

TECHNICAL REFERENCE MANUAL

KRYPTON V26-1



4. System overview

KRYPTON®

Rugged and distributed EtherCAT data acquisition system for field measurement in extreme and harsh environments. KRYPTON DAQ systems offer IP67 degree of protection and can operate in the extreme temperature range from -40 °C to +85 °C and offer high shock protection.



Voltage



Strain / Stress



Quarter Bridge



Half Bridge



Full Bridge



Thermocouple



Digital IO



IEPE



Charge



Current



Shock rating



RTD



Resistance



DSI
Compatible



TEDS
Compatible



EtherCAT



IP67



-10 °C to +50 °C

4.1. Main features

DISTRIBUTED DAQ: KRYPTON DAQ modules were designed for distributed measurements to bring data acquisition closer to sensors. This introduces many advantages as opposed to traditional DAQ systems. KRYPTON allows distributing DAQ units down to a single channel.

ETHERCAT DAQ: EtherCAT protocol with 100 Mbit/s bus speed is used for data transmission, data synchronization, and power supply. KRYPTONs are connected with a single cable for data, power, and sync.

UP TO 100m BETWEEN UNITS: KRYPTON units can be distributed over the large area with the distances up to 100 meters between DAQ nodes.

RUGGED IP67: All KRYPTON modules are rugged with the IP67 degree of protection and ready for testing in extreme weather and harsh environments.

1, 3, 4, 6, 8 and 16 CHANNEL UNITS: KRYPTON DAQ modules are available in various configurations spanning from tiny single channel units up to bigger 16-channel units. Instruments can be distributed down to the single channel.

UP TO 40 kHz/CH SAMPLING RATE: Most KRYPTON ONE channel units can achieve in the EtherCAT line sampling rate up to 40 kS/s. Most KRYPTON MULTICHANNEL units can achieve in the EtherCAT line sampling rate up to 20 kS/s.

UNIVERSAL ANALOG INPUTS: Universal analog inputs are available that can accept voltage and full/half/quarter bridge signals natively as well as IEPE, charge, thermocouples, RTD, current, resistance and LVDT signals with the use of DSI adapters.

SOFTWARE INCLUDED WITH FREE LIFETIME UPGRADES: Easy to use, yet very robust in functionality, award-winning DewesoftX® software is included. The software comes with lifetime free upgrades and no hidden costs, bringing you intuitive configuration, smart sensors, advanced storage and analysis capabilities.

4.1.1. EtherCAT Distributed DATA Acquisition

KRYPTON data acquisition systems are using 100 Mbit/s datalink based on EtherCAT protocol technology. Fast data bus allows many of the KRYPTON units to be daisy-chained together in the single measurement chain. At the end of the chain, RJ45 cable is used to plug into the Ethernet port of your PC computer or special, more rugged 8-pin LEMO connector to connect to our robust, powerful computers like KRYPTON CPU, SBOX, R2DB, R4 or R8.

EtherCAT brings another big advantage - zero configuration. KRYPTON devices do not require any complex IP setup. Simply connect them together into a PC and DewesoftX® software will recognize and set up devices automatically.

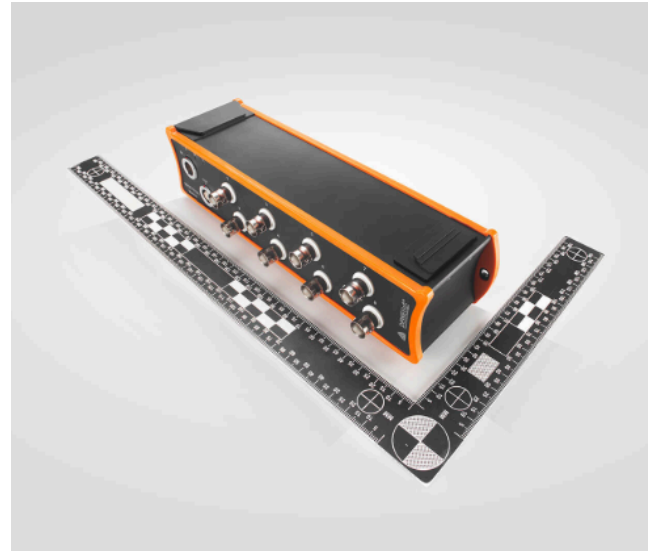
There is the single cable required for data, power, and synchronization which can run up to 100 meters (328 feet) from module to module connecting amplifiers together.

4.1.2. Small and Flexible Data Acquisition

KRYPTON data acquisition modules are designed to be small, rugged and modular especially made perfect for field measurements in any environment. The small size of KRYPTON modules allows them to fit perfectly in tight places and can be placed very near the sensors.

Traditional data acquisition systems are big boxes with many input channels, which means long and expensive sensor cabling is needed in order to perform data acquisition.

KRYPTON takes the opposite approach. We kept the same advantages of other Dewesoft DAQ devices like plug and play and sensor auto-detection), but with KRYPTON we are bringing data acquisition systems closer to the origin of data - near the sensors. This greatly reduces the **cost of the sensor cabling**, chances of wiring errors and greatly **improves the signal quality**.



KRYPTON-8xACC

4.1.3. Robust and rugged Data Acquisition

KRYPTON DAQ modules are extremely robust. We machine each one out of aluminium bricks and install industrial-grade electronics. Units are then sealed with thermally conductive and electrically insulative rubber. As a final touch, we add rubber bands around the KRYPTON chassis to further protect the unit from the shocks. The result is an **IP67 degree of protection**. Units are waterproof, shockproof, and can withstand **shocks up to 100g**.

KRYPTON can operate in extremely harsh environments and is rated to work in a temperature span from **-40°C to +85 °C**.

Extensive testing in our laboratories ensures bulletproof quality and worry-free testing under extreme conditions.

5.3. CURRENT MEASUREMENT

KRYPTON LA modules are rugged isolated DAQ devices for low amperage measurements. Currently, KRYPTONi-8xLA is available.

5.3.1. KRYPTONi-8xLA

KRYPTONi-8xLA has 8 BNC input connectors for current measurement.



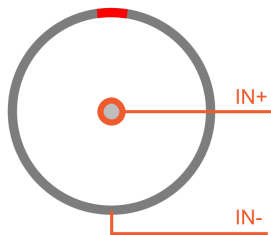
KRYPTONi-8xLA

5.3.1.1. KRYPTONi-8xLA: Specifications

Analog input	KRYPTONi-8xLA
Input type	Isolated current
Number of channels	8
ADC Type	24-bit oversampled SAR with 41 kHz anti-aliasing filter
Sampling Rates	Simultaneous 20k, 10k, 5k, 2k, 1k, 500, 200, 100 S/s (software-selectable)
Current Range	±20 mA
Accuracy	±0.02 % of reading ±8 µA
Typical noise floor @ 10 kS/s	-95 dB
Crosstalk (20 kS/s, -1 dBFS @ 1 kHz)	-124 dB
Gain Drift	Typical 10 ppm/K, max. 20 ppm/K
Offset Drift	Typical 100 nA/K, max. 200 nA/K
Gain Linearity	< 0.01 %
Input Coupling	DC
Input Impedance	50 Ω
Noise	0.3 µARMS
Overvoltage Protection	50 V
Analog input performance	
Bandwidth (-3 dB)	0.49 fs
Alias-free Bandwidth	DC to 0.453 fs
Alias Rejection	-100 dB (all sample rates)

Delay Through ADC	37 / fs
Oversampling	32
Additional Specifications	
Input Connector	BNC
Isolation Voltage	1000 V _{peak} channel/ground & channel/channel
Power	
Power Supply	9 - 48 V DC
Power Consumption	6.8 W
Environmental	
IP Rating (see 1)	IP67
Physical	
Weight	1000 g
Slice Dimensions	213 x 54 x 56 mm
Dimensions with Connectors	213 x 54 x 66.8 mm
1) Depending on the mating connector types	

5.3.1.2. KRYPTONi-8xLA: BNC Connector: Pinout



BNC connector: pinout (BNC)

Pin	Name	Description
1	In+	Input +
2	In-	Input -

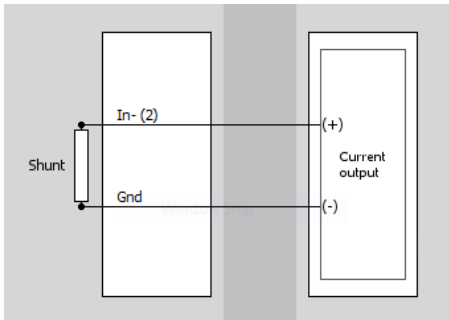


Note

KRYPTONi-8xLA has a single-ended input where IN- (Analog input -) represents isolated ground.

5.3.1.3. KRYPTONi-8xLA: Wiring diagrams

Current



5.4. STRAIN AND STRESS MEASUREMENT

KRYPTON STG modules have universal differential voltage and Full / Half / Quarter bridge input. STG modules are available in 1, 3 and 6 channel configurations and are compatible with DSI adapters:

- KRYPTON-3xSTG, KRYPTON-3xSTG-L2B10f,
- KRYPTON-6xSTG, KRYPTON-6xSTG-L2B10f, KRYPTON-6xSTG-L1T7f
- KRYPTONi-1xSTG.

5.4.1. KRYPTON-3xSTG, 6xSTG

KRYPTON-6xSTG module has 6 DSUB-9 female connectors for voltage or strain measurement.



KRYPTON-6xSTG

KRYPTON-3xSTG module has 3 DSUB-9 female connectors for voltage or strain measurement.



KRYPTON-3xSTG

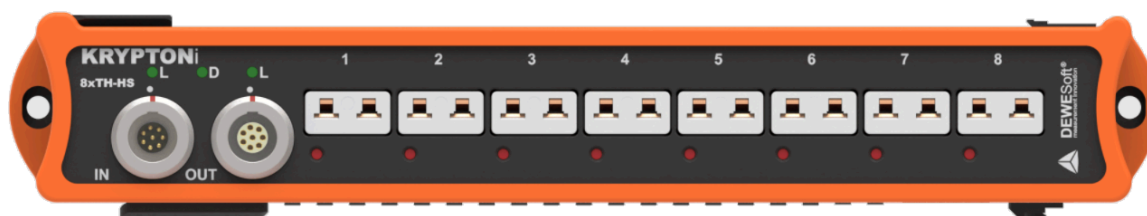
KRYPTON-6xSTG-L2B10f module has 6 LEMO L2B10f connectors for voltage or strain measurement.



KRYPTON-6xSTG-L2B10f

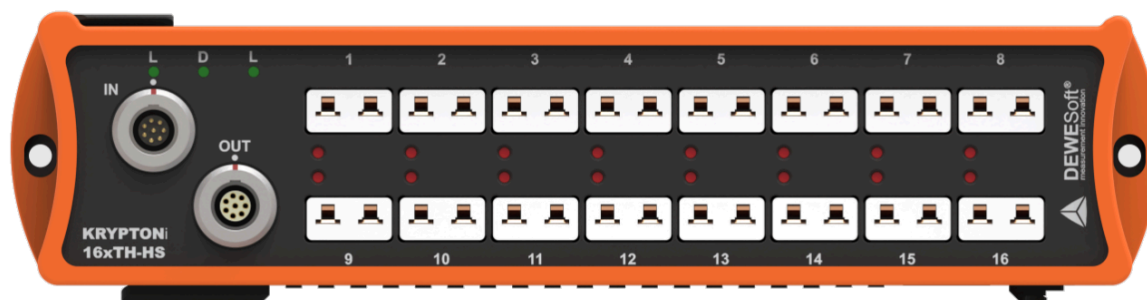
5.5.4. KRYPTONi-8xTH-HS, KRYPTONi-16xTH-HS

KRYPTONi-8xTH-HS module has 8 thermocouple-connectors for temperature measurement.



KRYPTONi-8xTH-HS

KRYPTONi-16xTH-HS module has 16 thermocouple-connectors for temperature measurement.



KRYPTONi-16xTH-HS

5.5.4.1. KRYPTONi-8xTH-HS, KRYPTONi-16xTH-HS: Specifications

Analog inputs		KRYPTONi-8xTH-HS	
Input type	Isolated universal thermocouple and voltage		
Number of channels	8		
ADC Type	24-bit delta-sigma		
Sampling rates	Simultaneous 10, 20, 40, 50, 80, 100, 200, 500, 1k, 2k, 5k, 10k S/s (optional)		
Voltage Mode			
Ranges	±1 V		±100 mV
Input Accuracy	±0.02 % of reading ±50 µV		±0.02 % of reading ±7 µV
Typical Noise Floor @ 10 / 100 / 1k / 10k S/s	-130 dB / -120 dB / -110 dB / -104 dB		-120 dB / -110 dB / -100 dB / -90 dB
Offset Drift	Typ. 0.05 µV/K (Max. 0.2 µV/K)		Typ. 0.01 µV/K (Max. 0.1 µV/K)
Gain Drift	Typ. 2 ppm/K (Max. 10 ppm/K)		
Gain Linearity	< 0.007 %		
Input Coupling	DC		
Input Impedance	100 MΩ		
Thermocouple			
Input type	TC Types: K, J, T, R, S, N , E, C, B		
Accuracy	±0.02 % of reading ±0.5 °C ±7 µV		

Typical Noise	0.002 °C RMS @ Type K @ 10 S/s 0.006 °C RMS @ Type K @ 100 S/s 0.02 °C RMS @ Type K @ 1 kS/s 0.05 °C RMS @ Type K @ 10 kS/s
Additional Specifications	
Input connector	Mini Thermocouple connector (copper)
Isolation voltage	1000 V _{peak} channel/ground & channel/channel
Power	
Power Supply	9 - 48 V DC
Power consumption	Typ. 2.6 W (Max. 3 W)
Environmental	
IP rating	IP67
Physical	
Weight	750 g
Dimensions	213 x 39 x 56 mm

Analog inputs		KRYPTONi-16xTH-HS	
Input type			
Number of channels	16		
ADC Type	24-bit delta-sigma		
Sampling rates	Simultaneous 10, 20, 40, 50, 80, 100, 200, 500, 1k, 2k, 5k, 10k S/s (optional)		
Voltage Mode			
Ranges	±1 V	±100 mV	
Input Accuracy	±0.02 % of reading ±50 µV	±0.02 % of reading ±7 µV	
Typical Noise Floor @ 10 / 100 / 1k / 10k S/s	-130 dB / -120 dB / -110 dB / -104 dB	-120 dB / -110 dB / -100 dB / -90 dB	
Offset Drift	Typ. 0.05 µV/K (Max. 0.2 µV/K)	Typ. 0.01 µV/K (Max. 0.1 µV/K)	
Gain Drift	Typ. 2 ppm/K (Max. 10 ppm/K)		
Gain Linearity	< 0.007 %		
Input Coupling	DC		
Input Impedance	100 MΩ		
Thermocouple			
Input type	TC Types: K, J, T, R, S, N , E, C, B		
Accuracy	±0.02 % of reading ±0.5 °C ±7 µV		
Typical Noise	0.002 °C RMS @ Type K @ 10 S/s		
	0.006 °C RMS @ Type K @ 100 S/s		
	0.02 °C RMS @ Type K @ 1 kS/s		
	0.05 °C RMS @ Type K @ 10 kS/s		
Additional Specifications			
Input connector	Mini Thermocouple connector (copper)		
Isolation voltage	1000 Vpeak channel/ground & channel/channel		

Power	
Power Supply	9 - 48 V DC
Power consumption	Typ. 4.3 W (Max. 5 W)
Environmental	
IP rating	IP67
Physical	
Weight	1060 g
Dimensions	213 x 54 x 56 mm

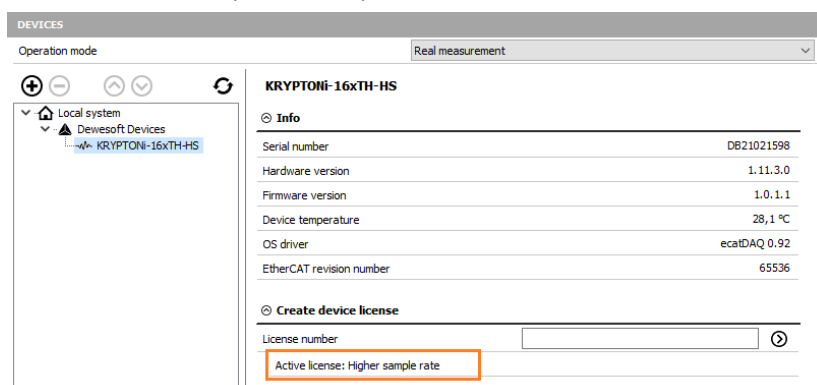
5.5.4.1.1. KRYPTONi-8xTH-HS, KRYPTONi-16xTH-HS: Specifications: Accuracy table

Temperature	Type K	Type J	Type T	Type R	Type S	Type N	Type E	Type B	Type C
-200 °C	1.00 °C	0.86 °C	0.98 °C	✗	✗	1.24 °C	0.71 °C	✗	✗
-100 °C	0.75 °C	0.69 °C	0.77 °C	✗	✗	0.85 °C	0.67 °C	✗	✗
0 °C	0.68 °C	0.64 °C	0.68 °C	1.82 °C	1.79 °C	0.77 °C	0.62 °C	✗	1.07 °C
100 °C	0.69 °C	0.65 °C	0.67 °C	1.46 °C	1.47 °C	0.76 °C	0.62 °C	7.96 °C	0.96 °C
400 °C	0.75 °C	0.71 °C	0.72 °C	1.26 °C	1.31 °C	0.77 °C	0.67 °C	2.30 °C	0.95 °C
700 °C	0.81 °C	0.75 °C	✗	1.23 °C	1.30 °C	0.82 °C	0.73 °C	1.67 °C	1.01 °C
1000 °C	0.88 °C	0.82 °C	✗	1.23 °C	1.31 °C	0.88 °C	0.83 °C	1.47 °C	1.07 °C
1300 °C	0.96 °C	✗	✗	1.26 °C	1.34 °C	0.98 °C	✗	1.40 °C	1.17 °C
1700 °C	✗	✗	✗	1.36 °C	1.45 °C	✗	✗	1.45 °C	1.34 °C



Hint

The higher sample rate is unlocked with a device license key as it is shown on the image below. This upgrade raises the maximum possible sample rate of the KRYPTONi-8xTH-HS or the KRYPTONi-16xTH-HS from 100 S/s to 10 kS/s.



5.5.4.2. KRYPTONi-8xTH-HS, KRYPTONi-16xTH-HS: Thermocouple connector: Pinout

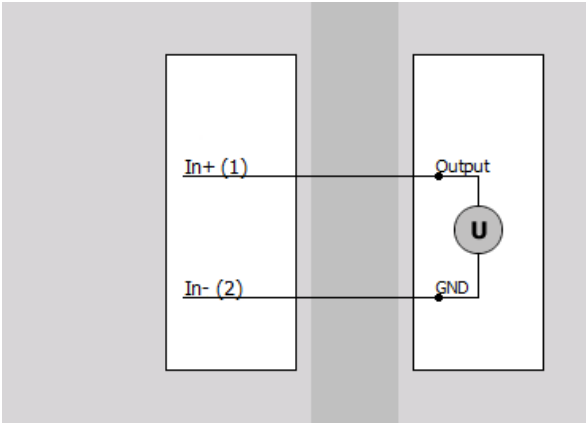


Thermocouple connector: pinout (Mini TC)

Pin	Name	Description
1	In+	Input +
2	In-	Input -

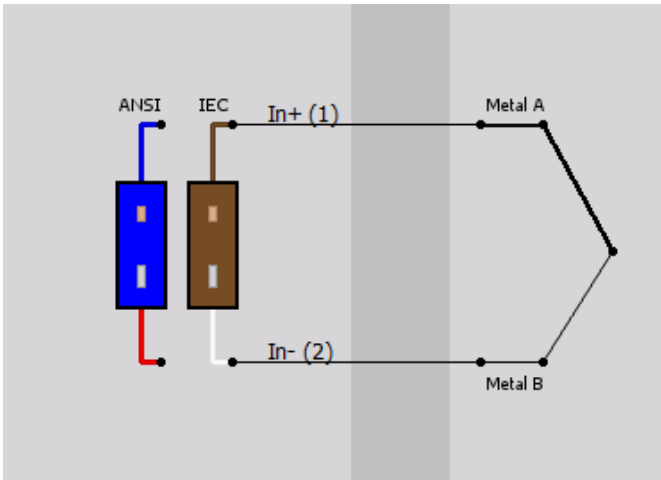
5.5.4.3. KRYPTONi-8xTH-HS, KRYPTONi-16xTH-HS: Wiring diagrams

Voltage

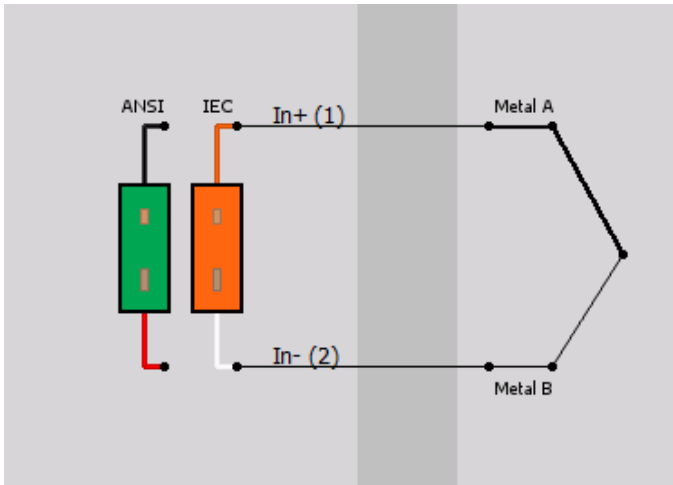


Temperature

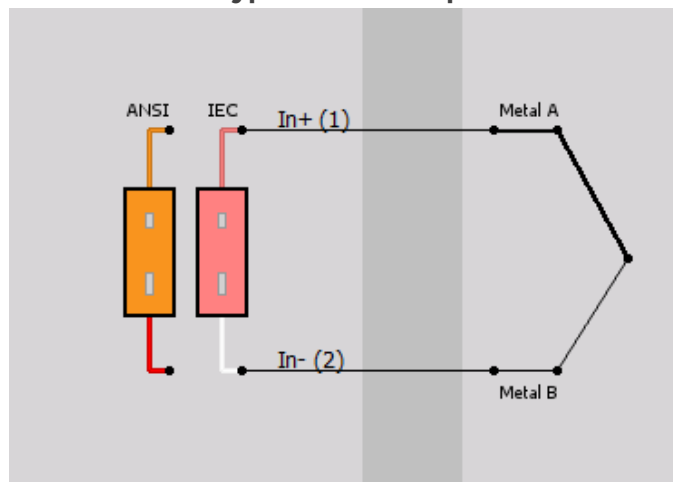
T-type thermocouple



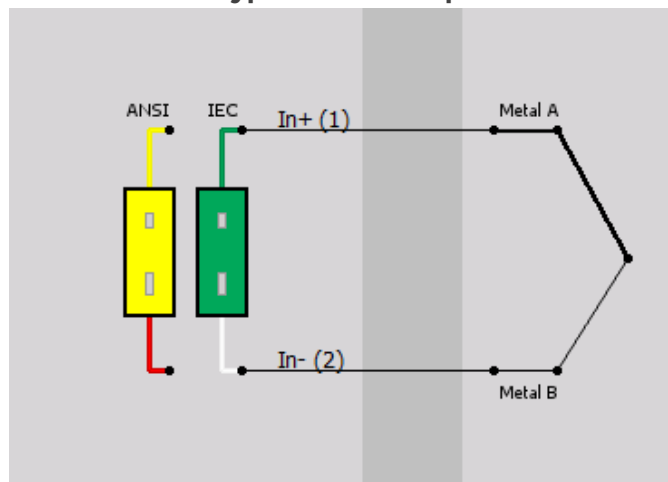
S-type, R-type thermocouple



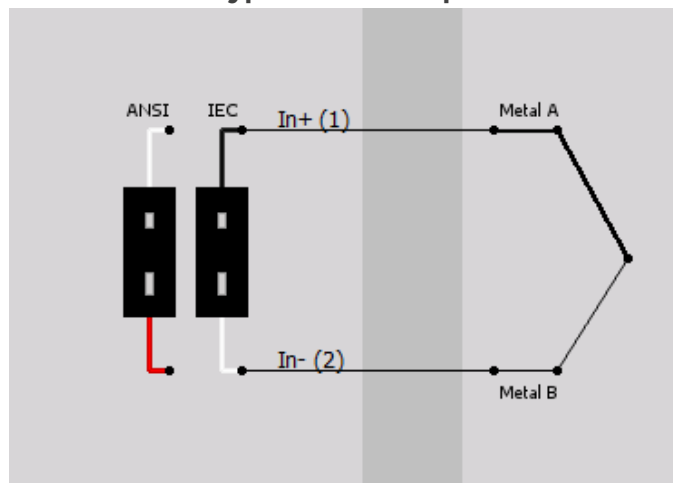
N-type thermocouple



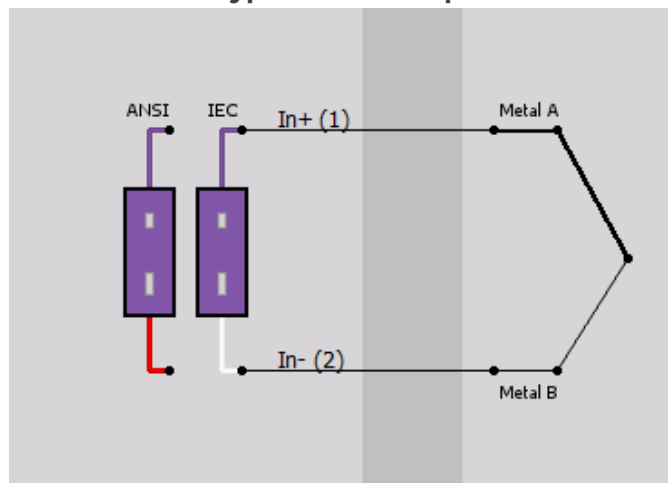
K-type thermocouple



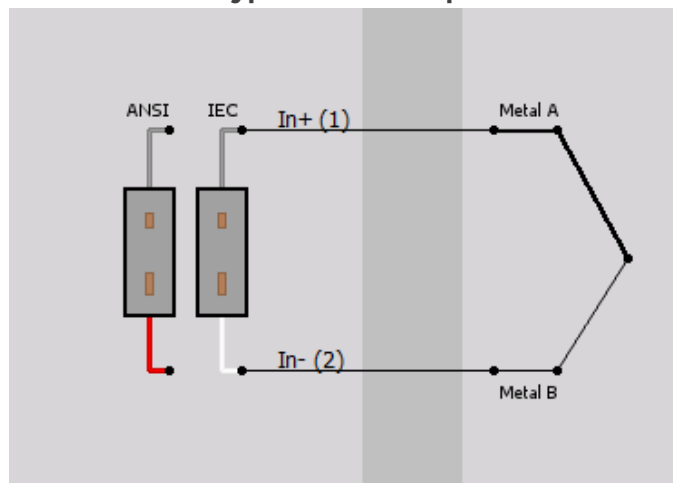
J-type thermocouple



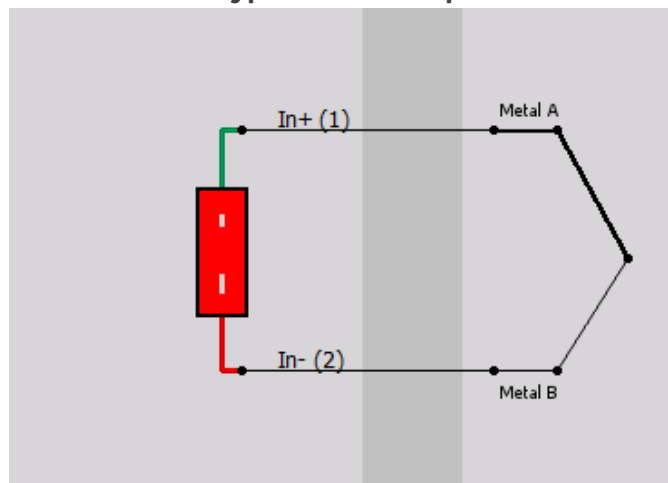
E-type thermocouple



B-type thermocouple

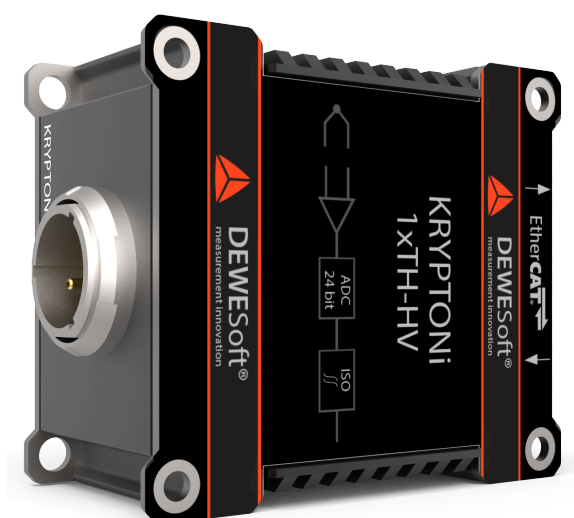


C-type thermocouple



5.5.5. KRYPTONi-1xTH-HV

KRYPTONi-1xTH-HV is a single channel isolated module with LEMO REDEL H02 input connector for thermocouple temperature measurement. KRYPTONi-1xTH-HV is a perfect solution as a thermocouple input for high voltage potential for battery measurements.



KRYPTONi-1xTH-H

5.5.5.1. KRYPTONi-1xTH-HV: Specifications

Inputs	
Input types	Thermocouple
Number of channels	1
ADC Type	24-bit delta-sigma
Sampling Rate	Simultaneous 100 S/s
Input Impedance	100 MΩ
Thermocouple	
TC type	Type K
Accuracy	±0.02 % of reading ±0.5 °C ±10 µV
Resolution	< 0.001 °C
Sampling rates	100, 80, 40, 20, 10 S/s
Typical Noise	0.007°C RMS @ Type K @ 10 S/sec
Additional specifications	
Input connector	K-type Thermocouple LEMO REDEL 2P series
Isolation voltage	CAT III 600 V, CAT II 1000 V
Power	
Power Supply	9 - 48 V DC
Power consumption	1.3 W (typ.)

Physical	
Dimensions	62 x 56 x 36 mm
Weight	300 g

5.5.5.1.1. KRYPTONi-1xTH-HV: Specifications: Accuracy table

Temperature	Type K
-200 °C	1.19 °C
-100 °C	0.85 °C
0 °C	0.75 °C
100 °C	0.76 °C
400 °C	0.82 °C
700 °C	0.88 °C
1000 °C	0.96 °C
1300 °C	1.05 °C
1700 °C	X

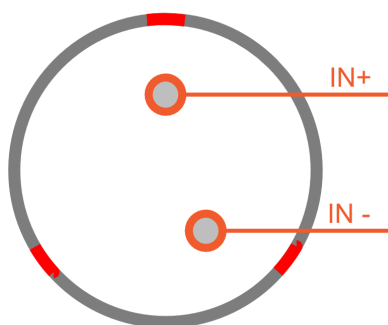


Hint

Linearisation curves used are based on international standards:

- IEC 60584-1 Thermocouples – Part 1: EMF specifications and tolerances.
- IEC 60751 Industrial platinum resistance thermometers and platinum temperature sensors
- EN standards or national SIST EN, DIN EN or others are the same as IEC standards.

5.5.5.2. KRYPTONi-1xTH-HV: LEMO REDEL: Pinout



Pin	Name	Description
1	In+	Input +
2	In-	Input -

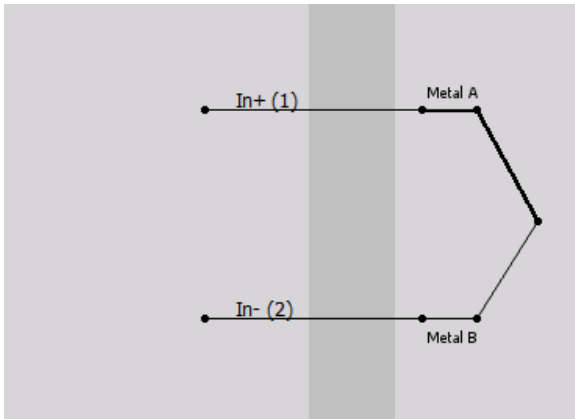
Thermocouple connector: pinout (2-pin LEMO REDEL H02 male)

Connector type LEMO CKC.H02.SLKGY
Mating connector: CFC.H02.SLK.C52GZY

5.5.5.3. KRYPTONi-1xTH-HV: Wiring diagrams

Temperature

K-type thermocouple



5.6. VIBRATION AND SOUND

The ACC modules have BNC input connectors and are perfect for sound and vibration IEPE channels.

Currently available:

- KRYPTON-8xACC, KRYPTON-4xACC,
- KRYPTONi-1xACC.

5.6.1. KRYPTON-4xACC, KRYPTON-8xACC

KRYPTON-4xACC module has 4 BNC connectors for voltage and IEPE measurements.



Caution

Inputs are single-ended, if isolation is required isolated sensors have to be used.



KRYPTON-4xACC