

COUPP-2L Instrumentation Wiring

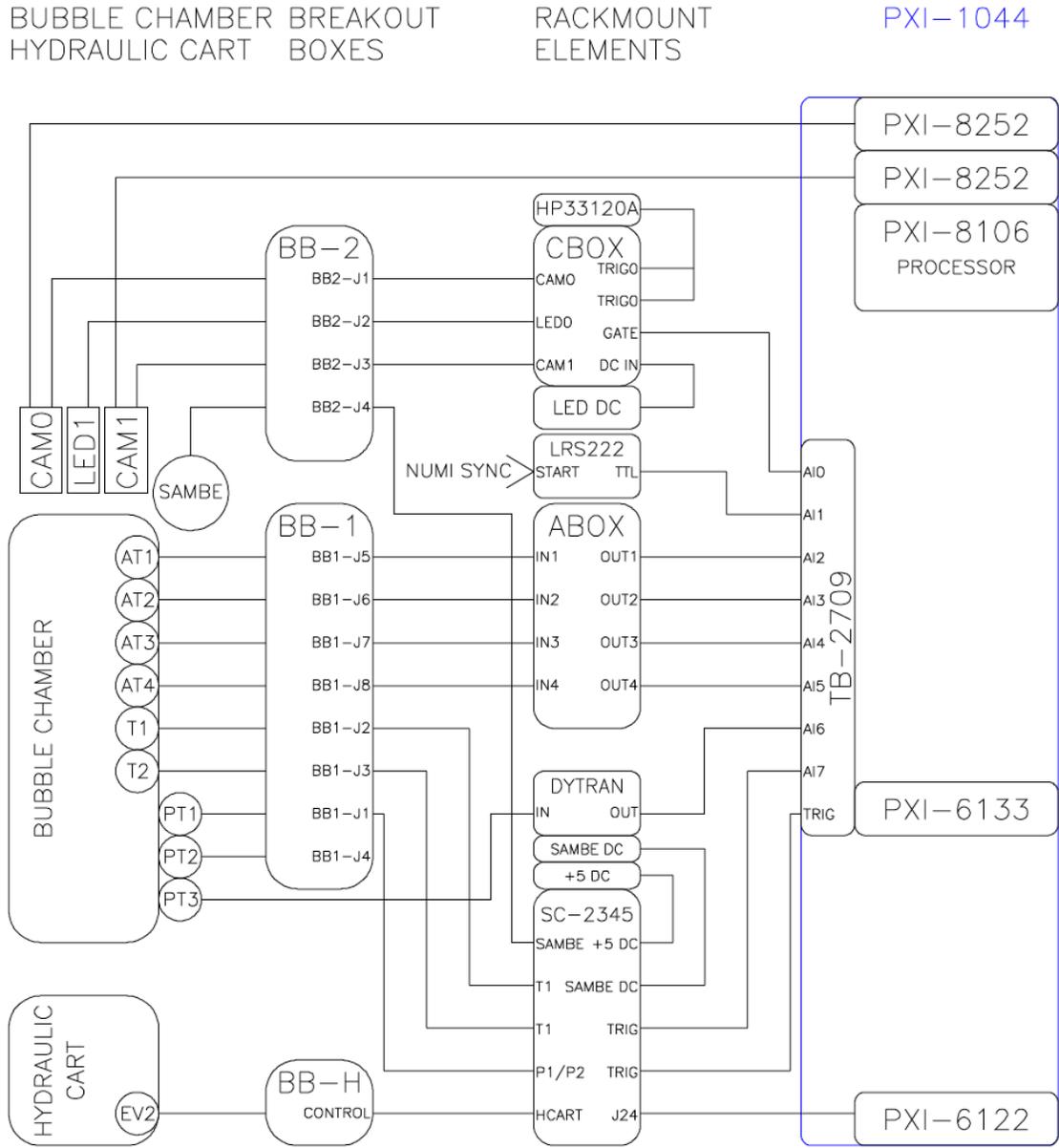


Figure 1: Top Level Instrumentation Wiring Diagram for the COUPP-2L Experiment. The bubble chamber and its hydraulic controls cart are indicated in the left column. Continuing from left to right, the second column indicates the instrumentation wiring breakout boxes on the chamber and on the hydraulic cart, the third column indicates the various instrumentation elements located in the DAQ rack, and the right-most column indicates the elements of the National Instruments Data Acquisition Chassis.

COUPP-2L Instrument Wiring Notes:

Bubble Chamber Instrumentation: The bubble chamber pressure vessel assembly is indicated schematically on the left side of Figure 1. The instrumentation attached directly to the bubble chamber:

- 1) Two video cameras denoted CAM0 and CAM1 on the drawing. These units are commercial BASLER A602f 100Hz FireWire video cameras. The cameras mounted external to the pressure vessel and view the quartz inner vessel assembly in small-angle stereo through one of the pressure-rated viewports.
 - a. Link: [Basler A602f FireWire Camera](#)

- 2) One “homemade” LED Array consisting of seven Luxeon Star LED units mounted on an aluminum bracket and wired in series. The LED array is mounted external to the chamber in between the two cameras. Light from the LED array is reflected from the back wall of the chamber by a sheet of 3M retro-reflective material which provides a backdrop to the chamber for bubble photography.
 - a. Link: [Homemade LED Array](#)

- 3) Four custom acoustic transducers developed and fabricated at Indiana University South Bend are glued directly to the quartz inner vessel of the COUPP-2L bubble chamber. These sensors are wired to an external breakout box via a pressure rated multi-conductor (16 twisted pair) electrical feed-through:
 - a. Link: [Pressure Vessel Electrical Feed-Through Information](#)
 - b. Link: [Acoustic Transducer Information](#)

- 4) Two temperature transducers. These are conventional, commercial RTD devices located on the bellows flanges of the inner vessel assembly. Each device is inserted into a loose-fitting hole and bonded with silver epoxy. The signal wires for these devices are carried through the same electrical feed-through as the acoustic transducers.
 - a. Link: [Sensortec RTD Data Sheet](#)

- 5) Two conventional slow pressure transducers. One sees the hydraulic pressure in the pressure vessel, the other sees the inner vessel pressure directly. The pressure transducers are also indicated on the process flow diagram for the experiment.
 - a. Link: [Setra GCT225 Pressure Transducers](#)
 - b. Link: [COUPP-2L Process Diagram](#)

- 6) One fast AC-coupled pressure transducer. This device is a DYTRAN 2005V.
 - a. Link: [Dytran 2005V Fast Pressure Transducer](#)

The Instrumentation Breakout Boxes: There are two instrumentation breakout boxes on the bubble chamber:

- 1) BB-1 is mounted on the bubble chamber top flange and provides access to signals originating on the bubble chamber inner vessel or on the top flange itself.
- 2) BB-2 is mounted at the base of the bubble chamber pressure vessel and provides a centralization point for signals that originate on the pressure vessel.
- 3) BB-H designates the wiring box that is integral to the hydraulic controls cart.
 - a. Link: [Hydraulic Cart Documentation](#)
- 4) The details of the wiring, from the instruments themselves to the DAQ system are spelled out in the COUPP-2L Instrument Wiring Table.
 - a. Link: [COUPP-2L Instrumentation Wiring Table](#)

Relay Rack Elements:

- 1) HP-33120A: This is a commercial Hewlett Packard 33120A arbitrary waveform generator used (or *misused...*) to provide the 100 Hz clock signal to synchronize our cameras. This is the main clock signal for the experiment.
 - a. Link: [HP 33120A Arbitrary Waveform Generator](#)
- 2) CBOX or Camera/LED/Clock Interface Box: This is a custom unit designed and fabricated by Martin Hu of the Fermilab Accelerator Division. This unit interfaces the camera control signals, distributing the camera trigger signal and enabling current flow through the LED array when either camera is active.
 - a. Link: [Camera/LED/Clock Interface Box](#)
- 1) LED Power Supply: The CAMERA/LED box provides only switching for the LED drive current. The power supply for the LED array is this external power supply box. The supply is a commercial Hewlett Packard 6023A 0-20 Volt 30A power supply. We use the current limit adjustment on the supply to control the current flow to the LED array.
 - a. Link: [LED Power supply](#)
- 3) LRS 222: This unit is a NIM module housed in a NIM bin in a rack external to the experiment. This device was used to stretch the NUMI spill synchronization signal provided by the Fermilab Accelerator Division to a width appropriate the COUPP DAQ. This signal will not be necessary for the SNOLAB installation of the experiment.
- 4) ABOX or Acoustic Sensor Bias Box: This is a custom unit designed and fabricated by the Fermilab Particle Physics Division EE Department. It

provides the +5 and -5 volt bias voltages for preamplifier boards encapsulated in our acoustic transducer packages (AT1 thru AT4 in the process flow diagram.)

a. Link: [Acoustic Transducer Bias & Breakout](#)

5) SC-2345 Instrumentation Wiring Chassis: This is the central instrumentation wiring nexus for the National Instruments DAQ. Documentation of the SC02345 Hardware and the details of the user-supplied wiring internal to the SC-2345 are provided in the links below:

a. SC-2345 Links: [SC-2345 Instrument Signal Conditioning](#)

b. SC-2345 Wiring: [SC-2345 Internal Wiring](#)