ISOF-8 for imc CRONOSflex (CRFX/ISOF-8)

8-channel, fast and isolated differential amplifier

The ISOF-8 is an isolated differential measurement amplifier with 8 galvanically-isolated channels for highly accurate measurements of:

- Voltage and current (20 mA)
- Temperature (Thermocoupe and PT100)
- IEPE/ICP sensors (with optional DSUB plug)

CRFX/ISOF-8 (Fig. similar) module shown in standard operating orientation

Highlights

- Channel-wise isolated, galvanically-separated inputs
- Finely adjustable input voltage range (from ±25 mV to ±60 V)
- High signal bandwidth up to 48 kHz
- Each channel with its own adjustable filter (e.g., anti-aliasing filter) and simultaneous A/D converter
- Supports imc Plug & Measure (Transducer Electronic Data Sheets)

Typical applications

- Ideally suited for measurements with unclear potential conditions such as in-vehicle or in the railway sector with higher bandwidths.

imc CRONOS*flex* - Frameless expansion, flexible modularity

The imc Click Mechanism and extruded aluminum case provide a firm mechanical and electrical connection. As a result, no mainframe or rack is needed.

imc Click Mechanism

An imc CRONOS*flex* system uses EtherCAT as an "internal" system bus for connecting various modules to the main base unit (CRFX-400 / CRFX-2000G). With the system bus, all imc CRONOS*flex* modules are guaranteed to be synchronized with each other. This allows various modules to be either connected in one central block or connected via standard network cable in a spatially distributed system.

Alternatively, connection can be made by means of standard Ethernet cables (RJ45, CAT5), thus creating a spatially distributed system.

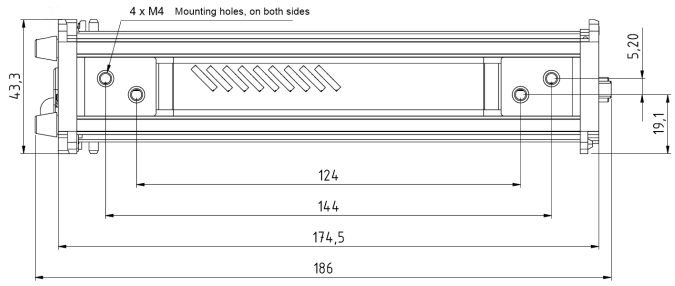
CRFX distributed system

Overview of available variants

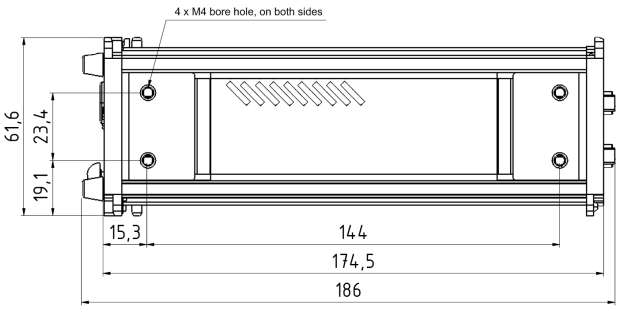
Standard version		ET version *	
Order code:	article no.	article no.	remarks
CRFX/ISOF-8	11900105	11910082	with DSUB-15 sockets
CRFX/ISOF-8-SUPPLY	11900155	11910098	with sensor supply
CRFX/ISOF-8-L	11900249	119100XX	with LEMO sockets
CRFX/ISOF-8-L-SUPPLY	11900228	11910135	with sensor supply

* ET: Version in extended temperature range

Mechanical drawings with dimensions



CRFX/ISOF-8(-SUPPLY)



CRFX/ISOF-8-L(-SUPPLY)

Module power supply options

- Direct connection (LEMO.EGE.1B.302 power socket)
- Adjacent module (module connector / imc Click Mechanism)
- EtherCAT network cable: Power over EtherCAT (PoEC)

For further details refer to the power options documentation.

Integrated sensor supply

- Version with an integrated sensor supply, requires no extra module expansion. With adjustable supply voltages (globally selectable for 8 channels), output on reserved pins.

Included accessories

DSUB-15 plug	for the DSUB-15 variant	article no.
ACC/DSUBM-T4	DSUB-15 plug with screw terminals for 4-channel measurement of voltages as well as temperatures with PT100 and thermocouples with integrated cold junction compensation (CJC).	13500167

Miscellaneous
Calibration certificate with test equipment verification as per DIN EN ISO 9001 (manufacturer's calibration certificate, PDF)
Getting started with imc CRONOS*flex* (one copy per delivery)

Optional accessories

DSUB-15 plug		
ACC/DSUBM-TEDS-T4	T4 plug with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	13500190
ACC/DSUBM-U4	DSUB-15 plug with screw terminals for 4-channel voltage measurement.	13500166
ACC/DSUBM-TEDS-U4	U4 plug variant with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	13500189
ACC/DSUBM-I4	DSUB-15 plug with screw terminals for 4-channel current measurement of up to 50 mA (shunt 50 Ω, scaling factor 0.02 A/V)	13500168
ACC/DSUBM-TEDS-I4	I4 plug variant with TEDS support, according IEEE 1451.4 for use with imc Plug & Measure	13500192
ACC/DSUB-ICP4	DSUB-15 plug with screw terminals for conditioning of 4 IEPE/ICP inputs	13500032

DSUB-15 plug		
ACC/DSUBM-ICP2I-BNC-S	DSUB-15 plug for 2 IEPE/ICP sensors[1], BNC connection, isolated, **slow**	13500293
ACC/DSUBM-ICP2I-BNC-F	DSUB-15 plug for 2 IEPE/ICP sensors[1], BNC connection, isolated, **fast**	13500294

AC/DC power adaptor 110-230 VAC 50-60 Hz (with appropriate LEMO.1B.302 plug)		article no.
48 V DC / 150 W	ACC/AC-ADAP-48-150-1B	13500148
24 V DC / 60 W	CRPL/AC-ADAPTER-60W-1B	10800066

Power plugs		
ACC/POWER-PLUG-5	Power plug for DC supply LEMO.FGE.1B.302 plug (male, E-coded: 2 coding keys)	13500150
CRFX/MODUL-PP-90	Power plug for DC supply 90° angular LEMO.FHE.1B.302 plug (male, E-coded: 2 coding keys)	11900074

Supply module (Power Handle)		article no.
CRFX/HANDLE-POWER-L	Handle with system power supply 50 V 100 W, without UPS	11900058
CRFX/HANDLE-UPS-L	Handle with system power supply 50 V 100 W, UPS with lead-gel battery	11900043
CRFX/HANDLE-LI-IO-L	Handle with system power supply 50 V 100 W, UPS with Li-Ion battery	11900010

Passive-Handle		
CRFX/HANDLE-L	standard unpowered left handle	11900008
CRFX/HANDLE-R	standard unpowered right handle	11900007

Mounting bracket for increased stability (recommended for lifetime and robustness)		
CRFX/BRACKET-CON	assembly element for 2 modules	11900071

Mounting brackets for fixed installations		
CRFX/BRACKET-90	mounting bracket 90°	11900068
CRFX/BRACKET-180	mounting bracket 180°	11900069
CRFX/BRACKET-BACK	rear panel mounting element	11900070
CRFX/RACK	19" RACK for imc CRONOS*flex* Modules	11900066
CRFX/BRACKET-RACK	mounting element in the RACK	11900072

Miscellaneous		
CRFX/CAL-P Calibration report set for each device	Report set with manufacturer's calibration certificate and individual readings, as well as list of test equipment used (PDF). Meets requirements of ISO 17025	11900051

1 When using the 2-channel plug only two channels (first and third channel) out of four are usable.

Technical Specs - CRFX/ISOF-8

Inputs, measurement modes, terminal connection		
Parameter	**Value**	**Remarks**
Inputs	8	
Measurement modes DSUB-15	voltage measurement current measurement thermocouple, RTD (PT100) current fed sensors IEPE/ICP	 shunt plug (ACC/DSUBM-I4) thermo plug (ACC/DSUBM-T4) IEPE/ICP expansion plug (ACC/DSUB-ICP4, not isolated ACC/DSUBM-ICP2I-BNC-S/-F [1], isolated)
Measurement modes LEMO	voltage measurement current measurement RTD (PT100)	 differential (internal shunt)
Terminal connection Standard LEMO	 2x DSUB-15 or 8x LEMO.1B.307	 4 channels per plug 1 channel per plug

Sampling rate, bandwidth, filter, TEDS		
Parameter	**Value**	**Remarks**
Sampling rate	≤100 kHz	per channel, max system throughput of all module channels: 800 kHz including monitor channels
Bandwidth	0 Hz to 48 kHz 0 Hz to 46 kHz	-3 dB -0.2 dB
Filter (digital) cut-off frequency characteristic order	 10 Hz to 20 kHz	 Butterworth, Bessel low pass filter: 8th order high pass filter: 8th order band pass: LP 4th and HP 4th order Anti-aliasing filter: Cauer 8.order with f_{cutoff} = 0.4 f_a
Resolution	 16 Bit 24 Bit	output format is selectable for each channel individually: a) 16 Bit Integer b) 32 Bit Float (24 Bit Mantissa)
TEDS - Transducer Electronic Data Sheets	conforming to IEEE 1451 Class II MMI	esp. with ACC/DSUBM-TEDS-xx (DS2433) not supported DS2431 (typ. IEPE/ICP sensor)
Characteristic curve linearization	user defined (max. 1023 supporting points)	

1 When using the two-channel IEPE plug in combination with the analog inputs, which provide four channels per socket, only channels 1 and 3 can be used. Only the IEPE base functionality is supported by this module, see also TD ACC/DSUBM-ICP2I-BNC.

General			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Isolation	galvanically isolated		channel-to-channel and against system ground (housing, CHASSIS), as well as against common reference of all PT100 current sources and TEDS.
nominal rating	±60 V		Isolation with IEPE/ICP connector: depends on plug type
test voltage	±300 V (10 sec.)		
Overvoltage protection	±100 V		differential input voltage (continuous)
	ESD 2 kV		human body model
	transient protection: automotive load dump ISO 7637		R_i=30 Ω, t_d=300 µs, t_r<60 µs
Input coupling	DC		
Input configuration	differential, isolated		
Input impedance	6,7 MΩ		range ≤±2 V or temperature mode
	1 MΩ		range ≥±5 V or device powered down
	50 Ω		current mode (shunt-plug) (ACC/DSUBM-I4)
Input current			
operating conditions		2.4 nA	for operation
on overvoltage condition	1 mA		$\|V_{in}\|$ >5 V on ranges <±5 V or device powered-down
Auxiliary supply			for IEPE/ICP plug
voltage	5 V	±5%	independent of optional
available current	>0.26 A	>0.2 A	sensor supply, short circuit proof
internal impedance	1.0 Ω	<1.2 Ω	power per DSUB-plug

Voltage measurement				
Parameter	**Value typ.**	**min. / max.**	**Remarks**	
Input ranges	±60 V / ±50 V / ±25 V / ±10 V ±5 V / ±2 V / ±1 V / ±500 mV ±250 mV / ±100 mV / ±50 mV / ±25 mV			
Gain error	<0.025%	<0.05%	of the measured value, at 25°C	
Gain drift		30 ppm/K $\cdot\Delta T_a$ 60 ppm/K $\cdot\Delta T_a$	ranges ≤±2 V ranges ≥±5 V	over full temperature range
Offset error	0.02 %	<0.05 %	of the range	
Offset drift		2.5 ppm/K $\cdot\Delta T_a$	over entire temperature range $\Delta T_a = \lvert T_a$ -25 °C$\rvert$ ambient temperature T_a	
Nonlinearity	<120 ppm			
Input voltage noise	2.6 μV_{rms} / 22 μV_{pkpk} 0.5 μV_{rms} / 3.5 μV_{pkpk} 0.1 μV_{pkpk} 14 nV / √Hz		range ±25 mV bandwidth 0.1 Hz to 48 kHz bandwidth 0.1 Hz to 1 kHz bandwidth 0.1 Hz to 10 Hz spectral noise density	
CMRR (common mode rejection ratio) / IMR	>145 dB (50 Hz) >80 dB (50 Hz)		ranges ≤±2 V ranges ≥±5 V	R_{source} = 0 Ω
Channel isolation	>1 GΩ, < 40 pF		channel-to-ground / CHASSIS (case)	
	>1 GΩ, < 10 pF		channel-to-channel	
Channel isolation (crosstalk)	>155 dB (50 Hz) >92 dB (50 Hz)		ranges ≤±2 V ranges ≥±5 V	R_{source} ≤100 Ω

Current measurement with shunt plug				
Parameter	**Value typ.**	**min. / max.**	**Remarks**	
Input ranges	±40 mA / ±20 mA / ±10 mA			
Shunt impedance	50 Ω		external plug ACC/DSUBM-I4	
Gain error	<0.07 %	<0.15 %	of the measured value, at 25 °C	
Gain drift		30 ppm/K $\cdot\Delta T_a$ 60 ppm/K $\cdot\Delta T_a$	ranges ≤±2 V ranges ≥±5 V	over full temperature range
Offset error	10 µV		range ±25 mV	
Offset drift	0.7 µV/K$\cdot\Delta T_a$		range ±25 mV $\Delta T_a = \lvert T_a$ -25 °C$\rvert$ ambient temperature T_a	

Current measurement with internal shunt (variant with round connector etc.)			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Input ranges	±40 mA / ±20 mA / ±10 mA		
Shunt impedance	50 Ω		internal
Input configuration	differential		
Gain error	<0.02 %	<0.05 %	of the measured value, with 25°C
Gain drift		40 ppm/K $\cdot\Delta T_a$	over entire temperature range
Offset error	0.02 %	<0.05 %	of the measurement range
Offset drift		2.5 ppm/K $\cdot\Delta T_a$	over entire temperature range $\Delta T_a = \lvert T_a - 25°C \rvert$ ambient temperature T_a

Temperature measurement - thermocouples			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Measurement mode	R, S, B, J, T, E, K, L, N		
Measurement range	-270°C bis 1370°C -270°C bis 1100°C -270°C bis 500°C		type K
Resolution	0.063 K (1/16 K) 32 bit float (24 Bit mantissa)		With selected data type / output format: a) 16-Bit integer b) Float (24-Bit mode)
Measurement error (gain + offset)		<±0.6 K <±1.0 K	type K, value -150°C to 1100°C else
Drift (gain + offset)		±0.02 K/K·ΔT_a ±0.05 K/K·ΔT_a	type K, range -270°C to 1100°C type K, range -270°C to 1370°C $\Delta T_a = \lvert T_a - 25°C \rvert$ ambient temperature T_a
Error of cold junction compensation		<±0.15 K	with ACC/DSUBM-T4
Cold junction drift	±0.001 K/K·ΔT_a		$\Delta T_a = \lvert T_a - 25°C \rvert$ ambient temperature T_a

Temperature measurement – PT100		
Parameter	**Value**	**Remarks**
Measurement range	-200°C to +850°C -200°C to +250°C	
Resolution	0.063 K (1/16 K) 32 bit float (24 Bit mantissa)	With selected data type / output format: a) 16-Bit integer b) Float (24-Bit mode)
Measurement error	<±0.05%	of the measured value
Offset error	<±0.2 K	4-wire connection
Offset drift	±0.01 K/K· ΔT_a ±0.02 K/K· ΔT_a	range -200°C to 250°C range -200°C to 850°C $\Delta T_a = \lvert T_a - 25°C \rvert$ ambient temperature T_a
Sensor feed (PT100)	250 µA	Not channel individually isolated. global block isolation, common reference: -I4, GND, TEDS_GND

Sensor supply (ISOF-8-SUPPLY, ISOF-8-L-SUPPLY)				
Parameter	**Value typ.**		**max.**	**Remarks**
Configuration options	5 selectable settings			5 settings only Default ranges: +5 V to +24 V
Output voltage	Voltage (+2.5 V) +5.0 V +10 V +12 V +15 V +24 V (±15 V)	Current 580 mA 580 mA 300 mA 250 mA 200 mA 120 mA 190 mA	Netpower 1.5 W 2.9 W 3.0 W 3.0 W 3.0 W 2.9 W 3.0 W	set globally for all channels of a module special order, +12 V or 15 V can be replaced by +2.5 V; default selection with 2.5 V: +2.5 V, +5.0 V, +10 V, +12 V, +24 V Special order: +15 V can be replaced by ±15 V. With the LEMO variant, TEDS support is omitted with this choice, LEMO pin 5 (TEDS) is then GND, pin 3 is +15 V and pin 4 -15 V, see manual.
Block isolation	60 V			Isolation of the entire global sensor supply (for all 8 channels, reference ground "-SUPPLY, GND") as well as the internal additional electronics from housing (CHASSIS, PE)
Short-circuit protection	unlimited duration			to output voltage reference ground
Accuracy of output voltage	<0.25 %		0.5 % 0.9 % 1.5 %	at terminals, no load at 25 °C over entire temperature range plus with optional bipolar output voltage
Max. capacitive load	>4000 µF >1000 µF >300 µF			2.5 V to 10 V 12 V, 15 V 24 V

Block isolation		
Parameter	**Value**	**Remarks**
Block isolation	60 V	all internal additional-electronics (PT100-current sources, TEDS, sensor supply) isolated from the housing (CHASSIS, PE)
Isolation impedance	500 kΩ || 1 nF	
Internal reference ground	GND, TEDS_GND, -I4, -SUPPLY	PT100 current sources and TEDS for all channels with one common, galvanically connected reference ground
External reference ground	CHASSIS, metal housing	internal additional-electronics as an entity, galvanically isolated from housing

Block isolation for improved suppression of ground loops and related interference. Does not constitute channel-wise individual isolation. Not rated nor intended for safety of equipment and personnel.

Power supply of the module		
Input supply voltage	10 V to 50 V DC	
Power consumption	10 W	10 V to 50 V DC
Isolation	60 V	nominal isolation specification of the supply input

Power supply of the module		
Power-over EtherCAT (PoEC)	42 V to 50 V DC	supply via EtherCAT network cable

Terminal connections of the module		
EtherCAT connection	2x RJ45	system bus for distributed imc CRONOS*flex* components
Input supply plug (female)	LEMO.EGE.1B.302	multicoded 2 notches for optional individually power supply
Module connector	2x 20 pin	direct connection of modules (click) supply and system bus

Pass through power limits	
Directly connected (clicked) imc CRONOS*flex* Modules	3.1 A (maximum current) Equivalent power with chosen DC power input: • 149 W @ 48 V DC (e.g. AC/DC line adaptor) • 37 W @ 12 V DC (typical vehicle supplied DC input)
Power-over EtherCAT (PoEC) for remote modules	350 mA (maximum current corresponding to IEEE 802.3) Equivalent power with chosen DC power input: • 17.5 W @ 50 V DC (e.g. Power-Handle) • 16.8 W @ 48 V DC (e.g. AC/DC line adaptor) • 14.7 W @ 42 V DC (minimum voltage for PoEC) Note: minimum system power of 42 V DC required for PoEC

Operating conditions		
Parameter	**Value**	**Remarks**
Operating environment	dry, non corrosive environment within specified operating temperature range	
Rel. humidity	80% up to 31°C, above 31°C: linear declining to50%	according IEC 61010-1
Ingress protection rating	IP20	
Pollution degree	2	
Operating temperature (standard)	-10°C to +55°C	without condensation
Operating temperature (extended: "-ET" version)	-40°C to +85°C	condensation temporarily allowed
Shock- and vibration resistance	IEC 61373, IEC 60068-2-27 IEC 60062-2-64 category 1, class A and B MIL-STD-810 Rail Cargo Vibration Exposure U.S. Highway Truck Vibration Exposure	
Extended shock- and vibration resistance	upon request	specific tests or certifications upon request
Dimensions	43.3 x 118 x 186 mm	W x H x D
Weight	714 g	