Multibeam Correlator Installation Guide

1.0 Install the correlator into its rack

There are 5 major items to be installed into the rack: 1) the power supply bin (5U) 2) the BCC/synthesiser bin (5U) 3) a blanking panel (1U) 4) the fan (2U) and 5) the correlator bin (6U). They should be placed in the order indicated below.

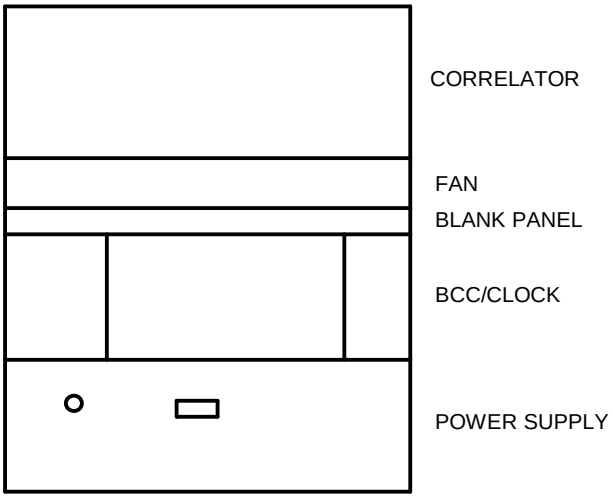


Figure 1. Mulibeam Rack Layout

Make sure that air flow out the top of the correlator bin is not obstructed for efficient cooling of the correlator modules. Also note that the perspex door of the correlator bin should be kept shut at all times to prevent the correlator chips from overheating.

2.0 Install rear signal cabling

If the cards are not already installed in the block control computer 5 slot motherboard do so now. The order from left to right: BCC Interface Card - Event Generator Card - Ethernet Card - Empty Slot - CPU Card. Connect the ethernet cable to the ethernet card and also the output of the AT Distributed Clock serial time bus to the 9 pin D connector on the front of the Event Generator card.

Now install the signal cables leading from the BCC bin to the correlator bin. There is a blue 50 way cable that connects from the BCC Interface card in the computer to the back of the correlator bin to the connector marked - J105 BCC Interface. There is also a 34 way multi-coloured twisted pair cable that connects from the Event Generator events output to the back of the correlator bin to the connector marked - J100 Event Generator. There are also 2 or 4 SMA terminated coax cables from the rear of the correlator bin, depending on how many correlator modules you have. Connect these to the splitter located just above the clock synthesizer unit.

Now check that the address of the correlator block, as set by the DIP switch SW1 on the back of the correlator bin, is correct. This must be the same value as that used in the correlator control computer software. If you are using Warwick's software this is configurable.

Also check that the identity of the Block Control Computer, as set by the DIP switch on the BCC Identity Board is correct for the IP address of your BCC. This should have been set correctly for you before shipping but to check consult the BCC Ident Board documentation.

3.0 Connect power supply

Now connect the correlator bin and the clock synthesizer to the power supply bin. This is done by connecting to the terminal block at the rear of the power supply bin. Unscrew the retaining screw to allow the terminal pin to fit into the terminal block hole then screw up firmly. Disconnection is the reverse of the above. Do not use side cutters to disconnect the power cables! The power cables and terminal block entry points are labelled with corresponding labels. As a reference the names, physical description and destination for each of the cables is listed below.

LABEL	DESCRIPTION	FUNCTION	DESTINATION
-5V RET	Thick green	-5.2V ground	Correlator
-5V	Thick white	-5.2V power	Correlator
-5V CLK	Thin white	-5.2V power	Clock synthesizer
-5V SENS RET	Thin green	-5.2V sense ground	Correlator
-5V SENS	Thin white	-5.2V sense	Correlator
+5V	Thick orange	+5V power	Correlator
+5V CLK	Thin orange	+5V power	Clock synthesizer
+5V RET	Thick green	+5V ground	Correlator
CLK RET	Thin green	Clock ground	Clock synthesizer
+5V SENS	Thin orange	+5V sense	Correlator
+5V SENS RET	Thin green	+5V sense ground	Correlator
+15V	Thin red	+15V power	Clock synthesizer
-15V	Thin black	-15V power	Clock synthesizer

Note: This is not necessarily the order in which the signals appear on the terminal block.

As an extra check you will notice the colour of the cable exiting the other side of the terminal block will be the same as the cable you are inserting, with the exception of the sense grounds which are not green. Once you have connected the power cables check the connections again. Then check it again to be sure! It is a good idea to loom the cable bundles neatly to the bin supports with cable ties to keep them out of the way and stop someone getting tangled and pulling out the power cables. Now plug the fan into the switched AC power outlet and the computer power supply into the unswitched AC outlet directly beneath the AC inlet. Now connect the AC power (220-240V). The computer will start booting. You can now turn the power supplies on by switching the front switch to the enable position. The fan will start blowing and some of the front LED indicators on the modules will light. If you are in any doubt that you have connected the power supplies correctly you should remove the modules from the bin before you turn it on for the first time. To remove the modules you have to grip the module and the rack and pull very firmly. The 256 pin connectors present a lot of contact resistance. To push them back in use the black injectors on the edge of the modules. Another thing is that you should not turn the power supply on with only some of the voltage outputs connected.

4.0 Test ethernet connectivity

Now reboot the BCC by pressing the front reset switch and allow to boot whilst the correlator bin is powered up. Note that the correlator bin must be turned on while the computer boots to allow it to assign itself its correct ID and hence IP address. When the computer has booted the orange BCC strobe LED should be flashing in an irregular fashion. If the computer fails to boot but instead beeps incessantly then the BIOS CMOS memory has been lost. You will have to remove the ethernet card and plug in an ISA video card, monitor and keyboard and setup the BIOS for booting off the a: drive with a 1.4 Mb disk drive and no monitor, keyboard, or hard disks attached. Then power off and remove the video card and replace the ethernet card.

You should now be able to communicate with the correlator. Go to the nearest computer and type

telnet hostname_or_IP where hostname_or_IP is either the name you have assigned to the BCC or its IP address. You should be greeted with the correlator status display which has 3 boxes and various pieces of information displayed. The first line should look something like:

V-Nov 18 1998 EG V2.0 1-94 SN6211 EE: 0 Error: 0 Late: 0

5.0 Setup the timing

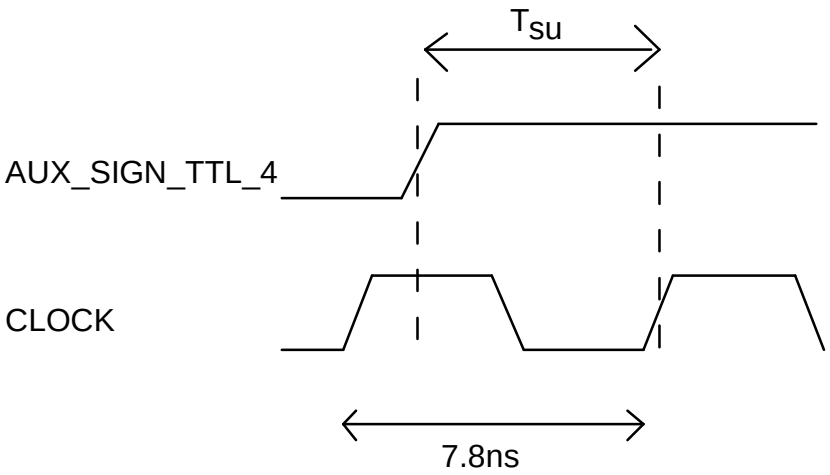
Since the clocks for the MB are sourced from the LBA-DAS the two instruments operate synchronously. As it is not known before installation how long data cables etc need to be it is necessary once the DAS and MB are installed that a calibration procedure is carried out so that the setup time between the data sent from the DAS and the sampling clock on the MB satisfies certain minimum requirements to ensure data is clocked correctly into the MB. This involves setting the length of the clock reference cable from the DAS once the data cable length has been determined.

Connect the data cables from the DAS to the correlator. These are the 20 way twisted pair cables and connect from the "CORR OUT" port on the DAS to the auxillary data input port on the correlator modules. This is the blue 20 pin connector near the front of the correlator module. To connect to it come through the open top of the correlator bin. You can't come through the front as you would not be able to close the door and this needs to be closed for adequete cooling. If you have a correlator with 4 modules the standard configuration is that one cable goes to modules 0 and 2 and the other cable goes to modules 1 and 3 (Your cables will have two connectors on one end). If you have a correlator with 2 modules simply connect one cable to each module. i.e DAS IFP 0 to correlator module 0 and DAS IFP2 to correlator module 1, where the correlator modules are number from left to right starting at 0.

Now connect a coaxial cable between the 32MHz clock output on the DAS and the 32MHz reference input on the correlator clock synthesizer. Set the DAS up for a 64MHz bandwidth. The DAS will need to be correctly operating (i.e. Locked to station 5MHz, synched to the 1Hz and noise of the correct power level on the input). Program the correlator to use a 128MHz clock as source with no dividing. This is done by issuing the command '.cd 0 0' to the correlator. If you have Warwick's software up and running you can do this by calling up any 64MHz configuration and doing a "prog" from within "config", alternatively, go to any unix box and type - telnet hostname 4000, where hostname is the name of the BCC in the correlator or its IP if you haven't named it. This makes a telnet connection to the correlator at port 4000. Now type .cd 0 0 CR and the correlator should respond with 0. You will see the command you entered come out on the correlator status display you fired up earlier. If you are having trouble talking to the correlator directly via telnet try escaping to the telnet shell with CNTRL] and issuing telnet> mode line. This puts the telnet connection into line mode instead of character by character mode which stops things getting mucked up when you are manually entering commands to the correlator.

Measure the setup time between the data sync signal (AUX_SIGN_TTL_4 on schematic) and the clock. These are measured on the data formatter xilinx chip. This is the PLCC 84 (XC3130A) chip in the socket which is adjacent to the blue connector and directly underneath the MC10H125 16 pin DIP chip. You will notice the socket has probe points (little holes) for each signal on the top circumference of the socket. It is here you measure the signal. The clock signal is the 4th pin up from the bottom right hand corner. The AUX_SIGN_TTL_4 signal is the 5th pin up from the bottom left hand corner. If in doubt refer to the schematics in the documentation (available on the web). It will be easiest to measure this on the last module since this is accessible.

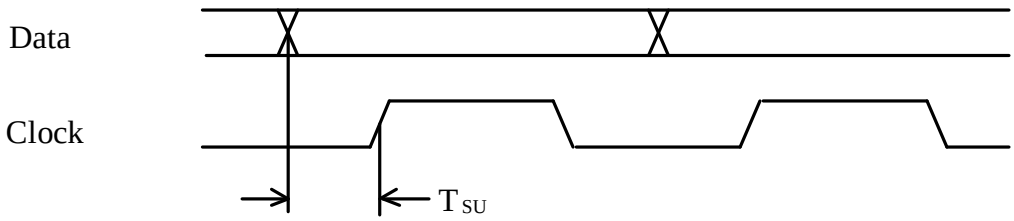
If you trigger off the AUX_SIGN_TTL_4 signal you will see something like the following



You must now adjust the length of the clock reference cable so that T_{su} (i.e the time that the AUX_SIGN edge occurs before the next clock edge) is within the range $2.6ns \leq T_{su} \leq 6.5ns$. The 128MHz clock is now correctly adjusted. Note: the clock is 128MHz so you will need a fairly good CRO to get a display something like that above. You will obviously need a bandwidth > 128Mhz but since a square wave is composed of odd harmonics (ie 128 , 384, 640 MHz etc) then even with a 300MHz CRO the clock will be rendered as a sine wave. The rule of thumb is that for digital signals you want a bandwidth at least 5 times the repitition rate, but that would imply a >600 MHz bandwidth CRO which you may not have. If not you will have to estimate the best you can from the inflection points.

Now program the correlator to use a 32MHz clock as source. This is done by issuing the command '.cd 2 1' in the same way as previously, or else call up any 16MHz bandwidth configuration in Warwick's software and do a "prog". Set the DAS up for a 16MHz bandwidth.

Measure the setup time between the data and the clock. This is measured on the same Xilinx chip as previously. The clock is the same pin as previously. The data (AUX_MAG_TTL_0) is on the 4th pin down from the top lefthand corner of the chip . If you trigger off the clock this time you will see something like the following (the clock is now 32MHz so much easier to measure and adjust):



Data Manipulation Xilinx IC - Data Setup Timing

The setup time needs to lie in the range $2.6ns \leq T_{su} \leq 28ns$. This is quite a large range so it is quite likely that this will not need adjusting. If it does need adjusting you will have to remove the top cover from the clock synthesizer box (These screws are 2 mm taptites and require a 0 point posi-drive screwdriver to remove. Using a Philips head will most likely result in stripping the head). There is a small black surface mount potentiometer near the output side of the clock. Slowly adjust this till the timing lies within the correct range.

The timing setup is now complete and should not require readjustment. The correlator should now be ready for use. If you are having any problems give me a call or an email.

Paul Roberts