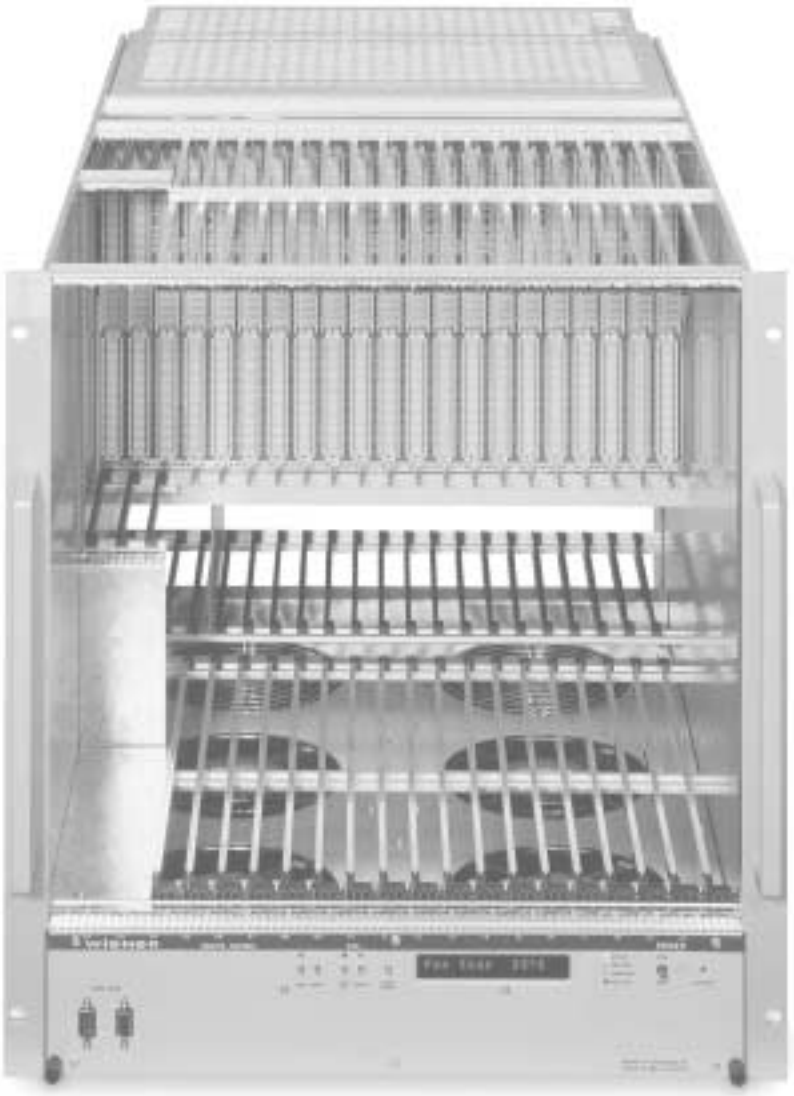

Series 6000 LHC

VME64x-Crate

Technical Manual

*00571.A4

General Remarks

The only purpose of this manual is a description of the product. It must not be interpreted as a declaration of conformity for this product including the product and software.

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Control Cabinet

In the context of this user manual, the control cabinet must fulfill the requirements on fire-protective enclosures according to EN 60950 / IEC 60950 / UL 60950.

The device is intended for operation in control cabinets or in closed areas. If operated outside of a control cabinet, the front and back of the crate must be closed by the front pannels of the inserted VME-Modules/ Transition Modules or by a well fitted front plate. The LAN connection must be done via a shielded cable with conductive connector shells, which are fixed with screws.

Furthermore, an additional fire-protective enclosure is required which must not affect proper air circulation.

Mains Voltage and Connection

The Power supplies are equipped with a “World”- mains input (rated voltage range: 100-240 VAC, frequency: 50-60 Hz, rated current: 16 A). Before connecting to the mains please double-check correspondence.

Mains input connection at the power supply side is done with a 3-pin HIRSCHMANN connector or power terminals. There is no main fuse inside. A circuit breaker for overcurrent protection 16A, type B or C (EN / IEC 60898, VDE 0641), has to be installed externally.

Before disconnection the HIRSCHMANN connector, the power supply should be switched into standby state. (Use the ON/OFF-Switch of the fan tray or the rocker switch beside the HIRSCHMANN connector to switch into standby)

Hirschmann.	Signal	Description	Color of the Wire
Pin 1	L	Phase	black or brown
Pin 2	N	Return, Neutral	blue
Pin 3		not connected	
Earth	PE	Protective Earth	green/yellow

Grounding Stud

Each VME- bin is outfitted with a grounding stud which has to be wired to mains earth or zero potential line **according to CERN's rule / law.**

The stud is situated at the right side panel behind the fan space (rear view).

Terms

The Terms "**Crate**" and "**Subrack**" are used interchangeable in this document

Safety

After connecting the Power box to the mains, the mains input module is powered permanently. Filter and storage capacitors of the power factor correction module are charged with about **400VDC**. The DC-On-Signal as well as a power switch at control board (if any installed) operates as a DC on/off switch only and not as a mains breaker. **Therefore it becomes dangerous if the box cover is open. In this case a lot of components on high voltage potential get touchable!**

Before starting any kind of work inside the power box remove the unit from mains and wait a couple of minutes with your activities! Discharge the primary DC Filter-capacitors by use of a well isolated 22 ohm 10W resistor.

We recommend in case of any male function to send the power box to Wiener or to one of our representative for service

CERTIFICATE

TÜV

of Conformity
Low Voltage Directive 73/23/EEC
as last amended by EEC Directive 93/68/EEC

Registration No.: AN 60005031 0001

Report No.: 21106169 001

Holder:
Plein & Baus GmbH
Wiener Elektronik
Müllersbaum 20
51399 Burscheid
Deutschland

Product:
Schaltnetzteil
(Switching Power Supply)

Identification:

Type designation	: UEP 6021 - LWC9U				
Input voltage	: 100-240 V AC 50-60 Hz				
Output voltages	: +5 V	+3.3 V	+12 V	-12 V	48 V
Output current	: 300 A	100 A	18 A	10 A	12 A
Protection class	: I				
Serial No.	: Engin. sample				

This certificate of conformity is based on an evaluation of a sample of the above mentioned product. Technical Report and documentation are at the Licence Holder's disposal. This is to certify that the tested sample is in conformity with all revision of Annex I of Council Directive 73/23/EEC, in its latest amended version, referred to as the Low Voltage Directive. This certificate does not imply assessment of the series-production of the product and does not permit the use of a TÜV Rheinland mark of conformity. The holder of the certificate is authorized to use this certificate in connection with the EC declaration of conformity according to Annex III of the Directive.

Certification Body

TÜV Rheinland Product Safety GmbH Zertifizierungsstelle

Cologne, 22.05.2003

Dipl.-Ing. H.-P. Pape

TÜV Rheinland Product Safety GmbH - Am Grauen Stein - D-51105 Köln

CE The CE marking may be used if all relevant and effective EC Directives are complied with. CE

EG-Konformitätserklärung nach Artikel 10.1 der Richtlinie 89/336/EWG (EMV-Richtlinie)
EC-Declaration of Conformity acc. to Article 10.1 of the Directive 89/336/EEC (EMC-Directive)
Déclaration de conformité CEE selon l'article 10.1 de la directive 89/336/CEE (Directive EMC)

Wir, **W-IE-NE-R Plein & Baus GmbH**
We, Müllersbaum 20
Nous, 51399 Burscheid-Hilgen

Name und Anschrift des Herstellers oder des in der EU niedergelassenen Inverkehrbringers
Name and address of the manufacturer or of the introducer of the product who is established in the EU
Nom et adresse du fabricant ou le la personne résidant dans la CEE qui introduit le sous-dit produit de la CEE

erklären in alleiniger Verantwortung, daß das Produkt
herewith take the sole responsibility to confirm that the product
soussignés déclarons de notre seule responsabilité que ce produit

Series 6000 LHC VME64x-Crate

Typenbezeichnung und ggf. Artikel-Nummer
Type designation and, if applicable, article no.
Type, nom et - si nécessaire - n° d'article du produit

mit den folgenden Normen bzw. normativen Dokumenten übereinstimmt
is in accordance with the following standards or standardized documents
est conforme aux normes ou spécifications Européennes suivantes

1.	**EN 61 000-6-3:2001**	**Störaussendung EMA [RF emission]**
	EN 55 022:1998 + Corr:2001 + A1:2000 Kl. B	Störspannung [conducted noise]
	EN 55 022:1998 + Corr:2001 + A1:2000 Kl. B	Störfeldstärke [radiated noise]
	EN 61 000-3-2:2001	Oberschwingungen [harmonics]
	EN 61 000-3-3:1995 +Corr:1997 +A1:2001	Spannungsschwankungen [flicker]
2.	**EN 61 000-6-2:2001**	**Störfestigkeit EMB [immunity]**
	EN 61 000-4-6:1996 + A1:2001	HF-Einströmung [injected HF currents]
	EN 61 000-4-3:1996 + A1:1998 + A2:2001	HF-Felder [radiated HF fields] incl. "900MHz"
	EN 61 000-4-4:1995 + A1:2001	Burst
	EN 61 000-4-5:1995 + A1:2001	Surge
	EN 61 000-4-11:1994 + A1:2000	Spannungs-Variationen [voltage variations]
	EN 61 000-4-2:1995 + A1:1998 + A2:2001	ESD

Folgende Betriebsbedingungen und Einsatzumgebungen sind vorauszusetzen
The following operating conditions and installation arrangements have to be presumed
Les conditions d'opération et d'installation suivantes sont à respecter

---

Dieser Erklärung liegt zugrunde der Prüfbericht
This confirmation is based on testreport
Cette confirmation est basée sur report de test

21106924_001 TÜV Rheinland Product Safety GmbH, 51101 Köln, Allemagne

---

Jürgen Baus, Techn. Director

Name, Anschrift, Datum und Unterschrift des rechtsverbindlich Verantwortlichen
Name, address, date and legally binding signature of the person being responsible
Nom, adresse, date et signature de la personne responsable

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3 General Information

3.1 6021 Subracks / Crates

Different versions are foreseen to fulfill the requirements of the LHC community.

Two formats, 6Ux160mm depth and 9U x 400mm depth are available, both with transition cages.

9U crates may optionally equipped with a **4slot 6U x 160mm front cage**, positioned on slot 1-4, but recessed in respect to the front panels of the 9U modules (connectors all on backplane level).

The crates are equipped either with 21 slot 64x backplane or with custom designed ones.

Topped on **slot 1 a temperature sensor** is situated. A second sensor will be delivered with each subrack for free positioning by the user. The **W-IE-NE-R** VME 64x backplane offers 7 free plugs at the top between different slots, to connect further sensors among slot-1-sensor.

According to IEEE1101.10 the mechanics are equipped with **easily replaceable EMC gaskets**

The power requirement of the bin (according to the label sticker) is stored in a bin memory **(Plug & Play)**. This memory logic compares any connected power supply for compatibility before enabling power on switch at fan tray front panel.

3.1.1 6021 Crate with Remote Power Supplies

3.1.1.1 Subrack Variant 1 (Remote)

The VME -Crate 6021- Variant 1 consists of a bin UEV 6021 with a 2 U high fan tray space for a UEL 6020 fan tray. The total height is 2U+modul format (6U or 9U)+1U wiring space in top of the bin. Totally 12U high for 9U and 9U high for 6U subracks.
Behind this wiring chamber there is a terminal board situated. This bears all power-contacts (thread-studs) and the sense/control connector, a 37 pin Sub D type for connecting subrack and remote power supply.

Subracks of Variant 1 have free unimpeded access to backplane rear side for
21 transition modules:
6U subracks features 160mm depth and 6U height, optionally 80mm deep,
9U subracks features 220mm depth and 9U height, optionally 160mm deep

3.1.1.2 Subrack Variant 1a (Remote)

Divergent from variant1 the variant 1a version is equipped with custom backplane(s)

3.1.2 6021 Crate with Local Power Supplies

3.1.2.1 Crate Variant 2 (Local)

The VME -Crate 6021- Variant 2 consists of a bin UEV 6021 with a 2 U high fan tray space for a UEL 6020 fan tray. The total height is 2U+modul format (6U or 9U). Totally 11U high for 9U and 8U high for 6U subracks.

The **Local Power supply** is placed behind the J1 Level. Therefore the access to backplane rear side is limited to the J2 and J3 (for 9U format) only.

Subracks of Variant 2 have limited access to backplane rear side for
21 transition modules:
6U crates have nothing foreseen, optionally 3U to J2, 160mm or 80mm deep,
9U subracks features 160mm depth and 6U height to J2/J3, optionally 220mm deep

3.2 6020 Fan Trays

The-fan trays are plugged into the bin from the front side. For efficient cooling, controlling and monitoring of the crate various fan trays are constructed according to the slot deepness. Air entry is from bottom side in general, which gives full cooling efficiency. Fan rotation speed is shown on the monitoring display and can be regulated. Furthermore temperature of the air entry and optionally the exhaust above selected slots.

The UEL 6020 fan tray and control unit occupies two units of a 6021 crate below the slots. To achieve an excellent airflow homogenization through the inserted VME modules, all fan trays for 400mm modules (and larger ones) are outfitted with a topped plenum chamber which acts as a pressure volume below the VME modules.

Among the different types high performance super blower with four or six blowers can be used, too.

All DC voltages (up to 8) at backplane level and the corresponding currents among other are shown by the alphanumeric monitoring. The threshold-limits (minimum / maximum voltages and currents) can be set manually or piloted by remote control and remain stored even after lack of voltage. In case of global trip off, the fault will be displayed by the diagnostic system.

VME-signals as ACFAIL and SYSRESET are generated according to VME-Specs. SYSRESET can also be released manually.

3.3 6021 Power Supplies

The VME power supply of the 6000 series is a micro-processor controlled switching power supply designed in the high density W-Ie-Ne-R - cavity technology, which provides a very low noise output voltage.

The mains input with power factor correction (PFC) works according to EN 61000-3-2 - IEEE 555-2. An external fuse or circuit breaker has to be installed (16A for 3U boxes with 3kW).

The inrush current is limited by a soft start-circuit and not higher as 16A, when the cold unit has been connected to the mains.

The AC- input module is permanently powered after connecting the unit to the AC- mains. Any POWER ON/OFF Switch activates only the DC on/off function of the power inverter modules.

The EN 50 081-1 for generic emissions as well as the EN 50 082-1 or 2 for immunity standards, in particular EN 55 011 RFI rejection (incl. VDE 0871 class B) and EN 55 022 electromagnetic compatibility is accomplished. The insulation performs the EN 60 950, ISO 380, VDE 0805 (SELV)! Furthermore are considered UL 1950, UL 1012, UL 478, C 22.2.950, C 22.2.220/234.

Therefore the UEP 6021 power supplies can fulfill the CE rules comprehensively and can CE marked for use at all power nets.

Turning on the power supply all voltages reach the nominal values nearly simultaneously within 50 ± 2.5 ms (start-end-time) whereby the voltage versus time curve shows a monotonic behavior. The switch-off-time is 5±2.5 ms. within this time the DC outputs are discharged to 10% of the nominal voltages or less.

The power packs are readily replaceable. The maximum output power is ca. 3000W for a 3U power box. The available DC output power is in correspondence with the 92... 265VAC

input voltage. Also the installed modules urge the efficiency (3,3V module efficiency is some lower then those of a 48V module).

3.4 Remote Monitoring and control (Slow control)

All local monitoring functions of the crates are also remotely available. In addition, it is possible to read and change the power supply and fan tray operating parameters (E.g. Overvoltage, Trip Points,etc.). If fan-relevant parameters are accessed, the power supply communicates with the fan tray over a crate- internal serial link.

3.4.1 CAN (Controller Area Network)

The power supply has a CAN field bus interface built in. So it is possible to link up to 100 devices with a simple 2-wire connection. The transmission speed, network address and broadcast address are selectable with the fan tray.

The programming details of the CAN bus can be found in the "CAN-Bus Interface for W-IE-NE-R Crate Remote Control" (Part No. 00183.A0)

3.4.2 OPC access

A server according to OPC Data Access V2.05 is optional available.

OPC (**O**LE for **P**rocess **C**ontrol) allows fast and secure access to data and information under Windows operating systems. As an industry-spanning, multi-vendor software interface, OPC minimizes connection and maintenance overheads.

This server, running on a Computer with the Microsoft Windows 2000 operating system, enables access to all power supplies which are connected to the computers CAN network card(s). It is possible to

- access from any OPC Client application to the data of one or more servers
- encapsulating the properties specific to the server and type of communication
- commissioning support due to automatic scanning of the network and registration of communication stations
- restricting access rights by the underlieing Microsoft DCOM.

The details of the OPC server can be found in the "OPC Server for W-IE-NE-R Crate Remote Control"

4 Operation, Function and Connections

4.1 Fan Tray Operation and Control

All monitoring and control operations are performed by a micro-processor based alarm and control circuit placed inside the UEP 6021 power supply monitored by UEL 6020 fan trays. The reasons of a trip off will be displayed on the alphanumerical display and monitored via network (CANbus).

To protect both the power supply and the VME modules, a DC cut-off is started in the case of:

- **overheat**: in the power modules (each module is equipped with over temperature sensors);
- **overcurrent:** if peak currents have been exceeded (any lower programmed current limit releases an undervoltage- trip off)
- **overvoltage:** if voltage >125% (default, crow bar function) and if voltage >105% (default, upper Status-level programmable via fan tray or network)
- **undervoltage:** if voltage <97.5% % (default, lower Status- level, programmable via fan tray or network)
- **fan failure:** if one or more fans fail

Voltages, currents, cooling air temperatures, fan speed, power dissipation of inserted modules, operation time of power supply and fan tray and net parameters can be shown on the fan-tray display. ADC resolution is 10 bit. The accuracy of the voltage measurement is better than 0.5%.

The total accuracy of the current measurement depends on the corresponding voltage, i.e. for 2-7V module it is better than 2A in the range between 5A - 50A. Above these current ranges the accuracy is +/-2% of the final value. The ±12V accuracy is better than 0.2A for the 10A and 0.4A for the 20A in the whole current range.

4.1.1 Function of Fan Tray Switches

POWER ON /Off	1. main switch for ventilation and power supply 2. Reset trip off
MODE SELECT	selection switch to choose items and values for fan-tray and power supply monitoring and control
SYS RES	protected located switch for VME SYSRESET circuit activation
FAN SPEED	push button for step wise in- or decrease of fan speed.
FAN AUTO OFF	one of two functions, selected by software (see 4.1.5): 1. Switch off after fan-failure (yes/no) 2. Activate the "hot swap" function of the fan
ADDRESS	selects crate address for remote network
LOCAL	permits only data transmitting, no commands receiving

The adjusting range of fan speed is from 1200 RPM up to >3000 RPM. The displayed value of RPM concerns the average of all blowers inside the fan tray. This average value will compared with the pre selected reference speed. The display shows the fan speed in flashing mode if the selected speed is not equal with the true speed. This happens when either the fans are still accelerated to any other selected turns or the selected value is not reachable. This could be the case, if

1. more than 3000 RPM are selected and high density modules block the airflow
2. or one ore more blower are slow (bearing problems)

In case of example 2. the FAN FAIL circuit will detect this status as fan fail after a certain time!

While the display shows average speed of all fans only, the CANbus option will transmit the turns of each fan tray separated.

4.1.2 Additional temperature sensors

The Slot-1-Sensor and optional installed temperature sensors, measure the temperature of the exhaust air and allows to switch the fans to stop. That will be achieved by keeping pushed the FAN SPEED button to lower speed about 10 seconds.

Also the sensors will

1. accelerate the fan speed to 3000 rpm if the first (FanUp) programmed temperature threshold exceeds (default: 45°C). During the air exhaust temperature is above these limits (max. 8 limits which may also different), the fan-speed-selection function is disabled, until the exhaust temperature is below the lowest of these limits again.

2. switch off the power supply if the second (PsOff) programmed temperature threshold exceeds (default: disabled).

Any additional installed sensor will be detected by the control logic of the power supply and monitored automatically.

4.1.3 Information by Fan Tray LED's

AC POWER	green large LED if *POWER* is on
STATUS	green LED if all voltages are within the limit
FAN FAIL	yellow LED if a fan failure is recognized
OVERHEAT	yellow LED if an overheat in the power supply occurs
SYS FAIL	red LED if VME-bus system generates the *SYSFAIL* signal
FAN SPEED	Red LED if fan speed below 100%
AUTO OFF	red LED indicates 1. DC cut off in case of fan fail disabled 2. hot swapping of fan tray enabled
LOCAL	indicates instruction receiving via network disabled

4.1.4 Hot Swapping of LX Fan Tray

If the "hot swap" function is activated (AUTO OFF), the crate can be full powered during withdrawal of the fan tray.

The power supply will trip off to prevent damage of inserted modules

1. if the fan tray is removed for a too long time (30 seconds)
2. when the programmed second limit of slot 1 temperature sensor (or of optional installed ones) exceed.

4.1.5 Programming of Fan tray

Fan tray parameters (and in the same way many power supply parameters!!) may be changed via the alphanumeric control.
The general procedure is:

- Switch the POWER and the MODE switch up simultaneous for 5 seconds. The display shows „Config: Wait....“ and „Config: Ready !“. Then release both switches.
- If a sub-menu exists, you may now select the sub-menu item (MODE switch up/down). If no sub-menu exists, you may change the parameter value (MODE switch up/down)

To change a parameter of a sub-menu, select it (POWER switch up). The selected parameter is flashing now.

You may alter the parameter now (MODE switch up/down)

- After finishing the parameter programming, leave the submenu or configuration menu (POWER switch down).

4.1.5.1 Programmable parameters of a fan tray:

Mode	**associated parameter submenu**	**Description**
Fans	Watching x Fans	Display of the number of monitored fans
Fan Temp	Temp Display: °C Temp Display: °F	Select the temperature unit: Celsius or Fahrenheit
	Function of the FAN AUTO OFF switch	AUTO OFF DIS: The switch will disable the trip off function of the power supply if the fans are not working correctly. (DANGER: The VME modules can burn! Should be used only for service purpose.) HOT SWAP *time*: The switch will activate the "hot swap" feature. The maximum time the user has got to change the fan tray is set here.
Bin Temp x (≤ 8 sensors)	PsOff	If the temperature of sensor x is above this limit, the power supply will switch off.
	FanUp	If the temperature of sensor x is above this limit, the fan speed will increase to full speed.

SYS Reset Switch (protected)

Power On LED
Main Switch **ON / OFF**; Trip off Rest

Status LEDs:

Green	Status
Yellow	Fan Fail
Yellow	Over Heat
Red	SYS Fail

Alphanumeric Display

MODE SELECT Switch

Fan **SPEED** Switch and LED
AUTO OFF Switch and LED
Network **ADDR**ess Switch
LOCAL Switch and LED

CANbus connector 1 female

CANbus connector 2 male

4.1.6 LX fan-tray UEL 6020
Front panel with CANbus Connectors

4.1.7 Monitoring Display: Standard Measurement Ranges

Available Modes and Display Examples			
Mode	Monitored	Peak-Values	Description
+5V	5.00 V	115A.... 230A (460)	+5V channel
+12V	12.0 V	11.5 / 20A	+12V channel
+3,3V	3.30 V	115.... 230A (460)	3,3V channel
48V	48,0 V	13,5... 67A	
POWER	135	W	output power
FANS	3000	RPM	fan rotation speed
FAN TEMP	25	° C or °F	fan air inlet temp.
FAN TIME	82000,6	h	Operating time Fan tray
P.S. TIME	150000,0	h	Operating time Power Supply
Options			
BIN TEMP 1	35°C	° C or °F	bin slot 1 (?) temp.
BIN TEMP 2		° C or °F	bin slot 2 (?) temp.
..... up to			
BIN TEMP 8		° C or °F	bin slot 8 (?) temp.
Networks *			
SPEED	RATE	1.0 MBAUD	CANbus bit rate
CANBUS	ADDR	1	CANbus address
GENERAL CALL	ADDR	127	CANbus group address

4.2 6021- Bin Technical details

4.2.1 VME 64x Bus Current Ratings

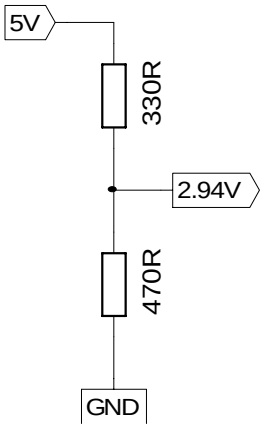
Bus current ratings

Power distribution **per slot**	**VME 64x** **20°C / 70°C ambient temp.**
+3,3V	17/12A
+5V with VPC in parallel	15,3/10,8A
5VSTDBY	1,7/1,2A
+/-12V	1,7/1,2A
48V (V1/V2)	1,7/1,2A
Layers	10
Type of ADC	active
Termination on board	active
Power Connections	Bugs, current copper sheets

4.3 Bus Termination

The active bus- termination is achieved by **four buffer chips**, placed in the corners of the backplane. A resistor divider generates the buffer input voltage, basically 2,94V (± 10%).

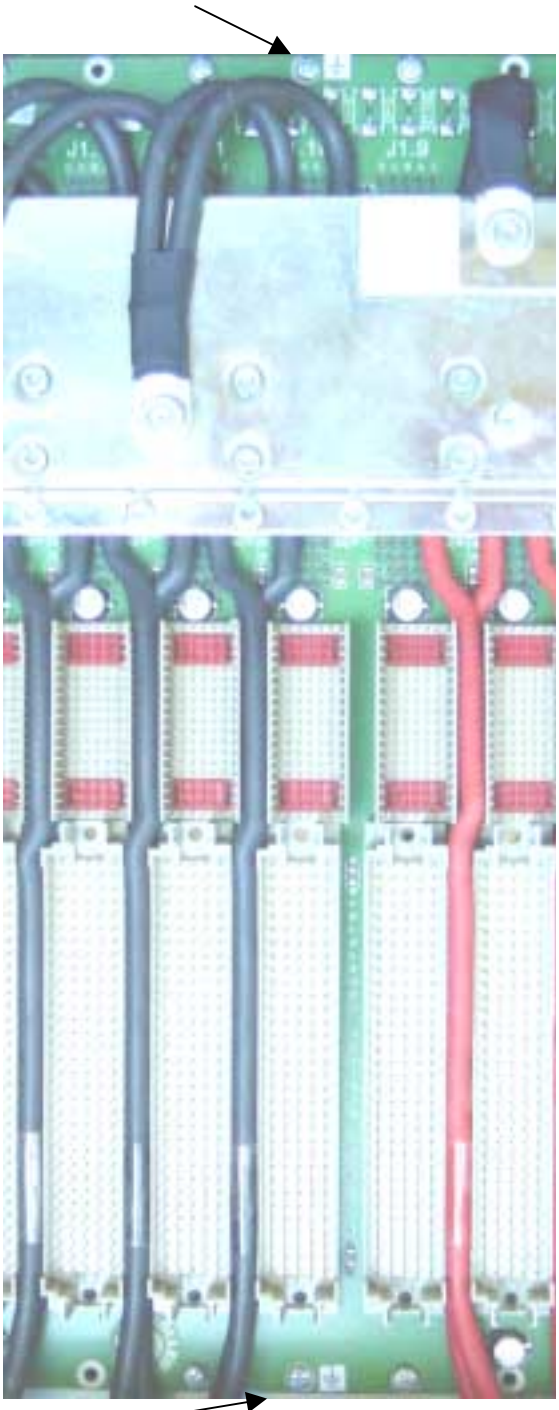
The termination network is connected to the 5V according to the VME Standard, in order to use power supplies without 3,3V, too.



4.3.1 Ground Connection

Two screws among the isolated backplane fastening screws are build in to connect the **VME Ground to mains earth** (bin mechanics). Disconnection is easily possible by accessing from the back side. The earth screw are near to slot 10 positioned.

The screws are marked with the earth symbol.



marked earth screw

4.3.2 Pin Assignments of VME 64x-Bus

J1 (extended)

Pin No.	Row Z	Row A	Row B	Row C	Row D
01	MPR	D00	BBSY*	D08	VPC (1)
02	GND	D01	BCLR*	D09	GND (1)
03	MCLK	D02	ACFAIL*	D10	+V1
04	GND	D03	BG0IN*	D11	+V2
05	MSD	D04	BG0OUT*	D12	RsvU
06	GND	D05	BG1IN*	D13	-V1
07	MMD	D06	BG1OUT	D14	-V2
08	GND	D07	BG2IN*	D15	RsvU
09	MCTC	GND	BG2OUT*	GND	GAP*
10	GND	SYSCLK	BG1IN*	SYSFAIL*	GAO*
11	RESP*	GND	BG3OUT*	BERR*	GA1*
12	GND	DS1*	BR0*	SYSRESET*	+3.3V
13	RsvBus	DS0*	BR1*	LWORD	GA2*
14	GND	WRITE*	BR2*	AM5	+3.3V
15	RsvBus	GND	BR3*	A23	GA3*
16	GND	DTACK*	AM0	A22	+3.3V
17	RsvBus	GND	AM1	A21	GA4*
18	GND	AS*	AM2	A20	+3.3V
19	RsvBus	GND	AM3	A19	RsvBus
20	GND	IACK*	GND	A18	+3.3V
21	RsvBus	IACKIN*	SERCLK	A17	RsvBus
22	GND	IAOUT*	SERDAT	A16	3.3V
23	RsvBus	AM4	GND	A15	RsvBus
24	GND	A07	IRQ7*	A14	+3.3V
25	RsvBus	A06	IRQ6*	A13	RsvBus
26	GND	A05	IRQ5*	A12	+3.3V
27	RsvBus	A04	IRQ4*	A11	LI/I*
28	GND	A03	IRQ3*	A10	+3.3V
29	RsvBus	A02	IRQ2*	A09	LI/O*
30	GND	A01	IRQ1*	A08	+3.3V
31	RsvBus	-12 V	+5V STDBY	+12 V	GND (1)
32	GND	+5 V	+5V	+ 5 V	VPC (1)

J2 (extended)

Pin No.	Row Z	Row A	Row B	Row C	Row D
01	User defined	User defined	+5 VAC	User defined	User defined(1)
02	GND	User defined	GND	User defined	User defined(1)
03	User defined	User defined	RESERVED	User defined	User defined
04	GND	User defined	A24	User defined	User defined
05	User defined	User defined	A25	User defined	User defined
06	GND	User defined	A26	User defined	User defined
07	User defined	User defined	A27	User defined	User defined
08	GND	User defined	A28	User defined	User defined
09	User defined	User defined	A29	User defined	User defined
10	GND	User defined	A30	User defined	User defined
11	User defined	User defined	A31	User defined	User defined
12	GND	User defined	GND	User defined	User defined
13	User defined	User defined	+5 V	User defined	User defined
14	GND	User defined	D16	User defined	User defined
15	User defined	User defined	D17	User defined	User defined
16	GND	User defined	D18	User defined	User defined
17	User defined	User defined	D19	User defined	User defined
18	GND	User defined	D20	User defined	User defined
19	User defined	User defined	D21	User defined	User defined
20	GND	User defined	D22	User defined	User defined
21	User defined	User defined	D23	User defined	User defined
22	GND	User defined	GND	User defined	User defined
23	User defined	User defined	D24	User defined	User defined
24	GND	User defined	D25	User defined	User defined
25	User defined	User defined	D26	User defined	User defined
26	GND	User defined	D27	User defined	User defined
27	User defined	User defined	D28	User defined	User defined
28	GND	User defined	D29	User defined	User defined
29	User defined	User defined	D30	User defined	User defined
30	GND	User defined	D31	User defined	User defined
31	User defined	User defined	GND	User defined	GND (1)
32	GND	User defined	+5 V	User defined	VPC (1)

J0 (extended)

Pos	Row f	Row e	Row d	Row c	Row b	Row a	Row z
1	GND	User defined	User defined	User defined	User defined	User defined	GND
2	GND	User defined	User defined	User defined	User defined	User defined	GND
3	GND	User defined	User defined	User defined	User defined	User defined	GND
4	GND	User defined	User defined	User defined	User defined	User defined	GND
5	GND	User defined	User defined	User defined	User defined	User defined	GND
6	GND	User defined	User defined	User defined	User defined	User defined	GND
7	GND	User defined	User defined	User defined	User defined	User defined	GND
8	GND	User defined	User defined	User defined	User defined	User defined	GND
9	GND	User defined	User defined	User defined	User defined	User defined	GND
10	GND	User defined	User defined	User defined	User defined	User defined	GND
11	GND	User defined	User defined	User defined	User defined	User defined	GND
12	GND	User defined	User defined	User defined	User defined	User defined	GND
13	GND	User defined	User defined	User defined	User defined	User defined	GND
14	GND	User defined	User defined	User defined	User defined	User defined	GND
15	GND	User defined	User defined	User defined	User defined	User defined	GND
16	GND	User defined	User defined	User defined	User defined	User defined	GND
17	GND	User defined	User defined	User defined	User defined	User defined	GND
18	GND	User defined	User defined	User defined	User defined	User defined	GND
19	GND	User defined	User defined	User defined	User defined	User defined	GND

4.3.3 Power Protection Memory PPM (Plug & Play Logic)

All Power requirements of the bin are stored in a memory to program the outputs of the connected power supply and check the compatibility.

An incompatible power supply will not start and the reason(s) will be displayed in the fan tray display as over/undervoltage related to the concerned output(s)

When the inserted power supply have been connected to mains it checks immediately:

4.3.3.1 PPM Comparing

1. pin assignment of the power connectors
2. channel wise voltage levels being inside the "Status good" levels (default of thresholds Umin and Umax)
3. CANbus address with automatic setting to previous used when power supply has been exchanged

4.3.3.2 PPM Automatic-Programming

Optional features

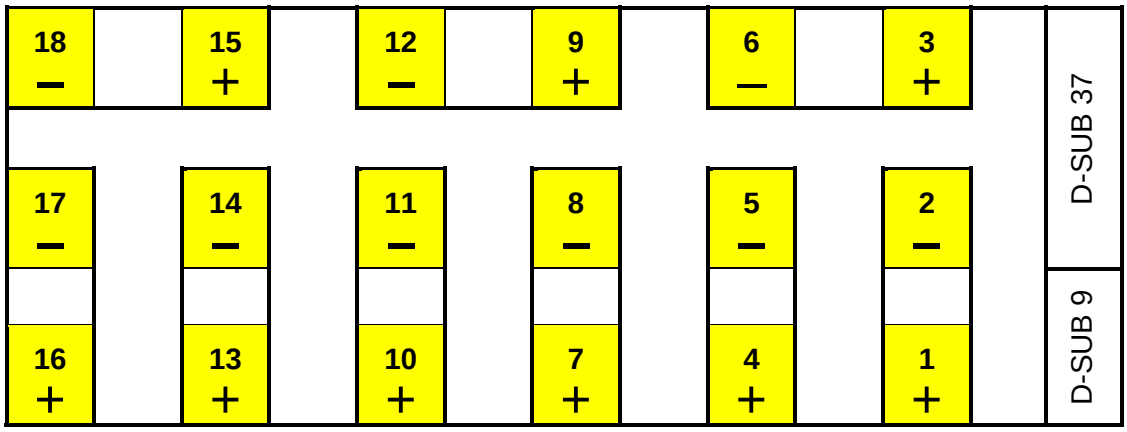
1. outputs adjustment to nominal voltages (Unom)
2. crow-bar thresholds adjustment (Uovp)

If nominal voltages are in the range of the power modules they will set it to bin compatible output, when the mains have been connected to that power supply. Default of this feature: disabled

4.4 Power Supply UEP6021 LHC

UEP 6021 power supplies feature floating DC outputs, each with a separate regulation circuit. Therefore no cross regulation effects will occur, even not for dual outputs like +/- 12V. The common VME Ground is formed at backplane site. Separate isolated grounds can be foreseen on special custom backplanes. Due to the floating output characteristics no ground shift by voltage drops can happen.

4.4.1 Power Connector Board (Round Contacts)



Pin 10,11,13...18: 6mm, 120A max.
Pin 1...9+12: 8mm, 240A max
Ret. **VME -Return** from common ground rail at backplane
Note: **Special Analog voltages** can be potential free floating

Ext. Res. is used for pin outs enlargement or keeping an output apart due to compatibilities.
Note: It is not an additional output! It will to be one of the available 8 outputs, connected to the related senses.

4.4.2 Power connector pin assignments

4.4.2.1 Voltages and Pin outs for UEP 6021-**LHC 6U**-Power Supply

+	–	Outp.		+	–	Outp.	
1	2	U0	+5V ≤ 200A /VME-GND	10	11	U1	+12V < 80A. /VME-GND
16	17	U2	48V < 80A	7	8	U3	+3,3V ≤ 200A. /VME-GND
		U4		13	14	U5	-12V < 80A. /VME-GND
		U6				U7	

4.4.2.2 Voltages and Pin outs for UEP 6021-**LHC 9U**-Power Supply

+	–	Outp		+	–	Outp	
1/4	2/5	U0	+5V ≤ 400A. /VME-GND	10	11	U1	+12V < 80A. /VME-GND
16	17	U2	48V < 80A. /VME-GND	7	8	U3	+3,3V ≤ 200A. /VME-GND
		U4		13	14	U5	-12V < 80A. /VME-GND
		U6				U7	

4.4.2.3 Voltages and Pin outs for UEP 6021-**SL-BI/A 6U**-Power Supply

+	–	Outp		+	–	Outp	
1	2	U0	+5V ≤ 200A. /VME-GND	10	11	U1	+12V < 80A. /VME-GND
		U2		7	8	U3	+3,3V ≤ 200A. /VME-GND
4	5	U4	+5V Analog ≤ 200A	13	14	U5	-12V < 80A. /VME-GND
3	6	U6	-5,2V Analog ≤ 200A	9	12	U7	-2V Analog ≤ 200A

4.4.2.4 Voltages and Pin outs for UEP 6021- **SL-BI/B 6U** -Power Supply

+	–	Outp		+	–	Outp	
1	2	U0	+5V ≤ 200A. /VME-GND	10	11	U1	+12V < 80A. /VME-GND
16	17	U2	+15V Analog < 80A	7	8	U3	+3,3V ≤ 200A. /VME-GND
4	5	U4	+5V Analog ≤ 200A	13	14	U5	-12V < 80A. /VME-GND
15	18	U6	-15V Analog < 80A			U7	

4.4.2.5 Voltages and Pin outs for UEP 6021- **SL-CO 6U** -Power Supply

+	–	Outp		+	–	Outp	
1	2	U0	+5V ≤ 200A. /VME-GND	10	11	U1	+12V < 80A. /VME-GND
		U2		7	8	U3	+3,3V ≤ 200A. /VME-GND
		U4		13	14	U5	-12V < 80A. /VME-GND
		U6				U7	

4.4.2.6 Voltages and Pin outs for UEP 6021- **LHC-Alice DiMuons 6U**-Power Supply

+	–	Outp		+	–	Outp	
1	2	U0	+5V ≤ 200A. /VME-GND			U1	
		U2		7	8	U3	+3,3V ≤ 200A. /VME-GND
		U4				U5	
		U6		3	6	U7	+2,5V Analog ≤ 200A

U0… U7 with the power pins corresponding senses (via internal power modules)

4.4.3 Sense and Signal Connector-SUB D 37

		19	TEMP RETURN
37	TEMP 0	18	TEMP 1
36	TEMP 2	17	TEMP 3
35	TEMP 4	16	TEMP 5
34	TEMP 6	15	TEMP 7
33	BIN EEPROM: IIC SDA	14	BIN EEPROM: IIC SCL
32	BIN EEPROM:+5V	13	VME LOGIC: SYSRESET
31	BIN EEPROM: GND	12	VME LOGIC: ACFAIL
30	VME LOGIC GND	11	VME LOGIC: SYSFAIL
29	U0 SENSE -	10	U0 SENSE + (VME: +5V)
28	(reserved)	9	(reserved)
27	(reserved)	8	(reserved)
26	U4 SENSE +	7	U4 SENSE -
25	U7 SENSE +	6	U7 SENSE -
24	U2 SENSE -	5	U2 SENSE +
23	U6 SENSE +	4	U6 SENSE -
22	U1 SENSE -	3	U1 SENSE + (VME: +12V)
21	U5 SENSE +	2	U5 SENSE – (VME: -12V)
20	U3 SENSE -	1	U3 SENSE + (VME: +3.3V)

Maximal 8 different floating outputs can be controlled in a single power box (U_0... U_7)

4.4.4 Fan tray and Control Connector SUB D9

		5	CAN_H
9	CAN_L	4	CAN GND
8	RXD	3	TXD
7	+15V (for fan only)	2	+15V (for fan only)
6	-15V (for fan only)	1	-15V (for fan only)

The CANbus Logic is an option. Data exchange between fan tray and power supply has been done by use of serial connection via RXD and TXD.

4.4.5 Plug & Play Logic

The bin memory (PPM) will be controlled via the 37 pin sense and control connector.

33	BIN EEPROM: IIC SDA	14	BIN EEPROM: IIC SCL
32	BIN EEPROM:+5V	13	
31	BIN EEPROM: GND	12	

4.4.6 Control and Adjustment of 6021 Power Supply

4.4.6.1 Control of the Power Supply 6021 via CAN-Bus (optional)

The CAN Bus Signals are provided on the 9 Pin DSUB:

CAN_H: Pin 5

CAN_L: Pin 9

CAN_GND: Pin 4

The software protocol is described in a separate document (Part No *00183)

CANbus is an independent port. It may used to operate the power supply separately or in combination with the fan tray inside the bin

4.4.6.2 Control of the Power Supply 6021 without PC or Fan Tray (display)

There is a on/off input and a status output function which can be used for service:

Remote On: 9 Pin DSUB: Close a "make" contact or switch between Pin 8 (Serial Data In, RXD) and Pin 2 or 7.

Status Output: 9 Pin DSUB: Connect a LED between Pin 3 (Serial Data Out, TXD) and Pin 1 or 6.

4.4.6.3 Control of the Power Supply 6021 via Fan tray

Many power supply parameters may be changed via the alphanumeric control of the connected fan tray.

The general procedure is:

- Switch the POWER and the MODE switch up simultaneous for 5 seconds. The display shows „Config: Wait....“ and „Config: Ready !“. Then release both switches.
- If a sub-menu exists, you may now select the sub-menu item (MODE switch up/down). If no sub-menu exists, you may change the parameter value (MODE switch up/down)
- To change a parameter of a sub-menu, select it (POWER switch up). The selected parameter is flashing now.
- You may alter the parameter now (MODE switch up/down)

After finishing the parameter programming, leave the submenu or configuration menu (POWER switch down).

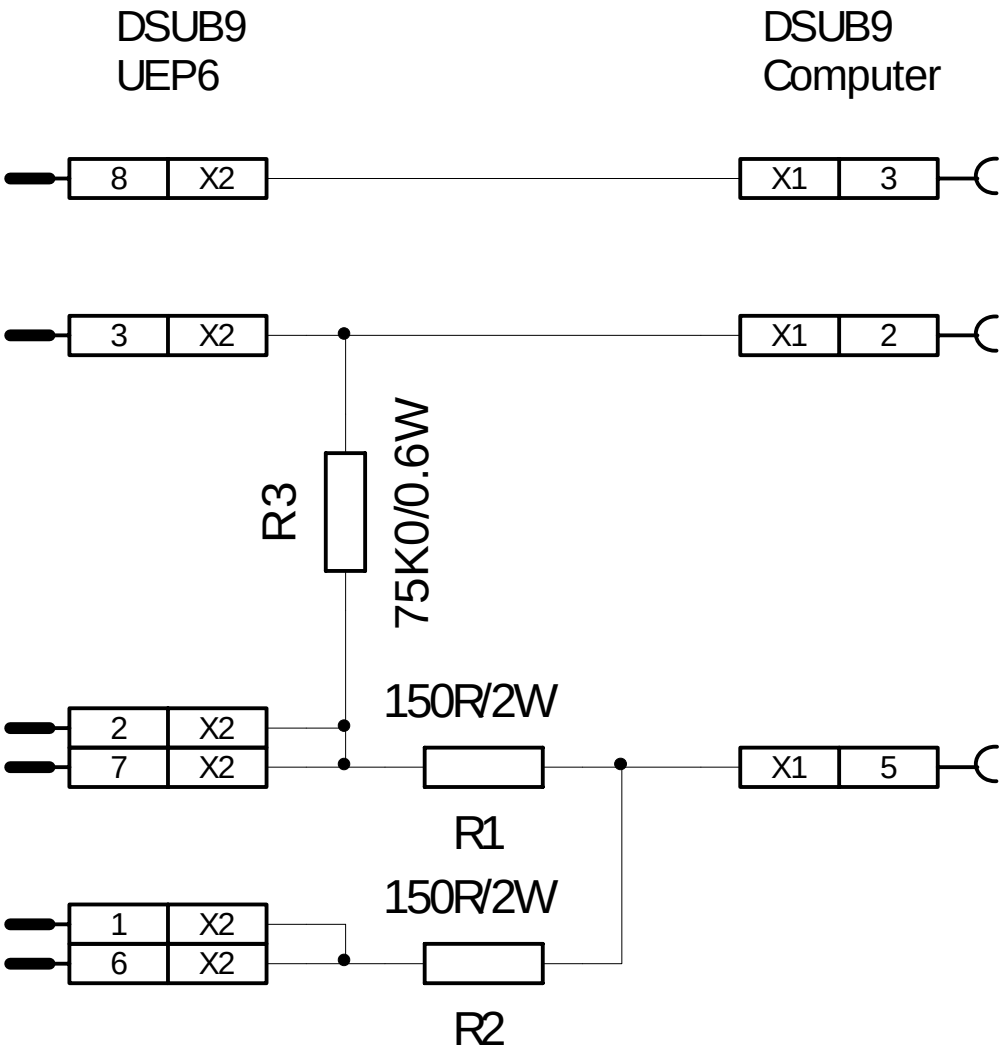
4.4.6.3.1 Table 1 List of manual Programming Features

Mode	associated parameter submenu	Description
Any Voltage (e.g. +5V or U0)	Ilim	Output Current limit
	Uadj	Output voltage fine adjustment. The same function as the switches in the power supply
	Unom	Output voltage coarse adjustment.
	Imax	Monitoring: Maximum current for good status.
	Umin	Monitoring: Minimum voltage for good status.
	Umax:	Monitoring: Maximum voltage for good status.
Power	Auto Power On No Auto Power On	After AC-fail 1. Automatic switch power on 2. Remains off (manual start necessary)
	Switch Off Normal Switch Off Delay	Delayed switch off: POWER switch has to push down for 5 seconds until the power supply switches off

4.4.7 Connection of a Personal Computer to UEP6021 Power Supply

This connection is intended **for service functions only**. Because of the direct connection between the PC and the power supply, the **ripple and noise of the DC outputs will increase!**

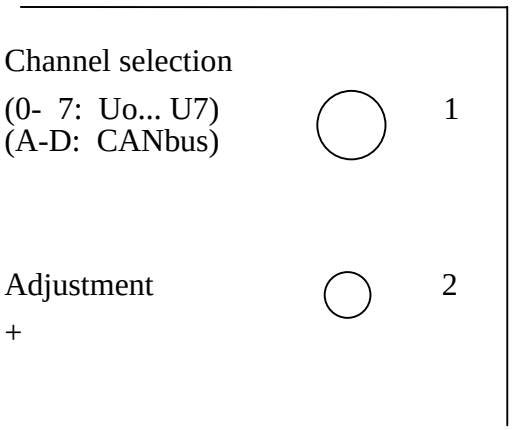
The needed staff is an PC running Windows, the control program UEP6 and a simple adapter ("Dongle"). The power supply is connected to the COM port of the PC. For more details, see document *00461.A0.



4.4.8 Output Voltage Adjustments & CAN-Bus Parameter Setting

All output voltages can be adjusted manually via the two rotary switches situated on the power supply top.

1. the 1. rotary switch selects the function which has to be adjust
2. the 2. rotary switch will change the settings when turned (right/left = +/-)



Mode Selection	Function
0-7	Adjust Voltage of U0-U7
A	CAN Address (low, Bit 0-3)
B	CAN Address (high, Bit 4-6)
C	CAN General Call Address (low, Bit 0-3)
D	CAN General Call Address (high, Bit 4-6)
E	CAN Transmission Speed Index

To change the CAN-Bus parameters, the following sequence is recommended *(Example: address 58 = 0x3A, general call address 127 = 0x7F, transmission speed index 1)*:

1. Set the MODE to "A"
2. Set the ADJUST to the low address value *("A")*
3. Set the MODE to "B"
4. Set the ADJUST to the high address value *("3")*
5. Set the MODE to "C"
6. Set the ADJUST to the low g.c. address value *("F")*
7. Set the MODE to "D"
8. Set the ADJUST to the high g.c. address value *("7")*
9. Set the MODE to "E"
10. Set the ADJUST to the speed index *("1")*
11. Set the MODE to "F" (park position)

4.4.9 CANbus Option, Transmission Speed Index

Index	Max. Distance	Bit Rate	Type
0	10 m	1.6 Mbit/s	high- speed
1	40 m	1.0 Mbit/s	
2	130 m	500 kbit/s	(needs termination)
3	270 m	250 kbit/s	
4	530 m	125 kbit/s	
5	620 m	100 kbit/s	low-speed
6	1.300m	50 kbit/s	
7	3.300 m	20 kbit/s	
8	6.700 m	10 kbit/s	
9	10.000 m	5 kbit/s	

For software protocol see separate manual No. *00183

4.4.10 Power Supply AC on / off

A rocker switch for AC on / off is situated at the rear side of the power supply.

Please note that this connector do not disconnect the power supply from mains completely! Many internal components remains under high voltage (about 400VDC).

When this switch is in OFF Position (O) all other functions are disabled, including any remote control action. Also the Main Switch at fan tray front panel doesn't work until the rear rocker switch is in "Power Supply AC on" (|) position again.

APPENDIX A: Technical Details of 6021 Power Supplies for LHC

Rated Input Voltage: 106 – 230 V AC, +/- 15% variation allowed
Rated Input Current: 16 A

Sinusoidal:	**CE**	EN 60555, IEC 555 pow. fact. 0,98 (230VAC),
Inrush current:		16 A, cold unit
Output Insulation (SELF)	**CE**	EN 60950 , ISO 380, VDE 0805, UL 1950, C22.2.950

DC Output power with different input voltages at the rated current (16A), calculated with typical efficiency of 75%

115VAC / 1.380Wnom, 1580Wpeak **230VAC / 2.760W, 3170Wpeak**

(modules selected for 64x application, 5V- 3,3V-+/-12V- 48V)

Available modules	min. to max. range	max. output, peak	nominal output
Type MEH	2... 7,0V	115A / 630W	100A / 550W
Type MEH	7... 16V	46A / 630W	40A / 550W
Type MEH	30... 60V	13,5A / 650W	12A / 580W
Type MDL (+/-)	7... 24V	11,5A / 2x276W	10A / 2x240W
Type MDH (+/-)	7... 14V	23A / 2x276W	20A / 2x280W

Regulation

static:	MEH 550W/650W	<15mV(+/-100% load, +/- full mains range)	
	MDL/MDH :	<0,05%	(+/-100% load, +/- full mains range)
dyn.:	MEH	<100mV	(50% ⇔ 75% load, 1A/µs)
	MDL/MDH	<0,7%	(+/-25% load, 1A/µs)

Recovery time +/-25% load:	within +-1%	within +-0,1%
Modules 550W	< 0,2ms	< 0,5ms
Modules 650W	< 0,5ms	< 1,0ms
MDL/MDH	0,0ms	< 1,0ms

Sense compensation range: full difference between min. and max. output voltage (OVP has to be adjusted accordingly)

Noise and Ripple

at Backplane side: <20mVpp, (0-20MHz) <3mVrms (0-2MHz)

at Power Supply output: <40mVpp, (0-20MHz) <3mVrms (0-2MHz)

EMI

RFI-rejection, emission:	**CE**	EN 50081-1 VDE 0871B
EMC immunity:	**CE**	EN 50082-1 or 2

Operation temperature: 0....50°C without derating, Storage:-30°C ... +85°C

Temp.-coefficient: < 0,2% / 10K
Stability (conditions const.): 10mV or 0,1% / 24 hours, 25mV or 0,3% / 6 month

Current limits: adjustable to any lower level

Voltage rise characteristics: monotonic 50ms, processor controlled.

Protection Provisions

Overvoltage crow bar protection:	trip off adjusted to 125% of nominal voltage each output
DC Off (trip off):	within 5ms if >+5 /-2,5% (≥ 5V output) deviation from nominal values, adjustable, after overload, overheat, overvoltage, undervoltage (bad status) and fan fail if temperatures exceed 110°C heat sink, 70°C ambient

Trip off points adjustable, processor controlled. Output capacitors will be discharged by the crow bars

Efficiency: 68% ... 85%, depends on used modules

M T B F

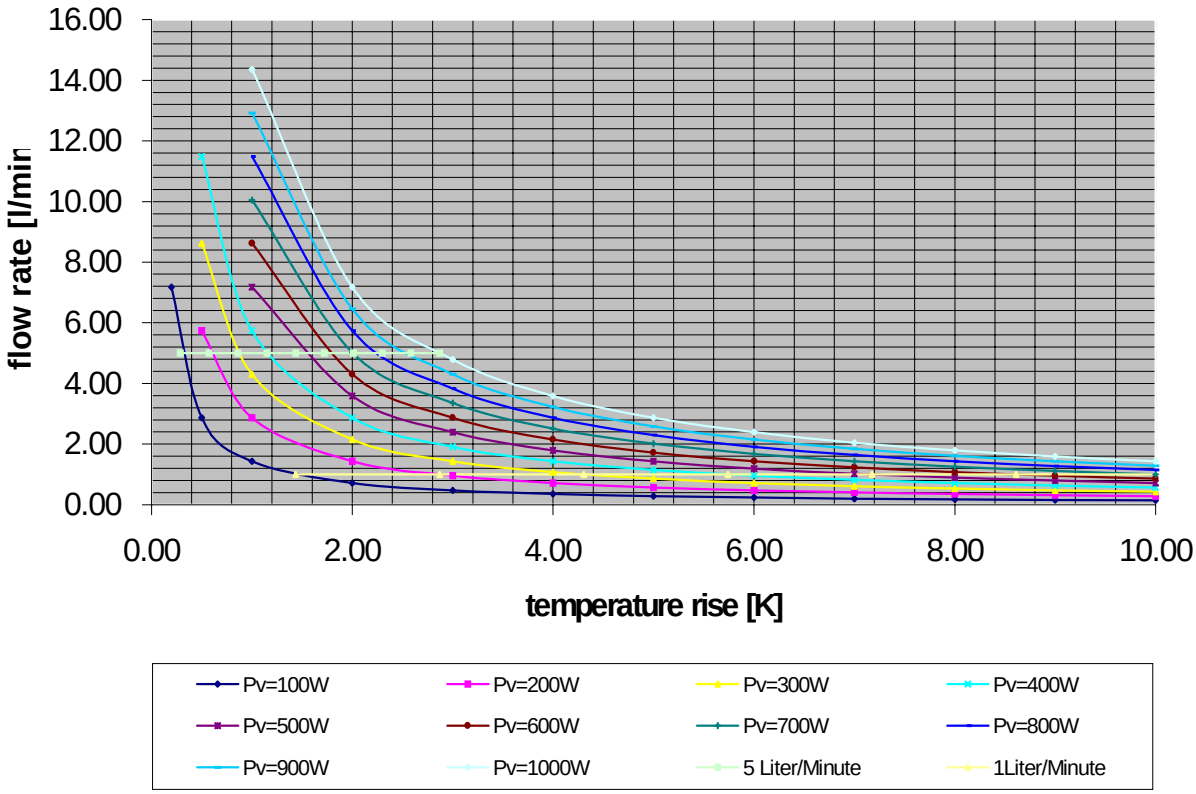
Power Supply air cooled	40°C ambient >65 000 h	25°C ambient	>100 000h
Power supply water cooled	20-40°C water, 40°C ambient		>100.000h

APPENDIX B: Typical Module Efficiency

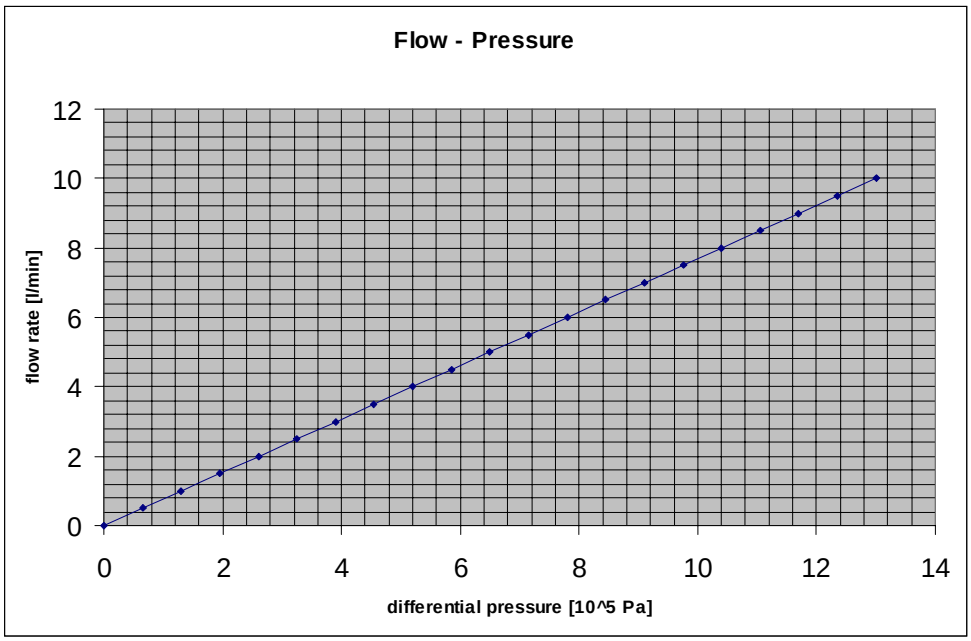
Module type	I_{out} %	U_{out} V	Iout A	Uin V	Iin A	Pout W	Pin W	Efficiency %
MEH 1409266.A6								
MEH 2V	50%	2,01	50	384	0,397	100,5	152,45	65,92
	80%	2,01	80	384	0,653	160,8	250,75	64,13
	100%	2,01	100	384	0,847	201	325,25	61,80
	115%	2,01	115	384	1,009	231,15	387,46	59,66
MEH3,3V	50%	3,31	50	384	0,57	165,5	218,88	75,61
	80%	3,31	80	384	0,936	264,8	359,42	73,67
	100%	3,31	100	384	1,203	331	461,95	71,65
	115%	3,31	115	384	1,418	380,65	544,51	69,91
MEH 5V	50%	5,01	50	384	0,807	250,5	309,89	80,84
	80%	5,01	80	384	1,314	400,8	504,58	79,43
	100%	5,01	100	384	1,666	501	639,74	78,31
	115%	5,01	115	384	1,954	576,15	750,34	76,79
MEH 1436890.A1								
MEH48V	50%	48,02	6	384	0,867	288,12	332,93	86,54
	80%	48,02	9,6	384	1,343	460,992	515,71	89,39
	100%	48,02	12	384	1,677	576,24	643,97	89,48
	115%	48,02	13,5	384	1,89	648,27	725,76	89,32
MDL 1409769.A5								
MDL12V	50%	24,02	5	384	0,383	120,1	147,07	81,66
	80%	24,02	8	384	0,6	192,16	230,40	83,40
	100%	24,02	10	384	0,745	240,2	286,08	83,96
	115%	24,02	11,5	384	0,859	276,23	329,86	83,74

APPENDIX C: Water Cooling

The following graphs were measured of a typical power supply (5 modules):



Water temperature rise at different flow rates (power dissipation as parameter)



Differeitial pressure as function of the flow rate

APPENDIX D: Technical Details of Fan Trays

Fan Tray	Type	No. of Blowers	Cooling Frontmodules	Space for Transitionmod	Max. Air Flow total
6020/9 690mm	9U fan tray	9 x DC 118mm²	400 mm	220mm	>1600m ^{3} / h
6020/6 400mm	9U fan tray	6 x DC 118mm²	400mm	No	>1000m ^{3} / h
6020/6 340mm	6U fan tray	6 x DC 118mm²	160mm	160 mm	>1000m ^{3} / h
6020/3 160mm	6U fan tray	3x DC 118mm²	160mm	No	>540m ^{3} / h
6020/4s 400mm	9U fan tray	4 x DC-Super 150mm	400mm	No	>1500m ^{3} / h
6020/6s 690mm	9U fan tray	6 x DC-Super 150mm	400mm	220mm	>2200m ^{3} / h

all fan trays for bottom air inlet only.

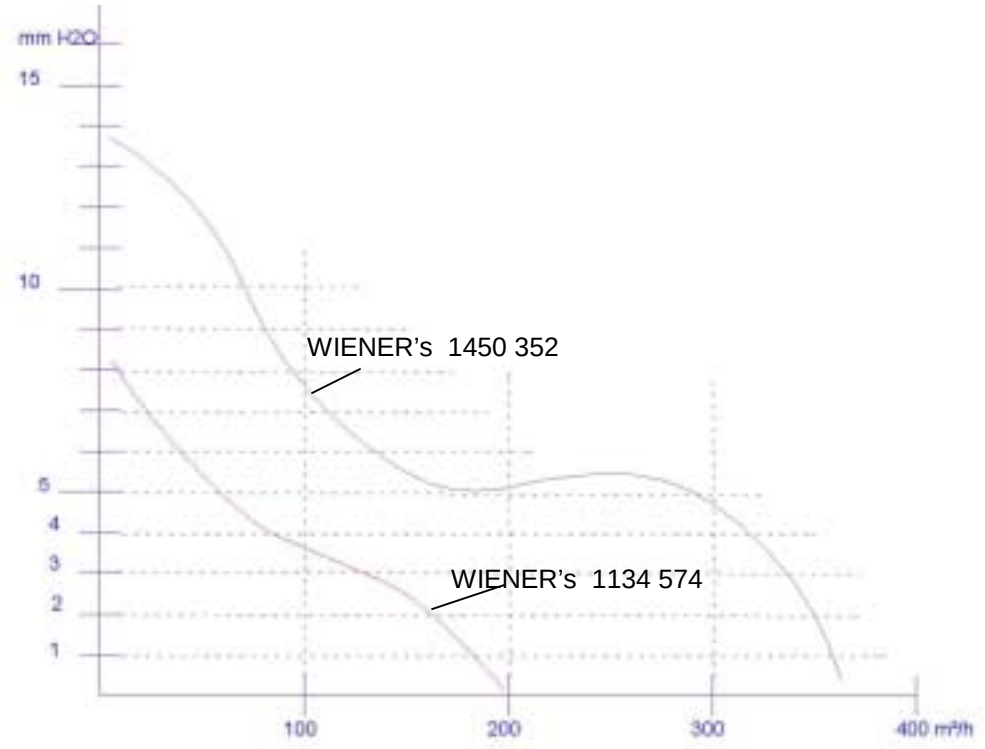
Except the 6U fan tray for 160mm front modules **all fan trays** are equipped with a topped plenum pressure chamber, 25mm high, for optimized air flow homogenization through all slots as well as for mixed module depths.

The construction features a second chamber, a sucking plenum, below the fan tray blowers which allows tight space free mounting above a heat exchanger.

Static pressure at 3000 RPM:	Blower type 1134 574	8 mm H_2O column
	Blower type 1450 352 (Super Blower)	14 mm H_2O column
Max. Speed of Rotation:	>3000 RPM	
Power Consumption per Blower:	Blower type 1134 574	6-8W typical
	Blower type 1450 352	12-15W Typical
Start up Current:	Limited by soft start circuit	
Operating Voltage:	Fan tray 30VDC, internal Blowers 0-24VDC,	

Most gainful Operating Range:	Blower type 1134 574	100-160m^3/h,	2- 3,8mmH_2O
	Blower type 1450 352	180-320m^3/h,	4- 5mmH_2O
Operating Temperature:	0... 70°C		
MTBF:	>65 000 h at 40°C ambient, > 85 000 h at 25°C ambient		

Blower efficiency



Typical pressure- volume curves per blower

APPENDIX E: VME 64x Backplane, Situation of Power Bugs