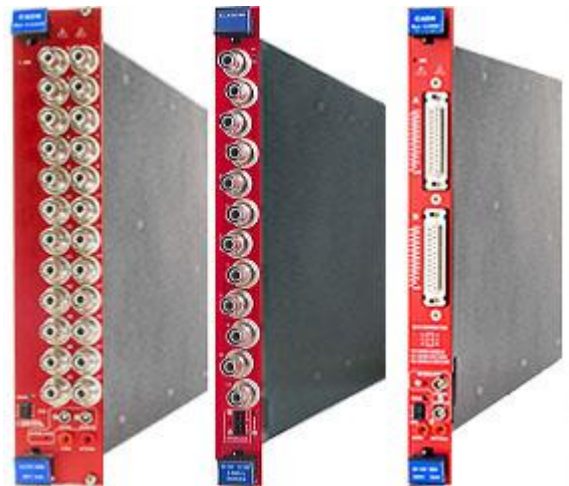


PRELIMINARY



**A1539, AG539, A154X, AG54X Power Supply
Boards**

Rev. 2 - 6 May 2015

Purpose of this Manual

This document is the A1539, AG539, A154X, AG54X Power Supply Boards manual; it contains information about the installation, the configuration and the use of the board.

Change Document Record

Date	Revision	Changes
25 November 2013	0	PRELIMINARY Release
5 December 2014	1	Updated with dual range versions
6 May 2015	2	Updated Technical specifications

Symbols, abbreviated terms and notation

T.B.D.

Reference Documents

Disclaimer

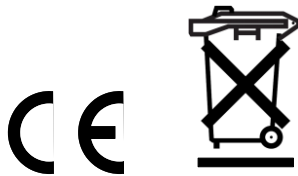
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CAEN will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal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

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 cannot attest to the manufacturing process of "third party" boards).



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1. Overview

Functional description

The Mod. A1539, AG539, A154X, AG54X is a family of HV boards, available with either positive or negative polarity, compatible with the CAEN Universal Multichannel Power Supply System (SYx527).

The A1539, A154x 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 return of the AG539, AG54x channels is wired to the crate Earth reference.

12, 24 and 32 channel versions are available; 12 channel versions output voltages are provided via SHV connectors; 24 channel versions are available with either SHV connectors or DB25 connector; 32 channel boards have the DB25 connectors. 24 channel SHV versions are double width boards (10 TE); all other versions are single width (5 TE).

All boards are 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 (TRIP range: $0 \div 999$ s; 1000 s = Infinite, current generator mode. Step = 1 s). 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 HV RAMP-UP and RAMP-DOWN rates may be selected independently for each channel.

Some models offer dual current range, selectable via software, with increased monitor resolution for the lower range.

The boards have also the safety board interlock: this protection allows to disable the primary HV generation when the HV outputs are not connected to their loads.

2. Technical Specifications

Channel Characteristic Table

Table 1 – Channel characteristics of the Mod. A1539, AG539, A154X, AG54X HV Boards

Version	A1539 – AG539	A1540 – AG540	A1540H	A1541 – AG541	A1542 – AG542	A1542H
Polarity	Positive / Negative / Mixed ¹ depending on purchased version					
Output Voltage	0÷100 V			0÷500 V		
Max. Output Current	10 mA	1 mA	1 mA	10 mA	1 mA	1 mA
			High Resolution			100 µA
Voltage Set Resolution	10 mV					
Voltage Monitor Resolution	1 mV					
Current Set Resolution	200 nA	20 nA	20nA	200 nA	20 nA	20 nA
Current Monitor Resolution	10 nA	1 nA	1 nA	10 nA	1 nA	1 nA
			High Resolution			100 pA
VMAX hardware	0÷100 V common to all board channels			0÷500 V common to all board channels		
VMAX hardware accuracy	1 V					
VMAX software	0÷100 V settable for each channel			0÷500 V settable for each channel		
VMAX software resolution	1 V					
Ramp Up/Down	1÷50 Volt/sec, 1 Volt/sec step			1÷100 Volt/sec, 1 Volt/sec step		
Voltage Ripple	<10mVpp (Max)	<5mVpp (Max)		<10mVpp (Max)	<5mVpp (Max)	
Vmon vs. Vout accuracy	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.
Vset Vs. Vout accuracy	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.
Imon vs. Iout accuracy	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.
Iset vs. Iout accuracy	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.	T.B.D.
Maximum output power	1 W/ch	0.1 W/ch	0.1 W/ch	5 W/ch	0.5 W/ch	0.5 W/ch
Consumption @ full power	32 ch: 64 W 24 ch: 48 W 12 ch: 24 W	32 ch: 6.4 W 24 ch: 4.8 W 12 ch: 2.4 W	32 ch: 6.4 W 24 ch: 4.8 W 12 ch: 2.4 W	32 ch: 320 W 24 ch: 240 W 12 ch: 120 W	32 ch: 32 W 24 ch: 24 W 12 ch: 12 W	32 ch: 32 W 24 ch: 24 W 12 ch: 12 W

¹ Mixed boards have half of the channels with positive polarity and half with negative

Front Panel

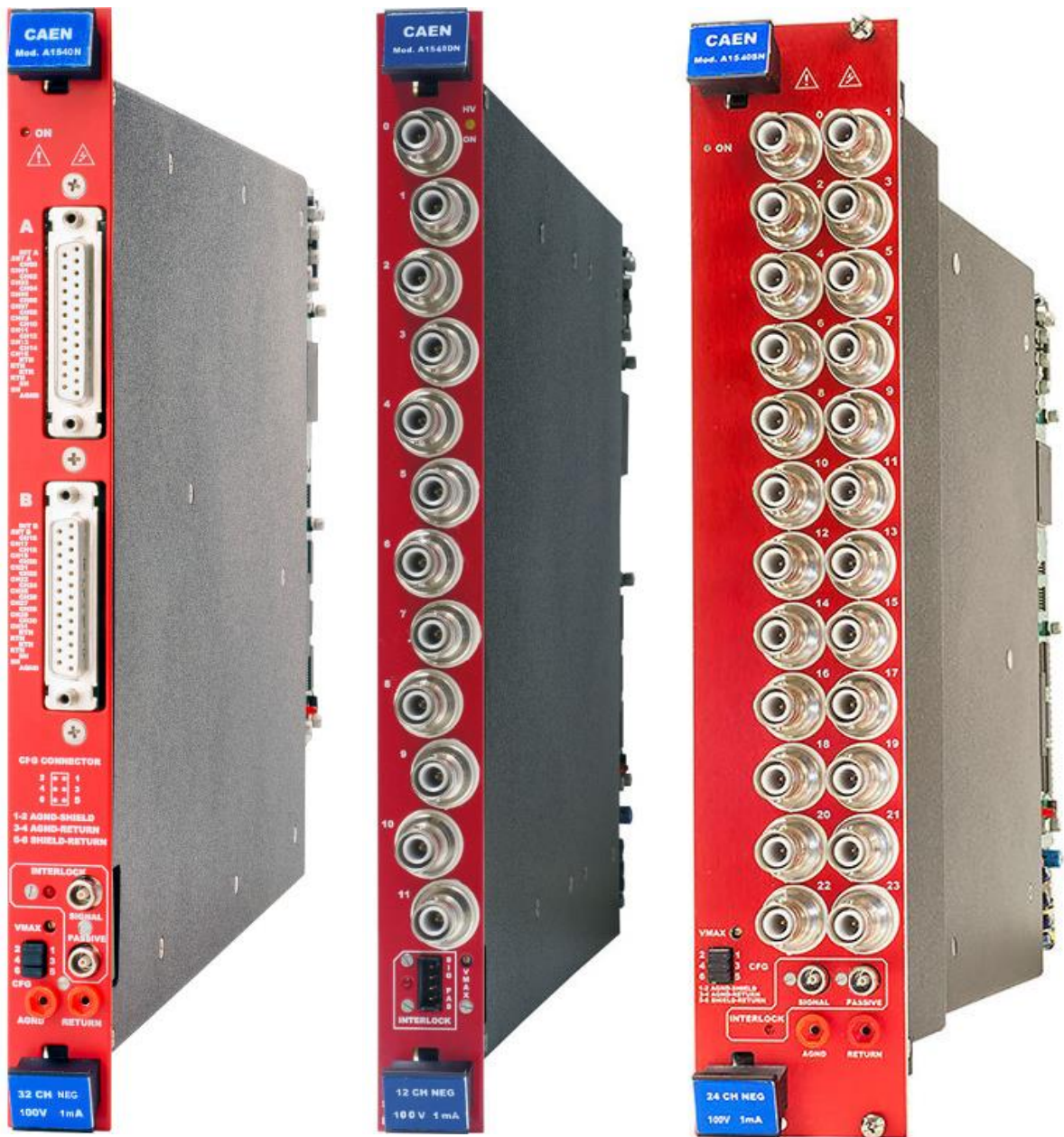


Fig. 1 – Mod. A15xx 32, 12, 24 Channel boards

Packaging

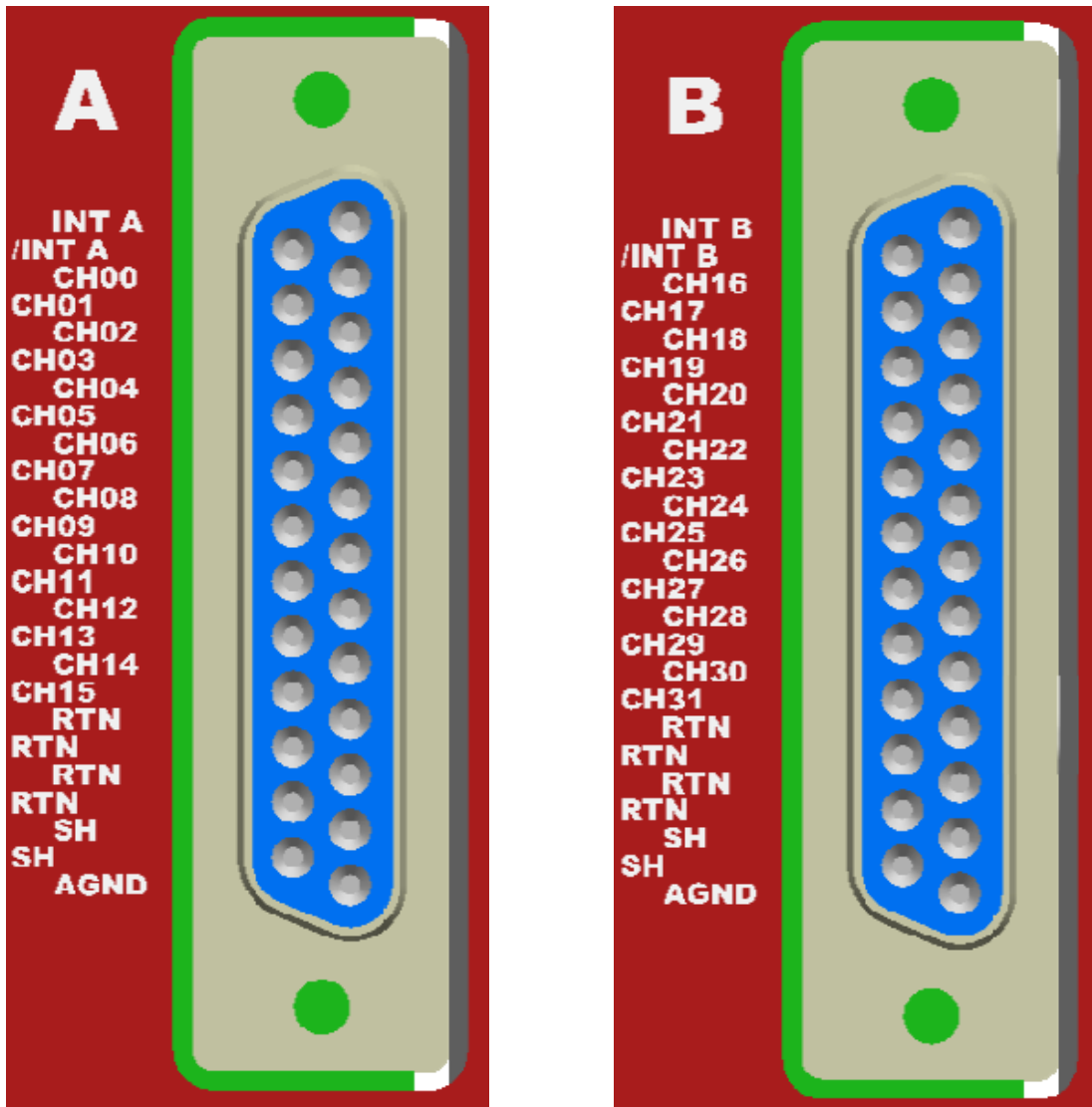
24 channel SHV versions are double width boards (10 TE); all other versions are single width (5 TE); height is 6U.

External connections

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

Version:	24, 32 channel DB25	12, 24 channel SHV
Output Channels:	FCI DBPV25S365GTLF; see below	HV coaxial connectors Radiall SHVR317580
Return & AGND:	Radiall R921921 socket, \varnothing 2mm (floating)	
PASSIVE & SIGNAL ILK:	00-type LEMO connector	AMP 280371-2 (12 channel)

DB25 connector pin assignment



INT - /INT: interlock; RTN: channel return; AGND: earth; SH: connector shield; NC: not connected;

Fig. 2 – DB25 connector pin assignment (32 channel version)

Displays


- HV ON LED:** *Function:* lights up as at least one channel is on
Type: red LEDs for positive polarity; yellow green LEDs for negative polarity.
- INTERLOCK LED:** *Function:* lights up as the board is in INTERLOCK (channel are disabled).
Type: red LED

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 CFG jumpers (24, 32 ch floating): *Function:* see table below

Table 2 – Configuration jumpers

	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

JA (A15xxD): Jumper connector; short circuit: connect FAGND (Earth) and AGND (CH rtn). See below for JA location.

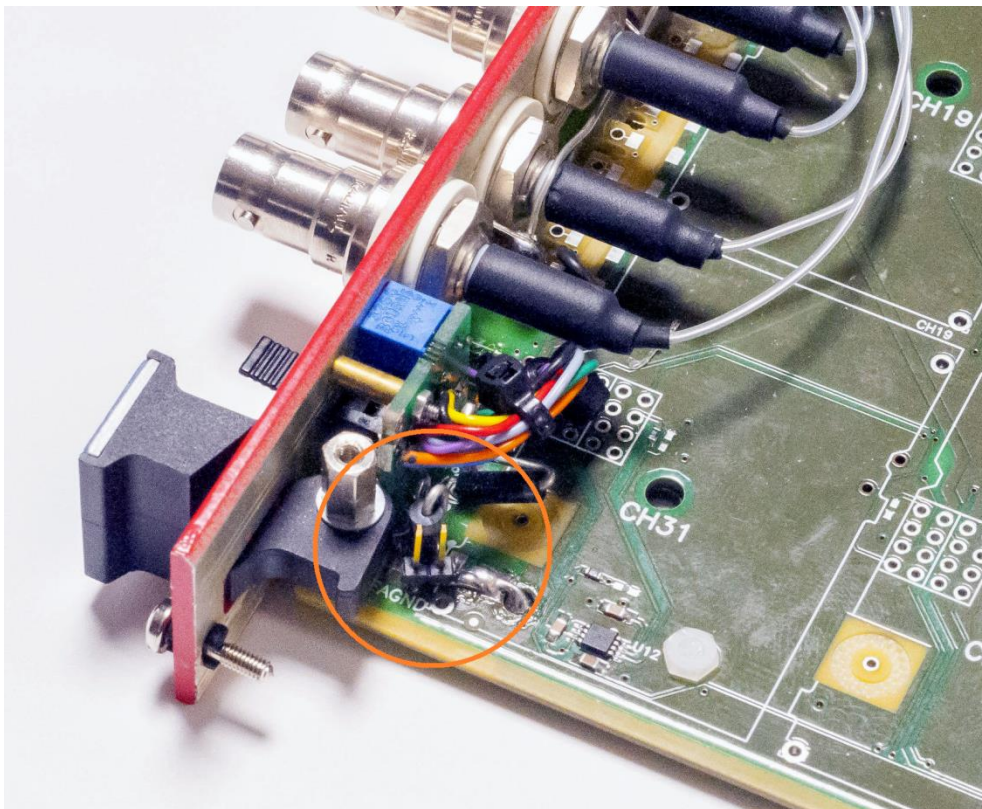


Fig. 3 – JA jumper location

3. Safety and installation requirements

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.

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.

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

Installation

The Mod. A1539, AG539, A154X, AG54X are SYx527 boards. At power ON the SYSTEM, the processor will scan all the slots in the crate to find out where the module is plugged and what kind of module it is.

4. Operating modes

The Mod. A1539, AG539, A154X, AG54X boards can be controlled, either locally or remotely, through the SYSTEM software interface. For details on 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.

Output control and monitoring

For each output channel, it is possible, through the system, to access the following parameters:

<i>CHANNEL NAME (settable):</i>	descriptive name for the relevant channel
<i>VOSET (settable):</i>	the first of the two allowed voltage programmable values.
<i>IOSET (settable):</i>	the first of the two allowed current limit programmable values
<i>V1SET (settable):</i>	the second of the two allowed voltage programmable values
<i>I1SET (settable):</i>	the second of the two allowed current limit programmable values
<i>RUp (settable):</i>	the Ramp-Up parameter value, i.e. the maximum voltage programmable increase rate.
<i>RDWn (settable):</i>	the Ramp-Down parameter value, i.e. the maximum voltage programmable decrease rate.
<i>TRIP (settable):</i>	the TRIP parameter value, i.e. the maximum time an Over Current condition is allowed to last.
<i>SVMAX (settable):</i>	the maximum voltage value programmable for the channel. If the value set as SVMAX is less than the current value of the VOSET/ V1SET parameter, the latter will automatically decrease to the SVMAX value.
<i>VMON (monitor):</i>	monitored voltage value
<i>IMON (monitor):</i>	monitored current value
<i>STATUS (monitor):</i>	it displays the channel status.
<i>PW (ON/OFF):</i>	the Power parameter shows the ON/OFF channel status. As this parameter is set ON, the channel is switched on (if the INTERLOCK is not active and if the channel is enabled either locally or remotely) highlighted in green when channel ON; onstate = ON; offstate = OFF
<i>POn (EN/DIS):</i>	Power-On option, which can be enabled or disabled. If this option is enabled, at Power-On or after a Restart each channel is restored in the same condition (defined by the Power parameter) it was before the Power-Off or Reset. If this option is disabled, at Power-On or after a Restart all the channels are off, independently from the condition in which they were before the Power-Off or Reset ; onstate = Enabled; offstate = Disabled
<i>PDwn (Kill/Ramp):</i>	Power-Down option, which can be set as KILL or RAMP. It affects the way the channels react at a Power-Off command caused by a TRIP condition. If the KILL option is selected, the relevant channel will be switched off at the maximum rate available. If the RAMP option is selected, the voltage will drop to zero at a rate determined by the value of the Ramp-Down parameter programmed for that channel; onstate = Ramp; offstate = Kill
<i>TripInt:</i>	2N-bit word (hexadecimal) maximum 16 lines, where N is the number of the board's Internal Trip Bus lines. Bits [0;N-1] allow the channel to sense the trip status from the corresponding lines when set to one; in the same way, bits [N;2N-1] allow the channel to propagate the trip status over the Trip Bus: bit N on line 0 and so on (see SY4527 User's manual).
<i>TripExt:</i>	Must be set in the 0÷255 range (hexadecimal). Bits [0;3] allow the channel to sense the trip status from the corresponding lines when set to one; in the same way, bits [4;7] allow the channel to propagate the trip status over the trip bus: bit 4 on line 0 and so on (see SY4527 User's manual).


If the POWER ON option is enabled, as the module is turned ON, the channel is restored to 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 SYSTEM 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)²
 E-TRIPPED (channel OFF due to external TRIP line signal)³
 I-TRIPPED (channel OFF due to internal OVERCURRENT condition)
 EXT_DIS (channel disabled by board INTERLOCK protection)

Moreover it is possible to monitor board parameters, such as measured Temperature and HVMax, and to check board status; the following messages may be returned by the POWER SUPPLY SYSTEM when monitoring the board status:

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

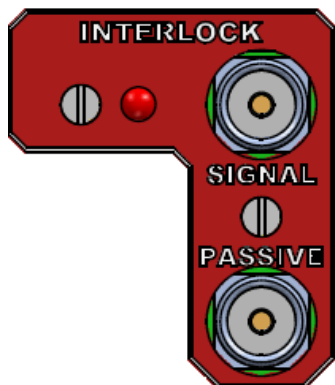
 **N.B.: Ax539; Ax541 and Ax542H must be operated with SYx527 ventilation fan speed set to "High"**

Output Enable

In order to enable the HV output channels, on boards with DB25 connectors, it is necessary that pin INT and /INT are short circuited (see External connections).

Then the enable procedure is completed in one of the following ways:

- Boards with LEMO interlock connectors

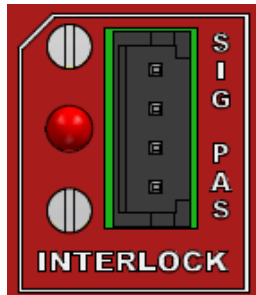


- terminating the PASSIVE INTERLOCK (see External connections) connector on 50 Ohm.
- supplying the SIGNAL INTERLOCK (see External connections) connector with a +5 V (3-4mA) signal.

² UNV is also reported when Hvmax limit is reached, it is up to the User to verify that VMON value does not exceed HVMAX.

³ EXTTRIP and INTTRIP parameters are expressed in Hexadecimal format

- Boards with AMP interlock connectors



- Short circuit pin 3 and 4 [the lower ones]. Leave contact open between pin 1 (+) and 2 (-) [upper ones]
- Apply +5 V (3-4mA) differential signal between pin 1 (+) and 2 (-); pin 1 is the upper one. Leave contact open between pin 3 and 4.

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..

Grounding specifications

The Mod. A1539 - A154X channels share a common floating return (FAGND, see External connections), available on the front panel multipin connector, insulated from the crate ground (AGND, see External connections), 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 environment requirements. Examples refer to 32 channel version.

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 A1539 - A154X 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
3. The “semi-open loop” Earth configuration
4. The “open loop” Earth configuration

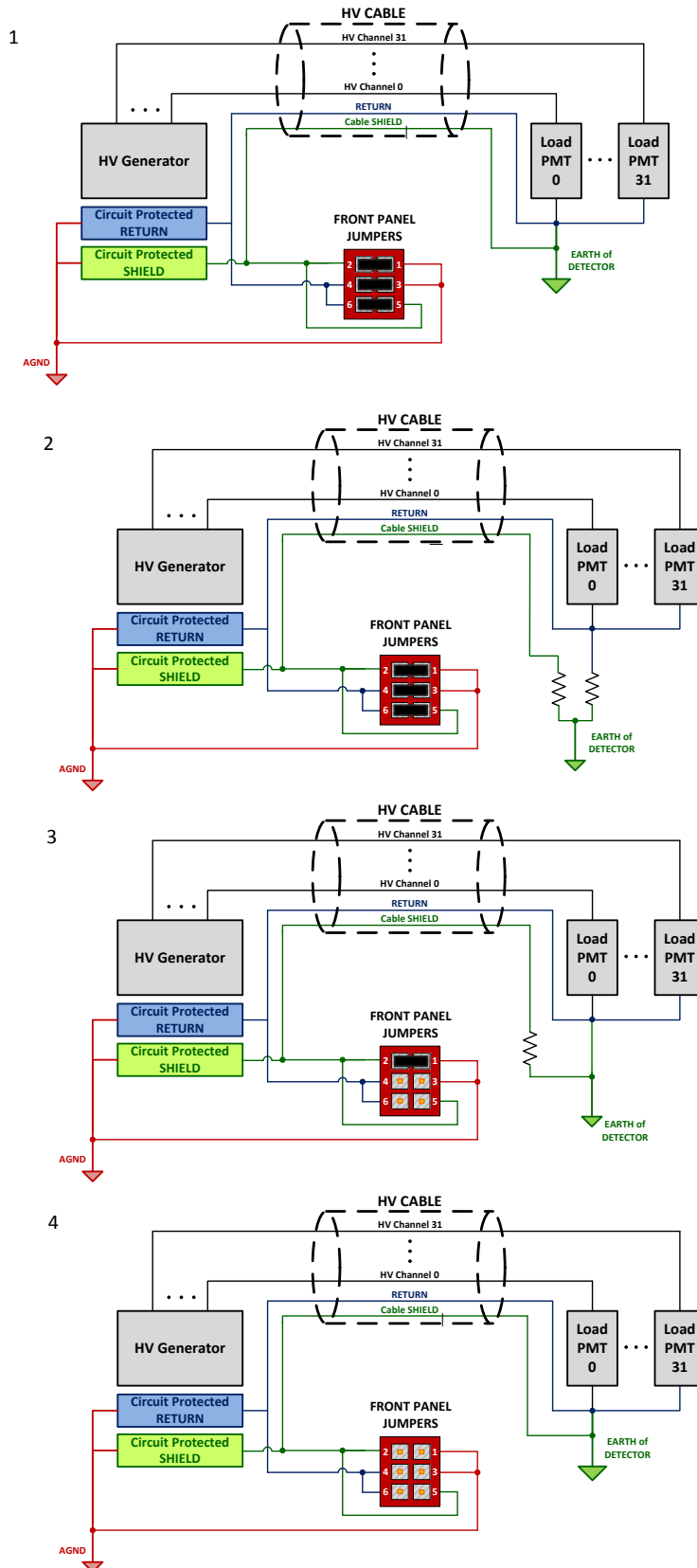


Fig. 4 – Earth configuration connection examples



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