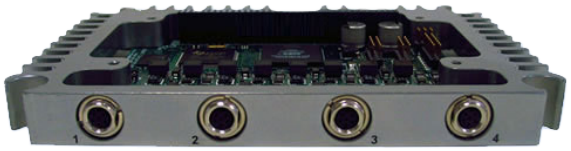
SOMAT®

Data sheet

1-ELBRG-120-2



1-EXRL-BRG-350-2

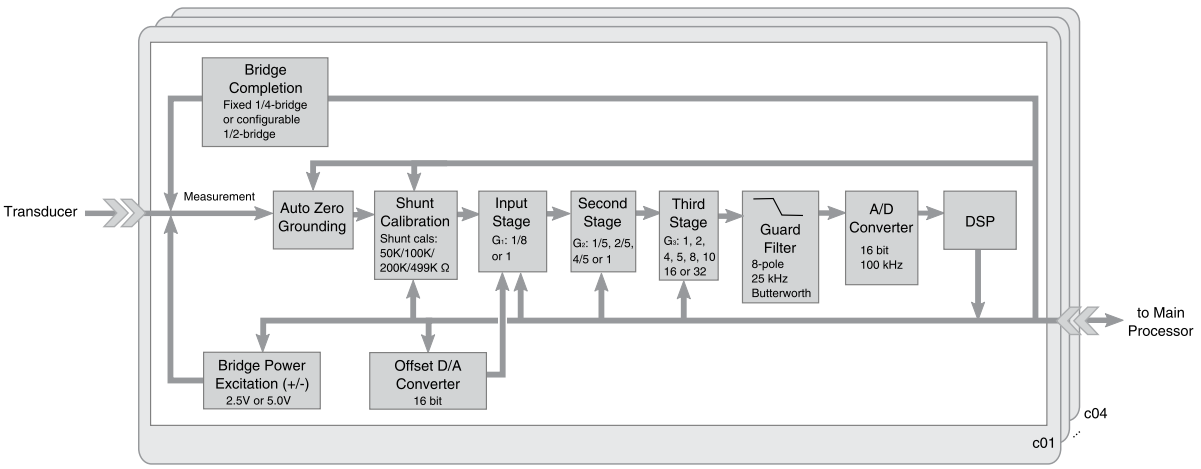
ELBRG/EXRL-BRG

eDAQ-lite or eDAQXR-lite Bridge Layer

Special Features

- **4 simultaneously-sampled, low-level differential analog inputs from ±0.000625 to ±10 V**
- **96 automatic gain states ensuring use of the fullest possible A/D converter range**
- **Sampling rates up to 100 kHz**
- **16-bit A/D converter per channel across full-scale range**
- **25 kHz, 8-pole analog Butterworth low-pass filter**
- **Software selectable sample rates, digital filtering, excitation voltage and shunt resistance**
- **Bipolar shunt calibration (Excitation (+) or (-)), Bridge voltage (±2.5V or ±5.0V)**

Block diagram



NOTE

A double-arrowhead symbol in the diagram represents male and female connectors only, not power polarity or input/output direction.

HBM

Detailed Description

The bridge layer offers four simultaneously sampled low-level differential analog inputs through independent connectors. An extremely versatile layer; the BRG layer works with both amplified and unamplified transducers including: strain gauges, accelerometers, pressure transducers, load cells and other general analog signals. The layer provides excellent strain gage conditioning with support for quarter-, half- and full-bridge configurations. Automatic balancing and gain settings, as well as software selectable sample rates, excitation, and digital filtering simplify set up of a strain channel. There are several calibration options including defined value, external and multipoint calibrations as well as shunt calibrations with embedded software tools. The layer also provides four shunt calibration resistors per channel with software selectable shunt direction for either upscale (-Sig to -Ex) or downscale (-Sig to +Ex) calibrations.
The New-design ring (1-EXR-ELBRG-120-2 and 1-EXR-ELBRG-350-2) and captive screws provide an improved seal with the eDAQXR-lite CPU. If legacy and New-design layer rings are in an eDAQXR-lite stack, the IP rating for the devices may be impacted. Always install standoffs when using legacy layers (1-ELBRG-120-2 and 1-ELBRG-350-2).

Ordering Options

Order No.	Description
1-ELBRG-120-2	Bridge Layer - 120-Ohm Completion, Integrated 120-ohm 1/4-bridge completion resistor Includes: (4) 1-SAC-TRAN-MP-2-2 Transducer Cables and (4) standoffs.
1-ELBRG-350-2	Bridge Layer - 350-Ohm Completion, Integrated 350-ohm 1/4-bridge completion resistor Includes: (4) 1-SAC-TRAN-MP-2-2 Transducer Cables and (4) standoffs.
1-EXRL-BRG-120-2	Bridge Layer - 120-Ohm Completion, Integrated 120-ohm 1/4-bridge completion resistor Includes: (4) 1-SAC-TRAN-MP-2-2 Transducer Cables, (4) captive layer screws and (4) standoffs for legacy system compatibility. The New-design ring and captive screws provide an improved seal with the eDAQXR-lite CPU.
1-EXRL-BRG-350-2	Bridge Layer - 350-Ohm Completion, Integrated 350-ohm 1/4-bridge completion resistor Includes: (4) 1-SAC-TRAN-MP-2-2 Transducer Cables, (4) captive layer screws and (4) standoffs for legacy system compatibility. The New-design ring and captive screws provide an improved seal with the eDAQXR-lite CPU.

Cables and Accessories (Order Separately)

Order No.	Description	Order No.	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench	1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length	1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length	1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length	1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	legacy 176 x 117.6 x 17.6; new-design 152.25 x 107.5 x 18.6
Weight	kg	legacy 0.36; new-design 0.29
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Excitation voltage	V	±2.5 or ±5.0

Parameter	Unit	Value
Bridge resistance	-	-
1/2- and full-bridge	Ω	100 ... 10000
1/4-bridge completion (1-ELBRG-120-2 or	-	-
1-EXRL-BRG-120-2)	Ω	120
1/4-bridge completion (1-ELBRG-350-2 or	-	-
1-EXRL-BRG-350-2)	Ω	350
Shunt calibration resistors	kΩ	49.9, 100, 200 and 499
Initial accuracy(1	% of full scale	±0.1
Excitation voltage change over temperature(2	-	-
single 5 V change	ppm/°C	15
single 2.5 V change	ppm/°C	10
±5 V out	ppm/°C	30
±2.5 V out	ppm/°C	20
Analog inputs surviving over voltage	V	±125
Maximum excitation output power per channel	mW	300
Maximum current output	mA	42
Voltage regulation efficiency (at 42 mA)	-	-
±2.5 V out	%	50
±5 V out	%	63
Power consumption (3	-	-
no load	W	1.2
350-Ω full-bridge at ±5 V	W	1.8
350-Ω 1/2- or 1/4-bridge at ±5 V	W	1.0
350-Ω full-bridge at ±2.5 V	W	0.6
350-Ω 1/2- or 1/4-bridge at ±2.5 V	W	0.3
120-Ω full-bridge at ±2.5 V	W	1.9
120-Ω 1/2- or 1/4-bridge at ±2.5 V	W	1.0
Input offset current over temperature(2	pA/°C	8
Typical input-referred voltage offset over temperature (2 (4	µV/°C	$\pm 0.25 \pm 4(G_3/G_O)$
Typical gain drift over temperature(2	ppm/°C	±10
Filters(5	-	-
100 samples/second	Hz	33 (FIR/Bessel) or 15 (Butterworth)
200 samples/second	Hz	67 (FIR/Bessel) or 30 (Butterworth)
500 samples/second	Hz	167 (FIR/Bessel) or 75 (Butterworth)
1000 samples/second	Hz	333 (FIR/Bessel) or 150 (Butterworth)
2000 samples/second	Hz	667 (FIR/Bessel) or 300 (Butterworth)
2500 samples/second	Hz	833 (FIR/Bessel) or 370 (Butterworth)
5000 samples/second	Hz	1667 (FIR/Bessel) or 750 (Butterworth)
10000 samples/second	Hz	3333 (FIR/Bessel) or 1500 (Butterworth)
20000 samples/second	Hz	6667 (FIR/Bessel)
25000 samples/second	Hz	8333 (FIR/Bessel)

(1 With a known cable leadwire resistance.

(2 Quantities are given per °C temperature change from the temperature at calibration.

(3 Power consumption measurements are taken with the stated load on all four channels and include the efficiency of the power supply.

(4 Where G_O is the overall gain setting and G_3 is the gain of the third stage. See the gain table in the following section for selected gain settings.

(5 Both filter types have -160 dBV / decade cutoff slopes.

Standards

Category	Standard	Description
Shock	MIL-STD-810F	Method 516.5, Section 2.2.2 Functional Shock - ground vehicle
Vibration	MIL-STD-202G	Method 204D, Test condition C (10 *g* swept sine tested from 5 Hz to 2000 Hz)
EMC requirements -	EN 61326-1:2006 EN 61326-1:2012	Before July 2018, CE conformity per EN 61326-1:2006 After June 2018, CE conformity per EN 61326-1:2012

Selected gain settings

NOTE

This table is a representative list only and does not show all available gain settings. In the TCE, to check the gain settings for a defined channel, click the Ampl button in the TCE transducer setup window. “Gain 1” is the input stage gain, “Atten2” is the second stage gain and “Gain2” is the third stage gain.

Desired Input Range [6] (Vpp)	Input Stage Gain, G_1 (1, 10 or 100)	Second Stage Gain, G_2 (1/5, 2/5, 4/5 or 1)	Third Stage Gain, G_3 (1, 2, 4, 5, 8, 10, 16 or 32)	Overall Gain
20	1	1/5	1	0.2
10	1	2/5	1	0.4
5	1	4/5	1	0.8
4	1	1	1	1
2	1	1	2	2
1.25	1	4/5	4	3.2
1	1	1	4	4
0.8	1	1	5	5
0.625	1	4/5	8	6.4
0.5	1	1	8	8
0.4	10	1	1	10
0.25	1	1	16	16
0.2	10	1	2	20
0.125	1	1	32	32
0.1	10	1	4	40
0.08	10	1	5	50
0.0625	10	4/5	8	64
0.05	10	1	8	80
0.04	100	1	1	100
0.025	10	1	16	160
0.02	100	1	2	200
0.0125	10	1	32	320
0.01	100	1	4	400
0.008	100	1	5	500
0.00625	100	4/5	8	640
0.005	100	1	8	800

Desired Input Range [6] (Vpp)	Input Stage Gain, G_1 (1, 10 or 100)	Second Stage Gain, G_2 (1/5, 2/5, 4/5 or 1)	Third Stage Gain, G_3 (1, 2, 4, 5, 8, 10, 16 or 32)	Overall Gain
0.004	100	1	10	1000
0.0025	100	1	16	1600
0.00125	100	1	32	3200

[6] The maximum A/D converter input, which is the product of the input stage and the overall gain, is 4.096 V_{pp}.

Channel Noise Characteristics

The input-referred noise and the signal to noise ratio (SNR) are defined by the following two equations:

$$\text{Input Referred Noise} = \frac{N}{G_O} \qquad \text{SNR} = 20_{\log}\left(\frac{4.096}{N}\right)$$

where G_O is the overall gain setting and N is the noise at the input of the A/D converter, defined by one of the following three equations depending on the gain of the first stage ($G1$):

$$N_{G_1} = 1 = \sqrt{\left(15.4[\text{microV}]G_2G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(37[\text{microV}]G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(45[\text{microV}]G_3\sqrt{\frac{x_2}{13[\text{kHz}]}}\right)^2 + \left(4{,}5[\text{microV}]G_3\sqrt{\ln\left(\frac{x_1}{0.1[\text{Hz}]}\right)}\right)^2 + 83[\text{microV}^2]}$$

$$N_{G_1} = 10 = \sqrt{\left(42.0[\text{microV}]\text{G}_2G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(37[\text{microV}]G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(45[\text{microV}]G_3\sqrt{\frac{x_2}{13[\text{kHz}]}}\right)^2 + \left(4.5[\text{microV}]G_3\sqrt{\ln\left(\frac{x_1}{0.1[\text{Hz}]}\right)}\right)^2 + 83[\text{microV}^2]}$$

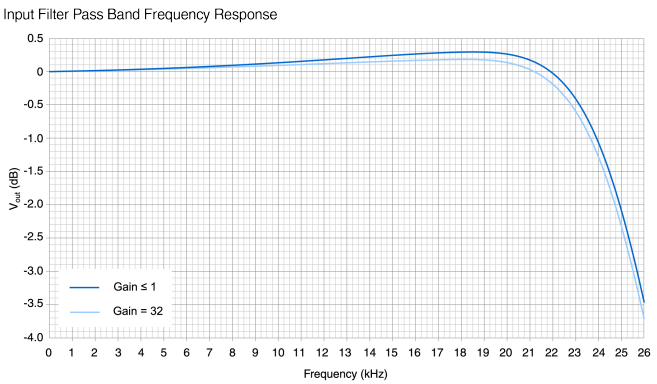
$$N_{G_1} = 100 = \sqrt{\left(322.8[\text{microV}]G_2G_3\sqrt{\frac{x_3}{15.7[\text{kHz}]}}\right)^2 + \left(37[\text{microV}]G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(45[\text{microV}]G_3\sqrt{\frac{x_2}{13[\text{kHz}]}}\right)^2 + \left(4.5[\text{microV}]G_3\sqrt{\ln\left(\frac{x_1}{0.1[\text{Hz}]}\right)}\right)^2 + 83[\text{microV}^2]}$$

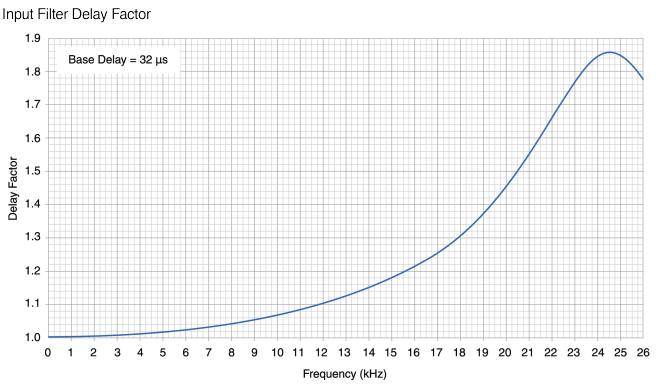
and where x_n is the cutoff frequency of the digital or analog filter to the specified maximum value.

x_n	Maximum Value	Cause
x_1	24 kHz	analog filter cutoff
x_2	13 kHz	secondary filter cutoff
x_3	15.7 kHz	early rolloff of first stage when $G_1 = 100$

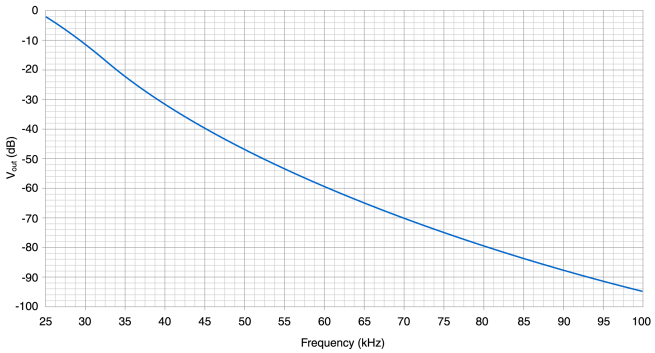
NOTE

When selecting the sampling rate in the TCE or web interface, the cutoff frequency of the selected filter is one third of the sampling rate.

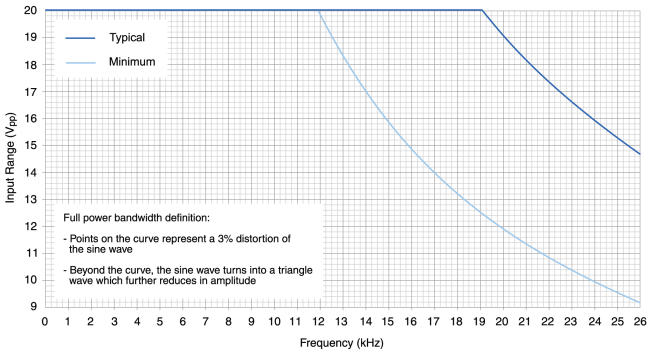




Input Filter Cut-Off Region



Full Power Bandwidth



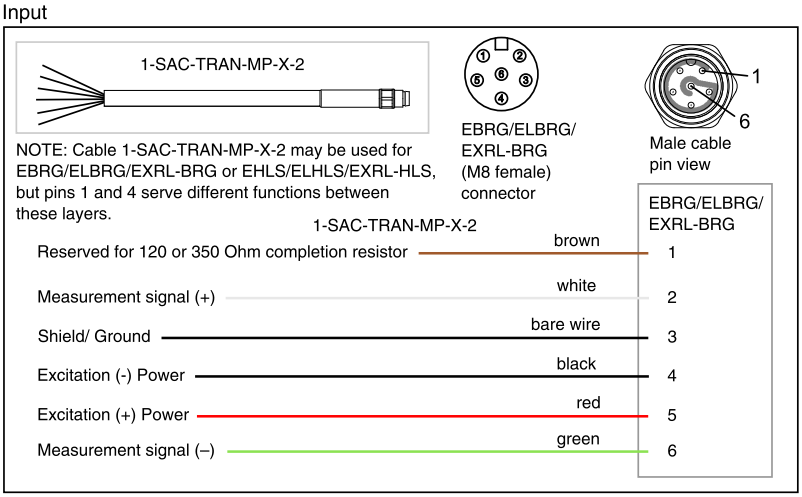
NOTE

The plot shows full power bandwidth for an overall gain of 0.2 or a 20 V_{pp} input range.

Input connectors

The diagram shows the M8 connectors on the ELBRG or EXRL-BRG layer.

Input



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