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

8 channel module for dynamic strain measurement

The ACI-8 is a module with 8 individually isolated channels, specifically designed for dynamic strain measurements with single strain gauge sensors. Unlike conventional bridge amplifiers it feeds the gauges with a constant current in 2 wire configuration. The measured signal is AC coupled and thus captures dynamic strain while suppressing any static signals originating from either the sensor or the cabling.

- Voltage mode with current source supply, AC coupled
- Assessment of dynamic strain with strain gauges

CRFX/ACI-8

Highlights

- Channel wise galvanic isolation
- Signal bandwidth 0.5 Hz to 48 kHz
- Connection of strain gauges in 2-wire configuration
- Configurable internal connection of cable shield via rotary switch (case, input, not connected)
- Current source disable for diagnosis

Typical applications

- Dynamic strain measurement, in particular on rotating turbines
- Applications that involve high temperature resistant thermo cables with very high impedance
- Aerospace industry and power generation (aircraft, gas and steam turbines)

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.

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.

imc Click Mechanism

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

| Order Code:	article no.	remarks
CRFX/ACI-8	11900187	with LEMO sockets

Mechanical drawings with dimensions
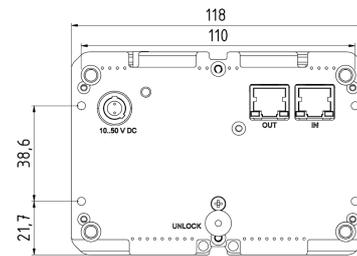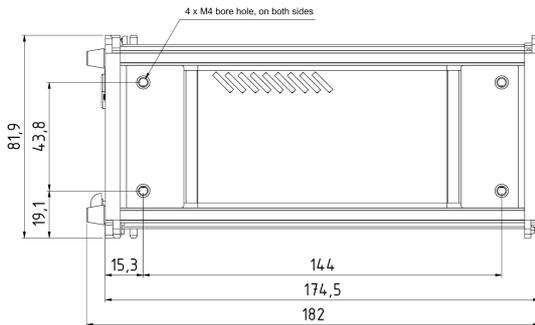
*rear view of the
imc CRONOSflex module*

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.

Included accessories

Documents
Getting started with imc CRONOS*flex* (one copy per delivery)
Device certificate

Optional accessories

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-NIMH-L	Handle with system power supply 50 V 100 W, UPS with NiMH battery	11900273
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

Documents		
SERV/CAL-PROT	Calibration protocol per amplifier imc manufacturer calibration certificate with measurement values and list of calibration equipment used (pdf).	150000566
SERV/CAL-PROT-PAPER	Calibration protocol per amplifier (paper print) imc manufacturer calibration certificate with measurement values and list of calibration equipment used with signature and seal.	150000578
Device certificates and calibration protocols: Detailed information on certificates supplied, the specific contents, underlying standards (e.g. ISO 9001 / ISO 17025) and available media (pdf etc.) can be found on our website, or you can contact us directly.		

Technical Specs - CRFX/ACI-8

Inputs, Modes		
Parameter	**Value**	**Remarks**
Inputs	8	
Measurement Mode	voltage	AC voltage on current fed strain gauge
Suitable sensor type	strain gauge	single STRG-sensor, 2-wire connection dynamic strain measurement
Scaling	voltage [V]	primary scaling of measured data output (includes correction values for selected current feed)
Scaling for strain measurement	strain [µeps] = voltage / (I · R_STRG · k)	scaling factor to be entered in operating software imc STUDIO I: selected nominal value of supply current R_STRG: nominal strain gauge impedance k: k-factor of strain gauge sensor
Terminal connection	LEMO.ERN.1S.303.GLN	1 channel per plug recommended plug: FFA.1S.303.CLA
Connection of cable shield	rotary switch on front panel: 1. case (CHASSIS) 2. +IN 3. -IN 4. not connected (float)	default setting of the switch = 1 cable shield will be internally connected accordingly (only for special applications)
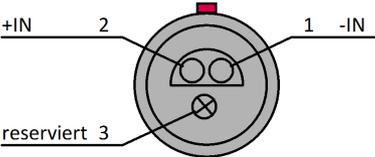
Sampling rate, Bandwidth, Filter			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Sampling rate	≤100 kHz		per channel max system throughput of all module channels: 800 kHz including monitor channels
Bandwidth		0.5 Hz to 48 kHz	-3 dB

Filter
  frequency
  characteristic
  order
 	
  Anti-Aliasing Filter
	
	10 Hz to 20 kHz
	Butterworth, Bessel
	8th order
	low- and high pass each 4th order
	Cauer 8th order
			
			low pass or high pass
			band pass
			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)

General			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Isolation (measurement inputs)	galvanically isolated		only switch position 1 or 4 channel-to-channel and against system ground (housing, CHASSIS)
nominal rating	60 V		peak or DC
test voltage	±100 V (10 sec.)		
isolation impedance	10 MΩ, <1 nF		to system ground, to drain off electrostatic charge
	20 MΩ, 680 pF		channel-to-channel
	10 MΩ, 850 pF		against system ground
Input coupling	AC		
Input configuration	differential, isolated		internally connected current source

Voltage measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Input ranges	±250 mV, ±100 mV, ±50 mV, ±25 mV, ±10 mV*, ±5 mV*, ±2,5 mV*		* deduced from ±25 mV input range
Gain error		±0.1 % ±0.15 %	of reading ±250 mV, ±100 mV, ±50 mV ±25 mV, ±10 mV*, ±5 mV*, ±2.5 mV* * gain error equivalent to ±25 mV input range
Gain drift		50 ppm/K·ΔT_a	$\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature
Isolation Mode Rejection Ratio IMRR	109 dB		50 Hz
Voltage noise		60 µVss	bandwidth: 50 kHz, ±250 mV range short-circuited input: without noise of current sources
Input capacity	330 pF		in parallel to internal impedance of the current source

Current supply

Parameter	Value typ.	min. / max.	Remarks
Current feed	16 mA, 8 mA, 4 mA, 2 mA		
	0 mA		current source can be deactivated for diagnosis
Max. compliance voltage	10 V		across total load / source impedance: (Strain gauge + cable)
Current feed error		±2 %	Does NOT affect accuracy of measurement! Actual current values will be assessed with individual correction values. These are accounted for by the firmware with voltage measurement already
Residual current with deactivated current feed	110 µA		
Temperature drift		50 ppm/°C	
Noise	300 µVss	400 µVss	2 mA, 100 Ω load
Current source bandwidth	50 kHz		load: 1 kΩ
Source impedance	1 MΩ		

Power supply of the module

Parameter	Value typ.	min. / max.	Remarks
Power supply	10 V to 50 V DC		
Power consumption	8 W	12 W	

Terminal connections of the module

Parameter	Value	Remarks
EtherCAT connection	2x RJ45	system bus for distributed imc CRONOSflex 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 CRONOSflex 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 imc CRONOSflex 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 to 50%	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	82 x 118 x 186 mm	W x H x D
Weight	1.15 kg	