

User instructions for CMS EE HV Distribution Crates

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1. Distribution crate

1.1. Overview

The distribution crate distributes one or more pairs (anode/dynode) of HV supplies from the CAEN HV supply to some of the supercrystals.

It includes a control card, one or more input cards, and one or more output cards, as described below.

1.1.1. View of front and rear of box

[With one input card and one output card]



1.1.2. Power supply

The distribution crate is powered by low voltage supplies from the low voltage supply crate. The supply inlet is on the rear panel.

To ensure the crate is properly earthed, even when the power supply is disconnected, the crate must be grounded using the M6 grounding stud on the rear panel.



1.1.3. Cages

There is a hinged bar (“front cage”) across the front of the box, to prevent any input or output cards being inserted or removed except when the HV supplies are turned off and all HV lines are discharged and clamped to ground.

Similarly there is a “rear cage” at the rear to prevent any of the cables to the detector being inserted or removed except under those conditions.

Both cages are secured by quarter-turn fasteners. If either cage is opened, the crate is disabled and all HV lines are clamped.

1.2. Control card

Each distribution crate requires one control card, which is placed in the right-most card slot.

It monitors the low-voltage supplies, manages interlocks, and interfaces with the rest of the distribution system.

1.2.1. View of front panel



The “HV on” led and “reset” button are duplicated on the rear panel of the distribution crate:



1.2.2. Trip conditions

The control card triggers a trip of the distribution system if any of the following conditions occur. The LEDs on the front panel indicate which of these conditions caused a trip.

“Cage” : The front and/or rear cage is open.

“Ext” : The “control in” signal is missing or in the off condition.

“15V” : The 15V power supply has failed or is inadequate.

“5V” : The 5V power supply is inadequate, or the crate has just been powered.

The “HV on” led is illuminated when there is no trip condition (on the control card or an input card). Whenever the “HV on” led is not illuminated, the input cards clamp all HV lines.

Once a trip condition occurs, the system remains in the disabled state until an explicit reset. A reset occurs when either one of the “reset” buttons is pressed, or as commanded by the “control in” signal (see below).

When the crate is powered up, the “5V” trip condition is always present. This ensures the crate is in a safe state until explicitly reset.

1.2.3. Control signals

There are two control signals, “Control In” and “Control Out”, which are intended to be connected to the CAEN HV power supply via the low voltage supply crate (see 2.1).

Control In

This input signal is a TTL logic signal. A LOW input puts the distribution crate in the disabled state; a HIGH input puts it in the enabled state (unless there is some internal trip condition). A LOW to HIGH transition causes a reset.

This input is intended to be driven from the GEN output of the CAEN supply.

Control Out

This output signal is a TTL logic signal. It is LOW when the distribution crate is disabled, and HIGH when it is enabled.

This output is intended to be connected to the INTERLOCK input of the CAEN supply, via the low voltage supply crate (which combines the “control out” signals from all the distribution crates).

1.3. Input cards

Each distribution crate can have up to three input cards, which are placed in the slots marked “Input1”, “Input2” and “Input3”.

Each input card accepts one pair of anode/dynode supplies (via the connectors on the rear panel of the distribution crate). It distributes these supplies to the output cards, monitors the voltages and currents, and initiates a trip if either voltage or current exceeds built-in limits.

When HV is disabled (for any reason – including when the distribution crate is unpowered) it clamps the HV lines to ground (through 2.2k Ω resistors).

1.3.1. View of front panel



1.3.2. View of HV inputs on rear of crate



Each pair of inputs (anode on upper connector, dynode on lower connector) supplies the input card directly behind it. Thus Input1 is on the right, and Input3 on the left.

1.3.3. Trip conditions

The input card triggers a trip of the distribution system if the voltage on either supply, or the current drawn by the supercrystals from either supply, exceeds a built-in limit.

The LEDs on the front panel indicate which of these conditions caused a trip.

The limits are fixed by on-board resistors, and are approximately 1.4kV and 450 μ A (for both supplies).

1.3.4. Voltage and current monitors

The input card provides monitor signals, via the front panel, showing the voltage on each supply and the current drawn by the supercrystals from each supply.

The monitor outputs are analog voltages scaled as follows:

Voltage monitor: 1V represent 1kV.

Current monitor: 1mV represents 100nA.

There is an offset on the current monitor which may be a few mV, and is thus significant when measuring very small currents. However, nA currents can be measured if this offset is taken into account.

1.4. Output card

Each distribution crate can have up to seven output cards, which are placed in the left-most seven card slots.

Each output card distributes the high voltage from the input cards to a single REDEL type connector supplying twelve supercrystals.

1.4.1. Installation of output cards

Once an output card is plugged into a slot, a secure grounding connection can be made using the screw fixing to its right on the rear panel (see picture below).



1.4.2. Configuration of output cards

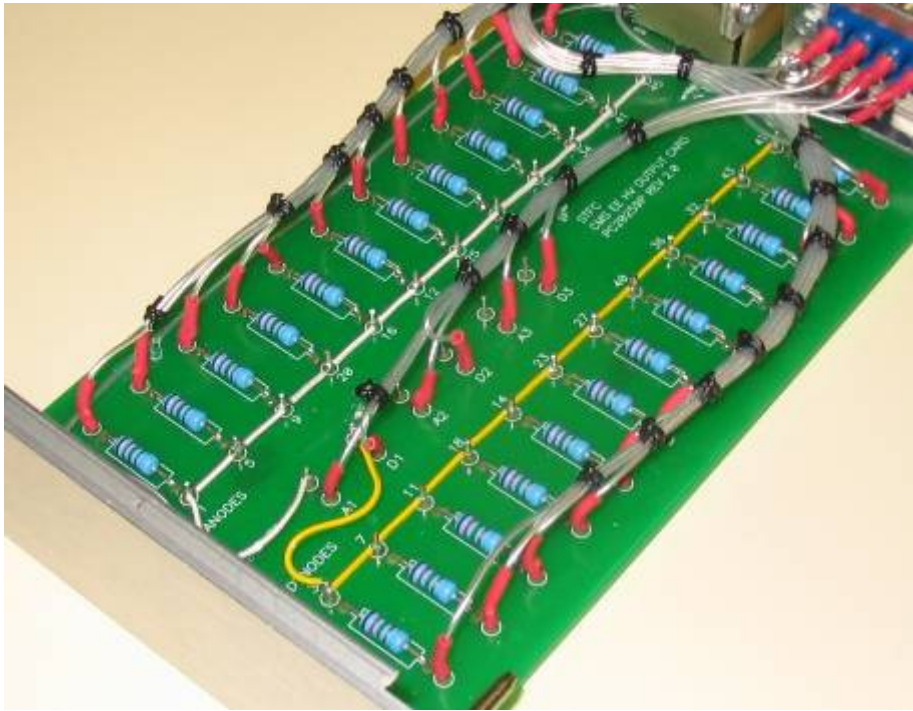
The output cards allow each supercrystal to be supplied by any of the three anode/dynode voltage pairs provided by the input cards. This is configured by making the appropriate wire links as follows. The picture below shows an output card.

The three supply voltage pairs are brought to the central pins (marked A1, D1 etc). Pins A1 and D1 provide the anode and dynode voltages from the input card in the “Input 1” slot. Similarly A2 and D2 provide the voltages from “Input 2”, and A3 and D3 provide the voltages from “Input 3”.

The connections to the supercrystal anodes are made from the row of pins marked “ANODES” and labelled “1”, “5”, “9” etc. Similarly, the connections to the supercrystal dynodes are made from the row of pins marked “DYNODES” and labelled “3”, “7”, “11” etc. The numbers correspond to the pin numbers on the REDEL connector. The pins are arranged so that the anode and dynode connections for a given supercrystal are aligned on opposite sides of the board.

Initially, the output card is configured so that all supercrystals are supplied from “Input 1”. To reconfigure the board, remake the wiring of the pins described in the paragraph above. Ensure there is sufficient separation between wires connected to different supplies to allow for the voltage differences that may occur. A separation of at least 10mm, or wire with a suitably rated insulation, is recommended.

There should be no need to remake any of the wiring secured by heatshrink.



2. Low voltage power supply crate

The low voltage power supply crate provides power for the distribution crates, and handles the distribution of control signals between the distribution boxes and the CAEN supply.

It is capable of supporting up to five distribution crates (enough for one endcap, allowing for a spare distribution crate).

2.1. Front panel

The connectors on the front panel handle the distribution of the control signals between the CAEN power supply and the distribution boxes.



2.1.1. Control signals from CAEN to distribution boxes

The “gen” signal from the CAEN supply is connected to the upper-left connector.

The crate distributes this signal to the five output connectors in the bottom-left group, which are connected to the “control in” inputs on the control cards of the distribution boxes. Unwanted outputs may be left unconnected.

If operating the distribution boxes without the CAEN supply, you may use any of the “control bypass outputs” in the central group as a dummy “gen” signal.

2.1.2. Control signals from distribution boxes to CAEN

The “control out” signals from the control cards in the distribution boxes are connected to the connectors in the lower-right group.

The crate combines these signals to produce an output on the upper-right connector, which is connected to the “interlock” input on the front of the CAEN supply.

A signal must be present on all five input connectors. If using fewer than five distribution boxes, connect the unused inputs to the “control bypass outputs” in the central group.

2.1.3. Control bypass outputs

The central group of connectors provide fixed 5V logic signals. They are intended to be used as dummy control signals as described above.

2.2. Rear Panel

The rear panel connectors provide the mains power inlet, with on/off switch, and five low voltage outputs which can be connected to the distribution boxes.

The mains supply is a ‘T’ type 1A fuse.



3. Use of CAEN HV power supply

The CAEN type 1527 HV supply must be set up as follows.

- Set NIM/TTL switch to TTL.
- Set ENABLE switch to LOC ENABLED.
- Set INTERLOCK switch to OPEN.
- Connect GEN output, and INTERLOCK input, to low voltage crate as described in 2.1.