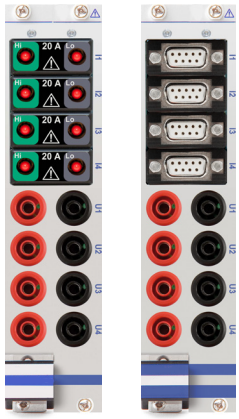
TY3-18xx-POWER-4

- TY3 module for 4-phase power analysis
- Sampling
  - TY3-1810M-POWER: up to 10 MS/s
  - TY3-1820-POWER: up to 2 MS/s
  - TY-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[1)].

General specifications

Fixed high-voltage inputs			
Input channels			
Sampling rate / resolution	TY3-1820-POWER	100 S/s to 2 MS/s	24-bit
	TY-1820-POWER		
	TY3-1810M-POWER	100 S/s to 2 MS/s	24-bit
		>2 MS/s to 10 MS/s	18-bit
Input range		1000 V_{RMS} (±2000 V_{PEAK}) CF = 2	
Accuracy[1) 2) 3)] – DC – 0.5 Hz to 1 kHz – 1 kHz to 5 kHz – 5 kHz to 10 kHz – 10 kHz to 50 kHz – 50 kHz to 300 kHz		 ±0.02 % of reading ±0.02 % of range ±0.03 % of reading ±0.15 % of reading ±0.35 % of reading ±0.6 % of reading ±(0.02 % * f) of reading f: frequency in kHz	
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 *Fig. 136*)	
Common mode voltage		1000 V_{RMS}	
Isolation voltage		3750 V_{RMS} (1 min), 35 kV/µs transient immunity	
Overvoltage protection		4250 V_{PEAK} or 3000 V_{RMS} (1 min)	
Input resistance		5 MΩ; 2 pF	
Isolation (earth) resistance		100 GΩ; 2.5 pF	

Tab. 48: Fixed high-voltage inputs

Fixed high-voltage inputs				
Connector	Safety banana sockets			
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
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 (8th 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

Power specifications

Power specifications		
Active power accuracy with PF=1[1) 3)] (f: frequency in kHz)	DC	±0.03 % of reading ±0.03% of range[2)]
	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/PF²-1)	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	<250 ns (0.1° @ 1 kHz, 0.005° @ 50 Hz); same board type only	
Fundamental frequency – Range – Accuracy HT2 – Accuracy HT3	 0.1 Hz–200 kHz (>500 kS/s: >0.2 Hz; >1 MS/s: >0.5Hz; >2MS/s: >1 Hz) ±0.01% of reading ± 1 mHz ±0.005% of reading ± 1 mHz	
Low pass filter (-3 dB, digital and analog combined) – TY3-1810M-POWER – TY3-1820-POWER – Filter order and characteristics	 100 Hz to 3 MHz freely programmable or OFF 100 Hz to 600 kHz freely programmable or OFF 2nd, 4th, 6th, 8th Bessel or Butterworth	
Filter delay compensation	Up to 15 µs the group delay of the selected filter will be automatically compensated. This works for: – 2nd order filter 15 kHz to 1 MHz – 4th order filter 30 kHz to 1 MHz – 6th order filter 60 kHz to 1 MHz	
Onboard data buffer	512 MB	
Power consumption – With sensor supply	Typ. 13 W, max. 15 W Max. 21 W	

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 TY-POWER-SUB-CUR-20A-1B sub-module: For self-generated heat caused by current input, add $1.5 \times 10^{-4} \times I^2$ %/A^2 of reading and additionally for DC only add $10^{-4} \times I^2$ %/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 TY-SUB modules

The TY3-18xx-POWER-4 modules have 4 highly fl exible 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 ±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. 137: Available TY sub-modules

The following TY-SUB modules can be used with the TY3-18xx-POWER-4 module. For detailed information about the various sub-modules refer to chapter *TY sub-modules* in the TY3 series modules technical reference manual.

Type	Range	Bandwidth	Isolated
TY-SUB-600V	600 V_{RMS} (±1500 V_{PEAK})	300 kHz	Yes
TY-SUB-5V	5 V_{RMS} (±10 V_{PEAK})	300 kHz	Yes
TY-SUB-XV	600 V_{RMS} (±1000 V)[1)] 60 V_{RMS} (±100 V) 6 V_{RMS} (±10 V) 0.6 V_{RMS} (±1 V)	300 kHz	Yes
TY-POWER-SUB-CUR-20A-1B	20 A_{RMS} (±40 A_{PEAK})	300 kHz	Yes
TY-POWER-SUB-CUR-2A-1B	2 A_{RMS} (±4 A_{PEAK})	300 kHz	Yes
TY-POWER-SUB-CUR-1A-1B	1 A_{RMS} (±2 A_{PEAK})	300 kHz	Yes
TY-POWER-SUB-CUR-02A-1B	0.2 A_{RMS} (±0.4 A_{PEAK})	300 kHz	Yes
TY-POWER-SUB-dLV-5V	5 V_{RMS} (±10 V_{PEAK})	5 MHz	No
TY-POWER-SUB-dLV-1V	1 V_{RMS} (±2 V_{PEAK})	5 MHz	No
TY-POWER-SUB-CT	1 A_{RMS} (±2 A_{PEAK}) 0.5 A_{RMS} (±1 A_{PEAK}) 0.25 A_{RMS} (±0.5 A_{PEAK}) 0.1 A_{RMS} (±0.2 A_{PEAK})	5 MHz	No
TY-POWER-SUB-dLV-1	5 V_{RMS} (±10 V_{PEAK})	100 kHz	No

Tab. 50: TY sub-modules overview [1)]

Max. allowed input: 600 V CAT II (850 V_{PEAK}).