IPE-ISO1 – Precision measuring amplifier with galvanic isolation

IPE-ISO1 – Version A: DIN rail housing

IPE-ISO1 – Version B: Aluminium profile housing

Housing mounting brackets available.

FEATURES

- Configurable precision amplifier for IEPE / AC / DC with triple galvanic isolation
  - signal input to signal output
  - signal input to power supply
  - signal output to power supply
- Application-specific configurable signal input to signal output ranges
- Unbalanced IEPE signals converted to balanced or on demand unbalanced signal outputs with offset shift
- Additional current output 4 - 20 mA (2-pole plug on the rear)
- Plug-in active filter for bandwidth limitation (e.g. as anti-aliasing filter)
- IEPE input control: Indication of errors in IEPE input and IEPE input OK
- Wide range power supply 9 to 36 VDC, approx. 2 W (banana and DC connector).

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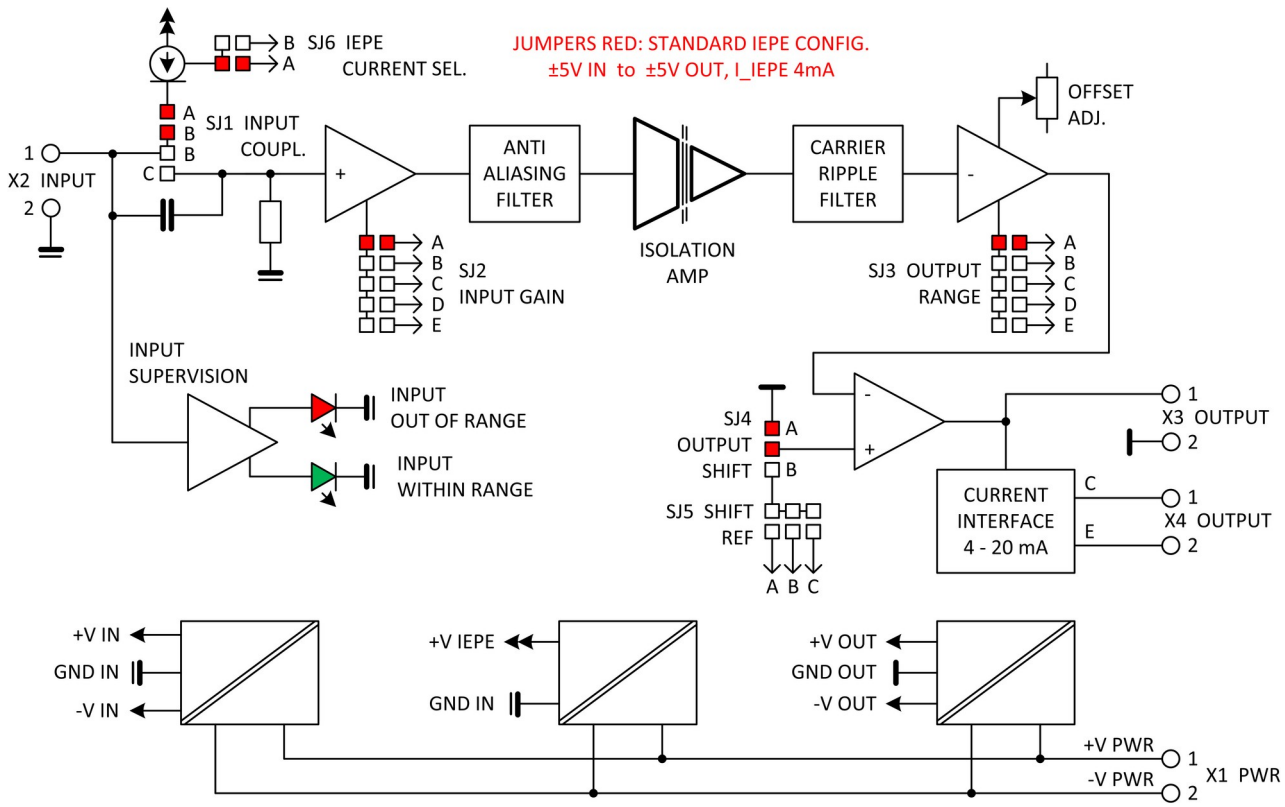
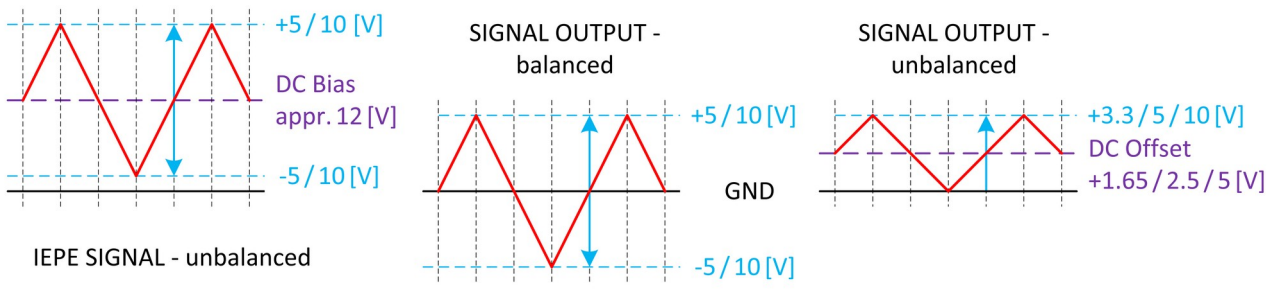
Functional circuit diagram



Functional circuit diagram with the function groups

- DC or AC coupling (high pass) of the input amplifier – setting SJ1
- Input amplification – setting SJ2
- Active low-pass filter (plug-in module Piggyback) as anti-aliasing filter for the isolation amplifier (must be bridged by a spare plug when not in use (included in the delivery if required)
- Isolation amplifier for galvanic isolation from signal input to signal output
- Signal adaptation to desired output ranges – setting SJ3
- Signal output shift from balanced to unbalanced – setting SJ4 and SJ5
- Constant current source (I_IEPE) to supply the IEPE sensor – setting SJ6
- Signal output available as voltage and current signal
- IEPE error indicator for open or shorted signal input (red LED) and also signal OK detection (green LED)

The output signal depends on the signal processing or the analog-to-digital converter used: Adaptation of the input signal to balanced or unbalanced ADCs



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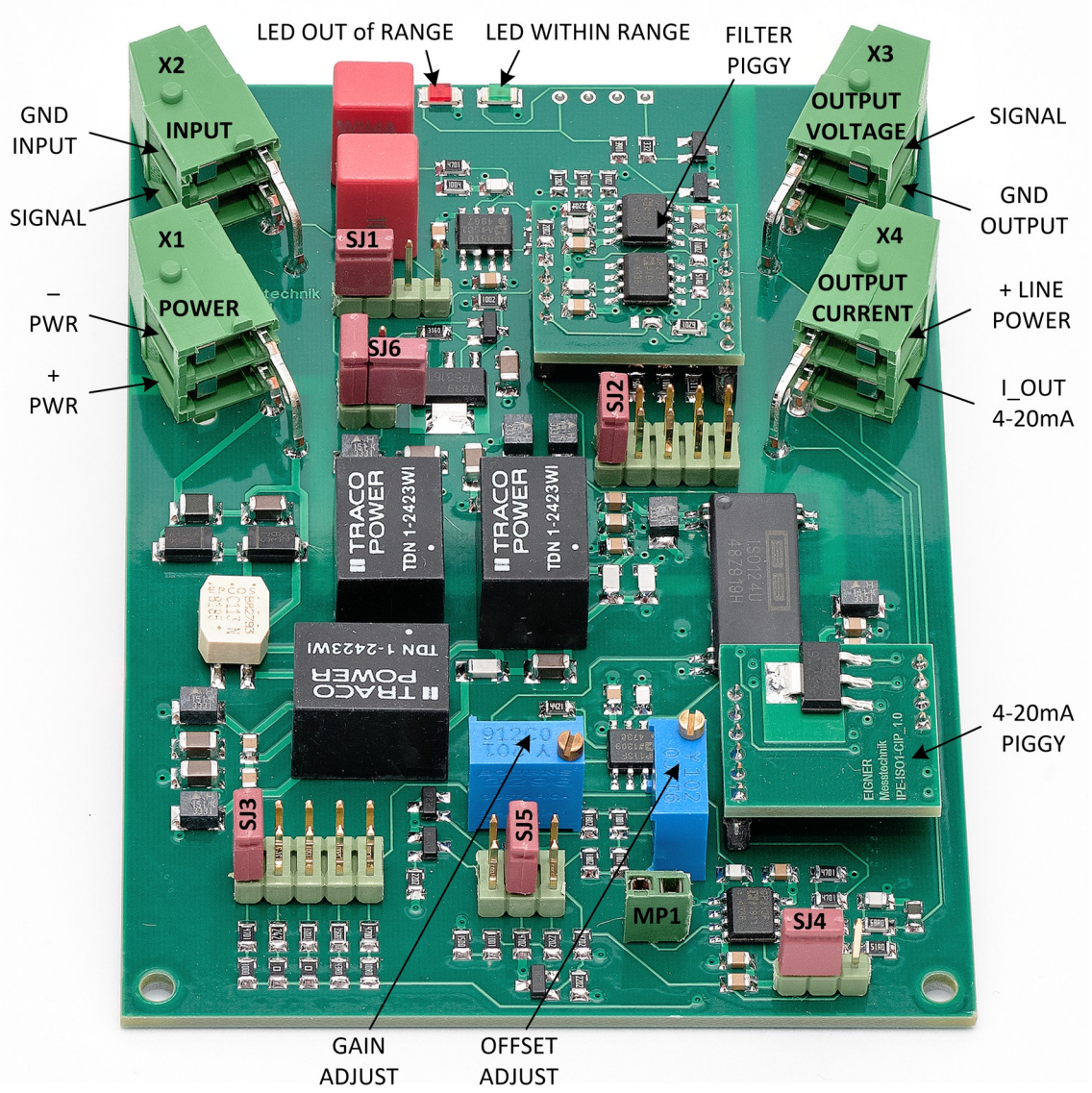
Board view



GAIN ADJUST:	OFFSET ADJUST:	MP1:
Is set at the factory, should normally not be adjusted by the user.	Calibrated ex works for the default configuration (as ordered). However, offset can be readjusted by the user if the configuration has been changed.	Measuring point for factory use.

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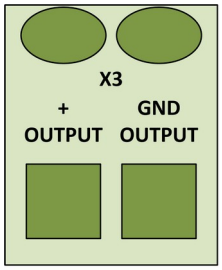
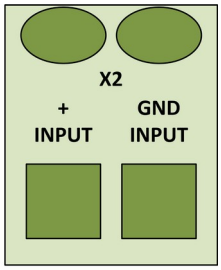
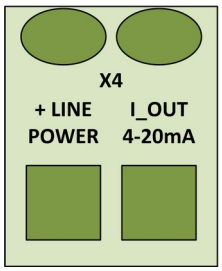
Table 1: Connection terminals

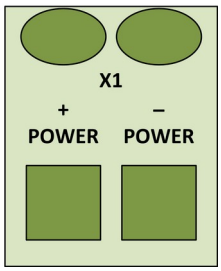
Terminal	Connection	Title
X1		Power supply
	1	+ Power (9 – 36 VDC)
	2	– Power
X2		Signal input
	1	+ INPUT
	2	GND INPUT
X3		Signal output (Voltage)
	1	+ OUTPUT
	2	GND OUTPUT
X4		Signal output (Current)
	1	+ LINE POWER 24 VDC nom. (12 – 36 VDC)
	2	I_OUT 4-20mA (offset 12mA) 500 Ohm nom. (100 – 1000 Ohm)

Klemmenorientierung

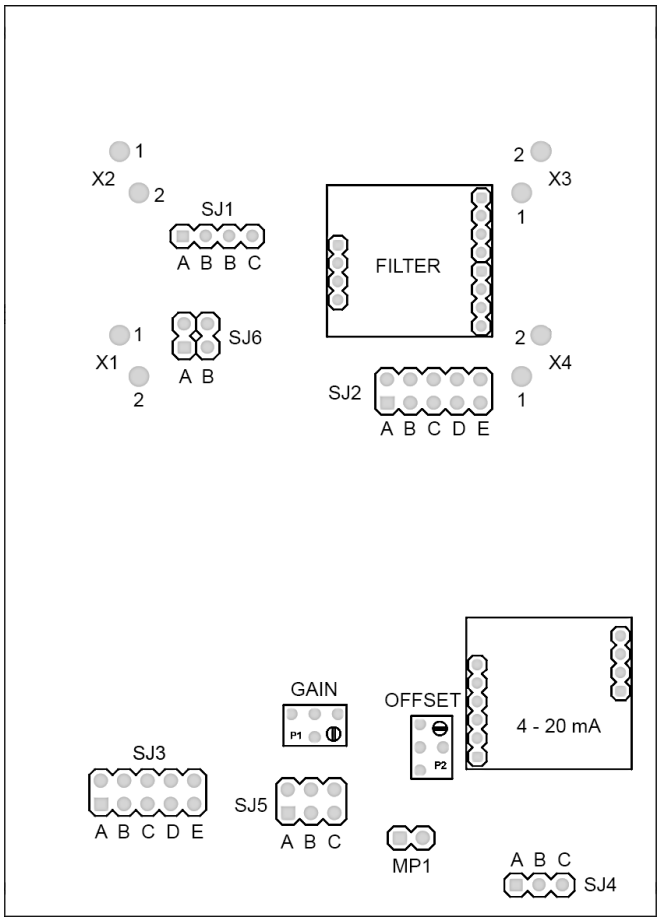








Position and contact designations (A-B-C ...) of the plug jumpers



SJ1: Signal input IEPE – AC – DC

SJ6: IEPE current

SJ2: Adaptation input signal

SJ3: Adaptation output signal

SJ5: Setting output offset

SJ4: Setting output offset type

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Table 2: Configuration from IEPE SIGNAL INPUT to SIGNAL OUTPUT

Signal input	Signal output	Amplification	Attenuation	Output offset	Jumper
[V_peak-peak]	[V_peak-peak]	Factor	Factor	[VDC]	No. [SJ]
Balanced output signal (balanced around GND)					
±10	±10	1	1	0	2 / 3 / 4
±10	±5	1	1 / 2	0	2 / 3 / 4
±5	±10	2	1	0	2 / 3 / 4
±2	±10	5	1	0	2 / 3 / 4
±2	±5	2.5	1	0	2 / 3 / 4
±1	±10	10	1	0	2 / 3 / 4
Unbalanced output signal (from GND to ...)					
±10	+10	1	1 / 2	+5.0	2 / 3 / 4 / 5
±5	+10	1	1	+5.0	2 / 3 / 4 / 5
±10	+5	1	1 / 4	+2.5	2 / 3 / 4 / 5
±5	+5	1	1 / 2	+2.5	2 / 3 / 4 / 5
±10	+3.3	1	200 / 33	+1.65	2 / 3 / 4 / 5
±5	+3.3	1	100 / 33	+1.65	2 / 3 / 4 / 5
±2	+3.3	1	40 / 33	+1.65	2 / 3 / 4 / 5
±1	+3.3	20 / 33	1	+1.65	2 / 3 / 4 / 5

Table 3: Plug-in jumpers for signal type at signal input

Number	Jumper on	Signal coupling	Application example
SJ1	A-B	AC with I_IEPE	Standard IEPE
	B-B (Parking position)	AC without I_IEPE	System test without I_IEPE
	B-C	DC	Test gain accuracy

Table 4: Plug-in jumpers for adapting the signal input

The input signal should always be boosted to the maximum level of ±10V in the input stage to maximize the signal-to-noise ratio (SNR) of the active filter and the isolation amplifier.
Alternatively, in some cases an INPUT-OUTPUT configuration of 1 / 1 can be set.
For example ±5V / ±5V or ±5V / +10V.

Number	Jumper on	Gain factor	For signal input
SJ2	A	1	±10V
	B	2	±5V
	C	4	±2.5V
	D	5	±2V
	E	10	±1V

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Table 5: Plug-in jumpers for adapting the signal output

The output adjustment is always from an internal level of ±10V to the desired output level by signal attenuation.

Number	Jumper on	Attenuation factor	For signal output
SJ3	A	1 / 1	±10V
	B	1 / 2	±5V / +10V
	C	1 / 4	+5V
	D	1 / 6.06	+3.3V
	E	1 / 10	±1V

Table 6: Plug-in jumpers for the output offset type

Number	Jumper on	Offset	For output type
SJ4	A-B	0V	balanced
	B-C	as selected with SJ5	unbalanced

Table 7: Plug-in jumpers for the output offset level

Number	Jumper on	Offset	For signal output
SJ5	A	+5V	0 – +10V
	B	+2.5V	0 – +5V
	C	+1.65V	0 – +3.3V

Please note:
When using the module "Current output 4-20mA" the configuration "Signal output +10V" must be set: SJ3 = B, SJ4 = B-C, SJ5 = A.

With the housing version B, the current loop is connected to the 2-pin connector on the back of the housing -
Pin 1 = + LINE POWER 24 VDC nom. (12 - 36 VDC)
Pin 2 = I_OUT 4 - 20 mA (Offset 12mA)

Table 8: Plug-in jumpers for IEPE current

Number	Jumper on	IEPE-Strom [mA]
SJ6	Open (parking position - both jumpers across)	2
	A (2. jumper in parking position)	4
	B (1. jumper in parking position)	6
	A + B	8

The selected current can be measured by means of a mA meter in short-circuit operation at the BNC socket "INPUT". This current source is permanently short-circuit proof.
When measuring at the BNC socket "INPUT" by means of a voltmeter, a voltage of approx. 28VDC should be measured.

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Filter plug-on module IPE-FM6.3

Application A: Internal anti-aliasing filter	Application B: External anti-aliasing filter
Anti-alising filter to avoid aliasing products in the switched isolation amplifier. The filter data for this application are set to • Butterworth 8th order (= 48 dB/octave) • Cut-off frequency 30kHz (-3dB) This is the standard version if no other configuration is ordered. This ensures that no relevant intermodulation with the signal bandwidth (50kHz) and the clock frequency (500kHz) of the isolation amplifier can occur.	Anti-aliasing filter for the digitizers (ADC) following the "IPE-ISO1" module. The user can select a lower cut-off frequency to meet the Nyquist/Shannon criteria of the subsequent digitizer when it is operated at lower sampling rates. With the filter plug-in module, filters • Butterworth 8th or 4th order (= 48 or 24 dB/octave) • Cut-off frequencies ≥ 500Hz ≤ 30kHz feasible.

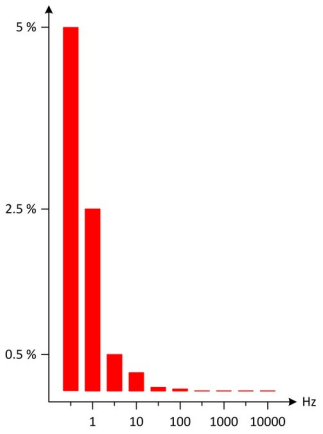
Filter order and cut-off frequency

Characteristics	Order	Cut-off frequency (-3dB]	Application
Butterworth	8 poles	30 kHz	These values only refer to the use as internal A-A filters for the isolation amplifier. Consequently, only lower frequencies can be selected for use as A-A filters for subsequent ADCs.
Butterworth	4 poles	18 kHz	

Table 9: INPUT / OUTPUT ERROR vs FREQUENCY

The input high pass (HP) at IEPE / AC setting causes a frequency dependent error, depending on the selected input capacitor (HP-C) and input resistance (HP-R).
The capacitance of the capacitor depends on the available design and the size of the resistor depends mainly on the parameters amplifier offset and noise-related offset fluctuations and can therefore not be selected arbitrarily large.
The behavior shown is not a specific error of IPE-ISO1, but a characteristic of each 1st order high pass.

HP-C [uF]	HP-R [kOhm]	FREQUENCY [Hz]	Xc [Ohm]	ERROR [V_{OUT} / V_{IN}]	ERROR [%]
3.3 + 3.3	1000	0.5	48253	0.9540	4.83
		1	24126	0.9764	2.41
		5	4825	0.9952	0.48
		10	2412	0.9976	0.24
		50	482.5	0.9995	0.05
		100	241.2	0.9998	0.02
		500	48.25	1.0000	0.00
		1000	24.13	1.0000	0.00



INPUT / OUTPUT AMPLIFICATION PRECISION

In general, the deviations from the nominal gain values are < 1%.
The offsets: 0V, +5V, +2.5V, +1.65V can be set to ± 1mV.

For the exact values please refer to the supplied individual measurement report "IPE-ISO1 - TEST REPORT".

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Table 10: Technical data	
Power supply:	9 – 36 VDC
Power consumption @ I_IEPE 4mA	approx. 80 mA @ 24 V approx. 150 mA @ 12 V
IEPE current:	Constant current: 2 – 4 – 6 – 8 [mA] @ 28 VDC
Bandwidth:	IEPE or AC coupling: 0.5Hz – 30kHz (-3dB) DC coupling: DC – 30kHz (-3dB)
Signal input:	See table 4
Signal output:	See table 5
Output shift:	See table 6 and 7
Error indication:	Green LED: Input in nominal range Red LED: Input short circuited or input open without IEPE sensor Please note: This indicator only works correctly in IEPE mode. With the other signal types "AC" or "DC", the two LEDs alternate depending on the input range and signal frequency
Housing versions:	A: DIN RAIL housing - size: 112 x 76 x 19 [mm], protection class IP30 B: aluminium profile housing - size: 85 x 39 x 140 [mm], protection class IP54
Environment:	Storage temperature -40 – +100°C, operating temperature -10 – +85°C
Active filters:	IPE-FM6.3_BU_4_F: Butterworth 4th order (= 24 dB/octave) IPE-FM6.3_BU_8_F: Butterworth 8th order (= 48 dB/octave) F = desired cut-off frequency (please specify when ordering)
Current loop:	IPE-ISO1-CIP: Current transmitter 4 – 20 mA, offset 12 mA