Instrument Backplane GPIB Tester

Revision History

Rev.	*Date*	*Author*	*Description of change*
1.0	2007-3-29	T. Felton	Original
1.1	2007-7-16	T. Felton	Added Figure 1

Abstract

An automated method of testing the analog connections in the MCE was required as manually testing nearly 500 signals was not practical. The circuit requires a GPIB multimeter, HP 34401A or similar. The Instrument Backplane GPIB Tester card is a GPIB Talker/Listener. It is used to test continuity on the Instrument Backplane, Delphi Flex, Filter Card and Cryostat connections. It is able to test continuity and shorts to ground, on the 96 pins of each backplane connector. A complete test of an MCE subrack's cryostat connections, including documenting the results in an Excel spreadsheet, takes less than 10 minutes using this card.

1. General Description

The Instrument Backplane GPIB Tester card is a dual 1 to 96 multiplexer circuit with a microcontroller and GPIB interface. The card has the same footprint as all plug in MCE cards. It has 2 front panel banana jacks that connect to a digital multimeter set to resistance mode. Each of the front panel banana jacks may be connected to any one of the pins on the 96 pin P2x connector using a simple ASCII protocol driven by a National Instruments Labview program. The program is very general purpose and uses an Excel template file as the definition file for the test. The spread sheet contains fields that define the slot location, multiplexer connections; the DVM read data command and a blank field to record the reading. Thus the template file when saved, with a new name, becomes a complete record of the test. Different test procedures involve new definitions in the spreadsheet with no changes required to the program. A complete test of an MCE subrack involves installing termination plugs on the P1-P5 MDM connectors and then plugging the card into each slot in the subrack. The card is powered externally and the Labview program allows the card to be moved between slots during the test. The spreadsheet has a field for slot identification. Data is only gathered when the slot ID that is read matches the slot ID in the spreadsheet. This allows a complete record to be gathered for a given MCE subrack using a single spreadsheet template. Typically a reading, or spreadsheet line, consists of recording the impedance on a signal high and signal low pair that is used in the cryostat. A complete test would repeat this for every signal pair used on the MDM connectors. This test also confirms that the correct load resistors are installed on the backplane. Another useful test is the impedance to ground for each signal used on the MDM connectors. See Figure 1 below for connection details.

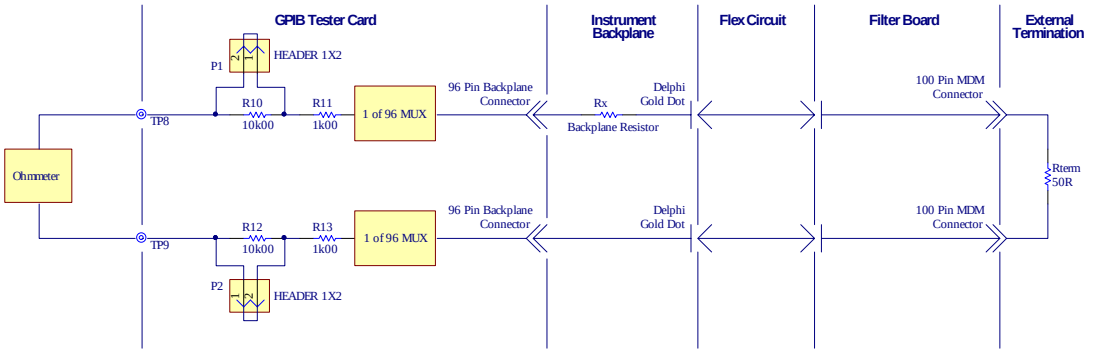

Figure 1

1.1 Background

It was a requirement to test the connections on the Instrument Backplane as part of our test procedure. Performing this test manually was not practical so the Instrument Backplane GPIB Tester card was developed. It has proved to be a very useful tool due to it's speed, ease of use and thorough test.

1.2 Functional description

Please refer to the schematic document, SC2-ELE-S58E-101, for this board. The board contains a flash programmable Atmel AT89C55WD microcontroller (U6) which is socket mounted. The microcontroller program is written using a Keil C cross compiler. Watchdog and reset functions for the microcontroller are provide by U2 in conjunction with SW1. A 32MHz crystal oscillator drives the microcontroller clock input. U7 provides IO addresses for U3, the GPIB controller. The clock divided by 4 (U11) also clocks the GPIB Controller. The GPIB Listener-Talker Address is set in firmware. U4 and U5 provide buffering for the GPIB bus. RN1, RN4, RN5 and RN6, which are not populated, can be used to improve GPIB bus termination. The slot ID is read into Port 1 pins 0-3. This allows the program to determine which slot the card is plugged in to. The slot ID is part of the Bus Backplane.

The board contains six multiplexer chips which are 1 of 32 multiplexers. Multiplexer IC's U9-U11 have their common connection to the red banana jack making a 1 of 96 multiplexer. The microcontroller controls the multiplexer enable and multiplexer address which allow the red banana jack to be connected to any one of the 96 pins on the P2x instrument backplane connector. Multiplexer IC's U13-U15 have their common connection to the black banana jack and are configured in a similar manner as U9-U11 allowing the black banana jack to connect to any one of the 96 pins on the P2x instrument backplane connector. Thus a multimeter connected between the red and black banana jacks is connected to any two pins on the P2x instrument backplane connector. The way the connections are made on the multiplexer chips appears to be disorganized, which may be true from a schematic point of view, but the physical connections on the printed circuit board are well organized and a firmware look up table restores order in the program. Inputs to the multiplexer are protected by limiting resistors R10-R13 and protection diodes D4-D7.

Power to this board may be obtained from the MCE subrack's Bus Backplane P1x connector or from a front panel barrel power connector. Typically the front panel connector is used, as the subrack is usually not powered when being tested and therefore there is no power available on the Bus Backplane. When using the front panel power connection power to the card is maintained when it is moved between slots.

The front panel also has 2 other banana jacks. The schematic shows a connection that may be used, in conjunction with shorting cards in other subracks slots, to check for shorts between signals. The Excel template spreadsheet would be quite long to test for shorts to any other signal and a template has not been created for this reason.

1.3 Other Requirements

2. Hardware

3. Firmware

The Users Manual SC2-ELE-S58E-101 contains a detailed description of the ASCII protocol used for GPIB communications used by this device. It also contains details of the Excel spreadsheet template file. Opening any of the template or data spreadsheets will make it clear what is expected in a new template design.

4. Future improvements (optional)

5. References

[1] Functional Description of Multi-Channel Electronics, SC2_ELE_S585_504, Rev. 7.1

[2] GPIB Instrument Bus Tester Users Manual, SC2-ELE-S58E-101

[3] GPIB Instrument Bus Tester Schematics, SC2-ELE-S58E-102

List of Acronyms (optional)