

# **Technical Information Manual**

Revision n. 1  
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**MODELS**  
*SY527*  
*DISTRIBUTOR*  
*BOARDS*  
**MANUAL REV.1**

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# 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 are some of the Boards currently available:

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

<b>Board Type</b>	<b>Ch.</b>	<b>Voltage full scale</b>	<b>Voltage Resolution</b>	<b>Current Full scale</b>	<b>Current Resolution</b>	<b>Current protection</b>
A515	16	100 V	40 mV	200 $\mu$ 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 $\mu$ A	fixed (30 mA)
A518	16	12 V	10 mV	150 mA	40 $\mu$ A	fixed (170 mA)
A519	16	200 V	40 mV	40 $\mu$ A	10 nA	fixed (200 $\mu$ A)
A520	16	200 V	40 mV	1 mA	200 nA	fixed (1.2 mA)

## **High Voltage Positive/Negative Boards**

(See CAEN's "High Voltage P. S. Boards User's Manual")

Board	Ch.	Voltage full scale	Voltage Resolution	Current Full scale	Current Resolution
A732	12	6 kV	0.5 V	1 mA	1 $\mu$ A
A733A	16	2.5 kV	0.2 V	3 mA	1 $\mu$ A
A734	16	3 kV	0.2 V	3 mA <sup>1</sup>	1 $\mu$ A
A753	9	2.5 kV	0.2 V	13 mA	10 $\mu$ A
A832	12	6 kV	0.5 V	200 $\mu$ A	20 nA
A834	16	3 kV	0.2 V	200 $\mu$ A	20 nA

**Distributor Boards**

( $\Delta V = 900$  Volt)

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

**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.

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<sup>1</sup>guaranteed on 14 channels only; slightly less on 16 channels.

## **2. DISTRIBUTOR BOARDS**

### **2.1. MOD. A932A H.V. DISTR. AND POWER SUPPLY BOARD (2.5 kV 500 mA)**

The Model A932A, High Voltage Positive (Mod. A932AP) or Negative (Mod. A932AN) Distributor and Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.5 kV.

The Board houses a Primary High Voltage Channel and 24 Active Distributor Output Channels, directly supplied by the Primary Channel.

The internal Primary H. V. Channel has a complete set of parameters that can be programmed, such as high voltage ( $V_{\text{PRIM}}$ ), current limit, ramp-up and ramp-down.

The Current Limit of the Primary Channel can be set/monitored with 1  $\mu\text{A}$  resolution. The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once the Primary Channel crosses the Current Limit it trips immediately via hardware.

The Voltage on each Distributed Output Channel ( $V_{\text{SET}}$ ) can be independently programmed in a range of 900 V drop from the Primary Channel  $V_{\text{PRIM}}$  setting with a Current of 0.5 mA on each Distributed Channel.

The difference between the  $V_{\text{PRIM}}$  set value and the minimum distributed voltage output cannot exceed 900 V. If via software a higher difference value is set, the distributed channels output will always follow the Primary channel value at a max. distance of 900 V. All the distributed voltages are programmable and monitorable in 0.2 V steps.

The output voltages are provided via two multiconductor block-type connectors.

By using 10 boards of the Mod. A 932A it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when the internal H. V. is switched ON.

The output connectors have two pins dedicated to realize the safety board interlock. This protection allows to disable the primary H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

Appendix A.3 describes the mounting procedure for the cable Male connectors.

### **2.1.1. MOD. A932A PACKAGING**

8 TE wide. Height: 6U.

### **2.1.2. MOD. A932A EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 2, "H.V. OUTPUT", Multiconductor Block-type female connectors (20 positions AMP203909-2 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

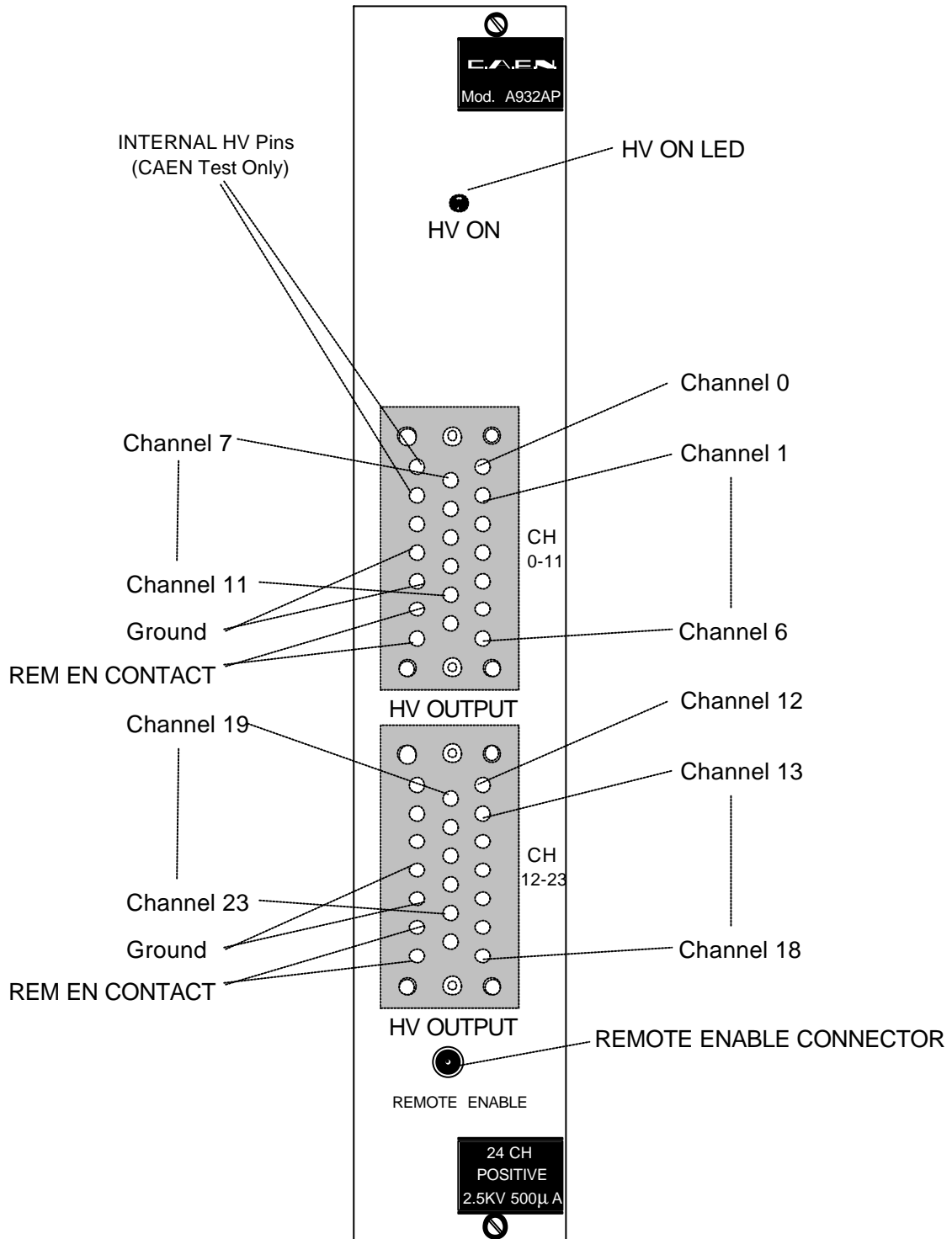


Fig. 2.1: Mod. A932AP Front Panel



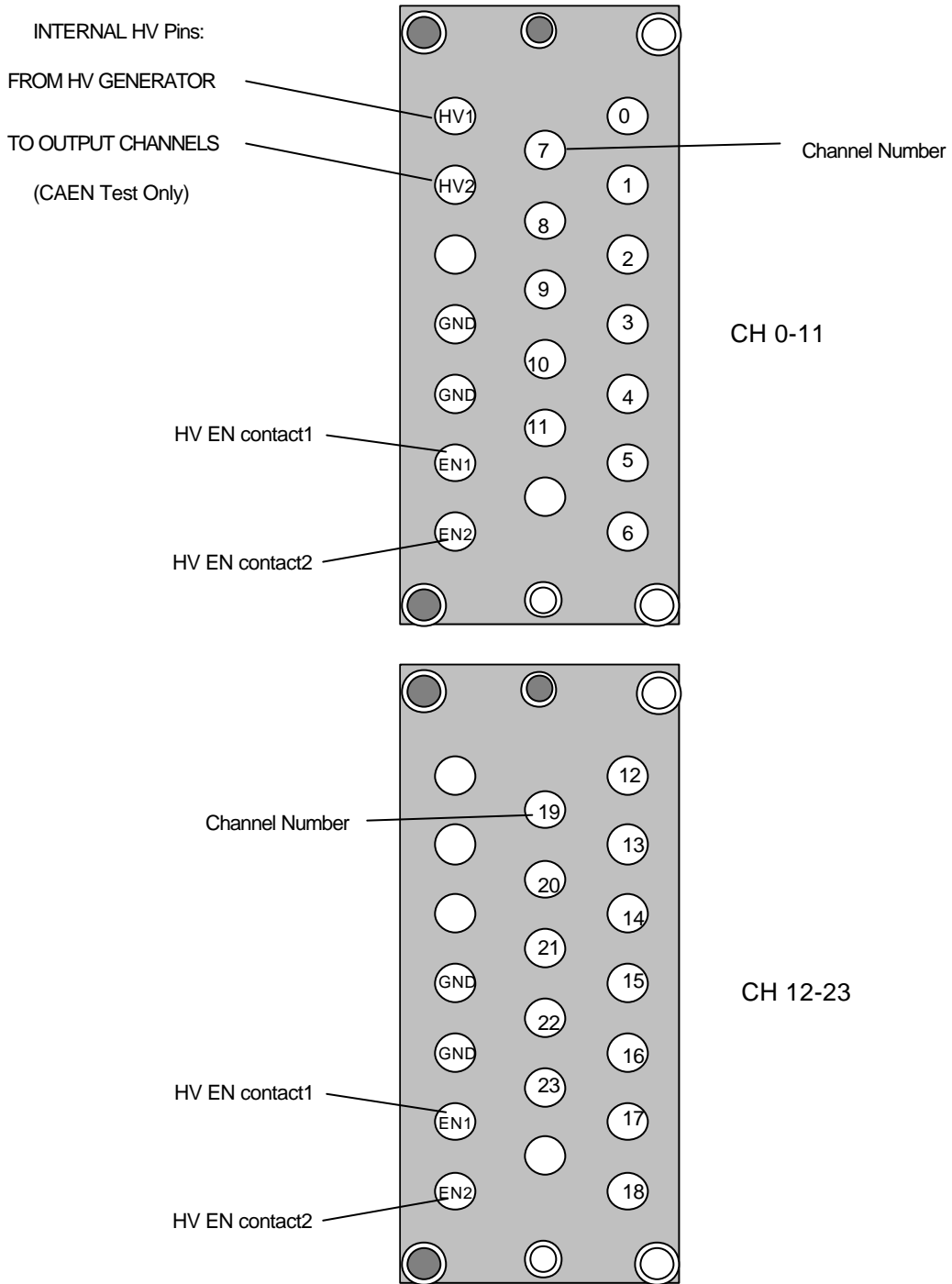


Fig. 2.2: Mod. A932A Block Connector Description

### 2.1.3. MOD. A932A CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive/Negative (Mod. A932AP and A932AN)
Primary Channel H.V.:	0÷2550 V
H.V. Drop:	0÷900 V (with Output Current > 50 $\mu$ A)
Max. Current:	500 $\mu$ A
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	1 $\mu$ A (*)
Ramp Up	10 ÷500 V/s, within drop range
Ramp Down	10 ÷500 V/s, within drop range
Voltage Ripple:	$\leq$ 5 mVpp (60 MHz bandwidth; with a load drawing > 200 $\mu$ A)
Voltage Monitor Accuracy:	$\pm$ 0.2% $\pm$ 1 LSB
Max. Ptot deliverable on the output channels, per board:	30 W
Max. Ptot drawn by a single board:	45 W

\*= The module allows to set and monitor the current of the internal primary High Voltage channel.

### 2.1.4. MOD. A932A REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also logically connected to the INTERLOCK pins of the Multipin Connectors.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connectors in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connectors. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connectors or at the end of the cable.

Figure 2.3 describes this protection scheme and the required connections on the Mod. A932A.

Appendix A.3 describes the mounting procedure for the cable Male connectors.

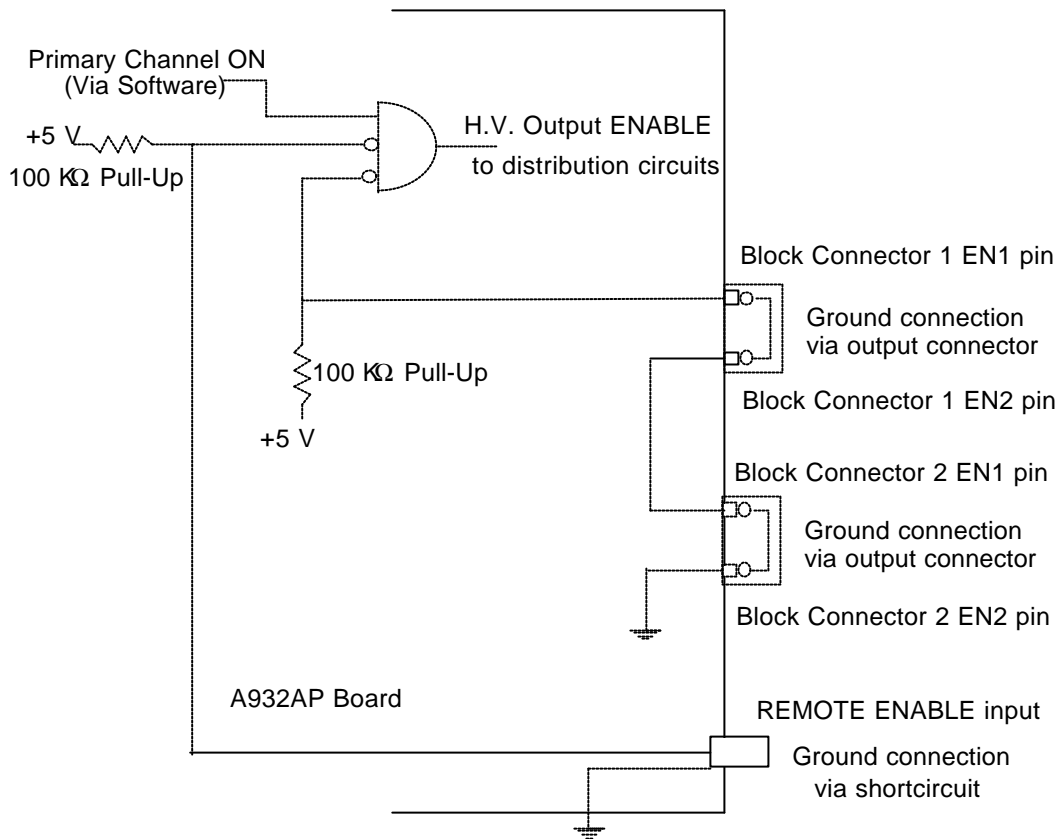


Fig. 2.3: Mod. A932A Remote Enable Scheme

### 2.1.5. MOD. A932A OPERATION

The Board houses 24 distributed channels and one H.V. primary channel. All these 25 channels appear both on the Mainframe display and on the RS232 Terminal. The 24 distributed channels are numbered from 0 to 23, while the primary H. V. channel appears as number 24.

In order to obtain the desired specifications, the distributed channels should be in regulation mode (i.e. the difference between the primary channel voltage setting and the distributors output voltage setting is between 50 V and 900 V with a load drawing more than 200  $\mu$ A).

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program the 24 distributed channels at the desired voltage set, taking care that the maximum difference between the 24 settings does not exceed 900 V.
- 2) Program the primary channel at a setting = [max. setting of distributed channels + 50 V].
- 3) Set all channels ON simultaneously (in common operation).

**N.B.:** Even if all distributed channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connectors.

For the A932A board, "Channel OFF" means that the A932A distributed channel supplies as output a voltage that is equal to the primary channel voltage minus the maximum drop (approx. 900 V). As an example, if the primary channel is set to 2200 V and the distributed channel is set to 1900 V, if the distributor channel is ON the output on the multipin connectors will be 1900 V with  $\pm 5$  mV ripple, while if the distributor channel is OFF the output on the multipin connectors will be approx. 1300 V with a higher ripple.

## 2.2. MOD. A933A H.V. DISTRIBUTOR BOARD (2.5 kV 500 mA)

The Mod. A933A, 24 CHANNEL. H. V. DISTRIBUTOR (2.5 kV, 500  $\mu$ A) Board houses 24 distributor channels. The outputs polarity is indicated by P or N suffix (Model A933AP and A933AN).

Each channel is capable to regulate a programmable output voltage in a range from  $V_{in}$  to  $V_{in} - 900V$  ( $V_{in}$  is the value of the common H.V. input). The output voltage is programmable in 0.2 V steps. The maximum output current is 500  $\mu$ A.

A yellow lamp near the H.V. input connector ("HV IN ON") lights up when the H.V. input is over 200 V, regardless whether the SY527 is switched ON or OFF.

The Mod. A933A has been designed to be used with the H. V. CHANNEL Board Mod. A753 that bears 9 H.V. channels.

This board allows to obtain in a single SY527 crate a complete system of 216 H.V. channels (nine A933A plus one A753 Boards in a SY527 crate).

The A933A Board is provided with a "REMOTE ENABLE" connector, that must be connected with the corresponding "EN" connector of the A753 channel that powers the distributor (the A753 "EN" input must be grounded in order to enable its output channel).

This protection allows to disable the H.V. input when the distributor outputs are not connected to their loads (see § 2.2.4).

The A933A board features also an optional High Voltage Relay as a safety protection.

### 2.2.1. MOD. A933A PACKAGING

8 TE wide. Height: 6U.

### 2.2.2. MOD. A933A EXTERNAL COMPONENTS

#### CONNECTORS

- No. 2, "H.V. INPUT", SHVR317580 type connectors, for the H.V. input.
- No. 2, "H.V. OUTPUT", Multiconductor Block-type female connectors (20 positions AMP203909-2 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### DISPLAYS

- No. 1, "ON", yellow LAMP, signalling the presence of an input high voltage (ON = H.V. present).

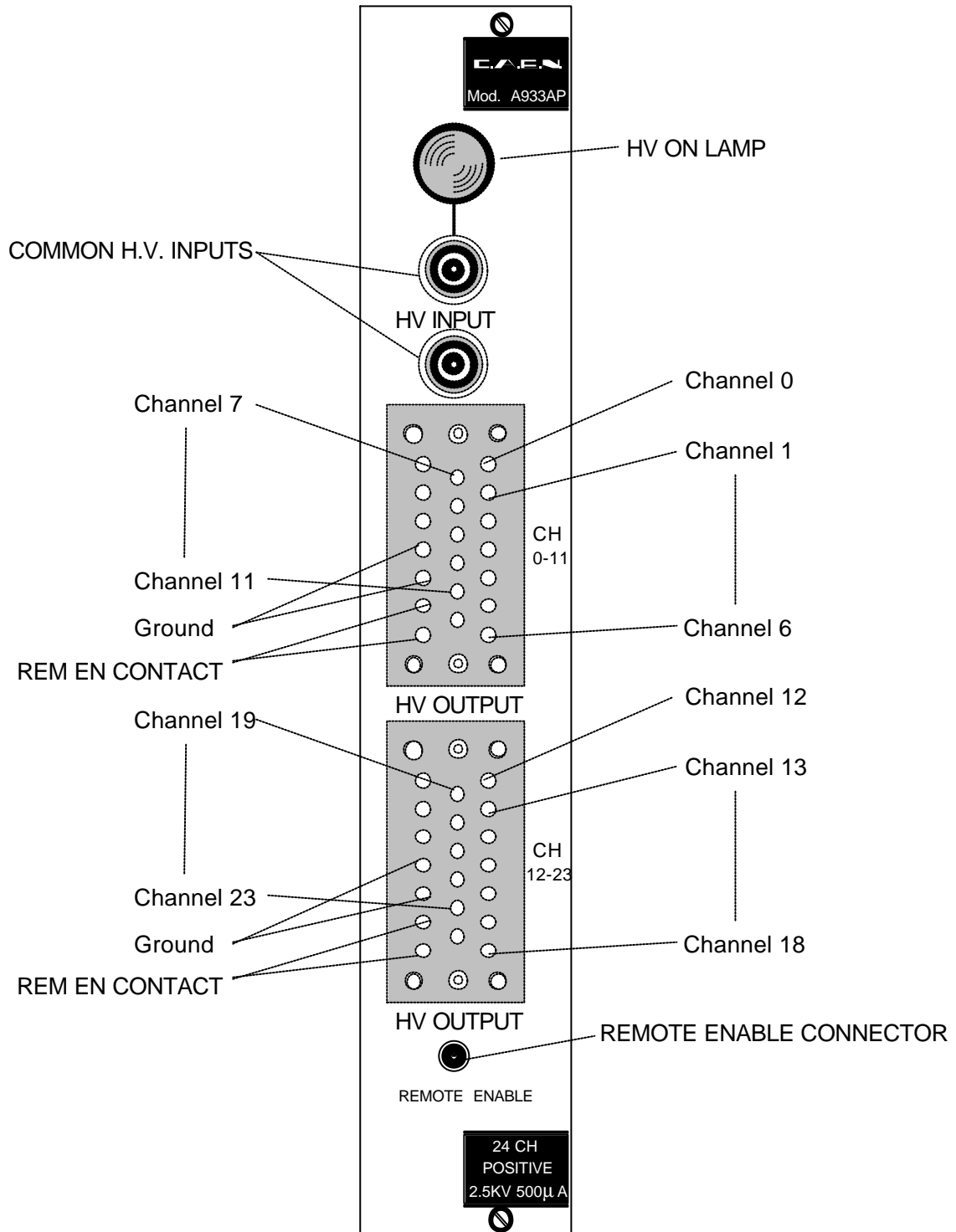
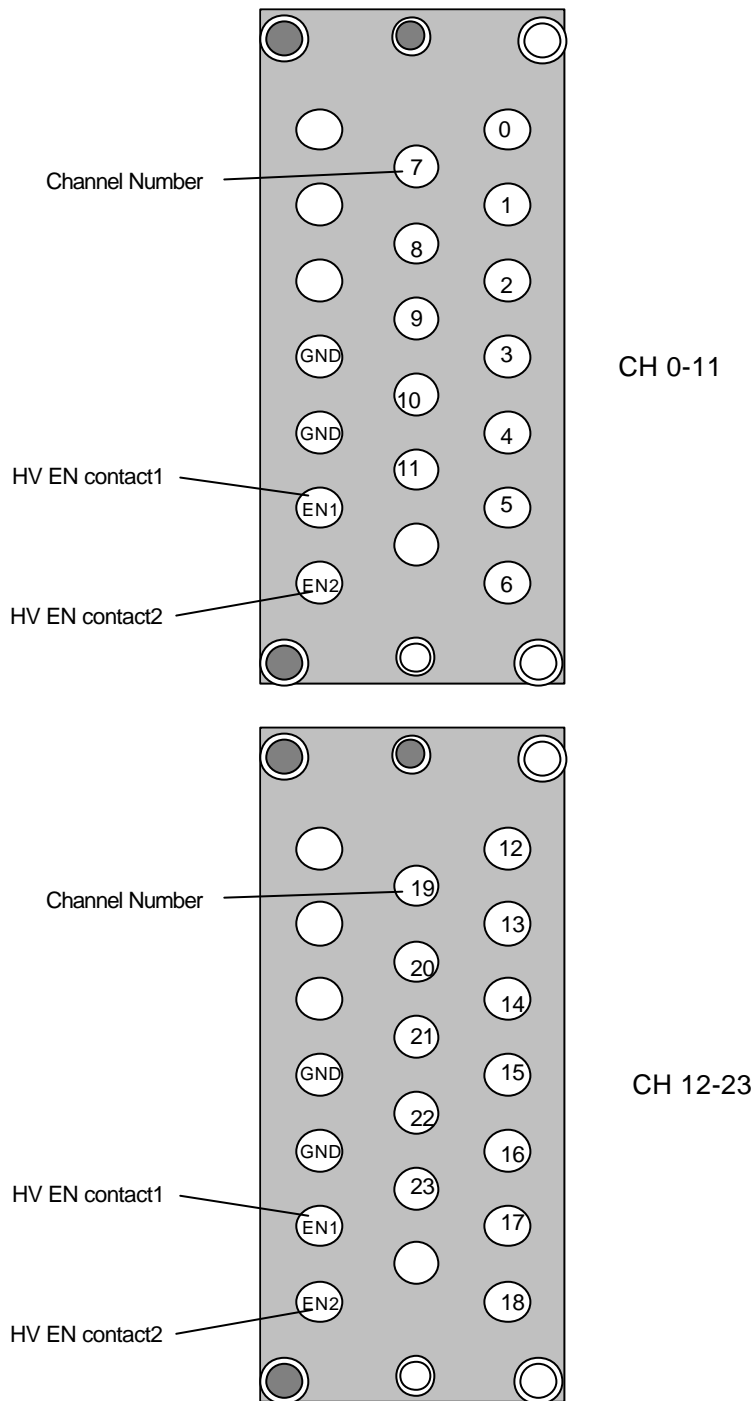


Fig. 2.4: Mod. A933AP Front Panel



**Fig. 2.5: Mod. A933A Block Connectors Description**

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

### 2.2.3. MOD. A933A CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive/Negative (Mod. A933AP and A933AN)
Input H.V.:	0÷2500 V
H.V. Drop:	0÷900 V
Max. Current:	500 $\mu$ A
Voltage Set/Monitor Resolution:	0.2 V
Ramp Up	10 $\pm$ 500 V/s, within drop range
Ramp Down	10 $\pm$ 500 V/s, within drop range
Voltage Ripple:	$\leq$ 5 mVpp (50 V minimum drop required, 150 V with relay); A933A at full load with A753 H. V. channel
Voltage Monitor Accuracy:	$\pm$ 0.2% $\pm$ 1 LSB

**N.B.:** Even if all channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connectors.

For the A933A board, "Channel OFF" means that the A933A channel supplies as output a voltage that is equal to the input voltage minus the maximum drop (approx. 900 V). As an example, if the A753 channel is set to 2200 V and the A933A distributed channel is set to 1900 V, if the A933A channel is ON the output on the multipin connectors will be 1900 V with  $\pm$ 5 mV ripple, while if the A933A channel is OFF the output on the multipin connectors will be approx. 1300 V with a ripple slightly higher than the one of the A753 channel.

With the Relay option, this remains true until ALL channels of the A933A distributor are set to OFF: in the latter case the input voltage is not supplied to the distributor circuits (see § 2.2.5) and thus there is no High Voltage on the multipin connectors.

### 2.2.4. MOD. A933A REMOTE ENABLE (NO RELAY)

The Board is provided with a Remote enable ("REM EN") connector, that must be connected with the corresponding "EN" connector of the A753 channel that powers the distributor.

The Remote Enable line is also connected to the Multipin Connector (REM EN contact pins).

Therefore it is sufficient to connect together the two REM EN pins in both the Multipin Connectors in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way when the output cables are both connected the REM EN contact is in place, and the H.V. input (A753 channel) is enabled.

On the contrary, when at least one of the cables is not connected, the REM EN connection to ground is removed, and the A753 channel output is disabled.

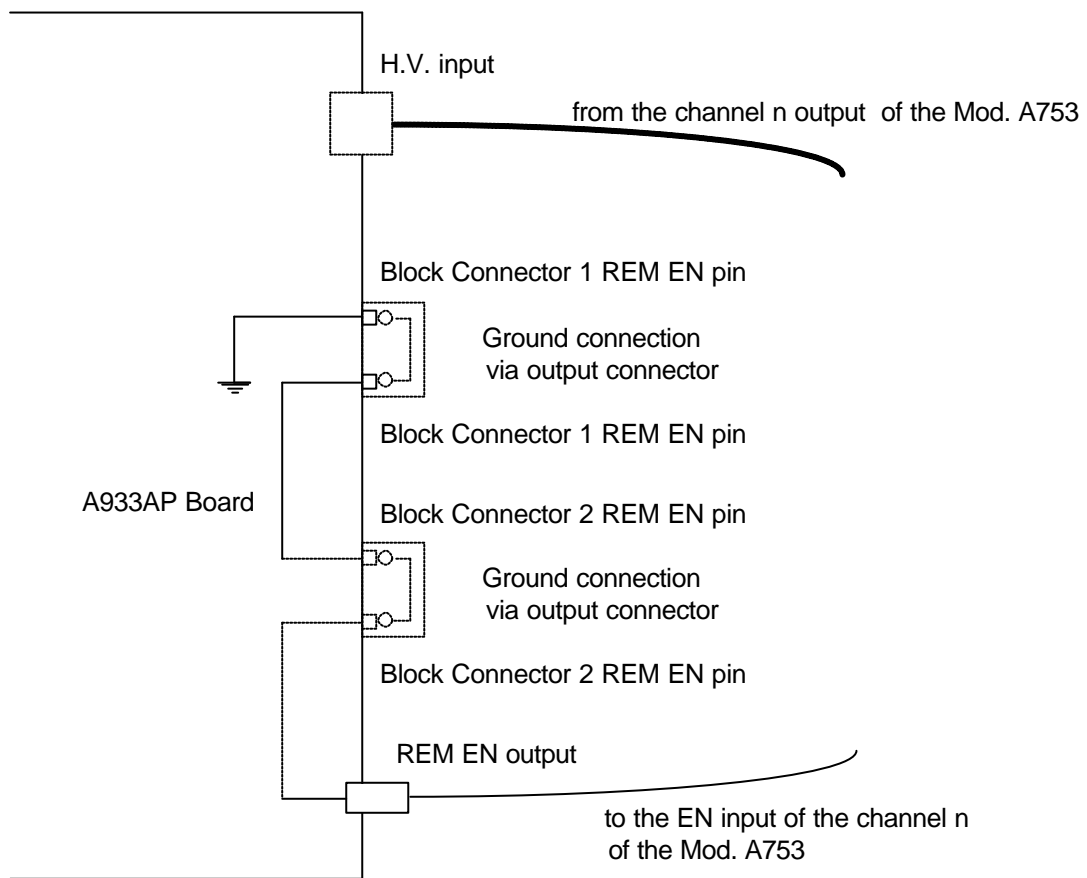
This protection allows to disable the H. V. input when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.



Figure 2.6 describes this protection scheme and the required connections between the Mod. A933A and the Mod. A753.

**N.B.:** If there is High Voltage supplied on the H. V. input of the A933A board with other connection schemes different than the one shown in Fig. 2.6 (e. g., if a H. V. primary channel different from the A753 is used), there is ALWAYS High Voltage on the Multipin connectors. For ordinary functioning or for tests of the A933A board, it is strongly suggested to stick to the Remote Enable connection scheme to avoid any H. V. hazard.

When the Remote Enable connections are in place according to Fig. 2.6, even if all channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connectors.



**Fig. 2.6: Mod. A933A-A753 Remote Enable Scheme**

### 2.2.5. MOD. A933A REMOTE ENABLE (RELAY OPTION)

The Board can be optionally provided with a High Voltage electronic Relay. This relay is enabled with a protection scheme different from the above mentioned. The relay is active (i.e. the H. V. can reach the distribution circuits) with the occurrence of ALL of the following conditions (see Fig. 2.7):

- 1) a connector is inserted in the Block Connector 1, shorting via the cable the two REM EN pins of the connector;
- 2) a connector is inserted in the Block Connector 2, shorting via the cable the two REM EN pins of the connector;
- 3) a short-circuit is made on the LEMO 00 "REMOTE ENABLE" connector;
- 4) at least one channel of the distributor is set to ON.

**N.B.:** With the relay option, if ALL channels of the distributor are set to OFF, the input High Voltage is NOT supplied to the distributor circuits (no H. V. output on the Multipin Connectors). The first channel of the A933A set to ON switches the Relay ON: the High Voltage Relay Output (see fig. 2.7) ramps up to the input voltage at approx. 250 V/s and the multipin connector will supply the programmed H. V. value on the channels ON and the input H. V. value minus the max. drop on the channels OFF (see § 2.2.3).

If at least one of the 4 above conditions becomes false, or if an overcurrent condition occurs (sum of output currents  $>15 \text{ mA} \pm 10\%$ ), the relay switches OFF and all channels are set to OFF and reach zero output voltage. In case of overcurrent, the STATUS of the channels previously ON displays an "I-Trped".

The minimum drop required with the relay option is 150 V.

**N. B.:** With the Relay option, when the Remote Enable connections are in place according to Fig. 2.7, in order to be sure that there is no H. V. present on the Multipin connectors, ALL channels must be set to OFF. If at least one channel is set to on, ALL channels of the board will supply High Voltage on the multipin connector.

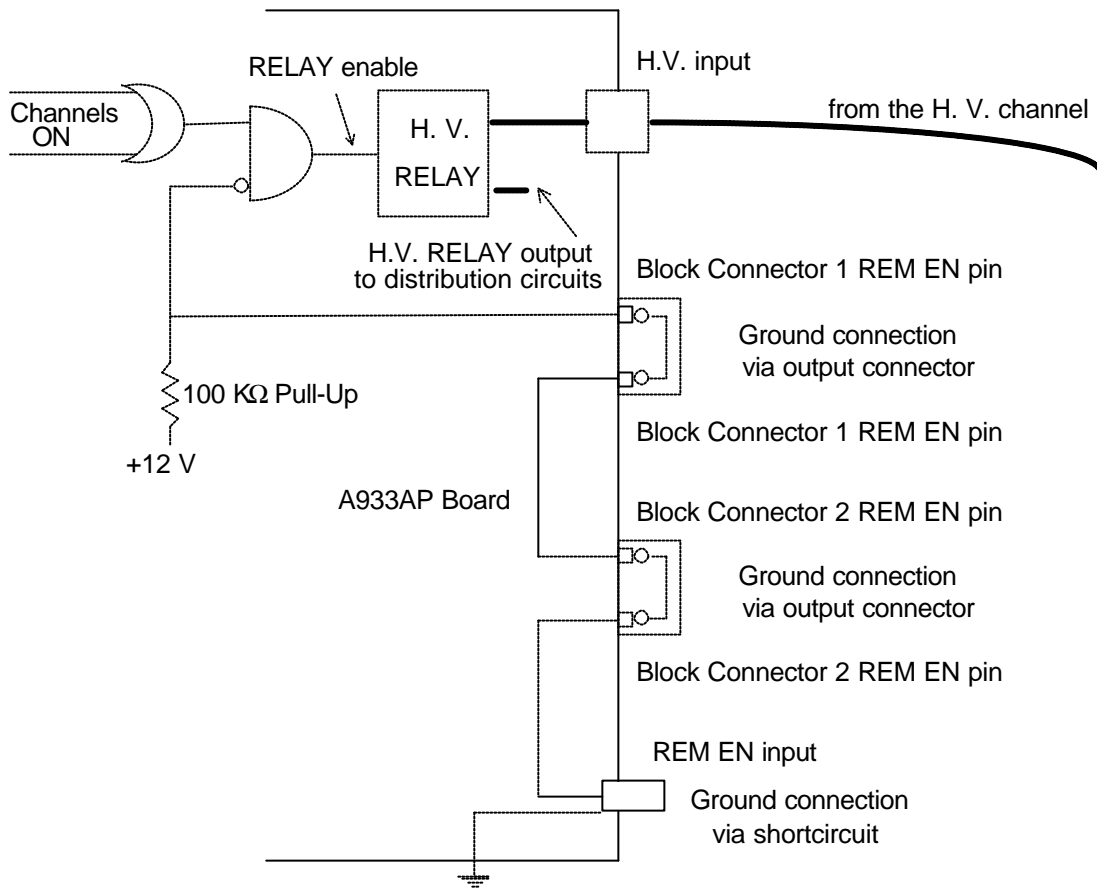


Fig. 2.7: Mod. A933A With Relay Remote Enable Scheme

## 2.3. MOD. A933K H.V. DISTR. AND P.S. BOARD (2.5 kV 500mA)

The Model A933K, High Voltage Positive (Mod. A933KP) or Negative (Mod. A933KN) Distributor and Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.5 kV.

The Board houses a Primary High Voltage Channel and 24 Active Distributor Output Channels, directly supplied by the Primary Channel.

The internal Primary H. V. Channel has a complete set of parameters that can be programmed, such as high voltage ( $V_{\text{PRIM}}$ ), current limit, ramp-up and ramp-down.

The Current Limit of the Primary Channel can be set/monitored with 1  $\mu\text{A}$  resolution. The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once the Primary Channel crosses the Current Limit it trips immediately via hardware.

The Voltage on each Distributed Output Channel ( $V_{\text{SET}}$ ) can be independently programmed in a range of 900 V drop from the Primary Channel  $V_{\text{PRIM}}$  setting with a Current of 0.5 mA on each Distributed Channel.

The difference between the  $V_{\text{PRIM}}$  set value and the minimum distributed voltage output cannot exceed 900 V. If via software a higher difference value is set, the distributed channels output will always follow the Primary channel value at a max. distance of 900 V. All the distributed voltages are programmable and monitorable in 0.2 V steps.

The output voltages are provided via a multiconductor block-type connector.

By using 10 boards of the Mod. A 933 K it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when the internal H. V. is switched ON.

The output connector has two pins dedicated to realize the safety board interlock. This protection allows to disable the primary H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

The cabling instructions for the Male connectors can be found in §A.4.

### **2.3.1. MOD. A933K PACKAGING**

8 TE wide. Height: 6U.

### **2.3.2. MOD. A933K EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 1, "H.V. OUTPUT", Multiconductor Block-type female connectors (75 positions AMP201311-3 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

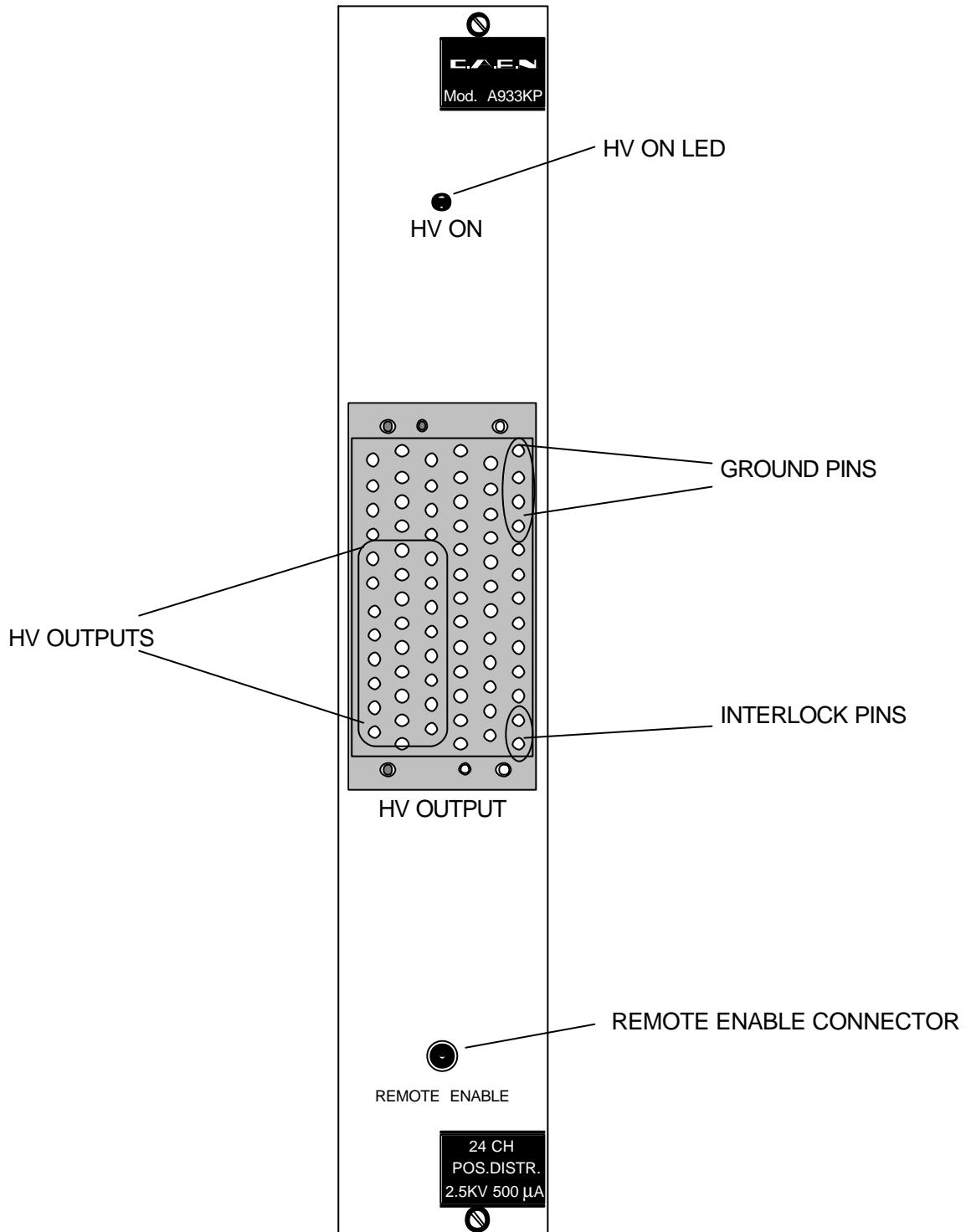
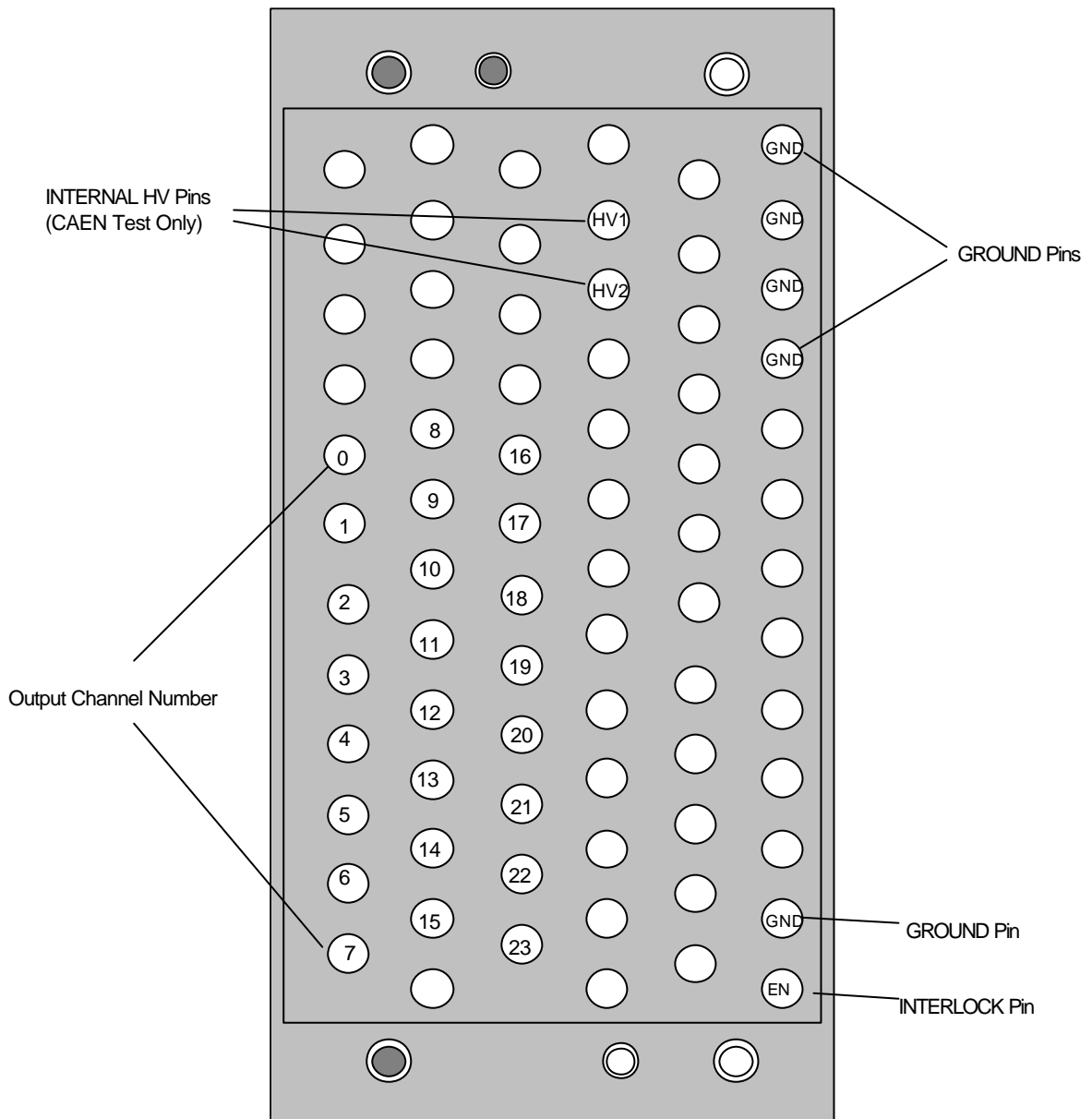


Fig. 2.8: Mod. A933KP Front Panel



**Fig. 2.9: Mod. A933K Block Connector Description**

### 2.3.3. MOD. A933K CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive/Negative (Mod. A933KP and A933KN)
Primary Channel H.V.:	0÷2550 V
H.V. Drop:	0÷900 V (with Output Current > 50 $\mu$ A)
Max. Current:	500 $\mu$ A
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	1 $\mu$ A (*)
Ramp Up	10 ÷500 V/s, within drop range
Ramp Down	10 ÷500 V/s, within drop range
Voltage Ripple:	$\leq$ 5 mVpp (60 MHz bandwidth; with a load drawing > 200 $\mu$ A)
Voltage Monitor Accuracy:	$\pm$ 0.2% $\pm$ 1 LSB
Max. Ptot deliverable on the output channels, per board:	30 W
Max. Ptot drawn by a single board:	45 W

\*= The module allows to set and monitor the current of the internal primary High Voltage channel.

### 2.3.4. MOD. A933K REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also connected to the INTERLOCK pins of the Multipin Connector.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connector in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.

Figure 2.10 describes this protection scheme and the required connections on the Mod. A933K.



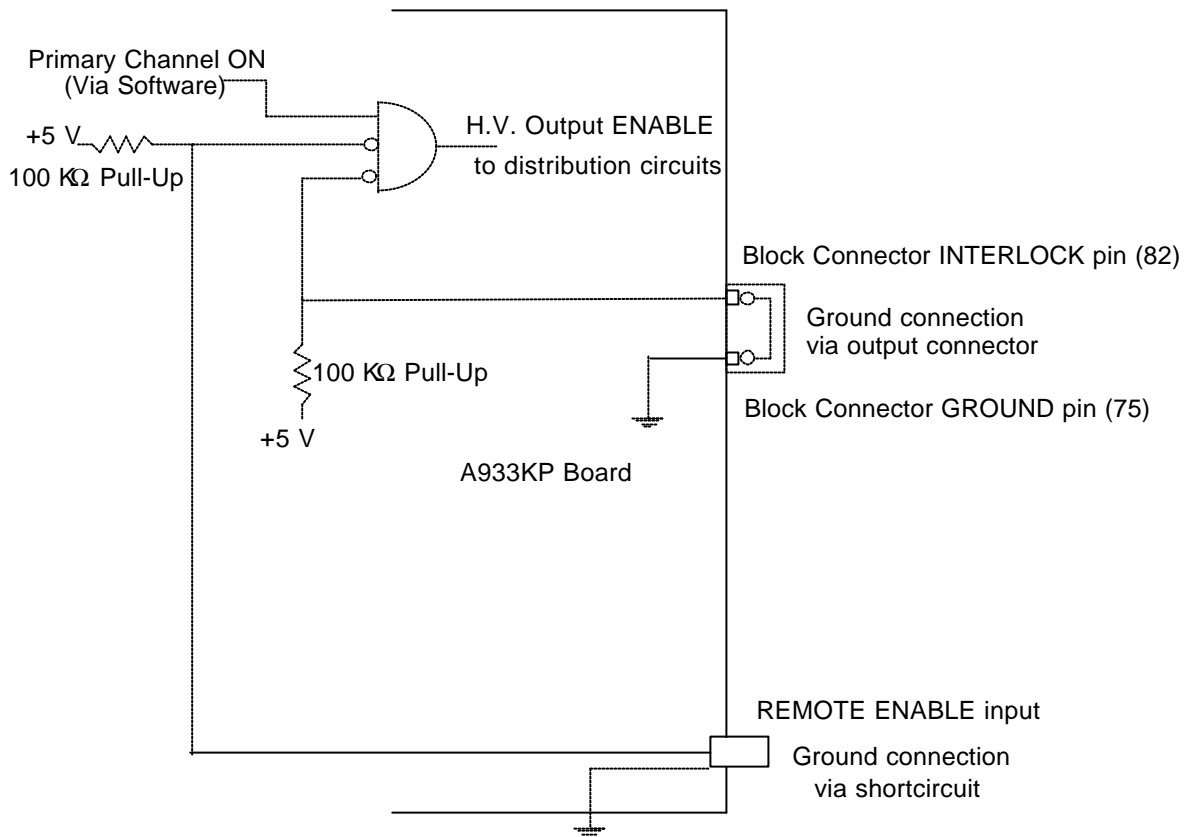


Fig. 2.10: Mod. A933K Remote Enable Scheme

### 2.3.5. MOD. A933K OPERATION

The Board houses 24 distributed channels and one H.V. primary channel. All these 25 channels appear both on the Mainframe display and on the RS232 Terminal. The 24 distributed channels are numbered from 0 to 23, while the primary H. V. channel appears as number 24.

In order to obtain the desired specifications, the distributed channels should be in regulation mode (i.e. the difference between the primary channel voltage setting and the distributors output voltage setting is between 50 V and 900 V with a load drawing more than 200  $\mu$ A).

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program the 24 distributed channels at the desired voltage set, taking care that the maximum difference between the 24 settings does not exceed 900 V.
- 2) Program the primary channel at a setting = [max. setting of distributed channels + 50 V].
- 3) Set all channels ON simultaneously (in common operation).

**N.B.:** Even if all distributed channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connector.

For the A933K board, "Channel OFF" means that the A933K distributed channel supplies as output a voltage that is equal to the primary channel voltage minus the maximum drop (approx. 900 V). As an example, if the primary channel is set to 2200 V and the distributed channel is set to 1900 V, if the distributor channel is ON the output on the multipin connectors will be 1900 V with  $\pm 5$  mV ripple, while if the distributor channel is OFF the output on the multipin connectors will be approx. 1300 V with a higher ripple.

## 2.4. MOD. A934A H.V. PROGR. FAST TRIP P. S. BOARD (2.5 kV 20 mA)

The Model A934A, High Voltage Positive (Mod. A934AP) or Negative (Mod. A934AN) Programmable Fast Trip Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.5 kV.

The Voltage on each Output Channel can be independently programmed and monitored for each channel up to 2500 V in 0.2 V steps.

The Current Limit of the Output Channels can be set up to 20  $\mu$ A with 20 nA resolution, in common to all channels. The drawn Current can be monitored individually for each channel with 20 nA resolution.

The maximum rate of change of the Voltage (Volt/second) may be programmed in steps of 1 V/s for each channel. Two distinct values are available, depending on the sign of the change (Ramp-up and Ramp-down). An attempt to change the voltage will result in a linear increase or decrease with time, the rate being determined by the Ramp-up and Ramp-down parameters.

The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once an Output Channel crosses the Current Limit it detects via hardware this condition in less than 1 ms and it trips immediately.

The output voltages are provided via a multiconductor block-type connector.

By using 10 boards of the Mod. A 934A it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when at least an H. V. channel is switched ON.

The output connector has two pins dedicated to realize the safety board interlock. This protection allows to disable the H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

The cabling instructions for the Male connectors can be found in §A.6.

**N.B.: This board requires SY527 software version 3.23 or higher.**

### **2.4.1. MOD. A934A PACKAGING**

8 TE wide. Height: 6U.

### **2.4.2. MOD. A934A EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 1, "H.V. OUTPUT", Multiconductor Block-type female connectors (75 positions AMP201311-3 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

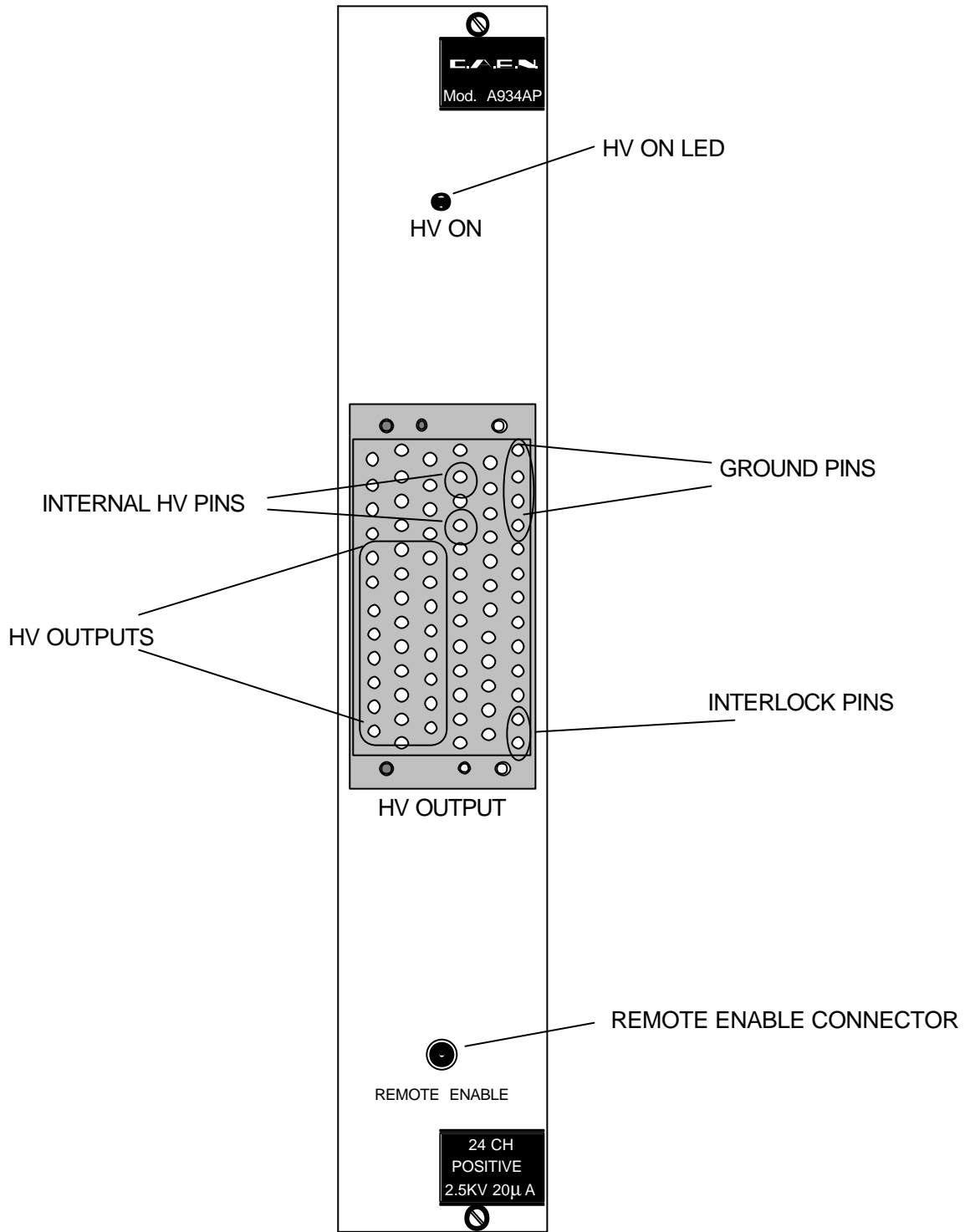


Fig. 2.11: Mod. A934AP Front Panel

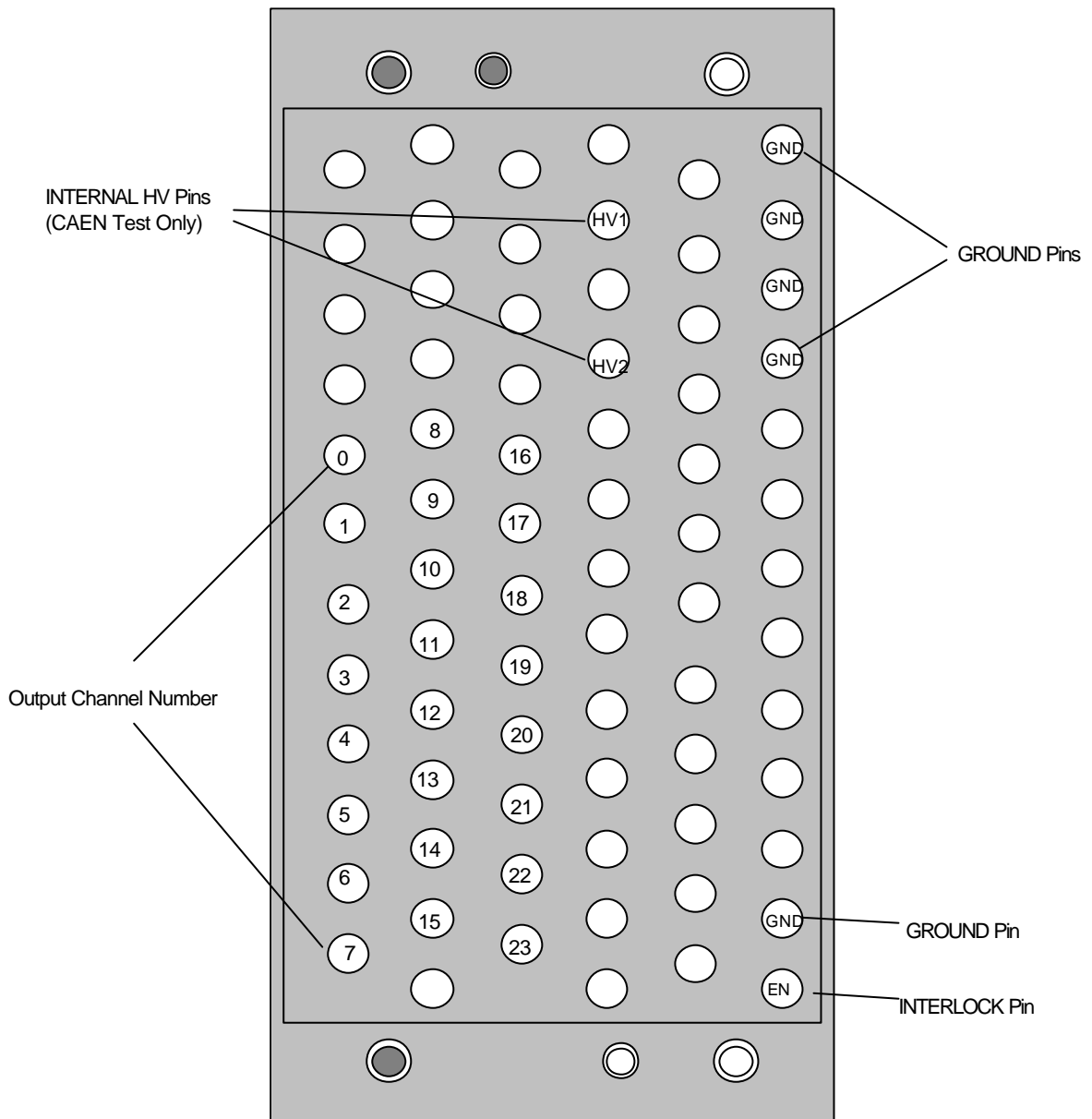


Fig. 2.12: Mod. A934A Block Connector Description

### 2.4.3. MOD. A934A CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive/Negative (Mod. A934AP and A934AN)
H.V. Output:	50÷2500 V
Max. Current:	20 $\mu$ A
Voltage Set/Monitor Resolution:	0.2 V
Current Monitor Resolution:	20 nA
Ramp Up	10 ÷100 V/s
Ramp Down	10 ÷100 V/s
Voltage Ripple:	$\leq$ 20 mVpp
Current Set Interchannel Spread	$<2\% \pm 200$ nA
Current Monitor Accuracy:	$3\% \pm 200$ nA

### 2.4.4. MOD. A934A REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also connected to the INTERLOCK pins of the Multipin Connector.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connector in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.

Figure 2.13 describes this protection scheme and the required connections on the Mod. A934A.

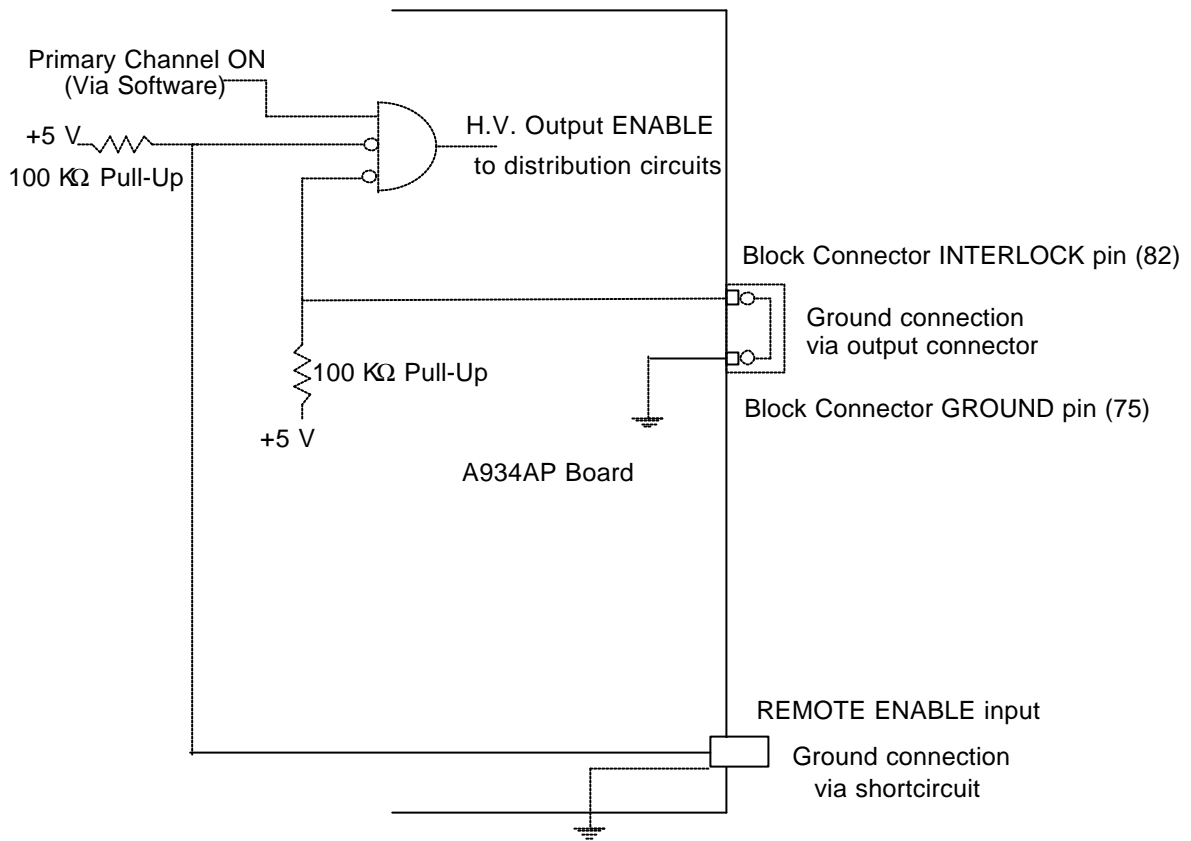


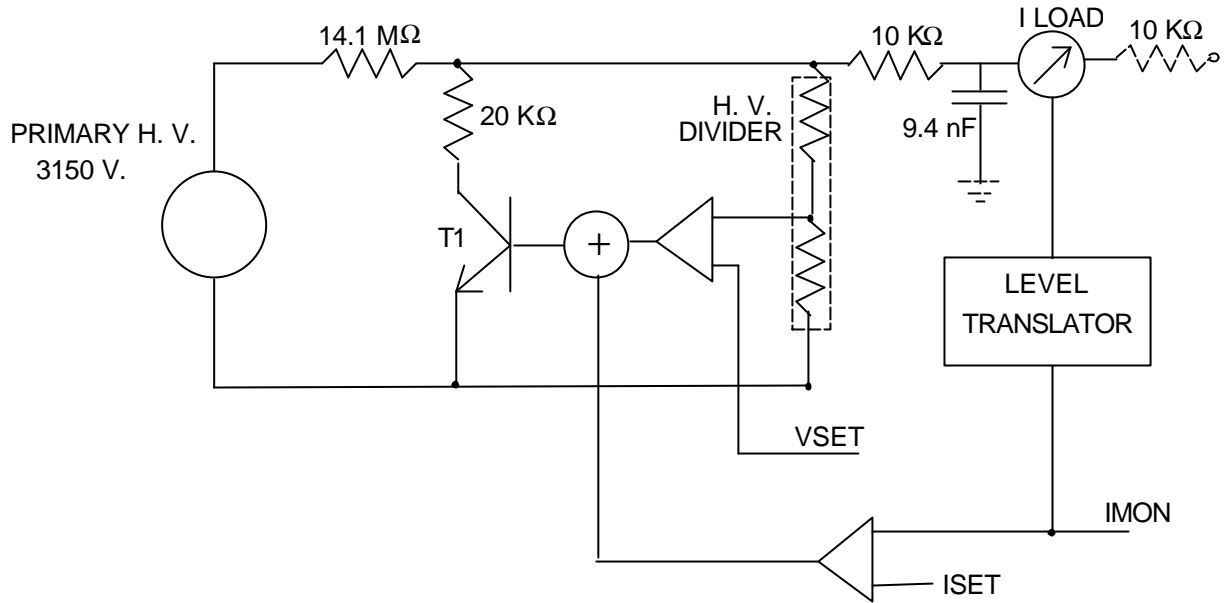
Fig. 2.13: Mod. A934A Remote Enable Scheme

**2.4.5. MOD. A934A OPERATING PRINCIPLE**

The Board houses 24 distributed channels and one H.V. primary channel, the latter completely transparent to the User. The 24 channels appear on the Mainframe display and on the RS232 Terminal and are numbered from 0 to 23, while the primary H. V. channel does not appear.

The internal Primary H. V. Channel is automatically switched ON whenever an Output Channel is switched ON.





**Fig. 2.14: Mod. A934A Operating Principle Scheme**

Figure 2.14 shows the operating principle of an A934 channel. When the T1 transistor is at saturation, the output voltage does not exceed 10 V, while when the T1 transistor is OFF, the output voltage is 2500 V.

In case the T1 transistor doesn't work, the maximum current on the load does not exceed 250  $\mu$ A. This feature ensures a safety protection for the wires of a chamber.

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program independently the 24 distributed channels at the desired voltage set.
- 2) Program in common the current for the 24 distributed channels at the desired set.
- 3) Set all channels ON simultaneously (in common operation) or with the desired priority.

## 2.5. MOD. A938AN H.V. DISTR. AND P.S. BOARD (2.2 kV 1.2 mA)

The Model A938AN, High Voltage Negative Distributor and Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.2 kV.

The Board houses a Primary High Voltage Channel and 24 Active Distributor Output Channels, directly supplied by the Primary Channel.

The internal Primary H. V. Channel has a complete set of parameters that can be programmed, such as high voltage ( $V_{\text{PRIM}}$ ), current limit, ramp-up and ramp-down.

The Current Limit of the Primary Channel can be set/monitored with 2  $\mu\text{A}$  resolution. The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once the Primary Channel crosses the Current Limit it trips immediately via hardware.

The Voltage on each Distributed Output Channel ( $V_{\text{SET}}$ ) can be independently programmed in a range of 700 V drop from the Primary Channel  $V_{\text{PRIM}}$  setting with a Current of 1.2 mA on each Distributed Channel.

The difference between the  $V_{\text{PRIM}}$  set value and the minimum distributed voltage output cannot exceed 700 V. If via software a higher difference value is set, the distributed channels output will always follow the Primary channel value at a max. distance of 700 V. All the distributed voltages are programmable and monitorable in 0.2 V steps.

The output voltages are provided via a multiconductor block-type connector.

By using 10 boards of the Mod. A 938 AN it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when the internal H. V. is switched ON.

The output connector has two pins dedicated to realize the safety board interlock. This protection allows to disable the primary H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

The cabling instructions for the Male connectors can be found in §A.7.

### **2.5.1. MOD. A938AN PACKAGING**

8 TE wide. Height: 6U.

### **2.5.2. MOD. A938AN EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 1, "H.V. OUTPUT", Multiconductor Block-type female connectors (75 positions AMP201311-3 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

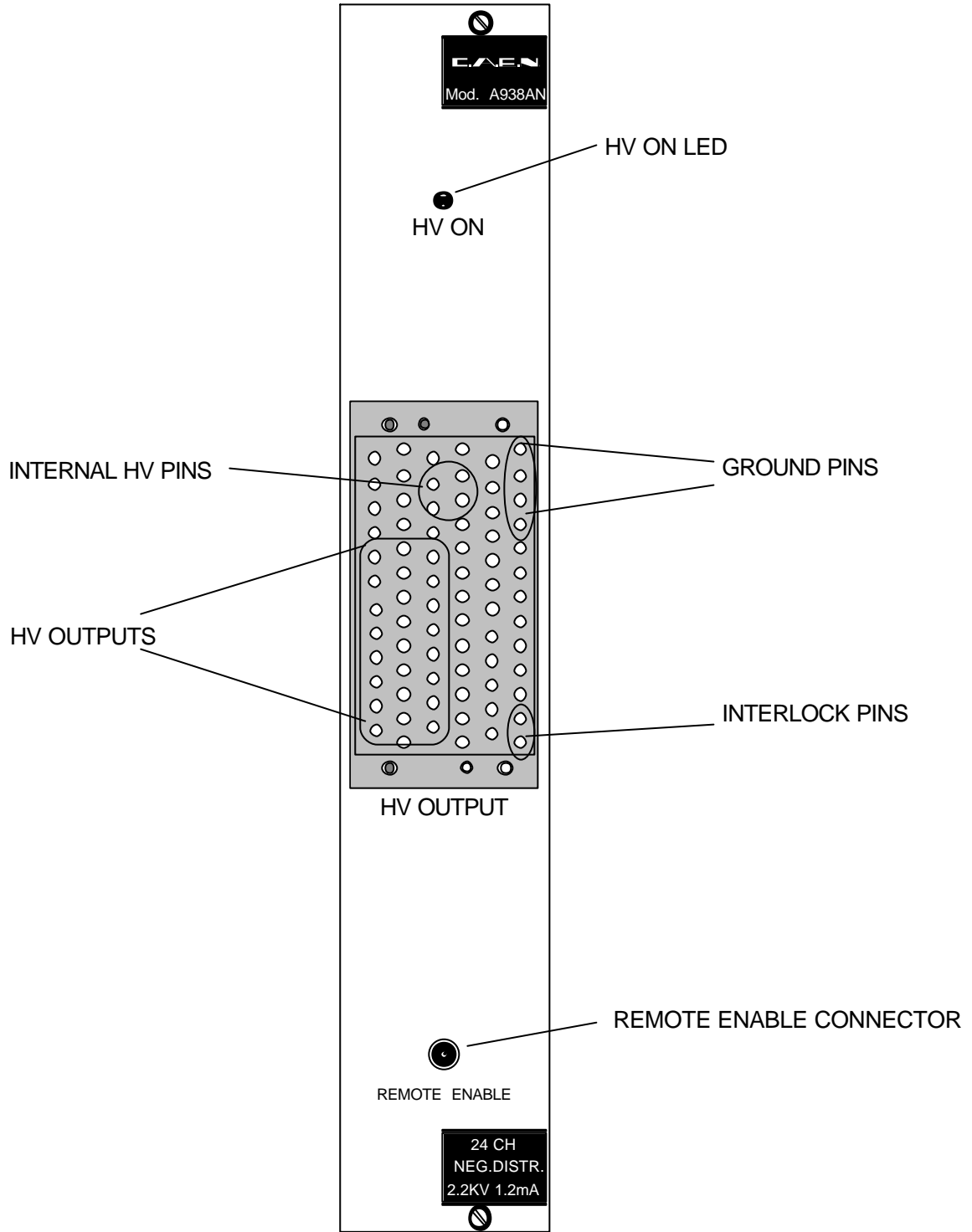


Fig. 2.15: Mod. A938AN Front Panel

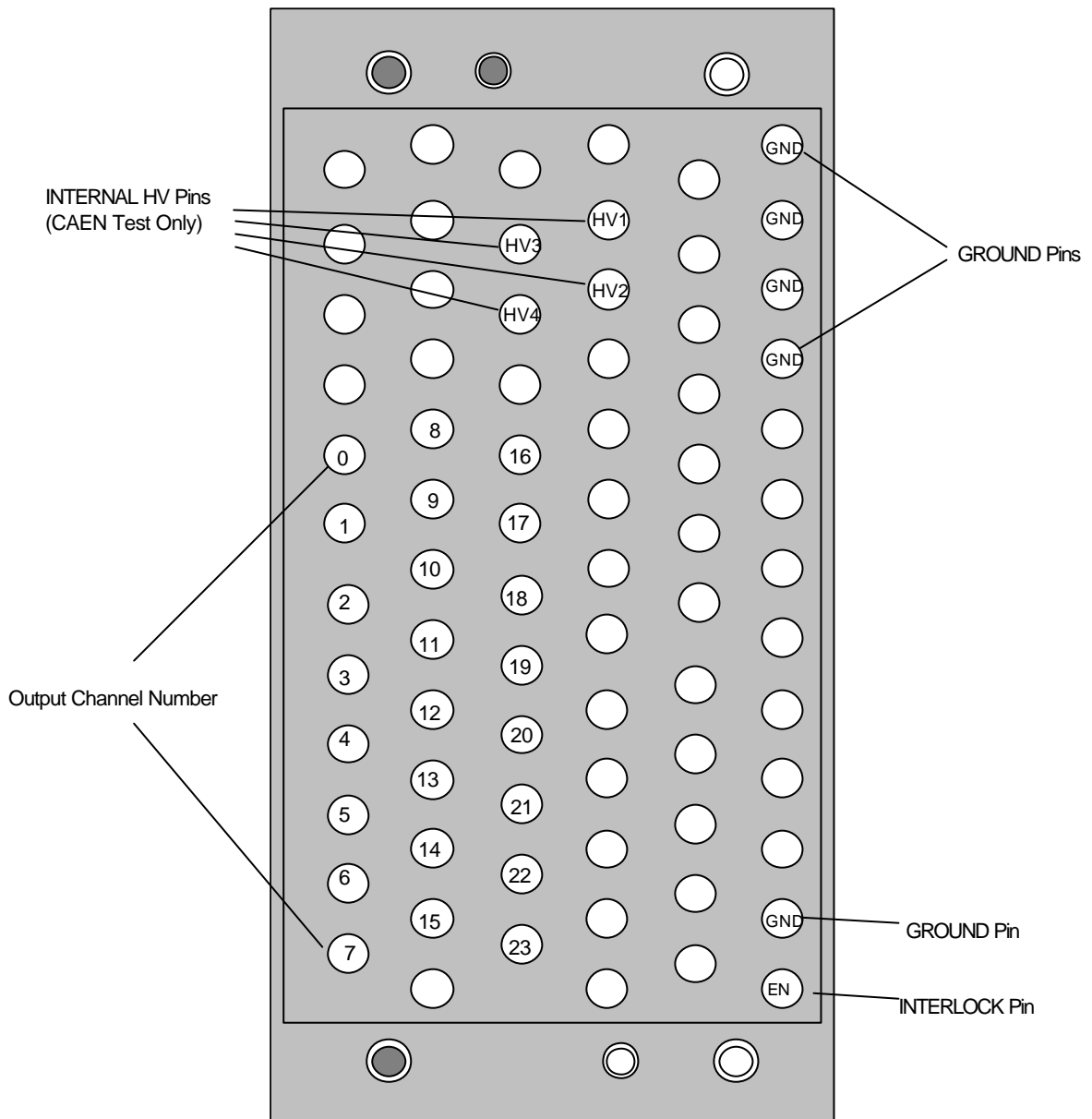


Fig. 2.16: Mod. A938AN Block Connector Description

### 2.5.3. MOD. A938AN CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Negative (Mod. A938AN)
Primary Channel H.V.:	0÷2250 V
H.V. Drop:	0÷700 V (with Output Current > 50 $\mu$ A)
Max. Current:	1.2 mA
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	2 $\mu$ A (*)
Ramp Up	10 ÷500 V/s, within drop range
Ramp Down	10 ÷500 V/s, within drop range
Voltage Ripple:	$\leq$ 10 mVpp (60 MHz bandwidth; with load drawing > 200 $\mu$ A)
Voltage Monitor Accuracy:	$\pm$ 0.2% $\pm$ 1 LSB
Max. Ptot deliverable on the output channels, per board:	68 W
Max. Ptot drawn by a single board:	96 W

\*= The module allows to set and monitor the current of the internal primary High Voltage channel.

### 2.5.4. MOD. A938AN REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also connected to the INTERLOCK pins of the Multipin Connector.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connector in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.

Figure 2.17 describes this protection scheme and the required connections on the Mod. A938AN.

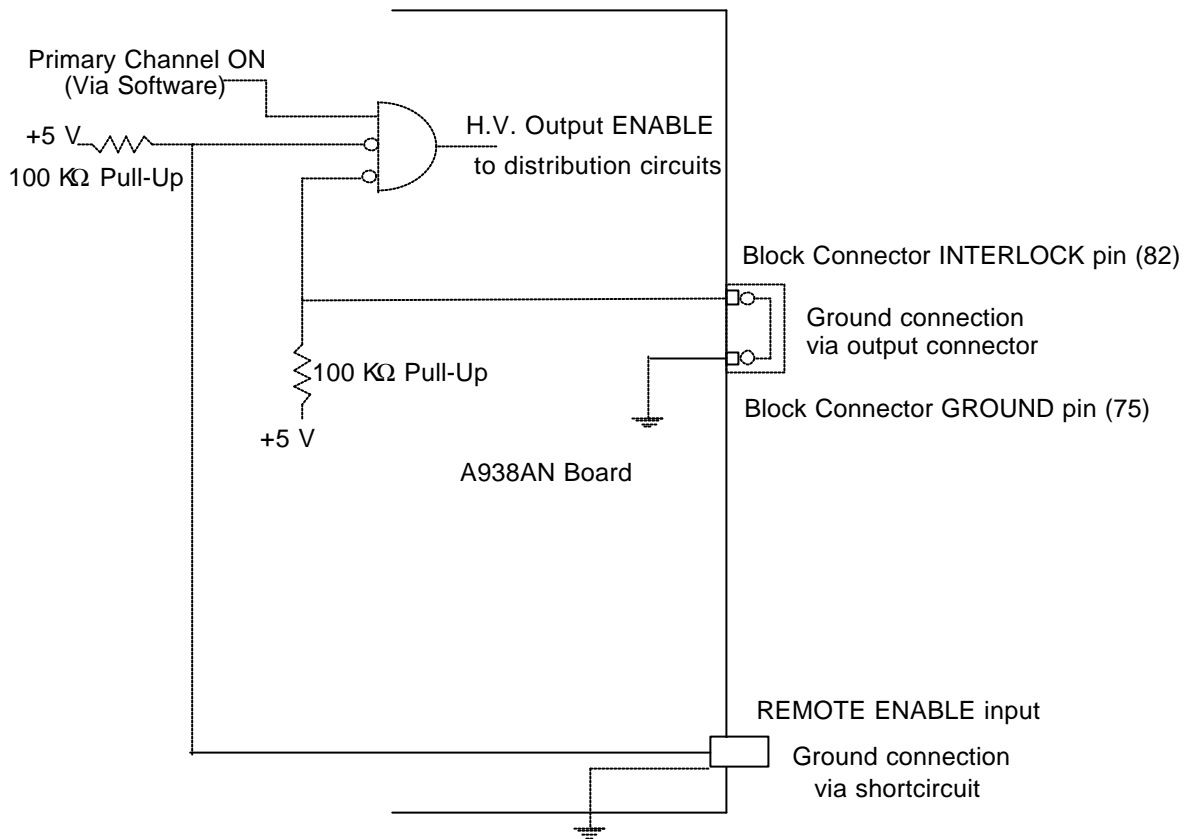


Fig. 2.17: Mod. A938AN Remote Enable Scheme

### 2.5.5. MOD. A938AN OPERATION

The Board houses 24 distributed channels and one H.V. primary channel. All these 25 channels appear both on the Mainframe display and on the RS232 Terminal. The 24 distributed channels are numbered from 0 to 23, while the primary H. V. channel appears as number 24.

In order to obtain the desired specifications, the distributed channels should be in regulation mode (i.e. the difference between the primary channel voltage setting and the distributors output voltage setting is between 50 V and 700 V with a load drawing more than 200  $\mu$ A).

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program the 24 distributed channels at the desired voltage set, taking care that the maximum difference between the 24 settings does not exceed 700 V.
- 2) Program the primary channel at a setting = [max. setting of distributed channels + 50 V].
- 3) Set all channels ON simultaneously (in common operation).

**N.B.:** Even if all distributed channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connector.

For the A938AN board, "Channel OFF" means that the A938AN distributed channel supplies as output a voltage that is equal to the primary channel voltage minus the maximum drop (approx. 700 V). As an example, if the primary channel is set to 2200 V and the distributed channel is set to 1900 V, if the distributor channel is ON the output on the multipin connectors will be 1900 V with  $\pm 10$  mV ripple, while if the distributor channel is OFF the output on the multipin connectors will be approx. 1500 V with a higher ripple.



## 2.6. MOD. A938AP H.V. DISTR. AND P.S. BOARD (2.2 kV 1.2 mA)

The Model A938AP, High Voltage Positive Distributor and Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.2 kV.

The Board houses a Primary High Voltage Channel and 24 Active Distributor Output Channels, directly supplied by the Primary Channel.

The internal Primary H. V. Channel has a complete set of parameters that can be programmed, such as high voltage ( $V_{\text{PRIM}}$ ), current limit, ramp-up and ramp-down.

The Current Limit of the Primary Channel can be set/monitored with 2  $\mu\text{A}$  resolution. The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once the Primary Channel crosses the Current Limit it trips immediately via hardware.

The Voltage on each Distributed Output Channel ( $V_{\text{SET}}$ ) can be independently programmed in a range of 700 V drop from the Primary Channel  $V_{\text{PRIM}}$  setting with a Current of 1.2 mA on each Distributed Channel.

The difference between the  $V_{\text{PRIM}}$  set value and the minimum distributed voltage output cannot exceed 700 V. If via software a higher difference value is set, the distributed channels output will always follow the Primary channel value at a max. distance of 700 V. All the distributed voltages are programmable and monitorable in 0.2 V steps.

The output voltages are provided via a multiconductor block-type connector.

By using 10 boards of the Mod. A 938 AP it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when the internal H. V. is switched ON.

The output connector has two pins dedicated to realize the safety board interlock. This protection allows to disable the primary H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

The cabling instructions for the Male connectors can be found in §A.8.

### **2.6.1. MOD. A938AP PACKAGING**

8 TE wide. Height: 6U.

### **2.6.2. MOD. A938AP EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 1, "H.V. OUTPUT", Multiconductor Block-type female connectors (75 positions AMP201311-3 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

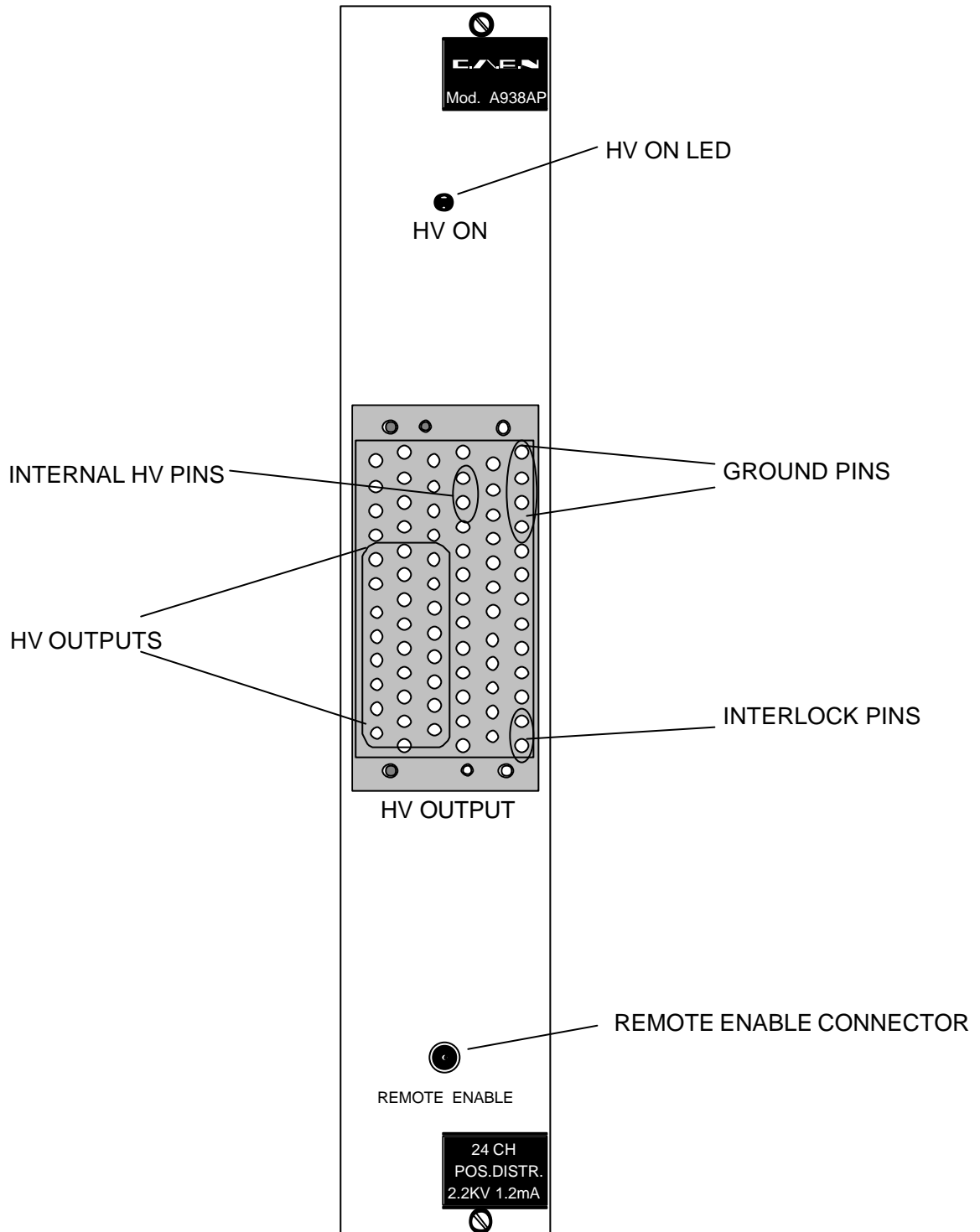


Fig. 2.18: Mod. A938AP Front Panel

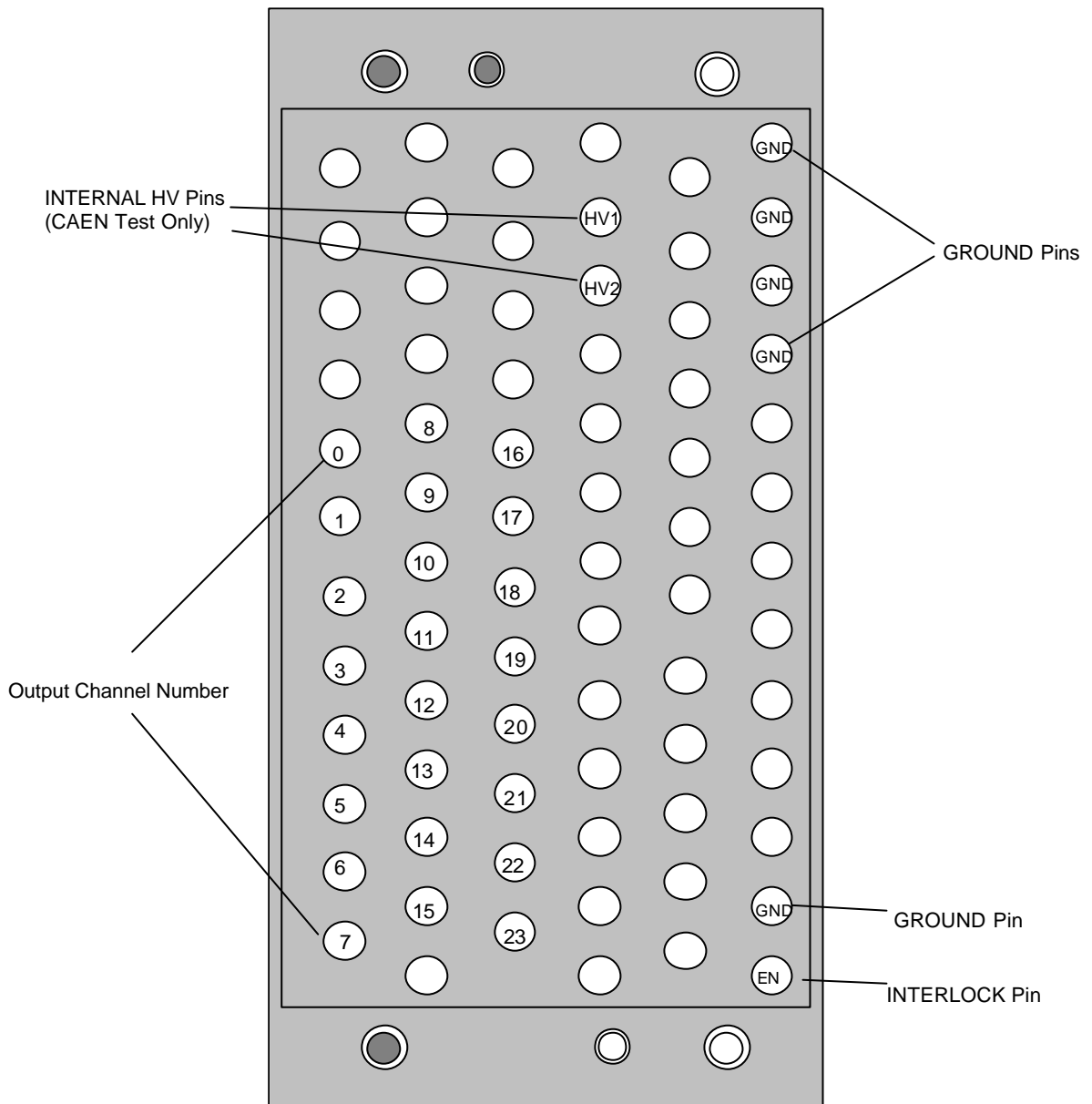


Fig. 2.19: Mod. A938AP Block Connector Description

### 2.6.3. MOD. A938AP CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive (Mod. A938AP)
Primary Channel H.V.:	0÷2250 V
H.V. Drop:	0÷700 V (with Output Current > 50 $\mu$ A)
Max. Current:	1.2 mA
Voltage Set/Monitor Resolution:	0.2 V
Current Set/Monitor Resolution:	2 $\mu$ A (*)
Ramp Up	10 $\pm$ 500 V/s, within drop range
Ramp Down	10 $\pm$ 500 V/s, within drop range
Voltage Ripple:	$\leq$ 10 mVpp (60 MHz bandwidth; with load drawing > 200 $\mu$ A)
Voltage Monitor Accuracy:	$\pm$ 0.2% $\pm$ 1 LSB
Max. Ptot deliverable on the output channels, per board:	68 W
Max. Ptot drawn by a single board:	96 W

\*= The module allows to set and monitor the current of the internal primary High Voltage channel.

### 2.6.4. MOD. A938AP REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also connected to the INTERLOCK pins of the Multipin Connector.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connector in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.

Figure 2.20 describes this protection scheme and the required connections on the Mod. A938AP.

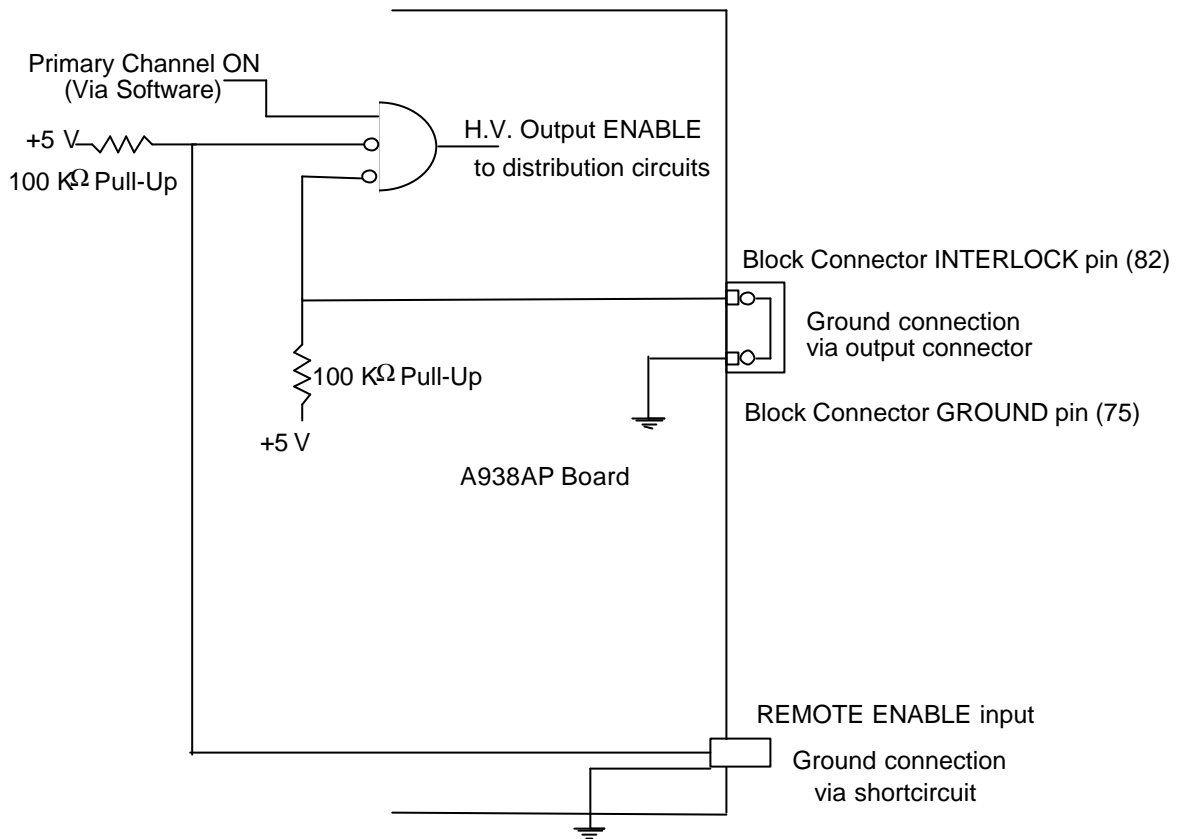


Fig. 2.20: Mod. A938AP Remote Enable Scheme

### 2.6.5. MOD. A938AP OPERATION

The Board houses 24 distributed channels and one H.V. primary channel. All these 25 channels appear both on the Mainframe display and on the RS232 Terminal. The 24 distributed channels are numbered from 0 to 23, while the primary H. V. channel appears as number 24.

In order to obtain the desired specifications, the distributed channels should be in regulation mode (i.e. the difference between the primary channel voltage setting and the distributors output voltage setting is between 50 V and 700 V with a load drawing more than 200  $\mu$ A).

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program the 24 distributed channels at the desired voltage set, taking care that the maximum difference between the 24 settings does not exceed 700 V.
- 2) Program the primary channel at a setting = [max. setting of distributed channels + 50 V].
- 3) Set all channels ON simultaneously (in common operation).

**N.B.:** Even if all distributed channels are set to OFF via terminal, H. S. CAENET or via front panel keyboard, this does NOT imply that there is no output voltage on the Multipin connector.

For the A938AP board, "Channel OFF" means that the A938AP distributed channel supplies as output a voltage that is equal to the primary channel voltage minus the maximum drop (approx. 700 V). As an example, if the primary channel is set to 2200 V and the distributed channel is set to 1900 V, if the distributor channel is ON the output on the multipin connectors will be 1900 V with  $\pm 10$  mV ripple, while if the distributor channel is OFF the output on the multipin connectors will be approx. 1500 V with a higher ripple.

## 2.7. MOD. A944A H.V. PROGR. FAST TRIP P. S. BOARD (2.5 kV 40 mA)

The Model A944A, High Voltage Positive (Mod. A944AP) or Negative (Mod. A944AN) Programmable Fast Trip Power Supply Board for the SY527 System, is a 24 Channels board with a maximum output voltage of 2.5 kV.

The Voltage on each Output Channel can be independently programmed and monitored for each channel up to 2500 V in 0.2 V steps.

The Current Limit of the Output Channels can be set up to 40  $\mu$ A with 40 nA resolution, in common to all channels. The drawn Current can be monitored individually for each channel with 40 nA resolution.

The maximum rate of change of the Voltage (Volt/second) may be programmed in steps of 1 V/s for each channel. Two distinct values are available, depending on the sign of the change (Ramp-up and Ramp-down). An attempt to change the voltage will result in a linear increase or decrease with time, the rate being determined by the Ramp-up and Ramp-down parameters.

The behaviour in case of an Overcurrent can be programmed in different ways. In particular, it can be also programmed in a way that once an Output Channel crosses the Current Limit it detects via hardware this condition in less than 2 ms and it trips immediately.

The output voltages are provided via a multiconductor block-type connector.

By using 10 boards of the Mod. A 944A it is possible to obtain in a single SY527 mainframe a complete system of 240 H. V. channels.

A front panel LED lights up when at least an H. V. channel is switched ON.

The output connector has two pins dedicated to realize the safety board interlock. This protection allows to disable the H. V. generation when the Distributor outputs are not connected to their loads.

All the relevant parameters are stored in a special "on-board" non volatile memory (EEPROM) so that this information is not lost at power off.

The cabling instructions for the Male connectors can be found in §A.6.

**N.B.: This board requires SY527 software version 3.23 or higher.**



### **2.7.1. MOD. A944A PACKAGING**

8 TE wide. Height: 6U.

### **2.7.2. MOD. A944A EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 1, "H.V. OUTPUT", Multiconductor Block-type female connectors (75 positions AMP201311-3 type) for the 24 channels H.V. outputs.
- No. 1, "REMOTE ENABLE", LEMO 00 type connector.

#### **DISPLAYS**

- No. 1, "HV ON", high luminosity red LED, signalling the presence of an output high voltage (ON = H.V. present).

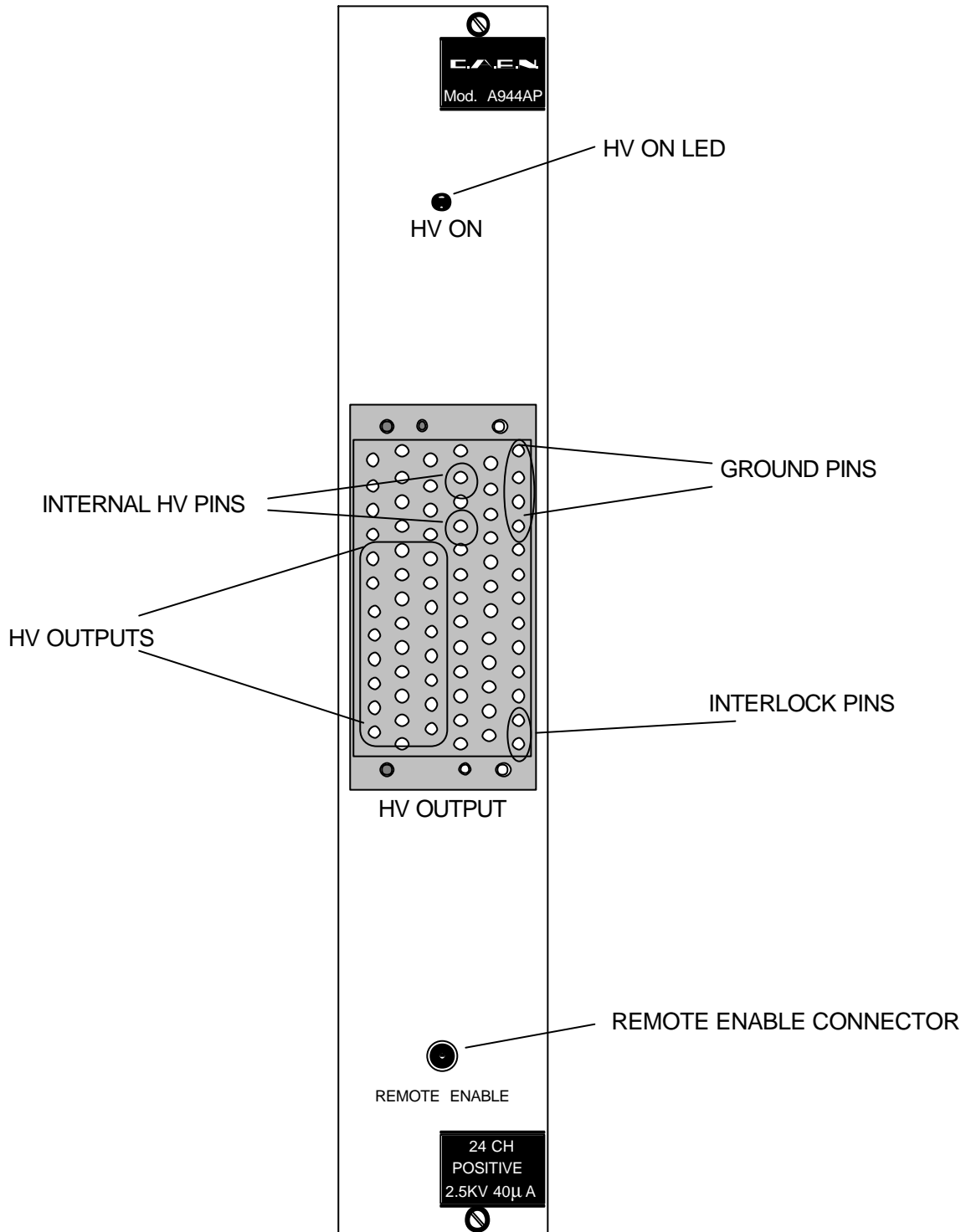


Fig. 2.21: Mod. A944AP Front Panel

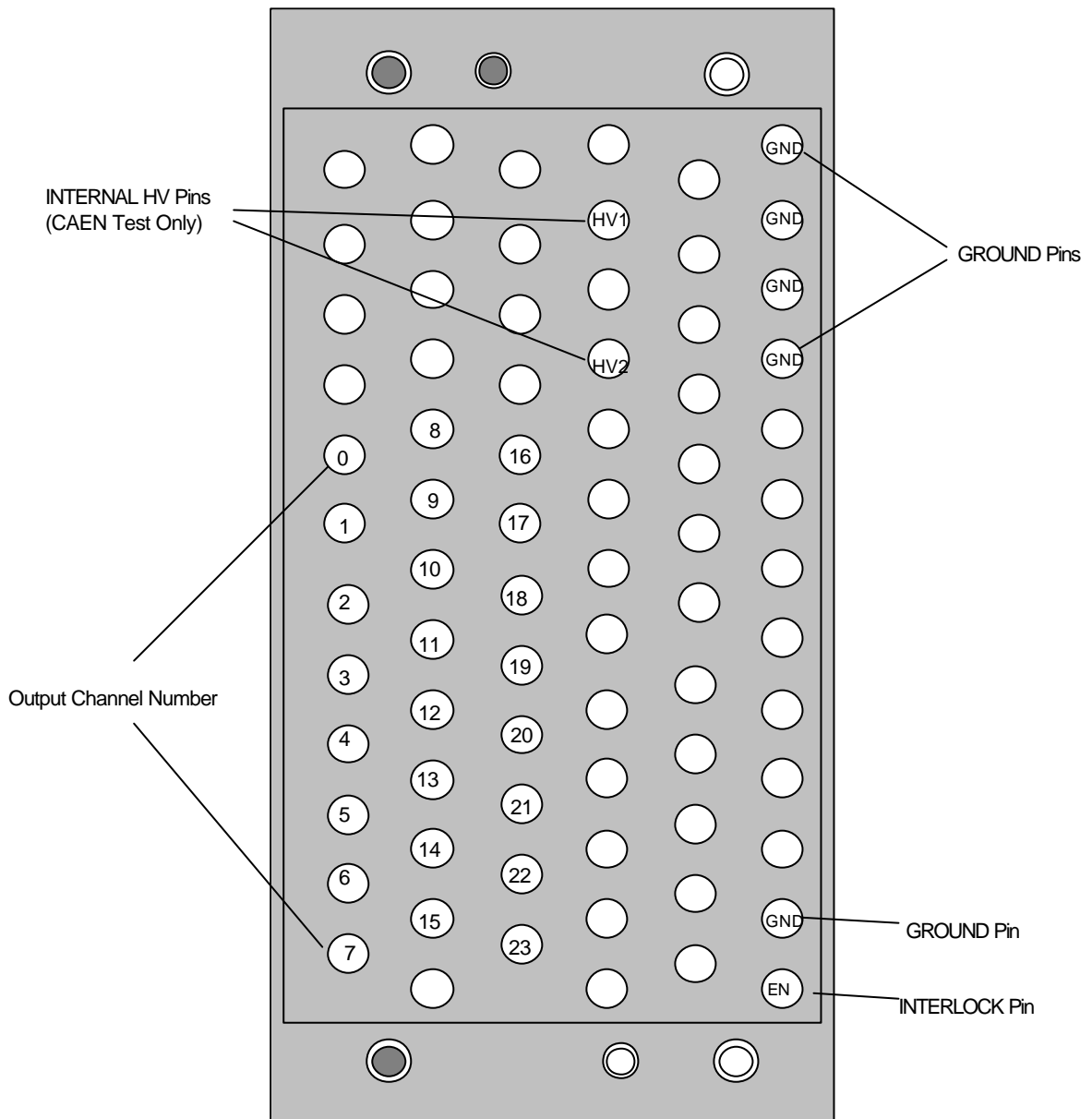


Fig. 2.22: Mod. A944A Block Connector Description

### 2.7.3. MOD. A944A CHANNEL CHARACTERISTICS (Preliminary)

Polarity:	Positive/Negative (Mod. A944AP and A944AN)
H.V. Output:	50÷2500 V
Max. Current:	40 $\mu$ A
Voltage Set/Monitor Resolution:	0.2 V
Current Monitor Resolution:	40 nA
Ramp Up	10 ÷100 V/s
Ramp Down	10 ÷100 V/s
Voltage Ripple:	$\leq$ 20 mVpp
Current Set Interchannel Spread	$<2\% \pm 400$ nA
Current Monitor Accuracy:	$3\% \pm 400$ nA

### 2.7.4. MOD. A944A REMOTE ENABLE

The Board is provided with a Remote enable ("REM EN") connector, that must be connected to ground in order to obtain an high voltage output.

The Remote Enable line is also connected to the INTERLOCK pins of the Multipin Connector.

Therefore it is necessary to connect together the two INTERLOCK pins in the Multipin Connector in order to enable the output channels.

This connection should be done at the level of the Detector to be supplied, in order to disable the H. V. on the Multipin Connector. In this way, when the output cable is connected to the Detector, the INTERLOCK contact is in place, and the H.V. output is enabled.

On the contrary, when the cable is not connected, the INTERLOCK connection to ground is removed and the H.V. output is disabled.

This protection allows to disable the H. V. output when the distributor outputs are not connected to their loads, and therefore to prevent H. V. hazards on the Multipin Connector or at the end of the cable.

Figure 2.23 describes this protection scheme and the required connections on the Mod. A944A.

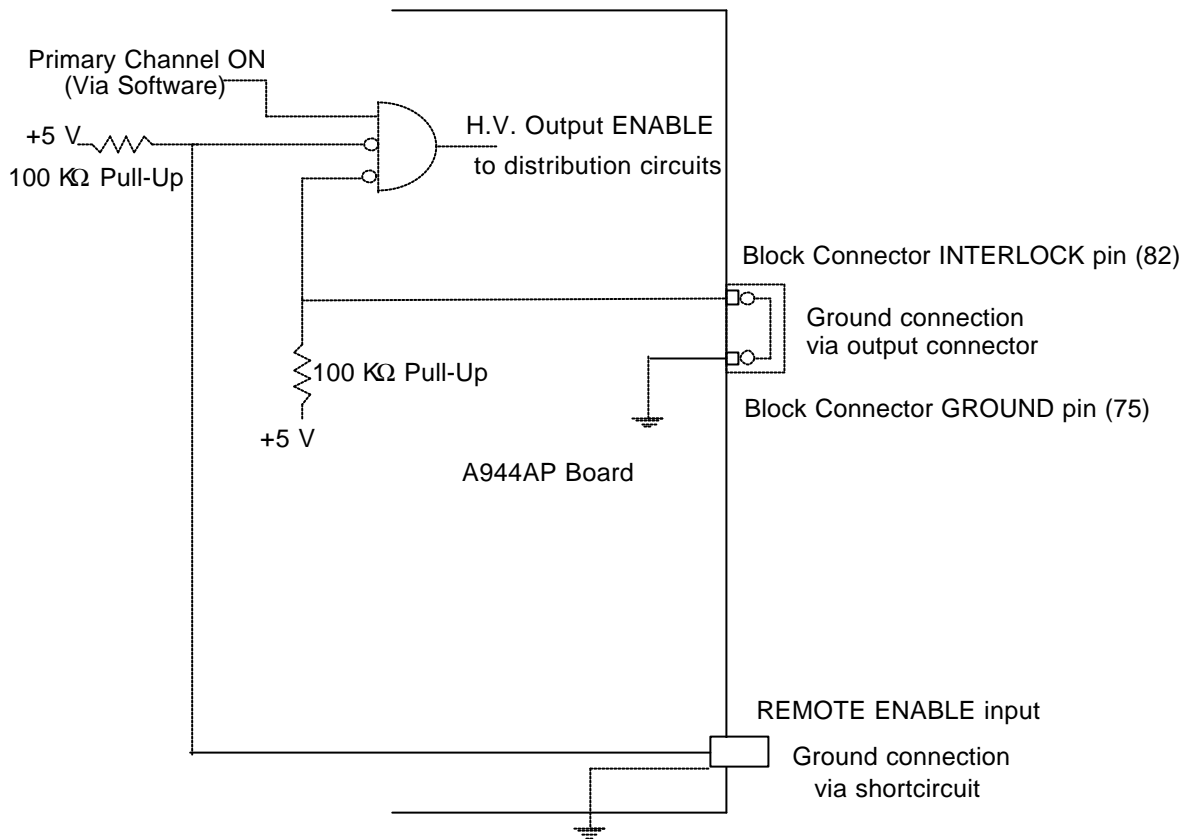
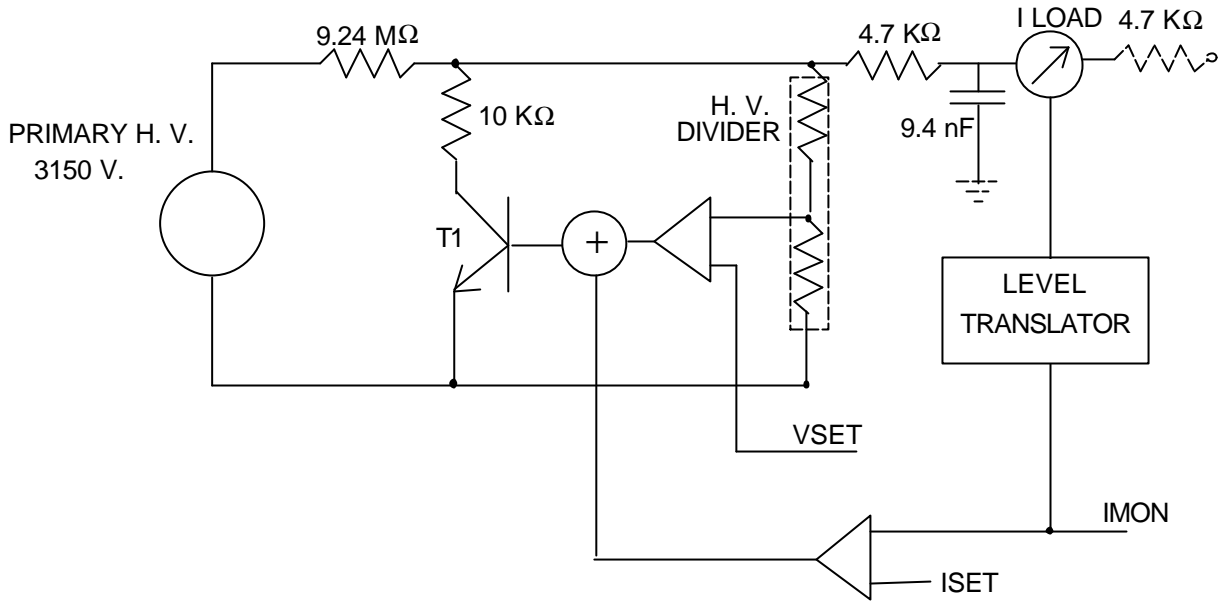


Fig. 2.23: Mod. A944A Remote Enable Scheme

### 2.7.5. MOD. A944A OPERATING PRINCIPLE

The Board houses 24 distributed channels and one H.V. primary channel, the latter completely transparent to the User. The 24 channels appear on the Mainframe display and on the RS232 Terminal and are numbered from 0 to 23, while the primary H. V. channel does not appear.

The internal Primary H. V. Channel is automatically switched ON whenever an Output Channel is switched ON.



**Fig. 2.24: Mod. A944 Operating Principle Scheme**

Figure 2.24 shows the operating principle of an A944 channel. When the T1 transistor is at saturation, the output voltage does not exceed 10 V, while when the T1 transistor is OFF, the output voltage is 2500 V.

In case the T1 transistor doesn't work, the maximum current on the load does not exceed 350  $\mu$ A. This feature ensures a safety protection for the wires of a chamber.

A suggested operation procedure for a Power-On of all channels could be the following:

- 1) Program independently the 24 distributed channels at the desired voltage set.
- 2) Program in common the current for the 24 distributed channels at the desired set.
- 3) Set all channels ON simultaneously (in common operation) or with the desired priority.

**APPENDIX A: MULTIPIN CONNECTORS**  
**DESCRIPTION**

## A.1. MOD. A932A-A933A MULTIPIN CONNECTOR COMPONENTS

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

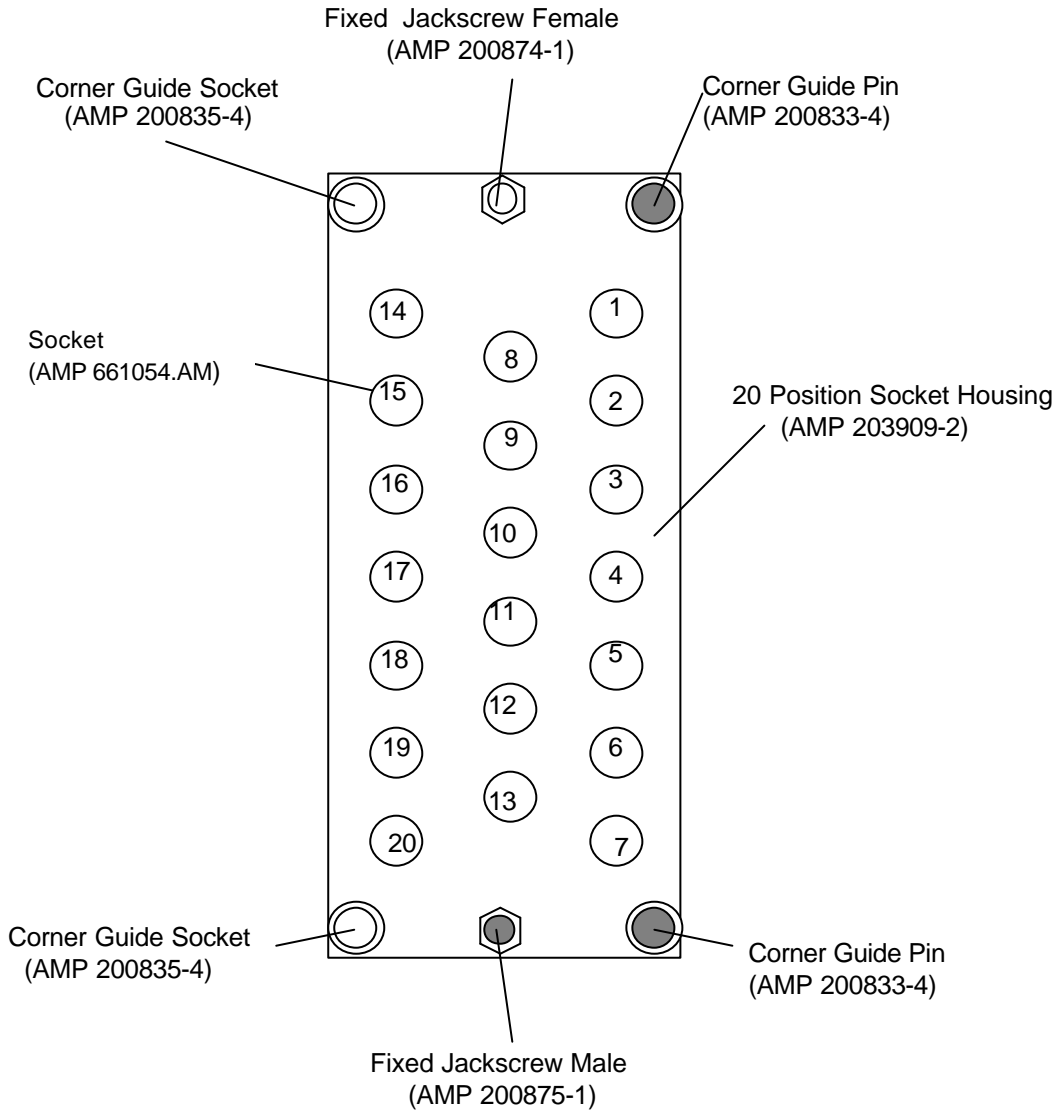


Fig. A.1: Mod. A932A-A933A Multiconductor Connector Description



## A.2. RECOMMENDED CONNECTOR FOR THE A932A-A933A CABLE

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

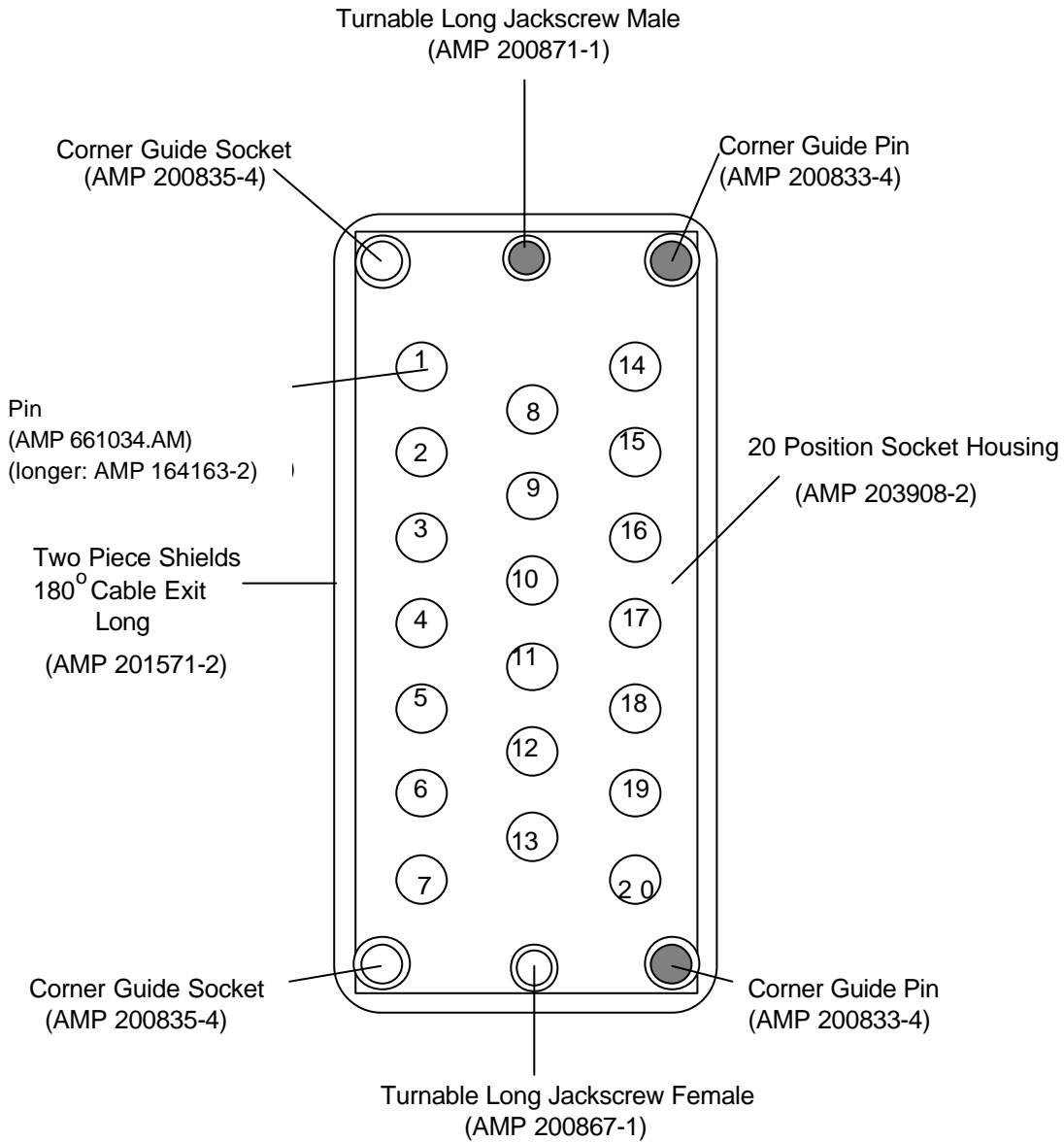
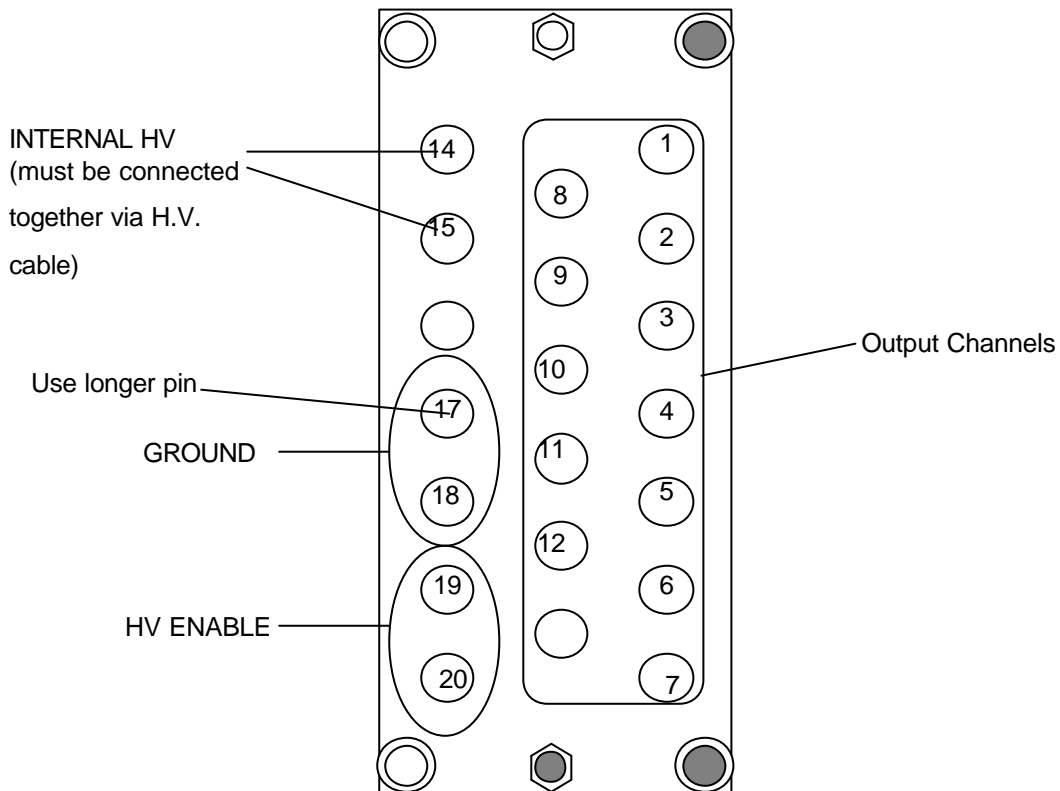


Fig. A.2: Recommended Connector for the A932A-A933A Cable

### A.3. MOD. A932A CABLES MOUNTING PROCEDURE

The AMP 203908-2 Multipin Male Connector used for the A932A H. V. cables must be assembled taking into account the following points:

- 1) pin 14 and pin 15 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (3000 V insulation with respect to ground). This MUST be done on the connector to be plugged in the "CH 0 - 11" connector of the A932".
- 2) Pins 17 and 18 carry the H.V. Ground. For safety reasons, in order to provide a Ground connection for first during insertion and for last during extraction, pin 17 of the Ground must be longer than the other on the MALE connector.
- 3) Pins 19 and 20 must be connected for a proper Interlock protection. This connection can be done at the level of the MALE multipin connector or directly on the Detector end of the cables, the latter solution being better for safety reasons.

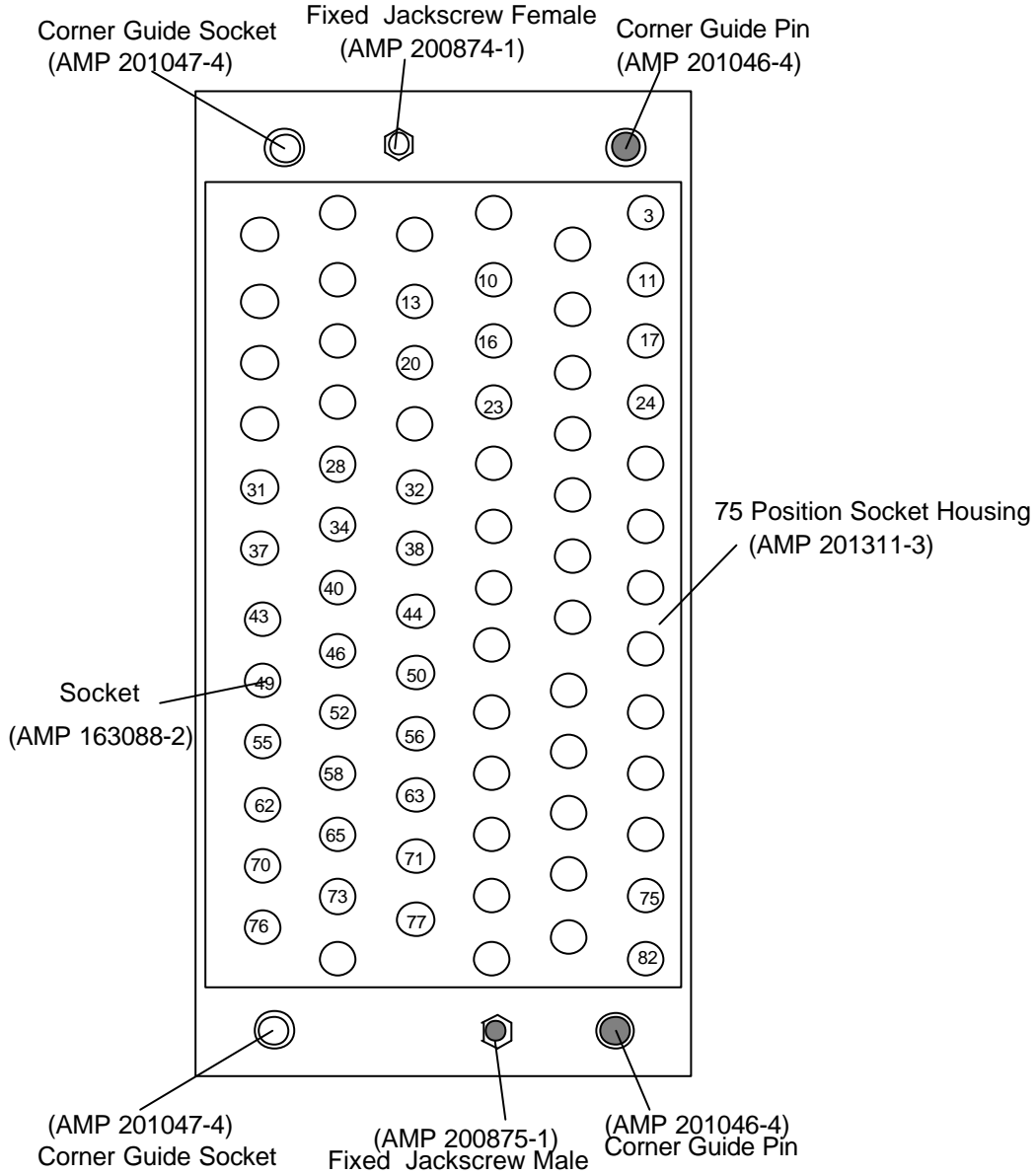


N.B.: Numbers in the above connector are referred to the AMP connectors numbering convention, NOT to the actual Channel Number!

**Fig. A.3: Mod. A932A Board Female Multipin Connector  
AMP Mod. 203909-2 (front view)**

## A.4. MOD. A933K-A934A-A938A-A944A MULTIPIN CONNECTOR

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

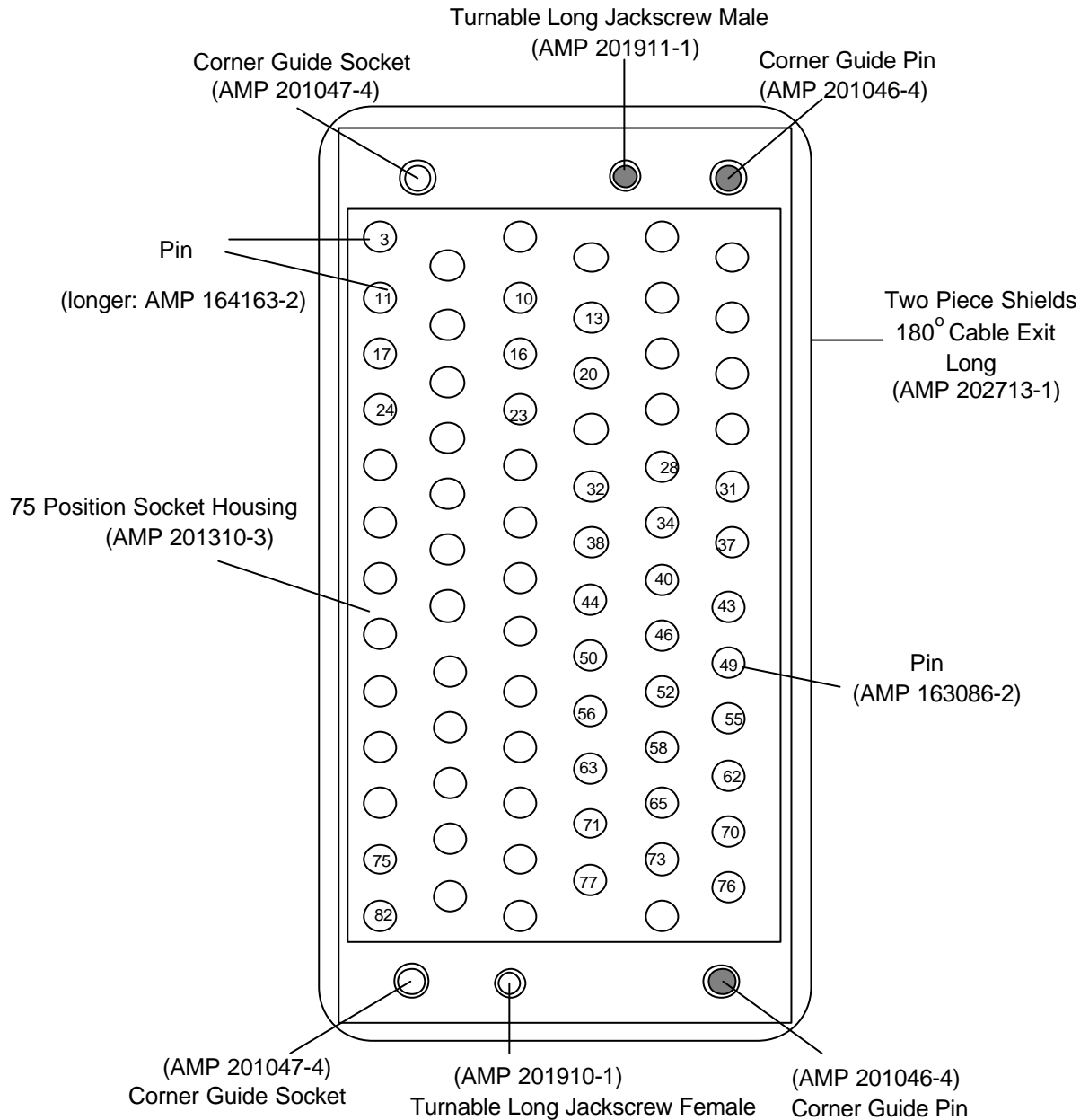


N.B.: Numbers in the above connector are referred to the AMP connectors numbering convention, NOT to the actual Channel Number!

**Fig. A.4: Mod. A933K-A934A-A938A-A944A Multiconductor Connector Description**

### A.5. RECOMMENDED CONN. FOR THE A933K-A934A-A938A-A944A CABLE

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



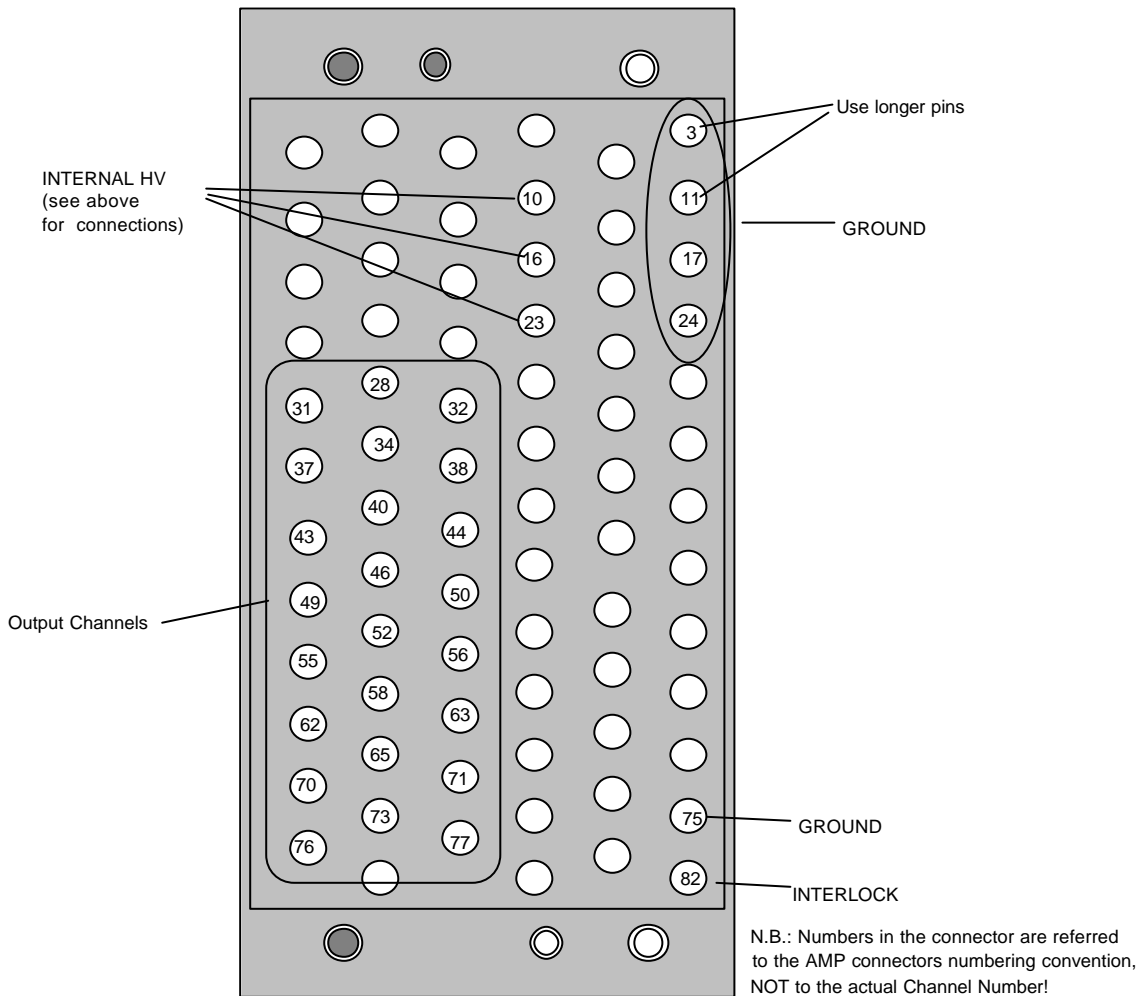
N.B.: Numbers in the above connector are referred to the AMP connectors numbering convention, NOT to the actual Channel Number!

Fig. A.5: Recommended Connector for the A933K-A934A-A938A-A944A Cable

### A.6. MOD. A933K-A934A-A944A CABLES MOUNTING PROCEDURE

The AMP 201310-3 Multipin Male Connector used for the A933K-A934A-A944A H. V. cables must be assembled taking into account the following points:

- 1) for the A933K, pin 10 and pin 16 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (2600 V insulation with respect to ground).
- 2) for the A934A and A944A, pin 10 and pin 23 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (3200 V insulation with respect to ground).
- 3) Pins 3, 11, 17 and 24 carry the H.V. Ground. For safety reasons, in order to provide a Ground connection for first during insertion and for last during extraction, pins 3 and 11 of the Ground must be longer than the other on the MALE connector.
- 4) Pins 75 and 82 must be connected for a proper Interlock protection. This connection can be done at the level of the MALE multipin connector or directly on the Detector end of the cables, the latter solution being better for safety reasons. Pin 75 carries the Ground for the Interlock return.



**Fig. A.6: Mod. A933K-A934A-A944A Boards Female Multipin Connector  
AMP Mod. 201311-3 (front view)**

PIN	CHANNEL
31	0

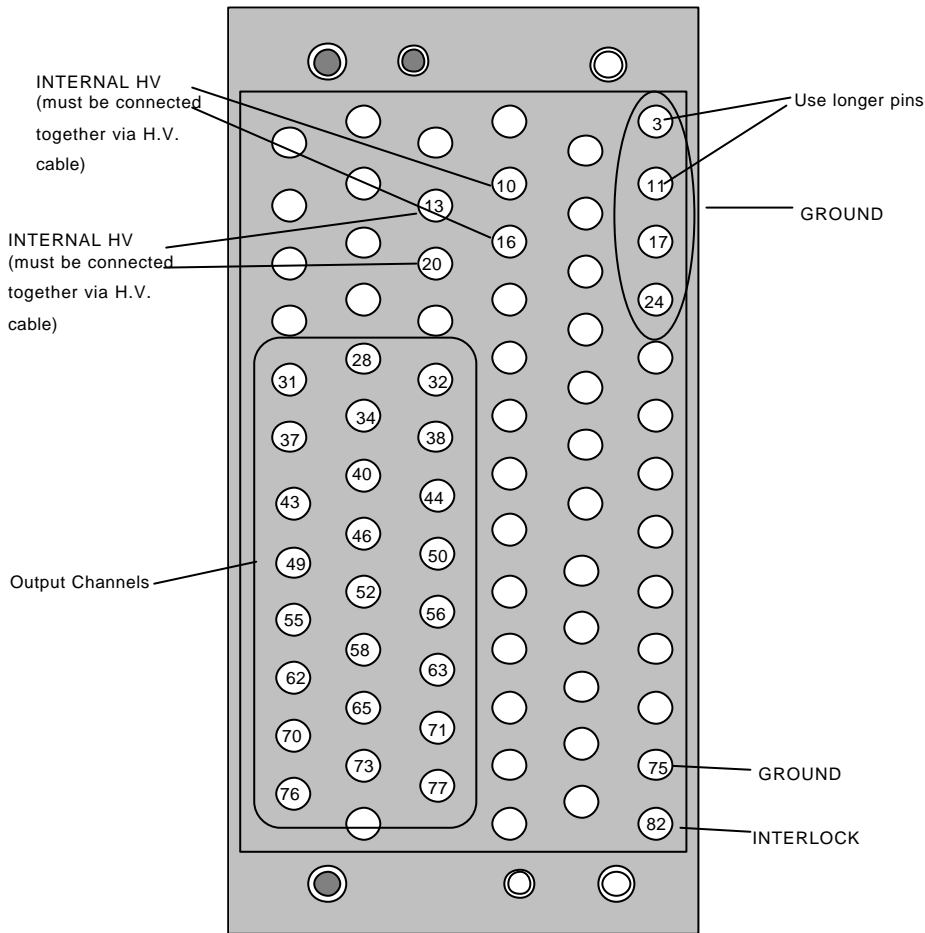
37	1
43	2
49	3
55	4
62	5
70	6
76	7
28	8
34	9
40	10
46	11
52	12
58	13
65	14
73	15
32	16
38	17
44	18
50	19
56	20
63	21
71	22
77	23

Fig. A.7: Mod. A933K-A934A-A944A Boards High Voltage Pins Assignment

## A.7. MOD. A938AN CABLES MOUNTING PROCEDURE

The AMP 201310-3 Multipin Male Connector used for the A938AN H. V. cables must be assembled taking into account the following points:

- 1) pin 10 and pin 16 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (2300 V insulation with respect to ground).
- 2) pin 13 and pin 20 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (2300 V insulation with respect to ground).
- 3) Pins 3, 11, 17 and 24 carry the H.V. Ground. For safety reasons, in order to provide a Ground connection for first during insertion and for last during extraction, pins 3 and 11 of the Ground must be longer than the other on the MALE connector.
- 4) Pins 75 and 82 must be connected for a proper Interlock protection. This connection can be done at the level of the MALE multipin connector or directly on the Detector end of the cables, the latter solution being better for safety reasons. Pin 75 carries the Ground for the Interlock return.



N.B.: Numbers in the above connector are referred to the AMP connectors numbering convention, NOT to the actual Channel Number!

**Fig. A.8: Mod. A938AN Boards Female Multipin Connector  
AMP Mod. 201311-3 (front view)**

PIN	CHANNEL
31	0
37	1

43	2
49	3
55	4
62	5
70	6
76	7
28	8
34	9
40	10
46	11
52	12
58	13
65	14
73	15
32	16
38	17
44	18
50	19
56	20
63	21
71	22
77	23

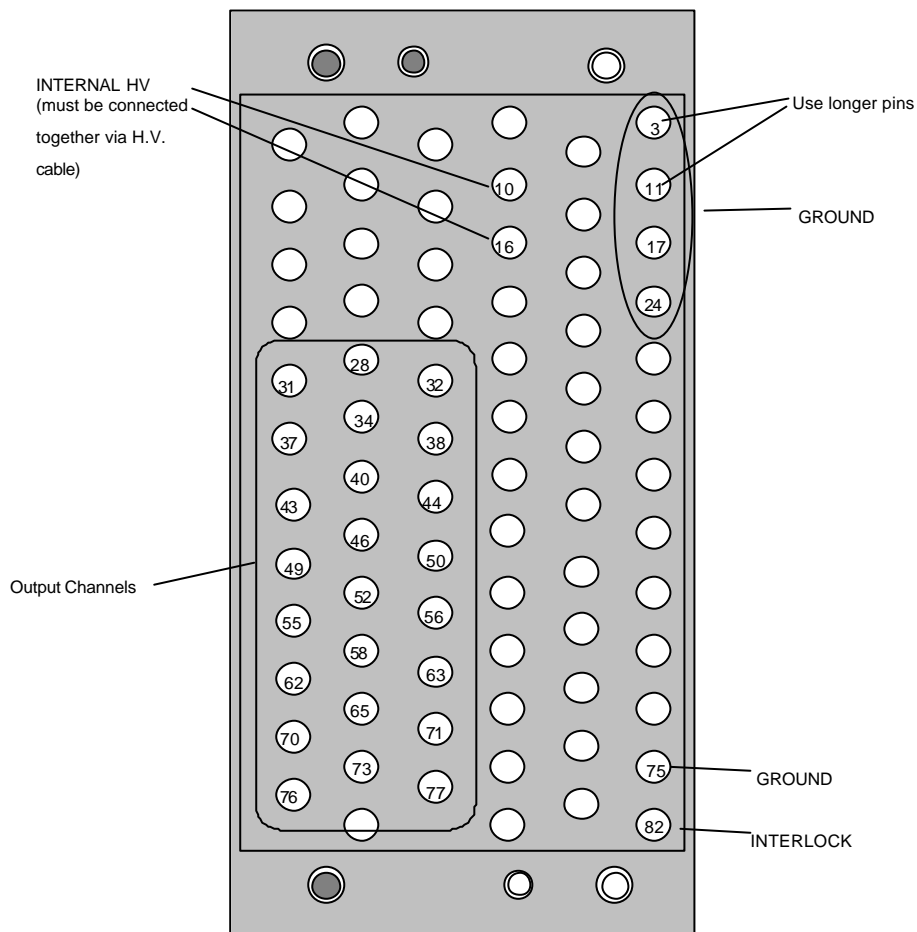
**Fig. A.9: Mod. A938AN Boards High Voltage Pins Assignment**



## A.8. MOD. A938AP CABLES MOUNTING PROCEDURE

The AMP 201310-3 Multipin Male Connector used for the A938AP H. V. cables must be assembled taking into account the following points:

- 1) pin 10 and pin 16 of the MALE connector must be connected together at the back of the Multipin connector itself via a High Voltage wire (2300 V insulation with respect to ground).
- 2) Pins 3, 11, 17 and 24 carry the H.V. Ground. For safety reasons, in order to provide a Ground connection for first during insertion and for last during extraction, pins 3 and 11 of the Ground must be longer than the other on the MALE connector.
- 3) Pins 75 and 82 must be connected for a proper Interlock protection. This connection can be done at the level of the MALE multipin connector or directly on the Detector end of the cables, the latter solution being better for safety reasons. Pin 75 carries the Ground for the Interlock return.



N.B.: Numbers in the above connector are referred to the AMP connectors numbering convention, NOT to the actual Channel Number!

**Fig. A.10: Mod. A938AP Boards Female Multipin Connector  
AMP Mod. 201311-3 (front view)**

PIN	CHANNEL
31	0
37	1
43	2
49	3
55	4
62	5
70	6
76	7
28	8
34	9
40	10
46	11
52	12
58	13
65	14
73	15
32	16
38	17
44	18
50	19
56	20
63	21
71	22
77	23

**Fig. A.11: Mod. A938A Boards High Voltage Pins Assignment**