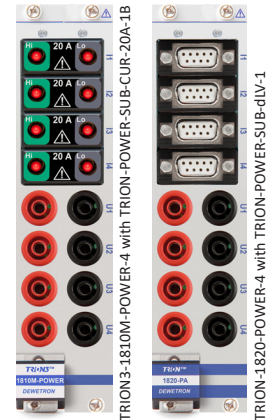


# TRION(3)-18xx-POWER-4



- ▶ TRION(3) module for 4-phase power analysis
- ▶ Sampling
  - TRION3-1810M-POWER: up to 10 MS/s
  - TRION3-1820-POWER: up to 2 MS/s
  - TRION-1820-POWER: up to 2 MS/s
- ▶ Voltage input:  $1000 V_{RMS} / 2000 V_{DC}$
- ▶ Modular current input



## Basic module with fixed high-voltage inputs

The following section provides detailed information on the fixed high-voltage inputs. The values given below were determined in a standardized test setting<sup>1)</sup>.

### General specifications

Fixed high-voltage inputs			
Input channels			
Sampling rate / resolution	TRION3-1820-POWER	100 S/s to 2 MS/s	24-bit
	TRION-1820-POWER		
	TRION3-1810M-POWER	100 S/s to 2 MS/s	24-bit
		>2 MS/s to 10 MS/s	18-bit
Input range		$1000 V_{RMS} (\pm 2000 V_{PEAK}) CF = 2$	
Accuracy <sup>1) 2) 3)</sup>			
– DC		$\pm 0.02 \% \text{ of reading } \pm 0.02 \% \text{ of range}$	
– 0.5 Hz to 1 kHz		$\pm 0.03 \% \text{ of reading}$	
– 1 kHz to 5 kHz		$\pm 0.15 \% \text{ of reading}$	
– 5 kHz to 10 kHz		$\pm 0.35 \% \text{ of reading}$	
– 10 kHz to 50 kHz		$\pm 0.6 \% \text{ of reading}$	
– 50 kHz to 300 kHz		$\pm (0.02 \% * f) \text{ of reading}$ <span style="float: right;">f: frequency in kHz</span>	
Gain drift		20 ppm/°C	
Offset drift		5 mV/°C	
Typical THD		-95 dB	
CMRR		>85 dB @ 50 Hz; >60 dB @ 1 kHz; >40 dB @ 100 kHz	
Bandwidth		5 MHz	
Rated input voltage to earth according to EN 61010-2-30		600 V CAT IV / 1000 V CAT III	
Differential input (floating circuits)		600 V CAT IV / 1000 V CAT III / $2000 V_{DC}$ (see <a href="#">Fig. 135</a> )	
Common mode voltage		$1000 V_{RMS}$	
Isolation voltage		$3750 V_{RMS}$ (1 min), 35 kV/ $\mu$ s transient immunity	
Overvoltage protection		$4250 V_{PEAK}$ or $3000 V_{RMS}$ (1 min)	
Input resistance		5 M $\Omega$ ; 2 pF	
Isolation (earth) resistance		100 G $\Omega$ ; 2.5 pF	

Tab. 48: Fixed high-voltage inputs

Fixed high-voltage inputs				
Connector	Safety banana sockets			
	SNR	SFDR <sup>4)</sup>	ENOB <sup>5)</sup>	Noise <sub>pp</sub>
Sample rate	[dB]	[dB]	[Bit]	[mV]
0.1 kS/s	126	144	20.6	2.6
1 kS/s	123	140	20.1	4.5
10 kS/s	118	137	19.3	9.5
100 kS/s	110	134	18.0	27.2
1000 kS/s	100	134	16.3	92.5
2000 kS/s	82	132	13.3	134.0

Tab. 48: Fixed high-voltage inputs

- 1) The following accuracy conditions were applied: Temperature: 23 ±5 °C; humidity: 40 to 60 % rel. humidity; input waveform: sine wave; common mode voltage: 0 V; line filter: Auto (8<sup>th</sup> or Butterworth); sample rate: 2 MS/s (1 MS/s TRION-1810-HV); resolution: 24-bit; power factor: 1; after warm-up; after zero level, accuracy: Frequency (f) in [kHz] (12-month accuracy ± reading error and range error)
- 2) Add 0.02 % of reading with filter settings OFF
- 3) Below 1 % of range, add 10 ppm of range.
- 4) SFDR excluding harmonics
- 5) ENOB calculated from SNR

## Connection

### Power specifications

Power specifications		
Active power accuracy with PF=1 <sup>1) 3)</sup> (f: frequency in kHz)	DC	±0.03 % of reading ±0.03% of range <sup>2)</sup>
	0.5 Hz–1 kHz	±0.04 % of reading
	1 kHz–5 kHz	±0.2 % of reading
	5 kHz–10 kHz	±0.5 % of reading
	10 kHz–50 kHz	±(0.5 % + 0.05 % * f) of reading
Influence of power factor	Add 0.01 % * f/50 * √(1/PF <sup>2</sup> -1) f: frequency in Hz	
Typ. channel-to-channel phase mismatch (Voltage-Voltage, Current-Current, Voltage-Current)	<250 ns (0.1° @ 1 kHz, 0.005° @ 50 Hz)	
Typical board-to-board phase mismatch		
– Same board type	<250 ns (0.1° @ 1 kHz, 0.005° @ 50 Hz)	
– Different board type	±1 sample or 0.2° @ 1 kHz (whichever is higher)	
Fundamental frequency		
– Range	0.1 Hz–200 kHz (>500 kS/s: >0.2 Hz; >1 MS/s: >0.5Hz; >2MS/s: >1 Hz)	
– Accuracy DEWE2	±0.01% of reading ± 1 mHz	
– Accuracy DEWE3	±0.005% of reading ± 1 mHz	
Low pass filter (-3 dB, digital and analog combined)		
– TRION3-1810M-POWER	100 Hz to 3 MHz freely programmable or OFF	
– TRION(3)-1820-POWER	100 Hz to 600 kHz freely programmable or OFF	
– Filter order and characteristics	2 <sup>nd</sup> , 4 <sup>th</sup> , 6 <sup>th</sup> , 8 <sup>th</sup> Bessel or Butterworth	
Filter delay compensation	Up to 15 μs the group delay of the selected filter will be automatically compensated. This works for:	
	– 2 <sup>nd</sup> order filter 15 kHz to 1 MHz	
	– 4 <sup>th</sup> order filter 30 kHz to 1 MHz	
	– 6 <sup>th</sup> order filter 60 kHz to 1 MHz	

Onboard data buffer	512 MB
Power consumption	Typ. 13 W, max. 15 W
– With sensor supply	Max. 21 W

Tab. 49: Power specifications

- 1) Voltage and current channel have a minimum input of 1 % range, otherwise individual uncertainty has to be calculated.      2) Add 0.03 % of range with no zero level.
- 3) When using the TRION-POWER-SUB-CUR-20A-1B sub-module: For self-generated heat caused by current input, add  $1.5 \times 10^{-4} \times I^2 \text{ %/A}^2$  of reading and additionally for DC only add  $10^{-4} \times I^2 \text{ %/A}^2$  of range to the active power accuracy. I is the current reading [A]. The influence from self-generated heat continues until the temperature of the shunt resistor inside the chassis lowers, even if the current input changes to a small value.

## Interchangeable sub-modules

### Available TRION-SUB modules

The TRION(3)-18xx-POWER-4 modules have 4 highly flexible voltage or current inputs. The 4 slots can be populated with four different direct current measurement modules or with three different D-SUB-9 modules to connect almost any kind of current transducer. Alternatively, this connector can also be used to measure any auxiliary  $\pm 10 \text{ V}$  signal (e.g. such as windspeed or water flow).

If more than 4 voltage inputs are required, the 4 slots can be also populated with our latest interchangeable voltage input sub-modules. Choose from a low-voltage, isolated 5 V or an isolated, 600 V CATII rated sub-module.



Fig. 136: Available TRION sub-modules

The following TRION-SUB modules can be used with the TRION(3)-18xx-POWER-4 module. For detailed information about the various sub-modules refer to chapter [TRION sub-modules](#) in the TRION(3) series modules technical reference manual.

Type	Range	Bandwidth	Isolated
<a href="#">TRION-SUB-600V</a>	$600 \text{ V}_{\text{RMS}} (\pm 1500 \text{ V}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-SUB-5V</a>	$5 \text{ V}_{\text{RMS}} (\pm 10 \text{ V}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-SUB-XV</a>	$600 \text{ V}_{\text{RMS}} (\pm 1000 \text{ V})^1$ $60 \text{ V}_{\text{RMS}} (\pm 100 \text{ V})$ $6 \text{ V}_{\text{RMS}} (\pm 10 \text{ V})$ $0.6 \text{ V}_{\text{RMS}} (\pm 1 \text{ V})$	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-20A-1B</a>	$20 \text{ A}_{\text{RMS}} (\pm 40 \text{ A}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-2A-1B</a>	$2 \text{ A}_{\text{RMS}} (\pm 4 \text{ A}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-1A-1B</a>	$1 \text{ A}_{\text{RMS}} (\pm 2 \text{ A}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-02A-1B</a>	$0.2 \text{ A}_{\text{RMS}} (\pm 0.4 \text{ A}_{\text{PEAK}})$	300 kHz	Yes
<a href="#">TRION-POWER-SUB-dLV-5V</a>	$5 \text{ V}_{\text{RMS}} (\pm 10 \text{ V}_{\text{PEAK}})$	5 MHz	No
<a href="#">TRION-POWER-SUB-dLV-1V</a>	$1 \text{ V}_{\text{RMS}} (\pm 2 \text{ V}_{\text{PEAK}})$	5 MHz	No
<a href="#">TRION-POWER-SUB-dLV-1</a>	$5 \text{ V}_{\text{RMS}} (\pm 10 \text{ V}_{\text{PEAK}})$	100 kHz	No

Tab. 50: TRION sub-modules overview

<sup>1)</sup> Max. allowed input: 600 V CAT II (850 V<sub>PEAK</sub>).

# TRION(3)-18xx-POWER-4

## Interchangeable sub-modules

### Available TRION-SUB modules

The TRION(3)-18xx-POWER-4 modules have 4 highly flexible voltage or current inputs. The 4 slots can be populated with four different direct current measurement modules or with three different D-SUB-9 modules to connect almost any kind of current transducer. Alternatively, this connector can also be used to measure any auxiliary  $\pm 10$  V signal (e.g. such as windspeed or water flow).

If more than 4 voltage inputs are required, the 4 slots can be also populated with our latest interchangeable voltage input sub-modules. Choose from a low-voltage, isolated 5 V or an isolated, 600 V CATII rated sub-module.



Fig. 136: Available TRION sub-modules

The following TRION-SUB modules can be used with the TRION(3)-18xx-POWER-4 module. For detailed information about the various sub-modules refer to chapter [TRION sub-modules](#) in the TRION(3) series modules technical reference manual.

Type	Range	Bandwidth	Isolated
<a href="#">TRION-SUB-600V</a>	600 V <sub>RMS</sub> ( $\pm 1500$ V <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-SUB-5V</a>	5 V <sub>RMS</sub> ( $\pm 10$ V <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-SUB-XV</a>	600 V <sub>RMS</sub> ( $\pm 1000$ V) <sup>1)</sup> 60 V <sub>RMS</sub> ( $\pm 100$ V) 6 V <sub>RMS</sub> ( $\pm 10$ V) 0.6 V <sub>RMS</sub> ( $\pm 1$ V)	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-20A-1B</a>	20 A <sub>RMS</sub> ( $\pm 40$ A <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-2A-1B</a>	2 A <sub>RMS</sub> ( $\pm 4$ A <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-1A-1B</a>	1 A <sub>RMS</sub> ( $\pm 2$ A <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-POWER-SUB-CUR-02A-1B</a>	0.2 A <sub>RMS</sub> ( $\pm 0.4$ A <sub>PEAK</sub> )	300 kHz	Yes
<a href="#">TRION-POWER-SUB-dLV-5V</a>	5 V <sub>RMS</sub> ( $\pm 10$ V <sub>PEAK</sub> )	5 MHz	No
<a href="#">TRION-POWER-SUB-dLV-1V</a>	1 V <sub>RMS</sub> ( $\pm 2$ V <sub>PEAK</sub> )	5 MHz	No
<a href="#">TRION-POWER-SUB-dLV-1</a>	5 V <sub>RMS</sub> ( $\pm 10$ V <sub>PEAK</sub> )	100 kHz	No

Tab. 50: TRION sub-modules overview

<sup>1)</sup> Max. allowed input: 600 V CAT II (850 V<sub>PEAK</sub>).