



## Electronic AC Load ZSAC Series



**400 W up to 21,000 W**  
**260 V up to 440 V**  
**3 A up to 100 A**



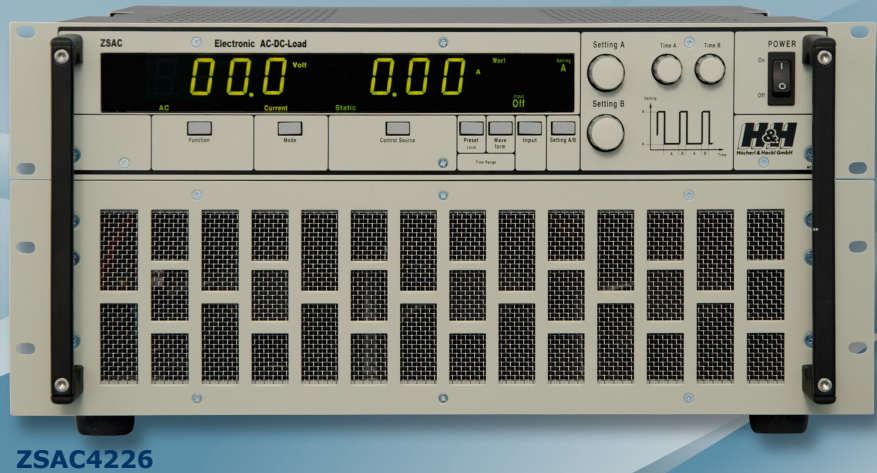
# Electronic AC Loads, ZSAC Series

**SCPI**

**Interface overview**

RS-232	○
USB	○
GPIB	○
LAN	○
System bus	○
Analog	/
Analog isolated	✕

✕ Standard ○ Option / not available



ZSAC4226

- Frequency range up to 800 Hz
- As single phase version and for 3-phase
- Star and delta connection possible
- Input voltages up to 440 V
- Power 400 W ... 21,000 W
- Current and resistance mode
- Programmable waveform

- Dynamic loads
- Phase angle adjustment combined with crest factor
- Harmonics, phase control
- SCPI programming with measurement function
- Electronic protection
- Isolated measurement outputs for voltage and current
- Isolated analog control input

**Operating Modes**

The AC current loads of the ZSAC series feature constant current and resistance operating modes.

In AC mode the current is set as sinusoidal. In resistance mode the height and waveform of the current depends on the input voltage.

**Voltage Types**

Depending on the type of voltage the devices can be switched between mains-synchronous voltage, AC voltage with variable frequency and DC voltage.

**Waveforms**

In current mode a low-distortion sinusoidal waveform is a permanently saved setting. In resistance mode the current depends on the waveform of the applied input voltage.

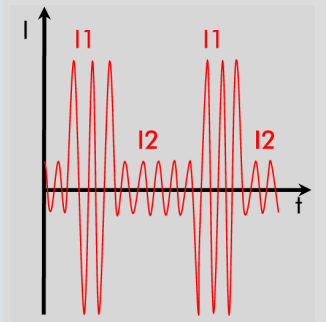
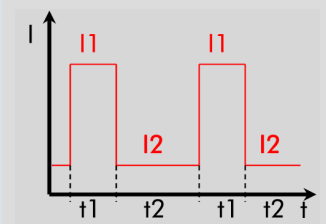
Any waveform can be specified by programming and saved in the retrievable waveform memory.

Functions for harmonics, phase controlled currents and currents with adjustable crest factor are stored permanently. The phase angle adjustment is combined with the crest factor adjustment.

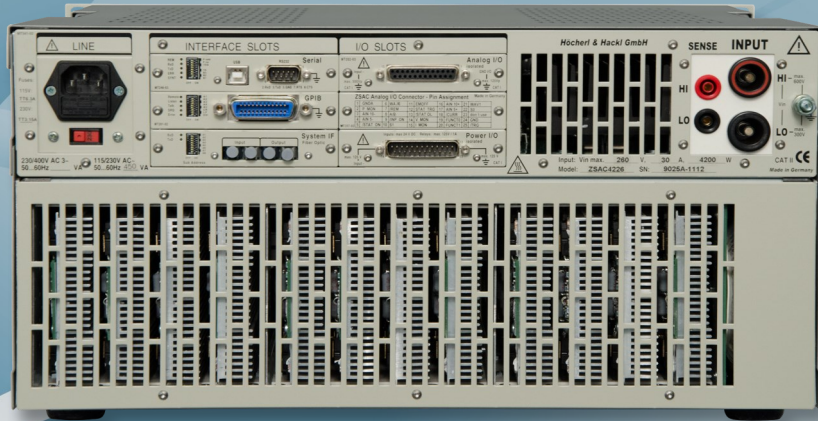
**Dynamics**

The inbuilt modulator enables two independently adjustable currents and times within the range from 100 μs ... 1 s.

In AC mode the modulator serves to adjust the envelope curve of the AC current (amplitude modulation).



ZSAC Series



ZSAC4226

This is H&H

PLA Low Power

PLI High Power

ZS Multi-Range

ERI Energy Recycling

PMLA Multi-Channel, GUI

PMLI Multi-Channel

ZSAC AC & DC

NL Source-Sink

Accessories

SE Power Distribution

GTC

**Remote Control**

All load functions can be controlled remotely via the standard Analog I/O Interface. The control inputs can be operated with TTL levels and 24 V from PLC controllers.

**Analog Control Input**

In the constant current operating mode the current can be set in real time by 0 ... 3.5 V or 0 ... 7 V DC.

**Analog Measurement Outputs**

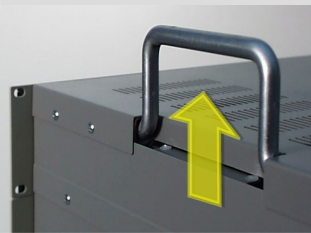
There are 0 ... 7 V analog measurement signals for voltage, current and power available in real time. The outputs are electrically isolated from the load input.

**Cooling**

The units are air-cooled. To keep the operating noise low, the fans are temperature and current-dependently controlled.

**Mechanics**

The ZS is a sturdy 19" rack design and can also be used as a table-top device.



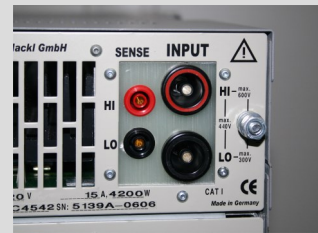
From 5 height units there are retractable handles on the top of the device.

Optional castors can be mounted

on heavy devices. Separate installation kits are needed for 19" rack installation.

**Connections**

All connections are at the rear. The input terminals are designed as touch-protected sockets for 4 mm or 6 mm plugs.



**Interfaces (Accessories)**

The interface cards are removable and can be exchanged or expanded as required. The devices can be fitted with the following interfaces:

- RS-232 + USB <sup>1)</sup> (Option ZS01)
- GPIB + RS-232 + USB <sup>1)</sup> (Option ZS02)
- System interface fiber optic (Option ZS05)
- Ethernet/RS-232 converter (Option ZS15)

<sup>1)</sup> Can be addressed as virtual COM Port in Windows

## Data Interfaces (Accessories) ZSAC Series

### Extended function range when using an optional data interface

- SCPI programming
- Settings with 16 bits resolution
- Measurement function for voltage, current and power
- Measurement data memory
- Dynamic load profiles
- Generation of harmonics
- Adjustable crest factor
- Arbitrary programmable waveform
- Phase control



The interface cards are removable and can be exchanged or expanded as required.

<b>Settings</b>	Resolution Accuracy	16 bits see Technical Data
<b>Measurement function</b>	Resolution Sampling rate	18 bits ca. 300 ms for V+I not synchronized see Technical Data
	Accuracy	
	Measurement data memory	max. 2,000 V/I values + timestamp
<b>Waveform memory</b>	Resolution Functions	512 points/period programmable waveforms Crest factor Harmonics (3rd to 15th) Phase control Phase shift *
<b>Load profile generator</b>	Steps	max. 50
	Pulse duration	200 $\mu$ s ... 2,000 s
	Ramp time	0 ... 2,000 s
	Cycling rate	once, n times, continuous

\* Phase shift in terms of apparent power is not possible

### RS-232 + USB Interface (Option ZS01) <sup>2)</sup>

Option ZS01 adds an RS-232 and a USB interface (as Virtual COM Port) to the device.

Programming is in SCPI.

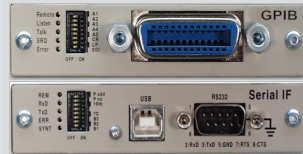
Including 2 m RS-232 cable.



### GPIB + RS-232 + USB Interface (Option ZS02) <sup>2)</sup>

The GPIB interface also includes the RS-232 + USB interface (Option ZS01).

Including 2 m RS-232 cable, no GPIB cable.



### GPIB Interface Expansion (Option ZS03) <sup>1) 3)</sup>

If there is an existing RS-232 interface (Option ZS01), option ZS03 can be upgraded to the GPIB interface. Simply insert the card.

Supplied without GPIB cable.

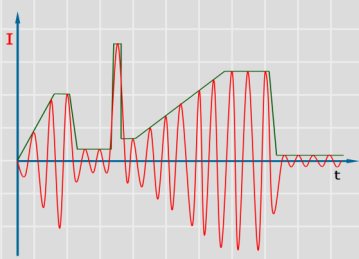


### Ethernet-RS-232 Converter (Option ZS15) <sup>1) 3)</sup>

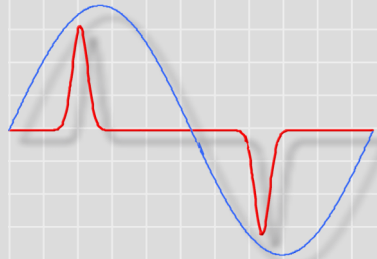
Data is sent via the LAN card to the serial interface of the unit. Option ZS01 is needed for this. If option ZS01 is already available the device can be easily upgraded with the ZS15 option.



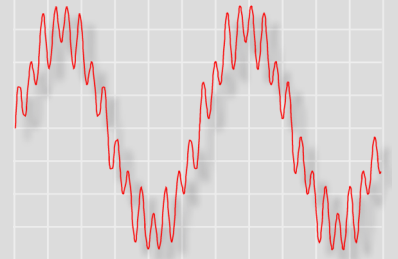
## Function Range by Programming



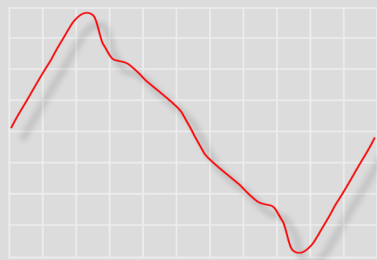
Programmable load profile



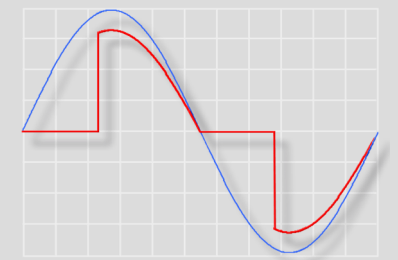
Adjustable crest factor



Harmonics generation



Arbitrarily programmable waveform



Phase controlled currents

- 1) Can be retrofitted at any time
- 2) Can only be retrofitted or produced by H&H
- 3) Requires ZS01 or ZS02

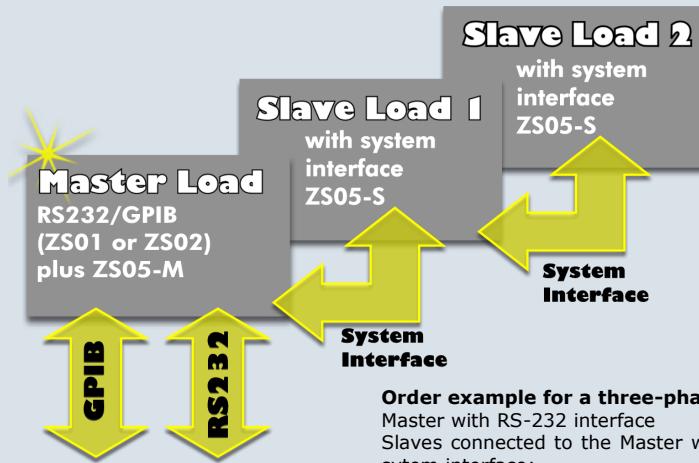
## Setting Up Three-Phase Systems ZSAC Series

### Fiber Optic System Interface (Option ZS05)

(ZS05-M for Master devices, ZS05-S for Slave devices)

The fiber optic connection is used to control three-phase systems. Option ZS01 or ZS02 required.

Including 5 m optical cable.



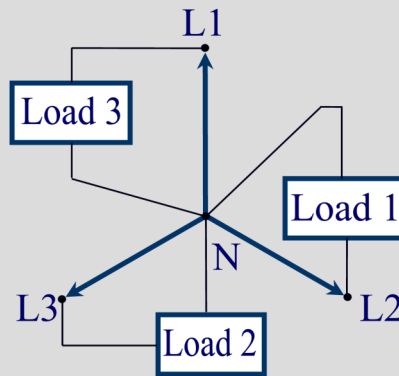
**Order example for a three-phase system:**  
 Master with RS-232 interface  
 Slaves connected to the Master with fiber optic system interface:

- Load 1+ZS01+ZS05-M,
- Load 2+ZS05-S
- Load 3+ZS05-S

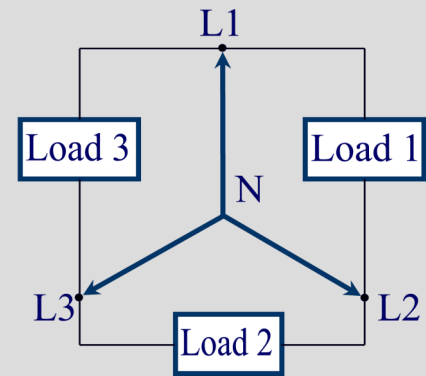
## Wiring of Three-Phase Systems

### Wiring of three-phase systems

Depending on the rated voltage, Phase-Phase, Phase-Neutral or mixed devices can be wired. The control can be either individual, in Master-Slave mode or via interface. For ease of programming we recommend connecting both Slave devices to the Master device by fiber optic interface. The devices can then be programmed jointly or individually.



Phase-neutral connection (260 V version)



Phase-phase connection (440 V version)

## Hardware Expansions

### Power I/O Card <sup>1) 3)</sup> (Option ZS07)

The Power I/O card can be expanded to control external devices. 8 relay contacts (N/O 125 V/1 A) can be actuated via the data interface and 8 logical inputs (5 ... 24 V, shared GND) can be queried.

The inputs and outputs are isolated from the load input. The isolation voltage is 500 V DC with respect to the negative load input.



### Castors <sup>1)</sup> (Option ZS09)

Steerable castors can be screwed onto large devices for easier transport. A 19" rack can then often be dispensed with.

This option is available for devices from 5 HU and is suitable only for hard floors.



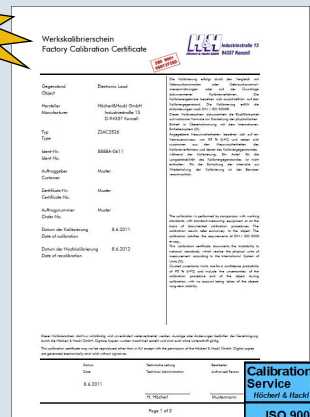
## Calibration

### (FCC-ZSxx)<sup>2)</sup>



We supply a free Factory Calibration Certificate (FCC) with the devices. The FCC meets the requirements according to DIN EN ISO 9000ff. This calibration certificate documents the traceability to national standards to illustrate the physical device in accordance with the International System of Units (SI).

Within 2 years after delivery, we calibrate your device another time free of charge!



- 1) Can be retrofitted at any time
- 2) Can only be retrofitted or produced by H&H
- 3) Requires ZS01 or ZS02

This is H&H
PLA Low Power
PLI High Power
ZS Multi-Range
ERI Energy Recycling
PMLA Multi-Channel, GUI
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Accessories
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## Software Tools ZSAC Series

The following SW tools and drivers are delivered as standard with the interfaces:

### Load Control

Individual devices and multi-channel systems can be controlled via the tool. The range of functions includes PC device setup, data logging with graphical display and logging data readable by other programs.

### Data Acquisition

As well as device control, measured time, voltage and current can be logged and saved.

### Waveform Editor

The Waveform Editor permits the intelligent generation of load profiles in the form of straight sections. The load waveform is displayed on entry. The profiles can be saved.

### Harmonics

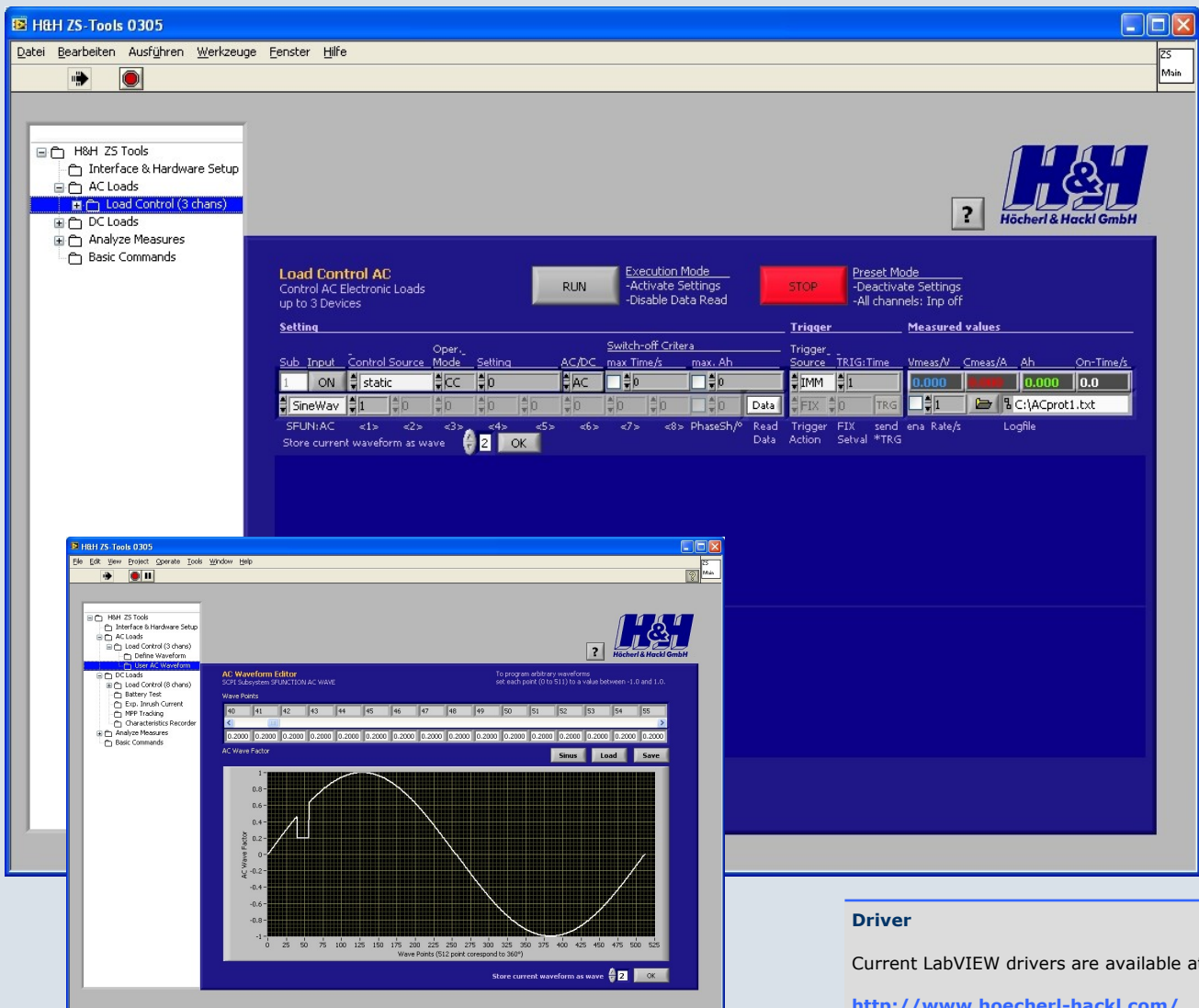
Harmonic contents up to the 8th can be added to the basic frequency.

### Phase Control

Phase-controlled currents with phase angles of 0 ... 180° can be set.

### Basic Communication Tool

The Basic Communication Tool can be used to send any commands for test purposes and for commissioning of test systems.



### Driver

Current LabVIEW drivers are available at:

<http://www.hoecherl-hackl.com/>

or

<http://www.ni.com/downloads/instrument-drivers/>

LabVIEW®

## 400 W ... 21,000 W AC ZSAC Series

Model (order number)	ZSAC426	ZSAC444	ZSAC1426	ZSAC1444	ZSAC2826	ZSAC2844
<b>Minimum ... maximum input voltage</b>	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC
<b>Current</b>	6 A	3 A	10 A	5 A	20 A	10 A
<b>Power</b>	400 W	400 W	1,400 W	1,400 W	2,800 W	2,800 W
<b>Resistance</b>	2 ... 2,000 Ω	3 ... 6,666 Ω	1 ... 1,200 Ω	2 ... 4,000 Ω	0,5 ... 600 Ω	1 ... 2,000 Ω
<b>Terminals <sup>1)</sup></b>	SBU4-32	SBU4-32	SBU4-32	SBU4-32	SBU6-125	SBU4-32
<b>Power consumption</b>	95 VA	78 VA	190 VA	140 VA	315 VA	250 VA
<b>Noise max. <sup>2)</sup></b>	53 dB(A)	53 dB(A)	71 dB(A)	71 dB(A)	72 dB(A)	71 dB(A)
<b>Weight ca.</b>	13 kg	13 kg	28 kg	29 kg	34 kg	33 kg
<b>Housing <sup>3)</sup></b>	19" - 2 HU	19" - 2 HU	19" - 5 HU	19" - 5 HU	19" - 5 HU	19" - 5 HU

Model (order number)	ZSAC4226	ZSAC4244	ZSAC5626	ZSAC5644	ZSAC7026	ZSAC7044
<b>Minimum ... maximum input voltage</b>	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	6 ... 260 V AC 6 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC
<b>Current</b>	30 A	15 A	40 A	20 A	50 A	25 A
<b>Power</b>	4,200 W	4,200 W	5,600 W	5,600 W	7,000 W	7,000 W
<b>Resistance</b>	0.33 ... 400 Ω	0.7 ... 1,333 Ω	0.25 ... 300 Ω	0.5 ... 1,000 Ω	0.2 ... 240 Ω	0.4 ... 800 Ω
<b>Terminals <sup>1)</sup></b>	SBU6-125	SBU4-32	SBU6-125	SBU6-125	SBU6-125	SBU6-125
<b>Power consumption</b>	450 VA	300 VA	560 VA	420 VA	670 VA	560 VA
<b>Noise max. <sup>2)</sup></b>	73 dB(A)	73 dB(A)	73 dB(A)	73 dB(A)	74 dB(A)	74 dB(A)
<b>Weight ca.</b>	41 kg	39 kg	53 kg	51 kg	58 kg	59 kg
<b>Housing <sup>3)</sup></b>	19" - 5 HU	19" - 5 HU	19" - 8 HU	19" - 8 HU	19" - 8 HU	19" - 8 HU

Model (order number)	ZSACRV8426	ZSAC8444	ZSACRV9826	ZSAC9844	ZSACRV11226	ZSAC11244
<b>Minimum ... maximum input voltage</b>	50 ... 260 V AC 50 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	50 ... 260 V AC 50 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	50 ... 260 V AC 50 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC
<b>Current</b>	60 A	30 A	70 A	35 A	80 A	40 A
<b>Power</b>	8,400 W	8,400 W	9,800 W	9,800 W	11,200 W	11,200 W
<b>Resistance</b>	0.84 ... 200 Ω	0.33 ... 666 Ω	0.72 ... 171 Ω	0.3 ... 570 Ω	0.63 ... 150 Ω	0.25 ... 500 Ω
<b>Terminals <sup>1)</sup></b>	SBU6-125	SBU6-125	SBU6-125	SBU6-125	SBU6-125	SBU6-125
<b>Power consumption</b>	380 VA	670 VA	440 VA	700 VA	515 VA	775 VA
<b>Noise max. <sup>2)</sup></b>	74 dB(A)	74 dB(A)	75 dB(A)	75 dB(A)	76 dB(A)	76 dB(A)
<b>Weight ca.</b>	63 kg	64 kg	76 kg	79 kg	82 kg	84 kg
<b>Housing <sup>3)</sup></b>	19" - 8 HU	19" - 8 HU	19" - 11 HU	19" - 11 HU	19" - 11 HU	19" - 11 HU

Model (order number)	ZSACRV12626	ZSAC12644	ZSACRV14026	ZSAC14044	ZSACRV15444	ZSACRV16844
<b>Minimum ... maximum input voltage</b>	50 ... 260 V AC 50 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	50 ... 260 V AC 50 ... 360 V DC	10 ... 440 V AC 10 ... 660 V DC	50 ... 440 V AC 50 ... 660 V DC	50 ... 440 V AC 50 ... 660 V DC
<b>Current</b>	90 A	45 A	100 A	50 A	55 A	60 A
<b>Power</b>	12,600 W	12,600 W	14,000 W	14,000 W	15,400 W	16,800 W
<b>Resistance</b>	0.56 ... 133 Ω	0.22 ... 444 Ω	0.5 ... 120 Ω	0.2 ... 400 Ω	0.91 ... 363 Ω	0.84 ... 333 Ω
<b>Terminals <sup>1)</sup></b>	SBU6-125	SBU6-125	SBU6-125	SBU6-125	SBU6-125	SBU6-125
<b>Power consumption</b>	580 VA	1,150 VA	640 VA	980 VA	695 VA	735 VA
<b>Noise max. <sup>2)</sup></b>	76 dB(A)	76 dB(A)	77 dB(A)	77 dB(A)	77 dB(A)	78 dB(A)
<b>Weight ca.</b>	84 kg	85 kg	91 kg	104 kg	98 kg	106 kg
<b>Housing <sup>3)</sup></b>	19" - 11 HU	19" - 11 HU	19" - 14 HU	19" - 14 HU	19" - 14 HU	19" - 14 HU

Model (order number)	ZSACRV18244	ZSACRV19644	ZSACRV21044
<b>Minimum ... maximum input voltage</b>	50 ... 440 V AC 50 ... 660 V DC	50 ... 440 V AC 50 ... 660 V DC	50 ... 440 V AC 50 ... 660 V DC
<b>Current</b>	65 A	70 A	75 A
<b>Power</b>	18,200 W	19,600 W	21,000 W
<b>Resistance</b>	0.77 ... 307 Ω	0.72 ... 285 Ω	0.67 ... 266 Ω
<b>Terminals <sup>1)</sup></b>	SBU6-125	SBU6-125	SBU6-125
<b>Power consumption</b>	805 VA	875 VA	900 VA
<b>Noise max. <sup>2)</sup></b>	78 dB(A)	78 dB(A)	79 dB(A)
<b>Weight ca.</b>	116 kg	123 kg	130 kg
<b>Housing <sup>3)</sup></b>	19" - 17 HU	19" - 17 HU	19" - 17 HU

1) Load terminals	Type of terminals
SBU4-32	Protected laboratory socket for 4 mm pin connector, max. 32 A
SBU6-125	Protected laboratory socket for 6 mm pin connector, max. 125 A, including 2 m cable and mating connector

2) Measured at the front in 1 m distance  
3) 1 HU = 44.45 mm

This is H&H

PLA Low Power

PLI High Power

ZS Multi-Range

ERI Energy Recycling

PMLA Multi-Channel, GUI

PMLI Multi-Channel

ZSAC AC & DC

NL Source-Sink

Accessories

SE Power Distribution

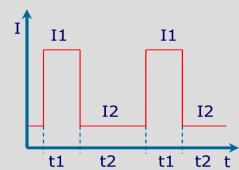
GTC

# Technical Data ZSAC, ZSACRV Series

- This is H&H
- PLA Low Power
- PLI High Power
- ZS Multi-Range
- ERI Energy Recycling
- PMLA Multi-Channel, GUI
- PMLI Multi-Channel
- ZSAC AC & DC
- NL Source-Sink
- Accessories
- SE Power Distribution
- GTC

Accuracy of manual setting, no preset function <sup>1)</sup>		
	of the setting value	of the corresponding range
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.3 % ±0.6 %
Accuracy of manual setting via preset function <sup>1)</sup>		
	of the setting value	of the corresponding range
<b>Current</b> DC, 50 Hz 400 Hz	±0.9 % ±1.4 %	±0.3 % ±0.6 %
<b>Resistist.</b> DC, 50 Hz 400 Hz	±1.9 % ±3.4 %	±0.5 % of current range ±1 % of current range
Total Harmonic distortion <sup>2)</sup>		
50 Hz	1 % at rated current	
400 Hz	5 % at rated current	
Accuracy of display		
	of the measured value (real value)	of the corresponding range
<b>Voltage</b> DC, 50 Hz 400 Hz	±0.3 % ±0.6 %	±0.1 % ±1 digit ±0.2 % ±1 digit
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.3 % ±1 digit ±0.6 % ±1 digit
Accuracy analog control 0 ... 3.5 V / 0 ... 7 V for current		
	of the setting value	of the corresponding range
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.3 % ±0.6 %
Input resistance of analog inputs >10kΩ		
Accuracy of analog measurement outputs 0 ... 7 V for current, voltage, 0 ... 5 V for power		
	of analog signal of real value	offset voltage
<b>Voltage</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±15 mV ±30 mV
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±15 mV ±30 mV
<b>Power</b> DC, 50 Hz 400 Hz	±2 % ±4 %	±30 mV ±60 mV
GND electrically isolated from load input, max. ±500 V referred to LO load input		
Input		
<b>Frequency range</b>	DC, 40 Hz ... 800 Hz	
<b>Input resistance</b>	DC: >50 kΩ when load input is off	
<b>Input capacity</b>	approx. 1.5 μF/1,400 W	
<b>Parallel operation</b>	up to 3 devices in Master-Slave mode (hardware-controlled)	
<b>Maximum input voltage</b>	see model overview	
<b>Minimum input voltage</b>	see model overview ZSAC ZSACRV	
<b>Permissible potential</b>	Input LO - case: 300 V <sup>3)</sup>	
<b>Rated power</b>	up to T <sub>A</sub> = 21 °C	
<b>Derating</b>	-1.2 %/°C for T <sub>A</sub> > 21 °C	
Protection and monitoring		
<b>Protective devices</b>	overcurrent overpower overtemperature	
<b>Monitoring</b>	overvoltage undervoltage (if the input voltage is too low for the set current)	

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.

Accuracy of setting Programming via Data Interface <sup>1)</sup>		
	of the setting value	of the corresponding range
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.3 % ±0.6 %
<b>Resistance</b> DC, 50 Hz 400 Hz	±1.5 % ±3 %	±0.5 % of current range ±1 % of current range
<b>Resolution of setting</b>	16 Bit	
Accuracy of reading, read out via data interface		
	of the measured value (real value)	of the corresponding range
<b>Voltage</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.05 % ±0.1 %
<b>Current</b> DC, 50 Hz 400 Hz	±0.5 % ±1 %	±0.05 % ±0.1 %
<b>Resolution of measurement</b>	18 Bit	
<b>Sampling rate</b>	330 ms, not triggerable	
<b>External control functions</b>	load on - off trigger input and output remote shut-down	
Dynamics		
<b>2 currents and 2 times can be set independently</b>		
<b>Time ranges</b>	100 ms	1000 ms
<b>Accuracy of time setting</b>	of the setting value ±1.4 %	of the corresponding range ±0.5 %
Operating conditions		
<b>Operating temperature</b>	5 ... 40 °C	
<b>Stock temperature</b>	-25 ... 65 °C	
<b>Max. operating height</b>	2,000 m above sea level	
<b>Pollution degree</b>	1	
<b>Overvoltage category of mains</b>	II	
<b>Max. humidity</b>	80 % at 31 °C, linear derating to 50 % at 40 °C	
<b>Min. distance rear panel - wall or other objects</b>	70 cm	
<b>Cooling</b>	variably controlled fans	
<b>Noise</b>	see model overview	
<b>Supply voltage</b>	115/230 V ~ ±10 %, 50 ... 60 Hz	
<b>Power consumption</b>	see model overview	
Housing		
<b>Dimensions, Weight</b>	see model overview	
<b>Color:</b> Front panel Side panels, top	RAL7032 (pebble grey) RAL7037 (dusty grey)	
Safety and EMC		
<b>Electrical safety</b>	DIN EN 61010-1 DIN EN 61010-2-030	
<b>EMC, CE marking</b>	DIN EN 61326-1 DIN EN 55011 DIN EN 61000-3-2 DIN EN 61000-3-3	
<b>Warranty</b>	2 years	

1) The accuracy applies for the specified frequencies. At higher frequencies the accuracy decreases.  
2) The Total Harmonic Distortion increases at lower currents.  
3) Positive or negative DC voltage or RMS value of a sinusoidal AC voltage



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