H&H

Höcherl & Hackl
The electronic load

INDUSTRY
ELECTRONIC DC LOAD
SERVICE
AUTOMOTIVE
HIGH TECH
TRADE
MULTI-CHANNEL LOAD

PRODUCTS & SOLUTIONS

RENEWABLE ENERGIES

MILITARY

MEDICINE

SUPPORT

ENERGY RECYCLING

Main Catalog | 2024 Rev. 6.01

SOURCE-SINK

ELECTRONIC AC LOAD

R+D

AEROSPACE

RAIL INDUSTRY

POWER DISTRIBUTION

EXPERIENCE THE POWER OF H&H

35 years
H&H

our CEOs: Marco Höcherl, Laura Hackl-Späth

WELCOME AT HÖCHERL & HACKL

In this catalog we present our entire product and service portfolio. Sometimes, however, a brochure cannot replace personal contact. Therefore we always have an open ear for your questions and wishes.
We look forward to talking to you.

Höcherl & Hackl GmbH was founded as a partnership in 1986 and changed its name to the present GmbH in 1990. For over 35 years Höcherl & Hackl has been developing and manufacturing electronic loads and systems for testing power supplies, energy storage systems and fuel cells. We can look back on a stable company development. Through continuous growth we were able to establish our company as one of the leading suppliers of electronic loads in the German and international markets.

Comprehensive Product Portfolio

During this time, we have also gradually expanded H&H's product portfolio. In doing so, we react to the needs of the market, as more and more individual solutions are in demand. Our answer to this is the development of products that enable the energy to be fed back into the local power grid. Today these devices have a firm place in our assortment. In addition to a wide standard product range, we also develop and produce product variants that are manufactured according to our customers' requirements.

The Complete Power Spectrum

At our factory in Konzell, Bavaria, we cover the entire spectrum of value creation: product development, mechanical design up to series production, production up to commissioning, quality assurance and provision of all necessary service and support services. Software development is also in our hands. We have all the resources and the complete know-how to further develop our products in a

targeted manner. With the necessary detailed knowledge we configure, implement and support tailor-made solutions for our customers.

"Made in Germany" Allover the Product Lifecycle

H&H loads are especially designed with regard to durability and reliability. "Made in Germany" has a particularly high priority at H&H. Our qualified and motivated team ensures that we produce seamless quality, deliver after testing and, if necessary, develop customer-specific individual solutions according to special specifications. Service is H&H's top priority. We provide support in the way our own employees expect from other companies. Together with local service providers with which we' ve been working for years, H&H forms a unique competence centre for the product area of electronic loads.

Responsibility for Humans and Environment

Our company has been certified according to DIN EN ISO 9001 since 1999. Our QM system includes an environmental management system that we take extremely seriously in our daily practice, because sustainability is a central component of our product philosophy and therefore also of our corporate philosophy. This is also reflected in the fact that we have been providing training for young people since 1992, enabling us to internally pass on our know-how to the next generation.

H&H

CONTENT

H&H
THE COMPANY

Germany

Konzell

1986 - Foundation of the company

1990 - Conversion to the legal form of a GmbH

1992 - Employment of the first trainee

1995 - New building of a production hall

1999 - Certification according to DIN EN ISO 9001

2001 - Enlargement to the double factory space

2014 - Construction of the extension building

2022 - More than 40 employees work in Konzell

Our Site

Our family-run company has a home:
The entire development and production process of H&H products takes place in Konzell in Lower Bavaria on an area of 1200m². The development of our location reflects our growth history: The production hall was built in 1995 and expanded to double the production area in 2001. The ground-breaking ceremony for an extension building took place in 2014. Today, More than 40 employees in Konzell develop and produce solutions for users of electronic loads worldwide.

Here, in the beautiful Bavarian Forest, we offer our employees the best conditions and an environment worth living in. This benefits the long-term and sustainable development of our company. Because the competence in the minds of our employees is the most important potential for the further success of our products and our company.

Apprenticeship

In our company we focus on passing on our knowledge and train our junior staff ourselves. The first trainee was hired as early as 1992. Today Höcherl & Hackl offers two apprenticeship professions: "Electronics Technician for Devices and Systems" and "Office Management Assistant". Our apprenticeship positions are always filled by young employees. Training and further education are firmly anchored in our company. It is important to us to involve our trainees in the teamwork right from the start and to entrust them with challenging work. Flat hierarchies and interesting tasks ensure an excellent learning climate and guarantee a high level of training success.

Quality

The claim to deliver complete quality runs like a red thread through Höcherl & Hackl's entire range of services. Already during development we pay attention to robust and durable parts and electronic components, which are accordingly robust and fail-safe. In production, regular quality controls ensure production at the highest level. Because the highest possible availability and a long service life of our devices is important to us.
Our quality assurance in production is constantly being expanded and improved. Each device is exposed to a run-in test at increased ambient temperatures before delivery in order to detect failures at an early stage.

On request, we offer our customers an extension of the warranty from 2 to 4 years.

We supply a Factory Calibration Certificate (FCC) with our products. Our special service: We calibrate each delivered device a second time free of charge within 2 years after delivery. For this purpose, simply register the respective serial number at www.hoecherl-hackl.com/service/device-registration/

Environment

"Protecting the environment" - that means that we think of our children. In a time of fast-moving globalization and rapid technological change, it becomes clearer every day how limited the resources on this planet are. Resources that recently seemed to be available in unlimited quantities - such as water and air - are now considered limited or threatened in their purity.

The responsible use of nature's valuable raw materials is therefore a fundamental part of H&H's corporate philosophy. Only the consistent observation of ecological findings can ensure the long-term success of our company.

For this reason, we implemented a quality management system in accordance with DIN EN ISO 9001 in 1999, which, together with the applicable health and safety regulations, is the indispensable prerequisite for our business activities. The H&H environmental management system is implemented as part of the QM system and is monitored and audited within this framework. Procedural instructions and associated work instructions regulate all environmentally relevant processes.

Our CEOs: Marco Höcherl, Laura Hackl-Späth

H&H on the Web

Up to date information is found on our website:
www.hoecherl-hackl.com

H&H **Höcherl & Hackl**
The electronic load

H&H worldwide

You will find H&H representatives in the following countries:

- Austria
- Belgium
- China
- Croatia
- Czech Republik
- Denmark
- Finland
- France
- Germany
- Great Britain
- India
- Israel
- Italy
- Liechtenstein
- Luxemburg
- Myanmar
- Netherlands
- Norway
- Philippines
- Poland
- Romania
- Singapore
- Slovakia
- Slovenia
- South Korea
- Spain
- Sweden
- Switzerland
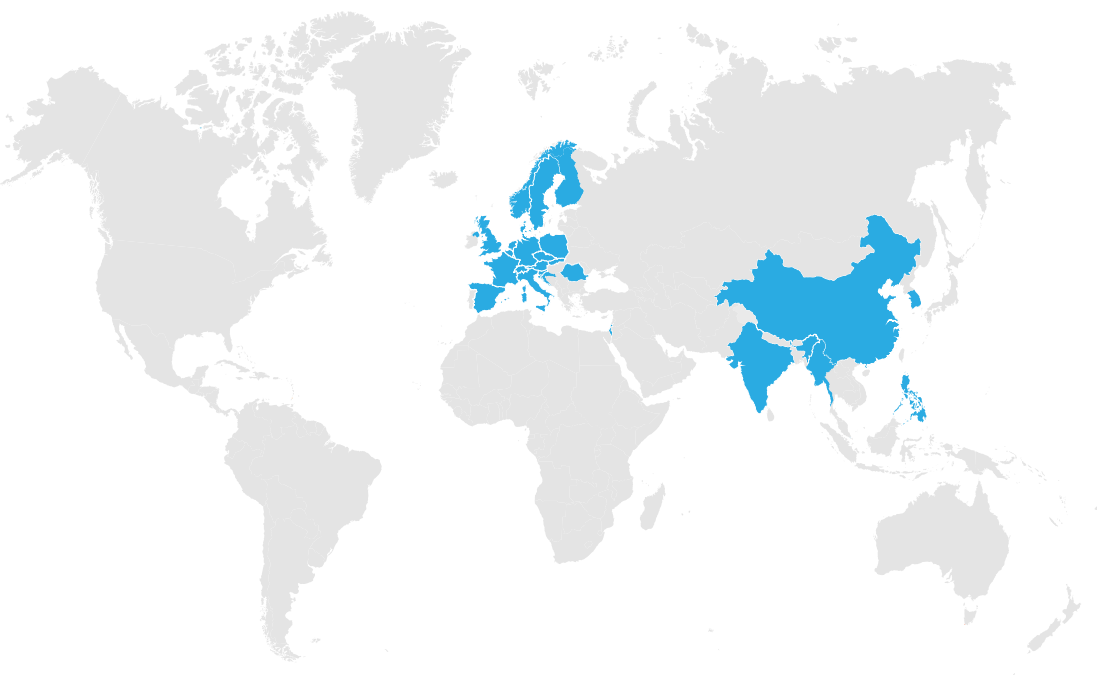
Labor and Social Standards

Our company effectively ensures compliance with high labor and social standards. At Höcherl & Hackl, the protection of human rights and compliance with applicable laws and standards are not a lip service but a top priority of our company policy.

With the H&H Code of Conduct, we commit our employees and suppliers to acting in a socially, ethically and ecologically responsible manner. The CoC is based on national laws and regulations as well as various international conventions.

Research and Development

We at Höcherl & Hackl have set ourselves the goal of actively promoting and effectively supporting innovative developments in the fields of renewable energies and electric mobility. For this reason, we make equipment available free of charge to research and educational institutions in order to realise innovative projects and thus familiarise students with the latest technologies.

TUM Hyperloop

Extremely fascinating is the Hyperloop project, in which Höcherl & Hackl also participates and supports the project development by providing electronic loads.

Hyperloop is the concept of a high-speed transport system in which a magnetic levitation train is transported in a vacuum tube.

The Hyperloop is similar to the Transrapid, except that no evacuated tubes are used. According to the old principle of the pneumatic tube system, electrically driven transport pods with travel speeds of up to about 1125 km/h are to be transported on air cushions using solar energy, and thus almost friction-free through a partially evacuated tube.

The initiator of this visionary idea, which shall solve many traffic problems, is the American entrepreneur Elon Musk, known as CEO of the electric car manufacturer TESLA. Musk already presented the concept in August 2013. On distances of up to 1500 km one should travel significantly faster and more environmentally friendly than by plane and cheaper than by train.

In Los Angeles Musk organizes an annual competition in which the fastest transport pod is awarded by student teams from all over the world.

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Fast Forest

The university project Fast Forest is a student project of the Deggendorf Institute of Technology. The students build a racing car every year, develop their own vehicle concepts and manufacture the cars themselves.

Fast Forest started in 2009 with the construction of electrically powered racing cars and has been building only electrically powered vehicles since the 2011/12 season. Since a few years ago, the team has also been developing an autonomous driving vehicle for the new „Formula Student Driverless" competition.
An old car with new hardware was used for this race. A new vehicle concept includes a hybrid car that can compete both autonomously and with a driver. The high voltage batteries of the cars are developed and manufactured every year by Fast Forest. The cells used are carefully selected and monitored by a battery management system developed in-house.

We support Fast Forest in developing the batteries and the powertrain with the electronic load PLI8460S-SC624. Thanks to the load, precise cell characteristics can be determined in order to operate the cells even further and more safely at their limits.
Among other things, load tests, temperature tests and cycle tests are performed. Due to the application-tailored high current range of the load, HV cable simulation results can also be reconstructed using the load to save weight without increasing the risk to the driver or the car.

Another device from H&H is a 2-quadrant power supply with 80 A charge/discharge current, which is used to determine the state of charge. For this purpose, open-circuit voltage characteristics with different currents are recorded, from which a battery model for the battery management system can be created.

Solar Team Twente

The Solar Team Twente (part of TU Twente) designs and builds a solar car every other year to participate in the World Solar Challenge in Australia. In 2017, this team took part with the RED SHIFT, a solar car in which the so-called Solar Balancing technique called "SABINE" was applied.
SABINE stands for Solar Array Balancing Interface Not Expected. It ensures that losses caused by the differences between the revenues of solar cells, also called Grouping Loss, are marginalized. SABINE "removes" energy from high-performance cell groups and gives it to poorly-performing groups. This gives a considerable boost to the total energy yield. In order for SABINE to perform at its best, it must be perfectly adjusted for the solar panel.

An electronic load PLI3230 load is connected to the output of the MPPT to replace a battery. Then the load is set to constant voltage, so that the MPPTs can boost the panel voltage to the set voltage. The load allowes a continuous test without having to charge a battery.

Electronic DC Loads

LOW POWER PLA SERIES

PLA Series – Brief Profile

The electronic loads of PLA series combine the classic design of large, easy-to-read displays with modern interfaces and a wide range of functions. The devices can optionally be equipped with various data interfaces. In addition to Ethernet, USB and RS-232, a CAN interface can also be installed as an option. GPIB is also available as an option for devices from 400 W upwards. An I/O port is available as standard.

- DC loads
- Low Power
- I/O port as standard
- Optional Ethernet/USB/RS-232, CAN, GPIB
- Basic operating modes CC, CV, CR, CP
- Combined operating modes CC+CV, CP+CV, CR+CV, CP+CC, CR+CC, CV+CC
- MPP Tracking
- SCPI programming with measurement
- Watchdog function in remote operation
- 19 inch installation possible
- Front and rear load inputs
- Silent cooling
- Adjustable protections for current and voltage
- Dynamic loads
- Temporary overload capacity up to 1.5 fold power, depending on model
- Electronic protection

Interfaces

○ RS-232
○ USB
○ LAN
○ GPIB
○ CAN
◉ Analog
— Analog isolated

◉ Standard ○ Option — not available

Operating Modes

The devices have the basic operating modes constant current, constant voltage, constant resistance, and constant power (CC, CV, CR, CP Mode). In addition, a protection value for voltage or current can be specified in each operating mode. This results in the combined operating modes CC+CV, CP+CV, CR+CV, CP+CC, CR+CC, CV+CC.

Protection, Monitoring

- Current limitation
- Power limitation
- Overtemperature protection
- Overvoltage indication
- Undervoltage protection
- Protection of the GND lines at the I/O port

Loading Capacity

There are 24 different models with 4 power classes of 200 W, 400 W, 800 W and 1200 W.
In addition, the models up to 300 V have an overload capability. The level and duration of the possible overload depends on the temperature of the power stage.
Therefore the units can be used even for considerably more powerful applications for a short time.

I/O-Port

Analog signals in realtime!

Standard I/O Port for:
- Analog load setting I, P, R and V
- Load on/off
- Analog voltage monitor output 0 ... 10 V
- Analog current monitor output 0 ... 10 V

Factory Calibration Certificate (FCC-PLAxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

Drivers

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

Overcurrent and Undervoltage Protection

An overcurrent or undervoltage protection may be activated and varied. The active protection works in all operating modes.
Undervoltage protection works in two different modes:

- regulating transition at slow regulation speed (e.g. battery discharge)
- switching transition at fast regulation sped (short dead time, e.g. when switching the input voltage)

Load Profiles (List Function)
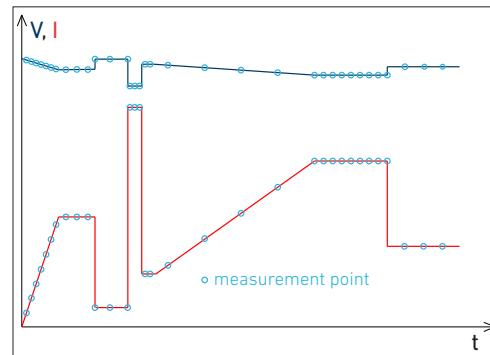
Waveform generated by LIST function with synchronized data acquisition of time, voltage, current

In all operating modes the electronic load can produce load profiles by LIST function. Up to 100 settings with variable dwell and ramp times are possible.
Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Data Acquisition (DAQ), Data Logging

In digital remote operation the electronic load can save voltage and current synchronously with timestamps. You decide if recording shall stop when the buffer is full or if old data shall be over-written in a ring buffer mode.

At slow processes the electronic load can directly save voltage and current to a USB flash drive. Logging intervals are in the seconds range.

V/I Characteristic Curve Function
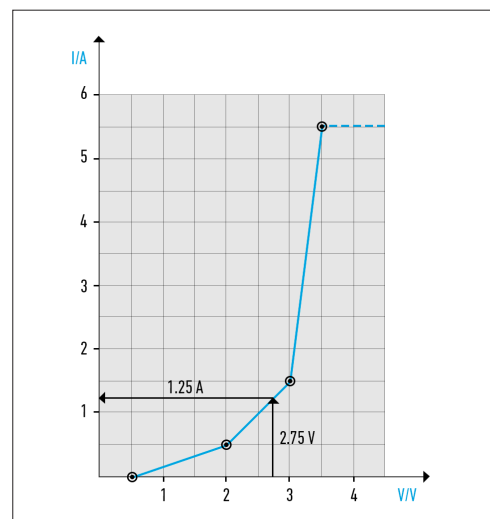
LED characteristic with 4 points

The characteristic curve function maps a sequence of voltage values linearly interpolated to a sequence of current values.
The characteristic to be simulated is defined by setting the voltage and current sequence with an SCPI command. Depending on the value of the input voltage, the PLA load sets the current which corresponds to the interpolated point of the characteristic.
Up to 100 points are possible.

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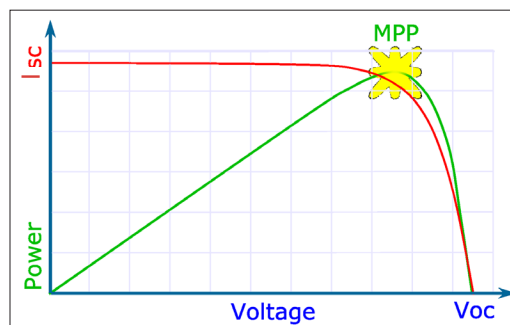
MPP Tracking

V/I and V/P characteristic of a PV panel

The Maximum Power Point Tracking (MPPT) function consists of the two subfunctions Sweeping and Tracking, which alternate continuously in an adjustable interval.

If the measured open circuit voltage at startup is higher than the minimum voltage, the electronic load performs a sweep and then controls the global MPP found.

The V/I characteristic can be read out via a data interface. It is composed as follows:

<Volt_0>,<Curr_0>,<Volt_1>,<Curr_1>,...,<Volt_99>,<Curr_99>

Watchdog Function

To protect the DUT from communication problems, the electronic load in digital remote control mode has a watchdog function that switches off the load input if the previously programmed watchdog delay time expires without the watchdog being reset.
The watchdog delay time is set by SCPI command, another command activates the watchdog.
When the watchdog is active, a control program must ensure that the command to reset the watchdog is periodically sent to the electronic load.

Master–Slave Operation
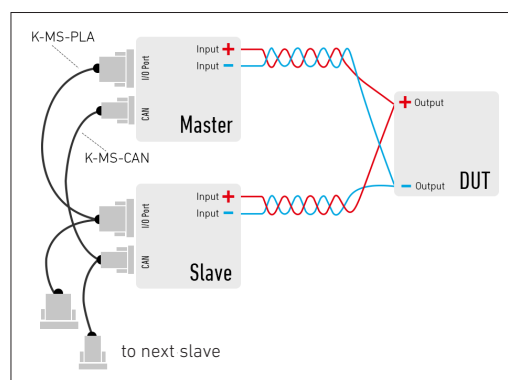
Master-Slave operation in system connection

In order to increase power or current, respectively, up to 5 equal PLA loads may be connected in parallel in Master–Slave operation. The system will outwardly operate like one device.
The Master unit controls the system's whole current, displays total measurement values and sends them in case of query via one of the data interfaces.

Preconditions:
Option PLA01 in all system units, a set of Master-Slave cable K-MS-PLA and K-MS-CAN cable in all Slave units (available from H&H or can be assembled by the user).

Restrictions in Master-Slave operation:
DAQ and characteristic curves are not available in Master–Slave operation. Functions for setting and reading device parameters are only restrictedly available.
The CAN interface is not available for data communication. When using the Master–Slave cable K-MS-PLA the I/O port is not available.

Regulation Speed Setting

For certain DUTs or very long connecting cables, it may be necessary to adapt the regulation time constant of the electronic load in order to achieve stable operation. For this purpose, the control speed can be changed.

Save Settings

The currently active device settings can be saved in non-volatile settings memories from which the settings may be recalled at a later time. 10 memory positions are available. The PLA load can either set reset state or memory position 1 to 9 at power-on.

Power switch

Display
input voltage

Display
current, resistance,
power, voltage, time

Rotary encoder
setting value,
menu navigation

Air entry
ca. 20 m³/h

Input terminals
4 mm pole terminals
or safety sockets

Function keys
operating mode,
function, menu

Status display
remote, external

Status display
operating mode, function,
protection, input

Input control

Input terminals
4 mm pole terminals
or safety sockets

Air outlet
ca. 20 m³/h

I/O port
external control,
status outputs

CAN interface
(Option PLA03)
requires PLA01
CAN 2.0 A
up to 1000 kBits/s

Mains connector
85 ... 264 V AC
50 ... 60 Hz

PE terminal

USB Flash Drive
firmware update

LAN interface
(Option PLA01)
Ethernet 100 Mbits/s

RS-232 interface
(Option PLA01)
up to 115200 Bits/s

USB interface
(Option PLA01)
Virtual COM Port

GPIB interface
(Option PLA02)
not for PLA2xx
requires PLA01

Software Tool

Setting Menu

The PLA Tool is a graphical software tool free of charge. It controls PLA series electronic loads. The user can choose different functions with the aid of the navigation bar.

The most important load settings are done in the Main Menu ("Settings"). Several graphical widgets inform the user about the measurements and the current device status. Further on, a data logging function can be activated.

www.hoecherl-hackl.com
–> Download area

Measurement Recorder
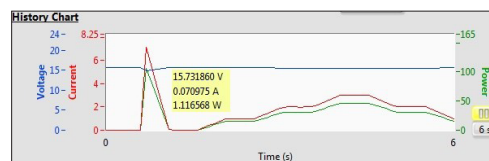
The measurement recorder records the voltage, current and power measured values for a selectable period of time. The period can be changed using the button at the bottom right of the graph.

After pressing the Pause key, individual measured values are displayed as tooltips.

List Editor
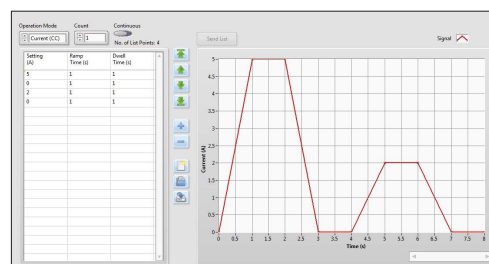
The list editor can be used to easily create dynamic load profiles for the electronic load. The user can enter the nominal setting values for current, voltage, power and resistance, the corresponding rise and fall times and the corresponding dwell times for each interpolation point of the list.

The generated list profile can be sent directly to the load via one of the data interfaces or saved on a USB flash drive for further processing.

Data Viewer
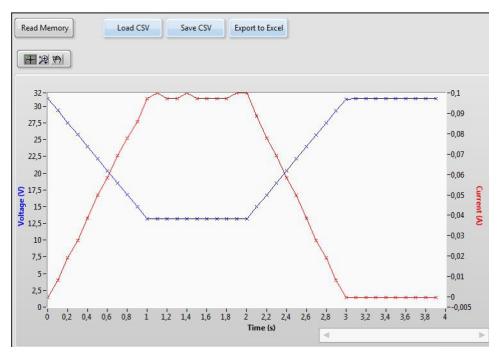
Measurements which are saved in the internal DAQ memory of the device can be read from the device and visualized with the aid of the "Data Viewer". Data can be saved as CSV file for further processing.

As the measurement recorder does, the single measurement points (timestamp, voltage, current) are shown as tooltip.

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Options, Mechanics and Rack Installation

Option PLA10
Installation kit for 1 device with ½ 19", 1 U

Option PLA11
Installation kit for 2 devices with ½ 19", 1 U

Option PLA12
Installation kit for 1 device with ½ 19", 2 U

Option PLA13
Installation kit for 2 devices with ½ 19", 2 U

Option PLA14
Installation kit for device with ½ 19", 2 U
and 1 device with ½ 19", 1 U

Option PLA15
Installation kit for 1 device with ½ 19", 2 U
and 2 devices with ½ 19", 1 U
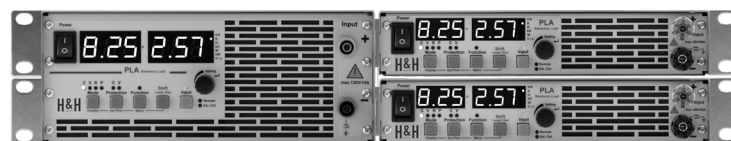
Option PLA16
Carrying handle for 1 device with ½ 19",
1 or 2 U

Option PLA17
Installation kit for 1 device with 19", 2 U

Option PLA18
12 V supply input

Input voltage:	10 … 18 V DC, reverse-polarity protected with audible alert
Input current:	max. 4 A

Optional Data Interfaces

Option PLA01
Ethernet + RS-232 + USB

Option PLA02
GPIB (only at 400 W, 800 W and
1200 W models. PLA01 necessary)
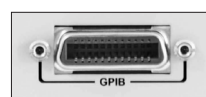
Option PLA03
CAN (PLA01 necessary)

Model (order number)	PLA206	PLA206C4	PLA406	PLA406C8	PLA506
Maximum input voltage Vmax	60 V	60V	60 V	60 V	60 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	30 A	4 A	30 A	8 A	30 A
Continuous power	200 W	200 W	400 W	400 W	500 W
Short-time power [2]	300 W	240 W	500 W	480 W	500 W
Voltage setting	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V
Current setting	0 ... 30 A	0 ... 4 A	0 ... 30 A	0 ... 8 A	0 ... 30 A
Resistance setting	67 mΩ ... 133 Ω	500 mΩ ... 1000 Ω	67 mΩ ... 133 Ω	250 mΩ ... 500 Ω	67 mΩ ... 133 Ω
Power setting [3]	0 ... 300 W	0 ... 240 W	0 ... 500 W	0 ... 480 W	0 ... 500 W
Rise/fall time [4]	30 µs	40 µs	40 µs	35 µs	40 µs
Input capacity ca.	1 µF	1 µF	1 µF	1 µF	1 µF
Load terminals [5] rear / front	PK4-30L / PK4-30L	PK4-30L / PK4-30L	PK4-30L / PK4-30L	PK4-30L / PK4-30L	PK4-30L / PK4-30L
Power consumption	30 VA	30 VA	37 VA	37 VA	37 VA
Noise max. ca. [6]	49 dB(A)	49 dB(A)	61 dB(A)	61 dB(A)	61 dB(A)
Weight / with handle	2.7 / 2.85 kg	2.7 / 2.85 kg	3.7 / 3.85 kg	3.7 / 3.85 kg	3.7 / 3.85 kg
Housing / 3D model [7]	½ 19", 1 U / PLA_M1	½ 19", 1 U / PLA_M1	½ 19", 2 U / PLA_M6	½ 19", 2 U / PLA_M6	½ 19", 2 U / PLA_M6

| Model (order number)	PLA212	PLA212C2	PLA412	PLA412C4	PLA512
Maximum input voltage Vmax	120 V	120 V	120 V	120 V	120 V
Minimum input voltage Vmin	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	15 A	2 A	15 A	4 A	15 A
Continuous power	200 W	200 W	400 W	400 W	500 W
Short-time power [1]	300 W	240 W	500 W	480 W	500 W
Voltage setting	0 ... 120 V	0 ... 120 V	0 ... 120 V	0 ... 120 V	0 ... 120 V
Current setting	0 ... 15 A	0 ... 2 A	0 ... 15 A	0 ... 4 A	0 ... 15 A
Resistance setting	134 mΩ ... 266 Ω	1,0 Ω ... 2000 Ω	134 mΩ ... 266 Ω	500 mΩ ... 1000 Ω	134 mΩ ... 266 Ω
Power setting [2]	0 ... 300 W	0 ... 240 W	0 ... 500 W	0 ... 480 W	0 ... 500 W
Rise/fall time [3]	40 µs	30 µs	35 µs	30 µs	35 µs
Input capacity ca.	1 µF	1 µF	1 µF	1 µF	1 µF
Load terminals [4] rear / front	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32
Power consumption	30 VA	30 VA	37 VA	37 VA	37 VA
Noise max. ca. [5]	49 dB(A)	49 dB(A)	61 dB(A)	61 dB(A)	61 dB(A)
Weight / with handle	2.7 / 2.85 kg	2.7 / 2.85 kg	3.7 / 3.85 kg	3.7 / 3.85 kg	3.7 / 3.85 kg
Housing / 3D model [7]	½ 19", 1 U / PLA_M2	½ 19", 1 U / PLA_M2	½ 19", 2 U / PLA_M7	½ 19", 2 U / PLA_M7	½ 19", 2 U / PLA_M7

Model (order number)	PLA230	PLA430	PLA280	PLA480
Maximum input voltage Vmax	300 V	300 V	800 V	800 V
Minimum input voltage Vmin	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	6 A	6 A	3 A	3 A
Continuous power	200 W	400 W	200 W	400 W
Short-time power [1]	200 W	400 W	200 W	400 W
Voltage setting	0 ... 300 V	0 ... 300 V	0 ... 800 V	0 ... 800 V
Current setting	0 ... 6 A	0 ... 6 A	0 ... 3 A	0 ... 3 A
Resistance setting	334 mΩ ... 666 Ω	334 mΩ ... 666 Ω	667 mΩ ... 1333 Ω	667 mΩ ... 1333 Ω
Power setting [2]	0 ... 200 W	0 ... 400 W	0 ... 200 W	0 ... 400 W
Rise/fall time [3]	35 µs	40 µs	40 µs	30 µs
Input capacity ca.	100 nF	100 nF	50 nF	50 nF
Load terminals [4] rear / front	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32
Power consumption	30 VA	37 VA	30 VA	37 VA
Noise max. ca. [5]	49 dB(A)	61 dB(A)	49 dB(A)	61 dB(A)
Weight / with handle	2.7 / 2.85 kg	3.7 / 3.85 kg	2.7 / 2.85 kg	3.7 / 3.85 kg
Housing / 3D model [7]	½ 19", 1 U / PLA_M2	½ 19", 2 U / PLA_M7	½ 19", 2 U / PLA_M2	½ 19", 2 U / PLA_M7

1. Minimum voltage for maximum static load current, linear derating to 0 V.
2. Level and duration of the peak power depend on the previous load.
3. The setting range corresponds to the peak power.
4. Rise and fall times are defined of 10 ... 90 % and 90 ... 10 % of the maximum current (constant current mode, FAST, tolerance ±20 %). Rise and fall time at setting „slow": ca. 500 µs.
5. Description of the available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
6. Measured at the front in 1 m distance.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLA Series

Model Overview 800 ... 1500 W

Model (order number)	PLA806	PLA806C16	PLA1006	PLA1206	PLA1206C24	PLA1506
Maximum input voltage Vmax	60 V	60V	60 V	60 V	60 V	60 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	80 A	16 A	80 A	120 A	24 A	120 A
Continuous power	800 W	800 W	1,000 W	1,200 W	1,200 W	1,500 W
Short-time power [2]	1,000 W	960 W	1,000 W	1,500 W	1,440 W	1,500 W
Voltage setting	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V
Current setting	0 ... 80 A	0 ... 16 A	0 ... 80 A	0 ... 120 A	0 ... 24 A	0 ... 120 A
Resistance setting	25 mΩ ... 50 Ω	125 m Ω ... 250 Ω	25 mΩ ... 50 Ω	17 mΩ ... 33 Ω	84 mΩ ... 166 Ω	17 mΩ ... 33 Ω
Power setting [3]	0 ... 1,000 W	0 ... 960 W	0 ... 1,000 W	0 ... 1,500 W	0 ... 1,440 W	0 ... 1,500 W
Rise/fall time [4]	50 µs	30 µs	40 µs	40 µs	30 µs	40 µs
Input capacity ca.	2 µF	2 µF	2 µF	3 µF	3 µF	3 µF
Load terminals [5] rear / front	FKS20/4-SM8 / FKS20/4-SM8	PK4-30L / PK4-30L	FKS20/4-SM8 / FKS20/4-SM8	FKS20/4-SM8 / FKS20/4-SM8	PK4-30L / PK4-30L	FKS20/4-SM8 / FKS20/4-SM8
Power consumption	55 VA	54 VA	55 VA	70 VA	69 VA	69 VA
Noise max. ca. [6]	62 dB(A)	62 dB(A)	62 dB(A)	61 dB(A)	61 dB(A)	61 dB(A)
Weight	7.2 kg	7.2 kg	7.2 kg	8.5 kg	8.5 kg	8.5 kg
Housing / 3D model [7]	19", 2 U / PLA_M10	19", 2 U / PLA_M12	19", 2 U / PLA_M10	19", 2 U / PLA_M10	19", 2 U / PLA_M12	19", 2 U / PLA_M10

Model (order number)	PLA812	PLA812C8	PLA1012	PLA1212	PLA1212C12	PLA1512
Maximum input voltage Vmax	120 V	120 V	120 V	120 V	120 V	120 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	40 A	8 A	40 A	60 A	12 A	60 A
Continuous power	800 W	800 W	1,000 W	1,200 W	1,200 W	1,500 W
Short-time power [2]	1,000 W	960 W	1,000 W	1,500 W	1,440 W	1,500 W
Voltage setting	0 ... 120 V	0 ... 120 V	0 ... 120 V	0 ... 120 V	0 ... 120 V	0 ... 120 V
Current setting	0 ... 40 A	0 ... 8 A	0 ... 40 A	0 ... 60 A	0 ... 12 A	0 ... 60 A
Resistance setting	50 mΩ ... 100 Ω	250 mΩ ... 500 Ω	50 mΩ ... 100 Ω	34 mΩ ... 66 Ω	167 mΩ ... 333 Ω	34 mΩ ... 66 Ω
Power setting [3]	0 ... 1,000 W	0 ... 960 W	0 ... 1,000 W	0 ... 1,500 W	0 ... 1,440 W	0 ... 1,500 W
Rise/fall time [4]	35 µs	40 µs	35 µs	40 µs	50 µs	35 µs
Input capacity ca.	2 µF	2 µF	2 µF	3 µF	3 µF	3 µF
Load terminals [5] rear / front	BPK4-60L / BPK4-60L	SBU4-32 / SBU4-32	BPK4-60L / BPK4-60L	BPK4-60L / BPK4-60L	SBU4-32 / SBU4-32	BPK4-60L / BPK4-60L
Power consumption	55 VA	55 VA	54 VA	70 VA	70 VA	69 VA
Noise max. ca. [6]	62 dB(A)	62 dB(A)	62 dB(A)	61 dB(A)	61 dB(A)	61 dB(A)
Weight	7.2 kg	7 kg	7.2 kg	8.5 kg	8 kg	8.5 kg
Housing / 3D model [7]	19", 2 U / PLA_M11	19", 2 U / PLA_M13	19", 2 U / PLA_M11	19", 2 U / PLA_M11	19", 2 U / PLA_M13	19", 2 U / PLA_M11

Model (order number)	PLA830	PLA1230	PLA880	PLA1280
Maximum input voltage Vmax	300 V	300 V	800 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	1.2 V	1.2 V
Maximum current	16 A	24 A	8 A	12 A
Continuous power	800 W	1,200 W	800 W	1,200 W
Short-time power [2]	800 W	1,200 W	800 W	1,200 W
Voltage setting	0 ... 300 V	0 ... 300 V	0 ... 800 V	0 ... 800 V
Current setting	0 ... 16 A	0 ... 24 A	0 ... 8 A	0 ... 12 A
Resistance setting	125 mΩ ... 250 Ω	84 mΩ ... 166 Ω	250 mΩ ... 500 Ω	167 mΩ ... 333 Ω
Power setting [3]	0 ... 800 W	0 ... 1,200 W	0 ... 800 W	0 ... 1,200 W
Rise/fall time [4]	40 µs	40 µs	40 µs	40 µs
Input capacity ca.	200 nF	300 nF	100 nF	150 nF
Load terminals [5] rear / front	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32	SBU4-32 / SBU4-32
Power consumption	55 VA	70 VA	55 VA	70 VA
Noise max. ca. [6]	62 dB(A)	61 dB(A)	62 dB(A)	61 dB(A)
Weight	7 kg	8.5 kg	7 kg	8.35 kg
Housing / 3D model [7]	19", 2 U / PLA_M13	19", 2 U / PLA_M13	19", 2 U / PLA_M13	19", 2 U / PLA_M13

1. Minimum voltage for maximum static load current, linear derating to 0 V.
2. Level and duration of the peak power depend on the previous load.
3. The setting range corresponds to the peak power.
4. Rise and fall times are defined of 10 ... 90 % and 90 ... 10 % of the maximum current (constant current mode, FAST, tolerance ±20 %). Rise and fall time at setting „slow": ca. 500 µs.
5. Description of the available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
6. Measured at the front in 1 m distance.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model	U display low	U display high	I display low	I display high
PLA206	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 30.0 A
PLA206C4	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 999 mA	1.00 ... 4.00 A
PLA212	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 15.0 A
PLA212C2	0 ... 99.9 V	100 ... 120 V	0 ... 999 mA	1.00 ... 2.00 A
PLA230	0 ... 99.9 V	100 ... 300 V	0 ... 999 mA	1.00 ... 6.00 A
PLA280	0 ... 99.9 V	100 ... 800 V	0 ... 999 mA	1.00 ... 3.00 A

Model	U display low	U display high	I display low	I display high
PLA406	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 30.0 A
PLA406C8	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 999 mA	1.00 ... 8.00 A
PLA506	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 30.0 A
PLA412	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 15.0 A
PLA412C4	0 ... 99.9 V	100 ... 120 V	0 ... 999 mA	1.00 ... 4.00 A
PLA512	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 15.0 A
PLA430	0 ... 99.9 V	100 ... 300 V	0 ... 999 mA	1.00 ... 6.00 A
PLA480	0 ... 99.9 V	100 ... 800 V	0 ... 999 mA	1.00 ... 3.00 A

Model	U display low	U display high	I display low	I display high
PLA806	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 80.0 A
PLA806C16	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 16.0 A
PLA1006	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 80.0 A
PLA812	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 40.0 A
PLA812C8	0 ... 99.9 V	100 ... 120 V	0 ... 999 mA	1.00 ... 8.00 A
PLA1012	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 40.0 A
PLA830	0 ... 99.9 V	100 ... 300 V	0 ... 9.99 A	10.0 ... 16.0 A
PLA880	0 ... 99.9 V	100 ... 800 V	0 ... 999 mA	1.00 ... 8.00 A

| Model	U display low	U display high	I display low	I display high
PLA1206	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 99.9 A	100 ... 120 A
PLA1206C24	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 9.99 A	10.0 ... 24.0 A
PLA1506	0 ... 9.99 V	10.0 ... 60.0 V	0 ... 99.9 A	100 ... 120 A
PLA1212	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 60.0 A
PLA1212C12	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 12.0 A
PLA1512	0 ... 99.9 V	100 ... 120 V	0 ... 9.99 A	10.0 ... 60.0 A
PLA1230	0 ... 99.9 V	100 ... 300 V	0 ... 9.99 A	10.0 ... 24.0 A
PLA1280	0 ... 99.9 V	100 ... 800 V	0 ... 9.99 A	10.0 ... 12.0 A

Options and Accessories

Order number	Article	Description
67-004-030-22	K-RS-SNM 9-9	RS-232 cable (nullmodem cable)
52-135-001-22	PLA01	RS-232 + USB + Ethernet interface
52-200-001-22	PLA02	GPIB interface (up from 400 W devices) PLA01 necessary
52-600-001-22	PLA03	CAN interface (PLA01 necessary)
64-307-000-22	PLA10	19" installation kit for 1 device with ½ 19", 1 U
64-308-000-22	PLA11	19" installation kit for 2 devices with ½ 19", 1 U
64-309-000-22	PLA12	19" installation kit for 1 device with ½ 19", 2 U
64-310-000-22	PLA13	19" installation kit for 2 devices with ½ 19", 2 U
64-311-000-22	PLA14	19" installation kit for 1 device with ½ 19", 2 U and 1 device with ½ 19", 1 U
64-312-000-22	PLA15	19" installation kit for 1 device with ½ 19", 2 U and 2 devices with ½ 19", 1 U
64-406-000-22	PLA16	Handle for 1 device with ½ 19", 1 or 2 U
64-313-000-22	PLA17	19" installation kit for 1 device with 19", 2 U
66-001-000-22	PLA18	12 V DC supply input, reverse polarity protected, 4 mm pole terminals
65-002-000-22	FCC-PLAxx	Factory calibration certificate
64-408-000-22	SAB-PLA-2	Additional safety cover for load terminals for devices with 2 U and copper bars
63-000-001-00	SENSADAPT/4BAN/ PH2/60V	Sense adapter from 4 mm banana plugs to Phoenix PH2, max. 60 V
63-000-002-00	SENSADAPT/4BAN/ PH2/1200V	Sense adapter from 4 mm safety plugs to Phoenix PH2, max. 1200 V
67-008-020-22	K-MS-PLA+K-MS-CAN	Cable set Master-Slave, consisting of K-MS-PLA and K-MS-CAN (each 2 m)
67-003-020-22	K-MS-PLA	Master-Slave cable I/O Port (2 m)
67-037-020-22	K-MS-CAN	Master-Slave cable CAN (2 m)
49-001-000-22	SX	Modified setting range for PLA series only after consulting H&H
49-002-000-22	SSX	Customized setting range only after consulting H&H
		Load cables see starting at page 127

PLA2xx

PLA4xx

PLA8xx
PLA12xx

Operating modes

Basic operating modes	CC, CV, CR, CP
Combined operating modes	CC+CV, CP+CV, CR+CV, CP+CC, CR+CC, CV+CC

Accuracy of setting

	of setting value	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Resistance (at V > 5 % of voltage range)	±1.4 %	±0.3 % of current range
Power (at V and I > 10 % of range)	±0.7 %	
(at V or I 5 ... 10 % of range)	±2 %	
Resolution	12 bits	

Accuracy of adjustable protections

	of setting value	of corresponding range
Overcurrent protection	±0.5 %	±0.05 %
Undervoltage protection	±0.3 %	±0.02 %
Resolution	12 bits	

Accuracy of measurement

	of measured (actual) value	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
External control voltage 0 ... 10 V	±0.2 %	±0.1 %
Resistance	is calculated from voltage and current	
Power	is calculated from voltage and current	
Resolution	16 bits	
Sampling rate	100 µs, not triggerable	

Accuracy of displays (user interface)

Display user interface	accuracy of each measurement, ±1 digit of the display value
Resolution	see display resolution page 22

Dynamic function (LIST)

Number of load levels	max. 100, with corresponding ramp, dwell and sampling times

	min.	max.
Dwell time	1 ms	100 s
Ramp time	0 s	100 s
Resolution	1 ms	
Accuracy of setting times	±0.02 %	
Sampling times	1 ms ... 100 s, resolution 1 ms	

Data acquisition

	of measured (actual) value	of corresponding range
Accuracy voltage	±0.1 %	±0.05 % ±1 LSB
Accuracy curent	±0.2 %	±0.05 % ±1 LSB
Resolution	16 bits	

to external memory

Sampling rate	0.1 ... 30 s, 0.1 s resolution
Measurement data	time stamp, voltage, current
Number of measurement points	limited by flash drive memory size
File format	.csv

to internal memory

Sampling rate	1 ms ... 100 s, 1 ms resolution
Measurement data	time stamp, voltage, current
Number of measurement points	max. 100

Settings memories

Number of user settings	10, selectable (incl. programmed list)

I/O port: outputs and inputs

Status and control outputs	status load input (on/off, low active) overload (OV, OCP, OPP, OTP, low active)
Output level	5 V
Control inputs	load input (on/off, low active) control input (activates I/O port, low active)
Input level	3 ... 30 V

I/O port: accuracy of analog control 0 ... 10 V

	of the setting value	of the corresponding range
Voltage	±0.2 %	±0.05 %
Current	±0.2 %	±0.05 %
Resistance (at V > 5 % of voltage range)	±1.6 %	±0.4 % of current range
Power (at V and I > 30 % of the corresponding range)	±0.55 %	±0.2 %
Power at V and I > 5 % and < 30 % of the corresponding range	±0.9 %	±0.35 %
	input resistance of analog inputs >10 kΩ	

I/O port: accuracy of analog monitor outputs 0 ... 10 V

	of analog signal of real value	offset voltage
Voltage	±0.1 %	±15 mV
Current	±0.2 %	±15 mV
	minimum load 2 kΩ	

I/O port: permissible voltages

Vin-io (GND - neg. load input)	max. 2 V [1]
VioPE (GND - PE)	max. 125 V [1]
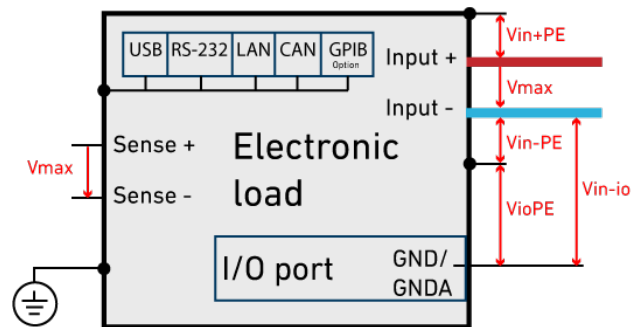
The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid when the sense lines (if available) are connected and when the unit is connected to undisturbed voltages (ripple and noise < 0.1 %). At voltages with higher disturbance values the accuracy can change for the worse.

1. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical Data

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
Maximum input voltage Vmax	see model overview
Minimum input voltage Vmin	see model overview

Input: permissible voltages	
Vin-PE (neg. load input - PE)	max. 125 V [1]
Vin+PE (pos. load input - PE)	Vmax + max. 125 V [1]

Power	
Continuous power	see model overview (at Ta = 21 °C)
Derating	-1.2 %/°C for Ta > 21 °C
Overload capacity	see model overview The possible short-time power depends on the temperature of the device and with that on the normal rating taken before.

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

Terminals	
Load input	see model overview
Sense	at I/O port, only at models up to 120 V

Operating conditions	
Operating temperature	5 ... 40 °C
Stock temperature	-25 ... 65 °C
Max. operating height	2000 m above sea level
Pollution degree	2
Max. humidity	80 % at 31 °C, linear decreasing to 50 % at 40 °C
Min. distance rear panel - wall or other objects	70 cm
Cooling	temperature-controlled air cooling
Noise	see model overview
Mains voltage with option PLA18	1/N/PE AC 85 ... 264 V 50 ... 60 Hz DC 10 ... 18 V, max. 4 A, reverse polarity protected
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm²
Power consumption	see model overview

Housing		
Color Front panel Rear panel Side panels, top	RAL7035 (light grey) stainless steel RAL7037 (dusty grey)	
Dimensions, weight	see model overview	

Safety and EMC		
Protection class	1	
Measuring category	O (CAT I according to EN 61010:2004)	
Electrical safety	DIN EN 61010-1 DIN EN 61010-2-030	
EMV, CE marking	DIN EN 55011 DIN EN 61326-1 DIN EN 61000-3-2 DIN EN 61000-3-3	

Standard interfaces		
Data interfaces	–	
I/O interface	standard I/O port (not isolated)	

Available options		
Data interfaces PLA01 PLA02 PLA03	USB, RS-232, Ethernet GPIB (for models up from 400 W, requires PLA01) CAN (requires PLA01)	
Mechanical options PLA08 PLA10 PLA11 PLA12 PLA13 PLA14 PLA15 PLA16 PLA17	safety cover for copper bars 19" installation kit for 1 device with ½ 19", 1 U 19" installation kit for 2 devices with ½ 19", 1 U 19" installation kit for 1 device with ½ 19", 2 U 19" installation kit for 2 devices eith ½ 19", 2 U 19" installation kit for 1 device with ½ 19", 2 U and 1 device with ½ 19", 1 U 19" installation kit for 1 device with ½ 19", 2 U and 2 devices with ½ 19", 1 U carrying handle for 1 device with ½ 19", 1 or 2 U 19" installation kit for 1 device with 19", 2 U	
DC-Versorgung PLA18	12 V DC supply (10 ... 18 V)	

Calibration, warranty		
FCC-PLAxx	Factory Calibration Certificate, twice free of charge	
Warranty	2 years	

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1. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical data of production series A, rev. 5. Subject to technical changes without notice.

Electronic DC Loads

HIGH POWER PLI SERIES

PLI Series – Brief Profile

The electronic loads of PLI series offer conveni-ent operation via a graphical user interface. The particular strength of the devices lies in the very extensive equipment of interfaces. In addition to Ethernet, USB, RS-232 and analog I/O port, a CAN interface is also installed as standard.
GPIB is optionally available (PLI02).
Setting and measuring smallest currents with high accuracy and resolution is possible with the PLI MR multi-range variant.

- High power density up to 28,800 W
- Basic operating modes CC, CV, CR, CP
- Combined operating modes CC+CV, CR+CC+CV, CP+C-C+CV, CV+CC
- Models with several current ranges
- Models with zero voltage, high voltage or extended current range
- Adjustable protections for current and undervoltage
- Optional MPP Tracking
- Optional Test of intelligent chargers
- Master-slave operation
- Dynamic loads with synchronous DAQ
- Data logging directly to USB flash drive
- Functions for testing energy storage devices
- Internal resistance measurement
- Watchdog function in remote operation
- Temporary overload capacity, depending on model
- Electronic protection
- Digital input and programmable control output
- Bilingual help system (German/English)

Interfaces

- ◉ RS-232
- ◉ USB
- ◉ LAN
- ○ GPIB
- ◉ CAN
- ◉ Analog
- ○ Analog isolated

◉ Standard   ○ Option   — not available

Operating Modes

The devices have the basic operating modes constant current, constant voltage, constant resistance and constant power (CC, CV, CR, CP Mode). A protection value for undervoltage and overcurrent can be set in each operating mode.
This allows the combined operating modes CC+CV, CR+CC+CV, CP+CC+CV, CV+CC to be realized.

Protection, Monitoring

- Current protection
- Power protection
- Overtemperature protection
- Overvoltage indication
- Reverse voltage indication
- Undervoltage indication
- Protection of the GND lines at the I/O port

Loading Capacity

The range of models includes power classes from 600 W to 28,800 W.
The models up to 300 V can also be temporarily overloaded. The level and duration of the possible overload power depends on the operating temperature of the power stage. The device displays the currently possible load capacity.
This means that these devices can also be used for significantly more powerful short-term applications.

Cooling

The units are air-cooled. In order to keep the operating noise low, for power classes with 3200 W and more, the fans are steplessly controlled according to temperature and current, smaller models have got 3 cooling steps. For better utilization of the maximum possible overload capacity, the fans can be set to full power.

I/O Port

Analog signals in realtime!

Standard I/O port for:
- Analog load setting I and V
- Analog setting of I and V protections
- Load on-off
- Analog voltage monitor output
- Analog current monitor output
- Trigger input
- Trigger output
- Digital input and programmable control output

Galvanically Isolated I/O Port (Option PLI06)

Option PLI06 can be installed for galvanic isolation of the analog I/O port from the load circuit.
By using this card ground loops are prevented and it is possible to test bipolar voltages with common analog control using two devices.

Factory Calibration Certificate (FCC-PLIxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

Options, Mechanics and Rack Installation

Option PLI10
Installation kit for 1 device with ½ 19", 2 U

Option PLI11
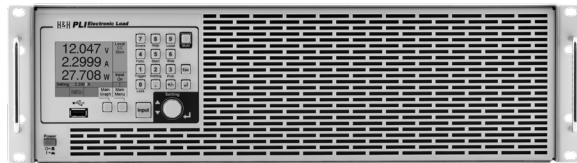Installation kit for 2 devices with ½ 19", 2 U

Option PLI12
Installation kit for 1 device with 19", 2 U

Option PLI13
Installation kit for 1 device with 19", 3 U

Mechanics

Retractable handle

The PLI series is designed in stable 19" technology and can be used as a desktop unit or installed in 19" racks. From 5 U there are retractable heavy-duty carrying handles on the top of the unit. Optional mounting kits are available for 19" installation for units up to 3,200 W. Larger units are already equipped for installation.
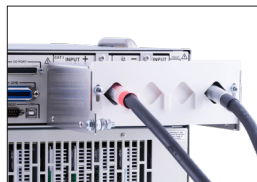
Heavy-Weight Castors (Option PLI14)
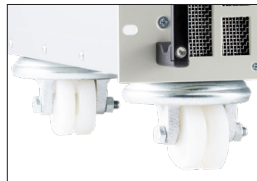
Castors

Steerable castors (option PLI14) can be mounted on large devices for easier transport. This often avoids the need for a 19" rack.
This option is available for units from 5 U and upwards and is only suitable for hard floors.

Safety Covers

Safety cover for PLI starting from 5 U

For devices for dangerous input voltages, covers are supplied as protection against accidental contact of the load inputs.

Option PLI18
12 V supply input
only for PLI14xx

Input voltage: 11 … 15 V DC

Option PLI19
12 V supply input
only for PLI32xx

Input voltage: 11 … 15 V DC

The installation of option PLI19 increases the housing height to 5 U.

H&H Höcherl & Hackl
The electronic load

Models with Zero Volt Supply (ZV), for High Voltage (HV) or with Extended Current Range (EC)

PLIxxxxZV
PLIxxxxHV
PLIxxxxEC

For applications needing to load the DUT down to almost 0 V (e.g. fuel cell testing) there is the PLI model set PLIxxxxZV. The ZV models can compensate voltage drops on the load lines up to approx. 0.5 V. If the I/O port of a PLIxxxxZV model is to be used, the GND signal of the I/O port must be galvanically isolated from the negative load input. Therefore we recommend to use a galvanically isolated I/O port (option PLI06).
Models for extra high input voltage (HV) or with extended current range (EC) are also available. See model overview starting at page 44.

Models with Multiple Current Ranges (MR)

PLIxxxxMR3
PLIxxxxMR4

Setting and measuring smallest currents with high accuracy and resolution is possible with the models from our MR multi-range variant. There are models with 3 or 4 "real" current and thus resistance and power ranges. At models up to 1.500 W current ranges are graduated with factor 10. See model overview at page 50.

Functions

Overcurrent and Undervoltage Protection

Adjustable overcurrent and undervoltage protections are permanently active. Both protections work in all operating modes.
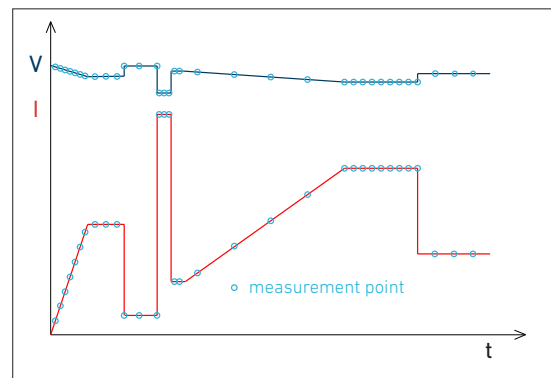Undervoltage protection operates in two different modes:
- regulating transition (e.g. CC-CV operation at battery discharge)
- switching transition (short dead time, e.g. when switching the input voltage)

Static Data Logging

At slow processes the electronic load can directly save voltage and current to a USB flash drive. Logging intervals are in the seconds range.

Load Profiles (List Function)

Waveform generated by LIST function with synchronized data acquisition of time, voltage, current

In all operating modes the electronic load can produce load profiles by LIST function. Up to 300 settings with variable dwell and ramp times are possible.
Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Rectangular Function

In addition to the list function, the user interface offers a convenient way of generating a rectangular load curve. When operating the load remotely via a data interface, a list of 2 setpoints is simply defined.

Data Acquisition (DAQ)

The electronic load can synchronously store data records of voltage and current with time stamp in a defined interval. Up to 40,000 data records are stored in a ring buffer.
After the recording is finished, the data can be read by SCPI queries or transferred to a USB flash drive.

Watchdog Function

To protect the DUT from communication problems, the electronic load in digital remote control mode has a watchdog function that switches off the load input if the previously programmed watchdog delay time expires without the watchdog being reset.
The watchdog delay time is set by SCPI command, another command activates the watchdog.
When the watchdog is active, a control program must ensure that the command to reset the watchdog is periodically sent to the electronic load.
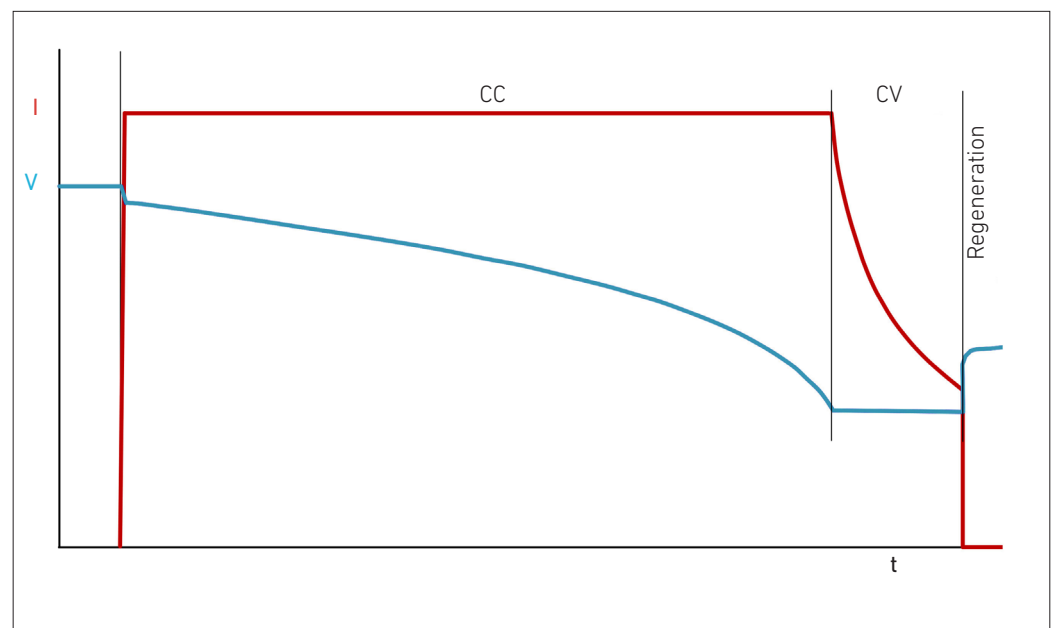
Trigger Model

Several functions or settings can be triggered by a configurable trigger model:
- Start/stop LIST function
- Start/stop data acquisition
- Set triggered settings of all operating modes

Trigger sources: External, Bus, Manual, Voltage, Current

Discharge Function, Enery Storage Test

IUa discharge with follow-up time

The discharge function tests energy storage devices such as batteries, ultracaps, electrolytic capacitors and solar panels etc. by discharging them in CC, CP or CR mode. The discharge function can be combined with the list function so that pulsed discharge is possible.
IUa discharge (CC+CV discharge) is also possible: the test object is discharged with constant current up to a defined voltage. This voltage is then kept constant until a defined minimum current is reached.
Stop criteria are charge, energy, time, current, voltage.
During data logging, a follow-up time can be defined to observe the regeneration phase.

Changing Regulation Speed

Sometimes special DUTs or very long load cables require modification of the electronic load's regulation time constant to avoid oscillations and establish stable operation.
Regulation speed slow - medium - fast are selectable at PLI loads.

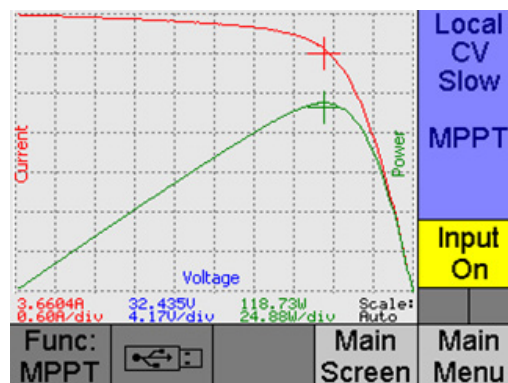## Internal Resistance Measurement
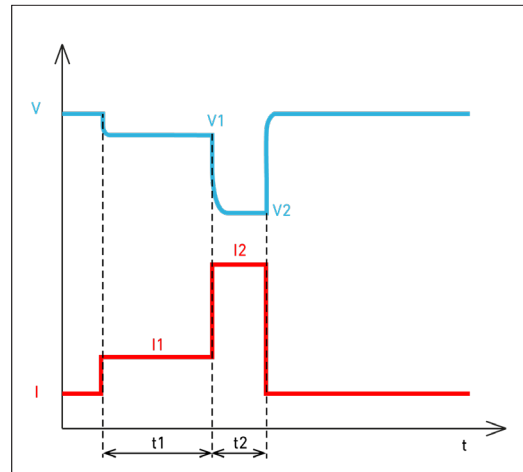
Ri calculation timing

The electronic load can measure the internal DC resistance of the connected DUT. The determination of the internal resistance Ri is based on the principle specified in various standards for batteries and accumulators, e.g. DIN EN 61951, DIN EN 61960.
At intervals of a few seconds, the load measures the terminal voltage of the DUT (V1, V2) at two defined load levels (I1, I2) and calculates Ri from this.
The load levels I1 and I2 as well as their durations are adjustable.
In manual mode, the load can store the parameters and the result of the measurement on a connected USB stick at the touch of a button, so that a high throughput with many DUTs can be achieved.

MPP Tracking (Option PLI21)

V/I and V/P characteristic at the user interface

The Maximum Power Point Tracking (MPPT) function consists of the two sub-functions Sweeping and Tracking, which alternate continuously in an adjustable interval.

If the measured open circuit voltage at startup is higher than the minimum voltage, the electronic load performs a sweep and then adjusts the global MPP found. The swept V/I curve is displayed together with the V/P curve in the function graph of the user interface. The previously found MPP is marked by a '+' in the diagram. The V/I characteristic can be read out via a data interface. It is composed as follows:
<Volt_0>,<Curr_0>,<Volt_1>,<Curr_1>,...,<Volt_249>,<Curr_249>

Testing Chargers with the Charger Starter Interface (Option PLI16)

The optional Charger Starter Interface (CST) is used to test intelligent chargers that do not start charging until they detect a corresponding energy storage device at their output. The PLI load simulates this by applying a certain voltage to the load input for a definable time.
The CST can be installed in any PLI model with 60 V or 120 V voltage range. In principle, it works like a programmable power supply. The activation of the output voltage can be coupled with the switching of the load input. As soon as the charger supplies current, a predefined voltage list corresponding to the charge curve of the accumulator can be started in the load via trigger.

The load stores the voltage and current measured values with a time stamp. The data can be read out via a data interface or transferred to a USB flash drive.

Master-Slave Operation
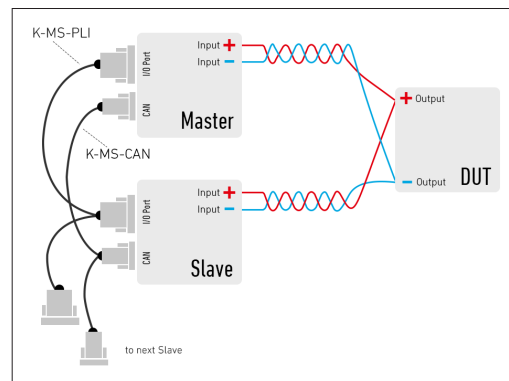
Master-Slave operation in system connection

Up to 5 PLI loads of the same type and firmware version can be connected in parallel in Master-Slave operation to increase power or current.
The system operates externally as if it were one device. The Master unit regulates the total current of the system, displays the total measured values and delivers these when queried via one of the data interfaces.

Wiring:
A set of Master-Slave cable K-MS-PLI and K-MS-CAN cable in all Slave units (available from H&H or can be assembled by the user).

Limitations:
DAQ functions are not available in Master-Slave operation, functions for setting and reading device parameters are limited. The CAN interface is not available for data communication. When using the Master-Slave cables K-MS-PLI, the I/O port is also not accessible anymore. Nevertheless we offer a "SubD25 Doubler" as an accessory to be able to measure e.g. monitor signals.

Save Settings

In order to be able to quickly reconstruct frequently recurring test tasks, the settings active in the electronic load can be stored non-volatile so that they can be reloaded at a later time. 9 memory positions are available.
The PLI load can optionally set the reset state when switching on, the last active settings at power-off or memory positions 1 to 9.

Drivers

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

H&H Höcherl & Hackl
The electronic load

Software Tool
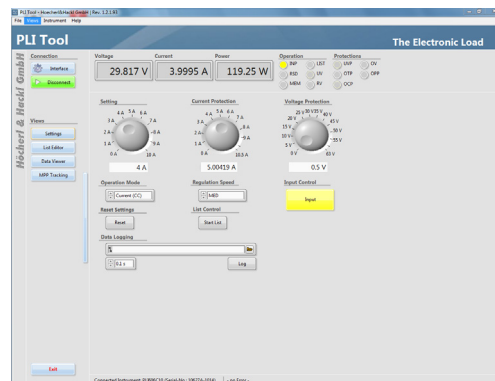
Setting Menu

The PLI software tool is a graphical software tool to control the PLI series electronic loads. The user can choose different functions with the aid of the navigation bar.

The most important load settings are done in the main menu ("Settings"). Several graphical widgets inform the user about the measurements and the current device status. Further on, a data logging function can be activated in the main menu.

www.hoecherl–hackl.com
–> Download area

List Editor
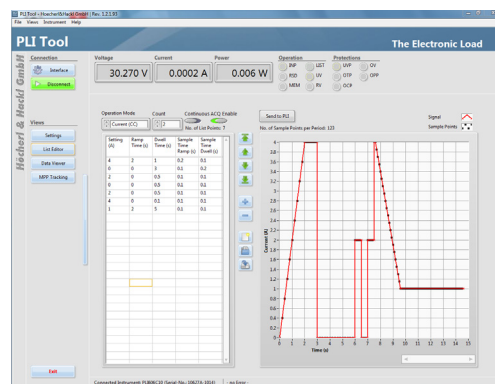
The list editor can be used to easily create dynamic load profiles for the electronic load. The user can enter the nominal setting values for current, voltage, power and resistance, the corresponding rise and fall times and the corresponding dwell times for each setting point of the list. Additionally, the List function allows the user to enable a synchronous data logging function for current and voltage measurements where the sampling times can be individually adjusted for each part of the load profile.

Data Viewer

Measurement values of the internal DAQ memory can be exported from the electronic load and displayed as a diagram with the aid of the "Data Viewer". The measurement data can also be saved on a data storage as a .CSV file for further processing.

MPP Tracking
(with Option PLI21)
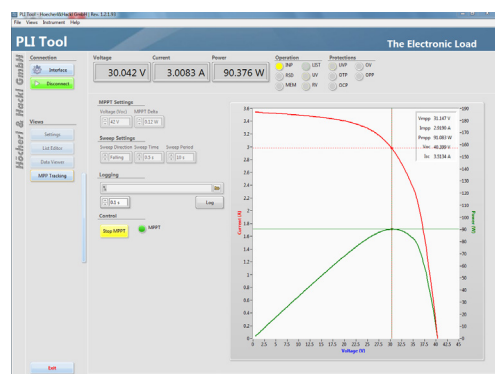
The MPPT function acquires measurement data from a connected solar panel.

The function changes continuously between the MPPT process and a sweep process. During the MPPT process, the load controls the optimum global MPP found at the sweep process.

Model (Order number)	PLI606C10	PLI1406C20	PLI2106C30
Maximum input voltage Vmax	60 V	60 V	60 V
Minimum input voltage Vmin [1]	1 V	1 V	0.8 V
Maximum current Imax [2]	10 A	20 A	30 A
Continuous power	600 W	1,200 W	1,800 W
Short-time power [3]	600 W	1,200 W	1,800 W
Voltage setting	0 … 60 V	0 … 60 V	0 … 60 V
Current setting	0 … 10 A	0 … 20 A	0 … 30 A
Resistance setting	200 mΩ … 64.5 Ω	100 mΩ … 32.2 Ω	67 mΩ … 21.5 Ω
Power setting [4]	0 … 600 W	0 … 1,200 W	0 … 1,800 W
Rise/fall time [5]	30 µs	30 µs	30 µs
Input capacity ca.	2 µF	6 µF	6 µF
Load terminals [6] rear / front	BPK4-30L / BPK4-30L	BPK4-30L / –	BPK4-30L / –
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	35 VA	55 VA	75 VA
Noise max. ca. [8]	55 dB(A)	57 dB(A)	60 dB(A)
Weight ca.	9 kg	14 kg	17.5 kg
Housing / 3D model [9]	½19", 2 U / PLI_M2	19", 2 U / PLI_M6	19", 2 U / PLI_M6

Model (Order number)	PLI606	PLI612	PLI630	PLI660	PLI680
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2.8 V	3.2 V	3.2 V
Maximum current Imax [2]	60 A	20 A	16 A	8 A	6 A
Continuous power	600 W	600 W	600 W	600 W	600 W
Short-time power [3]	1,200 W	1,200 W	900 W	600 W	600 W
Voltage setting	0 … 60 V	0 … 120 V	0 … 300 V	0 … 600 V	0 … 800 V
Current setting	0 … 60 A	0 … 20 A	0 … 16 A	0 … 8 A	0 … 6 A
Resistance setting	33 mΩ … 10.7 Ω	100 mΩ … 64.5 Ω	188 mΩ … 201 Ω	375 mΩ … 806 Ω	500 mΩ … 1,433 Ω
Power setting [4]	0 … 1,200 W	0 … 1,200 W	0 … 900 W	0 … 600 W	0 … 600 W
Rise/fall time [5]	35 µs	50 µs	20 µs	20 µs	20 µs
Input capacity ca.	2 µF	2 µF	2 µF	2 µF	2 µF
Load terminals [6] rear / front	FKS20/5-SM8 / BPK4-60L	BPK4-30L / BPK4-30L	BPK4-30L / BPK4-30L	BPK4-30L / BPK4-30L	BPK4-30L / BPK4-30L
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	35 VA	35 VA	35 VA	35 VA	35 VA
Noise max. ca. [8]	55 dB(A)	55 dB(A)	55 dB(A)	55 dB(A)	55 dB(A)
Weight ca.	9 kg	9 kg	9 kg	9 kg	9 kg
Housing / 3D model [9]	½19", 2 U / PLI_M1	½19", 2 U / PLI_M2	½19", 2 U / PLI_M2	½19", 2 U / PLI_M2	½19", 2 U / PLI_M2

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model (Order number)	PLI1406	PLI1412	PLI1430	PLI1460	PLI1480
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.3	1 V	3 V	3.4 V	3.4 V
Maximum current Imax [2]	120 A	40 A	32 A	16 A	12 A
Continuous power	1,400 W	1,400 W	1,400 W	1,400 W	1,400 W
Short-time power [3]	2,800 W	2,800 W	2,100 W	1,400 W	1,400 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 120 A	0 ... 40 A	0 ... 32 A	0 ... 16 A	0 ... 12 A
Resistance setting	17 mΩ ... 5,37 Ω	50 mΩ ... 32.2 Ω	94 mΩ ... 100 Ω	188 mΩ ... 403 Ω	250 mΩ ... 716 Ω
Power setting [4]	0 ... 2,800 W	0 ... 2,800 W	0 ... 2,100 W	0 ... 1,400 W	0 ... 1,400 W
Rise/fall time [5]	35 µs	50 µs	20 µs	20 µs	25 µs
Input capacity ca.	6 µF	6 µF	6 µF	6 µF	6 µF
Load terminals [6] rear / front	FKS20/5-SM8 / -	BPK4-60L / -	BPK4-60L / -	BPK4-30L / -	BPK4-30L / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	55 VA	55 VA	55 VA	55 VA	55 VA
Noise max. ca. [8]	57 dB(A)	57 dB(A)	57 dB(A)	57 dB(A)	57 dB(A)
Weight ca.	15 kg	15 kg	14.5 kg	15 kg	15 kg
Housing / 3D model [9]	19", 2 U / PLI_M6	19", 2 U / PLI_M8	19", 2 U / PLI_M8	19", 2 U / PLI_M7	19", 2 U / PLI_M7

Model (Order number)	PLI2106	PLI2112	PLI2130	PLI2160	PLI2180
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.6 V	3 V	3 V	3 V
Maximum current Imax [2]	180 A	60 A	48 A	24 A	18 A
Continuous power	2,100 W	2,100 W	2,100 W	2,100 W	2,100 W
Short-time power [3]	4,200 W	4,200 W	3,150 W	2,100 W	2,100 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 180 A	0 ... 60 A	0 ... 48 A	0 ... 24 A	0 ... 18 A
Resistance setting	12 mΩ ... 3.58 Ω	33 mΩ ... 21.5 Ω	63 mΩ ... 67.2 Ω	125 mΩ ... 268 Ω	167 mΩ ... 477 kΩ
Power setting [4]	0 ... 4,200 W	0 ... 4,200 W	0 ... 3,150 W	0 ... 2,100 W	0 ... 2,100 W
Rise/fall time [5]	35 µs	40 µs	20 µs	20 µs	40 µs
Input capacity ca.	8 µF	8 µF	8 µF	8 µF	8 µF
Load terminals [6] rear / front	FKS20/5-SM8 / -	BPK4-60L / -	BPK4-60L / -	BPK4-30L / -	BPK4-30L / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	75 VA	75 VA	75 VA	75 VA	75 VA
Noise max. ca. [8]	60 dB(A)	60 dB(A)	60 dB(A)	60 dB(A)	60 dB(A)
Weight ca.	17.5 kg	17.5 kg	17.5 kg	17.5 kg	17.5 kg
Housing / 3D model [9]	19", 2 U / PLI_M6	19", 2 U / PLI_M8	19", 2 U / PLI_M8	19", 2 U / PLI_M7	19", 2 U / PLI_M7

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI
high power

Model Overview 3,200 ... 4,800 W

Model (Order number)	PLI3206	PLI3212	PLI3230	PLI3260	PLI3280
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.6 V	1.6 V	2 V	1.5 V
Maximum current Imax [2]	300 A	150 A	60 A	40 A	30 A
Continuous power	3,200 W	3,200 W	3,200 W	3,200 W	3,200 W
Short-time power [3]	6,400 W	6,400 W	4,800 W	3,200 W	3,200 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 300 A	0 ... 150 A	0 ... 60 A	0 ... 40 A	0 ... 30 A
Resistance setting	7 mΩ ... 2.15 Ω	14 mΩ ... 8.6 Ω	33 mΩ ... 53.7 Ω	50 mΩ ... 161 Ω	66.7 mΩ ... 286 Ω
Power setting [4]	0 ... 6,400 W	0 ... 6,400 W	0 ... 4,800 W	0 ... 3,200 W	0 ... 3,200 W
Rise/fall time [5]	20 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	8 µF	8 µF	8 µF	8 µF	8 µF
Load terminals [6] rear / front	FKS25/8-SM10 / -	FKS25/8-SM10 with safety cover / -	BPK4-60L / -	BPK4-60L / -	BPK4-30L / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	140 VA	140 VA	140 VA	140 VA	140 VA
Noise max. ca. [8]	70 dB(A)	70 dB(A)	70 dB(A)	70 dB(A)	70 dB(A)
Weight ca.	22.5 kg	22.5 kg	22.5 kg	20.5 kg	22.5 kg
Housing / 3D model [9]	19", 3 U / PLI_M12	19", 3 U / PLI_M12	19", 3 U / PLI_M8	19", 3 U / PLI_M14	19", 3 U / PLI_M13

Model (Order number)	PLI4806	PLI4812	PLI4230	PLI4260	PLI4280
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.2 V	2 V	1 V	2 V
Maximum current Imax [2]	450 A	225 A	90 A	60 A	45 A
Continuous power	4,800 W	4,800 W	4,200 W	4,200 W	4,200 W
Short-time power [3]	9,600 W	9,600 W	6,300 W	4,200 W	4,200 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 450 A	0 ... 225 A	0 ... 90 A	0 ... 60 A	0 ... 45 A
Resistance setting	5 mΩ ... 1.43 Ω	9 mΩ ... 5.73 Ω	23 mΩ ... 35.8 Ω	34 mΩ ... 107 Ω	45 mΩ ... 191 Ω
Power setting [4]	0 ... 9,600 W	0 ... 9,600 W	0 ... 6,300 W	0 ... 4,200 W	0 ... 4,200 W
Rise/fall time [5]	20 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	10 µF	10 µF	10 µF	10 µF	10 µF
Load terminals [6] rear / front	FKS25/10-SM10 / -	FKS25/10-SM10 with safety cover / -	FKS25/10-SM10 with safety cover / -	FKS25/10-SM10 with safety cover / -	FKS25/10-SM10 with safety cover / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	190 VA	190 VA	190 VA	190 VA	190 VA
Noise max. ca. [8]	71 dB(A)	71 dB(A)	71 dB(A)	71 dB(A)	71 dB(A)
Weight ca.	39 kg	39 kg	39 kg	38 kg	39 kg
Housing / 3D model [9]	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model (Order number)	PLI6406	PLI6412	PLI5630	PLI5660	PLI5680
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.6 V	1.6 V	1.2 V	2 V
Maximum current Imax [2]	600 A	300 A	120 A	80 A	60 A
Continuous power	6,400 W	6,400 W	5,600 W	5,600 W	5,600 W
Short-time power [3]	12,800 W	12,800 W	8,400 W	5,600 W	5,600 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 600 A	0 ... 300 A	0 ... 120 A	0 ... 80 A	0 ... 60 A
Resistance setting	4 mΩ ... 1.07 Ω	7 mΩ ... 4.3 Ω	17 mΩ ... 26.8 Ω	25 mΩ ... 80.6 Ω	34 mΩ ... 143.3 Ω
Power setting [4]	0 ... 12,800 W	0 ... 12,800 W	0 ... 8,400 W	0 ... 5,600 W	0 ... 5,600 W
Rise/fall time [5]	20 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	14 µF	14 µF	12 µF	12 µF	12 µF
Load terminals [6] rear / front	FKS40/12-SM12 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	275 VA	275 VA	275 VA	275 VA	275 VA
Noise max. ca. [8]	73 dB(A)	73 dB(A)	73 dB(A)	73 dB(A)	73 dB(A)
Weight ca.	56 kg	53 kg	56 kg	52 kg	56 kg
Housing / 3D model [9]	19", 8 U / PLI_M24	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23

Model (Order number)	PLI8006	PLI8012	PLI7030	PLI7060	PLI7080
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.6 V	1.6 V	1 V	1 V
Maximum current Imax [2]	750 A	375 A	150 A	100 A	75 A
Continuous power	8,000 W	8,000 W	7,000 W	7,000 W	7,000 W
Short-time power [3]	16,000 W	16,000 W	10,500 W	7,000 W	7,000 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 750 A	0 ... 375 A	0 ... 150 A	0 ... 100 A	0 ... 75 A
Resistance setting	3 mΩ ... 0.86 Ω	6 mΩ ... 3.44 Ω	14 mΩ ... 21.5 Ω	20 mΩ ... 64.5 Ω	27 mΩ ... 114.7 Ω
Power setting [4]	0 ... 16,000 W	0 ... 16,000 W	0 ... 10,500 W	0 ... 7,000 W	0 ... 7,000 W
Rise/fall time [5]	20 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	16 µF	16 µF	14 µF	14 µF	14 µF
Load terminals [6] rear / front	FKS40/12-SM12 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	320 VA	320 VA	320 VA	320 VA	320 VA
Noise max. ca. [8]	74 dB(A)	74 dB(A)	74 dB(A)	74 dB(A)	74 dB(A)
Weight ca.	57 kg	57 kg	57 kg	57 kg	57 kg
Housing / 3D model [9]	19", 8 U / PLI_M24	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI high power

Model Overview 8,400 ... 11,200 W

Model (Order number)	PLI9606	PLI9612	PLI8430	PLI8460	PLI8480
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.6 V	1.6 V	1.5 V	2 V
Maximum current Imax [2]	900 A	450 A	180 A	120 A	90 A
Continuous power	9,600 W	9,600 W	8,400 W	8,400 W	8,400 W
Short-time power [3]	19,200 W	19,200 W	12,600 W	8,400 W	8,400 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 900 A	0 ... 450 A	0 ... 180 A	0 ... 120 A	0 ... 90 A
Resistance setting	3 mΩ ... 0.71 Ω	5 mΩ ... 2.86 Ω	12 mΩ ... 17.9 Ω	17 mΩ ... 53.7 Ω	23 mΩ ... 95.5 Ω
Power setting [4]	0 ... 19,200 W	0 ... 19,200 W	0 ... 12,600 W	0 ... 8,400 W	0 ... 8,400 W
Rise/fall time [5]	25 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	20 µF	20 µF	18 µF	18 µF	18 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	380 VA	380 VA	380 VA	380 VA	380 VA
Noise max. ca. [8]	74 dB(A)	74 dB(A)	74 dB(A)	74 dB(A)	74 dB(A)
Weight ca.	63 kg	63 kg	63 kg	63 kg	63 kg
Housing / 3D model [9]	19", 8 U / PLI_M24	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23

Model (Order number)	PLI11206	PLI11212	PLI9830	PLI9860	PLI9880
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.4 V	2 V	2 V	2 V
Maximum current Imax [2]	1,050 A	525 A	210 A	140 A	105 A
Continuous power	11,200 W	11,200 W	9,800 W	9,800 W	9,800 W
Short-time power [3]	22,400 W	22,400 W	14,700 W	9,800 W	9,800 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 1,050 A	0 ... 525 A	0 ... 210 A	0 ... 140 A	0 ... 105 A
Resistance setting	2 mΩ ... 0.61 Ω	4 mΩ ... 2.45 Ω	10 mΩ ... 15.3 Ω	15 mΩ ... 46 Ω	19.1 mΩ ... 81.9 Ω
Power setting [4]	0 ... 22,400 W	0 ... 22,400 W	0 ... 14,700 W	0 ... 9,800 W	0 ... 9,800 W
Rise/fall time [5]	25 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	24 µF	24 µF	20 µF	20 µF	20 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM1 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	450 VA	450 VA	450 VA	450 VA	450 VA
Noise max. ca. [8]	75 dB(A)	75 dB(A)	75 dB(A)	75 dB(A)	75 dB(A)
Weight ca.	80 kg	80 kg	80 kg	74 kg	74 kg
Housing / 3D model [9]	19", 11 U / PLI_M28	19", 11 U / PLI_M28	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview 9,800 ... 14,400 W

Model (Order number)	PLI12806	PLI12812	PLI11230	PLI11260	PLI11280
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.2 V	2 V	1.5 V	1.5 V
Maximum current Imax [2]	1,200 A	600 A	240 A	160 A	120 A
Continuous power	12,800 W	12,800 W	11,200 W	11,200 W	11,200 W
Short-time power [3]	25,600 W	25,600 W	16,800 W	11,200 W	11,200 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 1.200 A	0 ... 600 A	0 ... 240 A	0 ... 160 A	0 ... 120 A
Resistance setting	2 mΩ ... 0.53 Ω	4 mΩ ... 2.15 Ω	9 mΩ ... 13.4 Ω	13 mΩ ... 40.3 Ω	17 mΩ ... 71.6 Ω
Power setting [4]	0 ... 25,600 W	0 ... 25,600 W	0 ... 16,800 W	0 ... 11,200 W	0 ... 11,200 W
Rise/fall time [5]	25 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	26 µF	26 µF	24 µF	24 µF	26 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	500 VA	500 VA	500 VA	500 VA	500 VA
Noise max. ca. [8]	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	82 kg	82 kg	82 kg	82 kg	82 kg
Housing / 3D model [9]	19", 11 U / PLI_M28	19", 11 U / PLI_M28	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27

Model (Order number)	PLI14406	PLI14412	PLI12630	PLI12660	PLI12680
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.2 V	1.4 V	2 V	2 V
Maximum current Imax [2]	1,350 A	675 A	270 A	180 A	135 A
Continuous power	14,400 W	14,400 W	12,600 W	12,600 W	12,600 W
Short-time power [3]	28,800 W	28,800 W	18,900 W	12,600 W	12,600 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 1,350 A	0 ... 675 A	0 ... 270 A	0 ... 180 A	0 ... 135 A
Resistance setting	2 mΩ ... 477 mΩ	3 mΩ ... 1.91 Ω	8 mΩ ... 11.9 Ω	12 mΩ ... 35.8 Ω	15 mΩ ... 63.7 Ω
Power setting [4]	0 ... 28,800 W	0 ... 28,800 W	0 ... 18,900 W	0 ... 12,600 W	0 ... 12,600 W
Rise/fall time [5]	30 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	30 µF	30 µF	26 µF	26 µF	26 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	540 VA	540 VA	540 VA	540 VA	540 VA
Noise max. ca. [8]	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	89 kg	87 kg	85 kg	84 kg	89 kg
Housing / 3D model [9]	19", 11 U / PLI_M28	19", 11 U / PLI_M28	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI high power

Model Overview 14,000 ... 17,600 W

Model (Order number)	PLI16006	PLI16012	PLI14030	PLI14060	PLI14080
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.4 V	2 V	2 V	2 V
Maximum current Imax [2]	1,500 A	750 A	300 A	200 A	150 A
Continuous power	16,000 W	16,000 W	14,000 W	14,000 W	14,000 W
Short-time power [3]	32,000 W	32,000 W	21,000 W	14,000 W	14,000 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 1.500 A	0 ... 750 A	0 ... 300 A	0 ... 200 A	0 ... 150 A
Resistance setting	2 mΩ ... 0.430 Ω	3 mΩ ... 1.72 Ω	7 mΩ ... 10.7 Ω	10 mΩ ... 32.2 Ω	14 mΩ ... 57.3 Ω
Power setting [4]	0 ... 32,000 W	0 ... 32,000 W	0 ... 21,000 W	0 ... 14,000 W	0 ... 14,000 W
Rise/fall time [5]	30 µs	20 µs	25 µs	20 µs	20 µs
Input capacity ca.	32 µF	32 µF	26 µF	26 µF	26 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	600 VA	600 VA	600 VA	600 VA	600 VA
Noise max. ca. [8]	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	104 kg	104 kg	104 kg	104 kg	104 kg
Housing / 3D model [9]	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M31	19", 14 U / PLI_M31	19", 14 U / PLI_M31

Model (Order number)	PLI17606	PLI17612	PLI15430	PLI15460	PLI15480
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1 V	1.4 V	1.4 V	1.2 V	2 V
Maximum current Imax [2]	1,650 A	825 A	330 A	220 A	165 A
Continuous power	17,600 W	17,600 W	15,400 W	15,400 W	15,400 W
Short-time power [3]	35,200 W	35,200 W	23,100 W	15,400 W	15,400 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 1,650 A	0 ... 825 A	0 ... 330 A	0 ... 220 A	0 ... 165 A
Resistance setting	2 mΩ ... 0.391 Ω	3 mΩ ... 1.56 Ω	7 mΩ ... 9.77 Ω	10 mΩ ... 29.3 Ω	13 mΩ ... 52.1 Ω
Power setting [4]	0 ... 35,200 W	0 ... 35,200 W	0 ... 23,100 W	0 ... 15,400 W	0 ... 15,400 W
Rise/fall time [5]	30 µs	20 µs	20 µs	20 µs	20 µs
Input capacity ca.	36 µF	36 µF	32 µF	32 µF	32 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	675 VA	675 VA	675 VA	675 VA	675 VA
Noise max. ca. [8]	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	105 kg	106 kg	101 kg	98 kg	105 kg
Housing / 3D model [9]	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M31	19", 14 U / PLI_M31	19", 14 U / PLI_M31

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

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The electronic load

PLI Series — Model Overview 16,800 … 20,800 W

Model (Order number)	PLI19206	PLI19212	PLI16830	PLI16860	PLI16880
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.4 V	2 V	2 V	2 V
Maximum current Imax [2]	1,800 A	900 A	360 A	240 A	180 A
Continuous power	19,200 W	19,200 W	16,800 W	16,800 W	16,800 W
Short-time power [3]	38,400 W	38,400 W	25,200 W	16,800 W	16,800 W
Voltage setting	0 … 60 V	0 … 120 V	0 … 300 V	0 … 600 V	0 … 800 V
Current setting	0 … 1,800 A	0 … 900 A	0 … 360 A	0 … 240 A	0 … 180 A
Resistance setting	2 mΩ … 0.358 Ω	3 mΩ … 1.43 Ω	6 mΩ … 8.96 Ω	9 mΩ … 26.88 Ω	12 mΩ … 47.7 Ω
Power setting [4]	0 … 38,400 W	0 … 38,400 W	0 … 25,200 W	0 … 16,800 W	0 … 16,800 W
Rise/fall time [5]	30 µs	30 µs	25 µs	20 µs	20 µs
Input capacity ca.	40 µF	40 µF	34 µF	34 µF	34 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	700 VA	700 VA	700 VA	700 VA	700 VA
Noise max. ca. [8]	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	112 kg	112 kg	112 kg	112 kg	112 kg
Housing / 3D model [9]	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M31	19", 14 U / PLI_M31	19", 14 U / PLI_M31

Model (Order number)	PLI20806	PLI20812	PLI18230	PLI18260	PLI18280
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	1.6 V	2 V	2 V
Maximum current Imax [2]	1,950 A	975 A	390 A	260 A	195 A
Continuous power	20,800 W	20,800 W	18.200 W	18,200 W	18,200 W
Short-time power [3]	41,600 W	41,600 W	27,300 W	18,200 W	18,200 W
Voltage setting	0 … 60 V	0 … 120 V	0 … 300 V	0 … 600 V	0 … 800 V
Current setting	0 … 1,950 A	0 … 975 A	0 … 390 A	0 … 260 A	0 … 195 A
Resistance setting	2 mΩ … 0.33 Ω	3 mΩ … 1.32 Ω	6 mΩ … 8.27 Ω	8 mΩ … 24.8 Ω	11 mΩ … 44.1 Ω
Power setting [4]	0 … 41.600 W	0 … 41,600 W	0 … 27,300 W	0 … 18,200 W	0 … 18,200 W
Rise/fall time [5]	30 µs	30 µs	25 µs	25 µs	20 µs
Input capacity ca.	42 µF	42 µF	38 µF	38 µF	38 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	770 VA	770 VA	770 VA	770 VA	770 VA
Noise max. ca. [8]	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	126 kg	126 kg	118 kg	126 kg	126 kg
Housing / 3D model [9]	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 17 U / PLI_M35

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview 19,600 ... 24,000 W

Model (Order number)	PLI22406	PLI22412	PLI19630	PLI19660	PLI19680
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2 V	2 V	2 V
Maximum current Imax [2]	2,100 A	1,050 A	420 A	280 A	210 A
Continuous power	22,400 W	22,400 W	19,600 W	19,600 W	19,600 W
Short-time power [3]	44,800 W	44,800 W	29,400 W	19,600 W	19,600 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 2,100 A	0 ... 1050 A	0 ... 420 A	0 ... 280 A	0 ... 210 A
Resistance setting	1 mΩ ... 0.30 Ω	2 mΩ ... 1.22 Ω	5 mΩ ... 7.68 Ω	8 mΩ ... 23 Ω	10 mΩ ... 40.9 Ω
Power setting [4]	0 ... 44,800 W	0 ... 44,800 W	0 ... 29,400 W	0 ... 19,600 W	0 ... 19,600 W
Rise/fall time [5]	30 µs	30 µs	25 µs	25 µs	20 µs
Input capacity ca.	46 µF	46 µF	40 µF	40 µF	40 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	810 VA	870 VA	870 VA	870 VA	870 VA
Noise max. ca. [8]	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)
Weight ca.	131 kg	131 kg	124 kg	131 kg	131 kg
Housing / 3D model [9]	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 17 U / PLI_M35

Model (Order number)	PLI24006	PLI24012	PLI21030	PLI21060	PLI21080
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2 V	2 V	2 V
Maximum current Imax [2]	2,250 A	1,125 A	450 A	300 A	225 A
Continuous power	24,000 W	24,000 W	21,000 W	21,000 W	21,000 W
Short-time power [3]	48,000 W	48,000 W	31,500 W	21,000 W	21,000 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 2,250 A	0 ... 1,125 A	0 ... 450 A	0 ... 300 A	0 ... 225 A
Resistance setting	1 mΩ ... 0.28 Ω	2 mΩ ... 1.14 Ω	5 mΩ ... 7.16 Ω	7 mΩ ... 21.5 Ω	9 mΩ ... 38.2 Ω
Power setting [4]	0 ... 48.000 W	0 ... 48.000 W	0 ... 31,500 W	0 ... 21,000 W	0 ... 21,000 W
Rise/fall time [5]	35 µs	30 µs	25 µs	25 µs	20 µs
Input capacity ca.	48 µF	48 µF	42 µF	42 µF	42 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	875 VA	875 VA	875 VA	875 VA	875 VA
Noise max. ca. [8]	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)
Weight ca.	136 kg	136 kg	136 kg	136 kg	130 kg
Housing / 3D model [9]	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 17 U / PLI_M35

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI Series

Model Overview 22,400 ... 27,200 W

Model (Order number)	PLI25606	PLI25612	PLI22430	PLI22460	PLI22480
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2 V	1.5 V	2 V
Maximum current Imax [2]	2,400 A	1,200 A	480 A	320 A	240 A
Continuous power	25,600 W	25,600 W	22,400 W	22,400 W	22,400 W
Short-time power [3]	51,200 W	51,200 W	33,600 W	22,400 W	22,400 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 2,400 A	0 ... 1,200 A	0 ... 480 A	0 ... 320 A	0 ... 240 A
Resistance setting	1 mΩ ... 0.26 Ω	2 mΩ ... 1.07 Ω	5 mΩ ... 6.72 Ω	7 mΩ ... 20.1 Ω	9 mΩ ... 35.8 Ω
Power setting [4]	0 ... 51,200 W	0 ... 51,200 W	0 ... 33,600 W	0 ... 22,400 W	0 ... 22,400 W
Rise/fall time [5]	35 μs	30 μs	30 μs	25 μs	30 μs
Input capacity ca.	52 μF	52 μF	46 μF	46 μF	46 μF
Load terminals [6] rear / front	FKS40/12-SM12	FKS40/12-SM12 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	900 VA	900 VA	900 VA	900 VA	900 VA
Noise max. ca. [8]	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.	142 kg	142 kg	142 kg	142 kg	142 kg
Housing / 3D model [9]	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M39	19", 20 U / PLI_M39	19", 20 U / PLI_M39

Model (Order number)	PLI27206	PLI27212	PLI23830	PLI23860	PLI23880
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2 V	2 V	2 V
Maximum current Imax [2]	2,550 A	1,275 A	510 A	340 A	255 A
Continuous power	27,200 W	27,200 W	23,800 W	23,800 W	23,800 W
Short-time power [3]	54,400 W	54,400 W	35,700 W	23,800 W	23,800 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 2,550 A	0 ... 1,275 A	0 ... 510 A	0 ... 340 A	0 ... 255 A
Resistance setting	1 mΩ ... 0.25 Ω	2 mΩ ... 1.01 Ω	4 mΩ ... 6.32 Ω	6 mΩ ... 18.9 Ω	8 mΩ ... 33.7 Ω
Power setting [4]	0 ... 54,400 W	0 ... 54.400 W	0 ... 35,700 W	0 ... 23,800 W	0 ... 23,800 W
Rise/fall time [5]	35 μs	30 μs	30 μs	25 μs	30 μs
Input capacity ca.	56 μF	56 μF	48 μF	48 μF	48 μF
Load terminals [6] rear / front	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	1,000 VA	1,000 VA	1,000 VA	1,000 VA	1,000 VA
Noise max. ca. [8]	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.	152 kg	152 kg	152 kg	152 kg	152 kg
Housing / 3D model [9]	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M39	19", 20 U / PLI_M39

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 μs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI Series

Model Overview 25,200 ... 28,800 W

Model (Order number)	PLI28806	PLI28812	PLI25230	PLI25260	PLI25280
Maximum input voltage Vmax	60 V	120 V	300 V	600 V	800 V
Minimum input voltage Vmin [1]	1.2 V	1.2 V	2 V	1.5 V	2 V
Maximum current Imax [2]	2,700 A	1,350 A	540 A	360 A	270 A
Continuous power	28,800 W	28,800 W	25,200 W	25,200 W	25,200 W
Short-time power [3]	57,600 W	57,600 W	37,800 W	25,200 W	25,200 W
Voltage setting	0 ... 60 V	0 ... 120 V	0 ... 300 V	0 ... 600 V	0 ... 800 V
Current setting	0 ... 2,700 A	0 ... 1,350 A	0 ... 540 A	0 ... 360 A	0 ... 270 A
Resistance setting	1 mΩ ... 0.23 Ω	2 mΩ ... 0.95 Ω	4 mΩ ... 5.97 Ω	6 mΩ ... 17.9 Ω	8 mΩ ... 31.8 Ω
Power setting [4]	0 ... 57,600 W	0 ... 57,600 W	0 ... 37,800W	0 ... 25,200 W	0 ... 25,200 W
Rise/fall time [5]	35 µs	30 µs	30 µs	25 µs	30 µs
Input capacity ca.	58 µF	58 µF	52 µF	52 µF	52 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	1,050 VA	1,050 VA	1,050 VA	1,050 VA	1,050 VA
Noise max. ca. [8]	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.	160 kg	160 kg	160 kg	155 kg	160 kg
Housing / 3D model [9]	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M39	19", 20 U / PLI_M39

PLI Series

Models up From 0 V (ZV)

Model (Order number)	PLI606ZV	PLI612ZV	PLI1206ZV	PLI2606ZV	PLI2306ZV
Maximum input voltage Vmax	60 V	120 V	60 V	60 V	60 V
Minimum input voltage Vmin [1]	10 mV	10 mV	10 mV	10 mV	10 mV
Maximum current Imax [2]	60 A	20 A	120 A	200 A	300 A
Continuous power	600 W	600 W	1,200 W	2,600 W	2,300 W
Short-time power [3]	1,000 W	1,200 W	2,400 W	5,800 W	5,500 W
Voltage setting	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V
Current setting	0 ... 60 A	0 ... 20 A	0 ... 120 A	0 ... 200 A	0 ... 300 A
Resistance setting	34 mΩ ... 10.75 Ω	100 mΩ ... 64 Ω	17 mΩ ... 5.37 Ω	10 mΩ ... 3.22 Ω	7 mΩ ... 2.15 Ω
Power setting [4]	0 ... 1,000 W	0 ... 1,200 W	0 ... 2,400 W	0 ... 5,800 W	0 ... 5,500 W
Rise/fall time [5]	35 µs	40 µs	35 µs	20 µs	20 µs
Input capacity ca.	2 µF	2 µF	4 µF	6 µF	6 µF
Load terminals [6] rear / front	FKS20/5-SM8 / BPK4-60L	FKS20/5-SM8 / -	FKS20/5-SM8 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	-	1/N/PE AC 115 V 50 ... 60 Hz	-	-
Power consumption	320 VA	178 VA	600 VA	960 VA	1,500 VA
Noise max. ca. [8]	55 dB(A)	55 dB(A)	62 dB(A)	71 dB(A)	71 dB(A)
Weight ca.	14 kg	13 kg	16.5 kg	47 kg	50 kg
Housing / 3D model [9]	19", 2 U / PLI_M6	19", 2 U / PLI_M6	19", 2 U / PLI_M6	19", 8 U / PLI_M23	19", 8 U / PLI_M23

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

H&H Höcherl & Hackl
The electronic load

Model (Order number)	PLI2106ZV	PLI3706ZV	PLI3506ZV	PLI3206ZV	PLI4806ZV
Maximum input voltage Vmax	60 V	60 V	60 V	60 V	60 V
Minimum input voltage Vmin [1]	10 mV	10 mV	10 mV	10 mV	10 mV
Maximum current Imax [2]	360 A	360 A	450 A	540 A	540 A
Continuous power	2,100 W	3,700 W	3,500 W	3,200 W	4,800 W
Short-time power [3]	5,300 W	8,500 W	8,200 W	8,000 W	11,000 W
Voltage setting	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V
Current setting	0 ... 360 A	0 ... 360 A	0 ... 450 A	0 ... 540 A	0 ... 540 A
Resistance setting	6 mΩ ... 1.79 Ω	6 mΩ ... 1.79 Ω	5 mΩ ... 1.43 Ω	4 mΩ ... 1.19 Ω	4 mΩ ... 1.19 Ω
Power setting [4]	0 ... 5,300 W	0 ... 8,500 W	0 ... 8,200 W	0 ... 8,000 W	0 ... 11,000 W
Rise/fall time [5]	20 µs	25 µs	25 µs	20 µs	25 µs
Input capacity ca.	8 µF	8 µF	8 µF	8 µF	8 µF
Load terminals [6] rear / front	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	-	-	-	-	-
Power consumption	1,500 VA	1,770 VA	2,310 VA	2,500 VA	2,600 VA
Noise max. ca. [8]	71 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	78 dB(A)
Weight ca.	52 kg	53.5 kg	56 kg	56 kg	73 kg
Housing / 3D model [9]	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 11 U / PLI_M27

Model (Order number)	PLI4606ZV	PLI4306ZV	PLI6006ZV	PLI7506ZV
Maximum input voltage Vmax	60 V	60 V	60 V	60 V
Minimum input voltage Vmin [1]	10 mV	10 mV	10 mV	10 mV
Maximum current Imax [2]	600 A	720 A	720 A	720 A
Continuous power	4,600 W	4,300 W	6,000 W	7,500 W
Short-time power [3]	11,000 W	10,500 W	14,000 W	17,000 W
Voltage setting	0 ... 60 V	0 ... 60 V	0 ... 60 V	0 ... 60 V
Current setting	0 ... 600 A	0 ... 720 A	0 ... 720 A	0 ... 720 A
Resistance setting	4 mΩ ... 1.07 Ω	3 mΩ ... 0.89 Ω	3 mΩ ... 0.89 Ω	3 mΩ ... 0.89 Ω
Power setting [4]	0 ... 11,000 W	0 ... 10,500 W	0 ... 14,000 W	0 ... 17,000 W
Rise/fall time [5]	20 µs	20 µs	25 µs	25 µs
Input capacity ca.	10 µF	10 µF	12 µF	14 µF
Load terminals [6] rear / front	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	3/N/PE AC 400/230 V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230 V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230 V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230 V 50 ... 60 Hz, 16 A
Mains voltage toggleable [7]	-	-	-	-
Power consumption	2,800 VA	3,300 VA	3,300 VA	3,475 VA
Noise max. ca. [8]	79 dB(A)	79 dB(A)	78 dB(A)	78 dB(A)
Weight ca.	75.5 kg	75.5 kg	80.5 kg	84 kg
Housing / 3D model [9]	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI Series — Models With 1,200 V (HV)

Model (Order number)	PLI24K12HV	PLI36K12HV	PLI48K12HV	PLI60K12HV	PLI72K12HV
Maximum input voltage Vmax	1,200 V	1,200 V	1,200 V	1,200 V	1,200 V
Minimum input voltage Vmin [1]	1.6 V	1.6 V	2 V	1.5 V	2 V
Maximum current Imax [2]	12 A	18 A	24 A	30 A	36 A
Continuous power	2,400 W	3,600 W	4,800 W	6,000 W	7,200 W
Short-time power [3]	2,400 W	3,600 W	4,800 W	6,000 W	7,200 W
Voltage setting	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V
Current setting	0 ... 12 A	0 ... 18 A	0 ... 24 A	0 ... 30 A	0 ... 36 A
Resistance setting	167 mΩ ... 1075 Ω	112 mΩ ... 716 Ω	84 mΩ ... 537 Ω	67 mΩ ... 430 Ω	56 mΩ ... 358 Ω
Power setting [4]	0 ... 2.400 W	0 ... 3.600 W	0 ... 4.800 W	0 ... 6.000 W	0 ... 7.200 W
Rise/fall time [5]	30 µs	20 µs	20 µs	25 µs	20 µs
Input capacity ca.	6 µF	8 µF	10 µF	12 µF	14 µF
Load terminals [6] rear / front	SBU4-32 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	140 VA	190 VA	275 VA	320 VA	380 VA
Noise max. ca. [8]	70 dB(A)	71 dB(A)	73 dB(A)	74 dB(A)	74 dB(A)
Weight ca.	20 kg	37.5 kg	52 kg	56 kg	63 kg
Housing / 3D model [9]	19", 3 U /	19", 5 U / PLI_M19	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23

Model (Order number)	PLI84K12HV	PLI96K12HV	PLI108K12HV	PLI120K12HV	PLI132K12HV	PLI144K12HV
Maximum input voltage Vmax	1,200 V	1,200 V	1,200 V	1,200 V	1,200 V	1,200 V
Minimum input voltage Vmin [1]	2 V	2 V	2 V	2 V	2 V	2 V
Maximum current Imax [2]	42 A	48 A	54 A	60 A	66 A	72 A
Continuous power	8,400 W	9,600 W	10,800 W	12,000 W	13,200 W	14,400 W
Short-time power [3]	8,400 W	9,600 W	10,800 W	12,000 W	13,200 W	14,400 W
Voltage setting	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V	0 ... 1,200 V
Current setting	0 ... 42 A	0 ... 48 A	0 ... 54 A	0 ... 60 A	0 ... 66 A	0 ... 72 A
Resistance setting	48 mΩ ... 307 Ω	42 mΩ ... 268 Ω	38 mΩ ... 238 Ω	34 mΩ ... 215 Ω	31 mΩ ... 195 Ω	28 mΩ ... 179 Ω
Power setting [4]	0 ... 8,400 W	0 ... 9,600 W	0 ... 10,800 W	0 ... 12,000 W	0 ... 13,200 W	0 ... 14,400 W
Rise/fall time [5]	25 µs	25 µs	25 µs	25 µs	25 µs	25 µs
Input capacity ca.	18 µF	20 µF	22 µF	24 µF	28 µF	30 µF
Load terminals [6] rear / front	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	450 VA	500 VA	540 VA	600 VA	675 VA	700 VA
Noise max. ca. [8]	75 dB(A)	76 dB(A)	76 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	74 kg	82 kg	85 kg	104 kg	98 kg	112 kg
Housing / 3D model [9]	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 14 U / PLI_M31	19", 14 U / PLI_M31	19", 14 U / PLI_M31

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

300 V Models With Extended Current Range (EC)

Model (Order number)	PLI3230EC	PLI4230EC	PLI5630EC	PLI7030EC	PLI8430EC	PLI9830EC
Maximum input voltage Vmax	300 V	300 V	300 V	300 V	300 V	300 V
Minimum input voltage Vmin [1]	6 V	6 V	5 V	5 V	5 V	5 V
Maximum current Imax [2]	208 A	312 A	416 A	520 A	624 A	728 A
Continuous power	3,200 W	4,200 W	5,600 W	7,000 W	8,400 W	9,800 W
Short-time power [3]	3,200 W	4,200 W	5,600 W	7,000 W	8,400 W	9,800 W
Voltage setting	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V
Current setting	0 … 208 A	0 … 312 A	0 … 416 A	0 … 520 A	0 … 624 A	0 … 728 A
Resistance setting	25 mΩ … 15.5 Ω	17 mΩ … 10.3 Ω	13 mΩ … 7.75 Ω	10 mΩ … 6.2 Ω	9 mΩ … 5.16 Ω	7 mΩ … 4.3 Ω
Power setting [4]	0 … 3,200 W	0 … 4,200 W	0 … 5,600 W	0 … 7,000 W	0 … 8,400 W	0 … 9,800 W
Rise/fall time [5]	30 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Input capacity ca.	8 µF	10 µF	12 µF	14 µF	18 µF	20 µF
Load terminals [6] rear / front	FKS25/8-SM10 / –	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	140 VA	190 VA	275 VA	320 VA	380 VA	450 VA
Noise max. ca. [8]	70 dB(A)	71 dB(A)	73 dB(A)	74 dB(A)	74 dB(A)	75 dB(A)
Weight ca.	22.5 kg	38 kg	56 kg	59 kg	63 kg	80 kg
Housing / 3D model [9]	19", 3 U / PLI_M12	19", 5 U / PLI_M19	19", 8 U / PLI_M23	19", 8 U / PLI_M24	19", 8 U / PLI_M24	19", 8 U / PLI_M28

Model (Order number)	PLI11230EC	PLI12630EC	PLI14030EC	PLI15430EC	PLI16830EC	PLI18230EC
Maximum input voltage Vmax	300 V	300 V	300 V	300 V	300 V	300 V
Minimum input voltage Vmin [1]	5 V	5 V	5 V	5 V	5 V	5 V
Maximum current Imax [2]	832 A	936 A	1,040 A	1,144 A	1,248 A	1,352 A
Continuous power	11,200 W	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Short-time power [3]	11,200 W	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Voltage setting	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V
Current setting	0 … 832 A	0 … 936 A	0 … 1,040 A	0 … 1,144 A	0 … 1,248 A	0 … 1,352 A
Resistance setting	7 mΩ … 3.87 Ω	6 mΩ … 3.44 Ω	5 mΩ … 3.10 Ω	5 mΩ … 2.81 Ω	5 mΩ … 2.58 Ω	4 mΩ … 2.38 Ω
Power setting [4]	0 … 11,200 W	0 … 12,600 W	0 … 14,000 W	0 … 15,400 W	0 … 16,800 W	0 … 18,200 W
Rise/fall time [5]	30 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Input capacity ca.	24 µF	26 µF	28 µF	32 µF	34 µF	38 µF
Load terminals [6] rear / front	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	500 VA	540 VA	600 VA	675 VA	700 VA	770 VA
Noise max. ca. [8]	76 dB(A)	76 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	82 kg	87 kg	104 kg	105 kg	112 kg	126 kg
Housing / 3D model [9]	19", 11 U / PLI_M28	19", 11 U / PLI_M28	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 17 U / PLI_M36

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

300 V Models With Extended Current Range (EC) (continued)

Model (Order number)	PLI19630EC	PLI21030EC	PLI22430EC	PLI23830EC	PLI25230EC
Maximum input voltage Vmax	300 V	300 V	300 V	300 V	300 V
Minimum input voltage Vmin [1]	5 V	5 V	5 V	5 V	5 V
Maximum current Imax [2]	1,456 A	1,560 A	1,664 A	1,768 A	1,872 A
Continuous power	19,600 W	21,000 W	22,400 W	23,800 W	25,200 W
Short-time power [3]	19,600 W	21,000 W	22,400 W	23,800 W	25,200 W
Voltage setting	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V	0 … 300 V
Current setting	0 … 1,456 A	0 … 1,560 A	0 … 1,664 A	0 … 1,768 A	0 … 1,872 A
Resistance setting	4 mΩ … 2.21 Ω	4 mΩ … 2.0 Ω	3 mΩ … 1.93 Ω	3 mΩ … 1.82 Ω	3 mΩ … 1.72 Ω
Power setting [4]	0 … 19,600 W	0 … 21,000 W	0 … 22,400 W	0 … 23,800 W	0 … 25,200 W
Rise/fall time [5]	30 µs	30 µs	30 µs	30 µs	30 µs
Input capacity ca.	40 µF	44 µF	46 µF	48 µF	52 µF
Load terminals [6] rear / front	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS40/12-SM12 / -	FKS40/12-SM12 / -
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	810 VA	875 VA	900 VA	1000 VA	1050 VA
Noise max. ca. [8]	78 dB(A)	78 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.	131 kg	136 kg	142 kg	152 kg	160 kg
Housing / 3D model [9]	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M40

600 V Models With Extended Current Range (EC)

Model (Order number)	PLI3260EC	PLI4260EC	PLI5660EC	PLI7060EC	PLI8460EC	PLI9860EC
Maximum input voltage Vmax	600 V	600 V	600 V	600 V	600 V	600 V
Minimum input voltage Vmin [1]	2.5 V	5 V	5 V	5 V	2.5 V	5 V
Maximum current Imax [2]	104 A	156 A	208 A	260 A	312 A	364 A
Continuous power	3,200 W	4,200 W	5,600 W	7,000 W	8,400 W	9,800 W
Short-time power [3]	3,200 W	4,200 W	5,600 W	7,000 W	8,400 W	9,800 W
Voltage setting	0 … 600 V	0 … 600 V	0 … 600 V	0 … 600 V	0 … 600 V	0 … 600 V
Current setting	0 … 104 A	0 … 156 A	0 … 208 A	0 … 260 A	0 … 312 A	0 … 364 A
Resistance setting	49 mΩ … 62.0 Ω	33 mΩ … 41.3 Ω	25 mΩ … 31 Ω	20 mΩ … 24.8 Ω	17 mΩ … 20.6 Ω	14 mΩ … 17.7 Ω
Power setting [4]	0 … 3,200 W	0 … 4,200 W	0 … 5,600 W	0 … 7,000 W	0 … 8,400 W	0 … 9,800 W
Rise/fall time [5]	20 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Input capacity ca.	8 µF	10 µF	12 µF	14 µF	18 µF	20 µF
Load terminals [6] rear / front	FKS25/8-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -	FKS25/10-SM10 / -
Mains voltage [7]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	140 VA	190 VA	275 VA	320 VA	380 VA	450 VA
Noise max. ca. [8]	70 dB(A)	71 dB(A)	73 dB(A)	74 dB(A)	74 dB(A)	75 dB(A)
Weight ca.	20.5 kg	38 kg	56 kg	57 kg	63 kg	74 kg
Housing / 3D model [9]	19", 3 U / PLI_M12	19", 5 U / PLI_M19	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 11 U / PLI_M27

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model (Order number)	PLI11260EC	PLI12660EC	PLI14060EC	PLI15460EC	PLI16860EC	PLI18260EC
Maximum input voltage Vmax	600 V	600 V	600 V	600 V	600 V	600 V
Minimum input voltage Vmin [1]	2.5 V	2.5 V	5 V	2.5 V	2.5 V	5 V
Maximum current Imax [2]	416 A	468 A	520 A	572 A	624 A	676 A
Continuous power	11,200 W	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Short-time power [3]	11,200 W	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Voltage setting	0 ... 600 V	0 ... 600 V	0 ... 600 V	0 ... 600 V	0 ... 600 V	0 ... 600 V
Current setting	0 ... 416 A	0 ... 468 A	0 ... 520 A	0 ... 572 A	0 ... 624 A	0 ... 676 A
Resistance setting	13 mΩ ... 15. Ω	11 mΩ ... 13.7 Ω	10 mΩ ... 12.4 Ω	9 mΩ ... 11.2 Ω	8 mΩ ... 10.3 Ω	8 mΩ ... 9.5 Ω
Power setting [4]	0 ... 11,200 W	0 ... 12,600 W	0 ... 14,000 W	0 ... 15,400 W	0 ... 16,800 W	0 ... 18,200 W
Rise/fall time [5]	20 µs	20 µs	30 µs	30 µs	30 µs	30 µs
Input capacity ca.	24 µF	26 µF	28 µF	32 µF	34 µF	38 µF
Load terminals [6] rear / front	FKS25/10-SM10 / –	FKS25/10-SM10 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	500 VA	540 VA	600 VA	675 VA	700 VA	770 VA
Noise max. ca. [8]	76 dB(A)	76 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.	79 kg	89 kg	104 kg	105 kg	112 kg	126 kg
Housing / 3D model [9]	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 17 U / PLI_M36

Model (Order number)	PLI19660EC	PLI21060EC	PLI22460EC	PLI23860EC	PLI25260EC
Maximum input voltage Vmax	600 V	600 V	600 V	600 V	600 V
Minimum input voltage Vmin [1]	2.5 V	2.5 V	5 V	5 V	4 V
Maximum current Imax [2]	728 A	780 A	832 A	884 A	936 A
Continuous power	19,600 W	21,000 W	22,400 W	23,800 W	25,200 W
Short-time power [3]	19,600 W	21,000 W	22,400 W	23,800 W	25,200 W
Voltage setting	0 ... 600 V	0 ... 600 V	0 ... 600 V	0 ... 600 V	0 ... 600 V
Current setting	0 ... 728 A	0 ... 780 A	0 ... 832 A	0 ... 884 A	0 ... 936 A
Resistance setting	7 mΩ ... 8.86 Ω	7 mΩ ... 8.27 Ω	6 mΩ ... 7.75 Ω	6 mΩ ... 7.29 Ω	6 mΩ ... 6.89 Ω
Power setting [4]	0 ... 19,600 W	0 ... 21,000 W	0 ... 22,400 W	0 ... 23,800 W	0 ... 25,200 W
Rise/fall time [5]	30 µs	40 µs	40 µs	50 µs	50 µs
Input capacity ca.	40 µF	42 µF	46 µF	48 µF	52 µF
Load terminals [6] rear / front	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –	FKS40/12-SM12 / –
Mains voltage [7]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [7]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	810 VA	875 VA	900 VA	1000 VA	1050 VA
Noise max. ca. [8]	78 dB(A)	78 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.	131 kg	136 kg	142 kg	152 kg	160 kg
Housing / 3D model [9]	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M40

PLI
high power

1. Minimum voltage for maximum load current, linear derating to 0 V.
2. Each current range of a higher voltage class in the same power class can be chosen as special current range.
3. Level and duration of short-time power see diagram in technical data at page 57.
4. The setting range reaches up to the short-time power.
5. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, Tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
6. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
7. Mains voltage tolerance: ±10 %
8. Measured at the front in distance of 1 m.
9. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model (Order number)		PLI508MR4	PLI512MR4	PLI530MR3	PLI580MR3	PLI1008MR4	PLI1012MR4
Maximum input voltage Vmax		80 V	120 V	300 V	800 V	80 V	120 V
Minimum input voltage Vmin [1]	R1	0.5 V	0.75 V	0.8 V	0.8 V	0.5 V	0.75 V
	R2	0.5 V	0.75 V	0.8 V	0.8 V	0.5 V	0.75 V
	R3	0.75 V	1.5 V	1.5 V	2 V	0.75 V	1.5 V
	R4	1.5 V	3 V	-	-	1.5 V	3 V
Voltage range		0 ... 80 V	0 ... 120 V	0 ... 300 V	0 ... 800 V	0 ... 80 V	0 ... 120 V
Maximum current Imax		60 A	40 A	16 A	6 A	120 A	80 A
Current ranges	R1	0 ... 0.06 A	0 ... 0.04 A	0 ... 0.16 A	0 ... 0.06 A	0 ... 0.12 A	0 ... 0.08 A
	R2	0 ... 0.6 A	0 ... 0.4 A	0 ... 1.6 A	0 ... 0.6 A	0 ... 1.2 A	0 ... 0.8 A
	R3	0 ... 6 A	0 ... 4 A	0 ... 16 A	0 ... 6 A	0 ... 12 A	0 ... 8 A
	R4	0 ... 60 A	0 ... 40 A	-	-	0 ... 120 A	0 ... 80 A
Resistance ranges	R1	33.4 Ω ... 14.3 kΩ	75 Ω ... 32.2 kΩ	12.5 Ω ... 20.1 kΩ	33.4 Ω ... 143 kΩ	16.6 Ω ... 7.16 kΩ	38 Ω ... 16.1 kΩ
	R2	3.34 Ω ... 1.43 kΩ	7,5 Ω ... 3.22 kΩ	1.25 Ω ... 2.01 kΩ	3.34 Ω ... 14.3 kΩ	1.66 ... 716 Ω	3.8 Ω ... 1.61 kΩ
	R3	0.34 ... 143 Ω	0.75 ... 322 Ω	0.125 ... 201 Ω	0.34 ... 1.43 kΩ	0.16 ... 71.6 Ω	0.38 ... 161 Ω
	R4	0.034 ... 14.3 Ω	0.075 ... 32.2 Ω	-	-	0.016 ... 7.16 Ω	0.038 ... 16.1 Ω
Power ranges [2] continuous/short-time	R1	0 ... 4.8 W/4.8 W	0 ... 4.8 W/4.8 W	0 ... 48 W/48 W	0 ... 48 W/48 W	0 ... 9.6 W/9.6 W	0 ... 9.6 W/9.6 W
	R2	0 ... 48 W/48 W	0 ... 48 W/48 W	0 ... 300 W/300 W	0 ... 300 W/300 W	0 ... 96 W/96 W	0 ... 96 W/96 W
	R3	0 ... 200 W/200 W	0 ... 200 W/200 W	0 ... 500 W/750 W	0 ... 500 W/500 W	0 ... 400 W/400 W	0 ... 400 W/400 W
	R4	0 ... 500 W/1000 W	0 ... 500 W / 750 W	-	-	0 ... 1000 W/2000 W	0 ... 1000 W/1500 W
Rise/fall time [3]		35 μs	35 μs	30 μs	20 μs	35 μs	30 μs
Input capacity ca.		2 μF	2 μF	2 μF	2 μF	2 μF	2 μF
Load terminals [4] rear / front		FKS20/5-SM8 / BPK4-60L	BPK4-60L / BPK4-60L	BPK4-30L / BPK4-30L	BPK4-30L / BPK4-30L	FKS20/5-SM8 / -	FKS20/5-SM8 / -
Mains voltage [5]		1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [5]		1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption		35 VA	35 VA	35 VA	35 VA	55 VA	55 VA
Noise max. ca. [6]		55 dB(A)	55 dB(A)	55 dB(A)	55 dB(A)	57 dB(A)	57 dB(A)
Weight ca.		9 kg	9 kg	9 kg	9 kg	15 kg	15 kg
Housing / 3D model [7]		½ 19", 2 U / PLI_M1	½ 19", 2 U / PLI_M3	½ 19", 2 U / PLI_M2	½ 19", 2 U / PLI_M2	19", 2 U / PLI_M6	19", 2 U / PLI_M6

Model (Order number)		PLI1030MR3	PLI1080MR3	PLI1508MR4	PLI1512MR4	PLI1530MR3	PLI1580MR3
Maximum input voltage Vmax		300 V	800 V	80 V	120 V	300 V	800 V
Minimum input voltage Vmin [1]	R1	0.8 V	1.2 V	0.5 V	0.75 V	0.8 V	1.75 V
	R2	0.8 V	1.2 V	0.5 V	0.75 V	0.8 V	1 V
	R3	1.5 V	2.4 V	0.75 V	1.5 V	1.5 V	2.4 V
	R4	-	-	1.5 V	3 V	-	-
Voltage range		0 ... 300 V	0 ... 800 V	0 ... 80 V	0 ... 120 V	0 ... 300 V	0 ... 800 V
Maximum current Imax		32 A	12 A	180 A	120 A	48 A	18 A
Current ranges	R1	0 ... 0.32 A	0 ... 0.12 A	0 ... 0.18 A	0 ... 0.12 A	0 ... 0.48 A	0 ... 0.18 A
	R2	0 ... 3.2 A	0 ... 1.2 A	0 ... 1.8 A	0 ... 1.2 A	0 ... 4.8 A	0 ... 1.8 A
	R3	0 ... 32 A	0 ... 12 A	0 ... 18 A	0 ... 12 A	0 ... 48 A	0 ... 18 A
	R4	-	-	0 ... 180 A	0 ... 120 A	-	-
Resistance ranges	R1	6.25 Ω ... 10 kΩ	16.7 Ω ... 53.7 kΩ	11.2 Ω ... 4.77 kΩ	25 Ω ... 10.7 kΩ	4.17 Ω ... 6.72 kΩ	11.2 Ω ... 47.7 kΩ
	R2	0.63 Ω ... 1.01 kΩ	1.67 Ω ... 5.37 kΩ	1.12 ... 477 Ω	2.5 Ω ... 1.07 kΩ	0.42 ... 672 Ω	1.12 Ω ... 4.77 kΩ
	R3	0.063 ... 100 Ω	0.167 ... 537 Ω	0.112 ... 47.7 Ω	0.25 ... 107 Ω	0.042 ... 67.2 Ω	0.112 ... 477 Ω
	R4	-	-	0.012 ... 4.77 Ω	0.025 ... 10.7 Ω	-	-
Power ranges [2] continuous/short-time	R1	0 ... 96 W/96 W	0 ... 96 W/96 W	0 ... 14.4 W/14.4 W	0 ... 14.4 W/14.4 W	0 ... 144 W/144 W	0 ... 144 W/144 W
	R2	0 ... 600 W/600 W	0 ... 600 W/600 W	0 ... 144 W/144 W	0 ... 144 W/144 W	0 ... 900 W/900 W	0 ... 900 W/900 W
	R3	0 ... 1000 W/1500 W	0 ... 1000 W/1000 W	0 ... 600 W/600 W	0 ... 600 W/600 W	0 ... 1500 W/2250 W	0 ... 1500 W/1500 W
	R4	-	-	0 ... 1500 W/3000 W	0 ... 1500 W/2250 W	-	-
Rise/fall time [3]		30 μs	30 μs	30 μs	35 μs	30 μs	35 μs
Input capacity ca.		2 μF	2 μF	2 μF	2 μF	2 μF	2 μF
Load terminals [4] rear / front		BPK4-60L / -	BPK4-30L / -	FKS20/5-SM8 / -	FKS20/5-SM8 / -	BPK4-60L / -	BPK4-30L / -
Mains voltage [5]		1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [5]		1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption		55 VA	55 VA	75 VA	75 VA	75 VA	75 VA
Noise max. ca. [5]		57 dB(A)	57 dB(A)	60 dB(A)	60 dB(A)	60 dB(A)	60 dB(A)
Weight ca.		15 kg	15 kg	17.5 kg	17.5 kg	17.5 kg	17.5 kg
Housing / 3D model [6]		19", 2 U / PLI_M8	19", 2 U / PLI_M7	19", 2 U / PLI_M6	19", 2 U / PLI_M6	19", 2 U / PLI_M8	19", 2 U / PLI_M7

1. Minimum voltage for maximum static load current, linear derating to 0 V.
2. Level and duration of short-time power see diagram in technical data at page 57. The setting range reaches up to the short-time power.
3. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 μs, „slow": ca. 2 ms.
4. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
5. Mains voltage tolerance: ±10 %.
6. Measured at the front in distance of 1 m.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

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The electronic load

Models With Multiple Current Ranges (MR2, MR4) 3,600 … 9,600 W

Model (Order number)		PLI3608MR2	PLI4808MR4	PLI3612MR2	PLI4812MR4	PLI3230MR2	PLI4230MR4
Maximum input voltage Vmax		80 V	80 V	120 V	120 V	300 V	300 V
Voltage range		0 … 80 V	0 … 80 V	0 … 120 V	0 … 120 V	0 … 300 V	0 … 300 V
Maximum current Imax		336 A	448 A	168 A	224 A	66 A	88 A
Current ranges	R1	0 … 32 A	0 … 112 A	0 … 15 A	0 … 56 A	0 … 7 A	0 … 22 A
	R2	0 … 336 A	0 … 224 A	0 … 168 A	0 … 112 A	0 … 66 A	0 … 44 A
	R3	-	0 … 336 A	-	0 … 168 A	-	0 … 66 A
	R4	-	0 … 448 A	-	0 … 224 A	-	0 … 88 A
Resistance ranges	R1	62.5 mΩ … 26.8 Ω	17.9 mΩ … 7.68 Ω	133 mΩ … 107 Ω	35.8 mΩ … 28.8 Ω	286 mΩ … 460 Ω	91 mΩ … 146 Ω
	R2	6 mΩ … 2.56 Ω	9 mΩ … 3.84 Ω	12 mΩ … 9.6 Ω	17.9 mΩ … 14.4 Ω	30.4 mΩ … 48.8 Ω	45.5 mΩ … 73.3 Ω
	R3	-	6 mΩ … 2.56 Ω	-	12 mΩ … 9.6 Ω	-	31 mΩ … 48.8 Ω
	R4	-	4.5 mΩ … 1.92 Ω	-	9 mΩ … 7.2 Ω	-	22.8 mΩ … 36.6 Ω
Power ranges [1] continuous/short-time	R1	0 … 1,200/2,400 W	0 … 1,200/2,400 W	0 … 1,200/1,800 W	0 … 1,200/1,800 W	0 … 1,050/1,575 W	0 … 1,050/1,575 W
	R2	0 … 3,600/7,200 W	0 … 2,400/4,800 W	0 … 3,600/5,400 W	0 … 2,400/3,600 W	0 … 3,200/4,800 W	0 … 2,100/3,150 W
	R3	-	0 … 3,600/7,200 W	-	0 … 3,600/5,400 W	-	0 … 3,150/4,725 W
	R4	-	0 … 4,800/9,600 W	-	0 … 4,800/7,200 W	-	0 … 4,200/6,300 W
Rise/fall time [2]		20 µs	20 µs	20 µs	20 µs	20 µs	20 µs
Load terminals [3] rear		FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		190 VA	190 VA	190 VA	190 VA	190 VA	190 VA
Noise max. ca. [5]		71 dB(A)	71 dB(A)	71 dB(A)	71 dB(A)	71 dB(A)	71 dB(A)
Weight ca.		39 kg	39 kg	39 kg	39 kg	39 kg	39 kg
Housing / 3D model [6]		19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 5 U / PLI_M19

Model (Order number)		PLI3280MR2	PLI4280MR4	PLI7208MR2	PLI9608MR4	PLI7212MR2	PLI9612MR4
Maximum input voltage Vmax		800 V	800 V	80 V	80 V	120 V	120 V
Voltage range		0 … 800 V	0 … 800 V	0 … 80 V	0 … 80 V	0 … 120 V	0 … 120 V
Maximum current Imax		33 A	44 A	675 A	900 A	336 A	448 A
Current ranges	R1	0 … 3 A	0 … 11 A	0 … 64 A	0 … 225 A	0 … 30 A	0 … 112 A
	R2	0 … 33 A	0 … 22 A	0 … 675 A	0 … 450 A	0 … 336 A	0 … 224 A
	R3	-	0 … 33 A	-	0 … 675 A	-	0 … 336 A
	R4	-	0 … 44 A	-	0 … 900 A	-	0 … 448 A
Resistance ranges	R1	667 mΩ … 2.86 kΩ	182 mΩ … 782 Ω	31.3 mΩ … 13.4 Ω	8.9 mΩ … 3.82 Ω	66.7 mΩ … 53.7 Ω	35,8 mΩ … 28,8 Ω
	R2	61 mΩ … 260 kΩ	91 mΩ … 391 Ω	3 mΩ … 1.27 Ω	4.5 mΩ … 1.91 Ω	5.96 mΩ … 4.8 Ω	91 mΩ … 73,3 Ω
	R3	-	60.7 mΩ … 260 Ω	-	3 mΩ … 1.27 Ω	-	5,96 mΩ … 4,8 Ω
	R4	-	45.4 mΩ … 195 Ω	-	2.3 … 955 mΩ	-	4,47 mΩ … 3,6 Ω
Power ranges [1] continuous/short-time	R1	0 … 1,050/1,050 W	0 … 1,050/1,050 W	0 … 2,400/4,800 W	0 … 2,400/4,800 W	0 … 2,400/3,600 W	0 … 2,400/3,6000 W
	R2	0 … 3,200/3,200 W	0 … 2,100/2,100 W	0 … 7,200/14,400 W	0 … 4,800/9,600 W	0 … 7,200/10,800 W	0 … 4,800/7,200 W
	R3	-	0 … 3,150/3,150 W	-	0 … 7,200/14,400 W	-	0 … 7,200/10,800 W
	R4	-	0 … 4,200/4,200 W	-	0 … 9,600/19,200 W	-	0 … 9,600/14,400 W
Rise/fall time [2]		20 µs	20 µs	25 µs	25 µs	25 µs	25 µs
Load terminals [3] rear		FKS25/10-SM10	FKS25/10-SM10	FKS40/12-SM12	FKS40/12-SM12	FKS25/10-SM10	FKS25/10-SM10
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		190 VA	190 VA	380 VA	380 VA	190 VA	190 VA
Noise max. ca. [5]		71 dB(A)	71 dB(A)	74 dB(A)	74 dB(A)	71 dB(A)	71 dB(A)
Weight ca.		39 kg	39 kg	63 kg	63 kg	39 kg	39 kg
Housing / 3D model [6]		19", 5 U / PLI_M19	19", 5 U / PLI_M19	19", 8 U / PLI_M24	19", 8 U / PLI_M24	19", 8 U / PLI_M23	19", 8 U / PLI_M23

1. Level and duration of short-time power see diagram in technical data at page 57. The setting range reaches up to the short-time power.
2. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
3. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI
high power

Models With Multiple Current Ranges (MR3, MR4) 6,300 ... 14,400 W

Model (Order number)		PLI6330MR2	PLI8430MR4	PLI6380MR2	PLI8480MR4	PLI10808MR2	PLI14408MR4
Maximum input voltage Vmax		300 V	300 V	800 V	800 V	80 V	80 V
Voltage range		0 ... 300 V	0 ... 300 V	0 ... 800 V	0 ... 800 V	0 ... 80 V	0 ... 80 V
Maximum current Imax		135 A	180 A	66 A	88 A	1,011 A	1,348 A
Current ranges	R1	0 ... 14 A	0 ... 45 A	0 ... 6 A	0 ... 22 A	0 ... 96 A	0 ... 337 A
	R2	0 ... 135 A	0 ... 90 A	0 ... 66 A	0 ... 44 A	0 ... 1,011 A	0 ... 674 A
	R3	-	0 ... 135 A	-	0 ... 66 A	-	0 ... 1,011 A
	R4	-	0 ... 180 A	-	0 ... 88 A	-	0 ... 1,348 A
Resistance ranges	R1	143 mΩ ... 230 Ω	44.5 mΩ ... 71.6 Ω	334 mΩ ... 1.43 kΩ	91 mΩ ... 391 Ω	20.9 mΩ ... 8.96 Ω	5.94 mΩ ... 2.55 Ω
	R2	14.9 mΩ ... 23.8 Ω	22.3 mΩ ... 35.8 Ω	30.4 mΩ ... 130 Ω	45.5 mΩ ... 195 Ω	1.98 ... 850 mΩ	2.97 mΩ ... 1.27 Ω
	R3	-	14.9 mΩ ... 23.8 Ω	-	30.4 mΩ ... 130 Ω	-	1.98 ... 851 mΩ
	R4	-	11.2 mΩ ... 17.9 Ω	-	22.8 mΩ ... 97.7 Ω	-	1.49 ... 638 mΩ
Power ranges [1] continuous/short-time	R1	0 ... 2,100/3,150 W	0 ... 2,100/3,150 W	0 ... 2,100/2,100 W	0 ... 2,100/2,100 W	0 ... 3.6/7.2 kW	0 ... 3.6/7.2 kW
	R2	0 ... 6,300/9,450 W	0 ... 4,200/6,300 W	0 ... 6,300/6,300 W	0 ... 4,200/4,200 W	0 ... 10,8/21.6 kW	0 ... 7.2/14.4 kW
	R3	-	0 ... 6,300/9,450 W	-	0 ... 6,300/6,300 W	-	0 ... 10.8/21.6 kW
	R4	-	0 ... 8,400/12,600 W	-	0 ... 8,400/8,400 W	-	0 ... 14.4/28.8 kW
Rise/fall time [2]		25 µs	25 µs	25 µs	25 µs	30 µs	30 µs
Load terminals [3] rear		FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS40/12-SM12	FKS40/12-SM12
Mains voltage [4]		1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption		190 VA	380 VA	190 VA	190 VA	540 VA	540 VA
Noise max. ca. [5]		71 dB(A)	74 dB(A)	71 dB(A)	71 dB(A)	76 dB(A)	76 dB(A)
Weight ca.		39 kg	63 kg	39 kg	39 kg	89 kg	89 kg
Housing / 3D model [6]		19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 8 U / PLI_M23	19", 11 U / PLI_M28	19", 11 U / PLI_M28

Model (Order number)		PLI10812MR2	PLI14412MR4	PLI9530MR2	PLI12630MR4	PLI9580MR2	PLI12680MR4
Maximum input voltage Vmax		120 V	120 V	300 V	300 V	800 V	800 V
Voltage range		0 ... 120 V	0 ... 120 V	0 ... 300 V	0 ... 300 V	0 ... 800 V	0 ... 800 V
Maximum current Imax		504 A	672 A	201 A	268 A	99 A	132 A
Current ranges	R1	0 ... 45 A	0 ... 168 A	0 ... 21 A	0 ... 67 A	0 ... 9 A	0 ... 33 A
	R2	0 ... 504 A	0 ... 336 A	0 ... 201 A	0 ... 134 A	0 ... 99 A	0 ... 66 A
	R3	-	0 ... 504 A	-	0 ... 201 A	-	0 ...99 A
	R4	-	0 ... 672 A	-	0 ... 268 A	-	0 ... 132 A
Resistance ranges	R1	44.5 mΩ ... 35.8 Ω	12 mΩ ... 9.6 Ω	95.3 mΩ ... 153 Ω	29.9 mΩ ... 48.1 Ω	223 mΩ ... 955 Ω	60.7 mΩ ... 260 Ω
	R2	3.97 mΩ ... 3.2 Ω	5.96 mΩ ... 4.8 Ω	9.96 mΩ ... 16 Ω	15 mΩ ... 24 Ω	20.3 mΩ ... 86.8 Ω	30.4 mΩ ... 130 Ω
	R3	-	3.97 mΩ ... 3.2 Ω	-	9.96 mΩ ... 16 Ω	-	20.3 mΩ ... 86.8 Ω
	R4	-	2.98 mΩ ... 2.4 Ω	-	7.47 mΩ ... 12 Ω	-	15.2 mΩ ... 65.1 Ω
Power ranges [1] continuous/short-time	R1	0 ... 3.6/5.4 kW	0 ... 3.6/5.4 kW	0 ... 3.15/4.725 kW	0 ... 3.15/4.725 kW	0 ... 3.15/3.15 kW	0 ... 3.15/3.15 kW
	R2	0 ... 10.8/16.2 kW	0 ... 7.2/10.8 kW	0 ... 9.5/14.25 kW	0 ... 6.3/9.45 kW	0 ... 9.5/9.5 kW	0 ... 6.3/6.3 kW
	R3	-	0 ... 10.8/16.2 kW	-	0 ... 9.45/14.175 kW	-	0 ... 9.45/9.45 kW
	R4	-	0 ... 14.4/21.6 kW	-	0 ... 12.6/18.9 kW	-	0 ... 12.6/12.6 kW
Rise/fall time [2]		30 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Load terminals [3] rear		FKS40/12-SM12	FKS40/12-SM12	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10
Mains voltage [4]		1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption		540 VA	540 VA	540 VA	540 VA	540 VA	540 VA
Noise max. ca. [5]		76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.		89 kg	89 kg	89 kg	89 kg	89 kg	89 kg
Housing / 3D model [6]		19", 11 U / PLI_M28	19", 11 U / PLI_M28	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27	19", 11 U / PLI_M27

1. Level and duration of short-time power see diagram in technical data at page 57. The setting range reaches up to the short-time power.
2. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed (constant current mode, tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
3. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model (Order number)		PLI14408MR2	PLI19208MR4	PLI14412MR2	PLI19212MR4	PLI12630MR2	PLI16830MR4
Maximum input voltage Vmax		80 V	80 V	120 V	120 V	300 V	300 V
Voltage range		0 … 80 V	0 … 80 V	0 … 120 V	0 … 120 V	0 … 300 V	0 … 300 V
Maximum current Imax		1,350 A	1,800 A	725 A	900 A	270 A	360 A
Current ranges	R1	0 … 128 A	0 … 450 A	0 … 60 A	0 … 225 A	0 … 28 A	0 … 90 A
	R2	0 … 1,350 A	0 … 900 A	0 … 725 A	0 … 450 A	0 … 270 A	0 … 180 A
	R3	-	0 … 1,350 A	-	0 … 675 A	-	0 … 270 A
	R4	-	0 … 1,800 A	-	0 … 900 A	-	0 … 360 A
Resistance ranges	R1	15.7 mΩ … 6.72 Ω	4.45 mΩ … 1.91 Ω	33.4 mΩ … 26.8 Ω	8.89 mΩ … 7.16 Ω	71.5 mΩ … 115 Ω	22.3 mΩ … 35.8 Ω
	R2	1.49 … 637 mΩ	2.23 … 955 mΩ	2.76 mΩ … 2.22 Ω	4.45 mΩ … 2.86 Ω	7.41 mΩ … 11.9 Ω	11.2 mΩ … 17.9 Ω
	R3	-	1.49 … 637 mΩ	-	2.97 mΩ … 1.91 Ω	-	7.41 mΩ … 11.9 Ω
	R4	-	1.12 … 477 mΩ	-	2.23 mΩ … 1.79 Ω	-	5.56 mΩ … 8.96 Ω
Power ranges [1] continuous/short-time	R1	0 … 4.8/9.6 kW	0 … 4.8/9.6 kW	0 … 4.8/7.2 kW	0 … 4.8/7.2 kW	0 … 4.2/6.3 kW	0 … 4.2/6.3 kW
	R2	0 … 14.4/28.8 kW	0 … 9.6/19.2 kW	0 … 14.4/21.6 kW	0 … 9.6/14.4 kW	0 … 12.6/18.9 kW	0 … 8.4/12.6 kW
	R3	-	0 … 14.4/28.8 kW	-	0 … 14.4/21.6 kW	-	0 … 12.6/18.9 kW
	R4	-	0 … 19.2/38.4 kW	-	0 … 19.2/28.8 kW	-	0 … 16.8/25.2 kW
Rise/fall time [2]		30 µs	30 µs	30 µs	30 µs	30 µs	30 µs
Load terminals [3] rear		FKS40/12-SM12	FKS40/12-SM12	FKS40/12-SM12	FKS40/12-SM12	FKS25/10-SM10	FKS25/10-SM10
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		700 VA	700 VA	700 VA	700 VA	700 VA	700 VA
Noise max. ca. [5]		77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)
Weight ca.		112 kg	112 kg	112 kg	112 kg	112 kg	112 kg
Housing / 3D model [6]		19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M32	19", 14 U / PLI_M31	19", 14 U / PLI_M31

Model (Order number)		PLI12680MR2	PLI4280MR4	PLI18008MR2	PLI24008MR4	PLI18012MR2	PLI24012MR4
Maximum input voltage Vmax		800 V	800 V	80 V	80 V	120 V	120 V
Voltage range		0 … 800 V	0 … 800 V	0 … 80 V	0 … 80 V	0 … 120 V	0 … 120 V
Maximum current Imax		132 A	180 A	1,686 A	2,248 A	843 A	1,124 A
Current ranges	R1	0 … 12A	0 … 45 A	0 … 160 A	0 … 562 A	0 … 75 A	0 … 281 A
	R2	0 … 132 A	0 … 90 A	0 … 1,686 A	0 … 1,124 A	0 … 843 A	0 … 562 A
	R3	-	0 … 135 A	-	0 … 1,686 A	-	0 … 843 A
	R4	-	0 … 180 A	-	0 … 2,248 A	-	0 … 1,124 A
Resistance ranges	R1	167 mΩ … 716 Ω	44.5 mΩ … 191 Ω	12,5 mΩ … 5.37 Ω	3.56 mΩ … 1.53 Ω	26.7 mΩ … 21.5 Ω	7.12 mΩ … 5.74 Ω
	R2	15.2 mΩ … 65.1 Ω	22.3 mΩ … 95.5 Ω	1.19 … 510 mΩ	1.78 … 765 mΩ	2.38 mΩ … 1.91 Ω	3.56 mΩ … 2.87 Ω
	R3	-	14.9 mΩ … 63.7 Ω	-	1.19 … 510 mΩ	-	2.38 mΩ … 1.91 Ω
	R4	-	11.2 mΩ … 47.7 Ω	-	0.89 … 382 mΩ	-	1.78 mΩ … 1.43 Ω
Power ranges [1] continuous/short-time	R1	0 … 4.2/4.2 kW	0 … 4.2/4.2 kW	0 … 6/12 kW	0 … 6/12 kW	0 … 6/12 kW	0 … 6/9 kW
	R2	0 … 12.6/12.6 kW	0 … 8.4/8.4 kW	0 … 18/36 kW	0 … 12/24 kW	0 … 18/27 kW	0 … 12/18 kW
	R3	-	0 … 12.6/12.6 kW	-	0 … 18/36 kW	-	0 … 18/27 kW
	R4	-	0 … 16.8/16.8 kW	-	0 … 24/48 kW	-	0 … 24/36 kW
Rise/fall time [2]		30 µs	30 µs	35 µs	35 µs	35 µs	35 µs
Load terminals [3] rear		FKS25/10-SM10	FKS25/10-SM10	FKS40/12-SM12	FKS40/12-SM12	FKS40/12-SM12	FKS40/12-SM12
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		700 VA	700 VA	900 VA	900 VA	900 VA	900 VA
Noise max. ca. [5]		77 dB(A)	77 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)
Weight ca.		112 kg	112 kg	136 kg	136 kg	136 kg	136 kg
Housing / 3D model [6]		19", 14 U / PLI_M31	19", 14 U / PLI_M31	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 17 U / PLI_M36	19", 17 U / PLI_M36

1. Level and duration of short-time power see diagram in technical data at page 57. The setting range reaches up to the short-time power.
2. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
3. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

PLI high power

Model (Order number)		PLI16030MR2	PLI21030MR4	PLI16080MR2	PLI21080MR4	PLI21608MR2	PLI28808MR4
Maximum input voltage Vmax		300 V	300 V	800 V	800 V	80 V	80 V
Voltage range		0 … 300 V	0 … 300 V	0 … 800 V	0 … 800 V	0 … 80 V	0 … 80 V
Maximum current Imax		336 A	448 A	168 A	224 A	2,025 A	2,700 A
Current ranges	R1	0 … 35 A	0 … 112 A	0 … 15 A	0 … 56 A	0 … 192 A	0 … 675 A
	R2	0 … 336 A	0 … 224 A	0 … 168 A	0 … 112 A	0 … 2,025 A	0 … 1,350 A
	R3	-	0 … 336 A	-	0 … 168 A	-	0 … 2,025 A
	R4	-	0 … 448 A	-	0 … 224 A	-	0 … 2,700 A
Resistance ranges	R1	57.2 mΩ … 92.1 Ω	17.9 mΩ … 28.8 Ω	134 mΩ … 573 Ω	35.8 mΩ … 153 Ω	10.5 mΩ … 4.48 Ω	2.97 mΩ … 1.27 Ω
	R2	5.96 mΩ … 9.6 Ω	8.93 mΩ … 14.4 Ω	12 mΩ … 51.2 Ω	17.9 mΩ … 76.8 Ω	0.99 … 424 mΩ	1.49 … 637 mΩ
	R3	-	5.96 mΩ … 9.6 Ω	-	12 mΩ … 51.2 Ω	-	0.99 … 424 mΩ
	R4	-	4.47 mΩ … 7.2 Ω	-	8.89 mΩ … 38.2 Ω	-	0.75 … 318 mΩ
Power ranges [1] continuous/short-time	R1	0 … 5.25/7.875 kW	0 … 5.25/7.875 kW	0 … 5.25/5.25 kW	0 … 5.25/5.25 kW	0 … 7.2/14.4 kW	0 … 7.2/14.4 kW
	R2	0 … 16/24 kW	0 … 10.5/15.75 kW	0 … 16/16 kW	0 … 10.5/10.5 kW	0 … 21.6/43.2 kW	0 … 14.4/28.8 kW
	R3	-	0… 15.75/23.625 kW	-	0 … 15.75/15.75 kW	-	0 … 21.6/43.2 kW
	R4	-	0 … 21/31.5 kW	-	0 … 21/21 kW	-	0 … 28.8/57.6 kW
Rise/fall time [2]		35 µs	35 µs	35 µs	35 µs	40 µs	40 µs
Load terminals [3] rear		FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS40/12-SM12	FKS40/12-SM12
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		900 VA	900 VA	900 VA	900 VA	1,050 VA	1,050 VA
Noise max. ca. [5]		78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	80 dB(A)	80 dB(A)
Weight ca.		136 kg	136 kg	136 kg	136 kg	160 kg	160 kg
Housing / 3D model [6]		19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 17 U / PLI_M35	19", 20 U / PLI_M40	19", 20 U / PLI_M40

Model (Order number)		PLI21612MR2	PLI28812MR4	PLI19030MR2	PLI25230MR4	PLI19080MR2	PLI1580MR3
Maximum input voltage Vmax		120 V	120 V	300 V	300 V	800 V	800 V
Voltage range		0 … 120 V	0 … 120 V	0 … 300 V	0 … 300 V	0 … 800 V	0 … 800 V
Maximum current Imax		1,011 A	1,348 A	405 A	540 A	201 A	268 A
Current ranges	R1	0 … 90 A	0 … 337 A	0 … 42 A	0 … 135 A	0 … 18 A	0 … 67 A
	R2	0 … 1,011 A	0 … 674 A	0 … 405 A	0 … 270 A	0 … 201 A	0 … 134 A
	R3	-	0 … 1,011 A	-	0 … 405 A	-	0 … 201 A
	R4	-	0 … 1,348 A	-	0 … 540 A	-	0 … 268 A
Resistance ranges	R1	2.23 mΩ … 1.79 Ω	5.94 mΩ … 4.78 Ω	47.7 mΩ … 76.8 Ω	14.9 mΩ … 23.8 Ω	112 mΩ … 477 Ω	29.9 mΩ … 128 Ω
	R2	1.98 mΩ … 1.59 Ω	2.97 mΩ … 2.39 Ω	4.94 mΩ … 7.96 Ω	7.41 mΩ … 11.9 Ω	9.96 mΩ … 72.7 Ω	15 mΩ … 64.1 Ω
	R3	-	1.98 mΩ … 1.59 Ω	-	4.94 mΩ … 7.96 Ω	-	9.96 mΩ … 42.7 Ω
	R4	-	1.49 mΩ … 1.19 Ω	-	3.71 mΩ … 5.97 Ω	-	7.47 mΩ … 32 Ω
Power ranges [1] continuous/short-time	R1	0 … 7.2/10.8 kW	0 … 7.2/10.8 kW	0 … 6.3/9.45 kW	0 … 6.3/9.45 kW	0 … 6.3/6.3 kW	0 … 6.3/6.3 kW
	R2	0 … 21.6/32.4 kW	0 … 14.4/21.6 kW	0 … 19/28.5 kW	0 … 12.6/18.9 kW	0 … 19/19 kW	0 … 12.6/12.6 kW
	R3	-	0 … 21.6/32.4 kW	-	0 … 18.9/28.35 kW	-	0 … 18.9/18.9 kW
	R4	-	0 … 28.8/43.2 kW	-	0 … 25.2/37.8 kW	-	0 … 25.2/25.5 kW
Rise/fall time [2]		40 µs	40 µs	40 µs	40 µs	40 µs	40 µs
Load terminals [3] rear		FKS40/12-SM12	FKS40/12-SM12	FKS25/10-SM10	FKS40/12-SM12	FKS25/10-SM10	FKS25/10-SM10
Mains voltage [4]		1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable [4]		1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption		1,050 VA	1,050 VA	1,050 VA	1,050 VA	1,050 VA	1,050 VA
Noise max. ca. [5]		80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)	80 dB(A)
Weight ca.		160 kg	160 kg	160 kg	160 kg	160 kg	160 kg
Housing / 3D model [6]		19", 20 U / PLI_M40	19", 20 U / PLI_M40	19", 20 U / PLI_M39	19", 20 U / PLI_M40	19", 20 U / PLI_M39	19", 20 U / PLI_M39

1. Level and duration of short-time power see diagram in technical data at page 57. The setting range reaches up to the short-time power.
2. Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current at "fast" regulation speed (constant current mode, tolerance ±20 %). Rise and fall time in „medium" regulation speed: ca. 150 µs, „slow": ca. 2 ms.
3. Description of available terminals starting at page 123. Models with copper bars (FKS) are delivered with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Options and Accessories

Order number	Article	Description
52-200-001-17	PLI02	GPIB interface
56-003-000-17	PLI21	MPPT function with unlock code
67-004-030-17	K-RS-SNM 9-9	RS-232 cable (nullmodem cable)
53-100-006-17	PLI06-N	Galvanically isolated I/O port instead of standard I/O port
53-100-005-17	PLI06	Galvanically isolated I/O port for retrofitting of existing device
64-303-000-17	PLI10	19" installation kit for 1 device with ½ 19", 2 U
64-304-000-17	PLI11	19" installation kit for 2 devices with ½ 19", 2 U
64-305-000-17	PLI12	19" installation kit for 1 device with 19", 2 U
64-306-000-17	PLI13	19" installation kit for 1 device with 19", 3 U
64-400-000-17	PLI14	Castors for devices up from 5 U (1 set = 4 pcs.)
54-500-001-17	PLI16-06	Charger Starter Interface (CST) for 60 V models
54-500-002-17	PLI16-12	Charger Starter Interface (CST) for 120 V models
63-000-001-17	PLI17	Switch box external load activation via I/O port
66-001-000-17	PLI18	12 VDC mains supply, reverse polarity protection, 4 mm pole terminals (only for PLI14xx)
66-002-000-17	PLI19	12 VDC mains supply, 4 mm pole terminals (only for PLI32xx), 5 U height
65-002-000-17	FCC-PLIxx	Factory Calibration Certificate
64-410-000-17	SAB-PLI-2CUH	Additional safety cover for PLI 2 U copper bars and sense at rear panel (date code 0324 or later)
64-411-000-17	SAB-PLI-2PKH	Additional safety cover for PLI 2 U binding posts and sense at rear panel (date code 0324 or later)
64-412-000-17	SAB-PLI-2PKV	Additional safety cover for PLI 2 U binding posts at front panel (date code 0324 or later)
64-413-000-17	SAB-PLI-3S	Additional safety cover for PLI 3 U sense (date code 0324 or later)
64-407-000-17	SAB-PLI-3B	Additional safety cover for PLI 3 U load terminals for production series B
64-403-000-17	SAB-PLI-5	Additional safety cover for PLI up from 5 U load terminals and sense
63-000-005-17	PH2/7.62-ST16	Additional mating connector for sense terminal
63-000-003-00	SENSADAPT/PH2/POK/60V	Sense-Adapter from Phoenix PH2 to 4 mm binding post, max. 60 V
63-000-004-00	SENSADAPT/PH2/POK/1200V	Sense-Adapter from Phoenix PH2 to 4 mm touch-protected binding post, max. 1200 V
67-008-020-17	K-MS-PLI+K-MS-CAN	Cable set Master-Slave, consisting of K-MS-PLI and K-MS-CAN (each 2 m)
67-036-020-17	K-MS-PLI	Master-Slave cable I/O port (2 m)
67-037-020-17	K-MS-CAN	Master-Slave cable CAN (2 m)
63-000-006-17	SubD25 Doubler	Adapter 1x Sub-D 25 male connector to 2x Sub-D 25 female connector for I/O port
49-001-000-17	SX	Modified setting range for PLI Series - only after consulting H&H
49-002-000-17	SSX	Customized setting range - only after consulting H&H
		Load cables see starting at page 127

PLI6xx

PLI14xx
PLI21xx

Operating modes

Basic operating modes	CC, CV, CR, CP
Combined operating modes	CC+CV, CR+CC+CV, CP+CC+CV, CV+CC

Accuracy of setting

	of setting		of corresponding range	
Voltage	±0.2 %		±0.05 %	
Current	±0.2 %		PLI MR in R1 ±0.1 %, others ±0.05 %	
Resistance (at 5 % to 100 % of voltage range)	±1.4 %		±0.3 % of current range	
Power (at V and I > 30 % of range) (at V and I > 5 % and < 30 % of range)	PLI EC ±1 % ±2 %	others ±0.35 % ±0.7 %	PLI EC ±0.3 % ±0.75 %	others ±0.1 % ±0.25 %
Resolution	14 bits			

Accuracy of adjustable protections

	of setting	of corresponding range
Overcurrent protection	±1.4 %	±0.3 %
Undervoltage protection	±1.4 %	±0.3 %
Resolution	12 bits	

Accuracy of measurement slow

	of measured value (real value)	of corresponding range
Voltage	±0.01 %	±0.005 %
Current	±0.2 %	PLI MR in R1 ±0.1 %, others ±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	5
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 %	±0.05 %
Current	±0.2 %	PLI MR in R1 ±0.2 %, others ±0.1 %
External control voltage	±0.2 %	±0.1 %
Resistance	calculated from voltage and current values	
Power	calculated from voltage and current values	
Resolution	16 Bit	
Sampling time	200 µs … 1000 s	

Accuracy of trigger voltage and current

Voltage	±1 % of range
Current	±1 % of range

Dynamic function (LIST)

No. of load levels	max. 300, with ramp and dwell time setting	
	min.	max.
Dwell time	200 µs	1000 s
Ramp time	0 s	1000 s
Resolution	200 µs	
Accuracy of the setting times	±0.02 %	
Delay at triggered start	max. 300 µs	

Data acquisition

to external USB flash drive

Sampling time	0.5 to 30 s, resolution 0.1 s
Measurement data	timestamp, voltage, current
No. of measurement points	limited by USB memory capacity
File format	.csv

to internal memory

Sampling time	200 µs … 1000 s, resolution 200 µs, synchronized with dynamic function
Measurement data	timestamp, voltage, current
No. of measurement points	max. 40,000

Settings memories

No. of user settings	9, selectable (incl. programmed list) 1 for last device settings at power-off or power fail

I/O port: accuracy of analog control 0 … 10 V

	of setting	of corresponding range
Voltage	±0.2 %	±0.1 %
Current	±0.2 %	PLI MR in R1 ±0.2 %, others ±0.1 %
Resistance (at V > 5 % of Vmax)	±1.6 %	±0.4 % of current range
Power (at V and I > 30 % of max. value) (at V and I > 5 % and < 30 % of max. value)	±0.55 % ±0.9 %	±0.2 % ±0.35 %
Overcurrent protection	±1 %	±0.4 %
Undervoltage protection	±1 %	±0.4 %
	Input resistance of analog inputs >10 kΩ	

I/O port: accuracy of analog monitor outputs 0 … 10 V

	of analog signal of real value	offset voltage
Voltage	±0.2 %	±15 mV
Current	±0.2 %	±15 mV
	load capacity minimal 2 kΩ	

I/O port: permissible voltages

	standard I/O port	isolated I/O port (option PLI06)
Vin-io (GND - neg. load input)	PLIxxxxZV: must be galvanically isolated all others: max. 2 V [1]	PLIxxxxZV: max. 2 V [1] all others: max. 800 V [1]
VioPE (GND - PE)	max. 125 V [1]	max. 125 V [1]
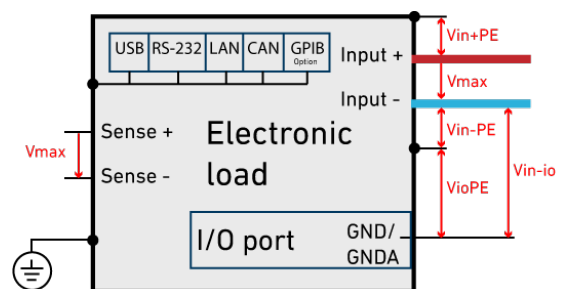
The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid when the sense lines are connected and when the unit is connected to undisturbed voltages (ripple and noise < 0.1 %). At voltages with higher disturbance values the accuracy can change for the worse.

1.   positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical Data

I/O port: control outputs and inputs

Outputs	activation state load input (low active) status overload (OV, OCP, OPP, OTP, low active) trigger output (low active) programmable logic output (by SCPI command)
Output level	selectable, 3.3 V, 5 V, 12 V or externally programmable up to 30 V
Control inputs	activation state load input (low active) operating mode selection trigger input (high active) readable logic input (by SCPI command) control input (activates the analog signals, low active) remote shut-down (low active)
input level	3 ... 30 V

Input

Input resistance	> 50 kΩ when load input is off diode function at reverse polarity up to nominal current, except ZV models
Input capacity	see model overview
Parallel operation	up to 5 devices in Master-Slave operation
Max. input voltage	see model overview
Min. input voltage	see model overview

Input: permissible voltages

	standard I/O port	isolated I/O port (option PLI06)
Vin-PE (neg. load input - PE)	max. 125 V [1]	PLIxxxxZV: max. 125 V[1] all others: max. 800 V[1]
Vin+PE (pos. load input - PE)	Vmax + max. 125 V[1]	PLIxxxxZV: Vmax + max. 125 V[1] all others: Vmax + max. 800 V[1]

Power

Continuous power	see model overview (at Ta = 21 °C)
Derating	-1.2 %/°C for Ta > 21 °C
Overload capability (short-time power)	see model overview The max. possible overload Po depends on the temperature of the device and therefore on the previously consumed continuous power Pd. The possible overload duration depends on the value of the overload Px.

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)

Terminals

Load input	see model overview
Sense	PH2/7.62-BU16, 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	70 cm
Cooling	3-stage air cooling, up from 3200 W variably controlled
Noise. weight	see model overview
Mains voltage	see model overview
with option PLI18	11 ... 15 V DC
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm²
Power consumption	see model overview

Housing

Color
  Front
  Rear
  Top, side panels
	RAL7035 (light grey)
	stainless steel
	RAL7037 (dusty grey)

Safety and EMC

Protection class	1
Measuring category	O (CAT I according to EN61010:2004)
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

Standard interfaces

Data interfaces	RS-232, USB, LAN, CAN
I/O port	standard I/O port (not isolated)

Available options

Data interfaces PLI02	GPIB
Mechanical options PLI10 PLI11 PLI12 PLI13 PLI14	19" installation kit for 1 device with ½ 19", 2 U 19" installation kit for 2 devices with ½ 19", 2 U 19" installation kit for 1 device with 19", 2 U 19" installation kit for 1 device with 19", 3 U heavy-load castors (5 U and upwards)
Function enhancement PLI21 Accuracy	MPPT function with activation code see accuracy of measurement fast
Hardware extensions PLI06	galvanically isolated I/O port
PLI16-06 PLI16-12 Accuracy Load current Activation Activation time	Charger Starter Interface (CST) for 60 V models (6...60 V) Charger Starter Interface (CST) for 120V models (6...120V) ±1 % ±200 mV max. 0.1 A can be coupled with activation state of load input 0.1 ... 100 s ±0.3 s
PLI17	switch box for external load activation via I/O port
DC mains supply PLI18 PLI19	12 V DC mains supply (only for PLI14xx) 12 V DC mains supply (only for PLI32xx with housing extension to 5 U, toggling by mains selection switch)

Calibration, warranty

FCC-PLIxx	Factory Calibration Certificate, twice for free
Warranty	2 years

1. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical data of production series B, rev. 6. Subject to technical changes without notice.

Electronic DC Loads

SINGLE CELL LOAD SCL SERIES

SCL Series – Brief Profile

With load currents of up to 1,200 A, these electronic loads are predestined for testing fuel cells or other high-current power sources.
Two variants are available: The standard SCL operates with maximum current from an input voltage of 600 mV, the SCL ZV even from 0 V.
Functions for testing energy storage devices are integrated as standard.

Various models with different power classes are available in the compact 19" housing with only 2 height units. The modern operation via a brilliant 4.3" touch display gives the user a comfortable smartphone feeling.

All common data interfaces are standard, only GPIB is optional.

- Loading down to min 0.6 V or even to 0 V (SCL ZV) at maximum current
- Basic operating modes CC, CV, CR, CP
- Combined operating modes
  CC+CV, CR+CC+CV, CP+CC+CV, CV+CC
- Adjustable protections for current and undervoltage
- Square, PWM and modulation function
- List function with synchronized DAQ
- MPP tracking
- Test of energy storage devices
- Internal resistance measurement function
- Data storage directly to USB flash drive
- Master-slave operation for parallel connection
- Electronic protection
- I/O port as standard
- Galvanically isolated I/O port optional
- Bilingual help system (German/English)

Interfaces

- ◉ RS-232
- ◉ USB
- ◉ LAN
- ○ GPIB
- ◉ CAN
- ◉ Analog
- ○ Analog isolated

◉ Standard   ○ Option   — not available

Operating Modes

The devices have the basic operating modes constant current, constant voltage, constant resistance and constant power (CC, CV, CR, CP mode). Additionally, a protection value for undervoltage and overcurrent can be set. This allows the combined operating modes CC+CV, CR+CC+CV, CP+CC+CV, CV+CC to be realized.

Protection, Monitoring

- Overcurrent protection
- Undervoltage protection
- Power protection
- Overtemperature protection
- Overvoltage indication
- Reverse polarity indication

Adjustable overcurrent and undervoltage protection are permanently active.
- Undervoltage protection works either with:
- regulating transition (e.g. CC-CV operation at battery discharge)
- switching transition (short dead time, e.g. when switching the input voltage)

Loading Capacity, Cooling

With different voltage classes, the loads of the SCL series allow the connected DUT to be loaded at full current down to a minimum voltage of 0.6 V, the SCL ZV variants even down to 0 V.
The devices are air-cooled with a stepless fan control.

I/O Port

Analog signals in realtime!

Standard I/O port for:

Outputs:
- Analog voltage monitor output 0 ... 10 V
- Analog current monitor output 0 ... 10 V
- Load input activation state
- Status overload
- Programmable logic output
- Trigger output

Inputs:
- Analog load setting I and V with 0 ... 5 V or with 0 ... 10 V
- Analog protection setting I and V with 0 ... 10 V
- Load activation
- Operating mode selection CC - CV
- Control speed selection
- Remote shut-down
- Readable digital input
- Trigger input

Galvanically Isolated I/O Port
(Option SCL06)

Option SCL06 can be installed for galvanic isolation of the analog I/O port from the load circuit. By using this card ground loops are prevented and it is possible to test bipolar voltages with common analog control using two devices.

Factory Calibration Certificate
(FCC-SCLxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

Operating Range

Minimum Voltage

Operating range SCL standard models
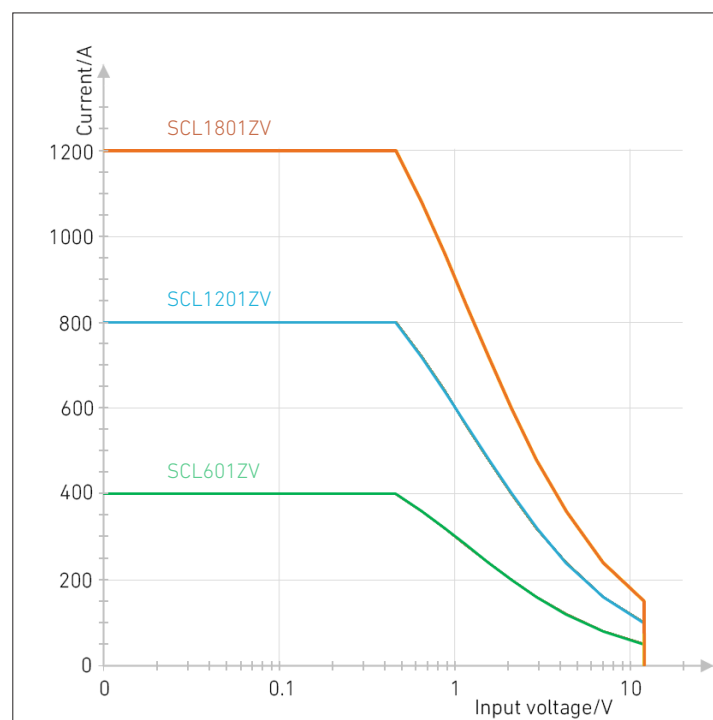
Operating range SCL ZV models

Unlike standard loads, the minimum voltage for maximum load current in the SCL series is in the millivolt range.
SCL ZV variants load with maximum current even down to 0 V. However, a current-dependent power reduction of (1 V * set current) must be calculated for these models.

H&H Höcherl & Hackl
The electronic load

Mechanics and Options

Mechanics

The SCL series is designed in stable 19" technology and can be used as a desktop unit or installed in 19" racks without any additional installation kits. When installing, a vented front panel with at least 1 U must be fitted above and below the unit.

Load Terminals

In all models of the SCL series, the load connections are implemented as solid flat copper bars. Per bar, up to 2 cable lugs can be contacted on both sides with M12 screws and a maximum of 150 mm^2 each.

Functions

Load Profiles (List Function)
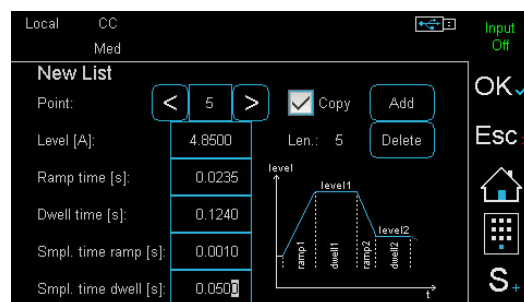
In all operating modes CC, CV, CR, CP the electronic loads can produce load profiles by List function. Up to 300 settings with variable dwell and ramp times are possible.
Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Rectangular Function
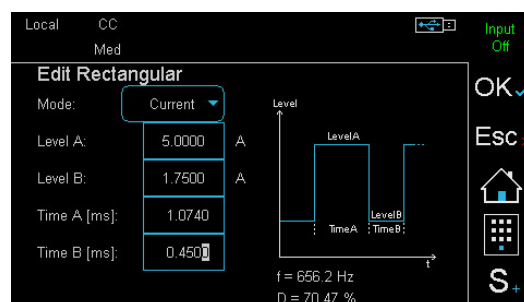
The rectangular function provides a convenient way to generate a rectangular waveform by entering absolute time and amplitude values.

PWM Function

With the PWM function, the switching frequency and the duty cycle can be set for the two amplitude values in manual operation.

Modulator

The modulator adds a sinusoidal, square-wave or triangular signal to a static setting in CC or CV mode. Frequency and modulation depth are adjustable.

MPP Tracking

V/I and V/P characteristic at the user interface

The Maximum Power Point Tracking (MPPT) function consists of the two sub-functions Sweeping and Tracking, which alternate continuously in an adjustable interval.

If the measured open circuit voltage at startup is higher than the minimum voltage, the electronic load performs a sweep and then adjusts the global MPP found. The swept V/I curve is displayed together with the V/P curve in the function graph of the user interface. The currently determined MPP is marked by a '+' in the diagram. The V/I characteristic can be read via a data interface.

Discharge Function, Energy Storage Test

IUa discharge with follow-up time

The discharge function tests energy storage devices such as batteries, ultracaps and electrolytic capacitors etc. by discharging them in CC, CP or CR mode. The discharge function can be combined with the list function so that pulsed discharge is possible.

IUa discharge (CC+CV discharge) is also possible: the test object is discharged with constant current up to a defined voltage.

This voltage is then kept constant until a defined minimum current is reached.
Stop criteria are charge, energy, time, current, voltage.
During data logging, a follow-up time can be defined to observe the regeneration phase.

Internal Resistance Measurement

Ri calculation timing

The electronic load can measure the internal DC resistance of the connected DUT. The determination of the internal resistance Ri is based on the principle specified in various standards for batteries and accumulators, e.g. DIN EN 61951, DIN EN 61960.
At intervals of a few seconds, the load measures the terminal voltage of the DUT (V1, V2) at two defined load levels (I1, I2) and calculates Ri from this.
The load levels I1 and I2 as well as their durations are adjustable.
In manual mode, the load can store the parameters and the result of the measurement on a connected USB mass storage device at the touch of a button, so that a high throughput with many DUTs may be achieved.

H&H Höcherl & Hackl
The electronic load

Data Logging (DAQ)

The electronic load is able to synchronously store data records of voltage and current with time stamp internally in a defined interval. Up to 40,000 data records are stored in a ring buffer and can be read via a data interface. After recording is finished, the data can also be transferred to a USB flash drive.

For processes with storage intervals in the seconds range, the data can also be stored directly on the USB flash drive.

Sweep Function

V/I characteristic

The sweep function is used to determine V/I characteristics. For this purpose, a voltage ramp is defined via the user interface by means of start and end voltage as well as the corresponding duration of the sweep process. The ramp can be rising or falling.

During the sweep process, the load continuously changes the voltage value until the end voltage is reached and records the measurement data. After the function execution, the recorded measurement data can be viewed in the graphical Data Viewer or exported to a connected USB flash drive.

Trigger Model

Several functions or settings can be triggered by a configurable trigger model:
- Activate/deactivate load input
- Start/stop LIST function
- Start/stop data acquisition
- Set triggered settings of all operating modes

Available trigger sources:
- Extern
- Bus
- Manual
- Voltage
- Current

Changing Regulation Speed

Sometimes special DUTs or very long load cables require modification of the electronic load's regulation time constant to avoid oscillations and establish stable operation.
Regulation speed slow - medium - fast are selectable. See model overview.

Master-Slave Operation

Master-slave operation in system connection

To increase the power or current, up to 5 loads[1] can be connected in parallel in master-slave operation[2].

The system operates externally as if it were one single device. The master unit controls the total current of the system, displays the total measured values and supplies these when queried via one of the data interfaces.

Wiring:
One set each of K-MS-SCL and K-MS-CAN master-slave cables on all slave units (available from H&H or can be assembled by the user).

To be able to access monitor signals etc. when using the master-slave cable K-MS-SCL, we offer a SubD25 doubler as an accessory.

1. Equal models and equal firmware versions
2. In master-slave mode reduced fuction scope, controlling via CAN interface not possible

Watchdog Function

In digital remote operation, the electronic load has got a watchdog function switching the load input off if the previously programmed watchdog delay expires without resetting the watchdog.
The watchdog delay is set by SCPI command. Another command activates the watchdog. Then the control program must ensure that the command to reset the watchdog is sent periodically to the electronic load before the delay time expires.

Save Settings

In order to be able to quickly reconstruct recurring test tasks, the settings active in the electronic load can be stored in non-volatile memory (internal or external to USB flash drive) so that they can be reloaded at a later time. 9 internal memory positions are available.
The load can alternatively set reset values at power-up or memory position 1 to 9.

Drivers

POWERED BY
LabVIEW

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

SCL Series — Model Overview

Model (Order number)	SCL604	SCL1204	SCL1804
Maximum input voltage Vmax	40 V	40 V	40 V
Minimum input voltage Vmin [1]	0.6 V	0.6 V	0.6 V
Maximum current Imax	400 A	800 A	1,200 A
Maximum power [2]	600 W	1,200 W	1,800 W
Voltage setting	0 ... 40 V	0 ... 40 V	0 ... 40 V
Current setting	0 ... 400 A	0 ... 800 A	0 ... 1.200 A
Resistance setting	0.0015 ... 1.008 Ω	0.00075 ... 0.504 Ω	0.0005 ... 0.336 Ω
Power setting	0 ... 600 W	0 ... 1,200 W	0 ... 1,800 W
Rise and fall time fast / medium / slow [3]	2 / 10 / 100 ms	2 / 10 / 100 ms	2 / 10 / 100 ms
Input capacity ca.	16 µF	33 µF	50 µF
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Power consumption	70 VA	80 VA	75 VA
Noise max. ca. [5]	73 dB(A)	74 dB(A)	64 dB(A)
Load terminals [6]	FKS30/10-SM12	FKS30/10-SM12	FKS30/10-SM12
Weight ca.	16 kg	19 kg	22 kg
Housing / 3D model [7]	19", 2 U / SCL_M1	19", 2 U / SCL_M1	19", 2 U / SCL_M1

Model (Order number)	SCL601ZV	SCL1201ZV	SCL1801ZV
Maximum input voltage Vmax	12 V	12 V	12 V
Minimum input voltage Vmin [1]	0 V	0 V	0 V
Maximum current Imax	400 A	800 A	1,200 A
Maximum power [2]	600 W	1,200 W	1,800 W
Voltage setting	0 ... 12 V	0 ... 12 V	0 ... 12 V
Current setting	0 ... 400 A	0 ... 800 A	0 ... 1,200 A
Resistance setting	0 ... 1.302 Ω	0 ... 0.151 Ω	0 ... 0.101 Ω
Power setting	0 ... 600 W	0 ... 1,200 W	0 ... 1,800 W
Rise and fall time fast / medium / slow [3]	2 / 10 / 100 ms	2 / 10 / 100 ms	2 / 10 / 100 ms
Input capacity ca.	16 µF	33 µF	50 µF
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Power consumption	685 VA	1,155 VA	1,725 VA
Noise max. ca. [5]	69 dB(A)	75 dB(A)	75 dB(A)
Load terminals [6]	FKS30/10-SM12	FKS30/10-SM12	FKS30/10-SM12
Weight ca.	16 kg	20.5 kg	24.5 kg
Housing / 3D model [7]	19", 2 U / SCL_M1	19", 2 U / SCL_M1	19", 2 U / SCL_M1

1. Minimum input voltage for maximum static load current. Linear derating of the load current at lower voltages.
2. For the ZV variants, a current-dependent power reduction of (1 V * set current) must be considered.
3. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current (constant current mode, tolerance ±20 %).
4. Mains voltage tolerance ±10 %.
5. Measured at the front in distance of 1 m.
6. Description of available terminals starting at page 123.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Options and Accessories

Order number	Article	Description
52-200-001-28	SCL02	GPIB interface extension
67-004-030-28	K-RS-SNM 9-9	RS-232 cable (null-modem cable)
53-100-002-28	SCL06-N	Galvanically isolated I/O port instead of standard I/O port with new device
53-100-001-28	SCL06	Galvanically isolated I/O port for retrofitting of existing device
67-008-020-28	K-MS-SCL+K-MS-CAN	Cable set master-slave, consisting of K-MS-SCL and K-MS-CAN (2 m each)
67-036-020-28	K-MS-SCL	Master-slave cable I/O port (2 m)
67-037-020-28	K-MS-CAN	Master-slave cable CAN (2 m)
63-000-006-28	SubD25 Doubler	Adapter 1x Sub-D 25 male connector to 2x Sub-D25 female connector for I/O port
65-002-000-28	FCC-SCLxx	Factory Calibration Certificate
63-000-005-28	PH2/7.62-ST16	Additional mating connector for sense terminal
63-000-003-00	SENSADAPT/PH2/POK/60V	Sense-Adapter from Phoenix PH2 to 4 mm binding post, max. 60 V
49-001-000-28	SX	Modified setting range for SCL Series only after consulting H&H
49-002-000-28	SSX	Customized setting range only after consulting H&H
		Load cables see starting at page 127

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 energy storage device test internal resistance measurement list function rectangular function PWM function modulation (sine, triangle, square) data acquisition (internally or to USB flash drive) sweep function save and recall of device settings watchdog in remote operation
User interface	4.3" TFT touch display

Accuracy of setting

	of setting	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Resistance (at 5 % to 100 % of voltage range)	±1.4 %	±0.5 % of resistance range ±0.3 % of current range
Power (at V and I > 30 % of range) (at V and I > 5 % and < 30 % of range)	±0.35 % ±0.7 %	±0.1 % ±0.25 %
Resolution	14 bits	

Accuracy of adjustable protections

	of setting	of corresponding range
Overcurrent protection	±1 %	±0.2 %
Undervoltage protection	±0.5 %	±0.2 %
Resolution	12 bits	

Accuracy of measurement slow

	of measured value (real value)	of corresponding range
Voltage	±0.025 %	±0.01 %
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	±0.2 %	±0.05 %
Current	±0.2 %	±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, CR
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
Accuracy	see accuracy of measurement slow

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
Accuracy	see accuracy of measurement fast

Settings memory

No. of memory positions	9, selectable (incl. programmed list)

I/O port: inputs and outputs

Inputs	analog load setting I and V with 0 ... 5 V and 0 ... 10 V analog protection setting I and V with 0 ... 10 V load input activation (low active) operating mode selection CC/CV control speed selection remote shut-down (high active) readable digital input (by SCPI command) trigger input (high active) control input (activates analog signals, low active)
Digital input level	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.
2. positive/negative DC voltage or RMS value of a sinusoidal AC voltage
3. only 0 ... 10 V

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)
Digital output level	**Standard**: logical low: 0 ... 0.8 V, logical high: 5 V, max. 10 mA (push-pull) **Isolated**: logical low: 0 ... 0.8 V, logical high: 5 V/24 V selectable, max. 10 mA (push-pull)

I/O port: accuracy of analog control 0 ... 5 V or 0 ... 10 V

	of setting	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.1 %
Overcurrent protection [3]	±1 %	±0.2 %
Undervoltage protection [3]	±0.5 %	±0.2 %
	input resistance of analog inputs >10 kΩ	

I/O port: 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
	minimum load > 2 kΩ	

I/O port: permissible voltages

	standard I/O port	isolated I/O port (option SCL06)
Vin-io (GND - neg. load input)	max. 2 V	max. 185 V [2]
VioPE (GND - PE)	max. 60 V [2]	max. 125 V [2]
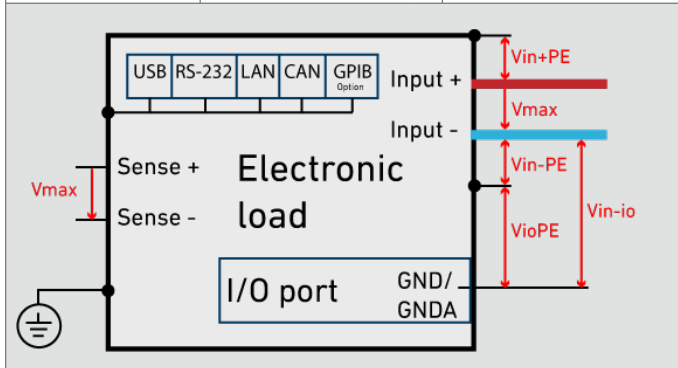
Input

Input resistance	>50 kΩ when load input is off standard models with diode function at reverse polarity up to nominal current ZV models have no reverse polarity protection!
Input capacity	see model overview
Max. input voltage Vmax	see model overview
Min. input voltage Vmin	see model overview

Input: permissible voltages

	standard I/O port	isolated I/O port (option SCL06)
Vin-PE (neg. load input - PE)	max. 60 V [2]	max. 60 V [2]
Vin+PE (pos. load input - PE)	max. 60 V [2]	max. 60 V [2]

Power

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

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)

Terminals

Load input	see model overview
Sense	PH2/7.62-BU16, 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	70 cm
Cooling	2-stage air cooling
Cabinet installation	with minimum 1 U vented front panel each above and below the device
Noise, weight	see model overview
Mains voltage	see model overview
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm²
Power consumption	see model overview

Housing

Dimensions	see model overview

Color
  front
  rear
  top
	RAL7035 (light grey)
	stainless steel
	RAL7037 (dusty grey)

Safety and EMC

Protection class	1
Measuring category	O (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

Standard interfaces

Data interfaces	RS-232, USB, LAN, CAN
I/O port	standard (not isolated)

Available options

Data interface SCL02	GPIB
Hardware extensions SCL06	galvanically isolated I/O port

Calibration, warranty

FCC-SCLxx	Factory Calibration Certificate, twice for free [4]
Recommended calibration interval	2 years
Warranty	2 years

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.
2. positive/negative DC voltage or RMS value of a sinusoidal AC voltage
3. only 0 ... 10 V
4. The second calibration is free of charge if the particular device has been registered with H&H: www.hoecherl-hackl.com/service/device-registration

Electronic DC Loads

MOBILE REGENERATIVE LOAD TRL SERIES

TRL Series – Brief Profile

The DC loads of the TRL series feed the absorbed energy back into the local supply network.

They do not require a fixed installation, but can simply be plugged into the wall socket. Because these loads are also very quiet, they are perfect for the developer in the lab.

Modern operation via a brilliant 4.3" touchscreen gives the user a comfortable smartphone feeling.

The TRL series also comes with many data interfaces as standard, only GPIB is optional.

- • Energy recycling to the local power grid
- • Low heat waste, silent
- • Basic operating modes CC, CV, CR, CP
- • Combined operating modes
  CC+CV, CR+CC+CV, CP+CC+CV, CV+CC
- • Load and sense terminals front and rear
- • Adjustable protections for current and undervoltage
- • Square, PWM and modulation function
- • List function with synchronized DAQ
- • MPP Tracking
- • Test of energy storage devices
- • Internal resistance measurement function
- • Master-slave operation for parallel connection
- • Data storage directly to USB flash drive
- • Electronic protection
- • I/O port as standard
- • Galvanically isolated I/O port optional
- • Bilingual help system (German/English)

Interfaces

- ◉ RS-232
- ◉ USB
- ◉ LAN
- ○ GPIB
- ◉ CAN
- — Analog
- ○ Analog isolated

◉ Standard   ○ Option   — not available

Operating Modes

The devices have the basic operating modes constant current, constant voltage, constant resistance and constant power (CC, CV, CR, CP mode). Additionally, a protection value for undervoltage and overcurrent can be set. This allows the combined operating modes CC+CV, CR+CC+CV, CP+CC+CV, CV+CC to be realized.

Protection, Monitoring

- Overcurrent protection
- Undervoltage protection
- Power protection
- Overtemperature protection
- Overvoltage indication
- Reverse polarity indication

Loading Capacity

There are 3 voltage classes of 80 V, 400 V and 1,200 V. All models have a maximum power of 1,000 W.

Energy Recycling, Cooling
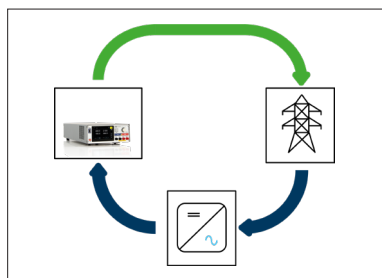
Energy recycling principle

The absorbed power is fed back into the mains supply[1]. This alone reduces electricity costs, and the environment is only minimally heated. Powerful fans are not required for regenerative loads, which makes the devices pleasantly quiet compared to linear loads and thus perfect for laboratory operation.

Galvanically Isolated I/O Port
(Option TRL06)

Analog signals in realtime!

The optional I/O port provides analog and digital signals for external control. The galvanical isolation prevents ground loops and it is possible to test bipolar voltages with common analog control using two devices.

Outputs:
- Analog voltage monitor output 0 ... 10 V
- Analog current monitor output 0 ... 10 V
- Load input activation state
- Overload status
- Programmable logic output
- Trigger output

Inputs:
- Analog load setting I and V with 0 ... 5 V and with 0 ... 10 V
- Analog protection setting I and V with 0 ... 10 V
- Load input activation
- Operating mode selection CC - CV
- Control speed selection
- Remote shut-down
- Readable digital input
- Trigger input

Factory Calibration Certificate
(FCC-TRLxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

1. The operation in the sense of a power generation into the public electricity grid is not provided with these energy recycling loads.

Mechanics, Options and Rack Installation

Mechanics

The TRL series is designed in stable 19" technology and can be used as a desktop unit or installed in 19" racks by the aid of optional installation kits.

Set-up Foot

standard

TRL1008   TRL10K12

Installation kit for 1 device
with ½ 19", 2 U
(Option TRL10)

Including:
- 1 device extender
- 2 attachment brackets with handle
- screws

Installation kit for 2 devices
with ½ 19", 2 U
(Option TRL11)

Including:
- 1 connecting element
- 2 attachment brackets with handle
- screws

Safety Cover

With devices for hazardous input voltages, safety covers are supplied as protection against contact. A loose cap is included for the unused load input.

Functions

Load Profiles (List Function)
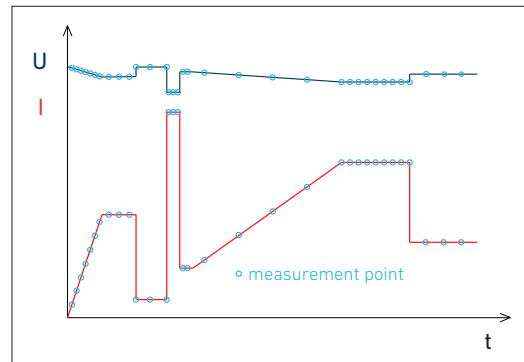
Load profile generated by List function with synchronized data acquisition of time, voltage, current

In all operating modes CC, CV, CR, CP the electronic loads can produce load profiles by List function. Up to 300 settings with variable dwell and ramp times are possible.
Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Rectangular Function

The rectangular function provides a convenient way to generate a rectangular waveform by entering absolute time and amplitude values.
High resolution is paired here with a wide range for time setting.

PWM Function

With the PWM function, the switching frequency and the duty cycle can be set for the two amplitude values in manual operation.

Modulator

The modulator adds a sinusoidal, square-wave or triangular signal to a static setting in CC or CV mode. Frequency and modulation depth are adjustable.

MPP Tracking

V/I and V/P characteristic at the user interface

The Maximum Power Point Tracking (MPPT) function consists of the two sub-functions Sweeping and Tracking, which alternate continuously in an adjustable interval.

If the measured open circuit voltage at startup is higher than the minimum voltage, the electronic load performs a sweep and then adjusts the global MPP found. The swept V/I curve is displayed together with the V/P curve in the function graph of the user interface. The currently determined MPP is marked by a '+' in the diagram. The V/I characteristic can be read via a data interface.

Discharge Function, Energy Storage Test

IUa discharge with follow-up time

The discharge function tests energy storage devices such as batteries, ultracaps and electrolytic capacitors etc. by discharging them in CC, CP or CR mode. The discharge function can be combined with the list function so that pulsed discharge is possible.

IUa discharge (CC+CV discharge) is also possible: the test object is discharged with constant current up to a defined voltage.

This voltage is then kept constant until a defined minimum current is reached.
Stop criteria are charge, energy, time, current, voltage.
During data logging, a follow-up time can be defined to observe the regeneration phase.

Internal Resistance Measurement

Ri calculation timing

The electronic load can measure the internal DC resistance of the connected DUT. The determination of the internal resistance Ri is based on the principle specified in various standards for batteries and accumulators, e.g. DIN EN 61951, DIN EN 61960.
At intervals of a few seconds, the load measures the terminal voltage of the DUT (V1, V2) at two defined load levels (I1, I2) and calculates Ri from this.
The load levels I1 and I2 as well as their durations are adjustable.
In manual mode, the load can store the parameters and the result of the measurement on a connected USB mass storage device at the touch of a button, so that a high throughput with many DUTs may be achieved.

H&H **Höcherl & Hackl**
The electronic load

Data Logging (DAQ)
(Internal memory or to USB flash drive)

The electronic load is able to synchronously store data records of voltage and current with time stamp internally in a defined interval. Up to 40,000 data records are stored in a ring buffer and can be read via a data interface. After recording is finished, the data can also be transferred to a USB flash drive.

For processes with storage intervals in the seconds range, the data can also be stored directly on the USB flash drive.

Trigger Model

Several functions or settings can be triggered by a configurable trigger model:
- Activate/deactivate load input
- Start/stop LIST function
- Start/stop data acquisition
- Set triggered settings of all operating modes

Available trigger sources:
- Extern (with opt. I/O port)
- Bus
- Manual
- Voltage
- Current

Changing Regulation Speed

Sometimes special DUTs or very long load cables require modification of the electronic load's regulation time constant to avoid oscillations and establish stable operation.

Regulation speed slow - medium - fast are selectable. See model overview.

Master-Slave Operation

Master-slave operation in system connection

To increase the power or current, up to 5 loads[1] can be connected in parallel in master-slave operation[2].

The system operates externally as if it were one single device. The master unit controls the total current of the system, displays the total measured values and supplies these when queried via one of the data interfaces.

Wiring:
One set each of K-MS-TRL and K-MS-CAN master-slave cables on all slave units (available from H&H or can be assembled by the user).

To be able to access monitor signals etc. when using the master-slave cable K-MS-TRL, we offer a SubD25 doubler as an accessory.

Watchdog Function

In digital remote operation, the electronic load has got a watchdog function switching the load input off if the previously programmed watchdog delay expires without resetting the watchdog.

The watchdog delay is set by SCPI command. Another command activates the watchdog. Then the control program must ensure that the command to reset the watchdog is sent periodically to the electronic load before the delay time expires.

Save Settings

In order to be able to quickly reconstruct recurring test tasks, the settings active in the electronic load can be stored in non-volatile memory (internal or external to USB flash drive) so that they can be reloaded at a later time. 9 internal memory positions are available.

The load can alternatively set reset values at power-up, the last active settings at power-down or memory position 1 to 9.

Drivers

POWERED BY
LabVIEW

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

1. Equal models and equal firmware versions
2. In master-slave mode reduced fuction scope, controlling via CAN interface not possible

TRL1008

TRL1008

H&H Höcherl & Hackl
The electronic load

TRL Series

Model Overview
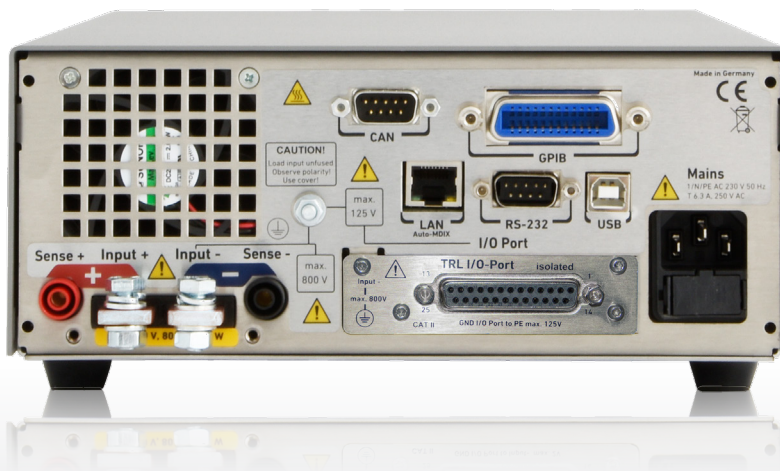
Model (Order number)	TRL1008	TRL1040	TRL10K12
Maximum input voltage Vmax	80 V	400 V	1,200 V
Minimum input voltage Vmin [1]	1 V	4 V	12 V
Maximum current Imax	60 A	15 A	5 A
Continuous power	1,000 W	1,000 W	1,000 W
Voltage setting	0 … 80 V	0 … 400 V	0 … 1,200 V
Current setting	0 … 60 A	0 … 15 A	0 … 5 A
Resistance setting	0.017 … 13.4 Ω	0.267 … 268 Ω	2.4 … 2,400 Ω
Power setting	0 … 1,000 W	0 … 1,000 W	0 … 1,000 W
Rise and fall time fast / medium / slow [2]	10 / 50 / 250 ms	10 / 50 / 250 ms	10 / 50 / 250 ms
Input capacity ca.	400 µF	120 µF	25 µF
Mains voltage [3]	1/N/PE AC 230 V 50 Hz	1/N/PE AC 230 V 50 Hz	1/N/PE AC 230 V 50 Hz
Power consumption (own consumption) [4]	85 VA	90 VA	85 VA
Maximum feed-in power	955 VA	975 VA	920 VA
Efficiency [5]	90 %	90 %	90 %
Noise max. ca. [6]	49 dB(A)	49 dB(A)	49 dB(A)
Load terminals [7]	FKL15/4-SM6	SBU4-24	SBU4-24
Weight ca.	7.7 kg	7.2 kg	7.2 kg
Housing / 3D model [8]	½19", 2 U / TRL_M1	½19", 2 U / TRL_M2	½19", 2 U / TRL_M2

Options and Accessories

Order number	Article	Description
52-200-001-26	TRL02	GPIB interface extension
67-004-030-26	K-RS-SNM 9-9	RS-232 cable (null-modem cable)
53-100-001-26	TRL06	Galvanically isolated I/O port
64-314-000-26	TRL10	19" installation kit for 1 device with ½ 19", 2 U
64-315-000-26	TRL11	19" installation kit for 2 devices with ½ 19", 2 U
67-008-020-26	K-MS-TRL+K-MS-CAN	Cable set master-slave, consisting of K-MS-TRL and K-MS-CAN (2 m each)
67-036-020-26	K-MS-TRL	Master-slave cable I/O port (2 m)
67-037-020-26	K-MS-CAN	Master-slave cable CAN (2 m)
63-000-006-26	SubD25 Doubler	Adapter 1x Sub-D 25 male connector to 2x Sub-D 25 female connector for I/O port
65-002-000-26	FCC-TRLxx	Factory Calibration Certificate
64-401-000-26	SAB-TRL	Additional safety cover for load terminals incl. cap for unused input terminals
63-000-002-00	SENSADAPT/4BAN/PH2/1200V	Sense adapter from 4 mm banana plug to Phoenix PH2
		Load cables see starting at page 127

1.	Minimum input voltage for maximum static load current.
2.	Rise and fall times are defined from 10 … 90 % and 90 … 10 % of maximum current (constant current mode, tolerance ±20 %).
3.	Mobile connection via cold device plug. Mains voltage tolerance ±10 %.
4.	Power consumption in idle operation (without load current).
5.	Maximum achievable efficiency.
6.	Measured at the front in distance of 1 m.
7.	Load and sense terminals both at front and rear panel. Safety covers are included in the delivery. Description of available terminals starting at page 123 .
8.	1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

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 [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/either 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)

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	

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	

I/O port (option TRL06): permissible voltages

Vin-io (GND - neg. load input)	max. 800 V [2]
VioPE (GND - PE)	max. 50 V [2]

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

Input: permissible voltages

Vin-PE (neg. load input - PE)	max. 800 V [2]
Vin+PE (pos. load input - PE)	Vmax + max. 800 V [2]

Power

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

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)

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 mm²
Own consumption	see model overview
Maximum feed-in power	see model overview

Housing

Dimensions	see model overview

Color
    front
    rear
    top
	RAL7035 (light grey)
	stainless steel
	RAL7037 (dusty grey)

Safety and EMC

Protection class	1
Measuring category	O (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

Standard interfaces

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

Available options

Data interfaces TRL02	GPIB
Mechanical options TRL10 TRL11	19" installation kit for 1 device with ½ 19", 2 U 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

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.hoecherl-hackl.com/service/device-registration

Electronic DC Loads

MULTI–CHANNEL LOAD PMLA SERIES

PMLA Series – Brief profile

The multi-channel load PMLA combines up to 12 load channels/modules in a compact 19" housing with only 2 height units. All load channels are galvanically isolated from each other, making multi-channel test systems such as burn-in devices very easy to configure.
A Master device, which has both a graphical user interface and various data interfaces, controls all load channels of the system, which can be extended by one or more Slave devices if required.

- Up to 12 channels in 19", 2 U
- Channel expansion via slave devices
- Maximum 72 channels per system
- Tailored configurations possible with modules in 4 voltage and 4 power classes
- 150 W - 300 W - 450 W - 600 W modules
- Voltages 40 V – 60 V – 120 V – 240 V
- Currents from 1 A to 120 A
- 1,800 W total power
- CC, CV, CR, CP mode
- Operated via graphical user interface
- Dynamic loads
- Group addressing and name assignment
- Discharge function for energy storage device test
- SCPI programming and measuring
- MPP tracking
- Trigger model
- Internal measurement data storage
- Electronic protection
- Analog control input for each channel
- Analog monitor outputs for V and I
- Extensive data interfaces
- Bilingual help system (German/English)

Interfaces

	Master	Slave
RS-232	◉	—
USB	◉	—
LAN	◉	—
GPIB	◯	—
CAN	◯	—
Analog	◉	◉
Analog isolated	—	—
System bus	◉	◉
User interface	◉	—

◉ Standard   ◯ Option   — not available

Applications

- Calibration of driver outputs
- Consumer test of electrical systems
- Burn-in applications

DUTs

- Batteries and accumulators
- Cables
- Absorbers
- DC/DC converters
- Electronic assemblies
- Sensors
- Fuse boxes
- Control units
- Power distributors

Load Modules, Configuration

The PMLA multi-channel load has up to 3 cooling units with 4 mounting positions each for load modules, depending on the version. Modules are available with outputs of 150 W, 300 W, 450 W or 600 W. Depending on the output, a module occupies one (150 W), two (300 W), three (450 W) or four (600 W) mounting positions.
The modules are available in four different voltage classes 40 V, 60 V, 120 V and 240 V and for currents of 1 A to 120 A. This allows any loads to be configured, such as:
1 x 600 W + 1 x 450 W + 2 x 300 W + 1 x 150 W. The total power is max. 1,800 W.
The load inputs of all channels are galvanically isolated from each other.
With the aid of configurable channel groups and names, several modules can be combined to form logical units, which are then programmed simultaneously.
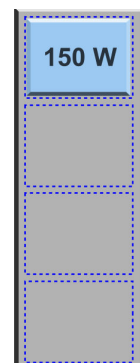
Cooling unit with
150 W module
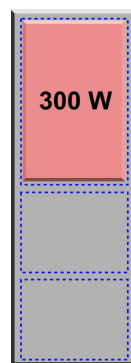
Cooling unit with
300 W module
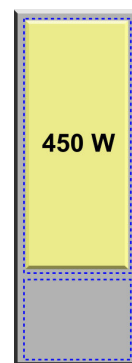
Cooling unit with
450 W module
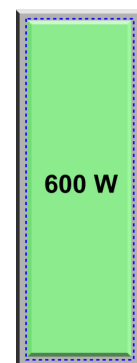
Cooling unit with
600 W module
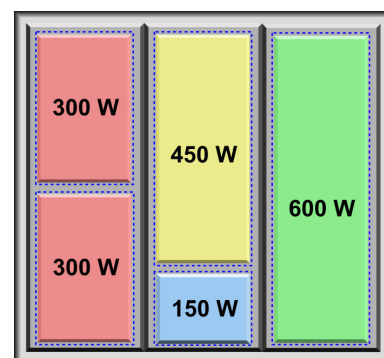
Example:

1 PMLA load (Master or Slave) with 5 load modules.
A module cannot be split over several cooling units.

Operating Modes

Each channel has the basic operating modes constant current, constant voltage, constant resistance and constant power (CC, CV, CR, CP mode). In addition, a protection value for voltage or current can be specified in each operating mode. This results in the combined operating modes CC+CV, CP+CV, CR+CV, CP+CC, CR+CC, CV+CC.
In addition to the static operating modes, dynamic operation with the LIST function is also possible.

Factory Calibration Certificate
(FCC-PMLAxx)

2 xfor free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

Drivers

POWERED BY
LabVIEW

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

Cooling

The air flow from the front panel to the rear panel allows compact rack systems with many channels to be realized without gaps.

Protective Devices, Monitoring

- Overcurrent protection
- Overpower protection
- Overtemperature protection
- Overvoltage indication
- Undervoltage protection

Load and Sense Terminals

The load inputs are connected to pluggable terminal strips PH8/7.62-ST43 (see starting at page 123). Suitable mating connectors and coding pins are supplied with the terminal strips.
All load inputs are galvanically isolated from each other.
The sense connections are located on the I/O ports (Sub-D).

I/O Port

Analog signals in realtime!

Standard I/O port with control and monitor signals for each channel:
- Analog load setting I and V
- Load on/off
- Analog voltage monitor output
- Analog current monitor output
- Sense inputs

Overcurrent and Undervoltage Protection

Adjustable overcurrent and undervoltage protection are permanently active. Both protections work in all operating modes.

Undervoltage protection operates in two different modes:
- regulating transition (e.g. CC-CV operation at battery discharge
- switching transition (short dead time, e.g. when switching the input voltage)

Trigger Model

In digital remote operation, the trigger model enables all channels to be switched on synchronously or a programmed waveform to be started.

H&H Höcherl & Hackl
The electronic load

Load Profiles (List Function)

In all operating modes PMLA series loads can generate dynamic load profiles. Up to 100 settings with variable dwell and ramp time are possible. Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.
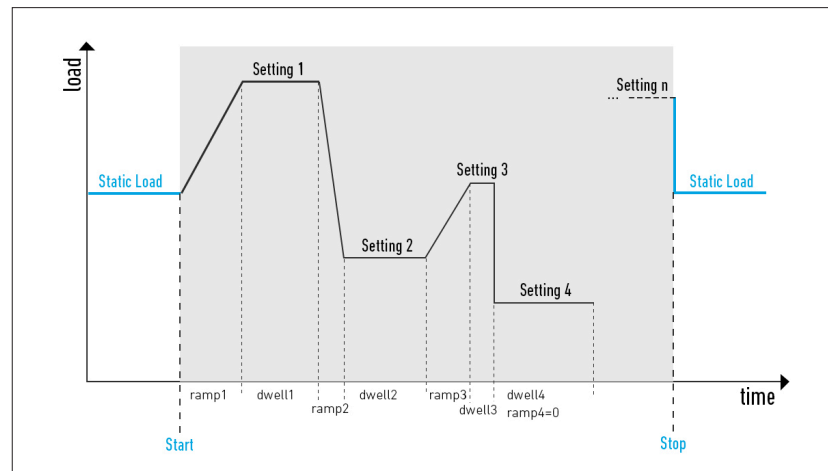
LIST function

Data Acquisition (DAQ)

In digital remote control mode, all channels can save voltage and current synchronously and independently of each other with a timestamp at a variable interval. The user decides whether the recording ends at the end of the data memory or whether the old data is overwritten in a ring buffer principle.

Discharge Function, Energy Storage Test

The discharge function tests energy storage devices such as batteries, ultracaps, electrolytic capacitors and solar panels etc. by discharging them in CC, CP or CR mode. The discharge function can be combined with the list function so that pulsed discharge is possible.
IUa discharge (CC+CV discharge) is also possible: the test object is discharged with constant current up to a defined voltage. This voltage is then kept constant until a defined minimum current is reached.
Stop criteria are charge, energy, time, current, voltage.

Watchdog Function

To protect the DUT from communication problems, the electronic load in digital remote control mode has a watchdog function that switches off the load input if the previously programmed watchdog delay time expires without the watchdog being reset.
The watchdog delay time is set by SCPI command, another command activates the watchdog.
When the watchdog is active, a control program must ensure that the command to reset the watchdog is cyclically sent to the electronic load.

Regulation Speed Setting

For certain DUTs or very long connecting cables, it may be necessary to adapt the regulation time constant of the electronic load in order to achieve stable operation. For this purpose, the control speed can be changed.

Save Settings

On request, the settings of all channels can be stored in one of 10 memory positions to be reloaded at a later time. Each channel stores its own settings.
Thus, the configuration of entire systems, such as those in automobiles, can be reconstructed at the touch of a button. At power-on, each channel can optionally set the reset state, the last active settings at switching off or memory positions 0 to 9.

MPP Tracking

V/I and V/P characteristic at the user interface

The Maximum Power Point Tracking (MPPT) function consists of the two sub-functions Sweeping and Tracking, which alternate continuously in an adjustable interval.

If the measured open circuit voltage at startup is higher than the minimum voltage, the electronic load performs a sweep and then adjusts the global MPP found. The swept V/I curve is displayed together with the V/P curve in the function graph of the user interface. The previously found MPP is marked by a '+' in the diagram. The V/I characteristic can be read out via a data

interface. It is composed as follows:
<Volt_0>,<Curr_0>,<Volt_1>,<Curr_1>,...,<Volt_249>,<Curr_249>

Software Tool

Setting Menu

The PMLA Tool is a control software for up to 72 channels of electronic multi-channel loads of the PMLA series. A navigation bar switches between the individual applications.
In the main menu (Settings) the most important instrument settings are made and the channel to be controlled is selected. A measurement and status bar provides information on the current device status. The data logger function can be configured and activated.

www.hoecherl-hackl.com –> download area

Data Viewer
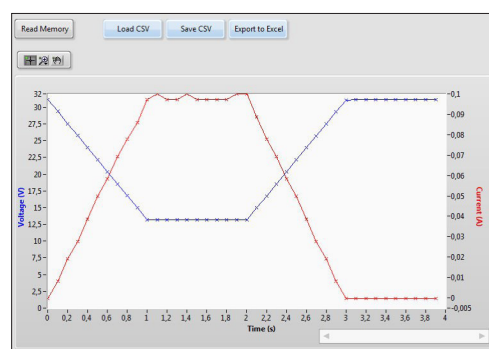
Measured values from the device's DAQ memory can be read from the device and displayed graphically using the Data Viewer.
The data can then be stored as a CSV file on a data carrier for further processing.
Individual measurement points (time stamp, voltage, current) are displayed as tooltips.

System View

In the "System View" the most important states as well as voltage and current of all channels in the system (up to 72) are displayed. By the quick selection of a channel the new channel is selected and immediately switched to the Settings view.

H&H Höcherl & Hackl
The electronic load

Operation and Connection

Master device front

Keypad
numeric entry, menu navigation

Graphical display

Power switch

Load input

USB flash drive
firmware update

Rotary encoder
setting, menu navigation

Master device rear

RS-2332 interface
max. 115,200 bits/s

CAN interface (option PMLA03)
CAN 2.0 A
up to 1,000 kbits/s

GPIB interface (option PMLA02)

I/O port
external control, status outputs of up to 4 channels

Input terminals
connection of up to 4 DUTs

Mains connector
115/230 V AC
50 ... 60 Hz

System bus
connection to Slave devices

USB interface
Virtual COM Port

PE terminal

LAN interface
Ethernet 100 Mbits/s

PMLA multi-channel

Models, Options, Modules and Accessories

Order number	Article	Description
23-001-000-03	PMLA-M	PMLA Master device with user interface, RS-232 + USB + LAN + PMLA system bus for connection of up to 5 Slave devices
23-002-000-03	PMLA-S	PMLA Slave device with system bus interface for connection of a Master device and of further Slave devices
23-003-000-03	Cooling unit	Empty cooling unit with 4 mounting positions (corresponding to configuration, 1, 2 or 3 cooling units per PMLA device required) incl. mating plug PMLA15
	MAxx-yyCzz	Load module (see module overview below). If not otherwise specified, the modules are mounted in the order of purchase.
52-200-001-23	PMLA02	GPIB interface for PMLA-M
52-600-001-23	PMLA03	CAN interface for PMLA-M (software option with unlock code)
63-000-001-23	PH8/7.62-BU43	Extra mating plug for 1x Cooling Unit
65-002-000-23	FCC-PMLA/CH	Factory Calibration Certificate for 1 module MAxx-yyCzz
67-004-030-23	K-RS-SNM 9-9	RS-232 cable (nullmodem cable) PMLA series
49-001-000-23	SX	Modified setting range for PMLA series, only after consulting H&H
49-002-000-23	SSX	Customized setting range, only after consulting H&H
67-001-005-23	Patch-Cable 0.5m	Patch cable 1:1 blue, 0.5 m

Interface	Transmission rate
USB / RS-232	up to 115.200 bits/s
LAN	up to 10.000 kbits/s
CAN (optional)	up to 1.000 kbits/s
System bus	up to 1.000 kbits/s
GPIB (optional)	up to 1.000 kbytes/s
Analog	realtime

USB or RS-232 or GPIB or LAN or CAN or Analog

PMLA-M Master

PMLA-S Slave 1

max. 5 Slaves

PMLA-S Slave 5

PMLA system bus

Module Overview
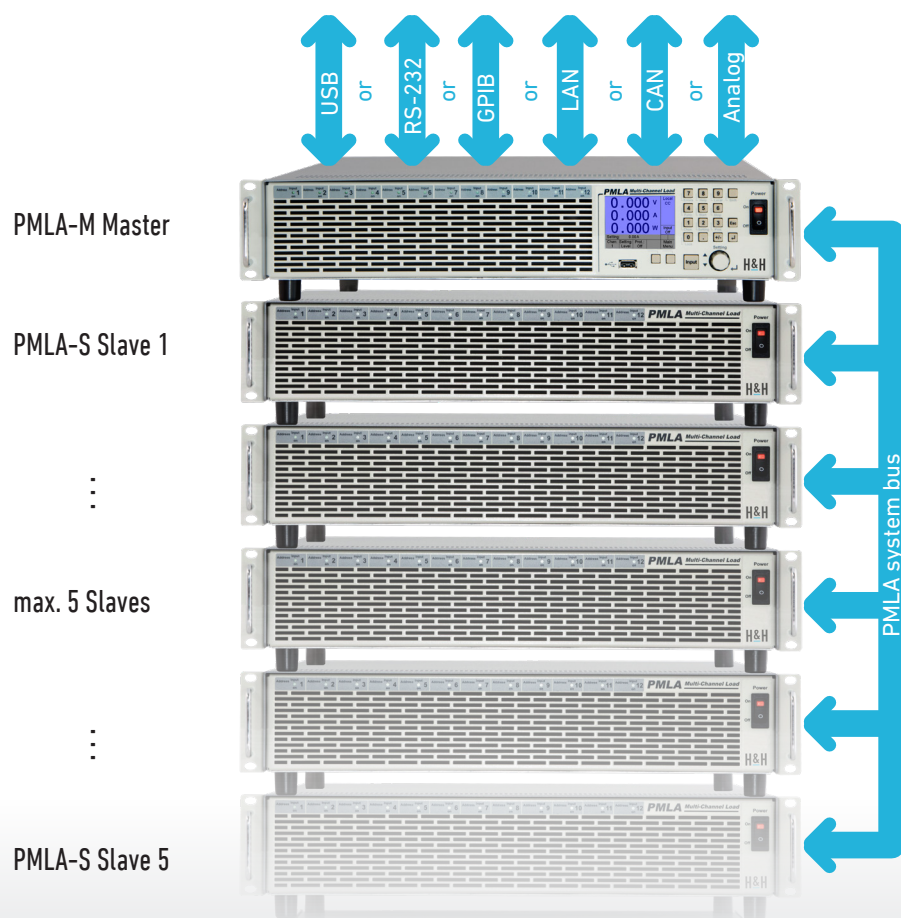
	150 W	300 W	450 W	600 W
40 V	MA15-04C30 30 A	MA30-04C60 60 A	MA45-04C90 90 A	MA60-04C120 120 A
60 V	MA15-06C20 20 A	MA30-06C40 40 A	MA45-06C60 60 A	MA60-06C80 80 A
60 V	MA15-06C5 5 A	MA30-06C10 10 A	MA45-06C15 15 A	MA60-06C20 20 A
120 V	MA15-12C10 10 A	MA30-12C20 20 A	MA45-12C30 30 A	MA60-12C40 40 A
120 V	MA15-12C2 2 A	MA30-12C4 4 A	MA45-12C6 6 A	MA60-12C8 8 A
240 V	MA15-24C5 5 A	MA30-24C10 10 A	MA45-24C15 15 A	MA60-24C20 20 A
240 V	MA15-24C1 1 A	MA30-24C2 2 A	MA45-24C3 3 A	MA60-24C4 4 A

PMLA Series

Module (Order number)	Continuous power	Max. input voltage Vmax	Min. input voltage Vmin [1]	Max. current Imax	Rmin [2]	Rmax [3]	Rise/fall time [4]	Input capacity	Required mounting positions [5]
MA15-04C30	150 W	40 V	1 V	30 A	0.067 Ω	133 Ω	200 µs	1 µF	1
MA15-06C20	150 W	60 V	1 V	20 A	0.100 Ω	200 Ω	200 µs	1 µF	1
MA15-06C5	150 W	60 V	1 V	5 A	0.400 Ω	800 Ω	200 µs	1 µF	1
MA15-12C10	150 W	120 V	1 V	10 A	0.200 Ω	400 Ω	200 µs	1 µF	1
MA15-12C2	150 W	120 V	1 V	2 A	1.000 Ω	2.000 Ω	200 µs	1 µF	1
MA15-24C5	150 W	240 V	1 V	5 A	0.400 Ω	800 Ω	200 µs	1 µF	1
MA15-24C1	150 W	240 V	1 V	1 A	2.000 Ω	4.000 Ω	200 µs	1 µF	1
MA30-04C60	300 W	40 V	1 V	60 A	0.034 Ω	66 Ω	200 µs	2 µF	2
MA30-06C40	300 W	60 V	1 V	40 A	0.050 Ω	100 Ω	200 µs	2 µF	2
MA30-06C10	300 W	60 V	1 V	10 A	0.200 Ω	400 Ω	200 µs	2 µF	2
MA30-12C20	300 W	120 V	1 V	20 A	0.100 Ω	200 Ω	200 µs	2 µF	2
MA30-12C4	300 W	120 V	1 V	4 A	0.500 Ω	1.000 Ω	200 µs	2 µF	2
MA30-24C10	300 W	240 V	1 V	10 A	0.200 Ω	400 Ω	200 µs	2 µF	2
MA30-24C2	300 W	240 V	1 V	2 A	1.000 Ω	2.000 Ω	200 µs	2 µF	2
MA45-04C90	450 W	40 V	1 V	90 A	0.023 Ω	44 Ω	200 µs	3 µF	3
MA45-06C60	450 W	60 V	1 V	60 A	0.034 Ω	66 Ω	200 µs	3 µF	3
MA45-06C15	450 W	60 V	1 V	15 A	0.134 Ω	266 Ω	200 µs	3 µF	3
MA45-12C30	450 W	120 V	1 V	30 A	0.067 Ω	133 Ω	200 µs	3 µF	3
MA45-12C6	450 W	120 V	1 V	6 A	0.334 Ω	666 Ω	200 µs	3 µF	3
MA45-24C15	450 W	240 V	1 V	15 A	0.134 Ω	266 Ω	200 µs	3 µF	3
MA45-24C3	450 W	240 V	1 V	3 A	0.667 Ω	1.333 Ω	200 µs	3 µF	3
MA60-04C120	600 W	40 V	1 V	120 A	0.017 Ω	33 Ω	200 µs	4 µF	4
MA60-06C80	600 W	60 V	1 V	80 A	0.025 Ω	50 Ω	200 µs	4 µF	4
MA60-06C20	600 W	60 V	1 V	20 A	0.100 Ω	200 Ω	200 µs	4 µF	4
MA60-12C40	600 W	120 V	1 V	40 A	0.050 Ω	100 Ω	200 µs	4 µF	4
MA60-12C8	600 W	120 V	1 V	8 A	0.250 Ω	500 Ω	200 µs	4 µF	4
MA60-24C20	600 W	240 V	1 V	20 A	0.100 Ω	200 Ω	200 µs	4 µF	4
MA60-24C4	600 W	240 V	1 V	4 A	0.500 Ω	1.000 Ω	200 µs	4 µF	4

1. Minimum input voltage for maximum static load current, linear derating to 0 V.
2. Minimum adjustable resistance
3. Maximum adjustable resistance
4. Rise and fall times are defined from 10 … 90 % of the maximum current in "fast" regulation speed. Rise/fall time in "slow" regulation speed: ca. 1 ms.
5. Required mounting positions on the cooling unit. A module cannot be split over several cooling units.

Number of channels

Channels per device	max. 12 [1]
Channels per system	max. 72 [1]

Operating modes

Basic operating modes	CC, CP, CR, CV
Combined operating modes	CC+CV, CP+CV, CR+CV, CP+CC, CR+CC, CV+CC

Accuracy of setting

	of setting	of corresponding range
Voltage	±0.1 %	±0.1 %
Current	40 V/60 V modules ±0.25% others ±0.1 %	±0.1 %
Resistance (at 5 % to 100 % of voltage range)	40 V/60 V modules ±2.8 % others ±1.4 %	±0.3 % of current range
Power (at V and I > 10 % of range) (at V or I 5 ... 10 % of range)	40 V/60 V modules ±1.4 % others ±0.7 % 40 V/60 V modules ±4 % others ±2 %	
Resolution	12 bits	

Accuracy of adjustable protections

	of setting	of corresponding range
Overcurrent protection	40 V/60 V modules ±0.4% others ±0.2 %	±0.2 %
Undervoltge protection	±0.2 %	±0.2 %
Resolution	12 bits	

Accuracy of measurement

	of measured value (real value)	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	40 V/60 V modules ±0.4 % others ±0.2 %	±0.05 %
Resistance	calculated from voltage and current	
Power	calculated from voltage and current	
Resolution	16 bits	
Sampling time	100 µs, not triggerable	

Accuracy of display (user interface)

Display user interface	Accuracy of corresponding measurement ±1 digit of displayed value

Dynamic function (LIST)

Number of load levels	max. 100, with corresponding ramp and dwell time	
	min.	max.
Dwell time	1 ms	100 s
Ramp time	0 s	100 s
Resolution	1 ms	
Accuracy of setting times	±0.02 %	
Delay time at triggered start	max. 200 µs	

Data acquisition

	of measured (actual) value	of corresponding range
Accuracy voltage	±0.1 %	±0.05 % ±1 LSB
Accuracy current	40 V/60 V modules ±0.4 % others ±0.2 %	±0.05 % ±1 LSB
Resolution	16 bits	

	to internal memory
Sampling time	1 ms ... 100 s, resolution 1 ms
Measurement data	timestamp, voltage, current
No. of measurement points	max. 100 per channel

Settings memory

No. of user settings	10, selectable (incl. programmed list)

I/O port: Accuracy analog control 0 ... 10 V

	of setting	of corresponding range
Voltage	±0.2 %	±0.1 %
Current	40 V/60 V modules ±0.4 % others ±0.2 %	±0.1 %
	Input resistance of analog inputs >10 kΩ GND max. 2 V [2] with respect to negative load input	

I/O port: control inputs

Control input	load input state on - off (per channel, low active)
Input level	3 ... 30 V

I/O port: Accuracy of analog monitor signals 0 ... 10 V

	of analog signal of real value	offset voltage
Voltage	±0.1 %	±15 mV
Current	40 V/60 V modules ±0.4 % others ±0.2 %	±15 mV
	Maximum load capacity 2 kΩ	

I/O port: permissible voltages

Vin-io (GND - neg. load input)	max. 2 V [2]
VioPE (GND - PE)	max. 100 V [2]
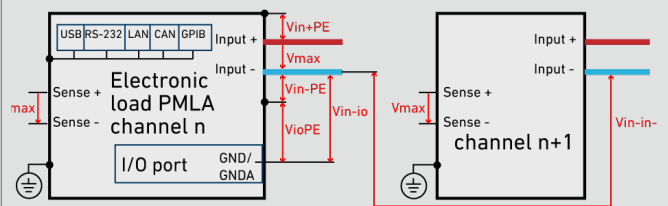
Input

Input resistance	>50 kΩ when load input is off diode function at reverse polarity up to nominal current
Input capacity	see module overview
Parallel operation	up to 5 channels in Master–Slave operation (hardware-controlled)
Maximum input voltage Vmax	see module overview
Minimum input voltage Vmin	see module overview
Continuous power	see module overview (at Ta = 21 °C)
Derating	–1,2 %/°C for Ta > 21 °C

Input: permissible voltages

Vin-PE (neg. load input - PE)	max. 100 V [2]
Vin+PE (pos. load input - PE)	Vmax + Vin-PE, but not more than 240 V [2]
Vin-in- (neg. load inputs between two channels)	max. 100 V [2]

Protection and monitoring

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

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. with all modules of 150 W
2. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

H&H   **Höcherl & Hackl**
The electronic load

Technical Data

Operating conditions

Operating temperature	5 ... 40 °C
Stock temperature	-25 ... 65 °C
Max. operating height	2000 m above sea level
Pollution degree	2
Max. humidity	80 % at 31 °C, linear decreasing to 50 % at 40 °C
Min. distance rear panel - wall or other objects	70 cm
Cooling	temperature-controlled air cooling
Noise	max. ca. 69 dB(A) measured in distance of 1 m
Mains voltage	1/N/PE AC 80 ... 264 V ±10 % 47 ... 63 Hz
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm²
Power consumption	max. 90 VA

Terminals

Load input	Phoenix Contact PH8/7.62-ST43, see starting at page 123
Sense	Sub-D at I/O port

Housing

Color
  Front
  Rear
  Side panels, top
	RAL7035 (light grey)
	stainless steel
	RAL7037 (dusty grey)

Housing
  Dimensions
  (B x H x T)
  3D models [1]
	19", 2 U
	485 x 88 x 485 mm (with mating connector, without feet)
	PMLA_M1 Master, PMLA_M10 Slave

Weight	max. 18.3 kg

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 55011 DIN EN 61326-1 DIN EN 61000-3-2 DIN EN 61000-3-3

Standard interfaces

Data interfaces	RS-232, USB, LAN (each only for Master)
I/O port	standard I/O port (not isolated)

Available options

Data interfaces PMLA02 PMLA03	 GPIB (only for Master) CAN (only for Master)
Hardware extensions PMLA15	 extra mating plug for 1x cooling unit

Calibration, warranty

FCC-PMLA/CH	Factory Calibration Certificate, 2 x for free
Warranty	2 years

PMLA-M Master
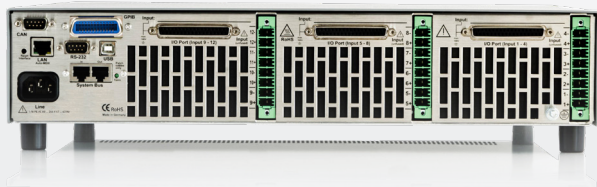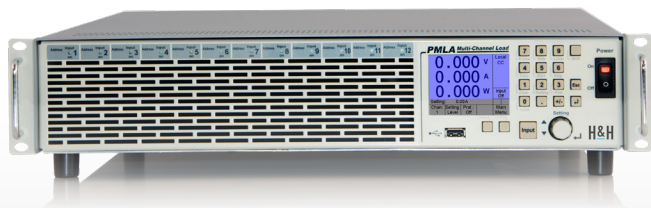
PMLA-S Slave
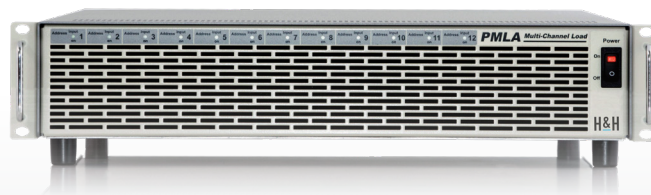
1.   1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.   Technical data of production series C, rev. 6. Subject to technical changes without notice.

Electronic AC and DC Loads

AC/THREE-PHASE LOAD ACL SERIES

ACL Series – Brief Profile

ACL series loads are suitable for DC and AC voltages up to 1,000 Hz.
There are single-phase models as well as three-phase loads which combine 3 channels or phases, respectively, in one housing.

The brilliant 4.3" touchscreen makes operation easy and convenient. Different waveforms are defined directly via the user interface, from phase angle and crest factor to harmonics and arbitrary current waveforms. Phase shifting between load current and voltage is possible in conjunction with crest factor or phase angle control.
The measured values are displayed numerically for all channels/phases or displayed in an oscil-loscope-like manner versus time in a graph.

The automatic amplitude correction keeps the RMS value of the current constant even with a variable crest factor.

- Frequency range up to 1,000 Hz
- Single and three-phase devices
- Parallel, star or delta connection
- Input voltage 280 V or 500 V
- Single-phase power from 500 … 21,000 W
- 3-phase power from 3 x 1,400 … 3 x 8,400 W
- User interface with 4.3" touchscreen
- Operation by mouse
- Operating modes CC, CR, CP, CV
- Arbitrary current waveforms
- Uninterrupted waveform change
- Synchronization to load input, line or extern
- Adjustable crest factor up to 4
- Automatic amplitude correction
- Phase shift combined with crest factor
- Harmonics up to 25th order, even and odd
- Phase cut from –180 … 180°
- Manual on board

Interfaces

- ◉ RS-232
- ◉ USB
- ◉ LAN
- ○ GPIB
- ◉ CAN
- ◉ System bus for Master-Slave operation
- — Analog
- ○ Analog isolated

◉ Standard   ○ Option   — not available

Operating Modes

The ACL series loads have constant current, constant resistance, constant power and constant voltage modes (CC, CR, CP, CV Mode).
In AC operation, the set waveform is applied to the load current, independent of the input voltage.
In resistance mode, the current level and waveform depend on the level and waveform of the input voltage. In power and voltage mode, the power or voltage is controlled by software by adjusting the input current.

Input Mode, Synchronization

The input mode defines the kind of voltage the electronic load expects at the input:
- DC: direct voltage
- AC: alternating voltage within the specified frequency range. Synchronization to
    - Input voltage
    - Line/mains voltage
    - External signal

Protection, Monitoring

- Adjustable overcurrent protection
- Overpower protection
- Overtemperature protection
- Overvoltage indication
- Undervoltage indication

I/O Port (Option ACL06)

Analog signals in realtime!

All inputs and outputs of the optional I/O port are galvanically isolated from the load input. The control inputs can be operated by 2 ... 24 V.
Signals for:
- Analog load setting from 0 ... 5 V or 0 ... 10 V in CC mode
- Input mode (AC, DC)
- Synchronization source (input, line, extern)
- Load activation
- Control source selection (intern, extern)
- Trigger input
- Trigger output
- Synchronization input
- Remote shut-down input
- Analog voltage monitor output 0 ... 7 V/0 ... 10 V
- Analog current monitor output 0 ... 7 V/0 ... 10V
- Analog monitor outputs as proportional AC curve (realtime waveform capture) or rms value, selectable
- Master output to control slave devices
- Programmable digital output
- Status output for load input activation
- Status output for overload

Factory Calibration Certificate (FCC-ACLxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.

Connection Examples

Single and 3-Phase Loads

Besides single-channel AC loads ACLS, the models of the ACLT series have been developed for loading three-phase systems. They combine 3 AC load channels in one housing. The 3 load channels can be used to load 3 different DUTs in AC or DC operation or to test a three-phase system. In the so-called balanced mode, all channels are loaded with the same setpoint and the same waveform. In synchronization mode Line, channel A synchronizes to the mains voltage, channels B and C are each phase-shifted by 120°.

To increase the maximum load current, 2 or 3 channels of an ACLT three-phase device or up to 3 ACLS single-phase devices can be connected in parallel.

Star Connection with 3-Phase Load
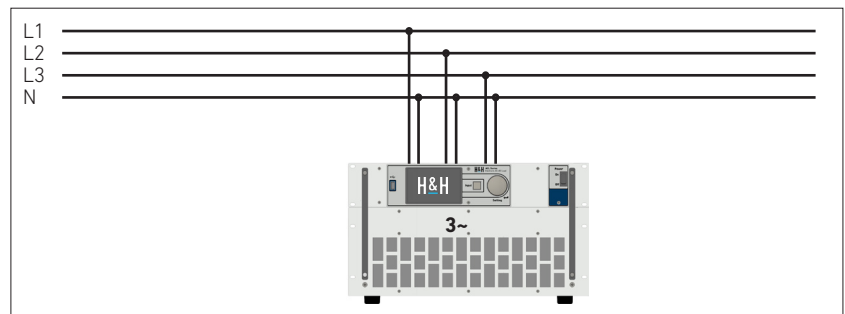
Star connection with ACLT 3-phase load

Delta Connection with 3 Single-Phase Loads in Master-Slave Connection
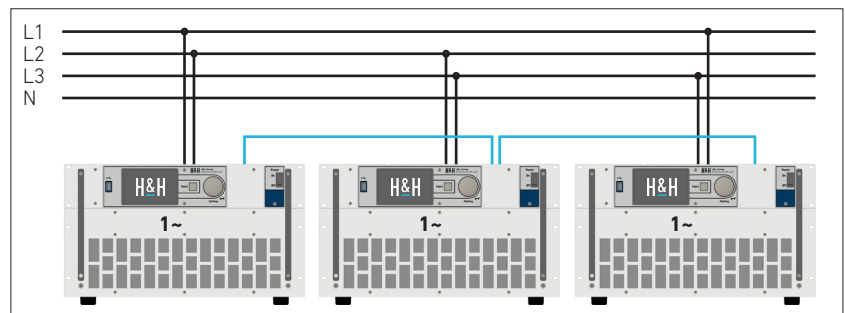
3-phase system in delta connection with 3 x ACLS single-phase loads in Master-Slave mode

Multi-Channel System with different DUTs
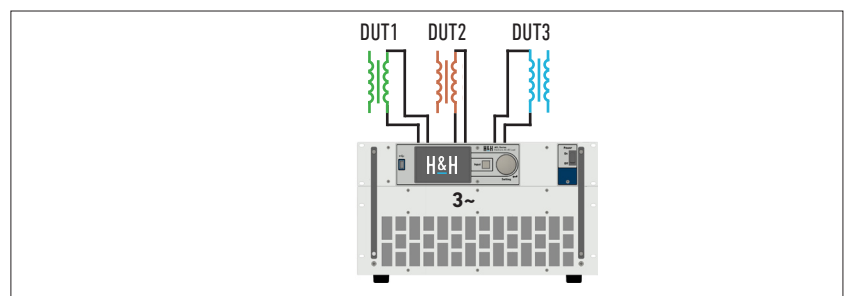
ACLT 3-phase load for 3 different DUTs

Parallel Connection of Several Channels
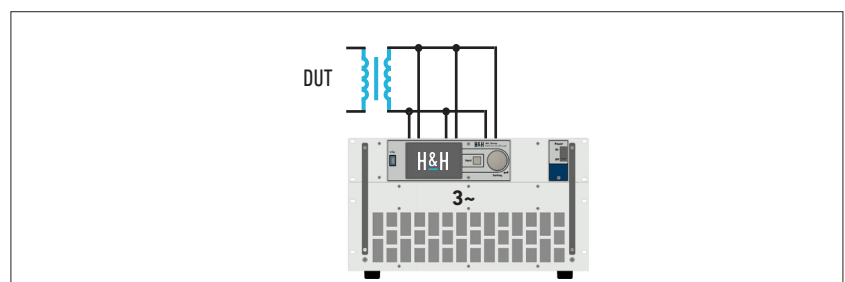
ACLT 3-phase load with paralleled inputs to increase current and power

H&H Höcherl & Hackl
The electronic load

Operation

User Interface
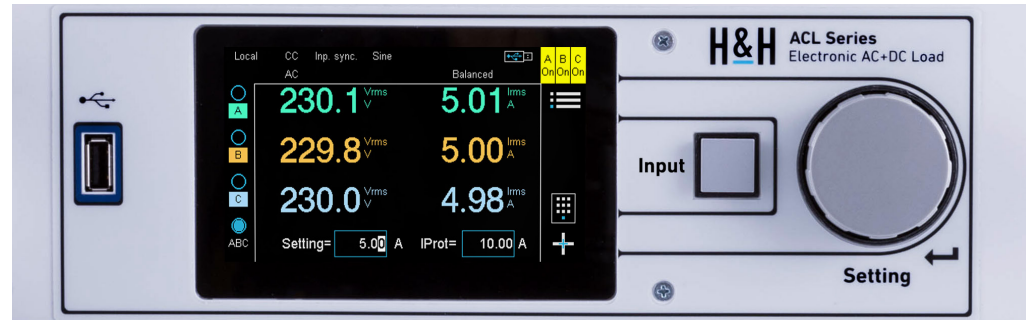
Operating elements

In addition to the load input, which is controlled by a large push-button, and the rotary knob for adjusting the setting value, the devices are operated by intuitive menu navigation via a 4.3" touch display like it is known with smartphones. If you prefer to operate by mouse, you can use the USB port on the front. The most common functions can be accessed via shortcuts. An associated help window is available for each dialog window, explaining the meaning of the respective elements. The help language can be set to German or English.
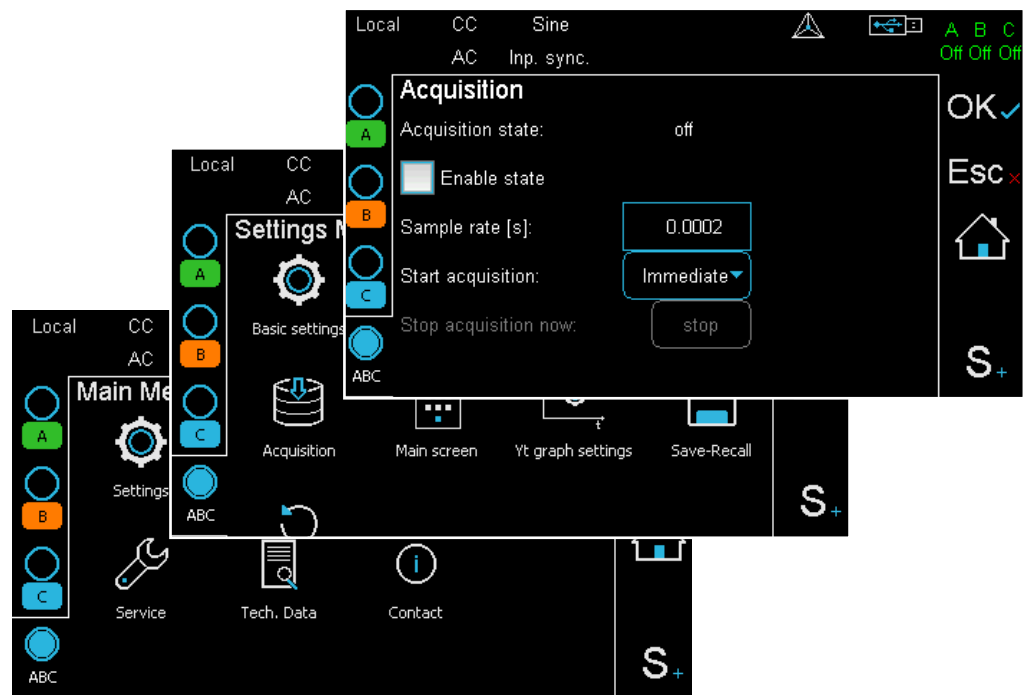
Menu-driven operation

Manual on Board

The ACL series user manual is stored in PDF format in the internal device memory. This can be copied to a USB flash drive or, conversely, updated from a USB flash drive if a newer version is available, e.g. after a firmware update with new functions. Thus, the user manual corresponding to the installed firmware doesn't get lost.

Waveforms

Crest Factor

CF = 2.3
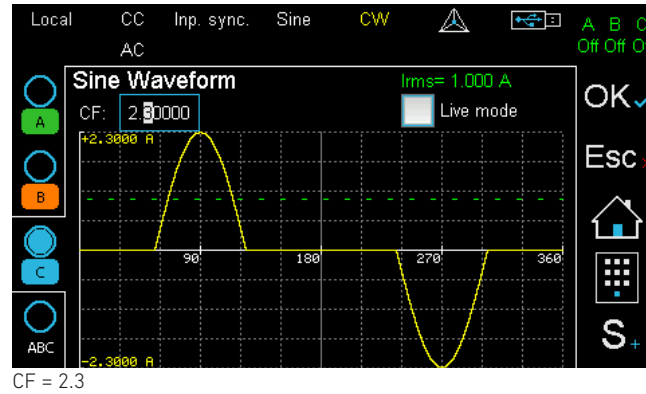
For sine waveforms the crest factor (CF) can be adjusted from 1.4142 to 4.0. The load corrects the resulting amplitude so that the RMS value remains constant.

Phase Cut, Phase Shift

CF = 2, PC = 90°, PS = -90 °
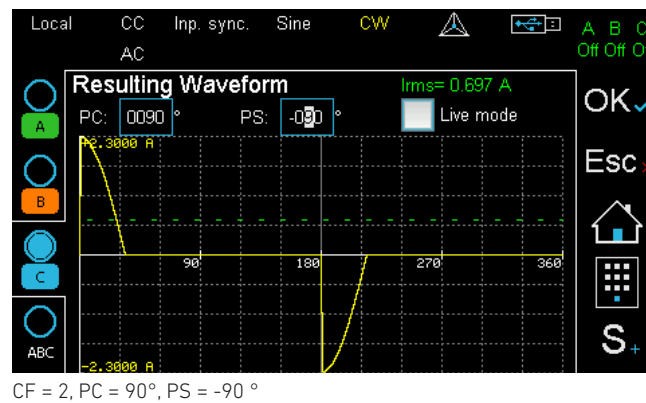
For each waveform, a phase cut (PC) and a phase shift (PS) of the current waveform can be set in the range from -180 to +180°. Depending on the phase angle, the RMS value of the current changes.

The phase shift must be combined with a phase cut or a crest factor. A phase shift in the sense of a purely capacitive or inductive load is not possible.

Harmonics

Sine with harmonics
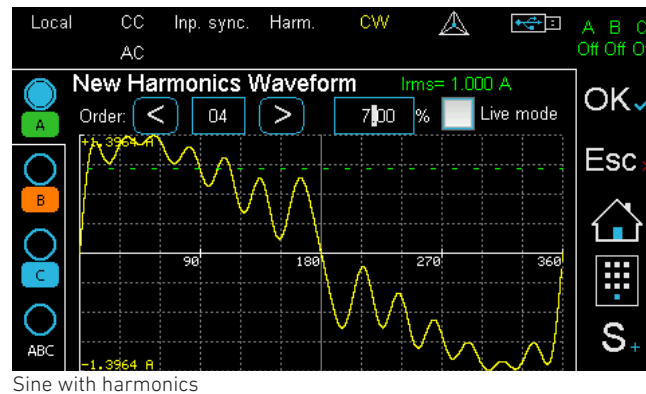
In the waveform with harmonics, the amplitudes of the basic wave normalized from 0 to 1 as well as the up to 24 harmonics (even and odd) are summed up. The load corrects the resulting amplitude so that the RMS value remains constant.

Arbitrary Waveforms

Arbitrary waveform on the base of a triangle
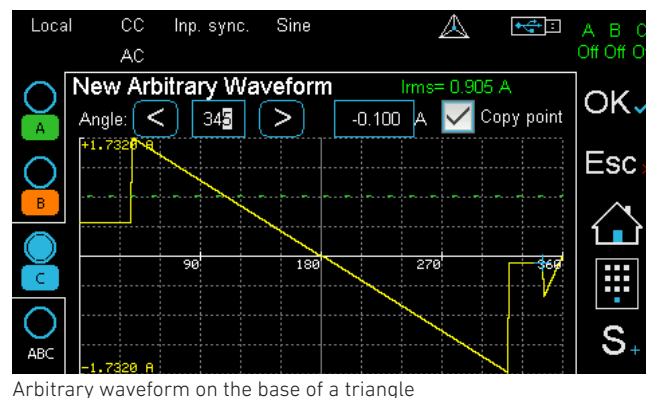
The definition of a period with 360 single points ensures maximum flexibility. The basis is either a sine, a square or a triangle signal, which can then be changed point by point. Depending on the waveform, the RMS value of the current changes.

Functions

Load Profile (List Function)
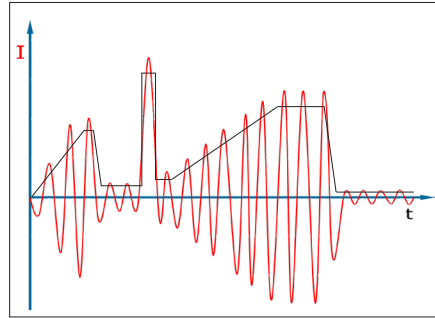
List function as RMS load profile

In all operating modes, the ACL load can emulate load profiles by means of the LIST function. Up to 300 setpoints of variable duration with associated ramp times are possible. In AC mode, the LIST function serves as a load profile of RMS values with the active waveform.

Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Rectangular Function
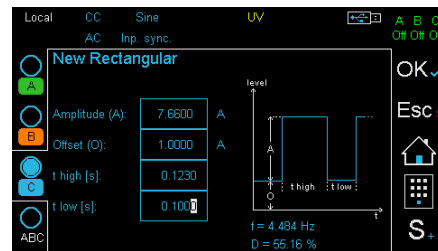
Likewise for all operating modes, the rectangle function offers a simple variant for changing between 2 setting values with adjustable durations. In AC mode, the rectangle function serves as a load profile of 2 rms values with the active waveform.

Data Acquisition (DAQ)

The electronic load can also store synchronous data records of voltage and current with time stamp in a defined interval, independent of the LIST function. Up to 40,000 data records are stored in a ring buffer. Once recording is complete, the data is read out via a data interface or transferred to a USB flash drive.

Static Data Logging

During slow processes, the electronic load can store voltage and current with timestamps directly on a USB flash drive in local mode. Sampling intervals are in the range of seconds.

Trigger Model

In remote operation via a data interface, several functions can be activated by a configurable trigger event:
- Activation/deactivation of list execution
- Activation/deactivation of data acquisition
- Activation/deactivation of load input
- Setting of all triggered setting values of all operating modes

Available trigger sources: Extern (with opt. I/O port), Bus.

Save Settings

In order to quickly reconstruct frequently recurring test tasks, the settings active in the electronic load can be stored non-volatile so that they can be reloaded later on. 9 memory positions are available.

The ACL load can optionally set the reset state when switching on, the last active settings at power-off or memory positions 1 to 9.

Watchdog Function

To protect the DUT from communication problems, the electronic load in digital remote control mode has a watchdog function that switches off the load input if the previously programmed watchdog delay time expires without the watchdog being reset.

The watchdog delay time is set by SCPI command, another command activates the watchdog. When the watchdog is active, a control program must ensure that the command to reset the watchdog is periodically sent to the electronic load.

Measurement and Display

Display of Measurements

Depending on the focus on the display, more or less measured values are shown per channel. A single-phase ACLS device displays the following measured values in the main display:
RMS value voltage, RMS value current, resistance, active power, apparent power, distortion reactive power, frequency, power factor, crest factor.
If all channels ABC of a multi-channel or three-phase device are focused, the effective value of the voltage and the effective value of the current are displayed for each channel.
All these measured variables can be queried via one of the data interfaces using a SCPI command.
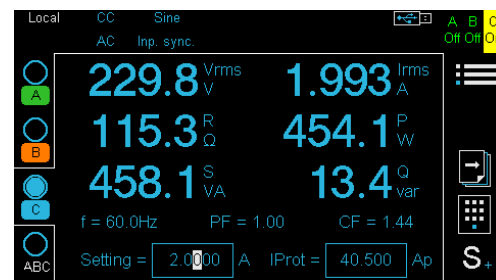
Main View 1 channel
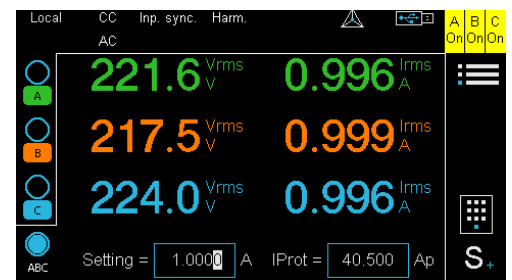
Main View 3 channels

Waveform Display

The last measured period of current and voltage is measured with 360 points and displayed in the Measured Waveform dialog.
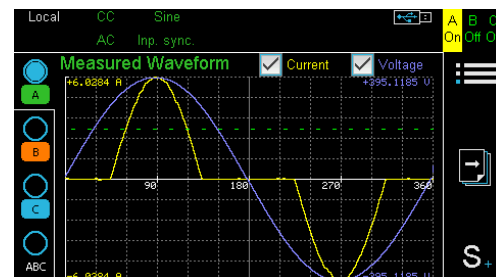
Crest factor affected current with AC voltage
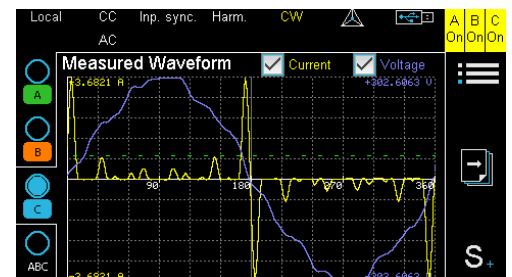
Current superimposed by Harmonics with line voltage

Yt Graph

The Yt-Graph shows the time course of the RMS value of voltage, current and/or power of the focused channel.
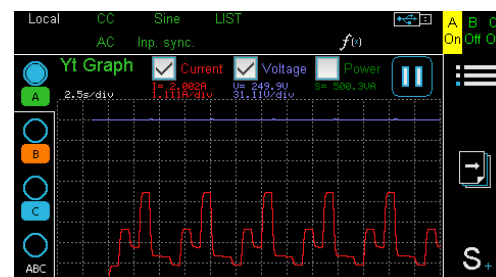
Yt Graph with running List function

H&H Höcherl & Hackl
The electronic load

| Drivers | | Current NI-certified LabVIEW drivers can be downloaded here: www.ni.com/downloads/instrument-drivers/ |

Drivers

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

Cooling

The units are air-cooled. In order to keep the operating noise low, for sizes starting from 5 U, the fans are controlled according to temperature and current.

Mechanics

Retractable handle

The ACL series is designed in stable 19" technology and can also be used as a desktop unit. From 5 U there are retractable heavy-duty carrying handles on the top of the unit.
No separate mounting kits are required for 19" installation.

**Castors
(Option ACL14)**

Heavy-load castors

Steerable castors can be mounted on big devices for easier transport. This often saves the need for a 19" cabinet.
This option is available for units with 5 U and higher.

Options and Accessories

Order number	Article	Description
52-200-001-25	ACL02	GPIB interface
67-004-030-25	K-RS-SNM 9-9	RS-232 cable (Nullmodem cable)
53-100-009-25	ACL06	Galvanically isolated I/O port (3 x necessary for ACLT)
64-400-000-25	ACL14	Heavy-load castors for devices from 5 U (1 set = 4 pieces)
65-002-000-25	FCC-ACLSxx	Factory Calibration Certificate single-phase load
65-002-001-25	FCC-ACLTxx	Factory Calibration Certificate 3-phase load
63-000-001-25	PH3/7.62-BU41	Additional mating connector for load terminal single-phase load up to 40 A
63-000-002-25	PH3/10.16-BU76	Additional mating connector for load terminal single-phase load up to 75 A
63-000-003-25	PH3/15-BU125	Additional mating connector for load terminal single-phase load up to 120 A
63-000-004-25	PH7/10.16-BU76	Additional mating connector for load terminal 3-phase load
63-000-005-25	PH2/7.62-ST16	Additional mating connector for sense terminal of one channel
63-000-004-00	SENSADAPT/PH2/POK/1200V	Sense adapter from Phoenix PH2 to 4 mm touch-protected binding post, max. 1200 V
67-036-020-25	K-MS-ACL	Master-Slave cable I/O port (2 m)
67-001-020-25	Patch cable 2 m	Patch-Kabel 1:1 blue, 2 m
63-000-006-25	SubD25 Doubler	Adapter 1x Sub-D 25 male connector to 2x Sub-D 25 female connector for I/O port
49-001-000-25	SX	Modified setting range for ACL series only after consulting H&H
49-002-000-25	SSX	Customized setting range for ACL series only after consulting H&H

Load cables see starting at page 127
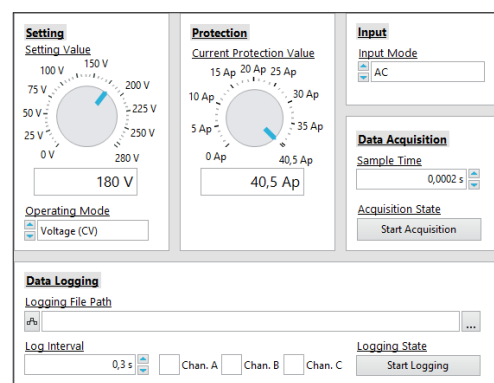
Software Tool

Setting Menu
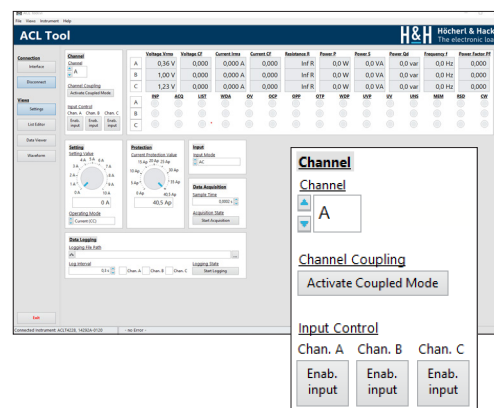
The ACL Tool is a control software for electronic loads of ACL series.

Besides the "Channel Coupling" setting, which is useful for three-phase applications, the load inputs of the existing channels can be controlled directly from any function view.

**www.hoecherl-hackl.com**
–> Download area

Basic Settings

The most important device settings are made in the main window (Basic Settings).

These are, in addition to the basic operating mode of the control with the associated setpoint, the peak value of the current protection, AC or DC mode and the data acquisition.

There are two different types of data acquisition: a high-resolution one, whose measurement data is stored internally in the load, and a low-resolution one for long measurement processes, which is controlled by the software tool and saves the data to a CSV file on the PC.

Waveforms
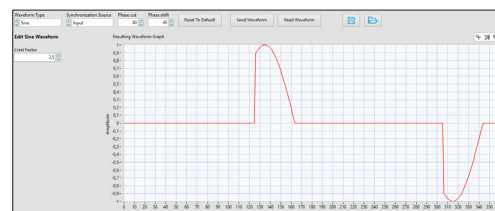
Sinusoidal waveform
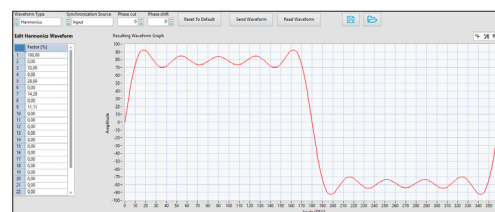
Harmonic waveform

Arbitrary waveform

In the "Waveform Editor" function view, the AC waveform of the load current and its synchronization source can be configured. The waveforms can be created, edited, exported and imported in the ACL tool.

All waveforms can be modified by crest factor, phase cut and phase shift. Phase shifting is only possible in combination with crest factor or phase cutting.

- Sinusoidal waveform

- Harmonic waveform

A harmonic waveform can be configured by entering the percentages of even and odd harmonics up to the 25th order.

- Arbitrary waveform

Arbitrary waveforms are possible with 360 individually editable points. For ease of use, the arbitrary waveform can be derived from a sinusoidal, triangular or rectangular reference waveform.

List Editor
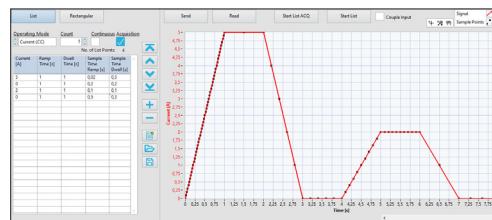
The „List" function view offers the following functions and settings:

- Defining a load profile in the chosen operating mode
- Number of iterations
- Synchronous data acquisition with individual sample rate for each load profile section
- Loading a *.LST load profile
- Saving the generated load profile as *.LST file (e.g. for direct list import from a USB mass storage device at the electronic load)

Rectangle Editor
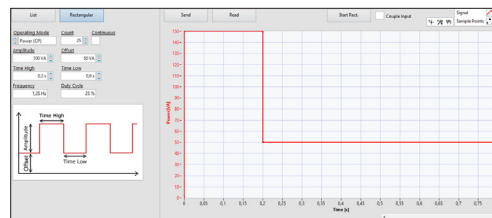
In the "Rectangular" function view, a simple square wave signal is defined by amplitude, offset, dwell time "Time High" as well as dwell time "Time Low". From this, frequency and duty cycle are calculated and displayed.

Measurement and Status Bar

The display elements of the measured value and status bar show currently measured values as well as important status signals of all available channels of the system.

Data Viewer
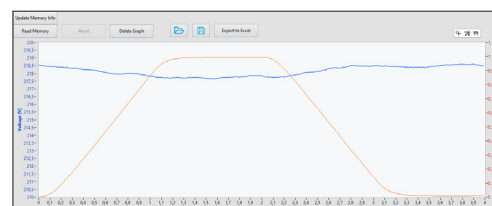
Measured values from the device's own measurement memory can be read from the device using the Data Viewer or as a CSV file from a storage medium and displayed graphically. The data can then in turn be saved as a CSV file on a memory medium for further processing.

Model (Order Number)	ACLS528	ACLS1028	ACLS1428	ACLS2828	ACLS4228
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	280 V AC	280 V AC	280 V AC	280 V AC	280 V AC
Maximum DC input voltage VmaxDC	400 V DC	400 V DC	400 V DC	400 V DC	400 V DC
Minimum input voltage Vmin[1]	6 V	6 V	6 V	6 V	6 V
Maximum current Imax	4 A	8 A	10 A	20 A	30 A
Maximum peak current Ipmax[2]	16 A	32 A	40 A	80 A	120 A
Power	500 W	1,000 W	1,400 W	2,800 W	4,200 W
Resistance	1.5 ... 991 Ω	0.75 ... 496 Ω	0.6 ... 396 Ω	0.3 ... 198 Ω	0.2 ... 132 Ω
Rise/fall time[3]	20 µs	20 µs	25 µs	20 µs	11 µs
Input capacity DC mode ca.	0,2 µF	0,3 µF	3,5 µF	7 µF	11 µF
Load terminals[4] rear	SBUS4-32	SBUS4-32	PH3/7.62-ST41	PH3/7.62-ST41	PH3/7.62-ST41
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	115 VA	178 VA	225 VA	380 VA	540 VA
Noise max. ca. [6]	70 dB(A)	71 dB(A)	72 dB(A)	72 dB(A)	73 dB(A)
Weight ca.	13.5 kg	15.5 kg	29.5 kg	35 kg	41 kg
Housing / 3D model[7]	19", 2 U / ACL_M14	19", 2 U / ACL_M14	19", 5 U / ACL_M8	19", 5 U / ACL_M8	19", 5 U / ACL_M8

Model (Order Number)	ACLS5628	ACLS7028	ACLS8428	ACLS9828	ACLS11228
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	280 V AC	280 V AC	280 V AC	280 V AC	280 V AC
Maximum DC input voltage VmaxDC	400 V DC	400 V DC	400 V DC	400 V DC	400 V DC
Minimum input voltage Vmin[1]	6 V	6 V	6 V	6 V	6 V
Maximum current Imax	40 A	50 A	60 A	70 A	80 A
Maximum peak current Ipmax[2]	160 A	200 A	240 A	280 A	320 A
Power	5,600 W	7,000 W	8,400 W	9,800 W	11,200 W
Resistance	0.15 ... 99 Ω	0.12 ... 79 Ω	0.10 ... 66 Ω	0.09 ... 57 Ω	0.08 ... 50 Ω
Rise/fall time[3]	20 µs	20 µs	10 µs	15 µs	20 µs
Input capacity DC mode ca.	14 µF	18 µF	21 µF	25 µF	28 µF
Load terminals[4] rear	PH3/7.62-ST41	PH3/10.16-ST76	PH3/10.16-ST76	PH3/15-ST125	PH3/15-ST125
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	–
Power consumption	650 VA	800 VA	1055 VA	1175 VA	1160 VA
Noise max. ca. [6]	74 dB(A)	74 dB(A)	75 dB(A)	75 dB(A)	75 dB(A)
Weight ca.	55 kg	59 kg	74 kg	88 kg	100 kg
Housing / 3D model[7]	19", 8 U / ACL_M9	19", 8 U / ACL_M9	19", 10 U / ACL_M10	19", 13 U / ACL_M11	19", 13 U / ACL_M11

1.   Minimum input voltage for maximum static load current.
2.   Maximum peak current at maximum crest factor.
3.   Rise and fall times are from 10 ... 90 % and 90 ... 10 % of maximum current (CC mode, tolerance ±20 %).
4.   Description of available terminals beginning at page 123.
5.   Mains voltage tolerance: ±10 %.
6.   Measured at the front in distance of 1 m.
7.   1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview Single-Phase 280 V

Model (Order Number)	ACLS12628	ACLS14028	ACLS15428RV[8]	ACLS16828RV[8]	ACLS18228RV[8]
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	280 V AC	280 V AC	280 V AC	280 V AC	280 V AC
Maximum DC input voltage VmaxDC	400 V DC	400 V DC	400 V DC	400 V DC	400 V DC
Minimum input voltage Vmin[1]	6 V	6 V	30 V	30 V	30 V
Maximum current Imax	90 A	100 A	110 A	120 A	120 A
Maximum peak current Ipmax[2]	360 A	400 A	440 A	480 A	480 A
Power	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Resistance	0.07 .. 44 Ω	0.06 ... 40 Ω	0.27 ... 36 Ω	0.25 ... 33 Ω	0.25 ... 33 Ω
Rise/fall time[3]	20 µs	20 µs	21 µs	20 µs	20 µs
Input capacity DC mode ca.	32 µF	35 µF	39 µF	43 µF	46 µF
Load terminals[4] rear	PH3/15-ST125	PH3/15-ST125	PH3/15-ST125	PH3/15-ST125	PH3/15-ST125
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	-	-	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	1300 VA	1440 VA	702 VA	755 VA	770 VA
Noise max. ca. [6]	76 dB(A)	80 dB(A)	81 dB(A)	81 dB(A)	82 dB(A)
Weight ca.	107 kg	116 kg	102 kg	105 kg	130 kg
Housing / 3D model[7]	19", 13 U / ACL_M11	19", 16 U / ACL_M12	19", 14 U / ACL_M21	19", 14 U / ACL_M21	19", 17 U / ACL_M22

Model (Order Number)	ACLS19628RV[8]	ACLS21028RV[8]	ACLS22428RV[8]
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	280 V AC	280 V AC	280 V AC
Maximum DC input voltage VmaxDC	400 V DC	400 V DC	400 V DC
Minimum input voltage Vmin[1]	30 V	30 V	30 V
Maximum current Imax	120 A	120 A	120 A
Maximum peak current Ipmax[2]	480 A	480 A	480 A
Power	19,600 W	21,000 W	22,400 W
Resistance	0.25 ... 33 Ω	0.25 ... 33 Ω	0.25 ... 33 Ω
Rise/fall time[3]	20 µs	20 µs	15 µs
Input capacity DC mode ca.	50 µF	53 µF	56 µF
Load terminals[4] rear	PH3/15-ST125	PH3/15-ST125	PH3/15-ST125
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	840 VA	934 VA	1,000 VA
Noise max. ca. [6]	82 dB(A)	83 dB(A)	83 dB(A)
Weight ca.	138 kg	128 kg	140 kg
Housing / 3D model[7]	19", 17 U / ACL_M22	19", 17 U / ACL_M22	19", 20 U / ACL_M23

1. Minimum input voltage for maximum static load current.
2. Maximum peak current at maximum crest factor.
3. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of maximum current (CC mode, tolerance ±20 %).
4. Description of available terminals beginning at page 123.
5. Mains voltage tolerance: ±10 %.
6. Measured at the front in distance of 1 m.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.
8. RV: Restricted Voltage. Models with increased minimum voltage.

Model Overview Single-Phase 500 V

Model (Order Number)	ACLS550	ACLS1050	ACLS1450	ACLS2850	ACLS4250
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	500 V AC	500 V AC	500 V AC	500 V AC	500 V AC
Maximum DC input voltage VmaxDC	700 V DC	700 V DC	700 V DC	700 V DC	700 V DC
Minimum input voltage Vmin[1]	10 V	10 V	10 V	10 V	10 V
Maximum current Imax	2 A	4 A	5 A	10 A	15 A
Maximum peak current Ipmax[2]	8 A	16 A	20 A	40 A	60 A
Power	500 W	1,000 W	1,400 W	2,800 W	4,200 W
Resistance	5.0 ... 3540 Ω	2.5 ... 1770 Ω	2.0 ... 1416 Ω	1.0 ... 708 Ω	0.67 ... 472 Ω
Rise/fall time[3]	20 µs	20 µs	20 µs	10 µs	20 µs
Input capacity DC mode ca.	0.2 µF	0.3 µF	3.3 µF	7 µF	10 µF
Load terminals[4] rear	SBUS4-32	SBUS4-32	PH3/7.62-ST41	PH3/7.62-ST41	PH3/7.62-ST41
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	110 VA	140 VA	150 VA	270 VA	300 VA
Noise max. ca. [6]	70 dB(A)	71 dB(A)	71 dB(A)	72 dB(A)	73 dB(A)
Weight ca.	13.5 kg	16 kg	29 kg	35 kg	43 kg
Housing / 3D model[7]	19", 2 U / ACL_M14	19", 2 U / ACL_M14	19", 5 U / ACL_M8	19", 5 U / ACL_M8	19", 5 U / ACL_M8

Model (Order Number)	ACLS5650	ACLS7050	ACLS8450	ACLS9850	ACLS11250
Frequency	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC	500 V AC	500 V AC	500 V AC	500 V AC	500 V AC
Maximum DC input voltage VmaxDC	700 V DC	700 V DC	700 V DC	700 V DC	700 V DC
Minimum input voltage Vmin[1]	10 V	10 V	10 V	10 V	10 V
Maximum current Imax	20 A	25 A	30 A	35 A	40 A
Maximum peak current Ipmax[2]	80 A	100 A	120 A	140 A	160 A
Power	5,600 W	7,000 W	8,400 W	9,800 W	11,200 W
Resistance	0.5 ... 354 Ω	0.40 ... 283 Ω	0.33 ... 236 Ω	0.29 ... 202 Ω	0.25 ... 177 Ω
Rise/fall time[3]	22 µs	20 µs	10 µs	20 µs	20 µs
Input capacity DC mode ca.	13 µF	16 µF	20 µF	23 µF	26 µF
Load terminals[4] rear	PH3/7.62-ST41	PH3/7.62-ST41	PH3/7.62-ST41	PH3/7.62-ST41	PH3/10.16-ST76
Mains voltage[5]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Power consumption	500 VA	500 VA	800 VA	675 VA	760 VA
Noise max. ca. [6]	74 dB(A)	74 dB(A)	74 dB(A)	75 dB(A)	75 dB(A)
Weight ca.	53 kg	59 kg	64 kg	79 kg	84 kg
Housing / 3D model[7]	19", 8 U / ACL_M17	19", 8 U / ACL_M17	19", 8 U / ACL_M17	19", 11 U / ACL_M15	19", 11 U / ACL_M16

1. Minimum input voltage for maximum static load current.
2. Maximum peak current at maximum crest factor.
3. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of maximum current (CC mode, tolerance ±20 %).
4. Description of available terminals beginning at page 123.
5. Mains voltage tolerance: ±10 %.
6. Measured at the front in distance of 1 m.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

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The electronic load

Model Overview Single-Phase 500 V

Model (Order Number)	ACLS12650	ACLS14050	ACLS15450	ACLS16850	ACLS18250
Frequency	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz
Maximum AC input voltage VmaxAC	500 V AC	500 V AC	500 V AC	500 V AC	500 V AC
Maximum DC input voltage VmaxDC	700 V DC	700 V DC	700 V DC	700 V DC	700 V DC
Minimum input voltage Vmin[1]	10 V	10 V	10 V	10 V	10 V
Maximum current Imax	45 A	50 A	55 A	60 A	65 A
Maximum peak current Ipmax[2]	180 A	200 A	220 A	240 A	260 A
Power	12,600 W	14,000 W	15,400 W	16,800 W	18,200 W
Resistance	0.22 … 157 Ω	0.20 … 142 Ω	0.18 .. 129 Ω	0.17 … 118 Ω	0.15 … 109 Ω
Rise/fall time[3]	20 µs	18 µs	20 µs	20 µs	20 µs
Input capacity DC mode ca.	30 µF	33 µF	36 µF	39 µF	43 µF
Load terminals[4] rear	PH3/10.16-ST76	PH3/10.16-ST76	PH3/10.16-ST76	PH3/10.16-ST76	PH3/10.16-ST76
Mains voltage[5]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	850 VA	1150 VA	1030 VA	1120 VA	1200 VA
Noise max. ca. [6]	76 dB(A)	77 dB(A)	80 dB(A)	81 dB(A)	82 dB(A)
Weight ca.	91 kg	99 kg	121 kg	126 kg	130 kg
Housing / 3D model[7]	19", 11 U / ACL_M16	19", 14 U / ACL_M20	19", 16 U / ACL_M18	19", 16 U / ACL_M18	19", 19 U / ACL_M19

Model (Order Number)	ACLS19650	ACLS21050
Frequency	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz
Maximum AC input voltage VmaxAC	500 V AC	500 V AC
Maximum DC input voltage VmaxDC	700 V DC	700 V DC
Minimum input voltage Vmin[1]	10 V	10 V
Maximum current Imax	70 A	75 A
Maximum peak current Ipmax[2]	140 A	160 A
Power	19,600 W	21,000 W
Resistance	0.14 … 101 Ω	0.13 … 94 Ω
Rise/fall time[3]	20 µs	20 µs
Input capacity DC mode ca.	46 µF	49 µF
Load terminals[4] rear	PH3/15-ST125	PH3/15-ST125
Mains voltage[5]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable[5]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz
Power consumption	1290 VA	1380 VA
Noise max. ca. [6]	82 dB(A)	83 dB(A)
Weight ca.	138 kg	146 kg
Housing / 3D model[7]	19", 19 U / ACL_M19	19", 19 U / ACL_M19

1. Minimum input voltage for maximum static load current.
2. Maximum peak current at maximum crest factor.
3. Rise and fall times are from 10 … 90 % and 90 … 10 % of maximum current (CC mode, tolerance ±20 %).
4. Description of available terminals beginning at page 123.
5. Mains voltage tolerance: ±10 %.
6. Measured at the front in distance of 1 m.
7. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.
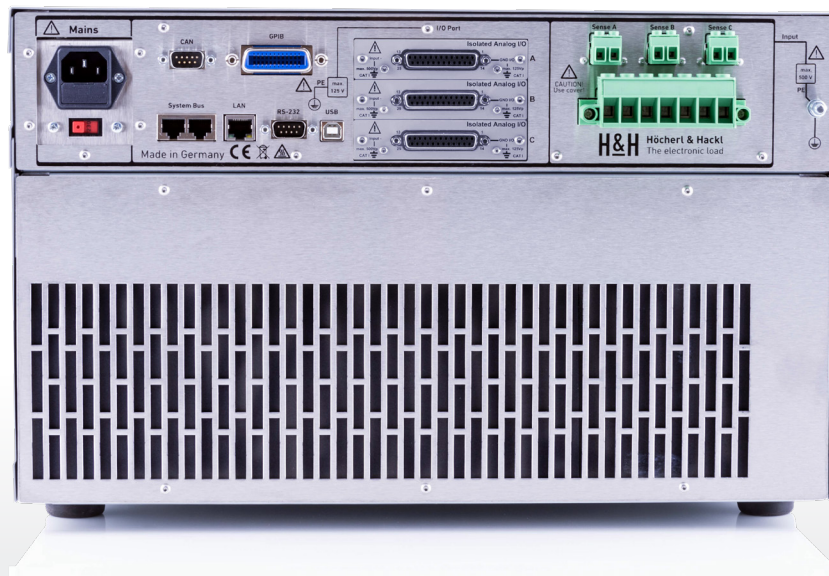
Model Overview 3-Phase 280 V

Model (Order Number)	ACLT4228	ACLT8428	ACLT12628	ACLT16828	ACLT21028
Frequency[1]	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz	DC, 40 … 1,000 Hz
Maximum AC input voltage VmaxAC[1]	280 V AC	280 V AC	280 V AC	280 V AC	280 V AC
Maximum DC input voltage VmaxDC[1]	400 V DC	400 V DC	400 V DC	400 V DC	400 V DC
Minimum input voltage Vmin[1][2]	6 V	6 V	6 V	6 V	6 V
Maximum current Imax[1]	10 A	20 A	30 A	40 A	50 A
Maximum peak current Ipmax[1][3]	40 A	80 A	120 A	160 A	200 A
Power[1]	1,400 W	2,800 W	4,200 W	5,600 W	7,000 W
Resistance[1]	0.6 … 396 Ω	0.3 … 198 Ω	0.2 … 132 Ω	0.15 … 99 Ω	0.12 … 79 Ω
Rise/fall time[1][4]	15 µs	10 µs	10 µs	18 µs	20 µs
Input capacity DC mode ca.[1]	4 µF	7 µF	11 µF	14 µF	18 µF
Load terminals[5]	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76
Mains voltage[6]	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable[6]	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	1/N/PE AC 115 V 50 … 60 Hz	-	-
Power consumption	480 VA	1055 VA	1330 VA	1775 VA	2170 VA
Noise max. ca.[7]	72 dB(A)	75 dB(A)	74 dB(A)	77 dB(A)	76 dB(A)
Weight ca.	41 kg	74 kg	98 kg	125 kg	151 kg
Housing[8]	19", 6 U / ACL_M2	19", 10 U / ACL_M3	19", 14 U / ACL_M4	19", 18 U / ACL_M5	19", 22 U / ACL_M6

Model (Order Number)	ACLT25228
Frequency[1]	DC, 40 … 1,000 Hz
Maximum AC input voltage VmaxAC[1]	280 V AC
Maximum DC input voltage VmaxDC[1]	400 V DC
Minimum input voltage Vmin[1][2]	6 V
Maximum current Imax[1]	60 A
Maximum peak current Ipmax[1][3]	240 A
Power[1]	8,400 W
Resistance[1]	0.10 … 66 Ω
Rise/fall time[1][4]	20 µs
Input capacity DC mode ca.[1]	21 µF
Load terminals[5]	PH7/10.16-ST76
Mains voltage[6]	1/N/PE AC 230 V 50 … 60 Hz
Mains voltage toggleable[6]	-
Power consumption	2600 VA
Noise max. ca.[7]	78 dB(A)
Weight ca.	179 kg
Housing[8]	19", 26 U / ACL_M7

1. Per phase
2. Minimum input voltage for maximum static load current.
3. Maximum peak current at maximum crest factor.
4. Rise and fall times are from 10 … 90 % and 90 … 10 % of maximum current (CC mode, tolerance ±20 %).
5. Description of available terminals beginning at page 123.
6. Mains voltage tolerance: ±10 %.
7. Measured at the front in distance of 1 m.
8. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview 3-Phase 500 V

Model (Order Number)	ACLT4250	ACLT8450	ACLT12650	ACLT16850	ACLT21050
Frequency[1]	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC[1]	500 V AC	500 V AC	500 V AC	500 V AC	500 V AC
Maximum DC input voltage VmaxDC[1]	700 V DC	700 V DC	700 V DC	700 V DC	700 V DC
Minimum input voltage Vmin[1] [2]	10 V	10 V	10 V	10 V	10 V
Maximum current Imax[1]	5 A	10 A	15 A	20 A	25 A
Maximum peak current Ipmax[1] [3]	20 A	40 A	60 A	80 A	100 A
Power[1]	1,400 W	2,800 W	4,200 W	5,600 W	7,000 W
Resistance[1]	2.0 ... 1416 Ω	1.0 ... 708 Ω	0.67 ... 472 Ω	0.5 ... 354 Ω	0.40 ... 283 Ω
Rise/fall time[1] [4]	20 µs	11 µs	11 µs	10 µs	20 µs
Input capacity DC mode ca.[1]	3 µF	6.6 µF	10 µF	13 µF	16 µF
Load terminals[5]	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76	PH7/10.16-ST76
Mains voltage[6]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable[6]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	-	-
Power consumption	380 VA	700 VA	960 VA	1315 VA	1890 VA
Noise max. ca. [7]	70 dB(A)	74 dB(A)	77 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	41 kg	71 kg	99 kg	127 kg	151 kg
Housing[8]	19", 6 U / ACL_M2	19", 10 U / ACL_M3	19", 14 U / ACL_M4	19", 18 U / ACL_M5	19", 22 U / ACL_M6

Model (Order Number)	ACLT25250
Frequency[1]	DC, 40 ... 1,000 Hz
Maximum AC input voltage VmaxAC[1]	500 V AC
Maximum DC input voltage VmaxDC[1]	700 V DC
Minimum input voltage Vmin[1] [2]	10 V
Maximum current Imax[1]	30 A
Maximum peak current Ipmax[1] [3]	120 A
Power[1]	8,400 W
Resistance[1]	0.33 ... 236 Ω
Rise/fall time[1] [4]	20 µs
Input capacity DC mode ca.[1]	20 µF
Load terminals[5]	PH7/10.16-ST76
Mains voltage[6]	1/N/PE AC 230 V
Mains voltage toggleable[6]	-
Power consumption	1,865 VA
Noise max. ca. [7]	80 dB(A)
Weight ca.	179 kg
Housing[8]	19", 26 U / ACL_M7

ACLT4228

ACL
AC & DC

Operating modes

Basic operating modes	CC, CV, CR, CP

Frequency

Frequency range	DC, 40 ... 1,000 Hz
Synchronization time	1 ... 5 periods of input signal

Synchronization time for rapidly changing frequencies or when connecting the input voltage	Synchronization to input/extern	Pre-synchronization to line voltage
	max. 500 ms	0 ms

Accuracy of voltage setting[1]

		of setting	of corresponding range
Voltage	DC	±0.5 %	±0.1 %
	AC	±1 %	±0.2 %

Accuracy of current setting[1]

		of setting	of corresponding range
Current	DC	±0.2 %	±0.15 %
	40 ... 400 Hz	±0.5 %	±0.3 %
	> 400 Hz	±0.75 %	±0.5 %
Resolution		14 bits	
Total harmonic distortion[2]	40 ... 400 Hz	<2 %	
	> 400 Hz	<4 %	

Accuracy of resistance setting[1]

	of setting	of corresponding range
Resistance[3]	±1.5 %	±1 % of resistance range ±0.3 % of current range

Accuracy of power setting[1]

		of setting	of corresponding range
Power[4]	DC, 40 ... 400 Hz	±1 %	±0.25 %
	> 400 Hz	±1.5 %	±0.3 %
Power[5]	DC, 40 ... 400 Hz	±3 %	±0.5 %
	> 400 Hz	±5 %	±2.5 %
Resolution		calculated from resolutions of voltage and current measurement and current setting	

Rise and fall time

CC mode		see model overview
CP, CV mode	DC	ca. 10 ms
	AC	ca. 1 s

Accuracy of adjustable protections

		of setting	of current range
Overcurrent protection		±1 %	±0.2 %
Resolution		12 bits	

Waveforms (Resolution: 360 points in 1° steps)

Sine	as fundamental waveform
Arbitrary waveforms	based on sine, triangle or rectangle, editable pointwise
Harmonics	2nd to 25th Harmonics in variable proportions superimposable to the fundamental wave
Crest factor	1.4142 ... 4.0 with automatic amplitude correction
Phase cut	-180 ... 180°

Phase shift	-180 ... 180° (only in combination with crest factor or phase cut, no capacitive or inductive load)

Measurement functions

Numeric display	rms value voltage, rms value current, resistance, active power, apparent power, reactive power, frequency, power factor, crest factor
Graphical display	last period of current and voltage with 360 points, temporal progression of rms values of voltage, current and/or power of focused channel

Accuracy of measurements/display

		of measured (real) value	of corresponding range
Voltage	DC	±0.2 %	±0.05 % ±1 digit
	AC	±0.3 %	±0.1 % ±1 digit
Current	DC	±0.2 %	±0.1 % ±1 digit
	40 ... 400 Hz	±0.5 %	±0.3 % ±1 digit
	> 400 Hz	±0.75 %	±0.5 % ±1 digit
Resolution		16 bits	
Resistance		calculated from voltage and current	
Power		calculated from voltage and current	
Sampling time		200 µs, triggerable	
Frequency		±0.1 % ±0.1 Hz	

Dynamic function (LIST)

Number of load levels	max. 300, with corresponding ramp and dwell times	
	min.	max.
Dwell time	200 µs	1.000 s
Ramp time	0 s	1.000 s
Resolution	200 µs	
Accuracy of setting times	±0.02 %	
Delay at triggered start	max. 300 µs	

Data acquisition

to external USB flash drive

Sampling time	0.5 ... 30 s, resolution 100 ms
Measurement data	timestamp, voltage, current
Number of measurement points	limited by USB memory capacity
Dateiformat	.csv

to internal memory

Sampling time	200 µs ... 1,000 s, resolution 200 µs, static or synchronized with LIST function
Measurement data	timestamp, voltage, current
Number of measurement points	max. 40,000

Settings memory

Number of user settings	9, selectable (incl. programmed waveform and List) 1 for last settings at power-off or power fail

I/O port (option ACL06): control inputs and outputs

Control inputs	mode selection load input on - off selection of control source (internal, external) input mode (AC, DC) synchronization source (input, line, extern) synchronization input remote shut-down trigger input (low-active)
Dig. input level	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 accuracy applies for the specified frequencies. At higher frequencies the accuracy decreases.
2. Measured at Imax. THD increases at lower currents.
3. At 5 % Vmax < V < 100 % Vmax and 5 % Imax < I < 100 % Imax.
4. At V > 30 % Vmax and I > 30% Imax.
5. At V < 30 % Vmax or I < 30 % Imax.

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Technical Data

Control outputs	load input activation state (low-active) status overload trigger output programmable output
Dig. output level	logical low: 0 … 0.8 V, logical high: 5 V/24 V selectable, max. 10 mA (push-pull)

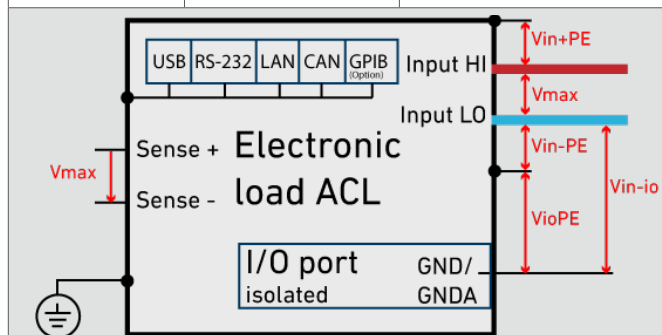## I/O port (option ACL06): accuracy analog control 0 … 10 V for current

	of setting	of corresponding range
Current DC 40 … 400 Hz > 400 Hz	±0.2 % ±0.5 % ±0.75 %	±0.1 % ±0.3 % ±0.5 %
	Input resistance of analog inputs >10 kΩ	

I/O port (option ACL06): accuracy analog monitor signals 0 … 7 V / 0 … 10 V for voltage and current

	of analog signal of real value	offset voltage
Voltage DC, 40 … 400 Hz >400 Hz	±0.3 % ±0.5 %	±15 mV ±20 mV
Current DC, 40 … 400 Hz >400 Hz	±0.5 % ±0.75 %	±30 mV ±50 mV
	Maximum load capacity 2 kΩ. Analog monitor outputs as proportional AC curve or RMS value, selectable	

I/O port (option ACL06): permissible voltages

	AC mode The external circuit is mains voltage up to 500 V AC with overvoltage category II.	DC mode The external circuit is a DC voltage derived from mains voltage with overvoltage category II.
Vin-io (GND - Input LO)	max. 600 V AC	max. 800 V DC
VioPE (GND - PE)	max. 100 V AC	max. 100 V DC

Input

Input resistance	> 50 kΩ at deactivated load input
Input capacity	see model overview
Parallel operation	up to 3 devices in Master-Slave operation
Max. input voltage Vmax	see model overview
Min. input voltage Vmin for max. current	see model overview

Input: permissible voltages

Vin-PE (Input LO - PE)	max. 500 V[1]
Vin+PE (Input HI - PE)	max. 500 V[1]

Power

Continuous power	see model overview (at TA = 21 °C)
Derating	–1.2 %/°C for TA > 21 °C

Protection and Monitoring

Protective devices	overcurrent overpower overtemperature
Monitoring	overvoltage undervoltage (if the input voltage is too low for the set current)

Terminals

Load input	see model overview
Sense	Phoenix PH2/7.62-BU16, see page 123 and following

Operating conditions

Operating temperature	5 … 40 °C
Stock temperature	-25 … 65 °C
Max. operation height	2,000 m over sea level
Pollution degree	2
Max. humidity	80 % at 31 °C, linear decreasing to 50 % at 40 °C
Min. distance rear panel to wall or other objects	70 cm
Cooling	temperature-controlled air cooling
Noise	see model overview
Mains voltage	see model overview
Mains cable	length max. 3 m cross-section of mains leads: 10 A cold device plug: (IEC C13): min. 1 mm² 16 A cold device plug: (IEC C19): min. 1.5 mm²
Power consumption	see model overview

Housing

Dimensions, weight	see model overview
Color front panel rear panel side panels, top	RAL7035 (light grey) stainless steel RAL7037 (dusty grey)

Safety and EMV

Protection class	1
Measuring category	CAT II
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

Standard interfaces

Data interfaces	RS-232, USB, LAN, CAN
I/O port	–

Available options

Data interface ACL02	GPIB interface
Hardware extensions ACL06 ACL14	galvanically isolated I/O port castors

Calibration, warranty

FCC-ACLxx	Factory Calibration Certificate, twice for free
Warranty	2 years

1.   positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical data of production series B, rev. 5. Subject to technical changes without notice.

ACL AC & DC

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The electronic load

SOURCE-SINK QL SERIES

SERIE QL – Brief Profile

QL series devices are sources and sinks or, respectively, power supply and electronic load in one device. They are used in testing a wide variety of energy storage devices, as well as other DUTs such as motors, chargers or coils.

The standard portfolio offers 2- or 4-quadrant devices up to 3,600 W. In addition to DC operation, 4-quadrant devices also provide the function of an AC source.

- 2- or 4-quadrant models
- DC source-sink
- Additionally AC source with 4-quadrant models
- Basic operating modes CC, CV, CP, CR
- Combined operating modes CC+CV, CV+CC
- Adjustable upper and lower protections for V and I
- Adjustable internal resistance in CC and CV mode
- Functions for test of energy storage devices
- Internal resistance measurement
- List function with synchronized DAQ
- Rectangular, PWM and modulation function

Interfaces

- ◉ RS-232
- ◉ USB
- ◉ LAN
- ○ GPIB
- ◉ CAN
- ◉ Analog
- ○ Analog isolated

◉ Standard   ○ Option   — not available

Operating Modes
in DC and AC mode

In addition to constant voltage (CV) and constant current (CC) operation, the QL source-sinks also operate in constant resistance (CR) and constant power (CP) mode.
In addition, one upper and one lower limit value each can be set for voltage and current. Thus the combined operating modes CC+CV, CV+CC, CP+CV and CR+CV are realized. 4-quadrant devices can also be used as AC sources.

Source-Sink Mode

Depending on the setting of the output variable and the properties of the connected DUT, the device automatically decides whether it operates as a source or as a sink.

2-/4-Quadrant Models

Devices for 2-quadrant operation can supply current or consume reverse current when the output voltage is positive. To ensure that the desired function is provided at settings close to 0 V and longer connection lines, the 2-quadrant devices already operate at negative voltages from -1 V. In principle, 2-quadrant devices are also 4-quadrant devices, but with a reduced negative voltage.
4-quadrant devices can set negative values of the same magnitude as positive values.

2-quadrant unit

4-quadrant unit
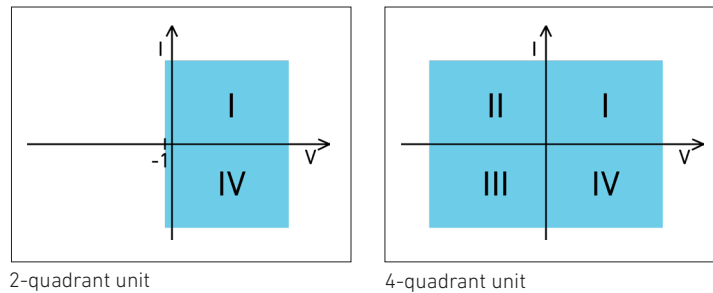
I/O Port
Standard or isolated (option QL06)

Analog signals in realtime!

The standard I/O port provides analog and digital signals for external control.

Outputs:
- Analog voltage monitor signal -10 ... 0 ... 10 V
- Analog current monitor signal -10 ... 0 ... 10 V
- Output activation state
- Status output for high protection level
- Status output for low protection level
- Trigger output

Inputs:
- Analog setting of I, V, P, R with -5 ... 0 ... 5 V or with -10 ... 0 ... 10 V
- Analog setting for upper and lower voltage or current protection with -10 ... 0 ... 10 V
- Output activation
- Operating mode selection CC - CV
- Control speed selection
- Remote shut-down
- Readable digital input (by SCPI command)
- Trigger input

As an option, there is a galvanically isolated version for the I/O port (option QL06).

Factory Calibration Certificate
(FCC-QLxx)

2 x for free

We supply a free Factory Calibration Certificate (FCC) with the devices. The calibration process is subject to supervision in accordance with DIN EN ISO 9001. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI). Within the 2-year warranty period, we will calibrate a second time free of charge if the respective device will have been registrated:
https://www.hoecherl-hackl.com/service/device-registration
For use under laboratory conditions, H&H recommends a calibration interval of 2 years. This is an empirical value that can be used as a guide for the first period of use. Depending on the intended use, service life, relevance of the application and ambient conditions, the operator should adjust this interval accordingly.
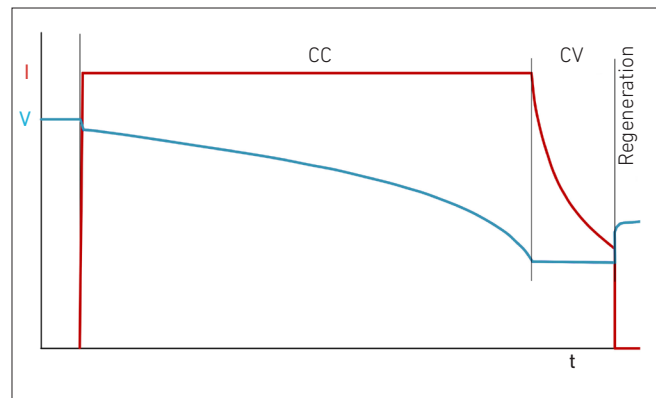
QL source-sink

Mechanics

Retractable handle

The QL series is designed in robust 19" technology and can be used as a desktop device or installed in a rack. No additional installation kits are required for 19" installation.
From 5 height units, there are retractable heavy-weight handles on the top of the device.

Functions

Discharge Function

IUa discharge with follow-up time

The discharge function tests energy storage devices such as batteries, accumulators, ultracaps, electrolytic capacitors, etc. by discharging them in CC, CP or CR mode. The discharge function can be combined with the list function so that defined discharge profiles are possible.
IUa discharge (CC+CV discharge) is also possible: in this case, the DUT is discharged with constant current until a defined voltage is detected. This voltage is then kept constant until a defined minimum current is reached.

Stop criteria are charge, energy, time, current, voltage.
During data logging, a follow-up time can be defined to observe the recovery phase.

Charge Function

Similarly to the discharge function, there is the charge function, where the same operating modes and switch-off criteria apply.

Cycling Function

During cycling, the charging and discharging functions are performed alternately with an adjustable number of cycles. A recovery time can be defined between the charging and discharging function.

Adjustable Internal Resistance, Capacitance Simulation
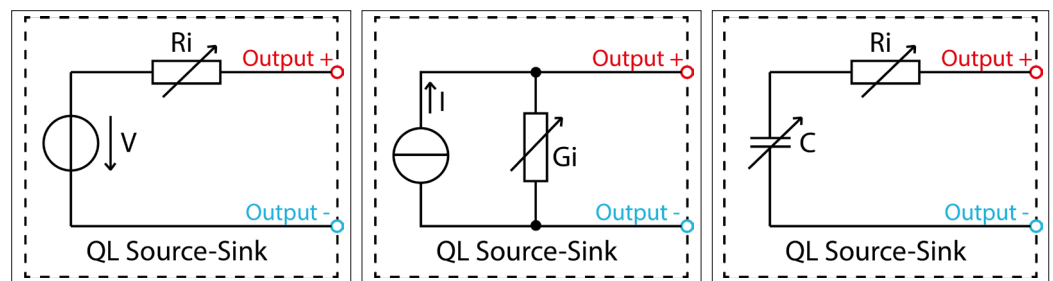
Voltage source with int. resistance

Current source with int. conductance

Capacity simulation

In order to simulate different sources as flexibly as possible, a variable internal resistance can be set in constant voltage mode CV, and analogously a conductance value in constant current mode CC.
In constant voltage mode, the source-sink can also simulate the behavior of a capacitance which charges or discharges with a certain initial voltage. In combination with an adjustable internal resistance, this allows batteries, electrolytic capacitors or other energy storage devices to be simulated and chargers to be tested.

List Function
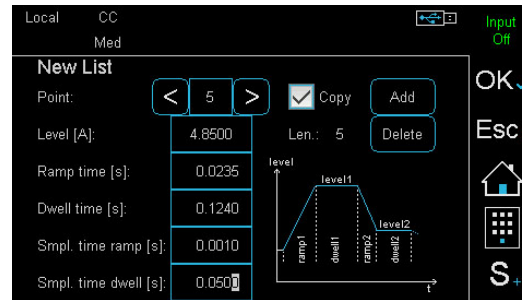
In all operating modes current, voltage, power or resistance profiles can be simulated with the list function. Up to 300 settings of variable duration with associated ramp time are possible. The setting lists may contain positive and negative values cross-quadrant, so that there are e.g. charging and discharging currents in one list.

Voltage and current are measured synchronously and stored with a time stamp. Associated sampling times can be defined for each curve section.

Rectangular Function
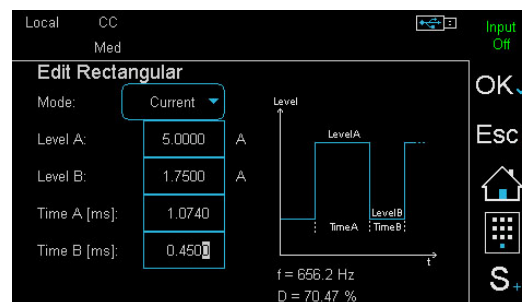
The rectangle function provides a convenient way to generate a rectangular waveform by entering absolute time and current/voltage values.

PWM Function
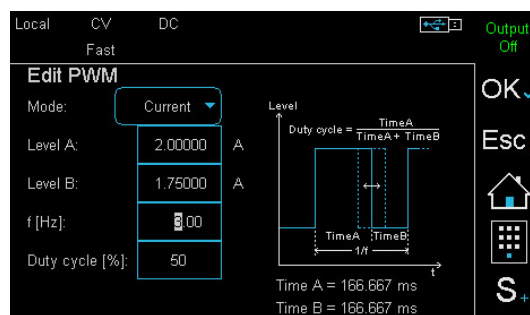
In manual operation of the PWM function, the frequency and the duty cycle can be set for the two current/voltage values.

Modulator
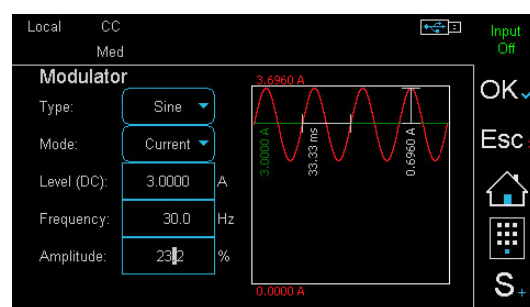
In CC or CV mode, the modulator adds a sinusoidal, square-wave, triangular or arbitrary signal to a constant setpoint. Frequency and modulation depth are adjustable.

AC Source
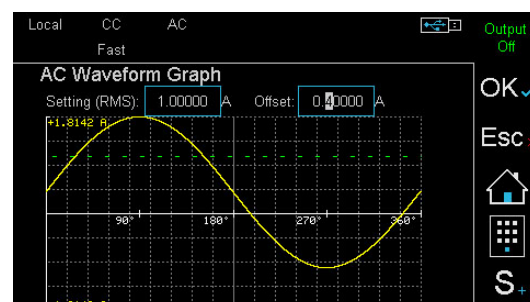
4-quadrant devices can be used as DC source-sinks in the basic operating modes CC, CV, CP and CR and additionally as AC sources in the operating modes CC and CV.
Selectable waveforms are sine, triangle, square, sawtooth or an arbitrary waveform with adjustable offset.
The waveform is mains synchronizable.

Internal Resistance Measurement
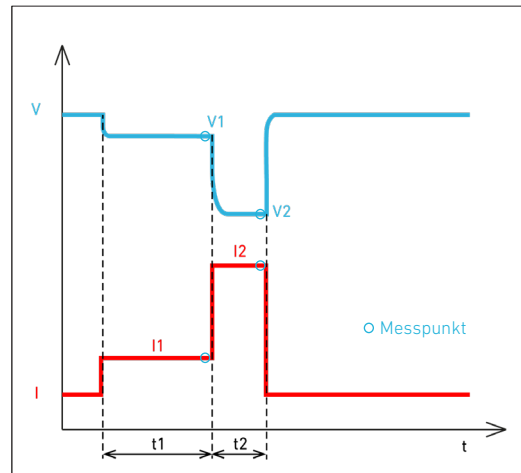
Ri calculation timing

The source-sink can measure the internal DC resistance of the connected DUT. The determination of the internal resistance Ri is based on the principle specified in various standards for batteries and accumulators, e.g. DIN EN 61951, DIN EN 61960.
Within a defined period of time, the device measures the DUT's terminal voltage (V1, V2) at two adjustable currents (I1, I2) and calculates Ri from this.
In manual mode, the device can store the parameters and the result of the measurement on a connected USB mass storage device at the touch of a button, so that a high throughput with many DUTs may be achieved.

Data Acquisition (DAQ)

The source-sink is able to synchronously store data records from voltage and current with time stamp internally in a defined interval. Up to 40,000 data records are stored in a ring buffer and can be read via one of the data interfaces. After the recording is finished, the user may transfer data to a USB flash drive.
For processes with storage intervals in the seconds range, the device can also save data directly on the USB flash drive.

Trigger Model

Several functions and settings may be triggered by a configurable trigger event:
- Set triggered output state
- Set triggered operating mode
- Start/stop list mode
- Start/stop data acquisition
- Set triggered settings of all operating modes

Available trigger sources:
- Extern
- Bus
- Manual
- Voltage
- Current

Changing Regulation Speed

For certain DUTs or very long connecting lines, it may be necessary to adjust the regulation time constant of the source-sink to avoid oscillation behavior and to achieve stable operation.
The control speed can be selected from slow - fast (see rise/fall times in model overview).

Watchdog Function

To protect the DUT from communication problems, the source-sink in digital remote control mode has a watchdog function that switches off the output if the previously programmed watchdog delay time expires without the watchdog being reset.
The watchdog delay time is set by SCPI command, another command activates the watchdog. When the watchdog is active, a control program must ensure that the command to reset the watchdog is periodically sent to the source-sink.

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The electronic load

Save Settings

In order to quickly reconstruct frequently recurring test tasks, the settings active in the source-sink can be stored non-volatile (internal or to USB flash drive) so that they can be reloaded later on. 9 internal memory positions are available.
When powered on, the source-sink can optionally set the reset state, the last active settings at power-off or memory positions 1 to 9.
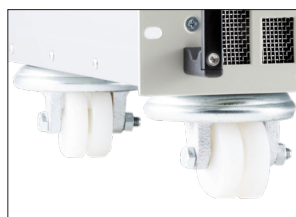
Drivers

POWERED BY
LabVIEW

Current NI-certified LabVIEW drivers can be downloaded here:
www.ni.com/downloads/instrument-drivers/

Hardware Extensions

Option QL14 [1]
Heavy-weight castors

Castors

Steerable castors (option QL14) can be screwed onto big devices for easier transport. This can often save a 19" rack. This option is available for devices from 5 U and is only suitable for hard floors.

Option QL06 [1]
Galvanically isolated I/O interface

In case of potential differences between the negative output and the signals at the I/O port, the standard I/O port can be exchanged for an isolated version. All control and measurement signals are routed via isolation amplifiers and optocouplers. The board is pin compatible to the standard I/O board.

1.   Retrofittable at any time

Model Overview 2-Quadrant Models

Model (Order Number)	QL1V10C20	QL1V20C10	QL1V30C8	QL1V42C6	QL1V80C3	QL1V100C2
Voltage range	-1 ... 10 V	-1 ... 20 V	-1 ... 30 V	-1 ... 42 V	-1 ... 80 V	-1 ... 100 V
Current range	±20 A	±10 A	±8 A	±6 A	±3 A	±2 A
Resistance range	0.0250 ... 10.0 Ω	0.100 ... 40.0 Ω	0.200 ... 75.0 Ω	0.350 ... 140 Ω	1.33 ... 533 Ω	2.50 ... 1000.0 Ω
Power	200 W	200 W	240 W	252 W	240 W	200 W
Rise/fall time CC, CV [1]	120 µs	120 µs	120 µs	120 µs	120 µs	120 µs
Bandwidth	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	1.00 Ω ... ∞	4.00 Ω ... ∞	7.50 Ω ... ∞	14.0 Ω ... ∞	53.3 Ω ... ∞	100 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.25 Ω	0 ... 1.00 Ω	0 ... 1.88 Ω	0 ... 3.50 Ω	0 ... 13.3 Ω	0 ... 25.0 Ω
Output terminals [3] rear	BPK4-30L	BPK4-30L	BPK4-30L	BPK4-30L	BPK4-30L	BPK4-30L
Power consumption	430 VA	380 VA	400 VA	391 VA	363 VA	310 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Noise max. ca. [5]	64 dB(A)	65 dB(A)	65 dB(A)	62 dB(A)	64 dB(A)	65 dB(A)
Weight ca.	13 kg	13 kg	13 kg	12.5 kg	12.5 kg	13 kg
Housing [6]	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 2 U

Model (Order Number)	QL1V8C80	QL1V10C60	QL1V20C40	QL1V26C32	QL1V44C22	QL1V60C16
Voltage range	-1 ... 8 V	-1 ... 10 V	-1 ... 20 V	-1 ... 26 V	-1 ... 44 V	-1 ... 60 V
Current range	±80 A	±60 A	±40 A	±32 A	±22 A	±16 A
Resistance range	0.00500 ... 200 Ω	0.00800 ... 3.30 Ω	0.0250 ... 10.0 Ω	0.0406 ... 16.3 Ω	0.100 ... 40.0 Ω	0.188 ... 75.0 Ω
Power	640 W	600 W	800 W	832 W	968 W	960 W
Rise/fall time CC, CV [1]	150 µs	120 µs	120 µs	120 µs	105 µs	120 µs
Bandwidth	2.5 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	0.200 Ω ... ∞	0.333 Ω ... ∞	1.00 Ω ... ∞	1.63 Ω ... ∞	4.00 Ω ... ∞	7.50 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.050 Ω	0 ... 0.083 Ω	0 ... 0.250 Ω	0 ... 0.406 Ω	0 ... 1.00 Ω	0 ... 1.88 Ω
Output terminals [3] rear	FKS25/10-SM10	BPK4-60L	BPK4-60L	BPK4-60L	BPK4-30L	BPK4-30L
Power consumption	1,400 VA	1,200 VA	1,300 VA	1,200 VA	1,400 VA	1,300 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Noise max. ca. [5]	71 dB(A)	68 dB(A)	68 dB(A)	67 dB(A)	70 dB(A)	67 dB(A)
Weight ca.	39 kg	33 kg	33 kg	23 kg	21 kg	23 kg
Housing [6]	19", 5 U	19", 5 U	19", 5 U	19", 3 U	19", 3 U	19", 3 U

Model (Order Number)	QL1V80C11	QL1V8C160	QL1V10C120	QL1V20C80	QL1V26C60	QL1V44C40
Voltage range	-1 ... 80 V	-1 ... 8 V	-1 ... 10 V	-1 ... 20 V	-1 ... 26 V	-1 ... 44 V
Current range	±11 A	±160 A	±120 A	±80 A	±60 A	±40 A
Resistance range	0.364 ... 145 Ω	0.0025 ... 1.00 Ω	0.00417 ... 1.67 Ω	0.0125 ... 5.00 Ω	0.0217 ... 8.70 Ω	0.055 ... 22.0 Ω
Power	880 W	1,280 W	1,200 W	1,600 W	1,560 W	1,760 W
Rise/fall time CC, CV [1]	120 µs	120 µs	120 µs	120 µs	120 µs	120 µs
Bandwidth	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	14.5 Ω ... ∞	0.100 Ω ... ∞	0.167 Ω ... ∞	0.500 Ω ... ∞	0.867 Ω ... ∞	2.20 Ω ... ∞
Adjustable int. resistance CV	0 ... 3.64 Ω	0 ... 0.0250 Ω	0 ... 0.0417 Ω	0 ... 0.125 Ω	0 ... 0.217 Ω	0 ... 0.550 Ω
Output terminals [3] rear	BPK4-30L	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	BPK4-60L	BPK4-60L
Power consumption	1,330 VA	2,700 VA	2,400 VA	2.520 VA	2,550 VA	2,500 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	-	-	-	-	-
Noise max. ca. [5]	67 dB(A)	77 dB(A)	76 dB(A)	73 dB(A)	75 dB(A)	75 dB(A)
Weight ca.	23 kg	57 kg	59 kg	56 kg	51 kg	52 kg
Housing [6]	19", 3 U	19", 8 U	19", 8 U	19", 8 U	19", 8 U	19", 8 U

1. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of the positive current (in CC mode) or voltage (in CV mode) setting range in "fast" regulation speed. Tolerance ±20 %. Measured with short-circuited output terminals (CC) or with open output terminals (CV). Other loads may increase rise/fall times. Rise/fall time in CP and CR mode: ca. 3 ms. Rise/fall time in "slow" regulation speed: ca. 2 ms in C and CV mode, ca. 20 ms in CP and CR mode.
2. Value is entered as conductance in S.
3. Description of available terminals beginning at page 123. Units with touchable terminals are supplied with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

H&H Höcherl & Hackl
The electronic load

Model (Order Number)	QL1V60C30	QL1V80C20	QL1V8C240	QL1V10C180	QL1V20C120	QL1V26C90
Voltage range	-1 ... 60 V	-1 ... 80 V	-1 ... 8 V	-1 ... 10 V	-1 ... 20 V	-1 ... 26 V
Current range	±30 A	±20 A	±240 A	±180 A	±120 A	±90 A
Resistance range	0.100 ... 40.0 Ω	0.200 ... 80.0 Ω	0.00167 ... 0.667 Ω	0.00278 ... 1.11 Ω	0.00833 ... 3.33 Ω	0.0144 ... 5.78 Ω
Power	1,800 W	1,600 W	1,920 W	1,800 W	2,400 W	2,340 W
Rise/fall time CC, CV [1]	150 µs	120 µs	120 µs	120 µs	120 µs	120 µs
Bandwidth	2.5 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	4.00 Ω ... ∞	8.00 Ω ... ∞	0.0667 Ω ... ∞	0.111 Ω ... ∞	0.333 Ω ... ∞	0.578 Ω ... ∞
Adjustable int. resistance CV	0 ... 1.00 Ω	0 ... 2.00 Ω	0 ... 0.0167 Ω	0 ... 0.0278 Ω	0 ... 0.0833 Ω	0 ... 0.144 Ω
Output terminals [3] rear	BPK4-30L	BPK4-30L	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10
Power consumption	2,750 VA	2,200 VA	4,340 VA	3,800 VA	3,800 VA	3,775 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A
Mains voltage toggleable [4]	-	-	-	-	-	-
Noise max. ca. [5]	75 dB(A)	75 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	52 kg	50 kg	81 kg	76 kg	76 kg	73 kg
Housing [6]	19", 8 U	19", 8 U	19", 11 U	19", 11 U	19", 11 U	19", 11 U

Model (Order Number)	QL1V44C60	QL1V60C45	QL1V80C30	QL1V8C320	QL1V10C240	QL1V20C160
Voltage range	-1 ... 44 V	-1 ... 60 V	-1 ... 80 V	-1 ... 8 V	-1 ... 10 V	-1 ... 20 V
Current range	±60 A	±45 A	±30 A	±320 A	±240 A	±160 A
Resistance range	0.0367 ... 14.7 Ω	0.0667 ... 26.7 Ω	0.133 ... 53.3 Ω	0.00125 ... 0.500 Ω	0.00208 ... 0.833 Ω	0.00625 ... 2.50 Ω
Power	2,640 W	2,700 W	2,400 W	2,560 W	2,400 W	3,200 W
Rise/fall time CC, CV [1]	120 µs	120 µs	120 µs	120 µs	150 µs	110 µs
Bandwidth	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	2.5 kHz	2.5 kHz
Adjustable int. resistance CC [2]	1.47 Ω ... ∞	2.67 Ω ... ∞	5.33 Ω ... ∞	0.0500 Ω ... ∞	0.0833 Ω ... ∞	0.250 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.367 Ω	0 ... 0.667 Ω	0 ... 1.33 Ω	0 ... 0.0125 Ω	0 ... 0.0208 Ω	0 ... 0.0625 Ω
Output terminals [3] rear	BPK4-60L	BPK4-60L	BPK4-30L	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10
Power consumption	4,000 VA	4,060 VA	3,200 VA	5,300 VA	4,500 VA	5,100 VA
Mains voltage [4]	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A
Mains voltage toggleable [4]	-	-	-	-	-	-
Noise max. ca. [5]	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	73 kg	75 kg	73 kg	99 kg	100 kg	95 kg
Housing [6]	19", 11 U	19", 11 U	19", 11 U	19", 14 U	19", 14 U	19", 14 U

Model (Order Number)	QL1V26C120	QL1V44C80	QL1V60C60	QL1V80C40
Voltage range	-1 ... 26 V	-1 ... 44 V	-1 ... 60 V	-1 ... 80 V
Current range	±120 A	±80 A	±60 A	±40 A
Resistance range	0.0108 ... 4.33 Ω	0.0275 ... 11.0 Ω	0.0500 ... 20.0 Ω	0.100 ... 40.0 Ω
Power	3,120 W	3,520 W	3,600 W	3,200 W
Rise/fall time CC, CV [1]	150 µs	120 µs	150 µs	150 µs
Bandwidth	2.5 kHz	3.0 kHz	2.5 kHz	2.5 kHz
Adjustable int. resistance CC [2]	0.433 Ω ... ∞	1.10 Ω ... ∞	2.00 Ω ... ∞	4.00 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.108 Ω	0 ... 0.275 Ω	0 ... 0.500 Ω	0 ... 1.00 Ω
Output terminals [3] rear	FKS25/10-SM10	FKS25/10-SM10	BPK4-60L	BPK4-60L
Power consumption	4,800 VA	4,900 VA	4,800 VA	4,400 VA
Mains voltage [4]	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A	3/N/PE AC 400/230V 50 ... 60 Hz, 16 A
Mains voltage toggleable [4]	-	-	-	-
Noise max. ca. [5]	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	96 kg	93 kg	93 kg	96 kg
Housing [5]	19", 14 U	19", 14 U	19", 14 U	19", 14 U

1. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of the positive current (in CC mode) or voltage (in CV mode) setting range in "fast" regulation speed. Tolerance ±20 %. Measured with short-circuited output terminals (CC) or with open output terminals (CV). Other loads may increase rise/fall times. Rise/fall time in CP and CR mode: ca. 3 ms. Rise/fall time in "slow" regulation speed: ca. 2 ms in C and CV mode, ca. 20 ms in CP and CR mode.
2. Value is entered as conductance in S.
3. Description of available terminals beginning at page 123. Units with touchable terminals are supplied with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

QL source-sink

Model (Order Number)	QL10V10C10	QL20V20C5	QL30V30C3.5	QL50V50C2	QL8V8C46	QL10V10C38
Voltage range	±10 V	±20 V	±30 V	±50 V	±8 V	±10 V
Current range	±10 A	±5 A	±3,5 A	±2 A	±46 A	±38 A
Resistance range	0.0500 ... 20.0 Ω	0.200 ... 80.0 Ω	0.429 ... 171.4 Ω	1.250 ... 500 Ω	0.00870 ... 3.48 Ω	0.0132 ... 5.26 Ω
Power	100 W	100 W	105 W	100 W	368 W	380 W
Rise/fall time CC, CV [1]	110 µs	120 µs	100 µs	120 µs	120 µs	120 µs
Bandwidth	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	2.00 Ω ... ∞	8.00 Ω ... ∞	17.1 Ω ... ∞	50.0 Ω ... ∞	0.348 Ω ... ∞	0.526 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.50 Ω	0 ... 2.00 Ω	0 ... 4.29 Ω	0 ... 12.5 Ω	0 ... 0.087 Ω	0 ... 0.132 Ω
Output terminals [3] rear	BPK4-30L	BPK4-30L	BPK4-30L	BPK4-30L	BPK4-60L	BPK4-30L
Power consumption	250 VA	218 VA	205 VA	215 VA	800 VA	750 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Noise max. ca. [5]	64 dB(A)	62 dB(A)	65 dB(A)	65 dB(A)	72 dB(A)	67 dB(A)
Weight ca.	13 kg	12.5 kg	13 kg	13 kg	21 kg	23 kg
Housing [6]	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 3 U	19", 3 U

Model (Order Number)	QL20V20C24	QL30V30C16	QL44V44C11	QL8V8C80	QL10V10C60	QL20V20C40
Voltage range	±20 V	±30 V	±44 V	±8 V	±10 V	±20 V
Current range	±24 A	±16 A	±11 A	±80 A	±60 A	±40 A
Resistance range	0.0417 ... 16.7 Ω	0.0938 ... 37.5 Ω	0.200 ... 80.0 Ω	0.00500 ... 2.00 Ω	0.00833 ... 3.33 Ω	0.0250 ... 10.0 Ω
Power	480 W	432 W	484 W	640 W	600 W	800 W
Rise/fall time CC, CV [1]	120 µs	120 µs	110 µs	150 µs	120 µs	150 µs
Bandwidth	3.0 kHz	3.0 kHz	3.0 kHz	2.5 kHz	3.0 kHz	2.5 kHz
Adjustable int. resistance CC [2]	1.67 Ω ... ∞	3.75 Ω ... ∞	8.00 Ω ... ∞	0.200 Ω ... ∞	0.333 Ω ... ∞	1.00 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.417 Ω	0 ... 0.938 Ω	0 ... 2.00 Ω	0 ... 0.0500 Ω	0 ... 0.0833 Ω	0 ... 0.250 Ω
Output terminals [3] rear	BPK4-30L	BPK4-30L	BPK4-30L	FKS25/10-SM10	BPK4-60L	BPK4-60L
Power consumption	780 VA	770 VA	715 VA	1,360 VA	1,325 VA	1,390 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz
Noise max. ca. [5]	68 dB(A)	75 dB(A)	70 dB(A)	77 dB(A)	77 dB(A)	76 dB(A)
Weight ca.	22 kg	22 kg	22 kg	54 kg	55 kg	49 kg
Housing [5]	19", 3 U	19", 3 U	19", 3 U	19", 8 U	19", 8 U	19", 8 U

Model (Order Number)	QL30V30C32	QL44V44C20	QL8V8C120	QL10V10C90	QL20V20C60	QL30V30C48
Voltage range	±30 V	±44 V	±8 V	±10 V	±20 V	±30 V
Current range	±32 A	±20 A	±120 A	±90 A	±60 A	±48 A
Resistance range	0.0469 ... 18.8 Ω	0.110 ... 44.0 Ω	0.00333 ... 1.33 Ω	0.00556 ... 2.22 Ω	0.0167 ... 6.67 Ω	0.0313 ... 12.5 Ω
Power	960 W	880 W	960 W	900 W	1,200 W	1,440 W
Rise/fall time CC, CV [1]	120 µs	120 µs	150 µs	150 µs	120 µs	120 µs
Bandwidth	3.0 kHz	3.0 kHz	2.5 kHz	2.5 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	1.188 Ω ... ∞	4.40 Ω ... ∞	0.133 Ω ... ∞	0.222 Ω ... ∞	0.667 Ω ... ∞	1.25 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.469 Ω	0 ... 1.10 Ω	0 ... 0.0333 Ω	0 ... 0.0556 Ω	0 ... 0.167 Ω	0 ... 0.313 Ω
Output terminals [3] rear	BPK4-60L	BPK4-30L	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	BPK4-60L
Power consumption	1,560 VA	1,400 VA	2,200 VA	2,088 VA	2,200 VA	2,340 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	1/N/PE AC 115 V 50 ... 60 Hz	1/N/PE AC 115 V 50 ... 60 Hz	-	-	-	-
Noise max. ca. [5]	67 dB(A)	67 dB(A)	73 dB(A)	77 dB(A)	77 dB(A)	76 dB(A)
Weight ca.	49 kg	55 kg	80 kg	80 kg	80 kg	80 kg
Housing [6]	19", 8 U	19", 8 U	19", 11 U	19", 11 U	19", 11 U	19", 11 U

1. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of the positive current (in CC mode) or voltage (in CV mode) setting range in "fast" regulation speed. Tolerance ±20 %. Measured with short-circuited output terminals (CC) or with open output terminals (CV). Other loads may increase rise/fall times. Rise/fall time in CP and CR mode: ca. 3 ms. Rise/fall time in "slow" regulation speed: ca. 2 ms in C and CV mode, ca. 20 ms in CP and CR mode.
2. Value is entered as conductance in S.
3. Description of available terminals beginning at page 123. Units with touchable terminals are supplied with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

QL Series — Model Overview 4-Quadrant Models

Model (Order Number)	QL44V44C30	QL8V8C160	QL10V10C120	QL20V20C80	QL30V30C64	QL44V44C40
Voltage range	±44 V	±8 V	±10 V	±20 V	±30 V	±44 V
Current range	±30 A	±160 A	±120 A	±80 A	±64 A	±40 A
Resistance range	0.0733 ... 29.3 Ω	0.00250 ... 1.00 Ω	0.00417 ... 1.67 Ω	0.0125 ... 5.00 Ω	0.0234 ... 9.38 Ω	0.0550 ... 22.0 Ω
Power	1,320 W	1,280 W	1,200 W	1,600 W	1,920 W	1,760 W
Rise/fall time CC, CV [1]	120 µs	120 µs	150 µs	150 µs	120 µs	120 µs
Bandwidth	3.0 kHz	3.0 kHz	2.5 kHz	2.5 kHz	3.0 kHz	3.0 kHz
Adjustable int. resistance CC [2]	2.93 Ω ... ∞	0.100 Ω ... ∞	0.167 Ω ... ∞	0.500 Ω ... ∞	0.938 Ω ... ∞	2.20 Ω ... ∞
Adjustable int. resistance CV	0 ... 0.733 Ω	0 ... 0.0250 Ω	0 ... 0.0417 Ω	0 ... 0.125 Ω	0 ... 0.234 Ω	0 ... 0.550 Ω
Output terminals [3] rear	BPK4-30L	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	FKS25/10-SM10	BPK4-60L
Power consumption	2,200 VA	2,830 VA	2,550 VA	2,700 VA	3,020 VA	2,700 VA
Mains voltage [4]	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz	1/N/PE AC 230 V 50 ... 60 Hz
Mains voltage toggleable [4]	-	-	-	-	-	-
Noise max. ca. [5]	76 dB(A)	74 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)	76 dB(A)
Weight ca.	80 kg	97 kg	92 kg	92 kg	92 kg	92 kg
Housing [6]	19", 11 U	19", 14 U	19", 14 U	19", 14 U	19", 14 U	19", 14 U

Options and Accessories

Order Number	Article	Description
67-004-030-27	K-RS-SNM 9-9	RS-232 cable (null-modem cable)
52-200-001-27	QL02	GPIB interface
53-100-002-27	QL06-N	Galvanically isolated I/O port instead of standard I/O port with new device
53-100-001-27	QL06	Galvanically isolated I/O port for retrofitting at existing device
64-400-000-27	QL14	Heavy-weight castors for devices from 5 U
67-008-020-27	K-MS-QL+K-MS-CAN	Cable set master-slave, consisting of K-MS-QL and K-MS-CAN (2 m each)
63-000-005-27	PH2/7.62-ST16	Additional mating connector for sense terminal
63-000-006-27	SubD25 Doubler	Adapter 1x Sub-D25 male connector to 2x Sub-D25 female connector for I/O port
65-002-000-27	FCC-QLxx	Factory Calibration Certificate
64-402-000-27	SAB-QL-3	Additional safety cover for devices with 3 U
64-403-000-27	SAB-QL-5	Additional safety cover for devices from 5 U
63-000-007-00	SENSADAPT/PH4/POK/60V	Sense-Adapter from Phoenix PH4 to 4 mm binding post, max. 60 V
63-000-008-00	SENSADAPT/PH4/POK/1200V	Sense-Adapter from Phoenix PH4 to 4 mm touch-protected binding post, max. 1200 V
		Load cables see starting at page 127.

1. Rise and fall times are from 10 ... 90 % and 90 ... 10 % of the positive current (in CC mode) or voltage (in CV mode) setting range in "fast" regulation speed. Tolerance ±20 %. Measured with short-circuited output terminals (CC) or with open output terminals (CV). Other loads may increase rise/fall times. Rise/fall time in CP and CR mode: ca. 3 ms. Rise/fall time in "slow" regulation speed: ca. 2 ms in C and CV mode, ca. 20 ms in CP and CR mode.
2. Value is entered as conductance in S.
3. Description of available terminals beginning at page 123. Units with touchable terminals are supplied with safety covers.
4. Mains voltage tolerance: ±10 %.
5. Measured at the front in distance of 1 m.
6. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Operating modes, functions

Basic operating modes	CC, CP, CR, CV
Combined operating modes	CC+CV, CV+CC, CP+CV, CR+CV
Functions	DC source-sink energy storage device test internal resistance measurement list function adjustable internal resistance capacitance simulation function rectangular function (also in PWM mode) modulation (sine, triangle, square, arbitrary) data acquisition (internally or to USB flash drive) save and recall of device settings watchdog in remote operation AC source (only with 4-quadrant models)
AC source (only 4Q models)	in CC, CV mode (sine, triangular, square, sawtooth, arbitrary) range values are peak values for V and I adjustable offset
Frequency range [1]	0.1 Hz … 10 kHz, also mains synchronizable
User interface	4,3" TFT touch display

Accuracy of setting DC

	of setting	of corresponding positive range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Resistance (at |V| > 5 % of positive voltage range)	±1.4 %	±0.3 % of current range
Power (at |V| and |I| > 30 % of corresp. pos. range) (at |V| and |I| > 5 % and < 30 % of corresp. pos. range)	±0.35 % ±0.7 %	±0.1 % ±0.25 %
Resolution	15 bits in each quadrant	
Ripple voltage	ca. 0.4 % p-p of positive voltage range	
Ripple current	ca. 0.4 % p-p of positive voltage range	

Accuracy of setting AC (only 4-quadrant models)

	of setting	of corresponding positive range
Voltage (RMS) [1] [2]	±3 %	±0.25 %
Current (RMS) [1] [2]	±3 %	±0.25 %

Accuracy of adjustable protections

	of setting	of corresponding positive range
Current protection	±0.2 %	±0.05 %
Voltage protection	±0.1 %	±0.05 %
Resolution	13 bits in each quadrant	

Accuracy of measurement DC

	of measured value (real value)	of corresponding positive range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Ext. control signal	±0.2 %	±0.1 %
Resistance	is calculated from current and voltage	
Power	is calculated from current and voltage	
Resolution	15 bits in each quadrant	
Sampling time	200 µs, triggerable	

Accuracy of measurement AC

	of measured value (real value)	of corresponding positive range
Voltage (RMS)	±0.5 %	±0.1 %
Current (RMS)	±0.5 %	±0.1 %
Time constant of RMS measurement	ca. 500 ms	

Accuracy of display

No. of dec. places	4
Accuracy	accuracy of measurement DC/AC ±1 digit of display value

Accuracy of trigger voltage and current

Trigger voltage	±1 % of positive voltage range
Trigger current	±1 % of positive current range
Sampling time	200 µs

Dynamic function LIST

Operating modes	CC, CV, CR, CP
No. of settings	max. 300, with corresponding ramp, dwell and sample times
Dwell time [1]	200 µs … 1,000 s
Ramp time [1]	0 … 1,000 s
Resolution	200 µs
Accuracy of setting times	±0.02 %
Delay at triggered start	max. 300 µs

Dynamic function rectangular

Operating modes	CC, CV
No. of levels	2
Pulse times [1], resolution	1 µs … 9,999.999 ms, resolution 1 µs
Accuracy of setting times	±0.02 %

Dynamic function PWM

Operating modes	CC, CV
No. of levels	2
Frequency [1], resolution	0.1 Hz … 10 kHz, resolution 0.1 Hz
Accuracy of frequency	±0.02 %
Duty cycle, resol.	1 … 99 %, resolution 1 %

Dynamic function modulation

Operating modes	CC, CV
Waveforms	Sine, square, triangular, arbitrary (1,024 points)
Frequency [1], resol.	0.1 Hz … 10 kHz, resolution 0.1 Hz
Accuracy of frequency	±0.01 %
Modulation depth	0 … 100 %

Capacitance simulation function

Capacitance	10 mF … 99999,99 F

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 meas. points	max. 40,000

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: inputs and outputs

Inputs	analog setting I and V with -5 … 0 … 5 V or -10 … 0 … 10 V analog protection setting I or V with -10 … 0 … 10 V output activation operating mode CC/CV control speed selection slow/fast remote shut-down readable digital input (by SCPI command) trigger input control input (activates I/O port)

The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid when the sense lines are connected. At voltages with higher disturbance values the accuracy can change for the worse.
1. The applicable time or frequency range is limited by the bandwidth of the respective device.
2. at 50 … 60 Hz
3. only −10 V … 0 … 10 V
4. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

Technical Data

Digital input level	logical low: 0 … 0.8 V, logical high: 3 … 30 V
Outputs	analog voltage monitor output -10 … 0 … 10 V analog current monitor output -10 … 0 … 10 V output activation state status output for upper protection value V or I status output for lower protection value V or I trigger output
Digital output level	logical low: 0 … 0.8 V logical high: 5 V/24 V selectable, max. 10 mA (push-pull)

I/O port: accuracy of analog control –5 … 0 … 5 V or –10 … 0 … 10 V

	of setting	of corresponding positive range
Voltage	±0.2 %	±0.1 %
Current	±0.2 %	±0.1 %
Resistance (at |V| > 5 % of positive voltage range)	±1.6 %	±0.4 % of current range
Power (at |V| and |I| > 30 % of corresp. pos. range) (at |V| and |I| > 5 % and < 30 % of corresp. pos. range)	±0.55 % ±0.9 %	±0.2 % ±0.35 %
Current protection[3]	±1 %	±0.4 %
Voltage protection[3]	±1 %	±0.4 %
	input resistance of analog inputs >10 kΩ	

I/O port: accuracy of analog monitor outputs –10 … 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	

I/O port: permissible voltages

	standard I/O port	isolated I/O port (option QL06)
Vout-io (GND - neg. output)	max. 2 V [4]	max. 125 V [4]
VioPE (GND - PE)	max. 125 V [4]	max. 125 V [4]
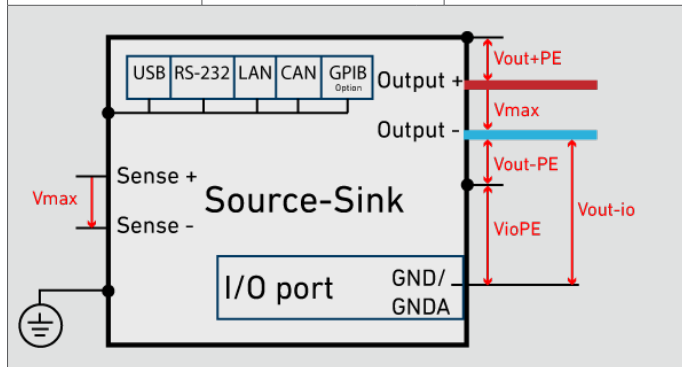
Output

Output resistance	>50 kΩ when output is off
Max. output voltage Vmax	see model overview
Min. output voltage Vmin	see model overview

Output: permissible voltages

	standard I/O port	isolated I/O port (option QL06)
Vout-PE (neg. output - PE)	max. 125 V [4]	max. 125 V [4]
Vout+PE (pos. output - PE)	Vmax + max. 125 V [4]	Vmax + max. 125 V [4]

Power

Nominal power	see model overview (at Ta = 21 °C)
Derating	-1.2 %/°C for Ta > 21 °C

Protection and monitoring

Protective devices	overcurrent overtemperature
Monitoring	overvoltage indication

Terminals

Output	see model overview
Sense	PH4/3.5-ST8, 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	70 cm
Cooling	temperature-controlled air cooling
Noise, weight	see model overview
Mains voltage	see model overview
Mains cable	length max. 3 m cross-section of mains leads min. 1 mm²
Power consumption	see model overview

Housing

Size	see model overview

Color
  front
  rear
  top, side panels
	
	RAL7035 (light grey)
	stainless steel
	RAL7037 (dusty grey)

Safety and EMC

Protection class	1
Measuring category	O (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

Standard interfaces

Data interfaces	RS-232, USB, LAN, CAN
I/O port	standard (not isolated)

Available options

Data interface QL02	 GPIB
Hardware extensions QL06 QL14	 galvanically isolated I/O port heavy-weight castors for models from 5 U

Calibration, warranty

FCC-QLxx	Factory Calibration Certificate, twice for free after registration
Recommended calibration interval	2 years
Warranty	2 years

Technical data of production series B, rev. 6. Subject to technical changes without notice.

The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid when the sense lines are connected. At voltages with higher disturbance values the accuracy can change for the worse.

1. The applicable time or frequency range is limited by the bandwidth of the respective device.
2. at 50 … 60 Hz
3. only –10 V … 0 … 10 V
4. positive/negative DC voltage or RMS value of a sinusoidal AC voltage

POWER DISTRIBUTION UNIT SE SERIES

Production Series A

SE Series – Brief Profile

H&H power distribution units are designed for the construction of comprehensive test facilities in connection with electronic loads.

They serve as a central mains switch with emergency stop function, whereby the emergency stop can also be integrated into a higher-level emergency stop system. Each circuit is individually fused. Some of the devices are equipped with their own residual current circuit breaker. An integrated DC power supply extends the flexibility.

- Central mains switch
- Emergency stop function
- Also with residual circuit breaker
- Can be integrated into external emergency stop systems
- All circuits individually fused
- Built-in DC power supply on most models

	Front View	Rear View
SE1PH16S-FP-TB SE3PH16S-FP-TB SE3PH32S-FP-TB		
SE1PH16SE-CB		
SE1PH16SU-CB		
SE3PH16SE-CBFI-DC12 SE3PH16SE-CBFI-DC24		
SE3PH32STU-CBFI-DC12 SE3PH32STU-CBFI-DC24		
SE3PH16STU-CBFI		
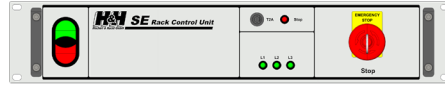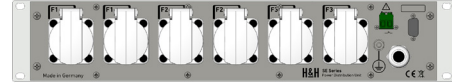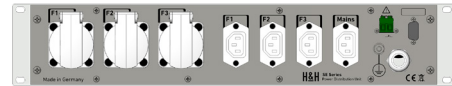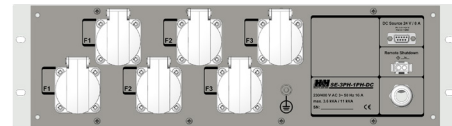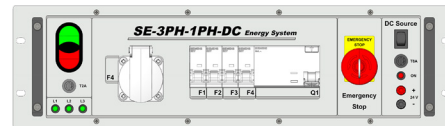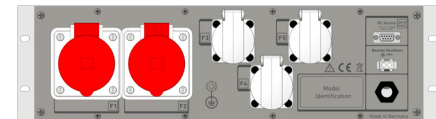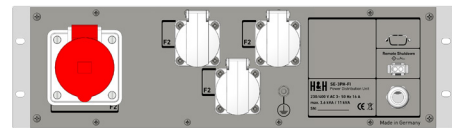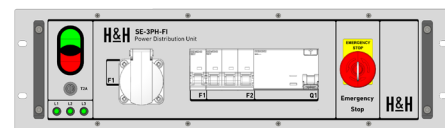
Model (Order number)	SE1PH16S-FP-TB [1]	SE3PH16S-FP-TB [1]	SE3PH32S-FP-TB [1]	SE1PH16SE-CB	SE1PH16SU-CB
Mains	1/N/PE AC 230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz	1/N/PE AC 230 V 50 … 60 Hz
Power distribution	max. 3.6 kVA	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)	max. 3.6 kVA (1~) / max. 22 kVA (3~)	max. 3.6 kVA	max. 3.6 kVA
Connection	16 A	16 A CEE	32 A CEE	16 A	16 A
Phase indicator	yes	yes	yes	yes	yes
Central power-off	yes	yes	yes	yes	yes
Residual current circuit breaker	-	-	-	-	-
Circuit breaker	-	-	-	3x 16 A Type C (1~)	3x 16 A Type C (1~)
Connections permanent	1x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	1x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	1x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	-	1x 1/N/PE AC 230 V 50 … 60 Hz (cold device socket)
Connections deactivatable	1x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	1x 3/N/PE AC 400/230 V 50 … 60 Hz (terminal blocks[2]), 2x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	1x 3/N/PE AC 400/230 V 50 … 60 Hz (terminal blocks[2]), 2x 1/N/PE AC 230 V 50 … 60 Hz (socket strip)	6x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)	3x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket), 3x 1/N/PE AC 230 V 50 … 60 Hz (cold device socket)
Low voltage source voltage, current, fuse	-	-	-	-	-
Weight	4 kg	4 kg	4.5 kg	9 kg	9 kg
Housing / 3D model[3]	19", 2 U / SE_M1	19", 2 U / SE_M1	19", 2 U / SE_M1	19", 2 U / SE_M2	19", 2 U / SE_M3

Model (Order number)	SE3PH16SE-CBFI-DC12	SE3PH16SE-CBFI-DC24	SE3PH32STU-CBFI-DC12	SE3PH32STU-CBFI-DC24	SE3PH16STU-CBFI
Mains	3/N/PE AC 400/230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz	3/N/PE AC 400/230 V 50 … 60 Hz
Power distribution	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)	max. 3.6 kVA (1~) / max. 10.8 kVA (3~)
Connection	16 A CEE	16 A CEE	32 A CEE	32 A CEE	16 A CEE
Phase indicator	yes	yes	yes	yes	yes
Central power-off	yes	yes	yes	yes	yes
Residual current circuit breaker	30 mA, In = 40 A	30 mA, In = 40 A	30 mA, In = 40 A	30 mA, In = 40 A	30 mA, In = 40 A
Circuit breaker	3x 16 A Type C (1~) 1x 10 A Type B (1~)	3x 16 A Type C (1~) 1x 10 A Type B (1~)	3x 16 A Type C (1~) 2x 16 A Type C (3~)	3x 16 A Type C (1~) 2x 16 A Type C (3~)	1x 16 A Type C (3~) 1x 10 A Type B (1~)
Connections permanent	-	-	-	-	-
Connections deactivatable	7x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)	7x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)	2x 1/N/PE AC 400/230 V 50 … 60 Hz (CEE16 protective contact socket), 3x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)	2x 1/N/PE AC 400/230 V 50 … 60 Hz (CEE16 protective contact socket), 3x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)	1x 3/N/PE AC 400/230 V 50 … 60 Hz (CEE16 protective contact socket), 3x 1/N/PE AC 230 V 50 … 60 Hz (protective contact socket)
Low voltage source voltage, current, fuse	12 V, 8 A, T8A	24 V, 8 A, T8A	12 V, 8 A, T8A	24 V, 8 A, T8A	-
Weight	19.5 kg	19.5 kg	20 kg	20 kg	19.5 kg
Housing / 3D model[3]	19", 3 U / SE_M7	19", 3 U / SE_M7	19", 3 U / SE_M8	19", 3 U / SE_M8	19", 3 U / SE_M13

1.   Assembled front panel, only in combination with a rack
2.   Terminals on top-hat rail at the front panel's rear side
3.   Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Control circuit	
Fuse	T2A

Operating conditions	
Operating temperature	5 ... 40 °C
Stock temperature	-25 ... 65 °C
Max. operating height	2,000 m above sea level
Pollution degree	2
Max. humidity	80 % at 31 °C, linear decreasing to 50 % at 40 °C
Weight	see model overview
Mains	see model overview
Mains voltage tolerance	-15 ... 10 %

Housing	
Dimensions, weight	see model overview
Color Front panel Rear panel Side, top	 RAL7035 (light grey) stainless steel (except SE1PH16S-FP-TB, SE3PH16S-FP-TB, SE3PH32S-FP-TB) zinc grey (except SE1PH16S-FP-TB, SE3PH16S-FP-TB, SE3PH32S-FP-TB)

Safety and EMC	
Protection class	1
Electrical safety	DIN EN 61010-1
EMC	DIN EN 61326-1 DIN EN 55011 DIN EN 61000-3-2 DIN EN 61000-3-3
Warranty	2 years

SE
power distribution

Binding Posts, Bolts, Copper Bars

TERMINALS

Terminals

On the following pages you will find the various load and sense terminals for H&H electronic loads and 4-quadrant power supplies.
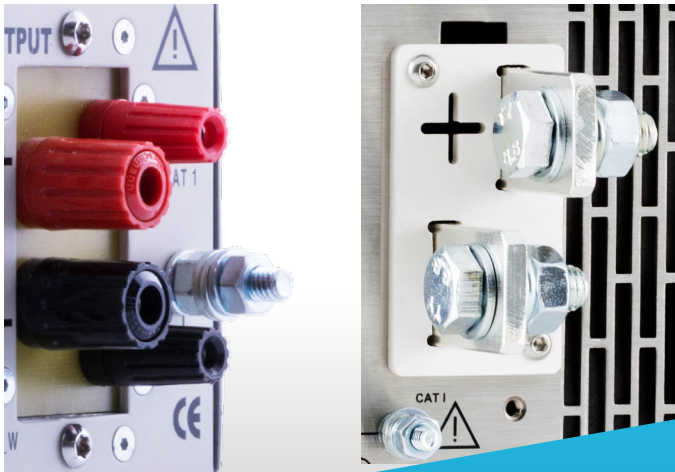
- Binding posts
- Touch-protected binding posts
- Terminal strips
- Bolts
- Flat copper bars

Terminal Overview

BO-M8x20
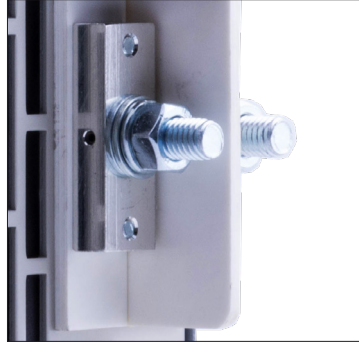
Bolts with continuous thread M8 with 20 mm length (including nuts and washers)

Installed e.g.:
NL series load terminals

BPK4-30L

Touch-protected binding posts for 4 mm banana plug
max. 30 A
Connection of stripped wires up to 4 mm diameter

Installed e.g.:
PLI series load terminals

BPK4-60L
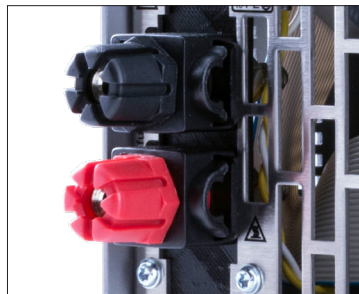
Touch-protected binding posts for 4 mm banana plug
max. 60 A
Connection of stripped wires up to 6 mm diameter

Installed e.g.:
PLI series load terminals
NL series load terminals

FKL15/4-SM6
FKS20/4-SM8
FKS20/5-SM8
FKS25/8-SM10
FKS25/10-SM10
FKS30/10-SM12
FKS40/12-SM12

Installed e.g.:
PLA load terminals
PLI load terminals

Horizontal (FKL) or vertical (FKS) flat copper bars with hole for screw (inclusive screws, nuts and washers).
FKL150/4-SM6:
flat copper bars 15 x 4 mm with screw M6
FKS20/4-SM8:
flat copper bars 20 x 4 mm with screw M8
FKS20/5-SM8:
flat copper bars 20 x 5 mm with screw M8
FKS25/8-SM10:
flat copper bars 25 x 8 mm with screw M10
FKS25/10-SM10:
flat copper bars 25 x 10 mm with screw M10
FKS30/10-SM12:
flat copper bars 30 x 10 mm with screw M12
FKS40/12-SM12:
flat copper bars 40 x 12 mm with screw M12

Terminals

PH2/7.62-BU16

Phoenix socket strip bipolar
Grid dimension 7.62 mm
max. 16 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1745629)

Installed e.g.: PLI series sense terminals,
adapter for banana plugs see page 128

PH4/3.5-ST8
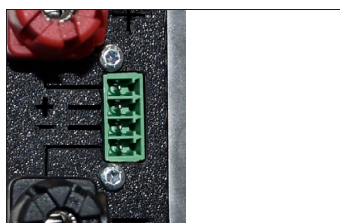
Phoenix plug strip bipolar
Grid dimension 3.5 mm
max. 8 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1840382)

Installed e.g.: QL series sense terminals

PH8/7.62-ST43
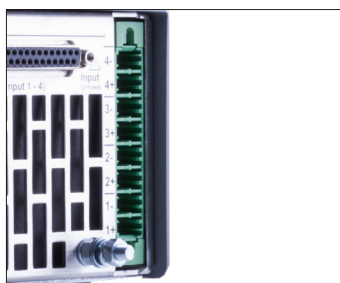
Phoenix plug strip 8-pole
Grid dimension 7.62 mm
max. 43 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1777891)

Installed e.g.: PMLA series load terminals

PH3/7.62-ST41
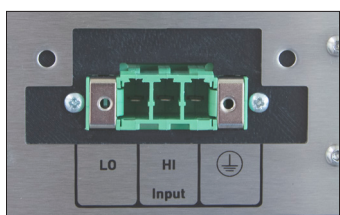
Phoenix plug strip 3-pole
Grid dimension 7.62 mm
max. 41 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1777846)

Installed e.g.: ACLS series load terminals

PH3/10.16-ST76

Phoenix plug strip 3-pole
Grid dimension 10.16 mm
max. 76 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1967469)

Installed e.g.: ACLS series load terminals

PH3/15-ST125
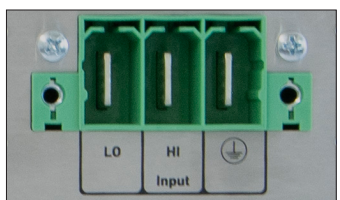
Phoenix plug strip 3-pole
Grid dimension 15 mm
max. 125 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1762602)

Installed e.g.: ACLS series load terminals

PH7/10.16-ST76
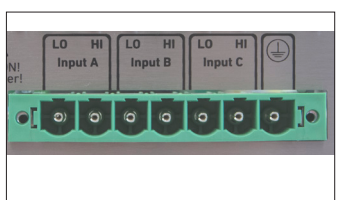
Phoenix plug strip 7-pole
Grid dimension 10.16 mm
max. 76 A
incl. mating connector from PHOENIX CONTACT
(Phoenix order no.: 1967508)

Installed e.g.: ACLT series load terminals

H&H Höcherl & Hackl
The electronic load

PK4-30L
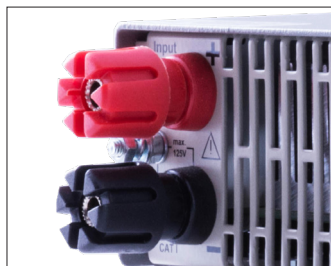
Binding posts for 4 mm banana plugs
max. 30 A
Connection of stripped wires up to 4 mm diameter

Installed e.g.:
PLA load terminals

PK4-35L-1
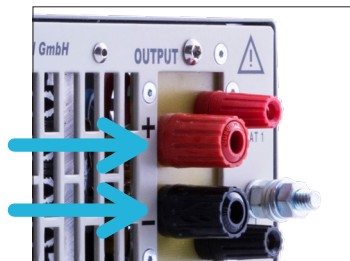
Binding posts for 4 mm banana plugs
max. 35 A
Connection of stripped wires up to 2 mm diameter

Installed e.g.:
NL series load terminals

PK4-35L-2
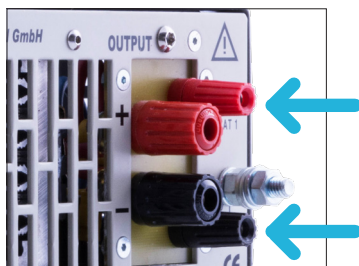
Binding posts for 4 mm banana plugs
max. 35 A
Connection of stripped wires up to 2 mm diameter
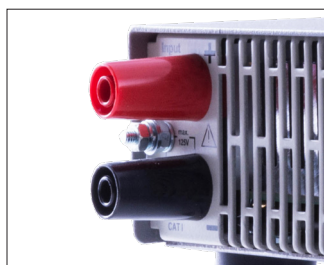
Installed e.g.:
NL series sense terminals

SBU4-24

Touch-protected binding post for 4 mm banana plugs
max. 24 A

Installed e.g.:
TRL series load terminals

SBU4-32

Touch-protected binding post for 4 mm banana plugs
max. 32 A

Installed e.g.:
PLA series load terminals

SBUS4-32

Touch-protected sunk binding post for 4 mm banana plug
max. 32 A

Installed e.g.:
ACLS series load terminals

Terminals

ACCESSORIES

Accessories

If required, we supply individually assembled load cables for electronic loads.
We offer 19" racks up to 42 U so that your equipment is properly stored and well protected.

- High current cables
- Super flexible cables
- Low-inductance cables
- Rack systems

Load Cables

High Current Cables HKS and HKV-F Standard

Flexible and super flexible cables in different lengths, cross sections and dielectric strengths with matching ring cable lugs, wire end ferrules or plugs. Color coding on the cable lug.
Two cables are always required for load connection. For higher currents, several cables are connected in parallel.

Standard cable HKS in different cross sections with cable lugs

Super flexible cables HKV-F10A/0 with wire end ferrules

Low-Inductance High Current Cables HKL-I
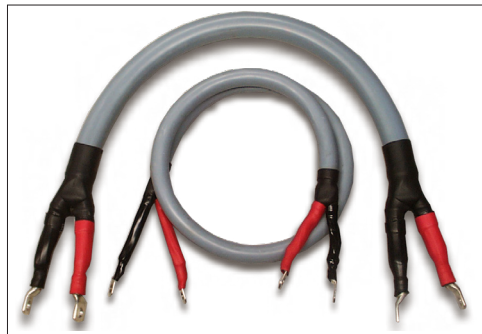
Low-inductance high current cable HKL-I

For dynamic loads with high slew rates and for long power leads.
These double cables enable the voltage of the DUT to be applied to the load input with very low inductive losses. This is the only way to achieve fast current rise times.
The maximum voltage is 300 V.

Comparison: standard cable – low inductance cable
Voltage source 5 V, load step 0 to 100 A
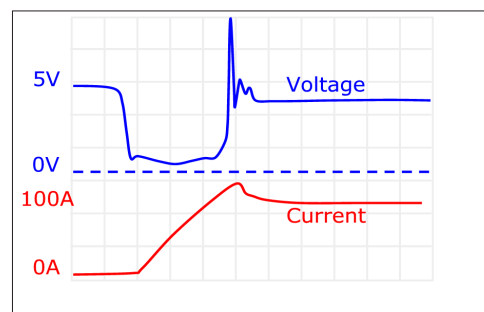
Voltage and current diagram with 2 m standard cable HKS-035, slack. Voltage drops as current on cable increases.
The cable determines the maximum rise speed of the current.
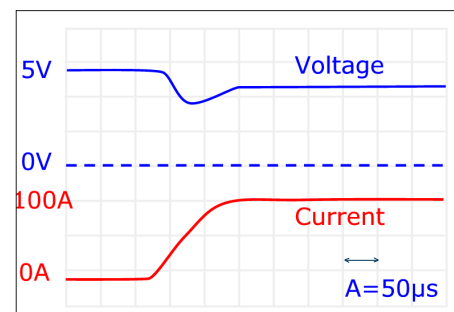
Voltage and current diagram with 2 m low-inductance cable HKL-I30. The voltage remains stable while the current increases at the load input.
The actual control behavior of the test unit can be analyzed.

Accessories

Composition of cable name [1]

Cable	Maximum voltage	Separation	Specialty	Cross section /mm²	Assembly 1. end	Separation	Assembly 2. end	Separation	Length /m	Separation	Color
HK	L max. 300 V R max. 600 V T max. 1,000 V V max. 1,500 V	-	O no I low-inductance F super flexible	4 6 10 16 25 etc.	O no K6 cable lug for screw M6 K8 cable lug for screw M8 K10 cable lug for screw M10 K12 cable lug for screw M12 K16 cable lug for screw M16 A wire end ferrule B4 banana plug 4 mm Conx connector x	/	O no K6 cable lug for screw M6 K8 cable lug for screw M8 K10 cable lug for screw M10 K12 cable lug for screw M12 K16 cable lug for screw M16 A wire end ferrule B4 banana plug 4 mm Conx connector x	-	l	-	rd (red) bk (black)

Table 1

If you need a cable not listed in table 2, you can use table 1 to request a special cable. We'll help you - just ask us!

Data of some high current cables (examples) [2]

| Cable (Order number)	Cross-section	Current	Voltage	L [3]	R [3]	Assembled for
HKL-I12K10/K10-1	2 x 12 mm²	80 A	300 V	0.065 µH	3.79 mΩ	Ø 10
HKL-I30K12/K12-1	2 x 30 mm²	130 A	300 V	0.065 µH	1.82 mΩ	Ø 12
HKR-O70K12/K12-1-rd	70 mm²	340 A	600 V	0,56 µH	0.68 mΩ	Ø 12
HKV-O16K10/O-1-rd	16 mm²	100 A	1,500 V	0.64 µH	3.02 mΩ	Ø 10
HKV-O70K12/O-1-rd	70 mm²	250 A	1,500 V	0.52 µH	0.68 mΩ	Ø 12
HKV-F16Con/O-1-rd	16 mm²	100 A	1,500 V	0.64 µH	3.02 mΩ	SBUS6-125

Table 2

Adapter for Sense Terminals
see also series-related accessories
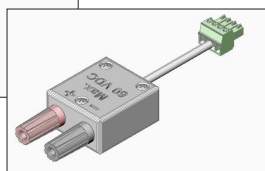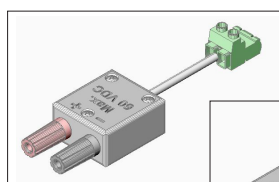
Sense adapter from 2 or 4pole Phoenix (sense) to 4 mm binding posts or safety sockets
SENSADAPT/PH2/POK/60V for 2pole sense, max. 60 V
SENSADAPT/PH2/POK/1200V for max. 1200 V
SENSADAPT/PH4/POK/60V for 4pole sense, max. 60 V
SENSADAPT/PH4/POK/1200V for max. 1200 V
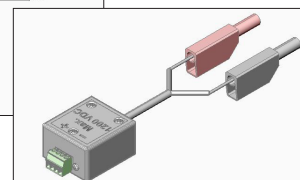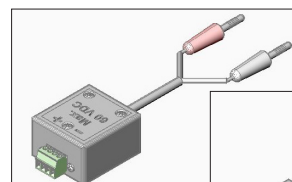
Sense adapter from 4 mm banana or safety plugs to 2 or 4pole Phoenix (sense)
SENSADAPT/4BAN/PH2/60V for 2pole sense, max. 60 V
SENSADAPT/4BAN/PH2/1200V for max. 1200 V
SENSADAPT/4BAN/PH4/60V for 2pole sense, max. 60 V
SENSADAPT/4BAN/PH4/1200V for max. 1200 V

I/O Port Doubler
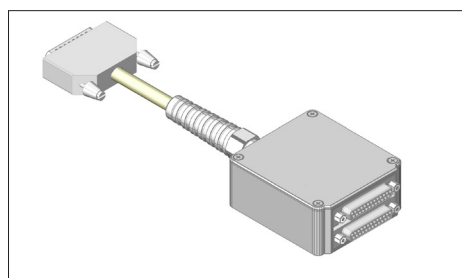
In order to be able to access measuring or status lines when using H&H master-slave cables, the I/O port doubler is plugged onto the I/O port. This provides a second parallel-connected female connector.

1. Not all possible combinations of cable names are actually available.
2. Other cable combinations not listed in this table can be supplied.
3. The specified values for L and R relate to two parallel cables per meter.

You will find further series-related accessories in this catalog with the corresponding series.

19" Racks

The installation of the electronic loads requires special racks, designed for a sufficient air outlet of the heated exhaust air. The H&H racks are equipped with large air vents on the rear so that the exhaust air can pass almost unhindered.

The rear door is shortened to feed the connection cables. The connecting cables of the mains supply are led through flexible foam lips.
Each cabinet contains a socket strip for the mains connection of the devices.

Model (Order number)	Installation height front	Air outlet rear	Dimensions H x W x D (H incl. crane lugs and castors)	Installation depth
Rack 33	33 U	26 U	ca. 1750 x 600 x 800 mm	675 mm
Rack 37	37 U	30 U	ca. 1950 x 600 x 800 mm	675 mm
Rack 42	42 U	35 U	ca. 2150 x 600 x 800 mm	675 mm

Front/side view 19" rack with 42 U

Side/rear view 19" rack with 42 U

Accessories

General Standard Terms and Conditions of Business (GTC) of Höcherl & Hackl GmbH (H&H) Rev. Jan 21, 2019

§ 1 General Information – Scope of Application
(1) Our General Standard Terms and Conditions of Business shall apply exclusively; we shall not recognize any terms or conditions on the part of the customer that oppose or deviate from our General Standard Terms and Conditions of Business unless we have expressly agreed to their applicability in writing. Our General Standard Terms and Conditions of Business shall apply even if we carry out delivery to the customer without reservation in the knowledge of terms or conditions on the part of the customer that oppose or deviate from our General Standard Terms and Conditions of Business.
(2) Any agreements reached between us and the customer for the purpose of performance of the present agreement shall be recorded in the present agreement in writing.
(3) Our General Standard Terms and Conditions of Business shall apply only with regard to entrepreneurs within the meaning of Section 310 Paragraph 1 of the German Commercial Code [BGB].
(4) We operate under the name: H&H Höcherl & Hackl GmbH, Industriestraße 13, 94357 Konzell, Germany, Tel.: +49 (0) 9963/94301-0, Fax: +49 (0) 9963/94301-84, Email: office@hoecherl-hackl.com.

§ 2 Offer – Performance Specifications
(1) If the purchase order is to be qualified as an offer in accordance with Section 145 of the German Civil Code [BGB], then we can accept such within a period of two weeks.
(2) The performance specifications applicable upon conclusion of contract shall form the scope of the service to be provided. In the case of subsequent changes the additions and/or deletions shall be charged and/or credited in accordance with the expenditure.

§ 3 Offer Documents
(1) We reserve the right of ownership and copyright to illustrations, drawings, drafts, circuit diagrams, calculations and other documents. This provision shall also apply to those written documents designated as "confidential." The customer shall be required to obtain our express consent in writing prior to disclosure to third parties.
(2) Any and all documents shall be immediately returned or destroyed to the extent that an order is not placed.

§ 4 Delivery Period
(1) Commencement of the delivery period indicated by us presupposes clarification of all technical matters.
(2) Compliance with our delivery obligation also presupposes timely and proper fulfillment of customer obligations. The plea of nonperformance of the agreement shall remain reserved.
(3) If the customer is in default of acceptance or culpably violates any other duties to cooperate, then we shall be entitled to require compensation for the damage and any additional expenditures incurred as a result. The right to assert other rights or claims shall be reserved.
(4) Insofar as the prerequisites of Paragraph (3) are given, then the risk of accidental perishing or deterioration of the purchase item shall pass to customer at the point in time in which the purchaser defaults on acceptance or is in debtor's delay.
(5) We shall be liable in accordance with statutory provisions insofar as the underlying purchase agreement represents a fixed-date purchase within the meaning of Section 286 Paragraph 2 No. 4 of the German Civil Code [BGB] or Section 376 of the German Commercial Code [HGB]. We shall also be liable in accordance with statutory provisions if as a consequence of a delay in delivery for which we may be held responsible the customer is entitled to assert that the customer's interest in further performance of the agreement has ceased.
(6) Furthermore, we shall be liable in accordance with statutory provisions if delay of delivery is based on intentional or grossly negligent violation of contract for which we may be held responsible; we shall be attributed culpability on the part of our representatives or vicarious agents. Insofar as delay of delivery is based on intent or grossly negligent violation of contract for which we may be held responsible, then our liability for payment of damages shall be limited to foreseeable, typically occurring damage.
(7) We shall also be liable in accordance with statutory provisions if delay of delivery is based on culpable violation of a material contract obligation; in this case, however, liability for payment of damages shall be limited to foreseeable, typically occurring damage.

§ 5 Prices and Terms of Payment
(1) Unless otherwise indicated in the confirmation of order our prices shall apply "ex factory" including packaging; exceptions for special packaging see §9 Packaging. Transport costs and special packaging will be invoiced separately.

We shall reserve the right to accordingly modify our prices if after conclusion of the agreement cost increases occur, in particular due to collective wage agreements or changes in the price of materials. We shall be obliged to proceed in the same manner in the event of cost reductions. We shall verify both cost increases and cost reductions to the customer on request insofar and once they occur.
(2) Our prices do not include the legally valid value added tax; it shall be shown separately in the invoice in the respective legally valid amount on the day of the invoice. As a rule the day of invoicing shall be the date of dispatch or the day of readiness for shipment.
(3) The net purchase price (without any deduction) shall be due for payment within 30 days as of the date of invoice unless otherwise indicated in the order confirmation. Statutory regulations shall apply with regard to the consequences of delayed payment.
As of a net order value of EUR 25,000 a 30 % prepayment upon order receipt and 70 % as of the date of invoice shall apply. In the case of the prepayment obligation calculation of the delivery period begins only when the complete prepayment amount is credited to our bank account.
(4) A discount shall be granted with receipt of payment by 14 days after the date of invoice at the latest. If payment is made upon notification of readiness for shipment, then a total of 3 % may be discounted. Any other discount deduction shall require special written agreement.
(5) We reserve the right to only delivery against payment in advance in the case of first and delinquent customers.
(6) The customer shall be entitled to assert rights to setoff only if the customer's counterclaims are the subject of a declaratory judgment, are undisputed or recognized by us. Furthermore, the purchaser may only exercise a right of retention only insofar as the purchaser's counterclaim is based on the same contractual relationship.

§ 6 Cancellation Regulation
Unilateral cancellation of the order shall be excluded. In the case of cancellation overall cancellation fees in the amount of 30 % of the net order value shall become due. A deviating agreement, e.g. in the case of special equipment shall remain reserved.

§ 7 Terms and Conditions of Delivery – Passage of the Risk
(1) Unless otherwise indicated in the confirmation of order carriage and insurance paid delivery "CIP" (Incoterms® 2010, ICC) shall be agreed. This means that we deliver the commodity to the carrier or another person designated by us – if agree: at an agreed location – and that we conclude the shipping agreement and pay the freight charges incurred for transport of the commodity up to the designated place of destination. We also conclude a contract of insurance against the risk of loss for which the customer shall be responsible or damage to the commodity during transport. The customer shall charged extra for the cost of insurance and transport; exceptions shall require written agreement. Passage of the risk shall be effected with delivery to the carrier or the other designated person.
(2) We shall be entitled to make partial deliveries.
(3) In the case of default of acceptance the customer shall be responsible for any associated costs as a result, in particular storage costs.
(4) Orders from sales partners shall be delivered exclusively to the principal place of business of the sales partner and/or to the principal place of business of the sales partner's forwarding depot.

§ 8 Export Control
(1) We have no obligation to make deliveries concerning those goods that are in regard to an export control subjects to an authorization requirement by relevant export regulations and embargos, especially of the European Union (EU), Germany respectively other member states and the USA because of their kind or their purpose of use or the designated end-use.
(2) If the customer exports the goods, he has to check whether there are any export restrictions and he has to ensure that the goods do not refer to any armour-relevant, nuclear or gun concerning facilities and / or uses or see use in these things. Furthermore he has to ensure that these goods are not passed to a company or to people, that are named within the framework of an embargo and/or an export restriction of the federal republic of Germany, of the EU or the US abstractly or concretely, and are not delivered to any military recipients.
(3) The customer dispenses us from all damages that result from culpable violation of the prementioned duties according to section 1) and 2).

§ 9 Packaging
(1) The device packaging is charged in the device price. Special packaging for e.g. cables shall be charged separately.

(2) The type and extent of packaging shall be accordingly selected for the respective purpose.
(3) The packaging shall be taken back without remuneration if it is delivered free of charge.
(4) Packaging shall also be used several times in the interest of environmental protection.

§ 10 Liability for Defects

(1) The customer's claims related to defects shall presuppose that the customer has properly complied with the customer's obligations to inspect and report in accordance with Section 377 of the German Commercial Code [HGB].
(2) If a defect is present in the purchase item, then the customer shall have the option of requiring subsequent performance through elimination of the defect or delivery of a new item free of defects. The place of subsequent performance shall be our principal place of business in Konzell (cf. Section 1 IV); there is where examination of the asserted defect also takes place. The customer shall be responsible for forwarding expenses to us. After subsequent performance the purchase item shall be shipped to the original place of performance; we shall assume the costs of return to the customer. If after consultation with us a warranty repair should take place locally through one or more of our staff, then the material and resulting hours of work shall not be invoiced. The costs of travel and the return journey, mileage and, if necessary, overnight accommodations shall be invoiced.
(3) If subsequent performance fails, then the customer shall have the option of rescission or requiring a reduction.
(4) We shall be liable in accordance with statutory provisions in the event that the customer asserts claims for damages based on intent or gross negligence, including the intent or gross negligence of our representatives or vicarious agents. If we are not held responsible for deliberate violation of contract, then liability for the payment of damages shall be limited to foreseeable, typically occurring damage.
(5) We shall be liable in accordance with statutory provisions insofar as we culpably violate a material contract obligation; however, the liability for the payment of damages shall be limited to foreseeable, typically occurring damage in this case as well. A material contract obligation shall be given if the violation of duty involves a duty, the performance of which the customer has relied upon and is entitled to rely upon.
(6) Insofar as the customer is entitled in all other respects to replacement of the loss instead of performance, our liability shall be limited to foreseeable, typically occurring damage.
(7) Liability due to culpable injury to life, limb or health shall remain unaffected; this shall also apply to mandatory liability in accordance with product liability law.
(8) Liability shall be excluded unless otherwise regulated in the above.
(9) The period of limitation for claims related to defects shall amount to 12 months as of passage of the risk. This shall not apply insofar as the purchase item is normally used for a building and is responsible for the defect.
(10) The period of limitation in the case of a delivery claim to damages in accordance with Sections 478, 479 of the German Civil Code [BGB] shall remain unaffected; it shall amount to five years as of delivery of the defective item.
(11) Required material and working hours shall be calculated following elapse of the warranty period. The purchaser of the service (customer) shall be responsible for both the forwarding expenses to us and return shipment. In the case of on site repairs the costs of travel and the return journey, mileage and, if necessary, overnight accommodations shall be additionally invoiced. The customer shall be charged for any and all costs in the case of unwarranted complaints. A lump sum service fee shall be charged if no error can be determined or if the purchaser of the service (customer) does not wish to have a repair.

§ 11 Joint and Several Liability

(1) Any other liability for payment of damages than provided for in Section 10 shall be excluded without consideration of the legal nature of the claim asserted. This applies in particular to claims for damages from culpability upon conclusion of contract due to other violations of duty or because of claims in tort for the replacement of property damage in accordance with Section 823 of the German Civil Code [BGB].
(2) Limitation in accordance with Paragraph (1) shall also apply instead of a claim to replacement of the damage the customer requires replacement of useless expenditure instead of performance.
(3) If liability for compensation against us is limited or excluded, then this shall also apply with regard to the personal liability for payment of damages on the part of our staff, employees, coworkers, representatives and vicarious agents.

§ 12 Retention of Title

(1) We reserve the right to ownership of the purchase item until receipt of all payments based on the supply agreement. In the event that the purchaser engages in behavior contrary to the terms of the agreement, in particular in the case of delay of payment, we shall be entitled to repossess the purchase item. Repossession of the purchase item by us shall be equivalent to cancellation of the agreement. We shall be entitled to exploit the purchase item following repossession of same, while the proceeds of any exploitation shall be set off with the customer's liabilities less reasonable exploitation costs.
(2) The customer shall be obliged to handle the purchase item with care; in particular the customer shall be obliged to sufficiently insure same for the reinstatement value at the customer's own expense against damage caused by fire, water and theft. If maintenance and inspection work are required, then the customer shall be responsible for timely performance of such.
(3) The customer shall be obliged to immediately notify us in writing in the event of attachment or any other interference by third parties so that we may file a complaint in accordance with Section 771 of the German Code of Civil Procedure [ZPO]. If the third party is unable to reimburse us for the court and out of court costs of a complaint in accordance with Section 771 ZPO, then the customer shall be liable for any loss that we may incur.
(4) The customer shall be entitled to resell the purchase item in the normal course of business; however, the customer shall hereby assign us any and all claims in the amount of the final invoice amount (including the value added tax) for our claim, which accrue to the customer from the latter's customers or third parties from resale, independently of whether the purchase item has been resold without or after processing. The customer shall remain authorized to collect the claim even after such assignment. Our power to collect the claim shall remain unaffected. However, we shall be obliged to refrain from collection of the claim as long as the customer meets the customer's payment obligations arising out of the collected proceeds, is not in delay of payment and in particular no request for institution of insolvency proceedings or composition has been submitted or suspension of payment. However, if this is the case, then we may require that the customer discloses the assigned claims and their debtors, provide any and all information required for collection, surrender the pertinent documents, while notifying respective the debtors (third parties) of assignment.
(5) Processing or reorganization of the purchase item by the customer shall always be performed for us. If the purchase item is processed with items that do not belong to us, then we shall acquire co-ownership of the new item in proportion to the value of the purchase item (final invoice amount including value added tax) to the other processed items at the time of processing. In all other respects the same shall apply for the item created through processing as in the case of the purchase item delivered with reservation.
(6) If the purchase item is inseparably commixed with items that do not belong to us, then we shall acquire co-ownership of the new item in proportion to the value of the purchase item (final invoice amount including value added tax) to the other commixed items at the time of commixture. If commixture takes place in such a way that the item belonging to the customer is to be regarded as the principal item, then it shall be agreed that the customer assigns us proportionate co-ownership. The customer shall safeguard the sole possession or joint possession thus created for us.
(7) The customer shall also assign us the claims to secure our claims against the customer which accrue from combination of the purchase item to real property against a third party.
(8) We shall be obliged to release the collateral to which we are entitled at the customer's request insofar as the realizable value of our collateral exceeds the respectively securable claims by more than 10%. We shall have the option of selecting the releasable collateral.

§ 13 Place of Performance, Place of Jurisdiction and Severability

(1) Insofar as the customer is a merchant our principal place of business shall be the place of jurisdiction; however, we shall also be entitled to bring action against the customer at the court responsible for the customer's place of domicile.
(2) The law prevailing in the Federal Republic of Germany shall apply; application of the United Nations (Vienna) Convention on Contracts for the International Sale of Goods (CISG) shall be excluded insofar as express reference is not made thereto in these terms and conditions.
(3) Unless otherwise indicated in the confirmation of order our principal place of business shall be the place of performance.
(4) Should one of the provisions or a part of a provision of the present agreement be or become invalid, then the validity of the remaining agreement shall not be affected. Instead of the invalid provision, an appropriate regulation shall apply which most closely approximates the intention of the contracting parties if they had considered the point upon conclusion of the present agreement.

H&H Höcherl & Hackl
The electronic load

Main Catalog

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