USER MANUAL

T122

TEMPERATURE TRANSMITTER WITH HART 7 PROTOCOL

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ORIGINAL INSTRUCTIONS

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Document revisions

DATE	REVISION	NOTES	AUTHOR
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1. INTRODUCTION

The T122 is a 2-wire temperature transmitter. The device converts the signal from the sensor into a 4...20 mA current output, while maintaining the possibility of configuration, diagnostics and advanced reading via the HART 7 protocol.
The design is oriented towards industrial applications requiring high reliability, measurement accuracy, remote configuration and integration with DCS/PLC systems or asset management software.

WARNING!

This user manual extends the information from the installation manual on device configuration. Please refer to the installation manual for further information.

WARNING!

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2. PRODUCT DESCRIPTION

The T122 supports universal inputs for temperature and resistance sensors.

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2.1. Main features

Item	Description
Type	2-wire temperature transmitter with HART 7 protocol
Mounting	DIN B head
Supported inputs	RTD, thermocouples, linear resistance, mV
Output	4...20 mA con comunicazione HART™ 7
Configuration	PC software, HART modem/interface, HART communicator, DCS/asset management
Write protection	Via software

WARNING!

- ***Verify the compatibility of the sensor with the configured input type.***
- ***Use cables and accessories suitable for the installation environment.***
- ***In classified areas, comply exclusively with the approvals and installation drawings valid for the purchased version.***
- ***Enable write protection once commissioning is complete, where required by company procedure.***

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3. SENSOR TYPES AND ACCURACY

FUNCTIONS	UoM	RANGE (Measure)	PRECISION (Measure)	RISOLUTION (Measure)	STANDARD	NOTES	CMRR-NMRR
VOLTAGE	[dc mV]	-10 ÷ 90	0.02% + 10 µV	5 µV	-		>100 dB
Pt100	[°C]	-200 ÷ +850	0.03% + 0.2°C	0.03 °C	IEC 60751		>140 dB
Pt500	[°C]	-200 ÷ +850	0.03% + 0.2°C	0.1 °C	IEC 60751		>140 dB
Pt1000	[°C]	-200 ÷ +850	0.03% + 0.2°C	0.03 °C	IEC 60751		>140 dB
Pt2000	[°C]	-200÷ +650	0.03% +0.2°C	0.02°C	IEC 60751		
Cu50, Cu100	[°C]	-180 ÷ +200	0.03% + 0.2°C	0.06 °C, 0.03 °C	GOST 8651-2009	α = 0,00428	>140 dB
Ni100, Ni120	[°C]	-60 ÷ +250	0.03% + 0.2°C	0.02 °C	DIN 43760	α = 0,006178	>100 dB
Ni1000	[°C]	-60 ÷ +250	0.03% +0.2°C	0.02°C	DIN 43760		
TERMOCOUPLE J	[°C]	-210 ÷ +1200	0.03% + 0.2°C	0.01 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE K	[°C]	-200 ÷ +1372	0.03% + 0.2°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE T	[°C]	-200 ÷ +400	0.03% + 0.2°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE E	[°C]	-200 ÷ +1000	0.03% + 0.2°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE N	[°C]	-200 ÷ +1300	0.03% + 0.2°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE R	[°C]	-50 ÷ +1768	0.03% + 0.3°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE S	[°C]	-50 ÷ +1768	0.03% + 0.3°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE B	[°C]	250 ÷ +1820	0.03% + 0.3°C	0.05 °C	EN 60584-1:1997	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>100 dB
TERMOCOUPLE L	[°C]	-200 ÷ +800	0.03% + 0.15°C	0.05 °C	GOST 8.585-2001	Cold Junction Error: 1°C between 10 and 35°C ambient, 2°C between -20 and 10°C and between 35 and 50°C ambient	>140 dB

4. MOUNTING AND INSTALLATION

The T122 HART 7 is designed for DIN B head mounting. Install the device inside an enclosure appropriate for the degree of protection required by the application. Ensure that the terminals are accessible for wiring, testing and maintenance.

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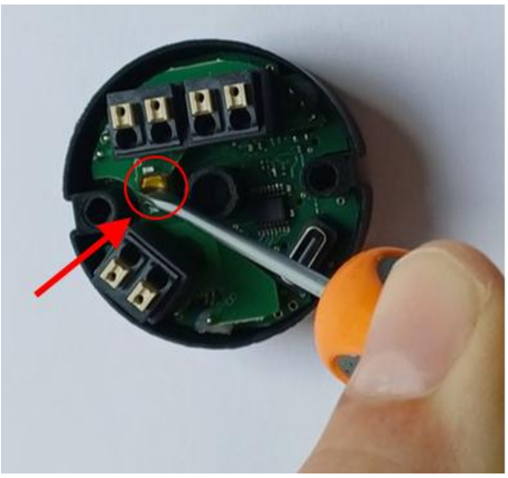
5. FIRMWARE UPDATE

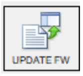
In order to include new features, the system provides the possibility of updating the device firmware.
To perform the firmware update, follow the procedure below:

1) Power off the T122, disconnect the USB cable
2) Using a screwdriver, remove the cover as shown in the image:

3) Hold down the button as shown in the figure



4) Insert the USB cable into the PC (power is supplied by this cable)
5) Release the button

6) In the Easy T122 software press the button 

7) Follow the on-screen instructions

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WARNING!

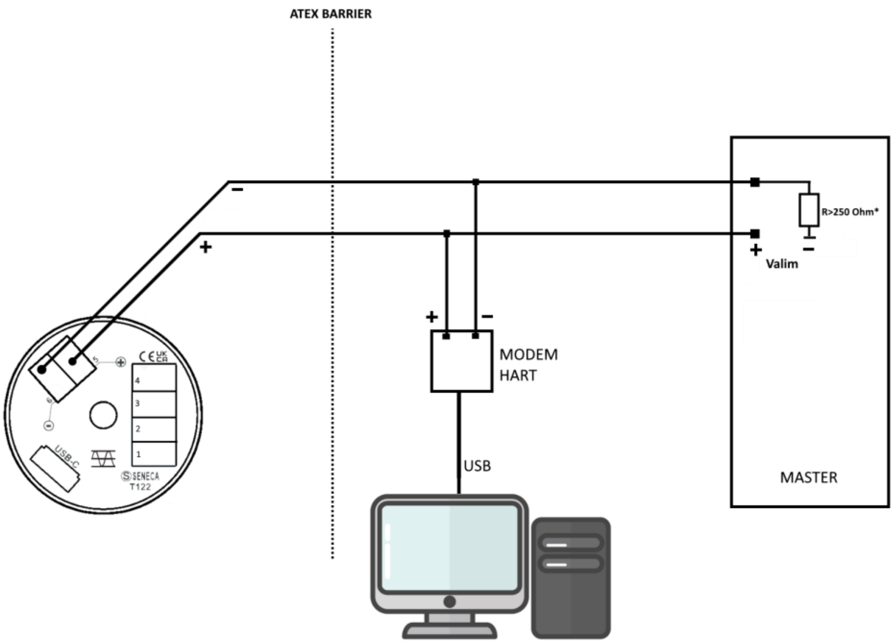
BEFORE PERFORMING THE firmware UPDATE, make a note of the current configuration. Once the firmware has been updated, the previous configuration may be changed and it is therefore MANDATORY to reconfigure the device.

6. THE CONFIGURATION SOFTWARE "EASY T122"

The "Easy T122" software allows complete configuration of the device; the software can be freely downloaded from the website:
www.seneca.it

6.1. CONNECTING T122 TO PC

To connect the T122 to the PC, follow the wiring diagram below (also shown in the installation manual):



The resistor R must always be present (if absent in the master, it must be added).
The maximum value of R depends on the supply voltage according to the following formula:

$$Rmax[Ohm]=(Valim-9)/0.023$$

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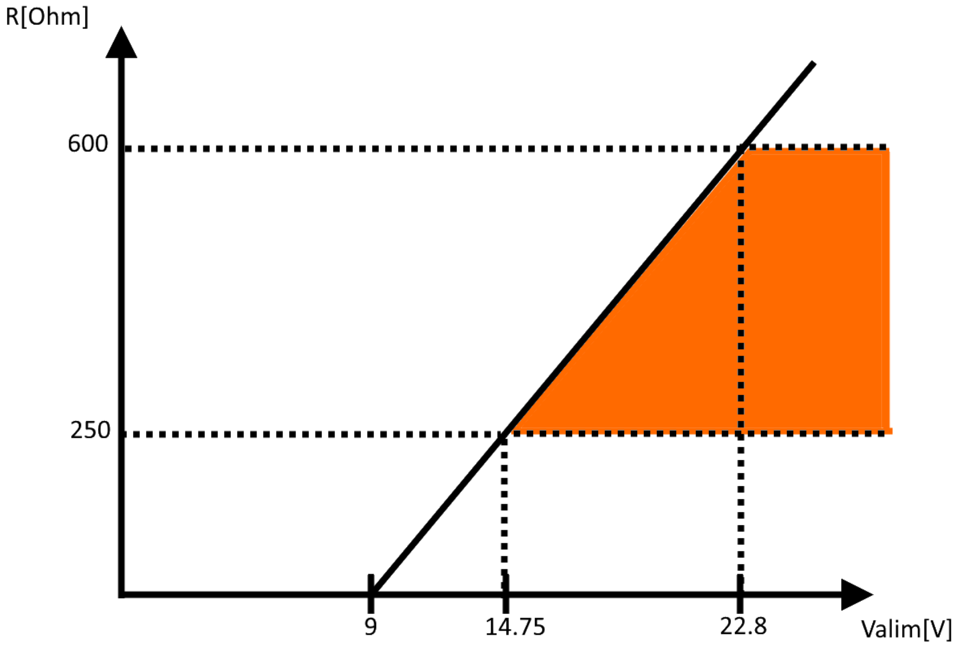

Therefore, for example, if Valim = 22.8 Vdc, R must be between 250 Ohm and 600 Ohm.
The maximum Valim is 30 Vdc.

WARNING!

The permitted range of Valim is from 9 Vdc to 30 Vdc

In the software, select the ComPort corresponding to the HART modem; at this point the PC and T122 are connected.

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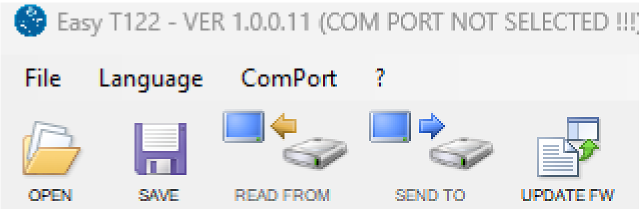
6.2. THE MENU



File
Allows opening or saving a configuration.

Language
Allows selection of the software interface language

ComPort
Allows selection of the serial/USB port of the HART modem

?
Allows viewing the software credits

"OPEN" BUTTON
Allows opening a previously saved configuration file

"SAVE" BUTTON
Allows saving a configuration file

"READ FROM" BUTTON
Allows reading the configuration from the T122

"SEND TO" BUTTON
Allows sending the current configuration to the T122

"UPDATE FW" BUTTON
Allows updating the firmware of the T122 (see the relevant chapter in this manual for further information)

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"PASSWORD" BUTTON

Allows setting a password to lock the writing of parameters.

To unlock a password-protected device, it is possible to enter the previously set write password, or reset the device to factory defaults.

6.3. TAB "INFO"

This section displays information about the connected device.

6.4. TAB "INPUT"

This section allows configuration of the type of sensor connected to the head, the measurement range of the primary variable and any compensations applied to the input signal.

Sensor Type

Defines the type of input used by the head.

Number of wires

Defines the type of electrical connection of the sensor.
This parameter is particularly important for RTD sensors, because the number of wires affects the cable resistance compensation.

Unit of measurement

Indicates the engineering unit associated with the input measurement.
This unit is used to display the measured value and to define the LRV/URV measurement range.

Error Detection

Allows configuration of the head behaviour in the event of an error on the sensor or the input signal.
No detection means that no specific error detection on the input is enabled.
Sensor Failure, on the other hand, enables detection of sensor breakage, out-of-range detection, short circuit etc...

CJ (Cold Junction Compensation)
Internal

For thermocouple inputs, CJ compensation is normally required because the thermocouple measurement depends on the temperature of the connection point to the head.
You can choose from:

None: no compensation
Enabled: compensation via sensor internal to the head

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CJ (Cold Junction Compensation)
Offset [°]

Allows a correction to be applied to the cold junction compensation.
This parameter can be used to compensate for small deviations due to installation, wiring or calibration.

Compensation Offset Manual
2 Wire [Ω] - RTD

Parameter used to compensate for the cable resistance in the case of RTD sensors connected with 2 wires. With a 2-wire RTD, the cable resistance adds to the sensor resistance and can generate a measurement error. By entering a value in this field, the device can compensate for this error.

Compensation Offset Manual
Measurement [Ω, %, …]

Allows an offset to be applied to the main measurement. The unit of measurement depends on the type of sensor configured. This parameter is used to correct small systematic errors in the measurement chain.

Variable Mapping
PV Mapped to Input 1

The Primary Value represents the main quantity transmitted by the device and is statically associated with the value measured by the sensor. This parameter cannot be modified.

Variable Mapping
SV Mapped to CJ Value/Electronic Temperature

The Secondary Variable is statically associated with the value measured by the cold junction or internal electronics temperature. This parameter cannot be modified.

PV Parameters
Filter Time [s]

Defines the filter time applied to the primary variable.
A low or zero value makes the measurement faster but potentially more sensitive to noise.
A higher value makes the measurement more stable but slower to follow rapid signal variations.
0 s: no filtering.

PV Parameters
High Range - URV

Defines the upper value of the measurement range of the primary variable.
This value represents the high end of the transmitted range. It is normally associated with the maximum analogue output value, i.e. 20 mA.

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PV Parameters
Low Range - LRV
Defines the lower value of the measurement range of the primary variable.
This value represents the low end of the transmitted range. It is normally associated with the minimum analogue output value, i.e. 4 mA.

Sensor Serial Number
Field used to associate a serial number with the connected sensor.
This parameter can be useful for traceability, maintenance, calibration and identification of the installed sensor.

Read Values
PV (Selected Sensor)
Displays the instantaneous value of the primary variable.

Read Values
Internal Temp. (CJ)
Displays the internal temperature of the head or the value used for cold junction compensation.

6.5. TAB "OUTPUT/MISC"

This section shows the various configurations and those relating to the analogue output.

This section defines how the PV measurement range is converted to output current.

PV Current Mapping
OUTPUT (HIGH)
URV mapped to… [mA]
Defines the current value associated with the upper limit of the measurement range.
This means that when the PV reaches the URV value, the analogue output will equal the output value in mA set here.

PV Current Mapping
LOW OUTPUT
LRV mapped to… [mA]
Defines the current value associated with the lower limit of the measurement range.
This means that when the PV reaches the LRV value, the analogue output will equal the output value in mA set here.

CURRENT output clipping
High Level [mA]
Defines the maximum current value that the output can reach during normal operation, regardless of the input value.

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CURRENT output clipping
Low Level [mA]
Defines the minimum current value that the output can reach during normal operation, regardless of the input value.

Device Variable Limits
DV0 High Level
Defines the high limit of Device Variable 0.
Below this value the input enters an error state and, depending on the configuration, may drive the output to the value of the parameter "Error Value [mA]"

Device Variable Limits
DV0 Low Level
Defines the low limit of Device Variable 0.
Above this value the input enters an error state and, depending on the configuration, may drive the output to the value of the parameter "Error Value [mA]"

Output Current Level on Error
Error Value [mA]
Defines the current value that the output must assume in the event of an error.
This value is typically used to indicate a fault condition, for example a failed sensor, below the normal 4–20 mA limit.

Current loop reading
When the "Read Loop mA Value" button is pressed, it shows the current value in [mA] and [%] of the loop current.

6.6. TAB "HART"

This section allows configuration of the communication and identification parameters of the HART device.

HART Device Properties
RSP Preambles
Defines the number of preambles used in the HART response.
The preamble is an initial sequence used in HART communication to synchronise the receiver. A higher number of preambles can increase compatibility with some masters or modems, but slightly increases communication time.

Polling Address
Defines the HART address of the device.
Address 0 is normally used for point-to-point operation with active 4–20 mA analogue output.
Values other than 0 are typically used in multidrop mode. In multidrop, multiple devices can share the same HART communication loop and the analogue current is fixed at a constant value.

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Loop Mode
Defines the operating mode of the current loop:

Analog and Digital: Means that the device uses both the 4–20 mA analogue output and the digital HART communication. This is the typical mode for a HART transmitter in point-to-point connection.

Digital: Means that the device forces the analogue output to a constant value and uses the loop for digital HART communication only. This is the typical mode for multidrop mode.

HART Description / Message
Tag
Short device identification field.

HART Description / Message
Description
Descriptive field associated with the device.

HART Description / Message
Long Tag
Extended device identification field.
The Long Tag allows a longer description to be used compared to the traditional Tag and is useful in modern plants with more descriptive naming.

HART Description / Message
Assembly NR
Numeric field associated with the assembly or configuration of the device.
Can be used for internal identification, traceability or configuration management.

HART Description / Message
Date
Date field, provides the date currently configured in the device

HART Description / Message
Message
HART message field associated with the device. This field can contain free text readable by the HART master, useful for maintenance notes, identification or additional information.

HW/SW Info
Hardware Version
Shows the hardware version of the device.

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HW/SW Info

Software Version

Shows the firmware version of the device.

6.7. TAB "Test"

This section allows verification of the device operation, reading of the primary variable, reading of the loop current or manual forcing of the output current.

Functional Mode

Fixed Loop Current [mA]

Allows manual setting of a fixed output current.

This function is used to test the current loop, the wiring, PLC/DCS inputs or the supervision system.

When this mode is active, the output current does not follow the sensor measurement, but is forced to the set value.

Read PV

Mode that allows reading the primary variable of the device.

When selected, the software reads and displays the PV trend over time.

Read Loop Current

Mode that allows reading the actual loop current.

It is useful to verify that the current generated by the device corresponds to the measurement or forced value.

Normal Mode

Returns the device to normal operation.

In this mode, the analogue output follows the sensor measurement according to the configured LRV/URV and 4–20 mA mapping.

With default values the configuration is:

Parameter	***Value***
LRV	-150 mV
URV	+150 mV
Corrente a LRV	4 mA
Corrente a URV	20 mA

Therefore:

-150 mV corresponds to 4 mA;

0 mV corresponds to approximately 12 mA;

+150 mV corresponds to 20 mA.

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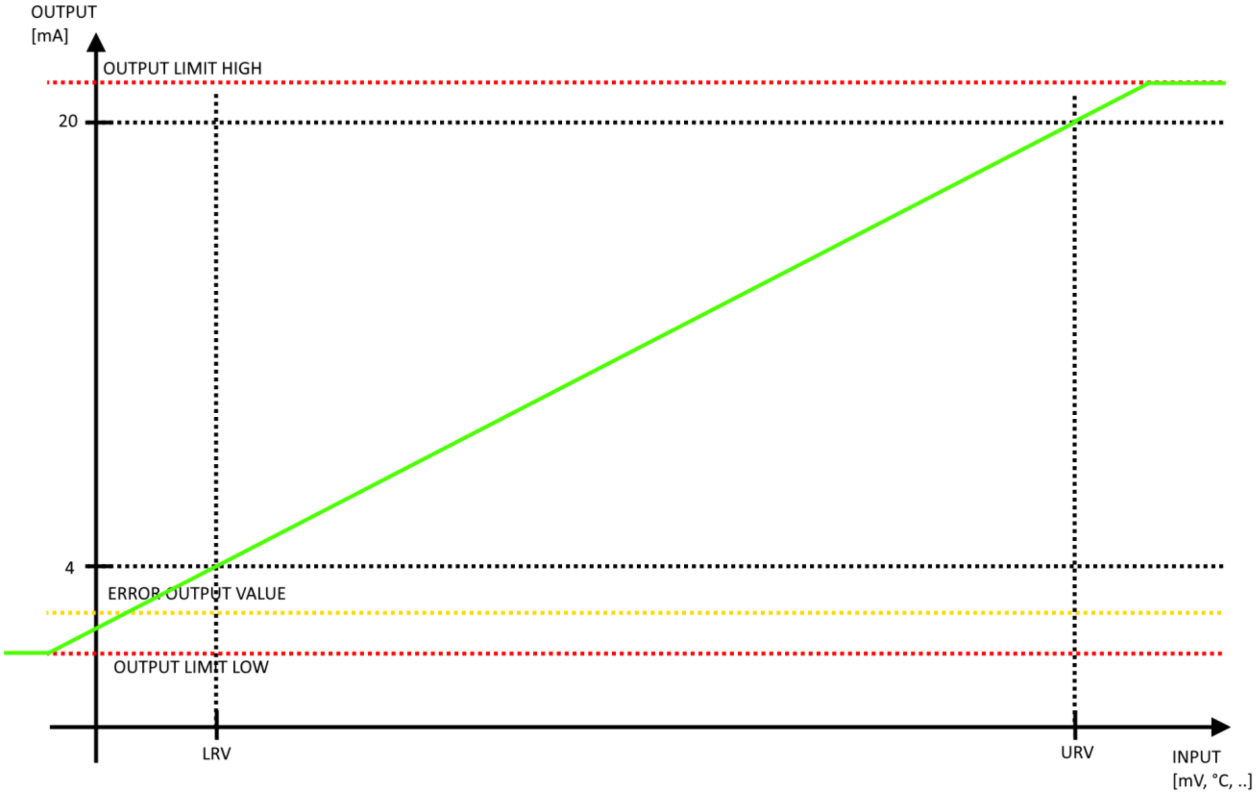
The current is calculated linearly within the configured range.
General formula:
Iout = 4 mA + ((PV - LRV) / (URV - LRV)) × 16 mA
In the specific case:
Iout = 4 mA + ((PV - (-150)) / (150 - (-150))) × 16 mA
Examples:

PV	***Output current***
-150 mV	4 mA
-75 mV	8 mA
0 mV	12 mA
+75 mV	16 mA
+150 mV	20 mA

6.8. GRAPHICAL EXPLANATION OF THE MAIN CONFIGURATION PARAMETERS

LRV and URV contribute to the definition of the output line (shown in green in the graph); the output cannot exceed the clipping limits (Output Limit High and Output Limit Low):



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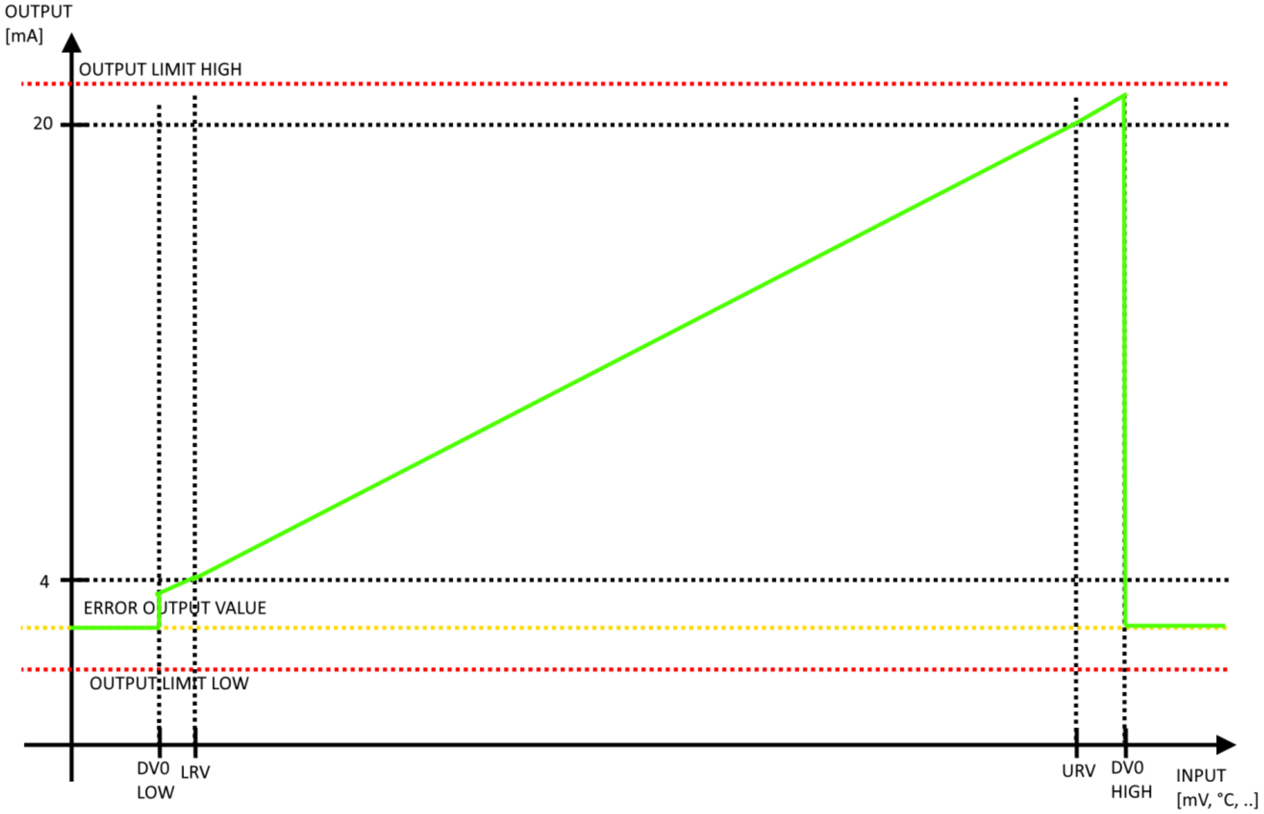
In the graph below, when the DV0 Low and DV0 High limit values are reached, the output value goes to the fail value (Error Output Value):



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