Rev. 7 - February 9th, 2023

A7505

1600 V/500 µA High Efficiency HV Power Supply

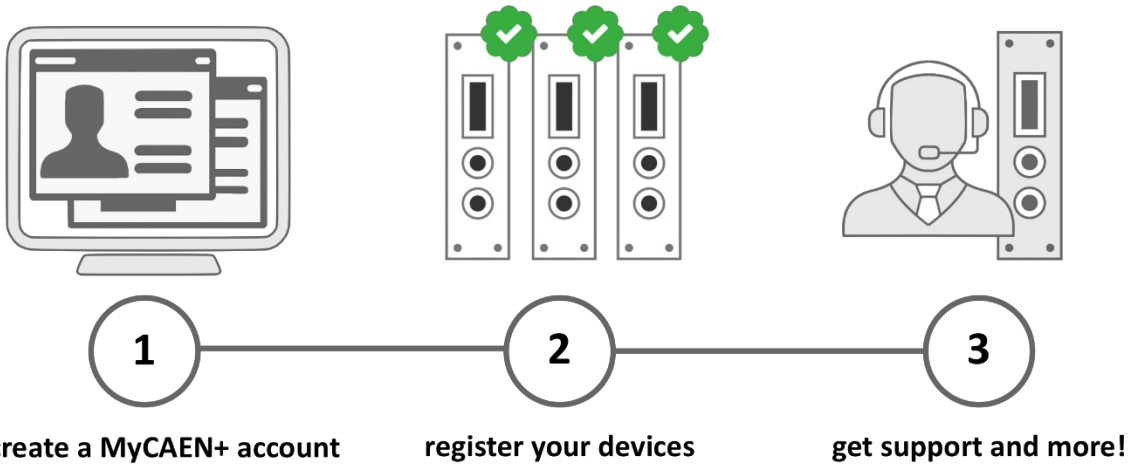
CAEN
Tools for Discovery

User Manual
UM3252

Register your device

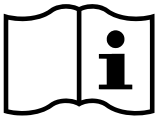
Register your device to your **MyCAEN+** account and get access to our customer services, such as notification for new firmware or software upgrade, tracking service procedures or open a ticket for assistance. **MyCAEN+** accounts have a dedicated support service for their registered products. A set of basic information can be shared with the operator, speeding up the troubleshooting process and improving the efficiency of the support interactions.

MyCAEN+ dashboard is designed to offer you a direct access to all our after sales services. Registration is totally free, to create an account go to https://www.caen.it/become-mycaenplus-user and fill the registration form with your data.



https://www.caen.it/become-mycaenplus-user/

Purpose of this User Manual



This document is the A7505 User's Manual; it contains information about the installation, the configuration and the use of the device.

Change Document Record

Date	Revision	Changes
05 Aug 2014	0	Initial release
09 Sep 2014	1	Fully revised
11 February 2015	2	Updated Iset / Iout and Imon / Iout Coefficient
16 May 2016	3	Added § 4
29 may 2017	4	Updated § 3 and A7505 images
19 April 2018	5	Updated § 4
24 January 2023	6	Updated specs
09 February 2023	7	Updated Layout added §8 §9

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Limitation of Responsibility

If the warnings contained in this manual are not followed, CAEN will not be responsible for damage caused by improper use of the device. The manufacturer declines all responsibility for damage resulting from failure to comply with the instructions for use of the product. The equipment must be used as described in the user manual, with particular regard to the intended use, using only accessories as specified by the manufacturer. No modification or repair can be performed.

Disclaimer

No part of this manual may be reproduced in any form or by any means, electronic, mechanical, recording, or otherwise, without the prior written permission of CAEN spa. The information contained herein has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies. CAEN spa reserves the right to modify its products specifications without giving any notice; for up to date information please visit www.caen.it.

Made in Italy

We remark that all our boards have been designed and assembled in Italy. In a challenging environment where a competitive edge is often obtained at the cost of lower wages and declining working conditions, we proudly acknowledge that all those who participated in the production and distribution process of our devices were reasonably paid and worked in a safe environment (this is true for the boards marked "MADE IN ITALY", while we cannot guarantee for third-party manufactures).

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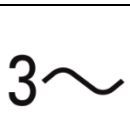
1 Safety Notices

N.B. Read carefully the "SAFETY, STORAGE AND SETUP INFORMATION PRODUCT SUPPORT SERVICE AND REPAIR" document provided with the product before starting any operation.

The following HAZARD SYMBOLS may be reported on the unit:

	Caution, refer to product manual
	Caution, risk of electrical shock
	Protective conductor terminal
	Earth (Ground) Terminal
	Alternating Current
	Three-Phase Alternating Current

The following symbol may be reported in the present manual:

	General warning statement

The symbol could be followed by the following terms:

- **DANGER**: indicates a hazardous situation which, if not avoided, will result in serious injury or death.
- **WARNING**: indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**: indicates a situation or condition that, if not avoided, could cause physical injury or damage the product and / or its environment.

CAUTION: To avoid potential hazards

USE THE PRODUCT ONLY AS SPECIFIED.
ONLY QUALIFIED PERSONNEL SHOULD PERFORM SERVICE PROCEDURES

CAUTION: Avoid Electric Overload

TO AVOID ELECTRIC SHOCK OR FIRE HAZARD, DO NOT POWER A LOAD OUTSIDE OF ITS SPECIFIED RANGE

CAUTION: Avoid Electric Shock

TO AVOID INJURY OR LOSS OF LIFE, DO NOT CONNECT OR DISCONNECT CABLES WHILE THEY ARE CONNECTED TO A VOLTAGE SOURCE

CAUTION: Do Not Operate without Covers

TO AVOID ELECTRIC SHOCK OR FIRE HAZARD, DO NOT OPERATE THIS PRODUCT WITH COVERS OR PANELS REMOVED

CAUTION: Do Not Operate in Wet/Damp Conditions

TO AVOID ELECTRIC SHOCK, DO NOT OPERATE THIS PRODUCT IN WET OR DAMP CONDITIONS

CAUTION: Do Not Operate in an Explosive Atmosphere

TO AVOID INJURY OR FIRE HAZARD, DO NOT OPERATE THIS PRODUCT IN AN EXPLOSIVE ATMOSPHERE

THIS DEVICE SHOULD BE INSTALLED AND USED BY SKILLED TECHNICIAN ONLY OR UNDER HIS SUPERVISION

DO NOT OPERATE WITH SUSPECTED FAILURES.
IF YOU SUSPECT THIS PRODUCT TO BE DAMAGED, PLEASE CONTACT THE TECHNICAL SUPPORT

2 Overview

The CAEN Mod. A7505 is a compact high efficiency power supply providing a programmable and monitorable output voltage ranging from 0 to 1600 V, when supplied with a +12 V input.

It is available with either positive or negative output voltage.

The board is provided with an over-current protection: if a current larger than the Iout maximum value is drawn, the module is not being damaged.

The output voltage is regulated by providing a 0 to +2.6 V external voltage (Vset).

The module is engineered on a FR4 PCB, coated and housed in DC01 steel box. CAD Altium library components and 3D step models are available on request.

Fig. 1: **Mod. A7505**

Ordering Option

Board Models	Description	Product Code
A7505N	A7505N -1.6kV 500µA HV Power Supply Module (12V in)	WA7505XAAAAA
A7505P	A7505P +1.6kV 500µA HV Power Supply Module (12V in)	WA7505XPAAAA

Tab. 2.1: Table of models and related items

3 Technical Specifications

Packaging	Material: DC01; dimension: W=29 mm ; L=54 mm ; H=16 mm
Contact pins	Male strip header; 2.54mm step; phosphor bronze; UL94V0 insulator
Operating temperature	-55° C ÷ +80° C
Storage temperature	-55° C ÷ +85° C
Voltage Supply (Vin)	+12 V ± 10%
Output Voltage (Vout)	0 ÷ ±1600 V
Output polarity	Available positive or negative
Enable	If Enable > 2.8 V Channel active If Enable < 1 V Channel disabled
Vmon Output (positive analog monitor)	0 ÷ +2.6 V
Vset Input (positive analog command)	0 ÷ +2.6 V **Important!: Vset must not exceed 2.6 V (Vout is not limited)**
Iset Input (positive analog command)	0 ÷ +2.5 V
Imon Output (positive analog monitor)[1]	0 ÷ +2.5 V
Status OVC bit	0÷5 V (low = OVC)
ΔVout/Vout (for ±5% **Vin** variations)	<1.5 X 10^{-3} @ full scale
Maximum Output Current (Iout)	500 µA @ ±1600 V
Power requirement	<1.6 W; @ 1600 V / 500 µA (Rload ≈ 3 MΩ)
Efficency	>60% @ Vout >1200 V (0° C ÷ +40° C)
Output Ripple (Full Load)	Typical 5mVpp; Maximum 10mVpp
Vout / Temperature coefficient	< 50 ppm / °C (@ Vout > 600 V)
Vset vs. Vout Integral Non Linearity	<±0.2% (-20° C ÷ +70° C); Valid if Vout > 25% of full scale range
Vmon vs. Vout Integral Non Linearity	<±0.2% (-20° C ÷ +70° C); Valid if Vout > 25% of full scale range
Electromagnetic compatibility	Weak emission of electromagnetic impulse and RF; one-piece metal shielding with several ground connections
Protection	Over current short circuit, sparks and humidity

Tab. 3.1: A7505 Technical Specifications

[1] N.B.: In parallel to the load we have a 300 MΩ resistor for the voltage feedback; therefore the Imon current with load ∞ is Vout/300MΩ.

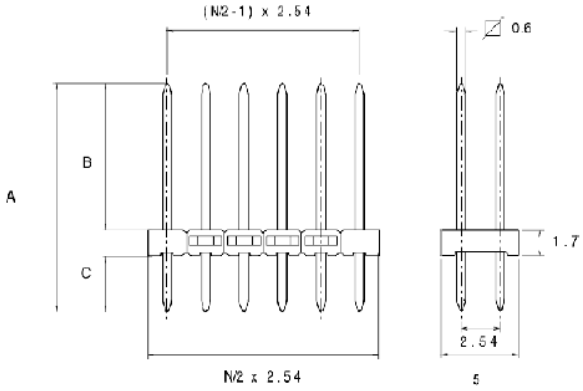


Fig. 2: **Male strip header of A7505**

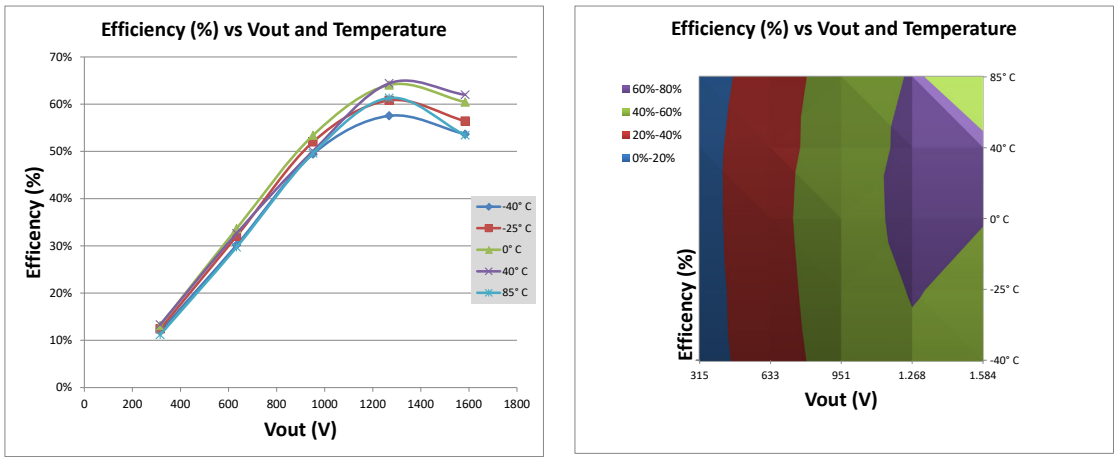


Fig. 3: **Efficiency vs Vout and Temperature**

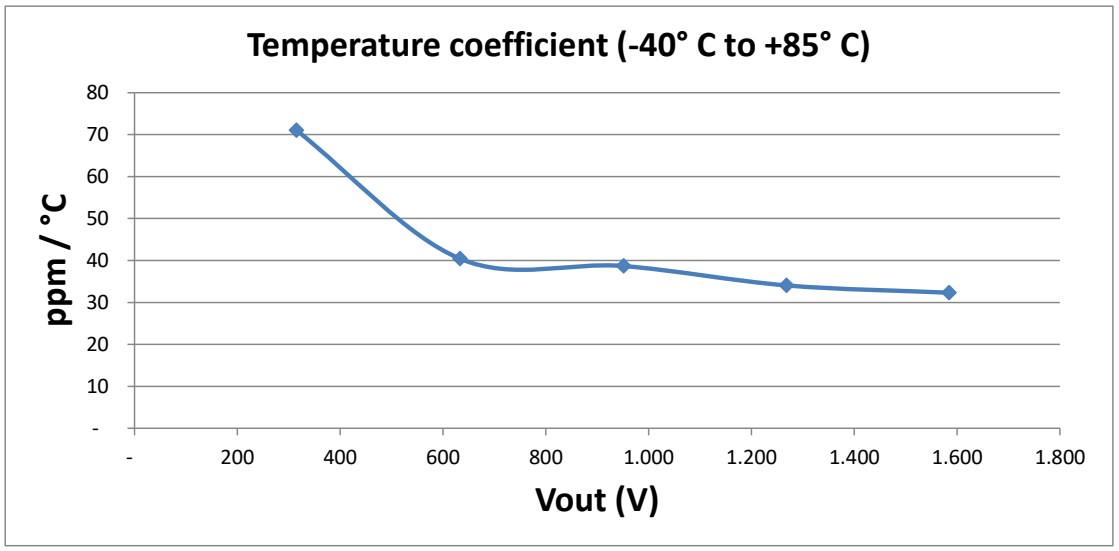


Fig. 4: **Temperature coefficient vs Vout (-40° C to +85° C)**

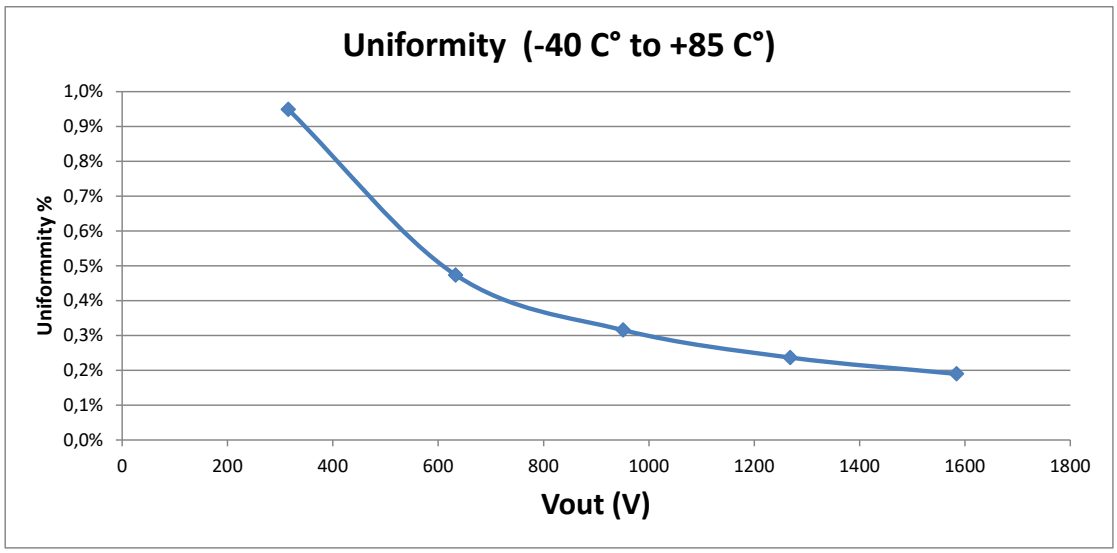


Fig. 5: **Uniformity of a Lot (ΔVout/Vout)**

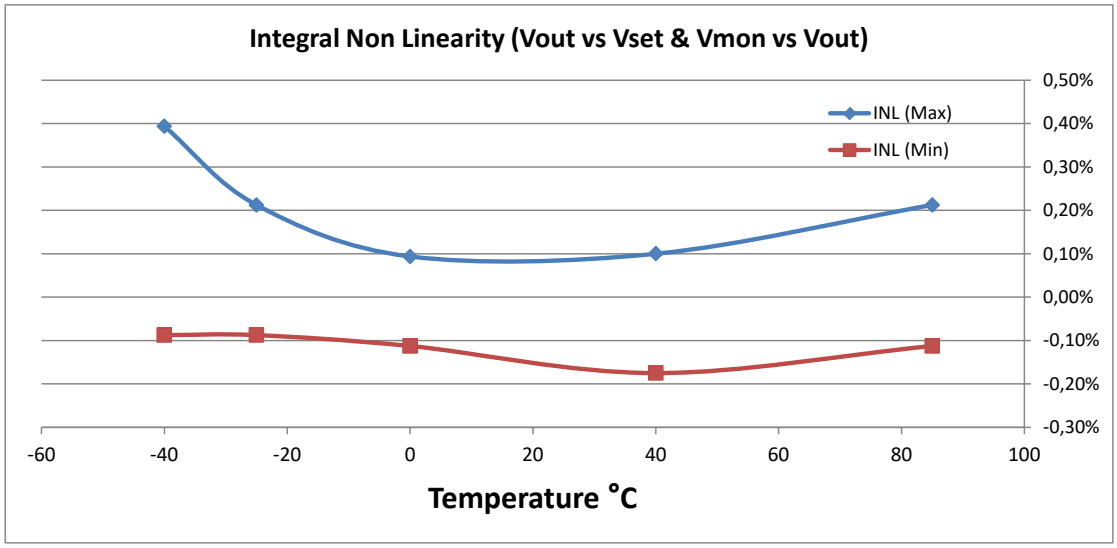


Fig. 6: **Integral non linearity (ΔVout/Vout)**

Vset / Vout and Vmon / Vout Coefficient

Coefficient	A7505N	A7505P	Accuracy	
Vout/ Vset	638	622	± 1%,	Vout > 25% of full scale range
Vout / Vmon	637	620	± 1%,	Vout > 25% of full scale range

Tab. 3.2: Table of Vset / Vout and Vmon / Vout coefficent

Example: if Vset = 2 V, then HV Out = 1276 V ± 13 V (A7505N); if Vset = 2 V, then HV Out = 1244 V ± 12 V (A7505P);

Example: if Vmon = 1.5 V, then HV Out = 955 V ± 10 V(A7505N); if Vmon = 1.5 V, then HV Out = 930 V ± 9 V(A7505P)

Iset / Iout and Imon / Iout Coefficient

Iset / Imax out	260(*)	Accuracy: ± 10%, Vout > 25% of full scale range (nominal load)
Imon / Iout	260(*)	Accuracy: ± 10%, Vout > 25% of full scale range (nominal load)

Tab. 3.3: Table of Iset / Imax out and Imon / Iout coefficent

(*) Iset and Imon expressed in V, Imax out and Iout expressed in µA. N.B.: In parallel to the load we have a 300 MΩ resistor for the voltage feedback; therefore the Imon current with load ∞ is Vout/300MΩ

Example: if Iset = 2 V, then Imax out = 520 µA ± 52 µA

Example: if Imon = 1 V, then Iout = 260 µA ± 26 µA

On / Off Timing

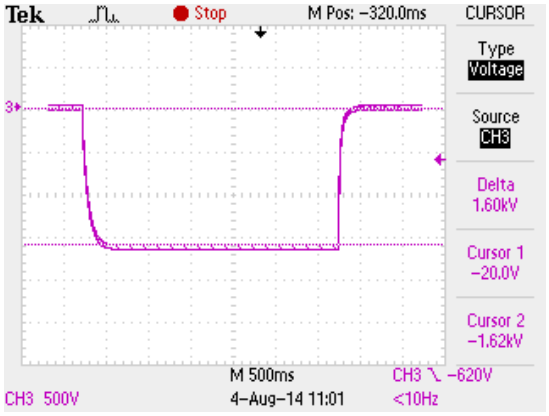


Fig. 7: Vout at turning On and Off (Load = 2.6 MΩ)

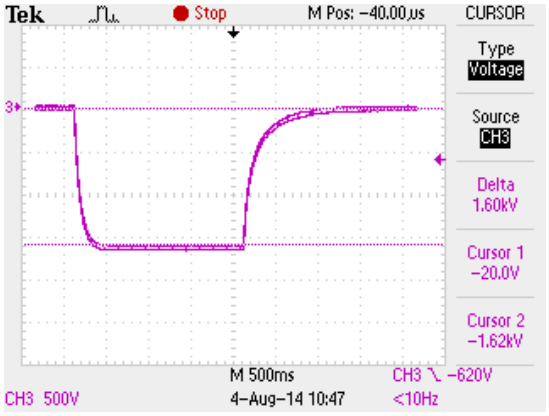


Fig. 8: Vout at turning On and Off (Load = 20 MΩ)

4 Packaging

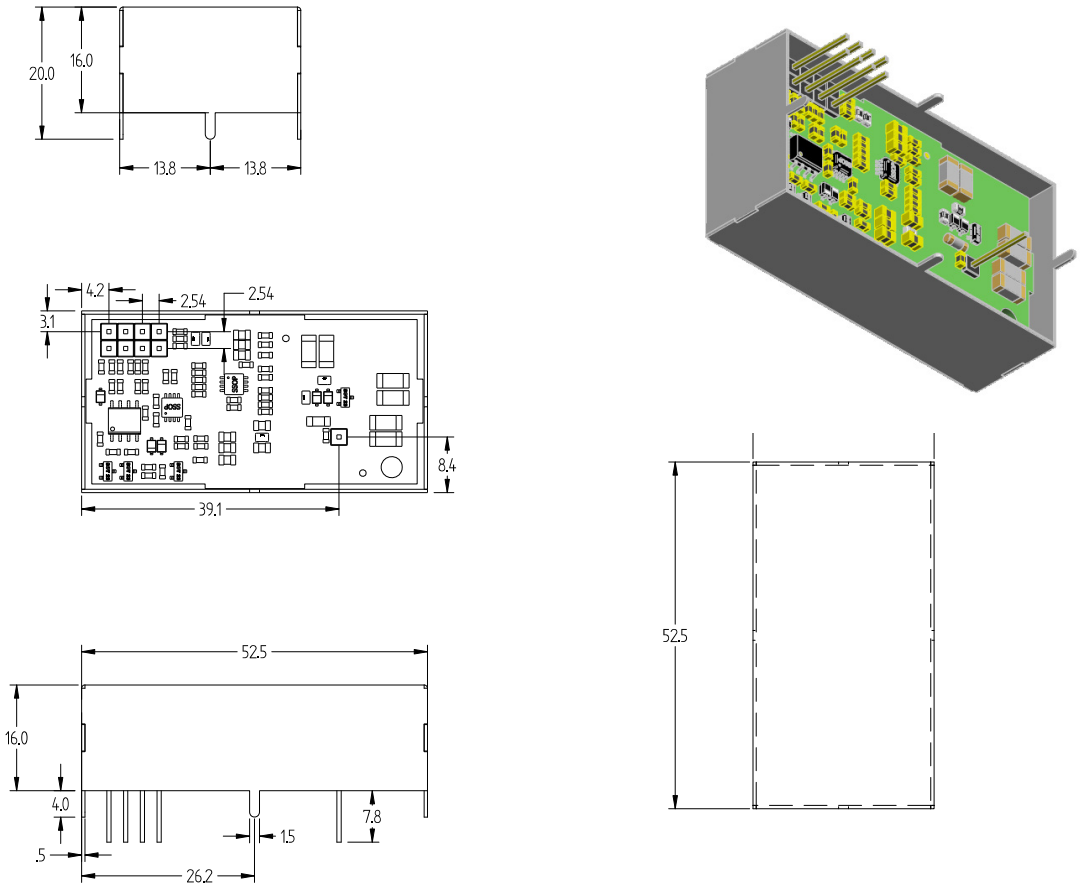
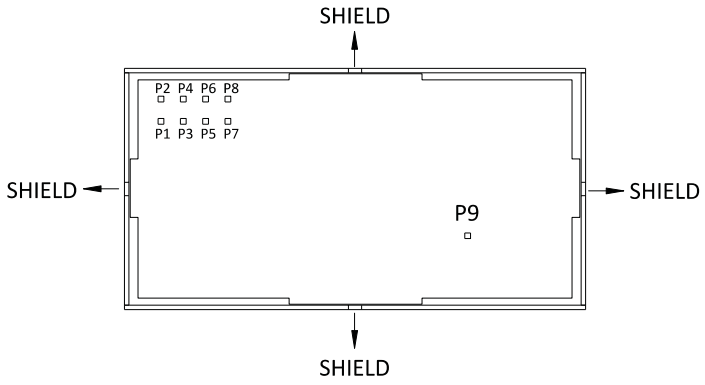


Fig. 9: A7505 External packaging (all dimension in mm)

External Connnection

The following diagram describes the Pin assignment:



Pin #	Description	Direction
P1	Enable (on >+2.8V)	In
P2	OVC Status	Out
P3	Vmon	Out
P4	Vset	In
P5	Iset	In
P6	Imon[2]	Out
P7	+12V (±10%) Input	In
P8	RTN ground - shield	
P9	HV Output	Out

Fig. 10: A7505 pins position (bottom view)

[2] It is necessary to add a regulation current proportional to the operation voltage; the regulation current I equal to Vout/300 MOhm

5 Appendix

Box for A7505

This appendix describes the Box for A7505 (Mod. A7505xB; x=N or P for negative or positive output). The HV outputs is delivered through **SHV** connector located on the front panel. The module can be controlled via **15 Pin Male High Density D-Sub Connector** located on the back panel.

Fig. 11**: A7505xB Front panel**

Fig. 12**: A7505xB Back panel with 15 Pin Male High Density D-Sub Connector**

Fig. 13: Mod. A7505NB connector pin description

Pin Number	Name	Description	Direction
1	VMON	A7505 Vmon (buffered)	Out
2	VSET	A7505 Vset (connected with filter)	In
3	IMON	A7505 Imon (buffered)	Out
4	N.C.		
5	+12V	A7505 Voltage Supply (Vin)	In
6	AGND		
7	AGND		
8	ISET	A7505 Iset (connected with filter)	In
9	N.C.		
10	AGND		
11	OVC	A7505 OVC Status	Out
12	AGND		
13	ENABLE	A7505 Enable (connected with filter)	In
14	AGND		
15	AGND		

Tab. 5.1: 15 Pin Male High Density D-Sub Connector pin description

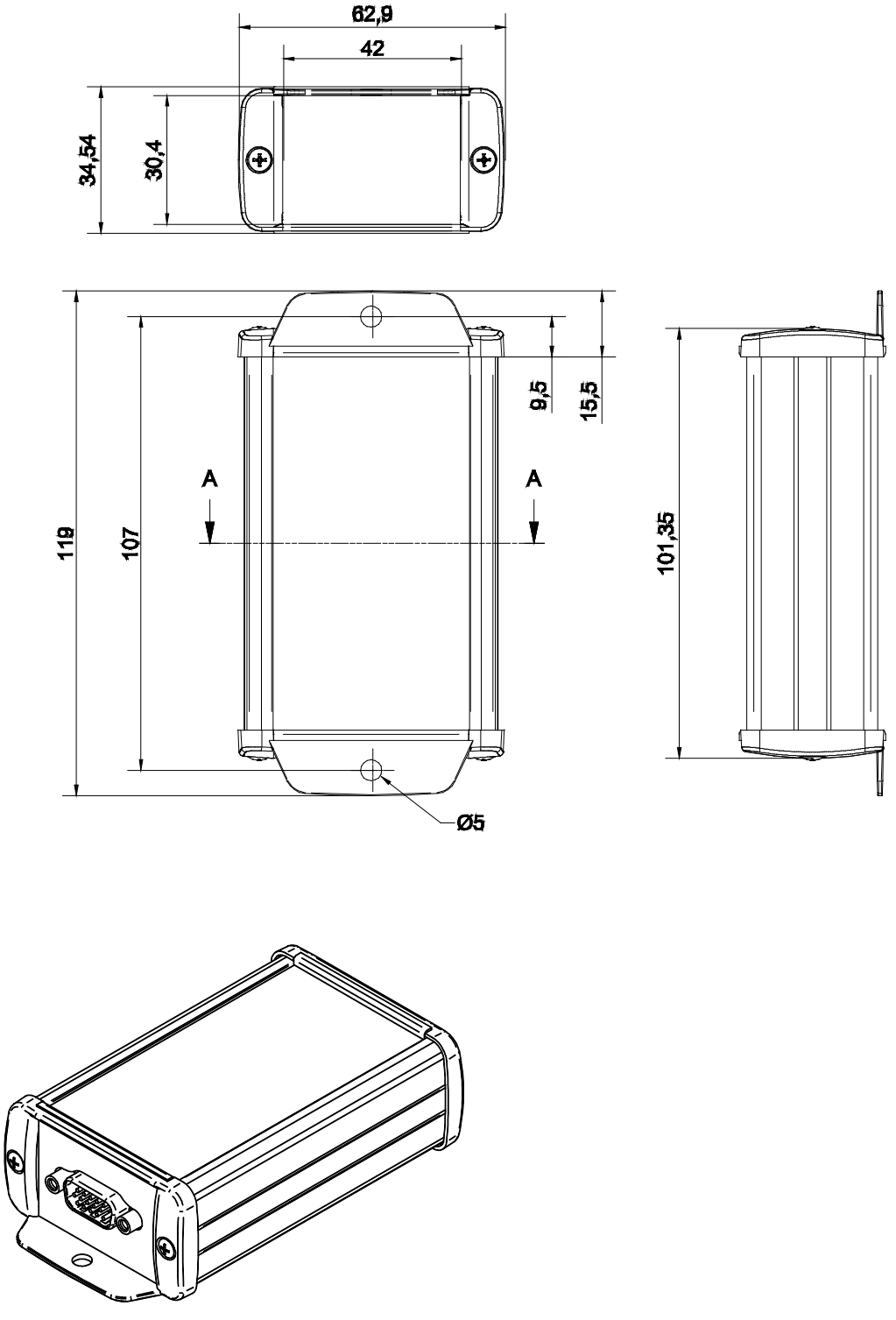


Fig. 14: A7505xB External packaging

6 Instructions for Cleaning

The equipment may be cleaned with isopropyl alcohol or deionized water and air dried. Clean the exterior of the product only.
Do not apply cleaner directly to the items or allow liquids to enter or spill on the product.

Cleaning the Touchscreen

To clean the touchscreen (if present), wipe the screen with a towelette designed for cleaning monitors or with a clean cloth moistened with water.
Do not use sprays or aerosols directly on the screen; the liquid may seep into the housing and damage a component. Never use solvents or flammable liquids on the screen.

Cleaning the air vents

It is recommended to occasionally clean the air vents (if present) on all vented sides of the board. Lint, dust, and other foreign matter can block the vents and limit the airflow. Be sure to unplug the board before cleaning the air vents and follow the general cleaning safety precautions.

General cleaning safety precautions

CAEN recommends cleaning the device using the following precautions:

- Never use solvents or flammable solutions to clean the board.
- Never immerse any parts in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.
- Always unplug the board when cleaning with liquids or damp cloths.
- Always unplug the board before cleaning the air vents.
- Wear safety glasses equipped with side shields when cleaning the board

7 Device decommissioning

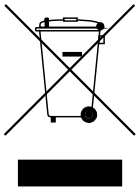
After its intended service, it is recommended to perform the following actions:

- Detach all the signal/input/output cable
- Wrap the device in its protective packaging
- Insert the device in its packaging (if present)

THE DEVICE SHALL BE STORED ONLY AT THE ENVIRONMENT CONDITIONS SPECIFIED IN THE MANUAL, OTHERWISE PERFORMANCES AND SAFETY WILL NOT BE GUARANTEED

8 Disposal

The disposal of the equipment must be managed in accordance with Directive 2012/19 / EU on waste electrical and electronic equipment (WEEE).



The crossed bin symbol indicates that the device shall not be disposed with regular residual waste.

9 Technical Support

To contact CAEN specialists for requests on the software, hardware, and board return and repair, it is necessary a MyCAEN+ account on www.caen.it:

https://www.caen.it/support-services/getting-started-with-mycaen-portal/

All the instructions for use the Support platform are in the document:

A paper copy of the document is delivered with CAEN boards.

The document is downloadable for free in PDF digital format at:

https://www.caen.it/wp-content/uploads/2022/11/Safety_information_Product_support_W.pdf

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