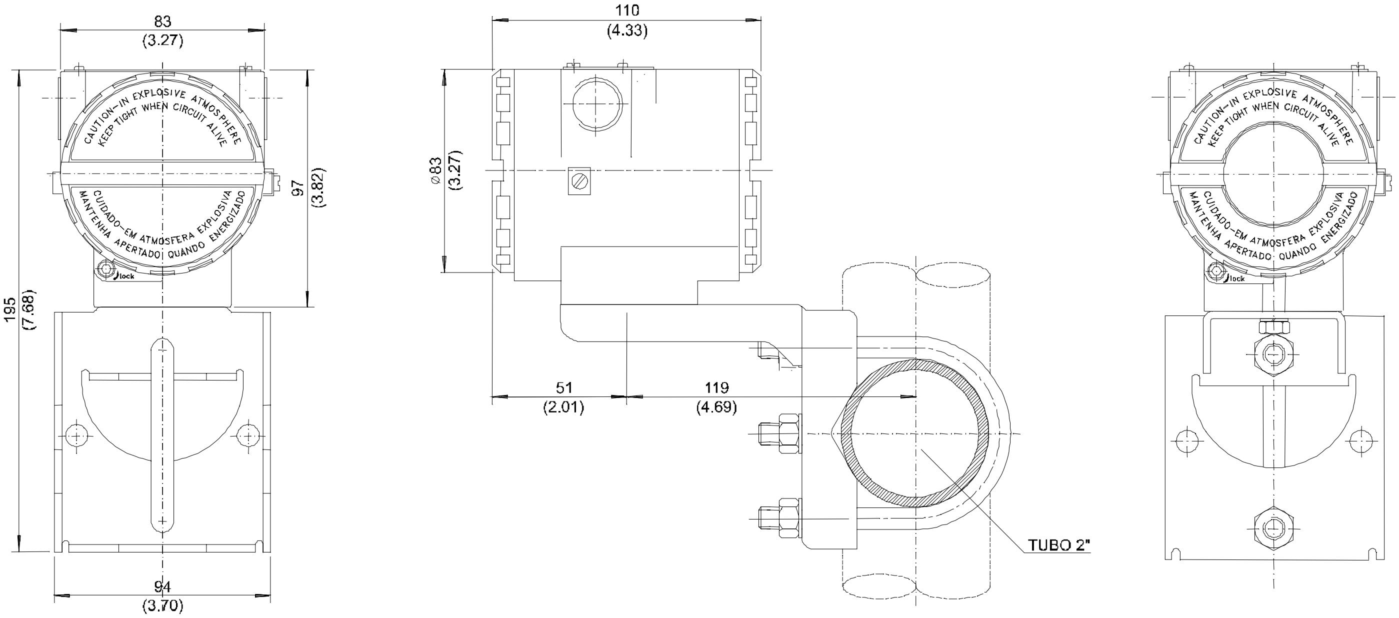


Figure 1.3 - Dimensional Drawing and Mounting Positions

WARNING

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 moisture or corrosive gases, tighten the O'ring until feeling the O'ring touching the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw.

In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

Cable access to wiring connections is obtained by the two conduit outlets. Conduit threads should be sealed by means of code-approved sealing methods.

Explosion proof, non-incendive and intrinsic safety Factory Mutual certification are standards for **FI302** (See Control Drawing in Appendix A).

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

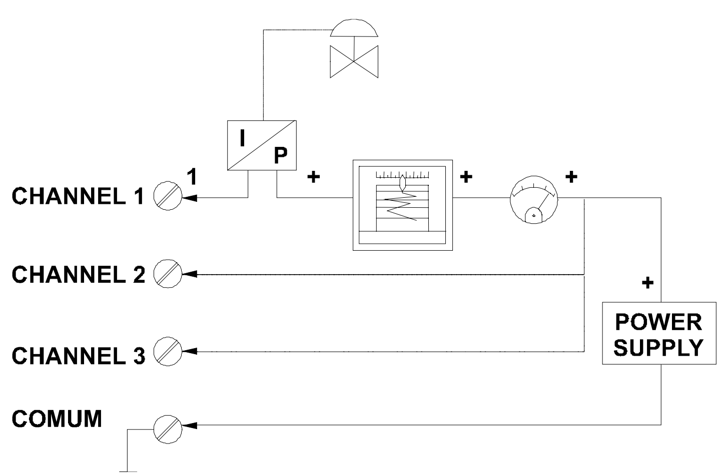


Figure 1.4 - Output Connections

Avoid routing signal wiring close to power cables or switching equipment.
The **FI302** is protected against reverse polarity, and can withstand ±35 V DC without damage.

NOTE

Please refer to the General Installation, Operation and Maintenance Manual for more details.

Topology and Network Configuration

Wiring

Other types of cable may be used, other than for conformance testing. Cables with improved specifications may enable longer trunk length or superior interface immunity. Conversely, cables with inferior specifications may be used subject to length limitations for trunk and spurs plus possible nonconformance to the RFI/EMI susceptibility requirements. For intrinsically safe applications, the inductance/resistance ratio (L/R) should be less than the limit specified by the local regulatory agency for the particular implementation.

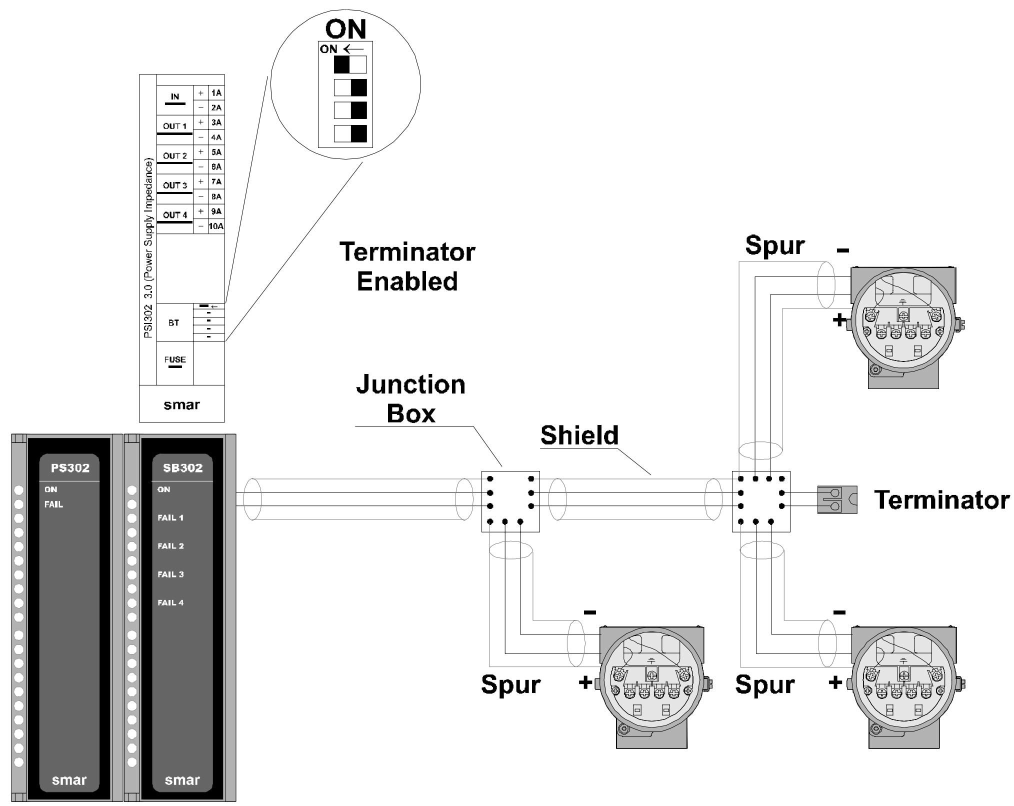


Figure 1.5 - Bus Topology

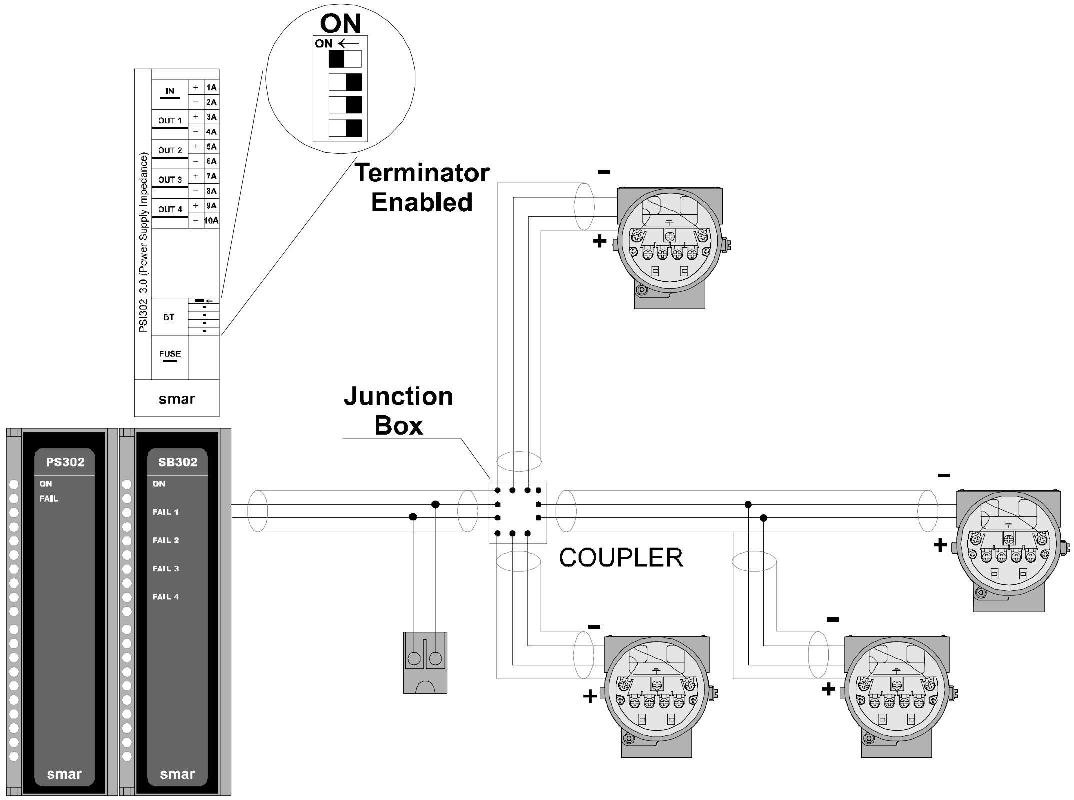


Figure 1.6 - Tree Topology

There are two ways to configure the communication and function block links for the **FI302**. The first is using a system configuration device. In this case the heaviest and most difficult task is automated and the risk for configurating the communication wrongly is almost eliminated. In this system, addressing of a device is first done using the physical device tag of that device. Before a new (non-initialized) device is connected to the network it must therefore be configured with this tag.

Connect a configurator to the non-initialized **FI302** without having any other devices on the line. Assign the physical device tag to the **FI302**.
The **FI302** is now initialized and can be connected to the network.

The system will now automatically assign a station address to the **FI302**, bringing it to its stand-by state.

The **FI302** can now be configured for the application and brought to the operational state.

The second method is manually pre-configured the communication using the local adjustment. This eliminates the need for a powerful system configurator, but requires more knowledge of the Fieldbus communication mechanism. This may be a money saving solution in a small system, but hard to do bug-free in a large system.

Operation

Functional Description – Electronics Refer to the block diagram

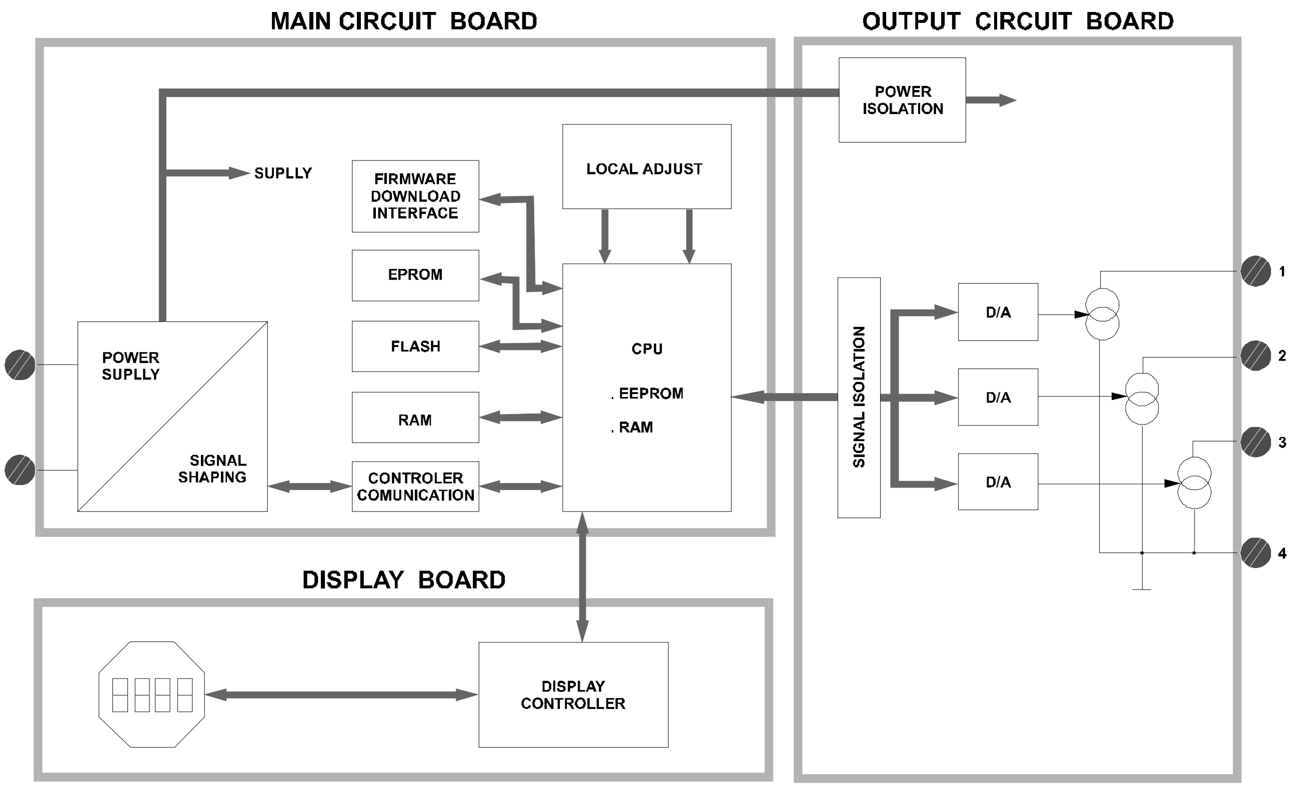


Figure 2.1 - FI302 Block Diagram

The function of each block is described below:

D/A
Receives the signal from the CPU and converts it to an analog voltage, used by the current control.

Current Control
Controls the current of the channel according the data received from the CPU.

Signal Isolator
Its function is to isolate the data signal between the output and the CPU.

(CPU) Central Processing Unit, RAM and PROM
The CPU is the intelligent portion of the converter, being responsible for the management and operation of block execution, self-diagnostics and communication. The program is stored in PROM. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off, however the device also has a nonvolatile EEPROM where data that must be retained is stored. Examples of such data are calibration, configuration and identification data.

Communication Controller
It monitors line activity, modulates and demodulates communication signals and inserts and deletes start and end delimiters.

Power Supply
Takes power of the loop-line to power the converter circuitry.

Power Isolation
Just like the signals to and from the output section, the power to the output section must be isolated.

Display Controller
Receives data from the CPU and drives the Liquid Crystal Display.

Local Adjustment
Two switches that are magnetically activated. They can be activated by the magnetic tool without mechanical or electrical contact.

Configuration

One of the many advantages of Fieldbus is that device configuration is independent of the configurator. The **FI302** may be configured by a third party terminal or operator console. Any particular configurator is therefore not addressed here.

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

Function Blocks are not covered in this manual. For explanation and details of function blocks, see the “Function Blocks Manual”.

Transducer Block

Transducer block insulates function block from the specific I/O hardware, such as sensors, actuators. Transducer block controls access to I/O through manufacturer specific implementation. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors without burdening the function blocks that use the data. It also insulates the function block from the manufacturer specific characteristics of certain hardware.
By accessing the hardware, the transducer block can get data from I/O or passing control data to it. The connection between Transducer block and Function block is called channel. These blocks can exchange data from its interface.
Normally, transducer blocks perform functions, such as linearization, characterization, temperature compensation, control and exchange data to hardware.

How to Configure a Transducer Block

Each time when you select a field device on SYSCON by instantiating on the Operation menu, automatically you instantiate one transducer block and it appears on screen.
The icon indicates that one transducer block has been created and by clicking twice on the icon, you can access it.

The transducer block has an algorithm, a set of contained parameters and a channel connecting it to a function block.
The algorithm describes the behavior of the transducer as a data transfer function between the I/O hardware and other function block. The set of contained parameters, it means, you are not able to link them to other blocks and publish the link via communication, defines the user interface to the transducer block. They can be divided into Standard and Manufacturer Specific.
The standard parameters will be present for such class of device, as pressure, temperature, actuator, etc., whatever is the manufacturer. Oppositely, the manufacturers specific ones are defined only for its manufacturer. As common manufacturer specific parameters, we have calibration settings, material information, linearization curve, etc.
When you perform a standard routine as a calibration, you are conducted step by step by a method. The method is generally defined as guide line to help the user to make common tasks. The SYSCON identifies each method associated to the parameters and enables the interface to it.

Terminal Number

The terminal number, which references a channel value, which is sent via internal, manufacturer-specific from the specified transducer, output to function block.
It starts at one (1) for transducer number one until three (3) for transducer number three.

The channel number of the AO block is related to the transducer’s terminal number. Channel number 1, 2, 3 corresponds bi-univocally to the terminal block with the same number. Therefore, all the user has to do is to select combinations: (1.1), (2.2), (3,3) for (CHANNEL, BLOCK).

Current Trim

The **FI302** provides the capability of making a trim in the output channels, if necessary.

A trim is necessary if the indicator reading of the transducer block output differs from the actual physical output. The reason may be:

- The user's current meter differs from the factory standard.
- The converter had its original characterization shifted by over-load or by long term drift.

The user can check the calibration of the transducer output by measuring the actual current in the output and compare it with the device's indication (of course an appropriate meter should be used). If a mismatch is detected, a trim can be done.

Trim can be done in two points:

LOWER TRIM: Is used to trim the output at the lower range.
UPPER TRIM: Is used to trim the output at the upper range.

These two points define the linear characteristic of the output. Trim in one point is independent from the other.

There are two ways of doing the trim: using local adjustment or using **SYSCON** (the System Configurator from **SMAR**). When doing the trim, make sure you are using an appropriate meter (with the necessary accuracy).

Via SYSCON

Configure in the Transducer, the parameter "TERMINAL_NUMBER" with 1,2, or 3, according to the "CHANNEL" number of Analog Output block.

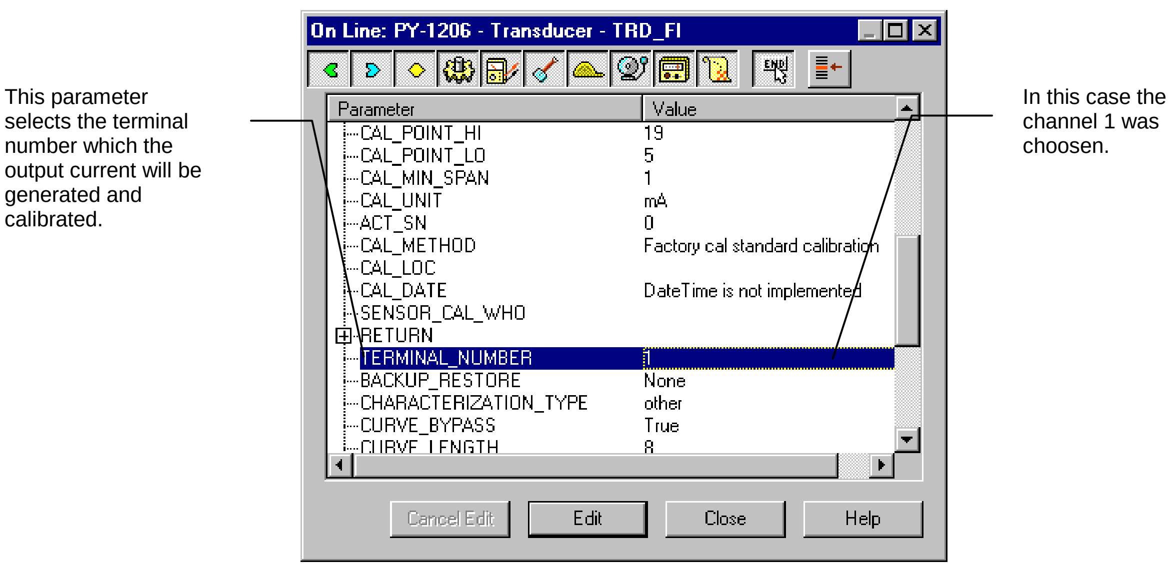
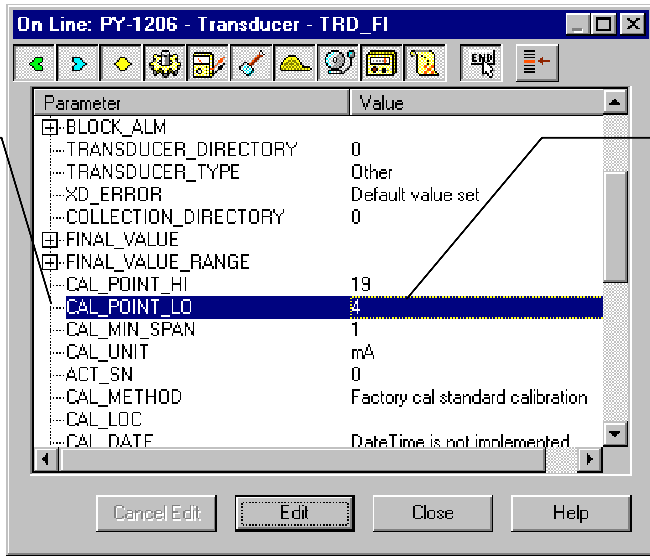


Figure 3.1 - Choosing the Output Channel – FI302

It is possible to calibrate the transmitter 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.

This parameter indicates where the converter should be when the setpoint lower value is 0%.

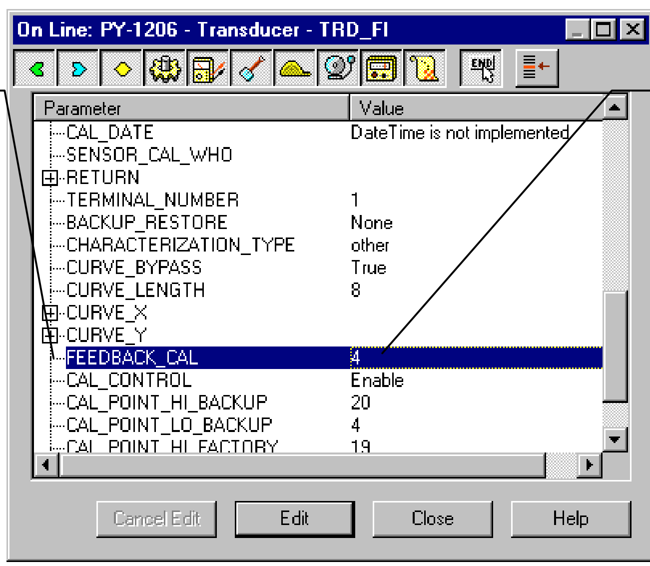


The desired value should be entered.

Figure 3.2 - 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.

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

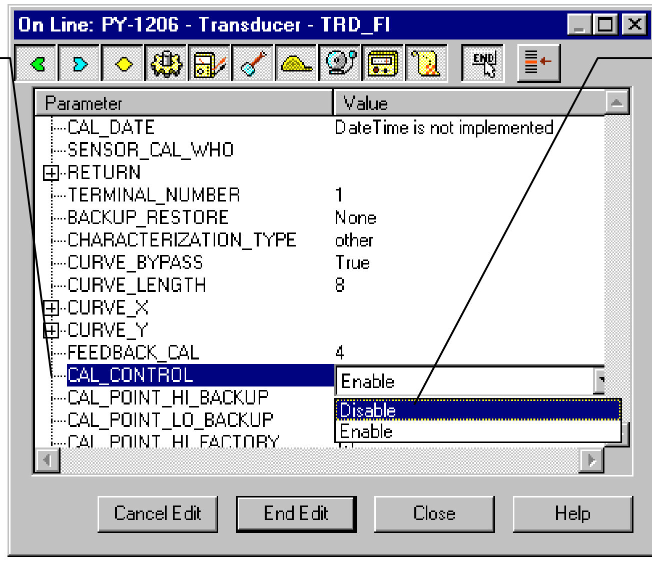


The value should be entered here.

Figure 3.3 - Feedback of Current Lo Value

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

This parameter ends the calibration procedure.

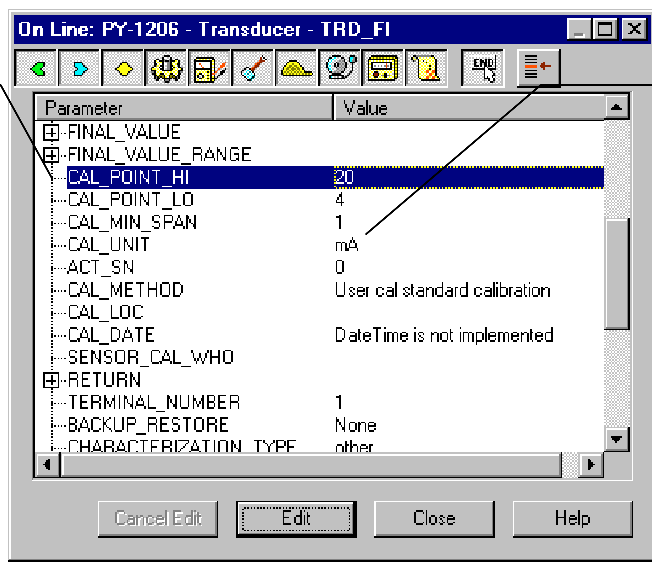


The enable option indicates that the calibration process is being done. In order to finalize its procedure, the user should set it to disable.

Figure 3.4 - 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 3.5 - 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.

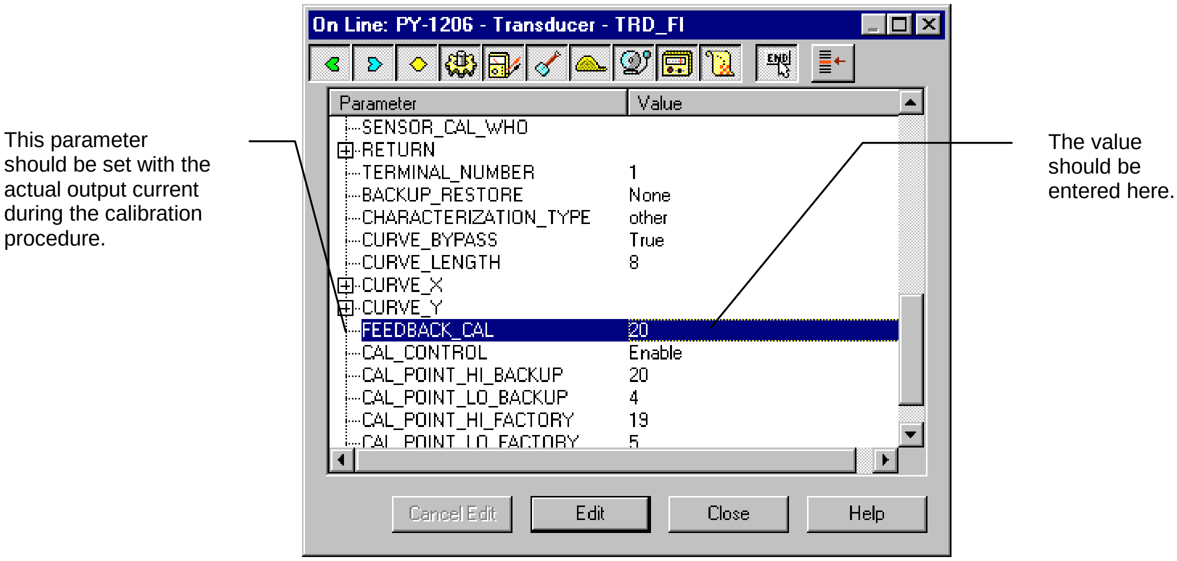


Figure 3.6 - Feedback of Current Hi Value – FI302

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

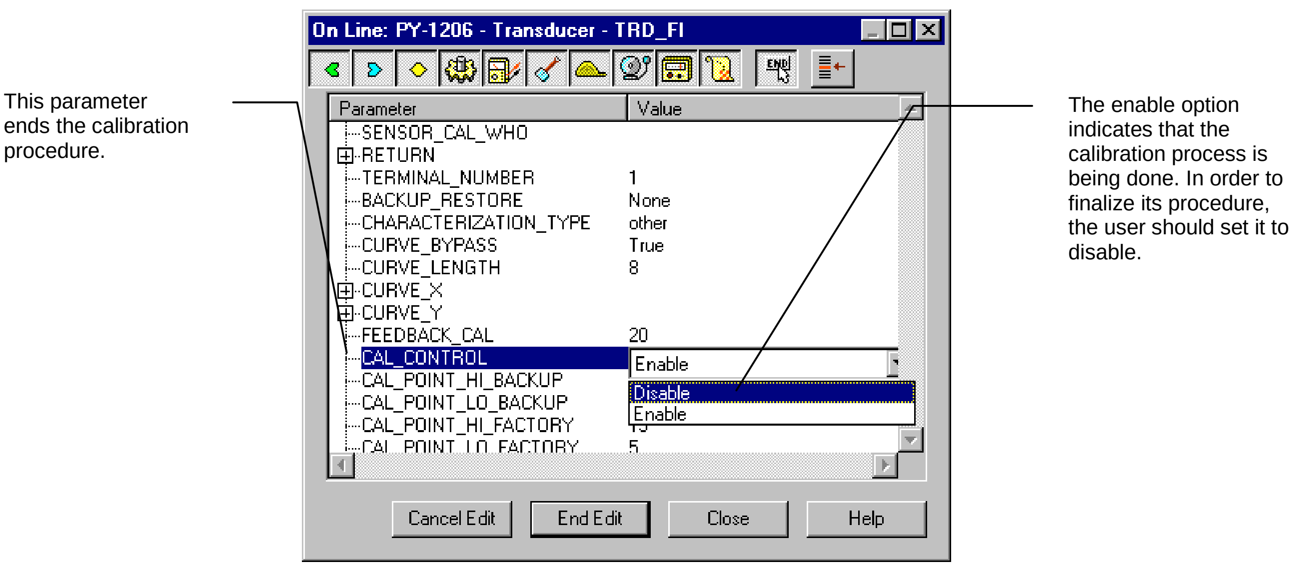
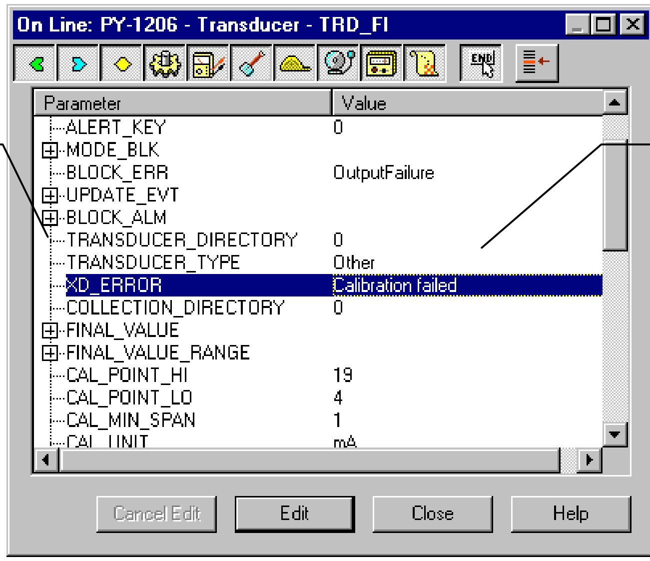


Figure 3.7 - Closing the Calibration Hi Procedure

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 3.8 - Calibration Error Message – FI302

NOTE

It is convenient to choose the unit to be used in parameter XD_SCALE of the Analog Output Block, considering that sensor limits at 100% and at 0% should be observed.

It is also recommendable, for every new calibration, save the existing trim data in parameters CAL_POINT_LO_BACKUP and CAL_POINT_HI_BACKUP, by means of parameter BACKUP_RESTORE, using option LAST_TRIM_BACKUP.

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** is controlling a valve with a non-linear characteristic. Characterization curve, when used, is applied to the input signal, before it is converted by the transducer to analog current.

Use of the curve is defined by the CURVE_BYPASS parameter. When CURVE_BYPASS is True (Bypass), the curve is not used and the input value is passed directly to the current conversion routine. When CURVE_BYPASS is false (No Bypass), curve is used.

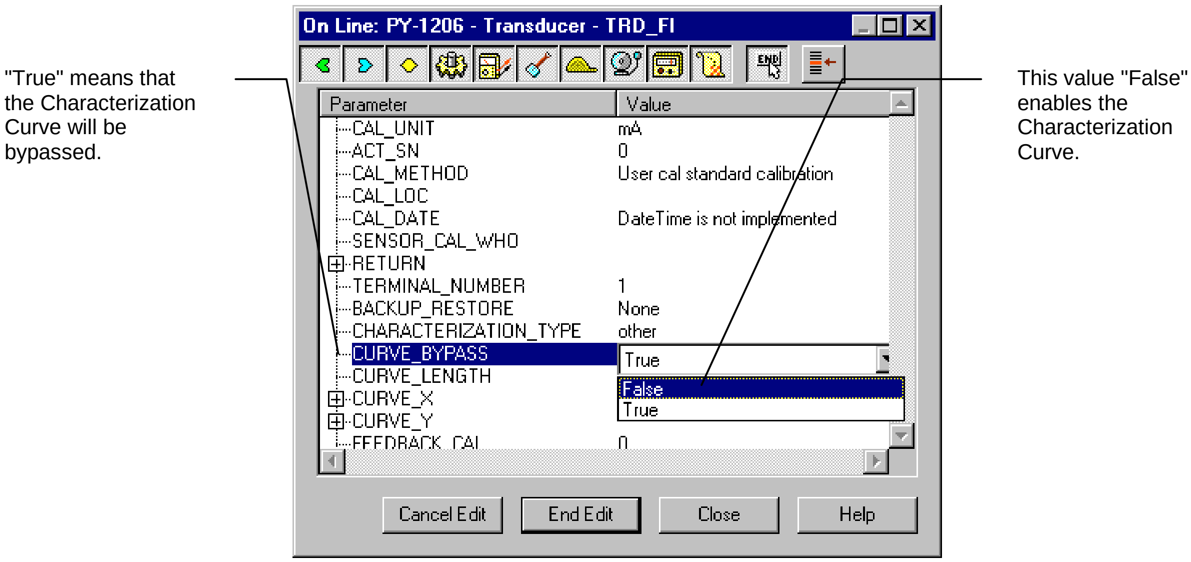


Figure 3.9 - Enabling the Characterization Curve

The characterization curve has 8 points. Each point has two coordinates (X and Y). These two coordinates define the location of the point in a X-Y space, and the 8 points form a curve. The curve is formed by connecting two adjacent points with a linear segment. Outside extreme points, the curve extrapolates the extreme segments.

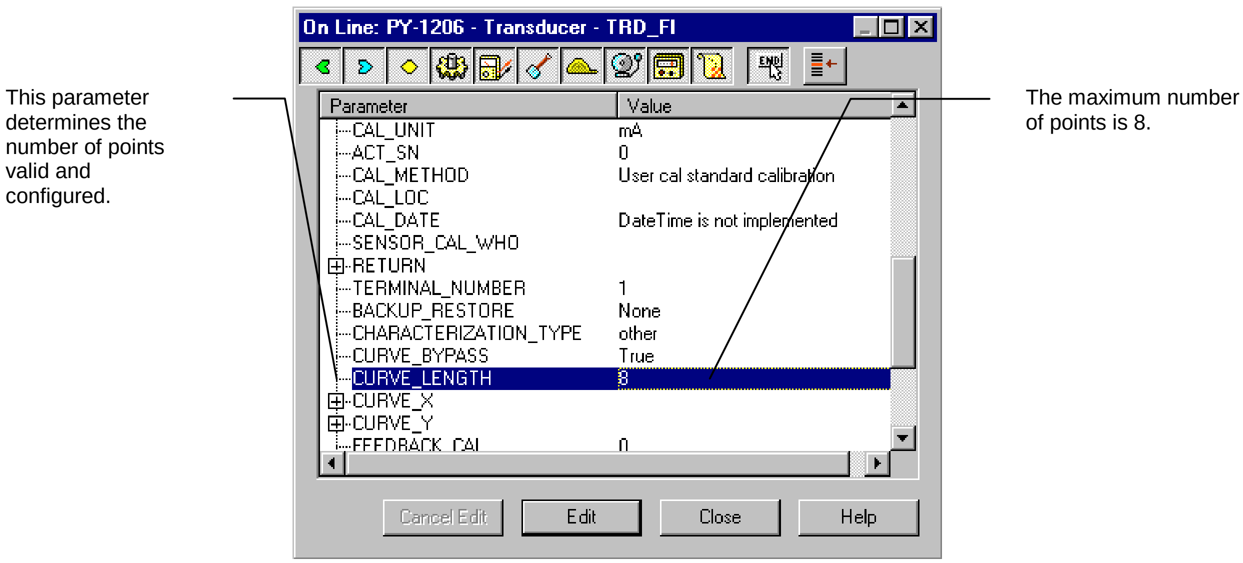


Figure 3.10 - Seting the Characterization Curve Length

Those 8 points are numbered from 1 to 8, and are contained in the CURVE_X (In Coordinates) and CURVE_Y (Out Coordinates) parameters. CURVE_X parameter requires points in crescent order. I.e. succeeding points be greater than preceding points, or parameter will not be accepted. CURVE_Y parameter does not require this, so a non-monotone curve is allowed.

When writing to CURVE parameters, remember to put the point coordinates in the correct order.

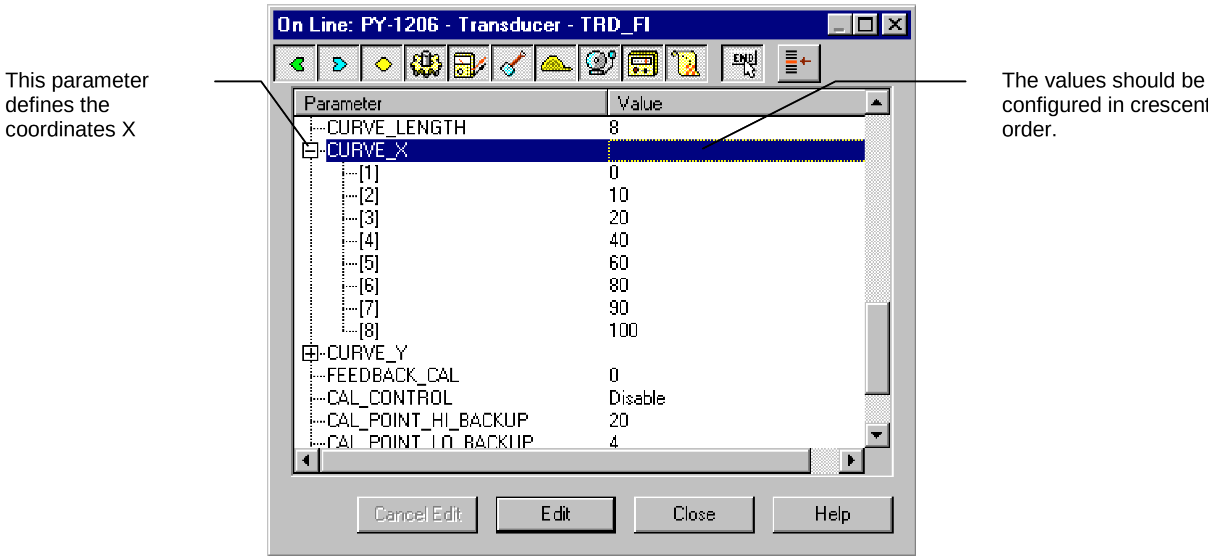


Figure 3.11 - Configuring the Characterization Curve - X points

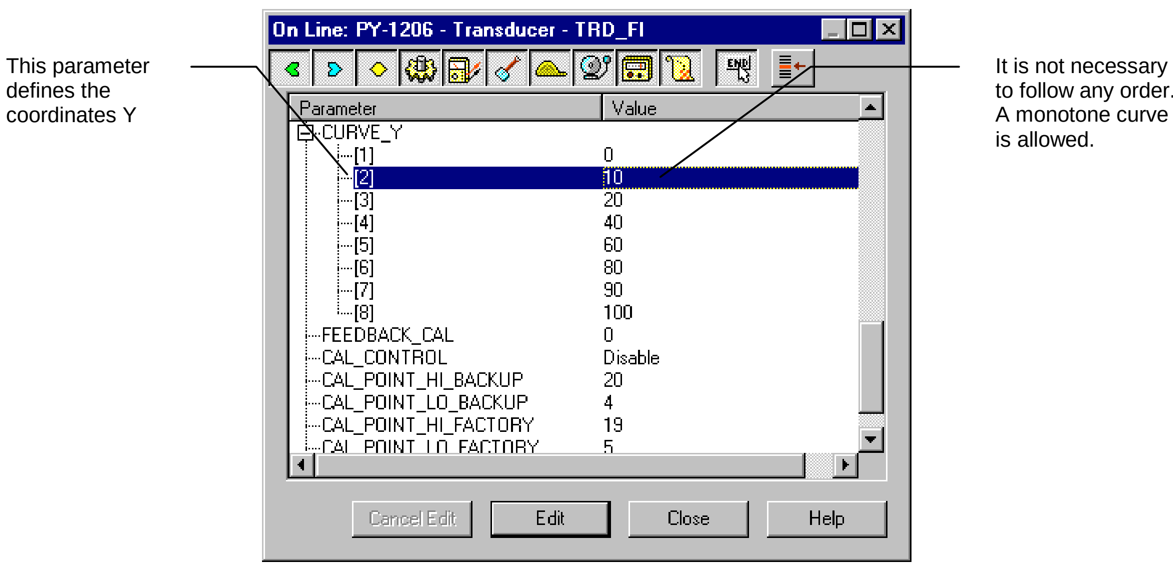


Figure 3.12 - Configuring the Characterization Curve - Y points

Via Local Adjustment

The **FI302** has 3 output transducers and its device leaves SMAR with factory settings. The factory setting establishes only the transducers #1 as default for local adjustment. In order to configure the others via local adjustment, the user should configure them in the display transducer via SYSCON, according specific instructions for this transducer block.

In order to enter the local adjustment mode, place the magnetic tool in orifice "Z" until flag "MD" lights up in the display. Remove the magnetic tool from "Z" and place it in orifice "S". Remove and reinsert the magnetic tool in "S" until the message "**Loc-Adj**" is displayed. The message will be displayed during approximately 5 sec. after the user removes the magnetic tool from “S”. By placing the magnetic tool in “Z” the user will be able to access the local adjustment/monitoring tree. Browse to parameter “LOWER”. After that, in order to start the calibration, the user should actuate parameter “LOWER” with the help of the magnetic tool placed in “S”.

For example, it is possible to enter 4.0 mA or the lower value. When the magnetic tool is removed from “S”, the output will be adjusted to a value close to the desired value. The user should then browse the tree up to parameter FEED (FEEDBACK_CAL), and actuate this parameter by placing the magnetic tool in “S” until reaching the value shown by the multimeter.

The user should write in this parameter the multimeter readout value until 4.0 mA or the desired lower values are displayed.

Browse up to parameter “UPPER”. Then, in order to start the calibration, the user should actuate parameter UPPER by planing the magnetic tool in “S”.

For example, it is possible to enter 20.0 mA or the upper value. When the magnetic tool is removed from “S”, the output will be adjusted to a value close to the desired value. The user should then browse the tree up to parameter FEED (FEEDBACK_CAL) and actuate this parameter by placing the magnetic tool in “S” until reaching the value shown by the multimeter.

The user should write in this parameter the multimeter readout value until 20.0 mA or the desired upper values are displayed.

NOTE

Trim mode exit via local adjustment occurs automatically. Should the magnetic tool not be used during approximately 16 seconds.

LIMIT CONDITIONS FOR CALIBRATION	
Lower	3.99 < NEW_LOWER < 11.5 mA, otherwise XD_ERROR = 22
Upper	12.50 < NEW_UPPER < 20.01 mA, otherwise XD_ERROR = 22

NOTE

Codes for XD_ERROR:
… 16: Default Value Set
… 22: Out of range
… 26: Invalid Calibration request
… 27: Excessive Correction

Display Transducer Block

The local adjustment is completely configured by SYSCON. It means, the user can select the best options to fit his application. From factory, it is configured with the options to set the Upper and Lower trim, for monitoring the input transducer output and check the Tag. Normally, the transmitter is much better configured by SYSCON, but the local functionality of the LCD permits an easy and fast action on certain parameters, since it does not rely on communication and network wiring connections. Among the possibilities by Local Adjustment, the following options can be emphasized: Mode block, Outputs monitoring, Tag visualization and Tuning Parameters setting.
The interface between the user is described very detailed on the "General Installation, Operation and Maintenance Procedures Manual". Please take a detailed look at this manual in the chapter related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 302 field devices from SMAR has the same methodology to handle with it. So, since the user has learned once, he is capable to handle all kind of field devices from SMAR.

All function block and transducers defined according Foundation Fieldbus™ have a description of their features written on binary files, by the Device Description Language. This feature permits that third parties configurator enabled by Device Description Service technology can interpret these features and make them accessible to configure. The Function Blocks and Transducers of Series 302 have been defined rigorously according the Foundation Fieldbus specifications in order to be interoperable to other parties.

In order to able the local adjustment using the magnetic tool, it is necessary to previously prepare the parameters related with this operation via SYSCON (System Configuration). The Figure 3.8 - Calibration Error Message – FI302 and the Figure 3.9 - Enabling the Characterization Curve show all parameters and their respective values, which shall be configured in accordance with then necessity of being locally adjusted by means of the magnetic tool. All values shown on the display are default values.

There are seven groups of parameters, which may be pre-configured by the user in order to able, a possible configuration by means of the local adjustment. As an example, let's suppose that you don't want to show some parameters; in this case, simply write an invalid Tag in the parameter, Block_Tag_Param_X. Doing this, the device will not take the parameters related (indexed) to its Tag as a valid parameters.

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).

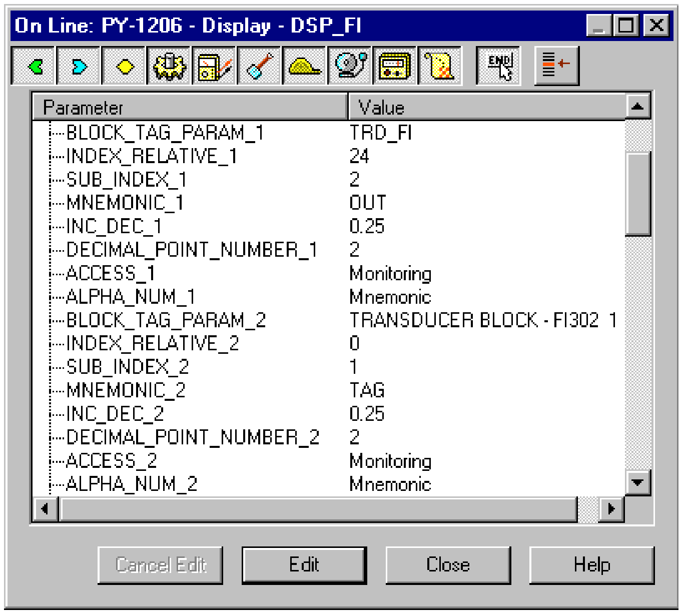


Figure 3.13 - Parameters for Local Adjustment Configuration

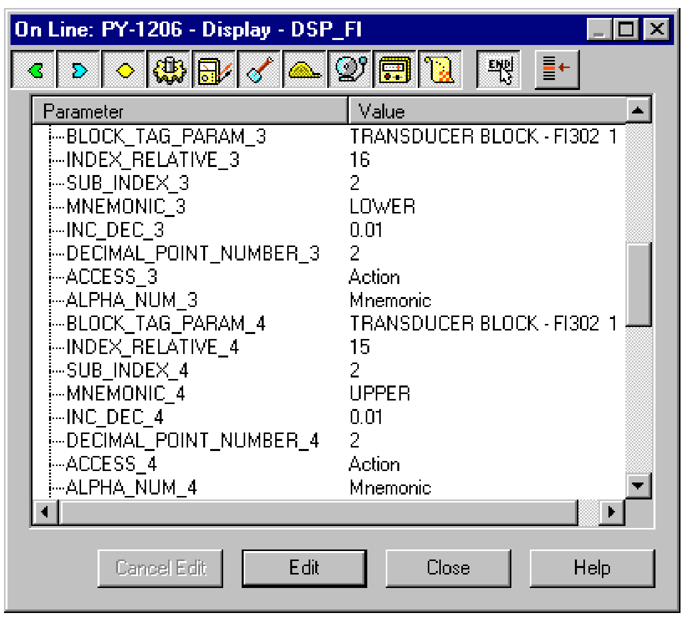


Figure 3.14 - Parameters for Local Adjustment Configuration

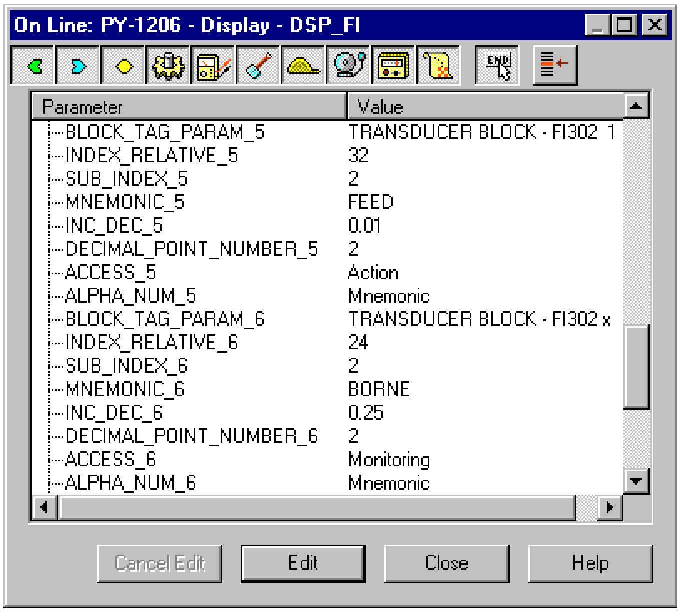


Figure 3.15 - Parameters for Local Adjustment Configuration

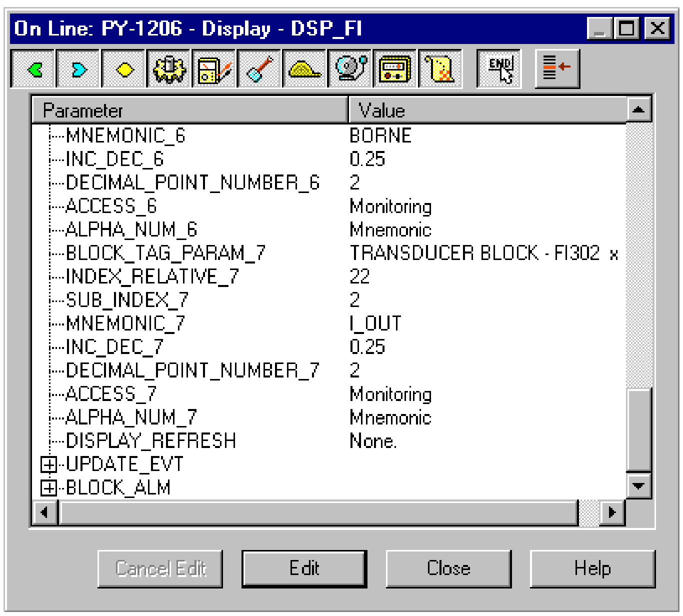
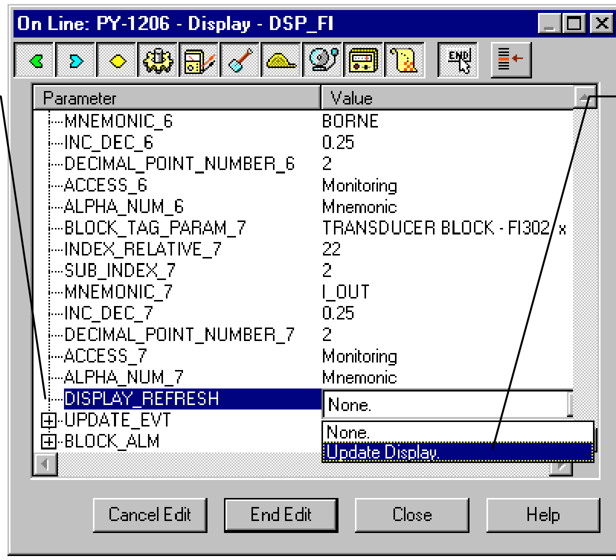


Figure 3.16 - Parameters for Local Adjustment Configuration

This parameter updates the local adjustment programming tree configured on each device.



The option "update" should be selected in order to execute the upgrade of local adjustment programming tree.

After its step all the parameters selected will be show on the LCD display.

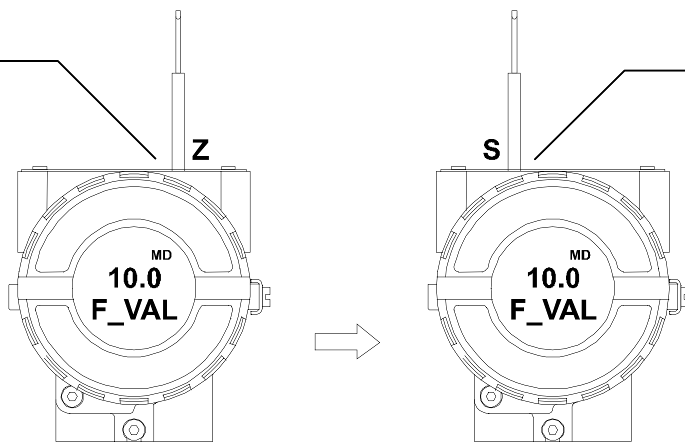
Figure 3.17 - Parameters for Local Adjustment Configuration

Programming Using Local Adjustment

Example

Let's say we want to calibrate the lower and upper current value. From normal display, enter local adjustment. The display will show:

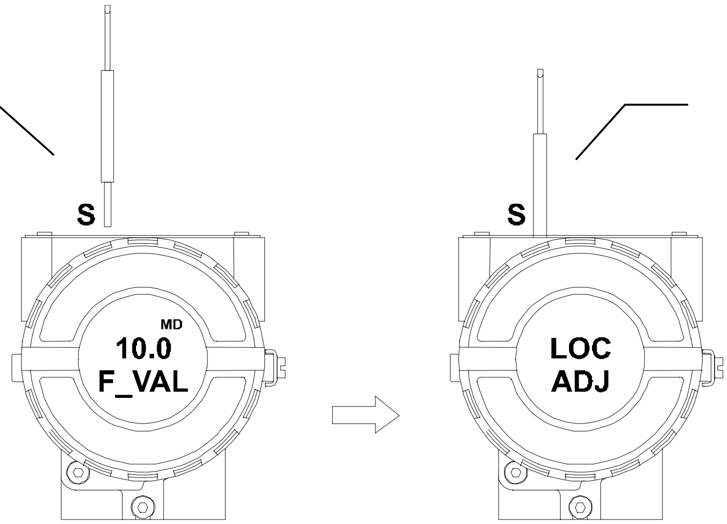
In order to start the local adjustment, place the magnetic tool in orifice **Z** and wait until letters **MD** are displayed.



Place the magnetic tool in orifice **S** and wait during 5 seconds.

Figure 3.18 - Step 1 - FI302

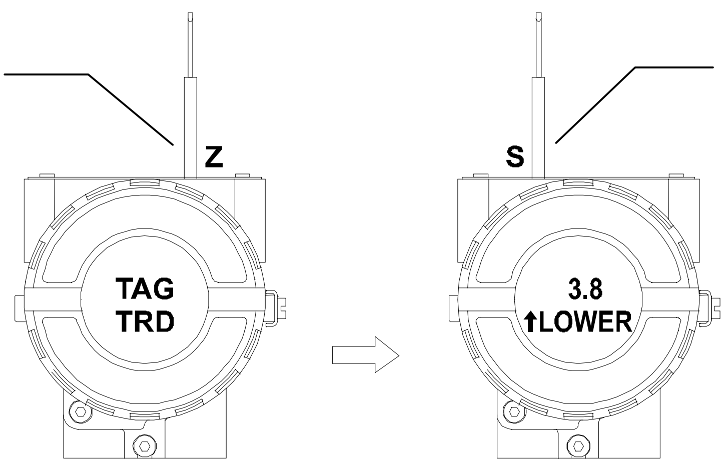
Remove the magnetic tool from orifice **S**.



Insert the magnetic tool in orifice **S** once more and **LOC ADJ** should be displayed

Figure 3.19 - Step 2 - FI302

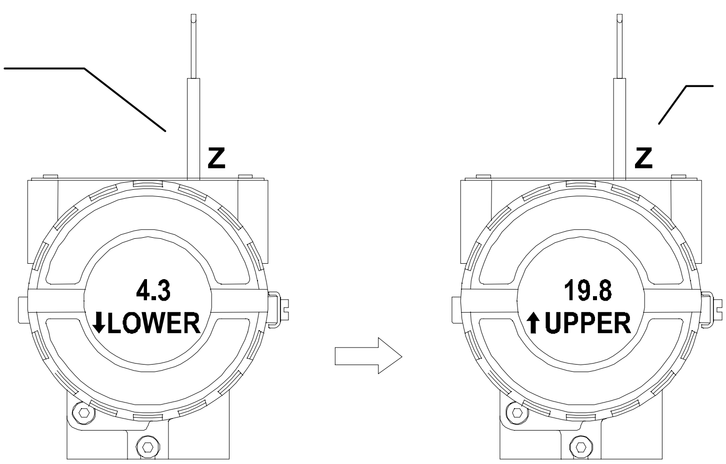
Place the magnetic tool in orifice **Z**. In case this is the first configuration, the option shown on the display is the **TAG** with its corresponding mnemonic configured by the SYSCON. Otherwise, the option shown on the display will be the one configured in the prior operation. By keeping the tool inserted in this orifice, the local adjustment menu will rotate.



This parameter is used to calibrate the lower current point. In order to change the lower value, simply insert the magnetic tool in orifice **S** as soon as upper is shown on the display. An arrow pointing upward (↑) increment the value and an arrow pointing downward (↓) decrement the value. Write 4.00 mA to lower parameter. Insert the mili-amperimeter in respective terminal and read the measured value to enter in Feed parameter and correct your desired generated current.

Figure 3.20 - Step 3 - FI302

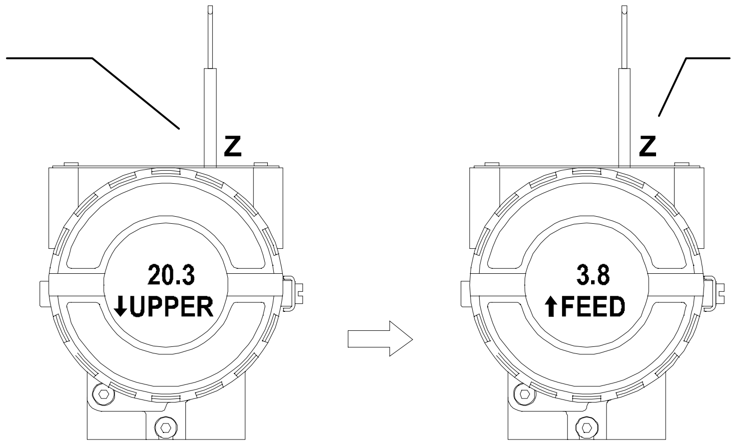
In order to decrement the lower value, place the magnetic tool in orifice **Z** to shift the arrow to the downward position and then, by inserting and keeping the tool in orifice **S**, it is possible to decrement the lower value.



This parameter is used to calibrate the upper current point. In order to change the upper value, simply insert the magnetic tool in orifice **S** as soon as upper is shown on the display. An arrow pointing upward (↑) increment the value and an arrow pointing downard (↓) decrement the value. Write 20 mA to upper parameter. Insert the miliamperimeter in respective terminal and read the measured value to enter in Feed parameter and correct your desired generated current.

Figure 3.21 - Step 4 - FI302

In order to decrement the upper value, place the magnetic tool in orifice **Z** to shift the arrow to the downward position an then, by inserting and keeping the tool in orifice **S**, it is possible to decrement the upper value.



Option FEED allows the user to correct the current calibration. In order to implement the correction, read the measured current on the miliamperimeter and enter with this value. This option makes it possible to correct Lower and Upper current calibration points. An arrow pointing upward increments the current.

Figure 3.22 - Step 5 - FI302

Place the magnetic tool in orifice **S** to shift the arrow to the downward position and decrement the calibration current in accordance with the measured value. An arrow pointing downward decrements the value.

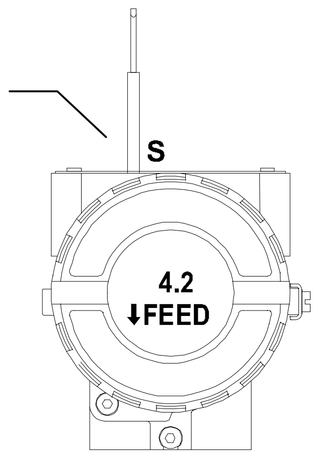


Figure 3.23 - Step 6 - FI302

Section 4

General

SMAR **FI302** Fieldbus to Current Converters are extensively tested and inspected before delivery to the end user. Nevertheless, during their design and development, consideration was given to the possibility of repairs by the end user, if necessary.

In general, it is recommended that the end-user do not try to repair printed circuit boards. Instead, he should have spare circuit boards, which may be ordered from SMAR whenever necessary.

TROUBLESHOOTING	
SYMPTOM	**PROBABLE SOURCES OF TROUBLE**
NO QUIESCENT CURRENT	*Converter Fieldbus Connections* Check wiring polarity and continuity. *Power Supply* Check power supply output. The voltage at the **FI302** Fieldbus terminals must be between 9 and 32 VDC. *Electronics Circuit Failure* Check circuit boards for defect by replacing them with spare ones.
NO COMMUNICATION	*Network Connection* Check network connections: devices, power supply and terminators. *Network Impedance* Check network impedance (power supply impedance and terminators). *Converter Configuration* Check configuration of communication parameters of converter. *Network Configuration* Check communication configuration of the network. *Electronics Circuit Failure* Try to replace the converter circuit with spare parts.
INCORRECT OUTPUTS	*Output Terminals Connection* Check wiring polarity and continuity. *Power Supply* Check power supply output. The voltage at the output terminals of **FI302** must be between 3 and 45 VDC. *Load Resistance* Load resistance must be between 0 and 2000Ω. Note that the maximum value depends on output power supply voltage. *Calibration* Check calibration of converter.

If the problem is not presented in the table above follow the Note below:

NOTE
The Factory Init should be tried as a last option to recover the equipment control when the equipment presents some problem related to the function blocks or the communication. **This operation must only be carried out by authorized technical personnel and with the process offline, since the equipment will be configured with standard and factory data.** This procedure resets all the configurations run on the equipment, after which a partial download should be performed. Two magnetic tools should be used to this efect,. On the equipment, withdraw the nut that fixes the identification tag on the top of the housing, so that access is gained to the "S" and "Z" holes. The operations to follow are: 1) Switch off the equipment, insert the magnetic tools and keep them in the holes (the magnetic end in the holes); 2) Feed the equipment; 3) As soon as Factory Init is shown on the display, take off the tools and wait for the "5" symbol on the right upper corner of the display to unlit, thus indicating the end of the operation. This procedure makes effective all the factory configuration and will eliminate eventual problems with the function blocks or with the equipment communication.

Disassembly Procedure

Refer to Figure 4.1 - FI302 Exploded View Make sure to disconnect power supply before disassembling the converter.

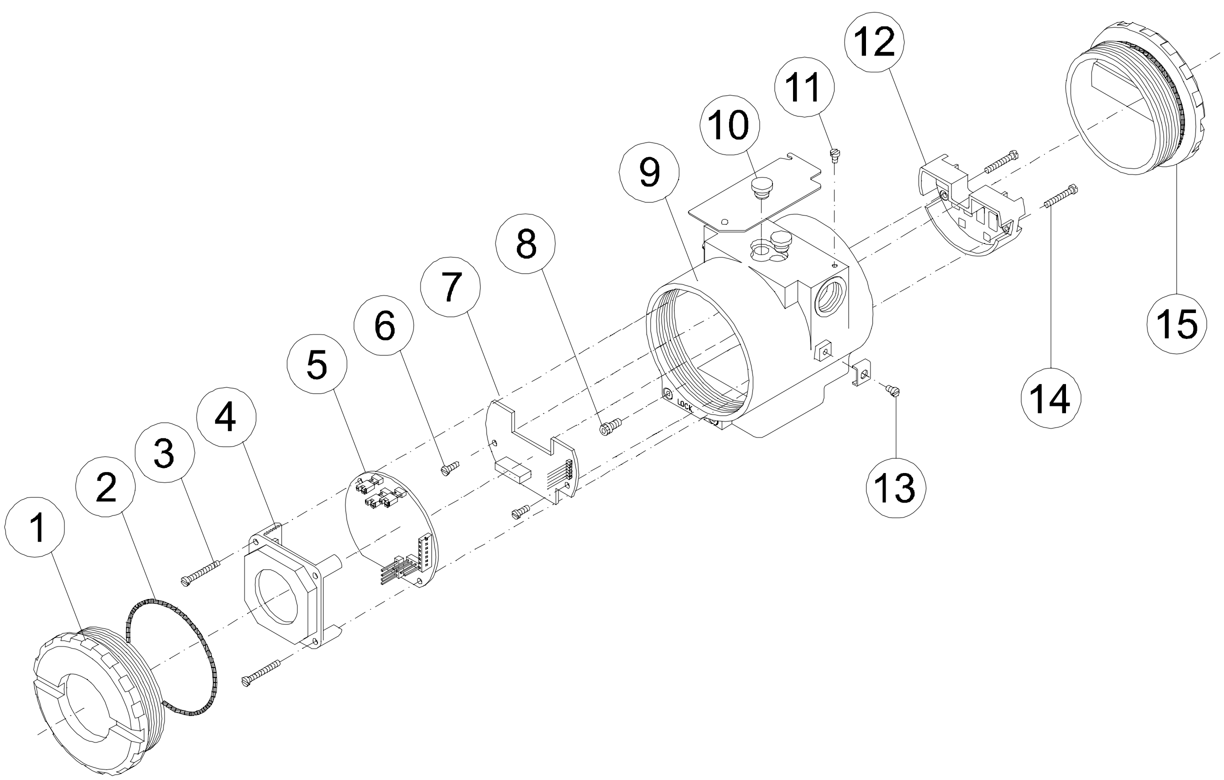


Figure 4.1 - FI302 Exploded View

Electronic Circuit
The main board (5) and output board (7) are matched pairs and must be changed together and not mixed with others.

To remove the circuit boards (5 and 7) and display (4), first loose the cover locking (8) on the side not marked "Field Terminals", then unscrew the cover (1).

WARNING
The boards have CMOS components, which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

Loosen the two screws (3) that anchors the display and the main circuit board. Gently pull out the display, and then the main board (5). To remove the output board (7), first unscrew the two screws (6) that anchors it to the housing (9), and gently pull out the board.

Reassemble Procedure

Put output board (7) into housing (9).
Anchor output board with its screws (6).
Put main board (5) into the housing, ensuring all inter connecting pins are connected.

Put display (4) into the housing, observing the four mounting positions. "⇧" should point in the direction desired as UP.

Anchor the main board and display with their screws (3).
Fit the cover (1) and lock it using the locking screw (8).

Interchangeability

Main and output boards are supposed to stay together, because calibration data from output board circuit is stored in EEPROM of the main board. If, for some reason, you separate the boards, you must do a calibration procedure to guarantee precision of the outputs.

Returning Materials

Should it become necessary to return the converter to SMAR, simply contact your local agent or SMAR office, informing the defective instrument’s serial number, and return it to our factory.

In order to expedite analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as many details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

SPARE PARTS LIST		
DESCRIPTION OF PARTS	**POSITION**	**CODE**
HOUSING, Aluminum (NOTE 1)		
½ - 14 NPT	9	324-0130
M20 x 1.5	9	324-0131
PG 13.5 DIN	9	324-0132
HOUSING, 316 SS (NOTE 1)		
½ - 14 NPT	9	324-0133
M20 x 1.5	9	324-0134
PG 13.5 DIN	9	324-0135
COVER (includes o'ring)		
Aluminum	1 AND 15	204-0102
316 SS	1 AND 15	204-0105
COVER WITH WINDOW FOR INDICATOR (includes o' ring)		
Aluminum	1	204-0103
316 SS	1	204-0106
COVER LOCKING SCREW	8	204-0120
EXTERNAL GROUND SCREW	13	204-0104
IDENTIFICATION PLATE FIXING SCREW	11	204-0116
DIGITAL INDICATOR	4	214-0108
TERMINAL INSULATOR	12	314-0123
MAIN AND OUTPUT CIRCUIT BOARD ASSEMBLY	5 AND 7	324-0140
0-RINGS (NOTE 2) Cover, BUNA-N	2	204-0122
TERMINAL HOLDING SCREW		
Housing in Aluminum	14	304-0119
Housing in 316 Stainless Steel	14	204-0119
MAIN BOARD SCREW WITH HOUSING IN ALUMINUM		
Units with Display	3	304-0118
Units without Display	3	304-0117
MAIN BOARD SCREW WITH HOUSING IN 316 STAINLESS STEEL		
Units with Display	3	204-0118
Units without Display	3	204-0119
INPUT BOARD SCREW		
Housing in Aluminum	6	314- 0125
Housing in 316 Stainless Stell	6	214-0125
MOUNTING BRACKET FOR 2" PIPE MOUNTING (NOTE 3)		
Carbon Steel	-	214-0801
Stainless Steel 316	-	214-0802
Carbon Steel bolts, nuts, washers and U-clamp in Stainless Steel	-	214-0803
LOCAL ADJUSTMENT PROTECTION CAP	10	204-0114

NOTE

1. It includes terminal holder insulator, bolts (cover lock, grounding and terminal holder insulator) and identification plate without certification.

2. 0-Rings are packaged in packs of 12 units.

3. Including U-clamp, nuts, bolts and washers. Spare Parts List.

Technical Characteristics

Functional Specifications

Output Signal
Three 4-20 mA current links, external supply, common ground

Input Signal
Digital only, Fieldbus™, 31.25 Kbit/s voltage mode with bus power.

Output Load Limitation
External Output Supply Voltage: 3-45 Vdc.

Power Supply
Bus power 9-32 Vdc.
Current consumption quiescent 12 mA.
Output impedance: non-intrinsic safety from 7.8 KHz - 39 KHz should be greater or equal to 3 KOhm.
Intrinsic safety output impedance (assuming an IS barrier in the power supply) from 7.8 KHz - 39 KHz should be greater or equal to 400 Ohm.

Display
Optional 4½ digit LCD Display.

Hazardous Location Certification
Explosion proof, weather proof and intrinsically safe CENELEC and FM standards.

Temperature Limits

Operation:	-40 to 85°C	(-40 to 185°F)
Storage:	-40 to 120°C	(-40 to 250°F)
Display:	-10 to 60°C	(14 to 140°F) operation
	-40 to 85°C	(-40 to 185°F) without damage.

Humidity Limits
0 to 100% RH.

Turn-on Time
Approximately 10 seconds.

Update Time
Approximately 0.2 second.

Performance Specifications

Accuracy
0.1%.

Ambient Temperature Effect
For a 10°C variation: ± 0.05%.

Output Power Supply Effect
± 0.005%/V

Vibration Effect
Meets SAMA PMC 31.1.

Electro-Magnetic Interference Effect
Designed to comply with IEC 801.

Physical Specifications

Electrical Connection
1/2-14 NPT, Pg 13.5 or M20 x 1.5.

Material of Construction
Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with Buna N O-rings on covers (NEMA 4X, IP67).

Mounting
With an optional bracket can be installed on a 2" pipe or fixed on a wall or panel.

Weight
Without display and mounting bracket: 0.80 kg.
Add for digital display: 0.13 kg.
Add for mounting bracket: 0.60 kg.

MODEL FI302	FIELDBUS TO CURRENT CONVERTER

CODE	Local Indicator
0	Without Indicator
1	With Digital Indicator

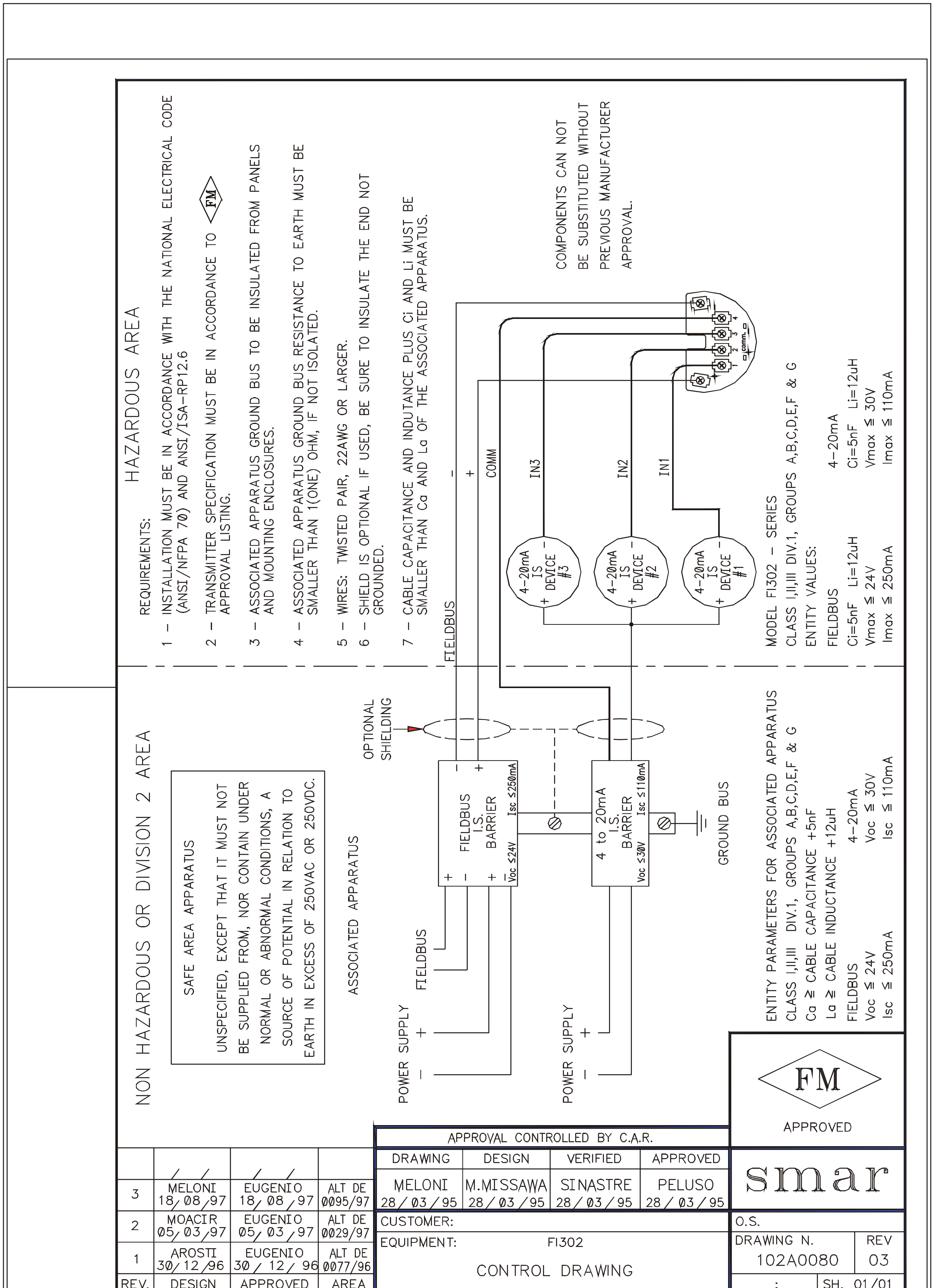
CODE	Mounting Bracket for 2" Pipe Mounting
0	Without Bracket
1	Carbon Steel Bracket
2	316 SST Bracket

CODE	Electrical Connections
0	1/2-14 NPT
A	M20 x 1.5
B	Pg 13.5 DIN

CODE	Options *
H1	316 SST Housing
A1	316 SST Bolts
ZZ	Special Options - Specify

FI302	1	1	0	*

* Leave it blank for no optional items.


NON HAZARDOUS OR DIVISION 2 AREA
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 FM 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(ONE) OHM, 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 INDUTANCE PLUS Ci AND Li MUST BE SMALLER THAN Ca AND La OF THE ASSOCIATED APPARATUS.
COMPONENTS CAN NOT BE SUBSTITUTED WITHOUT PREVIOUS MANUFACTURER APPROVAL.
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
OPTIONAL SHIELDING
FIELDBUS
POWER SUPPLY
FIELDBUS I.S. BARRIER
Voc ≤24V
Isc ≤250mA
4 to 20mA I.S. BARRIER
Voc ≤30V
Isc ≤110mA
GROUND BUS
COMM
IN3
IN2
IN1
4-20mA IS DEVICE #3
4-20mA IS DEVICE #2
4-20mA IS DEVICE #1
MODEL FI302 - SERIES
CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G
ENTITY VALUES:
FIELDBUS
Ci=5nF Li=12uH
Vmax ≤ 24V
Imax ≤ 250mA
4-20mA
Ci=5nF Li=12uH
Vmax ≤ 30V
Imax ≤ 110mA
ENTITY PARAMETERS FOR ASSOCIATED APPARATUS
CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G
Ca ≥ CABLE CAPACITANCE +5nF
La ≥ CABLE INDUCTANCE +12uH
FIELDBUS
Voc ≤ 24V
Isc ≤ 250mA
4-20mA
Voc ≤ 30V
Isc ≤ 110mA
FM APPROVED
smar
APPROVAL CONTROLLED BY C.A.R.
DRAWING MELONI 28/03/95
DESIGN M.MISSAWA 28/03/95
VERIFIED SINASTRE 28/03/95
APPROVED PELUSO 28/03/95
CUSTOMER:
EQUIPMENT: FI302
CONTROL DRAWING
O.S.
DRAWING N. 102A0080
REV 03
SH. 01/01
REV. DESIGN APPROVED AREA
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
1 AROSTI 30/12/96 EUGENIO 30/12/96 ALT DE 0077/96