# Universal programmable converter SUG2


- **An intelligent new generation converter. With its low price, it competes against analogue converters.**
- **One type of converter for all standard resistance sensors and thermoelectric sensors,**
  **voltage and current (DC)**
- **16-bit ADC conversion, 16-bit DAC conversion**
- **A 4 to 20 or a 20 to 4 mA linear output signal (passive two-wire circuit)**
- **The option of scaling the output to 0 to 20 mA, 0 to 5V or 0 to 10V**
- **Galvanic separation between the input and output**
- **Constant damping time selectable within a range of 0.3 to 100 seconds**
- **User linearization option from a custom file**
- **Can be used for galvanic separation of different signals to unified signals**
- **Two extra unified inputs: 0…20 mA (4…20 mA) and 0...10 V**

**Application:**
This programmable measuring converter is designed to convert industrial voltage or current signals from a resistance or voltage temperature sensor or resistive sensor into unified industrial signals with galvanic separation between the input and output signals.

**Description:**
The SUG2 is microprocessor-controlled measuring converter with digital signal processing. The input signal is converted via a 16-bit ADC converter into a digital signal which is modified according to the user's request, and via 16-bit DAC conversion, the input signal is converted into an output current signal of 4 to 20 mA or another unified signal. The SUG2 measuring converter is equipped with galvanic separation between the input and output signals. It is designed to be mounted on a TS 35 DIN rail.
Using a PC, the user can set the type of output signal (e.g. Pt100, Pt1000, Ni100, Ni1000, thermocouple, rheostat, potentiometer, voltage or current), measuring range, a request for signal linearization, or a request for a specific modification to the input signal (conversion specified by a table, etc.). The output signal can be set to a standard 4 to 20 mA, 0 to 20 mA, 0 to 5V, 0 to 10V (or others upon request), or the reverse 20 to 4mA or 10 to 0V. By default, the converter is delivered already programmed in accordance with the customer's request. For custom programming, WINDOWS-based software including a programming interface can be supplied.

## TECHNICAL DATA

**Input signal:** see table 1
**Sensor wiring:** see fig. 1
**Current flowing through the resistance sensor:** pulses of approx. 0.25 mA
**Linearization:** performed by a program
**Output signal:** 4 to 20 mA (option of reversing to 20 to 4 mA) – or others upon request
**Indication of faulty wiring or sensor:** undercurrent < 3.9 mA or overcurrent > 22 mA (25 mA max. current)
(selected during customer configuration)
**Time constant:** 1 to 100 sec (programmable)
**Converter supply voltage:** 9 to 30 VDC
**The maximum value of load resistance in a current loop:** Rz = (Vs-9) / 0.020 [ohm, V]
**The effect of changes in the supply voltage (ČSN EN 60529):** <0.005 % / 1V
**The effect of changes in load resistance (ČSN EN 60529):** < 0.005 % / 100 ohm
**Errors (ČSN EN 60529):**

| | |
|---|---|
| Pt, Ni | max. ±(0.1% + 0.1 °C) - four-wire sensor connection *) |
| | max. ±(0.1% + 0.15 °C) - four-wire sensor connection *) |
| Thermocouple E,J,K,L,T | max. ±(0.1% + 0.15 °C) - without cold end compensation *) |
| Thermocouple B,S,R,N | max. ±(0.1% + 0.2 °C) - without cold end compensation *) |
| R, potentiometer | max. ±(0.1% + 50 mΩ) *) |
| U | max. ±(0.1% + 50 μV) *) |
| cold end compensation error: | max ±0.5 °C |

**Temperature dependence (ČSN EN 60529):**

| | |
|---|---|
| Pt, Ni | max. ±(0.01% + 0.01 °C)/K *) |
| Thermocouple E,J,K,L,T | max. ±(0.01% + 0.01 °C)/K *) |
| Thermocouple B,S,R,N | max. ±(0.01% + 0.02 °C)/K *) |

R, potentiometer max. ±(0.01% + 5 mΩ)/K *)
U max. ±(0.01% + 5 μV)/K *)
*) errors listed in percentages are relative to the range

**Galvanic separation between the input and output signals**
electric strength 500 V (50 Hz, 1s)
**Converter long-term stability and drift:** 0.02% / 500 hours

**FIG. 1: INPUT SIGNAL**

| TYPE | MEASURING RANGE | MIN. RANGE | NOTE |
|---|---|---|---|
| **RESISTANCE TEMPERATURE SENSORS:** | | | |
| Pt100 (0,003850) | -200 to +850 ° C | 25 °C | 3 or 4-wire connection or 2-wire with a compensation loop |
| Pt1000 (0.003850) | -200 to +850 °C | 25 °C | 3 or 4-wire connection or 2-wire with a compensation loop |
| Ni100 (0.00618) | -70 to +250 °C | 20 °C | 3 or 4-wire connection or 2-wire with a compensation loop |
| Ni1000 (0.00618) | -70 to +250 °C | 20 °C | 3 or 4-wire connection or 2-wire with a compensation loop |
| **RESISTANCE TRANSMITTERS:** | | | |
| POTENTIOMETER-absol. eval. | 20 to 4000 Ohm | | 4-wire connection or 3-wire with a compensation loop |
| POTENTIOMETER-relat. eval. | 20 to 4000 Ohm | | 4-wire, 3-wire w/ comp. loop (ratio - R track parts / R whole tracks) |
| RHEOSTAT | 0 to 4000 Ohm | 20 Ohm | 3 or 4-wire connection or 2-wire with a compensation loop |
| **THERMOCOUPLES:** | | | |
| B ( PtRh30 - PtRh6 ) | +100 to +1820 °C | 500 °C | guaranteed accuracy: +500 to +1820 ° C |
| E ( NiCr - CuNi , ch - ko ) | -200 to +1000 °C | 100 °C | guaranteed accuracy: -200 to 0 °C; -50 to +200 °C; 0 to +1000 °C |
| J ( Fe- CuNi ) | -100 to +1200 °C | 100 °C | guaranteed accuracy: -100 to 0 °C; -50 to +200 °C; 0 to +1200 °C |
| K ( NiCr - Ni, ch - a ) | -200 to +1370 °C | 100 °C | guaranteed accuracy: -200 to 0 °C; -50 to +200 °C; 0 to +1370 °C |
| N ( NiCrSi - NiSi ) | -200 to +1300 °C | 200 °C | guaranteed accuracy: -200 to 0 °C; -50 to +200 °C; 0 to +1300 °C |
| L ( Fe - CuNi, Fe - ko) | -200 to +900 °C | 100 °C | guaranteed accuracy: -200 to 0 °C; -50 to +200 °C; 0 to +800 °C |
| R ( PtRh13 - Pt ) | -0 to +1760 °C | 500 °C | guaranteed accuracy: +100 to +1760 ° C |
| S ( PtRh10 - Pt ) | -0 to +1760 °C | 500 °C | guaranteed accuracy: +100 to +1760 ° C |
| T ( Cu-CuNi, Cu-ko ) | -200 to +400 °C | 100 °C | guaranteed accuracy: -200 to 0 °C; -50 to +200 °C; 0 to +400 °C |
| **VOLTAGE AND CURRENT:** | | | |
| DC VOLTAGE | 0.2 to 10 V | 2 V | **separate input (Rin > 1 MOhm)** |
| | 0.02 to 0.1 V | 20 mV | |
| | -0.003 to 0.016 V | 3 mV | |
| DC CURRENT | 0 to 20 mA | 4 mA | **separate input** |
| | 0 to 200 mA | 40 mA | 0.51 Ohm shunt resistor (must be added externally; or internally upon request by the customer) |
| | 0 to 20 mA | 4 mA | 5.1 Ohm shunt resistor (must be added externally; or internally upon request by the customer) |
| | 0 to 2 mA | 0.4 mA | 51 Ohm shunt resistor (must be added externally; or internally upon request by the customer) |
| | 0 to 0.2 mA | 0.04 mA | 510 Ohm shunt resistor (must be added externally; or internally upon request by the customer) |

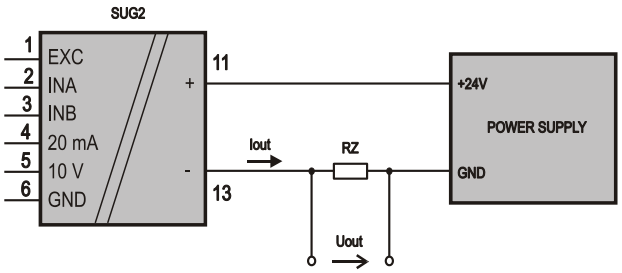
Note: Other voltage and current ranges are possible after changing the ballast or shunt resistors upon request by the customer.

## EQUIPMENT OPERATING CONDITIONS

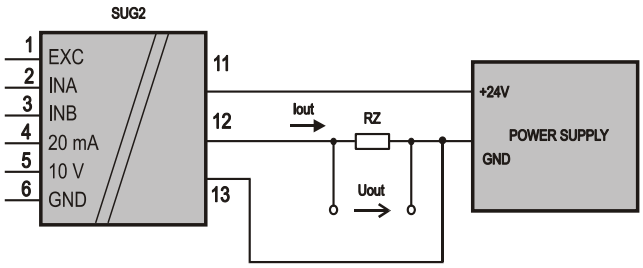
**Ambient temperature:** -30 to +80° C
**Relative humidity:** < 95% (without condensation)
**Atmospheric pressure:** 84 to 107 kPa
**Cover:** IP40 housing, IP20 terminals
**Admissible conductor cross-section:** 0.35 $mm^2$ to 4 $mm^2$
**Housing material:** self-extinguishing plastic (NORYL)
**Resistance and stability against vibration:**
10 to 60 Hz peak amplitude of 0.15 mm
60 to 500 Hz peak acceleration of 19.6 $m/s^2$
**Resistance to interference (EMC):**
EN 61 000 - 4 - 3 (wide-band field, level 3), criterion B
EN 61 000 - 4 - 6 (cable interference, level 2), criterion A
EN 61 000 - 4 - 6 (cable interference, level 3), criterion B

**NOTE: The converters come standard with Pt100 internal sensors to compensate for the thermocouple's cold end; they are programmed for this variant. Other cold end readings (external or three-wire) can be set by the program.**

Converter connection in a 4 - 20 mA loop

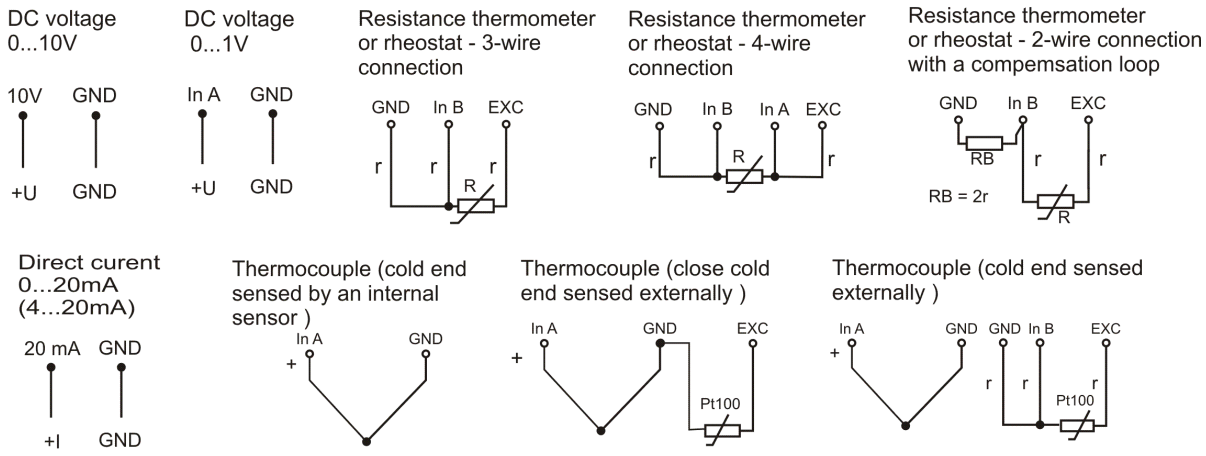



Converter connection for 0 - 20 mA

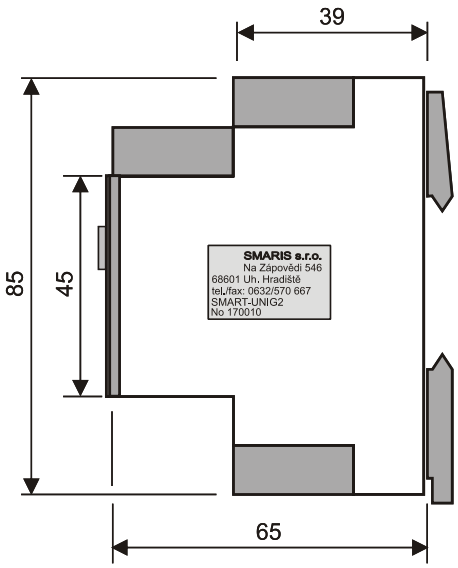



In models with voltage inputs, the voltage signal is taken directly from the OUT (12) terminal

**FIG.1: SUG2 input connection :**




## Dimensional drawing






**Standard model curent loop 4...20mA**

**Extended version with output 0...5V , 0...10V , 0...20 mA**

***Ordering:***

| Type | Construction |
|---|---|
| SUG2 | Intelligent programmabe converter with galvanic separator |

| Code | Input signal |
|---|---|
| 0 | unprogrammed |
| 1 | Pt100 |
| 2 | Pt1000 |
| 3 | Ni100 |
| 4 | Ni1000 |
| 5 | thermocouple type B ( PtRh30-PtRh6 ) |
| 6 | thermocouple type E ( NiCr-CuNi ,ch-ko ) |
| 7 | thermocouple type J ( Fe-CuNi ) |
| 8 | thermocouple type K ( NiCr-Ni , ch-a ) |
| 9 | thermocouple type N ( NiCrSi - NiSi ) |
| 10 | thermocouple type L ( Fe-CuNi , Fe-ko ) |
| 11 | thermocouple type R ( PtRh13-Pt ) |
| 12 | thermocouple type S ( PtRh10-Pt ) |
| 13 | thermocoupe type T ( Cu-CuNi , Cu-ko ) |
| 14 | direct voltage |
| 15 | direct current |
| 16 | potentiometer - absolute measurement |
| 17 | potentiometer - relative measurement |
| 18 | rheostat - absolute measurement |
| 19 | rheostat - relative measurement |

| Code | Sensor connected: |
|---|---|
| 0 | unprogrammed |
| 2 | double-wire (for each input signal ) |
| 3 | three-wire ( for resistance input signals ) |
| 4 | four-wire ( for resistance input signals ) |

| Code | Linearization |
|---|---|
| 0 | linearized ( Pt, Ni,thermocouples ) |
| 1 | no linearization |
| 2 | special linearization (for example. linearized in accordance to spreadsheet ) |

| Code | Output signal |
|---|---|
| 0 | 4 to 20 mA |
| 1 | 20 to 4 mA reversing |
| 2 | 0 to 20 mA |
| 3 | 0 to 5 V |
| 4 | 0 to 10 V |

| Code | Sensor´s error indication |
|---|---|
| 0 | according to input terminal condition |
| 1 | overcurrent |
| 2 | undercurrent |

| Code | Input time constant |
|---|---|
| 2 | standard time constant ( 2s ) |
| xxx | 0,3 to 100 sec. |

| Code | Measuring range |
|---|---|
| 0 | unprogrammed |
| xxx/xxx | lower / upper limit + unit |

| Code | Converter ssupply |
|---|---|
| - | standard current loop 4-20 mA |
| 1 | supply 19...30 VDC ( 0...20mA, 0...5V, 0...10V ) |

| SUG2 | 1 | 3 | 0 | 0 | 0 | 2 | 0/300°C | **Example of the order specification** |
|---|---|---|---|---|---|---|---|---|

There is ordered Intelligente programmable converter SUG2 having galvanic separator , input sensor Pt100, 3-wiring connection,standard linearized , output 4-20 mA in current loop , error indicated overcurrent or undercurrent - depends on the input sensor , time limit 2sec. ,input range from 0 to 300 °C.