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The following are the standard Factory settings for the present module:

Channel Polarity: Negative

MXVSET Trimmer: 6 kV (6 V test point readout)

ISET Trimmer: 1 mA (1 V test point readout)

VSET Trimmer: 0 kV (0 V test point readout)

1. DESCRIPTION

1.1. FUNCTIONAL DESCRIPTION

The CAEN Model N472 is a 4 CHANNEL HIGH VOLTAGE POWER SUPPLY housed in a 2-unit wide NIM module.

Each module consists of four High Voltage channels; each channel is able to supply an output Voltage from 0 up to ± 3 kV, 3 mA, or up to ± 6 kV, 1 mA. The User can change the polarity of the desired channels by following the simple instructions in paragraph 3.2. The selected channel polarity is shown by the relevant LEDs on the front panel.

All channels have individual settings and feature test points and a connector for the individual monitoring of Voltages and Currents. The setting of the output Voltages can be done locally, via front panel trimmers, or remotely, via analog signals into a front panel connector. The setting of the output maximum Voltages and Currents can be done only locally, via front panel trimmers.

Each channel can be switched ON or OFF via front panel switches and can be switched ON remotely via a TTL low level (or a short circuit connection to Ground) in the relevant connectors "RON". The H. V. output enable is in common for all channels and can be done via a front panel switch or via a TTL low level in the relevant connector "DISABLE". This feature allows to disable the High Voltage output also if the cable providing the TTL level is removed.

A "STATUS" connector for each channel provides a short-circuit-type flag in case of Voltages or Currents that reach the maximum set.

The module can be powered on either by the NIM crate or with 110 or 220 V AC, via a back panel Standard European connector.

N. B. If 110 V or 220 V power is selected, the module needs appropriate cooling.

Its wide range of Current and Voltage along with a simple operation and monitoring make it very useful for powering the full spectrum of detectors used in the modern Physical research, such as photomultipliers (PMs), wire chambers, streamer tubes and so on. The module is flexible enough to be adequate both for the lab tests, where simple manual operation of a limited number of channels is often required, and for a small experimental setup.

2. SPECIFICATIONS

2.1. EXTERNAL COMPONENTS

CONNECTORS

- No. 1, "DISABLE", LEMO 00 type. Connector for the High Voltage outputs ENABLE signal.
- No. 4, "RON", LEMO 00 type, one per channel. Connectors for the REMOTE ON of each channel.
- No. 4, "RVSET", LEMO 00 type, one per channel. Connectors for the remote Voltage setting for each channel.
- No. 4, "IMON/VMON", LEMO self-locking round multipin, ERA.0S.302.CNL type, one per channel. Connectors for the Voltage and Current monitoring for each channel.
- No. 4, "STATUS", LEMO self-locking round multipin, ERA.0S.302.CNL type, one per channel. Connectors for the status monitoring for each channel.
- No. 4, "1" to "4", High Voltage, SHV R317-580 type. Back panel connectors for the High Voltage output channels.
- No. 1, Standard European Socket with RF Filter and Fuse, for the Mains power supply.

DISPLAYS

- No. 1, "POWER ON", red LED. It lights up when the Main Power is ON.
- No. 1, "DISABLE", red LED. It lights up when the H. V. output is disabled.
- No. 4, "ON", red LEDs, one per channel. Light up when a H. V. channel is ON.
- No. 4, "POLARITY +", green LEDs, one per channel. Light up when a H. V. channel is in Positive polarity.
- No. 4, "POLARITY -", yellow LEDs, one per channel. Light up when a H. V. channel is in Negative polarity.
- No. 4, "MXVSET", red LEDs, one per channel. Light up when a H. V. channel output reaches the maximum Voltage setting.
- No. 4, "ISET", red LEDs, one per channel. Light up when a H. V. channel output reaches the maximum Current setting.
- No. 4, "STATUS", red LEDs, one per channel. Light up when a H. V. channel output reaches the maximum Current or Voltage setting.

SWITCHES, TRIMMERS, TEST POINTS

- No. 1, "POWER ON", Lever switch, to power ON the module.
- No. 1, "DISABLE", Lever switch, to enable the H. V. output on all channels.
- No. 4, "ON/OFF", Lever switches, one per channel, to switch ON each H. V. channel.
- No. 4, "MXVSET", Trimmers, one per channel, for the Maximum Voltage setting.
- No. 4, "ISET", Trimmers, one per channel, for the Maximum Current setting.
- No. 4, "VSET", Trimmers, one per channel, for the Local Operating Voltage setting.
- No. 4, "MXVSET", Test points, one per channel, for the Maximum Voltage monitoring.
- No. 4, "ISET", Test points, one per channel, for the Maximum Current monitoring.
- No. 4, "VSET", Test points, one per channel, for the Local Operating Voltage monitoring.
- No. 1, "GND", Test point, for the Ground reference.

2.2. INTERNAL COMPONENTS

JUMPERS

- No. 1, "220 / 110 / NIM", 4 pin jumper selector for the module's Main Power selection.

2.3. POWER REQUIREMENTS

220 V	0.6 A
110 V	1.2 A
+24 V	1.6 A
-24 V	1.6 A

2.4. CHARACTERISTICS OF THE SIGNALS

INPUTS:

- DISABLE: TTL level, active low. Works only when the DISABLE switch is in its leftmost position.
- RON: TTL level, active low.
- RVSET: Voltage level, -6 to +6 V (1 kV/ V setting), 100 k Ω impedance.

OUTPUTS:

- VMON: Voltage level, 0 to ± 6 V (1 V/ kV readout, same polarity as channel).
- IMON: Voltage level, 0 to ± 3 V (1 V/ mA readout, same polarity as channel).
- VSET (Test Point): Voltage level, 0 to +6 V (1 V/ kV readout, positive polarity).
- ISET (Test Point): Voltage level, 0 to +3 V (1 V/ mA readout, positive polarity).
- MXVSET (Test Point): Voltage level, 0 to +6 V (1 V/ kV readout, positive polarity).
- STATUS: Short Circuit when not active.

- HIGH VOLTAGE OUTPUTS:

- High Voltage range: 0 \div ± 6 kV, 1 mA (0 \div ± 3 kV, 3 mA) maximum output Current.
- Polarity: positive or negative, User selectable as described in section 3.2.
- HV accuracy: $\pm 1\%$ from 10% to 90% of Full Scale Range.
- Ripple (NIM supply): ≤ 30 mV pp at full load (3 kV, 3mA).
- Ripple (Mains supply): ≤ 150 mV pp at full load (3 kV, 3mA).

- MONITOR OUTPUTS:

- VMON accuracy: $\pm 1\%$ from 10% to 90% of Full Scale Range.
- IMON accuracy: $\pm 2\%$ from 10% to 90% of Full Scale Range.
- MXVSET accuracy: $\pm 1\%$ from 10% to 90% of Full Scale Range.

2.5. GENERAL

- Max Delivered Power: 9 Watt per channel.
- Humidity range: 0 \div 80%.
- Operating temperature: 0 \div 45° C.
- Weight: 2.1 Kg.

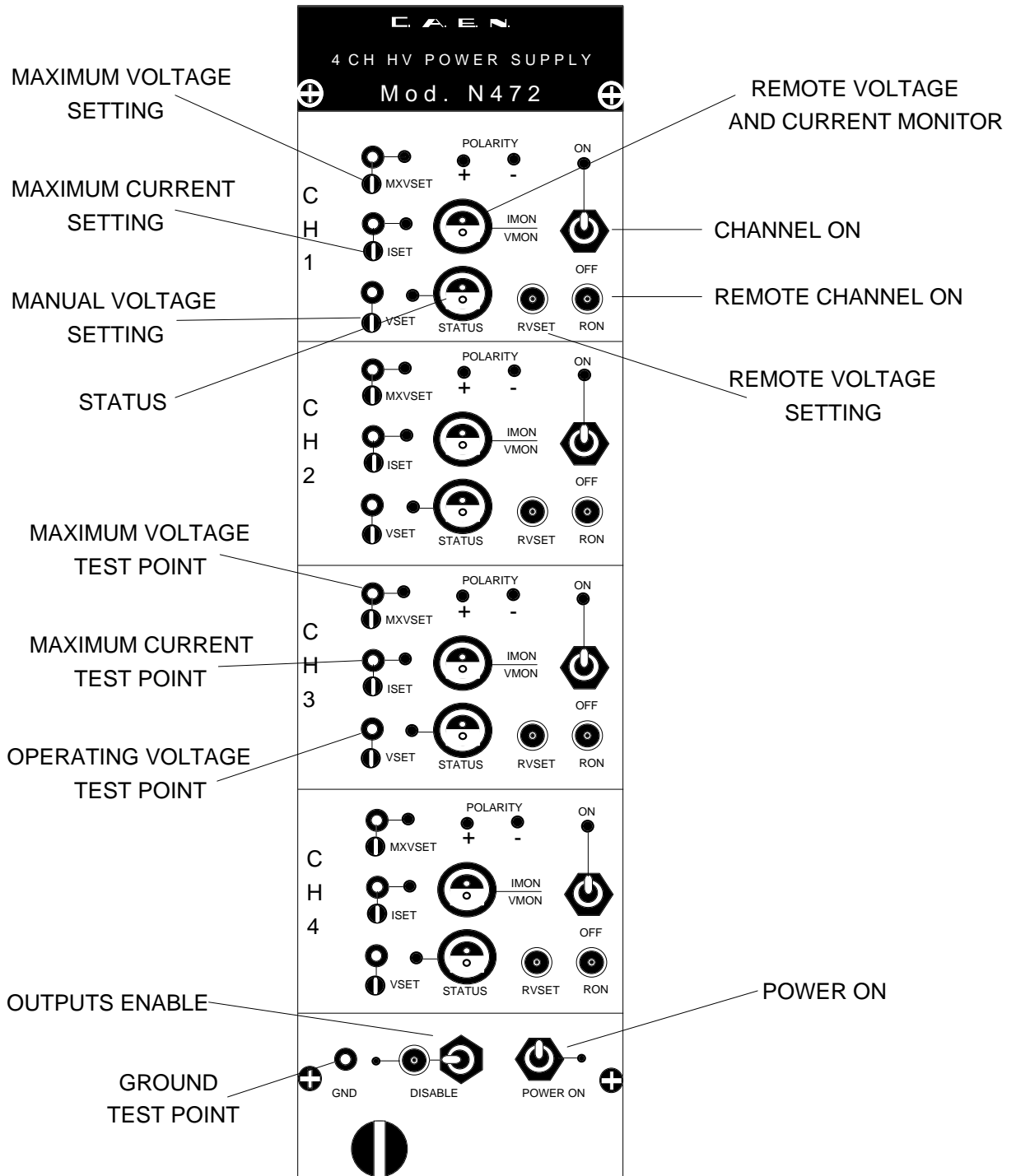


Fig. 2.1: Mod. N472 Front Panel

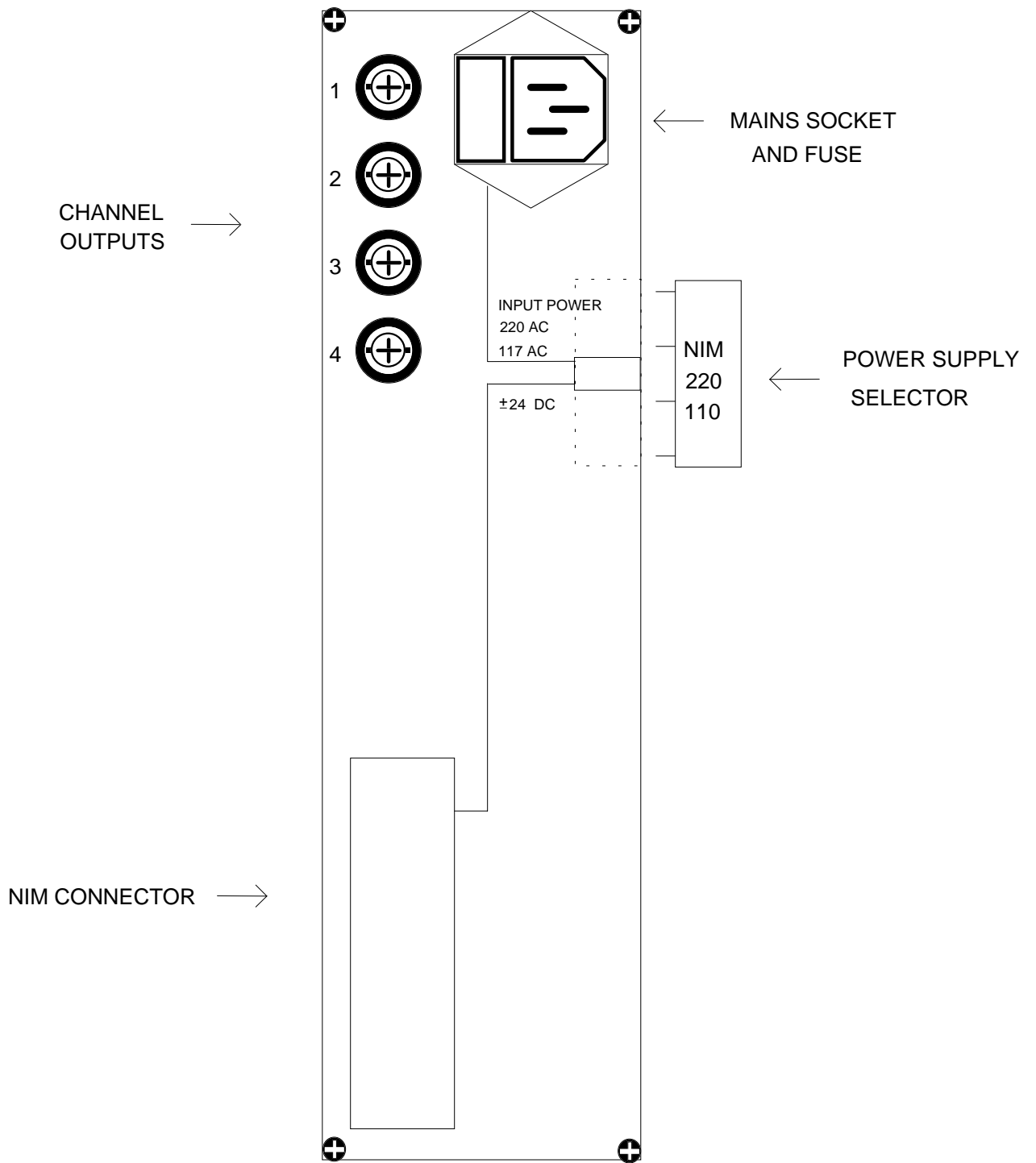


Fig. 2.2: Mod. N472 Back Panel

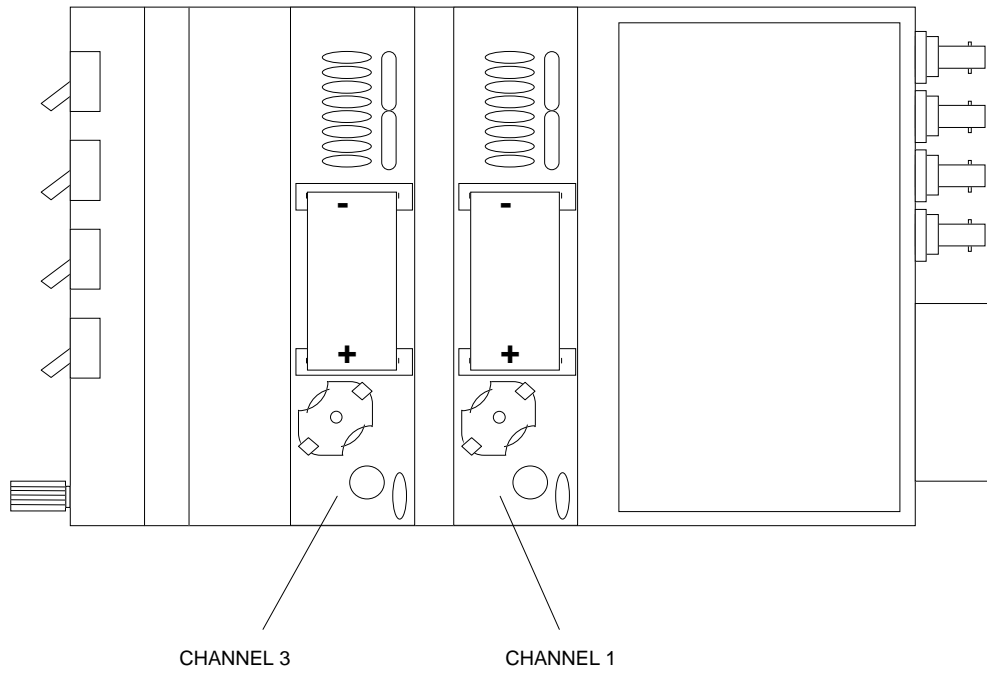


Fig. 2.3: Mod. N472 components locations (left side)

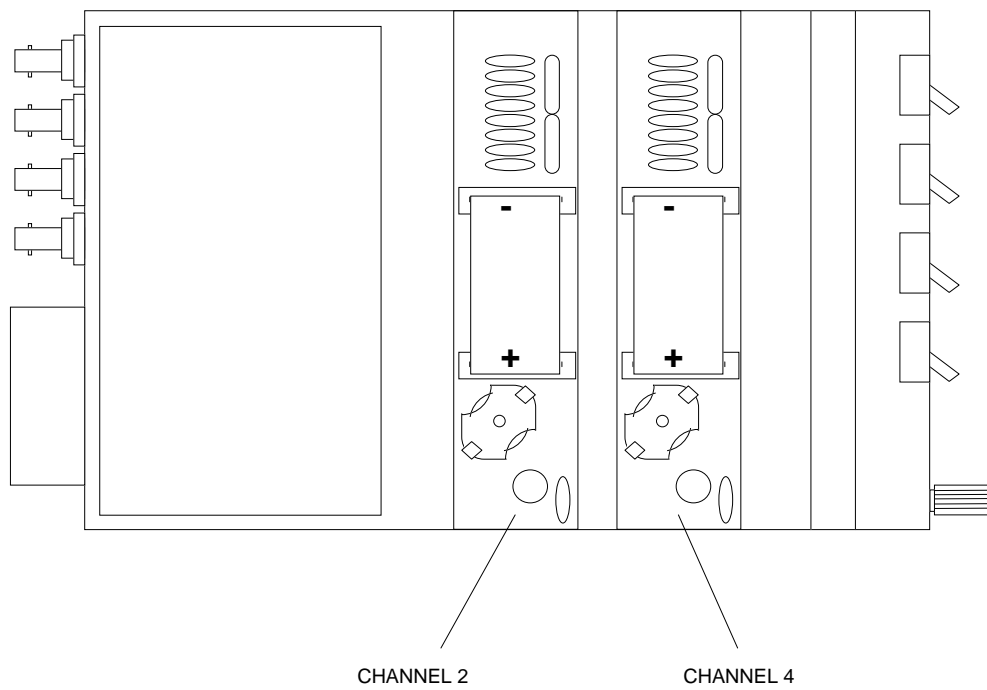


Fig. 2.4: Mod. N472 components locations (right side)

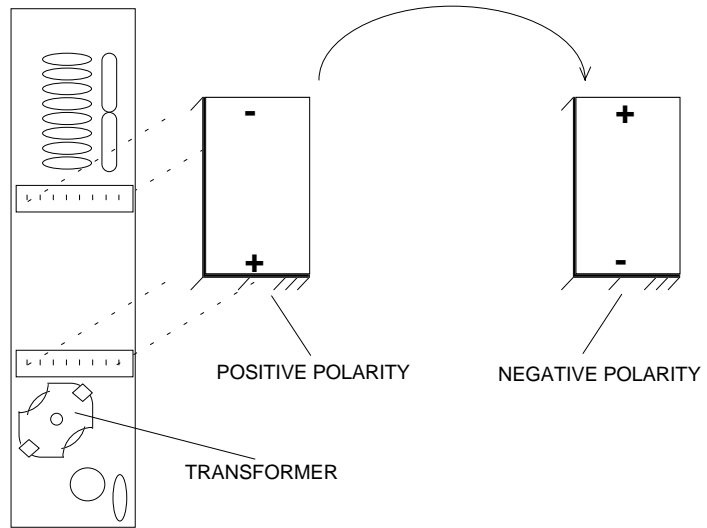


Fig. 2.5: Mod. N472 polarity selection (one channel)

3. OPERATING MODES

3.1. GENERAL INFORMATION

Each module consists of four High Voltage channels; each channel is able to supply an output Voltage from 0 up to ± 6 kV, 1 mA. The User can change the polarity of the desired channels by following the simple instructions in the following Section. The selected channel polarity is shown by the relevant LEDs on the front panel.

3.2. POLARITY SELECTION

The Model N472 allows the User to select the High-Voltage polarity with simple operations that are detailed in this Section. Note that the polarity is indicated by two LEDs for each channel on the front panel.

1. In order to change polarity, switch off the unit, remove the Mains plug and all the High Voltage cables and wait for the complete discharge of the capacitors, then remove the side covers thereby making access to the Printed Circuit Boards.

WARNING! Any attempt to operate inside the Module without turning OFF, unplugging all plugs and cables and waiting for 5 minutes, can be lethal.

2. Lay down the unit, NIM crate connector on the right and the front panel on the left, and refer to Fig. 2.3. The High-Voltage block houses two of the four multipliers of the channels (CH3 and CH1) and bears a "High-Voltage Danger" label. The cover of each multiplier is fixed to the base through two screws; remove the screws and the cover. The multiplier will appear as shown in Fig. 2.3 (for the polarity selection of channels CH2 and CH4 lay down the unit, NIM crate connector on the left and the front panel on the right as in Fig. 2.4, and follow the instructions hereafter). The multiplier base is accessible to the User. The front panel "POLARITY" LEDs indicate the correct polarity for each channel. Remove the multiplier base, rotate it by 180° and insert it back in its position.

3. Configure the unit to satisfy your requirements: if desired, it is possible to mix positive and negative channels in the same unit. If the polarity of one or more channels must be changed, extract the base from its contacts and insert it in the opposite position.

4. Reassemble the unit.

3.3. FRONT PANEL SETTINGS

The module can be powered on either by the NIM crate or with 110 or 220 V AC, via a back panel Standard European connector. The Mains supply selection can be done by means of a 10 pin jumper located on the internal side of the back panel: this jumper can be accessed by removing the side cover. A window in the back panel shows the selected power supply.

Once the User has selected the desired polarity of the channels and the Mains supply, the module can be powered ON via the POWER ON switch. A red LED will be lit when the Power is ON.

N. B. If 110 V or 220 V power is selected, the module needs appropriate cooling.

To set manually a certain output Voltage on a channel, the User should turn the "VSET" trimmer for that channel: a clockwise turn increases the Voltage, an anti clockwise turn decreases the Voltage setting. The relevant test point provides a Voltage proportional to the output Voltage at the rate of 1 V/ kV, i. e., if the test point shows a 2.9 V level, the output Voltage will be 2.9 kV.

The output Voltage can also be set remotely via a front panel connector "RVSET": an input Voltage on this connector will result in an output Voltage at the rate of 1 kV/V, with the chosen polarity. In this case, the trimmer "VSET" should be turned completely anti clockwise for a completely remote setting. In fact, the output High Voltage setting depends on the algebraic sum of the VSET setting (from 0 to +6 V) and the RVSET input Voltage (from -6 to +6 V) at the rate of 1 kV/V. This sum MUST in any case be positive.

N. B.: the "RVSET" connector has a 100 k Ω impedance, so for correct H. V. setting the input Voltage must be provided to this connector with a low impedance generator.

To set manually a certain maximum output Voltage on a channel, the User should turn the "MXVSET" trimmer for that channel: a clockwise turn increases the maximum Voltage, an anti clockwise turn decreases the maximum Voltage setting. The relevant test point provides a Voltage proportional to the output maximum Voltage at the rate of 1 V/ kV.

To set manually a certain maximum output Current on a channel, the User should turn the "ISET" trimmer for that channel: a clockwise turn increases the maximum Current, an anti clockwise turn decreases the maximum Current setting. The relevant test point provides a Voltage proportional to the output maximum Current at the rate of 1 V/ mA.

After the User has set the chosen operating parameters, He/She can switch ON the desired channel with the front panel "ON/OFF" switch.

Each channel can also be switched ON remotely by means of a TTL low level (or a short circuit to Ground) into the "RON" connector for that channel. This feature allows to disable the High Voltage output also if the cable providing the TTL level is removed.

N.B.: In order to obtain a High Voltage output, the "RON" connector MUST be shorted to GROUND (e.g. with a 50 Ω termination), otherwise no output will be obtained.

The High Voltage output enable is in common for all channels, and can be done either locally via a front panel DISABLE lever switch (in the rightmost position), or remotely by means of a TTL low level (or a short circuit to ground) into the contacts of the "DISABLE" connector (lever switch in the leftmost position). Also this feature allows to disable the High Voltage output also if the cable providing the TTL level is removed.

A front panel connector, "IMON/VMON" provides for each channel two monitoring Voltages, positive or negative according to the polarity of the channel, proportional respectively to the output Voltage (1 V/kV) and to the output Current (1 V/mA).

A front panel connector and relevant LED "STATUS" provides for each channel a short-circuit between the two contacts of the connector in case of proper functioning of the channel (LED is NOT lit). The short-circuit is opened to flag the occurrence of an overvoltage or an overcurrent (LED is lit).

