SVX III Silicon Strip Detector Upgrade Project

G-Link/Finisar Transmitter and Receiver Cards

--PRELIMINARY--

11/20/1995

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Document # ESE-SVX-951018

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1. GENERAL INFORMATION

This document describes the High Speed Optical Serial G-Link/Finisar Transmitter and Receiver cards, hereafter referred to as the G-Link TX and RX cards. The G-Link TX and RX cards are to be used on the SVX III readout system. These modules interface with the Fiber Interface Board (FIB), the VME Readout Buffer (VRB), and with the serial data G-Link receiver section of the SVT to transmit data from the remote detector location to the data acquisition system.

1.1 System Introduction

The G-Link TX is a daughter card that mounts on the FIB. Up to 20 bits of parallel data is serialized and transmitted over fiber at data rate speeds up to 1.25 Gbps. There will be four G-Link TX cards on a FIB. The Finisar optical devices on the G-Link card use a ST fiber connector and 50/125 μm or 62.5/125 μm multimode fiber. The four G-Link card fibers will have ST connectors on the front panel of the FIB. The data is transmitted over 4 individual fibers within a cable to an optical splitter. The data leaves the optical splitter on two fibers. One fiber goes to the G-Link RX card mounted on the VRB while the other fiber goes to the G-Link RX card at the SVT. To get a better understanding of the Hewlette Packard G-Link and Finisar optical devices, refer to the appropriate documentation [1] [2] [3]. There is a possibility that fusion splices will be used at the optical splitter to eliminate two connector losses. A block diagram of the hardware that makes up the data path is in figure 1.

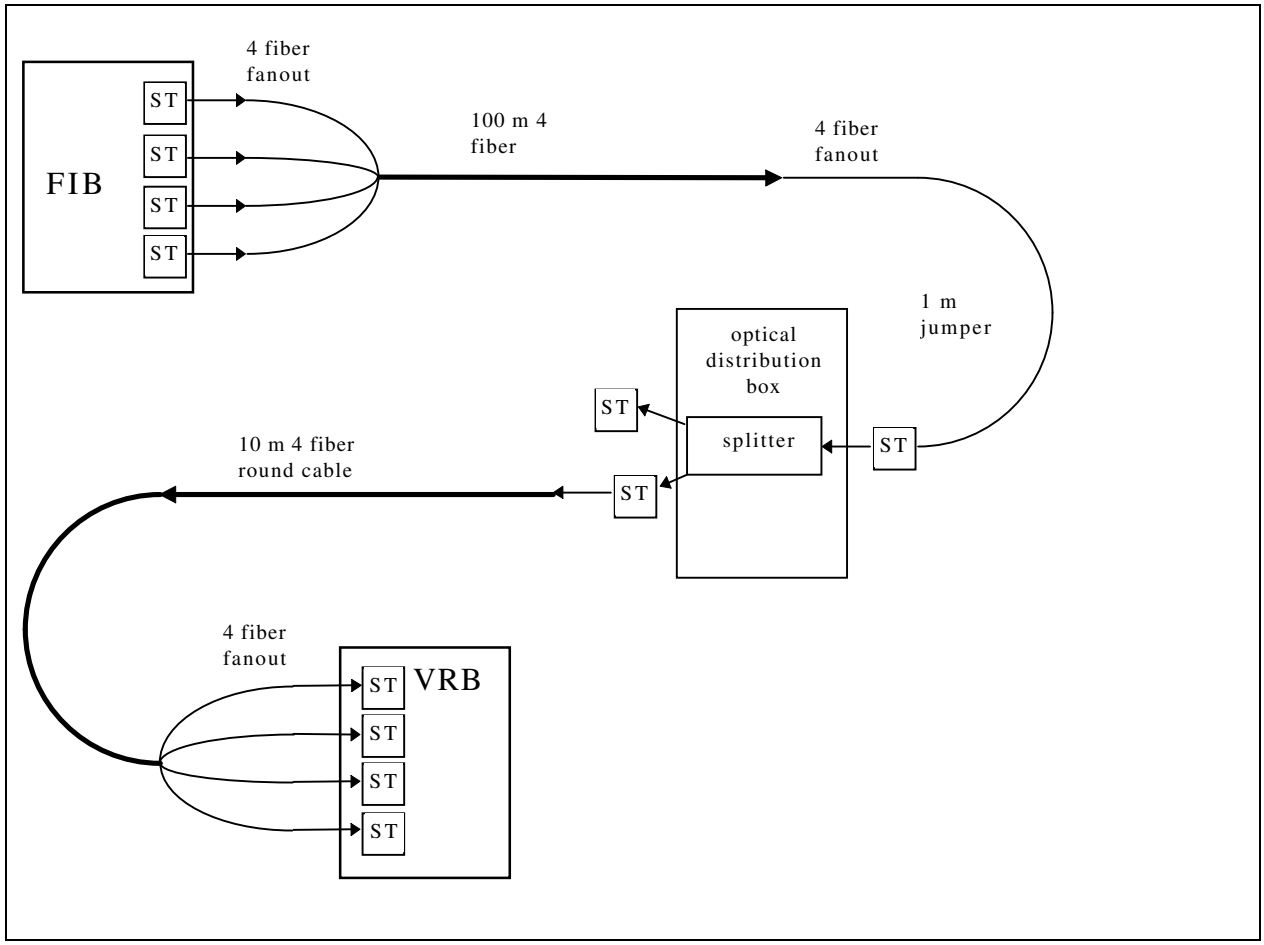

Figure 1: G-Link Data Path

The path to the SVT from the optical splitter is not shown but is the same as the path going to the VRB.

1.2 Description Of Component

The G-Link TX is a 2 inch by 3.75 inch card containing a 60 pin AMP 104068-6 connector, a HP HDMP-1012 transmitter, a Finisar FTM-8510 transmitter, and a few discrete surface mount components. The G-Link RX card contains the 60 pin AMP 104068-6 connector, the HP HDMP-1014 receiver, the Finisar FRM-8510 receiver, and some discrete surface mount components.

2. THEORY OF OPERATION AND OPERATING MODES

2.1 Basic Features & Operation

The G-Link cards are general purpose serial optical link cards that can be operated in several configurations. Control signals are available at the AMP connector to allow the motherboards to select the mode of operation. The simplex method III mode described in the HP data sheet [1] is recommended by Finisar.

2.2 Diagnostic Features

The G-Link cards can be tested with the Fermilab designed CD/ESE Bit Error Rate Tester (BERT) via an Adapter card. The BERT is a three board set consisting of the BERT, the G-Link TX Adapter board, the G-Link RX Adapter board, and interconnecting differential cables. This permits the motherboards to receive a tested G-Link card. With the use of extended cables, testing can include environmental testing at elevated temperatures.

2.2.1 INTERFACE SPECIFICATIONS

2.3 G-Link Daughter Card/Motherboard Pin Configuration

2.3.1 G-Link TX Card Connector Pin Configuration

The G-Link TX card connector is implemented on a 60 conductor 50 mil pitch connector. The pin assignment for the G-Link TX is provided in table 1.

Pin Number	Signal	Pin Number	Signal
1	DGND1	31	VCC4
2	VTT1	32	LOCK
3	VTT2	33	M20SEL
4	FLAGSEL	34	VEE1
5	VCC1	35	VEE2
6	DAV*	36	CAV*
7	FF	37	TXSTRBIN+
8	ED	38	TXSTRBIN-
9	D0	39	FLAG
10	D1	40	VCC5
11	D3	41	D2
12	D5	42	D4
13	D7	43	D6
14	D9	44	D8
15	VCC2	45	D10
16	D11	46	D12
17	D13	47	D14
18	D15	48	D16
19	D17	49	D18
20	D19	50	VCC6
21	VCC3	51	NC2
22	DIV1	52	OFC_STAT
23	LOOPEN	53	RST*
24	RX_OPT_PWR	54	DIV0
25	RX_SYS1	55	CS*
26	READY	56	SI
27	RX_SIG_DET	57	SO
28	RX_SYS2	58	SCLK
29	DVCC	59	VCC7
30	NC1	60	DGND2

Table 1: G-Link TX Connector Pin Configuration

2.3.2 G-Link RX Card Connector Pin Configuration

The G-Link RX card connector is implemented on a 60 conductor 50 mil pitch connector. The pin assignment for the G-Link RX is provided in table 2.

Pin Number	Signal	Pin Number	Signal
1	DVCC	31	DGND2
2	DIV0	32	DIV1
3	VCC1	33	ERR
4	D0	34	D1
5	D2	35	D3
6	D4	36	D5
7	D6	37	D7
8	D8	38	VCC4
9	D9	39	D10
10	D11	40	D12
11	D13	41	D14
12	D15	42	D16
13	D17	43	D18
14	VCC2	44	VCC5
15	D19	45	CAV*
16	FLAG	46	LINKRDY*
17	FF	47	LOOPEN
18	DAV*	48	ACTIVE
19	RX_SIG_DET*	49	FDIS
20	STRBOUT-	50	VCC6
21	STRBOUT+	51	EQEN
22	SIMCLK-	52	RX_OPT_PWR
23	SIMCLK+	53	RX_SYS2
24	STAT1	54	RX_SYS1
25	VCC3	55	FLAGSEL
26	STAT0	56	VEE1
27	M20SEL	57	VEE2
28	VTT1	58	SMC1*
29	VTT2	59	SMC0*
30	DGND1	60	VCC7

Table 2: G-Link RX Connector Pin Configuration

3. ELECTRICAL & MECHANICAL SPECIFICATIONS

3.1 Packaging & Physical Size

The G-Link cards are designed as daughter cards which interface with the motherboards. Figure 2 is a drawing of the G-Link cards.

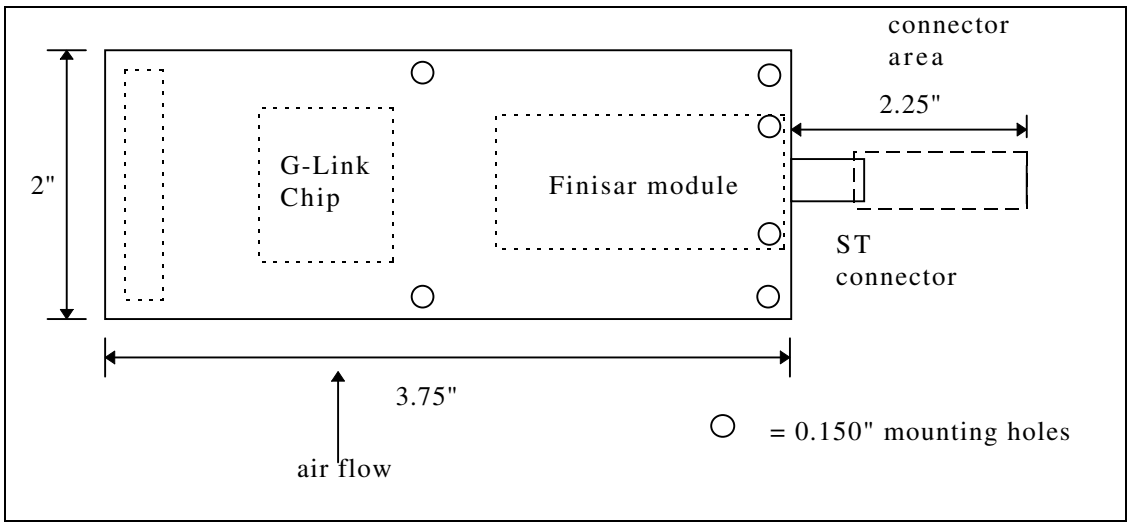

Figure 2: G-Link Card

The size of the card is 2 inches by 3.75 inches and has a maximum height of 0.583" to meet the overall component height of a standard VME slot. To accomplish this, the G-Link chip and Finisar module are mounted on the bottom side of the G-Link card. Discrete surface mount devices can be mounted on the top side of the card as long as the component height is less than 0.070". The motherboard uses a 60 pin AMP 104078-6 through-hole receptacle connector. The G-Link cards use a 60 pin AMP 104068-6 through-hole header connector. The 60 pin connector, HP G-Link chip, and Finisar optical module are mounted on the bottom side of the daughter card. The G-Link chip must have a correctly sized heat sink. Mounting holes are located for attaching the Finisar module to the card, attaching the card to the FIB or VRB, and attaching the card to the SVT G-Link motherboard. The mounting holes have a diameter of 0.150". The top and bottom end mounting holes

are 0.200" from the corners of the card. The Finisar mounting hole position is determined by the placement of the Finisar. The middle two mounting holes are 1.5" from the 60 pin connector end of the card. The motherboard must be void of any components under the daughter card. A 2.25 inch area where the ST fiber optic connection is made must remain clear of any other components on the motherboard. Figure 3 is a side view of the motherboard and daughter card.

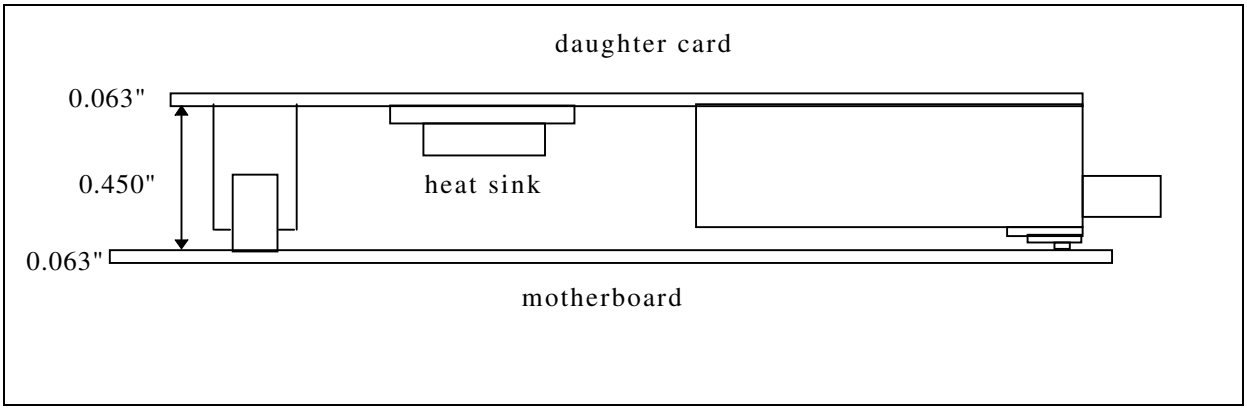

Figure 3: Side View of Daughter Card/Motherboard

The card to card spacing is 0.450". Adding the 0.063" for the thickness of the daughter card results in a total height of 0.513". This height is within the height requirements of VME for a single slot with 0.070" for surface mount resistors and surface mount bypass capacitors on the top side of the daughter card .

3.2 PC Board Construction

The G-Link cards are made up of four power/ground planes and four signals planes. The thickness of the card is 0.063" with a tolerance of 0.007". A 22 µF surface mount capacitor should be included on the +5 V and -5.2 V supply layers. The card must be constructed using high speed design rules. The G-Link traces must be less than 1 inch in length, with a recommended trace width of 0.025", and without any vias. The card impedance is 50 ohms. The Finisar and HP reference material should be referred to for further information on high speed layout.

3.3 Power Requirements

The Table 3 provides an estimate on the power requirements for the G-Link TX and G-Link RX.

Device	Supply Voltage	Supply Current	Power
G-Link TX	+5 V	120 mA	0.63 W
	-5.2 V	400 mA	2 W
G-Link RX	+5 V	90 mA	0.48 W
	-5.2 V	520 mA	2.6 W

Table 3: Power Supply Requirements for G-Link Cards

3.4 Cooling Requirements

The Finisar optical modules do not present any special cooling problems. The HP G-Link devices require heat sinks and fan cooling. The heat sink should be sized and positioned to provide for optimum cooling of the G-Link devices.

4. SAFETY FEATURES & QUALITY ASSURANCE PROCEDURES

4.1 Module Fusing

The G-Link cards will be powered by the motherboards that they are attached to. Fusing of the G-Link cards shall be provided by the motherboard in which they are installed.

5. APPENDICES

5.1 A1: Parts List

5.2 A2: Schematics

6. References

[1] "Low Cost Gigabit Rate Transmit/Receive Chip Set", Hewlett Packard document.

[2] "Design Notes: Using the FTM-8500, FRM-8500 and FCC-2000 to build high speed fiber optic links", Finisar Corporation document.

[3] "Application Note: Interfacing Various Gb/s Chip Sets to FTR-XX10 Transceivers, FTM-XX10 Transmitters, FRM-XX10 Receivers", Finisar Corporation document.