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# GBTx Communication Document

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*University of Maryland LHCb group*

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# 1 Hardware setup

## 1.1 Overview

Our current setup consists of one master and one slave GBTx board. The master is connected to the MiniDAQ GBTx channel 3 (fiber 8), and the slave can be connected to either GBT channel 0 (fiber 6) or channel 6 (fiber 11). The master synchronizes its on-board clock to the signal from the MiniDAQ, and propagates its clock signal to the slave. The slave does not have an on-board clock, and is configured to obtain clock signal externally.

The master I<sup>2</sup>C port is connected to an external USB device. The slave I<sup>2</sup>C port is connected to the master. Both are set to be programmed by the I<sup>2</sup>C channel, rather than GBT-IC channel.

The current setup is capable of:

1. Program the slave GBTx board with MiniDAQ directly.
2. Read/Write the register value of the master GBTx board with GBT-IC specification on the MiniDAQ.
3. Do PBPS tests from MiniDAQ to the slave, then back to the MiniDAQ. The master is also required<sup>1</sup> as the slave can only obtain its reference clock from the master.

## 1.2 Configure GBTx to use external I<sup>2</sup>C adapter

This setup is required to program a GBTx board using an external I<sup>2</sup>C adapter. Follow Figure 1 to connect an external I<sup>2</sup>C adapter.

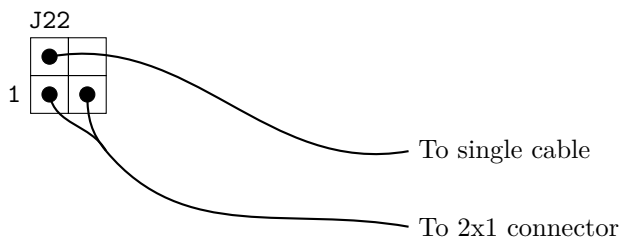


Figure 1: Schematic for external I<sup>2</sup>C adapter setup.

The I<sup>2</sup>C adapter used in our lab is made in-house. For the 2x1 connector, make sure the side that has *no* metal contact is facing up.

## 1.3 Configure slave GBTx to use master SCA channel

This setup is required to program a slave via a master SCA channel. In a typical scenario, the master is connected to a MiniDAQ so that programming the slave using the MiniDAQ directly<sup>2</sup> is possible. Follow Figure 2 to connect a slave GBTx to the SCA channel of a master GBTx board.

<sup>1</sup> The master GBTx is also connected to the MiniDAQ with a different channel, to provide reference clock to the slave.

<sup>2</sup> MiniDAQ → master GBTx → slave GBTx.



Figure 2: Schematic for slave to master SCA setup.

The black ground cable can be connected to any of the ground pin on the master GBTx.

There is a 2x1 to 2x1 cross-type cable made in-house to replace the red-blue cables. To use that cable, make sure the two 2x1 connectors have the same orientation (e.g. the sides *without* metal contact are both facing up).

#### 1.4 Configure GBTx to use GBT-IC channel

It might be useful to read/write individual registers from/to a GBTx board. In this case, follow the Figure 3 to flip the `configSelect` switch.

Flip the `configSelect` switch will render the external I<sup>2</sup>C adapter ineffective. None of the GBTx register value is fused onto the board, so a GBTx board in our lab must always be programmed externally via I<sup>2</sup>C before flipping the switch.

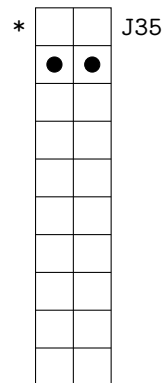


Figure 3: Schematic for flipping the `configSelect` switch. A jumper should be used to connect the two pins marked above.

## 1.5 Reset GBTx

Sometimes GBTx boards will not be properly reset by reprogramming. In such case, a hard reset is needed. Follow the Figure 4 to reset GBTx boards.

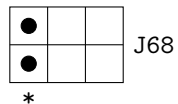


Figure 4: Schematic for resetting GBTx boards. A jumper should be used to connect the two pins marked above.

## 2 Software setup