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SCHAEFER

Power Conversion Systems

Innovation made in Germany

Switchmode

Power Supplies, Chargers & Inverters

Thyristor-controlled

Power Supplies & Chargers

www.schaeferpower.de

Certifications

All devices have to pass a strict test procedure during all steps of production. On demand, SCHAEFER can also provide additional customer specified tests in cooperation with external test laboratories.

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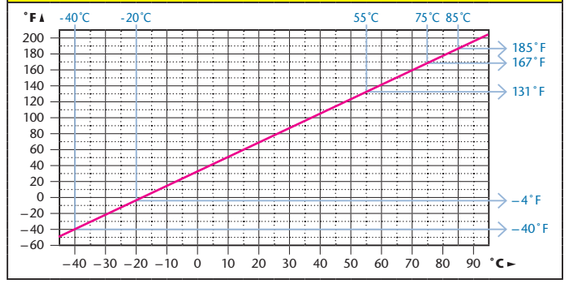
Conversion Diagram °C ► °F



Conversion Table	
Height	1 HE = 44.45 mm
	1 HE = 1.75″
Width	1 TE = 5.08 mm
	1 TE = 0.2″
	1″ = 25.4 mm
Weight	1 kg = 2.2 lbs

The manufacturer reserves the right to deviate from technical details given.

COMPANY

SCHAEFER being a wholly owned, privately run and assisted by a qualified, and experienced team of experts. SCHAEFER has grown in a controlled and sustainable manner to a dedicated workforce of over 200 people, who oversee the entire concept, design, control and manufacture of all of the SCHAEFER Product Portfolio. Stemming from more than 40 years experience, SCHAEFER Personnel can tap into a rich resource, that is our Intellectual Property, which can only be gained from Designing, Manufacturing solutions after detailed and in-depth consultation with Clients.

Welcoming the challenge, the SCHAEFER Team offers the highest quality engineering designed and manufactured in Germany.

MANUFACTURE

Immediate proximity also generates the free flowing information path, which is the production and development areas, along with the testing and customer support areas being all under the same roof. This enhances the SCHAEFER Teams ability to react to exacting demands with ease. Fruits of this labour are to be seen throughout the World, in a variety of fields such as:

- Rail & Automotive Industry
- Power Generation Plants
- Oil & Gas Industry
- Chemical Industry
- Industrial Automation
- Military Industry
- Building Security
- Integrated Airport Solutions

PRODUCTS

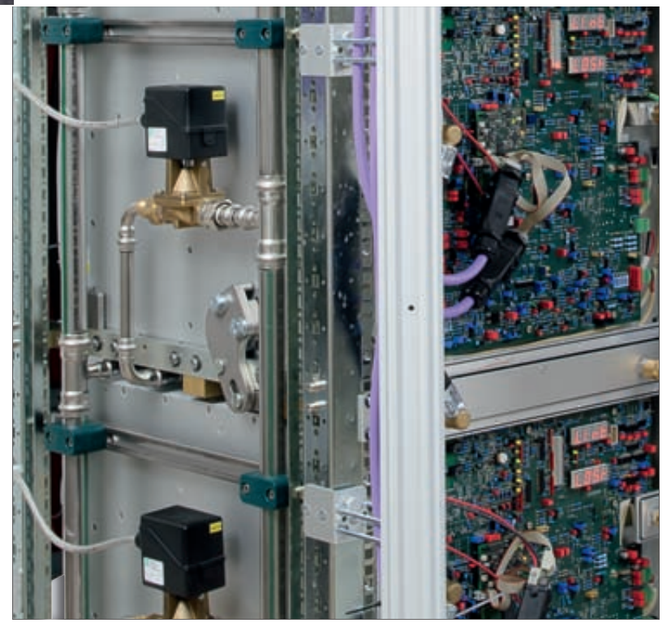
It is as a result of this intensive depth of Engineering that the Product Portfolio has been expanded to include

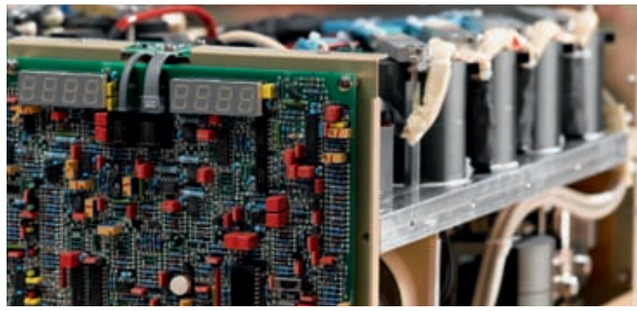
- DC / DC Converters
- AC / DC Rectifiers & Battery Chargers
- DC / AC Inverters – single & three phase
- AC / AC Frequency Converters - single & three phase
- Electronic By-pass switches
- DC & AC UPS systems
- THYRISTOR Controlled Power Supplies & Battery Chargers
- Control and monitoring systems, integrated and stand alone

FLEXIBILITY

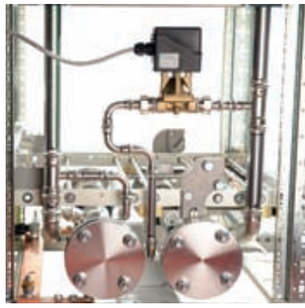
Maintaining the ability to design & manufacture in house generates a large degree of flexibility. The SCHAEFER Client profits from these engineering skills through an optimised solution tailored to the needs and parameters of the Project.

Be they on shore or off shore, stationary or mobile, land, air or marine based. A system component or complete system, environmentally Hazardous area 1, corrosive or simply Industrial, there is a SCHAEFER Power Solution to fit the parameters.





Innovation made in Germany



Switchmode Power Supplies

DC/DC Converters, AC/DC Rectifiers & Chargers

- **DC Input voltage:** DC/DC converters from 10 - 800V DC
- **AC Input voltage:** AC/DC rectifiers 115 / 230V AC, single phase (with or without PFC) or 200 / 400 / 480V AC, three phases
- **Output voltage:** up to 800V DC, additional outputs 5/ 12/ 15/ 24V DC upon request
- **Output current:** up to 450A
- **Output power:** 50W - 40kW

Features

- Continuous short circuit protection
- Overvoltage protection
- Thermal shutdown with auto-restart
- Operational from – 40 to +75 °C
- Industrial grade components
- Compact and robust design

Options

Input

- Inrush current limiting
- Automatic selection of 115 / 230V AC input
- Power factor correction for single phase input
- DC Input polarity protection

Output

- Remote on/off (inhibit)
- Output decoupling diode for redundant / parallel operation
- Active current sharing for parallel operation
- Automatic / manual selection of charging characteristic
- Temperature compensated charging voltage

General

- Output programmable via analogue signal
- Monitoring of input and output voltage
- RS232 or IEEE488 interface
- Wall mount, chassis mount or DIN rail mount
- Increased mechanical strength
- Tropical protection

Plug-in modules for 19" sub-racks with natural convection

DC output voltage											
5	9	12	15	24	28	48	60	110	200	220	400
Output power											
from 50 W up to 5 kW											

High power modules in 19" format with fan cooling

DC output voltage
5 V, 9 V, ... , 400 V, 600 V, 800 V
Output power
from 5 up to 30 kW

High power modules in 19" format with water/liquid cooling

DC output voltage
12 V, 15 V, ... , 400 V, 600 V, 800 V
Output power
from 8 up to 40 kW

Specifications

Input

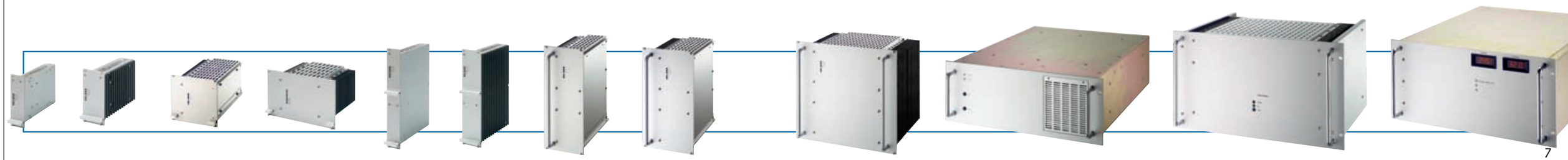
Frequency	47 - 400 Hz
Immunity - Fast transients - Surges	 acc. to EN 61000-4-4 level 3 acc. to EN 61000-4-5 level 3

Output

Line regulation (±10%)	0.1%
Load regulation (10 - 90%)	0.2%
Ripple and noise	< 1% + 30 mV pk-pk
Overload protection	current limited to 105-110% of full load
Overvoltage protection	OVP switches off module with automatic return to operation
Remote sense	up to 3 V per wire

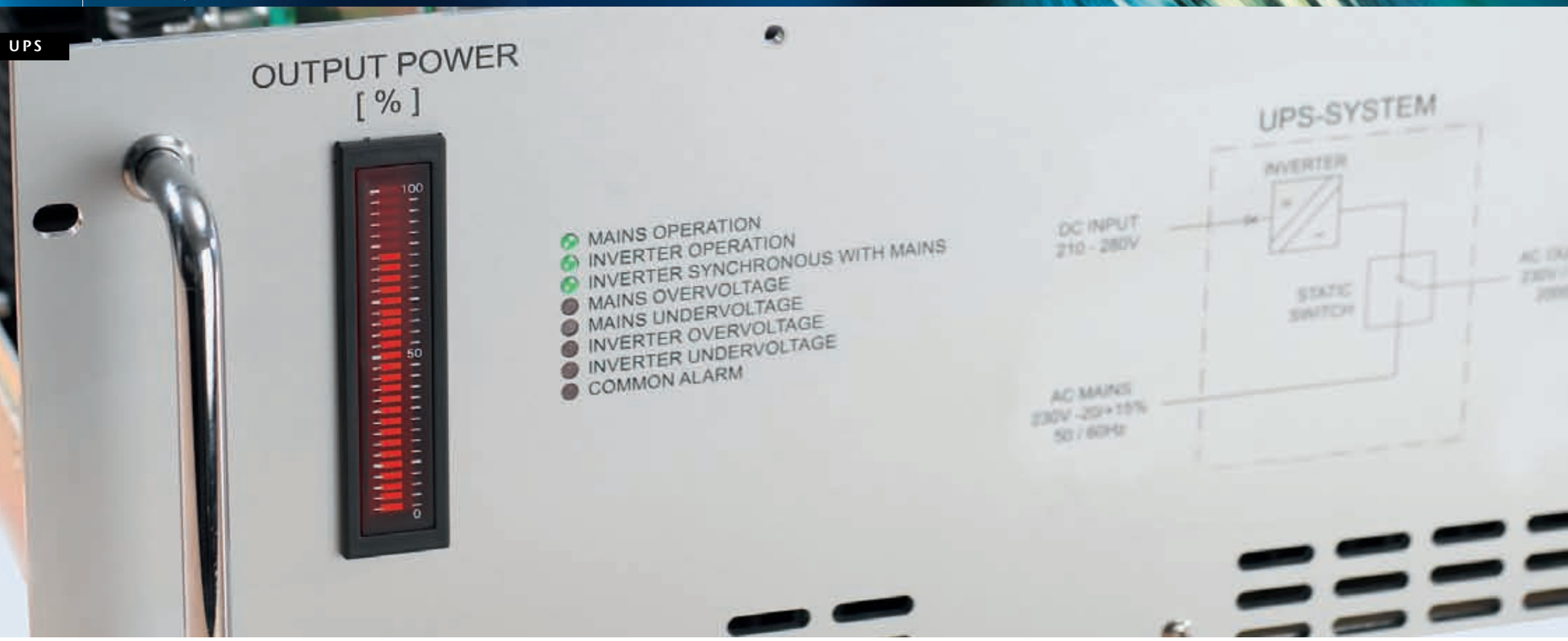
General

Efficiency	80 - 95% typical, for low input / output voltage: 75% typical
Operating temperature	-20 to +75 °C optional: -40 to +75 °C above + 55 °C derating 2.5%/ °C
Storage temperature	-40 to + 85 °C
I/O isolation voltage	2100 VDC (Vin < 60 VDC) 3500 VDC (Vin > 60 VDC)
Safety / Construction	acc. acc. to EN/IEC 61010-2-201 / EN/IEC 61010-1 / EN 50178
EMI	acc. to EN 61000-6-4, class A, optionally class B
Protection category	IP 20, NEMA upon request or others
Connector	H15 acc. to DIN 41612 high current connector or terminals / bolts / bars



Switchmode Inverters, 1 or 3-Phase Output

DC/AC Inverters, AC/AC Frequency Converters & UPS



- **Input voltage:** 10-800V DC or 115/ 230V AC, single phase, 47-400Hz or 200/ 400/ 480V AC, three phase, 47-400Hz
- **Output voltage:** 115/ 230 V AC, single phase or 200/ 400/ 480V AC, three phases
- **Output frequency:** 50/ 60/ 400/ 800Hz (crystal stabilized) or programmable within 40-400Hz or 400-800Hz
- **Output power:** 200VA - 45kVA

Features

- Sine Wave
- Continuous short circuit protection
- thermal shutdown with auto-restart for inverters >1kVA
- Suitable for complex load
- Surge power capability
- Industrial grade components
- Compact and robust design

Additional features for 3-Phase Output

- Unsymmetrical load permissible
- Modular system with interchangeable inverters

Options

Input

- Inrush current limiting
- Input polarity protection for DC input
- Automatic selection of 115 / 230 VAC input

Output

- Remote on / off (inhibit)
- Output parallel operation
- Monitoring of input and output voltage

General

- Output programmable via analogue signal
- Monitoring of input and output voltage
- RS232 or IEEE488 interface
- Wall mounting
- Increased mechanical strength
- Tropical protection
- Static Switch for uninterruptible power supply from 800VA to 10kVA

Inverters or Frequency Converters with 1-Phase Output

1-phase AC output voltage
115 or 230V or any other voltage (to be specified)
Output power
from 200VA to 15kVA

Inverters or Frequency Converters with 3-Phase Output

3-phase AC output voltage
200 / 400 / 480V or any other output voltage (to be specified)
Output power
from 600VA to 45kVA

Specifications

Input

No-load input power	10 – 30 W
Immunity	
ESD	acc. to DIN / EN 61000-4-2 level 3
Fast transients	acc. to DIN / EN 61000-4-4 level 3
Surges	acc. to DIN / EN 61000-4-5 level 3

General

Efficiency	75 – 94 %
Operating temperature	– 20 to + 75°C optional: -40 to +75°C
Load derating	2.5 % / °C from + 55°C
Storage temperature	– 40 to + 85°C
Humidity	up to 95 % RH, non-condensing
Safety / Construction	acc. to EN/IEC 61010-2-201 / EN/IEC 61010-1 / EN 50178
Protection category	IP 20, others or NEMA upon request
EMI	acc. to EN 61000-6-4, class A, optionally class B

Output

Line regulation (±10 %)	0.1 % for series CI, 2 % for series IT and IV
Load regulation (10 – 90 %)	1 % typical, 3 % max. (400 Hz: 3 % typical, 5 % max.)
Waveform	sine wave or any wave shape programmable by external signal
Frequency	40 – 800 Hz: adjustable or programmable or any fixed frequency (crystal stabilized)
Distortion	3 % typical, 5 % @ 400 Hz, 7 % @ 40 – 400 Hz, 800Hz
Overload protection (steady state)	current limited to approx. 1.05 x nominal current
Surge power	2 x nominal power for 1 s
Short circuit protection	electronically limited to 3 x nominal current, unit switches off after 1 s
Crest factor	approx. 3
Power factor	cos 0.7 inductive / capacitive

Thyristor-controlled power supplies & battery chargers

AC/DC Rectifiers & Chargers

- **Input voltage:**
  115 / 230V AC, single phase, 50 / 60Hz
  or 208 / 400 / 480V AC, 3-phase, 50 / 60Hz
- **Output voltage:** 12 / 24 / 48 / 60 / 72 / 110 / 220 / 440V DC
- **Output current:** up to 3250A
- **Output power:** 100W - 500kW

Features

- High level of humidity protection
- Robust design
- Turn Key solution
- Constant current & voltage operation
- Industrial grade components
- Concise & clear indication panel

Options

Input

- MCB, MCCB or isolator
- soft-start

Output

- parallel or redundant operation
- overload protection by electronic fuse
- 6 or 12-pulse performance
- filtering up to 0.1% pp (corresponding to 0.035% rms) or 2mV frequency weighted
- voltage stabilization

Control

IU characteristic acc. to DIN 41773 and 41774

- manual selection of charging characteristic (float / equalize / boost)
- automatic selection of charging characteristic with timer
- temperature compensated charging voltage

Supervision

analogue or micro-processor-controlled

- input/ output voltage
- battery circuit
- ground insulation failure
- over temperature

Battery

- MCB, MCCB or isolator
- deep discharge protection

QE - Series

1-phase thyristor-controlled recitifiers, 100W-5kW						
nominal output voltage						
12V	24V	48V	60V	110V	220V	440V
max. output current						
from 0 tp to 100A						

QD - Series

3-phase thyristor-controlled recitifiers, 100W-500kW					
nominal output voltage					
24V	48V	60V	110V	220V	440V
max. output current					
from 0 tp to 3250A					

Interface Card

- RS232
- LAN
- TCP / IP & others available upon request

Mechanics/Environment

- enclosures, IP20 up to IP55, for charger and / or batteries
- analogue or digital meters
- operating temperature up to +65°C (standard –10 to +40°C)
- tropical protection
- earthquake-proof
- vermin-proof

Specifications

Input

Voltage	230V AC ±10%, 1-phase or 400V AC ±10%, 3-phase (other voltage upon request)
Frequency	50 or 60Hz ±5%
Protection	by fuse

General

Efficiency	
- Series QE	78 – 90%
- Series QD	82– 92% for models <48V DC 85– 95% for models ≥48V DC
Operating temperature	–10 to +40°C, optional up to +65°C
Humidity	up to 95%RH, non-condensing
Enclosure	
- Protection category	IP20 acc. to EN 60529, optional up to IP55
- Color	RAL7035, others upon request
Transformer	acc. to IEC 76 / IEC14 / EN 60591 / DIN VDE 0532

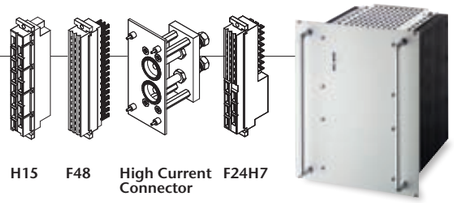
Output

Nominal voltage	12V – 440V (other voltage upon request) adjustable from 90 – 120% of U_{nom}
Line regulation (±10%)	± 0.5%
Load regulation (10-90%)	± 1%
Dynamic load (10-90-10%)	± 10% typical
Ripple	≤ 5% rms without battery, optional: < 2% rms or 2mV frequency weighted
Nominal current	up to 0 – 3250A electronic current limitation adjustable from 60 – 105% of I_{nom}
Overload protection	short circuit protected by fuse, optional: by electronic fuse
Charging characteristic	IU acc. to DIN 41773 for Pb batteries DIN 41774 for NiCd batteries
Charging voltage	
- float	2.23 – 2.27V / cell for Pb batteries / 1.4V / cell for NiCd batteries
- equalize	2.35 – 2.4V / cell for Pb batteries / 1.55V / cell for NiCd batteries
- boost (manual activated)	2.7V / cell for Pb batteries / 1.7V 7 cell for NiCd batteries

Standard

Plug-in module for 19" sub-rack with natural convection

The standard modules are typically equipped with one or two H15 connectors at the rear. For currents > 50 A „high current connectors" are used. For inverters with a transformer at the output a F24H7 connector is fitted in addition to the H15 connector and for static switches a F48 connector is fitted in addition to the H15 connector. All these modules are designed for insertion into a 19" sub-rack.



High power module with fan cooling

The high power modules are constructed in 19" format, having a terminal block at the rear. Depending on the current, bolts or bars may also be available for connection. Typically, these modules are cooled through air supply entering below and exiting above (see photo), with the exception of some modules whose airflow is from front to back.

High power module with liquid cooling

High power modules with liquid cooling are also constructed in 19" format, having bolts or bars and eventually Sub D connectors at the rear. The connections for the liquid inlet / outlet are also located at the rear.


rear view

Options

w **wall mount**

Modules, which have the wall mount option, are typically fixed to a structure or within a cabinet. Depending on the size of the module, this may be done with a flat or angled plate (see photo). The load connections are typically a terminal block. Should the application not require a pluggable module / rack solution, wall mounting presents an alternative for the customer to choose from.

cha **chassis mount**

Module is designed for installation to a structure or within a cabinet. Screw type mating connectors are supplied with the module. Due to the limited number of connector pins this option is not available for modules with dual AC input or for multi-output converters with output 4 supplying more than 10 A.

din **DIN rail mount**

Module is designed for DIN rail mounting to a structure or within a cabinet. Screw type mating connectors are supplied with the module. Due to the limited number of connector pins this option is not available for modules with dual AC input or for multi-output converters with output 4 supplying more than 10 A.

19" Sub-Racks

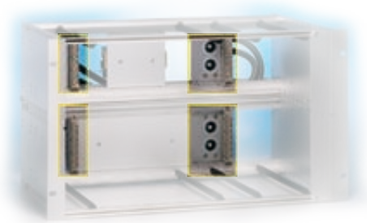
As standard, all of the modules are designed and manufactured for insertion into 19" sub-racks. Higher power modules are already constructed in 19" format.
19" sub-racks can be configured as 3U, 5U or 6U allowing any mix of units and can be upgraded in accordance to the customers' requirements, e.g.

- mating connectors wired to a terminal block
- fuses or circuit breakers
- hot swappable configuration upon request
- analog or digital meters
- switches
- fans
- filters
- decoupling diodes
- provisions for keying the modules to ensure module / slot designation

Alternatively, the racks can be provided in 23" format.
Furthermore the complete system can be installed in a cabinet.


front view


rear view
with terminal block


internal front view showing
various mating connectors


rear view showing
high current mating connectors

Control & Monitoring

TC 01	Control function
	analogue or micro-processor-controlled supervision: ▪ input voltage ▪ output voltage ▪ battery circuit ▪ ground insulation failure ▪ over temperature

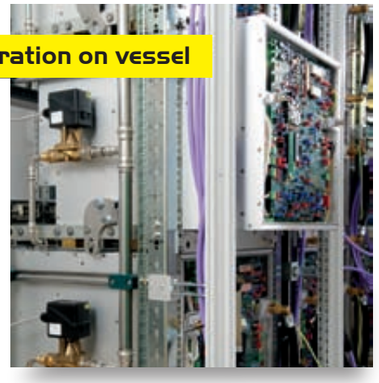
UC 03	Inhanced controller function
	Additional function: ▪ parallel operation ▪ load parameter monitoring ▪ additional application parameter monitoring ▪ computer interface

MU 1000	Full suite of functional control
	Additional function: ▪ local and remote interface ▪ CAN Bus Interface ▪ multiple battery string monitoring ▪ integration to third party hardware

Monitoring & Analyzing

VS 1000	Condition Monitoring & Analyzing System
	Parameters monitored: ▪ Electrical and thermal parameters ▪ Acceleration, seismic vibration, velocity, displacement ▪ Optional: rotation, temperature, etc. The VS-SERIES is a permanent condition monitoring and analyzing system for electrical systems, tower buildings, as well as rail, bridge and windturbine applications. The system performs accurate and informative diagnosis via sensors ensuring recognition of any electrical parameters, vibration in structural or rotating parts while calculating the remaining lifetime for any component of interest assisting in proactive maintenance. Integrated sensors, measuring several physical parameters, come with a Windows based configuration utility that can be operated locally, or remotely via a dial-up connection, if required.

360kW expandable power supply system for mineral exploration on vessel

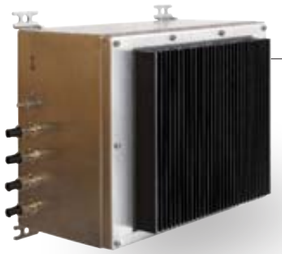


- Assisting the oil industries in the search of oil reserves offshore via electromagnetic streamer process
- Liquid cooled current source up to 2500 A with high dynamic regulation properties
- Modular, N+1 redundant concept via 30 kW single modules with Master/Slave configuration
- Automatic polarity switch-over device rated for 2500A supplying an inductive see-cable
- Signals transmission between the modules for communication and regulation via fiber optic
- Pluggable electrical and water connections for fast unit's removal on board
- Turn-key customised design with full integration incl. water cooled system
- CAN/Ethernet interface for control and monitoring of electrical parameters
- Supervision and diagnostic software
- High level an safety and reliability for continuous operation off-shore

300kW ultra fast charging station for electrical busses

allows the ultra fast charging in 3-10 min of Lithium Ion Batteries on board of electrical busses successfully tested in Umea (Sweden) in the "Artic-Whisper" prototype busses

- Modular and expandable power capability
- N+1 redundancy concept fully redundant and fault tolerant
- Easy system expandability up to 1 MW by adding additional fully wired 100 kW enclosures
- Output voltages available up to 1000 V
- Control and adjustability of electrical parameter
- Use of standard industrial power modules with proven design up to 40 kW
- Operation at extreme low temperature up to -40°C
- Additional customised options CAN/Modbus Interface
- Customisation of system for individual requirements

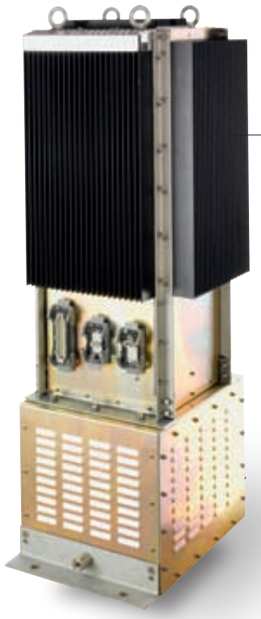


Hybrid Vehicle DC Power System

- Completely autonomous design, turn key solution
- protection category IP65
- stainless steel enclosure
- underfloor mounting
- natural convection
- increased mechanical strength
- designed for high DC input voltage

40kW On-board Power Supply System

- Multi input/ Multi output system
- Hermetically sealed enclosure
- Controlled air management
- Battery charger & DC Bus supply
- Challenging environmental specifications
- Engineered for high degree of shock & vibration
- Self-protecting, autonomous assessment of thermal and electrical parameters



Rolling Stock Mounted Inverter, IP66

- Client specific interface connection
- Anchored to the RAIL Car floor
- 600mm × 600mm foot print
- Impervious to both impulses and spikes across the input, this module delivers the full output range with a crest factor of 3, up to +75°C environmental temperature
- Full power ability, across a phase shifted load, capacitive & inductive load tolerant of ± 0.7cos φ

Coolant System Control for Reactor

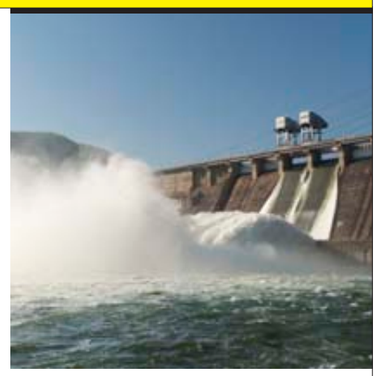
- KTA 3507 certified
- Integrated switch mode Power Supply
- Reactor Core temperature evaluation
- High level of reliability, redundant fault tolerant capability
- 19″ designed Rack mechanical solution
- Enhanced mechanical design
- Programmable output parameters through Client Interface

Power Supply Modules for Substations

- Fault tolerant power configuration
- Automated interrupt free by-pass operation
- Stabilized load feed
- Expandable to multiple redundant design
- Hot-pluggable
- Multiple mechanical solutions and styles

N+2 UPS System

- Configured both dual redundant & fault tolerant
- Supplied from multiple independent DC and an AC source
- Both automatically and manually operational by-pass system
- integrated & isolated AC by-pass
- The indication panel reflects the operational status, while multiple stage monitoring is both locally and remotely communicated.



Subsea Power Supply

- Module based on a C3700 standard unit
- Extreme Environmental Challenges
- Wide range of AC input supply
- Robust heat sink design to integrate into the titanium pipe / tube
- Enhanced mechanical integration
- High level of reliability

40kW Liquid cooled Power Supply

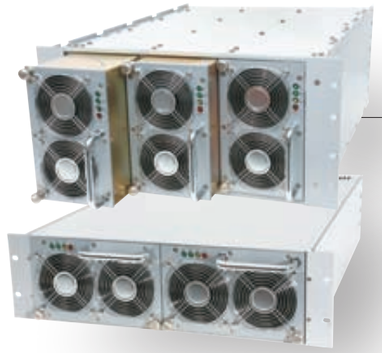
- for robotics power supply
- highly demanding environment
- extreme load variations
- transfer of thermal energy into a fluid for heat exchange re-capture
- Programmable output parameters through Client Interface

N+I DC UPS System

- Configured as a redundant & fault tolerant solution
- Supplied from multiple independent AC sources
- Both automatically and manually operational output characteristic
- High grade industrial components
- compliant with exacting environmental standards to ensure a highly reliable load power supply for critical applications

On-board Military UPS

- Military grade design
- Integrated Inverter, Static Switch and Battery Charger
- dimensions: 6U × 19" × 500mm deep solution (H x W x D)
- robust and reliable design



On-board 3-D Radar Power Supply

- 5kW Modules ensuring a high power density
- flexible orientation
- Capable of populating a 5U RACK with three units
- Capable of populating a 3U RACK with two units
- Engineered for high degree of shock & vibration

Integrated combined solution

- Multiple source power conversion system
- Adjustable extraction power
- synchronized output with specialized frequency
- pluggable system, installation on water heat sinks via pressure rails
- communication via EtherCat (PC-generator)