



PPD / EED / Infrastructure Group

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HyperCP MWPC Chamber Test Beam Telescope Readout

Pre-amplifier to LeCroy 2731A PCOS III Module Mapping

Overview:

Four HyperCP Multi-Wire Proportional Drift Chambers (MWPC) are installed in the M-Test beam line and can be used as elements in a beam telescope. Groups of 16 output signals from most of the more than 80 HyperCP MWPC pre-amplifiers are connected to E871 32-channel Discriminator Modules. Outputs of the Discriminator Modules are connected to LeCroy 2731A PCOS III Modules. This document describes the connection of the outputs of the chamber pre-amplifiers through the discriminators to the LeCroy modules.

We have implemented a numbering scheme for each array of pre-amplifiers on a chamber, each group of discriminator modules in a discriminator crate and each group of LeCroy modules in a CAMAC crate. Additionally, a cable labeling scheme has been implemented that should provide relatively easy tracing of connections from a given chamber pre-amplifier to / from a corresponding 2731A Module connector.

An Excel Workbook that defines the connections between all devices, including the identifying labels found on both ends of all cables should be able to clarify the following text.

Cables:

All cables used for this effort are identical; 34-conductor Twist-n-Flat cables 14 segments in length. The nominal segment length is 20 inches making the all cables ~23.3 feet long. Common length cables were chosen to minimize delay skew and to simplify the task of recovering these cables from the kTeV hall. Cable length was selected to permit chamber re-positioning at a later date (if necessary). All cables are terminated at both ends with 34-contact Insulation Displacement Connector plugs that will mate with the headers found on pre-amplifiers and Discriminator or LeCroy modules.

Chamber Pre-amplifier Position Numbering:

Connections can be made to a maximum of 80 pre-amplifiers on each MWPC; 20 associated with each plane (U, V, X and X'). Looking at either the U – X or the V – X' faces of a chamber, the numbering scheme we've adopted has pre-amplifier number 1 in the left-most position in the array of pre-amplifiers and increments by one for each position to the right. Note that for the U and V arrays of pre-amplifiers in a given chamber, there are more than 20 preamplifiers. The default cabling scheme has cables are connected to pre-amplifiers in positions 1 through and including 20. If the user would like to read out the signals from the pre-amplifier(s) in further right positions in these arrays, they can move the cables connected to the pre-amplifiers to meet their needs.

See Figure 1 for an example of the chamber pre-amplifier numbering scheme.

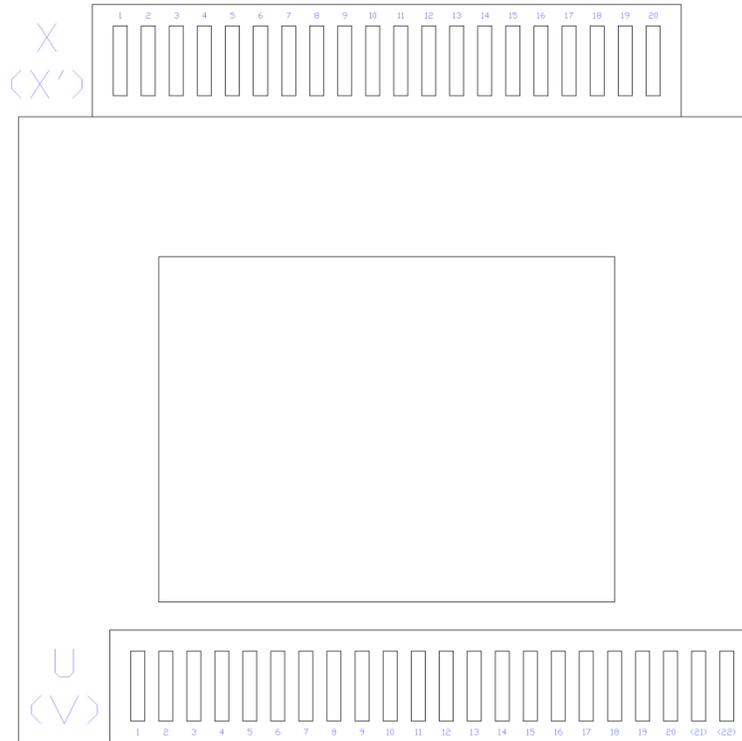


Figure 1. Generic HyperCP chamber pre-amplifier numbering scheme.

Discriminator Module Connector Numbering:

Up to 20 E871 Discriminator Modules can be installed in a 21-slot Discriminator Crate. The slot numbering convention that we've adopted has slot number 1 as the left-most position (when looking at the front of the crate) and to increment by one for each position to the right. Note that only a Controller Module can be installed in slot 11. The backplane in the discriminator crate consist only of power and control voltage distribution. Connections to the inputs of the Discriminator Modules are implemented as two 34-contact 3M© connectors mounted on the rear edge of each Discriminator Module. Cables from the chamber pre-amplifiers connect directly to these connectors after the modules are installed and secured in the crate. The output of a Discriminator Module is found on a 70-contact edge connector. As the format of this connector was judged inconvenient, we designed a Fan-Out Module that would mate with the edge connector and divide the 32 channels (differential ECL logic) into two groups of 16 that correspond with those found on the inputs to the Discriminator Module. The Fan-Out Module utilizes the same 3M© connectors found on the Discriminator Module for it's input.

With 20 Discriminator Modules (each with two input and two output connectors) installed, a crate has a total of 40 signal cables connected to it. We've differentiated the two input (or output) connectors for a given Discriminator Module as Lower and Upper (U and L).

See Figures 2 and 3 for examples of front (output) and rear (input) module / connector numbering.

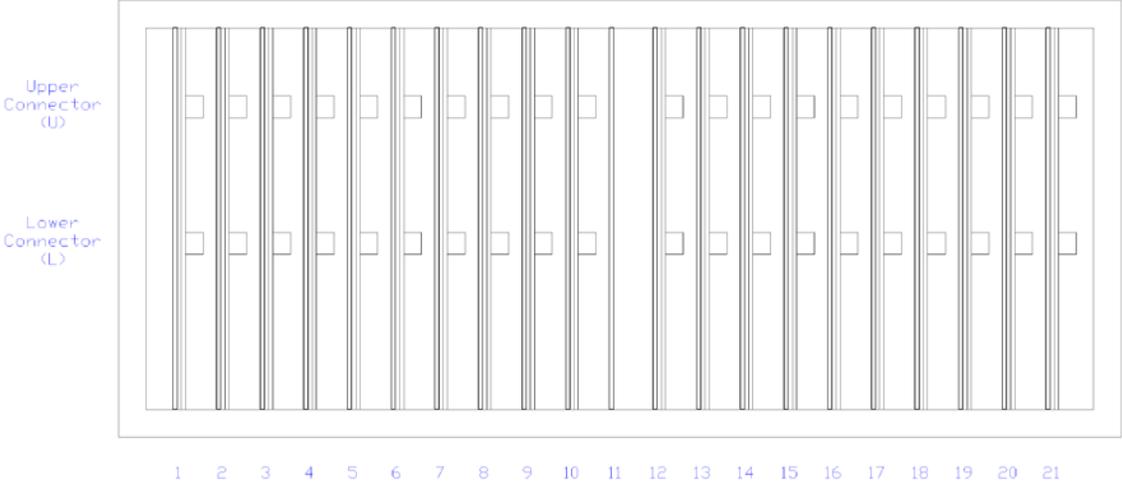


Figure 2. Discriminator Crate connector numbering scheme (viewed from the front of the crate).

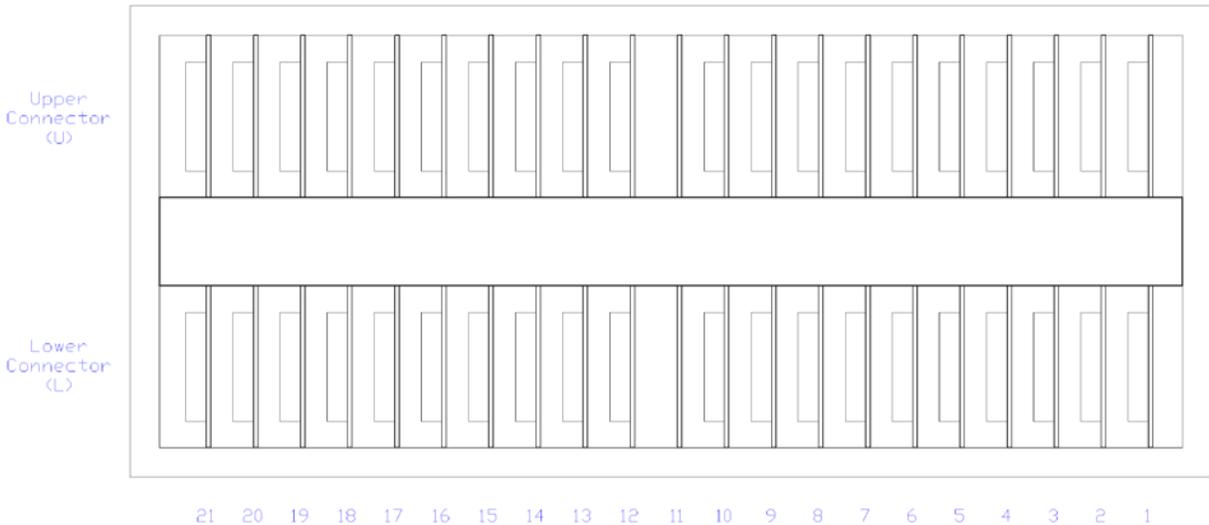


Figure 3. Discriminator Crate connector numbering scheme (viewed from the rear of the crate).

LeCroy 2731A Connector Numbering:

Each LeCroy 2731A PCOS III module has two 34-pin input headers located at the front panel, one at the top and one at the bottom. A 34-pin output header located in the middle is not used for this effort. Unlike the connectors found on the Discriminator Modules, the headers on the 2731A offer no means of securing the cable once connected. We've attempted to solve this problem by securing the bundles of cables to panels located to the left of the CAMAC crates.

Following the same convention adopted for the numbering of the Discriminator Modules and connectors, we've identified the left most slot in a CAMAC crate as number 1 and increment by one for each position

to the right. To maintain symmetry with the loading of modules in the Discriminator Crates, we've installed only twenty 2731A modules in any CAMAC crate. The two input connectors on a 2731A Module are differentiated as Upper and Lower (U and L).

See Figure 4 to view an example of the 2731A Module connector numbering scheme.

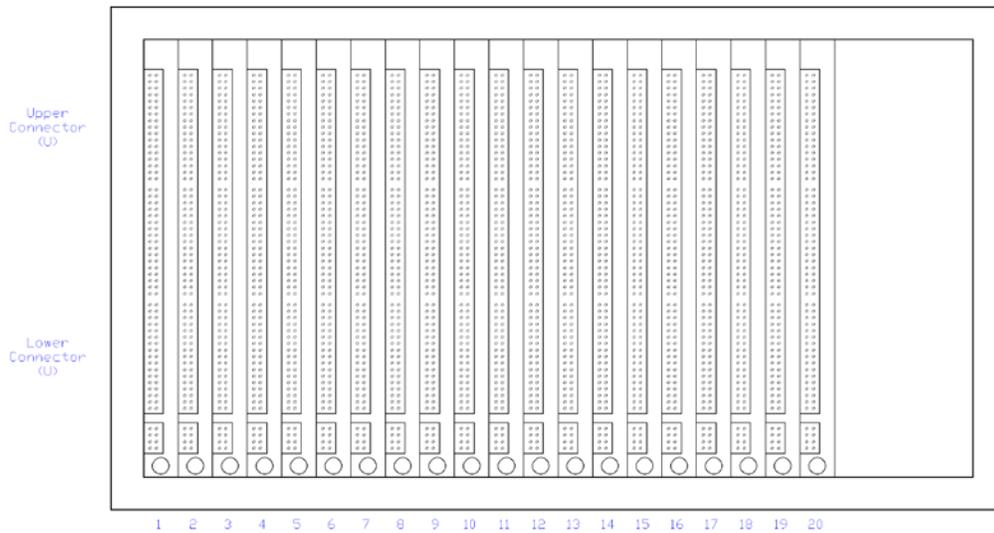


Figure 4. LeCroy 2731A Module connector numbering scheme (viewed from the front of the crate).

Crate and Rack Numbering:

A rack containing 4 CAMAC crates and a rack containing 4 Discriminator crates are physically connected together. Two such rack-pairs have been assembled to service the 4 MWPCs installed at M-Test. The

first pair service Wire Chambers (WC) 1 and 2, the second rack-pair service WC3 and WC4. Wire Chamber locations in M-Test are defined by the order in which beam passes through them; WC1 is closest to the target and WC4 is the last that the beam interacts with.

Both CAMAC (CA) and Discriminator (D) crates are numbered from 1 to 8. By the loading / cabling, there is a one-to-one correspondence between the two types of crates; D1 is connected to CA1, D2 to CA2 and so on. Crates CA1 – D1, CA2 – D2, CA3 – D3 and CA4 – D4 are located in the first rack pair (connected to WC1 and WC2). Crate 1 (of either type) is the lowest crate in the rack and crate numbers increment by one moving up the rack. The remaining crates are located in the second rack-pair. Crate 5 (of either type) is the lowest crate in the rack and crate numbers increment by one moving up the rack.

To facilitate ease of understanding connections between the two types of crates and the pre-amplifiers, we have connected like positions in Discriminator and CAMAC crates to each other. Looking at the front of either crate, the connector position in a given location in one crate (ie. 3rd module from the left – upper connector) is connected to the same position - connector in the related crate. Without looking at the connection map or cable label, one can identify the source of the input to any LeCroy 2731A Module by association.

Cable Labeling:

For every chamber pre-amplifier there is a cable connection to one input on a Discriminator Module and a cable connecting the corresponding Discriminator Module output to one input on a 2731A Module. Four chambers, 80 connections per chamber and two cables per connection result in a total of 640 cables. We have added a spare cable for every group of 10 cables in the system adding 64 for a total of 704 installed cables.

We've implemented a cable labeling scheme that should prove helpful in case signal debugging efforts are required. Ignoring the spare cables, there are 320 connections from chamber pre-amplifiers to Discriminator Module inputs. There are 320 connections from Discriminator Module outputs to 2731A inputs. All cable labels consist of a reference to either the wire chamber or Discriminator crate to which they are connected and a serial number. We've adopted a numbering scheme such that the serial number range for both types of cables (chamber to Discriminator and Discriminator to CAMAC) is 001 to 320. Further, we've connected the two types of cables in such a manner that the serial numbers are the same for both cables in the same position in a Discriminator Crate (ie. 3rd module from the right, lower connector). One can easily identify the location of a particular pre-amplifier on a chamber simply by matching the serial number found on the 2731A Module input cable to the serial number on the cable connected to a chamber.

Further, we've arranged the cables such that the two cables with serial number 001 are located in the lower connector of the Discriminator Module in slot 1 of Discriminator Crate D1. The next lower connector to the right is mated with cable 002. The cable numbers increment by one for each lower connector to the right, ending at 020. Cable 021 is connected to the upper connector of the Discriminator Module in slot 1 of D1. The lower row of connectors in D2 will be connected to cables 041 to 060 with the next 20 in the upper row of connectors. This pattern of incrementing by 40 for each Discriminator Crate is maintained for all 8 crates. Note that by the symmetry of the cable layout, the same pattern will be found in CAMAC crates.

The first 20 cables are connected to the pre-amplifiers associated with the U wires in Wire Chamber 1. The next 20 are associated with X wires, the next 20 with the V wires and the next 20 with X' wires (all in WC1). This pattern is repeated for the three remaining chambers. This indicates that the Discriminator Modules in a given crate are associated with either the U/X wires or the V/X' wires.