



**Model 560-5179-6  
Fault Monitor CPU Manual**

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# SECTION ONE

## 1. GENERAL INFORMATION

### 1.1. PURPOSE OF EQUIPMENT

The 560-5179-6 Fault Monitor CPU card is capable of monitoring the status of the individual cards installed in the chassis, the presence of the three reference frequencies (REFA-C), and the three external fault input signals (P,S,T). It provides a serial port capable of reporting information via either RS 232 or RS 422. There are eight programmable fault output lines which report fault conditions in various forms. Additionally, the CPU controls the selection of primary or secondary input signals on timing switch cards. On frequency switch cards, the CPU can cause a reference frequency to be ignored if it becomes corrupted.

#### 1.1.1. SPECIFICATIONS

##### 1.1.1.1. PHYSICAL

Height:	9.9 cm, (3.9 in)
Width:	2.0 cm, (0.8 in)
Depth:	22.1 cm, (8.7 in)
Weight:	≈0.5 lb

##### 1.1.1.2. ENVIRONMENTAL

Storage Temp:	-40° to +85°C
Operating Temp:	0° to +50°C
Humidity:	Up to 95% Relative, Non-Condensing
Cooling Mode:	Convection

##### 1.1.1.3. POWER

Voltage:	18-72 Vdc
Power:	5 W

##### 1.1.1.4. COMMUNICATION I/O SIGNALS

Use switch SW3-1 to select between RS-232 and RS-422:

SW3-1 off selects RS-232

SW3-1 on selects RS-422

Format:	ASCII, 9600 Baud, 8 Data, No parity, 1 Stop
RXDIN:	RS-232 Input
TXDOUT:	RS-232 Output
RIN+:	+RS-422 Input
RIN-:	-RS-422 Input
TOUT+:	+RS-422 Output
TOUT-:	-RS-422 Output

#### 1.1.1.5. INPUT SIGNALS

Inputs are TTL level signals with 4.7 K $\Omega$  pull-up resistors.

PFAULT:	Primary Fault Input (P)
SFAULT:	Secondary Fault Input (S)
TFAULT:	Tertiary Fault Input (T)
AUXIN:	P1-C15

#### 1.1.1.6. OUTPUT SIGNALS

All status outputs are TTL level signals capable of handling 10 mA. OUT1-8 are active-high. BEEP is active-low.

OUT1:	Composite Fault Active Since Last Clear
OUT2:	Fault Currently Active
OUT3:	Reserved
OUT4:	Reserved
OUT5:	Reserved
OUT6:	Primary External Fault Input Active
OUT7:	Secondary External Fault Input Active
OUT8:	Tertiary External Fault Input Active
BEEP:	Buzzer Control Line

#### LEDs:

A	No Activity On REFA
B	No Activity On REFB
C	No Activity On REFC
CPU	CPU Fault
P	Solid If Primary Fault Blinking if no Primary Fault, but timing cards are not using primary inputs.
S	Solid If Secondary Fault
T	Solid If Tertiary Fault

## SECTION TWO

### 2. INSTALLATION AND OPERATION

#### 2.1. HOT SWAPPING

All cards, input cables and output cables are hot swappable. It is not necessary to remove chassis power during insertion or removal. The system is designed to protect against permanent effects and minimize any temporary effects of hot swapping. The CPU card should be hot swapped when possible to allow the new CPU card to read previous configuration information from the other installed cards.

Adjacent-card hot swapping has a negligible effect on the Fault Monitor CPU.

Hot swapping of the Fault Monitor CPU has some effect on adjacent cards that use REFA, B, and/or C. Hot swapping this card causes a reference-input perturbation that does not result in a reference-source change. The effects of this are discussed in the specific manuals of cards that are sensitive to this type of event.

#### 2.2. REMOVAL AND INSTALLATION

**CAUTION: Individual components on this card are sensitive to static discharge. Use proper static discharge procedures during removal and installation.**

Refer to CARD COMPATIBILITY section prior to installing new card.

To remove card, loosen the captive retaining hardware at the top and bottom of the assembly, then firmly pull on the handle (or on any connector on rear panel adapter cards) at the bottom of the card. Slide the card free of the frame. Refer to the SETUP section for any required switch settings; or, set them identically to the card being replaced. Reinstall the card in the frame by fitting it into the card guides at the top and bottom of the frame and sliding it in until it mates with the connector. Seat card firmly to avoid contact bounce. Secure the retaining screws at the top and bottom of the card assembly.

#### 2.3. SETUP

The 560-5179-6 Fault Monitor has several switch-selectable features. SW1-1,2,3 control whether the input frequency detectors controlling the front panel LED's and fault detectors are Active or Inactive. Setting the switches to the OFF position will allow the individual detector outputs to pass through to the LED control circuitry and the processor. Setting the switches to ON pulls the output of the corresponding detector circuit high

indicating a valid input signal all of the time. Each of the three detectors may be activated or de-activated independently. SW1-4 selects the input termination of the RS-422 input lines. Silkscreen on the card indicates how to select either 100  $\Omega$  or none. SW3-1 selects between RS-232 and RS-422; OFF selects RS-232 and ON selects RS-422. Once the card has been configured, power may be applied and further software configuration may be done as desired. Software configuration is detailed in the software description.

Jumper default settings:

SW1-1,2,3	OFF (Active)
SW1-4	OFF
SW3-1	OFF (RS-232)

## 2.4. OPERATION

### 2.4.1. GENERAL INFORMATION

The 560-5179-6 Fault Monitor is designed to monitor the faults from each of the nineteen slots, three reference inputs: REFA, B, C; and three external fault inputs: P, S, and T. It also uses the address and data busses on the backplane to obtain additional information from some of the cards. When timing switch cards are installed in the chassis, the Fault Monitor will evaluate the fault information and control selection of the primary and secondary inputs. The Fault Monitor can send its information serially via RS-232 or RS-422/485 via an I/O Module rear panel card to the user. The Fault Monitor may control an audible beeper as well as the fault relay output lines. Operational parameters are described in Section 2.4.2.9., Command Summary. All parameters entered by the user are retained when the power is off.

### 2.4.2. FIRMWARE

#### 2.4.2.1. STARTUP

At power up or reset, the Fault Monitor CPU card will hold off fault detection for approximately four seconds. This allows the CPU to determine which cards are installed in the chassis and allows the individual cards to initialize. After the initialization period, the CPU will begin detecting faults and reporting them appropriately.

#### 2.4.2.2. EXTERNAL FAULT INPUTS

The 56000 chassis has three external fault inputs: Primary (P), Secondary (S), and Tertiary (T). The P, S, and T inputs are used to control which of the three reference frequencies are enabled to the frequency option cards, and whether to select the primary or secondary timing sources on the timing option cards. These controls are user configurable and should be setup at installation. See the User Interface Section 2.4.2.6 for configuration details.

#### 2.4.2.3. FREQUENCY OPTION CARDS

Frequency option cards are monitored by the Fault Monitor. Some of the option cards allow the user to configure the outputs via the serial port. Others are configured with switch settings on the option card. Details for option card configuration are given in the specific option card manual. In either case, the Fault Monitor identifies the cards and reports faults over the serial port.

#### 2.4.2.4. FREQUENCY SWITCH OPTION CARDS

Frequency switch option cards utilize the three reference frequency inputs REFA, REFB, and REFC. When REFA is valid, it is used to generate the output frequency. If REFA is invalid, the Fault Monitor will cause all frequency switch cards to disable REFA and use REFB to generate the outputs. Similarly, if REFA is disabled and REFB goes bad, the Fault Monitor will disable REFB on all frequency switch cards and REFC will be used to generate the frequency outputs.

At initialization, all reference inputs are enabled. When one of the external fault status inputs indicates an alarm condition, the corresponding reference will be disabled at each card. The primary status input, "P", will cause REFA to be disabled. Similarly, the secondary and tertiary status, "S" and "T", will disable REFB and REFC. Refer to Section 2.4.2.6.3 to configure the external fault status inputs. An Oscillator Fault on a 560-5147-X card will also cause the used reference to be disabled on the other frequency switch cards.

If all reference frequencies are considered "bad," then the Fault Monitor will leave any active references enabled.

The frequency cards can be commanded to use only a specific reference for test purposes with the commands: "REFA!", "REFB!", and "REFC!". These three test-mode commands disable the two unnamed references and cause the cards to use the specified frequency as its reference. To return to normal operation, send "REF" to the serial port.

#### 2.4.2.5. TIMING SWITCH OPTION CARDS

Timing switch option cards utilize two inputs (selected at installation of each card) from the eight inputs to the chassis (IN1-IN8). The Fault Monitor reads the configuration of the timing cards and provides it to the user in the report outputs as well as in configuration information. When the primary input to a Timing Switch card becomes inactive, this card automatically selects the secondary input. The Fault Monitor will then attempt to cause all timing switch cards to change to the secondary inputs. A card will not switch if it has an inactive secondary input.

The "PRI" command will first clear any latched fault status bits on the cards and then implement a switch to the primary inputs if the primary inputs are determined to be good. (Refer to the individual card manual for a description of the fault status bits.) "PRI!" allows the user to force

the switch cards to their primary inputs regardless of the primary status. Sending "PRI" to the unit after the PRI! command has been used will return the Timing Switch cards to normal operation. "SEC!" can be used to switch the Timing Switch cards to their secondary inputs at any time. "SEC" will cause a switch to the secondary inputs if the secondary inputs are good.

#### **2.4.2.6. USER INTERFACE**

##### **2.4.2.6.1. OPERATIONAL MODES**

The serial port operates in one of two modes: "VERBOSE" or "MACHINE". Verbose mode is intended for interfacing with a human operator and machine mode designed for interfacing with a computer. In machine mode, the interface does not respond to each command with "OK", as it does in verbose mode. To enter machine mode, type "M." Type V to enter verbose mode or press the ENTER key to send a carriage return, <CR>, three times in a row. This will place the unit in verbose mode. The interface will ignore any line feeds, <LF>, it receives.

##### **2.4.2.6.2. CONFIGURING CARDS**

The RS port can be used to send and retrieve configuration information from some option cards. Send C##? to retrieve data on the card in slot ##. Leading zeros may be omitted in the slot number. Send C##=[data]<CR> to configure the card. Refer to the individual card manual for a description of [data]. If a specific card is not configurable, attempts to set or retrieve configuration information from the card will result in an "ERROR 05 NO SUCH FUNCTION" message. "ERROR 02 SYNTAX" will be returned if a command is not entered properly. "OK" is returned for a valid entry. In some cases, a valid entry will be responded to with a statement affirming the change entered.

##### **2.4.2.6.3. CONFIGURING EXTERNAL FAULT STATUS INPUTS**

Each of the three fault status inputs (P, S, and T) have an internal pull-up so that a floating input is pulled high. Syntax to control the active level of these inputs is PSRC=a, SSRC=a, TSRC=a, where a is "H" for HIGH=ALARM, "L" for LOW=ALARM, "O" for OFF, and "D" for DISABLE. For example, to disable the T fault status input, use the TSRC=D command. To set the active level for the S fault status input to LOW=ALARM, use the SSRC=L command.

The status inputs P, S, and T must also be configured to control the operation of any timing switch cards in the chassis. This allows the user to decide which of the three external status inputs will be seen as the primary or secondary input faults for the timing switch cards. TPRI and TSEC can be set to P, S, T, or N for none. For example, the string TPRI=S will cause the secondary status input to be handled as a primary

timing signal failure. TSEC=T will use the tertiary external status input as a secondary timing input failure.

#### 2.4.2.6.4. CONFIGURING SITE INFORMATION

The CPU is capable of providing a chassis site number in the range 0 to 99. This function may be useful in systems where more than one chassis is present. To change the site number reported by the unit use the string: SITE=##. To request the site number of a chassis, send: SITE?

#### 2.4.2.6.5. FAULT AND STATUS REPORTING

The serial port is able to provide status information about the option cards installed in the chassis. The reports can be generated in three ways: On request, each time a fault condition changes, or at approximate time intervals. To request a report from the unit, send an R. A report will be returned which lists each slot and its current fault information.

To receive a report any time a fault condition changes, send an ARON to the port to turn Automatic Reporting ON. A report will be generated showing the current status of the fault signals. From that time, any change in one of the fault signals or system status will cause a report to be sent. When the chassis configuration is changed, a report will be sent when automatic reports are enabled. To disable the reports, send AROFF.

To receive reports at time intervals send PR##. This will enable Periodic Reports at approximately ## decimal minute intervals. To cancel the periodic reports, send PROFF. The three types of reporting can be used simultaneously.

#### 2.4.2.6.6 EXAMPLE OF FAULT/ STATUS READOUTS

The 560-5179-6 does not Fault or Status reports like many cards. However, it is included here for informational purposes only.

The Fault Monitor CPU has access to detailed card status. This status is available via the Fault Monitor CPU serial port. When it is presented in a 2-byte format, with individual bit definitions as follows:

The Verbose report displays the Fault status. In this context, a reported fault indicates a problem. The Machine report, when used, reports the current status (settings) of the switches and faults in hexadecimal characters. Together, they pinpoint problems and help the technician view the switch settings on the cards without removing them.



## VERBOSE REPORTS

The following is an example of a Fault Monitor CPU report in Verbose mode:

```
TrueTime 56000 Site 01
Automatic Reports Enabled
Periodic Reports Disabled
Primary Inputs Selected REFA No REFB No REFC Off PRI OK SEC OK TER Off

1. Undefined      OK          Undefined      OK
2. Undefined      OK          Undefined      OK
3. 5203-1 LOCAL OSC      Undefined OK
4. Undefined      OK          Undefined      OK
```

The above sample tells you that:

Automatic reports are enabled and Periodic reports are disabled. Primary inputs REF A and REF B are not bussing AUX REF. REF C is off. Primary and Secondary status inputs OK, Tertiary is OFF.

Numbers 1-4 are slots (not all slots are shown in the example). Slots 1,2,and 4 are undefined (empty) and functional (OK).

Slot 3 is read as follows:

5203-1 is the abbreviation of the 560-5203-1 card (this card is usually in Slot 17 and the read-out would reflect this).

## MACHINE REPORTS

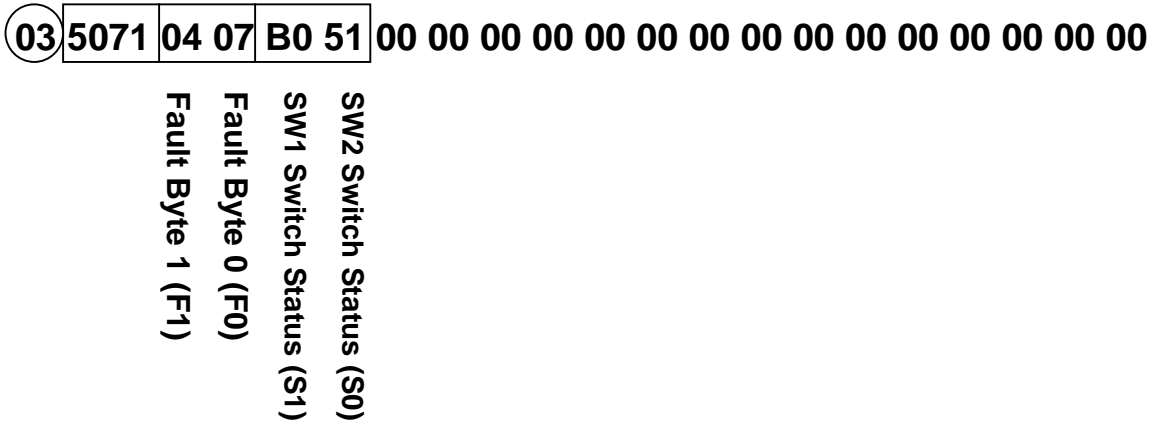
The Fault Monitor CPU has another serial output mode called machine report mode. This mode is usually used with a computer program to interrogate the 56000 system status.

The machine report mode displays hexadecimal (HEX) characters like the verbose mode report.

The following is an example of a Fault Monitor CPU report in Machine Mode:

```
TrueTime 56000 Site 01
AR1
PR10
P A1 B1 Co P1 S1 To
01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
03 50 71 04 07 B051 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(card slots 05 through 14 HEX not shown)
```

Example from card slot 3 :



Slot 3 shows that the Fault status is 0407 (F1, F0). The Status report read-out is B051(S1,S0).

REPORT CONVERSIONS

This section deals with how to read and convert the Fault and Status read-outs using various tables and binary conversions. To decipher a Fault Status report, use Fig. A.

Fig. A

Powercycle	Spare	Spare	Spare	Rub. Lockmon	Lock	PLL	Osc. Tune	Spare	+5VMON	Receiver	Antenna	Spare	Secondary	Primary	Aux. Ref.
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
$2^3$	$2^2$	$2^1$	$2^0$	$2^3$	$2^2$	$2^1$	$2^0$	$2^3$	$2^2$	$2^1$	$2^0$	$2^3$	$2^2$	$2^1$	$2^0$
0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1
Upper Byte High Nibble [Card]				Upper Byte Low Nibble [Oscillator]				Lower Byte High Nibble [GPS]				Lower Byte Low Nibble [Aux. Ref.]			
<b>0</b>				<b>4</b>				<b>0</b>				<b>7</b>			
<b>Fault Status F1 Report</b>								<b>Fault Status F0 Report</b>							

**Key:**

Above each 8,4,2,1 is the corresponding fault for that bit. For instance, above the 8 bit in the Upper byte/Low nibble reads Primary Source, which is the fault .

**Shaded area**

Informational only. The upper row: Bit value hex weights (8,4,2,1) The Lower row corresponds to the hex weight above. For instance, a readout of 7 equals 111 in binary and 4+2+1 hex weight.

Each section of 8,4,2,1 is a nibble of either an Upper or Lower byte and separated for easy recognition. Each nibble = 4 bits and each byte = 8 bits. "04" is the F1 report, "07" the F0 report.

**Non-shaded area**

This area is used according with the report read-out after a report is converted to binary. The 0407 is an example from a report.

Always read the report from Upper (High) byte to Lower (Low) Byte.

**BINARY CONVERSION TABLE**

Decimal	Displayed in report as	Binary
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Binary:  
1 = Fault/Switch On  
0 = No Fault/Switch Off

Use the Binary Conversion table to convert a read-out from the monitor to binary. For instance, if the report read-out was 3C15, this would be:

11\1100\1\101 in binary.

**USING THE FAULT STATUS REPORT (F0,F1)**

The hex weight has been assigned 8, 4, 2, 1. Beneath each number is the corresponding fault. Use Fig. A. The report example read 0407. The 0 is high byte/high nibble, the 4, high byte/low nibble, the 0, low byte/high nibble and 7, low byte/low nibble. Each nibble falls under a section on Fig. A, high to low or left to right.

Look at Fig. A. Below this is a sample read-out. This read-out would appear on the monitor when a Verbose report is requested. In the example, there are no faults in the upper byte/high nibble or in the lower byte/high nibble because both are zero (0). In the upper byte/low nibble, a 4 is reported. Looking directly above this, a 4 bit is easily spotted. The fault is Secondary Input Fault. However, In the lower byte/low nibble a 7 is reported. There is no 7 listed, only a 1, 2, 4, 8. Use the Binary Conversion table to determine the faults.

Seven (7) is converted to 111 in Binary. In Binary, a 1 = fault and 0 = no fault. Read 111 from right (low bit) to left (high bit) using the lower byte/low nibble group. The first three (from low bit to high bit) are 1's, indicating there is a fault with the Output Faults A, B and C.

Note that the hex weight assigned totals to 7 (4+2+1). If the 7 had been a 6, in binary this is 110. Reading from low bit to high bit, the 1's (i.e., faults) fall under hex weight 4 and 2, which equals a hex weight of 6. Of course, glancing at the lower byte/low nibble, you can quickly see (without converting to binary) that under 4 and 2 (i.e., 6) are the Output B and C that are in fault.

Each of the four nibbles is grouped by category for easy visual identification of an offending fault. Each nibble has 15 possible fault combinations. All faults are asserted as a logic 1. The faults are latched on the Oscillator card and must be cleared by the 560-5179-6 Fault Monitor CPU "CL" command. Aux Ref faults are suppressed when the Aux Ref operating mode is disabled (AUX DIP switch OFF). GPS faults are suppressed when the GPS operating mode is disabled (GPS DIP switch OFF).

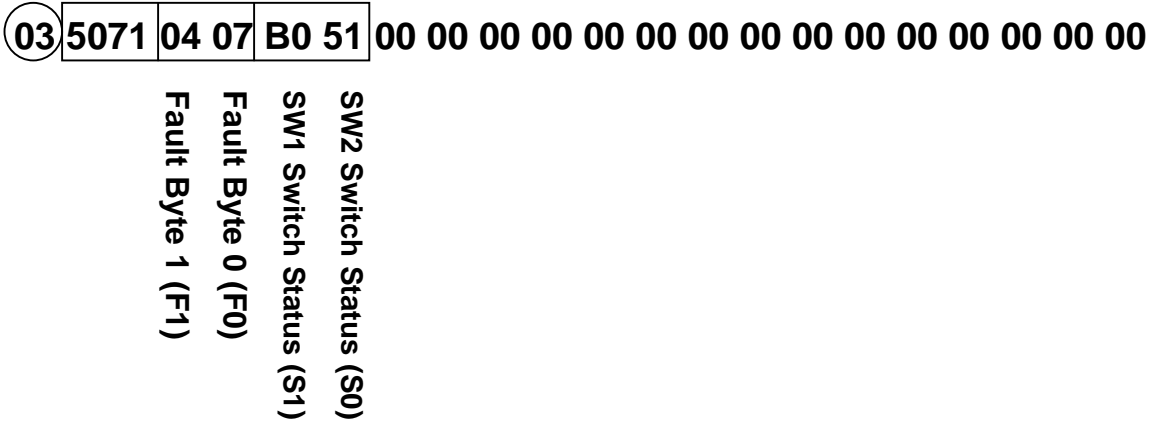
## QUICK REFERENCE SHEET FOR READING FAULT AND STATUS REPORTS

```

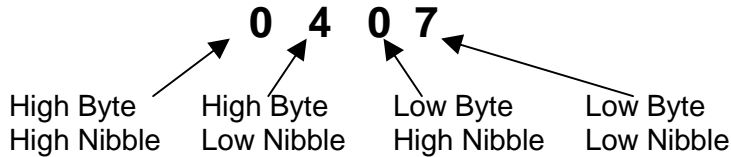
TrueTime 56000 Site 01
AR1
PR10
P A1 B1 Co P1 S1 To
01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
03 50 71 04 07 B0 51 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(card slots 05 through 14 HEX not shown)
  
```

0407 is the Fault Status read-out  
 B051 is the Status read-out report

04 = Fault Status 1 (F1) report  
 07 = Fault Status 0 (F0) report  
 B0 = Status 1 (S1) report  
 51 = Status 0 (S0) report



What's in a number?



END OF EXAMPLE SECTION

#### 2.4.2.7.FAULT OUTPUTS

The fault monitor also controls fault lines passing through to the back panel. These lines may be used for different purposes by different rear panel cards. The first line, OUT1, latches any alarm detected by the fault monitor. To reset the line, the CL command must be sent to the processor. The second line, OUT2, indicates the current status of the system at all times. When any fault is present, the line is active.

#### 2.4.2.8. AUDIBLE ALARM

The fault monitor also drives a line, /BEEP, which may be used to drive an audible alarm. The /BEEP line is activated any time a fault occurs in the chassis. The line can be deactivated by sending a Q command to quiet the alarm. It can also be disabled by sending BOFF to turn the buzzer off. The BON command will enable the buzzer.

#### 2.4.2.9.COMMAND SUMMARY

The serial I/O commands are listed in the following summary and syntax is described in the sections that follow. Correct entry of a command will be acknowledged with OK<CR><LF>. In machine mode there will be no acknowledgment. Incorrect or invalid entries will result in one of the following error messages:

ERROR 02 SYNTAX<CR><LF>

ERROR 05 NO SUCH FUNCTION<CR><LF>

The format for data input is:

<COMMAND><CR>

where <COMMAND>

<CR>

is one of the commands listed below.  
a carriage return <CR> or a carriage return/line feed combination <CR><LF>. Line feeds are ignored.

COMMAND DESCRIPTION:

<u>Command</u>	<u>Function</u>	<u>Modes</u>
AROFF<CR>	Turn off automatic fault reports.	V / M
ARON<CR>	Turn on automatic fault reports.	V / M
BOFF<CR>	Turn off / disable audible alarm.	V / M
BON<CR>	Turn on / enable audible alarm.	V / M
C##?<CR>	Request configuration on slot ##.	V / M
C## [data]<CR>	Configure slot ## (front card). Refer to manual for [data].	V / M
C##=xxxx<CR>	Enter card ID (xxxx) for slot ## (front card).	V / M
CR##=xxxx<CR>	Enter card ID (xxxx) for slot ## (rear card).	V / M
CL<CR>	Clear previous fault status.	V / M
DEFLT<CR>	Restore default parameters.	V / M
H<CR>	Request HELP!	V / M
M<CR>	Switch to machine mode.	V
PR##<CR>	Turn on periodic reports every ## minutes.	V / M
PROFF<CR>	Turn off periodic reports.	V / M
PRI<CR>	Switch to primary inputs if available.	V / M
PRI!<CR>	Switch to primary inputs regardless of faults.	V / M
PSRC=x<CR>	Set the P external fault status input to active high, active low, or disable when x=H,L,O, or D.	
PSRC?	Request the PSRC setting.	
Q<CR>	Quiet the audible alarm.	V / M
R<CR>	Request a report.	V / M
REF<CR>	Automatic REF selection based on PST status inputs.	V / M
REFA!<CR>	Enable A, Disable REFB and REFC.	V / M
REFB!<CR>	Enable B, Disable REFA and REFC.	V / M
REFC!<CR>	Enable C, Disable REFA and REFB.	V / M
SEC<CR>	Switch to secondary inputs if available.	V / M
SEC!	Switch to secondary inputs regardless of faults.	
SITE=##<CR>	Set the site of the chassis to ## (00-99).	V / M
SITE?<CR>	Request the site of the chassis.	V / M
SSRC=x<CR>	Set the S external fault status input to active high, active low, or disable when x=H,L,O, or D.	V / M
SSRC?	Request the SSRC setting.	V / M
TPRI=x<CR>	Connect the timing switch card primary input fault to an external fault input x=P,S,T, or N for none.	V / M
TPRI?	Request the TPRI setting.	V / M
TSEC=x<CR>	Connect the timing switch card secondary input fault to an external fault input x=P,S,T, or N for none.	V / M
TSEC?	Request the TSEC setting.	V / M
TSRC=x<CR>	Set the source of the T external fault status input to active high, active low, or disable when x=H,L,O, or D.	V / M
TSRC?	Request the TSRC setting.	V / M
V<CR>	Switch to verbose mode.	M
VER?	Request current software and FPGA version.	V / M
<CR><CR><CR>	Switch to verbose mode.	M
<CR><CR><CR>	Request HELP!	V

#### 2.4.2.9.1. AUTOMATIC FAULT REPORTS ON/OFF

Refer to section 2.4.2.6.6 for a description of fault and status reporting. Use the ARON/AROFF functions to enable/disable automatic fault and status reporting. To turn automatic fault reporting on (i.e., print a report when a fault condition changes), send the following string:

Sample Entry:       ARON<CR>  
Response:            OK<CR><LF>

To turn automatic fault reporting off, send the following character string:

Sample Entry:       AROFF<CR>  
Response:            OK<CR><LF>

#### 2.4.2.9.2. AUDIBLE BEEPER ON/OFF

Refer to section 2.4.2.8 for a description of disabling/enabling and deactivating the audible beeper. Use the BON/BOFF functions to enable/disable the audible beeper. Use the Q function to deactivate the beeper. To enable the audible alarm (/BEEP on the backplane), send the following string:

Sample Entry:       BON<CR>  
Response:            OK<CR><LF>

To disable the audible alarm (/BEEP on the backplane), send the following string:

Sample Entry:       BOFF<CR>  
Response:            OK<CR><LF>

To temporarily quiet the beeper, send the following string:

Sample Entry:       Q<CR>  
Response:            OK<CR><LF>

#### 2.4.2.9.3. REQUESTING/SETTING SLOT CONFIGURATION AND ID

Refer to section 2.4.2.6.2 for a description of setting and retrieving card slot configuration data. Refer to Section 2.4.2.6.5 for a description of setting board ID information. To retrieve data on a card in a particular card slot, send the following string:

Sample Entry:       C##?<CR>  
Response:            Front and back contents of Slot ## are  
                      returned

Where ## represents the slot number. Leading zeros may be omitted in the slot number.



To configure the front card of a particular slot, send the following string:

Sample Entry: C## [data]<CR>  
Response: OK<CR><LF>

Where ## is the slot number and [data] is the data for the command. Refer to the manual for the appropriate card for [data]. (Rear cards are not currently configurable.)

To configure the card ID for a particular slot, send the following string:

Sample Entry: C##=XXXX<CR> (front card) or  
CR##=XXXX<CR> (rear card)  
Response: OK<CR><LF>

Where ## is the slot number and XXXX is the configuration ID for the card.

#### 2.4.2.9.4. CLEARING PREVIOUS FAULT STATUS

This command will clear the CPU memory of old faults, clear any card latched fault status bits, clear fault outputs (Section 2.4.2.7), and silence the audible alarm (Section 2.4.2.8). Send the following string:

Sample Entry: CL<CR>  
Response: OK<CR><LF>

#### 2.4.2.9.5. RESTORE DEFAULT PARAMETERS

This command will restore the parameters stored in EEPROM to their default values. Send the following string:

Sample Entry: DEFLT<CR>  
Response: OK<CR><LF>

Default parameters are:

ARON	Automatic reports on
V	Verbose Mode
PR10	Periodic reporting interval, 10 minutes
PROFF	Periodic reports off
SITE=01	Site number is 01
BON	Audible alarm on
PSRC=D	Disable primary fault status input
SSRC=D	Disable secondary fault status input
TSRC=D	Disable tertiary fault status input
TPRI=N	No connection between primary external fault input and timing card primary input
TSEC=N	No connection between secondary external fault input and timing card secondary input

#### 2.4.2.9.6. REQUESTING HELP

To request help, send the following string:

Sample Entry:	H<CR>	or	<CR><CR><CR> (verbose mode only)
Response:	Help will be displayed.		

#### 2.4.2.9.7. SWITCHING BETWEEN VERBOSE AND MACHINE MODES

Refer to section 2.4.2.6.1 for a description of the operational modes. To go to machine mode, send the following string:

Sample Entry:	M<CR>
Response:	OK<CR><LF>

To go to verbose mode, send the following string:

Sample Entry:	V<CR>	or	<CR><CR><CR>
Response:	OK<CR><LF>		

#### 2.4.2.9.8. ENABLING/DISABLING PERIODIC REPORTING

Refer to section 2.4.2.6.6 for a description of enabling and disabling periodic reporting. To enable periodic reporting, send the following string:

Sample Entry:	PR##<CR>
Response:	OK<CR><LF>

Where ## is the decimal interval in minutes(0-99).

To cancel periodic reporting, send the following string:

Sample Entry:	PROFF<CR>
Response:	OK<CR><LF>

#### 2.4.2.9.9. SWITCHING TIMING CARD INPUTS

Refer to section 2.4.2.5 for a description of switching timing card inputs. To switch to primary inputs if there are no input faults, send the following string:

Sample Entry:	PRI<CR>
Response:	OK<CR><LF>

To switch to primary inputs regardless of input faults, send the following string:

Sample Entry:	PRI!<CR>
Response:	OK<CR><LF>

Note: Sending PRI<CR> after PRI!<CR> will return the Timing Switch card to normal operation.

To switch to secondary inputs, if there are no input faults, send the following string:

Sample Entry: SEC<CR>  
Response: OK<CR><LF>

To switch to secondary inputs regardless of input faults, send the following string:

Sample Entry: SEC!<CR>  
Response: OK<CR><LF>

#### 2.4.2.9.10. SETTING EXTERNAL STATUS INPUT LEVEL

Refer to section 2.4.2.6.3 for a description of setting the external fault status input level. To set the active level for the primary input, send the following string:

Sample Entry: PSRC=x<CR>  
Response: OK<CR><LF>

To set the active level for the secondary input, send the following string:

Sample Entry: SSRC=x<CR>  
Response: OK<CR><LF>

To set the active level for the tertiary input, send the following string:

Sample Entry: TSRC=x<CR>  
Response: OK<CR><LF>

Where x is "H" for HIGH=ALARM, "L" for LOW=ALARM, "O" for OFF, and "D" for DISABLE. If turning an external status input OFF, this will disable the corresponding reference frequency and any mapped timing input. In effect, this command turns off the entire associated channel. To request PSRC, SSRC, and TSRC command settings send the following strings:

Sample Entry: PSRC<CR>  
Response: PSRC=x<CR><LF>

Sample Entry: SSRC<CR>  
Response: SSRC=x<CR><LF>

Sample Entry: TSRC<CR>  
Response: TSRC=x<CR><LF>

NOTE: All unused status inputs should be set to OFF.

#### 2.4.2.9.11. REQUESTING A REPORT

Refer to section 2.4.2.6.6 for a description of requesting a report. To request a report from the unit, send the following string:

Sample Entry: R<CR>  
Response: A report will be immediately transmitted.

#### 2.4.2.9.12. ENABLING AND DISABLING THE REFERENCE FREQUENCY

Refer to section 2.4.2.4 for a description of enabling and disabling the Reference Frequency. To exit the reference frequency test mode and return to normal operation, send the following string:

Sample Entry: REF<CR>  
Response: OK<CR><LF>

To disable REFB and REFC and enable REFA, send the following string:

Sample Entry: REFA!<CR>  
Response: OK<CR><LF>

To disable REFA and REFC, and enable REFB send the following string:

Sample Entry: REFB!<CR>  
Response: OK<CR><LF>

To disable REFA and REFB, and enable REFC send the following string:

Sample Entry: REFC!<CR>  
Response: OK<CR><LF>

#### 2.4.2.9.13. REQUESTING / SETTING SITE NUMBERS

Refer to section 2.4.2.6.4 for a description of setting and returning the site number of the chassis. To set the site number of the chassis, send the following string:

Sample Entry:       SITE=##<CR>  
Response:            OK<CR><LF>

Where ## is the decimal number in the range 0 to 99 in which to set the chassis. To request the site number of the chassis, send the following string:

Sample Entry:       SITE?<CR>  
Response:            SITE=##<CR><LF>

#### 2.4.2.9.14. CONNECT THE TIMING CARD INPUT FAULTS TO AN EXTERNAL FAULT INPUT

Refer to section 2.4.2.6.3 for a description of connecting the timing card input faults. To connect the timing card primary input fault to an external fault input, send the following string:

Sample Entry:       TPRI=x<CR>  
Response:            OK<CR><LF>

To connect the timing card secondary input fault to an external fault input, send the following string:

Sample Entry:       TSEC=x<CR>  
Response:            OK<CR><LF>

Where x = "P" for Primary, "S" for Secondary, "T" for Tertiary, or "N" for None. To request TPRI and TSEC settings, send the following strings:

Sample Entry:       TPRI?<CR>  
Response:            TPRI=x<CR><LF>

Sample Entry:       TSEC?<CR>  
Response:            TSEC=x<CR><LF>

#### 2.4.2.9.15. REQUEST VERSION

To request the current software and FPGA versions (field programmable gate array), send the following string:

Sample Entry:       VER?<CR>  
Response:            560-3175 1.1 184-054 A

Where 560-3175 is the software number, 1.1 is the software version, 184-054 is the FPGA number, and A is the FPGA version.

## SECTION THREE

### 3. THEORY OF OPERATION

#### 3.1. GENERAL INFORMATION

This section contains a detailed description of the 560-5179-6 Fault Monitor circuitry. Refer to the drawings in part four of this section.

#### 3.2. HARDWARE DESCRIPTION

##### 3.2.1. POWER

The 560-5179-6 Fault Monitor runs on 48 Vdc power from the backplane. A DC to DC converter supplies the on-card circuitry with  $\pm 5$  Vdc.

##### 3.2.2. RESET

A reset to the 560-5179-6 can be caused in three ways. A reset is initiated at startup, when the +5 Vdc supply drops below 4.5 Vdc, or when a low going pulse is input via the /RESET line on P1-14. The MC34064 Undervoltage Detector pulls /HC11RST low whenever either of the latter two conditions are met.

##### 3.2.3. CPU FAULT MONITOR

The 560-5179-6 contains an on-card CPU Fault detector. The /NOFAULT line from the processor is AC coupled to an RC at the input of a comparator. While the RC circuit remains charged due to processor activity, the LM339 Comparator output will drive high. This signal is inverted, which provides the INHIBIT signal which enables the write ports. The same signal is input to an Opto-isolator, which controls the front panel LED. The LED is held off by the +15 Vdc power supply and by processor activity.

##### 3.2.4. FREQUENCY MONITORS

The 560-5179-6 monitors reference inputs from the backplane. REFA, REFB, and REFC signals enter the card through the backplane on pins C2, C4, and C6. Each input passes through an identical set of circuitry to provide control of the front panel LED's REFA, REFB, REFC, and the signals /AOK, /BOK, and /COK which are read by the processor. A copy of the frequency is sent buffered to the front panel test points REFA, B, and C. The incoming signal is routed through LT1016 Comparators, U5, 10, 23, which convert the incoming sinusoidal signal into TTL signals. The output of the comparators also charge capacitors at the input of voltage comparators. When the charge on the capacitors is higher than Vref ( $\approx 1.58$  Vdc), the corresponding LM339 Comparator output drops low. The comparator outputs drive the /AOK, /BOK, and /COK lines directly. The comparator outputs are also inverted to control the front

panel LED's. The frequency monitors can be made inactive by setting SW1 appropriately. This pulls the corresponding charge capacitor, C10,19,27, to +5 Vdc which will cause the output of the comparator to remain low.

### 3.2.5. SERIAL COMMUNICATION

The 560-5179-6 card simultaneously supports both RS-232 and RS-422 protocols at 9600 baud, 8 data bits, no parity, and 1 stop bit.

RXDIN and TXDOUT lines for RS-232 communication are connected via backplane pins B9 and B10. The LT1180A converts the RS-232 levels to TTL levels for the processor.

RIN± and TOUT± signals for RS-422 communication are connected from the backplane pins B13 & B14 and B11 & B12. The LTC491 converts the RS-422 levels into TTL levels for the processor.

### 3.2.6. PROCESSOR

The 560-5179-6 uses an HC11F1 Microcontroller. The processor runs on a 10 MHz frequency (20 MHz crystal X1 divided by 2). The processor has access to the read ports, /RDPORT0-4, the write ports, /WRPORT0-3, and the /NOFAULT signal. The read and write ports are described following this section. The /NOFAULT signal is toggled by the processor to indicate that the processor is running. If the /NOFAULT signal is not toggled, the CPU Fault Monitor will trigger.

### 3.2.7. READ PORTS

Many of the backplane signals can be read directly by the processor. The inputs /RDPORT0-4 have 4.7 KΩ pull-ups to +5 Vdc and are used to read the required signals from the data bus via Line Buffers. RDPORT0 (\$2000h) reads the slot identification information, SLOT0-4. The slot information is a 5 bit hex value representing the slot number in the chassis. The signals are controlled by the backplane card itself. /SW2 and /SW1 are used to read the status of switches S1 and S2 when present. The SPARE line is an external input which is connected to J2-23 of the rear panel Alarm Module. /RDPORT1,2,3 (\$3000h,\$4000h, \$5000h) are used to read the /FLTIN1-19 lines from each of the slots on the card. /FLTIN1-18 represent the first 18 slots in the system. /FLTIN19 represents slot 20. /RDPORT4 (\$6000h) reads the three frequency monitor signals, /AOK, /BOK, /COK, and the site information signals, SITE0, and SITE1. These signals have been described previously in the Frequency Monitor and Setup descriptions.

### 3.2.8. WRITE PORTS

The 560-5179-6 controls multiple signals on the backplane. The signals are controlled via /WRPORT0-3, Octal D Flip-Flops. /WRPORT0 (\$4000h) controls signals /OUT1-8. /OUT1-8 pass directly through to the backplane card via P1-A8, A9, C8, C9, A11, A12, C11, C12. The

INHIBIT line from the processor fault detector enables the write ports when the processor is functioning properly.

### 3.2.9. SIGNAL GROUND

All GND signals on the 560-5179-6 card are signal ground.



## **SECTION FOUR**

### **4. DETAILED DRAWINGS**

4.1. 560-5179-6 DETAILED DRAWINGS / BILL OF MATERIALS