



**Model 560-5203-1**  
**DISCIPLINED OVENIZED OSCILLATOR MANUAL**

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# SECTION ONE

## 1. FUNCTIONAL DESCRIPTION

### 1.1. PURPOSE OF EQUIPMENT

The Model 560-5203-1 Disciplined Oscillator card provides an accurate frequency source, an ovenized quartz oscillator, which is disciplined (locked) by either external frequency reference(s) or by GPS (if the 560-5202 GPS rear card is installed behind the 560-5203-1 Oscillator card).

The external frequency reference, which will be called Aux Ref in this manual, and the GPS disciplining modes may be enabled or disabled by on-card DIP switches depending on the system requirements. NOTE: The 560-5202 GPS option card is not required to discipline the 560-5203-1 ovenized quartz oscillator.

### 1.2. GPS DISCIPLINING MODE

Refer to the 560-5202 manual for a complete description of this option. The GPS Oscillator disciplining option requires that the 560-5202 GPS rear card be installed directly behind the 560-5203-1 Oscillator card and that the GPS mode DIP switch on the Oscillator card be enabled. When the GPS mode is used in conjunction with the Aux Ref mode, GPS has priority to discipline the local oscillator. When both modes are used, the Aux Ref source will provide local oscillator disciplining only when GPS is not a viable disciplining source. Refer to the 560-5202 manual for specifications on the timing outputs, serial port and other features that are available on the 560-5203-1 Oscillator card when the GPS (timing) option is installed.

### 1.3. OVERVIEW

This manual only covers the 560-5203-1 Oscillator card when operating in Aux Ref mode. Refer to the 560-5202 GPS card manual for details regarding the 560-5203-1 Oscillator card when operating in GPS mode. Note that the GPS option only provides additional features for the Oscillator card, all specifications in this manual also apply to the Oscillator card when operating in GPS mode.

### 1.4. PHYSICAL SPECIFICATIONS

Dimensions:	1.6"w X 3.94"h X 8.66"d (4 cm X 10 cm X 22 cm)
Weight:	Approximately 0.9 pound (0.4 kg)
Rack Slots:	2

1.5. ENVIRONMENTAL SPECIFICATIONS

Operating Temp: 0° to +50°C  
Storage Temp: -40° to +85°C  
Humidity: Up to 95% relative, non-condensing  
Cooling Mode: Convection

1.6. POWER REQUIREMENTS

Voltage: 18-72 VDC  
Power: 16.5 W during oscillator warm-up, 11 W thereafter

1.7. AUXILIARY REFERENCE INPUT(S) REFA, REFB, 7F, 8F

Function: REFA or 7F -- Primary External Disciplining  
Reference for Oscillator  
REFB or 8F -- Secondary External Disciplining  
Reference for Oscillator  
Input Amp/Freq: 3-5 Vpp at 1 MHz  
Input Amp/Freq: 2-5 Vpp at 5 or 10 MHz

1.8. OUTPUT FREQUENCY SPECIFICATIONS

Function: Reference mode: must be set to drive REFC  
Input Mode: Drives REFA or REFB or REFC  
(switch-selectable)  
Output Frequency: Input Mode: 1 or 5 or 10 MHz  
Reference Mode: Set for REFA & REFB frequency  
(switch-selectable)  
Output Amplitude: 3 Vpp into 50 ohms  
Frequency Stability: Equal to input reference  
Temp. Stability:  $2 \times 10^{-8}$  over 0 to +50°C when not tracking satellites  
(GPS) or no External Oscillator (Aux Ref) control.  
Oscillator Aging:  $2 \times 10^{-10}$  per day.  
To Initial Lock: < 20 minutes

1.9. CARD COMPATIBILITY

One Oscillator 2-slot module  
Location: Slot 1 (Left-most slot position)  
2nd Oscillator 2-slot module  
Location: Slot 3  
Compatibility: See Card Compatibility Matrix.

## SECTION TWO

### 2. OPERATION AND INSTALLATION

#### 2.1. AUX REF DISCIPLINING MODE

When the Aux Ref mode is enabled (DIP switch), the Oscillator uses the 56000 DRC backplane frequency reference bus to receive the Oscillator disciplining reference(s) and to distribute the Oscillator's output. The 56000 DRC chassis has up to five frequency reference bus lines -- REFA, REFB, REFC (standard) and the optional buses 7F and 8F. The 560-5203-1 Oscillator uses up to two of the frequency reference bus lines as inputs (primary and secondary) to discipline the local oscillator. Note that only one Aux Ref (external frequency reference) input is required to discipline the local Oscillator -- the second Aux Ref input provides disciplining redundancy.

When the Oscillator card is operated in Aux Ref mode, another operating mode choice must be made (DIP switch) to use either Reference or Input mode. Reference mode is used when the 56000 system has only one Oscillator installed and Input mode is used when two Oscillator assemblies (for redundant operation) are installed in the 56000 system. Both Reference and Input modes offer the Oscillator card two Aux Ref disciplining inputs (primary and secondary).

The 560-5203-1 Oscillator card performs automatic frequency detection (1, 5 or 10 MHz) of the Aux Ref disciplining inputs and also provides automatic switching between the primary and, if enabled, secondary Aux Ref sources based on a coarse frequency detection circuit. The Oscillator card cannot determine with any accuracy which frequency source should be used and depends on the Aux Ref source fault status to switch input references.

Fault status is a logic level output from external Aux Ref sources that connect to the 560-5179-1 Fault Monitor CPU card (refer to the 560-5179-1 manual). Connections to the P (primary) and S (secondary) Fault Status inputs on the Fault Monitor CPU card allows switching the 560-5203-1 Oscillator to steer and lock to a known good frequency. If the primary Aux Ref source provides a fault to the Fault Monitor CPU card and the secondary Aux Ref source is enabled (with no fault), the CPU commands the Oscillator card to switch to the secondary Aux Ref source. If only a primary Aux Ref source is used, the S (secondary) Fault Status input on the Fault Monitor CPU card and the secondary Aux Ref input on the Oscillator card must be disabled (DIP switch).

In either Reference or Input modes, the Oscillator provides a continuous, stable reference that flywheels through any external reference perturbations and provides backup during any loss of external reference. The 560-5203-1 Oscillator phase locking and long term averaging

technique provides a very stable frequency source that has a long-term stability equal to the external reference.

The differences between the Aux Ref Reference and Input operating modes is described in the following paragraphs.

## 2.2. REFERENCE MODE

In a system that has only one 560-5203-1 Oscillator card installed, and Aux Ref mode is enabled, the Aux Ref operating mode should be set to Reference. In this mode the Aux Ref disciplining signals are distributed on backplane bus lines REFA (primary) and REFB (secondary). The primary Aux Ref disciplining signal must be connected to the REFA input and if a second Aux Ref source is desired, to the REFB input. The Oscillator will steer and lock to the highest priority Aux Ref signal that is usable. If the secondary Aux Ref source (REFB) is not used, the input should be disabled on the Oscillator card (DIP switch).

When the 560-5203-1 Oscillator card is operated in Reference mode, the frequency output from the Oscillator card must be set to match the frequency of the Aux Ref source(s) (REFA and REFB). In Reference mode, the Oscillator must be set to distribute its output on REFC.

### REFERENCE MODE FAULT STATUS

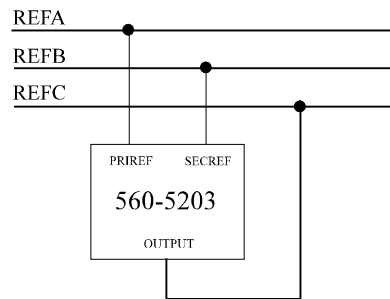
The primary Aux Ref signal REFA and if used, the secondary Aux Ref signal REFB, are monitored for fault status by the 560-5179-1 Fault Monitor CPU card. Fault status is a logic level output from the external Aux Ref source that should be connected to the Fault Monitor CPU card. The Fault status terms are used by the Fault monitor CPU card to control primary/secondary Aux Ref switching on the 560-5203-1 Oscillator card.

In Reference mode, the 560-5203-1 Oscillator uses the disciplining reference inputs from REFA and REFB. When the REFA disciplining source fault status is detected by the CPU (via status input "P" (primary), the REFA (primary) disciplining reference input on the Oscillator card is disabled. The REFB (secondary) disciplining reference input on the Oscillator card is controlled similarly via status input "S" (secondary) -- the REFB disciplining reference input is turned off whenever a fault condition exists. If the REFA and or REFB reference input is used, but the fault status from the external oscillator(s) is not used, the status inputs for these references should be disabled on the 560-5179-1 Fault Monitor CPU card (PSRC=D, SSRC=D commands). Refer to the 560-5179-1 manual. The CPU's fault status inputs "P" and "S" control feature ensures that only a viable external reference oscillator is used to discipline the 560-5203-1 Oscillator.

If only one Aux Ref disciplining input is used, this input must be connected to REFA (primary). The secondary Aux Ref input on the

Oscillator card should be disabled (DIP switch SEN = OFF) as well as the secondary status input on the Fault Monitor CPU card. When a primary fault status signal is detected by the CPU card, the primary Aux Ref input on the 560-5203-1 Oscillator card is turned off and the Oscillator will flywheel at the current frequency. If the primary Aux Ref source becomes viable again, CPU fault status and on-card frequency detection is OK, the disciplining source for the Oscillator will switch back on and the Oscillator will steer and lock to the primary Aux Ref source.

The following diagram depicts the 560-5203-1 in Reference mode.



### 2.3. INPUT MODE

In a system that has two 560-5203-1 Oscillator cards installed and Aux Ref mode is enabled, the Aux Ref operating mode should be set to Input. When the Oscillator is used in this mode, the disciplining Aux Ref signal(s) are distributed on 7F (primary) and 8F (secondary). The Oscillator will steer and lock to the highest priority Aux Ref signal that is viable. The output from each of the cards is delivered to other system cards via the backplane frequency bus on REFA or REFB or REFC. When the 560-5203-1 Oscillator cards are operated in Input mode, the outputs from the two Oscillators may be set for 1 or 5 or 10 MHz (but set the same) and may be distributed on REFA or REFB or REFC.

NOTE: Input 7F is the same backplane bus line as IN7 and input 8F is the same backplane bus line as IN8, therefore, the standard 56000 system timing line inputs IN7 and IN8 are not available when operating the 560-5203-1 Oscillators in Input mode. Also note that the backplane timing line terminator switch positions 7 and 8 should be ON (50 ohms).

If the 56000 system is configured to use the non-disciplining third external system reference input, REFC, the outputs from the 560-5203-1 Oscillators must be set for the same frequency as this reference.

## INPUT MODE FAULT STATUS

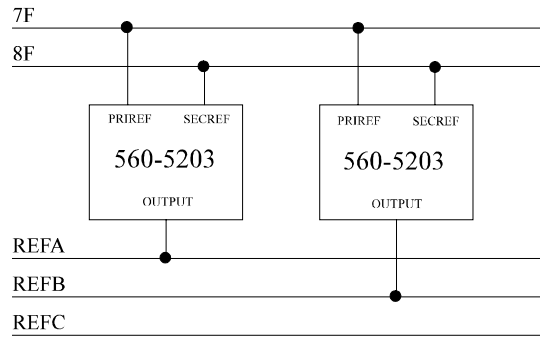
The primary Aux Ref signal (7F), and if used, the secondary Aux Ref signal (8F) are monitored for fault status by the 560-5179-1 Fault Monitor CPU card. Fault Status is a logic level output from the external Aux Ref source that should be connected to the Fault Monitor CPU card. The Fault status terms are used by the Fault monitor CPU card to control primary/secondary Aux Ref switching on the 560-5203-1 Oscillator card.

In Input mode, the 560-5203-1 Oscillator uses the disciplining reference inputs from 7F and 8F. When the 7F disciplining source fault status is detected by the CPU (via status input "P" (primary), the 7F (primary) disciplining reference input on the Oscillator card is disabled. The 8F (secondary) disciplining reference input on the Oscillator card is controlled similarly via status input "S" (secondary) -- the 8F disciplining reference input is turned off whenever a fault condition exists. If the 7F and or 8F reference input is used, but the fault status from the external oscillator(s) is not used, the status inputs for these references should be disabled on the 560-5179-1 Fault Monitor CPU card (PSRC=D, SSRC=D commands). Refer to the 560-5179-1 manual. The CPU's fault status inputs "P" and "S" control feature ensures that only a viable external reference oscillator is used to discipline the 560-5203-1 Oscillators.

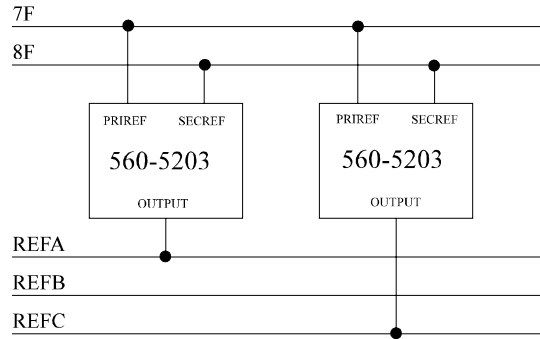
If only one Aux Ref disciplining input is used, this input must be connected to 7F (primary). The secondary Aux Ref input on the Oscillator cards should be disabled (DIP switch SEN = OFF) as well as the secondary status input on the Fault Monitor CPU card. When a primary fault status signal is detected by the CPU card, the primary Aux Ref input on the 560-5203-1 Oscillator cards is turned off and the Oscillators will flywheel at the current frequency. If the primary Aux Ref source becomes viable again, CPU fault status and on-card frequency detection is OK, the disciplining source for the Oscillator will switch back on and the Oscillators will steer and lock to the primary Aux Ref source.

The following diagrams depict the 560-5203-1 Oscillators in the three different Input mode configurations.

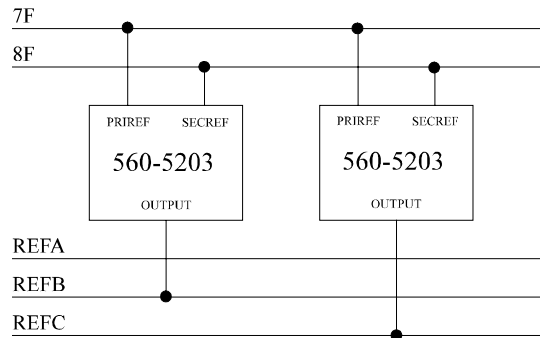
### INPUT MODE #1



### INPUT MODE #2



### INPUT MODE #3



## 2.4. FRONT PANEL LED

The Oscillator card has a bicolor RED/GREEN LED mounted to the front panel. This LED has the following states due to various fault conditions on the card:



SOLID RED represents a local power supply failure

BLINKING RED represents GPS faults (refer to the 560-5202 manual for possible GPS fault conditions). When the card is configured for Aux Ref mode only, this indication is not used.

BLINKING ORANGE = Aux Ref faults:

1. Primary Aux Ref source bad
2. Secondary (when enabled) Aux Ref source bad
3. PLL (on XL2) not locked. This PLL must be locked for Aux Ref Oscillator disciplining to occur.

SOLID ORANGE = No Aux Ref faults but the Oscillator has not locked to the external oscillator disciplining source.

GREEN (or OFF) = No Aux Ref faults and the Oscillator is locked to the external oscillator disciplining source. The GREEN LED enable switch "GRN" must be ON for the GREEN LED to illuminate. When the GREEN enable switch is OFF, the GREEN indication is replaced by LED OFF.

## 2.5. SETUP

The following setup applies to the 560-5203-1 card that is set to use Aux Ref mode to discipline the Oscillator. The setup involves selection of the Aux Ref operating mode (Reference or Input), secondary Aux Ref input enable/disable, the Oscillator output frequency, the backplane frequency bus to drive and the Green LED control switch.

Use steps 1 through 8 to perform the setup procedure.

- |                                     |              |               |
|-------------------------------------|--------------|---------------|
| 1. 560-5203-1 Required Settings     | SW1-5 thru 8 | (BRD0 - BRD3) |
| 2. Aux Ref mode (enable)            | SW2-2        | (AUX)         |
| 3. Operating Mode (Reference/Input) | SW2-3        | (REF/IN)      |
| 4. Secondary Aux Ref Input (ON/OFF) | SW2-4        | (SEN)         |
| 5. Timing Output Latch Enable       | SW2-7        | (#7)          |
| 6. Output Frequency (1, 5, 10 MHz)  | SW1-1 and 2  | (FRQ0 - FRQ1) |
| 7. Output Drive Select (REFA/B/C)   | SW1-3 and 4  | (DRV0 - DRV1) |
| 8. Green LED control                | SW2-8        | (GRN)         |

### 2.5.1.

560-5203-1 REQUIRED SETTINGS

SW1 positions 5, 6, 7 and 8 (BRD0, BRD1, BRD2, BRD3) sets the card type. This setting indicates what type of disciplined oscillator is used. SW1 MUST be set as follows:

Required Settings		
SW1-5	(BRD0)	ON
SW1-6	(BRD1)	OFF
SW1-7	(BRD2)	OFF
SW1-8	(BRD3)	OFF

2.5.2. AUX REF ENABLE

Set SW2-2 (AUX) ON to enable Aux Ref mode.

Aux Ref Enable		
SW2-2	(AUX)	ON

2.5.3. OPERATING MODE -- REFERENCE / INPUT

Set SW2-3 (REF/IN) for the desired operating mode -- Reference or Input. Reference mode is used for single 560-5203-1 Oscillator installations; Input mode is used when two 560-5203-1 Oscillators are installed. Note: Reference mode disciplining inputs are REFA / REFB; Input mode disciplining inputs are 7F / 8F.

Reference / Input mode (REF/IN)		
SW2-3	ON	Input
SW2-3	OFF	Reference

2.5.4. SECONDARY AUX REF SOURCE ENABLE

Use SW2-4 (SEN) to control whether a secondary Aux Ref disciplining source is to be used or not. NOTE: Reference mode secondary input = REFB; Input mode = 8F.

Secondary Aux Ref Source (SEN)		
SW2-4	ON	Enabled
SW2-4	OFF	Disabled

2.5.5. TIMING OUTPUT LATCH ENABLE

Use SW2-7 to latch the 1 PPS and IRIG B signals to the timing bus when GPS unlocks. Otherwise, these outputs are disabled when GPS is in unlocked status.

Timing Output Latch Enable (#7)		
SW2-7	ON	Enabled
SW2-7	OFF	Disabled

### 2.5.6. OUTPUT FREQUENCY SELECT (1, 5, 10 MHz)

Set SW1-1 and SW1-2 (FRQ0 and FRQ1) to select the Oscillator's output frequency. NOTE: When the Oscillator is operated using Reference mode, the Oscillator's output frequency must be set to match the REFA frequency.

Output Freq	10 MHz	5 MHz	1 MHz	0
SW1-1 (FRQ0)	ON	OFF	ON	OFF
SW1-2 (FRQ1)	OFF	ON	ON	OFF

### 2.5.7. OSCILLATOR DRIVE SELECT (REFA,B,C)

Set SW1-3 and SW1-4 (DRV0 and DRV1) to select which frequency bus to distribute the Oscillator output. NOTE: When using Reference mode, the driven output must be REFC.

Drive Select	REFA	REFB	REFC	0
SW1-3 (DRV0)	ON	OFF	ON	OFF
SW1-4 (DRV1)	OFF	ON	ON	OFF

### 2.5.8. GREEN LED CONTROL

Use SW2-8 (GRN) to control the front panel status LED. When the switch is ON, a GREEN LED indication is displayed when the Oscillator is locked to the Aux Ref source. When the switch is turned OFF, Oscillator lock is displayed as LED OFF.

Green LED Control (GRN)	
SW2-8 ON	GREEN
SW2-8 OFF	OFF

## 2.6. OPERATION

Upon installation, the Oscillator locks to the currently-highest priority (primary/secondary) disciplining reference. This occurs automatically after Oscillator power is cycled via hot swap or power-up. The process involves local oscillator warm-up and steering. Initial lock-up time, which varies with temperature, is typically <20 minutes. Prior to Aux Ref lock, the Oscillator output is enabled but the Oscillator FAULT is active (indicated by front panel LED = ORANGE). Once locked, the fault condition is deactivated (indicated by front panel LED = GREEN or OFF). If the disciplining reference is lost, the Oscillator flywheels at the current frequency.

## 2.7. HOT SWAPPING

All cards, input cables and output cables are hot swappable. It is not necessary to remove chassis power during insertion or removal. Hot swapping and reference-source changes are abrupt, the effects difficult to characterize; however, the system is designed to protect against permanent effects and minimize temporary effects of these events.

Adjacent-card hot swapping has a negligible effect on the Oscillator. The oscillator is highly-isolated from transient effects and the hot swapping event typically lasts less than one clock-period. The effect of redundant power supply switch-over is also negligible.

The effect of a reference-source change does not affect the Oscillator; however, it has varying effects on various function cards as discussed in specific manuals.

The disciplining reference input is delivered via backplane buses REFA, and REFB when operating using Reference mode or 7F (IN7 bus) and 8F (IN8 bus) when the 560-5203-1 is using Input mode. The Oscillator uses the currently-highest priority reference signal (REFA, 7F = primary and REFB, 8F = secondary) to discipline the local Oscillator. If a switch is made from the primary to the secondary input reference, the Oscillator locks to the new reference with negligible effect on the output frequency due to the long-term average that is made on the disciplining reference input frequency.

Hot swapping of an Oscillator affects the system in varying ways depending upon whether the Oscillator is configured to drive REFA, REFB, or REFC. These effects are discussed in individual card manuals. If the Oscillator that is being Hot swapped is the primary frequency source for the system (REFA), the user should use the REFB! or REFC! command (560-5179-1 Fault monitor CPU serial port) to temporarily switch the system frequency cards to a viable source. After the Hot swapped primary (REFA) oscillator card has locked, the user should restore the automatic frequency selection by using the REF command. Refer to the 560-5179-1 manual.

## 2.8. 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 a new card.

To remove a card, loosen the retaining hardware at the top and bottom of the assembly, then firmly pull on the handle at the bottom of the card. Slide the card out of the chassis. Refer to the SETUP section for any required switch settings or set them identically to the card being replaced. Reinstall the card by fitting it into the card guides at the top and bottom of the chassis and sliding it in slowly, avoiding contact between the bottom side of the card and the adjacent card front panel, until it mates with the connector. Seat the card firmly to avoid contact bounce. Secure the screws at the top and bottom of the card assembly.

## 2.9. DETAILED STATUS VIA CPU

The Fault Monitor CPU has access to detailed 560-5203-1 card status. When the CPU card provides the verbose mode serial report, fault status is available in a 2-byte format, with each binary nibble displayed as a hexadecimal (HEX) character. The 2-byte fault status has the following meaning:

nibble4				nibble3				nibble2				nibble1			
Card				Oscillator				GPS				Aux Ref			
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
Powercycle	spare (0)	spare (0)	spare (0)	Rb. Lockmon	Lock	PLL	Osc Tune	spare (0)	+5VMON	Receiver	Antenna	spare (0)	Secondary	Primary	Aux Ref

Each of the four nibbles is grouped by category for easy visual identification of an offending fault. All faults are asserted as a logic 1. The faults are latched on the Oscillator card and must be cleared by the 560-5179-1 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).

(Aux Ref) Nibble1 bit 0 -- Aux Ref:

Primary and if enabled, secondary disciplining source(s) not usable by the 87-902 XL2 card (oscillator disciplining card). This fault may be due to the external oscillator being off frequency or not connected.

(Aux Ref) Nibble1 bit 1 -- Primary:

The primary disciplining source is bad (frequency or amplitude).

(Aux Ref) Nibble1 bit 2 -- Secondary ("SEN" = ON):

When enabled, the secondary disciplining source is bad (frequency or amplitude).

(Aux Ref) Nibble1 bit 3 -- spare (0):

This bit is always 0.

(GPS) Nibble2 bits 0-3 -- Refer to the 560-5202 manual for GPS fault descriptions.

(Oscillator) Nibble3 bit 0 -- Osc Tune:

This fault is asserted when the tuning voltage for the disciplined local oscillator has nearly reached the maximum (or minimum) value. When this fault persists, the Oscillator card may need to be returned to the factory for calibration.

(Oscillator) Nibble3 bit 1 -- PLL:  
 The PLL on the 87-902 XL2 (oscillator disciplining card) is not locked. This PLL must be locked (no fault asserted) before the local oscillator can be disciplined to the external frequency reference (Aux Ref).

(Oscillator) Nibble3 bit 2 -- Lock:  
 This fault is asserted when the local oscillator is not locked.

(Oscillator) Nibble3 bit 3 -- Rb. Lockmon:  
 This fault is available only on Oscillator cards that have a Rubidium local oscillator. This bit is always 0 on the 560-5203-1 card.

(Card) Nibble4 bit 0-3:  
 These three bits are always 0.

(Card) Nibble4 bit 3 -- Powercycle:  
 This bit is initially set when the Oscillator is powered-up and is immediately cleared (0 value) after the Fault Monitor CPU card detects the card.

The following is an example of a Fault Monitor CPU serial verbose mode report:

```

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 XL2 LOCAL OSC    FAULT 0407      Undefined        OK
4, Undefined                OK                Undefined        OK
(card slots 5 through 20 not shown)
  
```

Refer to card slot three. The 5203-1 is an abbreviation of the 560-5203-1 oscillator card. The fault status for this card (0407) represents the following:

<u>Bit Weight</u>	<u>Meaning</u>
1	Aux Ref (primary and secondary) sources bad
2	Primary reference bad
+4	Secondary reference bad
7	
0	GPS faults = none (or mode disabled)
4	Oscillator not locked
0	No Card type faults

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. All faults are asserted as a logic 1. The faults are latched on the Oscillator card and must be cleared by the 560-5179-1 Fault Monitor CPU "CL" command.

The machine report mode displays hexadecimal (HEX) characters like the verbose mode report. (Refer to the fault descriptions mentioned previously.) The following is an example of a Fault Monitor CPU serial machine mode report:

```

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 05 07 B0 51 00 00 00 00 00 00 02 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)

```

Example from card slot 3 above:

03	50	71	06	07	B0	51	00	00	00	00	00	00	02	00	00	00	00	00	00	00	00	00
card slot	card ID	fault byte1 (F1)	fault byte0 (F0)	SW1 switch status (S1)	SW2 switch status (S0)								status byte2 (S2)									

1. 560-5203-1 card ID: 0x5071
2. Fault byte1 (F1) description:

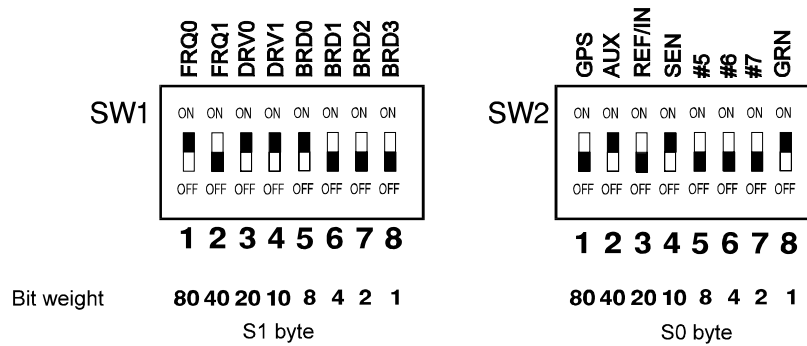
<u>bit</u>	<u>weight HEX</u>	<u>fault meaning</u>	<u>from example</u>
0	01	Osc Tune	00
1	02	PLL	02
2	04	Lock	04
3	08	Rb. Lockmon	00
4	10	always 0	00
5	20	always 0	00
6	40	always 0	00
7	80	Powercycle	<u>+ 00</u>
			06

3. Fault byte0 (F0) description:

<u>bit</u>	<u>weight HEX</u>	<u>fault meaning</u>	<u>from example</u>	
0	01	Aux Ref	01	
1	02	Primary	02	
2	04	Secondary	04	
3	08	always 0	00	
4	10	Antenna	00	GPS mode only
5	20	Receiver	00	GPS mode only
6	40	+5Vmon	00	GPS mode only
7	80	always 0	+ 00	
			<u>07</u>	

4. Status byte1 (S1) and status byte0 (S0) descriptions:

SW1 and SW2 switch status (settings) are displayed as four HEX nibbles. The switches are mapped to the machine report display in the following manner:



From the example:

$  \begin{array}{r}  \text{Status byte1} = 80 \\  \phantom{\text{Status byte1}} = 20 \\  \phantom{\text{Status byte1}} = 10 \\  + 08 \\  \hline  \text{B8}  \end{array}  $	$  \begin{array}{r}  \text{Status byte0} = 40 \\  \phantom{\text{Status byte0}} = 10 \\  \phantom{\text{Status byte0}} + 01 \\  \hline  51  \end{array}  $
--	--

5. Status byte2 (S2) description:

The least significant nibble of this byte includes 3 status bits.

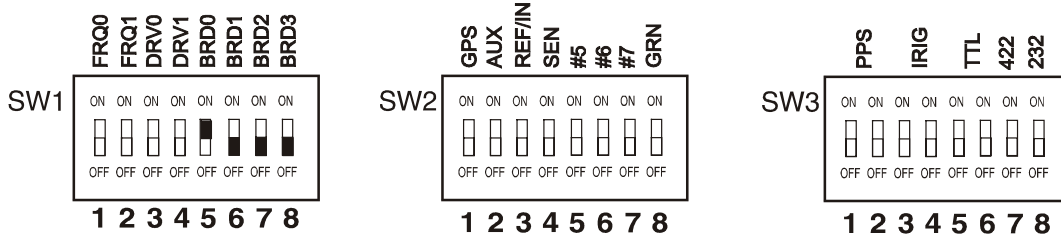
- Bit 0 = Oscillator has been locked to GPS = 1
- Bit 1 = The Oscillator has been locked (first time) = 1
- Bit 2 = GPS/AUX = 1 when using GPS to discipline the oscillator  
= 0 when using Aux Ref to discipline the oscillator
- Bit 4 = not used = 0

2.10.



# 560-5203-1 Switch Settings

(fill in the switch positions after configuring the card)



**Output Frequency Select – SW1-1,2 (FRQ0,FRQ1)**

- 10 MHz = 1 ON, 2 OFF
- 5 MHz = 1 OFF, 2 ON
- 1 MHz = 1 ON, 2 ON

**Output Drive Select – SW1-3,4 (DRV0,DRV1)**

- REFA = 3 ON, 4 OFF
- REFB = 3 OFF, 4 ON
- REFC = 3 ON, 4 ON

**GPS Mode – SW2-1 (GPS)**

- OFF = Disabled
- ON = Enabled

**Aux Ref Mode – SW2-2 (AUX)**

- OFF = Disabled
- ON = Enabled

**Operating Mode – SW2-3 (REF/IN)**

- OFF = Reference Mode
- ON = Input Mode

**Secondary Aux Ref control – SW2-4 (SEN)**

- OFF = Secondary Aux Ref Input Disabled
- ON = Secondary Aux Ref Input Enabled

**Timing Output Latch Enable – SW2-7 (#7)**

- OFF = Timing outputs will not latch
- ON = Timing outputs latch at GPS lock

**GREEN LED – SW2-8 (GRN)**

- OFF = No Green when locked
- ON = Green when locked

NOTE: SW3 selections only viable with GPS option.

## SECTION THREE

### 3. THEORY OF OPERATION

#### 3.1. GENERAL INFORMATION

This section contains a detailed description of the circuits in this card. These descriptions should be used in conjunction with the drawings in SECTION FOUR.

#### 3.2. CIRCUIT BOARD DESCRIPTION

The 560-5203-1 card is, in its simplest form, a disciplined oscillator whose disciplining frequency is provided by two separate frequency sources in such a way that no glitches are generated when either of the inputs are lost. The 560-5203-1 Oscillator uses an 87-902 card, which is piggybacked onto it, to provide the oscillator disciplining function.

#### 3.3. POWER SUPPLY

This card utilizes DC to DC Converters to provide the required voltages from the input 48 VDC. The power supplies are protected from overloads by a Polyswitch fuse device and a diode provides protection against polarity reversal of the input power. A PI section LC filter on the input of each converter reduces conducted emissions from the converters back into the mains. The input inductor and diode also minimize the effects of inrush current during hot-swapping. The output of each supply is filtered to reduce switching noise. The +12 VDC converter supplies +12V power and connects to a voltage inverter which provides -12V power.

#### 3.4. OSCILLATORS AND BUFFERS

The local oscillator is disciplined to the Aux Ref input frequency. Voltage comparators provide isolation, voltage gain, and level translation. The Aux Ref disciplining signal may be 1, 5, or 10 MHz, but the 87-902 card requires 1 MHz. The Aux Ref disciplining input is frequency detected automatically and a divider is employed to count 5 and 10 MHz down to 1 MHz. The 87-902 card provides a 10 MHz (XL10MHZ) output locked to the Aux Ref input. Again, a divider is employed to generate 1, 5 or 10 MHz (see OUTPUT FREQUENCY SELECT Section) for output via one of the three frequency signal buses FREQA/B/C (see OSCILLATOR OUTPUT DRIVE SELECT). A 1.5 second time delay network is used to hold off the application of this frequency to the selected frequency bus (after reset has stabilized during power up or during a hot swap event).

#### 3.5. FRONT PANEL STATUS LED

Refer to section 2.4, FRONT PANEL LED for possible indications. The bicolor LED is powered by the isolated 48 VDC that is the input power to

the card. The RED / GREEN LED is controlled by an optically isolated dual solid state relay. This LED control method allows the solid RED LED fault indication to occur when local card power is bad.

### 3.6. BACKPLANE FAULT OUTPUT

The Backplane FAULT output (/FLTOUT) is a bi-directional signal used by the Fault Monitor CPU in conjunction with BD7:0, DIR and /STB for bi-directional serial communications with fault detection and status/control logic within the Xilinx FPGA.

### 3.7. TIMING OUTPUTS

The 560-5203-1 Oscillator cards timing outputs, 1 PPS and IRIG-B AM signals are only available when the card has the GPS option (560-5202 card) installed. These signals are commanded OFF when the card is operated with only Aux Ref mode.

### 3.8. SERIAL PORT

The 560-5203-1 Oscillator cards serial port (RS-232 and RS-422) is only available with the 560-5202 GPS option card installed.

## **SECTION FOUR**

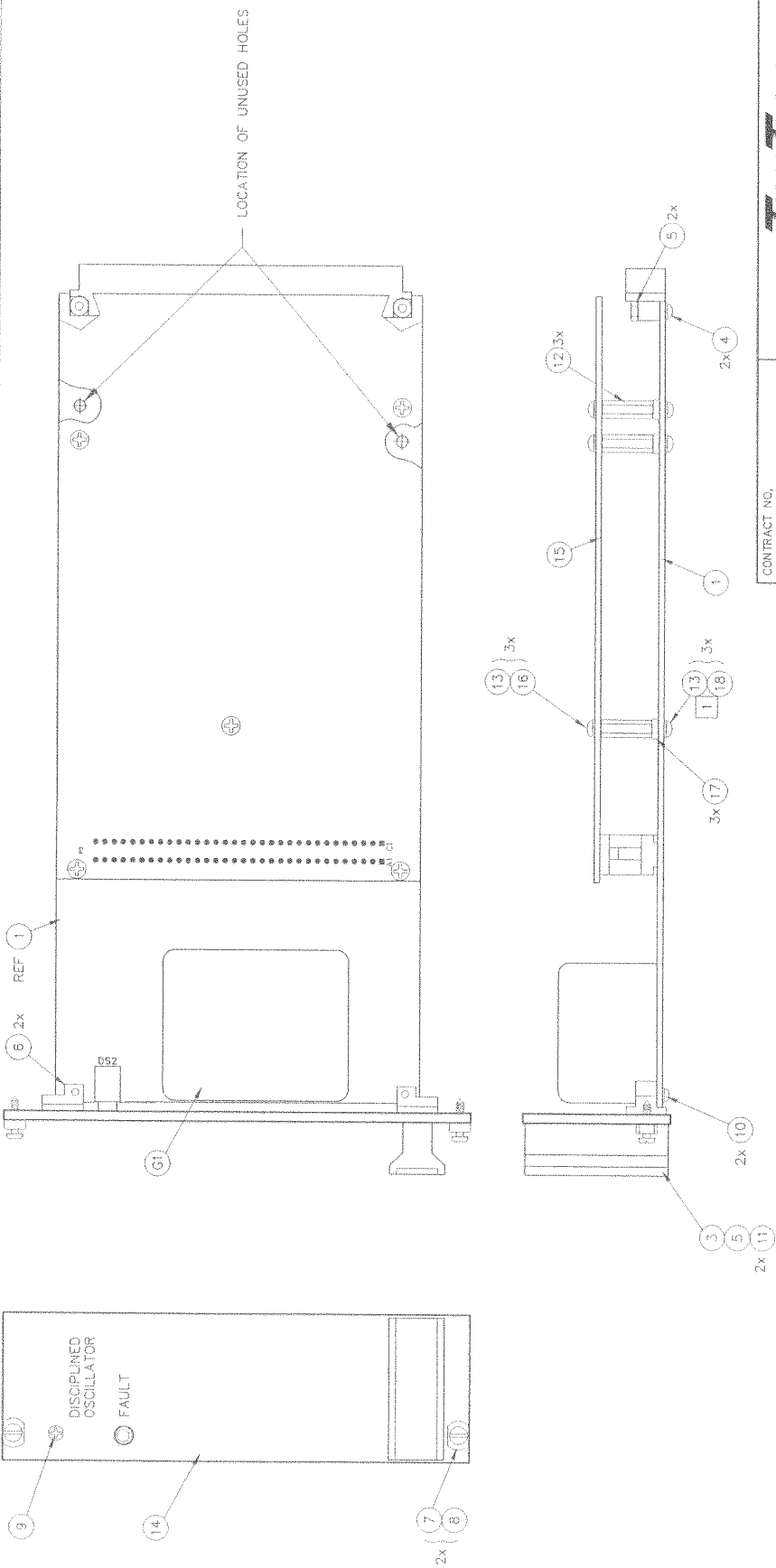
### 4. DETAILED DRAWINGS

4.1. 560-5203-1 DETAILED DRAWINGS / BILL OF MATERIALS

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REVISIONS

REV	DESCRIPTION	DATE	APPROVED
A	ADDED ITEMS 4 & 5	09/10/98	
B	CAR 1390	02/08/99	DR
C	SHOW UNUSED HOLES	08-03-00	RAY



CONTRACT NO.		DATE	
APPROVALS		5/98	
DRAWN BY KOLLANDER		DR	
CHECKED BY		2/99	
APPROVED BY		DR	
NEXT ASSY		DRAWING NO.	
SIZE		B	
CODE		560-5203-1	
IDENT NO.		REV	
SCALE		NONE	
SHEET		1 OF 1	

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 2835 Duke Ct. Santa Rosa, CA 95407

FINAL ASSY  
 OSC (OVENIZED)

FILENAME: \560\5203-1  
 DATE: 08-03-00

1 SECURE SCREWS USING LOCTITE (ITEM 18).  
 NOTES: UNLESS OTHERWISE SPECIFIED.

**ORIGINAL**

Parent Item	Component Item	Parent Description	Component Description	Batch Quantity	Quantity Per	Bubble			Level	Ty	Seq	T	Effective	
						UM	Seq No	Remarks					From	Thru
						EA	M	Rev	560-5203-1	S	2.0	M	1/1/00	12/31/10
560-5203-1	0000-PL	ASSY 56K OSC (OVENIZED)	PARTS LIST REV LEVEL	1.00	EA	EA	M	REV C (09-12-00)	1	S	2.0	M	1/1/00	12/31/10
0000-PRINT		REFERENCE PRINT		1.00	EA	EA	M	560-5203-1 REV C	1	S	3.0	M	1/1/00	12/31/10
182-8011		EPROM PROGRAMMING		1.00	EA	EA	M	DOWNLOAD TO XL2	1	S	4.0	M	1/1/00	12/31/10
223-008		HANDLE FOR 3U X 8HP		1.00	EA	EA	P		1	S	5.0	P	1/1/00	12/31/10
223-138		SCREW SH CH ZN M2.5X10		2.00	EA	EA	P		1	S	6.0	P	1/1/00	12/31/10
223-144		NUT M2.5		3.00	EA	EA	P		1	S	7.0	P	1/1/00	12/31/10
223-181		HOLDER (PB) DIE CAST		2.00	EA	EA	P		1	S	8.0	P	1/1/00	12/31/10
223-379		SCREW CAP NP M2.5 X 11		2.00	EA	EA	P		1	S	9.0	P	1/1/00	12/31/10
223-464		SLEEVE, STAINLESS		2.00	EA	EA	P		1	S	10.0	P	1/1/00	12/31/10
223-500		SCREW PH FH NP M2.5X10		1.00	EA	EA	P		1	S	11.0	P	1/1/00	12/31/10
240-004-002		SCREW PH PN SS 4-40X1/4		6.00	EA	EA	P		1	S	12.0	P	1/1/00	12/31/10
249-005		SCREW M2.5 X 8		2.00	EA	EA	P		1	S	13.0	P	1/1/00	12/31/10
249-007		SCREW SH CH ZN M2.5X12		2.00	EA	EA	P		1	S	14.0	P	1/1/00	12/31/10
253-004		REPLACED BY 253-004S		3.00	EA	EA	P		1	S	15.0	P	1/1/00	12/31/10
254-.312		WSHR SPLIT #4 SS		3.00	EA	EA	P		1	S	16.0	P	1/1/00	12/31/10
255-004-005S		SPACER HEX F-F 4-40X5/8		3.00	EA	EA	P		1	S	17.0	P	1/1/00	12/31/10
282-001		SEALANT 10 MIL		.01	EA	EA	P		1	S	18.0	P	1/1/00	12/31/10
345-058		OSC 10MHZ OCXO		1.00	EA	EA	P	G1 (ON 87-902)	1	S	19.0	P	1/1/00	12/31/10
560-1245		PANEL FRONT OSC (HISTAB)		1.00	EA	EA	P		1	S	20.0	P	1/1/00	12/31/10

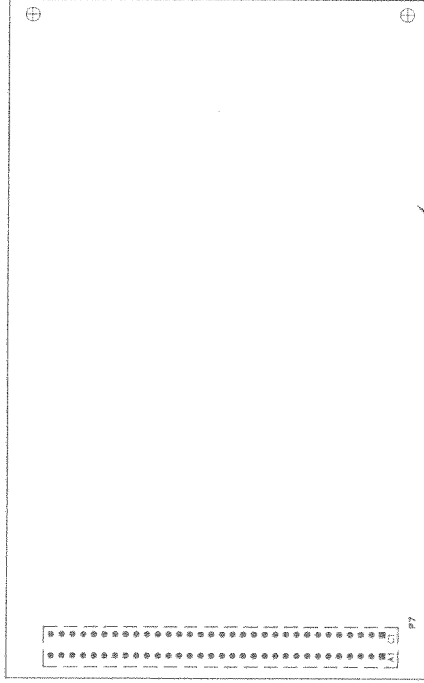
Parent Item	Parent Description	Batch Quantity	UM	Bubble	Effective
Component Item	Component Description	Quantity Per		Seq No	Thru
560-5203	ASSY 56K GPS (MOTHER)	1.00	EA	1	12/31/10
560-5203-1-OSV	ASSY 56K OSC (OVENIZED) - OSV	1.00	EA		12/31/10
87-902	FINAL ASSY GPS-XL2(F	1.00	EA	15	12/31/10

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REVISIONS

REV	DESCRIPTION	DATE	APPROVED



1 INSTALL ITEM 2 ON BOTTOM OF BOARD WITH PIN 32 IN PIN 1.

NOTES: UNLESS OTHERWISE SPECIFIED.

CONTRACT NO.

APPROVALS	DATE
DRAWN BY RNR	05/98
CHECKED BY [Signature]	
APPROVED BY [Signature]	4/98

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FINAL ASSEMBLY  
GPS-XL2 (56K)

SIZE	CODE IDENT NO.	DRAWING NO.	REV
B		87-902	N/C
SCALE NONE			SHEET 1 OF 1

FILENAME: 87\87-902  
DATE: 09-24-98



MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

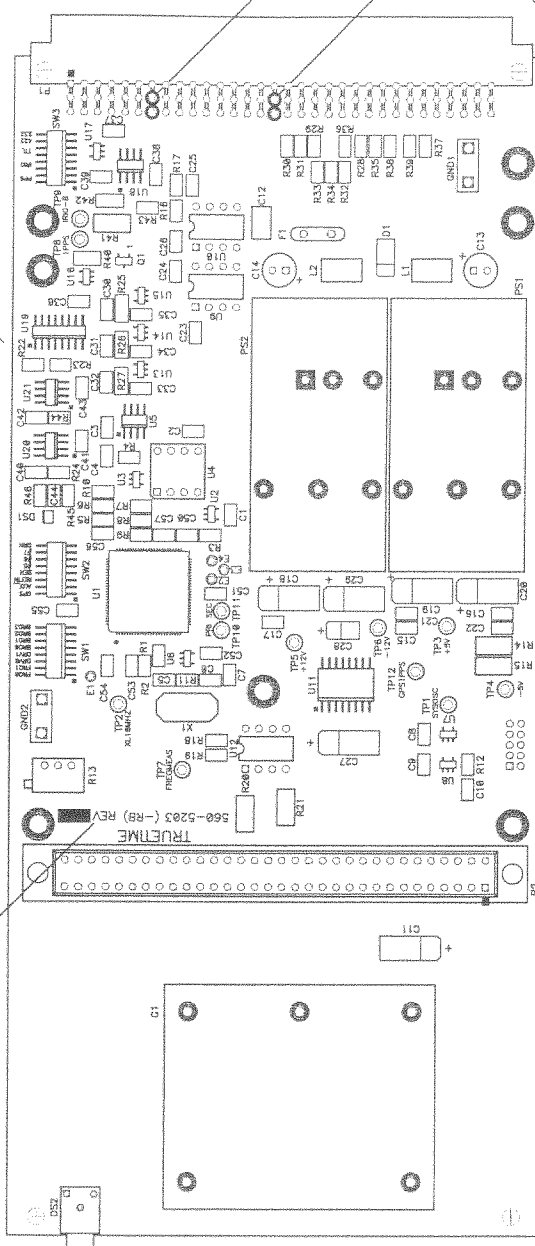
PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
87-902	FNL ASSY GPS-XL2(FOR 56K)					EA	
0000-APPROVAL	PARTS LIST APPROVAL		0000		1.0000	EA	<i>KKK / DC 7 / 98</i>
0000-PL	PARTS LIST REV LEVEL		0000		1.0000	EA	REV N/C (05-21-98)
0000-PRINT	REFERENCE PRINT		0000		1.0000	EA	87-902 REV N/C
372-64PI	CONN 64-P ML INVERSE DIN	T&B 211-96450-6008	0000		1.0000	EA	02
86-902	ASSY GPS-XL2 (FOR 56K)	MADE FROM 085-900	0000		1.0000	EA	01
LA	LABOR ASSEMBLY COST HRS		0000		0	EA	
LT	LABOR TEST COST HOURS		0000		0	EA	

REVISIONS		DATE	APPROVED
LIR	DESCRIPTION	06-25-98	
92	CORRECTED DS1 PIN SPACING, MODIFIED CIRCUITRY	02-09-99	KEL / SAC
A	MODIFIED PER ECO #1187		

NOTES: UNLESS OTHERWISE SPECIFIED

1. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 421-11.
2. RESISTOR VALUES IN OHMS, CAPACITORS IN MICRO FARADS.
3. POLARIZED CAPACITORS ARE SHOWN WITH A ROUNDED EDGE INDICATING THE POSITIVE SIDE.

**A** STAMP 560-5203 (-RE) PCB ASSEMBLY REVISION LEVEL



TOP SIDE

PLACE FERRITE BEADS AROUND CONNECTOR LEADS BEFORE SOLDERING TO PC BOARD

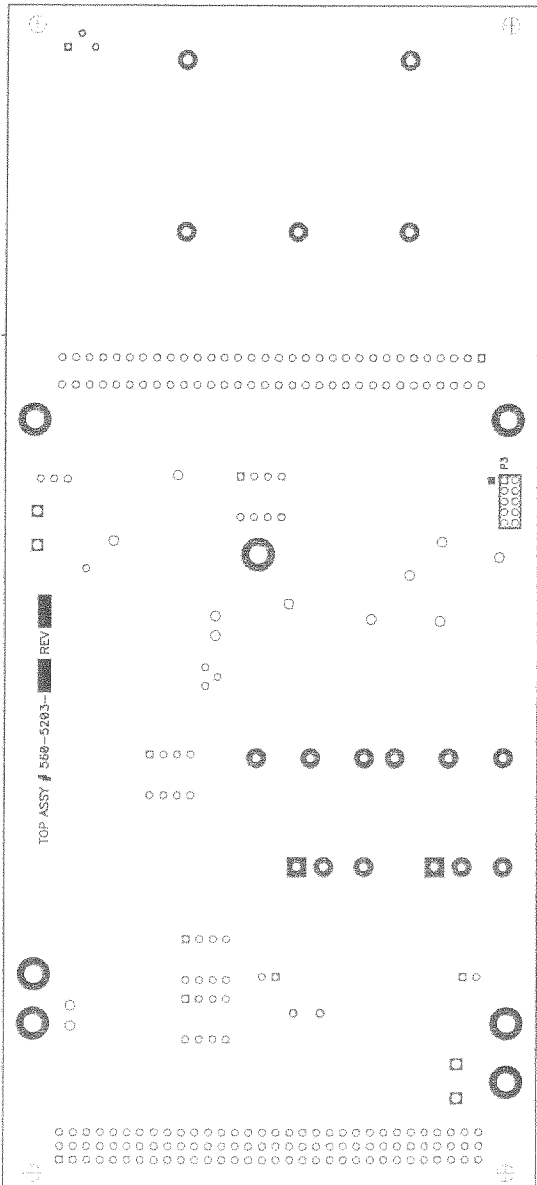


CONTRACT NO.	56000 XL2 MOTHERBOARD
APPROVALS	ASSEMBLY DRAWING, TOP SIDE
DRAWN BY	B.A.S.
CHECKED	KEL
APPROVED	KEL
DATE	05-19-98
Size	B
Number	560-5203
Rev	A
Date	Mon Feb 08, 1999 14:08:57
Drawn by	B.A.S.
Filename	2203-02.PCB
Sheet	1 of 5

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A B C D

1 2 3 4



BOTTOM SIDE



Title	56000 XL2 MOTHERBOARD ASSEMBLY DRAWING, BOTTOM SIDE		
Size	B	Number	560-5203
		Rev	A
Date	Mon Feb 08, 1999 14:09:58	Drawn by	B.A.S.
Filename	2203-02.PCB   Sheet 2 of 5		

A B C D

1 2 3 4

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
560-5203	ASSY 56K GPS (MOTHER)	MADE FROM 560-2203				EA	
0000-APPROVAL	PARTS LIST APPROVAL		000000		1.0000	EA	<i>02 2/99</i>
0000-PL	PARTS LIST REV LEVEL		000000		1.0000	EA	REV A (02-08-99)
0000-PRINT	REFERENCE PRINT		000000		1.0000	EA	560-5203 REV A
0000-REV	PCB REV LEVEL HERE >>>>		000000		1.0000	EA	560-2203 REV 02
002S-220	RES 22 OHM 1/4W 1206	NIC NRC25R220TR	000000		5.0000	EA	R25-27,40,42
003S-1000	RES 100 OHM 1/2W 1% 2010	DALE CRCW20101000FTR	000000		2.0000	EA	R14,15
003S-39R0	RES 39 OHM 1/2W 5% 2010	KOA RM73B2H390JP	000000		1.0000	EA	R41
003S-6801	RES 6.8K OHM 1/2W 5% 2010	KOA RM73B2H682JP	000000		2.0000	EA	R20,21
008S-101	RES 100 OHM 1/8W 0805 5%	NIC NRC12R101TR	000000		1.0000	EA	R10
008S-103	RES 10K OHM 1/8W 0805 5%	NIC NRC12R103TR	000000		2.0000	EA	R16,46
008S-104	RES 100K OHM 1/8W 1% 0805	NIC NRC12R104FTR	000000		2.0000	EA	R12,45
008S-105	RES 1 MEG 1/8W 0805 5%	NIC NRC12R105TR	000000		1.0000	EA	R11
008S-121	RES 120 OHM 1/8W 0805 5%	NIC NRC12R121TR	000000		1.0000	EA	R17
008S-122	RES 1.2K OHM 1/8W 0805 5%	NIC NRC12R122TR	000000		2.0000	EA	R22,23
008S-222	RES 2.2K OHM 1/8W 0805 5%	NIC NRC12R222TR	000000		11.0000	EA	R28-38
008S-471	RES 470 OHM 1/8W 0805 5%	NIC NRC12R471TR	000000		3.0000	EA	R2,18,19
008S-472	RES 4.7K OHM 1/8W 0805 5%	NIC NRC12R472TR	000000		8.0000	EA	R3-9,43
008S-473	RES 47K OHM 1/8W 0805	NIC NRC12R473TR	000000		1.0000	EA	R39
023-010-100	CAP AE 10UF 100V R	PANASONIC ECE-A2AU100	000000		2.0000	EA	C13,14
036S-NP0102	CAP .001UF NPO 100V 0805	NIC NMC0805NP0102J100TR	000000		5.0000	EA	C15-17,21,22
036S-NP0200	CAP 20PF NPO 100V 0805 5%	NIC NMC0805NP0200J100TR	000000		2.0000	EA	C5,6
036S-NP03R30	CAP 3.3PF NPO 100V 0805	NIC NMC0805NP03R30J100TR	000000		2.0000	EA	AT LOCATION R24,R44
036S-X7R104	CAP .1UF X7R 100V 1210	NIC NMC1210X7R104K100TR	000000		1.0000	EA	C12
036S-X7R104-50	CAP .1UF X7R 50V 0805 10%	NIC NMC0805X7R104K50TR	000000		34.0000	EA	
	C1-4,7-10,23,24,26,30-44,50-57						
036S-X7R223	CAP .022UF X7R 50V 0805	NIC NMC0805X7R223K50TR	000000		1.0000	EA	C25
037S-106	CAP 10UF 25V 7343 10%	NIC NTC-T106K25TRD	000000		2.0000	EA	C18,27
037S-107	CAP TANT 100UF 16V 7343	AVX TPSE107K016R0125	000000		2.0000	EA	C11,29
037S-225	CAP 2.2UF 16V 3528	NIC NTC-T225K16TRB	000000		1.0000	EA	C28
037S-686	CAP 68UF 6.3V 7343	NTC-T686K63TRD-BOM NAV	000000		2.0000	EA	C19,20
041-000	FERRITE BEAD	FAIR-RITE 2661000101	000000		4.0000	EA	12
045S-1.8	INDUCTOR 1.8UH 1812	TDK NLC1812-1R8K	000000		2.0000	EA	L1,2
057S-4002	DIODE 4002	ROHM RLR4002	000000		1.0000	EA	D1
058-027	LED RED/GREEN	DIALIGHT 550-3505	000000		1.0000	EA	DS2
058S-001	LED RED X SML W RES SFMT	HP HLMP6600-012	000000		1.0000	EA	DS1
059S-20000	XTAL 20.000 MHZ	MPC SM-65N1B2E-20.000MHZ	000000		1.0000	EA	X1
065S-005	SWITCH DIP 8 HALF PITCH	AUGAT GDH08S	000000		3.0000	EA	SW1-3
174S-XC5204V	XILINX XC5204V FPGA	XILINX XC5204-6VQ100C	000000		1.0000	EA	U1
175S-J177	TRANSISTOR J177 SOT-23	MOTOROLA MMBFJ177L	000000		1.0000	EA	Q1
176-75155P	UART TRANSCEIVER RS-232	TI #SN75155P	000000		1.0000	EA	U9
176-75179PB	UART TRANSCEIVER RS422	TI #SN75179PB	000000		1.0000	EA	U10
176-LH1512	1 NC 1 NO SSR	SIEMENS LH1512AB	000000		1.0000	EA	U12
176S-BUF634U	HIGH SPEED BUFFER	BURR-BROWN BUF634U (S08)	000000		1.0000	EA	U18
176S-LT1016	LT1016 (8SO)	LINEAR TECH LT1016CS8	000000		2.0000	EA	U20,21

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
176S-LT1054	LT1054 (16SOL)	LINEAR TECH LT1054CS	000000		1.0000	EA	U11
176S-MC34064	UNDER VOLTAGE SENSING CKT	MC34064DM (SEE BOM NAV)	000000		1.0000	EA	U5
178-17C128	FPGA CONFIG EEPROM	ATMEL AT17C128-10PC	000000		1.0000	EA	U4 SOCKETED
178S-74AHC1G04	SINGLE INVERTER	TI SN74AHC1G04DBVR	000000		3.0000	EA	U2,3,7
178S-74AHC1GU04	SINGLE UNBUFFERED INVERTR	TI SN74AHC1GU04DBVR	000000		2.0000	EA	U6,8
178S-HC4053D	ANALOG MUX, 2CHX3	MOT MC74HC4053D (NARROW)	000000		1.0000	EA	U19
178S-NC7SZ126	UHS BUFFER 3-STATE OUTPUT	NATL NC7SZ126M	000000		5.0000	EA	U13-17
184-063	XILINX GPS 56K		000000		1.0000	EA	FOR U4
273-009	TERMINAL TEST POINT	COMP CORP PJ-201-25	000000		2.0000	EA	GND1,GND2
273-015	TERM TEST POINT (WHITE)	COMP. CORP TP-104-01-09	000000		12.0000	EA	TP1-12
355-BXA10-1	DC-DC 18-75VIN +5/-5 OUT	CPI BXA10-48D05	000000		1.0000	EA	PS1
355-UWR-12	DC-DC 18-72VIN +12V OUT	DATL UWR-12/750-D48	000000		1.0000	EA	PS2
363-0.9LV	POLYSWITCH 0.9A (60 VOLT)	RAYCHEM RXE090	000000		1.0000	EA	F1
372-64PC	CONN 64-P C-DIN	T&B 162-96450-7058	000000		1.0000	EA	P2
372-96P	CONN,96-P ML DIN RT ANGLE	BERG 70077-027	000000		1.0000	EA	P1
379-008	SOCKET IC 8 PIN MACHINE	ROB. NUGENT ICA-083-STG	000000		1.0000	EA	FOR U4
560-2203	PCB 56K GPS (MOTHER)	FAB	000000		1.0000	EA	01
LA	LABOR ASSEMBLY COST HRS		000000		0	EA	
LT	LABOR TEST COST HOURS		000000		0	EA	
NOTE 1			000000		1.0000	EA	
	DO NOT INSTALL: R1,R13,G1,P3						
OSV560-5203	OUTSIDE LABOR 560-5203	PCA	000000		1.0000	EA	