Associated Files

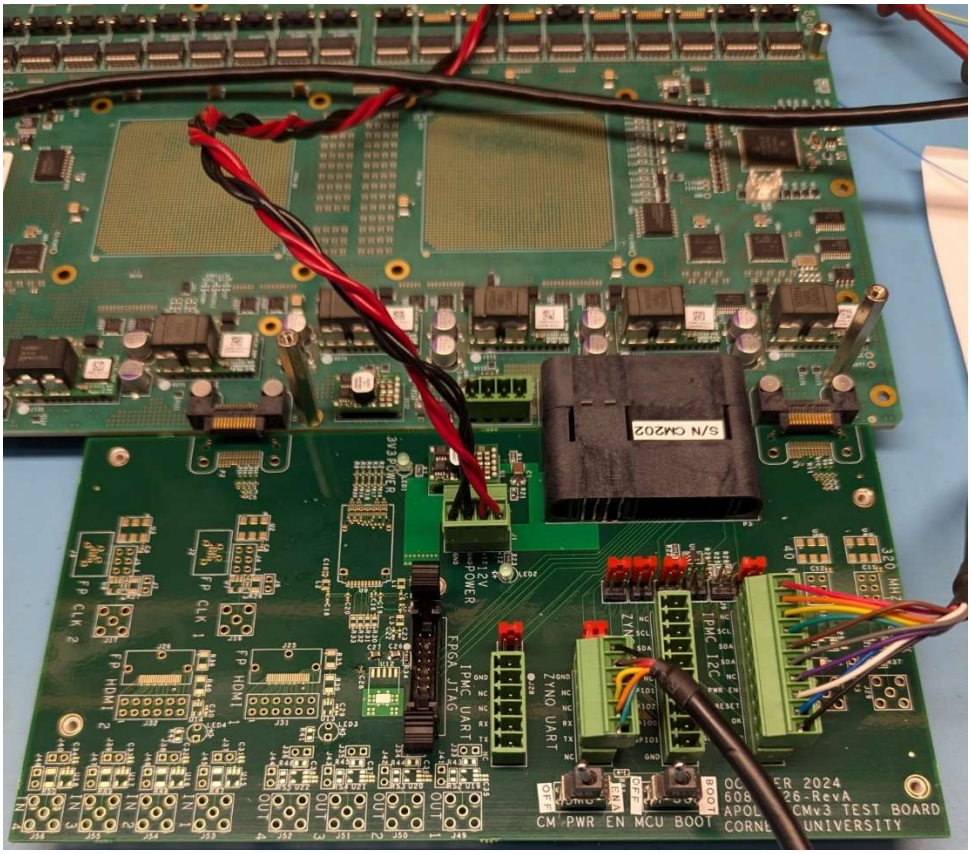
Many files are found on github at https://github.com/apollo-lhc/Cornell_CM_Rev3_HW . Documents related to testing are found in the “BoardTesting” directory.

Standalone Test Board

The 6089-129_CM_TESTBOARD has been designed to exercise the CM without using an SM. The schematic is in the “BoardTesting” directory.

The test board mates with the three main connectors on the CM. Optional short cables mate with the front panel connectors of the CM. The test board provides connectors for 12 volt power, the Xilinx JTAG programmer, Linux UART cables, and Linux I2C and digital I/O cables. It also has jumper sites to allow one to connect most CM signal traces in a loop-back mode. Single-ended to differential input buffers allow external sources to drive many CM signals, while differential to single-ended output buffers support connections to scopes or other test equipment.

The photo below shows the test board mated with an Apollo CMv2 board.



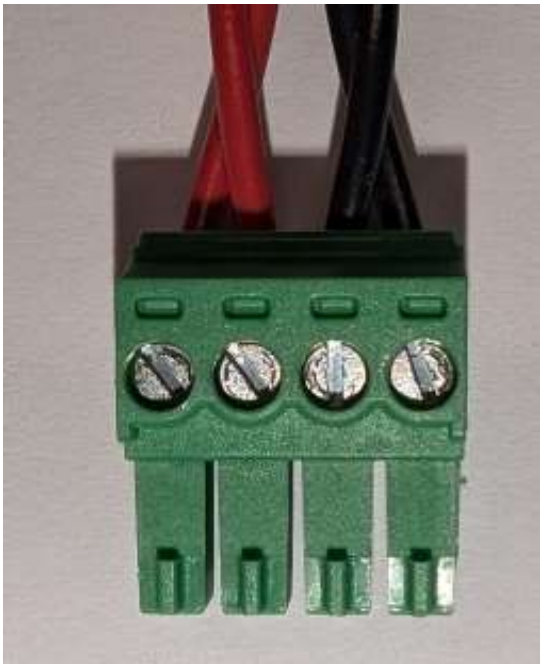
1 Power Connector

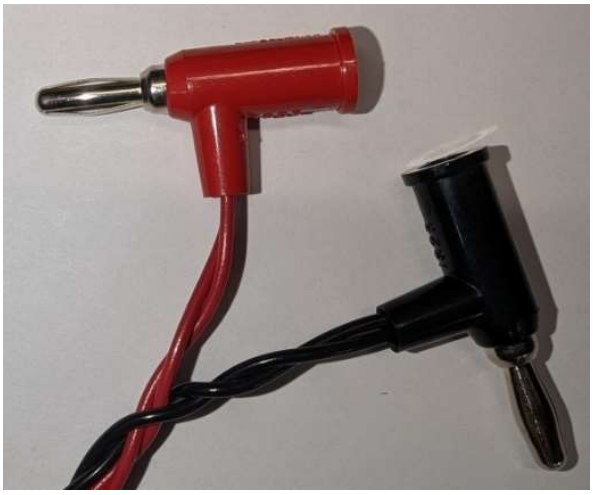
Connector J1 is used to provide DC power to the CM. The external power supply should provide a variable voltage from 0 to 12 volts at a current of at least 5 amps (60 watts). It is unlikely that sufficient cooling is available for using more power.

1.1 Power Cable

The power cable uses a 4-pin plug (DigiKey 277-2418) at the board end. The power supply end will use whatever is appropriate for the given supply. Banana plugs may be good for up to 5 amps.

Twist together two lengths of red and two lengths of black, #20 gauge, stranded wire. Then twist the two colors together. Connect as shown in the photo below.





2 UART Connections

Connector J27, labeled “ZYNQ UART”, is used to connect to the MCU’s UART #0. The is the SM’s ZYNC UART.

Connector J28, labeled “IPMC UART”, is used to connect to the MCU’s UART #3. The is the SM’s IPMC UART.

The UART signals are connected to a computer using a 3.3 volt USB-to-TTL_RS232 cable. This is an FTDI “TTL-232R-3V3” (DigiKey 768-1015). The 6-pin header that comes on the cable must be replaced with a 6-pin plug (DigiKey 277-2414). It is wired as shown in the photo below. Pins 2, 3, and 6 are not connected on the test board.

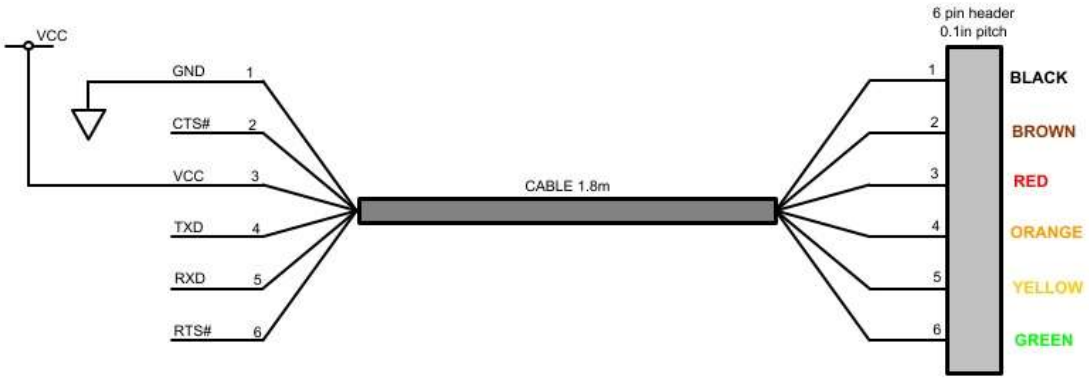


Figure 4.1 TTL-232R-5V and TTL-232R-3V3, 6 Way Header Pin Out

3 UART Jumpers

Headers J20 and J21 allow one to configure how the UART signals from the CM are connected. There are four options: A) MCU UART signals to cable, B) MCU UART signals looped back, C) MCU UART signals floating, and D) special wiring with wire-wrap wires.

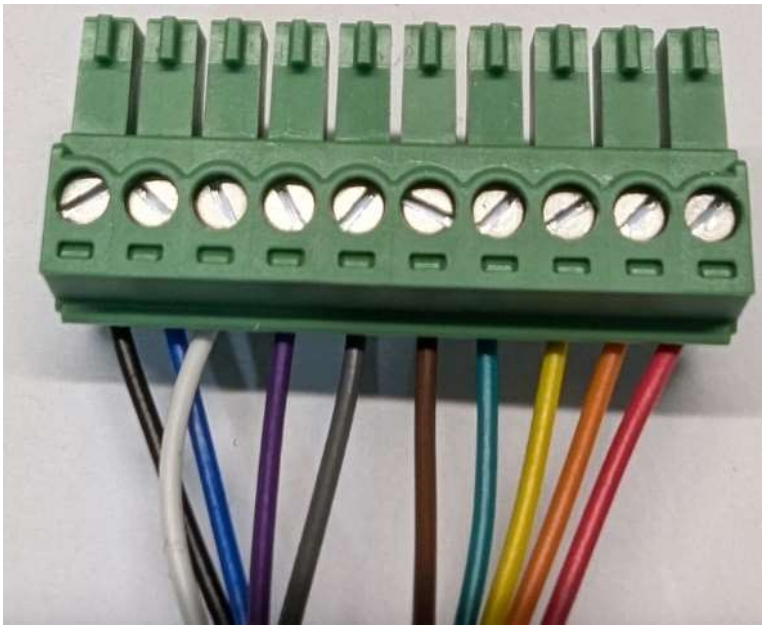
In the photo below, J20 is configured to connect the ZYNQ UART signals from the MCU to the UART cable that is plugged into the “ZYNQ UART” header. J21 is configured to loop the IPMC UART transmit signal back to the receive signal. This allows the MCU to test itself by activating the transmit line and verifying that the receive line detects the same activity.

4 I2C and GPIO Connections

Connector J19, labeled “ZYNQ I2C”, is used to connect to the MCU’s I2C channel #8. The is the MCU’s port on pins 35 and 36. It connects to the SM’s ZYNC. The current use is in flux. It might be used as a uni-directional UART, rather than an I2C port

Connector J18, labeled “IPMC I2C”, is used to connect to the MCU’s I2C channel #0. The is the MCU’s “slave” I2C port on MCU pins 91 and 92. It connects to the SM’s IPMC “master” I2C port.

The I2C signals are connected to a computer using a 3.3 volt USB-to-I2C cable. This is an FTDI “C232HM-DDHSL” (DigiKey 768-1106). The 10 flying leads that comes on the cable must be replaced with a 10-pin plug (DigiKey 277-5730). It is wired as shown in the photo below. Pins 1 and 5 are not connected on the test board.



5 I2C and GPIO Jumpers

Header J8 through J13 allow one to configure how the I2C and GPIO signals from the CM are connected. There are four options: A) signals to cable, B) signals looped back, C) signals floating, and D) special wiring with wire-wrap wires.

J8-1 (MCU pin-91): IPMC_I2C_SCL
J8-3 (MCU pin-92): IPMC_I2C_SDA
For basic testing, use loopback jumper, and program one pin as an output and the other pin as an input.

J9-1 (MCU RESET): CABLE_SM_TO_CM_PWR_EN
J9-3 (FIREFLY_RESET):
For basic testing, leave these floating. Install a jumper from J9-1 to J9-2 if GPIO#0 on the IPMC I2C connector will be used to control booting of the MCU. Otherwise, just use the MCU BOOT switch to take the MCU out of its RESET state (switch=OFF) and allow it to boot (switch=BOOT) .

J10-1 (MCU pin-76): CM_TO_SM_PWR_OK
J10-3: CABLE_SM_SOFT_PWR_EN
For basic testing, use loopback jumper, and program MCU pin-76 as an output. Program MCU pin-30 SM_SOFT_PWR_EN as an input. Set the CM_PWR_EN toggle switch to OFF. NOTE: A loopback jumper in this position will prevent “normal” MCU code from turning on the power supplies, due to the requirement that the PWR_EN be asserted before the MCU asserts PWR_OK.

J11-1 (MCU pin 35): ZYNQ_I2C_SCL
J11-3 (MCU pin-36): ZYNQ_I2C_SDA
For basic testing, use loopback jumper, and program one pin as an output and the other pin as an input.

J12-1 (MCU pin-25): ZYNQ_GPIO1
J12-3 (MCU pin-24): ZYNQ_GPIO2
For basic testing, use loopback jumper, and program one pin as an output and the other pin as an input.

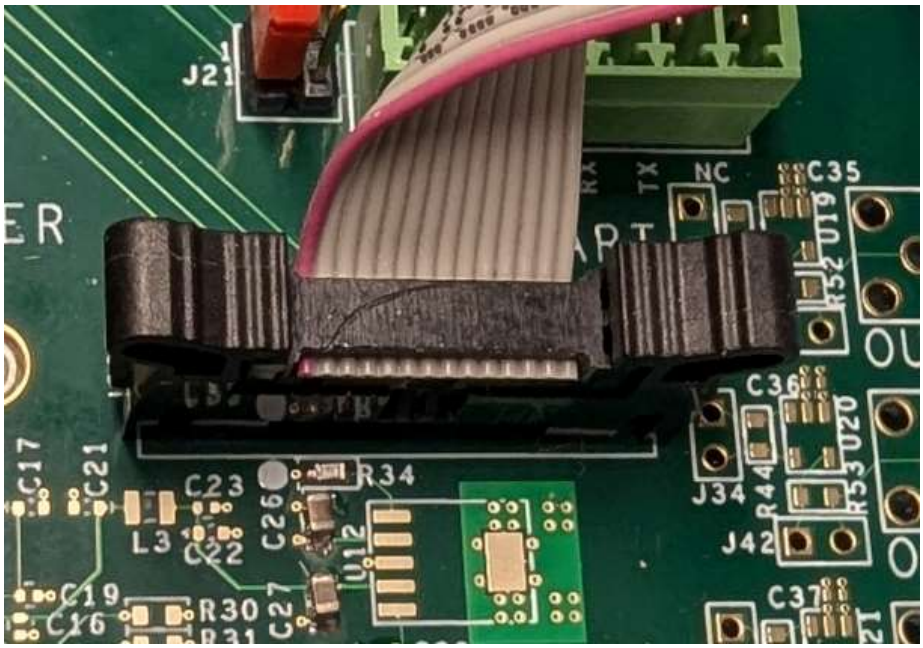
J13-1 (MCU pin-40): CPLD_GPIO0
J13-3 (MCU pin-41): CPLD_GPIO1
For basic testing, use loopback jumper, and program one pin as an output and the other pin as an input.

The photo below shows a typical jumper configuration using loopback jumpers on J8, J11, J12, and J13.


40 MHZ LHC
J15
C25
J8
R28
R25
R29
J9
NC
SCL
SDA
SDA
NC
IPMC I2C
J10
R24
J11
J12
NC
SCL
SDA
SDA
NC
ZYNQ I2C
J13

6 FPGA JTAG connector

Connector J22 is a keyed 14-pin header that will mate with the standard cable on a Xilinx JTAG programmer. It has latches to hold the connector in place. The ejectors may not engage with some cables. The voltage level for the JTAG signaling is 3.3 volts.



7 Switches

The toggle switch labeled “MCU BOOT” holds the MCU in its RESET state by pulling SM_TO_CM_PWR_EN low when the switch is in the OFF position. The BOOT position allows the MCU to boot up and run. It probably needs to be in the BOOT position to allow the CM’s front-panel MCU JTAG connector to be used.

The toggle switch labeled “CM PWR EN” controls the SM_SOFT_PWR_EN signal. It is low when the switch is in the OFF position. Moving to the ENA position allows normal MCU code to turn on the DC-DC converters on the CM. Basic test programs may not need to have this signal asserted.