

# TPS TRANSDUCER POWER SUPPLY & LEM IT CURRNET TRANSDUCER



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## 1. INTRODUCTION

The TPS is a single channel power supply for all LEM IT high precision current transducers from 60 A<sub>rms</sub> up to 1000 A<sub>rms</sub> sinusoidal current (85 A<sub>pk</sub> to 1414 A<sub>pk</sub>).

### 1.1 MAXIMUM RANGES

Transducer	rms <sup>1</sup> (100%)	pk <sup>2</sup> (100%)	DC <sup>3</sup> (100%)	Overload rms <sup>4</sup>
IT 60-S	60 A	85 A	60 A	300 A
IT 200-S	200 A	283 A	200 A	1000 A
IT 400-S	400 A	566 A	400 A	2000 A
IT 600-S	600 A	660 A	600 A	3000 A
IT 700-S	700 A	848 A	700 A	3500 A
IT 1000-S/SP1	1000 A	1414 A	1000 A	5000 A

- 1) Valid for sinusoidal current waveform
- 2) Maximum peak current range
- 3) Maximum DC current range
- 4) Shorttime overload range (500 % of DC current range for 100 ms)

### 1.2 MINIMUM RANGES

Linearity and offset error of the transducers are just a few ppm of the maximum current range. 1 ppm is equal to 0.0001 %. The lowest possible current to measure mainly depends on the input range of the connected instrument. Normally the TPS current output is connected directly to an instrument current input terminal. This is in fact the most precise and least noise sensitive solution. At instruments which are equipped with high current input terminals the TPS current output signal needs to be connected to the current sensor input (voltage input) of the instrument via a burden resistor.

## **2. RECEIVING OF GOODS**

- TPS power supply
- Transducer connection cable 2.5 meters
- Power cord
- Installation manual

The current transducer is not part of delivery. It needs to be ordered separately.

For the connection of the TPS to a power analyzer current sensor input terminal, plug-on burden resistors MCTS/BR are available. These burden resistors need to be ordered separately (see data sheet).

### 3. HARDWARE INSTALLATION

Before switching on the primary current through the transducer you need to verify the following items.

- It has to be certain that the TPS is connected to the grid and switched on. In addition the current output of the TPS must be connected to a power meter, a burden resistor or any other instrument which ensures a current loop through the transducer. If there is no instrument available the TPS current output terminals can be shorted.
- The right transducer type needs to be adjusted with the front switch.
  - 866: IT 600-S
  - 867: all other types (IT 60-S, IT 200-S, IT 400-S, IT 700-S, IT 1000-S/SP1)

The transducer adjustment 866 or 867 needs to be done when the TPS is switched off. When the unit is powered the type switch is locked to avoid an interruption of the compensation current under load.

#### **CAUTION !**

*Before you apply a primary current the transducer must be connected to the TPS and the unit must be powered.*

*A high current through a non-powered transducer can result in some 10 ppm offset.*

*A disconnection of the transducer connection cable or an interrupt in the current output loop under load can destroy the transducer electronics.*

### 3.1 CONNECTION OF TPS CURRENT OUTPUT TO A POWER ANALYSER CURRENT INPUT

The transducer is connected to the TPS back panel by means of the grey D-sub connection cables. The current output terminals are placed above the transducer connection input terminal. The output current will be connected to the current input terminals of the power meter via normal 4 mm safety leads. The direction of current and power is defined by the arrow on the transducer and the color of the current output terminals (red = high, black = low).

TO CURRENT INPUT TERMINALS  
OF THE POWER METER

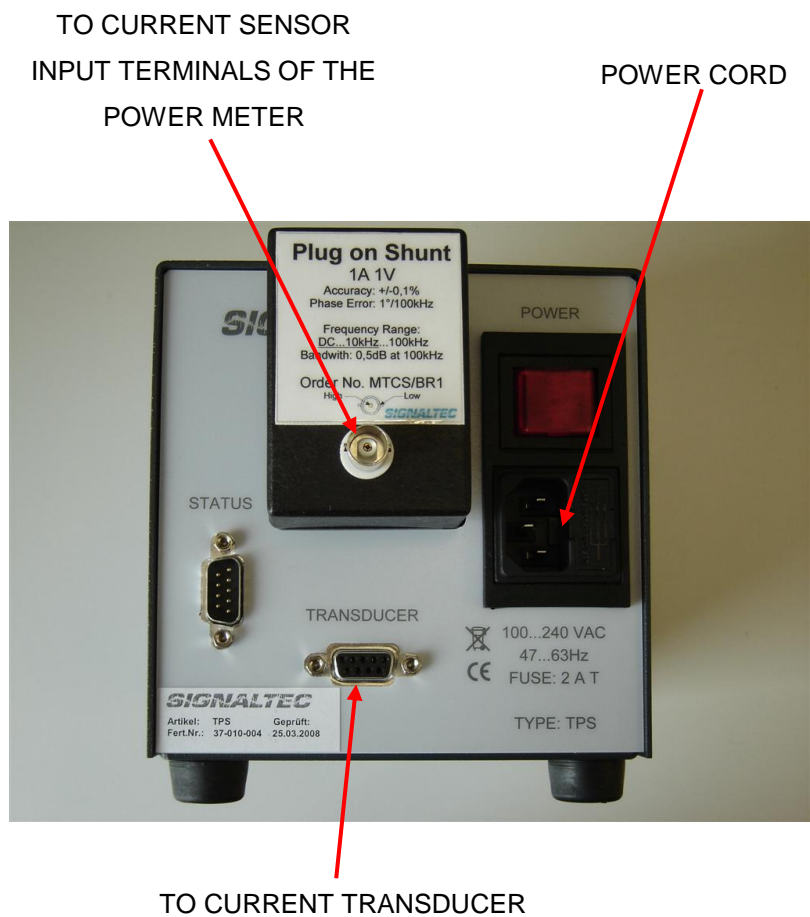
POWER CORD



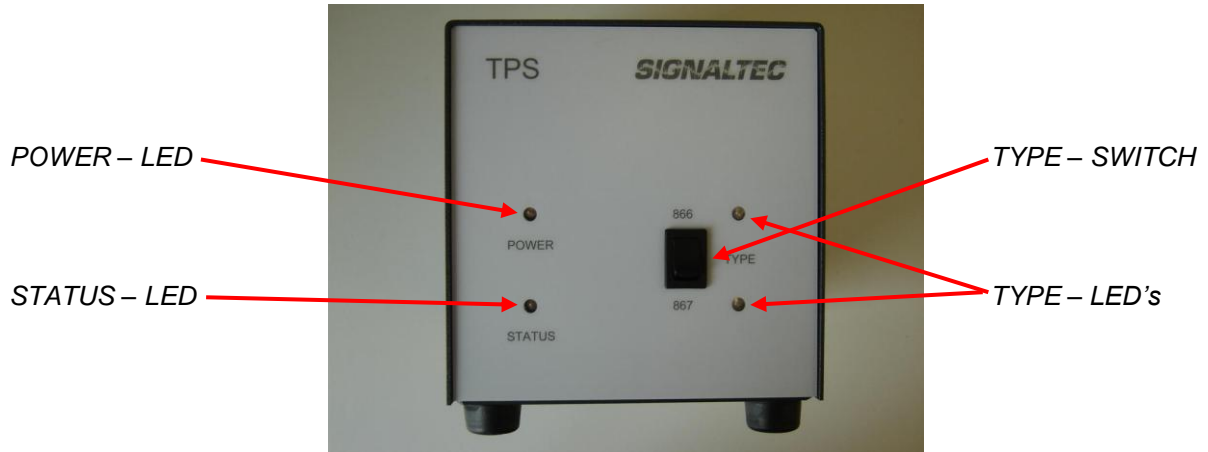
TO CURRENT TRANSDUCER

### 3.2 CONNECTION OF TPS CURRENT OUTPUT TO A POWER ANALYSER CURRENT SENSOR INPUT VIA A MCTS/BR BURDEN RESISTOR

The transducer will be connected to the TPS back panel by means of the grey D-sub connection cables. The current output terminals are placed above the transducer connection input terminal. The MCTS/BR burden resistor can be plugged in the current output terminals. Via a BNC connection cable the output voltage will be connected to the current sensor input of the power meter. The direction of current and power is defined by the arrow on the transducer, the color of the current output terminals (red = high, black = low) and the BNC connector (inner terminal = high, outer terminal = low).



#### 4. OPERATION INSTRUCTIONS



Before switching on the TPS the transducer type needs to be adjusted with the TYPE-SWITCH on the front panel. When the TPS is powered the TYPE-SWITCH is locked. The adjusted transducer type is assigned with the blue LED's.

866: IT 600-S

867: all other types (IT 60-S, IT 200-S, IT 400-S, IT 700-S, IT 1000-S/SP1)

The operation status of TPS and transducer is visualized by means of two LED's POWER and STATUS at the front panel.

*POWER*-LED off: TPS not powered

*POWER*-LED green: TPS powered

*STATUS*-LED off: TPS not powered

*STATUS*-LED green: Transducer connected, normal operation

*STATUS*-LED red: Transducer overloaded or interruption in output circuit, switch primary current off!



## 5. STATUS READOUT

The transducer STATUS information is available at the 9-pole D-SUB male connector on the back panel.

The internal change over switch is able to switch 50 V / 2 A. Three D-SUB-contacts 1-2-6, 4-5-9, 3-7-8 are connected in parallel.



Connection between 3-7-8 and 1-2-6: STATUS **OK**

Connection between 3-7-8 and 4-5-9: STATUS **ERROR**

## 6. SCALING OF POWER ANALYSER INPUT RANGES

### 6.1 SCALING OF ANALYSER DIRECT CURRENT INPUT RANGES

In this case the current transducer ratio needs to be programmed in the power meter menu for the direct current input terminal.

Transducer	Maximum Primary Current	Maximum Output Current	Current Transducer Ratio	Scaling Factor
IT 60-S	60 A <sub>rms</sub>	100 mA <sub>rms</sub>	60A/100 mA	600 : 1
IT 200-S	200 A <sub>rms</sub>	200 mA <sub>rms</sub>	200 A/200 mA	1000 : 1
IT 400-S	400 A <sub>rms</sub>	200 mA <sub>rms</sub>	400 A/200 mA	2000 : 1
IT 600-S	600 A <sub>rms</sub>	400 mA <sub>rms</sub>	600 A/400 mA	1500 : 1
IT 700-S	700 A <sub>rms</sub>	400 mA <sub>rms</sub>	700 A/400 mA	1750 : 1
IT 1000-S/SP1	1000 A <sub>rms</sub>	1000 mA <sub>rms</sub>	1000 A/1000 mA	1000 : 1

### 6.2. SCALING OF ANALYSER CURRENT SENSOR RANGES FOR MCTS/BR BURDEN RESISTORS

For the connection of the TPS to a current sensor input terminal of a power meter plug-on burden resistors MCTS/BR5 (5 Ω for IT 60-S, IT 200-S IT 400-S), MCTS/BR2.5 (2.5 Ω for IT 600-S, IT 700-S) and MCTS/BR1 (1 Ω for IT 1000-S/SP1) can be ordered. The resulting scaling factor needs to be programmed in the power meter sensor input menu.

Transducer	Current Transducer Ratio	Burden Resistor	Scaling Factor
IT 60-S	600 : 1	MCTS/BR10	16.67 mV / A
IT 200-S	1000 : 1	MCTS/BR5	5.000 mV / A
IT 400-S	2000 : 1	MCTS/BR5	2.500 mV / A
IT 600-S	1500 : 1	MCTS/BR2.5	1.667 mV / A
IT 700-S	1750 : 1	MCTS/BR2.5	1.429 mV / A
IT 1000-S/SP1	1000 : 1	MCTS/BR1	1.000 mV / A

### 6.3. SCALING OF ANALYSER CURRENT SENSOR RANGES FOR ANY BURDEN RESISTOR

Other burden resistors should meet the following requirements:

- The power losses must be high enough
- The amplitude accuracy must be high enough (low  $T_c$ )
- The angle error must be low enough
- The resistance value should not be too high (see transducer data sheet)

Calculation example for transducer IT 700-S and burden resistor 2.34  $\Omega$

Current transducer ratio IT 700-S: 1750:1

Resistance value: 2.34  $\Omega$

Maximum power losses ( $I^2 \cdot R$ ):  $(0.4 \text{ A})^2 \cdot 2.34 \Omega = 0.37 \text{ W}$

Resulting scaling factor: 2.34 V/A divided by 1750 A/A results in 1.337 mV/A

## **7. SWITCHING OFF AND DEINSTALLATION**

Before the TPS system can be switched off and transducer connection cables or current output connections can be interrupted the primary current circuit needs to be switched off.

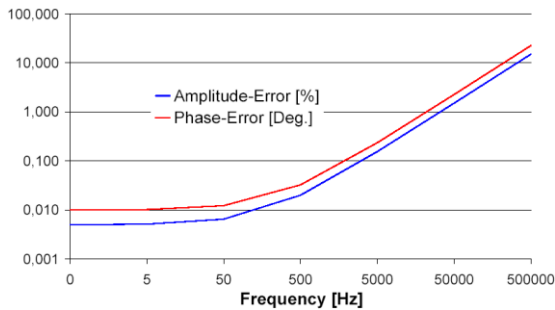
APPENDIX: DATA SHEET TPS

**Transducer Specifications**

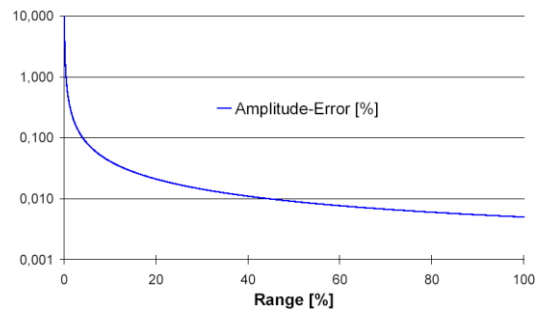
Transducer	IT 60-S	IT 200-S	IT 400-S	IT 600-S	IT 700-S	IT 1000-S/SP1
<b>Primary Current Range DC, RMS Sinus</b>	60 A	200 A	400 A	600 A	700 A	1000 A
<b>Overload Ability Short Time (100 mS)</b>	500 % (300 Apk)	500 % (1000 Apk)	500 % (2000 Apk)	500 % (3000 Apk)	500 % (3500 Apk)	500 % (5000 Apk)
<b>Bandwidth</b>	DC ... 1 MHz	DC ... 1 MHz	DC ... 500 kHz	DC ... 500 kHz	DC ... 250 kHz	DC ... 1 MHz
<b>Temperature Influence</b>	1 ppm/K	1 ppm/K	1 ppm/K	1 ppm/K	1 ppm/K	1 ppm/K
<b>Output Ratio</b>	100 mA at 60 A	200 mA at 200 A	200 mA at 400 A	400 mA at 600 A	400 mA at 700 A	1 A at 1000 A
<b>Linearity</b>	0.00 1%	0.001 %	0.001 %	0.001 %	0.001 %	0.001 %
<b>Offset</b>	0.004%	0.004 %	0.004 %	0.004 %	0.004 %	0.004 %
<b>Frequency Influence</b>	0.03 %/kHz	0.03 %/kHz	0.06 %/kHz	0.06 %/kHz	0.12 %/kHz	0.03 %/kHz
<b>Angular Influence</b>	0.01° + 0.045°/kHz	0.01° + 0.045°/kHz	0.01° + 0.06°/kHz	0.01° + 0.06°/kHz	0.01° + 0.12°/kHz	0.01° + 0.045°/kHz

**Graphs for Transducers 60 A, 200 A, 1000 A**

Amplitude- / Phase-Error depending on Frequency



Amplitude-Error depending on Range (DC)



**Dimensions**

TPS Transducer Power Supply	
Cabinet Width:	134 mm
Cabinet Height:	145 mm
Cabinet Depth:	230 mm
Cabinet Weight:	1.6 kG

**Transducers:**

See Transducer Datasheets  
IT 60-S ... IT 1000-S/SP1



Front Panel



Rear Panel

**General Data**

TPS Input Voltage:	100 ... 240 V / 650 mA AC, 47 ... 63 Hz
Test voltage transducer head:	5 kVrms AC
Operation temperature:	10 ... 50°C
Operation humidity:	20 ... 80%
Warranty period:	36 months

**Transducer Status Readout**

9-pole D-SUB connector for transducer status NORMAL OPERATION and OVERLOAD (relay output, 50 V / 2 A).

**Optional Voltage Output (Plug-On Shunts)**

<b>MCTS/BR1:</b> 1A/10/1W Shunt (for IT 1000) Amplitude Accuracy: 0.1% Angular Accuracy: 1° at 100 kHz Frequency Range: 300 kHz / 0.5 dB	<b>MCTS/BR10:</b> 100 mA/10Ω/1W Shunt (for IT 60) Amplitude Accuracy: 0.05% Angular Accuracy: 1° at 100 kHz Frequency Range: 300 kHz / 0.5 dB	<p>4 mm Input Terminals – BNC Output</p>	<p>Plug-On Solution</p>
<b>MCTS/BR2.5:</b> 400mA/2.5Ω/1W Shunt (for IT 600, IT 700) Amplitude Accuracy: 0.05% Angular Accuracy: 1° at 100 kHz Frequency Range: 300 kHz / 0.5 dB	<b>Resulting Ratio:</b> IT 60 with MCTS/BR5: 16.667 mV/A IT 200 with MCTS/BR5: 5.0000 mV/A IT 400 with MCTS/BR5: 2.5000 mV/A IT 600 with MCTS/BR5: 1.6667 mV/A IT 700 with MCTS/BR2.5: 1.4286 mV/A IT 1000 with MCTS/BR1: 1.0000 mV/A		
<b>MCTS/BR5:</b> 200mA/5Ω/1W Shunt (for IT 200, IT400) Amplitude Accuracy: 0.05% Angular Accuracy: 1° at 100 kHz Frequency Range: 300 kHz / 0.5 dB			

**Order Numbers**

For instruments with direct low current inputs a TPS power supply unit and one LEM current transducer must be ordered. For instruments with voltage input terminals (current sensor inputs) a TPS, one LEM transducer and one burden resistor are needed.

Nominal Current Range	TPS Power Supply	DANFYSIK Current Transducer	Optional Shunt
60 A	TPS	IT 60-S	MCTS/BR10
200 A		IT 200-S	MCTS/BR5
400 A		IT 400-S	MCTS/BR5
600 A		IT 600-S	MCTS/BR2.5
700 A		IT 700-S	MCTS/BR2.5
1000 A		IT 1000-S/SP1	MCTS/BR1
	consisting of: - 1 TPS Electronics Unit - 1 Connection Cable 2.5m - 1 Power Cord - 1 Manual	consisting of: - 1 IT Current Transducer	consisting of: - 1 Plug-On Shunt