Rev. 03 - 13/06/2019

A1588

8 Channel ± 2 kV/500 µA 4 Quad Bipolar Board

CAEN
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User Manual
UM2866

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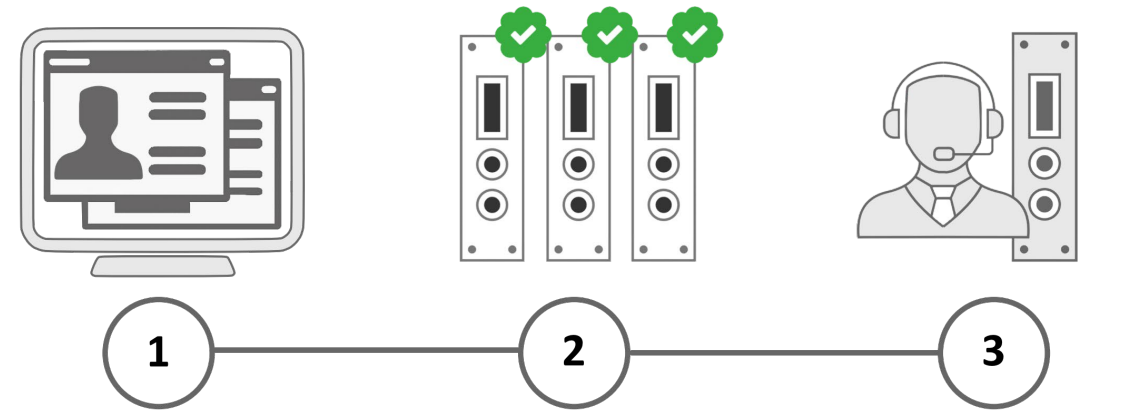

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Purpose of this Manual

This document is the A1588 8 Channel ± 2 kV/500 µA 4 Quad Bipolar Board manual; it contains information about the installation, the configuration and the use of the board.

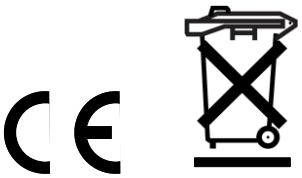
Change Document Record

Date	Revision	Changes
16 January 2014	0	PRELIMINARY Release
16 September 2014	1	Changed name to A1588
20 May 2015	2	Updated Output control and monitoring, Technical Specifications
13 June 2019	3	Updated Channel Characteristic Table

Symbols, abbreviated terms and notation

T.B.D.

Reference Documents



Index

1. A1588 Functional description

The A1588 board contains 8 independent channels providing high-voltage through SHV connectors; it is compatible with the CAEN Universal Multichannel Power Supply System (SY1527, SY2527, SY3527, SY4527, SY5527).

All channels are bipolar (±2 kV output range) and can operate in the so called four-quadrant regimes: besides supplying output voltage, they can operate as resistive loads. The channels can provide, with an excellent long term output stability, a maximum voltage of ±2 kV and a maximum current of ±500 µA. Voltage stability is guaranteed within 10 mVpp, with 100 mV setting resolution.

The output 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 65V hardware limit).

The board is provided with both current and voltage protections.

If a channel tries to draw a current larger than its programmed limit it is signaled to be in OVERCURRENT condition; the power supply system detects this state as a fault and reacts according to the setting of the TRIP parameter, namely:

TRIP = 1000 s: when the set output current value is reached the channel behaves like a constant current generator.

TRIP < 1000 s: the output current keeps the set value only for programmed time interval and then is switched off.

The maximum output voltage can be set through a potentiometer to a value which is common to all channels and can be read out via software. Channel can be enabled or disabled through the Interlock logic. 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).

2. Technical Specifications

Channel Characteristic Table

Voltage	0 ÷ ±2 kV
Maximum Current	500 µA
Voltage Set/Monitor Resolution	100 mV
Current Set/Monitor Resolution	100 nA
Ramp Up / Down	1 ÷ 500 Volt/sec, 1 Volt/sec step
VMAX hardware	2 kV
VMAX hardware accuracy	± 2% of FSR
VMAX software	2 kV
VMAX software Resolution	1V
Voltage Ripple	< 20 mVpp (Typical; common mode; 90 Hz ÷ 20 MHz range)
Voltage Set vs. Output Voltage Accuracy	±(0.02% of setting ± 1 V)
Voltage Monitor vs. Output Voltage Accuracy	±(0.02% of reading ± 1 V)
Current Monitor vs. Output Current Accuracy	±50 nA
Current Set vs. Current Monitor Accuracy	±50 nA
Maximum Output Power	1 W per channel
Long Term Stability (24h)	< 50 ppm * FSR
Vout / Temperature coefficient	< 50 ppm /°C

Component description

HV Output 0..7: Radiall SHVR317580 connector; HV channel output.

HV ON: Green Led; lights up as at least one channel is on.

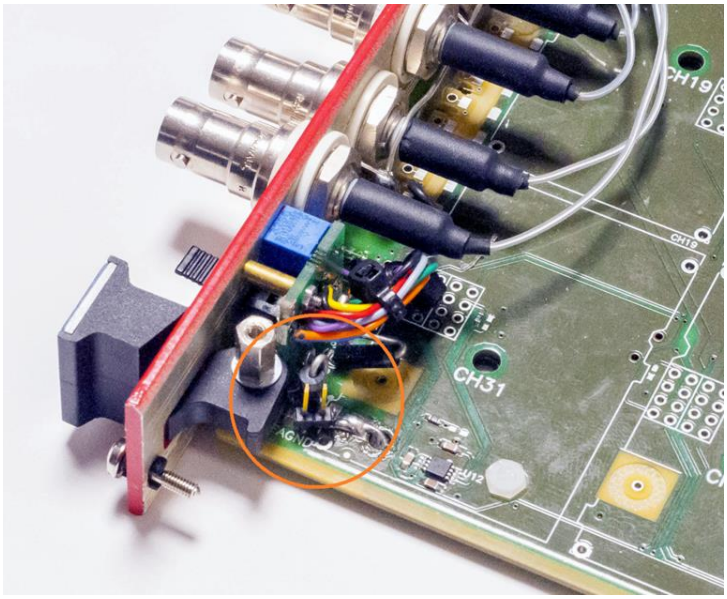
AGND: Radiall R921921 Ø 2mm connector; crate ground reference

Return: Radiall R921921 Ø 2mm connector; HV channel return (common floating)

Interlock: Red Led; AMP 280371-2 connector

VMax: Trimmer; it allows to adjust the hardware maximum voltage VMAX common to all the channels. Its value can be read out via software.

JA Configuration jumper: connects RTN and AGND (Earth), see also p. 10; accessible upon protection shield removal (see below)



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 A1588 is a single-width board. 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 A1588 board 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:

CHANNEL NAME (settable):	descriptive name for the relevant channel
V0SET (settable):	the first of the two allowed voltage programmable values.
I0SET (settable):	the first of the two allowed current limit programmable values
V1SET (settable):	the second of the two allowed voltage programmable values
I1SET (settable):	the second of the two allowed current limit programmable values
RUp (settable):	the Ramp-Up parameter value, i.e. the maximum voltage programmable increase rate.
RDWn (settable):	the Ramp-Down parameter value, i.e. the maximum voltage programmable decrease rate.
TRIP (settable):	the TRIP parameter value, i.e. the maximum time an Over Current condition is allowed to last.
SVMAX (settable):	the maximum voltage value programmable for the channel. If the value set as SVMAX is less than the current value of the V0SET/ V1SET parameter, the latter will automatically decrease to the SVMAX value.
VMON (monitor):	monitored voltage value
IMON (monitor):	monitored current value
STATUS (monitor):	it displays the channel status.
PW (ON/OFF):	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
POn (EN/DIS):	Power-On, can be enabled or disabled. If enabled, at Power-On or after Restart each channel is restored in the same condition (defined by Power parameter) it was before Power-Off or Reset. If disabled, at Power-On or after a Restart all channels are off, regardless the condition in which they were before Power-Off or Reset ; onstate = Enabled; offstate = Disabled
PDwn (Kill/Ramp):	Power-Down , can be set as KILL or RAMP. It affects the way channels react at Power-Off caused by TRIP condition. If KILL is selected, the relevant channel will be switched off in 1 second. If RAMP is selected, the voltage will drop to zero at a rate determined by the value of Ramp-Down parameter programmed for that channel; onstate=Ramp; offstate= Kill
TripInt:	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).
TripExt:	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)1
E-TRIPPED	(channel OFF due to external TRIP line signal)2
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 (hardware max voltage), 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)

Output Enable

HV output channels can be enabled in one of the following ways:

1. Short circuit pin 3 and 4 (the rightmost ones). Leave contact open between pin 1 (+) and 2 (-)
2. Apply +5 V (3-4mA) differential signal between pin 1 (+) and 2 (-). Leave contact open between pin 3 and 4

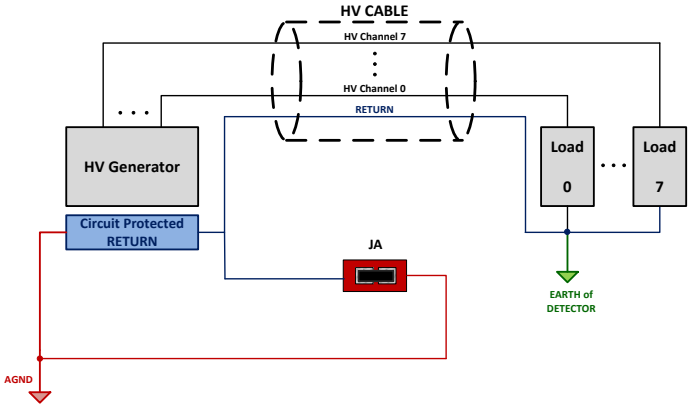
The INTERLOCK LED (red) is turned off as one of the actions above is performed: this means that channels are enabled to provide output voltage.
When the channels are disabled the voltage outputs drop to zero at the maximum rate available; when the output disable cause is removed, the channels remain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

[1] UNV is also reported when Hvmax limit is reached, it is up to the User to verify that VMON value does not exceed HVMAX.
[2] EXTTRIP and INTTRIP parameters are expressed in Hexadecimal format

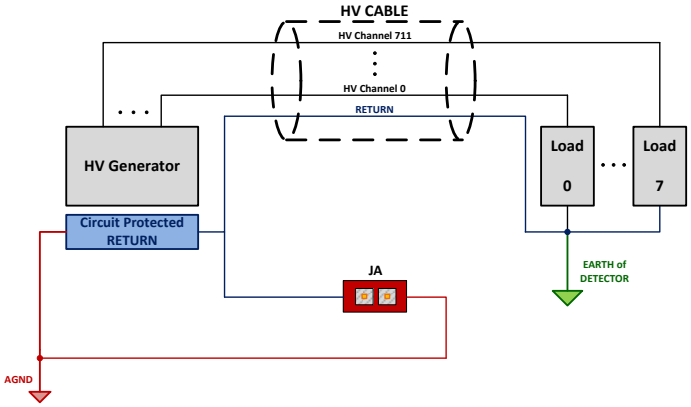
Safety Earth connection

The connection of return to Earth is fundamental for User safety. The connection must always be at the level of detector or power supply system.
Return connection even if not present or performed incorrectly, due to protection circuits implemented on the A1588 are bound to Earth; in this case the voltage difference between return and Earth (System), is limited to approximately 50V. Please note that this is a status of emergency-protection, not a working one. The Connector Configurator (see page 6) allows to optimize the connection 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 two examples of configuration:

- The “closed loop “ Earth configuration (JA contacts closed)



- The “open loop” Earth configuration (JA contacts open)



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