

| | |
|---|------------|
| LBT PROJECT 2 x 8.4m TELESCOPE | |
| Doc.No. | : 675s004 |
| Issue | : a |
| Date | : 2-Mar-07 |

LBT PROJECT

2 x 8.4m OPTICAL TELESCOPE

Instrument Rotator and Cable Chain Interface Module and Operations Manual

| | Signature | Date |
|----------|------------------|-------------|
| Prepared | J. Rosato | 2-Mar-07 |
| Reviewed | D. Ashby | 19-Mar-07 |
| Approved | | |

| | | | |
|--|---|---|--------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 2 |
|--|---|---|--------|

1. Revision History

| Issue | Date | Changes | Responsible |
|-------|----------|-------------|-------------|
| a | 2-Mar-07 | First draft | J. Rosato |
| | | | |
| | | | |
| | | | |

| | | | |
|--|---|---|--------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 3 |
|--|---|---|--------|

2. Table Of Contents

- 1. Revision History 2**
- 2. Table Of Contents 3**
- 3. About this document..... 4**
 - 3.1. Purpose..... 4
 - 3.2. Reference Documents 4
 - 3.3. Abbreviations 5
- 4. Instrument Rotator and Cable Chain Interface Module Description..... 6**
 - 4.1. General Purpose SERDES Communications PC Board 7
 - 4.2. Instrument Rotator Application Board..... 8
 - 4.2.1. Power Requirements 8
 - 4.2.2. Digital I/O section..... 8
 - 4.2.3. Analog outputs 8
 - 4.2.4. Motor Driver Incremental Quad Encoder Interface..... 9
 - 4.2.5. CAN Bus 9
 - 4.2.6. Relative Position Sensor Interface 9
 - 4.2.7. Inductosyn Tape Interface..... 9
 - 4.2.8. SSI Encoder Inteface..... 10
- 5. Mechanical Packaging and Environment..... 11**
 - 5.1. Environmental Specifications 11
 - 5.2. Module location 11
 - 5.3. Mechanical drawings 12
- 6. Input and Output Specifications..... 13**
 - 6.1. Front Panel 13
 - 6.2. Rear Panel 14
- 7. User Interface 23**
 - 7.1. Analog meter display 23
 - 7.2. General Purpose SERDES Communications Board Status Display..... 24
 - 7.3. Application Board Status Display..... 25
- 8. Debugging Module problems 26**
 - 8.1. Debugging the GPSCOM board 26
 - 8.2. Debugging the Application Board 26
- 9. Module BOM..... 27**

| | | | |
|--|---|---|--------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 4 |
|--|---|---|--------|

3. About this document

3.1. Purpose

This document describes the **Instrument Rotator and Cable Chain Interface Module (IRCCIM)**. This document is intended as an operator's manual as well as a technical description of the module. Since the IRCCIM consists of both the General Purpose SERDES Communications PC Board and the Instrument Rotator and Cable Chain Application Board, a brief description of each of these boards and their interaction with the system is given.

A description of how this product is interconnected with the Drive Power Module and to encoders on the rotators is provided. This document contains information regarding the user interface as well as information for detecting and correcting problems with this unit.

Technical information such as bill of materials, schematics and printed circuit board layouts for use in maintaining and debugging this product to the component level are listed among the Reference Documents.

3.2. Reference Documents

- [RD1] CAN Document 675s001a – General Purpose SERDES Communications Protocol Standard
- [RD2] CAN Document 675s002a – General Purpose SERDES Communications PC Board Description and Operations Manual
- [RD3] CAN Document 675s007a – Instrument Rotator and Cable Chain Application Board Description and Operations Manual
- [RD4] CAN Document **XXX.XXX.XXX, OPJ xxx** Application Board Schematics
- [RD5] CAN Document **XXX.XXX.XXX, OPJ xxx** Systems Application Connector Board Schematics

| | | | |
|--|---|---|--------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 5 |
|--|---|---|--------|

3.3. Abbreviations

| | | |
|---------------|---|--|
| MCS | – | Mount Control System |
| MCSPU | - | Mount Control System Processing Unit |
| FPGA | – | Field Programmable Gate Array |
| SERDES | – | Serializer - Deserializer |
| CRC | - | Cyclic Redundancy Check |
| VHDL | - | Very High Speed Integrated Circuit Hardware Description Language |
| DGR | - | Direct Gregorian Rotator |
| BGR | - | Bent Gregorian Rotator |
| FBGR | - | Front Bent Gregorian Rotator |
| TBD | - | To Be Determined |
| DAC | – | Digital to Analog Converter |
| ADC | – | Analog to Digital Converter |
| mA | - | Milliamps |

4. Instrument Rotator and Cable Chain Interface Module Description

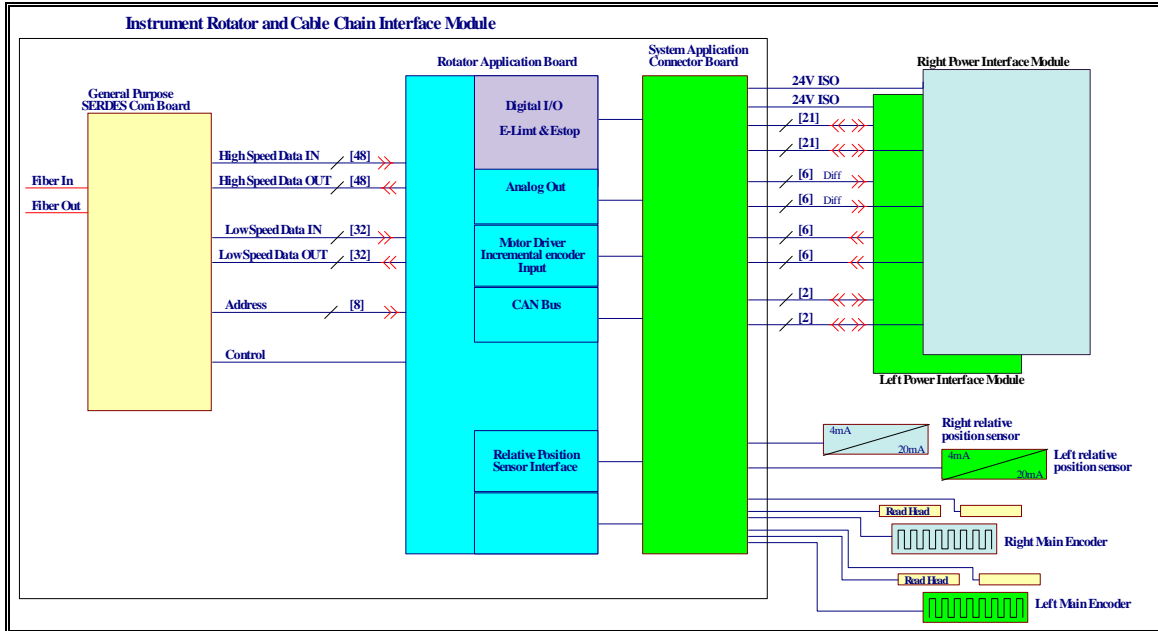


Figure 4.0.1: Block Diagram of Interface Module

Figure 4.0.1 shows a block diagram of the Instrument Rotator and Cable Chain Interface Module. The module contains the Rotator Application board, the General Purpose SERDES Communications (GPSCOM) PC Board and the System Application Connector Board (SACB).

The General Purpose SERDES Communications (GPSCOM) Board, plugs into the Rotator Application board as a daughter card. It receives frames of data from the Instrument Rotator and Cable Chain Reef SERDES Interface Module located in the Aux Control Room. This data is then de-serialized on the GPSCOM board. The GPSCOM produces a parallel interface for the Instrument Rotator Applications board. As shown in **Figure 4.0.1**, this interface consists of a 48 bit High-Speed Data In bus and 48 bit High-Speed Data Out bus, a 32-bit Low-Speed Data Out bus, a 32-bit Low-Speed Data In bus, an 8 bit Address bus and a Control bus. See **Figure 4.1.1** for more details.

The System Application Connector Board (SACB) [RD5] also plugs into the Rotator Application board. It provides a reliable method to interface all of the I/O signals from the Applications board to the connectors on the rear panel of the Interface Module.

4.1. General Purpose SERDES Communications PC Board

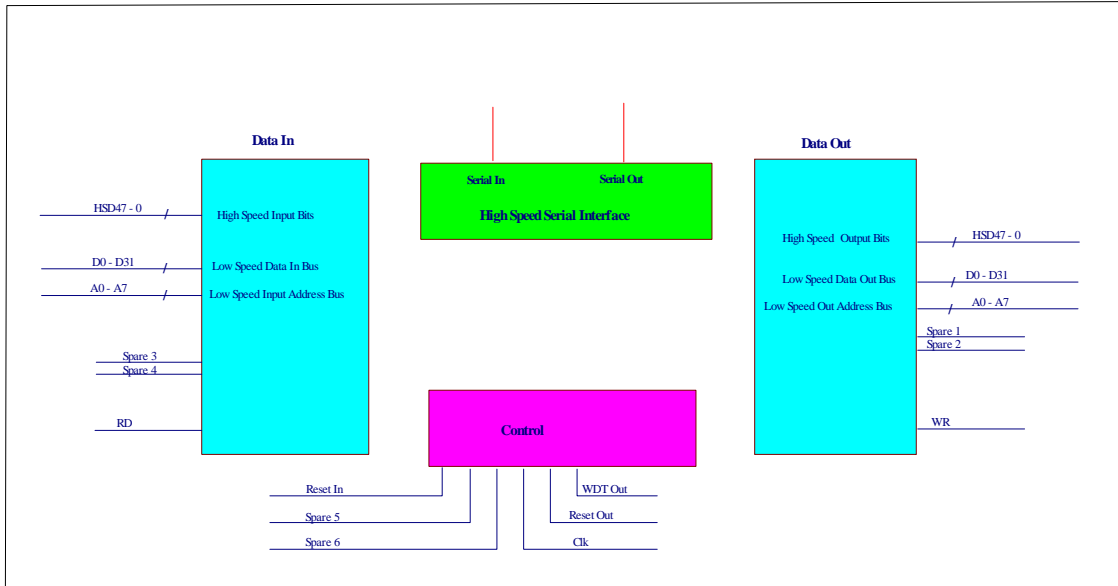


Figure 4.1.1: Block Diagram of GPSCOM Board

The General Purpose SERDES Communications Board is designed as a daughter board to allow serial control of a remote board. It contains an FPGA, the Cypress CYP15G0101DXB SERDES IC and a small form-factor pluggable (SFP) 1.25 Gb fiber transceiver . The board is designed to accept serialized data on a 62.5/125um fiber and produce both a high speed parallel data stream as well as a low speed (time multiplexed) parallel bus.

The GPSCOM board also provides dedicated outputs for providing status of the communications link.

See [RD2] for more information on the GPSCOM board hardware and [RD1] for details on the communications protocol used.

4.2. Instrument Rotator Application Board

The following sections give a functional overview of each of the Instrument Rotator Application Board sections. Refer back to figure 4.0.1 for a block diagram of these sections.

For more detail see [RD3].

4.2.1. Power Requirements

The Instrument Rotator Application board requires 4 separate voltages. Table 4.2.1 below details these power supply requirements. The power supplies for the Rotator Interface module must be supplied from an UPS source.

| | | |
|-------------|---------------------------|--------|
| Power Input | 24 Volt Digital Isolation | 10 A |
| | 24 Volt Analog Voltage | TBD A |
| | +15V Analog | TBD mA |
| | -15V Analog | TBD mA |

Table 4.2.1

Note that in addition to the 24 Volt Digital supply current used by this module, the power connector on the module must support all the current needed by the two attached Rotator Power Modules. This is because the Rotator Interface module distributes all 24 Volt Digital current to the system.

4.2.2. Digital I/O section

The Instrument Rotator Application board provides optically isolated digital I/O used to interface with two Rotator Power Interface Modules. All power for this interface is provided by a separate 24 Volt power supply which allows for isolating the motor drive analog functions from the digital functions and provides a separate grounding systems with a single point ground at the rack mount power supply output. See the table **J5L and J5R – Digital Input/Output** for more details regarding these signals.

4.2.3. Analog outputs

The Instrument Rotator Application board provides 12 16-Bit DAC outputs through differential drivers. See table **J4L –Analog Output (to Left Rotator Power Interface Module)** and **J4R –Analog Output (to Right Rotator Power Interface Module)** for more details regarding these signals.

Note that only 6 analog signals are needed to control the drives, Differential IN2+, and Differential IN2- are spares.

| | | | |
|--|---|---|--------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 9 |
|--|---|---|--------|

These signals are differential and use AGND as a reference.

4.2.4. Motor Driver Incremental Quad Encoder Interface

The Instrument Rotator Application board receives incremental encoder signals produced by the motor drivers. These signals are RS422 differential signals. See **J6L – Encoder Quadrature Output (from Left Rotator Power Interface Module)** and **J6R – Encoder Quadrature Output (from Right Rotator Power Interface Module)** for more details regarding these signals.

4.2.5. CAN Bus

The Instrument Rotator Application board provides a CAN bus interface to two separate Rotator Power Interface Modules. The signals are driven out two separate connectors to minimize the possibility of producing a ground loop between the Rotator Power Interface Modules and the Instrument Rotator and Cable Chain Interface Module.

Each Rotator Power Interface Module has three Motor Drives daisy chained on the CAN bus with a termination resistor on the last device. Since the two CAN connectors on the Application board share the same CAN driver, this results in a topology where the Application board is driving the middle of a CAN bus that is terminated on both ends

See **J2 – CAN 1 (Left Axis)** and **J3 – CAN2 (Right Axis)** for more details regarding these signals.

4.2.6. Relative Position Sensor Interface

The Instrument Rotator Application board interfaces to two separate linear position sensors. These sensors provide information about the relative position of the cable chain and rotator. The Rotator Application board provides power for the sensors (24VDC). The sensors output is 4-20mA signal which the Application board must digitize and return to the control system. See the table **J6** and **J7** for more details regarding these signals.

4.2.7. Inductosyn Tape Interface

The Instrument Rotator Application board interfaces to two Inductosyn tape encoders and four tape heads. For both the left and right rotators, the board provides power for the head preamps, signals to excite the tapes and interface circuitry to interpolate the signals from two separate heads which measure position. See the table **J6**, **J7**, **J10** and **J11** for more details regarding these signals.

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 10 |
|--|---|---|---------|

4.2.8. SSI Encoder Interface

The Instrument Rotator Application board interfaces with four SSI absolute position encoder subsystems (2 on the left and 2 on the right).

The interface provides 24 Volt power and a differential clock signal for each encoder. The encoders provide differential data in response to the clock signals from the application board. See table **J8** and **J9** for more details regarding these signals.

5. Mechanical Packaging and Environment

5.1. Environmental Specifications

| | |
|--------------------------|---|
| Temp | 0° to +50 °C |
| Humidity | 0 to 90% Non Condensing |
| Ventilation requirements | Unit must be mounted to allow adequate ventilation. (Minimum CFM airflow TBD) |
| Altitude | Operational to 11,000 ft. |

5.2. Module location

The Rotator Interface Modules for the DGR and FBGR rotators are located in the upper tree house in a 2U 19 inch rack mount enclosure. They are located just above the Rotator and Cable Chain Power Module that they control. These modules use several power supplies that are common to the Rotator and Cable Chain Power Module. These power supplies are located in a 3U 19 inch rack enclosure mounted at the top of the rack. See figure 5.2.1 for layout details. **Note: For proper operation of the control system this power supply must be operated from UPS power.**

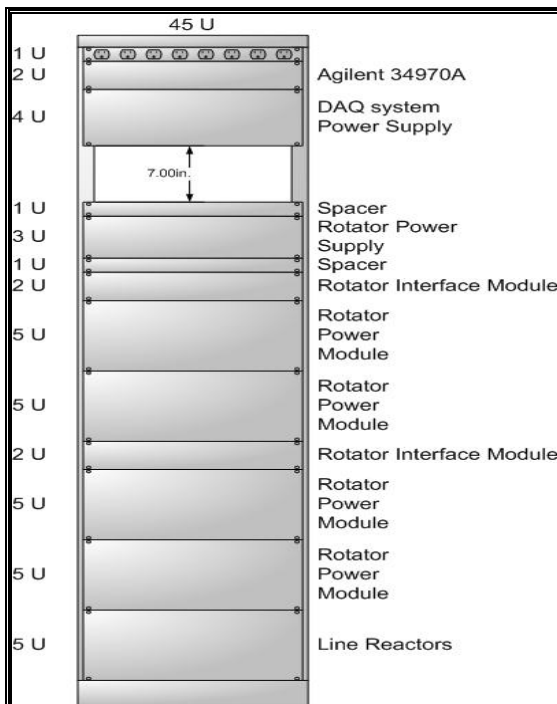


Figure 5.2.1

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 12 |
|--|---|---|---------|

5.3. Mechanical drawings

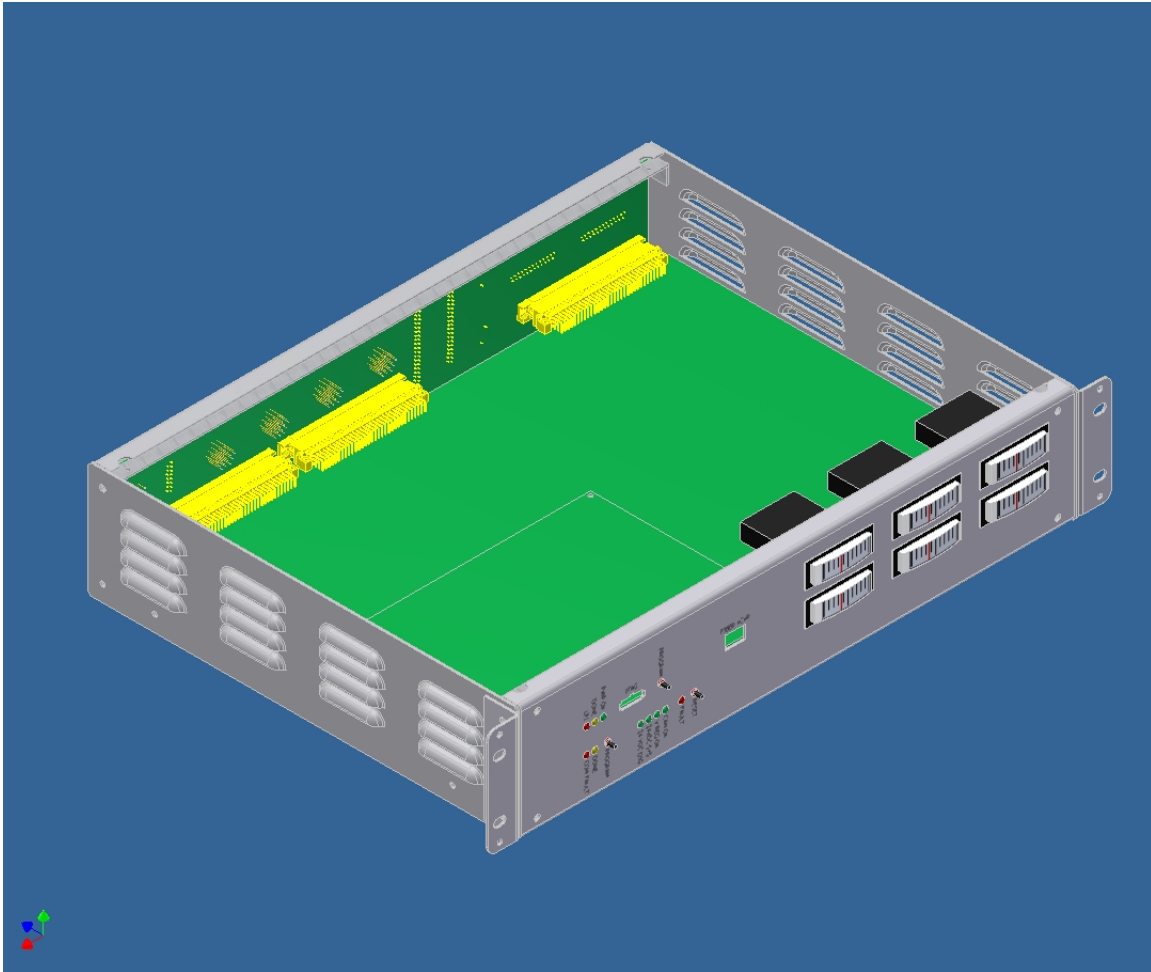


Figure 5.3.1: Isometric Rendering of Rotator Interface Modules

6. Input and Output Specifications

6.1. Front Panel

Figure 6.1.1 shows a rendering of the Module front panel.



Figure 6.1.1

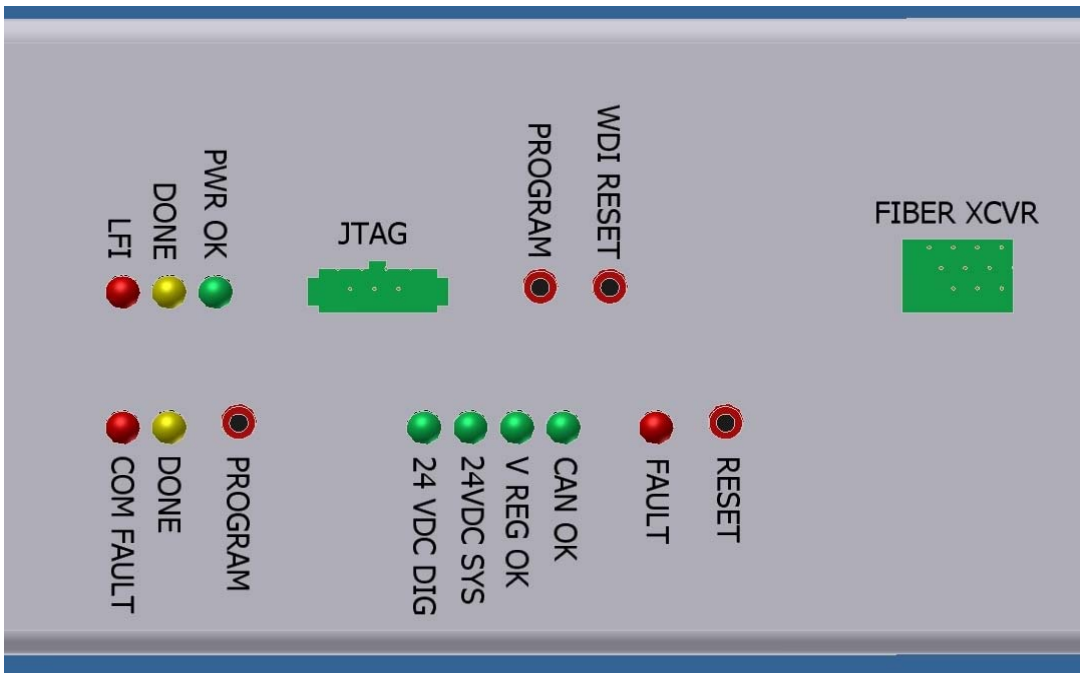


Figure 6.1.2

Figure 6.12 shows a detailed rendering of the left side of the front panel. The fiber transceiver is the only input connector on the front panel that is in normal use by the system. The JTAG connector is used to update the FPGAs in the GPSCOM board and Applications board. See section 7 for details regarding the front panel LEDs and switches.

6.2. Rear Panel

Figure 6.2.1 shows a rendering of the Module rear panel.

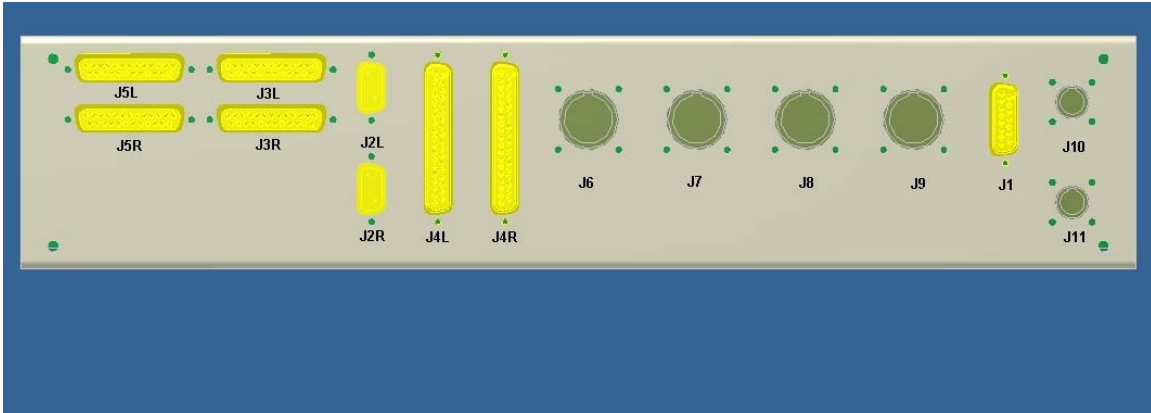


Figure 6.2.1

J1 – DC Power Input (to rack DC power supply) [DB15]

| Pin Number | Pin Name | Description |
|------------|--------------------|------------------------------|
| 1 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 2 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 3 | DCOM | Digital Gnd |
| 4 | DCOM | Digital Gnd |
| 5 | +24VDC System | + 24 V supply (ref to AGND) |
| 6 | +24VDC System | + 24 V supply (ref to AGND) |
| 7 | AGND | Analog Ground |
| 8 | +15V | Analog positive power supply |
| 9 | -15V | Analog negative power supply |
| 10 | AGND | Analog Ground |
| 11 | AGND | Analog Ground |
| 12 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 13 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 14 | DCOM | Digital Gnd |
| 15 | DCOM | Digital Gnd |

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 15 |
|--|---|---|---------|

J2L – CAN 1 (Left Axis) [DB9]

| Pin Number | Pin Name | Description |
|------------|---------------|-----------------------------|
| 1 | CANH | CAN Differential + |
| 2 | CANL | CAN Differential - |
| 3 | AGND | Analog Gnd |
| 4 | +24VDC System | + 24 V supply (ref to AGND) |
| 5 | Spare | |
| 6 | Spare | |
| 7 | Spare | |
| 8 | Spare | |
| 9 | Spare | |

J2R – CAN2 (Right Axis) [DB9]

| Pin Number | Pin Name | Description |
|------------|---------------|-----------------------------|
| 1 | CANH | CAN Differential + |
| 2 | CANL | CAN Differential - |
| 3 | AGND | Analog Gnd |
| 4 | +24VDC System | + 24 V supply (ref to AGND) |
| 5 | Spare | |
| 6 | Spare | |
| 7 | Spare | |
| 8 | Spare | |
| 9 | Spare | |

J3L –Analog Output (to Left Rotator Power Interface Module) [DB25]

| Pin Number | Pin Name | Description |
|------------|------------|------------------------------------|
| 1 | ROTDR0AN1+ | Rotator Drive 0 Differential IN1+ |
| 2 | ROTDR0AN1- | Rotator Drive 0 Differential IN1 - |
| 3 | ROTAGND0 | Rotator Drive 0 Analog Gnd |
| 4 | ROT01SHLD | Rotator Drive 0 Pair 1 Shield |
| 5 | ROTDR0AN2+ | Rotator Drive 0 Differential IN2+ |
| 6 | ROTDR0AN2- | Rotator Drive 0 Differential IN2 - |
| 7 | ROT02SHLD | Rotator Drive 0 Pair 2 Shield |
| 8 | ROTDR1AN1+ | Rotator Drive 1 Differential IN1+ |
| 9 | ROTDR1AN1- | Rotator Drive 1 Differential IN1 - |
| 10 | ROTAGND1 | Rotator Drive 1 Analog Gnd |
| 11 | ROT11SHLD | Rotator Drive 1 Pair 1 Shield |
| 12 | ROTDR1AN2+ | Rotator Drive 1 Differential IN2+ |
| 13 | ROTDR1AN2- | Rotator Drive 1 Differential IN2 - |
| 14 | ROT12SHLD | Rotator Drive 1 Pair 2 Shield |

| | | |
|----|------------|--------------------------------|
| 15 | CCDRAN1+ | Chain Drive Differential IN1+ |
| 16 | CCDRAN1- | Chain Drive Differential IN1 - |
| 17 | CCAGND2 | Chain Drive Analog Gnd |
| 18 | CABLE1SHLD | Chain Drive Pair 1 Shield |
| 19 | CCDRAN2+ | Chain Drive Differential IN2+ |
| 20 | CCDRAN2- | Chain Drive Differential IN2 - |
| 21 | CABLE2SHLD | Chain Drive Pair 2 Shield |
| 22 | NC | No Connect |
| 23 | NC | No Connect |
| 24 | NC | No Connect |
| 25 | NC | No Connect |

J3R –Analog Output (to Right Rotator Power Interface Module) [DB25]

| Pin Number | Pin Name | Description |
|------------|------------|------------------------------------|
| 1 | ROTDR0AN1+ | Rotator Drive 0 Differential IN1+ |
| 2 | ROTDR0AN1- | Rotator Drive 0 Differential IN1 - |
| 3 | ROTAGND0 | Rotator Drive 0 Analog Gnd |
| 4 | SHLD | Shield |
| 5 | ROTDR0AN2+ | Rotator Drive 0 Differential IN2+ |
| 6 | ROTDR0AN2- | Rotator Drive 0 Differential IN2 - |
| 7 | ROTDR1AN1+ | Rotator Drive 1 Differential IN1+ |
| 8 | ROTDR1AN1- | Rotator Drive 1 Differential IN1 - |
| 9 | ROTAGND1 | Rotator Drive 1 Analog Gnd |
| 10 | SHLD | Shield |
| 11 | ROTDR1AN2+ | Rotator Drive 1 Differential IN2+ |
| 12 | ROTDR1AN2- | Rotator Drive 1 Differential IN2 - |
| 13 | CCDRAN1+ | Chain Drive Differential IN1+ |
| 14 | CCDRAN1- | Chain Drive Differential IN1 - |
| 15 | CCAGND2 | Chain Drive Analog Gnd |
| 16 | SHLD | Shield |
| 17 | CCDRAN2+ | Chain Drive Differential IN2+ |
| 18 | CCDRAN2- | Chain Drive Differential IN2 - |
| 19 | SHLD | Shield |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |

J4L – Digital Input/Output (to/from Left Rotator Power Interface Module) [D sub 37]

| Pin Number | Pin Name | Description |
|------------|--------------------|--------------------------------|
| 1 | REL_CCW_NO_EMERG | IN - Relative CCW E-limit |
| 2 | REL_CW_NO_EMERG | IN - Relative CW E-limit |
| 3 | ABS_CCW_NO_EMERG | IN - Absolute CCW E-limit |
| 4 | ABS_CW_NO_EMERG | IN - Absolute CW E-limit |
| 5 | MCR_MON | IN - MCR monitor |
| 6 | ESTOP_MON | IN - E-Stop monitor |
| 7 | LOCK_MON | IN - Lock out switch monitor |
| 8 | FAN_OK | IN - Fan OK |
| 9 | 3PHASE_OK | IN - 3 Phase power OK |
| 10 | ROT_DR_ON | IN - Rotator drives ON |
| 11 | CABLE_DR_ON | IN - Cable drive ON |
| 12 | ROT_DR_OK | IN - Rotator drives OK |
| 13 | CABLE_DR_OK | IN - Cable drive OK |
| 14 | ROT_BRKS_REL | IN - Rotator brakes released |
| 15 | REL_BRAKE | OUT - Release Rotator Brakes |
| 16 | RESET_DR_FAULT | OUT - Reset all 3 drive faults |
| 17 | ROT_PWR | OUT - Power Rotator Drives |
| 18 | CABLE_PWR | OUT - Power Cable Drive |
| 19 | ROT_ENABLE | OUT - Enable Rotator Drives |
| 20 | CABLE_ENABLE | OUT - Enable Cable Drive |
| 21 | 3PHASE_RESET | OUT - 3 Phase Power Reset |
| 22 | DCOM | Digital common |
| 23 | DCOM | Digital common |
| 24 | DCOM | Digital common |
| 25 | DCOM | Digital common |
| 26 | DCOM | Digital common |
| 27 | +24VDC Digital ISO | Digital DC Power Out (Iso) |
| 28 | +24VDC Digital ISO | Digital DC Power Out (Iso) |
| 29 | +24VDC Digital ISO | Digital DC Power Out (Iso) |
| 30 | +24VDC Digital ISO | Digital DC Power Out (Iso) |
| 31 | +24VDC Digital ISO | Digital DC Power Out (Iso) |
| 32 | D0DOUT2 | Drive 0 Digital OUT2 |
| 33 | D0DIN2 | Drive 0 Digital IN2 |
| 34 | D1DOUT2 | Drive 1 Digital OUT2 |
| 35 | D1DIN2 | Drive 1 Digital IN2 |
| 36 | CABLEDOUT2 | Cable Drive Digital OUT2 |
| 37 | CABLEDIN2 | Cable Drive Digital IN2 |

J4R – Digital Input/Output (to/from Right Rotator Power Interface Module) [D sub 37]

| Pin Number | Pin Name | Description |
|------------|--------------------|--------------------------------|
| 1 | REL_CCW_NO_EMERG | IN - Relative CCW E-limit |
| 2 | REL_CW_NO_EMERG | IN - Relative CW E-limit |
| 3 | ABS_CCW_NO_EMERG | IN - Absolute CCW E-limit |
| 4 | ABS_CW_NO_EMERG | IN - Absolute CW E-limit |
| 5 | MCR_MON | IN - MCR monitor |
| 6 | ESTOP_MON | IN - E-Stop monitor |
| 7 | LOCK_MON | IN - Lock out switch monitor |
| 8 | FAN_OK | IN - Fan OK |
| 9 | 3PHASE_OK | IN - 3 Phase power OK |
| 10 | ROT_DR_ON | IN - Rotator drives ON |
| 11 | CABLE_DR_ON | IN - Cable drive ON |
| 12 | ROT_DR_OK | IN - Rotator drives OK |
| 13 | CABLE_DR_OK | IN - Cable drive OK |
| 14 | ROT_BRKS_REL | IN - Rotator brakes released |
| 15 | REL_BRAKE | OUT - Release Rotator Brakes |
| 16 | RESET_DR_FAULT | OUT - Reset all 3 drive faults |
| 17 | ROT_PWR | OUT - Power Rotator Drives |
| 18 | CABLE_PWR | OUT - Power Cable Drive |
| 19 | ROT_ENABLE | OUT - Enable Rotator Drives |
| 20 | CABLE_ENABLE | OUT - Enable Cable Drive |
| 21 | 3PHASE_RESET | OUT - 3 Phase Power Reset |
| 22 | DCOM | Digital common |
| 23 | DCOM | Digital common |
| 24 | DCOM | Digital common |
| 25 | DCOM | Digital common |
| 26 | DCOM | Digital common |
| 27 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 28 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 29 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 30 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 31 | +24VDC Digital ISO | Digital DC Power In (Iso) |
| 32 | D0DOUT2 | Drive 0 Digital OUT2 |
| 33 | D0DIN2 | Drive 0 Digital IN2 |
| 34 | D1DOUT2 | Drive 1 Digital OUT2 |
| 35 | D1DIN2 | Drive 1 Digital IN2 |
| 36 | CABLEDOUT2 | Cable Drive Digital OUT2 |
| 37 | CABLEDIN2 | Cable Drive Digital IN2 |

J5L – Encoder Quadrature Output (from Left Rotator Power Interface Module)

| Pin Number | Pin Name | Description |
|------------|-----------|-------------------------------|
| 1 | ROTDR0_A+ | Rotator Drive 0 Quad A+ Input |
| 2 | ROTDR0_A- | Rotator Drive 0 Quad A- Input |
| 3 | ROTDR0_B+ | Rotator Drive 0 Quad B+ Input |
| 4 | ROTDR0_B- | Rotator Drive 0 Quad B- Input |
| 5 | ROTDR1_A+ | Rotator Drive 1 Quad A+ Input |
| 6 | ROTDR1_A- | Rotator Drive 1 Quad A- Input |
| 7 | ROTDR1_B+ | Rotator Drive 1 Quad B+ Input |
| 8 | ROTDR1_B- | Rotator Drive 1 Quad B- Input |
| 9 | CCDR_A+ | Chain Drive Quad A+ Input |
| 10 | CCDR_A- | Chain Drive Quad A- Input |
| 11 | CCDR_B+ | Chain Drive Quad B+ Input |
| 12 | CCDR_B- | Chain Drive Quad B- Input |
| 13 | X0+ | Spare RS422 In |
| 14 | X0- | Spare RS422 In |
| 15 | X1+ | Spare RS422 In |
| 16 | X1- | Spare RS422 In |
| 17 | X2+ | Spare RS422 In |
| 18 | X2- | Spare RS422 In |
| 19 | X3+ | Spare RS422 In |
| 20 | X3- | Spare RS422 In |
| 21 | AGND | DR0AGND |
| 22 | AGND | DR1AGND |
| 23 | AGND | CABLEAGND |
| 24 | AGND | AGND |
| 25 | AGND | AGND |

J5R – Encoder Quadrature Output (from Right Rotator Power Interface Module)

| Pin Number | Pin Name | Description |
|------------|-----------|--------------------------------|
| 1 | ROTDR0_A+ | Rotator Drive 0 Quad A+ Output |
| 2 | ROTDR0_A- | Rotator Drive 0 Quad A- Output |
| 3 | ROTDR0_B+ | Rotator Drive 0 Quad B+ Output |
| 4 | ROTDR0_B- | Rotator Drive 0 Quad B- Output |
| 5 | ROTDR1_A+ | Rotator Drive 1 Quad A+ Output |
| 6 | ROTDR1_A- | Rotator Drive 1 Quad A- Output |
| 7 | ROTDR1_B+ | Rotator Drive 1 Quad B+ Output |
| 8 | ROTDR1_B- | Rotator Drive 1 Quad B- Output |
| 9 | CCDR_A+ | Chain Drive Quad A+ Output |
| 10 | CCDR_A- | Chain Drive Quad A- Output |
| 11 | CCDR_B+ | Chain Drive Quad B+ Output |
| 12 | CCDR_B- | Chain Drive Quad B- Output |

| | | | |
|--|---|-------------------|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a | Page 20 |
| | | Issue : a | |
| | | Date : 2-Mar-07 | |

| | | |
|----|------|----------------|
| 13 | X0+ | Spare RS422 In |
| 14 | X0- | Spare RS422 In |
| 15 | X1+ | Spare RS422 In |
| 16 | X1- | Spare RS422 In |
| 17 | X2+ | Spare RS422 In |
| 18 | X2- | Spare RS422 In |
| 19 | X3+ | Spare RS422 In |
| 20 | X3- | Spare RS422 In |
| 21 | AGND | DR0AGND |
| 22 | AGND | DR1AGND |
| 23 | AGND | CABLEAGND |
| 24 | AGND | AGND |
| 25 | AGND | AGND |

J6 – Right Main and Relative Encoder Interface (Tape heads, relative position sensor and misc. Analog inputs)

| Pin Number | Pin Name | Description |
|------------|----------------------|---|
| 1 | Sin1+ | Positive Sine output from head 1 preamp |
| 2 | Sin1- | Negative Sine output from head 1 preamp |
| 3 | Cos1 + | Positive Cosine output from head 1 preamp |
| 4 | Cos 1- | Negative Cosine output from head 1 preamp |
| 5 | Sin2+ | Positive Sine output from head 2 preamp |
| 6 | Sin2- | Negative Sine output from head 2 preamp |
| 7 | Cos2 + | Positive Cosine output from head 2 preamp |
| 8 | Cos 2- | Negative Cosine output from head 2 preamp |
| 9 | AGND | Analog Ground return |
| 10 | +15V | +15V supply to head preamp |
| 11 | AGND | Analog Ground return |
| 12 | -15V | -15V supply to head preamp |
| 13 | +24 VDC | +24 VDC |
| 14 | AGND | AGND |
| 15 | 4-20mA_Sig | Relative encoder feedback signal |
| 16 | Analog Spare 1 | |
| 17 | Analog Spare 2 | |
| 18 | Brake Air Pressure 1 | 4-20 mA representing Brake Air Pressure |

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 21 |
|--|---|---|---------|

J7 – Left Main and Relative Encoder Interface (Tape heads, relative position sensor and misc. Analog inputs)

| Pin Number | Pin Name | Description |
|------------|----------------------|---|
| 1 | Sin1+ | Positive Sine output from head 1 preamp |
| 2 | Sin1- | Negative Sine output from head 1 preamp |
| 3 | Cos1 + | Positive Cosine output from head 1 preamp |
| 4 | Cos 1- | Negative Cosine output from head 1 preamp |
| 5 | Sin2+ | Positive Sine output from head 2 preamp |
| 6 | Sin2- | Negative Sine output from head 2 preamp |
| 7 | Cos2 + | Positive Cosine output from head 2 preamp |
| 8 | Cos 2- | Negative Cosine output from head 2 preamp |
| 9 | AGND | Analog Ground return |
| 10 | +15V | +15V supply to head preamp |
| 11 | AGND | Analog Ground return |
| 12 | -15V | -15V supply to head preamp |
| 13 | +24 VDC | +24 VDC |
| 14 | AGND | AGND |
| 15 | 4-20mA_Sig | Relative encoder feedback signal |
| 16 | Analog Spare 1 | |
| 17 | Analog Spare 2 | |
| 18 | Brake Air Pressure 2 | 4-20 mA representing Brake Air Pressure |

J8 – Left SSI Encoder Interface

| Pin Number | Pin Name | Description |
|------------|--------------|-------------|
| 1 | 24VDC System | |
| 2 | DCOM | |
| 3 | SSI Clock1+ | |
| 4 | SSI Clock1- | |
| 5 | SSI Data 1+ | |
| 6 | SSI Data 1+ | |
| 7 | 24VDC System | |
| 8 | DCOM | |
| 9 | SSI Clock2+ | |
| 10 | SSI Clock2- | |
| 11 | SSI Data 2+ | |
| 12 | SSI Data 2+ | |
| 13 | Brake_sen1 | |
| 14 | Brake_sen2 | |
| 15 | Spare | |
| 16 | Spare | |
| 17 | Spare | |
| 18 | Spare | |

J9 – Right SSI Encoder Interface

| Pin Number | Pin Name | Description |
|------------|--------------|-------------|
| 1 | 24VDC System | |
| 2 | DCOM | |
| 3 | SSI Clock1+ | |
| 4 | SSI Clock1- | |
| 5 | SSI Data 1+ | |
| 6 | SSI Data 1+ | |
| 7 | 24VDC System | |
| 8 | DCOM | |
| 9 | SSI Clock2+ | |
| 10 | SSI Clock2- | |
| 11 | SSI Data 2+ | |
| 12 | SSI Data 2+ | |
| 13 | Brake_sen1 | |
| 14 | Brake_sen2 | |
| 15 | Spare | |
| 16 | Spare | |
| 17 | Spare | |
| 18 | Spare | |

J10 (Tape Excitation)

| Pin Number | Pin Name | Description |
|------------|----------|---------------------------|
| 1 | Tape_DR1 | Excitation signal to tape |
| 2 | Tape_DR2 | Excitation signal to tape |
| 3 | Shield | Shield |

J11 (Tape Excitation)

| Pin Number | Pin Name | Description |
|------------|----------|---------------------------|
| 1 | Tape_DR1 | Excitation signal to tape |
| 2 | Tape_DR2 | Excitation signal to tape |
| 3 | Shield | Shield |

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 23 |
|--|---|---|---------|

7. User Interface

A user can interact with the **Instrument Rotator and Cable Chain Interface Module** two ways. First the IRCCIM can be controlled and queried by the Rotator software running on the MCSPU.

Second, there are LEDs, Meters and switches on the front panel of the IRCCIM that allow a user to get feedback regarding the status of the Rotators. These indicators are in addition to those found on the front panel of the Power Module.

7.1. Analog meter display

The front panel of the IRCCIM contains 6 analog meters. These meters are generally used to display the current of each of the 6 motors used for a rotator pair. These meters are driven by DACs located on the Applications board. The information regarding the motor current is derived from the CAN bus. The Applications board can query each drive for information regarding the motor current. The Applications board then produces a voltage proportional to this current and drives the front panel meters with this voltage.

Additionally, these meters can be used to display additional parameters. These secondary functions will be controlled by a front panel switch to the left of the meters.

In one of the additional modes, the two right most meters will display data from the two Relative Position Sensors. This mode will help with mechanical alignment of these sensors.

7.2. General Purpose SERDES Communications Board (GPSCOM) Board Status Display

Figure 7.2.1 shows the LEDs and switches associated with the GPSCB. Table 7.2.1 provides details about the function of the LEDs, Table 7.2.2 provides details about the function of the push button switches.

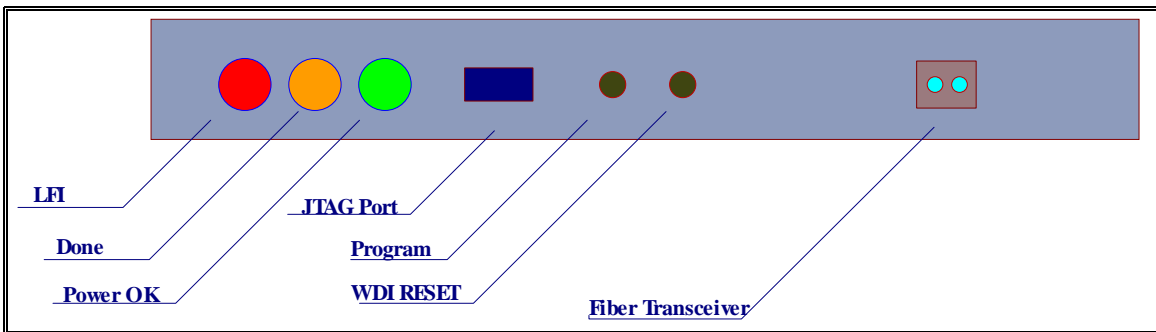


Figure 7.2.1: LEDs and Switch function on GPSCB

| | |
|----------|---|
| LFI | LFI- Link Fault Indication: This LED will be illuminated (Red) to indicate one of four errors detected by the SerDes chip. These error are: <ul style="list-style-type: none"> • Received serial data frequency outside of expected range • Analog amplitude below expected levels • Transition density lower than expected • Receive channel disabled |
| Done | This LED is illuminated (Amber) when the FPGA has completed its configuration correctly. |
| Power OK | This LED is green when power is applied to the GP com board. |

Table 7.2.1: GPSCB LED function details.

| | |
|-----------|---|
| Program | When this button is depressed then released, the FPGA on the GPSCB will begin loading its configuration data off the on board PROM |
| WDI Reset | Watch-Dog Reset – When this button is depressed, the Watch Dog timer on the GPSCB will be reset. |
| JTAG Port | This connector allows an external JTAG programmer to reprogram the FPGA configuration PROM on both the GPSCB and the Application Board. |

Table 7.2.2: GPSCB Push button and port functions.

7.3. Application Board Status Display

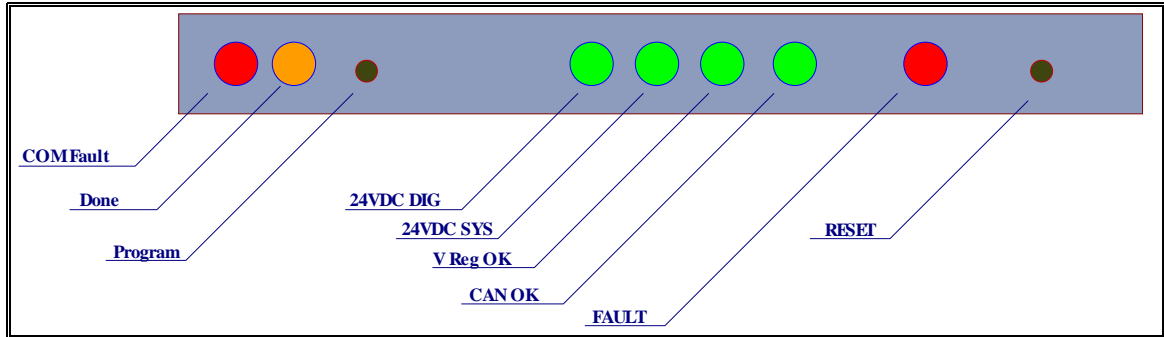


Figure 7.3.1

Figure 7.3.1 shows the LEDs and switches associated with the Rotator Applications Board. Table 7.3.1 provides details about the function of the LEDs, Table 7.3.2 provides details about the function of the push button switches.

| | |
|-----------|--|
| COM Fault | This LED indicates a problem with the communications link. Signal is a combination of Rx_Los and the watchdog timer output from the GP Com board |
| Done | Led is illuminated to indicate that the FPGA on the Application Board has been configured correctly. |
| 24VDC DIG | Led is illuminated to indicate that the 24 Volt DC Digital supply is present |
| 24VDC SYS | Led is illuminated to indicate that the 24 Volt DC System supply is present. |
| V Reg OK | This LED is illuminated to indicate that all regulated voltages on the Application board are within spec. |
| CAN OK | This LED is illuminated to indicate that all regulated voltages on the Application board are within spec. |
| Fault | This LED is illuminated to indicate that the application has detected a fault which has placed all control outputs into the “Safe” state. |

Table 7.3.1

8. Debugging Module problems

As detailed in section 7, the Rotator Interface Module contains a group of LEDs that give information about the status of the Module. Section 8.1 and 8.2 show tables of actions associated with the various LED indicators.

8.1. Debugging the GPSCOM board

Table 8.1.1

| Indication | Possible solution |
|------------------------------|---|
| LFI LED illuminated | <ul style="list-style-type: none"> • Insure that system software is running • Check fiber connection. • Replace fiber transceiver |
| Done LED not illuminated | FPGA on GPSCOM board not configured correctly. <ul style="list-style-type: none"> • Press Applications board program button. If LED does not light, remove and replace module. |
| Power OK LED not illuminated | <ul style="list-style-type: none"> • Check output of the system power supply in the rack • Check power connector on J1 of Module |

8.2. Debugging the Application Board

Table 8.2.1

| Indication | Possible solution |
|-------------------------------|--|
| Com fault LED illuminated | <ul style="list-style-type: none"> • Insure that system software is running • Check fiber connection. • Replace fiber transceiver |
| Done LED not illuminated | FPGA on Application board not configured correctly. <ul style="list-style-type: none"> • Press Applications board program button. If LED does not light, remove and replace module. |
| 24VDC DIG LED not illuminated | <ul style="list-style-type: none"> • Check output of the system power supply in the rack • Check power connector on J1 of Module |
| 24VDC SYS LED not illuminated | <ul style="list-style-type: none"> • Check output of the system power supply in the rack • Check power connector on J1 of Module |
| V Reg OK LED not illuminated | <ul style="list-style-type: none"> • Check output of the system power supply in the rack • Check power connector on J1 of Module • Remove module |
| CAN OK LED not illuminated | <ul style="list-style-type: none"> • Check the Power module is powered up. • Check that cable is plugged into J2. |
| Fault LED is illuminated | <ul style="list-style-type: none"> • If non of the above conditions are indicated and the Fault LED is illuminated, check status of system using software. |

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 27 |
|--|---|---|---------|

9. Module BOM

| Item | Count | Part Number | Description |
|------|-------|-------------|------------------------------------|
| 1 | 1 | TBD | GPSCOM board |
| 2 | 1 | TBD | Rotator Applications Board |
| 3 | 1 | TBD | System Application Connector Board |
| 4 | 2 | TBD | Fan |
| 5 | 1 | TBD | 2U Enclosure |
| 6 | 1 | TBD | Enclosure Mounting hardware Kit |

| | | | |
|--|---|---|---------|
| | Instrument Rotator and Cable Chain Interface Module and Operations Manual | Doc.No : 675s004a Issue : a Date : 2-Mar-07 | Page 28 |
|--|---|---|---------|

Doc_info_start

Title: *Instrument Rotator and Cable Chain Interface Module and Operations Manual*

Document Type: *Report*

Source: *Steward Observatory*

Issued by: *J. Rosato*

Date_of_Issue: *2/16/07*

Revised by:

Date_of_Revision:

Checked by:

Date_of_Check:

Accepted by:

Date_of_Acceptance:

Released by:

Date_of_Release:

File Type: *MS Word*

Local Name:

Category: *675*

Sub-Category: *004*

Assembly: *a*

Sub-Assembly:

Part Name:

CAN Designation: *675s004*

Revision: *a*

Doc_info_end