Technical Specifications

English

eDAQ XR lite

EXRLCPU

compatible eDAQ-lite equipment

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Contents Page

1 ELBRG/EXRL-BRG layer

1-ELBRG-120-2 shown

1-EXRL-BRG-350-2 shown

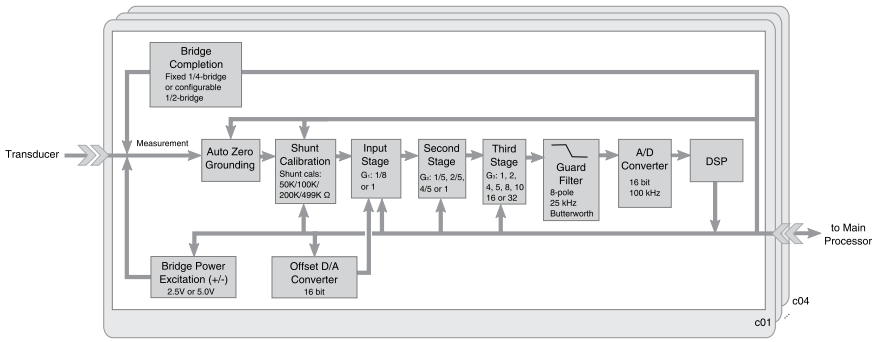
The Bridge Layer offers four simultaneously sampled low-level differential analog inputs through independent connectors. An extremely versatile layer; the layer works with both amplified and unamplified transducers including: strain gauges, accelerometers, pressure transducers, load cells, and other 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 the 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 layer supports Full and Half bridge types with resistance ranges from 100 to 10000 Ohm, and Quarter bridges with resistance of either 120 or 350 Ohm (as a factory installed option). A set of internal shunt resistors (50, 100, 200, and 500 kOhm) is available for sensor scaling and test setup sanity checks. Other features include the following.

a. Differential inputs provided for the analog input signals.
b. Synchronous sampling with other bridge (BRG), High Level Simultaneously Sampled (HLS) and Digital input/output (DIO) layer channels.
c. Flexible configuration option for filter type, low pass filter bandwidth, and sample rate on a per channel basis. FIR Linear Phase and FIR Butterworth 8P filters are available in the Decimal domain; only specialized FIR Butterworth 8P filters are available in the Binary domain.

New-design layer rings may be installed on legacy ELBRG, ELDIO, ELHLS and ELNTB printed circuit boards. Conditioning layer boards in new-design rings are available for purchase as 1-EXRL-BRG-120-2, 1-EXRL-BRG-350-2, 1-EXRL-DIO-B-2, 1-EXRL-HLS-2 or 1-EXRL-NTB-2. 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).

Block diagram



NOTE

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

Ordering options

Order number	Description
1-ELBRG-120-2	ELBRG bridge layer – 120 Ohm Completion, Inputs: Four channels, ±10V differential analog, simultaneous sampling, 16-bit resolution. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 120 Ohm ¼ -bridge completion resistor. Includes: (4) 1-SAC-TRAN-MP-2-2 cables and (4) standoffs.
1-ELBRG-350-2	ELBRG bridge layer – 350 Ohm Completion, Inputs: Four channels, ±10V differential analog, simultaneous sampling, 16-bit resolution. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 350 Ohm ¼ -bridge completion resistor. Includes: (4) 1-SAC-TRAN-MP-2-2 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.

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	176 x 117.6 x 17.6; new-design 152.25 x 107.5 x 18.6
Weight	kg	0.36; new-design 0.29
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]

Parameter	Unit	Value
Relative humidity range, non-condensing	%	0 ... 90
Excitation voltage	V	±2.5 or ±5.0
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	$\pm 0.25 \pm 4(G_3/G_O)$

Parameter	Unit	Value
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

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
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
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 (G_1):

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

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

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

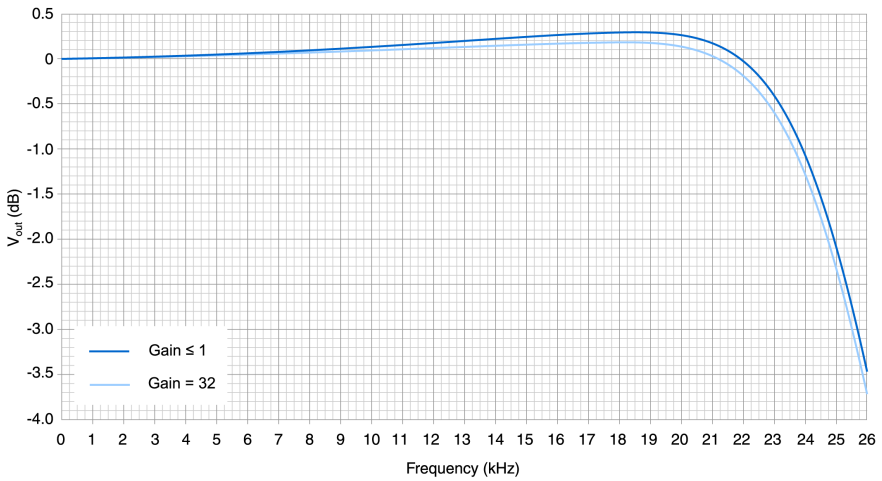
and where x_n is the cutoff frequency of the digital or analog filter to a specified maximum.

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

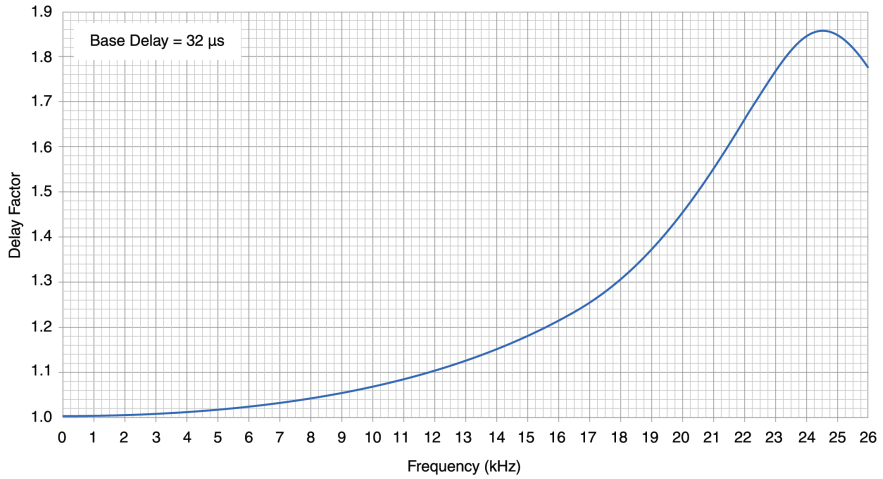
Charts

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

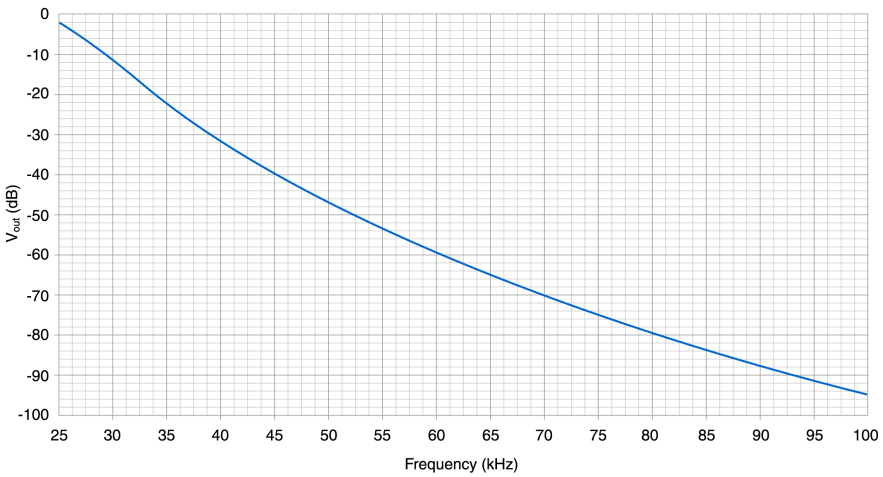
Input Filter Pass Band Frequency Response

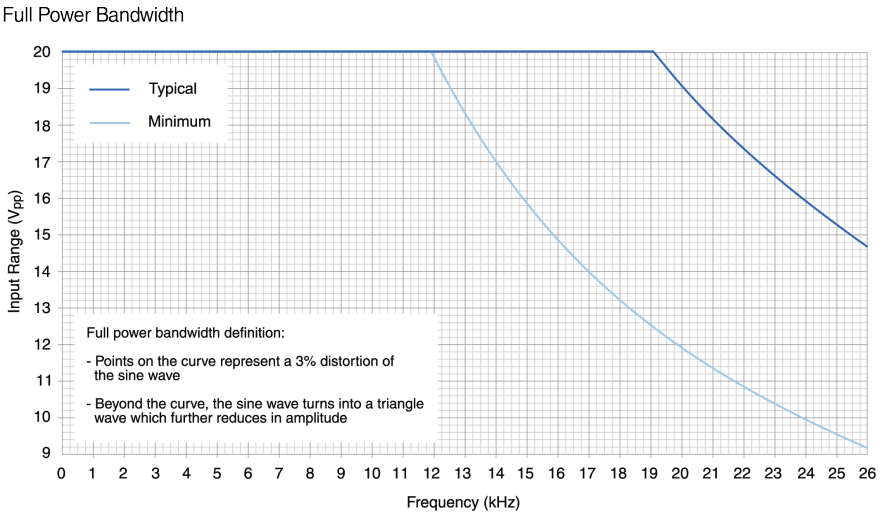


Input Filter Delay Factor



Input Filter Cut-Off Region





NOTE

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

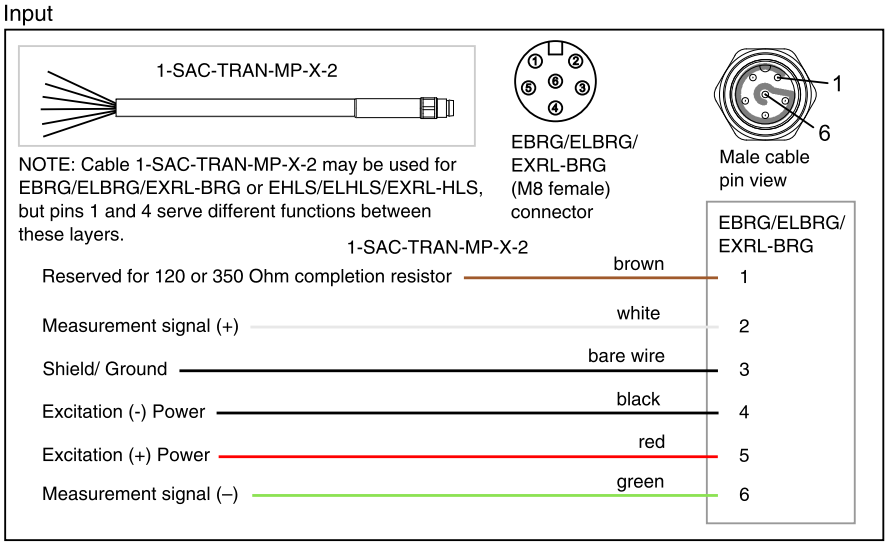
Input connectors

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

Each independent channel contains programmable excitation, an eight-pole Butterworth analog guard filter, a 16-bit A/D converter, software selectable digital filtering and output sample rate options of up to 100 kHz.

The layer supports full- and half-bridge types with a resistance from 100 to 10000 Ohms and quarter-bridges with a resistance of either 120 or 350 Ohms. All bridge configurations are accomplished using programmable switches , however, the quarter-bridge choice of 120- or 350-Ohm completion resistor is a factory installed option. A set of internal shunt resistors with selectable shunt direction is available for calibration purposes.

Input



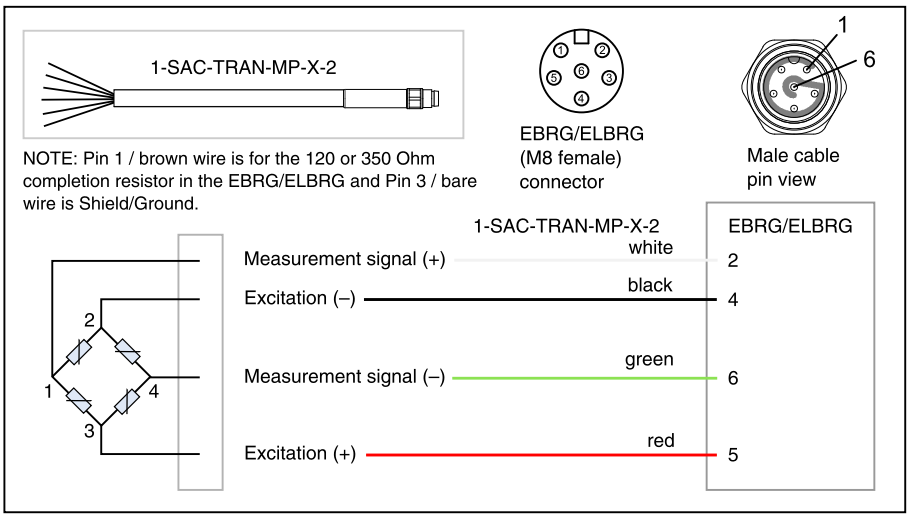
Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-EBB-AO-2	Breakout Box – Analog Output EHLS and EBRG Layers.
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length
1-SAC-TRAN-AO-2-2	Transducer Cable - Analog Out - 2 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

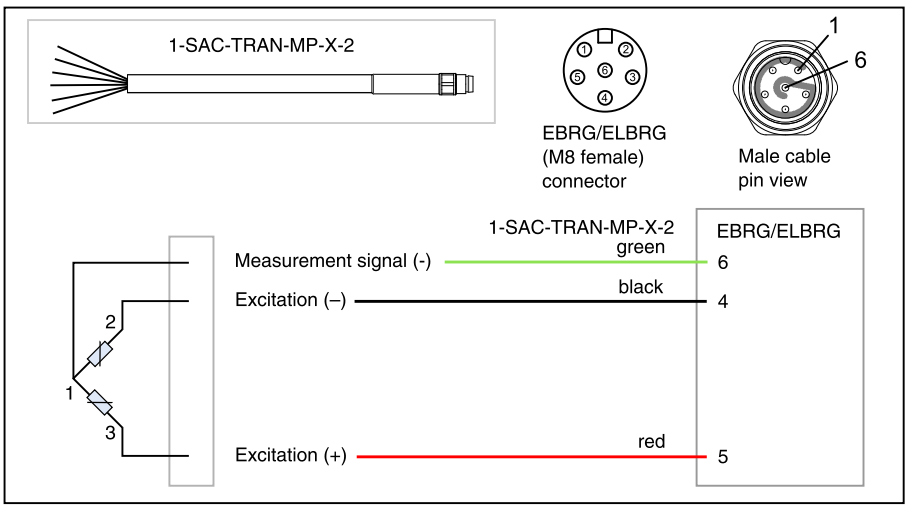
ELBRG/EXRL-BRG Bridge Transducers

Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire BRG bridge transducer inputs.

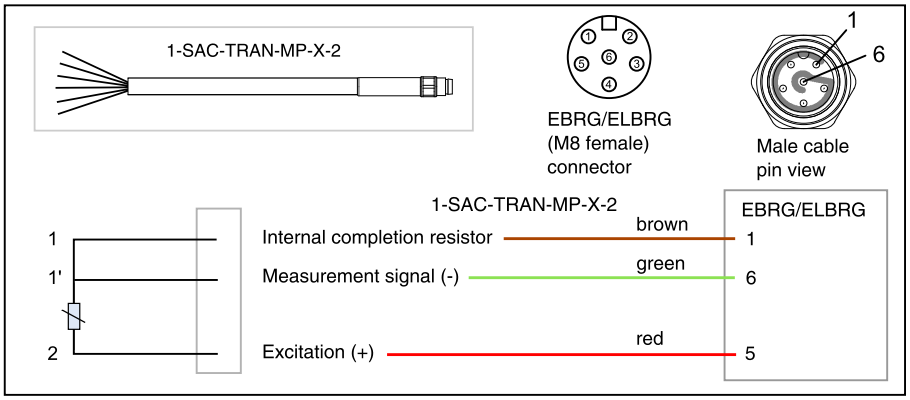
Full-bridge strain gage, four-wire configuration



Half-bridge strain gage, three-wire configuration



Quarter-bridge strain gage, three-wire configuration



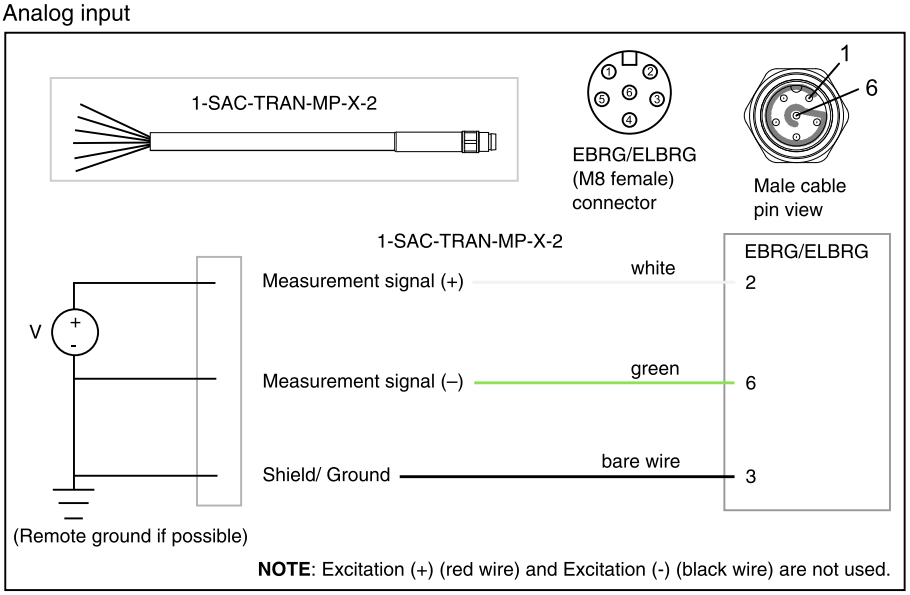
The internal completion resistor value depends on the resistor in the BRG layer (120 or 350 Ohms).

ELBRG/EXRL-BRG Analog Input

Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire BRG analog inputs.

NOTE
Do not use this wiring diagram for HLS channels.

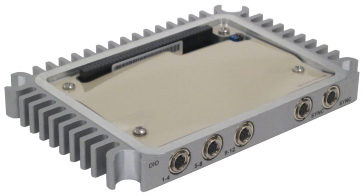
Analog input



This diagram shows wiring for a standard analog input on a BRG layer.

2 ELDIO/EXRL-DIO layer

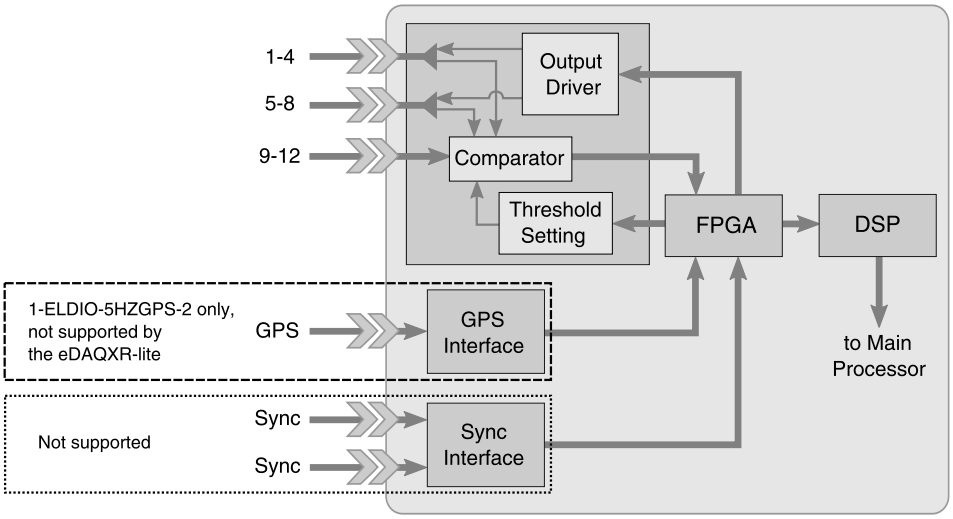
1-ELDIO-B-2 shown



1-EXRL-DIO-2 shown

The Digital Input/Output Layer is a versatile layer that supports digital input/output (I/O) and a pulse counter. The layer offers eight channels that can be used as digital inputs and outputs, four channels dedicated to wide-range inputs, six integrated configurable pulse counters. The legacy layer (1-ELDIO-5HZGPS-2) supports an optional GPS channel on the eDAQ-lite. Only the legacy layers (1-ELDIO-5HZGPS-2 and 1-ELDIO-2) support up to two independent vehicle bus modules (VBM). The eDAQ-lite and TCE support the GPS port and two vehicle bus modules (CAN or J1708). These are not supported on the eDAQXR-lite, but are superseded by a GPS port, 2 CAN ports and Ethernet ports with PTP on the eDAQXR-lite CPU.
The digital I/O channels are grouped into three Somat M8 female bulkhead connectors of four digital I/O channels (i.e., bits). The eight channels on connectors |1-4| and |5-8| are individually configurable to be either inputs or outputs. The four channels on connector |9-12| are dedicated wide-range input channels. Each connector also provides two pulse counter channels for a total of six pulse counter channels.
Vehicle bus modules are compatible with the first two connectors (|1-4| and |5-8|) for the eDAQ-lite only.
The pulse counters support pulse time period, pulse on period, pulse rate counting and quadrature decoder.
New-design layer rings may be installed on legacy ELBRG, ELDIO, ELHLS and ELNTB printed circuit boards. Conditioning layer boards in new-design rings are available for purchase as 1-EXRL-BRG-120-2, 1-EXRL-BRG-350-2, 1-EXRL-DIO-B-2, 1-EXRL-HLS-2 or 1-EXRL-NTB-2. The New-design ring (1-EXRL-DIO-B-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-ELDIO-B-2).

Block diagram



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

Ordering options

Order number	Description
1-ELDIO-B-2	ELDIO digital input / output layer – Base Layer Inputs: (8) digital I/O, (4) wide range (+/- 45V) digital inputs, (6) pulse counters. Includes: (9) 1-SAC-TRAN-MP-2-2 cables and (4) standoffs.
1-EXRL-DIO-B-2	Digital Input/Output Layer Includes: (3) 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.

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	176 x 1117.6 x 17.6; new-design 152.25 x 107.5 x 18.6
Weight	kg	0.42; new-design 0.29
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Power consumption, no load (1	W	1.55

Parameter	Unit	Value
Digital Inputs		
Steady-state input voltage (V_{in}) limits	-	-
minimum (channels 1-8)	V	-0.2
minimum (channels 9-12)	V	-45
maximum (channels 1-8 and 9-12)	V	+45
Transient input voltage (V_{in}) limits	-	-
minimum (channels 1-8)	V	-0.4
minimum (channels 9-12)	V	-100
maximum (channels 1-8 and 9-12)	V	+100
Input current	-	-
V_{in} < 5.5 V (channels 1-8)	µA	110
V_{in} < 5.5 V (channels 9-12)	µA	10
V_{in} < 5.5 V (channels 1-8)	mA	(V_{in}-5.5)/10+0.110
V_{in} < 5.5 V (channels 9-12)	mA	(V_{in}-5.5)/10+0.010
Threshold voltage	-	-
upper threshold ($V_{th,upper}$) range (channels 1-8)	V	0.8 ... 4.8
upper threshold ($V_{th,upper}$) range (channels 9-12)	V	0.001 ... 4.8
lower threshold ($V_{th,lower}$) (channels 1-12)	V	$V_{th,upper}$-1
accuracy (channels 1-12)	V	±0.02
Hysteresis voltage	V	1
Pulse Counters		
Pulse rate mode	-	-
maximum input frequency	MHz	1
maximum counts per sample period	counts	2^{32} = 4.295E^{+09} (Bi-direction counting, 2^{32}/2)
Quadrature decoder mode	-	-
maximum input frequency	MHz	1
Pulse time period mode	-	-
resolution	nanoseconds	200
accuracy	%	±0.01
minimum input frequency	Hz	0.0012
Pulse on period mode	-	-
resolution	nanoseconds	200
accuracy	%	±0.01
minimum input frequency	Hz	0.0012
Digital Outputs		
Logic 0 provided current sink to ground (at 100 mA)	-	-
maximum	V	1.1
typical	V	0.9

Parameter	Unit	Value
Maximum allowable output current sink (single output) (2	mA	400
Logic 1 voltage output (V_{out}) (with no pull-up)	V	5
Maximum allowable output pull-up voltage (channels 1-8)	V	45
Output power (3 5-V output 12-V output voltage tolerance	- A A %	- 1 1 ±10

(1 Power consumption measurements include the efficiency of the power supply.

(2 For multiple outputs, see Allowable Output Sink Current plot below.

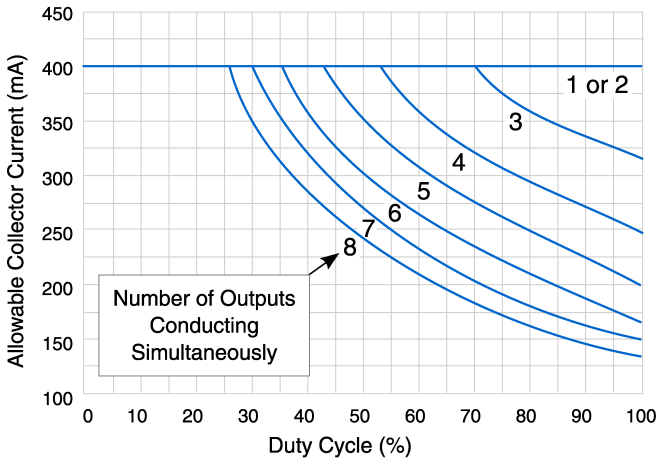
(3 On MSDIO.02 (or earlier) board models, the 12 volt option worked correctly only if the input power to the eDAQ was about 14 to 15 volts (or more); otherwise, the DIO output would be something less than 12 volts.

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

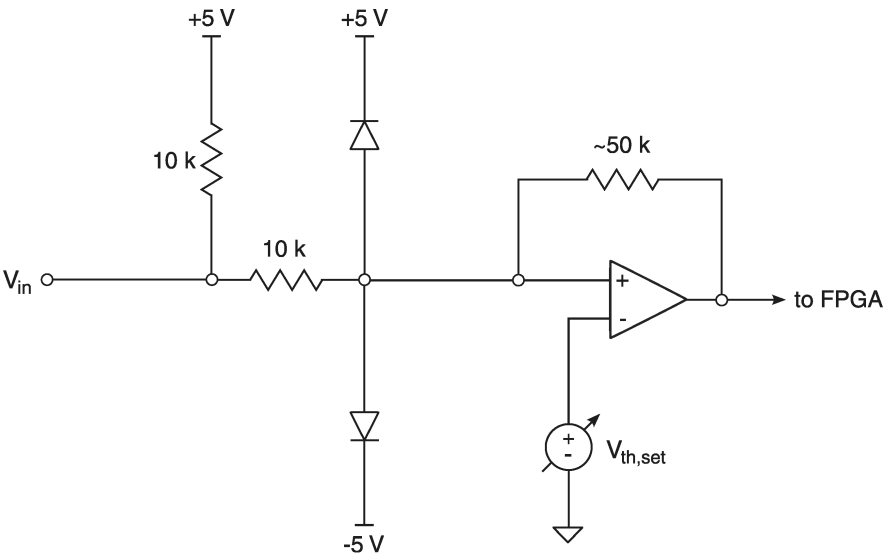
Allowable Output Sink Current

The following graph shows the allowable collector current at 50 °C depending on the number of simultaneous outputs. The data applies to the eight (8) output channels on one (1) DIO bank.



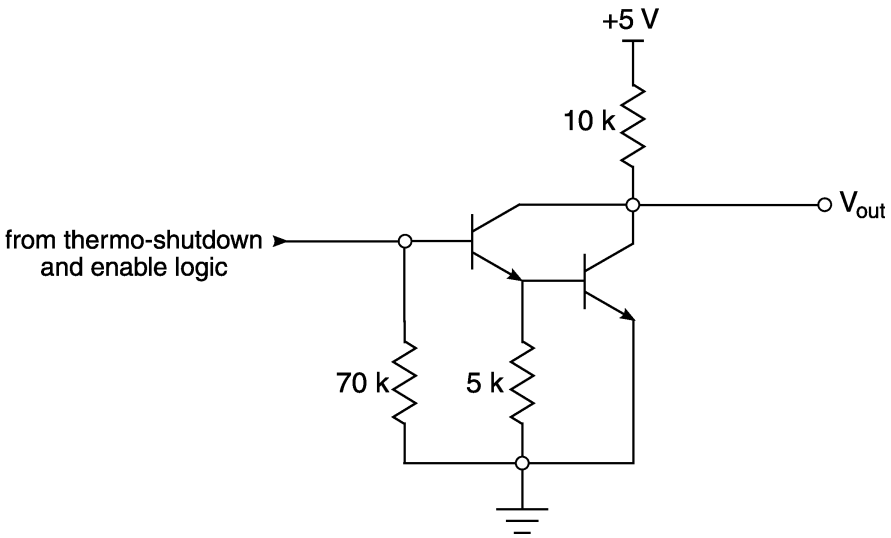
Digital Input Line Equivalent Circuit

The digital input circuitry sets the threshold voltages and determines the input as a logic 1 or 0. The input equivalent circuit is the same for all input channels.



Digital Output Line Equivalent Circuit

The output circuitry is applicable to the first two (2) connectors (channels 1–8). Note that since the outputs share common I/O lines with the digital inputs, the lines are not allowed a DC voltage level lower than -0.3 volts.



Input connectors

This diagram shows the connectors on an ELDIO or EXRL-DIO layer.

NOTE
Channels that are used for pulse counters can also be simultaneously used for Digital Input channels.

The digital input lines on each bank are sampled individually to generate logical (i.e., Boolean) data channels for triggering or other logical operations. The digital outputs are implemented as current sinks (i.e., they can only drive an output to ground). Up to 500 mA of current can be sunk on the bank. Output channels are designed to drive LED indicators, remote switches, etc.

Power to drive LEDs and other external output devices is on the bank, and the user can select either a nominal 5 volt or a nominal 12 V output level. At either level, the DIO bank can source approximately 1 Amp.

Connect inputs, outputs, and transducers to the ELDIO using one or more of the pins on the M8 connectors located on the front panel.

ELDIO/EXRL-DIO Available Inputs and Outputs

The digital I/O channels are grouped into one bank containing three connectors of four digital I/O channels (i.e., bits). The eight channels on connectors |1-4| and |5-8| are individually configurable to be either inputs or outputs. The four channels on connector |9-12| are dedicated wide-range input channels. Each connector also

provides two pulse counter channels for a total of six pulse counter channels per bank.

ELDIO/EXRL-DIO Digital Input/Output

There are 8 digital input/output lines available for the bank on the ELDIO. Use the web interface to configure the lines on the |1-4| and |5-8| connectors as either inputs or outputs. The input lines can be sampled individually to generate logical (i.e., Boolean) data streams for triggering or other logical operations.

Use the ELDIO bank configuration options to program the input threshold mode and limits for determining the Boolean state of the input channels. Connect channels to the ELDIO using the numbered M8 connectors on the front panel of the layer.

The output lines are updated at a low rate based on the user-defined pipe frame size and are designed to drive LED indicators, remote switches, etc.

ELDIO/EXRL-DIO Pulse Counter

The pulse counter channels share the same input lines as the digital input/output channels. Two (2) pulse counter channels are provided on each connector (|1-4|, |5-8| and |9-12|). Pulse counter channels can measure pulse width, count pulses or used in pairs as quadrature encoder inputs typically used to track angular or linear position. Connect pulse counter channels to the ELDIO using the numbered M8 connectors on the front panel.

NOTE
Input bits (i.e., channels) used for pulse counters can simultaneously be used for digital input channels.

Limits on ELDIO/EXRL-DIO Input Voltages

The four (4) channels on connector |9-12| of the DIO are wide range inputs that can accept steady state voltages in the range of ±45 volts. These channels can also tolerate short duration spikes up to +100 volts (as can be encountered using inductive pickup devices).

The eight (8) channels on connectors |1-4| and |5-8| on the ELDIO are configurable as either inputs or outputs and can accept steady state voltages in the range of -0.2 to +45 volts. These channels can also tolerate short duration spikes up to +100 volts. In general, it is advised that these channels be used only with positive voltage input sources.

Exceeding the input ranges described above can result in component damage, requiring factory repair. Layer damage caused by exceeding input voltage limits is not covered by HBM warranty.

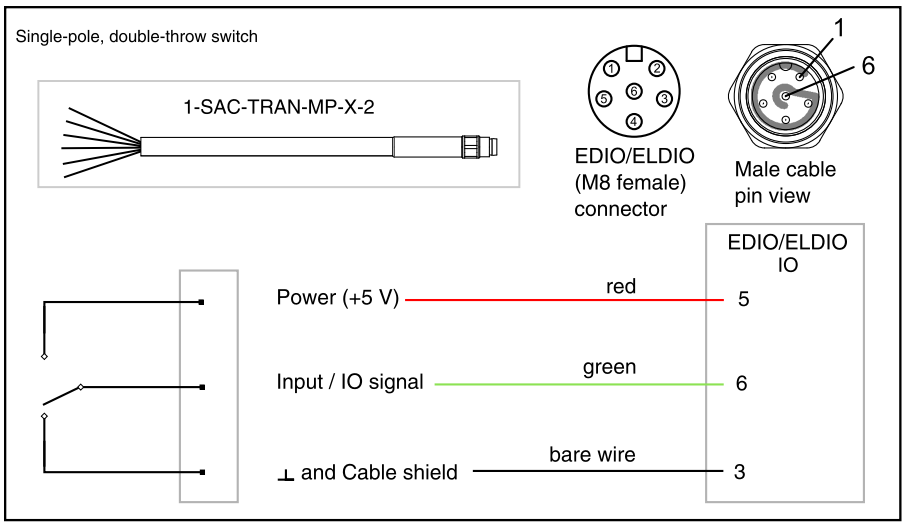
Wiring diagrams

ELDIO/EXRL-DIO digital input

Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire ELDIO digital inputs.

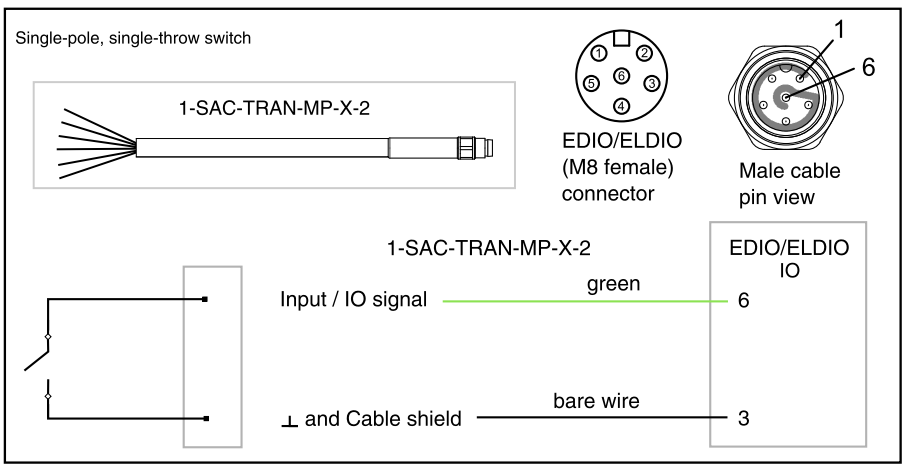
Preferred switch

Whenever possible, a single-pole, double-throw switch, wired as shown below, should be used for switched inputs. This circuit solidly switches the input line to either ground or +5 volts and prevents coupling of the input line to other digital input lines. Moving the switch to the ground side is identified as FALSE.



Alternate switch

The following diagram shows the circuit wiring for an alternate digital input involving a switch closure function. An open switch as shown is TRUE; a closed switch is FALSE. This circuit is adequate for most applications.

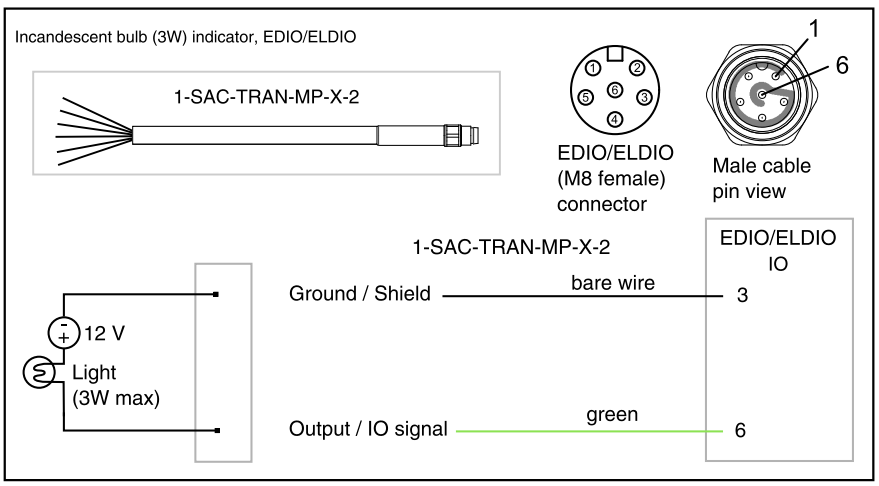


ELDIO/EXRL-DIO digital output

Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire ELDIO digital outputs.

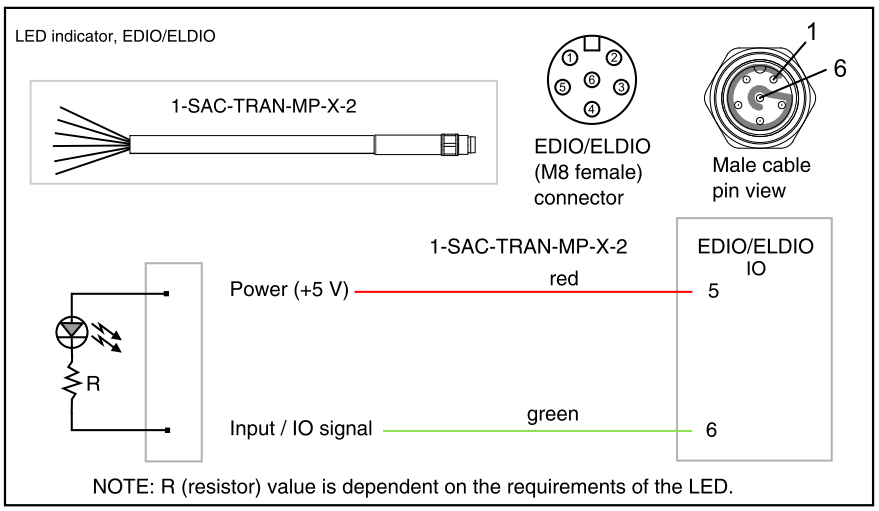
Operating a 12-volt incandescent bulb

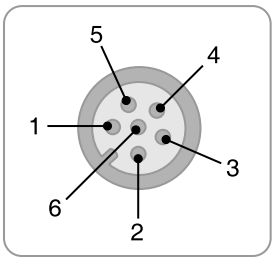
The following diagram shows an incandescent bulb (3 watts maximum) used as an indicator in the digital output circuit. An external 12-volt DC power supply provides power for the bulb. A three-watt bulb uses the current capacity of all lines in an ELDIO bank. The light turns on when the output is set to FALSE.



Operating a Light Emitting Diode (LED)

The following diagram shows the use of an LED as an indicator in the digital output circuit. A FALSE output causes the diode to light. The total of all diode currents must be less than 250 mA for an ELDIO bank. The resistor R limits the current through the diode when the LED is on. The resistor value is dependent on the requirements of the illumination device. For more information on output current limitations, refer to the ELDIO **Specifications** table above.





The following table lists the pinouts for the SAC-TRAN-MP cable when used for DIO inputs. The I/O pin depends on the bank connector (i.e., |1-4|, |5-8| or |9-12|).

NOTE

The quadrature encoder outputs as specified are for default signal polarity which assigns the positive direction to clockwise rotation. To reverse polarity, interchange encoder outputs A and B.

Pin	Function	Wire color	Quad encoder use
1	I/O 4, 8 or 12	Brown	Encoder 2, output B
2	I/O 3, 7 or 11	White	Encoder 2, output A
3	GND/Shield	Bare wire	Return
4	I/O 1, 5 or 9	Black	Encoder 1, output A
5	Power	Red	Power
6	I/O 2, 6 or 10	Green	Encoder 1, output B

$A = f_1(+); B = f_2(+)$

Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-EPCM-2	Pulse Conditioning Module In-line signal conditioning module. Amplifies and isolates incoming pulse signals to TTL levels compatible with the EDIO layers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

3 ELHLS/EXRL-HLS layer

1-ELHLS-2 shown

1-EXRL-HLS-2 shown

The High Level Simultaneously Sampled (High Level SS) layer is a high performance layer that supports multiple adapter modules to extend the range of supported transducers. The layer supports powered inputs with configurable full scale ranges from +/-64 mV up to +/-74.9 V. This board conditions each of the 4 input signals by means of programmable excitation circuitry, an eight (8) pole Butterworth analog guard filter, programmable amplifier gain and offset, 16-bit analog to digital converter sampling at 100000 S/s in the Decimal sample rate domain (or 98304 S/s in the Binary domain). The ELHLS features simultaneous sampling for all 4 channels, programmable digital filters, and the output sample rate achieved by means of multiple stages of combined down sampling / digital filtering. Some other features are itemized as follows.

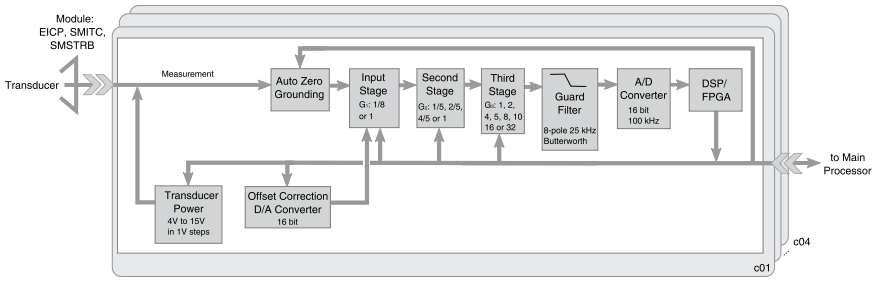
a. Differential inputs provided for the analog input signals.
b. Synchronous sampling with other High-level simultaneously sampled (HLS), bridge (BRG) and Digital input/output (DIO) layers.
c. 400 mW of transducer power supply with adjustable supply voltage for every channel (4–15 V). Power supplies can used in parallel for larger loads.
d. Isolated analog output signal for each channel.
e. Completely flexible configuration of filter type, filter pass bandwidth, and sample rate on a per channel basis.
f. IEPE adapter module and Smart modules that support resistive bridge and thermocouple sensors.

Connect transducers to the layer individually using the M8 connectors located on the front panel.

Each independent channel contains programmable transducer power, an eight-pole Butterworth analog guard filter, a 16-bit A/D converter, software selectable digital filtering and output sample rate options of up to 100 kHz.

The New-design ring (1-EXRL-HLS-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-ELHLS-2).

Block diagram



NOTE

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

Ordering options

Order number	Description
1-ELHLS-2	ELHLS high level analog layer – Base Layer Inputs: 4-channels, ±74.9V differential analog, simultaneous sampling, 16-bit resolution. With the addition of SMART Conditioning Modules this layer can also be used to measure strain gage based transducers, thermocouples and ICP devices. Includes: (4) 1-SAC-TRAN-MP-2-2 cables and (4) standoffs.
1-EXRL-HLS-2	ELHLS High-level Analog Layer - Includes: (4) 1-SAC-TRAN-MP-2-2 Transducer Cables, (4) captive layer screws and (4) standoffs. The New-design ring (1-EXRL-HLS-2) and captive screws provide an improved seal with the eDAQXR-lite CPU.

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	176 x 1117.6 x 17.6; new-design 152.25 x 107.5 x 18.6
Weight	kg	0.42; new-design 0.30
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Initial accuracy	% of full scale	±0.1
Common mode range plus signal $G_1 = 1/8$ $G_1 = 1$	- V V	- ±74.9 ±10
Analog inputs surviving over voltage	V	±125
Transducer power supply voltage range no adapter with IEPE adapter	- V V	- 4 ... 15 in 1 V steps 24

Parameter	Unit	Value
Transducer power supply output power	mW	400
Transducer power supply voltage change over temperature	%	±1
Voltage regulation	-	-
4 V out, 2 mA to 150 mA	mV	10
10 V out, 2 mA to 60 mA	mV	5
15 V out, 2 mA to 40 mA	mV	5
24 V out, 2 mA to 25 mA	mV	10
Voltage regulation efficiency	-	-
4 V out, 2 mA to 150 mA	%	67
10 V out, 2 mA to 60 mA	%	78
15 V out, 2 mA to 40 mA	%	80
24 V out, 2 mA to 25 mA	%	82
Ripple (4 V out)	-	-
1.4 MHz at 2 mA	mV	5
1.4 MHz at 60 mA	mV	18.5
Ripple (10 V out)	-	-
1.4 MHz at 2 mA	mV	5
1.4 MHz at 60 mA	mV	14
Ripple (15 V out)	-	-
1.4 MHz at 2 mA	mV	2
1.4 MHz at 40 mA	mV	12
3.4 kHz at 2 mA	mV	7
Ripple (24 V out)	-	-
1.4 MHz at 2 mA	mV	2
1.4 MHz at 25 mA	mV	10
10.5 MHz at 2 mA	mV	9
Power consumption(1	-	-
no load	W	3.3
SBSTRB4-120, quarter bridge or half bridge (5 V out)	W	4.26
SBSTRB4-120, full bridge (5 V out)	W	5.14
SMSTRB4-350, quarter bridge or half bridge (5 V out)	W	3.52
SBSTRB4-350, full bridge (5 V out)	W	3.62
SMSTRB4-350, quarter bridge or half bridge (10 V out)	W	5.36
SMSTRB4-350, full bridge (10 V out)	W	5.74
SMITC	W	3.96
IEPE plus accelerometer	W	4.5
40 mA load (12 V out)	W	5.6
Minimum input resistance	-	-
$G_1 = 1$	GΩ	2
$G_1 = 1/8$	kΩ	108

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

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. To check the gain settings for a defined channel, see the Test configuration Channel settings in the TCE transducer setup window or the eDAQXR-lite web interface. “Gain1” is the input stage gain, “Atten2” is the second stage gain and “Gain2” is the third stage gain.

Desired Input Range (2 (V_{pp})	Input Stage Gain, G_1 (1/8 or 1)	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
149.8	1/8	1/5	1	0.025
80	1/8	2/5	1	0.05
40	1/8	4/5	1	0.1
32	1/8	1	1	0.125
20	1	4/5	2	0.2
10	1/8	4/5	4	0.4
5	1/8	4/5	8	0.8
4	1/8	1	8	1
2	1/8	1	16	2
1	1/8	1	32	4
0.5	1	1	8	8
0.25	1	1	16	16
0.125	1	1	32	32

(2 The maximum A/D converter input, which is the product of the input range 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 defined by the following equation:

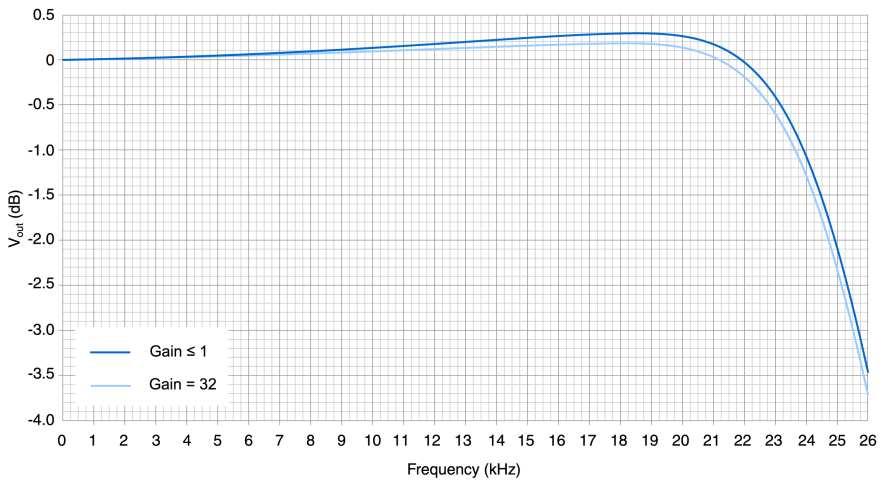
$$N = \sqrt{\left(17.6[\mu\,\text{V}]G_2G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(37[\mu\,\text{V}]G_3\sqrt{\frac{x_1}{24[\text{kHz}]}}\right)^2 + \left(45[\mu\,\text{V}]G_3\sqrt{\frac{x_2}{13[\text{kHz}]}}\right)^2 + \left(4.5[\mu\,\text{V}]G_3\sqrt{\ln\left(\frac{x_1}{0.1[\text{Hz}]}\right)}\right)^2 + 83[\mu\,\text{V}^2]}$$

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

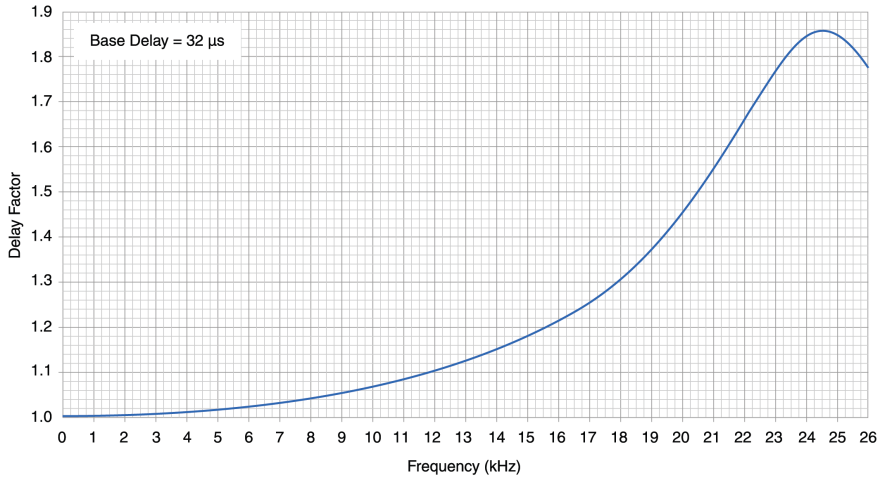
x_n	Maximum Value	Cause
x_1	24 kHz	analog filter cutoff
x_2	13 kHz	secondary filter cutoff

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.

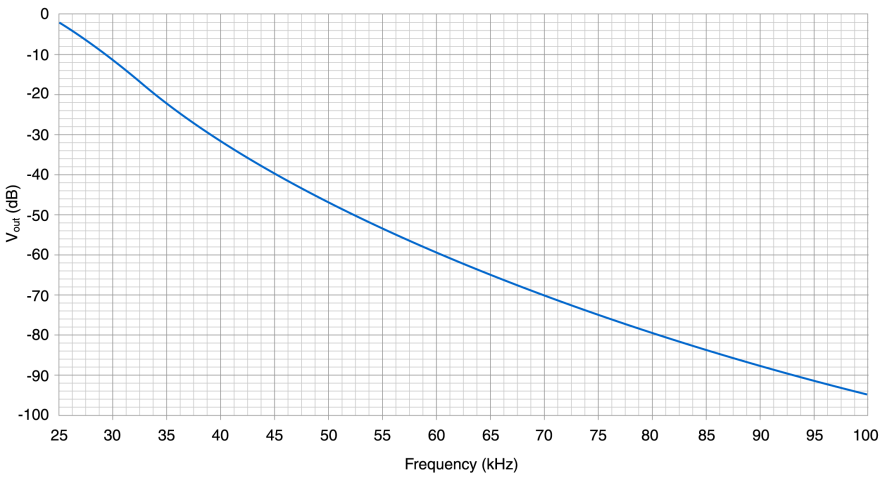
Input Filter Pass Band Frequency Response



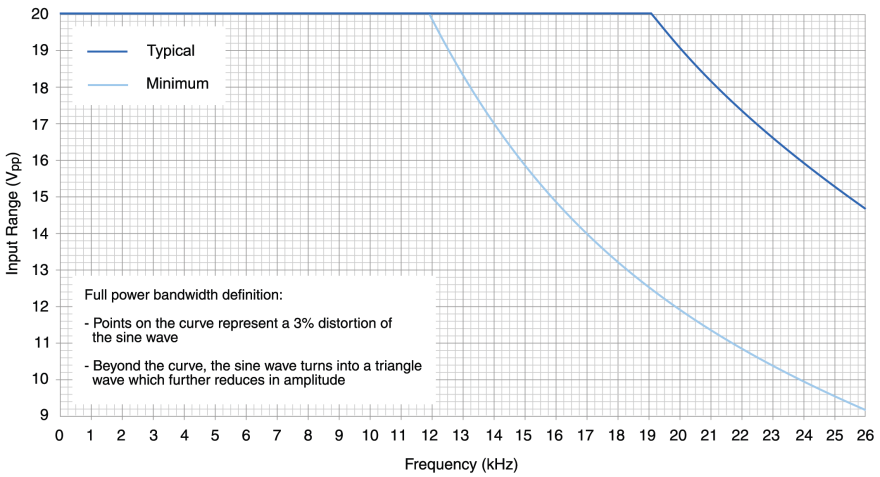
Input Filter Delay Factor



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 ELHLS or EXRL-HLS layer.

Each independent channel contains programmable transducer power, an eight-pole Butterworth analog guard filter, a 16-bit A/D converter, software selectable digital filtering and output sample rate options of up to 100 kHz. The ELHLS also provides 400 milliwatts of transducer power supply with an adjustable supply voltage of 4-15 volts for every channel. Use the transducer power supplies in parallel for larger loads.

NOTE
The analog guard filters on the ELHLS/EXRL-HLS channels result in some gain amplification for high frequency inputs. Some selected gain settings are shown above.

NOTE
The ELHLS/EXRL-HLS uses a nominal ±2-volt A/D converter. However, do not assume that the user-defined full-scale values are even approximately equivalent to ±2 volts for any particular channel. This is primarily because the eDAQXR-lite automatically provides a minimum over range protection of 1% and the eDAQXR-lite can set gains only at certain discrete values resulting in actual over range protection that is sometimes significantly larger than 1%.

Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-EBB-AO-2	Breakout Box – Analog Output EHLS and EBRG Layers.
1-EICP-B-2	IEPE-Type Conditioning Module – BNC Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-EICP-M-2	IEPE-Type Conditioning Module – Microdot Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-SMSTRB4-120-2	Strain SMART Module – 120 Ohm Completion In-line signal conditioning module for EHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 120 Ohm ¼ -bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

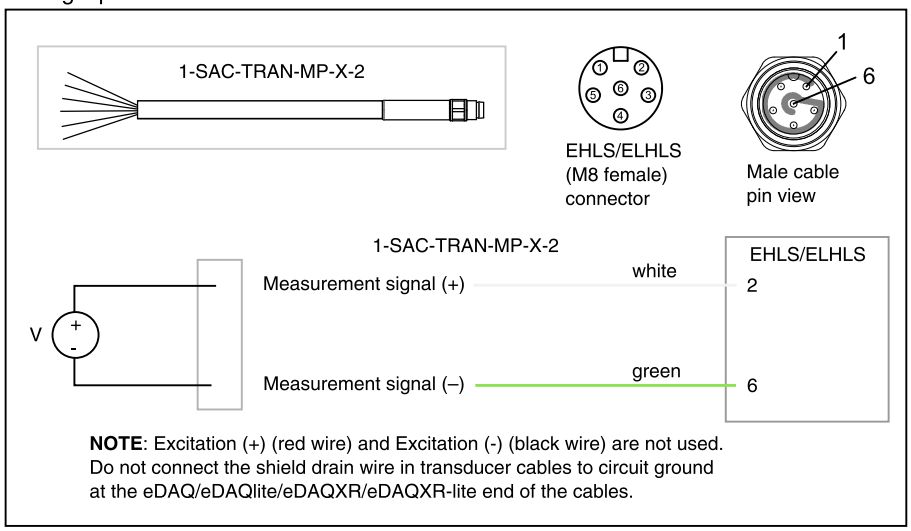
Order Number	Description
1-SMSTRB4-350-2	Strain SMART Module – 350 Ohm Completion In-line signal conditioning module for EHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 350 Ohm ¼ -bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-SMITC-2	Thermocouple SMART Module In-line signal conditioning module for EHLS Layers. Inputs: Isolated Thermocouple, 500 V Isolation, Software selectable J, K, T and E Thermocouple Calibrations. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length
1-SAC-TRAN-AO-2-2	Transducer Cable - Analog Out - 2 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

EHLS/EXRL-HLS Analog Input

Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire ELHLS/EXRL-HLS analog inputs.

NOTE
Do not use this wiring diagram for ELBRG/EXRL-BRG channels.

Analog input

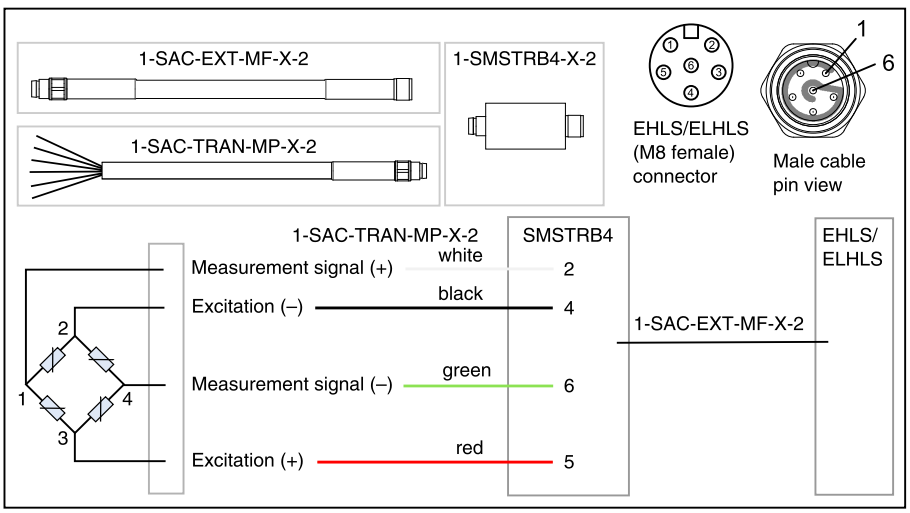


This diagram shows wiring for a standard analog input on an EHLS/EXRL-HLS layer.

SMSTRB4 (Strain SMART Module)

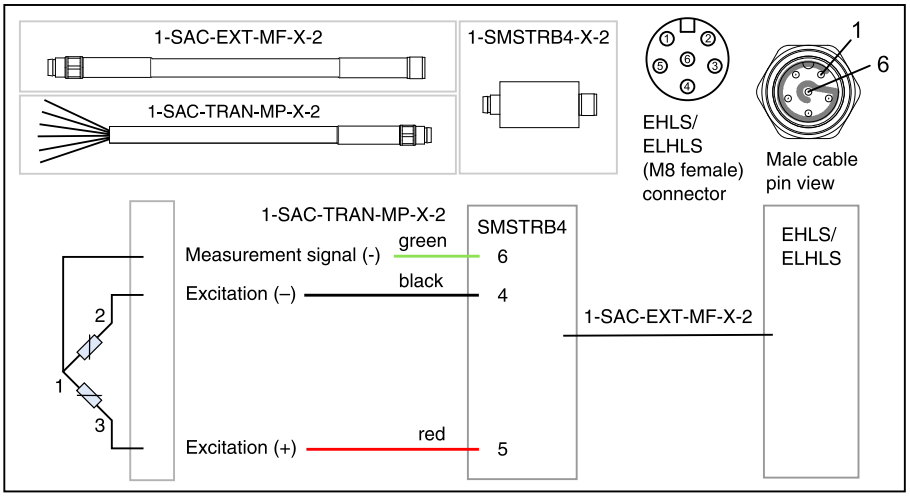
Use the Somat SAC-TRAN-MP Transducer Cable (1-SAC-TRAN-MP-2-2 or 1-SAC-TRAN-MP-10-2) to wire SMSTRB4 inputs. See Strain SMART modules for pin assignments on the SMSTRB4.

Full-bridge strain gage, four-wire configuration



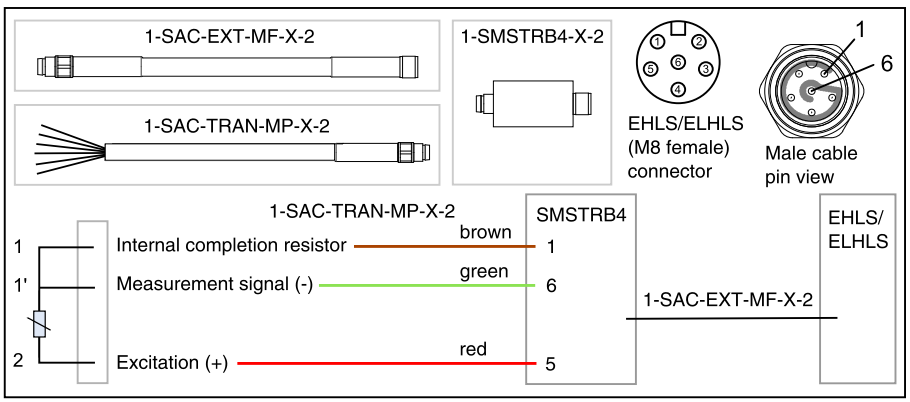
This diagram shows a full-bridge configuration using a Strain SMART Module.

Half-bridge strain gage, three-wire configuration



This diagram shows a half-bridge configuration using a Strain SMART Module.

Quarter-bridge strain gage, three-wire configuration



This diagram shows a quarter-bridge configuration using a Strain SMART Module.

4 ELNTB/EXRL-NTB layer

1-ELNTB-2 shown

1-EXRL-NTB-2 shown

The layer provides non-isolated thermocouple inputs in a bank of 16 channels. The layer supports the four (4) most common thermocouple types: J, K, T and E. The user-specified thermocouple type for each channel is independent of the other channels. The 16 channels of the bank share a common cold junction resulting in high channel-to-channel accuracy, which is particularly valuable when measuring thermal gradients.

Each channel uses a notched filter processor that generates about seven samples per second. Since these channels are not isolated from each other, they can only be used in applications where the individual thermocouples are electrically isolated from each other. A cold junction box is required for the bank and is connected to the layer with the cable provided (1-CBL-0007-00-2) using the connector labeled “A01-A16” on the front panel. Each thermocouple is connected to the miniature barrier strip type paired inputs in the junction box.

The non-isolated thermocouple layer (1-ELNTB-2 and 1-EXRL-NTB-2) measures temperatures on 16 channels of non-isolated thermocouple signal conditioning through a 37-pin high density D-sub connector. The layer is compatible with the four most common thermocouple calibration types: K, J, T and E. Each channel is independently software-selectable between these calibration types. Since the 16 channels share a common cold junction, the layer has excellent channel-to-channel accuracy. This is particularly useful when measuring thermal gradients. The layer requires an ECJTB Cold Junction Thermocouple Box (sold separately) for thermocouple termination.

The New-design ring (1-EXRL-NTB-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-ELNTB-2).

NOTE
Thermocouple leads should not exceed 30 meters in length from connector to tip.

The layer uses the industry standard software compensation algorithm to generate the temperature data samples. The layer first measures the cold-junction

compensation (CJC) temperature and converts it to the equivalent microvolt value using a high-resolution lookup table. The layer then subtracts the CJC equivalent microvolt value from the thermocouple's output microvolt value. The temperature is found using another high-resolution lookup table. The lookups are based on the ITS-90 Thermocouple Direct and Inverse Polynomials.

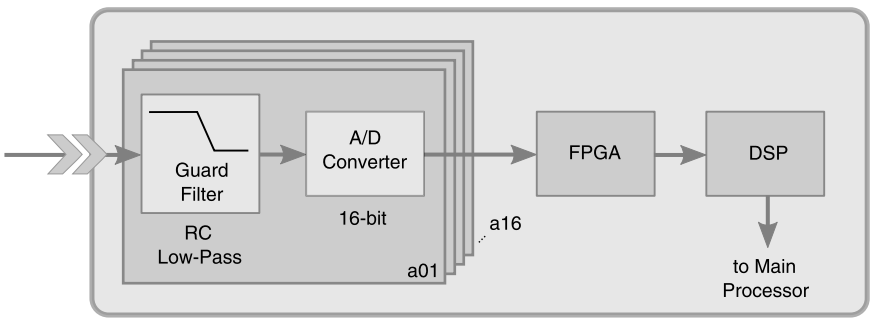
Application Note on Measuring Differential Temperatures

To measure differential temperatures using the layer, select two or more adjacent channels on the same bank. Use matched thermocouples for optimum differential accuracy.

Due to instrumentation noise, it is recommended that the maximum sample rate (e.g., 5 Hz for the 100 KHz MSR option) and a Smoothing Filter computed channel be used for each input channel. Using a five- or seven-tap Smoothing Filter typically reduces the instrumentation noise to below 0.2° C peak to peak (for all thermocouple types). Using more taps can further reduce the noise.

To generate the differential temperature, use a simple Signal Calculator computed channel. Use a Down Sampler computed channel to achieve the desired data storage rate.

Block diagram



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

Ordering options

Order number	Description
1-ELNTB-2	Non-Isolated Thermocouple Layer Inputs: 16-channels, Software selectable J, K, T and E Thermocouple Calibrations. Requires: Cold Junction Thermocouple Box (not included). Includes: (1) 1-CBL-0007-00-2 cable and (4) standoffs.
1-EXRL-NTB-2	Non-Isolated Thermocouple Layer Inputs: 16-channels, Software selectable J, K, T and E Thermocouple Calibrations. Requires: Cold Junction Thermocouple Box (not included). 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.

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	legacy 176 x 1117.6 x 17.6; new-design 152.25 x 107.5 x 18.6
Weight	kg	legacy 0.36; new-design 0.30
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Overall accuracy(1	°C	0.5
Maximum thermo-equilibrium temperature change rate(1	° C/min	2
Channel-to-channel thermocouple accuracy(2	°C	0.1
Input temperature range	-	-
K-type thermocouple	°C [°F]	-100 ... +1350 [-148 ... +2462]
J-type thermocouple	°C [°F]	-100 ... +760 [-148 ... +1400]
T-type thermocouple	°C [°F]	-100 ... +400 [-148 ... +752]
E-type thermocouple	°C [°F]	-270 ... +1000 [-454 ... +1832]
Typical thermocouple response time constant	-	-
30 AWG	seconds	0.3
12 AWG	seconds	6.0
10 AWG	seconds	9.0
Sample rate range	Hz	0.1 ... 5
Power consumption with thermocouples(3	W	0.66

(1 The overall accuracy specification is not valid if the maximum thermo-equilibrium temperature change rate is exceeded. Maximum accuracy is obtained when the ELNTB layer is calibrated at a steady-state operating temperature. Due to tolerance and temperature characteristics of the components, a change in temperature may cause an offset to the temperature measurement which may be eliminated by channel recalibration.

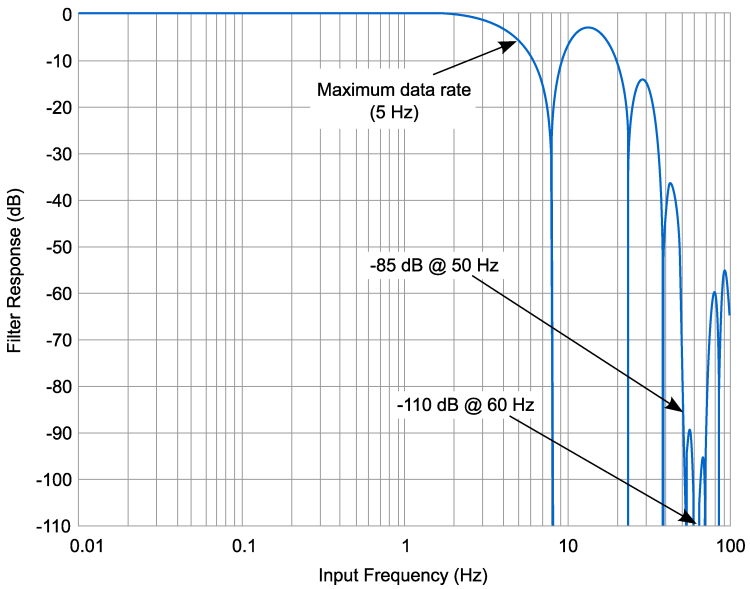
(2 Channel-to-channel thermocouple accuracy does not include inaccuracies in the thermocouples themselves.

(3 Power consumption measurements are taken with the stated load on all 16 channels and include the efficiency of the power supply.

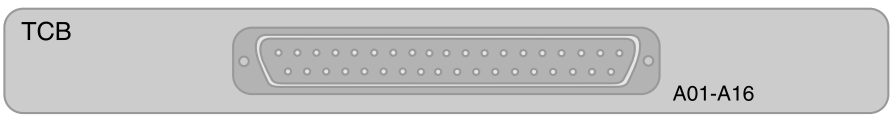
Standards

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

Input Filter Frequency Response



Input connector



This diagram shows the 37-pin D-Sub connector on an ELNTB/EXRL-NTB layer.

Application Note on Measuring Differential Temperatures

To measure differential temperatures using the layer, select two or more adjacent channels on the same bank. Use matched thermocouples for optimum differential accuracy.

Due to instrumentation noise, it is recommended that the maximum sample rate (e.g., 5 Hz for the 100 KHz MSR option) and a Smoothing Filter computed channel be used for each input channel. Using a five- or seven-tap Smoothing Filter typically reduces the instrumentation noise to below 0.2° C peak to peak (for all thermocouple types). Using more taps can further reduce the noise.

To generate the differential temperature, use a simple Signal Calculator computed channel. Use a Down Sampler computed channel to achieve the desired data storage rate.

Cables and accessories (sold separately)

Order number	Description
1-CBL-0007-00-2	Extension Cable - 2 Meters Length
1-ECJTB-2	Cold Junction Thermocouple Box, Compatible with J, K, T and E Calibrations
1-ECJTB-E-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type E Thermocouple Connectors.
1-ECJTB-K-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type K Thermocouple Connectors.
1-ECJTB-T-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type T Thermocouple Connectors.
1-ECJTB-J-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type J Thermocouple Connectors.

5 eDAQXR-lite compatible layer accessories

Order Number	Description	Compatible Layers
1-HDW-0034-00-2	M8 Hex Nut Wrench	ELDIO, ELBRG and ELHLS
1-EBB-AO-2	Breakout Box – Analog Output ELHLS and ELBRG Layers.	EHLS and EBRG
1-EPCM-2	Pulse Conditioning Module In-line signal conditioning module. Amplifies and isolates incoming pulse signals to TTL levels compatible with the EDIO layers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELDIO
1-EICP-B-2	IEPE-Type Conditioning Module – BNC Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELHLS
1-EICP-M-2	IEPE-Type Conditioning Module – Microdot Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELHLS
1-SMSTRB4-120-2	Strain SMART Module – 120 Ohm Completion In-line signal conditioning module for EHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 120 Ohm ¼-bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELHLS
1-SMSTRB4-350-2	Strain SMART Module – 350 Ohm Completion In-line signal conditioning module for EHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 350 Ohm ¼-bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELHLS
1-SMITC-2	Thermocouple SMART Module In-line signal conditioning module for EHLS Layers. Inputs: Isolated Thermocouple, 500 V Isolation, Software selectable J, K, T and E Thermocouple Calibrations. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).	ELHLS

Order Number	Description	Compatible Layers
1-ECJTB-2	Cold Junction Thermocouple Box, Compatible with J, K, T and E Calibrations	ELNTB
1-ECJTB-E-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type E Thermocouple Connectors.	ELNTB
1-ECJTB-K-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type K Thermocouple Connectors.	ELNTB
1-ECJTB-T-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type T Thermocouple Connectors.	ELNTB
1-ECJTB-J-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type J Thermocouple Connectors.	ELNTB
1-ECJTB-K-32-2	Cold Junction Thermocouple Box, Inputs: 32-channels, thermocouples are terminated using (32) miniature spade Type K Thermocouple Connectors.	ELNTB

Cables (sold separately)

Order Number	Description	Compatible Layers
1-CBL-0007-00-2	Extension Cable - ENTB Layer - 2 Meters Length	ELNTB
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-TRAN-AO-2-2	Transducer Cable - Analog Out - 2 Meters Length	ELHLS and ELBRG

Order Number	Description	Compatible Layers
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length	ELDIO, ELBRG and ELHLS
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length	ELDIO, ELBRG and ELHLS

GPS accessories

See the GPS modules topic in the eDAQXR-lite user manual for more information about supported GPS accessories for the EXRLCPU layer.

6 Strain SMART modules

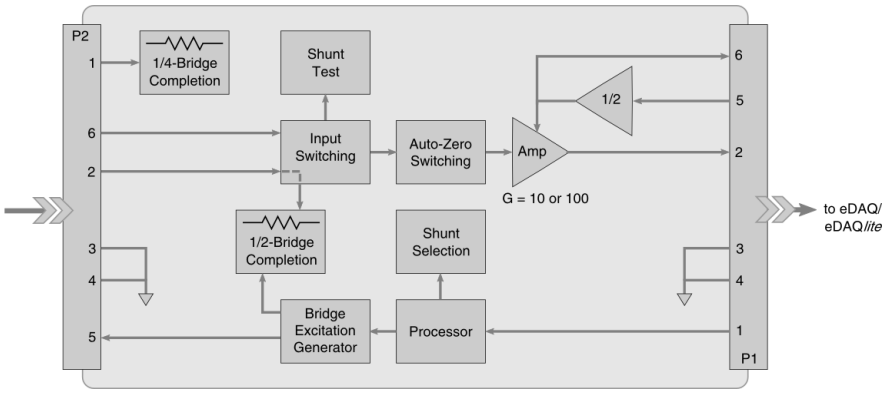
The SMSTRB Strain SMART modules condition signals for the ELHLS/EXRL-HLS layer. The SMSTRB provides excellent strain gage support with support for quarter-, half- and full-bridge configurations. As an external module, the SMSTRB is like taking a piece of the eDAQXR-lite hardware and placing it next to the application. A digital line communicates with the eDAQXR-lite for setup and calibration and the module conditions and amplifies the output to a high level signal. Sending a high level signal has several advantages, including the elimination of lead wire resistance and protection of the signal integrity from noise. These benefits are numerous across many applications from bridge monitoring with 50-meter leads over a structure to heavy equipment with long leads in a noisy environment. The SMSTRB also provides two shunt calibration resistors per channel with software selectable shunt direction for either upscale (-Sig to -Ex) or downscale (-Sig to +Ex) calibrations.

Additionally, as a SMART Module, the SMSTRB can be programmed to store transducer identification and calibration information. A hardware query automatically identifies the module and loads the channel and its calibration in the web interface. The module also contains a partition in its flash memory for storing pass-through information such as physical location or associated vehicle for the transducer. The external LED allows for easy module identification when queried from the software.

The SMSTRB module has male and female M8 connectors. Use of the module requires an Extension Cable (1-SAC-EXT-MF-x-2).

See ELHLS/EXRL-HLS layer for quarter-, half- and full-bridge strain gage configuration wiring diagrams for use of a SMSTRB module with an ELHLS/EXRL-HLS conditioning layer.

Block Diagram



NOTE

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

These strain SMART modules are available.

Order Number	Description
1-SMSTRB4-120-2	Strain SMART Module – 120 Ohm Completion In-line signal conditioning module for EHLS/ELHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 120 Ohm ¼ -bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x is different lengths in meters (0.4, 2, 5, 10, 15)).
1-SMSTRB4-350-2	Strain SMART Module – 350 Ohm Completion In-line signal conditioning module for EHLS/ELHLS Layers. Strain Gage Conditioning: Supports ¼, ½, and Full-bridge Strain Gage configurations. Integrated 350 Ohm ¼ -bridge completion resistor. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x is different lengths in meters (0.4, 2, 5, 10, 15)).

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	31.9 x 76.9 x 19.3
Weight	g	69.2
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Excitation voltage (V_{ex}) (1 <350-Ω bridge resistance ≥350-Ω bridge resistance initial accuracy ripple maximum change over temperature (3σ)	- V V % mV ppm/°C	- 5 5 or 10 0.05 < 1 15
Excitation current (I_{ex}) short circuit limiting short circuit duration (at 25 °C)	- mA s	- 46 5
Module power consumption 5-volt excitation 10-volt excitation	- W W	- I_{ex}*2.65[V]+0.234[W] I_{ex}*2.65[V]+0.144[W]
Quarter-bridge completion resistance resistance (specified at production) accuracy change over temperature (3σ)	- kΩ % ppm/°C	- 120 or 350 0.01 ±1
Half-bridge completion resistance internal resistance accuracy change over temperature (3σ)	- kΩ % ppm/°C	- 12.5 (50-kΩ split) 0.05 ±2
Shunt calibration resistance resistance accuracy maximum change over temperature (3σ)	- kΩ % ppm/°C	- 49.9 or 100 0.1 ±10
Amplifier gain gain, G initial accuracy (on calibration) typical drift over temperature maximum drift over temperature	- - % of full scale ppm/°C ppm/°C	- 10 or 100 ±0.1 -1 ±5
Maximum amplifier input voltage	V	33

Parameter	Unit	Value
Amplifier input current	-	-
range	nA	0.5 ... 1.5
typical input offset change over temperature (2	pA/°C	0.3
maximum input offset change over temperature (2	pA/°C	1.5
input protection resistance (in series)	kΩ	10
Amplifier input-referred voltage	-	-
typical offset (G=10)	µV	±50
maximum offset (G=10)	µV	±150
typical offset (G=100)	µV	±25
maximum offset (G=100)	µV	±50
typical drift over temperature (G=10) (3	µV/°C	±0.6
maximum drift over temperature (G=10) (3	µV/°C	±1.5
typical drift over temperature (G=100) (3	µV/°C	±0.1
maximum drift over temperature (G=100) (3	µV/°C	±0.6
Bandwidth	-	-
ultra-flat bandwidth	kHz	70
3-dB bandwidth (G=10)	kHz	800
3-dB bandwidth (G=100)	kHz	200
Output noise, N	-	-
G=10 (to 25 kHz)	µV	36.4
G=10 (with filter cutoff of *x* kHz) (4	µV	$36.4\ (x / 25)^{½}$
G=100 (to 25 kHz)	µV	333
G=100 (with filter cutoff of *x* kHz)(5	µV	$333\ (x / 25)^{½}$
Input referred noise	µV	N/G
Signal to noise ratio, SNR(6	-	$20_{log}(V_{in,max}$ / InputReferredNoise)
Common mode input range	-	-
minimum	V	Ground + 2.1
maximum (5-volt excitation)	V	6.6
maximum (10-volt excitation)	V	11.6
Maximum input signal range (7	-	-
5-volt excitation (G=10)	V	-0.24 ... 0.25
5-volt excitation (G=100)	V	-0.024 ... 0.025
10-volt excitation (G=10)	V	-0.49 ... 0.35
10-volt excitation (G=100)	V	-0.049 ... 0.035
Initial accuracy in conjunction with the ELHLS layer	%	0.1

(1 Excitation voltage can be set at zero volts.

(2 Use change over temperature to calculate the offset voltage over temperature to the EHLS layer. Offset voltage [V] = current change over temperature [pA/°C] x change in temperature [Δ°C] x input resistance [10 kΩ].

(3 The total input referred voltage drift is a combination of drift over temperature at the gain setting [µV/°C] and the drift

due to the input current change over temperature (discussed in (2).

(4 The filter can be either analog or digital and has a maximum cutoff frequency of 976 kHz. Note that when selecting the sampling rate, the cutoff frequency of the selected filter is one third of the sampling rate.

(5 The filter can be either analog or digital and has a maximum cutoff frequency of 244 kHz. Note that when selecting the sampling rate, the cutoff frequency of the selected filter is one third of the sampling rate.

(6 $V_{in,max}$ is set in the web interface when used with an EHLS layer.

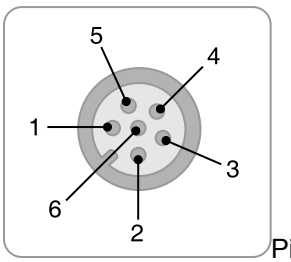
(7 The maximum input range is irrespective of the ELHLS gain settings and reflect the output saturation of the SMSTRB module or the input saturation of the ELHLS layer.

SMART module flash memory

All SMART modules (1-SMSTRB4-120-2, 1-SMSTRB4-350-2 and 1-SMITC-2) have three logical segments of flash memory. Two are reserved for factory use; one to store the microprocessor execution code and the other to store serial number and factory calibration parameters. The third area is the user data segment broken into two logical partitions.

1. The first partition holds device parameters that can completely configure the transducer channel setup when the SMART module is installed. If no information exists in this partition, the web interface sets up the transducer channel in a default mode when the module is added.
2. The second partition is designed for pass-through information not used by the web interface. Add any desired information such as physical locations of transducers or associated vehicle or system identifications. All pass-through keywords must start with the prefix “UI_” (“UI” followed by the underscore character).

Strain SMART module connector pin assignments



Pin diagrams are shown from the pin side of the cable connector.

Connector and Pin	Function
P1 (EHLS channel) 1	HLS Module I/O
P1 (EHLS channel) 2	+ Signal input
P1 (EHLS channel) 3	Shield to PCB ground
P1 (EHLS channel) 4	PCB ground
P1 (EHLS channel) 5	Power
P1 (EHLS channel) 6	- Signal input
P2 (Bridge) 1	Quarter-bridge completion resistor
P2 (Bridge) 2	+ Signal input
P2 (Bridge) 3	Open
P2 (Bridge) 4	- Excitation(1
P2 (Bridge) 5	+ Excitation
P2 (Bridge) 6	- Signal input

(1The negative excitation on pin 4 of the Bridge connector is the ground on pin 4 of the ELHLS channel connector.

Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-SAC-TRAN-MP-2-2	Transducer Cable - Male/Pigtail - 2 Meters Length
1-SAC-TRAN-MP-10-2	Transducer Cable - Male/Pigtail - 10 Meters Length
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

7 SMITC thermocouple SMART module

The SMITC Thermocouple SMART Module (1-SMITC-2) is a part of a family of signal conditioners for the EHLS/ELHLS/EXRL-HLS layers. The SMITC provides isolated thermocouple conditioning with software selectable linearization tables for J-, K-, T- and E-type calibrations. The module has universal cold-junction compensation and is fully isolated to 500 volts. Data can be configured to °C or °F.

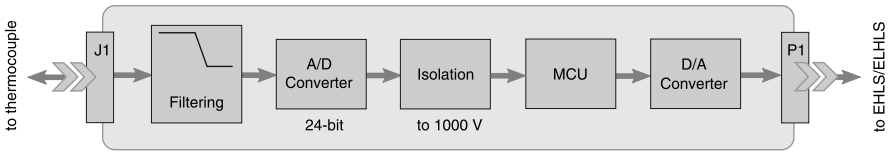
Additionally, as a SMART Module, the SMITC can be programmed to store transducer identification and calibration information. A hardware query automatically identifies the module and loads the channel and its calibration in the eDAQXR/eDAQXR-lite web interface. The module also contains a partition in its flash memory for storing pass-through information such as physical location or associated vehicle for the transducer. The external LED allows for easy module identification when queried from the software.

The SMITC module includes a male M8 connector and a universal miniature spade thermocouple connector. Use of the module requires an Extension Cable (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

This thermocouple SMART module is available.

Order Number	Description
1-SMITC-2	Thermocouple SMART Module In-line signal conditioning module for EHLS/ELHLS Layers. Inputs: Isolated Thermocouple, 500 V Isolation, Software selectable J, K, T and E Thermocouple Calibrations. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

Block Diagram



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

NOTE
The eDAQXR/eDAQXR-lite uses the full-scale min and max values defined in the EHLS/ELHLS parent channel to configure the converter that outputs analog voltage as a function of computed thermocouple temperature. To optimize the temperature measurement accuracy, set the full-scale values as close as possible to the temperature extremes expected in the test.

Thermocouple Type

Select the type of thermocouple as T, J, K or E. If the channel is calibrated, delete the calibration before selecting a different thermocouple type.

Hardware Configuration

In Test configuration Hardware view the SMART module user data parameters as they are defined in the hardware setup configuration. Parameters may not update reprogrammed SMART modules until a hardware query is performed.

SMART module flash memory

All SMART modules (1-SMSTRB4-120-2, 1-SMSTRB4-350-2 and 1-SMITC-2) have three logical segments of flash memory. Two are reserved for factory use; one to store the microprocessor execution code and the other to store serial number and factory calibration parameters. The third area is the user data segment broken into two logical partitions.

1. The first partition holds device parameters that can completely configure the transducer channel setup when the SMART module is installed. If no information exists in this partition, the web interface sets up the transducer channel in a default mode when the module is added.
2. The second partition is designed for pass-through information not used by the web interface. Add any desired information such as physical locations of transducers or associated vehicle or system identifications. All pass-through

keywords must start with the prefix “UI_” (“UI” followed by the underscore character).

Specifications

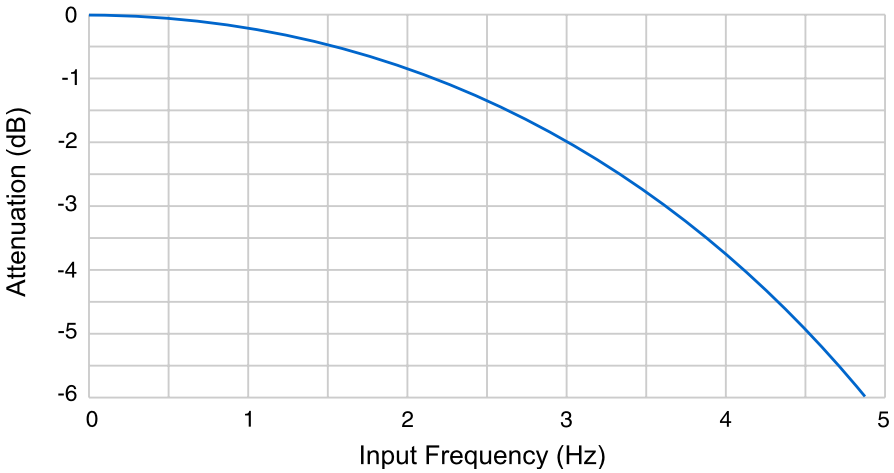
Parameter	Unit	Value
Dimensions: width x length x height	mm	32 x 80 x 19
Weight	g	68
Operating temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Storage temperature range	°C [°F]	-20 ... +125 [-4 ... +257]
Relative humidity range, non-condensing	%	0 ... 90
Input voltage	V	5.5 ... 7
Accuracy(1	°C	±1.0
Maximum thermo-equilibrium temperature change rate(1	°C/min	2
Isolation (at 1 minute)	V	500
Input temperature range K-type thermocouple J-type thermocouple T-type thermocouple E-type thermocouple	- °C [°F] °C [°F] °C [°F] °C [°F]	- -260 ... +1372 [-436 ... +2501.6] -200 ... +1200 [-328 ... +2192] -260 ... +400 [-436 ... +752] -260 ... +1000 [-436 ... +1832]
Typical thermocouple response time constant (in air) 30 AWG 12 AWG 10 AWG	- s s s	- 0.3 6.0 9.0
Output data rate	Hz	7.5
Filtering break frequency (3 dB point) analog filter (common model) digital filter	- Hz Hz	- 159 3.63
Notch filter attenuation 50 Hz notch 60 Hz notch	- dB dB	- 80 110
Power consumption with thermocouple	W	0.51
Input resistance (from thermocouple end to chassis ground)	MΩ	50

(1 The overall accuracy specification is not valid if the maximum thermo-equilibrium temperature change rate is exceeded.

Pin assignments

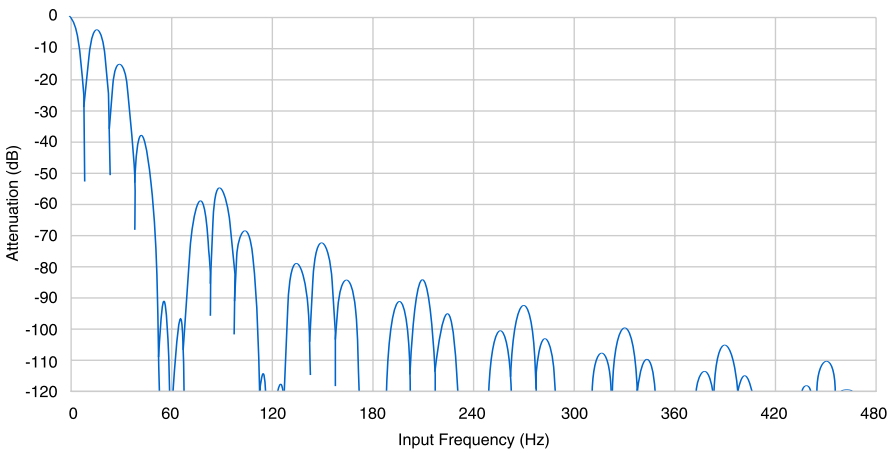
M8 Connector Pin	P1 (to EHLS/ELHLS channel) Function
1	EHLS/ELHLS Module I/O
2	+ Signal Input
3	Shield to PCB Ground
4	Ground
5	Power
6	- Signal Input

Digital filter attenuation



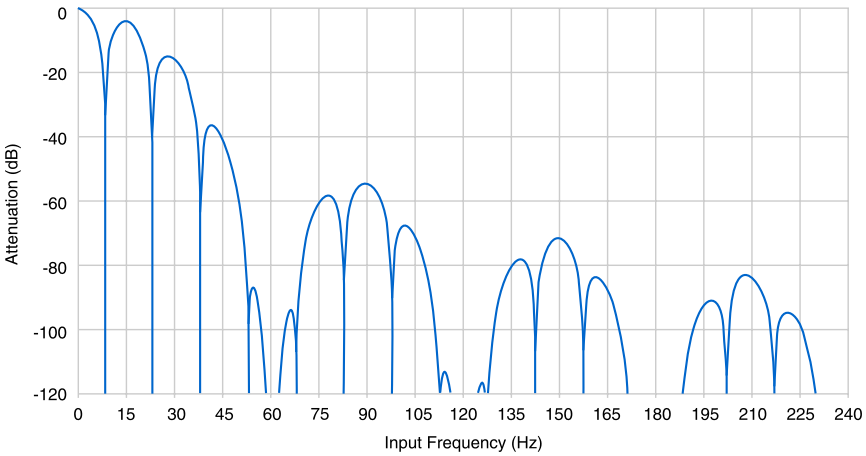
Digital Filter Primary Band Stop

The primary band stop is at multiples of 60 Hz, the notch frquency F_N.



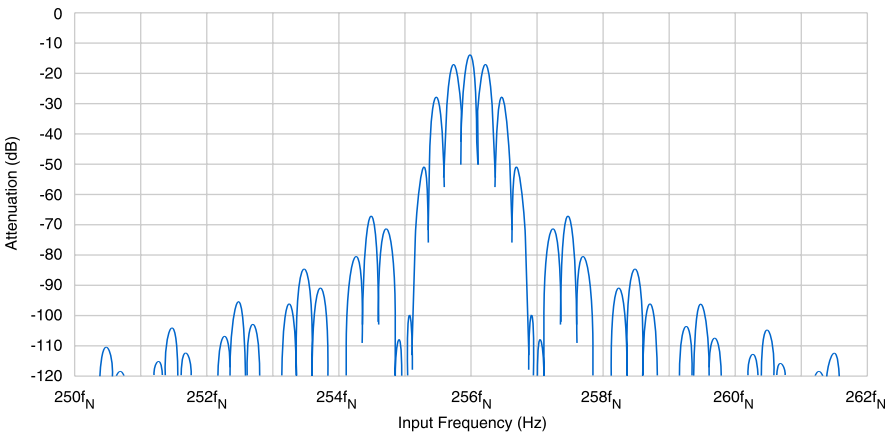
Digital filter secondary band stop

The secondary band stop to band peak is in 7.5-Hz intervals.



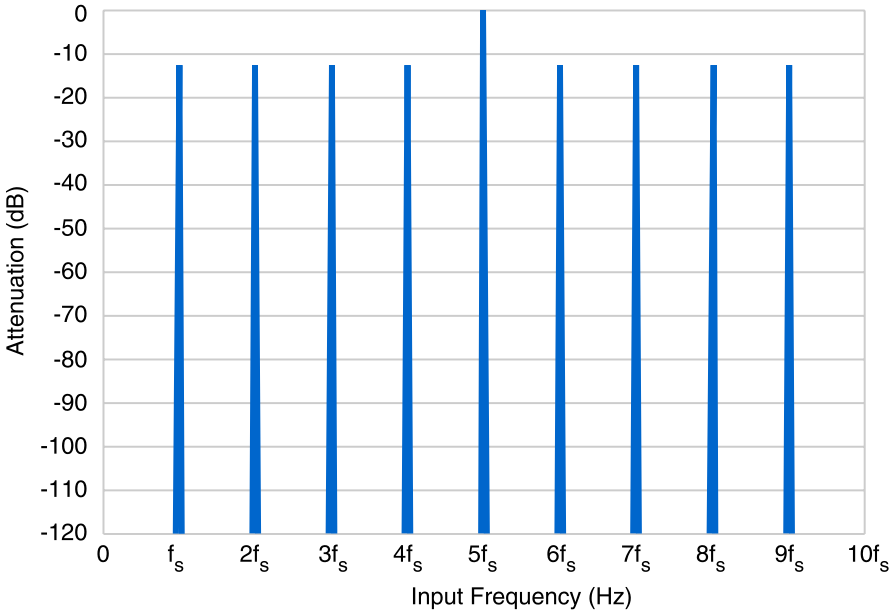
Digital Filter Modulator Sampling Frequency

The modulator sampling frequency F_s is at 15,360 Hz, which is $256F_N$ where F_N is the notch frequency 60 Hz.

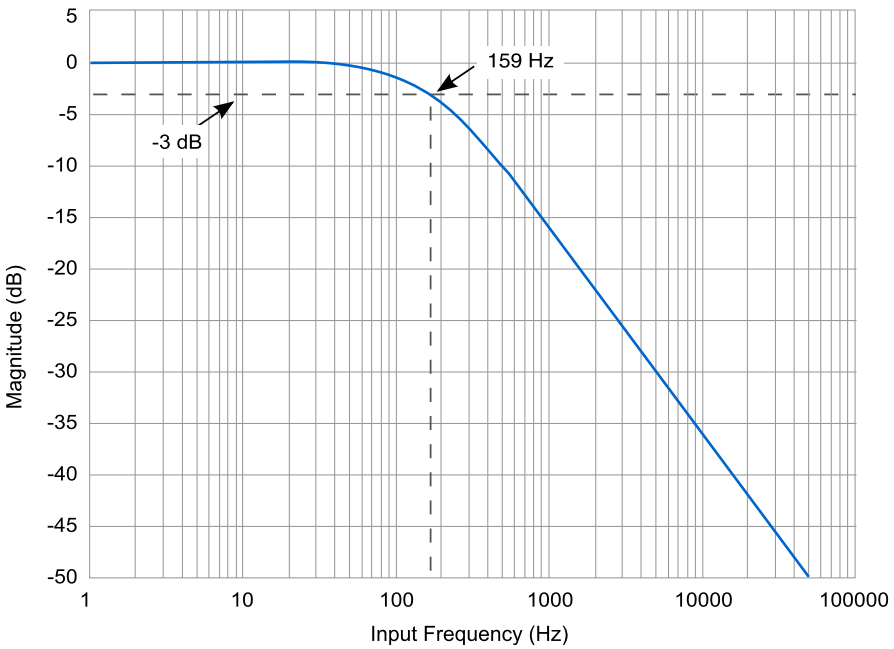


Digital Filter Multiples of Modulator Sampling Frequency

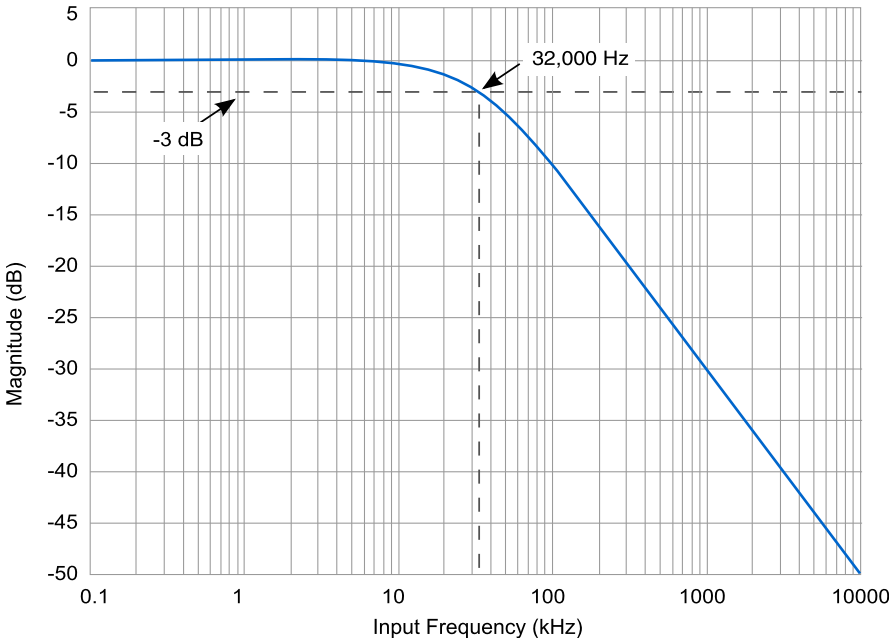
Note that there is zero attenuation at 78,000 Hz, which is $5F_s$ where F_s is the modulator sampling frequency.



Analog Input Filter (Common Mode)



Analog Input Filter (Differential Mode)



Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

8 IEPE-type conditioning module

Two IEPE-type conditioning modules support use of integrated electronics piezoelectric transducers with an ELHLS/EXRL-HLS layer. The module is available with either a BNC or microdot mating connector for compatibility with the two most popular types of ICP-type transducer cables.

Two modules are available.

Order Number	Description
1-EICP-B-2	IEPE-Type Conditioning Module – BNC Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).
1-EICP-M-2	IEPE-Type Conditioning Module – Microdot Connector In-line signal conditioning module for EHLS Layers. Inputs: IEPE (Integrated Electronics Piezoelectric) Transducers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	mm	8 x 66 x 6
Weight	g	90
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Relative humidity range, non-condensing	%	0 ... 90
Current source current initial tolerance change over temperature	- mA % ppm/°C	- 4 ±1.2 100
Input power (at 4 mA)	Vdc	15 ... 24
Linear gain	-	1
Load	MΩ	1
Specifications environmental	- -	- IP67

Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

9 Pulse conditioning module

The pulse isolation module is ideal for magnetic pickup type transducers. Simply, this conditioning module amplifies and isolates incoming pulse signals to TTL levels compatible with the ELDIO/EXRL-DIO layers. The module dynamically changes the threshold which determines the true and false state based on the incoming signal. This signal can range from ±200mV to ±100 Volts. Each module supports two pulse counter channels from a single ELDIO/EXRL-DIO connector. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

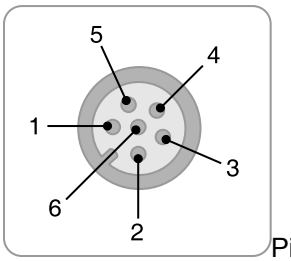
This module is available.

Order Number	Description
1-EPCM-2	Pulse Conditioning Module In-line signal conditioning module. Amplifies and isolates incoming pulse signals to TTL levels compatible with the EDIO layers. Requires: (1) 1-SAC-EXT-MF-x-2 Extension Cable (not included) (x notes different lengths in meters (0.4, 2, 5, 10, 15)).

Specifications

Parameter	Unit	Value
Dimensions: width x length x height	cm	6.03 x 11.11 x 3.49
Weight	g	140
Temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Available channels	-	-
Bit 1	-	Pulse counter conditioning
Bit 2	-	Input/output
Bit 3	-	Pulse counter conditioning
Bit 4	-	Input/output
Bit 5	-	Isolated power
Bit 6	-	Isolated power

Pin assignment



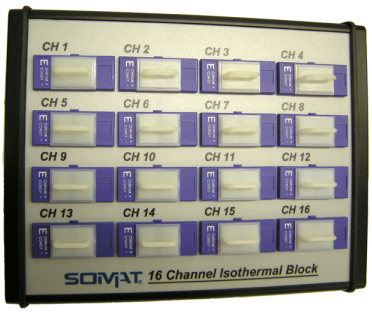
Pin diagrams are shown from the pin side of the cable connector.

M8 Connector Pin	P1 (to EHLS/ELHLS/EXRL-HLS channel) Function	Wire color
1	Channel 4, 8 or 12	Brown
2	Channel 3, 7 or 11	White
3	ISO GND (Shield)	Blue
4	Channel 1, 5 or 9	Black
5	ISO PWR, 12Vdc	Red
6	Channel 2, 6 or 10	Green

Cables and accessories (sold separately)

Order Number	Description
1-HDW-0034-00-2	M8 Hex Nut Wrench
1-SAC-EXT-MF-0.4-2	Extension Cable - Male/Female Connectors - 0.4 Meters Length
1-SAC-EXT-MF-2-2	Extension Cable - Male/Female Connectors - 2 Meters Length
1-SAC-EXT-MF-5-2	Extension Cable - Male/Female Connectors - 5 Meters Length
1-SAC-EXT-MF-10-2	Extension Cable - Male/Female Connectors - 10 Meters Length
1-SAC-EXT-MF-15-2	Extension Cable - Male/Female Connectors - 15 Meters Length

10 Cold junction thermocouple box



The Non-Isolated Thermocouple Layer measures temperatures on 16 channels of non-isolated thermocouple signal conditioning through a 37-pin high density D-sub connector. The ELNTB/EXRL-NTB conditioning layer requires a ECJTB Cold Junction Thermocouple Box for thermocouple termination. An extension cable (1-CBL-0007-00-2) is required to connect an ELNTB/EXRL-NTB layer to a cold junction thermocouple box.

These cold junction thermocouple boxes are available.

Order Number	Description
1-ECJTB-2	Cold Junction Thermocouple Box, Compatible with J, K, T and E Calibrations
1-ECJTB-E-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type E Thermocouple Connectors.
1-ECJTB-K-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type K Thermocouple Connectors.
1-ECJTB-T-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type T Thermocouple Connectors.
1-ECJTB-J-16-2	Cold Junction Thermocouple Box, Inputs: 16-channels, thermocouples are terminated using (16) universal (combination standard and miniature) Type J Thermocouple Connectors.

Cables and accessories (sold separately)

Order Number	Description
1-CBL-0007-00-2	Extension Cable - ENTB Layer - 2 Meters Length

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