Technical Information Manual

Revision n.8
22 November 2012

MOD. A1535
24 CH 3.5KV/3 mA
COMMON FLOATING
RTN BOARD

NPO:
00113/04:A1535.MUTx/08

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.

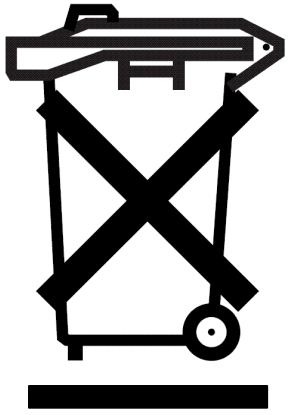
CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.

CE

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

Disposal of the Product

The product must never be dumped in the Municipal Waste. Please check your local regulations for disposal of electronics products.



MADE IN ITALY : We stress the fact that all the boards are made in Italy because in this globalized world, where getting the lowest possible price for products sometimes translates into poor pay and working conditions for the people who make them, at least you know that who made your board was reasonably paid and worked in a safe environment. (this obviously applies only to the boards marked "MADE IN ITALY", we can not attest to the manufacturing process of "third party" boards).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Mod. A1535 High Voltage Board

1.1 Functional description

The Mod. A1535 is a single width (5 TE wide) board housing 24 HV channels, available with either positive or negative polarity. The channels share a common floating return, which allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).

The output voltage range is 0 ÷ 3.5 kV, with 3 mA maximum output current and 0.5 V set and monitor resolution. The boards is provided with both current and voltage protections. If overcurrent occurs, the relevant channel can be programmed either to turn off after a programmable trip time or to keep on providing the maximum allowed current: this particular feature allows the modules to work as current generator. The maximum output voltage can be fixed, through a potentiometer located on the front panel, at the same common value for all the board channels and this value can be read out via software.

The board channels can be enabled according to the the interlock logic (see § 3.2)

The HV RAMP-UP and RAMP-DOWN rates may be selected independently for each channel in the 1 ÷ 500 V/s range (1 V/s step).

The Mod. A1535 board is provided with the Radiall 52 pin connector, whose mate cable connector (CAEN Mod. A996) and the relevant insertion/extraction tool (Mod. A995), are also available.

1.2 Channel Characteristic Table

Table 1.1 – Channel characteristics of the Mod. A 1535 HV Board

Polarity:	Positive / Negative depending on purchased version
Output Voltage:	0 ÷ 3.5 kV
Max. Output Current:	3 mA
Voltage Set/Monitor Resolution:	0.5 V
Current Set/Monitor Resolution:	500 nA
VMAX hardware:	0 ÷ 3.5 kV common for all the board channels
VMAX hardware accuracy:	± 2% of FSR
VMAX software:	0 ÷ 3.5 kV settable for each channel
VMAX software resolution:	1 V
Ramp Down:	1÷ 500 Volt/sec, 1 Volt/sec step
Ramp Up:	1÷ 500 Volt/sec, 1 Volt/sec step
Voltage Ripple: [1]	<20 mV typical; 30mV max
Voltage Monitor vs. Output Voltage Accuracy: [2,3]	typical: ± 0.3% ± 0.5 V max: ± 0.3% ± 2 V
Voltage Set vs. Voltage Monitor Accuracy: [2]	typical: ± 0.3% ± 0.5 V max: ± 0.3% ± 2 V
Current Monitor vs. Output Current Accuracy: [2]	typical: ± 2% ± 1 µA max: ± 2% ± 5 µA
Current Set vs. Current Monitor Accuracy: [2]	typical: ± 3% ± 1 µA max: ± 3% ± 5 µA
Maximum output power:	8 W (per channel, software limit)
Power consumption:	310 W @ full power

[1] From 10 Hz to 15 MHz at full load; ripple may exceed such limits whenever OVC and UNV occur (see § 3.1)

[2] From 10% to 90% of Full Scale Range

[3] During operation in Overcurrent or when VMAX Hardware is reached (and/or exceeded), VMON values have to be assumed as "indication"; possible monitor drifts are caused by the different regulation mode.

1.3 Front Panel

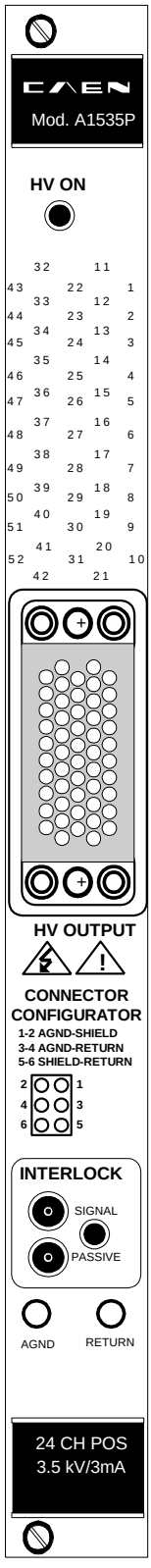


Fig. 1.1 – Mod. A1535 front panel

1.4 Technical Specifications

1.4.1 Packaging

The module is housed in a 1 unit wide, 6U-high mechanics.

1.4.2 External connections

The function and electro-mechanical specifications of the external connectors are listed in the following subsections.

Output Channels (0…23); Shield, Return:	Multipin connector Radiall 691803004 type, 52 pin male (to be mated with Radiall 691802002 [*SCEM 09.41.34.700.2*] type[4]); see Table 2.2 for pin assignment
Return:	Radiall R921921 socket, Ø 2mm
AGND:	Radiall R921921 socket, Ø 2mm
PASSIVE INTERLOCK:	00-type LEMO connector
SIGNAL INTERLOCK:	00-type LEMO connector

1.4.2.1 Multipin connector pin assignment

Table 1.2 – 52 pin connector assignment

1	N.C.	14	HVOUT18	27	HVOUT15	40	N.C.
2	N.C.	15	HVOUT19	28	HVOUT16	41	N.C.
3	HVOUT23	16	HVOUT20	29	HVOUT17	42	Return
4	N.C.	17	HVOUT21	30	N.C.	43	N.C.
5	N.C.	18	HVOUT22	31	SHIELD	44	N.C.
6	N.C.	19	N.C.	32	Return	45	HVOUT0
7	N.C.	20	N.C.	33	N.C.	46	HVOUT1
8	N.C.	21	Return	34	HVOUT6	47	HVOUT2
9	INT_A	22	N.C.	35	HVOUT7	48	HVOUT3
10	INT_B	23	N.C.	36	HVOUT8	49	HVOUT4
11	Return	24	HVOUT12	37	HVOUT9	50	HVOUT5
12	N.C.	25	HVOUT13	38	HVOUT10	51	N.C.
13	N.C.	26	HVOUT14	39	HVOUT11	52	SHIELD

[4] Requires 52 pins Radiall 691804300 [*SCEM 09.41.33.830.7*] type, to be inserted using the insertion/extraction tool Radiall 282549024 [*SCEM 34.95.17.125.3*] type.

1.4.3 Displays

HV ON LED: *Function:* lights up as at least one channel is on.
Type: red LEDs for positive polarity version; yellow LEDs for negative polarity version

INTERLOCK LED: *Function:* lights up as the board ia in INTERLOCK (channel are disabled).
Type: red LED

1.4.4 Other components

VMAX trimmer: *Function:* it allows to adjust the hardware maximum voltage VMAX common to all the channels. Its value can be read out via software.

Shield configuration jumpers: *Function:* see table below

Table 1.3 – Configuration jumpers

Jumper	Connector configuration	Function
1-2	Agnd -shield	Connects Agnd (Earth) to HV cable shield
3-4	Agnd - Return	Connects Agnd (Earth) to HV channels return
5-6	Shield - Return	Connects Shield to HV channels return

Internal switches (SW1): *Function:* SW1 (if installed) shall be used only for test purposes; keep on OFF position during normal use, otherwise TEMPERATURE sensor might not work properly.

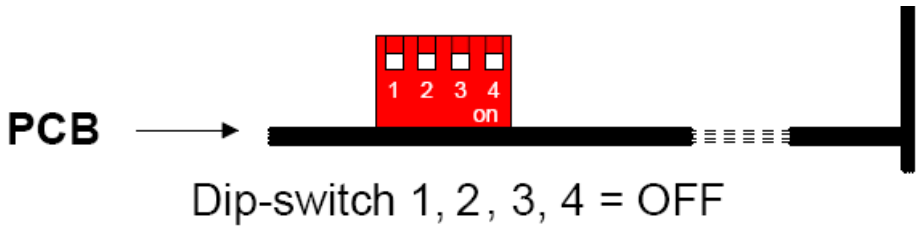


Fig. 1.2 – SW1 Internal dip switches

2. Safety information and installation requirements

2.1 General safety information

This section contains the fundamental safety rules for the installation and operation of the board. Read thoroughly this section before starting any procedure of installation or operation of the product.

2.1.1 Injury Precautions

Review the following precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified. Only qualified personnel should perform service procedures.

Avoid Electric Overload.

To avoid electric shock or fire hazard, do not power a load outside of its specified range.

Avoid Electric Shock.

To avoid injury or loss of life, do not connect or disconnect cables while they are connected to a voltage source.

Do Not Operate Without Covers.

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions.

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere.

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Do Not Operate With Suspected Failures.

If you suspect this product to be damaged, have it inspected by qualified service personnel.

2.2 Safety Terms and Symbols on the Product

These terms may appear on the product:

- **DANGER** indicates an injury hazard immediately accessible as you read the marking.
- **WARNING** indicates an injury hazard not immediately accessible as you read the marking.
- **CAUTION** indicates a hazard to property including the product.

The following symbols may appear on the product:

DANGER

High Voltage

WARNING

Refer to Manual

2.3 Installation

The Mod. A 1535 is a double-width board. At power ON the SY x527 system processor will scan all the slots in the crate to find out where the module is plugged and what kind of module it is.

3. Operating modes

The Mod. A 1535 board can be controlled, either locally or remotely, through the SY x527 software interface. For details on SY x527 system operation, please refer to the User's Manual of this product. The following sections contain a description of commands available for the board control and status monitoring.

WARNING

THE MOD. A 1535 BOARD REQUIRE

SY 1527 FIRMWARE VERSION 2.00.01 OR LATER

3.1 Output control and monitoring

For each output channel, it is possible, through the SY x527 system, to perform the following operations:

- Assign to channel a symbolic name
- Set output voltage (VSET)
- Set max. output current (ISET)
- Set output voltage software limit (SVMAX)
- Set voltage ramp-up rate (RAMP-UP)
- Set voltage ramp-down rate (RAMP-DOWN)
- Set TRIP parameter
- Enable/disable POWER ON option
- Switch channel ON/OFF
- Monitor output voltage (VMON)
- Monitor output current (IMON)
- Monitor channel status

If the POWER ON option is enabled, the channel, at POWER ON, is restored in the same condition it was before the POWER OFF or RESET; if this option is disabled, at POWER ON or after a RESET, the channel is kept OFF independently from its previous condition.

The following messages may be returned by the SY x527 when monitoring the channel status:

- OFF (channel turned OFF)
- RUP (channel ramping up)
- RDWN (channel ramping down)
- OVC (channel in OVERCURRENT condition)
- OVV (channel in OVERVOLTAGE condition)

- UNV (channel in UNDERVOLTAGE condition)[5]
- EXTTRIP (channel OFF due to external TRIP line signal) [6]
- INTTRIP (channel OFF due to internal OVERCURRENT condition)
- EXT_DIS (channel disabled by board INTERLOCK protection)

Moreover it is possible to monitor board temperature and to check board status; the following messages may be returned by the SY x527 when monitoring the board status:

- UNDER_TEMP (board temperature < 5°C)
- OVER_TEMP (board temperature > 65°C)

3.2 Output Enable

In order to enable the HV output channels, first of all it is necessary that pin 9 and 10 on the output connector are short circuited (see § 1.4.2.1).
Then the enable procedure is completed in one of the following ways:

– terminating the PASSIVE INTERLOCK (see § 1.4.2) connector on 50 Ohm.
– supplying the SIGNAL INTERLOCK (see § 1.4.2) connector with a +5 V (3-4mA) differential signal.

The INTERLOCK LED (red) is turned off as one of the actions above is performed.
When the channels are disabled the voltage outputs drop to zero at the maximum rate available; when the output disable cause is removed (see above), the channels remain OFF until the User turns them ON via software.

3.3 Grounding specifications

The Mod. A1535 channels share a common floating return (FAGND, see § 1.4.2), available on the front panel multipin connector, insulated from the crate ground (AGND, see § 1.4.2), which is available as front panel 2mm socket connector. This feature allows on-detector grounding, thus avoiding loops which may increase noise level. FAGND and AGND may be coupled in several ways, according to the environment requirements.

3.3.1 Safety Earth connection

The connection of shield and return to Earth is fundamental for User safety. The connection must always be at the level of detector or power supply system. Return and Shield connections even if not present or performed incorrectly, due to protection circuits implemented on the A1535 are bound to Earth; in this case the voltage difference between return and Earth (System), shield and Earth is limited to approximately 50V. Please note that this is a status of emergency-protection, not a working one. The Connector Configurator allows to optimize the connection of the shield, of the return and of AGND (Earth). The best configuration must be determined by the user upon application, the optimal connection depends on many characteristics of the related experiment. The following diagrams show four examples of configuration, namely:

1. The “closed loop “ Earth configuration
2. The “closed loop “ Earth configuration, with protection stage on the load grounding

[5] UNV is also reported when Hvmax limit is reached, it is up to the User to verify that VMON value does not exceed HVMAX.

[6] EXTTRIP and INTTRIP parameters are expressed in Hexadecimal format

3. The “semi-open loop” Earth configuration
4. The “open loop” Earth configuration

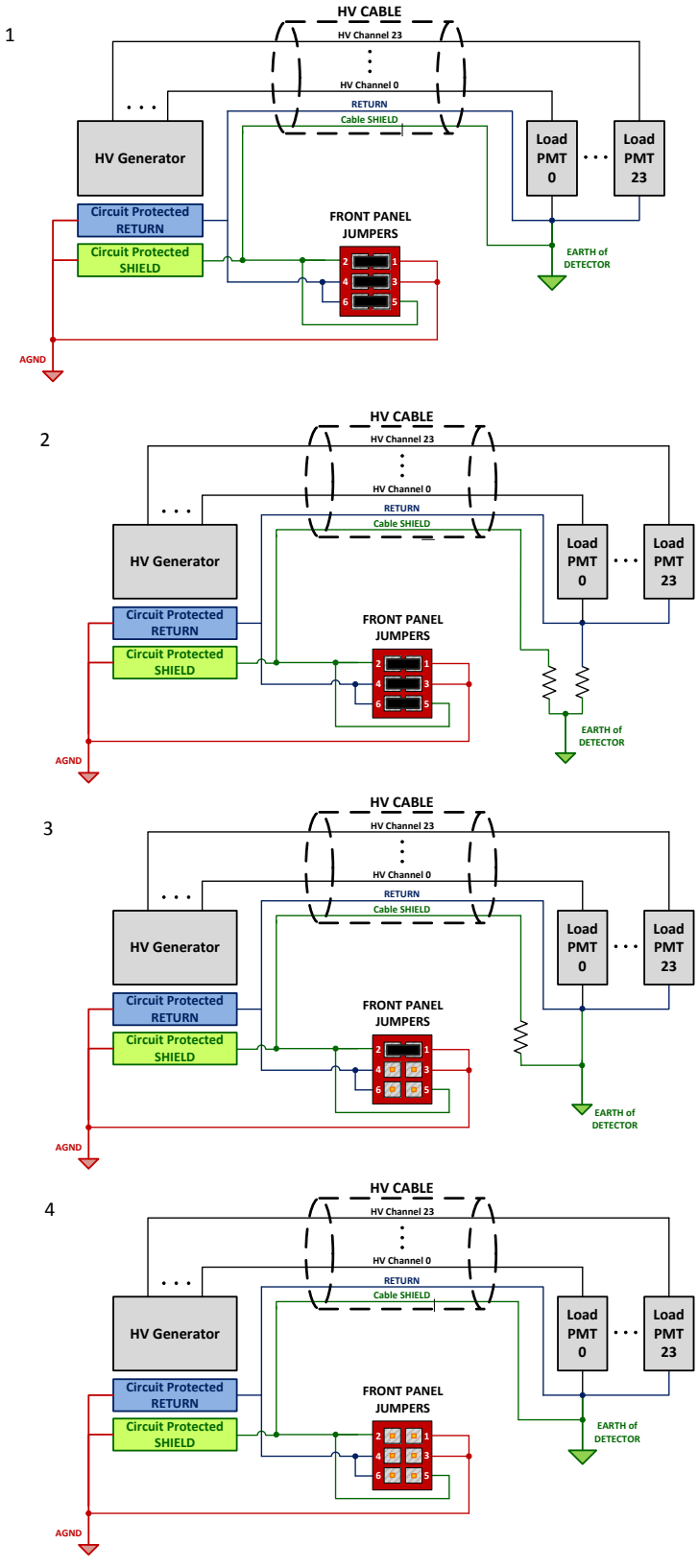


Fig. 3.1 – Earth configuration connection examples