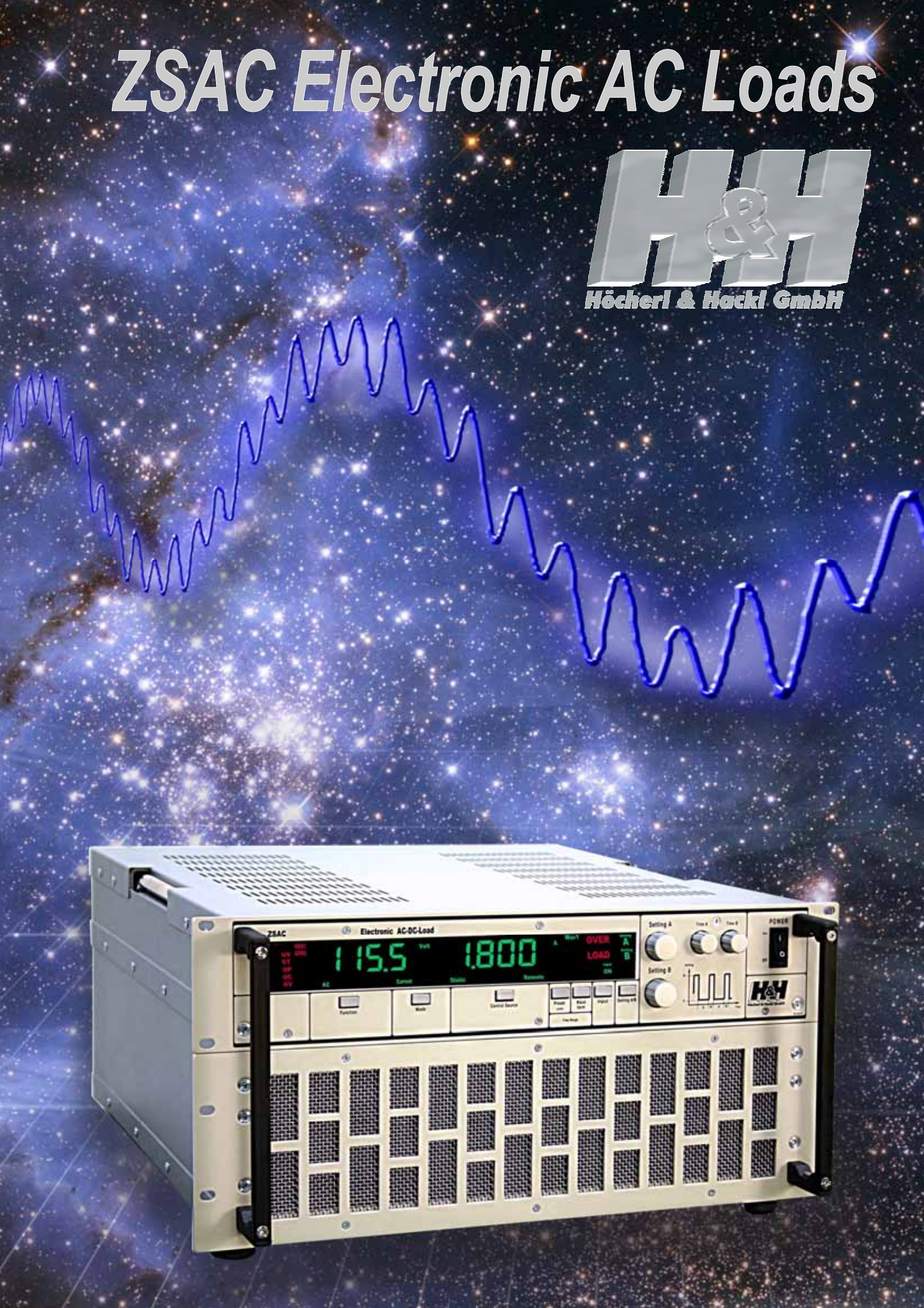
ZSAC Electronic AC Loads

Höcherl & Hackl GmbH



Description

The electronic loads of the ZSAC series are optimized for the practical use in laboratories, manufacturing and quality control.

The ZSAC loads are suitable for use at both AC and DC voltages. The loads are provided in two voltage classes 260V and 440V.

The power spectrum contains models from 400W up to 12600W and currents up to 50A.
In AC mode the units can be used for 50Hz or 60Hz mains voltage as well as for other frequencies up to 700Hz including 400Hz for aircraft applications.

When working at mains voltages even heavily distorted input voltages can be loaded. In current mode there can be stored up to six current waveforms.

The ZSAC loads provide special functions to generate phase-gated currents, load currents with superimposed harmonics and with programmable crest factor.

Extensive equipment options support an optimal adaptation to test projects.
For example, different interfaces can be used as plug-ins to replace or upgrade the existing interface.
Multi-channel systems are easy to build up. A galvanically isolated Analog I/O interface is standard.
The ZSAC loads have excellent dynamic characteristics, and are ideal for pulsed loading applications.
The robust mechanical housing is intended for either 19" rack mount or benchtop use.

The larger, higher power devices can be supplied directly mounted on castors.

Features

Power:	400W ... 12600W	
Voltage:	260V ... 440V	
Current:	3A ... 50A	
Operating Modes:	Current	CC
	Resistance	CR
Waveform:	Sinewave	
	Phase-gated currents	
	Harmonics	
	Crest factor	
	Arbitrary programmable	
Frequency range:	40Hz ... 700Hz	
Cooling:	Current and power controlled fan cooling	
Analog-Interface:	Galvanically isolated per standard	
3-phase application:	3 units in L-N or L-L connection (also in Master-Slave)	
Data interfaces: (optional):	RS232 (SCPI)	
	IEEE488 (SCPI)	
	USB (Virtual COM Port)	

Applications

For Test of

- Transformers
- Alternators
- Aircraft applications
- Protection and switching devices
- Uninterruptible power supplies
- Power inverters
- Electronic components

As well as for

- Load Simulation
- Dynamic tests
- Lifetime tests

Model Overview ZSAC

I \ V	260V		440V	
	Power	Model	Power	Model
3A			400W	ZSAC444
5A			1400W	ZSAC1444
6A	400W	ZSAC426		
10A	1400W	ZSAC1426	2800W	ZSAC2844
15A			4200W	ZSAC4244
20A	2800W	ZSAC2826	5600W	ZSAC5644
25A			7000W	ZSAC7044
30A	4200W	ZSAC4226	8400W	ZSAC8444
35A			9800W	ZSAC9844
40A	5600W	ZSAC5626	11200W	ZSAC11244
45A			12600W	ZSAC12644
50A	7000W	ZSAC7026		

Application Areas

Test of 400Hz board supply systems

Test of Transformers

Test of power converters

Test of uninterruptible power supplies

Features

Operating Modes

CC Constant Current

CR Constant Resistance

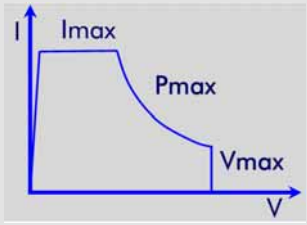
The electronic loads of the series ZS support the operating modes constant current and resistance.
In AC mode the load produces a sinusoidal current with low harmonic distortion.

Voltage

Depending on the type of input voltage the units can be switched from mains line, respectively line-synchronous voltages, to AC voltage with variable frequency or DC voltage.

Operating Range

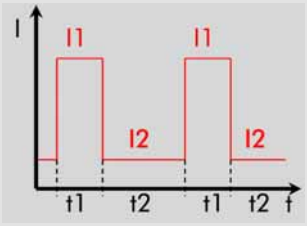
The operating range is determined by the minimum input voltage (ca. 2V) as well as by the maximum current and the power of the device.



Operating Range

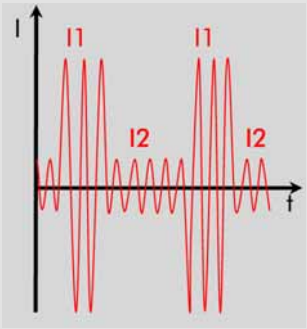
Dynamic Load Settings

The built-in modulator supports two independently adjustable currents and times from 100µs ... 1s.



Dynamic Mode DC

In AC mode the modulator is used to produce the envelope curve (amplitude modulation).

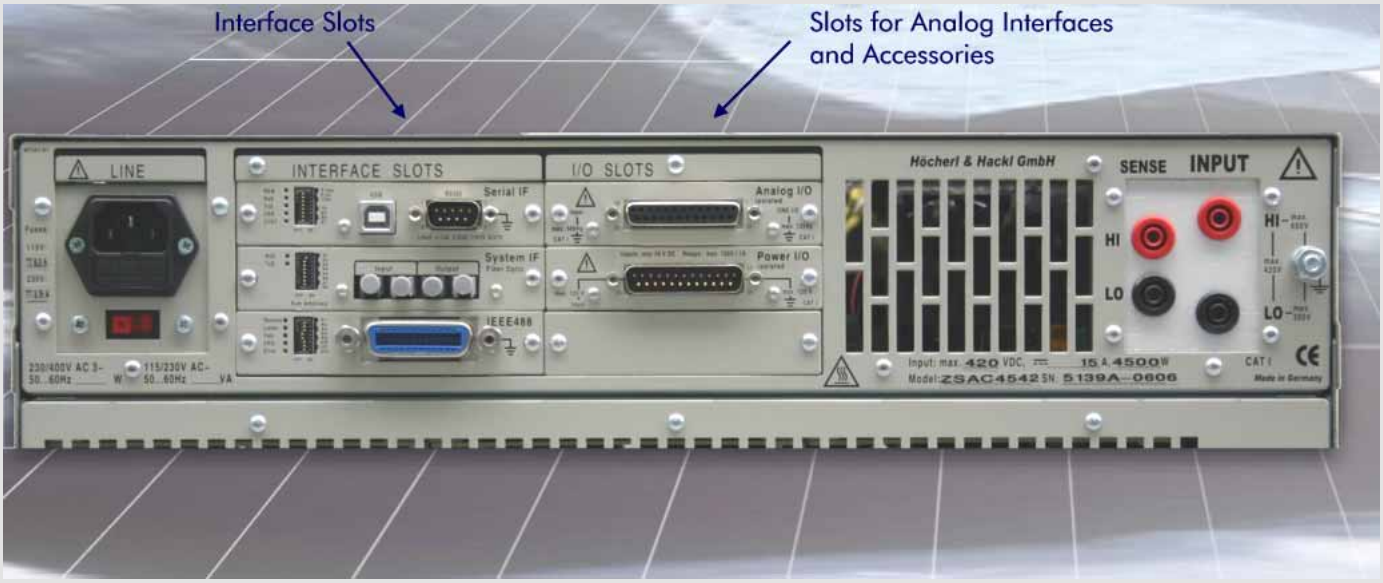


Dynamic Mode AC

Remote Control

All functions of the load can be remotely controlled using the analogue I/O connector. The controlling inputs can be operated using TTL level and 24V of PLC controllers.
All signals on the Analog I/O connector are isolated from the load input.

Features



Analog Control

In the operating mode constant current CC the setting can be made with an analog voltage 0 ... 3.5V or 0 ... 7V DC.

Analog Monitor Outputs

For voltage, current and power analog measuring signals 0 ... 7V are provided. The signals are isolated from the load input. The monitor outputs can be switched from RMS signal to waveform output.

Cooling

The devices are aircooled. For keeping the operating noise low, the controlling of the fans is depend on power and current.

Mechanics

The ZSAC series loads are manufactured in robust 19" rack mount case which are also suitable for benchtop use. At the top of the device there are retractable handles.
For heavy devices castors can be mounted. For 19" fitting no separate kits are needed.


Retractable Handles

Terminals

All connections are provided at the rear of the device.
The terminals are touch-protected for 4mm banana plugs.
For currents higher than 20A 6mm plugs are used.

Load Terminals

Interfaces (Accessories)


Interface Board Slots

Uniquely the ZS Series has slots for 3 digital communications interfaces, and 3 analog interfaces or accessory cards. These can be exchanged or upgraded as required. This gives the ZSAC series huge application flexibility. The following interfaces are available:

- RS232 + USB * (Option ZS01)
- IEEE488 + RS232 + USB * (Option ZS02)
- System Interface (Fiber Optic) (Option ZS05)

* Controllable as Virtual COM interface under Windows 98/ME/2000/XP

The interfaces allow the use of additional features of the loads, e.g.:

- **Programmable load curves**
- **Dynamic load changes with wide setting ranges**
- **Data acquisition**
- **Trigger functions**
- **Using the provided software tools and LabVIEW drivers**

For loading 3-phase systems the System Interface Board ZS05 can be used.
Then the connected loads can be controlled by the interface of the master load. All connected loads are isolated from the others.

Programming syntax is SCPI.

Hardware-Extensions

Power I/O Board (Option ZS07)

The Power I/O Board can be upgraded for controlling external equipment. Via the interface of the load, 8 relay contacts (make contact 125V/1A) can be controlled and 8 logic inputs (5V ... 24V, common GND) can be queried. Outputs and inputs are insulated from the load input.
The insulating voltage is 500VDC against input -.

Status Driver (Option ZS14)

The status driver contains an amplifier for the signals „Input on", „Overload" and „Trigger Voltage" up to 30V/0.5A in an external connector housing. There is a power supply 5V ... 30V required.

Castors (Option ZS09)

For heavy devices castors can be fitted for an easier transportation. By using these castors often the fitting in a 19" rack can be avoided.

Castors

Calibration

Factory Calibration Report (Option ZS11)

For all devices a Factory Calibration Option is available. The repatriation to international norms is possible.
The recommended calibration interval is 1 year. On request we can do the annual calibration.

ZSAC444

Extended Functionality by using a Data Interface

- SCPI Programming
- Setting with 16 Bit Resolution
- Data Acquisition of Voltage, Current and Power
- Measuring Data Memory
- Dynamic Load Profiles
- Generation of Superimposed Harmonics
- Variable Crest Factor
- Current Waveform Arbitrary Programmable
- Phase-gated Current

RS232 Interface (Option ZS01)

Option ZS01 extends the device with an RS232 interface and a USB connector (as virtual COM interface). The programming is in SCPI. Inclusive 2m RS232 cable.

System Interface Fiber Optic (Option ZS05)
(ZS05-M for master device, ZS05-S for slave devices)

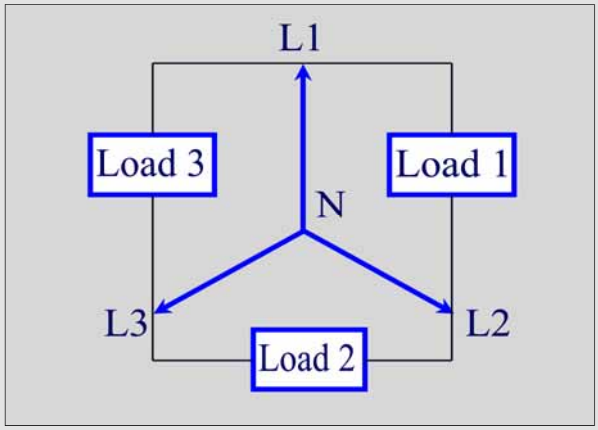
For controlling the load in 3-phase systems the fiber optic system ZS05 interface is used.
ZS05 includes 5m fiber optic cable.

IEEE488 + RS232 Interface (Option ZS02)

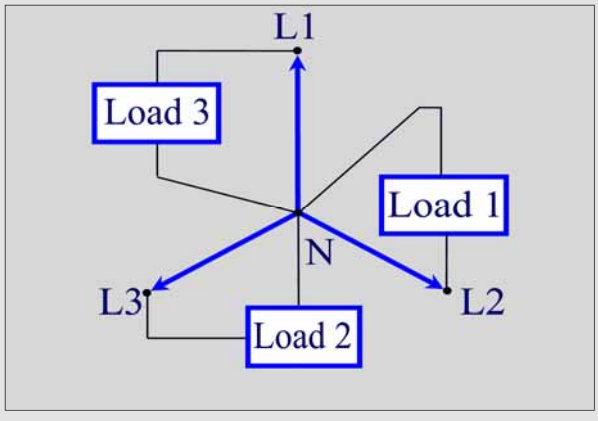
The IEEE488 (GPIB) interface also includes the RS232 interface (Option ZS01).

IEEE488 Interface Extension (Option ZS03)

A device with existing RS232 interface (Option ZS01) may be updated to IEEE488 interface by plugging in the ZS03 option.



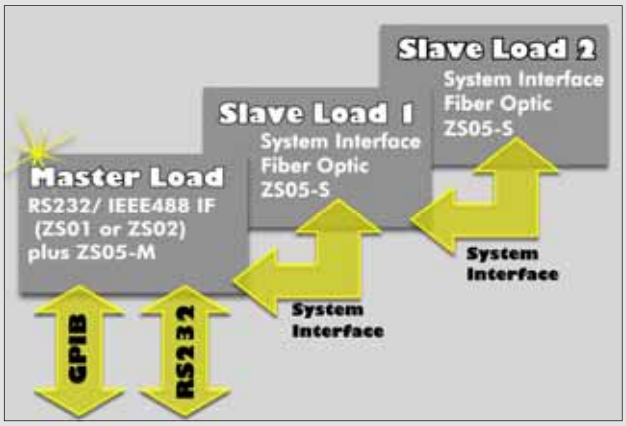
Connection Phase-Phase (440V-Version)



Connection Phase-Neutral (260V-Version)

Loading 3-Phase Systems

Depending on the voltage of the loads they can be connected from phase to phase, phase to neutral or mixed. They can be controlled separately, in Master-Slave Mode or by programming.
For easy programming it is recommended to connect the slave devices by fiber optic interface to the master (Option ZS05). The loads can then be programmed separately or all together.



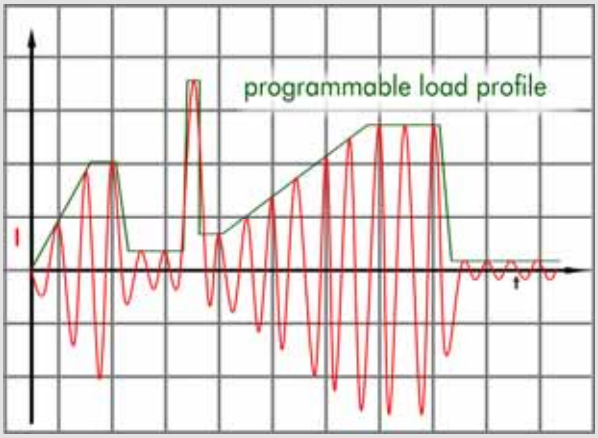
Ordering example for a 3-phase system:
Master with RS232 interface,
Slaves are connected by system interface fiber optic to the master:
Load 1+ZS01+ZS05-M,
Load 2+ZS05-S, Load 3+ZS05-S

Programming Functions

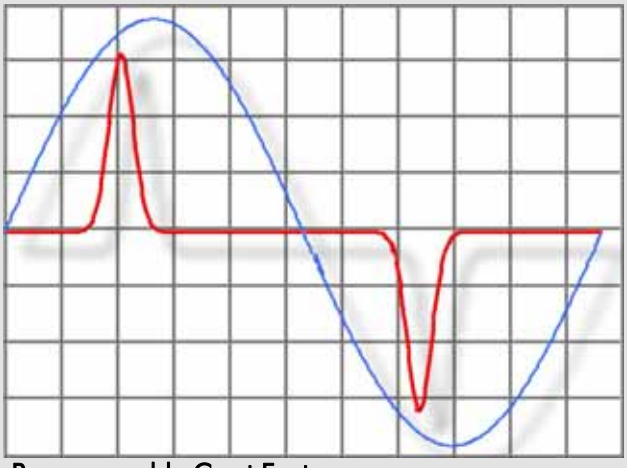
- SCPI Programming Language
- Settings with 16Bit Resolution
- Measuring Function for Current and Voltage

Settings:	Resolution: Accuracy:	16Bit See technical data
Measuring Function:	Resolution: Reading Rate: Data Memory:	18Bit ca. 300ms for V+I, not synchronized max 2000 V/I values with timestamp
Waveform Memory:	Resolution: Functions:	512 Steps/Period Free programmabe waveform Crest factor Harmonics (3th ...15th) Phase gating Phaseshift *
Load Profile Generator	No. of steps: Pulse duration: Ramp-time: Repetition rate:	Max. 50 200µs ... 3600s 0 ... 3600s Single, n-times, continuously

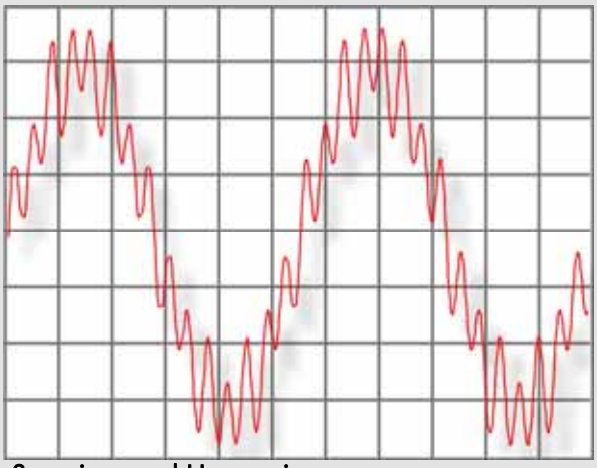
- Programmable Current Waveforms
- Dynamic Load Variations with Programmmable Load Profile



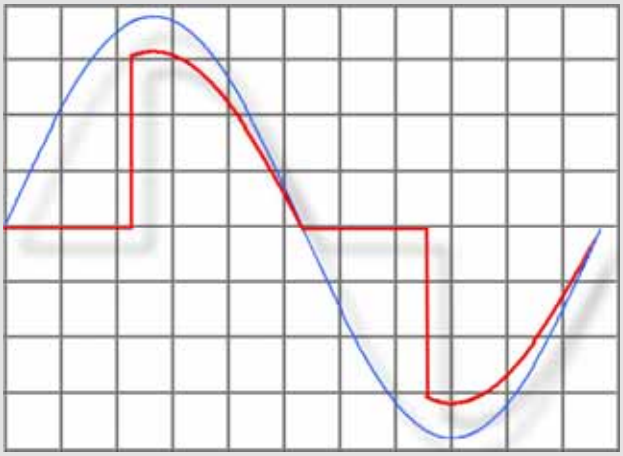
Programmable Load Profiles in AC and DC



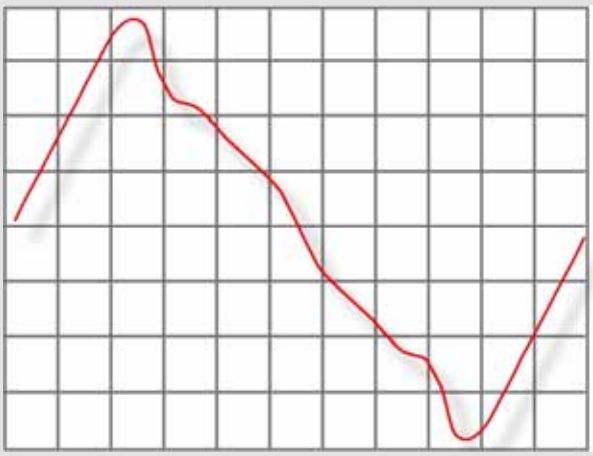
Programmable Crest Factor



Superimposed Harmonics



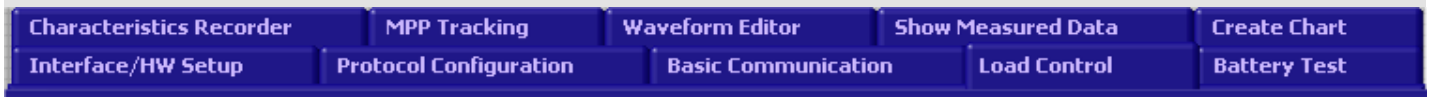
Phase-Gated Currents



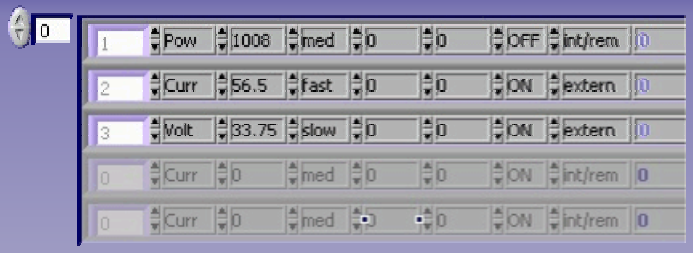
Free Programmable Current Waveform

* Phaseshift is not possible in the meaning of apparent power

Software Tools



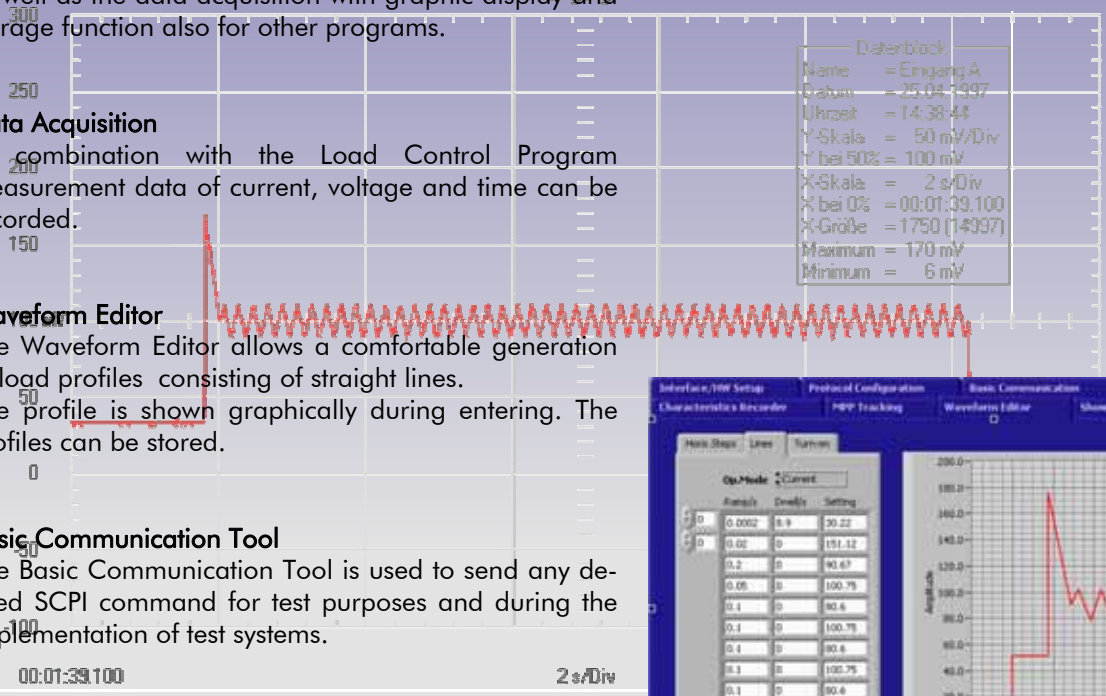
The following tools und drivers are included in the interface options:



Load Control

The supplied tool can control single loads as well as multichannelled load systems.

The function includes the Electronic Load setting by PC as well as the data acquisition with graphic display and storage function also for other programs.

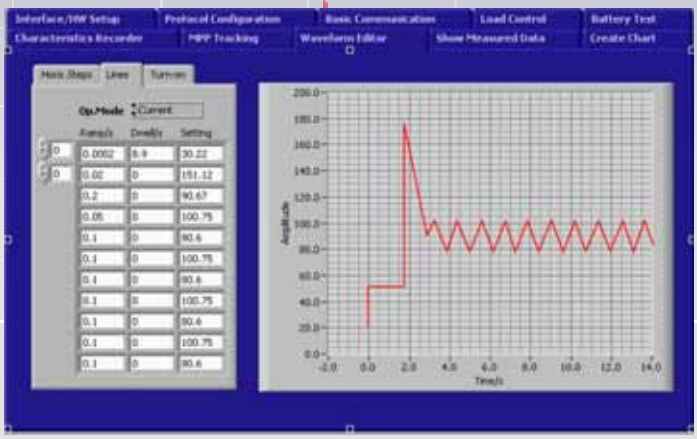


Data Acquisition

In combination with the Load Control Program measurement data of current, voltage and time can be recorded.

Waveform Editor

The Waveform Editor allows a comfortable generation of load profiles consisting of straight lines.
The profile is shown graphically during entering. The profiles can be stored.



Basic Communication Tool

The Basic Communication Tool is used to send any desired SCPI command for test purposes and during the implementation of test systems.

```
*RST
MODE:CURR
CURR:RANG 200
LIST:CURR 30.22,151.12,90.67,100.75,80.6,100.75,80.6,100.75,80.6,100.75,80.6,100.75,80.6
LIST:CURR:RTIM 0.0002,0.02,0.2,0.05,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1
LIST:CURR:DWEL 8,9,0,0,0,0,0,0,0,0,0,0,0
LIST:COUN 1
INP ON
LIST:STAT ON
```

Characteristics Recorder

The Characteristics Recorder can measure and display V-I curves of solar panels and power supplies.

Battery Test

With the battery tool any batteries can be discharged.
The discharge diagrams are recorded, displayed and stored. Ah and Wh are displayed.

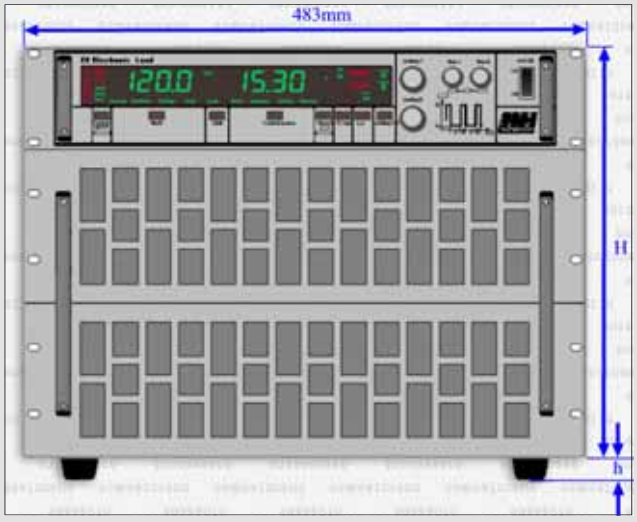
Driver

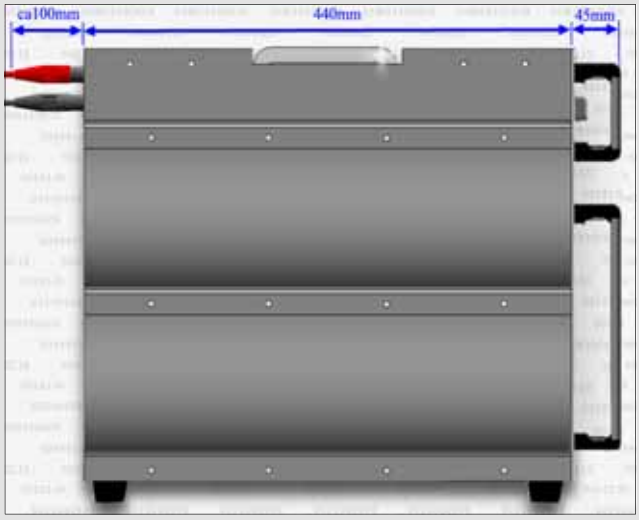
LabVIEW®

Updates see www.hoecherl-hackl.com

Specifications 400W ... 12600W

Model (Order No.)	Voltage AC / DC	Current	Power	Resistance	Input Terminals[1]	Power Consumption	Noise max.[2]	Weight [3]	Housing [4]
ZSAC426	260V	6A	400W	2 ... 2000Ω	SB4	85VA	53 dB(A)	13kg	19"-2HE
ZSAC444	440V	3A	400W	3 ... 6666Ω	SB4	75VA	53 dB(A)	13kg	19"-2HE
ZSAC1426	260V	10A	1400W	1 ... 1200Ω	SB4	190VA	71dB(A)	28kg	19"-5HU
ZSAC1444	440V	5A	1400W	2 ... 4000Ω	SB4	140VA	71dB(A)	29kg	19"-5HU
ZSAC2826	260V	20A	2800W	0.5 ... 600Ω	SB6	280VA	72dB(A)	34kg	19"-5HU
ZSAC2844	440V	10A	2800W	1 ... 2000Ω	SB4	230VA	72dB(A)	34kg	19"-5HU
ZSAC4226	260V	30A	4200W	0.33 ... 400Ω	SB6	485VA	73dB(A)	41kg	19"-5HU
ZSAC4244	440V	15A	4200W	0.7 ... 1333Ω	SB4	300VA	73dB(A)	39kg	19"-5HU
ZSAC5626	260V	40A	5600W	0.25 ... 300Ω	SB6	510VA	73dB(A)	56kg	19"-8HU
ZSAC5644	440V	20A	5600W	0.5 ... 1000Ω	SB6	420VA	73dB(A)	54kg	19"-8HU
ZSAC7026	260V	50A	7000W	0.2 ... 240Ω	SB6	690VA	74dB(A)	58kg	19"-8HU
ZSAC7044	440V	25A	7000W	0.4 ... 800Ω	SB6	610VA	74dB(A)	59kg	19"-8HU
ZSAC8444	440V	30A	8400W	0.33 ... 666Ω	SB6	630VA	74dB(A)	64kg	19"-8HU
ZSAC9844	440V	35A	9800W	0.3 ... 570Ω	SB6	700VA	75dB(A)	79kg	19"-11HU
ZSAC11244	440V	40A	11200W	0.25 ... 500Ω	SB6	775VA	76dB(A)	84kg	19"-11HU
ZSAC12644	440V	45A	12600W	0.22 ... 444Ω	SB6	1150VA	76dB(A)	85kg	19"-11HU





Height	2HU	5HU	8HU	11HU
H (mm)	88	222	355	488

h: Standard: 15mm
With Option ZS09 (castors) 45mm

1) SB4: 4mm banana safety plug
SB6: 6mm safety plug (fits also for 4mm plugs)
2) Measured at 1m distance
3) For 19" assembly use slide bars because of the weight.
4) 1HU = 44.45mm

Technical Data

Accuracy* of Settings:
- Current: ±0.5% of setting, ±0.3% of range
- Resistance: ±1.5% of setting, ±0.5% of current range
- Stability: <0.2%, <100ppm/°C

Presetting Accuracy* : ±0.4% of setting plus accuracy of respective mode

Power:
- Nominal power: up to T_A=21°C
- Derating: -1.2%/°C for T_A>21°C

Frequency Range: DC, 40Hz ... 700Hz

Harmonic Distortion*:
- 50Hz/60Hz: <1% at nominal current
- Higher frequencies: >1%

Input Capacitance: ca. 1.5µF/1400W

Operating Temperature: 5°C ... 40°C

Analog Programming:
- 0 ... 3.5V/0 ... 7V: for current setting 0 ... 100%
- Accuracy*: ±0.5% of setting, ±0.3% of range
- Input Resistance: >10kΩ
- GND: isolated from the load input (max. ±500V)

Analog Monitor Outputs:
- Current, voltage: 0...7V
  - Accuracy*: ±0.5% ±15mV
- Power: 0...5V
  - Accuracy*: ±2% ±30mV
- GND: isolated from the load input (max. ±500V)
- Loading capacity: min. 2kΩ

External Control: Load switching, Trigger input and output, Emergency shutdown

Protection Equipment: Current and power limitation, over-voltage protection up to 120% of rated voltage, over-temperature deactivation, transient protection

Minimum Voltage:
- 260V-Devices: Full current from ca. 3V
- 440V-Devices: Full current from ca. 5V

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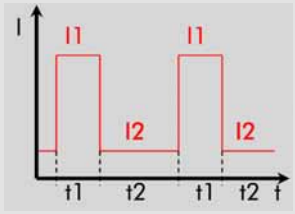
* The accuracy data are referred to input frequency 50/60 Hz. At higher frequencies the accuracy will be worse.

Modulator for AC & DC:



Pulse t1: 100µs ... 1s
Pulse t2: 100µs ... 1s
(in two ranges)
Accuracy:
±1% of setting,
±0.5% of end value
Load level: each 0 ... 100%

Programming (for interface options):
- Settings: 16 Bit resolution
- Accuracy: see accuracy of settings
- Measurements: 18 Bit resolution
  - Accuracy* I: ±0.5% of m. v., ±0.05% of range
  - Accuracy* V: ±0.5% of m. v., ±0.05% of range
- Measuring rate: ca. 3 measurements/s

Parallel Operation: up to 3 devices in master-slave operation (hardware-controlled)

Cooling: infinitely variable controlled fans

Noise: see type overview

Dimensions, Weight: see type overview, table page 10

Mains Supply : 115/230V±10%, 50...60Hz

Colour:
- Front panel: RAL7032 (pebble grey)
- Sides, lid: RAL7037 (stone grey)

Electric Safety: DIN EN 61010-1

EMC, CE Mark:
DIN EN55022
DIN EN 61326
(DIN EN 61000-4-2,
DIN EN 61000-4-3,
DIN EN 61000-4-4,
DIN EN 61000-4-5,
DIN EN 61000-4-6,
DIN EN 61000-4-8,
DIN EN 61000-4-11)
DIN EN 61000-3-2
DIN EN 61000-3-3

Technical updates are possible

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