INSTRUCTION MANUAL
ST0028 - Intrinsically safe self-powered 4-20 mA indicator

1. DESCRIPTION

ST0028 is an intrinsically safe LCD indicator that shows in engineering form the current value of a 4÷20mA loop. ST0028 consists of a module designed to be inserted in a 70mm case, the instrument can be used both as a single module and combined with another IS device such as a transmitter. The installation of the IS equipment connected to ST0028 must be carried out in compliance with the directives relating to intrinsic safety; see the relevant Safety Instructions.
The electrical connections consist of a pair of terminals for connecting the input loop and a pair of wires that reproduce the output loop.
ST0028 is powered by a small voltage drop on the loop. Through three keys it is possible to modify the main reading configuration parameters such as: zero, full scale, decimal point position, set a reading filter, resolution, and over-range limits. Using the same keys, it is possible to calibrate the A/D converter. All configuration and calibration data are saved in a non-volatile EEPROM memory.
The instrument is fixed by means of screws through three holes provided for fixing.

2. SPECIFICATIONS

2.1 Physical characteristics

- Loop connections: 2 terminals max 1 mm^2 (AWG 16).
- Transmitter connections: 2 wires 0.5 mm^2
- Operating temperature: -40 ÷ +70 °C
- Storage temperature: -40 ÷ +80 °C
- Humidity: 0 ÷ 90 % non-condensing
- Dimensions: diameter = 59 mm; height = 20 mm
- Input signal: 4 ÷ 20 mA
- Operating range: 3.6 ÷ 22 mA
- Operating range (max): 2.5 ÷ 30 mA
- Loop drop: max 2.5V (@ 22 mA)
- Indication: 4-digit 7 segment LCD h = 12 mm
- Display: positive reflective TN; Viewing angle h 6:00
- Calibration and programming data memory: EEPROM
- Data retention: 10 years
- Mounting: three fixing holes Ø 3 mm

2.2 Functional features

- Indication programming: Zero settings
- Full scale and decimal point position
- Indication limits: -1999 ÷ 9999
- Settable range: any field within the indication limits
- Decimal point position: 0, 1, 2 or 3 decimal places
- Functions applicable to reading: reading filter, overload limit selection, resolution selection
- Filter settings: 1 to 8 averages on reading
- Refresh time: 0.25 ÷ 2 s depending on the filter
- Over-load limits: 3.6 ÷ 22 mA
- Resolution: selectable from 1 to 10 points
- Calibrations: zero (4 mA) and full-scale (20 mA) calibration with data saving in EEPROM

2.3 Performance

- Accuracy: 0.1 % of the set range ± 1 digit
- Thermal drift: 100 ppm/°C
- EMC: according to EN61000-6-4 and EN61000-6-2 with correctly installed instrument

3. PROGRAMMING

3.1 Keypad

Programming is done via the three buttons on the back of the instrument: the central button acts as "Enter" (F), the left button acts as a decrease (↓), and the right button acts as an increase (↑). The ↑ and ↓ buttons pressed simultaneously act as "Exit".
The programming functions are supported by the display (see Table 1).

↓	F	↑

Table 1

KEY	FUNCTION
F	Access to programming, move to subsequent menus, save data and leave the window
↑	Decrease digit, select / set parameter
↓	Digit increment, parameter selection / setting
↑ + ↓	" Exit "

Press the F button for more than three seconds to access the programming procedure.
The display shows the word “dP” which corresponds to the first programming window for setting the decimal point. At this point, by acting on the ↑ (Increase) and ↓ (Decrease) keys, it is possible to scroll through all the other programming windows. The parameters modified during programming are automatically stored upon exiting the programming and are maintained even when the instrument is switched off.

3.2 Programming window

3.2.1 Setting the decimal point (dP)
Use the ↑ and ↓ keys to select the decimal point position (from zero to 3 decimals).
Default = one decimal.

3.2.2 Setting the engineering zero (ZErO)
Use the ↑ and ↓ keys to set the engineering value of zero (-1999 / +9999).
Default =0

3.2.3 Setting the engineering full scale (SPAn)
Use the ↑ and ↓ keys to set the engineering value of the full scale (-1999 / +9999).
Default = 100.0

3.2.4 Input limit selection (Li)
Allows you to select the over-load limit of the display. With LI = 0 and current greater than 20 mA the message OL is displayed (-OL with current less than 4 mA). With LI = 1, the display extends by 10% beyond the 4÷20 mA range before the over-load indication. In both cases, exceeding the limits of the engineering indication (-1999÷9999) results in the over-load indication.
Default = 0.

3.2.5 Filter setting (FiLt)
Press the ↑ key to increase the input filter and the ↓ key to decrease it. Values between 1 and 8 can be set; with Filt = 1 no filter is applied, and the measurement is updated every 250 ms. In the presence of particularly disturbed signals, a higher value can be selected to obtain a more stable display. The display update interval is equal to 250 ms multiplied by the selected number.
Default = 1

3.2.6 Resolution setting (riS)
Allows to set the resolution of the displayed value; with RIS = 1 all the points of the set field are displayed, while higher settings determine the step between two closer values, for example, with a resolution equal to 2, it will not be possible to display odd numbers.
The selectable values are: 1, 2, 5 and 10; it is recommended to increase the resolution only if the set field is very large (e.g. 10000 points) and/or if the signal to be measured is particularly unstable, otherwise the maximum resolution can be maintained (Ris = 1).
Default = 1

Table 2: Instrument setting

Key	Function	Display
↑ o ↓	Scan: Decimal Point Setting Engineering Zero Setting Engineering Range Setting OverLoad Limit Setting Input Filter Factor Setting Resolution Setting	 DP / 0.000 ZerO / 0.000 SPAn / 1.000 Li / 0 FiLt / 1 RiS / 0
F	Enter the settings window. Exit the window with saving changes.	
↑	Digit increment	0 → 9
↓	Decrease digit	9 → 0
↑ + ↓	Exit programming. Exit setting without saving.	

3.3 Instrument calibration
By pressing the ↑ and ↓ keys simultaneously for more than three seconds you access the calibration function where it's possible to calibrate the zero and full scale of the converter.

WARNING: Entering this procedure and changing the calibration parameters means modifying factory parameters. This operation must be performed only by specialized personnel and using appropriate equipment. An incorrect calibration compromises the correct functioning of the indicator.

WARNING: The calibration sequence includes zero calibration followed by full scale calibration; it is important to respect the calibration sequence to avoid inaccurate indications.

3.3.1 Zero calibration

Inside the calibration window, select the zero calibration (C4), apply a current of 4,000mA, let the signal stabilize and hold down the F key until the word CAL appears on the display. After a few seconds, the new zero value is displayed in engineering format. Exit the zero calibration menu using the ↑ + ↓ keys and proceed with the full scale calibration.

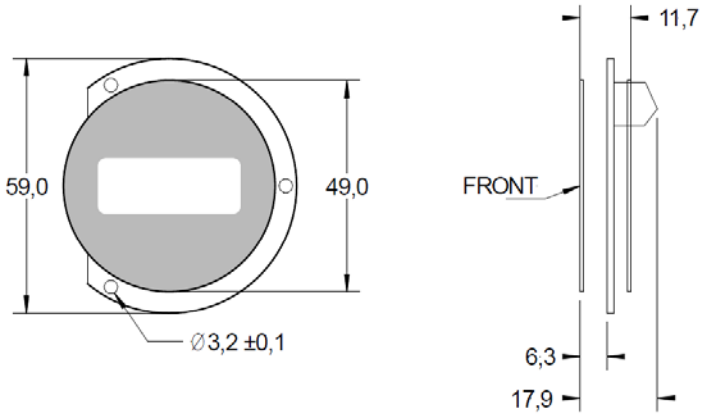
3.3.2 Full scale calibration

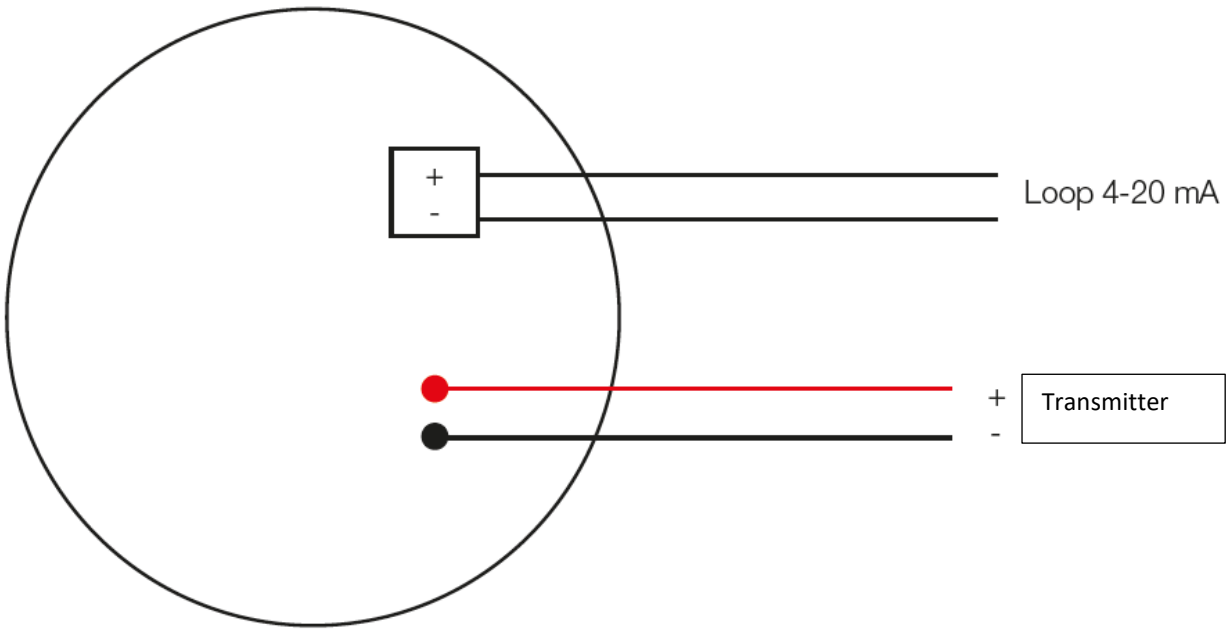
Inside the calibration window, select the full scale calibration (C20), apply a current of 20,000 mA and proceed as for the zero calibration.

4. MARKING

ST0028 is equipped with an identification label applied on the back. The label shows the manufacturer and Intrinsic Safety data, as well as the serial number and, in the case of the classified area version, the references to the notified bodies responsible for certification.

5. OVERALL DIMENSIONS



Dimensions are in millimetres. Unless otherwise indicated, tolerances ±0.2mm. The fixing holes are placed at 120° on a diameter of 54mm.

6. WIRING