TRUETIME

Model 560-5187-3
Oscillator I/O / Frequency Reference Input Module Manual

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SECTION ONE

1. FUNCTIONAL DESCRIPTION

1.1. PURPOSE OF EQUIPMENT

The TrueTime Model 560-5187-3 Oscillator I/O / Frequency Reference Input Module provides an input/output interface, via a Male DB-9 connector (labeled Oscillator I/O), between the 560-5203-X Disciplined Oscillator Series and the user. The use of these signals is described in the manual section for the compatible oscillator.

The card provides an AC-coupled, controlled impedance input interface to the backplane signals IN7 and IN8. The signal IN7 is accessed via the BNC connector labeled 7F. The signal IN8 is accessed via the BNC connector labeled 8F. These signals can be used as frequency reference inputs by any card that accesses a frequency reference via IN7 and/or IN8.

This card can be used for the Disciplined Oscillator I/O and for reference input only.

1.1.1. PHYSICAL SPECIFICATIONS

Dimensions:	0.8”w X 4.4”h X 5.0”d (2 cm X 11 cm X 13 cm)
Weight:	Approximately ½ pound (¼ kg)

1.1.2. ENVIRONMENTAL SPECIFICATIONS

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

1.1.3. POWER REQUIREMENTS

Power:	None

1.1.4. OSCILLATOR INPUT/OUTPUT

Connector Type: DB-9M

Connector Pinout:

Pin 1:	Not Used		
Pin 2:	RXD / RS-232 In	Pin 6:	RIN- / Differential- In
Pin 3:	TXD / RS-232 Out	Pin 7:	RIN+ / Differential+ In
Pin 4:	Not Used	Pin 8:	TOUT- / Differential- Out
Pin 5:	SIGNAL GND	Pin 9:	TOUT+ / Differential+ Out

1.1.5. FREQUENCY REFERENCE INPUTS 7F AND 8F

Connector Type:	BNC
Input Impedance:	50 ohms
Coupling:	AC-coupled
Signal Type:	1, 5 or 10 MHz as specified for card(s) using signal.

1.1.6. CARD COMPATIBILITY

Location:	Slots 1-5 with compatible card in front slot.
Compatibility:	See Card Compatibility Matrix.

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.

2.2. 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 slowly, avoiding contact between bottom side of card and adjacent card front panel, 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

This card has no setup requirements. However, for proper use the backplane terminators and cards using these signals **must** be setup properly. See chassis manual for setting backplane terminators. See appropriate card manual for setup of cards using these signals.

2.4. FAULT INDICATION

This card has no fault indication.

2.5. MAINTENANCE

This card has no maintenance requirements.

SECTION THREE

3. THEORY OF OPERATION

3.1. GENERAL INFORMATION

This section contains a detailed description of the circuits in the Oscillator I/O Module. These descriptions should be used in conjunction with the drawings in SECTION FOUR.

3.2. HARDWARE DESCRIPTION

The Module incorporates various connectors and comes in various configurations controlled by component installation. Use the Bill of Materials in conjunction with the Schematic to determine the exact configuration of this version.

The DB-9M connector, J5, supports RS-232 and differential communications to/from the Disciplined Oscillator Series.

The two Frequency Reference Signal inputs are supported via BNC connectors J3 and J4, which drive reference IN 7 and 8, respectively. These signals are distributed via 50 ohm traces. On the backplane, they are terminated at Slot 17 with 50 ohm termination resistors. As a result of this architecture, this card must be located at or near Slot 1 with all input signal users located in higher slots.

If a second I/O card is installed, its reference inputs should not be used as the card will be too far from the optimal Slot 1. The I/O card nearest Slot 1 should be used for reference IN 7F and 8F.

3.3. SERIAL INTERFACE

The user serial port can be connected to a terminal or computer. These instructions assume that a terminal is connected. The serial connection, data format and Functions are explained in the following section.

3.3.1. RS-232/RS-422 CONNECTION

The male 9-pin D connector (DB-9P) mounted to the 560-5187-3 panel is the Oscillator user port. Refer to manual SECTION ONE for the pinout and protocol of this port.

3.3.2. SERIAL FUNCTION LIST

Initially at power-up, the serial port may not respond until it receives a control-C character (HEX 03). Then any of the following commands may be used:

COMMAND	FUNCTION
F18	Software Version Request
F71	Oscillator Statistics Request
F72	Fault Status
F73	Request Alarm Status

These functions provide data about the function of the oscillator directly ahead of the 560-5187-3 card only. GPS receiver warnings and parameters should be ignoredwhile using the 560-5187-3, as both a GPS receiver card and a 560-5187-3 can NOT be installed behind the same oscillator.

3.3.3. GENERAL INPUT AND OUTPUT FORMAT

Data may be sent to or requested from the Serial port by using various function commands and ASCII character strings. In general those functions which request status or data fit the form:

F<FUNC#><CR>

where

F	=	ASCII character F or f
<FUNC>	=	two-digit function number
<CR>	=	ASCII carriage return character (Hex 0D)

The format for both data input and data output strings is:

F<FUNC#>[<SEP><FIELD>]<LT>

where

F	=	ASCII character F or f
<FUNC>	=	function number
<SEP>	=	one or more separator characters: either space, comma or tab
<FIELD>	=	data entry or request
<LT>	=	line terminator, either a carriage return and line feed for output strings or a carriage return only for input strings
[ ]	=	encloses a phrase that is repeated as often as necessary

Output strings from the Serial port are kept to fixed lengths whenever possible. This means that numeric values will often contain many leading

blanks. Numeric values are right justified so that the least significant digit is always in the same position in the string. Quantities that can be positive or negative will have a sign even if positive. This is done to simplify the task of programming computer systems that receive the data. The formats of the output strings are designed so that it is possible to request the state of a function and save the response string. Later that string can be sent to the unit to restore the original state of that function.

Input strings sent to the unit may be of variable length. The number of separators between fields may be varied. Numeric values may be entered with or without leading zeros. Where a sign is allowed, it may be omitted for positive quantities. String fields (such as "on" or "off") may be entered in upper or lower case, as can the "F" that starts all Serial commands. All commands may be ended with a carriage return alone or by a carriage return line feed combination. Some fields of some commands are optional, and may be replaced by a semicolon. If a field is so replaced, the corresponding value will be left unchanged.

Incorrect entry may result in an error message as described under "SERIAL ERROR MESSAGES" in this section. Correct entries are acknowledged with OK<CR><LF>.

3.3.4. SERIAL ERROR MESSAGES

The Serial port will respond with the message "ERROR 01 VALUE OUT OF RANGE" if the input string was in the correct format but contained a value, probably numeric, that was out of the range of acceptable values. Refer to the paragraphs explaining the function in use for the correct range of values.

3.4. SERIAL FUNCTION DESCRIPTIONS

3.4.18 SERIAL FUNCTION F18 - SOFTWARE VERSION REQUEST

Use Serial Function F18 to obtain information about the current version of the software installed in the unit.

Send the string:

F18<CR>

The unit will respond with a string no longer that 80 characters.

Example:

TRUETIME Mk III sys ver 2.002 GPS-XL2 ver 8010v001<CR><LF>

This string indicates that the system software is version 2.002, and the time and frequency module-specific software is 8010v001.

3.4.71 SERIAL FUNCTION F71 OSCILLATOR STATISTICS REQUEST

Use Serial Function F71 to request the local oscillator's phase, frequency offset, drift rate and DAC value. The phase is the instantaneous error in seconds between the oscillator and the control loop zero servo point. The frequency offset is computed using an averaging time that is equal to the effective averaging time of the oscillator controller. The oscillator drift rate is computed using a 24 hour average and is the daily drift rate of the oscillator. The oscillator DAC value is the signed 16 bit integer which controls the DAC output voltage. It ranges from 32767 to -32768. Send the string F71<CR> to the Serial port and it will respond with the continuous string:

F71<SP>phase=<SIGN><MULT>E<SIGN><EXP><SP>s<SP><SP>offset=
<SIGN><MULT>E<SIGN><EXP><SP><SP>drift=<SIGN><MULT>E<SIGN>
<EXP>/DAY<SP><SP>DAC=<SIGN><INT><CR><LF>

where

F	=	ASCII character F
71	=	function number
<SP>	=	ASCII space character
<MULT>	=	multiplier, 4 digits with decimal point
E	=	ASCII character E for exponent
s	=	ASCII character s for seconds abbreviation
<SIGN>	=	- for negative or <SP> for positive
<EXP>	=	2 digit exponent
/DAY	=	ASCII characters, units of drift rate
<INT>	=	integer, 5 digits
<CR>	=	carriage return
<LF>	=	line feed

Sample request: F71<CR>
Response: F71 phase=-5.678E-09 s offset=-1.986E-07
drift= 6.013E-08/DAY DAC=-24567<CR><LF>

3.4.72 SERIAL FUNCTION F72 - FAULT STATUS

This function provides the current status of the basic faults in the GPS/Oscillator sub-systems. Currently, the status of the antenna, PLL synthesizer lock status and the GPS lock status are the only such faults being monitored. When the 560-5203-X is operated in GPS mode, the faults indicated here are reported to the 560-5179-1 Fault Monitor CPU card.

Send the string F72<CR> and the serial port will respond:

F72<SEP>Antenna: <ANT STATUS> PLL: <PLL STATUS> GPS: <GPS STATUS><CR><LF>

where

F	=	ASCII character F
72	=	function number
<SEP>	=	one or more separator characters: either space, comma or tab
<ANT STATUS>	=	OK, OPEN or SHORT
<PLL STATUS>	=	OK, UNLOCKED
<GPS STATUS>	=	LOCKED, UNLOCKED
<CR>	=	ASCII carriage return character
<LF>	=	ASCII line feed character

3.4.73 SERIAL FUNCTION F73 - REQUEST/SET ALARM STATUS/CONTROL

This function allows the user to control which conditions will signal an alarm through serial port interrogations of the GPS/Oscillator sub-assembly. The fault status flags can be read by the following command, regardless of whether the faults are enabled or not:

F73<CR>

which returns:

F73<SP>S12345678<SP>M12345678<SP>m12345678<CR><LF>

where:

F	=	ASCII character F	
7	=	ASCII character 7	
3	=	ASCII character 3	
<SP>	=	ASCII space character	
S	=	'S'	Status delimiter
1	=	'L'	Satellite Lock OK
		'U'	Unlock Spec Reached
2	=	'A'	Position Accurate, Full Accuracy and Stability When Locked

		'B'	Position Approximate, Slightly Degraded Accuracy and Stability When Locked
		'C'	Position Unknown, Highly Degraded Accuracy and Stability, Not Locked
		'D'	Position and Time Unknown, Not Locked
3	=	'A'	Auto Mode
		'T'	Time Mode
		'S'	Survey Mode
		'D'	Differential Mode (Special Option)
4	=	'0'	Number of Current Satellites used through '6'
5	=	'N'	No timing source
		'G'	GPS is timing source
		'F'	AUX REF is timing source
6	=	'-'	Currently not used
7	=	'-'	Currently not used
8	=	'-'	Currently not used
M	=	'M'	Major Alarm delimiter
1	=	'-'	PLL Synthesizer OK
		'P'	PLL Synthesizer Unlocked
2	=	'-'	Antenna OK
		'O'	Antenna Open
		'S'	Antenna Short
3	=	'-'	Receiver OK
		'R'	Receiver Fault
4	=	'-'	EEPROM Data OK
		'N'	EEPROM Data Fault
5	=	'-'	The minor alarm, 'Time Error Threshold Reached', has not persisted for Timeout seconds.
		'U'	The minor alarm, 'Time Error Threshold Reached', has persisted for Timeout seconds.
6	=	'-'	Currently not used
7	=	'-'	PLL AuxIntOsc OK (TCXO version only)
		'p'	PLL AuxIntOsc unlocked (TCXO version only)
8	=	'-'	Currently not used
m	=	'm'	Minor Alarm delimiter
1	=	'-'	Time Error Threshold Not Reached
		'U'	Time Error Threshold Reached
2	=	'-'	Tracking OK
		'T'	Not Tracking Satellites
3	=	'-'	Oscillator Tuning Voltage OK
		'X'	Oscillator Tuning Voltage Requires Adjustment
4	=	'-'	Not used
5	=	'-'	Unit has locked at least once.

		‘a’	Unit has not locked since power on but is still within the user defined power-on time-out.
		'A'	Initial Acquisition Mode, unit has not yet locked since power on.
6	=	'-'	Aux Ref source OK
		‘R’	Aux Ref source bad / not connected
7	=	'-'	Currently not used
8	=	'-'	Currently not used
<CR>	=		ASCII carriage return character
<LF>	=		ASCII line feed character

Sending

F73<SP>LATCH<CR>

will return

F73<SP>LATCH<SP>M12345678<SP>m12345678<CR><LF>

which shows the latched faults, if any, which have occurred since the last time that the latch was cleared. These may or may not continue to be present in the non-latched indications.

Sending

F73<SP>CLEAR<SP>ALARM<SP>LATCH<CR>

will clear the latched fault indicators.

The user can query or control which faults affect the alarm output by the following commands. When setting the mask, the letter 'E' enables the fault, the letter 'D' disables it, and a '-' leaves it unchanged.

Sending

F73<SP>MASK<CR>

returns:

F73<SP>MASK<SP>M12345678<SP>m12345678<CR><LF>

Sending

F73<SP>MASK<SP>M12345678<SP>m12345678<CR>

sets the alarm mask where the mask characters are:

M	=	'M'	Major Alarm delimiter
1	=	'E'	PLL Synthesizer Alarm Enabled
		'D'	PLL Synthesizer Alarm Disabled
2	=	'E'	Antenna Alarm Enabled
		'D'	Antenna Alarm Disabled
3	=	'E'	Receiver Alarm Enabled
		'D'	Receiver Alarm Disabled
4	=	'E'	EEPROM Data Alarm Enabled
		'D'	EEPROM Data Alarm Disabled
5	=	'E'	The minor alarm, 'Time Error Threshold Reached', has persisted for Timeout seconds, Alarm Enabled
		'D'	The minor alarm, 'Time Error Threshold Reached', has persisted for Timeout seconds, Alarm Disabled
6	=	'-'	Currently not used
7	=	'E'	PLLAuxIntOsc Alarm Enabled (TCXO version only)
		'D'	PLLAuxIntOsc Alarm Disabled (TCXO version only)
8	=	'-'	Currently not used
m	=	'm'	Minor Alarm delimiter
1	=	'E'	Time Error Threshold Reached Alarm Enabled
		'D'	Time Error Threshold Reached Alarm Disabled
2	=	'E'	Tracking Alarm Enabled
		'D'	Tracking Alarm Disabled
3	=	'E'	Oscillator Tuning Voltage Alarm Enabled
		'D'	Oscillator Tuning Voltage Alarm Disabled
4	=	'-'	Currently not used
5	=	'E'	Initial Acquisition Mode Alarm Enabled
		'D'	Initial Acquisition Mode Alarm Disabled
6	=	'E'	Aux Ref Alarm Enabled
		'D'	Aux Ref Alarm Disabled
7	=	'-'	Currently not used
8	=	'-'	Currently not used

The command returns:

OK<CR><LF> if successful.

NOTE: Although the user may set the F73 mask, there will be no change in the 560-5179-1 Fault Monitor CPU or 560-5203-X Oscillator front panel LED fault reporting. Only serial Function F73 faults will change.

The default F73 Alarm Mask settings for the GPS/Oscillator are as follows:

MEEEED-D- mEDD-DD--

Major Alarms	Default Major Mask	Minor Alarms	Default Minor Mask
1 PLL	E Enabled	1 Time Error	E Enabled
2 Antenna	E Enabled	2 Tracking	D Disabled
3 Receiver	E Enabled	3 Osc Tuning	D Disabled
4 EEPROM	E Enabled	4 not used	- not used
5 Timeout	D Disabled	5 Init. Acq.	D Disabled
6 not used	- not used	6 Aux Ref	D Disabled
7 AuxIntOsc	D Disabled	7 not used	- not used
8 not used	- not used	8 not used	- not used

Other settings	Default Mask
Timeout delay	00000 s
Time Threshold	00000000000 ns
PowerOn m delay	00000 s

The time error threshold at which the time error fault is activated can be queried or set by the following command.

Sending

F73<SP>THRESHOLD<CR>

returns:

F73<SP>THRESHOLD<SP><nanoseconds><SP>ns<CR><LF>

where <nanoseconds> is the time error threshold in nsec.

Sending

F73<SP>THRESHOLD<SP><nanoseconds><CR>

sets the time error threshold and returns:

OK<CR><LF> if successful.

The timeout after which a time error fault becomes a timeout fault can be queried or set by the following command:

F73<SP>TIMEOUT<CR>

which returns:

F73<SP>TIMEOUT<SP><seconds><SP>s<CR><LF>

where <seconds> is the timeout in seconds, between 0 and 86400.

Sending

F73<SP>TIMEOUT<SP><seconds><CR>

sets the timeout and returns:

OK<CR><LF> if successful.

If a checksum error is detected while recalling settings from the EEPROM, an EEPROM data fault is indicated. This same fault is active if an attempt was made to recall EEPROM settings and default settings were created since no settings were found. In this case, an EEPROM fault is indicated and the operator should check all of the stored settings to verify that they are correct. After the operator has confirmed that all settings are correct, the following command can be used to cancel the error, so that future errors of this kind can be caught.

F73<SP>CLEAR<SP>EEPROM<SP>FAULT<CR>

clears the fault and returns:

OK<CR><LF>

SECTION FOUR

4. DETAILED DRAWINGS

4.1. 560-5187-3 DETAILED DRAWINGS / BILL OF MATERIALS