BR2-4 for imc CRONOSflex (CRFX/BR2-4)

4-channel high performance bridge measurement amplifier

The BR2-4 is a universal DC and CF bridge measurement amplifier for 4 channels and can also be used as a DC differential amplifier. It is capable of measuring:

- 4 strain gauges, with selectable DC or CF (AC) excitation
- LVDT
- Voltage and current (20 mA)
- IEPE/ICP sensors (with optional DSUB-15 plug)

CRFX/BR2-4
(Fig. similar)

Highlights

- Carrier frequency excitation (5 kHz) for bridges and LVDT
- Single and dual sense line configurations are supported (e.g., 5/6-wire connection with full bridge)
- Symmetric bridge supply of 1 V, 2.5 V, 5 V with DC as well as with CF (AC) mode
- broken wire detection
- Integrated calibration resistor for shunt calibration
- Software selectable quarter-bridge completion 120 and 350 Ω
- Graphical configuration wizard to set strain gauge bridges

Typical applications

- Ideal for bridge measurements in CF mode with elevated requirements for noise suppression and stability, as well as LVDT and inductive displacement sensors.

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.

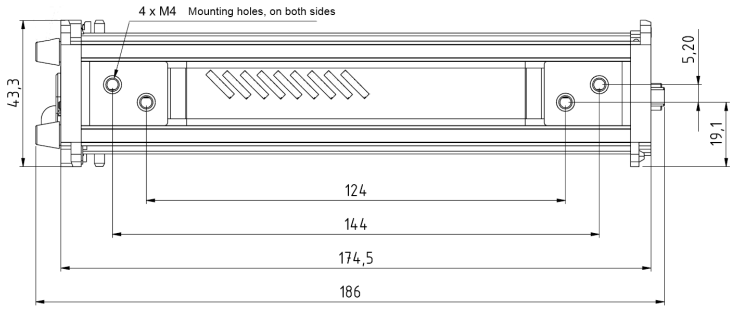
CRFX distributed system

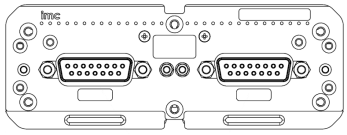
Overview of available variants

Standard version		ET-version *	
Order Code:	article no.	article no.	remarks
CRFX/BR2-4	11900042	11910067	with DSUB-15 sockets

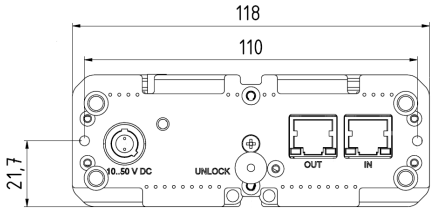
* ET: Version for an extended temperature range

Mechanical drawings with dimensions





front view



rear view

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

DSUB-15 plug		
ACC/DSUBM-B2	DSUB-15 plug with screw terminals for 2-channel measurement of strain gauges, bridges and voltage	13500170

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

Optional accessories

DSUB-15 plug		
ACC/DSUBM-TEDS-B2	Version mit TEDS Unterstützung, gemäß IEEE 1451.4 für eine Nutzung mit imc Plug & Measure	13500191
ACC/DSUBM-I2	DSUB-15 plug with screw terminals for 2-channel current measurement of up to 50 mA (50 Ω shunt, scaling factor: 0.02A/V)	13500180
ACC/DSUBM-TEDS-I2	version with TEDS support, according to IEEE 1451.4 for use with imc Plug & Measure	13500193
ACC/DSUBM-ICP2I-BNC-S	DSUB-15 plug for 2 IEPE/ICP sensors, BNC connection, isolated, **slow**	13500293
ACC/DSUBM-ICP2I-BNC-F	DSUB-15 plug for 2 IEPE/ICP sensors, 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-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/BR2-4

Inputs, measurement modes, terminal connection		
Parameter	**Value**	**Remarks**
Inputs	4	
Measurement modes DSUB-15	bridge sensor strain gauge LVDT voltage measurement current measurement current-fed sensors IEPE/ICP	ACC/DSUBM-B2 full-, half- and quarter bridge inductive transducers (CF) voltage or bridge mode globally selected for all four channels with current plug: ACC/DSUBM-I2 with IEPE/ICP extension plug (DSUB-15): ACC/DSUBM-ICP2I-BNC-S/-F, isolated, basic functionality (ICP-operation)
Measurement modes LEMO	full, half- and quarter bridge LVDT voltage measurement	
Terminal connection DSUB-15 LEMO	 2x DSUB-15 or 4x LEMO.1B.307(308)	 2 channels per plug 1 channel per plug

Sampling rate, Bandwidth, Filter, TEDS		
Parameter	**Value**	**Remarks**
Sampling rate	≤100 kHz	per channel
Bandwidth	14 kHz (DC) 3.9 kHz (CF)	-3 dB -3 dB
Filter cut-off frequency characteristic order	 20 Hz to 10 kHz	 Butterworth, Bessel low pass filter 8. order Anti-aliasing filter: Cauer 8. order with $f_{cutoff} = 0.4\ f_s$
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 DataSheets	conforming to IEEE 1451.4 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)	

General	Value typ.	min. / max	Remarks
Overvoltage protection		±50 V ±80 V	long term (differential- and SENSE-inputs) short-term
Input impedance	10 MΩ 1 MΩ		range ±5 mV to ±2 V range ±5 V to ±50 V and for deactivated device
Input current		40 nA	
Input capacitance	300 pF		
Auxiliary supply voltage available current internal resistance	 +5 V >0.26 A 1.0 Ω	 ±5 % >0.2 A <1.2 Ω	for IEPE (ICP)-expansion plug independent of integrated sensor supply, short circuit proof power per DSUB-plug

Voltage measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Input ranges	±50 V / ±25 V / ±10 V ±5 V / ±2 V / ±1 V ±500 mV / ±250 mV / ±100 mV ±50 mV / ±25 mV / ±10 mV / ±5 mV		
Gain error	0.02 %	≤0.05 %	of reading (measurement value)
Gain drift	60 ppm / K	<100 ppm / K	
Offset drift	0.02 %	 ≤0.05 % ≤0.1 % ≤0.2 %	of measurement range range ≥±25 mV range = ±10 mV range = ±5 mV
Input offset-drift	0.05 µV / K	0.3 µV / K	DC voltage measurement
Non-linearity	<200 ppm		
Common mode voltage (max.)	±50 V ±2.8 V		ranges ±50 V to ±5 V ranges ±2 V to ±5 mV
Common mode rejection ratio (CMRR) range: ±5 mV to ±25 mV ±50 mV to ±100 mV ±250 mV to ±2 V ±5 V to ±50 V ±5 mV to ±2 V ±5 V to ±50 V all ranges	 >100 dB >68 dB 	 >120 dB >110 dB 95 dB >54 dB >90 dB >54 dB >50 dB	DC f ≤ 50 Hz f = 5 kHz
SNR (signal to noise ratio)	>90 dB >88 dB >82 dB >75 dB >69 dB		full-scale / rms-noise full bandwidth ranges ±100 mV to ±50 V range ±50 mV range ±25 mV range ±10 mV range ±5 mV
Input noise, voltage (RTI)	16 nV/√Hz$_{rms}$ 16 µV$_{pk-pk}$ 2 µV$_{rms}$		DC-Mode (range ±5 mV) spectral noise density 1 kHz 0 Hz to 10 kHz 0 Hz to 10 kHz

Voltage measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
	0.6 μV_{pk-pk}		0.1 Hz to 10 Hz

Current measurement with shunt plug		
Parameter	**Value**	**Remarks**
Input ranges	±40 mA / ±20 mA / ±10 mA ±5 mA / ±2 mA / ±1 mA ±400 µA / ±200 µA / ±100 µA	
Shunt impedance	50 Ω	shunt plug ACC/DSUBM-I2, not for LEMO version

Bridge measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Mode	DC, CF		
Sensors	LVDT, strain gauge: full-, half-, quarter bridge piezo-resistive bridge transducer potentiometer		directly connectable
Measurement mode	full-, half-, quarter bridge		
Input ranges	±1 mV/V to ±400 mV/V ±2 mV/V to ±800 mV/V ±5 mV/V to ±2000 mV/V		for bridge voltage: 5 V 2.5 V 1 V
Bridge supply DC CF (5 kHz)	1 V; 2.5 V; 5 V (symmetric) 1 V; 2.5 V; 5 V (peak)		set globally for 4-channel groups corresponding to ±0.5 V, ±1.25 V, ±2.5 V corresponding to RMS: 0.7 V; 1.8 V; 3.5 V
Internal quarter-bridge completion	120 Ω, 350 Ω		selectable
Min. bridge impedance Bridge impedance (max.)	120 Ω, 10 mH full bridge 60 Ω, 5 mH half bridge 5 kΩ		bridge supply = 1 V to 5 V, $I_{load} \leq 42$ mA
Gain error	<0.05 %		of measurement value
Offset after bridge balance	<0.02 %		of the range
Input offset-drift	0.01 µV/V / K	0.06 µV/V / K	DC full bridge (Bridge supply=5 V, 1 mV/V range) without ext. bridge offset
Drift of bridge balance Equivalent offset drift corresponding to balanced ext. bridge offset	50 ppm/K 0.05 µV/V/K	<90 ppm/K 0.09 µV/V/K	of compensated offset value full bridge (DC or CF), ext. bridge offset = 1 mV/V 1 mV/V input range
Half-bridge drift (int. half-bridge)	0.05 µV/V/K	1 µV/V/K	DC or CF
Bridge balancing range	≥measurement range not less than: ≥±5 mV/V ≥±10 mV/V ≥±25 mV/V		 for bridge supply = 5 V for bridge supply = 2.5 V for bridge supply = 1 V

Bridge measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Cable length (max.)	500 m (one-way length)		A = 0.14 mm², R = 130 mΩ/m, 65 Ω
Cable-Compensation			
full bridge / half bridge	4-wire-technique 3-wire-technique with shunt-calibration		any cable for symmetric (similar) cables one-time non-adaptive compensation
quarter bridge	full compensation in 3-wire-technique		including Gain-Correction!
Automatic shunt-calibration	0.5 mV/V		for 120 Ω and 350 Ω bridges
Input noise (bridge)			range: 1 µV/V (bridge voltage = 5 V)
DC full bridge	3 $\mu V/V_{pkpk}$, 0.39 $\mu V/V_{rms}$		0 Hz to 10 kHz
	0.9 $\mu V/V_{pkpk}$, 0.12 $\mu V/V_{rms}$		1 kHz, lowpass filter
	0.3 $\mu V/V_{pkpk}$, 0.04 $\mu V/V_{rms}$		100 Hz, lowpass filter
	0.1 $\mu V/V_{pkpk}$		10 Hz, lowpass filter
DC half-/quarter bridge	3.3 $\mu V/V_{pkpk}$, 0.45 $\mu V/V_{rms}$		0 Hz to 10 kHz
	1.1 $\mu V/V_{pkpk}$, 0.15 $\mu V/V_{rms}$		1 kHz, lowpass filter
	0.35 $\mu V/V_{pkpk}$, 0.05 $\mu V/V_{rms}$		100 Hz, lowpass filter
	0.3 $\mu V/V_{pkpk}$		10 Hz, lowpass filter
CF full bridge, half bridge	3.5 $\mu V/V_{pkpk}$, 0.47 $\mu V/V_{rms}$		0 Hz to 10 kHz
	1.7 $\mu V/V_{pkpk}$, 0.22 $\mu V/V_{rms}$		1 kHz, lowpass filter
	0.6 $\mu V/V_{pkpk}$, 0.07 $\mu V/V_{rms}$		100 Hz, lowpass filter
	0.3 $\mu V/V_{pkpk}$		10 Hz, lowpass filter

Block isolation		
Parameter	**Value**	**Remarks**
Block isolation	60 V	all internal electronics isolated from the housing (CHASSIS, PE)
Isolation impedance	500 kΩ || 1 nF	
Internal reference ground	-VB, GND, TEDS_GND	all channels with one common, galvanically connected reference ground
External reference ground	CHASSIS, metal housing	internal 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.

Devices or modules purchased before ca. 2012 do not feature block isolation.

Power supply of the imc CRONOS*flex* module			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Power supply	10 V to 50 V DC		
Power consumption	9.3 W		10 V to 50 V DC including bridge sensors (120 Ω 5 V all channels)
Isolation	60 V		nominal isolation specification of the supply input
Power-over EtherCAT (PoEC)	42 V to 50 V DC		supply via EtherCAT network cable

Terminal connections of the imc CRONOS*flex* module		
Parameter	**Value**	**Remarks**
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 imc CRONOS*flex* Modules	350 mA (maximum current corresponding 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	ca. 820 g	