

Technical Information Manual

Revision n. 0
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MODELS

*SY527 HIGH VOLTAGE
BOARDS*

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CAEN will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal conditions or operations.

CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the User's Manual before any kind of operation.

CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.

1. INTRODUCTION

The CAEN UNIVERSAL MULTICHANNEL POWER SUPPLY SYSTEM, Model SY527, has been designed specifically to power the variety of detectors used in modern High Energy Physics Experiments, such as photomultipliers, wire chambers, streamer tubes, silicon detectors, etc.

The System is modular and flexible enough to be adequate both for big experiments, where a large number of channels are to be monitored by an on-line computer, and for test labs where simple manual operation of a limited number of channels is often desired.

The system is organized into "crates". Each crate is a 19" wide 8 U high euro mechanics rack; the modules bearing the output channels (Channels Boards) are realized in 6 U plug-in modules, the remaining 2 U is dedicated to house the system Fan Tray unit.

Up to 10 Channels Boards may be plugged into a single crate. Different plug-in modules are available (Positive, Negative, Floating or Distributor Boards) and can be freely mixed in a single system in order to obtain the necessary configuration.

Two voltage values (V0set, V1set) and two current limit values (I0set, I1set) can be programmed for each power channel. The switching from one value to the other is performed via two external (NIM or TTL) input levels (VSEL, ISEL).

The maximum rate of change of the voltage (Volt/sec), may be programmed for each channel. Two distinct values are available, depending on the sign of the change (Ramp-Up, Ramp-Down). Any attempt to change the voltage will result in a linear increase or decrease with time, the rate being determined by "Ramp-Up" or "Ramp-Down" parameter. This feature has been provided to protect those devices that could be harmed by a sudden voltage step-up.

For some Boards the ISET values of the channels represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Boards with programmable current hardware protections**).

Other Boards has the current hardware protection fixed to a value common for all the channels; the ISET values are used to signal a fault, but the channels can draw a current larger than their ISET values (**Boards with fixed current hardware protections**).

The following types of Boards are currently available:

Floating Power Supply Boards (See CAEN's "Floating P. S. Boards User's Manual")

Board Type	Ch.	Voltage full scale	Voltage Resolution	Current Full scale	Current Resolution	Current protection
A515	16	100 V	40 mV	200 μ A	50 nA	fixed (1 mA)
A516	8	12 V	10 mV	1.5 A	10 mA	programmable
A517	32	18 V	10 mV	10 mA	10 μ A	fixed (30 mA)
A518	16	12 V	10 mV	150 mA	40 μ A	fixed (170 mA)
A519	16	200 V	40 mV	40 μ A	10 nA	fixed (200 μ A)
A520	16	200 V	40 mV	1 mA	200 nA	fixed (1.2 mA)

High Voltage Positive/Negative Boards

Board Type	Ch.	Voltage full scale	Voltage Resolution	Current Full scale	Current Resolution
A732	12	6 kV	0.5 V	1 mA	1 μ A
A733A	16	2.5 kV	0.2 V	3 mA	1 μ A
A734	16	3 kV	0.2 V	3 mA ¹	1 μ A
A735	16	250 V	0.1 V	12 mA	1 μ A
A753	9	2.5 kV	0.2 V	13 mA	10 μ A
A832	12	6 kV	0.5 V	200 μ A	20 nA
A833A	16	2.5 kV	0.2 V	200 μ A	20 nA
A834	16	3 kV	0.2 V	200 μ A	20 nA
A835	12	1 kV	0.1 V	50 μ A	10 nA

Distributor Boards (See CAEN's "Distributor P. S. Boards User's Manual")
($\Delta V = 900$ Volt)

Board Type	Ch.	Voltage full scale	Voltage Resolution	Current Full scale
A932A	24	2.5 kV	200 mV	500 μ A
A933A	24	2.5 kV	200 mV	900 μ A
A933K	24	2.5 kV	200 mV	500 μ A
A934A	24	2.5 kV	200 mV	20 μ A

Other Board types are under development:

Floating Power Supply Boards

Board Type	Ch.	Voltage full scale	Voltage Resolution	Current Full scale	Current Resolution
A521	8	3 V	10 mV	3 A	10 mA

N.B.: All CAEN High Voltage boards are available as "POSITIVE" or "NEGATIVE". The NEGATIVE boards are indicated by a white circle surrounding the channels' SHV output connector, or a white line surrounding the Multipin output connector where used. This Manual shows only the front panels for the Positive Boards.

¹guaranteed on 14 channels only; slightly less on 16 channels.

2. HIGH VOLTAGE POWER SUPPLY BOARDS

2.1. MOD. A732 H.V. CHANNEL BOARD (6 kV, 1 mA)

The A732 12 CHANNEL. HIGH VOLTAGE (6 kV, 1 mA) Board houses 12 H. V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 6000 V. The maximum output current is 1 mA.

The Mod. A732 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.5 V steps and the ISET is programmable from 0 to the maximum in steps of 1 μ A.

For each channel a LED has been placed on the Front Panel Board to signal when the channel is ON.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same value in common for all the Board channels and this value can be read-out via software.

Each A732 channel is provided with two 2-pin connectors "EN" for twisted pair that disable the channel output when not connected to ground.

Each A732 channel is also provided with two 2-pin connectors "OVC" and "TRIP" for twisted pair. The OVC connector provides an Open Collector signal in case an overcurrent occurs on the relevant H. V. channel. The TRIP connector is an Open Collector: once at least one channel generates a Trip, all the channels connected to the latter via the TRIP connectors will trip themselves. The User can program, if desired, the same switch-off mode upon occurrence of a Trip for internal reasons (Internal Trip) or for external reasons, i.e. another channel in the chain has tripped (External Trip). Moreover it is possible to disable each channel to receive the TRIP IN signal. The TRIP signals remains until a CLEAR ALARM operation is performed.

2.1.1. MOD. A732 PACKAGING

8 TE wide. Height: 6U.

2.1.2. MOD. A732 EXTERNAL COMPONENTS

CONNECTORS

- No. 12, "CH0 ÷ CH11", SHVR317580 type connector, for the 12 H. V. channels' outputs.
- No. 12, "EN", 2-pin connectors for twisted pair.
- No. 12, "TRIP", 2-pin connectors for twisted pair.
- No. 12, "OVC", 2-pin connectors for twisted pair.

DISPLAYS

- No. 12, "ON0 ÷ ON11" red LEDs, signalling, when lit, that the corresponding channel is ON.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.1.3. MOD. A732 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative
Output Voltage:	0 ÷ 6000 V
Max. Current:	1 mA
Voltage Set/Monitor Resolution:	0.5 V
Current Set/Monitor Resolution:	1 μ A
VMAX software:	0 ÷ 6000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 100 mV (<50 mVpp @ 5000 V, 1 mA)
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\%$ ± 1 LSB (300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\%$ ± 1 LSB

2.1.4. MOD. A732 H. V. OUTPUTS CONTROL

Each A732 channel is provided with an "EN" input that disables the channel when the ground connection in the "EN" input is removed.

When the channel is disabled, the Voltage outputs of the channel (if ON) drop to zero at the maximum rate available.

This individual interlock acts on the channel like the SY527 front panel interlock: it sets to Off the Power parameter of its channel (see "*Output Voltage Control*" in the SY527 User's Manual). This causes the following:

- When the interlock condition is removed the channel remains Off.
- Any attempt to turn the channel On without removing the Interlock condition will result unsuccessful.

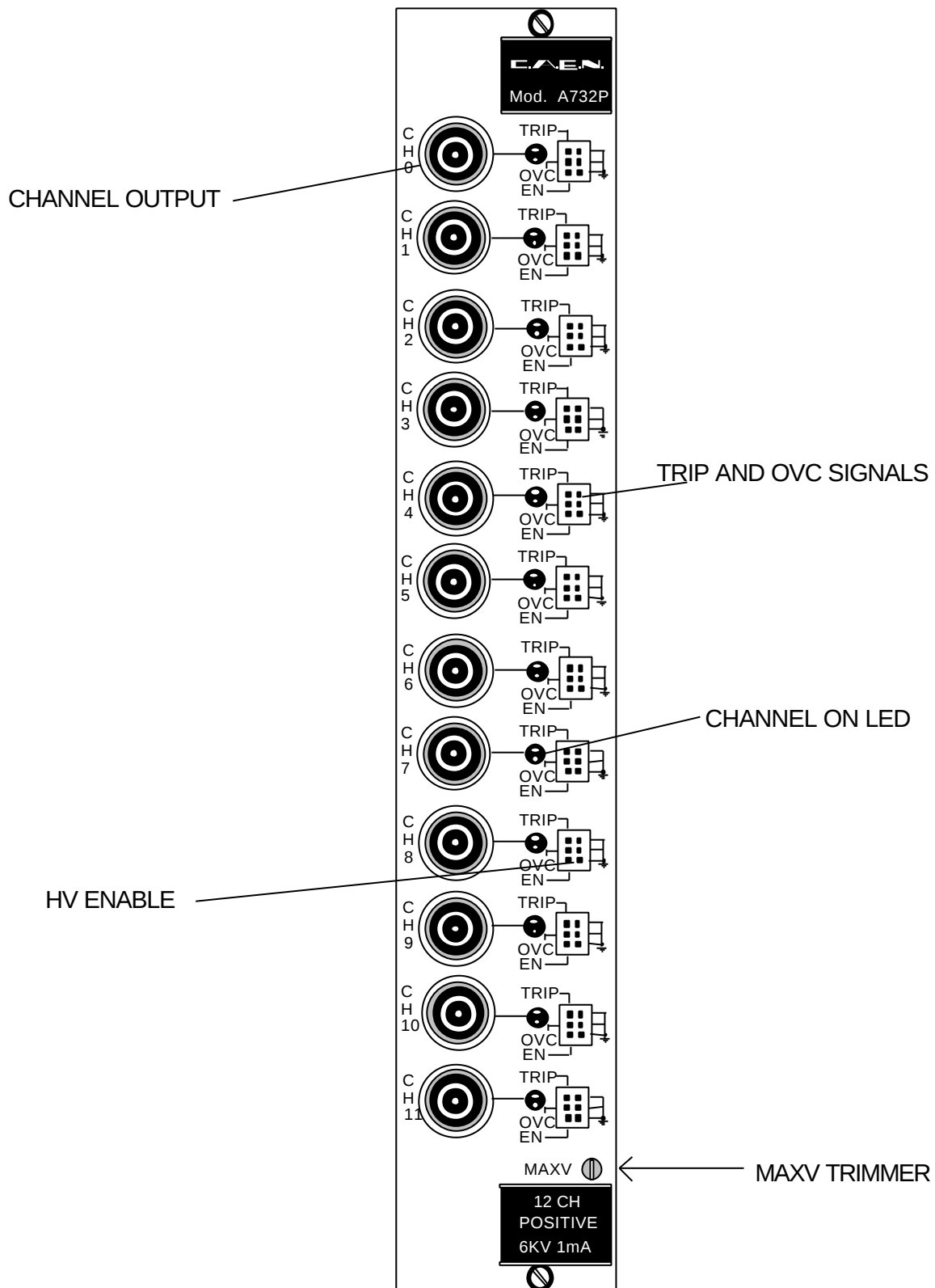


Fig. 2.1: Mod. A732P Front Panel

2.2. MOD. A733 A H.V. CHANNEL BOARD (2.5 kV, 3 mA)

The Mod. A733 A, 16 CHANNEL. HIGH VOLTAGE (2.5 kV, 3 mA) Board houses 16 H.V. channels. Each channel is capable to generate programmable voltage values in a range from 0 to 2500V. The maximum output current is 3 mA.

These Boards are provided with Multiconductor Block type connector for the H. V. outputs. The outputs polarity is indicated by P or N suffix (Model A733AP and A733AN).

The Mod. A733A ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 1 μ A to the maximum in steps of 1 μ A.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same value in common for all the Board channels and this value can be read-out via software.

The boards are provided with an H.V. Enable control to disable all the 16 channels when the "HV EN" contacts are opened (see Fig. 2.4).

On the Front Panel a red LED ("HV") lights up when the Board is capable to generate High Voltage on its outputs. It is not affected by the H.V. Enable control: it signals that the output channels may be active (it may be ON when the output channels are disabled).

2.2.1. MOD. A733 A PACKAGING

8 TE wide. Height: 6U.

2.2.2. MOD. A733 A EXTERNAL COMPONENTS

CONNECTORS

- No. 1, "HV OUT", Multiconductor Block-type female connector (20 positions AMP203909-2 type) for the 16 H.V. channels' outputs.
- No. 1, "HV EN", LEMO 00 type, 50 Ω connector.

DISPLAYS

- No. 1, "HV", red LED, signalling, when lit, that the High Voltage output can be present.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.2.3. MOD. A733 A CHANNEL CHARACTERISTICS

Polarity:	Positive: (Mod. A733AP) Negative (Mod. A733AN)
Output Voltage:	0 ÷ 2500 V
Max. Current:	3 mA
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	1 μ A
VMAX hardware:	0 ÷ 2500 V common for all the board channels
VMAX software:	0 ÷ 2500 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 30 mVpp (at 2500 V, 3 mA)
H. V. Output Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (from 300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB
H. V. Output Long Term Stability:	± 1 V

2.2.4. MOD. A733A H. V. OUTPUT CONTROL

The Mod. A733 A is provided with a H. V. Enable control that disables all the 16 channels when the "HV EN" contacts of the block connector are opened (see Fig. 2.4).

The same function is performed via the "HV EN" input that disables the channels when it is not connected to ground.

When the channels are disabled the Voltage outputs of the channels ON drop to zero at the maximum rate available.

When the output disable cause is removed, i. e. the "HV EN" contacts are connected together, the channels remain OFF until the User doesn't turn them ON via software.

If the connection is obtained via the H.V. cable on the board to be supplied, when the cable is not connected the outputs are automatically disabled. This protection scheme is described in Figure 2.4.

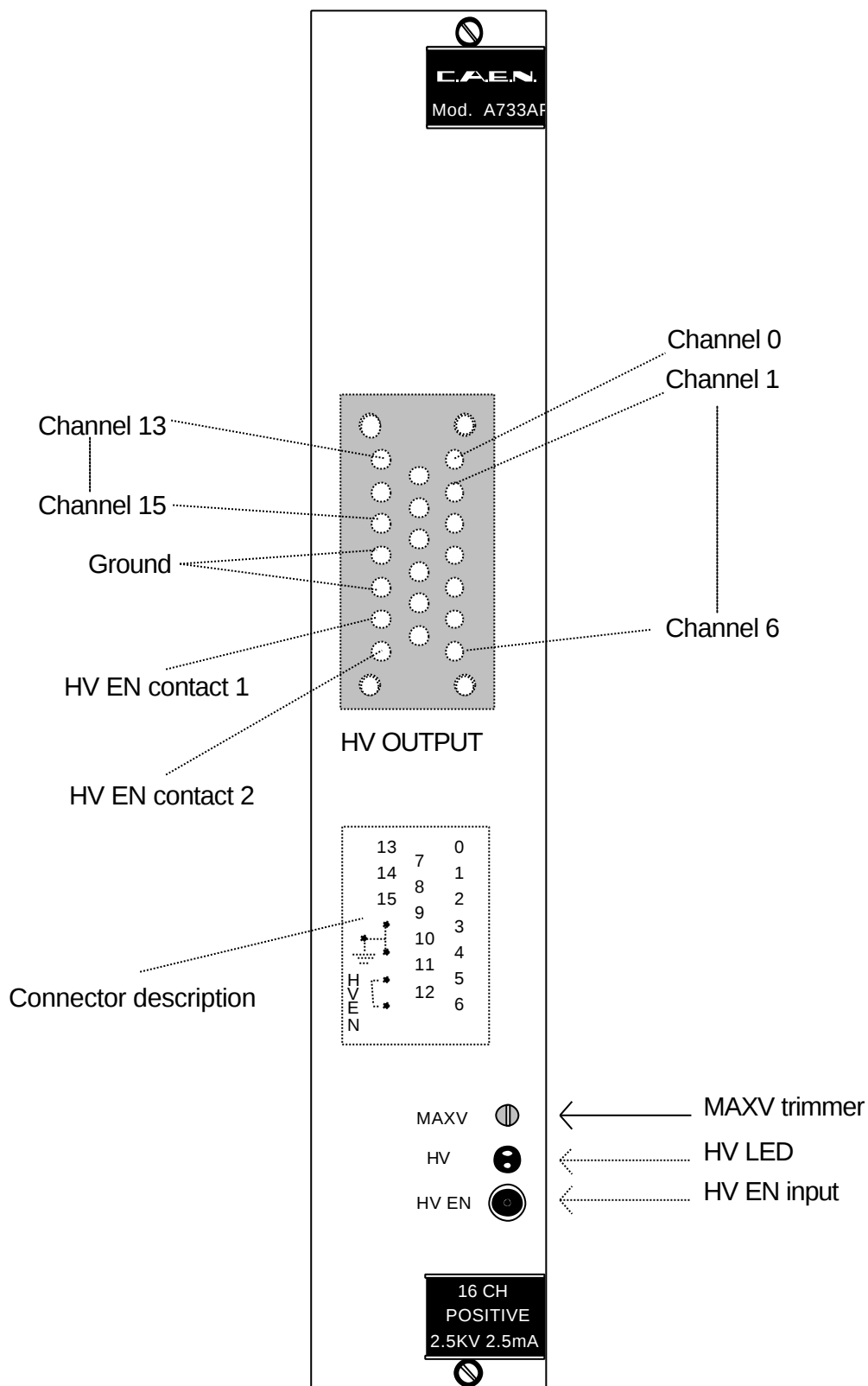


Fig. 2.2: Mod. A733AP Front Panel

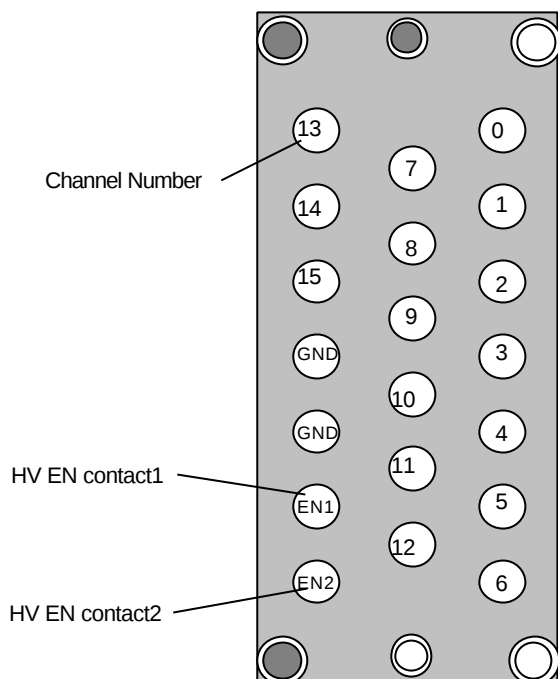


Fig. 2.3: Mod. A733A Block Connector Pin Description

The appendix A contains a complete description of the Block Connector components and of the recommended connector and hardware for the cable.

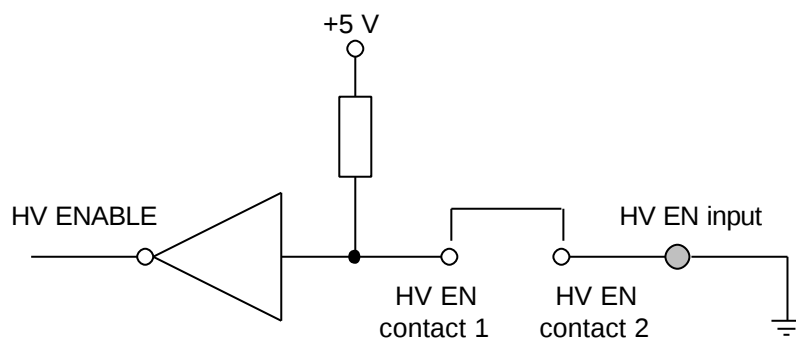


Fig. 2.4: Mod. A733A HV ENABLE Scheme

2.3. MOD. A734 H.V. CHANNEL BOARD (3 kV, 3 mA)

The Mod. A734, 16 CHANNEL HIGH VOLTAGE (3 kV, 3 mA) Board houses 16 H.V. channels. Each channel is capable to generate programmable voltage values in a range from 0 to 3000 V. The maximum output current is 3 mA, guaranteed on 12 full power channels. With a 16 channels operation, the maximum output current decreases to 2.7 mA on all channels. The outputs polarity is indicated by P or N suffix (Model A734P and A734N).

The Mod. A734 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 1 μ A to the maximum in steps of 1 μ A.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same common value for all the Board channels and this value can be read out via software.

The Mod. A734 is provided with an "HV EN" input that disables the channels when it is not connected to ground.

On the Front Panel a red LED ("HV") lights up when the Board is capable to generate High Voltage on its outputs. It is not affected by the H.V. Enable control: it signals that the output channels may be active (it may be ON when the output channels are disabled).

2.3.1. MOD. A734 PACKAGING

8 TE wide. Height: 6U.

2.3.2. MOD. A734 EXTERNAL COMPONENTS

CONNECTORS

- No. 16, "CH0 ÷ CH15", SHVR317580 type connector, for the 16 H.V. channels' outputs.
- No. 1, "HV EN", LEMO 00 type, 50 Ω connector.

DISPLAYS

- No. 1, "HV", red LED, signalling, when lit, that the Board is capable to generate High Voltage on its outputs.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.3.3. MOD. A734 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative (Mod. A734P and A734N)
Output Voltage:	0 ÷ 3000 V
Max. Current:	3 mA (guaranteed on 12 channels @ full power)
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	1 μ A
VMAX hardware:	0 ÷ 3000 V common for all the board channels
VMAX hardware accuracy:	$\pm 2 \%$
VMAX software:	0 ÷ 3000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 30 mVpp (at 2500 V, 2.5 mA)
Voltage Monitor / HV Out Accuracy:	$\pm 0.3\% \pm 2 \text{ V}$
Voltage Set / Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1 \text{ LSB}$
Current Monitor / Output Current Accuracy:	$\pm 2\% \pm 2 \mu\text{A}$
Current Set / Current Monitor Accuracy:	$\pm 2\% \pm 1 \text{ LSB}$
H.V. Out Long Term Stability:	$\pm 1 \text{ V}$

All parameters are referred to a range from 10% to 90% of full scale range.

2.3.4. MOD. A734 H.V. OUTPUT CONTROL

The Mod. A734 is provided with an "HV EN" input that disables the channels when it is not connected to ground.

When the channels are disabled the Voltage outputs of the channels ON drop to zero at the maximum rate available.

When the output disable cause is removed, i. e. the "HV EN" connector is connected to ground, the channels remain OFF until the User doesn't turn them ON via software.

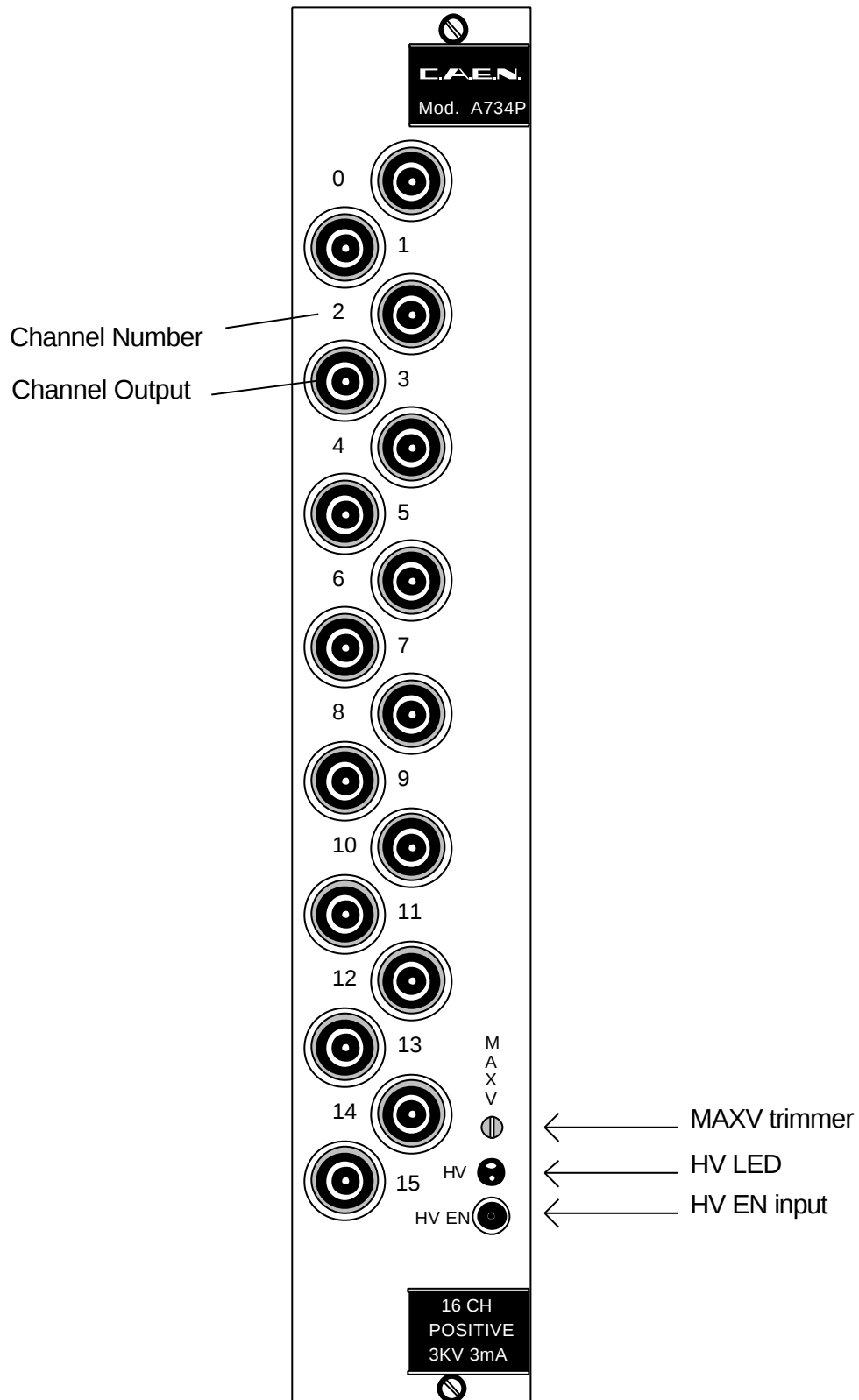


Fig. 2.5: Mod. A734P Front Panel

2.4. MOD. A735 H.V. CHANNEL BOARD (250 V, 12 mA)

The Mod. A735, 16 CHANNEL HIGH VOLTAGE (250 V, 12 mA) Board houses 16 H.V. channels. Each channel is capable to generate programmable voltage values in a range from 0 to 250 V. The maximum output current is 12 mA, guaranteed on all channels. The outputs polarity is indicated by P or N suffix (Model A735P and A735N).

The Mod. A735 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.1 V steps and the ISET is programmable from 1 μ A to the maximum in steps of 1 μ A.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same common value for all the Board channels and this value can be read out via software.

The Mod. A735 is provided with an "HV EN" input that disables the channels when it is not connected to ground.

On the Front Panel a red LED ("HV") lights up when the Board is capable to generate High Voltage on its outputs. It is not affected by the H.V. Enable control: it signals that the output channels may be active (it may be ON when the output channels are disabled).

2.4.1. MOD. A735 PACKAGING

8 TE wide. Height: 6U.

2.4.2. MOD. A735 EXTERNAL COMPONENTS

CONNECTORS

- No. 16, "CH0 ÷ CH15", SHVR317580 type connector, for the 16 H.V. channels' outputs.
- No. 1, "HV EN", LEMO 00 type, 50 Ω connector.

DISPLAYS

- No. 1, "HV", red LED, signalling, when lit, that the Board is capable to generate High Voltage on its outputs.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.4.3. MOD. A735 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative (Mod. A735P and A735N)
Output Voltage:	1 ÷ 250 V
Max. Current:	12 mA
Voltage Set/Monitor Resolution:	0.1 V
Current Set/Monitor Resolution:	1 μ A
VMAX hardware:	1 ÷ 250 V common for all the board channels
VMAX hardware accuracy:	± 2 %
VMAX software:	1÷250 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	2 ÷50 Volt/sec, 1 Volt/sec step
Ramp Up:	2 ÷50 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 10 mVpp
H.V. Out Accuracy:	± 0.5 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (from 10 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB
H.V. Out Long Term Stability:	± 1 V

All specifications are measured with a load drawing a current higher than 50 μ A.

2.4.4. MOD. A735 H.V. OUTPUT CONTROL

The Mod. A735 is provided with a "HV EN" input that disables the channels when it is not connected to ground.

When the channels are disabled the Voltage outputs of the channels ON drop to zero at the maximum rate available.

When the output disable cause is removed, i. e. the "HV EN" connector is connected to ground, the channels remain OFF until the User doesn't turn them ON via software.

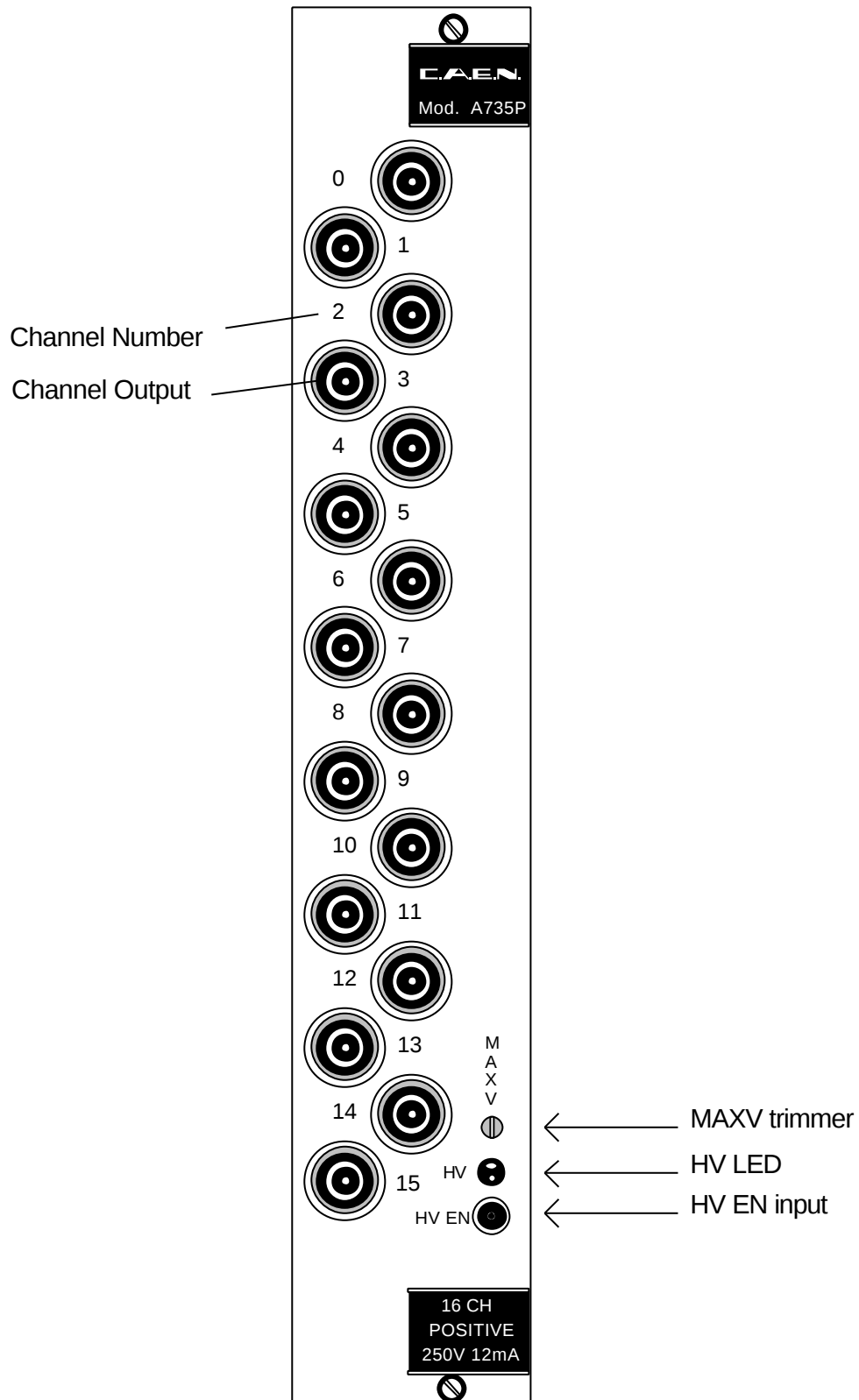


Fig. 2.6: Mod. A735P Front Panel

2.5. MOD. A753 H.V. CHANNEL BOARD (2.5 kV, 13 mA)

The A753 9 CHANNEL. HIGH VOLTAGE (2.5 kV, 13 mA) Board houses 9 H.V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 2550 V. The maximum output current is 13 mA.

The Mod. A753 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 10 μ A to the maximum in steps of 10 μ A.

For each channel a LED has been placed on the Front Panel Board to signal when the channel is ON.

Each A753 channel is provided with an "EN" input that disables the channel output when it is not connected to ground. If one channel of the Mod. A753 is used to power the Mod. A933A Distributor board the corresponding "EN" input must be connected to the A933A output "REM EN". This allows to disable the H.V. output when the distributor outputs are not connected to their loads (see "*Mod. A933A Remote Enable*" in CAEN's "SY527 Distributor P. S. Boards User's Manual").

Each A753 channel is provided with two 2-pin connectors "OVC" and "TRIP" for twisted pair. The OVC connector provides an Open Collector signal in case an overcurrent occurs on the relevant H. V. channel. The TRIP connector is an Open Collector: once at least one channel generates a Trip, all the channels connected to the latter via the TRIP connectors will trip themselves. The User can program, if desired, the same switch-off mode upon occurrence of a Trip for internal reasons (Internal Trip) or for external reasons, i.e. another channel in the chain has tripped (External Trip). Moreover it is possible to disable each channel to receive the TRIP IN signal. The TRIP signals remains until a CLEAR ALARM operation is performed.

2.5.1. MOD. A753 PACKAGING

12 TE wide. Height: 6U.

2.5.2. MOD. A753 EXTERNAL COMPONENTS

CONNECTORS

- No. 9, "CH0 ÷ CH8", SHVR317580 type connector, for the 9 H. V. channels' outputs.
- No. 9, "EN0 ÷ EN8", LEMO 00 type connector.
- No. 9, "TRIP", 2-pin connectors for twisted pair.
- No. 9, "OVC", 2-pin connectors for twisted pair.

DISPLAYS

- No. 9, "ON0 ÷ ON8" red LEDs, signalling, when lit, that the corresponding channel is ON.

2.5.3. MOD. A753 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative
Output Voltage:	0 ÷ 2550 V
Max. Current:	13 mA
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	10 μ A
VMAX software:	0 ÷ 2550 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 20 mVpp (at 2500 V, 13 mA)
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.2\% \pm 1$ LSB (from 300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB

2.5.4. MOD. A753 H. V. OUTPUTS CONTROL

Each A753 channel is provided with an "EN" input that disables the channel when the ground connection in the "EN" input is removed.

When the channel is disabled, the Voltage outputs of the channel (if ON) drop to zero at the maximum rate available.

This individual interlock acts on the channel like the SY527 front panel interlock: it sets to Off the Power parameter of its channel (see "*Output Voltage Control*" in the SY527 User's Manual). This causes the following:

- When the interlock condition is removed the channel remains Off.
- Any attempt to turn the channel On without removing the Interlock condition will result unsuccessful.

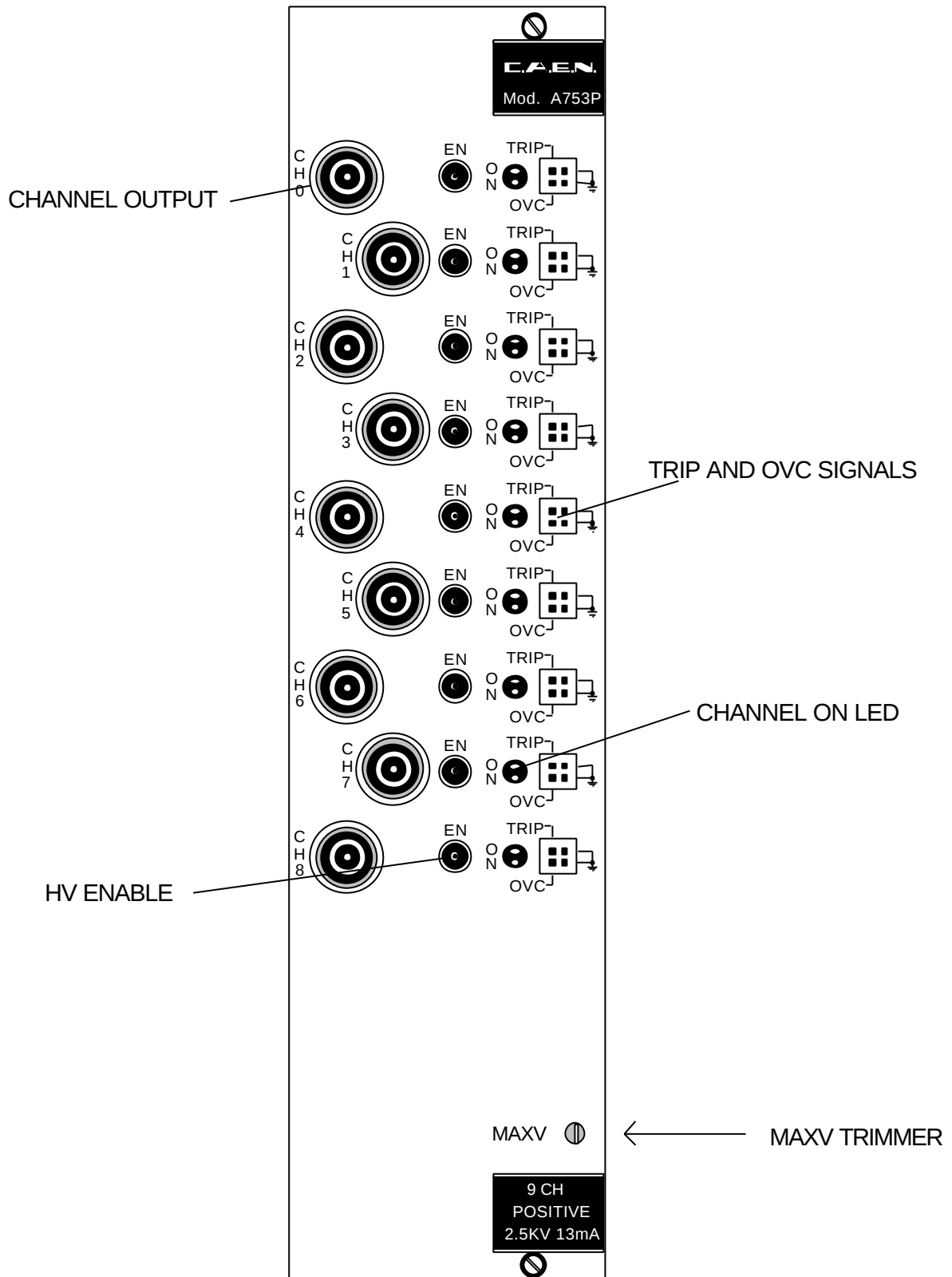


Fig. 2.7: Mod. A753P Front Panel

2.6. MOD. A821 H.V. CHANNEL BOARD (3 kV, 20 mA)

The A821 12 CHANNEL. HIGH VOLTAGE (3 kV, 20 μ A) Board houses 12 H. V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 3000 V. The maximum output current is 20 μ A.

The Mod. A821 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 2 nA (though it is suggested to set a minimum of 10 nA without connected output cables) to the maximum in steps of 2 nA.

For each channel a LED has been placed on the Front Panel Board to signal when the channel is ON.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same value in common for all the Board channels and this value can be read-out via software.

Each A821 channel is provided with two 2-pin connectors "EN" for twisted pair that disable the channel output when not connected to ground.

Each A821 channel is also provided with two 2-pin connectors "OVC" and "TRIP" for twisted pair. The OVC connector provides an Open Collector signal in case an overcurrent occurs on the relevant H. V. channel. The TRIP connector is an Open Collector: once at least one channel generates a Trip, all the channels connected to the latter via the TRIP connectors will trip themselves. The User can program, if desired, the same switch-off mode upon occurrence of a Trip for internal reasons (Internal Trip) or for external reasons, i.e. another channel in the chain has tripped (External Trip). Moreover it is possible to disable each channel to receive the TRIP IN signal. The TRIP signals remains until a CLEAR ALARM operation is performed.

2.6.1. MOD. A821 PACKAGING

8 TE wide. Height: 6U.

2.6.2. MOD. A821 EXTERNAL COMPONENTS

CONNECTORS

- No. 12, "CH0 ÷ CH11", SHVR317580 type connector, for the 12 H. V. channels' outputs.
- No. 12, "EN", 2-pin connectors for twisted pair.
- No. 12, "TRIP", 2-pin connectors for twisted pair.
- No. 12, "OVC", 2-pin connectors for twisted pair.

DISPLAYS

- No. 12, "ON0 ÷ ON11" red LEDs, signalling, when lit, that the corresponding channel is ON.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.6.3. MOD. A821 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative
Output Voltage:	0÷3000 V
Max. Current:	20 μ A
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	2 nA
VMAX software:	0 ÷3000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 20 mVpp (10 Hz to 20 MHz bandwidth)
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm(1 \text{ LSB} + 0.4 \text{ V})$ [300 V to full scale value]
Current Set/Monitor Accuracy:	$\pm 3\% \pm 2 \text{ LSB}$

2.6.4. MOD. A821 H. V. OUTPUTS CONTROL

Each A821 channel is provided with an "EN" input that disables the channel when the ground connection in the "EN" input is removed.

When the channel is disabled, the Voltage outputs of the channel (if ON) drop to zero at the maximum rate available.

This individual interlock acts on the channel like the SY527 front panel interlock: it sets to Off the Power parameter of its channel (see "*Output Voltage Control*" in the SY527 User's Manual). This causes the following:

- When the interlock condition is removed the channel remains Off.
- Any attempt to turn the channel On without removing the Interlock condition will result unsuccessful.

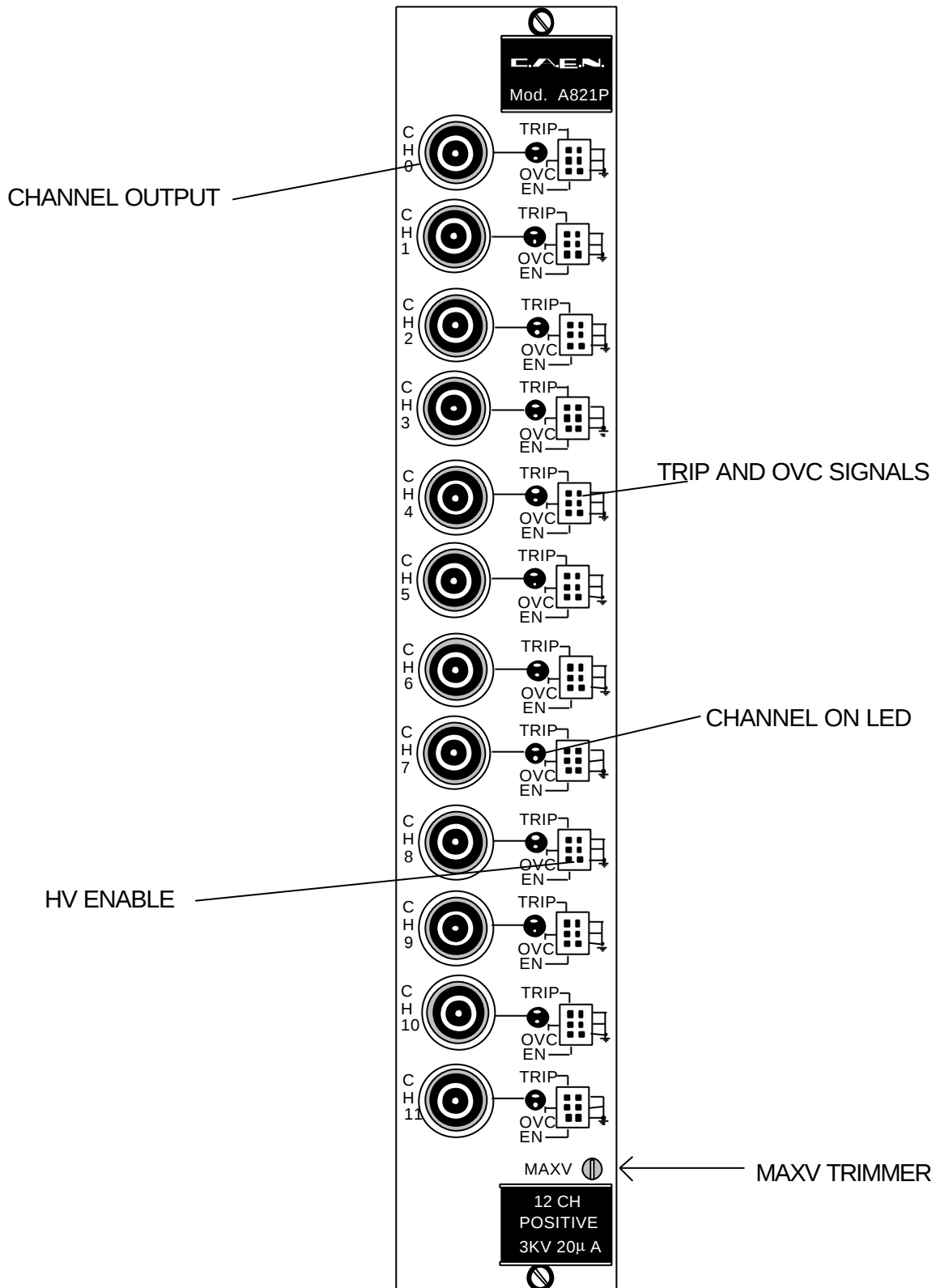


Fig. 2.8: Mod. A821P Front Panel

2.7. MOD. A832 H.V. CHANNEL BOARD (6 kV, 200 mA)

The A832 12 CHANNEL. HIGH VOLTAGE (6 kV, 200 μ A) Board houses 12 H. V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 6000 V. The maximum output current is 200 μ A.

The Mod. A832 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.5 V steps and the ISET is programmable from 20 nA to the maximum in steps of 20 nA.

For each channel a LED has been placed on the Front Panel Board to signal when the channel is ON.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same value in common for all the Board channels and this value can be read-out via software.

Each A832 channel is provided with two 2-pin connectors "EN" for twisted pair that disable the channel output when not connected to ground.

Each A832 channel is also provided with two 2-pin connectors "OVC" and "TRIP" for twisted pair. The OVC connector provides an Open Collector signal in case an overcurrent occurs on the relevant H. V. channel. The TRIP connector is an Open Collector: once at least one channel generates a Trip, all the channels connected to the latter via the TRIP connectors will trip themselves. The User can program, if desired, the same switch-off mode upon occurrence of a Trip for internal reasons (Internal Trip) or for external reasons, i.e. another channel in the chain has tripped (External Trip). Moreover it is possible to disable each channel to receive the TRIP IN signal. The TRIP signals remains until a CLEAR ALARM operation is performed.

2.7.1. MOD. A832 PACKAGING

8 TE wide. Height: 6U.

2.7.2. MOD. A832 EXTERNAL COMPONENTS

CONNECTORS

- No. 12, "CH0÷CH11", SHVR317580 type connector, for the 12 H. V. channels' outputs.
- No. 12, "EN", 2-pin connectors for twisted pair.
- No. 12, "TRIP", 2-pin connectors for twisted pair.
- No. 12, "OVC", 2-pin connectors for twisted pair.

DISPLAYS

- No. 12, "ON0÷ON11" red LEDs, signalling, when lit, that the corresponding channel is ON.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.7.3. MOD. A832 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative
Output Voltage:	0 ÷ 6000 V
Max. Current:	200 μ A
Voltage Set/Monitor Resolution:	0.5 V
Current Set/Monitor Resolution:	20 nA
VMAX software:	0 ÷ 6000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	10 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 20 mVpp
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB

2.7.4. MOD. A832 H. V. OUTPUTS CONTROL

Each A832 channel is provided with an "EN" input that disables the channel when the ground connection in the "EN" input is removed.

When the channel is disabled, the Voltage outputs of the channel (if ON) drop to zero at the maximum rate available.

This individual interlock acts on the channel like the SY527 front panel interlock: it sets to Off the Power parameter of its channel (see "*Output Voltage Control*" in the SY527 User's Manual). This causes the following:

- When the interlock condition is removed the channel remains Off.
- Any attempt to turn the channel On without removing the Interlock condition will result unsuccessful.

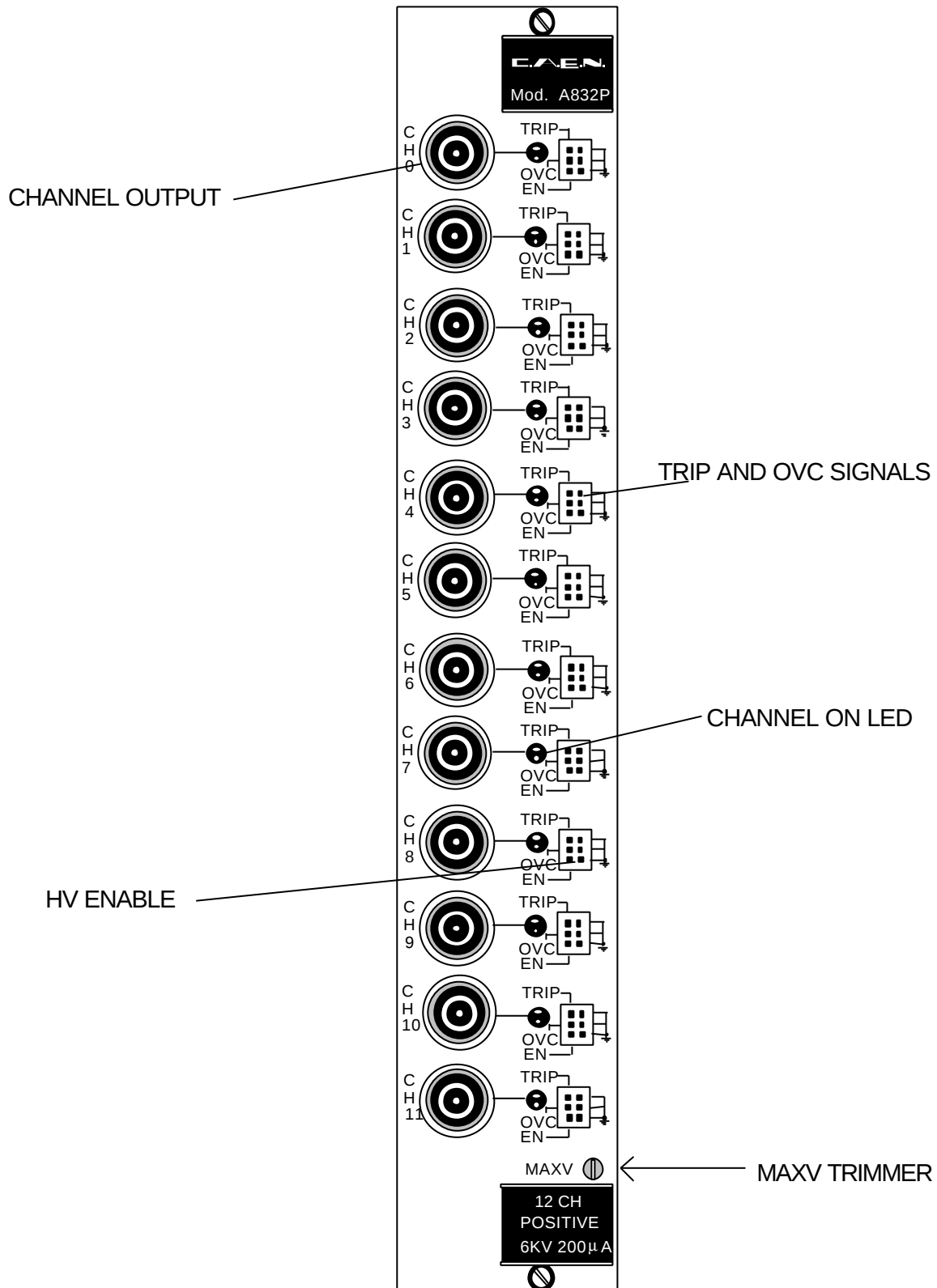


Fig. 2.9: Mod. A832P Front Panel

2.8. MOD. A833A H.V. CHANNEL BOARD (2.5 kV, 200 mA)

The Mod. A833A, 16 CHANNEL HIGH VOLTAGE (2.5 kV, 200 μ A) Board houses 16 H.V. channels. Each channel is capable to generate programmable voltage values in a range from 0 to 2500 V. The maximum output current is 200 μ A.

These Boards are provided with Multiconductor Block type connector for the H. V. outputs. The outputs polarity is indicated by P or N suffix (Model A833AP and A833AN).

The Mod. A833A ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 20 nA to the maximum in steps of 20 nA.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same common value for all the Board channels and this value can be read out via software.

The Mod. A833A is provided with an H.V. Enable control to disable all the 16 channels when the "HV EN" contacts are opened (see Fig. 2.12).

On the Front Panel a red LED ("HV") lights up when the Board is capable to generate High Voltage on its outputs. It is not affected by the H.V. Enable control: it signals that the output channels may be active (it may be ON when the output channels are disabled).

2.8.1. MOD. A833A PACKAGING

8 TE wide. Height: 6U.

2.8.2. MOD. A833A EXTERNAL COMPONENTS

CONNECTORS

- No. 1, "HV OUT", Multiconductor Block-type female connector (20 positions AMP203909-2 type) for the 16 H.V. channels' outputs.
- No. 1, "HV EN", LEMO 00 type, 50 Ω connector.

DISPLAYS

- No. 1, "HV", red LED, signalling, when lit, that the Board is capable to generate High Voltage on its outputs.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.8.3. MOD. A833A CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative (Mod. A833AP and A833AN)
Output Voltage:	0 ÷ 2500 V
Max. Current:	200 μ A
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	20 nA
VMAX hardware:	0 ÷ 2500 V common for all the board channels
VMAX hardware accuracy:	± 2 %
VMAX software:	0 ÷ 2500 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 20 mVpp (at 2500 V, 200 μ A)
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB
H.V. Out Long Term Stability:	± 1 V

2.8.4. MOD. A833A H.V. OUTPUT CONTROL

The Mod. A833 A is provided with a H. V. Enable control that disables all the 16 channels when the "HV EN" contacts of the block connector are opened (see Fig. 2.12).

The same function is performed via the "HV EN" input that disables the channels when it is not connected to ground.

When the channels are disabled the Voltage outputs of the channels ON drop to zero at the maximum rate available.

When the output disable cause is removed, i. e. the "HV EN" contacts are connected together, the channels remain OFF until the User doesn't turn them ON via software.

If the connection is obtained via the H.V. cable on the board to be supplied, when the cable is not connected the outputs are automatically disabled. This protection scheme is described in Figure 2.12.

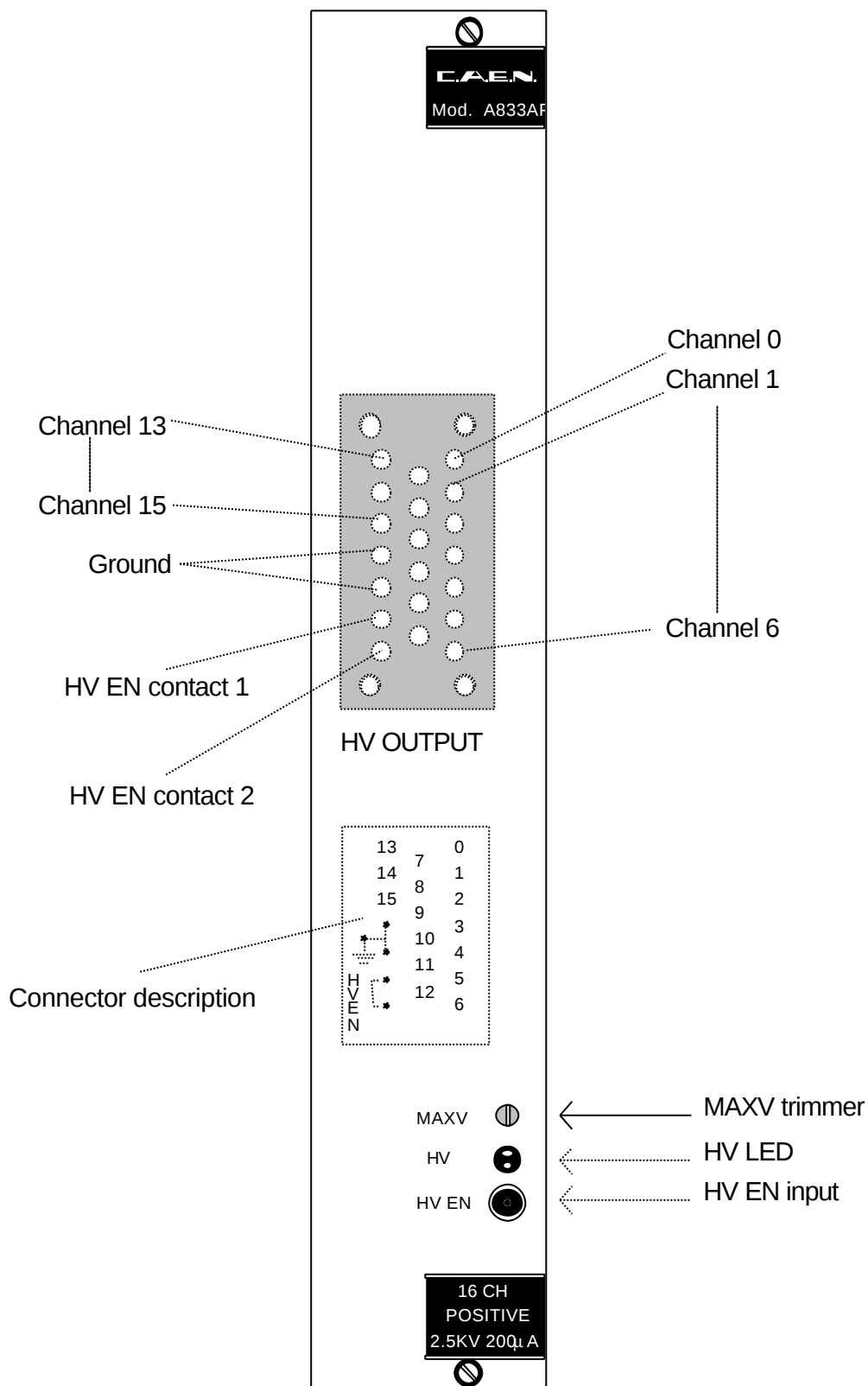


Fig. 2.10: Mod. A833AP Front Panel

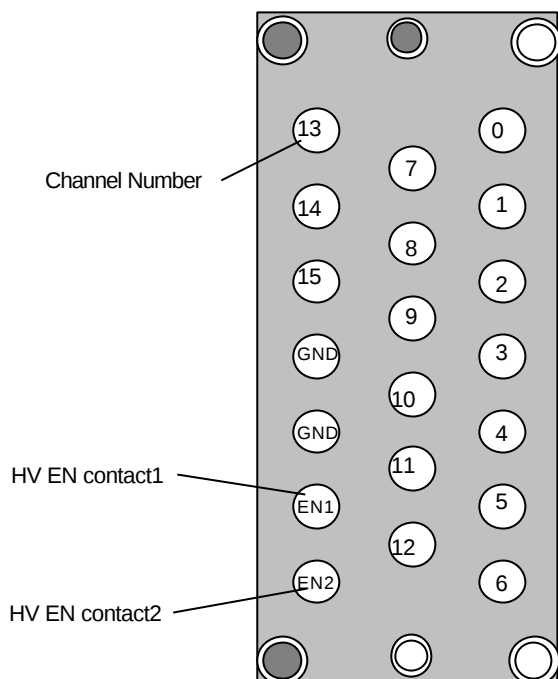


Fig. 2.11: Mod. A833A Block Connector Pin Description

The appendix A contains a complete description of the Block Connector components and of the recommended connector and hardware for the cable.

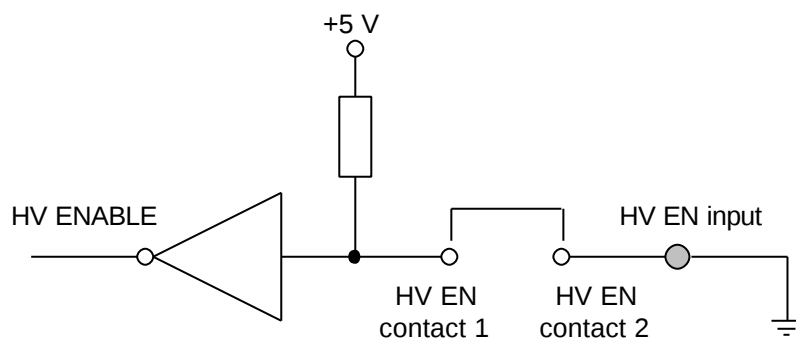


Fig. 2.12: Mod. A833A HV ENABLE Scheme

2.9. MOD. A834 H.V. CHANNEL BOARD (3 kV, 200 μ A)

The Mod. A834, 16 CHANNEL HIGH VOLTAGE (3 kV, 200 μ A) Board houses 16 H.V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 3000 V. The maximum output current is 200 μ A.

The outputs polarity is indicated by P or N suffix (Model A834P and A834N).

The Mod. A834 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.2 V steps and the ISET is programmable from 20 nA to the maximum in steps of 20 nA.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same common value for all the Board channels and this value can be read out via software.

The Mod. A834 is provided with an "HV EN" input that disables the channels when it is not connected to ground.

On the Front Panel a red LED ("HV") lights up when the Board is capable to generate High Voltage on its outputs. It is not affected by the H.V. Enable control: it signals that the output channels may be active (it may be ON when the output channels are disabled).

2.9.1. MOD. A834 PACKAGING

8 TE wide. Height: 6U.

2.9.2. MOD. A834 EXTERNAL COMPONENTS

CONNECTORS

- No. 16, "CH0 ÷ CH15", SHVR317580 type connector, for the 16 H.V. channels' outputs.
- No. 1, "HV EN", LEMO 00 type, 50 Ω connector.

DISPLAYS

- No. 1, "HV", red LED, signalling, when lit, that the Board is capable to generate High Voltage on its outputs.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.9.3. MOD. A834 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative (Mod. A834P and A834N)
Output Voltage:	0 ÷ 3000 V
Max. Current:	200 μ A
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	20 nA
VMAX hardware:	0 ÷ 3000 V common for all the board channels
VMAX hardware accuracy:	± 2 %
VMAX software:	0 ÷ 3000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	11 ÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 20 mVpp (at 3000 V, 200 μ A)
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB
H.V. Out Long Term Stability:	± 1 V

2.9.4. MOD. A834 H.V. OUTPUT CONTROL

The Mod. A834 is provided with an "HV EN" input that disables the channels when it is not connected to ground.

When the channels are disabled the Voltage outputs of the channels ON drop to zero at the maximum rate available.

When the output disable cause is removed, i. e. the "HV EN" connector is connected to ground, the channels remain OFF until the User doesn't turn them ON via software.

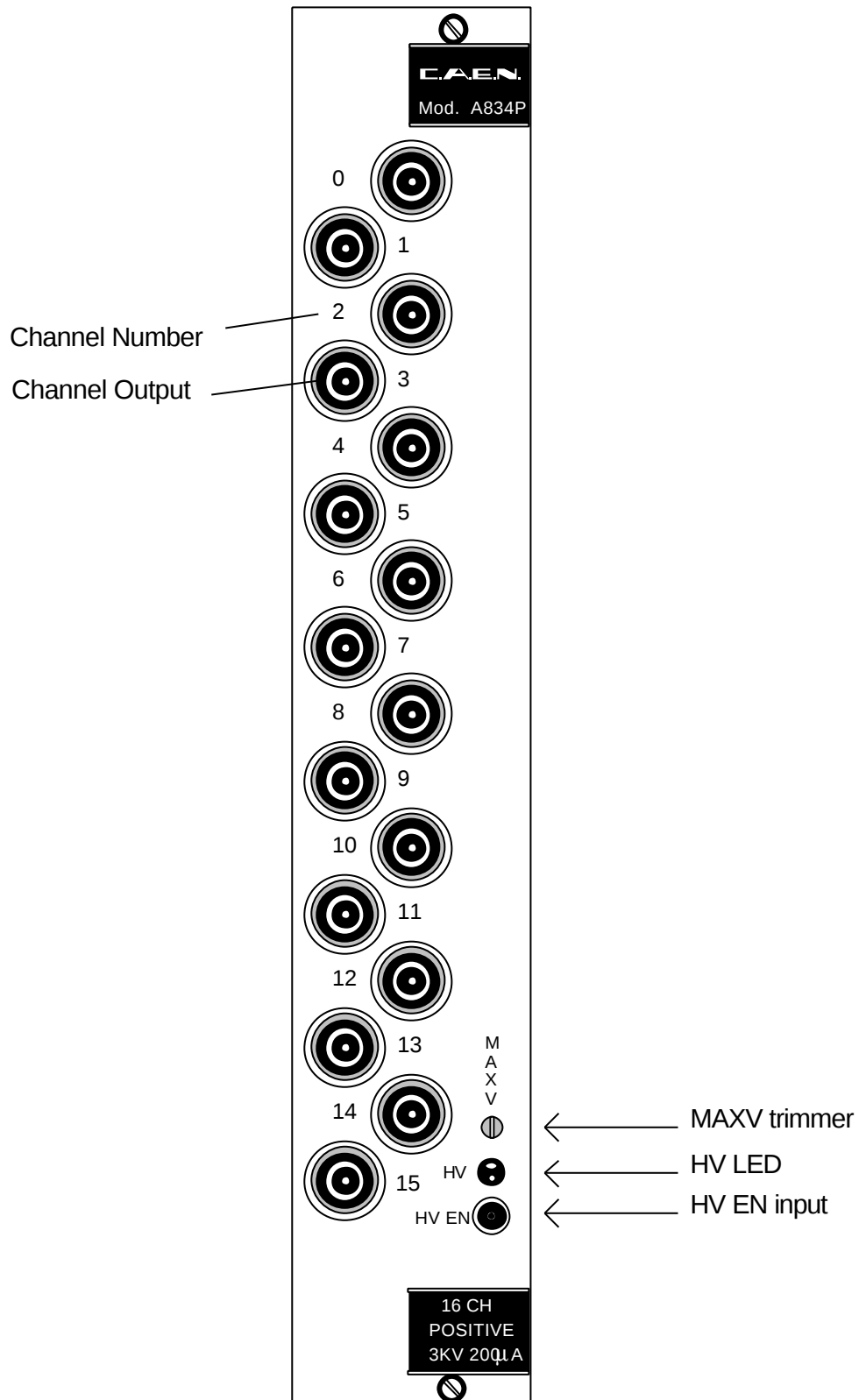


Fig. 2.13: Mod. A834P Front Panel

2.10. MOD. A835 H.V. CHANNEL BOARD (1 kV, 50 mA)

The A835 12 CHANNEL. HIGH VOLTAGE (1 kV, 50 μ A) Board houses 12 H. V. channels.

Each channel is capable to generate programmable voltage values in a range from 0 to 1000 V. The maximum output current is 50 μ A.

The Mod. A835 ISET values are independent for each channel and represent a "software controlled" hardware protection on the channels' currents: the channel cannot draw a current higher than its programmed limit (**Board with programmable current hardware protections**).

The output voltage is programmable from 0 to the maximum value in 0.1 V steps and the ISET is programmable from 10 nA to the maximum in steps of 10 nA.

For each channel a LED has been placed on the Front Panel Board to signal when the channel is ON.

The Maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer, at the same value in common for all the Board channels and this value can be read-out via software.

Each A835 channel is provided with two 2-pin connectors "EN" for twisted pair that disable the channel output when not connected to ground.

Each A835 channel is also provided with two 2-pin connectors "OVC" and "TRIP" for twisted pair. The OVC connector provides an Open Collector signal in case an overcurrent occurs on the relevant H. V. channel. The TRIP connector is an Open Collector: once at least one channel generates a Trip, all the channels connected to the latter via the TRIP connectors will trip themselves. The User can program, if desired, the same switch-off mode upon occurrence of a Trip for internal reasons (Internal Trip) or for external reasons, i.e. another channel in the chain has tripped (External Trip). Moreover it is possible to disable each channel to receive the TRIP IN signal. The TRIP signals remains until a CLEAR ALARM operation is performed.

2.10.1. MOD. A835 PACKAGING

8 TE wide. Height: 6U.

2.10.2. MOD. A835 EXTERNAL COMPONENTS

CONNECTORS

- No. 12, "CH0 ÷CH11", SHVR317580 type connector, for the 12 H. V. channels' outputs.
- No. 12, "EN", 2-pin connectors for twisted pair.
- No. 12, "TRIP", 2-pin connectors for twisted pair.
- No. 12, "OVC", 2-pin connectors for twisted pair.

DISPLAYS

- No. 12, "ON0 ÷ON11" red LEDs, signalling, when lit, that the corresponding channel is ON.

TRIMMERS

- No. 1, "MAXV", trimmer, for the VMAX Hardware setting.

2.10.3. MOD. A835 CHANNEL CHARACTERISTICS

Polarity:	Positive/Negative
Output Voltage:	0 ÷ 1000 V
Max. Current:	50 μ A
Voltage Set/Monitor Resolution:	0.1 V
Current Set/Monitor Resolution:	10 nA
VMAX software:	0 ÷ 1000 settable for each channels
VMAX software resolution:	1 V
Ramp Down:	7 ÷ 150 Volt/sec, 1 Volt/sec step
Ramp Up:	7 ÷ 150 Volt/sec, 1 Volt/sec step
Voltage Ripple:	< 10 mVpp
H.V. Out Accuracy:	± 1 V
Voltage Monitor Accuracy:	$\pm 0.3\% \pm 1$ LSB (300 V to full scale value)
Current Set/Monitor Accuracy:	$\pm 2\% \pm 1$ LSB

2.10.4. MOD. A835 H. V. OUTPUTS CONTROL

Each A835 channel is provided with an "EN" input that disables the channel when the ground connection in the "EN" input is removed.

When the channel is disabled, the Voltage outputs of the channel (if ON) drop to zero at the maximum rate available.

This individual interlock acts on the channel like the SY527 front panel interlock: it sets to Off the Power parameter of its channel (see "*Output Voltage Control*" in the SY527 User's Manual). This causes the following:

- When the interlock condition is removed the channel remains Off.
- Any attempt to turn the channel On without removing the Interlock condition will result unsuccessful.

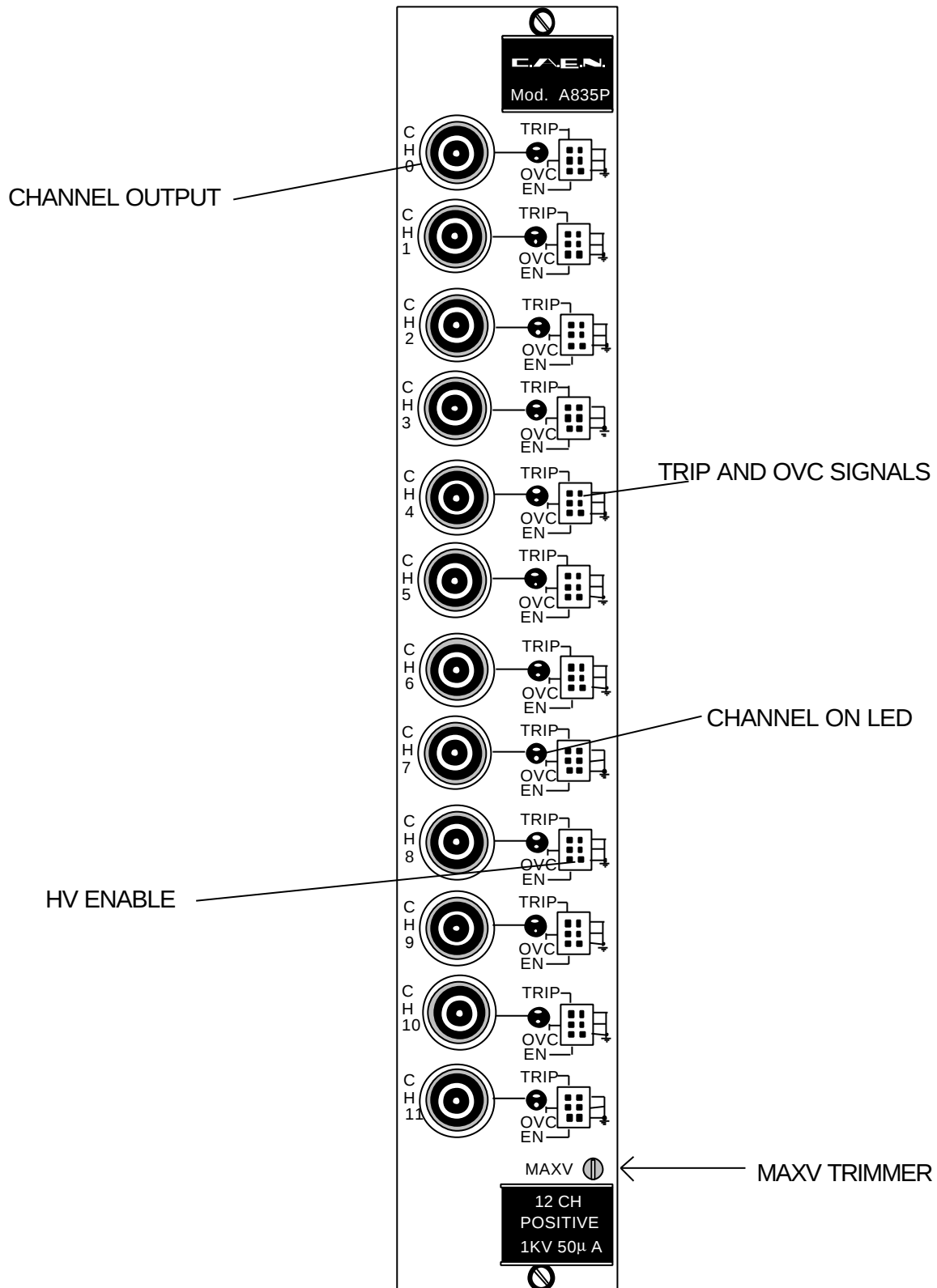


Fig. 2.14: Mod. A835P Front Panel

APPENDIX A: MULTIPIN CONNECTORS DESCRIPTION

A.1. MOD. A733A-A833A MULTIPIN CONNECTOR COMPONENTS

The following parts are available from AMP INCORPORATED, Harrisburg Pennsylvania 17105, U.S.A. (Phone: 717-564-0100 Telex: 842313).

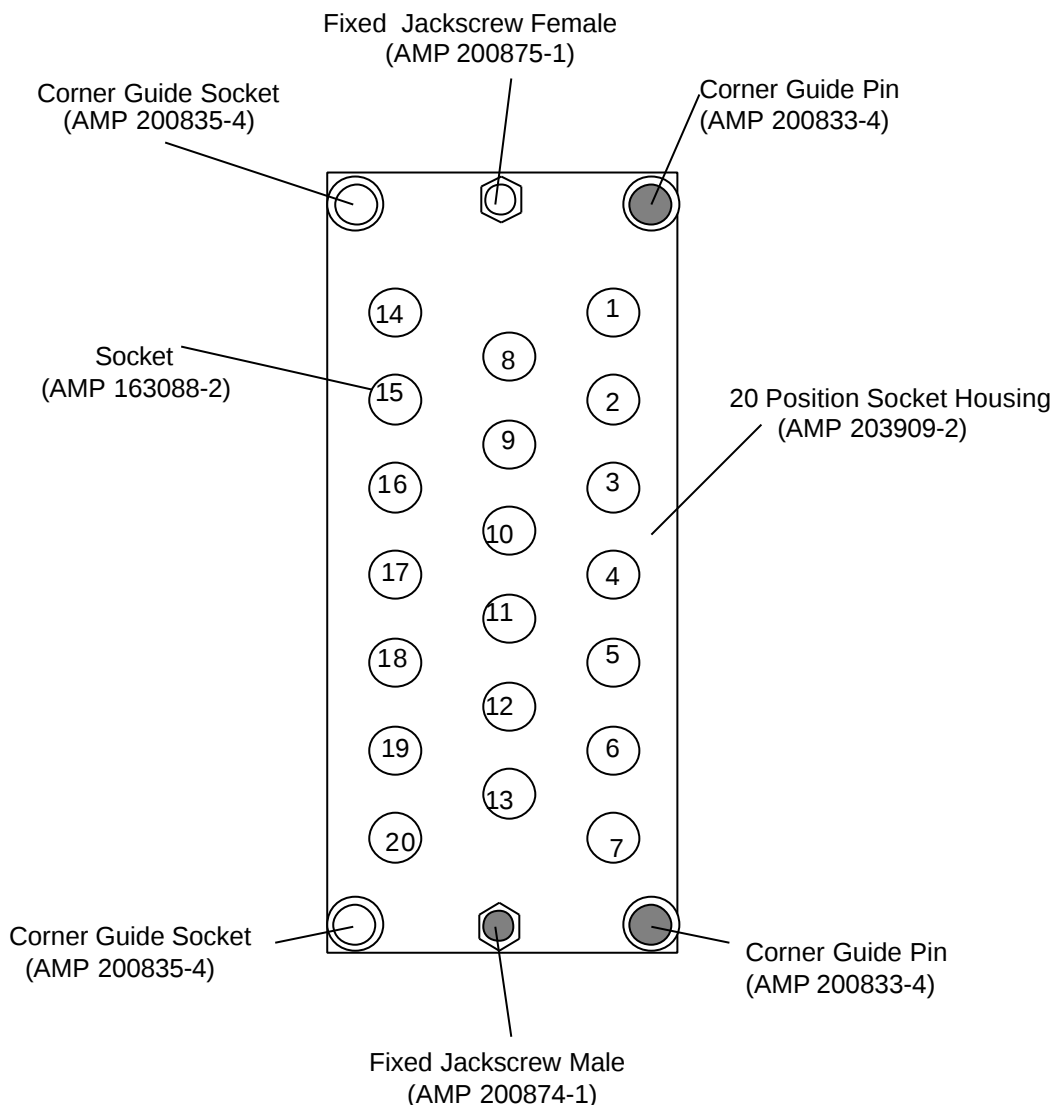


Fig. A.1: Mod. A733A-A833A Multiconductor Connector Description

A.2. RECOMMENDED CONNECTOR FOR THE CABLE

The following parts are available from AMP INCORPORATED, Harrisburg Pennsylvania 17105, U.S.A. (Phone: 717-564-0100 Telex: 842313).

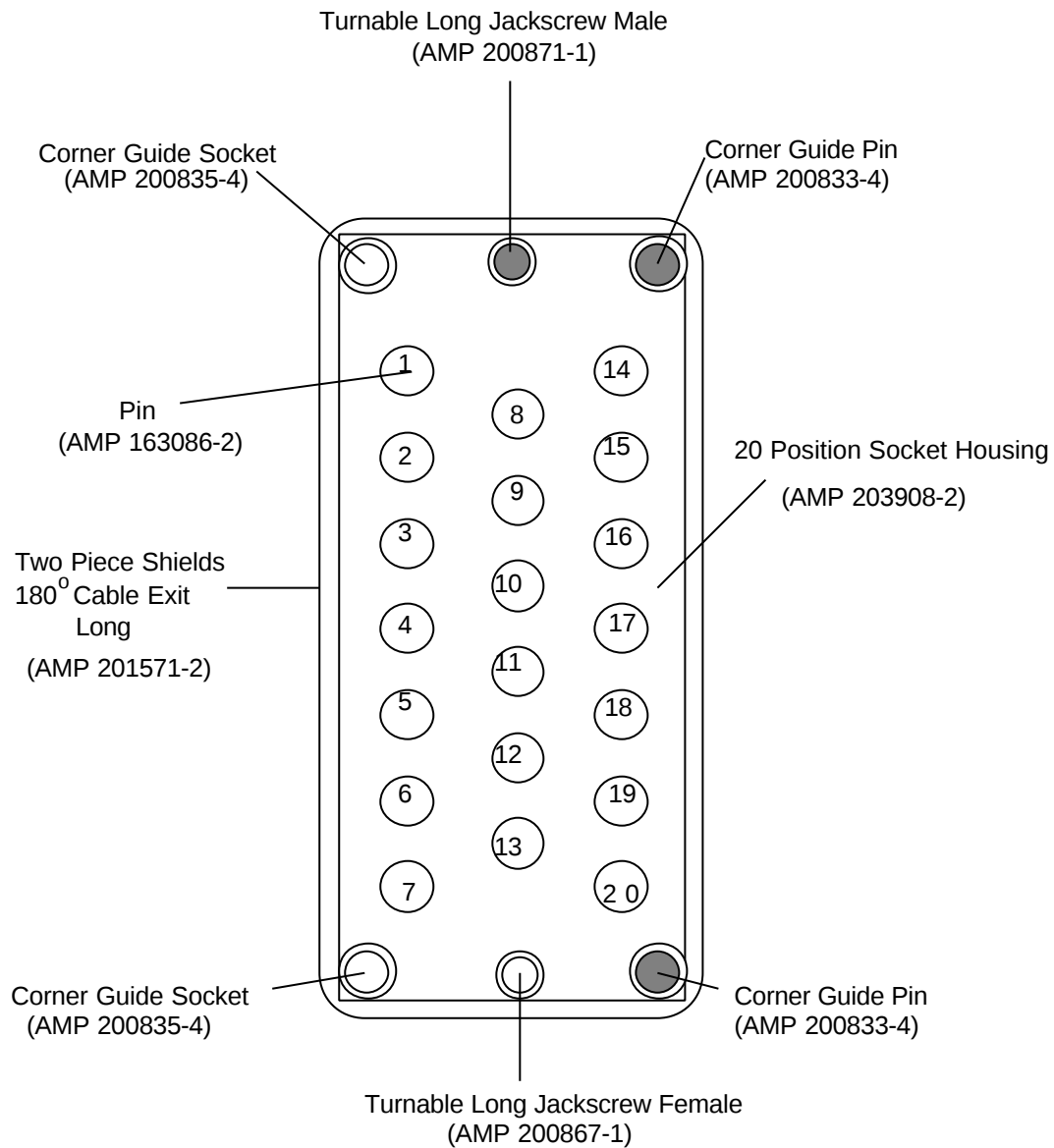


Fig. A.2: Recommended Connector for the Cable