Source-Sinks

SOURCE-SINK NL SERIES

- 2-quadrant or 4-quadrant versions
- Source-sink function
- Rapid regulation time
- Current and voltage mode
- Adjustable limitations
- Analog measurement outputs for voltage and current
- Analog control inputs
- USB + RS-232 interface
- Programmable waveform
- SCPI programming with measurement function
- Software tools for battery testing

NL Series – Brief Profile

NL series source-sinks are power supply and electronic load in one device. They are the choice when it comes to testing energy storage devices.
The standard portfolio provides 2- or 4-quadrant devices up to 3,600 W.

Interfaces

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

◉ Standard ○ Option — not available

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Operating Modes

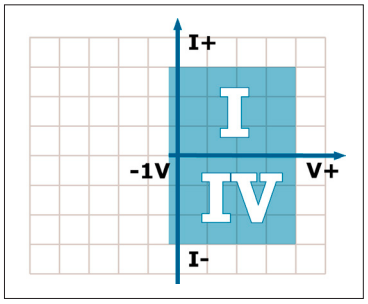
The NL source sinks can operate in constant voltage or constant current mode (CC - CV mode). In voltage mode, two current protections (source current and sink current) can be set independently of each other. In current mode, an upper and a lower voltage protection can be set. This allows the extended operating modes CC+CV and CV+CC to be realized.

Source-Sink Mode

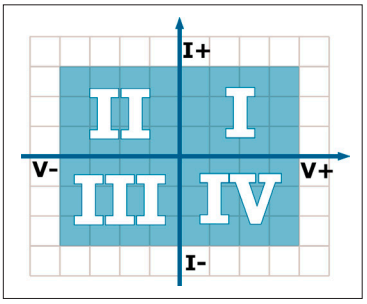
Depending on the setting and the characteristics of the connected test unit, the device automatically decides whether to operate as a source or a sink. Switching from source to sink mode is very rapid.

2-Quadrant/4-Quadrant Units

Devices for two-quadrant mode can supply or consume current with a positive output voltage. To guarantee the required function in the case of settings close to 0 V and long connection leads, the 2-quadrant devices start to operate from an output voltage of -1 V.
The 2-quadrant devices therefore also act as 4-quadrant devices but with limited negative voltage. 4-quadrant devices can set negative values as well as positive values.



2-quadrant unit



4-quadrant unit

I/O Port

Analog signals in realtime!

Standard I/O port for:

- Analog load setting from -5 ... 0 ... 5 V or -10 ... 0 ... 10 V in CC, CV mode
- Analog setting for upper and lower voltage or current protection
- Operating mode selection
- Input activation
- Control speed selection
- Analog voltage monitor signal from -10 ... 0 ... 10 V
- Analog current monitor signal from -10 ... 0 ... 10 V

As an option, the I/O port is available in a galvanically isolated version (option NL06).

Factory Calibration Certificate

(FCC-NLxx)

2 x for free

The devices are supplied with a free Factory Calibration Certificate (FCC). The FCC meets the requirements of DIN EN ISO 9000ff. This calibration certificate documents the traceability to national standards for the representation of the physical unit in accordance with the International System of Units (SI). Within the warranty period, we calibrate a second time free of charge. The recommended calibration interval is 2 years.

Mechanics

Retractable handle

The ZSAC 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. Castors can optionally be mounted on heavy equipment. No separate mounting kits are required for 19" installation.

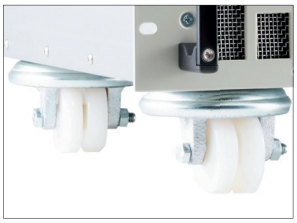
Safety Covers

For devices for dangerous input voltages, safety covers for the load inputs are supplied.

Hardware Expansions

Option ZS09 [1)]

Heavy-Load Castors



Heavy-load castors

Optional castors can be mounted on heavy equipment.

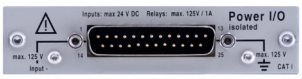
Option NL06 [1)]

Galvanically isolated I/O port

If there may be potential differences between the negative output and the signals at the I/O port, the standard analog I/O card can be replaced by an isolated version. All control and measurement signals are routed via isolation amplifiers and optocouplers. The card is pin compatible to the standard analog I/O card. The insulation voltage is 500 V referred to the negative output.

Option ZS07 [1)]

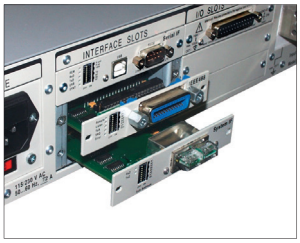
Power I/O Card



The Power I/O card can be added to control external equipment. 8 relay contacts (make contact 125 V/1 A) can be controlled and 8 logic inputs (5 ... 24 V, common GND) can be queried via the data interface of the load. The outputs and inputs are isolated from the load input. The insulation voltage is 500 V DC against the negative load input.

1) can be retrofitted at any time 2) can only be retrofitted or produced by H&H

Data Interfaces



All optional interface cards are pluggable and can be exchanged or extended if required.
The combined RS-232/USB interface is standard in the NL series.

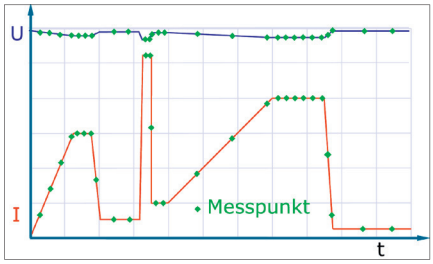
Option ZS03 [1]
GPIB Interface Expansion

With the option ZS03 you can upgrade to the GPIB interface. The card is simply plugged in.
Delivery without GPIB cable.

Option ZS15 [1]
LAN Ethernet/RS-232 Converter

Data is sent via the LAN Ethernet/RS-232 converter to the serial interface of the device.
Delivery without patch cable.

Option NL13 [2]
Data Acquisition Tool



Synchronized data logging with variable sampling rate for waveform. Simultaneous measurement of voltage and current.

The Data Acquisition Tool extends the range of functions of the devices with fast measurement data acquisition with data memory synchronized for waveform generation. The measurement intervals can be defined independently for each curve section.

Drivers

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

Watchdog Function

In digital remote control mode, the electronic load has a watchdog function that switches off the load input when the previously programmed watchdog delay time expires without a valid command arriving via the data interface.

1) can be retrofitted at any time 2) can only be retrofitted or produced by H&H

Software Tools

Control Tool (Universal Control Program)

Tool supplied as standard can be used to control single device.
Scope of functions:

- Device settings
- Data logging with numerical display
- Trigger source selection
- Activation of cut-off criteria
- Data logging

Dynamic List and Data Acquisition Tool

The Dynamic List Tool permits the intelligent generation of profiles in the form of straight sections.
The waveform can be graphically displayed before testing.
The profiles set can be stored and reactivated when needed.
If the NL13 option is installed, fast synchronous data logging can be carried out for the programmed waveform. The measurement points can be imported directly after the end of the measurement.

Battery Test Tool

- Charging
- Discharging
- Cycling
- Capacity determination
- Logging
- Cut-off criteria
- Dynamic test

The Battery Test Tool enables the testing of the most diverse energy storage units to be tested with the NL series.
Different storage types and their technical data can be saved in a library.
At the end of charging or discharging phases there are different monitoring criteria.

- Current
- Time
- Capacity
- -dV/Cell
- External event (Option ZS07 required)

To test the DUT for specific requirement it is possible to apply a predefined waveform.
The most important current test information is available at a glance.
A report can be produced for documentation of the test.
The time resolution can be adjusted from 300 ms onwards.
The data can be saved to a text file for further processing, e.g. with MS Excel.

The following data are logged:

- Voltage
- Current
- Time
- Capacity
- Status
- Test conditions
- Switch-off criteria

Model Overview Bipolar Devices

Model (Order number)	NL10V10C10	NL20V20C5	NL30V30C3.5	NL50V50C2	NL8V8C46	NL10V10C38
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
Power	100 W	100 W	105 W	100 W	368 W	380 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	PK4-35L	PK4-35L	PK4-35L	PK4-35L	BO-M8x20	BO-M8x20
Power consumption	250 VA	250 VA	205 VA	215 VA	800 VA	750 VA
Mains supply	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC
Dimensions W x H x D [3]	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 132 x 520 mm	483 x 132 x 520 mm
Weight ca.	13 kg	13 kg	13 kg	13 kg	23 kg	23 kg
Housing	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 3 U	19", 3 U

Model (Order number)	NL20V20C24	NL30V30C16	NL44V44C11	NL8V8C80	NL10V10C60	NL20V20C40
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
Power	480 W	432 W	484 W	640 W	600 W	800 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	BO-M8x20	BO-M8x20	BO-M8x20	FKS25/8-SM10	BPK4-60L	BPK4-60L
Power consumption	770 VA	770 VA	710 VA	1,360 VA	1,325 VA	1,400 VA
Mains supply	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC
Dimensions W x H x D [3]	483 x 132 x 520 mm	483 x 132 x 520 mm	483 x 132 x 520 mm	483 x 355 x 561 mm	483 x 355 x 520 mm	483 x 355 x 520 mm
Weight ca.	23 kg	23 kg	23 kg	54 kg	55 kg	55 kg
Housing	19", 3 U	19", 3 U	19", 3 U	19", 8 U	19", 8 U	19", 8 U

Model (Order number)	NL30V30C32	NL44V44C20	NL8V8C120	NL10V10C90	NL20V20C60	NL30V30C48
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
Power	960 W	880 W	960 W	900 W	1,200 W	1,440 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	BPK4-60L	BPK4-60L	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10
Power consumption	1,560 VA	1,400 VA	2,200 VA	2,088 VA	2,200 VA	2,340 VA
Mains supply	115/230 V AC	115/230 V AC	230 V AC	230 V AC	230 V AC	230 V AC
Dimensions W x H x D [3]	483 x 355 x 520 mm	483 x 355 x 520 mm	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 488 x 561 mm
Weight ca.	55 kg	55 kg	80 kg	80 kg	80 kg	80 kg
Housing	19", 8 U	19", 8 U	19", 11 U	19", 11 U	19", 11 U	19", 11 U

Model (Order number)	NL44V44C30	NL8V8C160	NL10V10C120	NL20V20C80	NL30V30C64	NL44V44C40
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
Power	1,320 W	1,280 W	1,200 W	1,600 W	1,920 W	1,760 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10
Power consumption	2,200 VA	2,700 VA	2,550 VA	2,700 VA	3,020 VA	2,700 VA
Mains supply	230 V AC	230 V AC	230 V AC	230 V AC	230 V AC	230 V AC
Dimensions W x H x D [3]	483 x 488 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm
Weight ca.	80 kg	92 kg	92 kg	92 kg	92 kg	92 kg
Housing	19", 11 U	19", 14 U	19", 14 U	19", 14 U	19", 14 U	19", 14 U

Models up to 3 kW at request

1. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed. Tolerance ±20 %. Measured at short-circuited output terminals (current) and open output terminals (voltage). Other loads may increase the rise/fall times.
2. Description of available terminals starting at page 101.
3. Device height incl. feet, largest width and depth. Installation depth without wiring. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview Unipolar Devices

Model (Order number)	NL1V10C20	NL1V20C10	NL1V30C8	NL1V42C6	NL1V80C3	NL1V100C2
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
Power	200 W	200 W	240 W	252 W	240 W	200 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	PK4-35L-1	PK4-35L-1	PK4-35L-1	PK4-35L-1	PK4-35L-1	PK4-35L-1
Power consumption	430 VA	380 VA	400 VA	400 VA	350 VA	310 VA
Mains supply	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC
Dimensions W x H x D [3]	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm	483 x 88 x 520 mm
Weight ca.	13 kg	13 kg	13 kg	13 kg	13 kg	13 kg
Housing	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 2 U	19", 2 U

Model (Order number)	NL1V8C80	NL1V10C60	NL1V20C40	NL1V26C32	NL1V44C22	NL1V60C16
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
Power	640 W	600 W	800 W	832 W	968 W	960 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	FKS25/8-SM10	BPK4-60L	BPK4-60L	BO-M8x20	BO-M8x20	BO-M8x20
Power consumption	1,400 VA	1,200 VA	1,300 VA	1,200 VA	1,400 VA	1,200 VA
Mains supply	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC	115/230 V AC
Dimensions W x H x D [3]	483 x 222 x 561 mm	483 x 222 x 520 mm	483 x 222 x 520 mm	483 x 132 x 520 mm	483 x 132 x 520 mm	483 x 132 x 520 mm
Weight ca.	39 kg	33 kg	33 kg	23 kg	23 kg	23 kg
Housing	19", 5 U	19", 5 U	19", 5 U	19", 3 U	19", 3 U	19", 3 U

Model (Order number)	NL1V80C11	NL1V8C160	NL1V10C120	NL1V20C80	NL1V26C60	NL1V44C40
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
Power	880 W	1,280 W	1,200 W	1,600 W	1,560 W	1,760 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	BO-M8x20	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	BPK4-60L	BPK4-60L
Power consumption	1,330 VA	2,700 VA	2,550 VA	2,700 VA	2,550 VA	2,500 VA
Mains supply	115/230 V AC	230 V AC	230 V AC	230 V AC	230 V AC	230 V AC
Dimensions W x H x D [3]	483 x 132 x 520 mm	483 x 355 x 561 mm	483 x 355 x 561 mm	483 x 355 x 561 mm	483 x 355 x 520 mm	483 x 355 x 520 mm
Weight ca.	23 kg	57 kg	55 kg	55 kg	51 kg	52 kg
Housing	19", 3 U	19", 8 U	19", 8 U	19", 8 U	19", 8 U	19", 8 U

1. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed. Tolerance ±20 %. Measured at short-circuited output terminals (current) and open output terminals (voltage). Other loads may increase the rise/fall times.
2. Description of available terminals starting at page 101.
3. Device height incl. feet, largest width and depth. Installation depth without wiring. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Model Overview Unipolar Devices (continued)

Model (Order number)	NL1V60C30	NL1V80C20	NL1V8C240	NL1V10C180	NL1V20C120	NL1V26C90
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
Power	1,800 W	1,600 W	1,920 W	1,800 W	2,400 W	2,340 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	BPK4-60L	BPK4-60L	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10
Power consumption	2,520 VA	2,200 VA	4,340 VA	3,800 VA	3,800 VA	3,775 VA
Mains supply	230 V AC	230 V AC	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A
Dimensions W x H x D [3]	483 x 355 x 520 mm	483 x 355 x 520 mm	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 488 x 561 mm
Weight ca.	52 kg	50 kg	81 kg	76 kg	76 kg	73 kg
Housing	19", 8 U	19", 8 U	19", 11 U	19", 11 U	19", 11 U	19", 11 U

Model (Order number)	NL1V44C60	NL1V60C45	NL1V80C30	NL1V8C320	NL1V10C240	NL1V20C160
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
Power	2,640 W	2,700 W	2,400 W	2,560 W	2,400 W	3,200 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10 mit Abdeckung	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10
Power consumption	4,000 VA	4,060 VA	3,200 VA	5,300 VA	4,500 VA	5,100 VA
Mains supply	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A
Dimensions W x H x D [3]	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 488 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm
Weight ca.	73 kg	75 kg	73 kg	99 kg	100 kg	96 kg
Housing	19", 11 U	19", 11 U	19", 11 U	19", 14 U	19", 14 U	19", 14 U

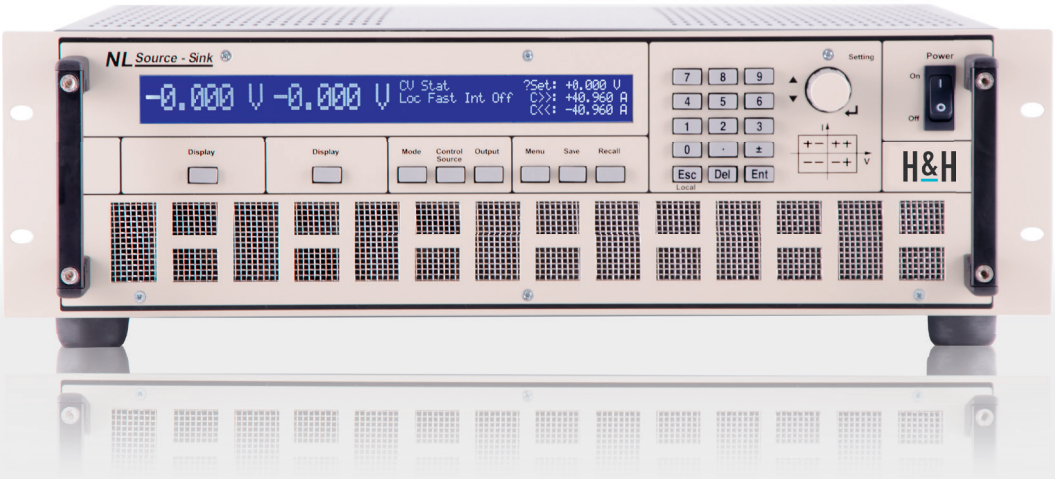
Model (Order number)	NL1V26C120	NL1V44C80	NL1V60C60	NL1V80C40
Voltage range	-1 ... 26 V	-1 ... 44 V	-1 ... 60 V	-1 ... 80 V
Current range	±120 A	±80 A	±60 A	±40 A
Power	3,120 W	3,520 W	3,600 W	3,200 W
Rise/fall time [1] current	200 µs	200 µs	200 µs	200 µs
Rise/fall time [1] voltage	200 µs	200 µs	200 µs	200 µs
Load terminals [2] rear	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-SM10	FKS25/8-M10 mit Abdeckung
Power consumption	4,800 VA	4,900 VA	4,800 VA	4,400 VA
Mains supply	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A	230/400 V AC, 16 A
Dimensions W x H x D [3]	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm	483 x 622 x 561 mm
Weight ca.	96 kg	90 kg	93 kg	96 kg
Housing	19", 14 U	19", 14 U	19", 14 U	19", 14 U

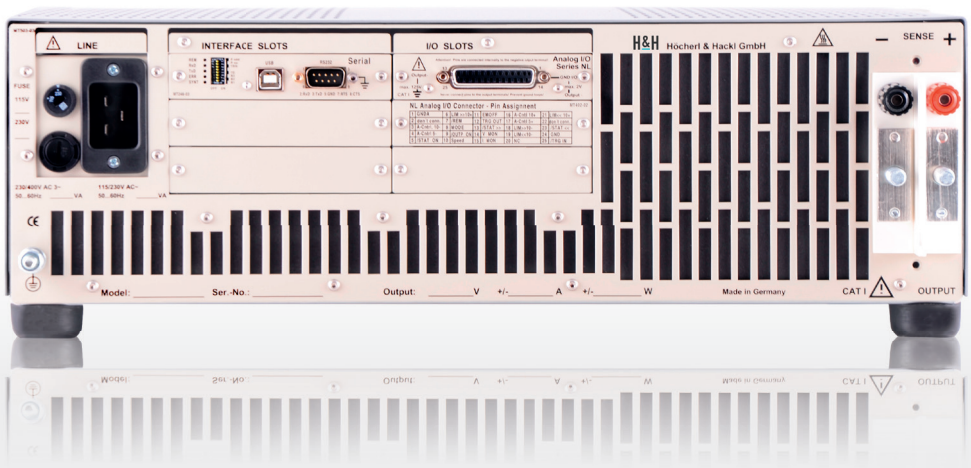
Models up to 6 kW at request

1. Rise and fall times are defined from 10 ... 90 % and 90 ... 10 % of maximum current at "fast" regulation speed. Tolerance ±20 %. Measured at short-circuited output terminals (current) and open output terminals (voltage). Other loads may increase the rise/fall times.
2. Description of available terminals starting at page 101.
3. Device height incl. feet, largest width and depth. Installation depth without wiring. 1 U = 44.45 mm. Detailed dimensions by means of 3D models at www.hoecherl-hackl.com/downloads.

Options (Summary) and Accessories

Order number	Article	Description
67-004-030-15	K-RS-SNM 9-9	RS-232 Cable (nullmodem cable) NL series
52-200-001-15	ZS03	GPIB interface extension
54-500-001-15	NL13	Data Acquisition Tool - fast data logging
52-500-001-15	ZS15	Ethernet-RS-232 Converter
53-100-004-15	NL06-N	Galvanically isolated I/O port instead of standard I/O port
53-100-003-15	NL06	Galvanically isolated I/O port for retrofitting of existing device
54-001-000-15	ZS07	Power I/O board 8 relay contacts 1x ON, 8 logic inputs
64-400-000-15	ZS09	Heavy-load castors for devices from 5 U (1 set = 4 pieces)
65-002-000-15	FCC-NLxx	Factory Calibration Certificate
64-401-000-15	SAB-NL-2	Additional safety cover for load terminals for devices with 2 U
64-402-000-15	SAB-NL-3	Additional safety cover for load terminals for devices with 3 U
64-403-000-15	SAB-NL-5	Additional safety cover for load terminals for devices from 5 U
67-003-020-15	K-MS-NL-2	Master-Slave cable for 2 devices (2 m)
67-003-040-15	K-MS-NL-3	Master-Slave cable for 3 devices (2 x 2 m)
		Load cables see starting at page 105





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Technical Data

Setting accuracy		
	of setting	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Current protection	±0.2 %	±0.05 %
Voltage protection	±0.1 %	±0.05 %
Setting resolution	16 bits	
Ripple	0.05 % RMS of range	
Load Effect 0 ... 100 %	0.1 % of range	
Line Effect ±10 %	0.02 % of range	
Display accuracy		
	of measured value (real value)	of corresponding range
Voltage	±0.1 %	±0.05 % ±1 digit
Current	±0.2 %	±0.05 % ±1 digit
Resistande	calculated of voltage and current	
Power	calculated of voltage and current	
Accuracy of standard measurement, read out via data interface		
	of measured value (real value)	of corresponding range
Voltage	±0.1 %	±0.05 %
Current	±0.2 %	±0.05 %
Resolution	18 bits	
Sampling rate (not synchronized)	330 ms, not triggerable	
Accuracy of measurement with option NL13, read out via data interface		
	of measured value (real value)	of corresponding range
Voltage	±0.15 %	±0.07 %
Current	±0.3 %	±0.07 %
Resolution	13 bits	
Sampling rate (programmable)	minimum 200 µs (to memory) triggerable	

I/O port: accuracy analog control -5 ... 0 ... 5 V / -10 ... 0 ... 10 V		
	of setting	of corresponding range
Voltage	±0.2 %	±0.15 %
Current	±0.4 %	±0.15 %
Current protection [1]	±0.2 %	±0.15 %
Voltage protection [1]	±0.4 %	±0.15 %
	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 capacity 2 kΩ	
I/O port: further functions		
External control functions	standby operating mode change trigger input and output remote shut-down	

I/O port: permissible potentials		
	standard I/O port	isolated I/O port (option NL06)
GND - neg. output	max. 2 V [2]	max. 125 V [2]
GND - PE	max. 125 V [2]	max. 125 V [2]
Output		
Output resistance	> 50 kΩ in standby	
Output capacity	ca. 1.5 µF/1,400 W	
Parallel operation	up to 3 devices in Master-Slave mode (hardware-controlled only in current mode)	

Output: permissible potentials		
	standard I/O port	isolated I/O port (option NL06)
neg. output - PE	max. 125 V [2]	max. 125 V [2]
Power		
Nominal power	see model overview (at Ta = 21 °C)	
Derating	-1.2 %/°C for Ta > 21 °C	
Protection and monitoring		
Protective devices	overcurrent protection overtemperature cut-off	
Monitoring signals	overvoltage indication	
Terminals		
Output	see model overview	
Sense	PK4-30L (see starting at page 101)	
Operating conditions		
Operating temperature	5 ... 40 °C	
Stock temperature	-25 ... 65 °C	
Max. operating height	2,000 m above sea level	
Pollution degree	1	
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	
Supply voltage	115/230 V~ ±10 %, 50 ... 60 Hz 230/400 V AC, 16 A CEE [3]	
Power consumption	see model overview	

Mechanics	
Dimensions, weight	see model overview
Color Front Rear Side panels, top	 RAL7032 (pebble grey) RAL7032 (pebble grey) RAL7037 (dusty grey)
Safety and EMC	
Protection class	1
Protection	IP20
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
Calibration, warranty	
FCC-NLxx	Factory Calibration Certificate, twice free of charge
Warranty	2 years

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. –10 ... 0 ... +10 V only
2. positive or negative DC voltage or RMS value of a sinusoidal AC voltage
3. Class C protective equipment recommended due to high inrush current