


Datasheet Series TRL

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| Model | TRL1040 |  |
| Order no. | 29-002-000-01 | |
| Basic operating modes | CC, CV, CR, CP | |
| Standard interfaces | RS-232, USB, LAN, CAN | |
| Max. input voltage V_{max} | 400 V | |
| Min. input voltage V_{min} ¹⁾ | 4 V | |
| Max. load current I_{max} | 15 A | |
| Continuous power | 1000 W | |
| Short-time power | 1000 W | |
| Voltage setting | 0 ... 400 V | |
| Current setting | 0 ... 15 A | |
| Resistance setting | 0.267 Ohm ... 268 Ohm | |
| Power setting | 0 ... 1000 W | |
| Rise and fall time fast / medium / slow ²⁾ | 10 / 50 / 250 ms | |
| Mains | 1/N/PE AC 230 V 50 Hz | |
| Power consumption ³⁾ | 85 VA | |
| Max. feed-in power | 920 VA | |
| Max. efficiency | 90 % | |
| Noise max. ca. ⁴⁾ | 49 dB(A) | |
| Load terminals ⁵⁾ | SBU4-24 | |
| Weight ca. | 7.2 kg | |
| Housing ⁶⁾ | 1/2 19", 2 U | |
| Width x Height x Depth | 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 % |
| Power (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 ¹⁾ | 200 µs ... 1,000 s |
| Ramp time ¹⁾ | 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 ¹⁾ , 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 ¹⁾ , 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 ¹⁾ , 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.

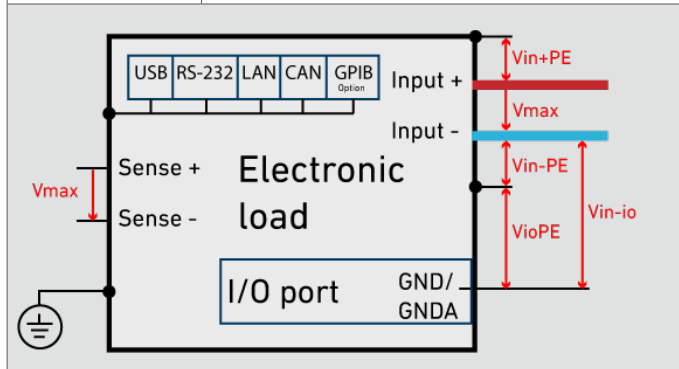
Technical Data

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| 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) |

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

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

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



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| Input | |
| 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 |

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| Input: permissible voltages | |
| Vin-PE (neg. load input - PE) | max. 800 V ²⁾ |
| Vin+PE (pos. load input - PE) | Vmax + max. 800 V ²⁾ |

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

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

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| Terminals | |
| Load input | see model overview |
| Sense | SBU4-24, see starting at page 123 |
| Operating conditions | |
| 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 ² |
| Own consumption | see model overview |
| Maximum feed-in power | see model overview |

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| Housing | |
| Dimensions | see model overview |
| Color | front: RAL7035 (light grey) rear: stainless steel top: RAL7037 (dusty grey) |
| Safety and EMC | |
| 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 |

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| Standard interfaces | |
| Data interfaces | RS-232, USB, LAN, CAN |
| I/O port | none |

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| Available options | |
| 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 |

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| Calibration, warranty | |
| FCC-TRLxx | Factory Calibration Certificate, twice for free ³⁾ |
| Recommended calibration interval | 2 years |
| Warranty | 2 years |

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

1. Only 0 ... 10 V

2. Positive/negative DC voltage or RMS value of a sinusoidal AC voltage

3. The second calibration is free of charge if the particular device has been registered with H&H: www.hoerchert-hackl.com/service/device-registration

Series-specific data from catalog rev. 6.01