


# Datasheet Series TRL

<b>Model</b>	<b>TRL10K12</b>	
<b>Order no.</b>	<b>29-003-000-01</b>	
<b>Basic operating modes</b>	CC, CV, CR, CP	
<b>Standard interfaces</b>	RS-232, USB, LAN, CAN	
<b>Max. input voltage V<sub>max</sub></b>	1200 V	
<b>Min. input voltage V<sub>min</sub></b> <sup>1)</sup>	12 V	
<b>Max. load current I<sub>max</sub></b>	5 A	
<b>Continuous power</b>	1000 W	
<b>Short-time power</b>	1000 W	
<b>Voltage setting</b>	0 ... 1200 V	
<b>Current setting</b>	0 ... 5 A	
<b>Resistance setting</b>	2.4 Ohm ... 2400 Ohm	
<b>Power setting</b>	0 ... 1000 W	
<b>Rise and fall time fast / medium / slow</b> <sup>2)</sup>	10 / 50 / 250 ms	
<b>Mains</b>	1/N/PE AC 230 V 50 Hz	
<b>Power consumption</b> <sup>3)</sup>	85 VA	
<b>Max. feed-in power</b>	920 VA	
<b>Max. efficiency</b>	90 %	
<b>Noise max. ca.</b> <sup>4)</sup>	49 dB(A)	
<b>Load terminals</b> <sup>5)</sup>	SBU4-24	
<b>Weight ca.</b>	7.2 kg	
<b>Housing</b> <sup>6)</sup>	1/2 19", 2 U	
<b>Width x Height x Depth</b>	219 x 101 x 465 mm	

1. Minimum input voltage for maximum static load current.
2. Rise and fall times are defined of 10 ... 90 % and 90 ... 10 % of the maximum current at 10 % of the maximum input voltage (CC mode, tolerance ±20 %). Times will vary at different settings.
3. Power consumption in idle operation (without load current)
4. Measured at the front in distance of 1 m
5. Load and sense terminals both at front and rear panel.  
FKL15/4-SM6: Flat copper bars 15 x 4 mm horizontal with hole for screw M6  
SBU4-24: Safety sockets touch-protected for 4 mm laboratory jacks, max. 24 A
6. Largest width and depth without wiring. 1 U = 44.45 mm.

Operating modes, functions		
Basic operating modes	CC, CP, CR, CV	
Combined operating modes	CC+CV, CR+CC+CV, CP+CC+CV, CV+CC	
Functions	DC load MPP Tracking for solar panel test energy storage device test internal resistance measurement List function rectangular function (in local operation also in PWM mode) modulation (sine, triangle, square) data acquisition (internally or to USB flash drive) save and recall of device settings watchdog in remote operation master-slave mode for power extension	
User interface	4.3" TFT touch display	
Accuracy of setting		
	of setting	of corresponding range
Voltage	±0.2 %	±0.05 %
Current	±0.5 %	±0.05 %
Resistance (at 5 % to 100 % of voltage range)	±1.4 %	±0.3 % of current range ±0.5 % of resistance range
Power (at V and I > 10 % of range)	±0.35 %	±0.1 %
(at V or I 5 ... 10% of range)	±0.7 %	±0.25 %
Resolution	14 bits	
Accuracy of adjustable protections		
	of setting	of corresponding range
Overcurrent protection	±1 %	±0.3 %
Undervoltage protection	±1 %	±0.3 %
Resolution	12 bits	
Accuracy of measurement slow		
	of measured value (real value)	of corresponding range
Voltage	±0.01 %	±0.025 %
Current	±0.2 %	±0.05 %
Resistance	is calculated from current and voltage	
Power	is calculated from current and voltage	
Resolution	23 bits	
Sampling time	250 ms, not triggerable	
Accuracy of display		
Number of decimal places	4	
Accuracy	accuracy of measurement slow ±1 digit of the display value	
Accuracy of measurement fast		
	of measured value (real value)	of corresponding range
Voltage	±0.1 %	±0.1 %
Current	±0.7 %	±0.1 %
Resistance	is calculated from current and voltage	
Power	is calculated from current and voltage	
Resolution	16 bits	
Sampling time	200 µs ... 1,000 s, resolution 200 µs	
Accuracy of trigger voltage and current		
Trigger voltage	±1 % of voltage range	
Trigger current	±1 % of current range	
Sampling time	200 µs	

Dynamic function LIST	
Operating modes	CC, CV, CR, CP
No. of load levels	max. 300, with corresponding ramp and dwell times
Accuracy of load levels	see accuracy of setting
Dwell time <sup>1)</sup>	200 µs ... 1,000 s
Ramp time <sup>1)</sup>	0 ... 1,000 s
Resolution	200 µs
Accuracy of setting times	±0.02 %
Sampling time	see accuracy of measurement fast
Delay at triggered start	max. 300 µs
Dynamic function rectangular	
Operating modes	CC, CV
No. of load levels	2
Accuracy of load levels	see accuracy of setting
Pulse times <sup>1)</sup> , resolution	1 µs ... 9999.999 ms, resolution 1 µs
Accuracy of setting times	0.02 %
Dynamic function PWM	
Operating modes	CC, CV, CR
No. of load levels	2
Accuracy of load levels	see accuracy of setting
Frequency <sup>1)</sup> , resol.	0.1 Hz ... 10 kHz, resolution 0.1 Hz
Duty cycle, resol.	1 ... 99 %, resolution 1 %
Dynamic function modulation	
Operating modes	CC, CV
Waveforms	sine, square, triangle
Frequency <sup>1)</sup> , resol.	0.1 Hz ... 10 kHz, resolution 0.1 Hz
Modulation depth	0 ... 100 %
Data acquisition	
to external USB flash drive	
Sampling time	0.1 ... 30.0 s, resolution 0.1 s
Measurement data	timestamp, voltage, current
No. of measurement points	limited by flash drive memory capacity
File format	.csv
to internal memory	
Sampling time	200 µs ... 1,000 s, resolution 200 µs, synchronized with dynamic function
Measurement data	timestamp, voltage, current
No. of measurement points	max. 40,000 in ring buffer
Settings memory	
No. of memory positions	9, selectable (incl. programmed list) 1 for last device settings at power-off or power failure
I/O port (option TRL06): inputs and outputs	
Inputs	analog load setting I and V 0 ... 5 V and 0 ... 10 V analog protection setting I and V 0 ... 5 V and 0 ... 10 V load input activation (low active) operating mode selection CC/CV control speed selection fast/slow remote shut-down (high active) readable digital input (by SCPI command) trigger input (positive/negative/edge) control input (activates I/O port, low active)
Dig. input levels	logical low: 0 ... 0.8 V, logical high: 3 ... 30 V

The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid when the sense lines are connected and when the unit is connected to undisturbed voltages (ripple and noise < 0.1 %). At voltages with higher disturbance values the accuracy can change for the worse.

1. The applicable time or frequency range is limited by the rise/fall time of the respective model.

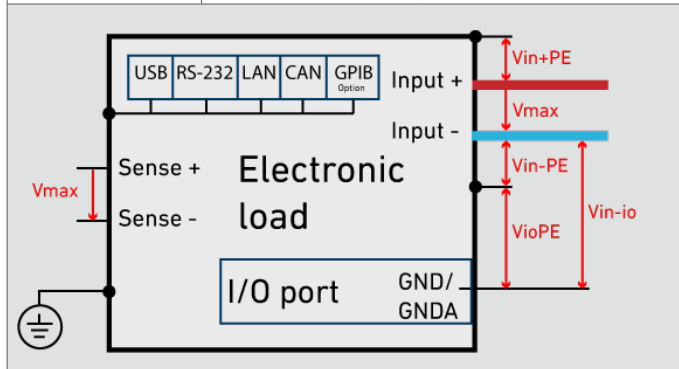
## Technical Data

Outputs	analog voltage monitor output 0 ... 10 V analog current monitor output 0 ... 10 V load input activation state (low active) overload status (OV, OCP, OPP, OTP, low active) programmable logic output (by SCPI command) trigger output (low active)
Dig. output levels	logical low: 0 ... 0.8 V logical high: 5 V/24 V selectable, max. 10 mA (push-pull)

<b>I/O port (option TRL06): accuracy of analog control 0 ... 5 V or 0 ... 10 V</b>		
	of setting	of corresponding range
Voltage	±0.2 %	±0.05 %
Current	±0.2 %	±0.05 %
Overcurrent protection <sup>1)</sup>	±1 %	±0.3 %
Undervoltage protection <sup>1)</sup>	±1 %	±0.3 %
input resistance of analog inputs >10 kΩ		

<b>I/O port (option TRL06): accuracy of analog monitor outputs 0 ... 10 V</b>		
	of analog signal of actual value	offset voltage
Voltage	±0.2 %	±15 mV
Current	±0.2 %	±15 mV
permissible load > 2 kΩ		

<b>I/O port (option TRL06): permissible voltages</b>	
Vin-io (GND - neg. load input)	max. 800 V <sup>2)</sup>
VioPE (GND - PE)	max. 50 V <sup>2)</sup>



<b>Input</b>	
Input resistance	>50 kΩ when load input is off diode function at reverse polarity up to nominal current
Input capacity	see model overview
Parallel operation	up to 5 devices in master-slave operation
Max. input voltage Vmax	see model overview
Min. input voltage Vmin	see model overview

<b>Input: permissible voltages</b>	
Vin-PE (neg. load input - PE)	max. 800 V <sup>2)</sup>
Vin+PE (pos. load input - PE)	Vmax + max. 800 V <sup>2)</sup>

<b>Power</b>	
Continuous power	see model overview (at Ta = 21 °C)
Derating	-1.2 %/°C for Ta > 21 °C
Effectivity	see model overview

<b>Protection and monitoring</b>	
Protective devices	overcurrent overpower overtemperature
Monitoring	overvoltage indication reverse polarity indication undervoltage indication (if the input voltage is too low for the set current)

<b>Terminals</b>	
Load input	see model overview
Sense	SBU4-24, see starting at page 123
<b>Operating conditions</b>	
Operating temperature	5 ... 40 °C
Stock temperature	-25 ... 65 °C
Max. operating height	2,000 m above sea level
Pollution degree	2
Overvoltage category of mains	II
Max. humidity	80 % at 31 °C, linear decreasing to 50 % at 40 °C
Min. distance rear panel to wall or other objects	20 cm
Cooling	2-stage air cooling
Noise, weight	see model overview
Mains voltage	see model overview
Mains fuse	see specification on the rear panel near mains fuse
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm <sup>2</sup>
Own consumption	see model overview
Maximum feed-in power	see model overview

<b>Housing</b>	
Dimensions	see model overview
Color	front: RAL7035 (light grey) rear: stainless steel top: RAL7037 (dusty grey)
<b>Safety and EMC</b>	
Protection class	1
Measuring category	0 (CAT I according to EN 61010:2004)
Electrical safety	DIN EN 61010-1 DIN EN 61010-2-030
EMC	DIN EN 61326-1 DIN EN 55011 DIN EN 61000-3-2 DIN EN 61000-3-3

<b>Standard interfaces</b>	
Data interfaces	RS-232, USB, LAN, CAN
I/O port	none

<b>Available options</b>	
Data interfaces TRL02	GPIB
Mechanical options TRL10	19" installation kit for 1 device with ½ 19"; 2 U
TRL11	19" installation kit for 2 devices with ½ 19"; 2 U
TRL08	additional safety cover for load input incl. cap for unused load terminals
Hardware extensions TRL06	galvanically isolated I/O port

<b>Calibration, warranty</b>	
FCC-TRLxx	Factory Calibration Certificate, twice for free <sup>3)</sup>
Recommended calibration interval	2 years
Warranty	2 years

Technical data of production series A, rev. 3. Subject to technical changes without notice.

- Only 0 ... 10 V
- Positive/negative DC voltage or RMS value of a sinusoidal AC voltage
- The second calibration is free of charge if the particular device has been registered with H&H: [www.hoercht-hackl.com/service/device-registration](http://www.hoercht-hackl.com/service/device-registration) Series-specific data from catalog rev. 6.01