

# Module Keying for the CP and JEP Crates

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## Introduction

The different modules in the CP and JEP subsystems of the Level-1 trigger are physically capable of being inserted in others' positions on the backplane. But the different use of pins and levels for signal fanin/fanout make this hazardous, since components could easily be damaged. Similarly, the PreProcessor and ROS both occupy CERN-standard VME64 crates, but special modules such as the CPU and TCM may only occupy certain slots. A keying scheme is needed to ensure modules are only inserted in their intended positions.

## Hardware

The LHC crates and trigger modules follow the IEEE 1101.10 standard. The card guides (Figure 1) and inject/eject handles (Figure 2) each have three square holes that accept special coding pins.

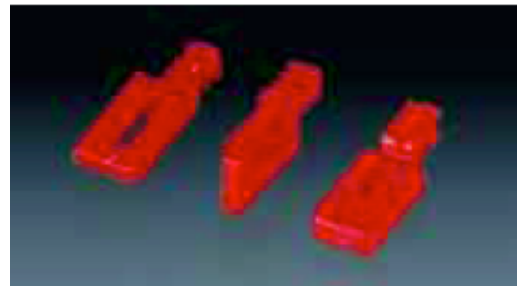
The L1Calo keying scheme uses coding pins manufactured by ELMA (Figure 3), catalog numbers 81-054-03-2 (red) and 81-054-02-2 (grey). They can be inserted in the three square holes with up to 4 orientations, for up to 64 unique coding combinations, far more than the 10 module types in the L1Calo systems.



**Figure 1:** Bottom “foot” of the crate guide rail. The three square holes are used for module keying.



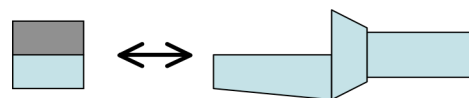
**Figure 2:** IEEE-standard inject/eject handle



**Figure 3:** Three views of the coding pins, from the manufacturer's catalog.

## Implementation

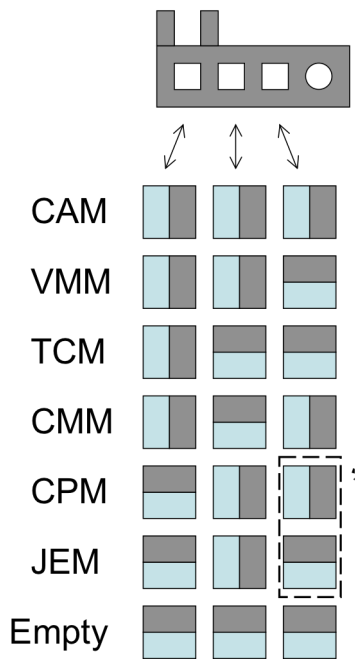
A representation of the head-on view of a coding key is shown in Figure 4, where the lighter half of the square designates the extended part of the key. The CP/JEP crates use two orientations and the PreProcessor/ROD crates use the other two.



**Figure 4:** Representation of a coding key. The box on the left represents the view from the front.

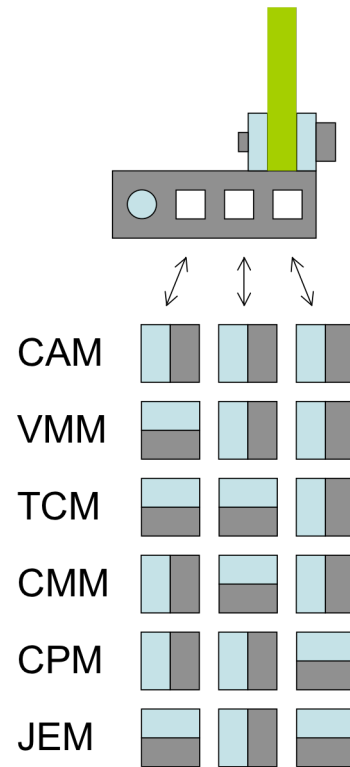
## CP/JEP crates

Figure 5 shows the coding scheme for the front of the bottom rails in the processor crates. In test rigs where both CPMs and JEMs may be inserted, the right-most pins are omitted to allow both module types to be inserted.



**Figure 5:** Coding scheme for the front of the CP/JEP crates.

The corresponding scheme for the handles at the bottom of each module is shown in Figure 6. Note that the view is from the module side, looking towards the reverse side of the front panel.

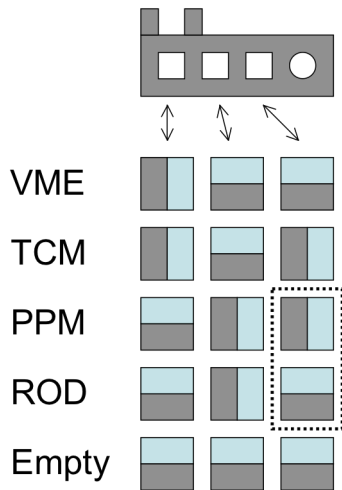


**Figure 6:** Coding scheme for the module handles in the CP/JEP subsystems.

## PreProcessor/Readout Crates

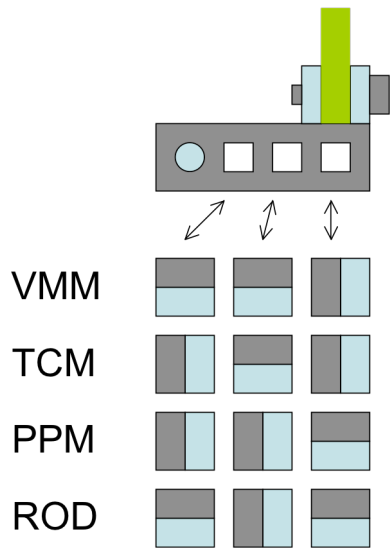
The PreProcessor and readout subsystems both use CERN standard VME64 crates. Both subsystems contain a CPU and a TCM, while the PreProcessor is populated with PPMs and the readout with RODs. In test rigs, it may be sometimes useful to put either a PPM or a ROD in a given position, so the keying scheme allows for this possibility.

Figure 7 shows the coding scheme for the front of the bottom rails in the PreProcessor and readout crates. In test rigs where both PPMs and RODs may be inserted, the right-most pins are omitted to allow both module types to be inserted.



**Figure 7:** Coding scheme for the front of the PreProcessor/Readout crates.

The corresponding scheme for the handles at the bottom of each module is shown in Figure 8. Again note that the view is from the module side, looking towards the reverse side of the front panel.



**Figure 8:** Coding scheme for the PreProcessor/Readout module handles