Rev. 05 - 20/06/2013

A1535D/AG535D

12 CH 3.5kV/ 3 mA High Voltage Boards

CAEN
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User Manual

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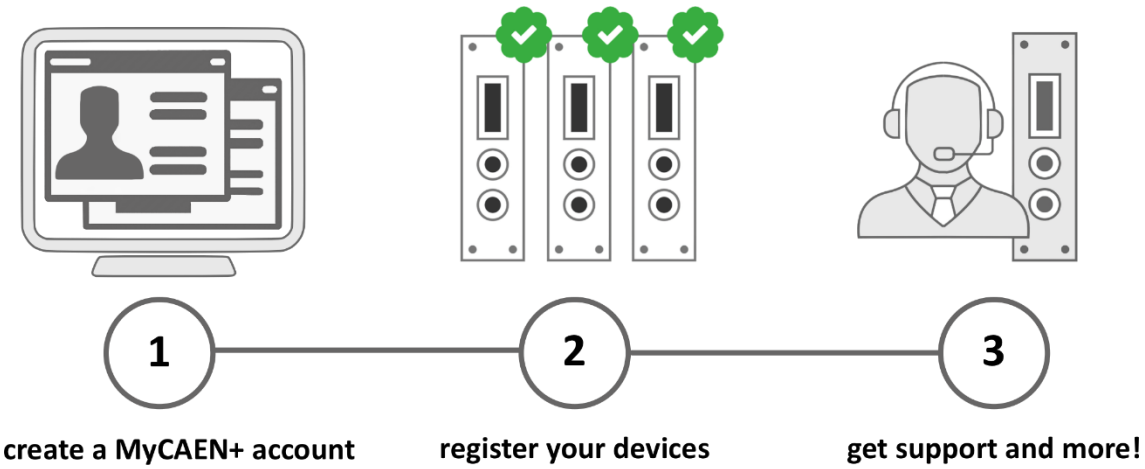

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Technical Information Manual

Revision n.5
20 June 2013

MOD. A1535D
12 CH 3.5KV/3 mA
COMMON FLOATING
RTN BOARD

NPO:
00112/09:1535D.MUTx/05

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.

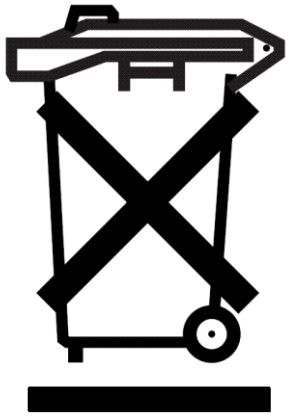
CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.

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).

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1. Functional description

1.1 Overview

The Mod. A1535D is a single width (5TE wide) board housing 12 HV channels, available with either positive or negative polarity it is compatible with the CAEN Universal Multichannel Power Supply System (SYx527). 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 Mod. AG535D is the "ground return" version of the board: the channels return is wired to the crate Earth reference.
The output voltage range is 0 ÷ 3.5 kV, with 3 mA maximum output current and 0.5 V set and monitor resolution. The board is provided with both current and voltage protections. If over-current 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 interlock logic (see § 2.2)
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).

Table 1.1 – Available Items

Code	Description
WA1535DXAAAA	A1535DN - SYx527 HV channels -3.5 KV 3 mA SHV common floating (12 ch)
WA1535DXPAAA	A1535DP - SYx527 HV channels +3.5 KV 3 mA SHV common floating (12 ch)
WA1535DXMAAA	A1535DM – SYx527 HV ch +3 KV 3 mA (6ch) -3 KV 3 mA (6ch) – SHV Conn. common floating
WAG535DXAAAA	AG535DN - SYx527 H.V. channels -3.5 KV 3 mA (6W) - SHV common ground (12 ch)
WAG535DXMAAA	AG535DM – SYx527 H.V. ch +3 KV 3 mA (6W)(6ch) -3 KV 3 mA (6W)(6ch) – SHV common gnd
WAG535DXPAAA	AG535DP - SYx527 H.V. channels +3.5 KV 3 mA (6W) -common ground (12 ch)

1.2 Channel Characteristic Table

Table 1.2 – Channel characteristics of the Mod. A1535D / AG535D HV Board

Polarity:	Negative, Positive or Mixed
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:	A1535D: 8W, AG535D: 6W (per channel, software limit)
Power consumption:	A1535D: 160W, AG535D:120 W (@ full power)

[1] From 10 Hz to 15 MHz at full load; ripple may exceed such limits whenever OVC and UNV occur (see § 2.1)

[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

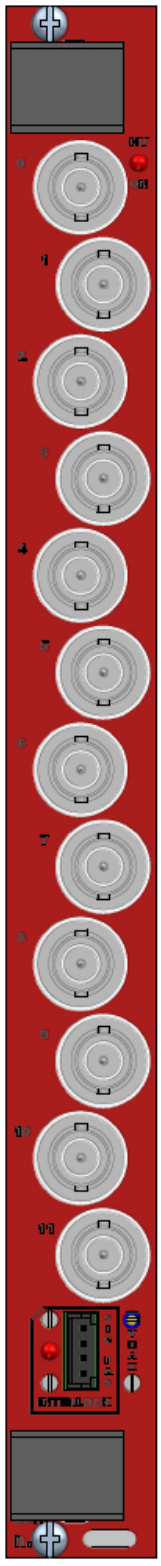

Fig. 1.1 – Mod. A1535D front panel

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…11):	HV coaxial connectors Radiall SHVR317580-type
PASSIVE INTERLOCK:	AMP 280371-2
SIGNAL INTERLOCK:	AMP 280371-2

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.

J17 (A1535D only): Socket connector; short circuit 5-6 (default): interlock connector control disabled; short circuit 1-2: connect FAGND and AGND. See § 2.3 for J17 location.

Internal switch (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.

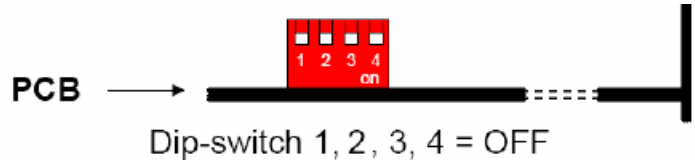

Fig. 1.2 – SW1 Internal dip switches

1.5 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.

1.5.1 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.

1.6 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

1.7 Installation

The Mod. A1535D / AG535D is a single-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.

2. Operating modes

The Mod. A1535D / AG535D 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

IF USED WITH SY 1527, THE MOD. A1535D / AG535D BOARDS REQUIRE SY 1527 SYSTEMS RUNNING FIRMWARE VERSION 2.00.01 OR LATER

2.1 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)[4]
- EXTTRIP (channel OFF due to external TRIP line signal) [5]
- 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)

2.2 Output Enable

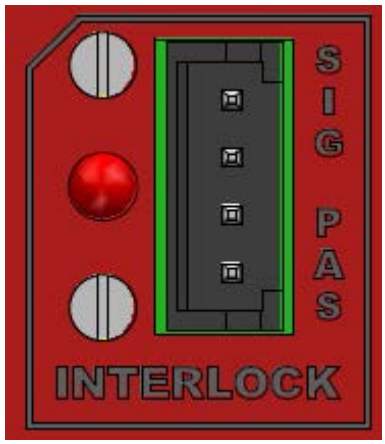

Fig. 2.1 – INTERLOCK connector

The enable procedure is completed in one of the following ways:
- short the PASSIVE INTERLOCK (see § 1.4.2) pins (lower couple).
- supply the SIGNAL INTERLOCK (see § 1.4.2) pins (upper couple) with a +5 V (3-4mA) differential signal (Pin 1 = upper is Pole+; Pin 2 is Pole-)

The INTERLOCK LED (red) is turned off and the channels enabled 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.

2.3 Grounding specifications

The Mod. A1535D channels share a common floating return (FAGND), insulated from the crate ground (AGND). This feature allows on-detector grounding, thus avoiding loops which may increase noise level. FAGND and AGND may be connected, by short circuiting pin 1 and 2 of J17 socket connector on the motherboard.

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

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

Fig. 2.2 – J17 socket connector location

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