

Power Conversion Systems



Switchmode Power Supplies

DC/DC Converters
AC/DC Rectifiers
Chargers

Switchmode Inverters

DC/AC Inverters
AC/AC Frequency Converters
UPS

Thyristor-controlled

Power Supplies
Chargers

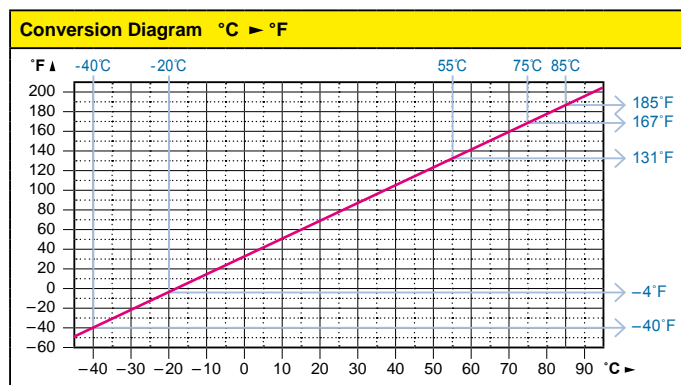
Certifications



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 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 Profile

Workforce SCHAEFER is wholly owned and privately run 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, which dates back to the founding days of the company, SCHAEFER Personnel can tap into a rich resource of our internal intellectual property which can only be gained from designing and manufacturing solutions after detailed and in-depth consultation with clients.

Products The level of in-depth engineering which has occurred from working very closely with our clients has allowed our Product Portfolio to be 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-in house & manufacture in-house generates a large degree of flexibility. The SCHAEFER Client profits from these engineering skills through an optimized solution tailored to the needs and parameters of the project.

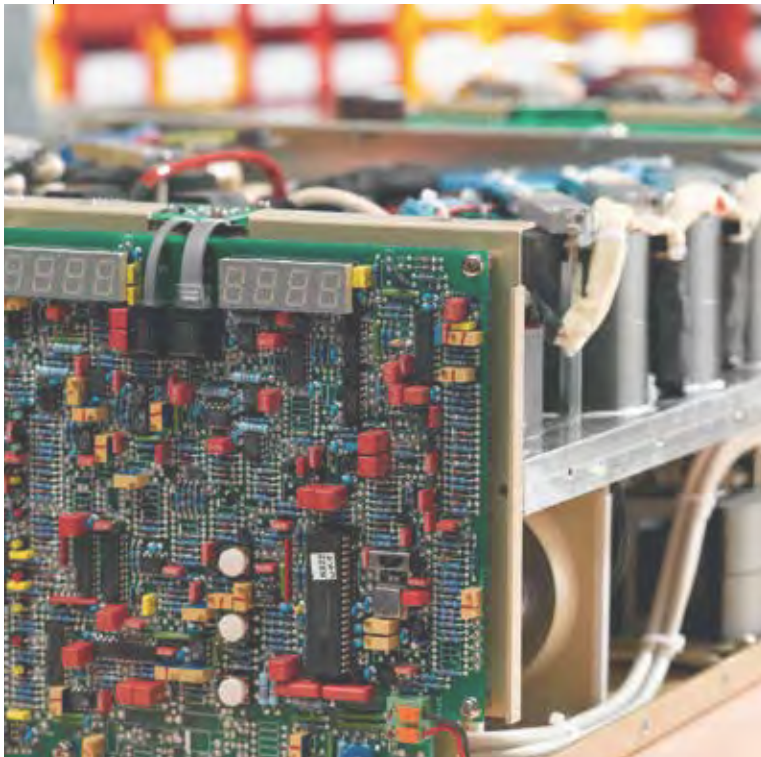
Manufacture

Immediate proximity also generates the free flowing information path (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 efficiently. Fruits of this labor are to be seen throughout the world, in a variety of fields such as:

- Rail & Automotive Industry
- Power Generation Industry
- Oil & Gas Industry
- Chemical Industry
- Factory Automation
- Military Industry

Whether on-board or trackside, 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 your requirements.

Welcoming the challenge, the SCHAEFER Team offers the highest level of quality, engineering and support.



Switchmode Power Supplies

DC/DC Converters, AC/DC Rectifiers & Chargers

- **DC Input voltage:** DC/DC converters from 10 - 800V DC (Custom configurations to 1000's of volts)
- **AC Input voltage:** AC/DC rectifiers 115 / 230V AC, single phase (with or without PFC) or 208 / 400 / 480V AC, three phases
- **Output voltage:** up to 800V DC, (Custom configurations to 1000's of volts) additional outputs 5 / 12 / 15 / 24V DC upon request
- **Output current:** up to 450A / module
- **Output power:** 50W - 40kW / module

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 analog 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	acc. to EN 61000-4-4 level 3
- Surges	acc. to EN 61000-4-5 level 3

Output

Line regulation ($\pm 10\%$)	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 ($V_{in} < 60$ VDC) 3500 VDC ($V_{in} > 60$ VDC)
Safety / Construction	acc. to DIN / EN 60950-1: 2006
EMI	acc. to EN 55022, class A optional: class B
Protection category	IP 20, others or NEMA upon request
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
208 / 400 / 480V AC, three phase, 47 - 400Hz
- **Output voltage:** 115 / 230 V AC, single phase or
208 / 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 loads
- Surge power capability
- Industrial grade components
- Compact and robust design
- Output parallel operation

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

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

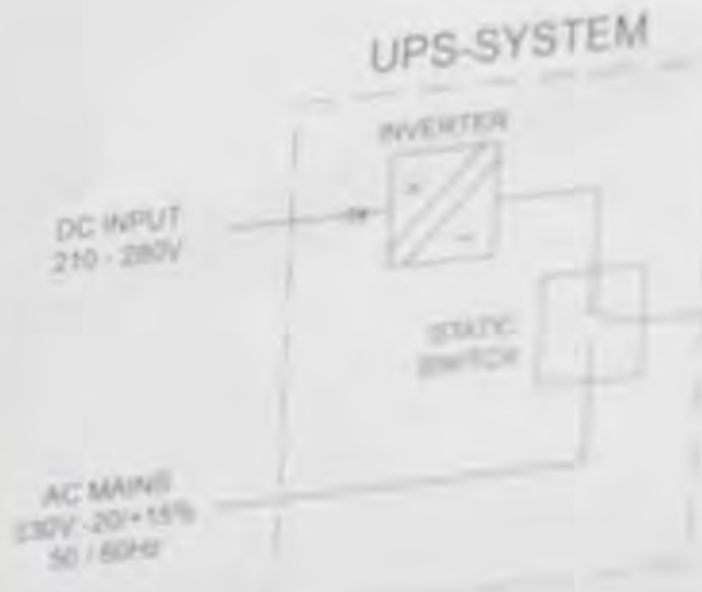
3-phase AC output voltage
208 / 400 / 480V or any other output voltage (to be specified)
Output power
from 600VA to 45kVA

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

WER

- MAINS OPERATION
- INVERTER OPERATION
- INVERTER SYNCHRONOUS WITH MAINS
- MAINS OVERVOLTAGE
- MAINS UNDERVOLTAGE
- INVERTER OVERVOLTAGE
- INVERTER UNDERVOLTAGE
- COMMON ALARM



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 DIN / EN 60950-1: 2006
Protection category	IP 20, others or NEMA upon request
EMI	acc. to EN 55022 , class A, optionally class B
Connectors	H15, high current connector, F24H7 or terminals

Output

Line regulation ($\pm 10\%$)	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

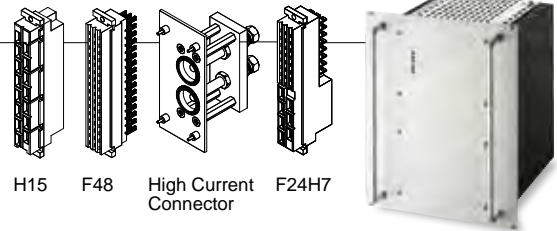


Mechanics and Accessories

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 with 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

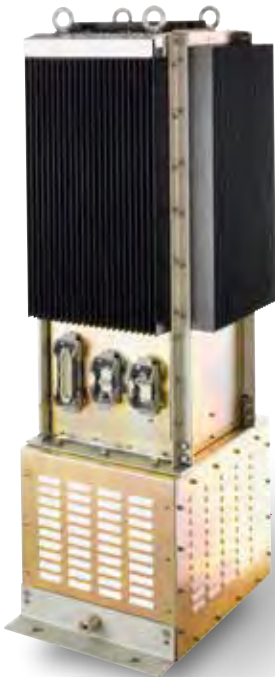


rear view showing
high current mating connectors



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



Rolling Stock Mounted Inverter, IP66

- Client specific interface connection
- Anchored to the RAIL Car floor
- 600mm x 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 $\pm 0.7 \cos \varphi$



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



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" Rack mechanical solution
- Enhanced mechanical design
- Programmable output parameters through the 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.



Design Solutions - Demanding Markets

Subsea Power Supply



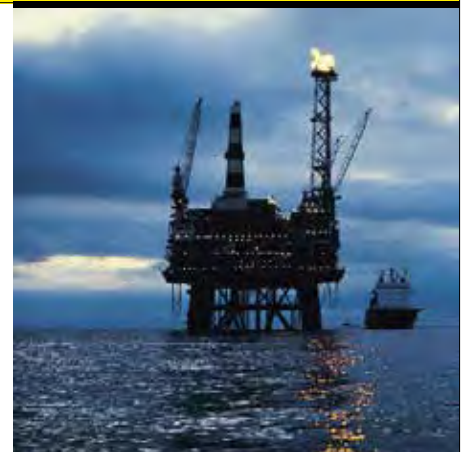
- Module based on a C3700 standard unit
- Extreme Environmental Challenges
- Wide range of AC input supply
- Robust heat sink plate to integrate into the subsea bell / tube
- Enhanced mechanical integration
- High level of reliability



Power Supply for Off-shore Oil & Gas Industry



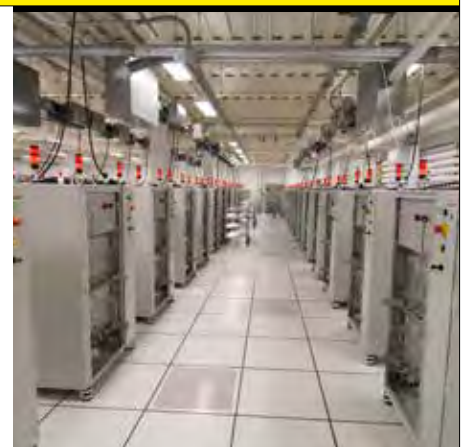
- 15kW liquid cooled power supply system
- Dimensions: 5U × 19" × 600mm (H x W x D)
- Redundant fault tolerant capability
- High efficiency through ZVS topology
- Assisting the industry in the search for mineral resources



40kW Liquid cooled Power Supply



- For semiconductor manufacturing industry
- Highly demanding environment
- Extreme load variations
- Transfer of thermal energy into a fluid for heat exchange re-capture
- Programmable output parameters through the client interface.



On-board Military UPS



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



On-board 3-D Radar Power Supply



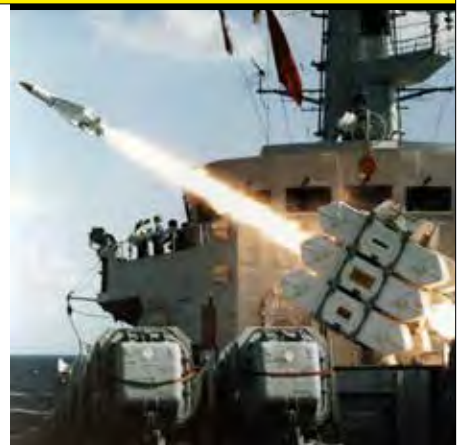
- 5kW Modules ensuring a high power density
- Flexible orientation
- Capable of populating a 5U RACK with three units
- Capable of populating a 3U RACK with two units
- Engineered for high degree of shock & vibration



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)



SCHAEFER International

SCHAEFER Inc.

45 South Street
Hopkinton, MA 01748
USA
Phone 508-435-6400
Fax 508-435-6401
sales@schaeferpowers.com

SCHÄFER Elektronik GmbH

Germany

SCHAEFER GmbH Middle East

UAE