Electronic DC Loads

MULTI-CHANNEL LOAD PMLA SERIES

Production Series A

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 fpr energy storage device test
- SCPI programming and measuring
- Trigger model
- Internal measurement data storage
- Electronic protection
- Analog control input for each channel
- Analog monitor outputs for V and I
- Extensive data interfaces
- 19 inch mountable
- Bilingual help system (German/English)

Interfaces

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

◉ Standard ○ Option — not available

Applications

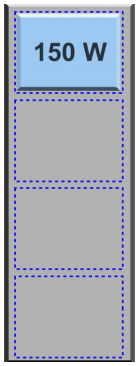
- Calibration of driver outputs
- Consumer test of electrical systems
- Burn-in applications

DUTs

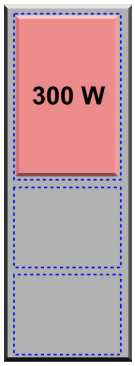
- Batteries and accumulators
- Cables
- Absorbers
- DC/DC converters
- Electronic assemblies
- Sensors
- Fuse boxes
- Control units
- Power distributors

Load Modules, Configuration

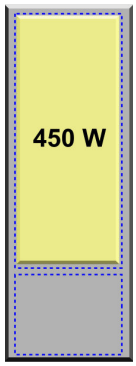
The PMLA multi-channel load has up to 3 cooling units with 4 mounting positions each for load modules, depending on the version. Modules are available with outputs of 150 W, 300 W, 450 W or 600 W. Depending on the output, a module occupies one (150 W), two (300 W), three (450 W) or four (600 W) mounting 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

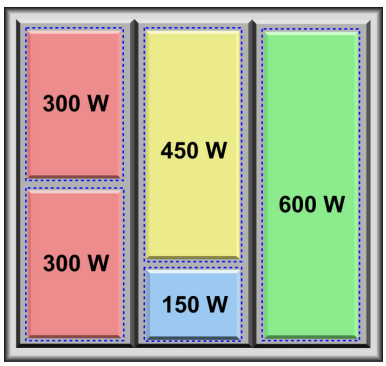


Cooling unit with 300 W module



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 limit 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 109). 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.

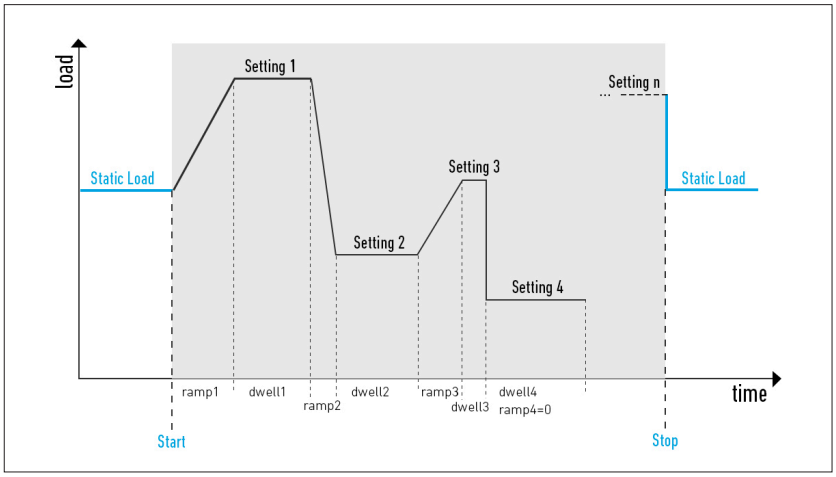
Undervoltage protection operates in two different modes:
- regulating transition (e.g. CC-CV operation at battery discharge
- switching transition (short dead time, e.g. when switching the input voltage)

Trigger Model

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

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.



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

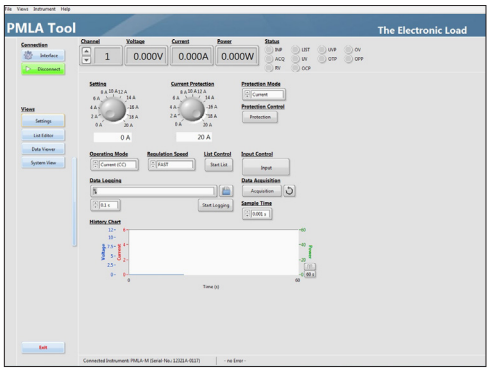
For certain DUTs or very long connecting cables, it may be necessary to adapt the regulation time constant of the electronic load in order to achieve stable operation. For this purpose, the control speed can be changed.

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.

Software Tool

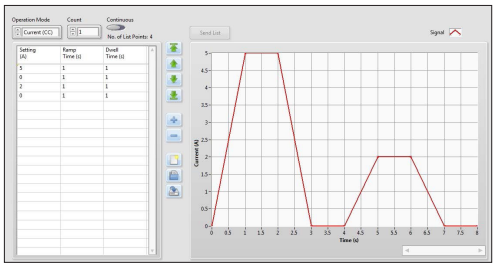
Setting Menu



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.

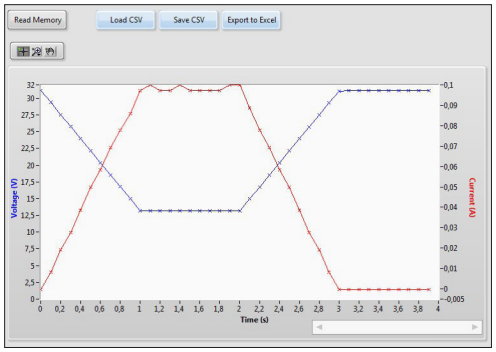
www.hoecherl-hackl.com
–> download area

List Editor



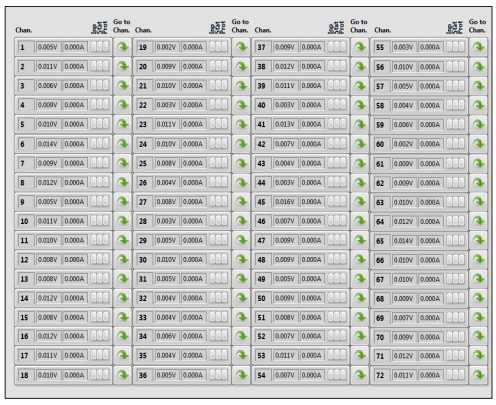
The List Editor is used to generate tabular setting values for current, voltage, power or resistance, the associated ramp times and the dwell times.
The generated waveform is sent directly to the device via a data interface or stored on a data memory medium (e.g. USB flash drive) for further processing.

Data Viewer



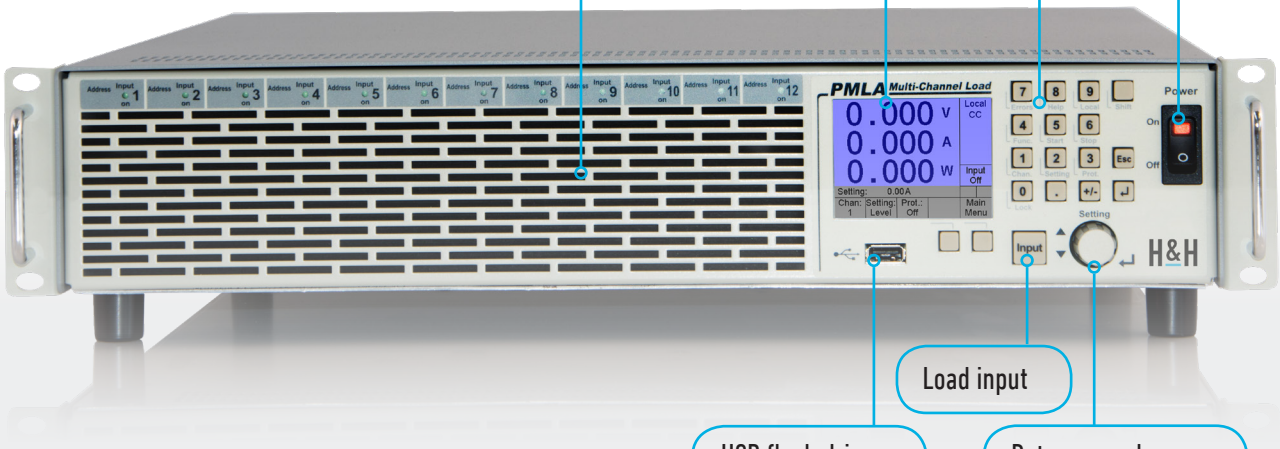
Measured values from the device's DAQ memory can be read from the device and displayed graphically using the Data Viewer.
The data can then be stored as a CSV file on a data carrier for further processing.
Individual measurement points (time stamp, voltage, current) are displayed as tooltips.

System View

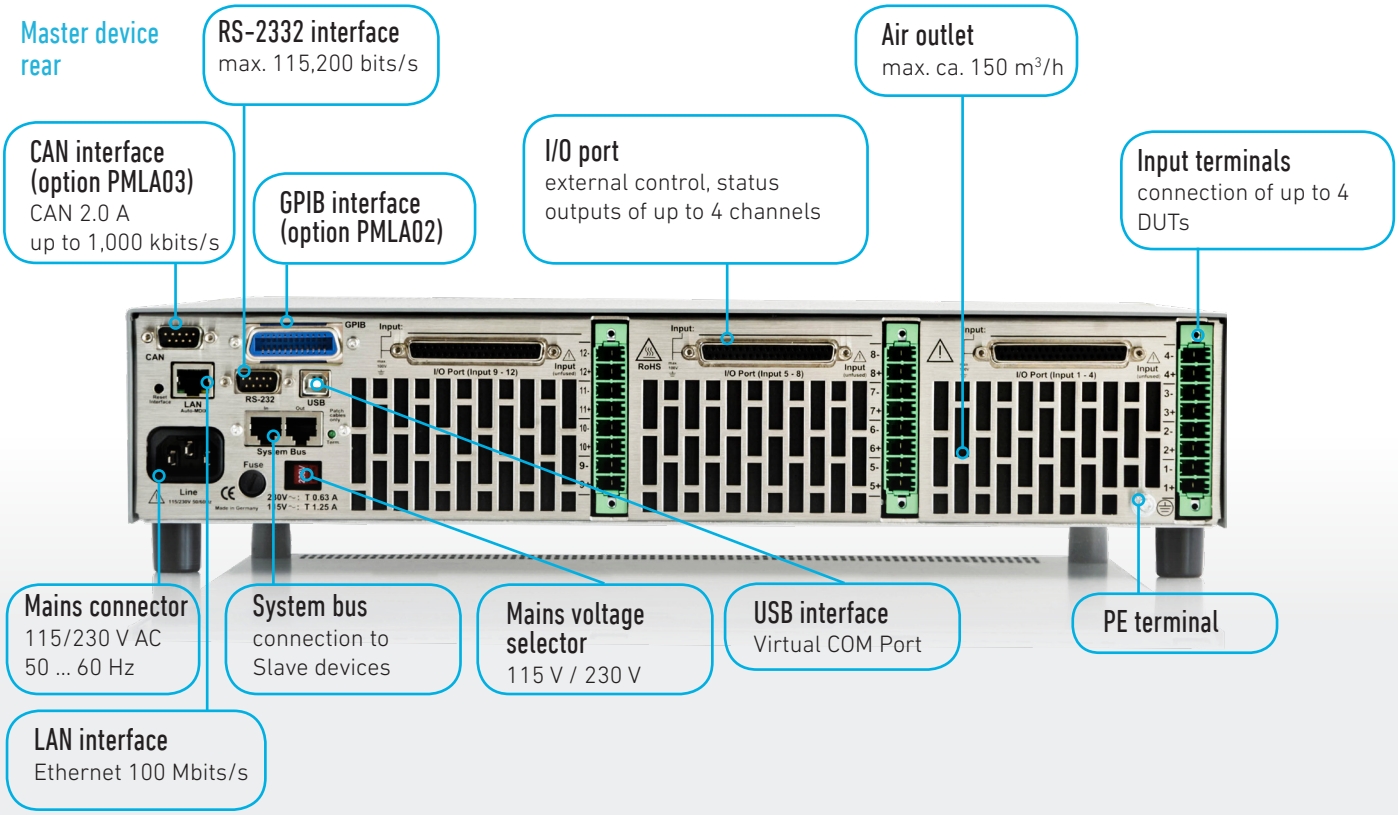


In the "System View" the most important states as well as voltage and current of all channels in the system (up to 72) are displayed. By the quick selection of a channel the new channel is selected and immediately switched to the Settings view.

Master device front



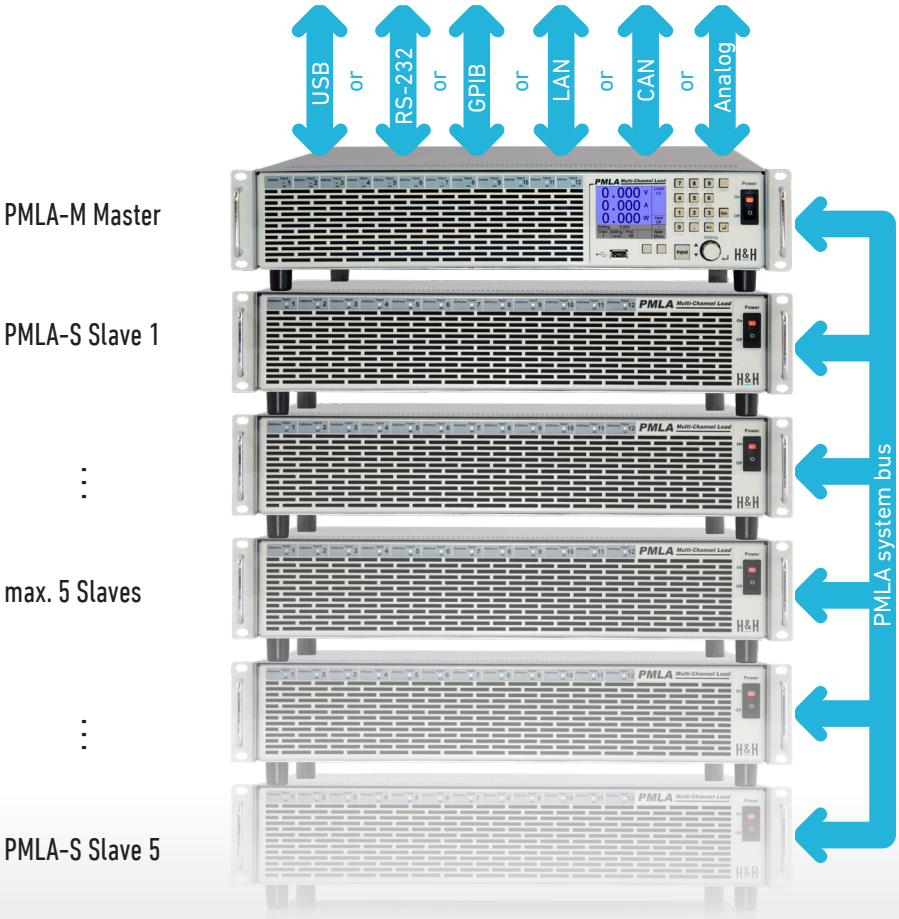
Master device rear



Models, Options, Modules and Accessories

Order number	Article	Description
23-001-000-01	PMLA-M	PMLA Master device with user interface, RS-232 + USB + LAN + PMLA system bus for connection of up to 5 Slave devices
23-002-000-01	PMLA-S	PMLA Slave device with system bus interface for connection of a Master device and of further Slave devices
23-003-000-01	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	PMLA15	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
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



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
	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
	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
	MA15-24C1 1 A	MA30-24C2 2 A	MA45-24C3 3 A	MA60-24C4 4 A

PMLA Series

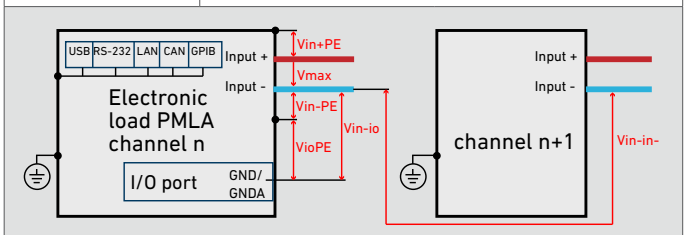
Module (Order number)	Continuous power	Max. input voltage Vmax	Min. input voltage Vmin [1]	Max. current Imax	Rmin [2]	Rmax [3]	Rise/fall time [4]	Input capacity	Required mounting positions [5]
MA15-04C30	150 W	40 V	1 V	30 A	0.067 Ω	133 Ω	200 µs	1 µF	1
MA15-06C20	150 W	60 V	1 V	20 A	0.100 Ω	200 Ω	200 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	±0.1 %	±0.1 %
Resistance (at 5 % to 100 % of voltage range)	±1.4 %	±0.3 % of current range
Power (at V and I > 10 % of range) (at V or I 5 ... 10 % of range)	±0.7 % ±2 %	
Resolution	12 bits	
Accuracy of adjustable protections		
	of setting	**of corresponding range**
Overcurrent protection	±0.1 %	±0.1 %
Undervoltge protection	±0.1 %	±0.1 %
Resolution	12 bits	
Accuracy of measurement		
	of measured value (real value)	**of corresponding range**
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Resistance	calculated from voltage and current	
Power	calculated from voltage and current	
Resolution	16 bits	
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 curent	±0.2 %	±0.05 % ±1 LSB
Resolution	16 bits	
	to internal memory	
Sampling rate	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	±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	±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

The specified accuracies refer to an ambient temperature of 23 ±5 °C. The specified accuracies are valid 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

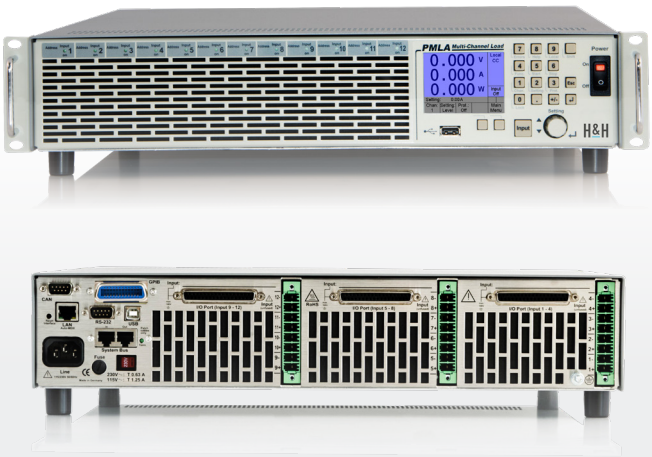
Technical Data (continued)

Monitoring	overvoltage undervoltage (if the input voltage is too low for the set current) reverse polarity
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. 69 dB(A) measured in distance of 1 m
Mains voltage	1/N/PE AC 230 V ±10 % 50 ... 60 Hz
Mains voltage toggleable	1/N/PE AC 115 V ±10 % 50 ... 60 Hz
Power consumption	max. 90 VA

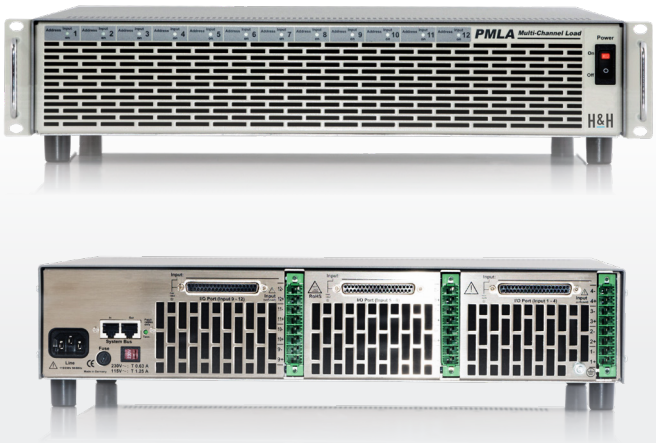
Terminals	
Load input	Phoenix Contact PH8/7.62-ST43, see starting at page 109
Sense	Sub-D at I/O port
Housing	
Color Front Rear Side panels, top	 RAL7035 (light grey) stainless steel RAL7037 (dusty grey)

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
Protection	IP20
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.