

# Transducers for Thermocouples

Microprocessor-based technology, two- or three-port isolation



Isolating transducers with digital programming of ranges, for DIN-rails or for printed circuit boards.

Modules with one fixed range or programmable, multi-range versions with RS-interface and DIL-switches.


## General Description

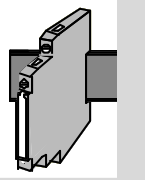
These transducers convert the output voltage from a thermocouple into an output signal (e.g., 0-10 V or 4-20 mA), which is linearly proportional to the thermovoltage. Frequency output is available as an option, max. 10 kHz. Electronic reference junction for all common thermocouples - can be deactivated. A microprocessor controls the electronic circuit and the calibration; highest accuracy and stability can be guaranteed (no potentiometers). The multi-range versions can be programmed via RS-232 with up to 8 different measurement ranges. The programmed ranges can be selected (without PC) via DIL-switches. Programming with specific ranges (to be specified by the customer) can be done at the factory.

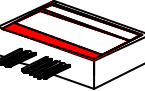
The RS232-interface allows also the exchange of other information (AD-value, serial number, calibration date etc.).

- Galvanic isolation between input and output, as option for power-supply (3-port isolation), 1kV or 2 kV test voltage.
- Programmed and calibrated in factory or by the customer (via RS232), up to 8 different ranges. Once programmed, the ranges are selected via DIL-switches (without PC).
- Self test (only with multi-range versions), initiated via a DIL-switch.
- Many options: Frequency output, limit switches, multiplexers, digital interfaces, and low cost special versions.

## Overview

For DIN-Rails	Type	Output	Range	Features
 55x60x23mm	IT270	V	1	One range, voltage output
	IT282	0/4-20mA	1	One range, current output
	IT290	V, 0/4-20mA	1-8, multirange	RS-232, DIL-switches for range selection, self test

For DIN-Rails	Type	Output	Range	Features
 79X80X6.2mm	IT170	V	1	One range, voltage output
	IT182	0/4-20mA	1	One range, current output
	IT190	V, 0/4-20mA	8, multirange	RS-232, DIL-switches for range selection, self test

For Printed Circuits	Type	Output	Range	Features
 55x32x15mm	IT210	V	1	One range, voltage output
	IT232	0/4-20mA	1	One range, current output
	IT215	V, 0/4-20mA	8, multirange	RS-232, DIL-switches for range selection, self test

All DIN-Rail-modules are available with 2- or 3-port isolation

# Technical Data

Specifications for accuracy classes A, C, and D (Max. values at 23°C, unless otherwise stated)

General	A	C	D	Unit
Conversion error (linearity) <sup>1</sup>	0.015	0.03	0.1	%
Total error, including calibration error (factory calibrated), 23°C	0.05	0.1	0.2	%
3 dB-Bandwidth, typ. <sup>2</sup>	10	10	10	Hz
Settling time to 1% of final value, typ.	100	100	100	ms
Input impedance, min. <sup>3</sup>	330	330	330	kOhm
Cold junction compensation (T>0°C)	A	C	D	Unit
Error, 23°C	0.5	1	1.5	°C
Lin. Error between 0 and 60°C	0.5	0.8	1.5	°C
Input	A	C	D	Unit
Input impedance, voltage input, min. <sup>3</sup>	330	330	330	kOhm
Input impedance, current input, typ. <sup>3</sup>	100	100	100	Ohm
Output	A	C	D	Unit
Output impedance, voltage, typ. <sup>3</sup>	50	50	50	Ohm
Output current (voltage output), max.	5	5	5	mA
Burden, current output, min. <sup>3</sup>	400	400	400	Ohm
Ripple and noise, voltage output, 50mV input, typ.	0.5	0.5	0.5	mV RMS
Influence of supply voltage <sup>1</sup>	0.002	0.005	0.005	%/V
Stability of Offset (RTI) with	A	C	D	Unit
Temperature <sup>1</sup>	0.3	0.5	2	µV/K
Age, 1 year <sup>1</sup>	10	20		µV
Age, 10 years <sup>1</sup>	20	40		µV
Stability of Gain with	A	C	D	Unit
Temperature <sup>1</sup>	40	80	150	ppm/K
Age, 1 year <sup>1</sup>	400	800		ppm
Age, 10 years <sup>1</sup>	1200	2500		ppm

<sup>1</sup> The typical error is two- to four-times smaller than the quoted maximum error.

<sup>2</sup> Different bandwidths on request

<sup>3</sup> Different impedances/burden on request.

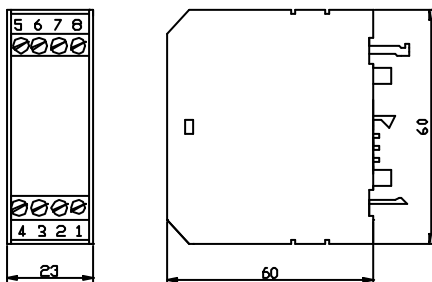
Temperature range °C: recommended: 0/60, functional: -20/90

## Please note:

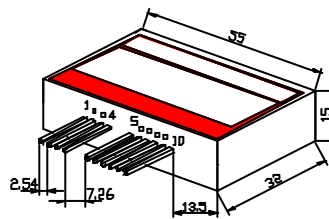
The errors quoted are only valid for a measurement range where the start of the range is not more than 50% of full scale (e.g., 40°C-100 °C). Where the zero-point is shifted considerably (e.g. measurement range of 400-500 °C), then the quoted error refers to the range calculated to have begun at zero (0-500 °C).

## Dimensions and Connections

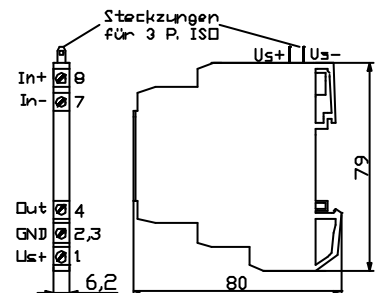
22.5 mm-DIN-rail module



Printed circuit module



6.2 mm DIN-rail-module



## Input

Modules for all thermocouples are available, max. input voltage is 80 mV. Min. input is 2 mV, input noise is 1-2  $\mu$ V RTI. Overvoltage protection up to 30 VDC, surge/burst protection up to 3 kV.

## Output

**Voltage Output:** Low noise, low ripple output ( $<0.8$  mV RMS for 50 mV input). Standard output between 0 und 10 V, as option also negative values (down to  $-10$  V, the optional DC-DC-converter must be ordered). The output is short circuit proof and protected against overvoltages (max. 30 VDC). The technical data (specs) are valid for the current output; the voltage output is usually slightly more accurate and stable (no voltage-to-current conversion).  
Min. output voltage: approx. 15 mV. Using the optional DC-DC-converter (without galvanic isolation) one can obtain also exactly 0 mV.

**Current Output:** Standard 0-20 mA or 4-20 mA, short circuit proof. Other output ranges on request.

**Option:** Frequency output (max. 10 kHz), for more info, see „Analog to Frequency transducers“.

## Power Supply

All modules are suited for **unregulated, noisy industrial power supplies**; nominal value is 24 VDC (min. 17 V, max. 30 V). IT2XX-3 (Option 1: 3-port): min. 20 V. Other supply voltages on request (e.g. 15 V). Current consumption without load is approx. 18 mA. AC power supply on request.

**Negative outputs** (down to  $-10$  V) do not require a negative power supply (built in DC-DC-converter, option 2)

**6.2mm-modules:** supply voltage from 12 V to 35 V, current consumption without load approx. 8 mA

## Options

1. **3-port-isolation** with DC-DC-converter (integrated in the module) for 24 V power supply. Test voltage 1 kV or 2 kV. Power is connected via 2.8mm-flat connectors (suited receptacles are supplies).



2. **DC-DC converter (not isolated)** for negative output voltages
3. **Adjustable limit switch** GW1 (integrated), only with 22.5-housing. Details see separate date sheet.
4. **Other ranges**, other time constants etc.

5. **Frequency output** (up to 10 kHz), for details see separate date sheet.
6. **Limitation of max. output** (mA, V or Hz) to a specific value
7. **Potentiometer** (offset and gain) for a fine-adjustment without PC

## When ordering, please specify

### Module type

**Accuracy class** (A, C, or D)

**Input and output range** (in mV,  $^{\circ}$ C or K). This information is only needed if the transmitter has to be factory calibrated to a specific range (free of charge for one range).

**Supply voltage:** standard is 24 V, others on request

**Options** For 3-port isolation add  $-3$  to the module number (eg IV1195-3).

## Selection of Ranges of the Standard-Range-Module IT290, IT190, IT215

The range-switch is located inside the housing. In case of a housing without a window please remove the transparent plastic cover carefully, then the printed circuit board can be pulled out (pull the screw terminals).

6.2 mm housings without window: release carefully the 9 holders (e.g. with aid of a screw driver), then the cover can be removed.

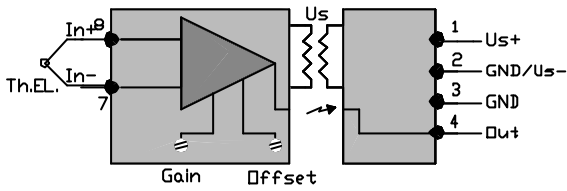
Up to 8 ranges can be realized within the same transducer, either via RS 232 or in the factory.

The electronic cold junction compensation (e.g. for calibration) is switch off, if switch 1 is "on"

Switch 5 und 6 (if present): 5 always off, 6 always on.

**Self test:** One of the ranges can be foreseen for a self test (open input or short circuit). Consult factory if required.

## Block Diagram and Connections, 2-Port-Isolation, DIN-Rail Modules



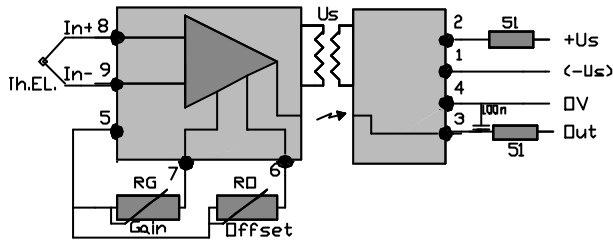
### IT 270-290, IT 170-190

- Terminal 1: Pos. power supply, 24 VDC nominal
- Terminal 2: Power supply ground
- Terminal 3: Signal ground
- Terminal 4: Signal output (plus)

- Terminal 7: Thermocouple input (minus)
- Terminal 8: Thermocouple input (plus)

IT170-190: Terminals 2 and 3 are common  
 IT 270-290: The potentiometers are available as option, usually they are not necessary, but may be used for fine-adjustment without a PC. Adjustment range: some %.

## Block Diagram and Connections, 2-Port-Isolation, Modules for Printed Circuits



### IT 210-230

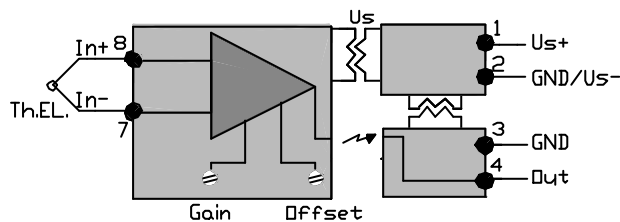
- Terminal 1: Power supply ground
- Terminal 2: Pos. power supply, 24 VDC nominal
- Terminal 3: Signal output (plus)
- Terminal 4: Signal ground

- Terminal 5: Ground
- Terminal 6, 7: Potentiometer (option)
- Terminal 8: Thermocouple input (plus)
- Terminal 9: Thermocouple input (minus)

If HF-noise can't be excluded, we recommend adding filters (e.g. 50 Ohm/100nF).

Versions with potentiometers are available as option, usually they are not necessary, but may be used for fine-adjustment without a PC. Adjustment range: some %.

## Block Diagram and Connections, 3-Port-Isolation, DIN-Rail Modules



### IT 2XX-3, IT 1XX-3

3-port-isolation also with 6.2mm-housing!

- Terminal 1: Pos. power supply, 24 VDC nominal
- Terminal 2: Power supply ground
- Terminal 3: Signal Ground
- Terminal 4: Signal output (plus)

- Terminal 7: Thermocouple input (minus)
- Terminal 8: Thermocouple input (plus)

IT170-190: Terminals 1 and 2 are 2.8mm flat connectors (two receptacles are supplied)

IT 270-290: The potentiometers are available as option, usually they are not necessary, but may be used for fine-adjustment without a PC. Adjustment range: some %.

# Programming Transducers IT190, IT290, IT215 via RS 232

## General

These transducers can be programmed via RS 232. A special cable supplied by SOCLAIR ELECTRONIC is necessary as well as special programming software. The transducer stores all parameters in non-volatile EEPROM, switching the transducer off and on does not result in a loss of the values.

## Ranges

These transducers are suited for ranges between 2 mV and 80 V (span). The input offset as well as the output offset may be different from zero (within certain limits). Input offset can't be below  $-2.8$  mV (standard versions, lower offsets on request). Thermocouple types: K, T, J, E (others on request).

## Programming

Connect the module with the PC (use special cable). Enter starting point and end point of input and output into the text box. The module can now be programmed, typ. error is 0.2%. If necessary, a manual fine adjustment can be executed by entering the actual output readings into the corresponding text boxes. It's possible to program up to 8 ranges into the same module. Later, the ranges can be selected via a DIL-switch (without PC).

The software also allowed reading information from the module (serial number, soft- and hardware version, date of last programming).

As option it's possible to read the AD-values (12 bit or more). Please contact your distributor or the factory for details.

## Detailed Instructions:

1. Connect power supply (24 VDS) to transducer, connect special RS-232-cable to PC and transducer and select COM-Port (Menu 'RS-Port'). Input and output of transducer may be connected or not. If connected, a check of the programming can immediately be executed.
2. Start the program (.exe-file). Load the information of the transmitter (Menu File/Load...). Select for this operation a .typ-file corresponding to the transmitter type. Select using menu 'Ranges' a range number. All settings (entered in 3.) can be saved under the same (File/Save) or a different (File/Save as...) name. If more than one range per transmitter is used, select the desired range. Working with only one range, the usual selection is range number 1. To change the name/description of the range, select 'range/change name'. Once programmed, the selection of the range takes place via the SMD-switch on the transmitter: (switch 2,3,4 'off' = range 1; 2 'on', 3,4 'off' = range 2 etc.)"
3. Enter In- and output-range into the foreseen textboxes (in units according the selected type), select in- and output-type.
4. Start programming with a mouse click on 'Execute adjustment', this operation needs approx. 1 sec. An error message is generated if the desired range cannot be realized. Other error messages will pop up if a communication error occurs (after several seconds of trials), e.g. because there is no power to the transmitter or no RS-232-cable connected or wrong port etc. In some special error cases the program will be terminated and has to be started again.
5. The programming error is typ. 0.1-0.2%, can be more with certain ranges and offsets. If necessary, a fine adjustment can be executed as follows:

## Fine Adjustment:

1. Connect transmitter to a calibrator (input) and a meter (output). Apply offset (input) and full scale (input) to the transmitter. Enter the readings of the corresponding outputs (offset and full scale) of the mA- or V-meter into the corresponding text boxes (Output: in frame 'Manual fine tuning').
2. Start download of corrected values by clicking on 'Execute fine adjustment'. Repeat the procedure 1. and 2. if necessary.

## Programming Software

In order to program a transducer just enter offset and full scale of input and output and select the type. Clicking on "Execute Adjustment" programs the transducer within a second.

The error is typ. 0.2%. If necessary, one can execute a manual fine tuning.

It's also possible to read information from the transducer.

All settings can be saved using File/Save or File/Save as...

### Important note:

Soclair Electronics is continually working to improve the quality and reliability of its products. MTBF (using MIL217) is well above 10 years (in most cases even more than 100 years). Nevertheless, electronic devices in general can malfunction or fail due to their inherent physical and chemical properties. It is the responsibility of the buyer, when utilizing Soclair Electronic products, to observe standards of safety and to avoid a situation in which a malfunction or failure of a Soclair Electronic device could cause loss of human life, injuries or damage to properties. Soclair Electronic products are not authorized for use in life support systems.