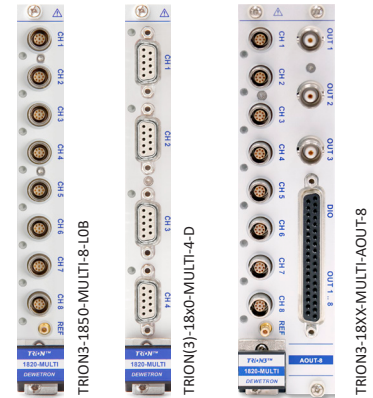


# TRION(3)-18xx-MULTI



- ▶ Universal input module
- ▶ Sampling: 5 MS/s per channel
- ▶ Input types: Voltage, bridge, resistance, RTD, IEPE® current and counter
- ▶ Isolated
- ▶ CAN: High-speed CAN2.0 port
- ▶ Bandwidth: 2 MHz
- ▶ TRION3-18xx-MULTI-AOUT-8: Isolated  $\pm 5$  V,  $\pm 10$  V or  $\pm 30$  mA output



## Module specifications

### General specifications

TRION(3)-18xx-MULTI specifications				
Input types			Ranges	Supported sensors
	Voltage		$\pm 2$ mV to $\pm 100$ V freely programmable	-
	IEPE		$\pm 100$ mV to $\pm 10$ V freely programmable	IEPE® sensors
	Bridge		$\pm 1$ to 1000 mV/V	4-, 5-, 6-wire full bridge 3-, 4-, 5-wire $\frac{1}{2}$ bridge 2-, 3-, 4-wire $\frac{1}{4}$ bridge 120/350/1000 $\Omega$ internal $\frac{1}{4}$ bridge completion
	Resistance		10 $\Omega$ to 30 k $\Omega$	Potentiometer, resistance temperature detection: Pt100, Pt200, Pt300, Pt500, Pt2000 (2-, 3-, 4-wire)
	Current		$\pm 30$ mA	4 to 20 mA sensors; loop-powered sensors
	MSI		MSI2-CH-x: 500 to 50000 pC MSI2-TH-x: various TC ranges MSI2-LVDT	LVDT, RVDT, charge output and thermocouple sensors
Input channels / connectors	TRION-1820-MULTI-4-D	4 channels D-SUB		
	TRION3-1820-MULTI-8-LOB	8 channels 0B LEMO		
	TRION3-1820-MULTI-4-D	4 channels D-SUB		
	TRION3-18xx-MULTI-AOUT-8 <sup>1)</sup>	3 channels BNC, 1 D-SUB-37		
		8 channels 0B LEMO		
	TRION3-1850-MULTI-8-LOB	8 channels 0B LEMO		
	TRION3-1850-MULTI-4-D	4 channels D-SUB		

Tab. 18: General specifications

TRION(3)-18xx-MULTI specifications			
Sampling rate / resolution	TRION-1820-MULTI	100 S/s to 2 MS/s	24-bit
	TRION3-1820-MULTI	100 S/s to 2 MS/s	24-bit
	TRION3-1850-MULTI	>2 MS/s to 5 MS/s	18-bit
Onboard data buffer		512 MB	
Rated input voltage to earth according to EN 61010-2-30		33 V <sub>RMS</sub> , 46.7 V <sub>PEAK</sub> , 70 V <sub>DC</sub>	
Isolation voltage (channel-to-channel and channel-to-chassis)		±350 V <sub>DC</sub>	
REF connector		SMB connector to apply external calibration signal (LEMO version only)	
Input connector		9-pin LEMO EPG.0B.309 (TRION3-18xx-MULTI-8-LOB) 9-pin D-SUB connector (TRION(3)-18xx-MULTI-4-D)	
Environmental specifications	Operating temperature	0 to +45 °C (32 to 113 °F)	
	Storage temperature	-20 to +70 °C (-4 to 158 °F)	
	Humidity	10 to 80 % non cond., 5 to 95 % rel. humidity	
MTBF <sup>2)</sup> (MIL HDBK 217 F, GB)	TRION3-1820-MULTI-4-D	196 187 hours	
	TRION3-1850-MULTI-8-LOB	93 843 hours	
Power consumption	TRION(3)-1820-MULTI-4-D	Typ. 10 W, max. 14 W	
	TRION3-1850-MULTI-8-LOB	Typ. 18 W, max. 25 W	
		Voltage mode, no excitation	15 W
		IEPE <sup>®</sup> mode (4 mA / 20 mA)	15 W / 19 W
		Loop powered sensor (24 V, 20 mA)	20 W
		350 Ω full bridge (5 V / 10 V)	18 W / 21 W
		PT100, PT1000	15 W
TRION3-18xx-MULTI-AOUT-8	Typ. 32 W, max. 50 W		

Tab. 18: General specifications

1) Occupies 2 module slots.

2) Mean time between failures

### Input amplifier

Input amplifier			
Voltage input accuracy <sup>1) 2)</sup>	≤10 V	DC 0.1 Hz to 10 kHz 10 kHz to 100 kHz	±0.02 % of reading ±0.02 % of range ±20 μV ±0.02 % of reading ±0.02 % of range ±20 μV ±(0.005 % * f) of reading ±0.02 % of range ±20 μV f: frequency in kHz
	>10 V input divider on	DC 0.1 Hz to 5 kHz 5 kHz to 100 kHz	±0.02 % of reading ±0.02 % of range ±0.02 % of reading ±0.02 % of range ±(0.015 % * f) of reading ±0.02 % of range f: frequency in kHz
Amplifier drift		Gain drift Offset drift	Typical 10 ppm/°C max. 20 ppm/°C Typical 0.3 μV/°C + 10 ppm of range/°C, max 2 μV/°C + 20 ppm of range/°C
Linearity		Typical <25 ppm	
Current input accuracy <sup>1) 2)</sup>		Direct input	0.1 % of reading ±10 μA
		Loop-powered sensor	0.1 % of reading ±30 μA
Current input impedance		Direct input (IN- to GNDi)	75 Ω ±25 Ω
		Loop-powered sensor	120 Ω ±1 Ω

Tab. 19: Input amplifier

Input amplifier																	
Input impedance	≤100 mV range				Differential				Input (single-ended)								
					20 MΩ or 1 MΩ (prog.) // 35 pF				10 MΩ or 1 MΩ (prog.) // 130 pF								
	>100 mV to 10 V range				200 MΩ or 1 MΩ (prog.) // 35 pF				100 MΩ or 1 MΩ (prog.) // 120 pF								
>10 V to 100 V				2 MΩ // 20 pF				1 MΩ // 90 pF									
Input configuration					Single-ended or differential (programmable)												
Input coupling					2 <sup>nd</sup> order Bessel filter:				DC ... 100 Hz freely programmable								
					0.15 Hz:				Analog highpass filter								
					0.16...100 Hz:				Digital highpass filter, freely programmable								
Common mode voltage to GND <sub>isolated</sub>		0 to 10 V range			±10 V <sub>DC</sub>												
		>10 to 100 V range			±100 V <sub>DC</sub>												
Overvoltage protection		0 to 10 V range			±50 V <sub>DC</sub> , 100 V <sub>PEAK</sub> (1 min)												
		>10 to 100 V range			±200 V <sub>DC</sub>												
Low pass filter (-3 dB, digital)					1 Hz to 1.5 MHz freely programmable or OFF												
– Characteristic					Bessel or Butterworth												
– Filter order					2 <sup>nd</sup> , 4 <sup>th</sup> , 6 <sup>th</sup> , 8 <sup>th</sup> , 10 <sup>th</sup>												
– Filter setting AUTO					30 % of sample rate with 10 <sup>th</sup> order Bessel												
Analog anti-aliasing filter					2 <sup>nd</sup> order Bessel, automatically selected												
					100 kHz, 500 kHz, 2 MHz, (≤1 V range bandwidth is limited to 1.8 MHz)												
Typ. channel-to-channel phase mismatch					<10 ns between channels using the same range												
Typ. CMRR					135 dB @ 50 Hz; 110 dB @ 1 kHz; 90 dB @ 10 kHz; 90 dB @ 100 kHz												
Typical crosstalk					-134 dB (10 V range; 0 to 100 kHz)												
Input noise (100 mV range)		0 to 10 Hz			0.3 μV <sub>pp</sub>												
		Noise density			6.9 nV/SQRT(Hz)												
Typical THD		10 V range			-108 dB								for 1 kHz fundamental frequency				
		1 V range			-102 dB												
Typ. signal to noise ratio; Spurious free SNR; Effective number of Bits <sup>3)</sup> ; noise V <sub>pp</sub>		100 mV range				1 V range				10 V range				100 V range			
		SNR	SFDR <sup>4)</sup>	ENOB <sup>5)</sup>	Noise	SNR	SFDR <sup>4)</sup>	ENOB <sup>5)</sup>	Noise	SNR	SFDR <sup>4)</sup>	ENOB <sup>5)</sup>	Noise	SNR	SFDR <sup>4)</sup>	ENOB <sup>5)</sup>	Noise
Sample rate		[dB]	[dB]	[Bit]	[mV <sub>pp</sub> ]	[dB]	[dB]	[Bit]	[mV <sub>pp</sub> ]	[dB]	[dB]	[Bit]	[mV <sub>pp</sub> ]	[dB]	[dB]	[Bit]	[mV <sub>pp</sub> ]
1 kS/s		113.5	130	18.6	0.001	112.4	135	18.4	0.010	127.2	140	20.8	0.018	120.1	140	19.7	0.400
10 kS/s		103.0	130	16.8	0.003	109.0	135	17.8	0.017	119.5	140	19.6	0.055	114.7	140	18.8	0.950
100 kS/s		94.7	130	15.4	0.011	103.9	130	17.0	0.038	109.8	140	17.9	0.190	106.6	140	17.4	2.700
200 kS/s		91.4	130	14.9	0.016	101.4	130	16.6	0.051	107.4	140	17.6	0.260	104.1	140	17.0	3.800
1000 kS/s		84.7	125	13.8	0.038	95.0	130	15.5	0.116	99.8	139	16.3	0.650	97.7	135	15.9	8.300
2000 kS/s		81.4	120	13.2	0.058	91.0	128	14.8	0.170	95.4	132	15.6	1.100	94.1	132	15.3	14.000
5000 kS/s		78.7	110	12.8	0.080	88.7	125	14.4	0.270	93.1	130	15.2	1.600	91.4	130	14.9	19.000
Filter = OFF		76.2	105	12.4	0.110	86.5	120	14.1	0.330	90.5	130	14.7	2.000	89.0	130	14.5	23.000

Tab. 19: Input amplifier

1) 1 year accuracy 23 °C ±5 °C.

2) Add 0.02 % of reading with filter settings OFF.

3) LP Filter in auto mode.

4) SFDR excluding harmonics.

5) ENOB calculated from SNR.

## Excitation

Excitation				
Excitation voltage	0 to 24 V <sub>DC</sub> ; freely programmable separately for each channel, 1 mV resolution, balanced around GNDi, remote sense support			
	1 year accuracy (23 °C ±5 °C)	±0.03 % ±1.5 mV		
	Drift	±10 ppm/°C ±50 µV/°C		
	Current limit	0.1 to 5 V:	100 mA	
		>5 V to <24 V:	limited to 0.6 W	
		24 V:	limited to 1 W; >0.6 W accuracy: ±5 %	
	Protection	Continuous short		
	Load and line regulation error	±0.002 % with sense line connected		
Voltage regulation reserve	0.1 to 10 V:	>2 V		
	>10 to 24 V:	>1 V		
Excitation current	0.1 to 60 mADC (programmable, 16-bit DAC) 1 µA; balanced around GNDi			
	1 year accuracy (23 °C ±5 °C)	0.1 to 5 mA:	0.05 % ±2 µA	
		>5 to 60 mA:	0.5 % ±5 µA	
	Drift	15 ppm/°C		
	Compliance voltage	0.1 to 20 mA	24 V	
		>20 mA	10 V	
	Output impedance	>10 MΩ		
Load regulation bandwidth	100 kHz			
IEPE® excitation	2 to 20 mA; 10 %; >21 V compliance voltage			

Tab. 20: Excitation

## Bridge functions

Bridge functions			
Supported bridge types	Full bridge	4-, 5- or 6-wire full bridge	
		4-wire full bridge with constant current excitation (piezoresistive bridge sensors), potentiometer	
	Half bridge	3-, 4- or 5-wire ½ bridge with internal completion (software programmable)	
	Quarter bridge	2-, 3- or 4-wire ¼ bridge with internal completion resistor for 120 Ω, 350 Ω and 1000 Ω (software programmable)	
2-wire ¼ with constant current excitation for dynamic measurement (AC coupled)			
Internal quarter bridge completion	120 Ω, 350 Ω, 1000 Ω	±0.05 %	
Bridge resistance	80 Ω to 10 kΩ @ ≤ 5 V <sub>DC</sub> excitation	the lower limit is caused by the maximum power supply	
Bridge excitation volage	Max. 10 V		
Shunt calibration	4000 steps programmable shunt; shunt target can be programmed in mV/V		
Completion resistor accuracy	0.05 % ±15 ppm/K		
Automatic bridge balance	±400 % of range		
Bridge features	Bridge balance, line-resistance compensation		

Tab. 21: Bridge functions

## CAN functions

CAN functions	
CAN specification	CAN 2.0
CAN physical layer	High-speed
CAN termination	Programmable: high impedance or 120 $\Omega$
Bus pin fault protection	$\pm 36 V_{DC}$

Tab. 22: CAN functions

## Counter functions

Counter functions	
Counter	2x counter channels linked to the last two analog channels; trigger level is adjustable within the input range
Counter modes <sup>*)</sup>	Simple event counting, period measurement, pulse width measurement, frequency, duty cycle
Timebase / resolution	5 MHz (200 ns)
Filter	0.1 $\mu s$ to 100 $\mu s$

Tab. 23: Counter functions

\*) The available counter functions depend on the application software used and may differ from this list.

## AOUT functions

AOUT functions <sup>1)</sup>			
Analog outputs	8 isolated channels, independently programmable		
Output range	$\pm 5 V$ , 0 to 5 V, $\pm 10 V$ , 0 to 10 V, $\pm 30 mA$ ; 0 to 30 mA		
Load current	$\pm 30 mA$ max.		
Modes <sup>2)</sup>	Constant output	-10 to +10 V or -30 to +30 mA	
	Function generator	Waveform	Sine, square, triangle, custom
		Frequency	0.001 Hz to 1 MHz
		Amplitude	0–10 V <sub>PEAK</sub> or 0–30 mA <sub>PEAK</sub>
		Offset	-10 to 10 V or -30 to 30 mA
		Phase	-180 to 180°
		Symmetry (triangle)/duty cycle (square)	0.01 to 100 %
	Custom waveforms	Up to 4 custom waveforms Max. 16384 samples per waveform	
	Stream output	Output signal	-10 to +10 V or -30 to +30 mA
		Optional factor and offset	
Math output	A*B; A+B; A-B		
Monitor output	Direct conditioned signal output: -10 to +10 V or -30 to +30 mA		
Function generator	Sine, triangular, square or custom waveforms		
Analog output accuracy	See Tab. 25.		
Temperature drift	$\pm 25 ppm/K$		
Linearity	<100 ppm		
Output impedance	<1 $\Omega$ at D- SUB connector, 50 $\Omega$ at BNC		
Output protection	Continuous short to ground		

Tab. 24: AOUT functions

AOUT functions <sup>1)</sup>		
DAC mode	High-speed mode	High-resolution mode
Update rate	2.5 MS/s	500 kS/s
DAC resolution	16-bit	32 bit
Bandwidth	600 kHz, 4 <sup>th</sup> order Bessel characteristic	70 kHz, 6 <sup>th</sup> order Bessel characteristic
Latency	<5µs	<100 µs
LSB	305 µV	1 µV
Linearity	50 ppm	10 ppm
THD	90 dB	100 dB
Noise floor	100 dB	115 dB
Output noise static	2 mV <sub>PP</sub> / 0.3 mV <sub>RMS</sub>	2 mV <sub>PP</sub> / 0.3 mV <sub>RMS</sub>
Output noise on 1 kHz signal	11 mV <sub>PP</sub> / 0.7 mV <sub>RMS</sub>	3 mV <sub>PP</sub> / 0.3 mV <sub>RMS</sub>
Rise/fall time	400 ns	4 µs
Latency (filter=off)	4 µs	15 µs
Input to output Jitter	400 ns	3.5 µs
Number of DIO	6 DI + 3 DI (isolated) + 4 DO + 1 DO (isolated)	
Non isolated digital I/O	<ul style="list-style-type: none"> <li>– Compatibility (input) CMOS/TTL, 100 kΩ pullup</li> <li>– Compatibility (output) TTL, 20 mA</li> <li>– Overvoltage protection ±30 V<sub>DC</sub>, 50 V<sub>PEAK</sub> (100 ms)</li> </ul>	
Isolated digital input	<ul style="list-style-type: none"> <li>– Compatibility (input) CMOS Low: &lt;1.5 V High: &gt;3.2 V</li> <li>– Overvoltage protection ±35 V<sub>DC</sub>, 65 V<sub>PEAK</sub> (100 ms)</li> <li>– Bandwidth 50 kHz</li> <li>– Pulse width distortion 2.3 µs</li> <li>– Input high current @ 5V UIN &lt;3 mA</li> <li>– Input high current @ 35V UIN &lt;5 mA</li> </ul>	
Isolated digital output	<ul style="list-style-type: none"> <li>– Compatibility (output) Open collector</li> <li>– Max. collector voltage ±30 V<sub>DC</sub></li> <li>– Collector current 5 mA</li> </ul>	
Connector	D-SUB-37 socket for all 8 channels, additionally 3x BNC sockets for CH1 to CH3	
BNC connector	Analog out	AO1, AO2, AO3
D-SUB-37 connector	Analog out	AO1 to AO8
	Digital in	DI3 to DI8
	Digital in (isolated)	DI1, DI2, DI11
	Digital out	DO1 to DO4
	Digital out (isolated)	DO5
Auxiliary power supply	+5 V, 20 mA	

Tab. 24: AOUT functions

1) TRION3-18x0-MULTI-AOUT-8 only

2) Analog output channels can be assigned variably (e.g. AO1 = CH4; AO2 = CH2 + CH7)

Output 1 year accuracy (23 °C ±5 °C)					
Voltage output (+10 V; 0 to 10 V; ±5 V; 0 to 5 V)		High-speed mode		High-resolution mode	
		DC	±0.02 % of reading	±1 mV	±0.02 % of reading
	0.1 to 1 kHz	±0.02 % of reading	±1 mV	±0.02 % of reading	±1 mV
	0.1 to 10 kHz	±0.02 % of reading	±1 mV	-	
	10 to 100 kHz	±(0.015 % * f) of reading	±1 mV	-	
Current output (±30 mA; 0 to 30 mA)	DC	±0.03 % of reading	±3 µA	±0.02 % of reading	±3 µA
	0.1 to 1 kHz	±0.07 % of reading	±3 µA	±0.05 % of reading	±3 µA
	0.1 to 10 kHz	±0.07 % of reading	±3 µA	-	
	10 to 100 kHz	±(0.015 % * f) of reading	±3 µA	-	

Tab. 25: Output accuracy