

Robust signal conditioning frontend

- ▶ Portable data acquisition system
- ▶ Rugged industrial design
- ▶ 8 versatile analog input channels
- ▶ 4 counter, 2 CAN-FD interfaces
- ▶ Programmable sensor supply 2 to 24 V
- ▶ TEDS and MSI support
- ▶ 24-bit; 200 kS/s or 1 MS/s



System specifications

General specifications	
Synchronization	Via Ethernet; PTP/IEEE1588
Cooling	Passive; no fan
Isolation	Ethernet, USB and power supply are isolated from input channels
Channel-to-channel isolation	No
Data rate	40 MB/s
MTBF (MIL-HDBK-217 F, GB)	137,215 h
Dimensions (l x w x h)	242 x 120 x 43.3 mm (9.52 x 4.72 x 1.7 in)
Weight	1250 g (2.76 lbs)
Interfaces	
Ethernet	10/100/1000BASE-TX Gigabit Ethernet (2x)
– Ethernet topology	Dasychain; Star
– Ethernet connector	Industrial Ethernet M12 X-coded
– LAN configuration	DHCP or static IP
USB	USB 2.0; USB 3.0; USB-C
– USB connector	USB-C with screw terminals
Configuration	
Analog in	8 channels with: bridge excitation; sensor supply; TEDS/MSI support; 9-pin D-SUB female
Counter	4 encoder input at LEMO 1B 8 auxiliary counter for frequency measurement on DIO connector (37-pin D-SUB female)
Digital in	8 on DIO connector
Digital out	4 on DIO connector
CAN	2 CAN-FD; 9-pin D-SUB male
Environmental specifications	
Operating temperature	-20 °C to +70 °C
Humidity	10 % to 90 %, non condensing

Tab. 1: General specifications

Ingress protection class according to EN 60721-3-2:2018	IP67 (see IP rating on page 71)	
Vibration test EN 60068-2-6:2008	Shape	Sine
	Frequency range	10–150 Hz
	Acceleration	20 m/s ²
	Sweep rate	1 oct./min.
	Duration	20 cycles each axis (X, Y, Z)
Vibration test EN 60721-3-2:2018 Class 2M5	Shape	Random
	Total frequency range	10–2000 Hz
	Acceleration spectral density	1–20 Hz: 3 (m/s ²) ² /Hz
		500–2000 Hz: 1 (m/s ²) ² /Hz
	RMS value of acceleration	5.015 g
Duration	30 min per axis	
Shock test EN 60068-2-27:2009	Pulse shape	Half-sine
	Acceleration amplitude	30 g
	Duration of the pulse	11 ms
	Number of shocks	18 (3 shocks in two directions of x, y and z axis each)
Shock test EN 60068-2-27:2009	Pulse shape	Half-sine
	Acceleration amplitude	50 g
	Duration of the pulse	6 ms
	Number of shocks	18 (3 shocks in two directions of x, y and z axis each)














Tab. 1: General specifications

Power supply		
Power supply inlets		USB-PD, PoE, Lemo
Power buffer		0.5 s
Power consumption		Typ. 12 W without sensor supply; up to 20 W with sensor supply
LEMO	Connector	LEMO 1B
	Isolated power supply	10 to 32 V; buffered for 0.5 s in case of voltage drop
	Rated input voltage	DC (9 to 36 V _{DC})
USB-PD	Connector	USB-C Type “PD-IN”
	Standard	USB-PD 3.0
	Power supply requirements	USB-PD 3.0 compliant power supply with 12 V, 15 V or 20 V; at least 36 W
PoE	Supported standards	PoE Plus (802.3at-2009); PoE (802.3bt-2018)
	Power supply requirements	PoE Plus (802.3at-2009); PoE (802.3bt-2018) compliant with at least 24 W

Tab. 2: Power supply

Digital in	
Digital input	8 CMOS/TTL compatible digital inputs; weak pull-up via 100 kΩ
Overvoltage protection	±30 V, 50 V (for 100 ms)

Tab. 3: Digital in specifications

Input types		Input	Sensor excitation	Band-width	Accuracy	Sensor connection
Direct	 Voltage	100 mV to 100 V	2 to 24 V	DC to 250 kHz	±0.05 %	D-SUB-9
	 Bridge	1 mV/V to 100 mV/V full bridge; half bridge	1 to 10 V	DC to 130 kHz	±0.05 %	D-SUB-9
	 Counter	Event counting, waveform timing, encoder mode (X1, X2 and X4)	12 V	-	-	LEMO 1B
	 CAN	CAN 2.0B / CAN-FD	12 V	-	-	D-SUB-9
	 Digital in	TTL	12 V/5 V	-	-	D-SUB-37
MSI	 MSI2-250R-20mA	4 to 20 mA sensors	2 to 24 V	DC to 250 kHz	±0.1 %	Miniature spring terminals
	 MSI2-STG	Bridge-type sensors; full-bridge, half-bridge, quarter bridge 120 Ω and 350 Ω	5 V and 10 V	60 kHz	±0.1 %	Miniature spring terminals
	 MSI2-LVDT	LVDT and RVDT sensors, 5- or 6-wire connection	3 V at 2.5, 5 or 18 kHz	1 kHz	±0.1 %	Soldering pads
	 MSI-BR-ACC	IEPE® sensors, typ. accelerometer, microphone	4 mA	1.4 Hz to 250 kHz	±0.2 %	BNC
	 MSI2-CH-x	Charge type sensors up to 100 000 pC	n/a	0.08 Hz to 250 kHz	±0.5 %	BNC
	 MSI2-TH-x	Thermocouple sensors; Standard models for type K, J, T, others on request	n/a	DC to 250 kHz	±1 °C	Mini TC socket
	 MSI2-V-600	Voltage up to 600 VDC	n/a	DC to 60 kHz	±0.1 %	Banana sockets
	 MSI-BR-RTD	RTD sensors; Pt100, Pt200, Pt500, Pt1000, Pt2000; 2, 3 and 4 wire connection	1.25 mA	DC to 10 kHz	±0.1 %	Binder 712 series 5-pin socket

Tab. 4: Input specifications

Analog channel specification			
Input connector	8x 9-pin female D-SUB		
Rated input voltage	33 V _{RMS} , 46.7 V _{PEAK} , 70 V _{DC}		
Input range	100 mV to 100 V; freely programmable		
Sampling	200 kS/s, 24-bit (optional: 1 MS/s, 24-bit)		
Voltage input accuracy ¹⁾	≤10 V	DC to 1 kHz	±0.05 % of reading ±0.02 % of range ±50 μV
		>1 kHz to 10 kHz	±0.5 % of reading ±0.02 % of range ±50 μV
	≥10 V	DC to 1 kHz	±0.05 % of reading ±0.02 % of range ±50 μV
		>1 kHz to 10 kHz	±1 % of reading ±0.02 % of range ±50 μV
Gain drift	Typ. 20 ppm/°C; max. 40 ppm/°C		
Offset drift	Typ. 1 μV/°C + 10 ppm of range; max. 3.5 μV/°C + 20 ppm of range		

Tab. 5: Analog channel specifications

Analog channel specification																
Linearity	<50 ppm															
CMRR	Typ. CMRR at 10 V range: 90 dB @ 50 Hz; 90 dB @ 1kHz; 70 dB @ 10 kHz; 50 dB @ 100 kHz															
Crosstalk	Typ. better 110 dB															
Input noise	0 to 10 Hz			1.5 μV_{pp}												
	Noise density			19 nV/ $\sqrt{\text{Hz}}$												
Signal-to-noise ratio; spurious free SNR	100 mV range				1 V range				10 V range				100 V range			
Effective number of bits ²⁾ ; filter=auto	SNR	SFDR ³⁾	ENOB ⁴⁾	Noise	SNR	SFDR ³⁾	ENOB ⁴⁾	Noise	SNR	SFDR ³⁾	ENOB ⁴⁾	Noise	SNR	SFDR ³⁾	ENOB ⁴⁾	Noise
Sample rate	[dB]	[dB]	[Bit]	[mV _{pp}]	[dB]	[dB]	[Bit]	[mV _{pp}]	[dB]	[dB]	[Bit]	[mV _{pp}]	[dB]	[dB]	[Bit]	[mV _{pp}]
1 kS/s	105	125	17.1	0.0028	123	145	20.1	0.0035	129	150	21.2	0.016	126	144	20.6	0.24
10 kS/s	100	125	16.3	0.006	117	145	19.1	0.008	122	147	19.9	0.045	118	144	19.3	0.6
100 kS/s	92	125	15.0	0.015	109	145	17.8	0.021	112	147	18.3	0.16	109	144	17.8	2.4
200 kS/s	89	125	14.6	0.02	106	145	17.3	0.032	109	147	17.8	0.23	106	144	17.3	3.4
Filter = OFF	86	120	14.1	0.033	99	138	16.1	0.09	100	143	16.3	0.7	99	140	16.1	8.3
Input impedance	0 to 10 V range			200 M Ω												
	>10 to 100 V range			2 M Ω												
Input configuration	Differential															
Input coupling	DC															
Common mode voltage	<1 V range			$\pm 10 V_{DC}$												
	1 to 10 V range			$\pm 15 V_{DC}$												
	>10 to 100 V range			$\pm 100 V_{DC}$												
Overvoltage protection	0 to 10 V range			$\pm 50 V_{DC}$												
	>10 to 100 V range			$\pm 200 V_{DC}$												
Analog bandwidth	1 to 100 V range			250 kHz												
	100 mV range			130 kHz (bridge mode)												
Low pass filter (-3 dB, digital)	1 Hz to 40 % of sample rate; freely programmable or OFF															
	Characteristic			Bessel or Butterworth												
	Filter order			2 nd , 4 th , 6 th , 8 th												
	Filter setting AUTO			30 % of sample rate with 8 th order Bessel												

Tab. 5: Analog channel specifications

1) 1 year accuracy 23 °C \pm 5 °C

2) LP filter in auto mode

3) SFDR excluding harmonics

4) ENOB calculated from SNR

Bridge functions		
Supported bridge types	Full bridge	4 or 6 wire
	Half bridge	3 or 5 wire
	Quarter bridge	With optional MS12-STG 120 Ω and 350 Ω
Bridge resistance	5 V excitation	120 to 10 k Ω
	10 V excitation	300 to 10 k Ω
Autom. bridge balance	± 400 % of range	

Tab. 6: Bridge functions

Sensor excitation		
Bridge excitation	V bridge	1 to 10 V freely programmable; balanced around ground; remote sense support
	1 year accuracy	± 1 mV
	Drift	25 ppm/ $^{\circ}$ C
	Current limit	40 mA
	Protection	Continuous short to ground
	Load and line regulation error	± 0.002 % with sense lines connected
Sensor supply	V sensor	2 to 24 V freely programmable in 100 mV steps; referenced to GND
	Accuracy	± 3 %
	Limit	Max. 100 mA; max. 0.5 W
	Protection	Continuous short to ground
	Total sensor supply limit	All sensor supplies combined, including Counter and CAN bus sensor supply, must not exceed 5 W.

Tab. 7: Sensor excitation

CAN	
CAN bus	2x CAN bus at male 9-pin D-SUB
CAN specification	CAN 2.0B; CAN FD 1.0
CAN physical layer	High-speed
Bus pin fault protection	± 36 V
Termination	Programmable: high impedance or 120 Ω

Tab. 8: CAN specifications

Counter		
4x full featured counter	Connector	4x LEMO connector female, EGG.1B.307.CLL
	Input signal	8 CMOS/TTL compatible digital inputs; weak pullup via 100 k Ω
	Sensor supply	12V ± 5 % 100 mA
	Modes	Event counting; gated event counting; up/down counting; frequency; dutycycle; edge seperation; encoder (x1, x2, x4)
	Filter	0.1 to 100 μ s
8x basic counter	Connector	Shared with Digital IN on 37-pin D-SUB
	Modes	Event counting; Frequency;
	Filter	0.1 to 100 μ s

Tab. 9: Counter specifications

Connections and ports

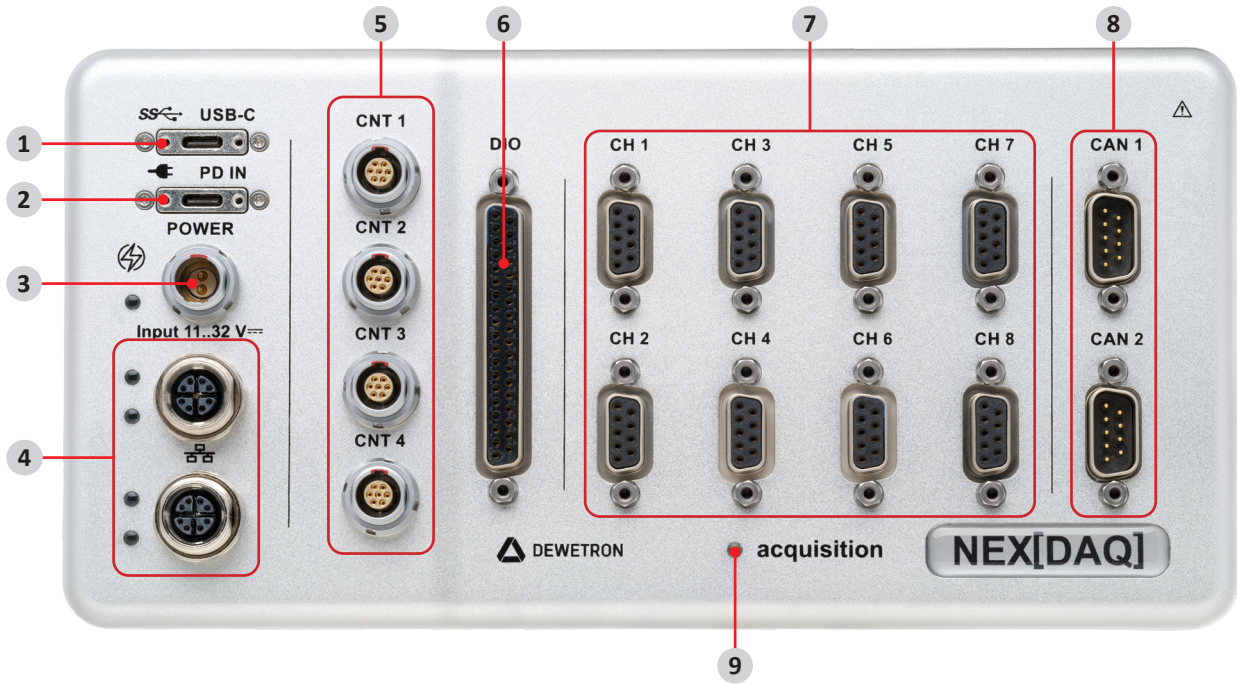


Fig. 3: NEX[DAQ] connectors and ports

- | | |
|--------------------------------|------------------------------------|
| 1. USB-C data | 6. DIO |
| 2. USB-C PD IN | 7. Channels 1–8 |
| 3. Power | 8. CAN 1–2 |
| 4. Ethernet | 9. Acquisition LED |
| 5. Counter 1–4 | |

USB-C data

USB-C specifications		
	Connector type:	USB-C
	Function:	Data transfer

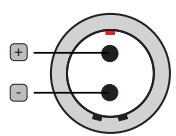
Tab. 10: USB-C specifications

USB-C PD IN

PD IN specifications		
	Connector type:	USB-C
	Function:	Power in

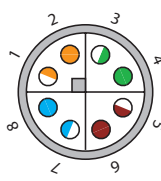
Tab. 11: PD IN specifications

Power

POWER specifications		
	Input <ul style="list-style-type: none"> - Rated input voltage - Input frequency - Power - Connector 	11...32 V _{DC} (max. 10...36 V _{DC}) DC 210 W 2-pin male LEMO HMJ.1B.302
	LED <ul style="list-style-type: none"> - Off - Green 	Power off Power on; independent from power source

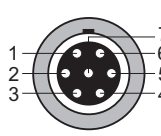
Tab. 12: POWER specifications

Ethernet

Ethernet specifications										
	Connector type:	8-pin female M12 x-coded								
	Pin assignment	<table border="0"> <tr> <td>1. DA+</td> <td>5. DD+</td> </tr> <tr> <td>2. DA-</td> <td>6. DD-</td> </tr> <tr> <td>3. DB+</td> <td>7. DC-</td> </tr> <tr> <td>4. DB-</td> <td>8. DC+</td> </tr> </table>	1. DA+	5. DD+	2. DA-	6. DD-	3. DB+	7. DC-	4. DB-	8. DC+
	1. DA+	5. DD+								
2. DA-	6. DD-									
3. DB+	7. DC-									
4. DB-	8. DC+									
LEDs <ul style="list-style-type: none"> - t.b.d. 										

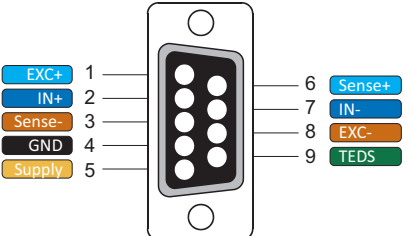
Tab. 13: Ethernet specifications

Counter 1-4

Counter specifications									
	Connector type:	7-pin female LEMO HEG.1B.307							
	Pin assignment:	<table border="0"> <tr> <td>1. Input A</td> <td>5. +5 V out</td> </tr> <tr> <td>2. Input B</td> <td>6. +12 V out</td> </tr> <tr> <td>3. Input Z</td> <td>7. GND signal</td> </tr> <tr> <td>4. GND power</td> <td></td> </tr> </table>	1. Input A	5. +5 V out	2. Input B	6. +12 V out	3. Input Z	7. GND signal	4. GND power
1. Input A	5. +5 V out								
2. Input B	6. +12 V out								
3. Input Z	7. GND signal								
4. GND power									

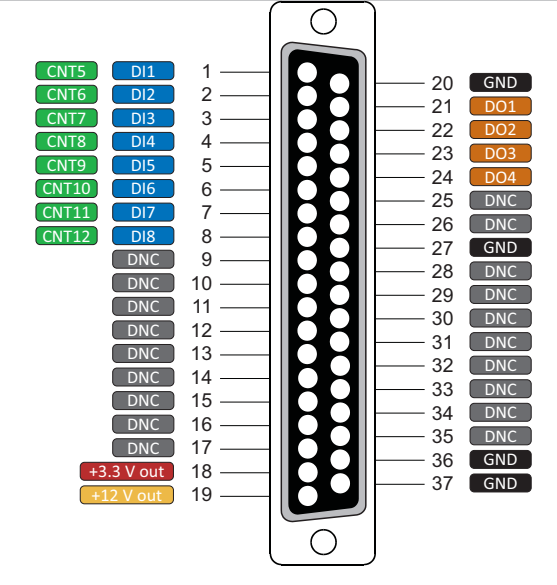
Tab. 14: Counter specifications

Channels 1-8

Channel specifications		Connector type:	9-pin female D-SUB	
	Connector type:	Pin assignment:		

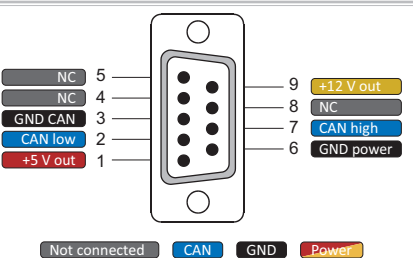
Tab. 15: Channel specifications

DIO

DIO specifications		Connector type:	37-pin female D-SUB		
	Connector type:	Pin assignment:			
					Pin assignment:

Tab. 16: DIO specifications

CAN 1-2

CAN specifications		Connector type:	9-pin male D-SUB	
	Connector type:	Pin assignment:		

Tab. 17: CAN specifications

Acquisition LED

The following table gives an overview of the different types of LED lighting.

Color	Description	Comment
Static green	Ready	-
Fading green	Preparing acquisition and network interface	During firmware updating process
Flashing green	Recording	-
Fading orange	Booting	-

Tab. 18: Acquisition LED