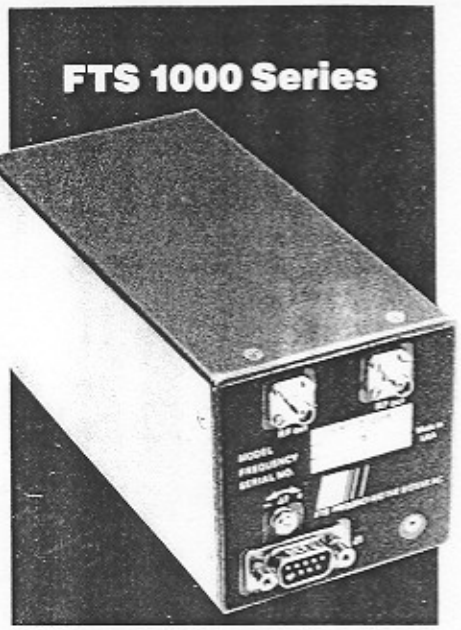
Ultra-Stable OCXO (4-18 MHz)



ADVANTAGES

- low aging
- low phase noise
- independently buffered outputs
- linearized electronic frequency control
- standard frequencies at 5, 10, and 15 MHz
- special frequencies available
- high reliability versions available

GENERAL DESCRIPTION

The FTS 1000 crystal oscillator series is designed for a wide range of applications, including operational environments. Aging rates of $<1 \times 10^{-10}$ per day, linear voltage tuning, and multiple, independently buffered outputs are featured.

State-of-the-art design techniques result in very low values of single-sideband phase noise. The FTS 1000 is ideally suited for use in microwave multiplier chains, phase noise calibration equipment, test equipment, and as a frequency standard. 5 and 10 MHz units are usually in stock.

DESIGN FEATURES

The FTS 1000 series achieves low aging rates by utilizing high performance quartz crystal resonators. The specified aging is reached within 30 days of continuous operation, and typically continues to improve. Following years of continuous operation, aging rates as low as 1×10^{-12} per day have been observed. The higher frequencies are generated by frequency doubling and tripling techniques, allowing full utilization of the superior performance of the quartz crystal resonators. The maximum frequency change over the operating temperature range of the oscillator is $<5 \times 10^{-10}$. An oven monitor signal (0 to 5 V) representing oven current is provided at the power connector.

The oscillator circuit design produces state-of-the-art low phase noise outputs to as low as -116 dBc at 1 Hz. Low noise, high isolation buffer amplifiers provide two or four independent outputs that are available with an amplitude of 0.5 or 1 V rms. Linearized electronic frequency control allows the use of servo loop techniques for fine frequency tuning. Linearity is better than 5% over the specified tuning range.

SPECIAL PURPOSE APPLICATIONS

The Global Positioning System (GPS) is the most advanced navigation system in use, requiring stable and spectrally pure frequency sources for system applications. The FTS 1000 can be furnished at 5.115 MHz and 10.230 MHz to meet the demanding requirements of these systems.

The telecommunications industry is moving toward full digitization of communications networks, increasing the demands on the frequency sources that provide the time base for network switches. FTS 1000 oscillators have qualified to the Stratum II performance level and are being supplied to switch manufacturers at standard telecommunications frequencies.

CUSTOMER SPECIFIED FREQUENCIES

Special frequencies are available in the ranges listed below. Contact the factory for performance specifications at your required frequency or for other special needs.

4 to 6 MHz	FTS 1000A/Sxx (two outputs)
4 to 6 MHz	FTS 1200/Sxx (four outputs)
8 to 12 MHz	FTS 1002A/Sxx (two outputs)
12 to 18 MHz	FTS 1003A/Sxx (two outputs)

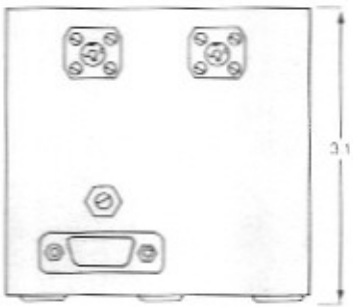
FTS

FTS 1000 SERIES SPECIFICATIONS

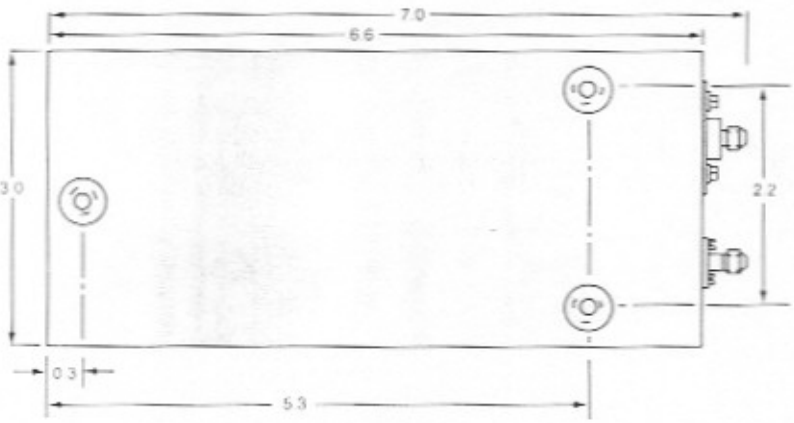
PARAMETER		SPECIFICATION			
MODEL		**FTS 1000A**	**FTS 1200**	**FTS 1002A**	**FTS 1003A**
Output Frequency		5 MHz	5 MHz	10 MHz	15 MHz
Aging Per Day (see NOTE 1)		1×10^{-10}	1×10^{-10}	1×10^{-10}	1×10^{-10}
Short-Term Stability $\sigma_y(\tau)$	1 s	1×10^{-12}	1×10^{-12}	1×10^{-12}	1×10^{-12}
For averaging time τ of:	10 s	1×10^{-12}	1×10^{-12}	1×10^{-12}	1×10^{-12}
	100 s	1×10^{-12}	1×10^{-12}	1×10^{-12}	1×10^{-12}
SSB Phase Noise £(f), BW = 1 Hz					
For offset from signal of:	1 Hz	– 116 dBc	– 116 dBc	– 110 dBc	– 106 dBc
	10 Hz	– 136 dBc	– 136 dBc	– 130 dBc	– 126 dBc
	100 Hz	– 140 dBc	– 140 dBc	– 134 dBc	– 130 dBc
	1000 Hz	– 140 dBc	– 140 dBc	– 134 dBc	– 130 dBc
Outputs (Independently buffered)		Two @ 5 MHz	Four @ 5 MHz	Two @ 10 MHz	Two @ 15 MHz
Output Amplitude/50Ω		1 V rms	Two @ 1 V rms Two @ 0.5 V rms	1 V rms	1 V rms
Harmonic Distortion		– 40 dBc	– 40 dBc	– 40 dBc	– 40 dBc
Spurious Signals		– 80 dBc	– 80 dBc	– 80 dBc	– 80 dBc
Signal-to-Phase Noise Ratio (BW = 30 kHz)		– 87 dB	– 87 dB	– 81 dB	– 77 dB
Frequency Adjustment Range					
Coarse (25-turn trimmer)		4×10^{-7}	—	4×10^{-7}	4×10^{-7}
Fine (voltage controlled)		2×10^{-7}	4×10^{-7}	2×10^{-7}	2×10^{-7}
		– 10 to 10 V dc	0 to 10 V dc	– 10 to 10 V dc	– 10 to 10 V dc
Maximum Frequency Change as a Function of					
Operating Temperature		5×10^{-10}	1×10^{-9}	5×10^{-10}	5×10^{-10}
Load Change (50Ω ± 10%)		5×10^{-11}	5×10^{-11}	5×10^{-11}	5×10^{-11}
Operating Temperature Range		– 28 to 61°C	0 to 50°C	– 28 to 61°C	– 28 to 61°C
Non-Operating Temperature Range		– 60 to 80°C	– 60 to 80°C	– 60 to 80°C	– 60 to 80°C
Input Voltage		22 to 30 V dc	22 to 30 V dc	22 to 30 V dc	22 to 30 V dc
Power Requirement (typical)					
	Warm-Up	14W	14W	14W	14W
	Operating @ – 28°C	3.0W	—	3.4W	3.4W
	0°C	2.4W	2.8W	2.8W	2.8W
	25°C	1.9W	2.3W	2.3W	2.3W
	61°C	1.3W	1.7W (@ 50°C)	1.7W	1.7W
Dimensions					
Height		3.1" (79 mm)	3.1" (79 mm)	3.1" (79 mm)	3.1" (79 mm)
Width		3.0" (76 mm)	3.0" (76 mm)	3.0" (76 mm)	3.0" (76 mm)
Depth		7.0" (178 mm)	7.4 (188 mm)	7.4 (188 mm)	7.4 (188 mm)
Weight		1.9 lb (0.86 kg)	2.1 lb (0.95 kg)	2.1 lb (0.95 kg)	2.1 lb (0.95 kg)

NOTE 1: Aging typically improves to a level of parts in 10^{11} per day. Aging rates as low as 1×10^{-12} have been observed after years of unperturbed operation.

METAL CASE OUTLINE



Front View
(FTS 1000A, 1002A, 1003A)



Bottom View
(FTS 1000A)

FTS

FREQUENCY AND TIME SYSTEMS, INC.
a DATUM company
34 TOZER ROAD, BEVERLY, MASSACHUSETTS 01915
Telephone (617) 927-8220/Telex 94-0518 FTS BLVY
FACSIMILE: AUTOANSWER, GROUP II/III, (617) 927-4099

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE. (04/86)

3. INSTALLATION AND OPERATION

3.1 Installation

3.1.1 Mounting

The oscillator can be mounted in any orientation. Three 6-32 threaded mounting holes are provided. The maximum allowable screw penetration is 0.23 inch. An outline drawing of the FTS 1000 is shown in Figure 3.

3.1.2 Connections

A matching power connector (ITT/Cannon DE9S or equivalent) is furnished with the unit. Connect the oscillator to a well-regulated 22- to 30-V dc power supply (24 V dc nominal) through pins 5 and 8 of connector J1 (see Figure 4), observing the polarity. A series diode is provided to protect against inadvertent polarity reversal.

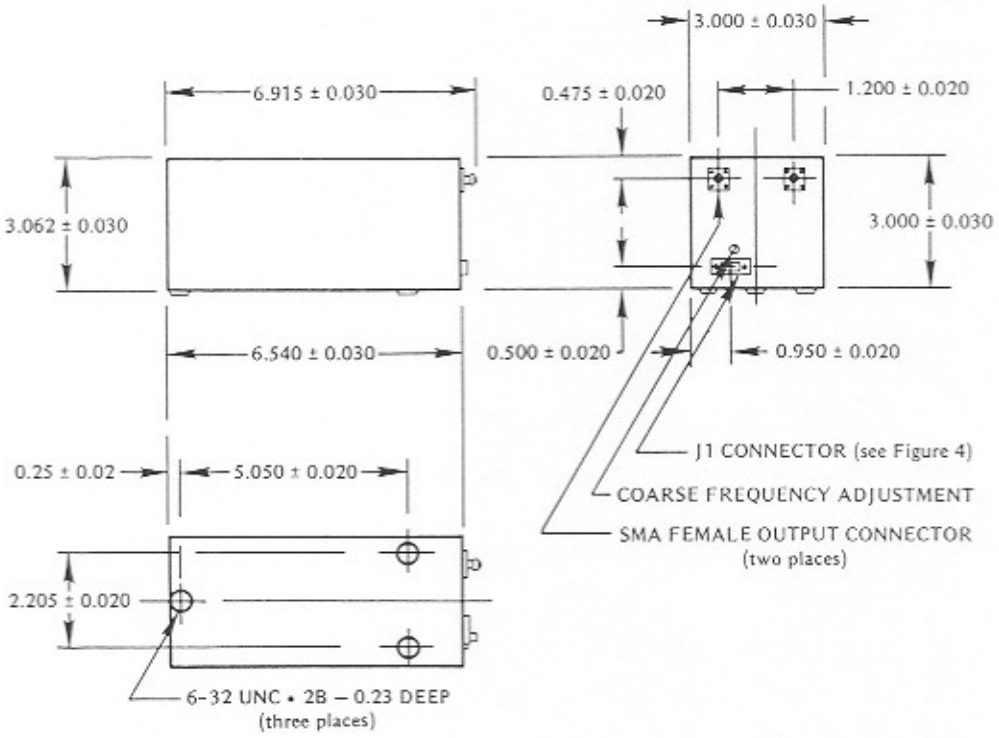


Figure 3. Outline drawing of the FTS 1000 (dimensions are given in inches).

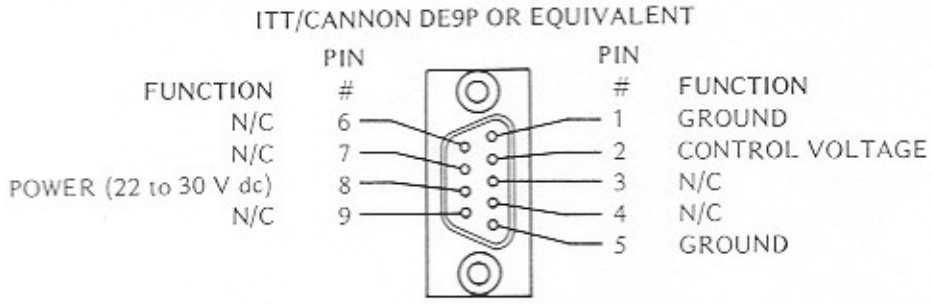


Figure 4. Front view of the J1 power connector.

3.2 Operating Instructions

3.2.1 Start-up procedure

To turn on the oscillator, apply power as indicated in Section 3.1.2.

When the oscillator is turned on after having been off for any length of time, the initial current required to warm up the oven will be 550 to 600 mA. When the oven approaches the operating temperature, approximately 20 min after a cold start, the current will decrease rapidly to below 200 mA and then continue to decrease more gradually for another half hour.

> CAUTION
>
> THERE ARE NO FUSES IN THE FTS 1000. CAREFULLY OBSERVE THE MAXIMUM VOLTAGE RATING TO AVOID PERMANENT DAMAGE TO THE INSTRUMENT.

3.2.2 Coarse frequency adjustment

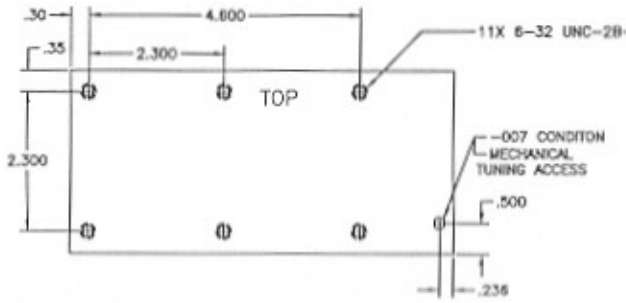
The output frequency can be adjusted over a range of ±1 Hz (4 parts in 10^7) from 5 MHz by means of the 25-turn adjustment potentiometer, which is accessible from the front panel (see Figure 2). This adjustment is effective whether the fine frequency control is used or not, and the ranges of the two controls are cumulative.

3.2.3 Fine frequency adjustment

The oscillator frequency can be varied by applying a voltage from pin 2 to pin 1 (ground) of connector J1. The total range is approximately 1 Hz for an input span of -10 to 10 V. The input voltage should not be allowed to exceed these limits. The control coefficient is positive; that is, the frequency increases with increasing voltage. Figure 2 shows details of the input filtering on the control line.

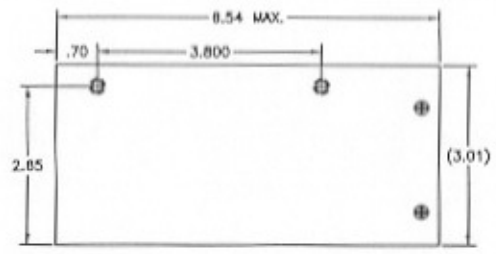
NOTE: The frequency stability of the oscillator and all other related specifications are directly correlated with the quality and stability of the control voltage. A shielded cable is recommended for this connection. If a fine frequency adjustment is not required, the control input should be grounded directly at the input connector.

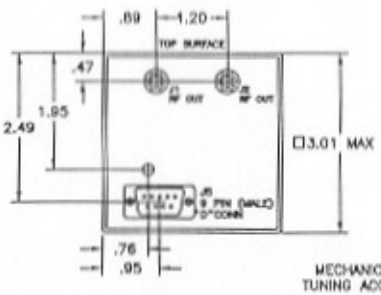
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	RELEASED FROM A2 W/0005.	5/14/92	DM
B	REDRAWN & REV'D PER ECO# 8509 LAR		



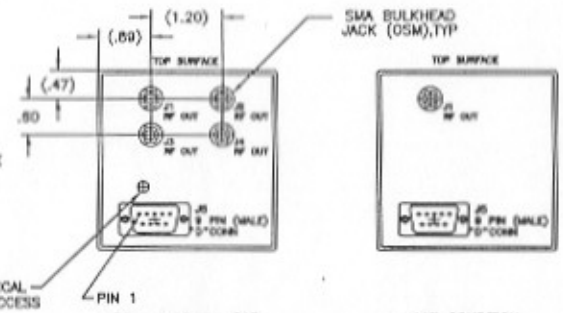
J5 CONNECTOR	
PIN	DESIGNATION
1	ELEC GND
2	ELEC TUNE
3	MECH TUNE (OPT)
4	AGC MON (OPT)
5	OVEN GND
6	OVEN MON
7	+OVEN SUPPLY
8	+ELEC SUPPLY
9	CASE

PART DASH NO.	QTY RF OUT CONN.	3 HOLE MTG PATTERN TOP OR BOTTOM	TUNING POT (R12) YES OR NO	TOP ASSY
-001	2	BOTTOM	YES	05818-501
-001	2	BOTTOM	YES	05818-506
-001	2	BOTTOM	YES	05818-507
-001	2	BOTTOM	YES	05818-509
-001	2	BOTTOM	YES	05818-510
-002	4	BOTTOM	YES	05818-502
-003	4	BOTTOM	NO	05818-503
-004	2	BOTTOM	NO	05818-504
-004	2	BOTTOM	NO	05818-511
-007	1	BOTTOM	YES (TOP)	05818-512
-015	4	BOTTOM	YES	05818-515



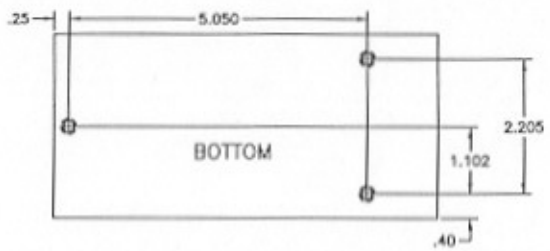


-001 & -004 CONDITIONS



-002, -003 & -015 CONDITIONS

-007 CONDITION



-001,-002,-003,-004,&-007 CONDITONS

REV STATUS OF SHEET									
SHEET	1	2	3	4	5	6	7	8	9
REVISION	B	A							

DISTRIBUTION

NOV 8

RELEASED FOR PRODUCTION

INTERFACE CONTROL DRAWING

datum inc

ICD, OSCILLATOR

SIZE	DWG NO.	REV
D	05820	B

SCALE NONE SHEET 1 OF 2

SEE ABOVE PART DASH NO.	SEE ABOVE NEXT ASSY	QTY USED ON	QTY
		1 10008	1

APPLICATION

DO NOT SCALE DRAWING

10. Measure the STABILIZED OVEN CURRENT at J5-7 approx. 25°C per the following specification:

Options	Specification
(All)	30 mA ±8 mA @ 24 V

11. Center Frequency

Measure the stabilized center frequency to be f nominal $\pm .7 \times 10^{-7}$. (Electronic tuning and coarse tuning centered). Record data in log book and ATP Data Sheet.

12. Measure the MECHANICAL TUNING RANGE per the specifications below:

Options	Specification
05846-101	$>4 \times 10^{-7}$*
05846-102	$>4 \times 10^{-7}$*
05846-103	N/A
05846-104	N/A
05846-105	N/A
05846-106	$>4 \times 10^{-7}$
05846-107	$>4 \times 10^{-7}$
05846-108	$>4 \times 10^{-7}$ $\pm 1.5 \times 10^{-7}$ * Use external pot
05846-109	$>4 \times 10^{-7}$
05846-110	N/A
05846-111	$>4 \times 10^{-7}$*
05846-112	$>4 \times 10^{-7}$

*NOTE: 0-12 V input on J4 Pin 5 with solder jumper 9-16.

13. Measure the ELECTRONIC TUNING RANGE (J5 Pin 2) per specifications below:

Options	Specification		Slope
05846-101	±10 V	2.0 to 2.6×10^{-7}	POS
05846-102	±10 V	2.0 to 2.6×10^{-7}	POS
05846-103	0, +10 V	4.5 to 6.4×10^{-7}	POS
05846-104	0, +10 V	3.4 to 5.2×10^{-7}	NEG
05846-105	±10 V	6.0 to 8.0×10^{-7}	NEG
05846-106	±10 V	2.0 to 2.8×10^{-7}	NEG
05846-107	±10 V	2.0 to 2.8×10^{-7}	NEG
05846-108	±10 V	3.0×10^{-7} $\pm 0.75 \times 10^{-7}$	POS
05846-109	±10 V	± 1.8 to $\pm 2.6 \times 10^{-7}$	POS
05846-110	0, +10 V	± 3.4 to $\pm 5.2 \times 10^{-7}$	NEG
05846-111	±10 V	2.0 to 2.8×10^{-7}	NEG
05846-112	±10 V	2.0 to 2.8×10^{-7}	NEG

BISHOP GRAPHICS/ACCUPRESS