

# BR-4/ BR2-4 for imc CRONOS-PL/-SL/compact

## 4-channel bridge amplifier

Datasheet Version 3.6, 19.10.2011



CRPL/BR-4



CRC/BR2-4

The **BR-4 / BR2-4** is an all-purpose bridge amplifier for 4 channels (also employable as a DC differential amplifier). It enables measurement of four bridges, load cells, strain gauges and inductive LVDTs, supplied with a software selectable choice of either DC or CF (AC carrier frequency) excitation. The BR-4 is available as a modular plug-in for the imc CRONOS-PL and as a configuration module for imc CRONOS-SL. The BR2-4 is a successor model of the BR-4 and available as a modular plug-in for the imc CRONOS *compact*, imc CRONOS-PL and as a configuration module for imc CRONOS-SL.

### Highlights:

- DC and Carrier frequency mode (5 kHz)
- Lead wire compensation with single and dual sense line configurations are supported ( e.g. 5/6-wire-circuit with full bridge )
- Symmetric bridge supply of 1 V, 2.5 V, 5 V and with DC and CF (AC) mode
- Software selectable quarter bridge completion 120  $\Omega$  and 350  $\Omega$  switchable

Additionally with **BR2-4**:

- Cable breakage recognition
- Supports *imc Plug & Measure* (Transducer Electronic Data Sheets (IEEE 1451.4))

Order code:	Article number	Remarks
<b>CRPL/BR-4</b>	1080091	for installation in a imc CRONOS-PL housing
<b>CRPL/BR-4-ET</b>	1081055	Version in extended temperature range
<b>CRSL/BR-4-D</b>	1180028	for installation in a imc CRONOS-SL housing with DSUB interconnections
<b>CRSL/BR-4-L</b>	1180029	for installation in a imc CRONOS-SL housing with 7 pin LEMO interconnections
<b>CRC/BR2-4</b>	1170041	for installation in a imc CRONOS <i>compact</i> housing
<b>CRC/BR2-4-ET</b>	1171025	Version in extended temperature range
<b>CRC/BR2-4-L</b>	special order	for installation in a imc CRONOS <i>compact</i> housing with 7 pin LEMO interconnections (8-pin LEMO with TEDS)
<b>CRC/BR2-4-R</b>	1170114	for installation in a imc CRONOS <i>compact</i> 19" RACK
<b>CRC/BR2-4-R-ET</b>	1171073	Version in extended temperature range

Order code:	Article number	Remarks
<b>CRPL/BR2-4</b>	1080227	for installation in a imc CRONOS-PL housing
<b>CRPL/BR2-4-ET</b>	1081145	Version in extended temperature range
<b>CRPL/BR2-4-L</b>	special order	for installation in a imc CRONOS-PL housing with 7 pin LEMO interconnections (8-pin LEMO with TEDS)
<b>CRSL/BR2-4-D</b>	1180103	for installation in a imc CRONOS-SL housing with DSUB interconnections
<b>CRSL/BR2-4-L</b>	special order	for installation in a imc CRONOS-PL housing with 7 pin LEMO interconnections (8-pin LEMO with TEDS)

**Physical structure:**

- Plug-in module for imc CRONOS-PL/*compact* systems, occupying one slot.

**Terminal connections:**

- 2x DSUB-15 terminals for each channel pair
- 4x 7-pin LEMO connectors for one channel (without TEDS)
- 4x 8-pin LEMO connectors for one channel (with TEDS)

**Included accessories for CRC/BR2-4, CRPL/BR2-4:**
**DSUB-15 Connector plug:**

- 2x **ACC/DSUB-B2** for measurement with strain gauges, bridges, and voltages with 2 channels per plug

**Included accessories for CRPL/BR-4:**
**DSUB-15 Connector plug:**

- 2x **CRPL/DSUB-BR-4-BR** for measurement with strain gauges, bridges, and voltages with 2 channels per plug

**Included accessories for imc CRONOS-SL: -----**
**Power supply:**

- provided by imc CRONOS-PL/-SL/compact unit
- Additional power consumption by plug-in module: 4.5 W

**Operating conditions:**

- The module varieties' (with or without an extended temperature range) respective operating conditions depend on the corresponding housing type.
- As of imcDevices Version 2.7 R3 SP7: experiments created with a CRPL/BR-4 can be used with a CRPL/BR2-4

**Required software version:**

CRPL/BR-4 CRSL/BR-4	CRPL/BR2-4 CRSL/BR2-4	CRC/BR2-4
as of imcDevices Version 2.4 R12 SP16	as of imcDevices Version 2.7 R3 SP7 TEDS are supported as of 2.7 R3 SP8	as of imcDevices Version 2.7 R3 TEDS are supported as of 2.7 R3

**Data storage:** handled via imc CRONOS-PL/-SL/compact

**Optional accessories (Connectors):**

- **ACC/DSUB-ICP2**, 15-pin DSUB terminal connectors with conditioning for 2 IEPE (ICP) inputs
- **ACC/DSUB-I2**, 15-pin DSUB terminal connectors for each channel pair. For measurement of currents of up to 50 mA (50  $\Omega$  shunt, scaling factor: 0.02 A/V)
- **ACC/DSUB-TEDS-B2**, for BR2-4: 15-pin DSUB clamp terminal with TEDS for measurement with strain gauges, bridges, and of voltages; 2 channels per terminal
- **ACC/DSUB-B2-IP65**, 15-pin DSUB clamp terminal adapted to CRONOS-SL for measurement with strain gauges, bridges, and of voltages; 2 channels per terminal
- **ACC/DSUB-ICP2-IP65**, 15-pin DSUB clamp terminal adapted to CRONOS-SL with signal conditioning for 2 IEPE (ICP) inputs
- **ACC/DSUB-I2-IP65**, 15-pin DSUB clamp terminal adapted to CRONOS-SL for each channel pair. For measurement of currents of up to 50 mA (50  $\Omega$  shunt, scaling factor: 0.02 A/V)

## BR-4 / BR2-4 Bridge, Voltage, Current

### Technical Specs: Datasheet Version 3.6

Parameter	Value (typ. / max.)	Remarks
Inputs	4	differential, analog
Measurement modes with DSUB	full bridge half bridge quarter bridge LVDT voltage current current-fed sensors IEPE/ICP	Voltage or bridge mode globally selected for all four channels.  inductive transducers (CF)  with ACC/DSUB-I2 ACC/DSUB-ICP2
Measurement modes with LEMO	full bridge half bridge quarter bridge LVDT voltage	inductive transducers (CF)
Terminal connections standard	2x DSUB-15 / 2 channels	BR2-4: ACC/DSUB-(TEDS-)B2 BR-4: CRPL/DSUB-BR-4-BR ACC/DSUB-I2 ACC/DSUB-ICP2
LEMO	or 4x LEMO.1B.307(308) / 1 channel	7 pin (no TEDS) / 8 pin (with TEDS)

Bandwidth, Filter, TEDS		
Parameter	Value (typ. / max.)	Remarks
Filter cut-off frequency characteristic, order	2 Hz to 5 kHz	Butterworth, Bessel low pass filter 8. order Anti-aliasing filter: Cauer 8. order with $f_{\text{cutoff}} = 0.4 f_s$
Bandwidth	8,6 kHz (DC) 3,9 kHz (TF)	-3 dB
Sampling rate/ channel	20 kHz (max)	per channel
Resolution	16 Bit	internal 24 Bit
TEDS - Transducer Electronic DataSheets (only BR2-4)	conform IEEE 1451.4 Class II MMI	ACC/DSUB-TEDS-B2 ACC/DSUB-TEDS-I2

Voltage measurement			
Parameter	Value (typ. / max.)		Remarks
Voltage input ranges	$\pm 50 \text{ V} / \pm 25 \text{ V} / \pm 10 \text{ V}$ $\pm 5 \text{ V} / \pm 2 \text{ V} / \pm 1 \text{ V}$ $\pm 500 \text{ mV} / \pm 250 \text{ mV} / \pm 100 \text{ mV}$ $\pm 50 \text{ mV} / \pm 25 \text{ mV} / \pm 10 \text{ mV} / \pm 5 \text{ mV}$		
Overvoltage protection	$\pm 50 \text{ V}$  $\pm 80 \text{ V}$		long term (differential- and SENSE-inputs) short-term
Input impedance	$10 \text{ M}\Omega$ $1 \text{ M}\Omega$		range $\pm 5 \text{ mV}$ to $\pm 2 \text{ V}$ range $\pm 5 \text{ V}$ to $\pm 50 \text{ V}$ and for deactivated device
Input current	40 nA (max.)		
Input capacitance	300 pF (typ.)		
Gain uncertainty	0.02 %	$\leq 0.05 \text{ %}$	of reading (measurement value)
Gain drift	60 ppm / K	< 100 ppm / K	
Offset drift	0.02 %	$\leq 0.05 \text{ %}$ $\leq 0.1 \text{ %}$ $\leq 0.2 \text{ %}$	of measurement range range $\geq \pm 25 \text{ mV}$ range = $\pm 10 \text{ mV}$ range = $\pm 5 \text{ mV}$
Input offset-drift	0.05 $\mu\text{V} / \text{K}$	0.3 $\mu\text{V} / \text{K}$	DC voltage measurement
Non-linearity	<200 ppm		
Common mode voltage (max.)	$\pm 2.8 \text{ V}$ $\pm 50 \text{ V}$		ranges $\pm 5 \text{ mV}$ to $\pm 2 \text{ V}$ ranges $\pm 5 \text{ V}$ to $\pm 50 \text{ V}$
Common mode rejection ratio (CMRR)	      $>100 \text{ dB}$ $>68 \text{ dB}$	$>120 \text{ dB}$ $>110 \text{ dB}$ 95 dB $>54 \text{ dB}$  $>90 \text{ dB}$ $>54 \text{ dB}$  $>50 \text{ dB}$	DC range $\pm 5 \text{ mV}$ to $\pm 25 \text{ mV}$ range $\pm 50 \text{ mV}$ to $\pm 100 \text{ mV}$ range $\pm 250 \text{ mV}$ to $\pm 2 \text{ V}$ range $\pm 5 \text{ V}$ to $\pm 50 \text{ V}$ 50 Hz range $\pm 5 \text{ mV}$ to $\pm 2 \text{ V}$ range $\pm 5 \text{ V}$ to $\pm 50 \text{ V}$ 5 kHz all ranges
SNR (signal to noise ratio)	$>90 \text{ dB}$ $>88 \text{ dB}$ $>82 \text{ dB}$ $>75 \text{ dB}$ $>69 \text{ dB}$		full-scale / rms-noise full bandwidth ranges $\pm 100 \text{ mV}$ to $\pm 50 \text{ V}$ range $\pm 50 \text{ mV}$ range $\pm 25 \text{ mV}$ range $\pm 10 \text{ mV}$ range $\pm 5 \text{ mV}$
Input noise, voltage (RTI)	16 nV/ $\sqrt{\text{Hz}}$ rms 16 $\mu\text{V}$ pk-pk 2 $\mu\text{V}$ rms 0.6 $\mu\text{V}$ pk-pk		DC-Mode (range $\pm 5 \text{ mV}$ ) spectral noise density 1 kHz 0 Hz to 10 kHz 0 Hz to 10 kHz 0.1 Hz to 10 Hz

Current			
Parameter	Value (typ. / max.)		Remarks
Current input ranges	$\pm 40 \text{ mA} / \pm 20 \text{ mA} / \pm 10 \text{ mA}$ $\pm 5 \text{ mA} / \pm 2 \text{ mA} / \pm 1 \text{ mA}$ $\pm 400 \text{ }\mu\text{A} / \pm 200 \text{ }\mu\text{A} / \pm 100 \text{ }\mu\text{A}$		with special connector (shunt $50 \text{ }\Omega$ ), ACC/DSUB-I2 , not for LEMO version
Bridge and strain gauges			
Parameter	Value (typ. / max.)		Remarks
Sensors	LVDT, strain gauge: full-, half-, quarter bridge piezo-resistive bridge transducer potentiometer		directly connectable
Bridge input ranges	$\pm 1 \text{ mV/V to } \pm 400 \text{ mV/V}$ $\pm 2 \text{ mV/V to } \pm 800 \text{ mV/V}$ $\pm 5 \text{ mV/V to } \pm 2000 \text{ mV/V}$  corresponding to strain gauge: $\pm 2\,000 \text{ }\mu\text{m/m to } \pm 800\,000 \text{ }\mu\text{m/m}$ $\pm 4\,000 \text{ }\mu\text{m/m to } \pm 1\,600\,000 \text{ }\mu\text{m/m}$ $\pm 10\,000 \text{ }\mu\text{m/m to } \pm 4\,000\,000 \text{ }\mu\text{m/m}$		for bridge voltage: 5 V 2.5 V 1 V  for bridge voltage: 5 V 2.5 V 1 V
Internal quarter-bridge completion	120 $\Omega$ , 350 $\Omega$		selectable
Bridge voltage DC CF Carrier frequency	1 V; 2.5 V; 5 V (symmetric) 1 V; 2.5 V; 5 V (peak) 5 kHz		set globally for 4-channel groups $\pm 0.5 \text{ V}$ , $\pm 1.25 \text{ V}$ , $\pm 2.5 \text{ V}$ RMS: 0.7 V; 1.8 V; 3.5 V
Gain uncertainty	<0.05 %		of measurement value @ 25°C
Offset after bridge balance	<0.02 %		of range @ 25°C
Input offset-drift	0.01 $\mu\text{V/V} / \text{K}$	0.06 $\mu\text{V/V} / \text{K}$	DC full bridge ( $V_b=5 \text{ V}$ , 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 $\mu\text{V/V/K}$	<90 ppm/K 0.09 $\mu\text{V/V/K}$	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)	0,5 $\mu\text{V/V/K}$	1 $\mu\text{V/V/K}$	DC or CF
Bridge balancing range	$\geq$ measurement range not less than: $\geq \pm 5 \text{ mV/V}$ $\geq \pm 10 \text{ mV/V}$ $\geq \pm 25 \text{ mV/V}$		for $V_b = 5 \text{ V}$ for $V_b = 2.5 \text{ V}$ for $V_b = 1 \text{ V}$
Min. bridge impedance Bridge impedance (max.)	120 $\Omega$ , 10 mH full bridge 60 $\Omega$ , 5 mH half bridge 5 k $\Omega$		$V_b = 1 \text{ V to } 5 \text{ V}$ , $I_{\text{load}} \leq 42 \text{ mA}$
Cable length (max.)	500 m (one-way length)		0.14 mm <sup>2</sup> , 130 m $\Omega$ /m, 65 $\Omega$
Lead wire compensation technique	3 schemes available: double Sense simple Sense by means of shunt-calibration		(half-/full bridge) any cables; for symmetric cables of same type; one-time compensation (not continuously adapted)
Automatic shunt-calibration	0.5 mV/V		for 120 $\Omega$ and 350 $\Omega$ bridges

Bridge and strain gauges		
Parameter	Value (typ. / max.)	Remarks
Input noise (bridge) DC full bridge	3 $\mu\text{V/V}$ pk-pk, 0.39 $\mu\text{V}$ rms 0.9 $\mu\text{V/V}$ pk-pk, 0.12 $\mu\text{V}$ rms 0.3 $\mu\text{V/V}$ pk-pk, 0.04 $\mu\text{V}$ rms 0.1 $\mu\text{V/V}$ pk-pk	range: 1 mV/V (bridge voltage = 5 V) 0 Hz to 10 kHz 1 kHz, lowpass filter 100 Hz, lowpass filter 10 Hz, lowpass filter
DC half-/quarter bridge	3.3 $\mu\text{V/V}$ pk-pk, 0.45 $\mu\text{V}$ rms 1.1 $\mu\text{V/V}$ pk-pk, 0.15 $\mu\text{V}$ rms 0.35 $\mu\text{V/V}$ pk-pk, 0.05 $\mu\text{V}$ rms 0.3 $\mu\text{V/V}$ pk-pk	0 Hz to 10 kHz 1 kHz, lowpass filter 100 Hz, lowpass filter 10 Hz, lowpass filter
CF full bridge, half bridge	3.5 $\mu\text{V/V}$ pk-pk, 0.47 $\mu\text{V}$ rms 1.7 $\mu\text{V/V}$ pk-pk, 0.22 $\mu\text{V}$ rms 0.6 $\mu\text{V/V}$ pk-pk, 0.07 $\mu\text{V}$ rms 0.3 $\mu\text{V/V}$ pk-pk	0 Hz to 10 kHz 1 kHz, lowpass filter 100 Hz, lowpass filter 10 Hz, lowpass filter

Parameter	typ.	min. / max	Remarks
Additional sensor supply			per IEPE/ICP-extension connector only with DSUB-15 version
voltage	+5 V	$\pm 5\%$	independent of bridge supply
current	>0.26 A	>0.2 A	short circuit proof
internal resistance	1.0 $\Omega$	<1.2 $\Omega$	power per DSUB-plug