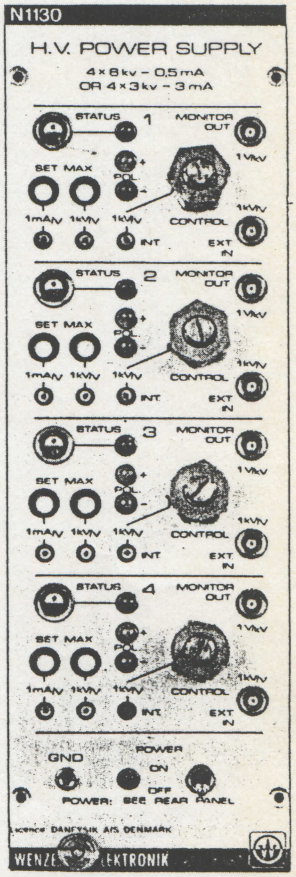
2 or 4 CHANNEL
6 KV VOLTAGE SUPPLY

TYPE
N 1130

- 2/12 NIM Module
- 2 or 4 independent High Voltage Channels
- Modular assembly internally for ease of servicing



Each Channel incorporates

- High Voltage 0.1 - 6 kV
- Current 0-3 mA to 3 kV reducing to 0,5 mA at 6 kV
- Independent polarity-internally selectable
- HV output continuously variable by 10 turn potentiometer or by analogue control input 0 - 6 V.
- Analogue and status outputs
- Adjustable limits for voltage and current
- High stability - low ripple
- Input power - switch selectable $220V_{AC}$, $117V_{AC}$ or $24V_{DC}$
- HV Output with gradual rise/fall time

The 2 or 4 channel 6 kV High Voltage Power Supply N1130 is designed to use with multi - wire proportional chambers and photomultipliers and for many other applications. The analogue and digital control outputs and analogue inputs allow the use of the N1130 in computer controlled as well as standard experiments.

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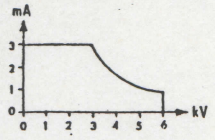
TECHNICAL DATA (each channel)[2]

Output voltage	0.1 to 6,0 kV via SHV high voltage connector on rear panel
Polarity	Positive or negative as selected by internal switch and displayed on front panel by LED's
HV setting	
a) Internal control	Full output range continously controlable by 10-turn potentiometer with locking knob and set point monitor on front panel; (+ 1V/kV, accuracy $\pm$ 1%) (3)
b) External control	Analogue voltage input to control summing point via LEMO connector on front panel; (1V/kV, accuracy $\pm$ 1%, input impedance 30 kohm)
Output current	0 to 3.0 mA up to 3.0 kV de-rated to 0.5mA at 6.0 kV 
Voltage limit	adjustable from 0.1 to 6.2 kV by single turn potentiometer with set-point monitor on front panel; (1V/kV, accuracy +10/-0 %). (3)
Current limit	adjustable from 50 μA to 3.2 mA by single turn potentiometer with set-point monitor on front (1V/mA, accuracy $\pm$ 5%) (3)
Status output	normally closed contact opens when either voltage limit, current limit or output rate circuit is activated. Available through LEMO connector on front panel. LED extinguishes simultaneously.
Status indication	LED on front panel in parallel with status output
Regulation	No load to full load $\leq \pm 2 \times 10^{-4}$ $\pm$ 1% NIM supply variations $\leq 0.5 \times 10^{-4}$ $\pm$ 10% line variation $\leq 2 \times 10^{-4}$
Temperature Coefficient	Ambient temperature range 0-50°C. When 220 or 117 V_{AC} input is used forced air cooling is recommended. Output temperature coefficient $\leq 10^{-4}$/°C.
Stability	Over 24 hours after warm up $\leq 5 \times 10^{-4}$ Over 1 month $\leq 10^{-3}$
Noise and ribble	less than 100 mVpp or 10^{-4} whichever is greater.
Output monitor	a) Voltage: output from internal voltage divider via LEMO connector on front panel. 1 V/kV, same polarity as output, accuracy $\pm$ 0.1 % (typ. $\pm$ 0,02%). Output Impedance 10 ohm, short circuit proof, max. current 100 μA.
	b) Current: 1 V/mA, accuracy $\pm$ 1 % Input Impedance 1 kohm
	a) and b) on the photograph a single lemo connector is shown. Units will be delivered with a double Lemo connector.
Output rate control	By switching on, by control voltage steps or by recovery from overload the rate of output voltage changes is limited to 1 kV/sec. Overshoot when reaching the desired voltage is less than 50 V (resistive load).
Short circuit current	The outputs are short-circuit proof. Current as set by current limit, after discharge of 27 nF internal capacitor through a 100 ohm stop resistor.
Power	Mains: 220 V_{AC} $\pm$ 10% 0.4A via standard AC mains plug.
	NIM power: 117 V_{AC} 0.8A or $\pm$ 24 V_{DC} 1.1A.
	As selected by three position rear panel control.
Dimensions	2/12 NIM unit.

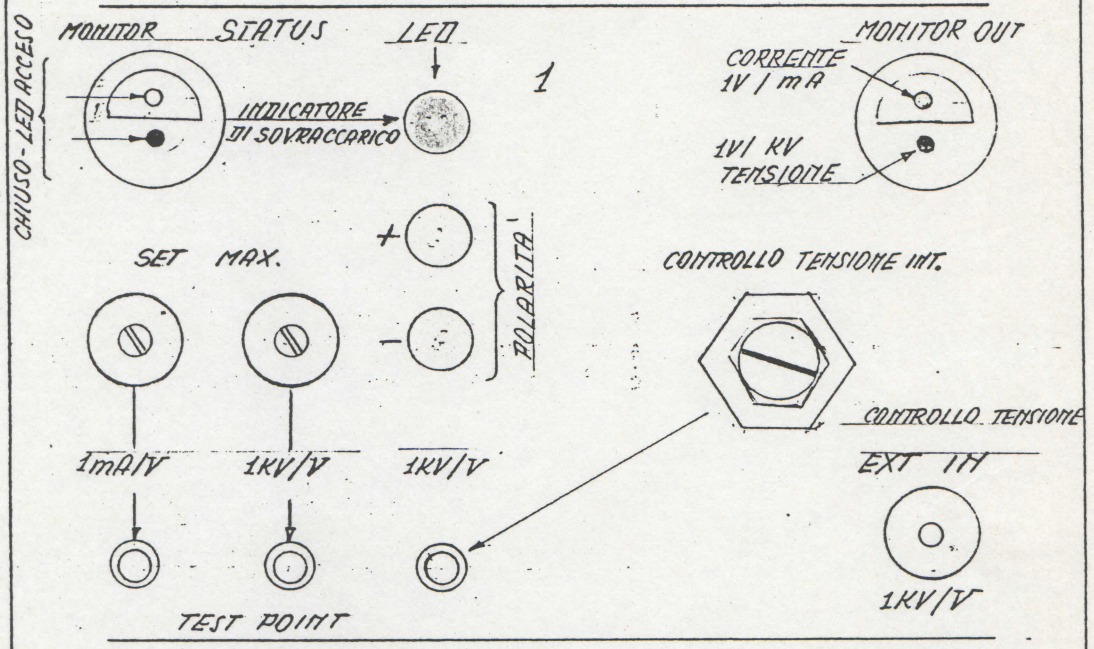
1) Licenced by DANFYSIK A/S, Denmark.

2) Meets specifications as required by CERN.

3) Use a high impedance instrument (Z_{IN} > 200 kohm). Short of test point can activate overload circuit and/or reduce output voltage.

HV POWER SUPPLY WENZEL

TYPE 1130



HIGH VOLTAGE POWER SUPPLY N1130

consisting of 4 individually regulated outputs in one 2/12 NIM module.

Specifications per output

Output voltage (pos. or neg.):	0.1 - 6 kV
Output current capability:	3 mA at 3 kV 0.5 mA at 6 kV
Output ripple:	less than 10^{-4} or 100 mV whichever is greater
Stability:	better than 5×10^{-4} for 24 hours
Temperature coefficient:	better than $10^{-4}/^{\circ}C$, over 0 - 50°C

Features:

a) Positive or negative output individually selectable
b) Internal or external reference setting
c) Automatic current limit circuit, adjustable 0.05 - 3 mA
d) Automatic voltage limit circuit, adjustable 0.1 - 6 kV
e) Fully short circuit protected
f) Monitor output 0.1 - 6 V (1 : 1000)
g) Status indication: overload/normal operation
h) Rate control on output voltage 1 kV/sec.
i) Max. overshoot on output voltage 50 Volts

Input power, common for all 4 outputs

Voltage selector between:

a) $\pm$24 V DC from NIM crate (1.1 Amp)
b) 117 V AC from NIM crate (0.8 Amp)
c) 220 V AC from LINE (0.4 Amp)

The DANFYSIK N1130 high voltage power supply is designed as a high frequency (approx. 25 kHz) supply in which energy from a primary circuit is stored as magnetic energy in a high reluctance core transformer which transfers its stored energy as electrical energy into a secondary coil equipped with the rectifying and filtering circuits necessary to obtain a DC output voltage of low ripple.

The design principle of the supply makes it inherently short-circuit proof, and ensures a very high power efficiency (low loss in the low to high voltage conversion unit) over a very wide of voltage current range, illustrated by curve fig. 1.

Main description of the N1130 high voltage power supplies

Each 2/12 NIMBmodule contains four (4) independent power supplies which can operated within the voltage range 100 V to 6 kV maintaining the voltage and ripples specified in the general specifications sheet.

Input power to the four supplies contained in one unit can be 220 V AC 50 - 60 cycles, 117 V AC 50 - 60 e/s or $\pm$24 V DC (both polarities supplied).

The 117 V AC and the $\pm$24 V DC will be available when the unit is inserted in a NIMB crate equipped with a standard NIMB power supply.

If 220 V AC powering is wanted it has to be supplied separately to the 3 terminal plug located centrally on the rear panel of the unit. The central connector of the plug is a ground terminal while upper and lower terminals are for 220 V AC input.

When looking at the rear panel of the unit (from the rear end) the 4 high voltage output connectors are located at the top of the panel. The 220 V AC connector is located in the central left side of the panel and below it is located a 0.8 A slow blow fuse in the input terminals of the 220/117 V supply lines. However, each of the four supplies are equipped with a separate fuse located on the respective circuit boards.

In case any of the four HV supplies should develop a malfunction causing a major increase in its current consumption this fuse will blow and in most cases no interference with the proper functioning of the other supplies in the cassette will occur.

NB : If primary input power is taken from the 117 V or 220 V AC lines, a major short-circuit in one supply might blow the common input fuse for all 4 supplies in one cassette.

A standard NIMB bin connector is mounted on the lower rear panel according to NIMB standards.

An interconnecting power in plug is located on the inside of the panel. This plug, dependent on its vertical position, will connect the four HV supplies to a common input voltage supply, the voltage of which will be indicated in a slotted window in the central right side of the rear panel.

Only the power terminals indicated in this window are connected, and there is no need for disconnection of power terminals not used.

If a change of input power source is wanted, the plug is pulled out of its socket and reinserted in a position, indicating in the window the supply voltage preferred.

NB: It is recommended that this operation is performed with the cassette disconnected from input power lines.

A surge limiting circuit is inserted in the $\pm$24 V DC input lines, in order to prevent possible inadvertant cut out of the NIMB supply.

Output control of the HV supplies

Front panel:

The front panel is devided in five sections vertically (fig. 3). The lower section is common to all four supplies and contains an input power on/off switch, an indicator lamp which will be lit when input power is on, and a ground terminal.

The four devisions are identical and each is related to one HV supply.

Within one devision there are three connectors which makes possible continuous monitoring of

1. "status" condition
2. actual output voltage
3. input reference voltage

The upper signal light will be lit and the two contacts in the "status" connector are shorted as long as the supply is properly working within the preset max. voltage and max. current envelope. The high voltage supplies have a built-in slew rate of approx. 1 kV/sec. In case there is a sudden change in output voltage requirement, the status indication will indicate outside range until the output voltage is within $\pm$6 Volts of the requested voltage.

This status will also be indicated for a few seconds after main power has been turned on.

The output from the "monitor out" connector is tapped from the HV measuring resistor and will monitor the actual output voltage of the supply.

The connector labeled "ext. in." makes possible external

(or remote) output voltage control by means of a suitable reference voltage source.

The external reference voltage supply should be "floating", as a general rule.

NB : Please, remember that the ripple and drift of the HV supply will not be lower than that of the reference voltage!

The input impedance of the "ext. in." connection is 29.4 K , and 1 V input is required per 1 kV out.
Without external control input, the output voltage is set by the built in ten-turn potentiometer which is mounted on the front panel and labeled "control". The reference voltage from this potentiometer is directly added to a voltage supplied to the "ext. in." connector.

The voltage supplied by the built in ten-turn potentiometer can be checked on the right test point labeled "1 kV/V INT.".

Two single turn potentiometers labeled "set max." are used for presetting the maximum voltage output and the maximum output current limits wanted. It is recommended to set these limit e.g. 10 % higher than the max. values wanted. In case a smaller margin is wanted we recommend to measure the actual output voltage on the "monitor out" connector, and with the actual load connected to the HV output terminal.

The set max. potentiometers are turned left until a drop in output voltage is observed. The potentiometer are turned slightly to the right in order to lift the max. limits slightly above the voltage and current outputs needed.

Be aware that the voltages measured on the test points are

Be aware that the voltages measured on the test points are reference voltages which can be set regardless of actual output from the HV supply, and that these voltages do not give any direct information about a possible malfunction of the supply.

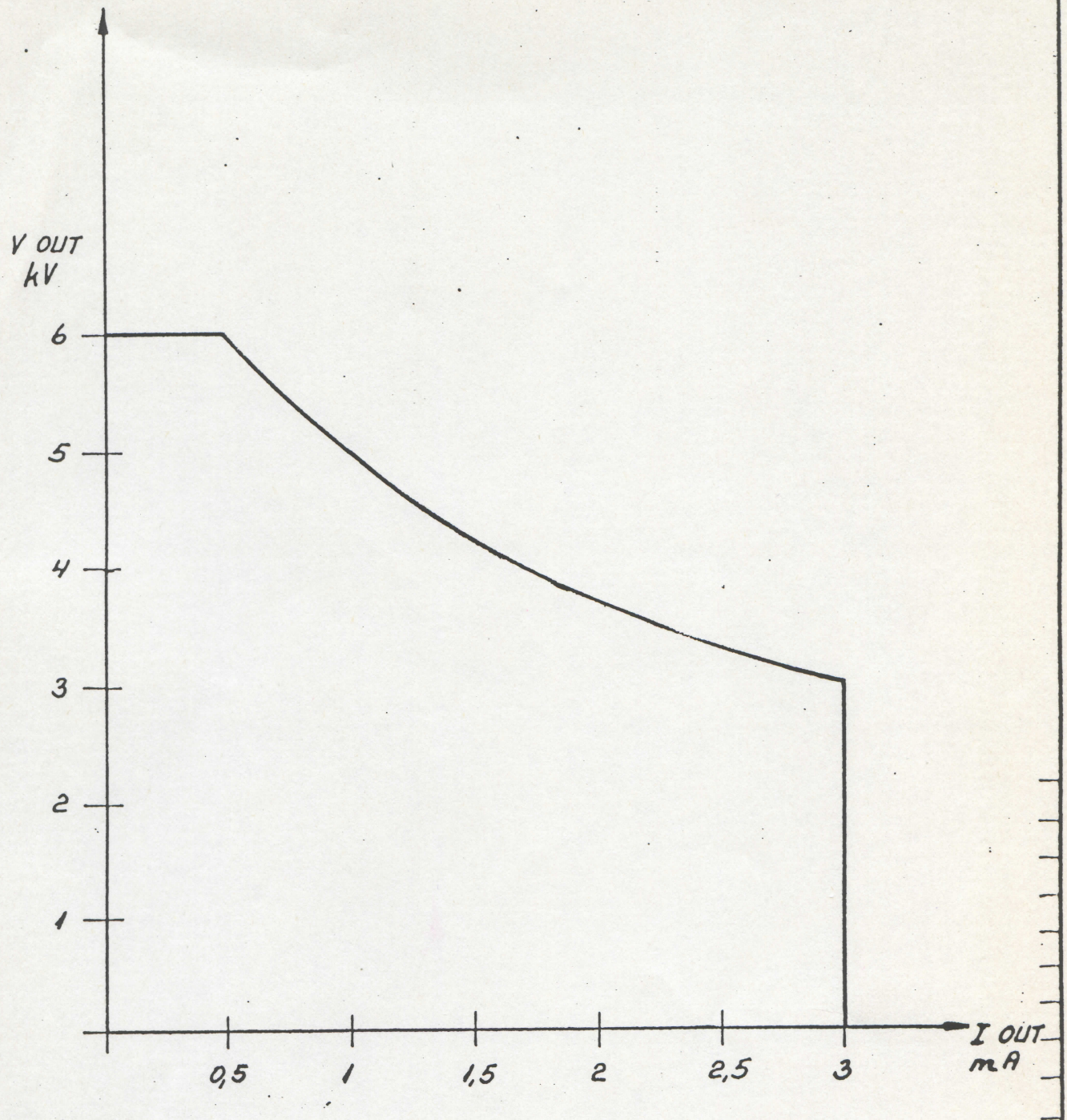
Measurements on the test points should be done with a voltmeter with an input restance of at least 20 k .

High voltage output polarity

Output polarity of each supply is indicated by either of two signal lights on the front panel. If the opposite polarity is wanted whis can be changed in the following way:

1. The NIMB cassette is removed from the crate.
2. Dependent on which one of the four supplies either the top or bottom cover is removed.
   Inside the cover are located two square (one for each supply) "switch boards". The switch board of the supply in question is lifted off its connecting pins and a small toggle switch which mates with a small notch in hedge of the square board is switched to the opposite position, the board is then rotated 90^{o} around its vertical axis and pressed back on the connecting pins.

   NB : Be careful not to bend the connecting pins when manipulating the switch board. Switch boards for supplies 1 and 2 are located at the bottom, and for supplies 3 and 4 at the top of the cassette.



NO.	ITEM	MATERIAL	QTY	ITEM NO.	DWG. NO.
REV.					
MACHINING:		SURF. TREATMENT:			

TOLERANCE:	HIGH VOLTAGE POWER SUPPLY N 1130 OUTPUT CAPABILITY	DRAWN BY 21/11.75. VN.
SCALE:		DESIGN APP.
		PROD. APP.
		PROJ. ENGR.
		SUPERSEDING DWG.
		SUPERSEDED BY