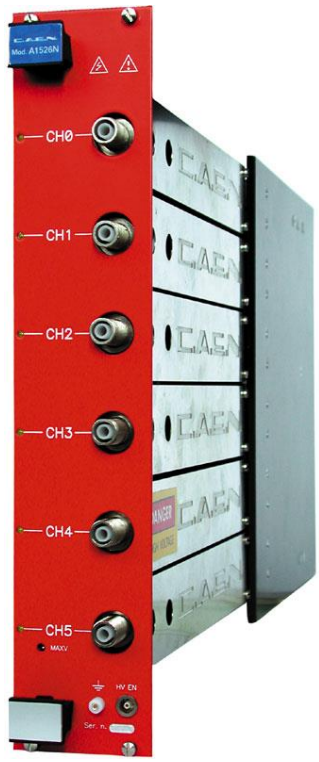
Rev. 11 - 30 June 2016

HV Boards

A1523-AG523-A1524-AG524/A1526 6 Ch. 12/15 kV High Voltage Boards



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User Manual

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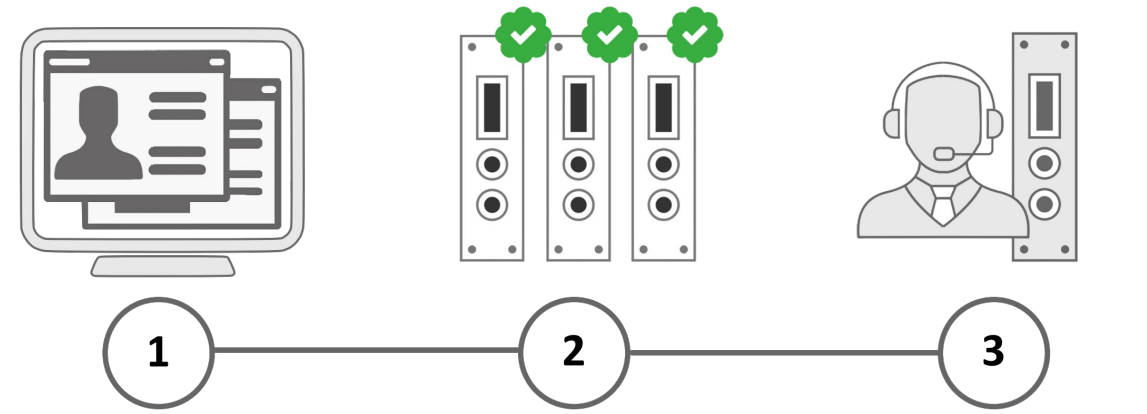

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Purpose of this Manual

This document is the A1523 A1524 A1526 AG523 AG524 HV Boards User Manual; it contains information about the installation, the configuration and the use of the boards

Change Document Record

Date	Revision	Changes
3 July 2103	5	Added Mod. A1523, A1524, AG523, AG524
18 July 2103	6	Functional description updated
10 September 2013	7	Added Mod. AG526
9 October 2013	8	Updated External connections
25 June 2015	9	Updated ripple value Table 1
15 July 2015	10	Removed AG526
30 June 2016	11	Updated with “mixed” version

Symbols, abbreviated terms and notation

T.B.D.

Reference Documents

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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. Introduction

Functional description

The Mod. A1523, A1524, A1526 are double width boards (10 TE), that house 6 H.V. channels, compatible with the CAEN Universal Multichannel Power Supply System (SYx527); the boards are available with positive, negative or "mixed" (3 positive and 3 negative) channels. The channels share a common floating ground. Moreover, the A1526 offer 100 μA / 1 mA dual current Full Scale Range (dip switch selectable). The "ground return" version of the boards are also available (AG523, AG524); the channels return is wired to the crate Earth reference.
The output ranges are as follows:

Model	A1523/AG523	A1524/AG524	A1526
V Full Scale	12 kV	12 kV	15 kV
I Full Scale	1 mA	0.1 mA	1 / 0.1 mA
Vset/Vmon resolution	1000 mV	1000 mV	1000 mV
Iset/Imon resolution	100 nA	10 nA	100 / 10 nA

In all models voltage can be programmed and monitored with 1 V resolution.
If the output voltage differs from the programmed value by more than 3% of voltage full scale range, the channel is signalled to be either in OVERVOLTAGE or UNDERVOLTAGE condition. Moreover, for each channel, a voltage protection limit SVMAX can be fixed via software with 1 V resolution and the output voltage can not be programmed beyond this value.

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

The output current is monitored with 10 nA (A1524, AG524, A1526 low range) or 100 nA (A1523, AG523, A1526 high range) resolution; if a channel tries to draw a current larger than its programmed limit it is signalled to be in OVERCURRENT condition; the SY x527 system detects this state as a fault and reacts according to the setting of the TRIP parameter[1], namely:

TRIP=infinite (= 1000 s)

When the set output current value is reached the channel behaves like a constant current generator.

TRIP=finite (< 1000 s)

The output current keeps the set value only for programmed time interval and then is switched off.

The TRIP time (i.e. the maximum time an OVERCURRENT condition is allowed to last) can be programmed in 0.1 s steps.
The maximum output voltage (VMAX Hardware) 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 hosts also a temperature sensor located on the PCB near the HV channels: the temperature values measured by this sensor are used to signal Over Temperature condition on the SYx527.
The board is provided with an "HV EN" input that disables the channels when it is not connected to ground. The front panel hosts an Earth connector for flexible grounding scheme (see § 4.4).
HV Output is provided through CPE HV coaxial connectors; A652 cable adapters (CPE HV into LEMO HV *ERA3S415CTL*) are available.

[1] Refer to the SYx527 User's Manuals for details about the TRIP Handling.

Channel Characteristic Table

Table 1 – Channel characteristics

Model:	A1523/AG523	A1524/AG524	A1526
Polarity:	Positive / Negative depending on purchased version		
Output Voltage:	0 ÷ 12 kV		0 ÷ 15 kV
Max. Output Current:	1mA	100 µA	high range 1mA; low range 100µA
Voltage Set/Monitor Resolution:	1 V		
Current Set/Monitor Resolution:	100 nA	10 nA	10 nA /100 nA depending on current range
VMAX hardware:	0÷12 kV common for all channels		0÷15 kV common for all channels
VMAX hardware accuracy:	± 2% of FSR		
VMAX software:	0÷12 kV settable for each channel		0÷15 kV settable for each channel
VMAX software resolution:	1 V		
Ramp Up / Down:	1÷500 Volt/sec, 1 Volt/sec step		
Voltage Ripple: [2]	< 30 mV pp		
Voltage Monitor vs. Output Voltage Accuracy: [3]	± 0.3% ± 2 V		
Voltage Set vs. Voltage Monitor Accuracy: [4]	± 0.3% ± 1 V		
Current Monitor vs. Output Current Accuracy:[5]	± 2% ± 1 µA	± 2% ± 0.1 µA	± 2% ± 1 µA (1 mA range) ± 2% ± 0.1 µA (100 µA range)
Current Set vs. Current Monitor Accuracy: [6]	± 2% ± 0.1 µA	± 2% ± 0.01 µA	± 2% ± 0.1 µA (1 mA range) ± 2% ± 0.01 µA (100 µA range)

[2] Typical value, from DC to 15 MHz at full load
[3] From 10% to 90% of Full Scale Range
[4] From 10% to 90% of Full Scale Range
[5] From 10% to 90% of Full Scale Range
[6] From 10% to 90% of Full Scale Range

Front Panel

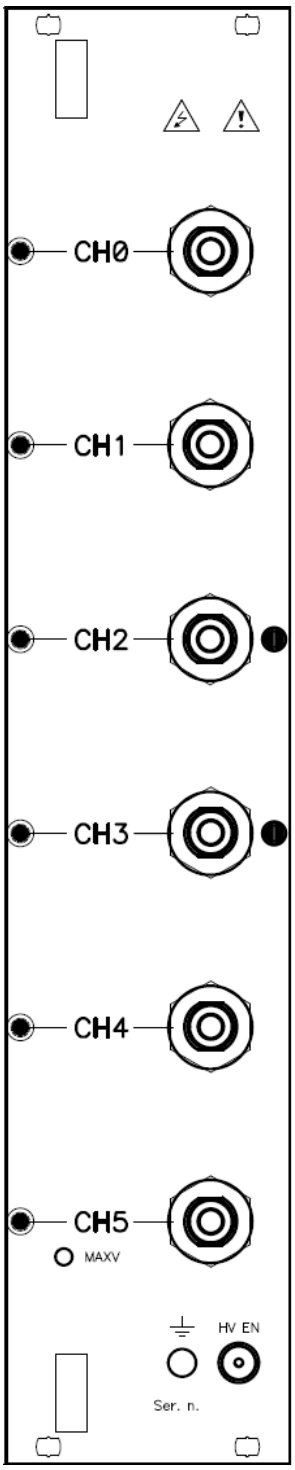

Fig. 1 – A1526 front panel

Technical Specifications

Packaging

The module is housed in a 2 units wide, 6U-high mechanics.

External connections

The location of all components of the front panel is shown at p.6. The function and electro-mechanical specifications of the external connectors are listed in the following subsections.

CH 0…5 HV CONNECTORS:	Mechanical specifications: CPE 23.100.151-046 type male connector to be mated with CPE 23.100.052-045 type. Electrical specifications; HV coaxial connector operating voltage (mated): 15 kV dc operating intensity: 1 mA
HV EN CONNECTOR	Mechanical specifications: 00-type LEMO connector. Electrical specifications: board ENABLE input, if it is connected to ground, the channels are enabled.
EARTH CONNECTOR:	Mechanical specifications: R921921000 RADIALL 2mm Socket Electrical specifications; R contact: ≤ 2 mΩ

Displays

CH ON 0..5 LEDs:	Function: they light up as the relevant channel is on. Type: red LEDs for positive polarity version; yellow LEDs for negative polarity version

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.

2. Safety information 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 apply a voltage to a load that is outside the range specified for that load.
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 there is damage to this product, 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

ATTENTION
Refer to Manual

Installation

The modules are double-width boards. At power ON the SYx527 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 modules can be controlled, either locally or remotely, through the SYx527 software interface. For details on SYx527 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 SYx527 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 speed (RAMP-UP)
- Set voltage ramp-down speed (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 SYx527 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)
- EXTTRIP (channel OFF due to external TRIP line signal)
- 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 SYx527 when monitoring the board status:

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

Output Enable

The board is provided with an "HV EN" input that enables the channels when it is connected to ground.
When the channels are disabled the voltage outputs drop to zero at the maximum rate available; when the output disable cause is removed, i.e. the "HV EN" connector is connected to ground, the channels remain OFF until the User turns them ON via software.

A1526 Current range setting

The Mod. A 1526 current Full Scale Range, can be selected between 100 µA and 1 mA by dip-switch (please refer to the figure below for the dip-switch location on the board).

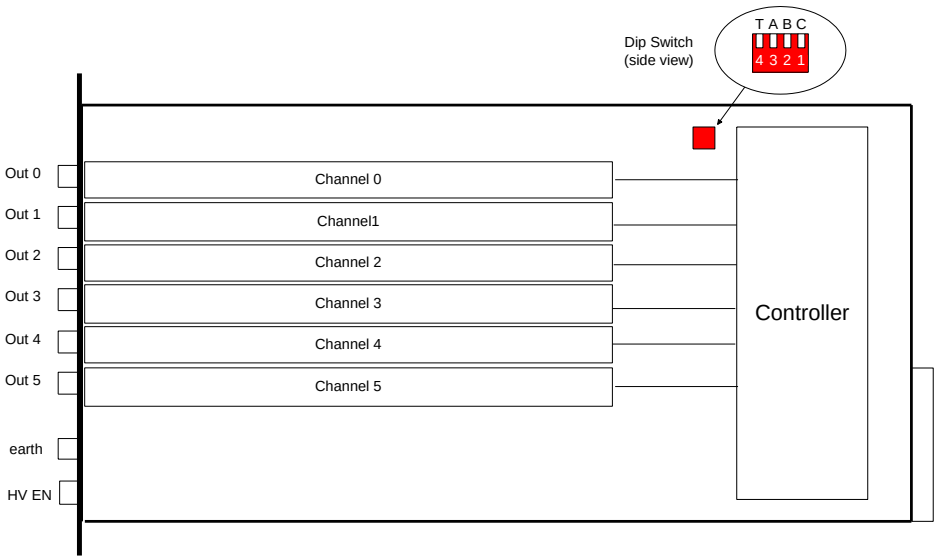

Fig. 2 – A1526 side view

In order to select the desired current Full Scale Range (common to all channels), the dip-switch must be set, by looking at the board's top side, as illustrated in figure below.

Current range selection must be performed before inserting the board into the crate.
Default factory setting is 1 mA Full Scale Range.

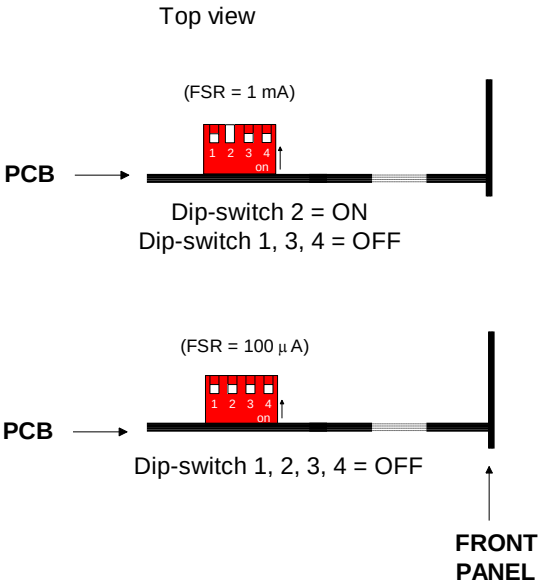

Fig. 3 – A1526 Current range dip-switch top view

Grounding specifications

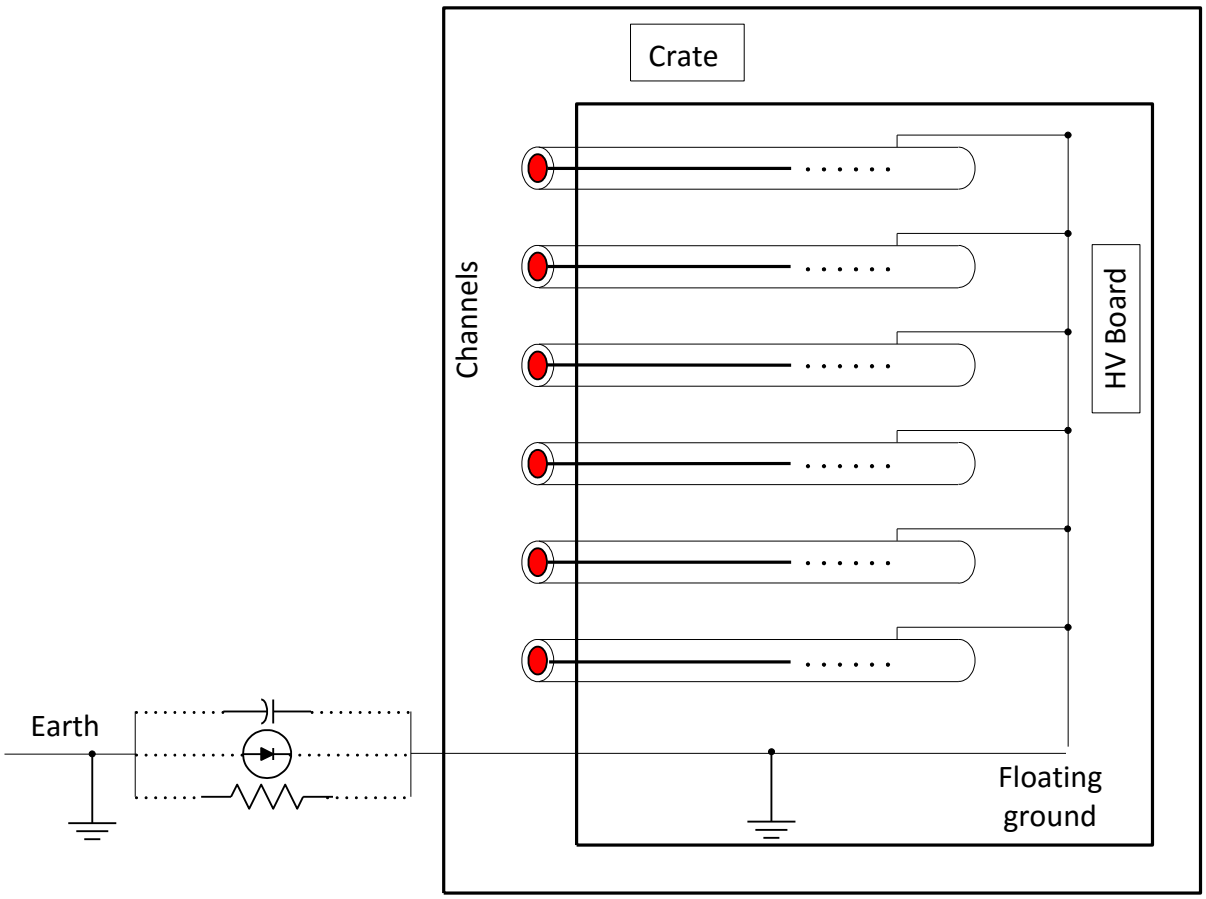

Fig. 4 – A1526 grounding scheme

The Mod. A1523, A1524 and A1526 channels share a common floating ground, which does not coincide with the crate ground, which is available as Earth connector on the front panel of the board. This feature allows on-detector grounding, thus avoiding loops which may increase noise level. Floating ground and Earth may be coupled in several ways (see scheme above), according to the environment requirements.

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