TPS II
Single Channel Current Transducer System

Installation Manual

SIGNALTEC GmbH, Reutersbrunnenstrasse 27, D-90429 Nürnberg, GERMANY, T. +49 911 2550993-0, F. +49 911 2550993-13, Email: info@signaltec.com, Web: www.signaltec.com

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1. Introduction

The TPS is a power supply unit for the high precision CT current transducers, mainly used for the range extension of current- and power-meters. The current output terminals deliver the transducer output current on the back panel. Passive plug-on burden resistors and active plug-on voltage amplifiers are available as an option. The status-readout-interface delivers the transducer status (ok or overload/error) by means of internal galvanic isolated relay contacts.

Warning
Please be aware that an unpowered transducer or a transducer used with open output can be destroyed. The same can happen if a transducer is heavily overloaded. Power and transducer status are visible on the front panel. The information of the status-readout-interface on the back panel can be used to switch off the primary current via a relay or a PLC in case the transducer is overloaded, the TPS is switched off or the output loop is interrupted. All these events will change the transducer status to error on the front panel led and the status-readout-interface. There is more information about the status-readout-interface available in chapter 6.

2. Receiving of goods

The TPS system usually is delivered together with a high precision CT transducer and a connection cable. The CT transducers are available from 100 A up to 2000 A. Connection cables are available in different lengths. Passive plug-on shunts and active plug-on voltage amplifiers can be ordered as an option. A status-readout cable and different current and voltage output cables are available as options either.

Please compare your order papers with our packing list and the received goods.

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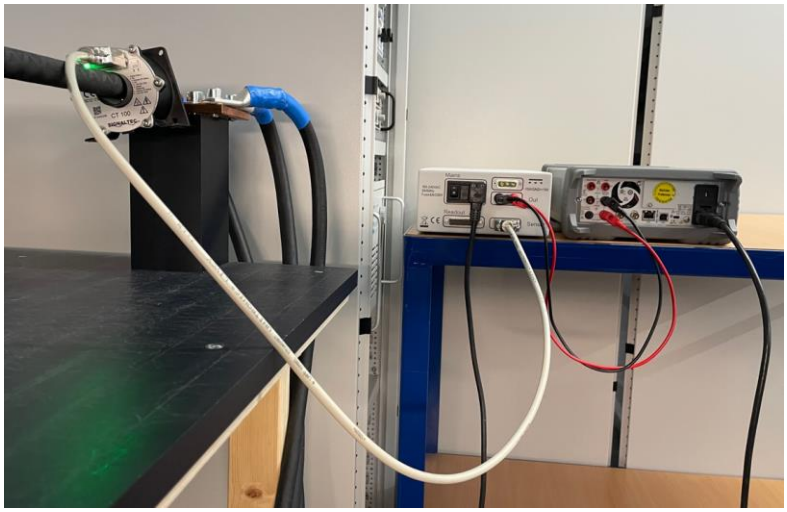
3. Hardware Installation

The TPS is delivered as a desktop unit. 19” rack mounting brackets are available as an option. The brackets can be installed easily with four screws on the left and right panel side.

3.1. Connection of the TPS current output terminals to the current input terminals of a current- or power-meter



The current transducer will be connected to the TPS rack with the delivered D-SUB current transducer connection cable.
The transducer output current can be connected directly to the current input terminals of a current or a power meter with 4 mm safety leads.

3.2 . Connection of the optional plug-on voltage output module to the voltage input terminals of a multimeter

The current transducer will be connected to the TPS rack with the delivered D-SUB current transducer connection cable.
Before you connect the current output to the voltage input terminals of a multimeter or the sensor input terminal of a power meter you have to transfer the output current into a voltage signal. For this purpose, passive plug-on burden resistors and active plug-on output voltage amplifiers are available.

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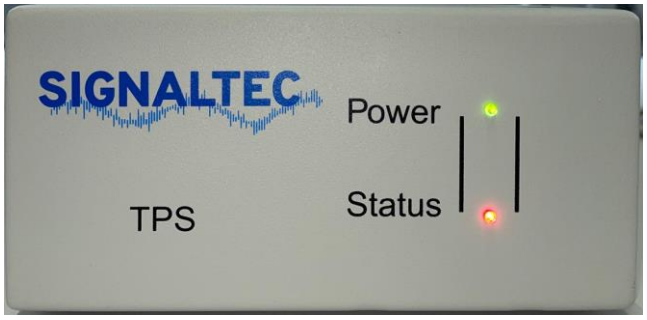
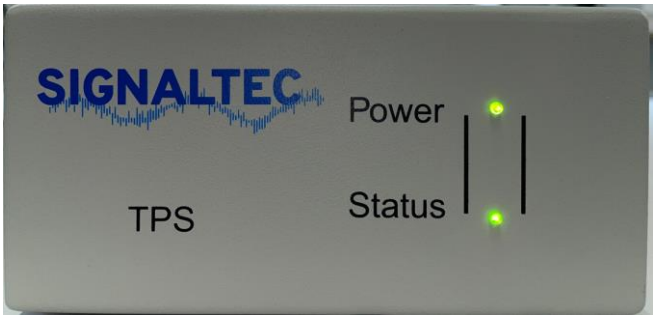
4. Operating instructions

Before you switch on the primary current through the current transducer, be sure that the transducer is powered by the TPS rack and the output current loop is closed. An unpowered transducer can be damaged as well as a sensor with open current output loop. The power and transducer status (ok or error/overload) are visible on the front panel and available on the status-readout interface (see chapter 6).

Power-LED off:	TPS system switched off
Power-LED green:	TPS switched on
Status-LED off:	TPS system switched off
Status-LED green:	Transducer connected, normal operation
Status-LED red:	Transducer overloaded or interruption in the output loop, switch primary current off!





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5. Scaling

Six transducer types are available for the TPS system. 100 A, 200 A, 400 A, 500 A, 1000 A and 2000 A. To adapt the sensor to the power meter you need to program either the transducer ratio or the scaling factor in the instrument software.

5.1. Current output ratio

Transducer	Range DC RMS (CF 2)	Sensor-Ratio	Scaling Factor
CT 100	100 A	100 A / 200 mA	500
CT 200	200 A	200 A / 200 mA	1000
CT 400	400 A	400 A / 266.667 mA	1500
CT 500	500 A	500 A / 750 mA	750
CT 1000	1000 A	1000 A / 666.667 mA	1500
CT 2000	2000 A	2000 A / 1000 mA	2000

5.2 . Sensor output ratio when using the passive plug-on resistors

Transducer	Range DC RMS (CF 2)	Standard Burden Resistor	Ratio	Scaling Factor
CT 100	100 A	MCTS/BR10/0.015	100 A / 2000 mV	20 mV / A
CT 200	200 A	MCTS/BR10/0.015	200 A / 2000 mV	10 mV / A
CT 400	400 A	MCTS/BR3.75/0.015	400 A / 1000 mV	2.5 mV / A
CT 500	500 A	MCTS/BR1.5/0.025	500 A / 1000 mV	2 mV / A
CT 1000	1000 A	MCTS/BR1.5/0.025	1000 A / 1000 mV	1 mV / A
CT 2000	2000 A	MCTS/BR1/0.025	2000 A / 1000 mV	0.5 mV / A

5.3 . Sensor output ratio when using the active plug-on voltage amplifiers

Transducer	Range DC RMS (CF 2)	Standard Voltage Module	Ratio	Scaling Factor
CT 100	100 A	MCTS/VM0.2/0.02	100 A / 7000 mV	70 mV / A
CT 200	200 A	MCTS/VM0.2/0.02	200 A / 7000 mV	35 mV / A
CT 400	400 A	MCTS/VM0.26/0.02	400 A / 7000 mV	17.5 mV / A
CT 500	500 A	MCTS/VM0.26/0.02	500 A / 7000 mV	14 mV / A
CT 1000	1000 A	MCTS/VM0.66/0.02	1000 A / 7000 mV	7 mV / A
CT 2000	2000 A	MCTS/VM1/0.02	2000 A / 7000 mV	3.5 mV / A

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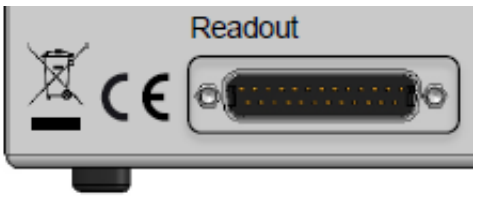
6. Status-Readout-Interface



Status-Readout-Interface

The channel and transducer status are visible on the TPS front panel and can be read out via the Status-Readout-Interface.

The interface gives out the transducer status by means of potential free relay contacts.

Switching voltage: 200 V
Switching current: 2 A

Transducer status ok: TPS on and transducer in normal range
Transducer status error: TPS off, transducer in over range or current output loop open

6.1. Pin-out of the 25-pole D-SUB

Status	Pin-Connection	Wire Color*
ok	14 - 2	green - brown
power off, error, overload	14 - 1	green - white

* A Status-Readout-Interface cable TPS/ROC is available as an option

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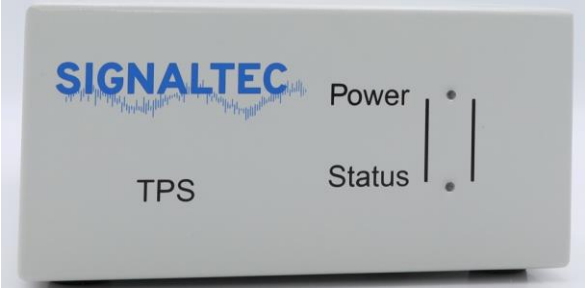
7. Specifications

7.1 . TPS Rack

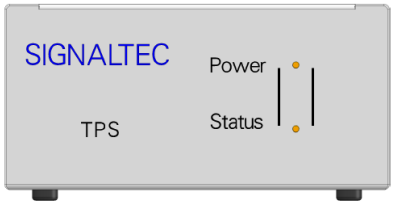


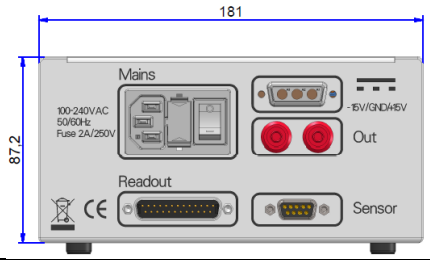
Front panel

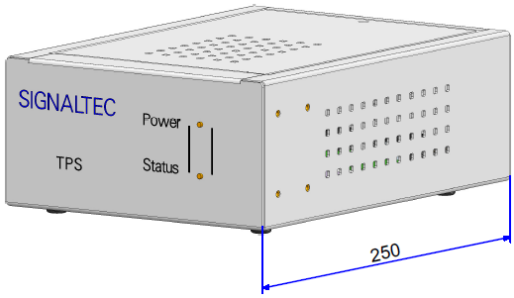
Rear panel

Dimensions

Cabinet Width:	181 mm
Cabinet Height:	87,2 mm (2 HU)
Cabinet Depth:	250 mm
Mass:	2.7 kg







General Data

Operation Temperature:	-10 … 60 °C
Operation Humidity:	20 … 90 % RH, noncondensing
Warranty period:	36 Months

Electrical Data

Supply voltage:	100-240 VAC, 50/60 Hz, fused with 6 A slow blow
Output voltages:	+ 15 V_{DC}, 3.4 A_{max} / -15 V_{DC}, 2.0 A_{max}
Max. Power Consumption:	The maximum power consumption depends on the current consumption of each transducer. The maximum power consumption of a TPS with transducer IN 2000-S at 2000 A_{rms} primary current is around 30 W.

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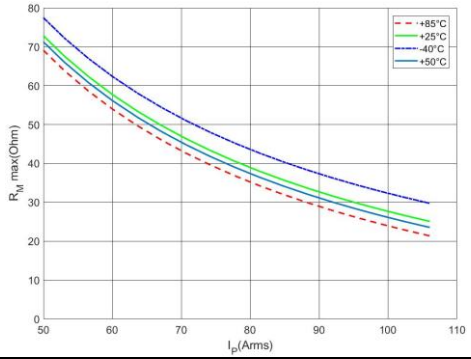
7.2. Transducers

Type	CT 100	CT 200	CT 400	CT 500	CT 1000	CT 2000
Current Range DC / AC_{rms} (Crestfactor 2)	100 A	200 A	400 A	500 A	1000 A	2000 A
100 ms Overload	20 kA_{pk}	20 kA_{pk}	20 kA_{pk}	3 kA_{pk}	5 kA_{pk}	10 kA_{pk}
Ratio	500 : 1	1000 : 1	1500 : 1	750 : 1	1500 :1	2000 : 1
Output Range	0 … 200 mA_{rms}	0 … 200 mA_{rms}	0 … 266.667 mA_{rms}	0 … 666.667 mA_{rms}	0 … 666.667 mA_{rms}	0 … 1 A_{rms}
Max. Measuring Resistance [1]	25 Ω	20 Ω	10 Ω	5 Ω	4 Ω	3.5 Ω
Bandwidth (-3 dB)	DC … 2 MHz	DC … 1.1 MHz	DC … 800 kHz	DC … 520 kHz	DC … 440 kHz	DC … 140 kHz
Step Response (0 … 90 %)	0.2 µs	0.2 µs	1 µs	1 µs	1 µs	1 µs
DC Accuarcy (of MR) [2]	0.002 %	0.001 %	0.0008 %	0.00115 %	0.0012 %	0.0012 %
AC Accuarcy (of MV) [3]						
> 0 … ≤ 100 Hz	0.015 %	0.015 %	0.015 %	0.015 %	0.015 %	0.015 %
> 100 … ≤ 1000 Hz	0.025 %	0.02 %	0.02 %	0.02 %	0.02 %	0.05 %
> 1000 … ≤ 10000 Hz	0.2 %	0.15 %	0.15 %	0.1 %	0.15 %	0.25 %
> 10000 … ≤ 50000 Hz [4]	0.5 %	0.5 %	0.5 %	0.2 %	1.5 %	1 % [4]
> 50000 … ≤ 100000 Hz	1 %	1 %	1 %	0.5 %	4 %	
Angular Accuracy						
> 0 … ≤ 100 Hz	0.01 °	0.01 °	0.01 °	0.01 °	0.01 °	0.01 °
> 100 … ≤ 1000 Hz	0.05 °	0.02 °	0.01 °	0.01 °	0.01 °	0.05 °
> 1000 … ≤ 10000 Hz	0.1 °	0.05 °	0.1 °	0.05 °	0.1 °	0.1 °
> 10000 … ≤ 50000 Hz [4]	0.25 °	0.25 °	0.5 °	0.5 °	1 °	1 ° [4]
> 50000 … ≤ 100000 Hz	0.5 °	0.5 °	1 °	1 °	2 °	
Temp.-Coefficient (of MR)	0.2 ppm/K	0.2 ppm/K	0.1 ppm/K	1 ppm/K	0.3 ppm/K	0.1 ppm/K
Temperature Range	-40 … 85 °C	-40 … 85 °C	-40 … 85 °C	-40 … 85 °C	-40 … 85 °C	-40 … 85 °C
Test Voltage 50 Hz	4.95 kV	4.95 kV	4.95 kV	4.2 kV	4.2 kV	6 kV
Inner Diameter	28 mm	28 mm	28 mm	38 mm	38 mm	70 mm
Mass	0.275 kg	0.295 kg	0.305 kg	1.3 kg	1.3 kg	4.2 kg

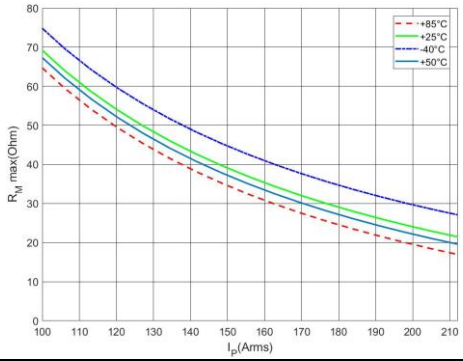
[1] At full scale and 25 °C. For other current values and temperatures see graphs below. Max measuring resistance = cable loop resistance + burden resistance (see page 11).
[2] Error of measuring range. At 25 °C.
[3] Error of measured value. For range 3 % … 100 %. Test current 0 … 100 Arms, DC … 100 kHz. At 25 °C.
[4] CT 2000: 10000 … ≤ 20000 Hz. The precision frequency range of CT 2000 is limited to 20 kHz.

Maximum measuring resistance (cable- + burden-resistance) depending on primary rms current and temperature

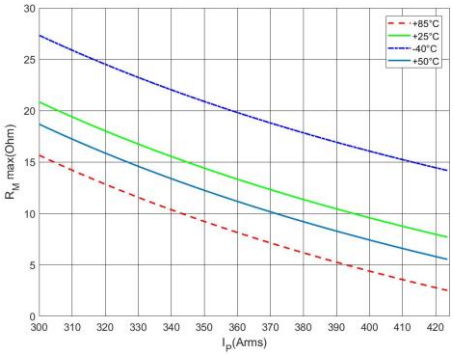
CT 100



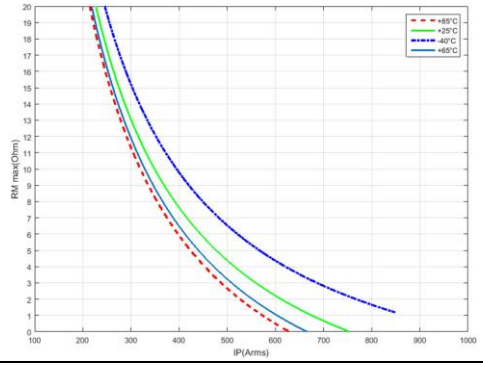
CT 200



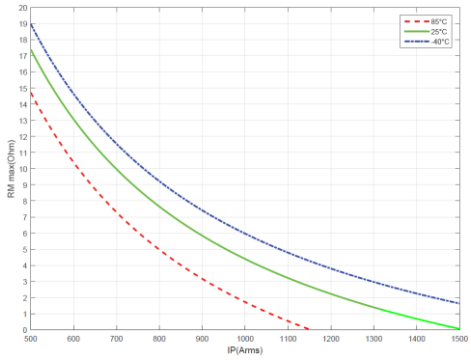
CT 400



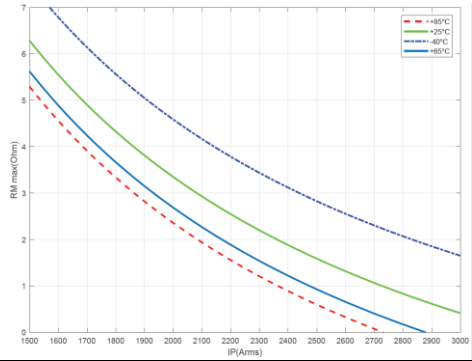
CT 500



CT 1000



CT 2000



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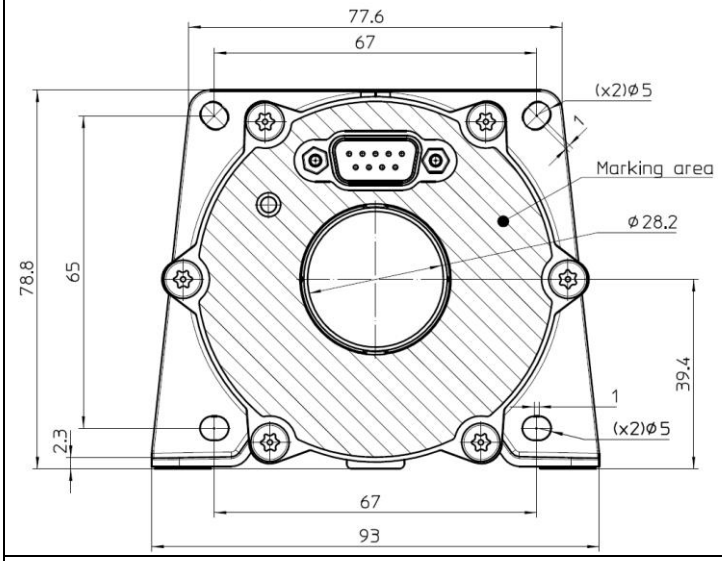
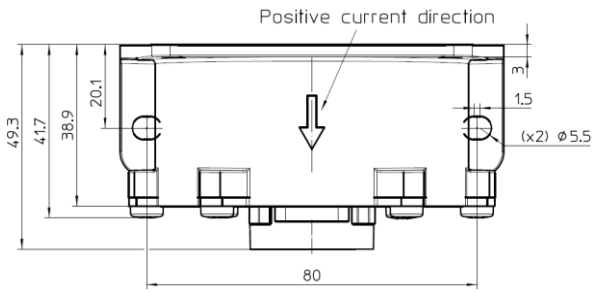
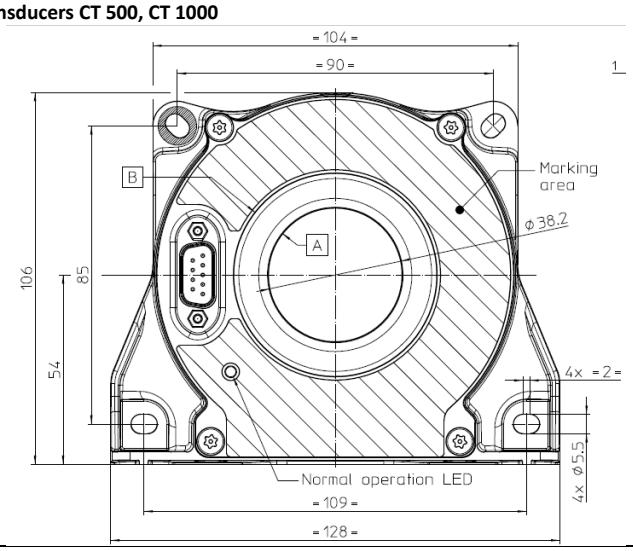
Dimensions

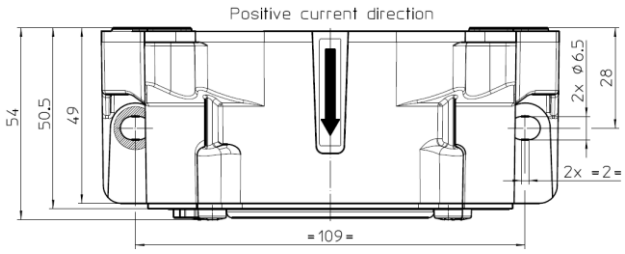
Transducers CT 100, CT 200, CT 400



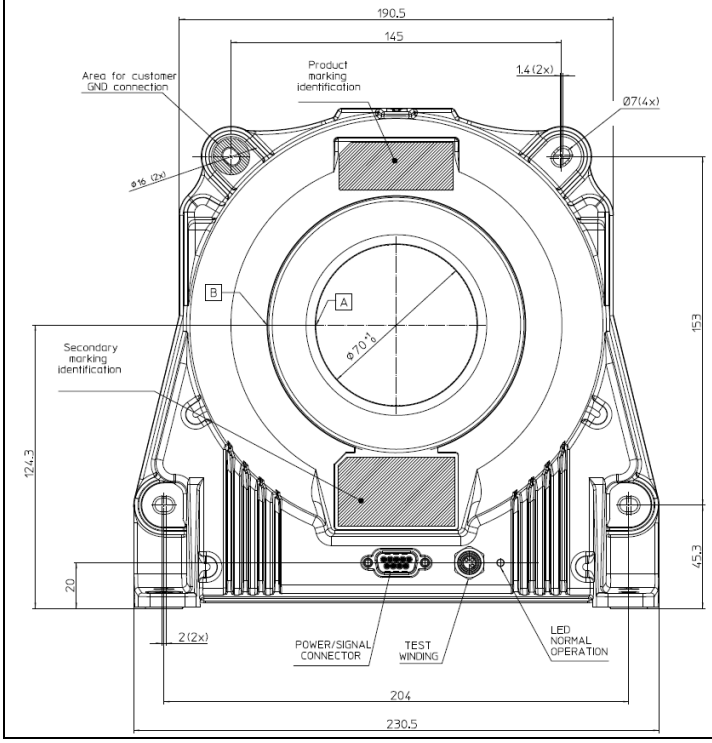


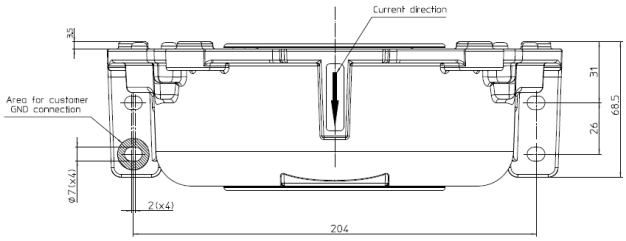
Transducers CT 500, CT 1000





Transducer CT 2000





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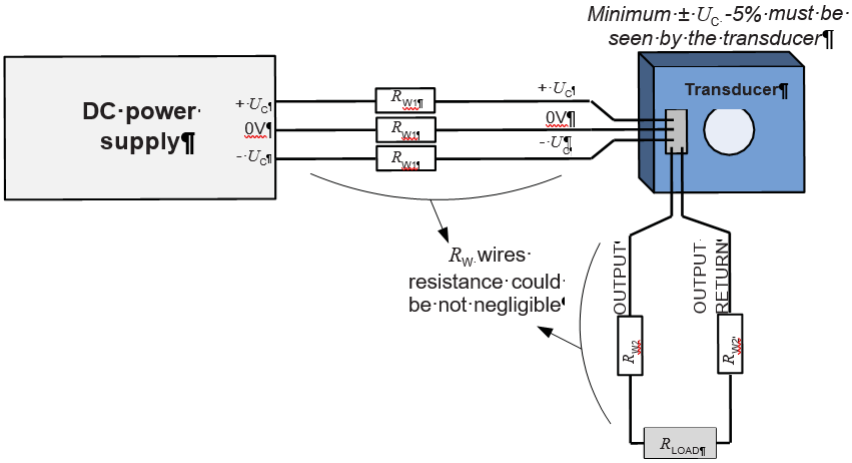
7.3. Connection cables

Connection cables from the TPS rack to the transducers are available in various cable lengths. Be aware that the cable resistance is part of the maximum measuring resistance mentioned in the transducer data sheets. The cables are available with two different wire cross sections, 0.34 mm² and 0.75 mm².



7.3.1 Standard Connection Cables

Order Number	Cable Length	Wire Cross Section	Single Wire Resistance	Loop Resistance (4 x R_{WIRE})	Mass
MCTS/TPS/1	1 m	0.34 mm²	0.05 Ω	0.21 Ω	0.15 kg
MCTS/TPS/1.5	1.5 m	0.34 mm²	0.08 Ω	0.31 Ω	0.21 kg
MCTS/TPS/2.5	2.5 m	0.34 mm²	0.13 Ω	0.52 Ω	0.28 kg
MCTS/TPS/3	3 m	0.34 mm²	0.16 Ω	0.63 Ω	0.32 kg
MCTS/TPS/5	5 m	0.34 mm²	0.26 Ω	1.05 Ω	0.47 kg
MCTS/TPS/10	10 m	0.34 mm²	0.52 Ω	2.09 Ω	0.84 kg
MCTS/TPS/15	15 m	0.34 mm²	0.79 Ω	3.14 Ω	1.21 kg
MCTS/TPS/20	20 m	0.34 mm²	1.05 Ω	4.19 Ω	1.58 kg
MCTS/TPS/2.5/0.75	2.5 m	0.75 mm²	0.06 Ω	0.24 Ω	0.37 kg
MCTS/TPS/5/0.75	5 m	0.75 mm²	0.12 Ω	0.47 Ω	0.65 kg
MCTS/TPS/10/0.75	10 m	0.75 mm²	0.24 Ω	0.95 Ω	1.15 kg
MCTS/TPS/15/0.75	15 m	0.75 mm²	0.36 Ω	1.42 Ω	1.70 kg
MCTS/TPS/20/0.75	20 m	0.75 mm²	0.47 Ω	1.90 Ω	2.30 kg
MCTS/TPS/25/0.75	20 m	0.75 mm²	0.59 Ω	2.37 Ω	2.80 kg
MCTS/TPS/30/0.75	30 m	0.75 mm²	0.71 Ω	2.85 Ω	3.30 kg

7.3.2 Total Measuring Resistance at Full Scale

Transducer	Max. Measuring Resistance
CT 100	25 Ω
CT 200	20 Ω
CT 400	10 Ω
CT 500	5 Ω
CT 1000	4 Ω
CT 2000	3.5 Ω

Other resistance values depending on primary current and temperature in graphs on page 9

Maximum Burden Resistor depending on Transducer and Connection Cable

The remaining burden resistance can be calculated by the subtraction of the connection cable loop resistance from the transducer total measuring resistance.

Example CT 1000 with 15 meters cable 0.34 mm² and 0.75 mm²:
CT 1000 total measuring resistance: 4 Ω at 1000 A_{rms}
MCTS/TPS/15 loop resistance: 3.14 Ω → Maximum allowed burden resistor = 4 Ω - 3.14 Ω = 0.86 Ω
MCTS/TPS/15/0.75 loop resistance: 1.42 Ω → Maximum allowed burden resistor = 4 Ω - 1.42 Ω = 2.58 Ω

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7.4. Burden modules

The TPS system delivers the transducer output current at the 4 mm output terminals on the back panel of the rack. For those instruments that don't have current input terminals, optional high precision passive and active plug-on burden modules with very low phase angle error are available. The active voltage output modules are supplied by the TPS unit with a 3-pole D-SUB connector.

7.4.1. Passive plug-on burden resistors

Passive plug-on burden resistors are available from 1 Ω to 50 Ω. The burden resistor is limited by the transducer and the length of the connection cable. For higher output voltages active plug-on burden amplifiers are available.

Order Number	Resistance Value	Accuracy	Frequency Influence	Phase Error	Bandwidth	Max. Output Voltage	Load Influence
MCTS/BR1/0.025	1 Ω	0.025 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	1.00 V_{rms} @ 1000 mA_{rms}	< 0.1 ppm/mW
MCTS/BR1.5/0.025	1.5 Ω	0.025 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	1.00 V_{rms} @ 667 mA_{rms}	< 0.1 ppm/mW
MCTS/BR2.5/0.025	2.5 Ω	0.025 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	1.58 V_{rms} @ 632 mA_{rms}	< 0.1 ppm/mW
MCTS/BR3.75/0.025	3.75 Ω	0.025 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	1.94 V_{rms} @ 516 mA_{rms}	< 0.1 ppm/mW
MCTS/BR5/0.025	5 Ω	0.025 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	2.24 V_{rms} @ 447 mA_{rms}	< 0.1 ppm/mW
MCTS/BR10/0.015	10 Ω	0.015 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	3.16 V_{rms} @ 316 mA_{rms}	< 0.1 ppm/mW
MCTS/BR25/0.015	25 Ω	0.015 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	5.00 V_{rms} @ 200 mA_{rms}	< 0.1 ppm/mW
MCTS/BR50/0.015	50 Ω	0.015 % of MV	0.0005 %/kHz	< 1° @ 100 kHz	> 1 MHz	7.07 V_{rms} @ 141 mA_{rms}	< 0.1 ppm/mW

Resulting scaling with standard transducer / passive burden-combinations

Transducer	Passive BR	Scaling	Output Voltage
CT 100	MCTS/BR10/0.015	20 mV/A	2 V_{rms} @ 100 A_{rms}
CT 200	MCTS/BR10/0.015	10 mV/A	2 V_{rms} @ 200 A_{rms}
CT 400	MCTS/BR3.75/0.025	2.5 mV/A	1 V_{rms} @ 400 A_{rms}
CT 500	MCTS/BR1.5/0.025	2 mV/A	1 V_{rms} @ 500 A_{rms}
CT 1000	MCTS/BR1.5/0.025	1 mV/A	1 V_{rms} @ 1000 A_{rms}
CT 2000	MCTS/BR1/0.025	0.5 mV/A	1 V_{rms} @ 2000 A_{rms}

Dimensions

Width:	51 mm
Height:	51 mm
Depth:	62 mm (connectors included)
Mass:	85 g

7.4.2. Active plug-on voltage amplifiers

The output voltage level the transducer can drive is limited. The active plug-on burden modules combine a very precise burden resistor with a highly accurate voltage amplifier. The plug-on burden voltage modules deliver 7 V_{rms} (± 9.9 V_{pk}) at transducer nominal value. The active plug-on voltage output modules are powered by the 3-pole D-SUB on the back panel of the system.

Order Number	Input Resistance	Accuracy	Frequency Influence	Phase Error	Bandwidth	Max. Output Voltage	Load Influence
MCTS/VM1/0.02	1 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 1000 mArms	< 0.1 ppm/mW
MCTS/VM0.66/0.02	1.5 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 667 mArms	< 0.1 ppm/mW
MCTS/VM0.4/0.02	2.5 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 400 mArms	< 0.1 ppm/mW
MCTS/VM0.26/0.02	3.75 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 267 mArms	< 0.1 ppm/mW
MCTS/VM0.2/0.02	5 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 200 mArms	< 0.1 ppm/mW
MCTS/VM0.1/0.02	10 Ω	0.01 % of MV + 0.01 % of MR	0.015 %/kHz	< 1° @ 100 kHz	> 300 kHz	7 Vrms @ 100 mArms	< 0.1 ppm/mW

Resulting scaling with standard transducer / passive burden-combinations

Transducer	Active VM	Scaling	Output Voltage
CT 100	MCTS/VM0.2/0.02	20 mV/A	2 V_{rms} @ 100 A_{rms}
CT 200	MCTS/VM0.2/0.02	10 mV/A	2 V_{rms} @ 200 A_{rms}
CT 400	MCTS/VM0.26/0.02	2.5 mV/A	1 V_{rms} @ 400 A_{rms}
CT 500	MCTS/VM0.66/0.02	2 mV/A	1 V_{rms} @ 500 A_{rms}
CT 1000	MCTS/VM0.66/0.02	1 mV/A	1 V_{rms} @ 1000 A_{rms}
CT 2000	MCTS/VM0.66/0.02	0.5 mV/A	1 V_{rms} @ 2000 A_{rms}

Dimensions

Width:	51 mm
Height:	51 mm
Depth:	62 mm (connectors included)
Mass:	105 g

SIGNALTEC GmbH, Reutersbrunnenstrasse 27, D-90429 Nürnberg, GERMANY, T. +49 911 2550993-0, F. +49 911 2550993-13, Email: info@signaltec.com, Web: www.signaltec.com

8. Switching off and deinstallation

Before you switch off the TPS rack, open the output current loop or remove any cable between rack and sensor, make sure that the primary current is switched off. An unpowered transducer can be damaged.

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9. Accessories

	TPS/RMB Rack mounting brackets for installation into a 19” cabinet
	TPS/CB Carrying bag for rack, transducers, cables and burden modules
	TSC Transducer soft case for use with carrying bag **TSC1** for CT 100, CT 200, CT 400 **TSC2** for CT 500, CT 1000 **TSC4** for CT 2000
	TPS/ROC 18-pole D-SUB-cable for status-readout-interface, length 3 m
	BNC4A BNC to 4 mm banana-plug adapter
	BPL0.5 4 mm banana-plug test lead set, length 0.5 m
	BPL01 4 mm banana-plug test lead set, length 1 m
	BNCL1 BNC to BNC test lead, length 1 m
	BNC4L1 BNC to 4 mm banana-plug test lead, length 1 m

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