

Programmable Analog to Frequency Transducer

Microprocessor-based technology




Transducer with frequency output for currents, voltages, Pt-100/1000, resistances, thermocouples; versions with frequency bus.

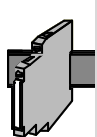
General Description

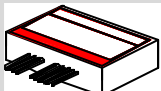
These transducers convert an input voltage or current or the signal from a resistive sensor (e.g., Pt-100/1000) or from a thermocouple into a frequency output (e.g. 0-10 kHz). A microprocessor controls the electronic circuit and the calibration; highest accuracy and stability can be guaranteed (no potentiometers). 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 RS-232-interface allows also the exchange of other information (AD-values, serial number, calibration date etc.).

- Galvanic isolation between input and output, as option also for power-supply (3-port isolation, 1kV or 2kV test voltage).
- Linearization for Pt-100 (Pt-1000 and others on request), 2-, 3-, or 4-wire sensor connection.
- Programmed and calibrated in factory or by the customer (via RS-232), 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 DIL-switch.
- Many options: Frequency output limitation, limit switches, multiplexers, digital interfaces, low cost special versions.

Overview

For DIN-rails 22.5mm	Type	Output	Ranges	Features
	IVI270F	Frequency	1	One range
	IVI290F	Frequency	1-8	RS-232, SMD-switch, self test

For DIN-rails 6.2mm	Type	Output	Ranges	Features
	IVI170F	Frequency	1	One range
	IVI190F	Frequency	1-8	RS-232, SMD-switch, self test

For printed circuits	Type	Output	Ranges	Features
 Dimensions 55x32x15mm	IVI210F	Frequency	1	One range
	IVI215F	Frequency	1-8	RS-232, SMD-switch, self test

All types also available for thermocouples (ITXXXF) and for Pt-100/1000/resistances (IRXXXF).

Technical Data

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

General	A	C	D	Unit
Conversion error (linearity) ¹	0.02	0.04	0.1	%
Total error, including calibration error (factory calibrated), 23°C	0.05	0.1	0.2	%
3 dB-Bandwidth, current/voltage input, typ. ²	30	30	30	Hz
3 dB- Bandwidth, thermocouple, Pt-100, typ. ²	10	10	10	Hz
Settling time to 1% of final value, current/voltage input, typ.	20	20	20	ms
Settling time to 1% of final value, thermocouple, Pt-100, typ	100	100	100	ms
Influence of supply voltage ¹	0.002	0.005	0.005	%/V
Input (current, voltage)	A	C	D	Unit
Input impedance, voltage input, min. ³	330	330	330	kOhm
Input impedance, current input (mA-range), typ. ³	100	100	100	Ohm
Input (thermocouple, cold junction compensation)	A	C	D	Unit
Error, 23°C	1.0	2	3	°C
Lin. error between 0 and 60°C	0.5	1	1	°C
Input Pt-100/Resistance	A	C	D	Unit
Influence of wire resistance (Pt-100), 4-L	0.002	0.005	0.01	%/Ohm
Linearization error Pt-100, Pt-1000, span < 300°C	0.02	0.03	0.05	%
Linearization error Pt-100, Pt-1000, span < 600° (progr.: 400°)	0.05	0.07	0.1	%
Output, up to 10kHz	A	C	D	Unit
Output impedance, internal pull-up to supply, typ. ³	2400	2400	2400	Ohm
External or internal pull-up to 24V, min.	1000	1000	1000	Ohm
Output current, 1000 Ohm pull-up to 24 V, max.	10	10	10	mA
Output high value with 1000 Ohm to 24V, 1mA load, min.	20	20	20	V
Stability of Offset (RTI) with	A	C	D	Unit
Temperature ¹ (thermocouples and span < 500 mV)	0.3	2	5	µV/K
Age (thermocouples and span < 500 mV), 1 year ¹	10	20		µV
Age (thermocouples and span < 500 mV), 10 year ¹	20	40		µV
Stability of Gain with:	A	C	D	Unit
Temperature ¹	40	80	150	ppm/K
Age, 1 year ¹	400	800		ppm
Age, 10 years ¹	1200	2500		ppm

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

² Different bandwidths on request

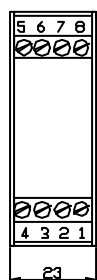
³ Different impedances/burden on request.

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

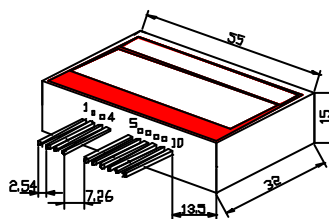
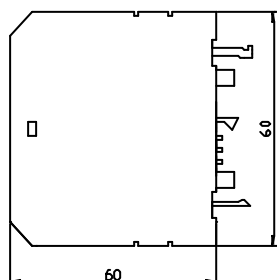
Please note:

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. 40-100 mV). Where the zero-point is shifted considerably (e.g. measurement range of 4-5 mA), then the quoted error refers to the range calculated to have begun at zero (0-5 mA).

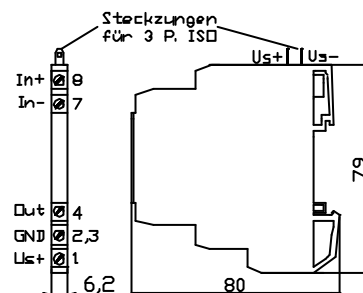
Dimensions and Connections



22.5 mm-DIN-rail module



Printed circuit module



6.2 mm DIN-rail-module

Input

Current input: DC-currents from μA to 100 mA, input impedance ca. 100 Ohm (20 mA range)

Voltage input: standard up to 30 VDC, also neg. values. On request up to 100 VDC. Input impedance typ. 330 kOhm.

Pt-100/resistances: 2-, 3- or 4-wire connection. Sensor current (Pt-100): ca. 0.5 mA. All ranges, also for Pt-500/1000, Ni, Cu.

Thermocouples: all types and all ranges

Overvoltage protection up to 30 VDC (self resetting fuse), surge/burst impulse protection up to 3 kV.

Frequency Output

Standard 2-port-isolation: up to 10 kHz output frequency, rise- and fall-time typ. 10 μs , pulsewidth (high) typ. 50 μs /10 kHz, duty cycle (for ranges below 5kHz) 1:1.

The output stage is an "open drain" transistor. With the internal pull one gets ca. 20-22 V high level. An external pull up resistor (min. 1 kOhm) may be used (terminal 4 DIN-rail housing) for other voltages. As an option it's also possible to have a 5 V-output (TTL or CMOS) or other voltages.

The output is short circuit proof and has an overvoltage protection up to 30 VDC.

3-port-isolation, 6.2mm housing: same data as 2-port, no frequency-bus output stage possible.

3-port-isolation, 23mm housing: high level voltage with internal pull up: ca. 14 V, with external pull up max. 30 V. A frequency-bus output is available as option.

Power Supply

All modules are suited for **unregulated, noisy industrial power supplies**; nominal value is 24 VDC (min. 17V, max. 30V). IV1295-3 (Option 1: 3-port): min. 20V. Other supply voltages on request (e.g. 15V). Current consumption without load is approx. 18 mA. AC power supply on request.

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

Please note than with a pull-up resistor to power supply the high level may show a ripple.

Options

1. **3-port-isolation** with DC-DC-converter (integrated in the module) for 24 V power supply. Test voltage 1 kV or 3 kV. 6.2mm-housing: power is connected via two flat connector (suited receptacles are supplied).



2. **Adjustable limit switch** GW1 (integrated), only with 22.5-housing. Details see separate data sheet.
3. **Other ranges**, other time constants etc.
4. **Limitation** of max. output frequency to a specific value
5. **Potentiometer** (Offset and Gain) for a fine-adjustment without PC, adjustment range ca. 5%
6. **Version XXXXFB:** Frequency bus output, different transmitters may be switched on and off via an enable input.

When ordering, please specify

Module type, input type (voltage, current, Pt-100, TE...)

Accuracy class (A, C, or D)

Input and output range (input in V, mV, mA, Ohm or $^{\circ}\text{C}$, output in Hz). 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 IV1170F-3)

Selection of Ranges of the Standard-Range-Module IXX290F, IXX210 und IXX190

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.

The ranges are programmed in the factory according to customer requirements or by the user via RS-232.

Switch 1 is on for current input (e.g. 4-20 mA), switches 2,3,4 are range switches (for max. 8 ranges, including a self test range). 5 is always off, 6 always on.

Connections (DIN-Rail Housing)

1: Supply + (24 V DC)

2: Supply - (24 V DC), Ground

3: Ground frequency output (standard version -F), version -FB: enable input (5 -30 V)

4: Frequency output. Version -FB: 1-5kOhm load to ground, enable level equal output level

IVIXXF (Version for current, voltage)

5: open

6: open

7: Input -

8: Input +

ITXXXF (Version for thermocouples):

5: open

6: open

7: thermocouple -

8: thermocouple +

IRXXXF (Version for resistors, Pt-100)

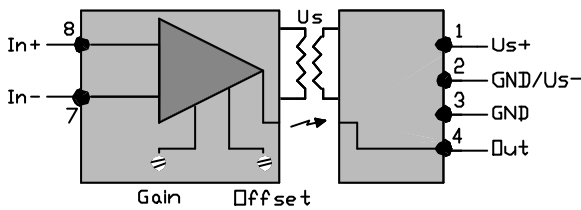
5: Se-

6: So-

7: Se+

8: So+

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



Terminal 1: Pos. power supply, 24 VDC nominal

Terminal 2: Power supply ground

Terminal 3: Ground

Terminal 4: Frequency output (plus)

Terminal 7: Signal input (minus)

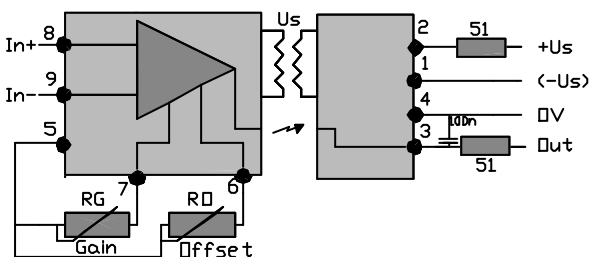
Terminal 8: Signal input, voltage, current or thermocouple (plus)

IVIF170-190: Terminals 2 and 3 are common

IVI F270-290: The potentiometers are available as option, usually they are not necessary, but may be used for fine-adjustment without a PC. Adjustment range: some %.

IVI 270-290F, IVI 170-190F

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



Terminal 1: Power supply ground

Terminal 2: Pos. power supply, 24 VDC nominal

Terminal 3: Ground

Terminal 4: Frequency output (plus)

Terminal 5: Ground

Terminal 6, 7: Potentiometer (option)

Terminal 8: Signal input, voltage or current (plus)

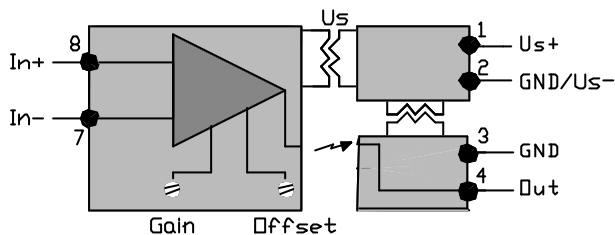
Terminal 9: Signal input (minus)

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

IVI 210-215F

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



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

Terminal 7: Signal input (minus)
 Terminal 8: Signal input, voltage or current (plus)

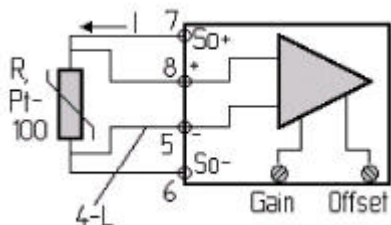
IXX170-190: Terminals 1 and 2 are 2.8mm flat connectors (two suited receptacles are supplied)

IXX 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 %.

IVI 2XX-3F, IVI 1XX-3F

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

Connection of a Resistor/Pt-100 to a DIN-Rail Module

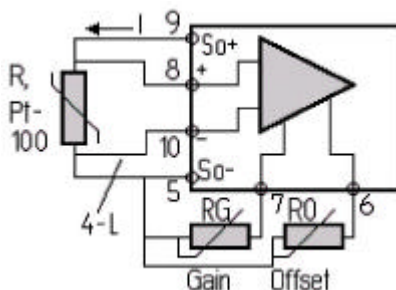


2L-connection: external short circuit between 5-6 and 7-8
 3L-connection: terminal 5 not connected

Please note: A 3-wire connection can't be realized with a 4-wire module and vice versa. Only programmable modules offer both input modes.

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

Connection of a Resistor/Pt-100 to a Module for Printed Circuits



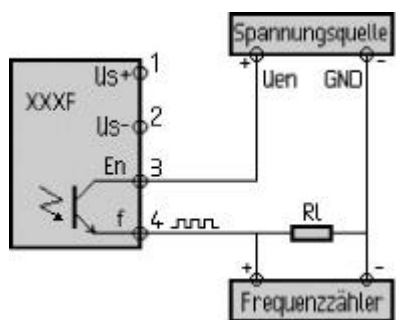
2L-connection: external short circuit between 5-10 and 9-8
 3L-connection: terminal 10 not connected

Filter (2x51 Ohm, 1x100nF) to be used in case of HF-interferences

Please note: A 3-wire connection can't be realized with a 4-wire module and vice versa. Only programmable modules offer both input modes.

Option: External Potentiometer: 1KOhm each, adjustment range approx. 5%

Option IVI2XXFB, Frequency Output (with Enable)

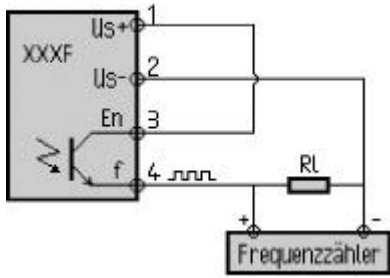


Terminal 1: Pos. power supply, 24 VDC nominal
 Terminal 2: Power supply ground
 Terminal 3: Enable input, 4-30 VDC, open or 0 V: no output (tristate)
 Terminal 4: Frequency output (plus). This version needs a load resistor (RL) between 1Kohm and 5 kOhm to frequency counter ground.

The output high voltage is equal to the enable voltage minus voltage drops in protective elements (ca. 600 Ohm).

Isolation barrier (output-input-supply) is not allowed for mains (Vmax = 60 V)

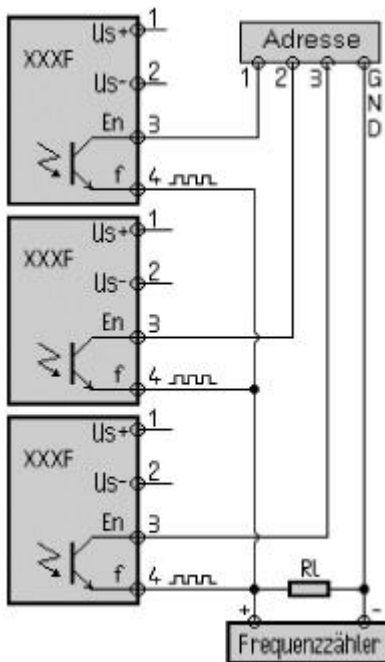
Option IVI2XXFB, Always Enabled



- Terminal 1: Pos. power supply, 24 VDC nominal
- Terminal 2: Power supply ground
- Terminal 3: Enable input connected to power supply (always enabled)
- Terminal 4: Frequency output (plus). This version needs a load resistor (R_L) between 1Kohm and 5 kOhm to frequency counter ground.

The output high voltage is equal to the enable voltage minus voltage drops in protective elements (ca. 600 Ohm).

Option IVI2XXFB, Common Frequency Bus



With this version, a bus can be realized. An address-generator (5-30 VDC) switches a module on and off. The output of all modules is connected to the same line. The output high voltage is equal to the enable voltage.

- Terminal 1: Pos. power supply, 24 VDC nominal
- Terminal 2: Power supply ground
- Terminal 3: Enable input, 4-30 VDC, open or 0 V: no output (tristate)
- Terminal 4: Frequency output (plus). This version needs a load resistor (R_L) between 1Kohm and 5 kOhm to frequency counter ground.

The output high voltage is equal to the enable voltage minus voltage drops in protective elements (ca. 600 Ohm).

Isolation barrier (output-input-supply) is not allowed for mains ($V_{max} = 60 V$)

Adjustment of Measurement Range and Zero Point (Offset)

The modules with a fixed measurement range are precisely calibrated at the factory (error usually less than 0.05%), further calibration is generally unnecessary. If the output values are not correct, first of all check the connections, the power supply (is the supply voltage correct ?), the experimental arrangement and all instruments in use.

We recommend that when working with programmable or configurable modules, the calibration should be checked after each new adjustment.

Adjustment is performed using a calibrator or a calibrated sensing device. The zero point (offset) is adjusted via the "Offs" potentiometer and the full scale value is adjusted via the "gain" potentiometer. The zero point is adjusted first and then the full scale. Where large adjustments are necessary, the procedure should be carried out several times. For additional reliability, the output value should be measured at half the measurement range (linearity test).

The output of modules with a unipolar supply voltage can't reach exactly 0. In such cases, zero point adjustment must be performed with an input value which produces a non-zero output value.

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.