

Physical *nstruments*

CONVERTERS



POWER SUPPLIES



GENERATORS & AMPLIFIERS



CONNECTORS & CABLES



CHASSIS & MODULES



ELECTRICAL MEASUREMENT



PRODUCTS OVERVIEW

2016-2017

Since 2005 PHYSICAL Instruments has been a sales agency distributing over the French market a wide range of electronic devices for industry and research. For several years we have developed strong partnerships with the following companies:

ISEG Spezialelektronik GmbH

HIVOLT.de GmbH & Co. KG

GBS Elektronik GmbH

W-IE-NE-R Plein & Baus GmbH

WME Power Systems GmbH

NDB Technologie Inc.

We invite you to look at our catalog which is only an overview of our portfolio. Products appearing in this catalog do not represent all of our expertise; it shows the main lines of the devices we offer. For more detailed references we ask you to download the PDF files from our suppliers on our website (www.physical-instruments.fr/catalogues-fournisseurs). If you prefer a paper version, please fulfil the web contact form with your address and we will provide you with a copy through a postal mail.

If you are developing a new experiment with advanced characteristics and need a custom device, please feel free to contact us, we will help you by offering a new design with modified specifications.

47, Chemin du Vieux Chêne
38240 MEYLAN - FRANCE

Tél. : +33 (0)9 50 13 94 03
Port. : +33 (0)6 27 74 53 38
Fax : +33 (0)9 58 49 78 29

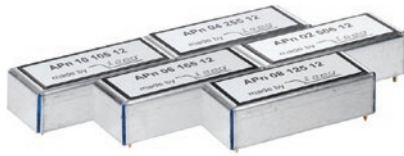
E-mail : ludovic.ruse@physical-instruments.fr

www.physical-instruments.fr

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► High voltage DC to DC converters



▲ APS



▲ BPS



▲ CPS

APS	200 V to 1 kV / 0,5 W and 1 W PCB mounting, RoHS compliant	NEW
BPS	300 V to 6 kV / 1 W, 3 W and 4 W PCB mounting, RoHS compliant	NEW
CPS	500 V to 30 kV / 12 W Standard	
DPS-Mini	500 V to 10 kV / 9 W Compact, high precision, low ripple & noise	NEW
DPS	500 V to 6 kV / 12 W High precision, low ripple & noise, electronically switchable polarity (TTL signal)	
EPS	500 V to 30 kV / 60 W to 150 W Standard	

FEATURES:

- Patented resonance converter technology.
- Positive, negative or reversible polarity.
- Analog control and monitor voltage / current.
- INHIBIT, adjustable hardware limits.
- PCB mounting, compact box.
- Wide supply range.
- 3U cassette with address identification (ID-cheap).
- Used as a single unit or
- Used as integrated into a multichannel HV power system (MMC see page 24) or
- Used as integrated into a desktop / rack power supply (THQ see page 06).

► PMT base integrated high voltage converters



PHQ

- Multi (6 to 14) dynodes / up to 3 kV
- Ripple and noise [$f > 10 \text{ Hz}$] $< 10 \text{ mVp-p}$
- Stability [ΔV_{out}] $< 1 \cdot 10^{-4} \cdot V_{\text{nominal}}$
- Temperature coefficient $< 5 \cdot 10^{-5} / ^\circ\text{C}$

FEATURES:

- Directly integrated into the socket.
- No HV cabling or connectors necessary.
- Stabilized dynode voltages.
- High linearity at high pulse loads and pulse rates.
- Control and monitor capabilities, analog and digital.
- Power dissipation reduced by factor 10 and more.
- High temperature stability and thermal balance.
- Small form factor.
- Custom design on all kinds of PMTs: ET Enterprise, Photonis, Hamamatsu.
- To be used in very large scale experiment like HESS, ANTARES, NeCTAr, etc.

POWER SUPPLIES

► Multichannel low voltage power supplies

PL 504

NEW

PL 504 series is a 19" rack / 1,5U power supply with a total power of 2 kW and up to 4 low noise DC outputs. It is equipped with individual power modules, MEH single channel or MDH dual channels. Full redundancy operation is available, two rack and two 94 – 265 VAC inputs for a total power of 4 kW. Customized output connectors, remote control with USB and Ethernet.



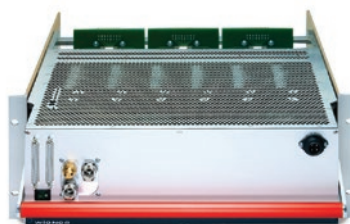
▲ PL 504

POWER MODULES

MEH-02/07	2 V ... 7 V	1 channel	115 A / 550 W
MEH-06/10	6 V ... 10 V	1 channel	80 A / 550 W
MEH-07/16	7 V ... 16 V	1 channel	46 A / 550 W
MEH-12/30	12 V ... 30 V	1 channel	23 A / 550 W
MEH-30/60	30 V ... 60 V	1 channel	13,5 A / 650 W
MDH-02/07	2 V ... 7 V	2 channels	+/- 40 A / 230 W (460 W total)
MDH-07/16	7 V ... 16 V	2 channels	+/- 23 A / 250 W (500 W total)
MDH-07/24	7 V ... 24 V	2 channels	+/- 11,5 A / 275 W (550 W total)

PL 506 - PL 512

PL 506 and PL 512 series consist of a "Power Bin" in 19" enclosure, a plug-in "Power Box" with an easy lever extraction mechanism containing a PFC mains input module, a control card and internal slots for elementary power modules, MEH single channel, MDH and MDL dual channels.



▲ PL 506 (water cooled)



▲ PL 512 (power box)

POWER BIN

PBN506 / PBN512	3U / folded metal case, bottom air intake
PBN506 / PBN512	4U / aluminium side panels, front air intake

POWER BOX

PBX506 / PBX512	3U x 19" / 1 to 6 channels / 3 kW / Ethernet, USB, "Easy Lever" extraction mechanism
PBX506 / PBX512EX	3U x 19" / 2 to 12 channels / 3 kW / Display, Ethernet, USB, "Easy Lever" extraction mechanism

POWER MODULES

MEH-02/07	2 V ... 7 V	1 channel	115 A / 550 W
MEH-06/10	6 V ... 10 V	1 channel	80 A / 550 W
MEH-07/16	7 V ... 16 V	1 channel	46 A / 550 W
MEH-12/30	12 V ... 30 V	1 channel	23 A / 550 W
MEH-30/60	30 V ... 60 V	1 channel	13,5 A / 650 W
MDL-07/24	7 V ... 24 V	2 channels	+/- 11,5 A / 275 W (550 W total)
MDH-02/07	2 V ... 7 V	2 channels	+/- 30 A / 210 W (420 W total)
MDH-07/16	7 V ... 16 V	2 channels	+/- 20 A / 250 W (500 W total)
MDH-30/60	30 V ... 60 V	2 channels	+/- 6 A / 250 W (500 W total)

FEATURES:

- Voltage / current regulation modes.
- Programmable voltages, current limits, ramp up / down, group behaviour.
- Sense line compensations via slow, medium and fast regulation loops.
- Individual or common Interlock (optional).
- Power Fail and System Reset Signal (optional).
- USB and Ethernet interfaces, optional display for front panel control.
- Web interface using SNMP protocol, Webserver, OPCserver.
- LabVIEW program available (VIs).
- Floating range: +/-100V (default, optimal for low noise), increased up to +/- 500V.
- Master - slave mode for paralleling of two or more outputs.
- 94 – 265 VAC world-wide auto-range AC input.

► Pulsed magnet power supply



▲ PA 1025P

PA 1025P +/- 250 A / +/- 100 V

NEW

The PA1025P is a highly stable pulsed magnet power supply unit that is used to feed the chicane dipole magnets of the cooler synchrotron COSY at FZ Jülich.

FEATURES:

- Current mode control.
- Output current: - 250 A to + 250 A peak.
- Output voltage: - 100 V to + 100 V peak.
- Average current: < 2 A.
- Overall pulse accuracy: $< \pm 1 \cdot 10^{-3}$.
- Rise time: 1 ms – 100 ms (load dependent).
- Overshoot: $< \pm 1 \cdot 10^{-3}$.
- Common mode voltage: - 50 V to + 50 V.
- Ambient temperature: + 10 to + 35°C (operating).
- External triggering.
- Ethernet with SCPI interface.
- Mains Voltage: 230 VAC / $\pm 10\%$ / 47 - 63 Hz.
- Dimensions (W / H / D): 483 x 176 x 554 mm (19", 3 U).
- Weight: 25 Kg

► Linear 4-Q magnet power supply



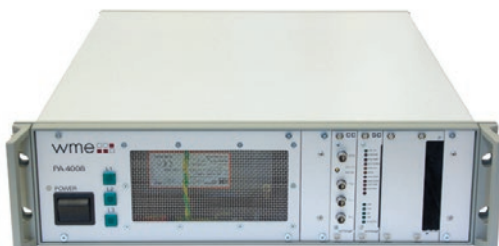
▲ PA 2540

PA 2540 +/- 40 A / +/- 25 V

The PA2540 is a highly stable 4-quadrant power supply unit that is used to feed different magnets of the storage rings of BESSY II and the PTB Metrology Light Source in Berlin.

FEATURES:

- Current mode control.
- Output current: - 40 A to + 40 A.
- Output voltage: - 25 V to + 25 V.
- Overall stability: $< \pm 100$ ppm (including ripple & noise, 8 Hr drift).
- Ripple & noise: < 50 ppm peak to peak (load 1 mH / 200 mOhm).
- Absolute accuracy: $< \pm 5 \cdot 10^{-3}$.
- Bandwidth (-3dB): DC – 1000 Hz (via modulation input, into a suitable load).
- Slew-Rate: 8 A / s (adjustable).
- Common mode voltage: - 50 V to + 50 V.
- Mains voltage: 3*400 VAC / $\pm 10\%$ / 47 - 63 Hz.
- Power factor: > 0.9.
- Ambient temperature: + 10 to + 40 °C (operating).
- Dimensions (W / H / D): 483 x 132.5 x 554 mm (19", 3 U).
- Weight : 40 Kg.



▲ PA 4008

PA 4008 +/- 8 A / +/- 40 V

The PA4008 is a highly stable 4-quadrant power supply unit that is used to feed different magnets of the storage rings of BESSY II and the PTB Metrology Light Source in Berlin.

FEATURES:

- Current mode control.
- Output Current: - 8 A to + 8 A.
- Output voltage: - 40 V to + 40 V / - 20 V to + 20 V (switch selectable).
- Overall stability: $< \pm 100$ ppm (including ripple & noise, 8 Hr drift).
- Ripple & noise: < 50 ppm (load 100 mH / 1.5 Ohm).
- Absolute accuracy: $< \pm 5 \cdot 10^{-3}$.
- Power bandwidth (-3dB): DC – 1000 Hz (via modulation input, into a suitable load).
- Slew rate: 1.6 A / s (adjustable).
- Common mode voltage: - 100 V to + 100 V.
- Mains voltage: 3*400 VAC / $\pm 10\%$ / 47 - 63 Hz.
- Power factor: > 0.6.
- Ambient temperature: + 10 to + 30 °C (operating).
- Dimensions (W / H / D): 483 x 132.5 x 554 mm (19", 3 U).
- Weight: 36 Kg.

POWER SUPPLIES

► Hybrid magnet power supply



▲ PA 20100

PA 20100 100 A / 20 V

The PA20100 is an ultra stable magnet power supply unit. It is used to feed quadrupole magnets of the PTB Metrology Light Source storage ring in Berlin.

FEATURES:

- Switched-mode pre-regulator with linear output stage.
- Output current: 1 A to 100 A.
- Output voltage: 0 V - 20 V.
- Overall stability: $< \pm 10$ ppm (including ripple & noise, repeatability and drift over 24 h).
- Ripple & noise: < 5 ppm (load: 40 mH / 150 mOhm).
- Absolute accuracy: $< \pm 100$ ppm.
- Slew rate: 3 A - 100 A / s (adjustable).
- Common mode voltage: - 100 V to + 100 V.
- Mains voltage: 230 VAC / $\pm 10\%$ / 47 - 63 Hz.
- Power factor: > 0.98 .
- Ambient temperature: 0 to + 40 °C (operating); + 20 to + 30 °C (maintaining drift specifications).
- Dimensions (W / H / D): 483 x 132.5 x 554 mm (19", 3 U).
- Weight: 40 Kg.

► High voltage AC to DC power supplies



▲ THQ



▲ HPS



▲ FPS

THQ	500 V to 30 kV / 12 W to 150 W Multichannel power supply, 1 up to 3 independent channels, desktop or 19" - 2U rack
SHQ	2 kV to 6 kV / 12 W High precision power supply, ultra low ripple & noise, 1 or 2 channels, desktop size
HPS	1 kV to 70 kV / 350 W Compact box
HPS	1 kV to 30 kV / 300 W and 800 W 19" - 1U rack
HPS	1 kV to 100 kV / 1.5 kW and 3 kW 2 nd generation, 19" - 2U/3U/4U rack NEW
HPS	1 kV to 20 kV / 6 kW and 10 kW 2 nd generation, 19" - 4U rack
FPS	10 V to 30 V / 3 A to 50 A / 30 W to 600 W 19" - 2U rack, floating low voltage power supply dedicated to filament supply e.g. for e-beam based coating applications NEW

FEATURES:

- Patented resonant converter topology, up to 93 % efficiency.
- Positive, negative or switchable polarity depending on model.
- Regulated unit (voltage / current) or capacitor charger available (current source).
- **Ultrafast configurable ARC management, recovery in less than 1 ms (option ARC).** **NEW**
- **Current limitation during an ARC to less than 4 A (option ACL).** **NEW**
- Manual front panel or blank panel unit available.
- Analog, CANbus, IEEE488 – GPIB, USB, Ethernet interfaces.
- **Floating LV supply on HV potential via HV-in connector.** **NEW**
- **Direct filament heating control or parent emission regulation.** **NEW**
- **Isolation voltage: 5 kV to 75 kV.** **NEW**

GENERATORS & AMPLIFIERS

► RUP Series (Rossendorfer Universal Pulse Generator)

It consists of pulse generators dealing with a broad range of load impedances and pulse parameters. The RUP generator includes pulse devices with close to square wave pulses and pulse parameters like frequency, pulse width and amplitude freely adjustable.

APPLICATIONS:

- Magnetron sputtering.
- Dielectric barrier discharge.
- Surface treatment.
- Beam deflection.
- Insulation test.
- General laboratory.

PULSE GENERATOR REQUIREMENT:

- Design your own project (see page 35)

FEATURES:

- Unipolar or bipolar outputs.
- Voltage setting by 10-turn potentiometer.
- Analog meter for voltage setting.
- Analog meter for average current monitoring (option).
- Pulse control by external TTL signal (from a wave generator).
- Voltage monitor output.
- Current monitor output: 100 mV / A to 1 V / A.
- External interlock.
- Option with RS232 light fibber cable (pulse width, frequency, voltage).
- Supply voltage: 230 VAC or 3 x 380 VAC.
- Output: fitted connector and 3m cable.

► RUP 3

PRELIMINARY:

Limited demand for voltage, peak current and power. It switches a DC voltage with a MOSFET switch module to the output. The MOSFETS transistors are protected by current limiting series resistors.

WAVEFORM:

Arbitrary rectangular wave, duty cycle up to DC operation. Ultrafast rise and fall times, at the lower voltages typically < 100 nS.

VOLTAGE:

Devices with 2,2 kV, 3 kV, 5 kV, 6 kV, 7,5 kV, 9 kV, 10 kV, 15 kV and 25 kV.

CURRENT:

Up to 0,5 A to 12 A peak current, output impedances defined by the limiting resistors are in the range of 50 Ohms to 1 200 Ohms.

POWER:

Wide range of devices with internal power supplies in the range of 3 W to 1 kW.

SIZE:

19" rack, Height 6U, Depth 500 mm or Mini cabinet with casters, 19", Height 860 mm, Depth 600 mm. OEM boards on few models.



▲ RUP3

Model	Voltage	Average Power	Average Current	Peak Current	Short-circuit Current
RUP3-2200-10p	0 à 2,2 kV	10 W	5 à 10 mA	4 A	40 A
RUP3-3000-300n	0 à 3 kV	300 W	100 mA	5 A	40 A
RUP3-5000-100p	0 à 5 kV	100 W	20 mA	1 A	25 A
RUP3-5000-100n	0 à 5 kV	100 W	20 mA	1 A	25 A
RUP3-5000-900n	0 à 5 kV	900 W	180 mA	2 A	25 A
RUP3-6000-700bip	± 6 kV	700 W	125 mA	5 A	45 A
RUP3-7500-500bip	± 7,5 kV	500 W	66 mA	5 A	50 A
RUP3-9000-12p	0 à 9 kV	12 W	1,3 mA	12 A	120 A
RUP3-10000-3p	0 à 10 kV	3 W	0,3 mA	5 A	30 A
RUP3-10000-15p	0 à 10 kV	15 W	1,5 mA	1 A	30 A
RUP3-10000-500p	0 à 10 kV	500 W	500 mA	5 A	50 A
RUP3-10000-500bip	± 10 kV	500 W	50 mA	6 A	45 A
RUP3-15000-750n	0 à 15 kV	750 W	50 mA	5 A	50 A
RUP3-25000-25p	0 à 25 kV	25 W	1 mA	1 A	25 A

* Custom specific, many other models on request.

RUP 6

PRELIMINARY:

Medium voltage and high current pulses with significant average power. The common part of all these pulse generators is the fact that they are made of several short circuit proof 1 kV elementary modules, switched in series for the pulse. The maximum average power decreases linearly with duty cycle. 100 % duty cycle (= DC) is not possible. The pulse width is selectable within a wide range and limited only by the stored energy. The voltage is dynamically switched off and therefore the fall time is very fast and nearly independent from load.

WAVEFORM:

Square wave with very fast rise time (100 nS to 10 μ S) and fast fall time (200 nS to 3 μ S), pulse width can be adjusted in a wide range, but average power capability decreases with duty cycle.

DUTY CYCLE:

Can be chosen nearly arbitrarily, it has only to be noted that maximum possible output power will decrease to zero when the duty cycle is approaching 100 %, as the internal power supply is off during pulse and starts again after end of pulse.

DC VOLTAGE:

Devices with 1 kV, 6 kV, 10 kV, 12 kV, 17 kV, 18 kV, 20 kV, 22 kV, 25 kV and 35 kV.

CURRENT:

Pulse modules with peak current capabilities of 50 A, 100 A and 200 A are available; output impedances are in the range of 1 Ohm to 30 Ohms.

POWER:

Customized power supplies in the range of 2 kW to 12 kW.

SIZE:

Mini cabinet with casters, 19", Height 860 mm, Depth 600 mm or Cabinet with casters, 19", Height 1 850 mm, Depth 800 mm.



▲ RUP6

Model	Voltage	Average Power	Average Current	Peak Current	Short-circuit Current
RUP6-1000-100n	0 à 1 kV	100 W	100 mA	10 A	100 A
RUP6-1000-5000n	0 à 1 kV	5 000 W	5 000 mA	100 A	190 A
RUP6-6000-2500n	0 à 6 kV	2 500 W	420 mA	50 A	100 A
RUP6-10000-40n	0 à 10 kV	40 W	4 mA	120 A	200 A
RUP6-10000-2500n	0 à 10 kV	2 500 W	250 mA	44 A	100 A
RUP6-12000-2500n	0 à 12 kV	2 500 W	200 mA	100 A	160 A
RUP6-12000-3000n	0 à 12 kV	3 000 W	250 mA	90 A	120 A
RUP6-12000-6000n	0 à 12 kV	6 W	500 mA	120 A	200 A
RUP6-17000-12000n	0 à 17 kV	12 000 W	700 mA	200 A	270 A
RUP6-18000-1700bip	± 18 kV	1 700 W	100 mA	15 A	50 A
RUP6-18000-2000bip	± 18 kV	2 000 W	110 mA	50 A	90 A
RUP6-20000-2500n	0 à 20 kV	2 500 W	125 mA	50 A	190 A
RUP6-22000-2000n	0 à 22 kV	2 000 W	80 mA	50 A	190 A
RUP6-25000-2000n	0 à 25 kV	2 000 W	80 mA	40 A	80 A
RUP6-25000-2000bip	± 25 kV	2 000 W	80 mA	50 A	90 A
RUP6-25000-3000n	0 à 25 kV	3 000 W	120 mA	60 A	80 A
RUP6-36000-3000n	0 à 35 kV	3 000 W	80 mA	60 A	80 A

* Custom specific, many other models on request.

Minipuls Series

PRELIMINARY:

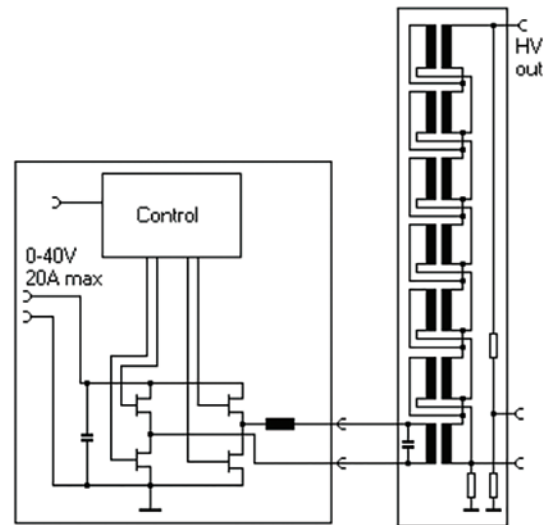
Series of generators delivering high AC voltages pulses - sinusoidal or approximate sinusoidal - with frequencies in the range of 5 kHz to 20 kHz through cascaded transformers.

OEM boards are delivered including full bridge converter + voltage transformer cascade board.

APPLICATIONS:

Dielectric Barrier Discharge (DBD) in an open setup.

- › Average power: 120 W up to 700 W.
- › Voltage: 10 kVAC, 20 kVAC and 30 kVAC.
- › Voltage monitor output: 1:1000, 1:2000, 1:3000 (BNC).
- › Current monitor output: 10 V / A (BNC).
- › Supply voltage: 15 VDC to 40 VDC.
- › Positive and negative pulses.
- › Pulses control by external logic input (TTL or +/- 5 V) and Inhibit signal.
- › Dead time – output off (Vout = 0 volts).
- › Load capability: few hundreds of pF.



▲ Minipuls - bridge & cascade schematic

Minipuls 2

FULL BRIDGE CONVERTER

- › Maximum input power: 140 W.
- › Output current: 10 A max.
- › Size: 100 * 160 mm / Weight: 300 g.

VOLTAGE TRANSFORMER CASCADE

- › 5 cascaded output transformers, RM14 ferrite cores.
- › Voltage: +/- 10 kV to 10 kHz, depending on the load and the frequency.
- › Transformer ratio selectable: 1:102, 1:121 and 1:148.
- › Overvoltage limited by spark gap: 12 kV.
- › Capacitive loads: 300 pF max.
- › Resistive load: 100 kΩ min.
- › Size: 160 * 190 mm / Weight: 800 g.



▲ Minipuls 2 - bridge



▲ Minipuls 2 - cascade

FEATURES:

- › Voltage: +/- 10 kV.
- › Peak current: 60 mA max.
- › Average power: 120 W max.
- › Average current: 12 mA max.
- › Nominal frequency: 10 kHz (sinusoidal).
- › Adjustable frequency: 5 to 20 kHz (approximate sinusoidal).

Minipuls 4

FULL BRIDGE CONVERTER

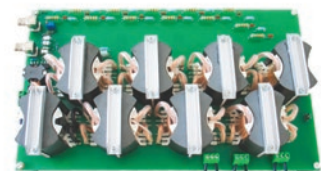
- › Maximum input power: 320 W.
- › Output current: 40 A max.
- › Size: 127 * 178 mm / Weight: 370 g.

VOLTAGE TRANSFORMER CASCADE

- › 7 cascaded output transformers, PM62 ferrite cores.
- › Voltage: +/- 20 kV to 10 kHz, depending on the load and the frequency.
- › Transformer ratio selectable: 1:184 to 1:158, 1:132, 1:106.
- › Overvoltage limited by spark gap: 24 kV.
- › Capacitive loads: 100 pF max.
- › Size: 199 * 345 mm / Weight: 4100 g.



▲ Minipuls 4 - bridge



▲ Minipuls 4 - cascade

FEATURES:

- › Voltage: +/- 20 kV.
- › Peak current: 220 mA max.
- › Average power: 300 W max.
- › Average current: 15 mA max.
- › Nominal frequency: 10 kHz (sinusoidal).
- › Adjustable frequency: 5 to 20 kHz (approximate sinusoidal).

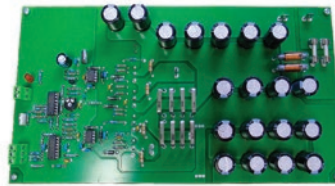
Minipuls 6

FULL BRIDGE CONVERTER

- ▶ Maximum input power: 720 W.
- ▶ Output current: 80 A max.
- ▶ Size: 280 * 150 mm / Weight: 1200 g.

VOLTAGE TRANSFORMER CASCADE

- ▶ 8 cascaded output transformers, PM74 ferrite cores.
- ▶ Voltage: +/- 30 kV to 10 kHz, depending on the load and the frequency.
- ▶ Transformer ratio selectable: 1:321 to 1:281, 1:241, 1:201.
- ▶ Overvoltage limited by spark gap: 35 kV.
- ▶ Capacitive loads: 100 pF max.
- ▶ Size: 485 * 200 mm / Weight: 7500 g.



▲ Minipuls 6 - bridge



▲ Minipuls 6 - cascade

FEATURES:

- ▶ Voltage: +/- 30 kV.
- ▶ Peak current: 250 mA max.
- ▶ Average power: 700 W max.
- ▶ Average current: 23 mA max.
- ▶ Nominal frequency: 10 kHz.
- ▶ Adjustable frequency: 5 to 20 kHz.

▶ Multichannel high voltage amplifiers



▲ HAR2



▲ HA05B2

FEATURES:

- ▶ Voltage: +/- 500 V.
- ▶ Peak power: 1 W.
- ▶ Peak current: +/- 2 mA.
- ▶ Channels: 2.
- ▶ Equipped with HA05B2 Standard or HA05B2-BA High Speed amplifier.
- ▶ Bandwidth: DC to 500 Hz (HA05B2) or 15 kHz (HA05B2-BA) at -3 dB.
- ▶ Slew rate: 2 V / μ s (HA05B2) or 50 V / μ s (HA05B2-BA).
- ▶ Low noise: < 10 mVp-p.
- ▶ Manual front panel with display for voltage / current.
- ▶ Waveform: sine, triangle, saw tooth, square.
- ▶ To be used with a +/- 10 V arbitrary generator.
- ▶ Size: mini-rack - 3U.
- ▶ Application: electrostatic deflection, ion guidance, general high voltage testing.

HAR2



▲ HAR12



▲ HA05B2

FEATURES:

- ▶ Voltage: +/- 500 V.
- ▶ Peak power: 1 W.
- ▶ Peak current: +/- 2 mA.
- ▶ Channels: 12.
- ▶ Equipped with HA05B2 Standard or HA05B2-BA High Speed amplifier.
- ▶ Bandwidth: DC to 500 Hz (HA05B2) or 15 kHz (HA05B2-BA) at -3 dB.
- ▶ Slew rate: 2 V / μ s (HA05B2) or 50 V / μ s (HA05B2-BA).
- ▶ Low noise: < 10 mVp-p.
- ▶ Manual front panel with display for voltage / current.
- ▶ Waveform: sine, triangle, saw tooth, square.
- ▶ To be used with a +/- 10 V arbitrary generator.
- ▶ Size: full 19" rack - 3U.
- ▶ Application: electrostatic deflection, ion guidance, general high voltage testing.

HAR12

► Single channel low voltage power amplifier



▲ PA120A

PA120A

FEATURES:

- Voltage: ± 30 VAC.
- Peak current: ± 10 A max.
- Average current: ± 4 A max.
- Slew rate: $250 \text{ V} / \mu\text{S}$.
- Bandwidth: DC to 1.5 MHz (-3 dB).
- 2 coupled input channels with AC / GND / DC modes and $\times 1 / \times 10$ gains.
- Sophisticated limiting (Limit + / Limit -) and protection concept (junction temp. of transistors).
- Size: Desktop case with DC fans on top.
- Application: component testing, development in power electronics.

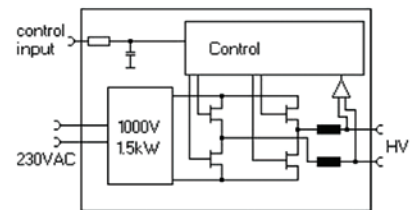
► Single channel high current power amplifier



▲ HV10002F front



▲ HV10002F topview



▲ HV10002F schematic

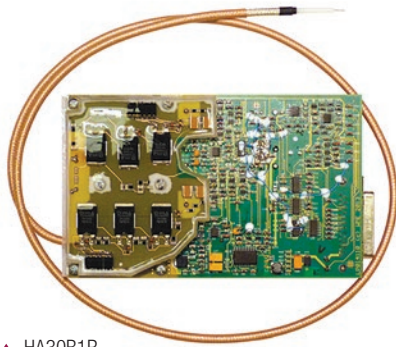
HV10002F

FEATURES:

- Current source, class D, full bridge IGBT topology.
- Average current: ± 2 A.
- Voltage: $\pm 1 \text{ kVAC}$ max voltage.
- Average power: 1.5 kW .
- Bandwidth: DC to 2 kHz (-3 dB).
- Switching frequency: 50 kHz .
- Ripple & noise: 50 mA to 100 mA .
- High voltage floating outputs.
- Output impedance: 50Ω .
- Current setting (control input), voltage & current monitoring.
- Size: $19'' - 6 \text{U}$ rack.
- Applications: plasma physics.
- Custom specific, many other models on request.

GENERATORS & AMPLIFIERS

► Single channel modular high voltage amplifier



▲ HA30B1R

HA30B1R

NEW

FEATURES:

- Voltage: ± 3000 V.
- Current: ± 1 mA static, ± 2 mA dynamic peak.
- Channels: 1.
- Bandwidth: DC to 1 kHz at -3 dB.
- Low noise: < 10 mVp-p at 100 pF load.
- Capacitive loads: 100 pF max.
- Output offset voltage : $< \pm 100$ mV.
- Inactive source / high-impedance control.
- Voltage & current monitoring.
- To be used with a ± 10 V arbitrary generator.
- Supply voltage: 20 VDC to 36 VDC.
- Size: 160 * 100 * 22 mm in an open frame (PCB).
- Applications: deflectors driving, general high voltage testing.

High Voltage Connectors

Our portfolio includes standard HV connectors for voltages up to 100 kV. We offer single and multi pin HV connectors in different designs.



▲ Radial R317

RADIAL

FEATURES:

- ▶ Mating cycles: 500.
- ▶ Shield connection: bayonet coupling, 2 pins.
- ▶ Insulation material: PTFE (Teflon).
- ▶ Temperature range: -65°C to +165°C.
- ▶ Contact material: copper.
- ▶ Suitable shielded cable: 130660 or HTV-30S-22-2.

Plug	Socket	Operating Voltage	Rated Current
R317 005	R317 580	8 kVDC	10 A



▲ Lemo ERA

LEMO

FEATURES:

- ▶ Termination inner contact: push-pull self-locking.
- ▶ Shield connection: solder contacts.
- ▶ Insulation material: PTFE (Teflon).
- ▶ Temperature range: -55°C to +250°C.
- ▶ Contact material: copper.
- ▶ Suitable shielded cable: 130660 or HTV-30S-22-2.

Plug	Socket	Operating Voltage	Rated Current
FFA 1Y 410	PSA 1Y 410	10 kVDC	8 A
FFB 3S 410	PSA 3S CTA	10 kVDC	10 A
FFR 1Y 410	ERA 1Y 416	15 kVDC	6 A
FFR 3Y 410	ERA 3Y 425	30 kVDC	8 A



▲ HB Plug / HS Socket

GES - HS / HB series

FEATURES:

- ▶ Termination inner contact: soldering.
- ▶ Shield connection: screw joint / cable gland.
- ▶ Contact surface: Ag.
- ▶ Insulation material: PTFE white (Teflon), POM white (Delrin) on request.
- ▶ Temperature range: - 50 °C to + 200 °C (PTFE), - 20 °C to + 100 °C (POM).
- ▶ Insulation resistance: 10 exp(16) Ω (contact / housing).
- ▶ Contact resistance: max. 300 μΩ.
- ▶ Wire gauge: 3 mm² max. / bore hole: 2.4 mm.
- ▶ Mating / unmating force: 5.5 N / 4 N.
- ▶ Mating cycles: > 100000.
- ▶ Max. outer diameter - screened: 6.5 mm.
- ▶ Max. inner insulation diameter: 4.5 mm.
- ▶ Suitable cable type: type 130660 or HTV-30S-22-2, for use up to 30kVDC.

Model		Operating Voltage	Test Voltage	Rated Current	Cable Diameter	
Plug	Receptacle				max. inner	max. outer
HS11	HB11	10 kVDC	15 kVDC	30 A	4,5 mm	6,5 mm
HS21	HB21	20 kVDC	30 kVDC	30 A	4,5 mm	6,5 mm
HS31	HB31	30 kVDC	45 kVDC	30 A	4,5 mm	6,5 mm



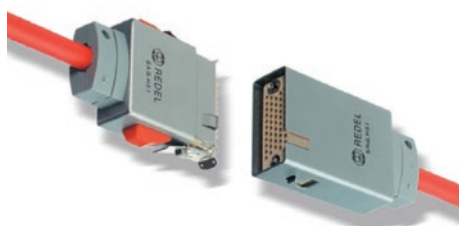
▲ SB100

GES - SB100 series

FEATURES:

- ▶ Termination inner contact: soldering.
- ▶ Shield connection: screw joint / cable gland.
- ▶ Contact surface: Ag.
- ▶ Insulation material: PTFE white (Teflon), POM white (Delrin) on request.
- ▶ Temperature range: - 50 °C to + 200 °C (PTFE), -20 °C to + 100 °C (POM).
- ▶ Insulation resistance: 10 exp(16) Ω (contact / housing).
- ▶ Contact resistance: max. 300 μΩ.
- ▶ Wire gauge (plugs): 30 A type: max. 3mm² / bore hole: 2.4 mm, 80 A type: max. 8 mm² / bore hole: 4 mm.
- ▶ Two different sizes of outer cable glands A: 7 – 12 mm or B: 10 – 14 mm.
- ▶ Mating- / unmating force: 5.5 N / 4 N.
- ▶ Mating cycles: > 100000.
- ▶ Suitable cable type: shielded high voltage cable, numerous types available on request.

Model		Operating Voltage	Test Voltage	Rated Current	Cable Diameter	
Plug	Receptacle				max. inner	max. outer
S110/A S110/B	B110	10 kVDC	15 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S120/A S120/B	B120	20 kVDC	30 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S130/A S130/B	B130	30 kVDC	45 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S150/A S150/B	B150	50 kVDC	75 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S160/A S160/B	B160	60 kVDC	90 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S1100/A S1100/B	B1100	100 kVDC	150 kVDC	30 A	10 mm	7 -12 mm 10 - 14 mm
S115/A S115/B	B115	10 kVDC	15 kVDC	80 A	10 mm	7 -12 mm 10 - 14 mm
S125/A S125/B	B125	20 kVDC	30 kVDC	80 A	10 mm	7 -12 mm 10 - 14 mm
S135/A S135/B	B135	30 kVDC	45 kVDC	80 A	10 mm	7 -12 mm 10 - 14 mm
S155/A S155/B	B155	50 kVDC	75 kVDC	80 A	10 mm	7 -12 mm 10 - 14 mm
S165/A S165/B	B165	60 kVDC	90 kVDC	80 A	10 mm	7 -12 mm 10 - 14 mm



▲ Redell Plug Socket

REDELL

FEATURES:

- ▶ 51 pins miniature HV connector.
- ▶ Self-latching connecting system.
- ▶ Mechanical life: 100 cycles.
- ▶ Working temperature: -20°C to +120°C.
- ▶ Contact resistance: < 8 mΩ.
- ▶ Insulation material: PEEK (Polyether Ether Ketone).
- ▶ Outer shell: Aluminium.
- ▶ Contact material: Brass (male) / Bronze (female).
- ▶ Sealing gland: Silicone.
- ▶ Suitable shielded cable: multi cores KERPEN.

Plug	Socket	Operating Voltage	Rated Current
SAG H51	SLG H51	9 kVDC	4 A

CONNECTORS & CABLES



▲ VP-CL-1F



▲ VP-CL-2F



▲ VP-CL-3F

GES - VP-CL series

FEATURES:

- ▶ 1, 2 or 3 poles HV connector.
- ▶ Operating voltage: 13 kVDC.
- ▶ Test voltage: 20 kVDC.
- ▶ Rated current: 13 A (AWG 14 / 2.5mm²).
- ▶ Clip lock mechanism.
- ▶ Easy and fast mating and unmating.
- ▶ Mating cycles: ≥ 1000 .
- ▶ Contact resistance: $\leq 5 \text{ m}\Omega$.
- ▶ Crimp contact material: Brass (CuZn).
- ▶ Crimp contact plating: Silver (Ag) or Gold (Au).
- ▶ Crimp contact available for wire sizes of AWG 26 to AWG 14.
- ▶ Contact rated temperature: 120 °C.
- ▶ Housing material: PBT (UL94 V-0).
- ▶ Operating temperature: - 40 °C - + 150 °C.
- ▶ Insulation group: I (DIN IEC 60664).
- ▶ Crimp tool available on request.
- ▶ Applications: to be used for internal wiring.

No. of Poles	Plug	Receptacle
1	VP-CL-1M	VP-CL-1F
2	VP-CL-2M	VP-CL-2F
3	VP-CL-3M	VP-CL-3F

Conductor		Plug		Receptacle	
Size [AWG]	Area [mm ²]	Silver-plated	Gold-plated	Silver-plated	Gold-plated
26 - 22	0,14 - 0,37	VP-CM-24-AG	VP-CM-24-AU	VP-CF-24-AG	VP-CF-24-AU
20	0,5	VP-CM-20-AG	VP-CM-20-AU	VP-CF-20-AG	VP-CF-20-AU
20 - 16	0,75 - 1,0	VP-CM-18-AG	VP-CM-18-AU	VP-CF-18-AG	VP-CF-18-AU
16 - 15	1,5	VP-CM-16-AG	VP-CM-16-AU	VP-CF-16-AG	VP-CF-16-AU
14	2,5	VP-CM-14-AG	VP-CM-14-AU	VP-CF-14-AG	VP-CF-14-AU

► High Voltage Cables

PRELIMINARY:

You can find a large offer of unshielded and shielded coaxial cables for voltages up to 150 kV. The standardized offer contains Silicone and PE dielectrics, but miscellaneous cables with XLPE, LDHMMW PE, EPR, EPDM dielectrics are available too. We offer cables with semi-conductive layers providing low partial discharge levels and good AC ratings.



► Unshielded High Voltage Cables



▲ HSU Series

Rated Voltage		Type	Conductor Size		Dielectric Material	Outer DIA [mm]	Max Oper. Temp. [°C]
DC [kV]	AC [kV]		[AWG]	[mm²]			
5		HSW-0520-2	20	0,51	Silicone	2,3	150
6		HSW-0624-0	24	0,24	Silicone	2,3	150
10	[6,7]	8511R	15	1,50	Silicone	4,8	180
10		HSU-1012-65-2	12	3,31	Silicone	4,6	150
10		HSU-1022-7-2	22	0,36	Silicone	3,1	150
15	[5]	2075	12	3,10	Silicone	6,0	200
15	[3]	2132	6	13,6	Silicone	7,6	149
20		2185R	20	0,51	Silicone	3,2	149
20		HSW-2010-2	10	5,32	Silicone	5,5	150
20		HSW-2018-0	18	0,81	Silicone	3,8	150
30		HSU-3014-41-9	14	2,08	Silicone	5,6	150
30		HSU-3018-19-0	18	0,96	Silicone	4,8	150
30		HSU-3022-7-9	22	0,36	Silicone	4,3	150
30		HTV-30-22-2	22	0,36	XLPE	5,0	105
40	[15]	2012	18	0,96	Silicone	6,0	200
40		HSW-4022-2	22	0,36	Silicone	5,7	150
50	[15]	2032	16	1,20	Silicone	7,5	200
50		HSU-5012-19-8	12	3,88	Silicone	8,2	150
50		HSU-5018-19-2	18	0,96	Silicone	6,8	150
50		HSU-5022-7-2	22	0,36	Silicone	6,3	150
50		HTV-50-22-2	22	0,36	XLPE	6,6	105
60	[20]	2024	12	3,10	Silicone	9,1	200
60	[20]	2149	18	0,97	LDHMMW PE	5,8	60
80	[25]	2229	12	3,10	Silicone	10,7	200
100	[30]	2062	8	8,50	Silicone	16,5	200
100	[30]	2124A	16	1,20	LDHMMW PE	9,4	60
100	[30]	2125A	12	3,10	LDHMMW PE	9,4	60
125		2243A	8	8,00	EPR	15,7	121
150	[45]	2121A	12	3,10	LDHMMW PE	12,4	60

* A larger variety of HSU and HSW series high voltage cables is available. For detailed information, please ask us for our HV cable & connectors catalog or refer to our dedicated web pages.

► Shielded Coaxial High Voltage Cables



▲ 2024SVJ & 130660

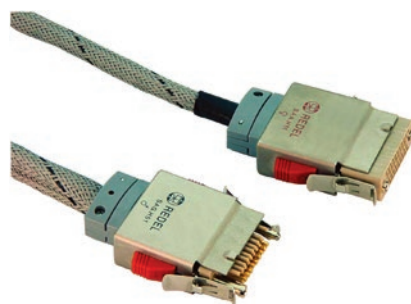
Rated Voltage		Type	Conductor Size		Dielectric Material	Jacket Material	Outer DIA [mm]	Max Oper. Temp. [°C]
DC [kV]	AC [kV]		[AWG]	[mm²]				
8	3	HSL-8S-0,75-B-2	18	0,75	Silicone	Silicone	4,9	180
8	3	HSL-8S-1,5-A-2	16	1,50	Silicone	Silicone	6,7	180
10	3	2232	6	13,60	LDHMW PE	TPR	12,7	60
10	6	HSL-10-1,5-SS-A-2	15	1,50	Silicone	Silicone	11,2	135
10		HSUS-1022-19-2	22	0,36	Silicone	Silicone	6,1	150
15	5	2075S	12	3,10	Silicone		7,1	200
15	5	2075SVJ	12	3,10	Silicone	PVC	9,7	200
15	6	HSL-15S-6-A-9	10	6,00	Silicone	Silicone	11,6	180
20	6,6	HSL-20-0,38-SS-A-0	22	0,38	Silicone	Silicone	7,3	180
30		130660	22	0,36	PE	PVC	5,5	80
30		HSUS-3022-7-2	22	0,36	Silicone	Silicone	7,2	150
30		HTV-30S-22-2	22	0,36	XLPE	PVC	5,5	105
40	15	2012S	18	0,96	Silicone		7,1	200
40	15	2012STJ	18	0,96	Silicone	TPR	10,2	200
50	15	2032S	16	1,20	Silicone		8,3	200
50	15	2032STJ	16	1,20	Silicone	TPR	10,7	200
50		HSUS-5018-19-9	18	0,96	Silicone	Silicone	9,7	150
60	20	2024SVJ	12	3,10	Silicone	PVC	12,7	60
60	20	2149SVJ	18	0,96	LDHMW PE	PVC	8,6	60
60	20	HSC-60-1PSUA-2	18	0,96	LDHMW PE	TPE-U	7,7	60
60		HXC-60-1EA-8	14	2,00	EPR (black)	PVC	11,1	70
100	30	2062SVJ	8	8,50	Silicone	PVC	20,8	200
100	30	2124	16	1,20	LDHMW PE	PVC	11,2	60
100	30	2125	12	3,10	LDHMW PE	PVC	11,2	60
100	30	HSC-100-1PSUA-2	16	1,20	LDHMW PE	TPE-U	13,2	60
125	40	2243	8	8,00	EPR	PVC	19,7	80
150	45	2121	12	3,10	LDHMW PE	PVC	15,9	60
150	45	HSC-150-1PSUA-2	12	3,10	LDHMW PE	TPE-U	16,4	60

* A larger variety of HSUS series high voltage cables is available. For detailed information, please ask us our HV cable & connectors catalog or refer to our dedicated web pages.

CONNECTORS & CABLES

► High Voltage Assemblies

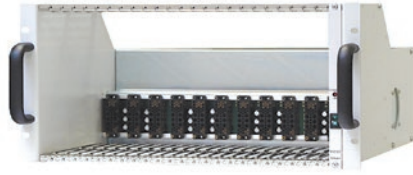
Our offer consists of HV cables fitted with molded connectors. HV assemblies are available for voltages up to 100 kV, fitting medical and industrial applications, electron beam welding, analytical instruments, test stations, high energy and particle physics, pulsed power systems, etc.



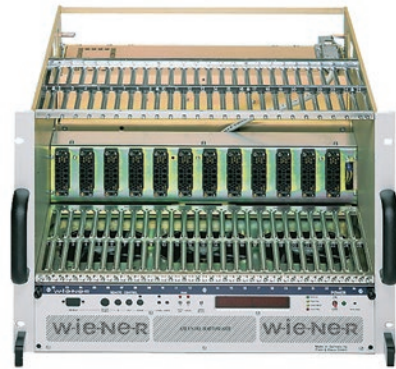
► NIM Crates



▲ NIM 150T



▲ NIMpact



▲ NIM300L & NIM300LS

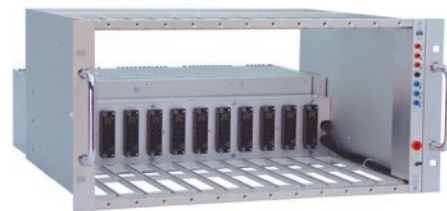
NIM 150T	5U / 5 slots / power 150 W - Portable
NIM 150C	5U / 10 slots / power 150 W - Compact
NIMpact I23, I24, I26, I27	5U / 12 slots / power 300 W - Low Price
NIMpact I23, I24, I26, I27	7U / 12 slots / power 300 W - Low Price
NIM300 & NIM300S CERN Spec.	5U / 12 slots / power 300 W - Standard
NIM600 & NIM600S CERN Spec.	5U / 12 slots / power 600 W - Standard
NIM300L & NIM300LS CERN Spec.	7U / 12 slots / power 300 W - Standard
NIM600L & NIM600LS CERN Spec.	7U / 12 slots / power 600 W - Standard
NIM1920L & NIM6000	7U / 12 slots / power 1500 W to 2700 W

FEATURES:

- Small size or 19" full rack, 5U non-ventilated or 7U ventilated.
- Mono-bloc power supply and mono-bloc fan tray for the NIMpact series.
- Pluggable power supply and pluggable 2U fan tray for the CERN Spec. series.
- Linear power supply and lowest ripple & noise technology (< 3 mVp-p).
- Switching technology for the NIM1920L and NIM6000 series.
- CERN Spec. series: microprocessor controlled and graphic display for reading and programming internal parameters (voltage and current limits, fan speed, control of temperature, address), CANbus and Ethernet interfaces.



▲ NIM N-C 2010



▲ NIM N-C 2030

NIM N-C 2010	5U / 6 slots / power 90 W - Portable	NEW
NIM N-C 2020	5U / 12 slots / power 200 W - Special	NEW
NIM N-C 2030 & N-C 2030A	5U / 12 slots / power 300 W - Special	NEW
NIM N-C 2040 & N-C 2040B	5U / 12 slots / power 400 W - Special	NEW

FEATURES:

- Small size or 19" full rack, non-ventilated and mono-bloc linear power supply.
- N-C 2030A & N-C 2040B with increased current on +/- 24 V for NIM high voltage modules NHQ & NHS series (see page 23).

► CAMAC Crates

MiniCAMAC400	4U / 11 slots / power 300 W
MiniCAMAC400x	4U / 11 slots / power 300 W / no +/- 12 V
MiniCAMAC600	4U / 11 slots / power 600 W
MiniCAMAC600x	4U / 11 slots / power 600 W / no +/- 12 V

FEATURES:

- 19" full rack suitable as tower or desktop box.
- Built-in power supply with VHF switching technology, ripple & noise < 10 mVp-p.
- CAMAC dataway backplane. Optional Crate controller with USB on slot 10/11.
- Microprocessor controlled with alphanumeric high-visibility LED display, efficient DC blower and adjustable fan speed (1200 up to 3200 RPM), temperature controlled, CANbus, RS232, Ethernet interfaces.

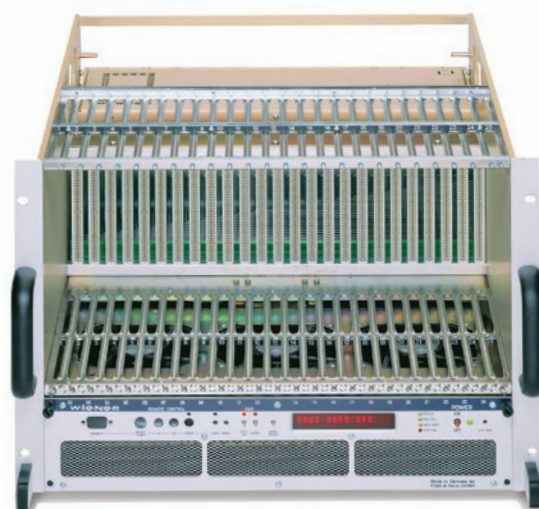


▲ MiniCAMAC 400

CAMAC300 CERN Spec	7U / 25 slots / power 300 W
CAMAC600 CERN Spec	7U / 25 slots / power 600 W
CAMAC650+ CERN Spec	7U / 25 slots / power 600 W increased current on + 6 V
CAMAC650- CERN Spec	7U / 25 slots / power 600 W decreased current on + 6 V
CAMAC1650	7U / 25 slots / power 1900 W

FEATURES:

- 19" full rack with pluggable power supply and pluggable 2U fan tray.
- Linear power supply and lowest ripple & noise technology (< 3 mVp-p) for the CERN Spec series. Switching technology for the CAMAC1650 series.
- Microprocessor controlled and graphic display for reading and programming internal parameters (voltage and current limits, fan speed, control of temperature, address), CANbus and Ethernet interfaces.



▲ CAMAC 600

► VME 64/64x Crates

VME 64/64x 195 **5U / 9 slots / power 500 W and 1000 W**
integrated power supply

VME 64/64x 395 **5U / 9 slots / power 250 W and 500 W**
pluggable cPCI power supplies

FEATURES:

- 19" full rack suitable as tower or desktop box for 6U*160 mm modules.
- VME64/64x backplane, J1/J2, optional J0 connectors.
- Microprocessor controlled with alphanumeric high-visibility LED display, efficient DC blower and adjustable fan speed (1200 up to 3200 RPM), temperature controlled.
- CANbus and Ethernet interfaces for the 195 series, USB and Ethernet for the 395 series (CML shelf manager).

VME 64/64x NIXI-E **7U / 21 slots / power 1100 W - Low Price**
pluggable fan tray and integrated power supply

FEATURES:

- 19" full rack for 6U*160 mm modules.
- VME64/64x backplane, J1/J2, optional J0 connectors.
- Plug in 1U fan tray with high efficient 3-fold fans.
- Power supply with low noise VHF switching technology based, rear side mounted (behind J1).
- No remote control and monitor.

VME 64/64x 3200 **7U / 16 slots / power 500 W and 1000 W**
pluggable fan tray and power supply

FEATURES:

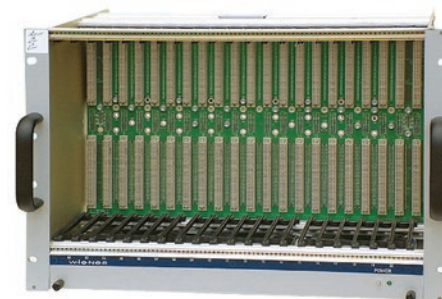
- 19" full rack for 6U*160 mm modules.
- VME64/64x backplane, J1/J2, optional J0 connectors.
- Plug in 1U fan tray with high efficient 3-fold fans.
- 500 W / 6U / cPCI hot swappable and redundant power supply, front mounted.
- USB and Ethernet for the remote control & monitoring (CML shelf manager).



▲ VME 64 195



▲ VME 64x 395



▲ VME 64 NIXI-E



▲ VME 64 3200

VME 64/64x 6021 & 6023 8U/9U / 21 slots / power 1100 W to 3700 W

FEATURES:

- ▶ 6U/160 mm modules.
- ▶ Very rugged steel-aluminium construction with 5 mm thick heavy duty side plates.
- ▶ Monolithic backplane VME64/64x, 8/10 layer PCB, active termination, automatic daisy chain, J1/J2, optional J0 connectors.
- ▶ Removable power supply in rear top or bottom position.
- ▶ Removable 2U fan tray with 3 to 6 (for transition modules) controlled DC fans.
- ▶ 1U air compression chamber (6023 series).
- ▶ Rear side access via transition card cage 3U or 6U (6023 series) with 80/120/160/220 mm deep.
- ▶ Microprocessor controlled and graphic display for reading and programming internal parameters (voltage and current limits, fan speed, control of temperature, address), CANbus and Ethernet interfaces.

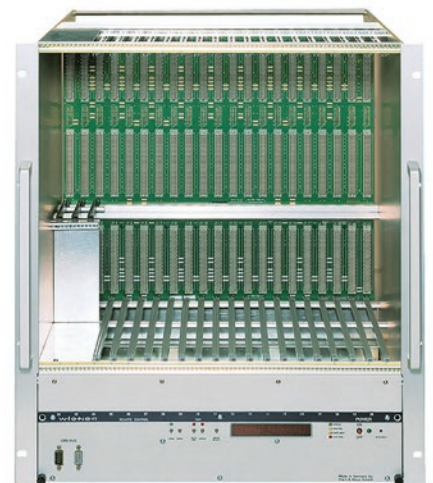


▲ VME 64x 6023

VME 64/64x 6021 & 6023
for 9U modules 11U/12U / 21 slots / power 1100 W to 3700 W

FEATURES:

- ▶ Identical to 6021/6023 for 6U modules +
- ▶ 9U/400 mm modules.
- ▶ Backplane J1/J2/J3, optional J0 connectors.
- ▶ VARIO option with mixed 6U/160 mm and 9U/400 mm modules.
- ▶ Removable 2U fan tray with 4, 6 or 9 (for transition modules) controlled DC fans.
- ▶ 1U air compression chamber (6023 series).
- ▶ Rear side access via transition card cage 3U/6U or 9U (6023 series) with 80/120/160/220 mm deep.



▲ VME 64 9U 6023

▶ VME 430 Crates

VME 430 195

- ▶ Identical to VME/VME64x 195 +
- ▶ 9 slots monolithic backplane CERN VME 430 with J1/Jaux/J2
- ▶ Voltages + 5 V, +/- 12 V, - 5,2 V, - 2 V (+/- 15 V)

VME 430 6021/6023
for 6U/9U modules

- ▶ Identical to VME/VME64x 6021/6023 +
- ▶ 21 slots monolithic backplane CERN VME430 with J1/Jaux/J2
- ▶ Voltages + 5 V, +/- 12 V, - 5,2 V, - 2 V (+/- 15 V)

▶ VXS, VXI, cPCI Crates

For more information: please visit our dedicated web pages or contact us.

► Micro TCA.4 power supplies

NEW

FEATURES:

- 1000 W power supply according to micro TCA.4.
- Efficiency: 89 %.
- Low ripple & noise: < 4 mVp-p (0 – 20 MHz); < 40 mVp-p (0 – 350 MHz).
- Wide range AC input: 90 to 264 VAC / 50 – 60 Hz.
- Integrated μ TCA.4 digital controller.
- 12 V / 8,4 A (payload power), max 1000 W.
- 3,3 V / 0,2 A (management power).
- USB interface for remote control / monitoring.
- Hot-swappable mode.
- Micro TCA.4 double height - double width size.
- Micro TCA.0 double height must fit.
- Size: 187,3 mm * 170 mm * 59,4 mm.



▲ MTCA.4



▲ Crate MTCA.4

► High voltage DC modules for universal Crates



▲ NHQ



▲ NHS



▲ VDS

EHQ 2 kV to 5 kV / 12 W / 1 channel / Euro cassette – 3U

EHQ for PXI 2 kV to 5 kV / 12 W / 1 channel / Euro cassette – 3U
Power supply compatible to PXI backplane

NHQ 2 kV to 10 kV / 12 W to 30 W / NIM unit / 1 or 2 channels
Low Price - Standard and High Precision versions

NHS 100 V to 6 kV / 9 W / NIM unit / 6 channels
Standard and High Precision versions

NEW

VHQ 2 kV to 5 kV / 12 W / VME64 unit / 1 or 2 channels
Standard and High Precision versions

VHS 500 V to 20 kV / 9 W / VME64 unit / 2, 4 or 12 channels
Standard and High Precision versions

NEW

VDS 500 V to 3 kV / VME64 unit / 8 or 24 channels
Distribution module

FEATURES:

- Fixed, mixed or switchable polarity depending on model.
- Very high overall stability and accuracy.
- Low temperature & time drift.
- 2 mV, 5 mV, 50 mV, 200 mV ripple & noise depending on model.
- 50 pA, 100 pA, 1 nA, 10 nA, 100 nA, 1 μ A resolution depending on model.
- Manual front panel operation with LCD or TFT display, potentiometer or robust digital encoder.
- Remote control: analog, CANbus, RS232, USB, VMEbus.
- Compact size, 1 slot width.
- To be integrated into Euro – 3U, PXI, NIM, VME64 Crates (see pages 19, 20, 21 and 22).

► Multichannel high voltage DC power systems



▲ MMC



▲ EBS



▲ HV-switch



▲ WIEN-filter

MMC

500 V to 30 kV / 120 W to 300 W total power

NEW

FEATURES:

- Equipped with 4, 8 or 10 modules max.
- Standard CPS and EPS types (see page 3).
- Electronically switch polarity for DPS type (see page 3).
- **Bipolar +/- 500 V with full 4-quadrant capabilities for EBS type.** **NEW**
- **HV switch 19 kV for ZS type.** **NEW**
- **Dual HV supplies 2 kV for Wien-filter type.** **NEW**
- Desktop – 3U and 19" – 3U versions.
- 16 x 20 bit analog out, 32 x 24 bit analog in, 24 digital I/O.
- Inhibit, Kill-Enable.
- CANbus, USB, Ethernet interfaces (MICC controller).
- Multiple MICC chainable via CANbus.
- Set and read of voltage / current / ramp / switch.
- Control software isegSCPIControl, isegCANHVControl, isegOPCserver.
- SHV, LEMO or GES connectors depending on voltages.

► Multichannel Low & High voltage DC modules for proprietary Crates

LOW & HIGH VOLTAGE DC MODULES



▲ MPV



▲ EHS 40/80/F0



▲ ESS

MPV 4000

8 V to 60 V / 20 A / 100 W / channel / 4 channels
Each channel floating

NEW

MPV 8000

8 V to 120 V / 10 A / 50 W / channel / 8 channels
Each channel floating

EHS F1/201

100 V to 4 kV / 4 W / 16 or 32 channels - Standard
Common-GND

NEW

EHS 40/80/F0

100 V to 20 kV / 9 W / 4, 8 or 16 channels - Standard
Common floating-GND

NEW

EHS 46/86/F6

100 V to 20 kV / 9 W / 4, 8 or 16 channels - Standard
Each channel floating

NEW

EHS 42/82/F2

100 V to 20 kV / 9 W / 4, 8 or 16 channels - High Precision
Common floating-GND

NEW

EHS 44/84/F4

100 V to 20 kV / 9 W / 4, 8 or 16 channels - High Precision
Each channel floating

NEW

EDS F1/181/201/301

500 V to 3 kV / 16, 24, 32 or 48 channels
Distributor, common floating-GND

EBS 80/F0

+/- 500 V and +/- 3 kV / 8 or 16 channels / Full 4-quadrant operation (source / sink)

ESS 10x00

10 kV and 20 kV / 1 channel / 2-quadrant operation (source / sink)
Common floating-GND

NEW

FEATURES:

- Embedded processor, 15 bit, 20 bit or 24 bit DAC / ADC.
- 1 or 2 automatic current measurement ranges.
- Low noise (< 20 mVp-p) and ultra low noise (< 5 mVp-p).
- High resolution: 10-6 • Inominal.
- High stability: < 0.01 % • Vnominal.
- High accuracy: +/- (0,01 % • Iout + 0,02 % • Inominal).
- Low temperature drift: 50 ppm / °C, 30 ppm / °C or 10 ppm / °C.
- KillEnable, Inhibit, Safety loop, Interlock.
- 6U cassette - 1 slot - 220 mm depth.
- BNC, SHV, KINGS, REDEL or RADIALL connectors.
- Expandable to any size by using ISEG or WIENER Crates (see page 26 and 27).

PROPRIETARY CRATES - ISEG CRATES



▲ ECH242 - ECH244



▲ ECH224



▲ ECH44A

ECH 242	2 slots / 200 W / built-in webserver / CANbus / USB / Ethernet / WIFI	NEW
ECH 244	4 slots / 300 W / built-in webserver / CANbus / USB / Ethernet / WIFI	NEW
ECH 224	4 slots / 300 W / CANbus for daisy chaining setup	
ECH 238	8 slots / 1200 W / CANbus for daisy chaining setup	NEW
ECH 44A	10 slots / 600 W to 1200 W / built-in webserver / CANbus / USB / Ethernet / WIFI	NEW
ECH 43A	10 slots / 600 W to 1200 W / CANbus for daisy chaining setup	NEW

FEATURES:

- ▶ Backplane dedicated to high voltage modules EHS, EDS, EBS, ESS (see page 25).
- ▶ No display, no local control, remote control only.
- ▶ Integrated or optional fan unit, optional UPS.
- ▶ Desktop or 19" full size rack.
- ▶ **Controller with USB / Ethernet (CCx4) / CANbus (CCx3) / Wifi.** **NEW**
- ▶ **Software system running on integrated communication server (ICS).** **NEW**

- ▶ **Web browser based interface with controlling, monitoring, charts and updates.** **NEW**
- ▶ Simple Object Access Protocol (SOAP) with libraries for Linux, Windows, OS.
- ▶ Extendable with 3rd party Application Programming Interface (API): EPICS, OPC.
- ▶ Ready to run programs: IsegCANHVControl, IsegOPCServer.

PROPRIETARY CRATES - WIENER CRATES



▲ Mpod Micro



▲ Mpod Mini



▲ Mpod



▲ Mpod Mixte

Mpod Micro

1 slot / 100 W or 600 W / backplane for low or high voltage modules

NEW

Mpod Mini

4 slots / 300 W, 600 W, 1200 W, 3000 W / backplane for low and high voltage modules

Mpod

10 slots / 600 W, 1200 W, 3000 W / backplane for low and high voltage modules

Mpod Mixte

5 slots for LV / HV modules / 8 slots VME64 / 64x / cPCI / 3000 W

NEW

FEATURES:

- ▶ Mixed backplane for LV / HV modules MPV, EHS, EDS, EBS, ESS (see page 25).
- ▶ Optional display and rotary encoder.
- ▶ Integrated fan unit.
- ▶ 19" full size rack.
- ▶ Controller with USB / Ethernet / CANbus.
- ▶ Ethernet based on Simple Network Management Protocol (SNMP).
- ▶ Script file via SNMP commands for an easy integration into your system.
- ▶ Ready-to-run program IsegSNMPControl.
- ▶ LabVIEW program with free access to copy-paste VIs.

ELECTRICAL MEASUREMENT

► XDP-II: Portable partial discharge recorder.



▲ XDP II

FEATURES:

- Portable battery operated.
- Easy to use.
- pC and dB value display.
- Several display modes for on-site real time analysis and diagnostic.
- Keeps the wave form and edge of PD in memory, with the date and the hour.
- Transfers the collected data stored in a computer to ensure the follow-up of the measurements.
- Network synchronization for random noise reduction.
- Differential technique for noise reduction.
- Splash-proof and rugged design.

The XDP-II is a portable device for, online, factory and laboratory partial discharge measurement on electrical apparatus, or components. The XDP-II can be used in accordance to IEC 60270. It records partial discharge measurements for computer analysis and diagnostic using the optional XDP-II software for a PC. Using the appropriate accessories, the XDP-II can be used in several applications.

Partial discharge testing is a predictive & qualitative analysis tool that can warn of a potential upcoming system failure. The XDP-II is a powerful and flexible partial discharge measurement system. It displays the partial discharge wave form and the built-in speaker plays a sound reproduction of the signal measured. Those can be recorded in the XDP-II along with date and time of the reading. The recorded measurements remain stored in memory allowing the transfer to a computer upon return from the worksite.

APPLICATIONS:

- Quality control of MV / HV equipment on production line (transformers, switchgears, arrestors, insulators, couplers, etc...).
- Quality control of the insulators during installation or underground network repair (cable joints, elbows, etc.).
- Online follow-up of the ageing process of the critical components (transformers, switchgears, cable joints etc.).
- TEV testing on switchgear cabinets.
- PD detection in switchgear using the VIS capacitive coupler.
- Corona and arc detection on aerial devices using the acoustic sensor.
- PD detection in oil-filled transformer using UHF antenna / HFCT clamp.

► XDP-TRANS: Offline Partial Discharge Testing



▲ XDP-TRANS

FEATURES:

- Light, portable and easy to use.
- Data analysis with XDP-Soft.
- Cost effective graphic display.
- Can store over 380 recordings.
- Simultaneous display in dB and pC.

This partial discharge measuring kit provides you with the easiest way to measure PD in a variety of MV / HV equipment such as transformers, cables, arrestors, couplers, power electronic devices, semiconductor components, etc ... partial discharge diagnosis has been established as the most convincing technique for the evaluation of the insulation quality of MV / HV apparatus. Design, manufacturing or handling problems can be quickly identified using partial discharge testing and then improve design, network reliability and reduce operation cost by installing reliable components.

The well-established XDP-II PD measuring system is the heart of this cutting edge diagnosis kit. It allows quick measuring, simplicity of use, graphic display of the signal while staying portable. The XDP-II is used with its unique pico-coulombs mode that displays the dB level as well as the pC reading. The embedded speaker allows the user to quickly determine the presence of partial discharge in the equipment under test. A great variety of accessories makes the XDP-II a versatile instrument that allows many more applications.

Also included in the kit is our new design of the capacitive coupler where the integrator module is now embedded. Its refreshed design is not only good looking; it is also well made with high quality materials for years and years of service. Also included are a 200pC calibrator module, an AC line filter, high voltage cables and connectors and all other necessary tools.

► PDS: Partial discharge scanner for underground cable

The PDS allows online partial discharge detection on underground cable accessories and equipment for security and maintenance purposes. This equipment is perfect for a high voltage predictive maintenance program. The PDS is very accurate to detect partial discharge on cable joints (XLPE / EPR type), switchgear, elbows, cable terminations, and more.

Insulation faults are an important factor in degradation and reduction of the lifetime of an electrical joint. This translates into raised exploitation costs and questionable reliability, while economic performance and reliability are key criteria in the evaluation of an electricity supplier. It is important that an electric utility have a widespread, quick and efficient tool to check for quality and health of its electrical network.

The PDS indicates the intensity of the partial discharges, converting the electrical charge units (pC) into decibels (dB). Thus, the reading is kept as a simple intensity level indication, proportional to the probability of a fault's presence in the tested joint. The visual indicator is a bar graph with eight steps, each step corresponding to twice the intensity (6dB) of the previous level, for a total range from 6dB to 54dB. An audio indicator, the frequency of which is proportional to the displayed intensity, allows the user to locate any fault even if the handling conditions do not allow him to see the display.



▲ PDS

FEATURES:

- Easy to use.
- Compact, lightweight and battery powered for maximum flexibility.
- High sensitivity inductive and capacitive sensors.
- Rugged Delrin® made casing.
- Up to 30 hours autonomy.

► ULD-40: Ultrasonic Corona and arcing detector

Electrical arcs in the air and corona effects emit sounds and ultrasounds. The rule of the ULD-40 consists of capturing emitted ultrasounds and of translating them into the audible range. The ULD-40 accurately pinpoints and identifies corona effects and arcs that may be encountered on any type of high voltage installation simply by scanning around the suspected area. The ULD-40 sensor is positioned in a directional amplifier cone that is integrated in the front of the enclosure. An external parabolic sensor, which enables the user to pinpoint electrical defects from a longer distance, is also available. It is equipped with a laser pointing device which enables pinpointing the ultrasound emission source. The dismantlable parabolic antenna and the small dimensions of the ULD-40 facilitate its use in the field and allow access to any type of installations.

The ULD-40 enables remote acoustic inspections with great accuracy. The equipment is user friendly and does not necessitate any training. The applications of the ULD-40 are countless and make it a global leak detection tool: a must for any prevention and maintenance department.



▲ ULD 40

APPLICATIONS:

- Electrical Inspections: corona effect localization, arcs on shields.

► DRM-1A and DRM-10A: 1 amp and 10 amps Micro-ohmmeter



▲ DRM 10A



▲ DRM 4012 probe

FEATURES:

- Much lighter than other equipment in its category.
- Shock resistant, it is suitable for all types of applications.
- Back-lighting liquid crystal display (LCD) enables it to be used in dark areas.
- Weak current injection for applications that require small measurement contacts.
- A variety of probes adapted to types of specific measurements such as the inspection of exothermal welds. (Cadweld®), are available as options.

DRM-1A and DRM-10A micro-ohmmeters can be used to measure very low resistances which vary from $0,01 \mu\Omega$ to 200Ω ($1 \mu\Omega$ to 200Ω for the DRM-1A). They are suitable for both in-plant maintenances and fields. Resistance measurements are calculated automatically. This equipment has become the number one choice for industries, products engineers and manufacturers. DRM-10A is recognized as the most accurate in its category, it is easy to use, shock resistant and suitable for many applications.

APPLICATIONS:

- Quality control of smelting parts.
- Control of mechanical joints and exothermic joints (Cadweld®).
- Control of electrodes for aluminium plants.
- Inspection of contacts, circuit breakers and power fuses.

► Terminology A (cable specs)

OPERATING VOLTAGE

The maximum voltage (DC or AC according to the specified values) that may be applied between the centre conductor(s) and:

- the environment for unshielded cable or
- the shield for shielded or X-Ray cable or
- the chassis part for single pole connectors (only when plug and receptacle are mated).

For X-Ray, triaxial and multiconductor cable additional relations may apply for the additional conductors. In case of applied AC voltage the term AC refers to sinusoidal RMS voltage at 50/60Hz. AC voltages of higher frequency or pulsed voltages must be examined individually. Cables without AC voltage specification must not be operated with AC voltage applied.

TEST VOLTAGE

The voltage applied to the cable during production to test the dielectric strength on the insulation. The cable must not be operated at test voltage levels.

CONDUCTOR

Diameter: Conductor cross-sectional area, given in AWG or mm.

Area: Conductor cross-sectional area, given in mm².

Strands: Conductor construction, given in number of strands / AWG of strands.

Weight: Weight of the bare conductor per given length.

NO. OF CONDUCTORS

Effective number of individual, insulated conductors in a multiconductor or X-Ray cable. Multiple bare conductors in X-Ray cables are counted as one conductor.

DIELECTRIC

A non-conducting, insulating material with a specific dielectric constant. Used to insulate the high voltage carrying conductor from the environment or the shield.

DIELECTRIC (MATERIAL)

Specifies the type of compound used for the dielectric. Typical dielectric materials are:

SILICONE: Silicone rubber

PE: Polyethylene

XLPE: Cross-Linked Polyethylene

LDHMMW PE: Low Density High Molecular Weight Polyethylene

EPR: Ethylene Propylene Copolymer rubber

EPDM: Ethylene Propylene Diene Monomer rubber

PEEK: Polyether Ether Ketone

SEMICON

A semi-conducting material that has a specific resistance characteristic. When bonded to the dielectric of a cable, the electrical field will be flattened reducing the field strength and the voltage stress to the dielectric. Furthermore, voids between metallic conductors and the dielectric will be avoided, thus reducing partial discharge or internal corona. Semicon is used for both the inner conductor shielding and between the dielectric insulation and metallic shield.

CAPACITANCE

Electrical capacitance of a shielded cable measured between conductor and shield per given length.

IMPEDANCE

Characteristic impedance of a shielded cable. Not to be confused with conductor resistance.

SHIELD (BRAID)

A conducting layer or sheath of material applied around an insulated conductor or conductors. Typical shields in high voltage cables are constructed of copper braid. The purpose of the shield is:

- protection in case of breakdown of the high voltage insulation,
- electrostatic shielding of the enclosed conductors,
- return path for the operating current.

Area equivalent

The conductor size equivalent of the complete braid.

Coverage (%)

The physical area of the shield layer covered by the shielding material.

JACKET (MATERIAL)

An outer sheath or protective covering over a conductor or insulation, mainly used for protection against the environment, but may also be used to provide additional insulation. Typical jacket materials are:

NEOPRENE: Polychloroprene rubber

PU: Polyurethane rubber

PVC: Polyvinyl Chloride

TPR: Thermoplastic Rubber

OUTER DIAMETER

Nominal diameter of the finished cable.

WEIGHT / TOTAL WEIGHT

Weight of the finished cable per given length.

COLOR

Color of the finished cable.

MIN. BEND RADIUS

Minimum admissible radius when bending the cable. Normally shown for static/fixed bending. Additional information for dynamic / moving bending given for some cables.

TEMPERATURES

Max. Oper. Temp.: The maximum continuous operating temperature of the finished cable. Depends on the ambient temperature and the actual operating current.

HALOGEN

No: No halogenes (Fluorine, Chlorine, Bromine, Iodine, Astatine) are intentionally present in the cable.

Yes: Halogenes (Fluorine, Chlorine, Bromine, Iodine, Astatine) may intentionally be present in the cable.

OIL RESISTANCE

The finished cable is oil resistant according to the listed standards.

► Terminology B (pulse generator specs)

AMPLIFIER

An electronic device that increases the voltage, current or power of a signal.

AVERAGE CURRENT

The current obtained by summing up the products of current flowing in a circuit and duration of the flow, divided with the total time. An average value for direct current is constant while it is zero for true alternating current.

AVERAGE POWER

Rate of energy flow averaged over one full period. (Similar to average current definition).

BANDWIDTH

Bandwidth is expressed in terms of the difference between the highest-frequency signal component and the lowest-frequency signal component. At constant input amplitude the output wave amplitude decreases to 70 % (- 3 dB) of the maximum value.

BIPOLAR POWER SUPPLY

A high-precision, regulated, direct-current power supply that can be set to provide any desired voltage between positive and negative design limits, with a smooth transition from one polarity to the other.

CAPACITIVE LOADS

The capacitive load does not only represent the capacity of the load but is often an unwanted parasitic, such as the capacitance of a length of coaxial cable. The capacitive load reduces the output bandwidth and slew rate.

CURRENT MONITOR

A buffered output voltage providing a low voltage representation of the load current of an amplifier or power supply.

DUTY CYCLE

A duty cycle is the percentage of one period in which a signal is active. A period is the time it takes for a signal to complete an on-and-off cycle. As a formula, a duty cycle may be expressed as: $D = t_{on} / T \times 100 \%$. Where D is the duty cycle, t_{on} is the time the signal is active, and T is the total period of the signal. Thus, a 60 % duty cycle means the signal is on 60 % of the time but off 40 % of the time.

FALL TIME

It is the time taken for the amplitude of a pulse to decrease (fall) from a specified value (usually 90 % of the peak value exclusive of overshoot or undershoot) to another specified value (usually 10 % of the maximum value exclusive of overshoot or undershoot).

FERRITE

A ceramic material that exhibits low loss at high frequencies, and which contains iron oxide mixed with oxides or carbonates of one or more metals such as manganese, zinc, nickel or magnesium.

FULL BRIDGE CONVERTER

A switching (forward) power converter using 4 semiconductor switches (MOSFETS, IGBTs) configured as a bridge circuit. Operates by commutating an input DC supply to produce an AC drive voltage, with a peak-to-peak value equal to twice the DC supply voltage, to the primary of a transformer.

IGBT

Insulated-gate bipolar transistor.

MOSFET

Metal-oxide-semiconductor field-effect transistor.

NOISE

The aperiodic random component on the power source output which is unrelated to source and switching frequency. Unless specified otherwise, noise is expressed in Root Mean Square (RMS) or peak-to-peak voltage over a specified bandwidth.

NOMINAL FREQUENCY

The nominal frequency is the desired center frequency of a crystal or oscillator.

OUTPUT IMPEDANCE

The output impedance of an electronic device is the opposition exhibited by its output terminals to an alternating current (AC) of a particular frequency as a result of resistance, inductance and capacitance. Output impedance can be modeled as being in series with an ideal voltage source (Thevenin Model), or in parallel with an ideal current source (Norton Model). An amplifier with a 100 - ohm output impedance means the output voltage signal appears to be in series with a 100 ohm resistor.

OPERATING TEMPERATURE RANGE

It is the temperature at which an electrical device operates. The device operates effectively within a specified temperature range which varies based on the device function and application context, and ranges from the minimum operating temperature to the maximum operating temperature.

PEAK CURRENT

Peak current is the maximum value of a waveform reached during a particular cycle or operating time.

PEAK-TO-PEAK

The difference between the maximum positive and the maximum negative amplitudes of a waveform.

PULSE DURATION

In signal processing, pulse duration is the interval between the time, during the first transition, that the amplitude of the pulse reaches a specified fraction (level) of its final amplitude, and the time the pulse amplitude drops, on the last transition, to the same level. The interval between the 50 % points of the final amplitude is usually used to determine or define pulse duration.

RIPPLE

The periodic AC component at the power source output harmonically related to source or switching frequencies. Unless specified otherwise, noise is expressed in Root Mean Square (RMS) or peak-to-peak voltage over a specified bandwidth. Ripple is directly proportional to load current, decreasing in value with decreasing current. Power supplies have two components of ripple voltage; a low frequency voltage derived from the AC main and a high frequency related voltage generated by the switching circuits in the power supply.

RISE TIME

The time taken by a signal to change from a specified low value to a specified high value. Typically, in analog electronics, these values are 10 % and 90 % of the step height.

SLEW RATE

The maximum rate of voltage or current change a power supply output can produce when subjected to a large step response or specified step change.

VOLTAGE MONITOR

A buffered output voltage providing a low-voltage representation of the load voltage of an amplifier or power supply.

► AWG TABLE*

Size [AWG]	Diameter [mm]	Area [mm ²]
1	7,35	42,4
2	6,54	33,6
3	5,83	26,7
4	5,19	21,2
5	4,62	16,8
6	4,12	13,3
7	3,66	10,5
8	3,26	8,37
9	2,91	6,63
10	2,59	5,26
11	2,30	4,17
12	2,05	3,31
13	1,83	2,62
14	1,63	2,08
15	1,45	1,65
16	1,29	1,31
17	1,15	1,04
18	1,02	0,823
19	0,912	0,653
20	0,812	0,518

Size [AWG]	Diameter [mm]	Area [mm ²]
21	0,723	0,410
22	0,644	0,326
23	0,573	0,258
24	0,511	0,205
25	0,455	0,162
26	0,405	0,129
27	0,361	0,102
28	0,321	0,0810
29	0,286	0,0642
30	0,255	0,0529
31	0,227	0,0404
32	0,202	0,0320
33	0,180	0,0254
34	0,160	0,0201
35	0,143	0,0160
36	0,127	0,0127
37	0,113	0,0100
38	0,101	0,00797
39	0,0897	0,00632
40	0,0799	0,00501

* Approximate values at 20°C.

► Pulse Generator Requirement

Physical
Instruments

Company: _____ Date: _____
 Address: _____
 Surname: _____ First name: _____
 Phone number: _____ Fax number: _____
 E-mail: _____

☐ Voltage generator ☐ Unipolar model (+ or -)
☐ Current generator ☐ Bipolar model (+/-)

U Amplitude: Peak to peak: _____ **Accuracy:** Voltage: _____
 RMS: _____ Current: _____

U adjustable: _____ **to:** _____
I adjustable: _____ **to:** _____

Pulse shape: ☐ triangle ☐ rectangle ☐ sinus ☐ trapeze ☐ square ☐ other (pls provide your timing diagram)

Peak current: _____ **Average current:** _____
Peak power: _____ **Average power:** _____

Rise time: _____ **Fall time:** _____

Dead time (Off): _____ **F adjustable:** _____ **to:** _____

Pulse duration: _____ **Duty cycle:** _____

Control: ☐ manual ☐ remote
Size: ☐ rack ☐ other : _____

Application: _____

Type of load: ☐ capacitive ☐ inductive ☐ resistance

Quantity: _____ **Budget:** _____ **Delivery time:** _____

OUR PARTNERS



hivolt.de

GBS ELEKTRONIK



wme



On the road to "Mont Aiguille" from Grenoble (Isère - France)

Physical
instruments

47, Chemin du Vieux Chêne - 38240 MEYLAN - FRANCE

Tél. : +33 (0)9 50 13 94 03 / Port. : +33 (0)6 27 74 53 38 / Fax : +33 (0)9 58 49 78 29
E-mail : ludovic.ruse@physical-instruments.fr

www.physical-instruments.fr