

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	Daisychain; 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	Bandwidth	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				$\pm 10 V_{\text{DC}}$											
	1 to 10 V range				$\pm 15 V_{\text{DC}}$											
	>10 to 100 V range				$\pm 100 V_{\text{DC}}$											
Overvoltage protection	0 to 10 V range				$\pm 50 V_{\text{DC}}$											
	>10 to 100 V range				$\pm 200 V_{\text{DC}}$											
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

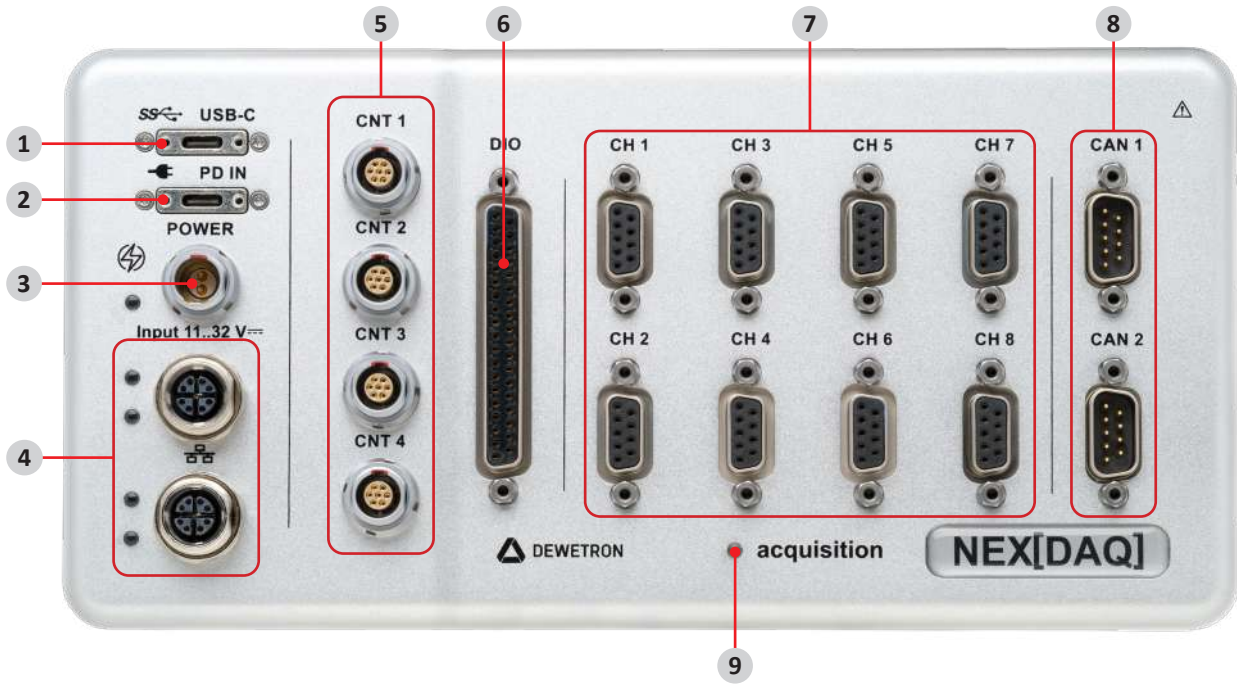


Fig. 3: NEX[DAQ] connectors and ports

- | | |
|--------------------------------|------------------------------------|
| 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

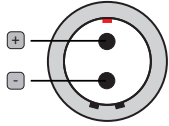
Tab. 10: USB-C specifications

USB-C PD IN

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

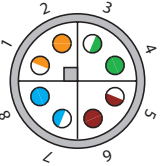
Tab. 11: PD IN specifications

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

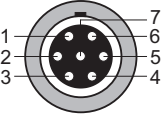
Tab. 12: POWER specifications

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. 										

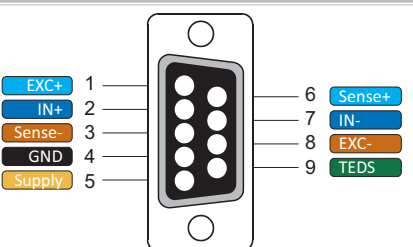
Tab. 13: Ethernet specifications

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									

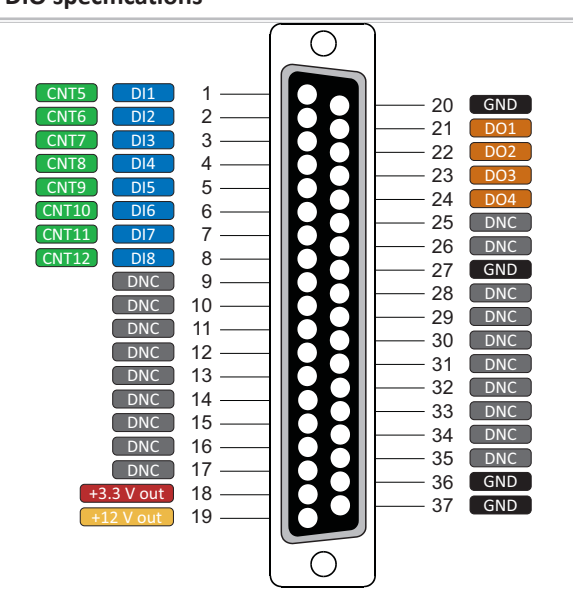
Tab. 14: Counter specifications

Channels 1-8

Channel specifications		Connector type:	9-pin female D-SUB	
	Connector type:	9-pin female D-SUB		
		Pin assignment:	1. +EXC 2. +IN 3. -Sense 4. GND 5. Supply	6. +Sense 7. -IN 8. -EXC 9. TEDS

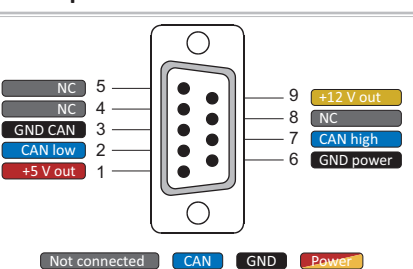
Tab. 15: Channel specifications

DIO

DIO specifications		Connector type:	37-pin female D-SUB		
	Connector type:	37-pin female D-SUB			
		Pin assignment:	1. DI1/CNT5 2. DI2/CNT6 3. DI3/CNT7 4. DI4/CNT8 5. DI5/CNT9 6. DI6/CNT10 7. DI7/CNT11 8. DI8/CNT12 9. DNC 10. DNC 11. DNC 12. DNC 13. DNC 14. DNC 15. DNC 16. DNC 17. DNC 18. +3.3 V out 19. +12 V out 20. GND 21. DO1 22. DO2 23. DO3 24. DO4 25. DNC 26. DNC 27. GND 28. DNC 29. DNC 30. DNC 31. DNC 32. DNC 33. DNC 34. DNC 35. DNC 36. GND 37. GND	14. DNC 15. DNC 16. DNC 17. DNC 18. +3.3 V out 19. +12 V out 20. GND 21. DO1 22. DO2 23. DO3 24. DO4 25. DNC 26. DNC	27. GND 28. DNC 29. DNC 30. DNC 31. DNC 32. DNC 33. DNC 34. DNC 35. DNC 36. GND 37. GND

Tab. 16: DIO specifications

CAN 1-2

CAN specifications		Connector type:	9-pin male D-SUB	
	Connector type:	9-pin male D-SUB		
		Pin assignment:	1. +5 V out 2. CAN low 3. GND CAN 4. NC 5. NC	6. GND power 7. CAN high 8. NC 9. +12 V out

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