2009

luff research

COMPANY PROFILE

Our highly experienced and seasoned team of dedicated engineers and technicians bring today's leading technologies to all our products; resulting in products that meet or exceed the customer's expectations. We monitor quality in every phase of product development and manufacturing, ensuring a product that is superior in reliability as well as a great value.

Our product line offers many standard designs that cover a wide range of applications. In addition, our designs can easily be customized for specific requirements.

A primary asset of Luff is our ability to focus our broad technical resources on the development of custom products that can be developed in a rapid and cost effective manner.

We look forward to working with you on your new frequency source requirement.

20 N. Tyson Ave, Floral Park, NY 11001 Tel. (516) 358-2880 Fax (516) 358-2757 Email: sales@luffresearch.com Web: www.luffresearch.com

GENERAL INFORMATION

Ordering Information

To obtain a quotation, please an order or get additional information, please contact the factory directly or one of our sales representatives. Our quotations generally go out within 48 hours.

Contact us direct:
Luff Research, Inc.
20 N. Tyson Avenue
Floral Park, NY 11001-1514
Tel.: (516) 358-2880
Fax: (516) 358-2757
Email: sales@luffresearch.com

For a list of our current reps in your area, please visit our website at www.luffresearch.com

Application Support

Frequency sources generally are customized and optimized components. Luff Research's dedicated senior design engineers are available to provide technical support to assist in specifying the appropriate frequency source for a given requirement.

Contact:
Richard Scheer
Tel.: (516) 358-2880
Fax: (516) 358-2757
Email: rich@luffresearch.com

Terms and Conditions of sale

Terms of sale are outlined in the "General Policy and Terms of Sale" document available upon request.

Quality Assurance

Looking for *Old Fashion Quality and Service*?

At Luff our policy and passion is to provide products that exceed the customer's expectations. Products that meet specification and function reliably throughout their expected life.

All of our products are continuously scrutinized for performance and for possible latent problems. This ensures that the equipment we deliver is of the highest quality possible.

We pride ourselves on our custom support. When you contact Luff, you will always deal with a senior engineer who is a specialist in frequency sources and is happy to assist in the characterization of a best solution for a given problem.

For more information about our Quality Control please look at our Quality Assurance page.

Warranty

Each product manufactured by Luff Research Inc. is thoroughly tested and inspected, and is warranted against defects in materials and workmanship. This warranty applies for **two years** from date of original delivery. Luff will perform all appropriate repairs during the warranty period, provided the parts are returned by buyer to Luff Research, and have not been subject to misuse. No other warrantee is expressed or implied. We are not liable for any consequential damage.

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FREQUENCY SOURCE WORKSHEET

DATE:		QUOTE # _____
CONTACT:		
COMPANY NAME:		DATE: _____
PHONE #:		
FAX #:		
E-MAIL:		

Output Frequency		**Requirement**	**Comments**
Tuning range (in MHz):			
Frequency step size (in kHz):			
Frequency stability and accuracy (in PPM):			
Phase noise in dBc/Hz (typ.)	L(100 Hz)		
	L(1 kHz)		
	L(10 kHz)		
	L(100 kHz)		
	L(1 MHz)		
Spurious (in dBc):			
Harmonics (typical in dBc):			
Power out (minimum in dBm):			
Output power variation (in dB):			
Output VSWR:			
Load VSWR:			

Input Frequency

Input reference frequency (in MHz):		
Input ref. freq. level (in dBm):		

Frequency Tuning / Alarm

Frequency control (serial or parallel):		
Acquisition time (msec):		
Phase-lock indicator:		

Typical DC Power

+5.2 to +7.0 VDC (in mA):		
+15.0 to +17.0 VDC (in mA):		
Other		

Mechanical

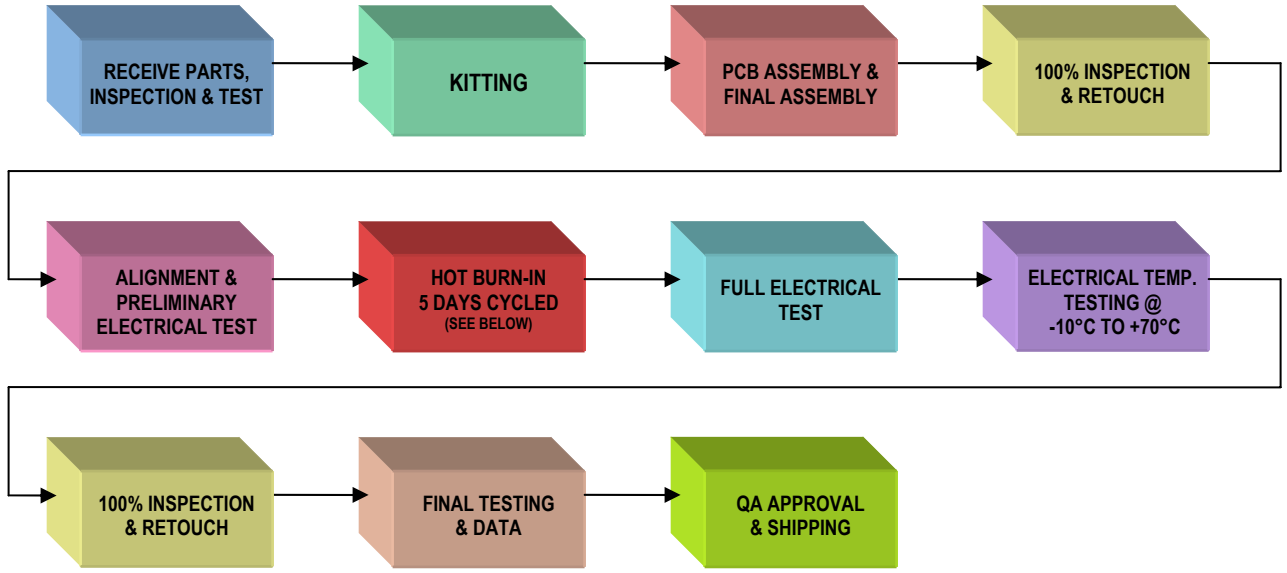
RF connectors:		
Digital & DC connection:		

Environment		**Standard**
Operating temperature range (surface):		0°C to 60°C
Storage temperature range:		-40°C to 85°C
Relative humidity (non-condensing):		90%RH @ 40°
Shock:		30 G / 10msec
Vibration:		4 G / 20 Hz - 20 kHz

QUALITY ASSURANCE

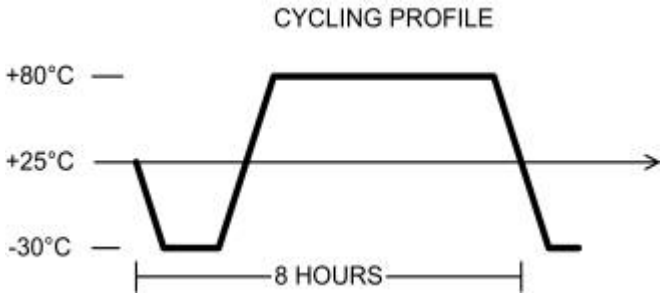
At Luff our focus is on component performance and quality. Our quality control program is designed to result in the manufacture of products that perform to all specifications and are highly reliable. We achieve this by modeling our quality assurance program after ISO9001: 2001 and IDC-A-610 as a starting point. Then improvements are continuously made to attain higher and higher levels of quality and reliability of our products.

The typical steps in the manufacture of our products are shown below. Our manufacturing cycle employs sophisticated manufacturing techniques, automatic testing, temperature cycling and burn-in before final electrical and ATE testing.



Quality is forged into our products by the team of dedicated professionals that perform and monitor all of the manufacturing processes. All aspects of design and production issues are continuously monitored. Any identified problems are immediately dealt with so that our products can have the highest possible reliability.

Our quality control manual is available upon request.



PRODUCT LINE OVERVIEW

FREQUENCY SYNTHESIZERS

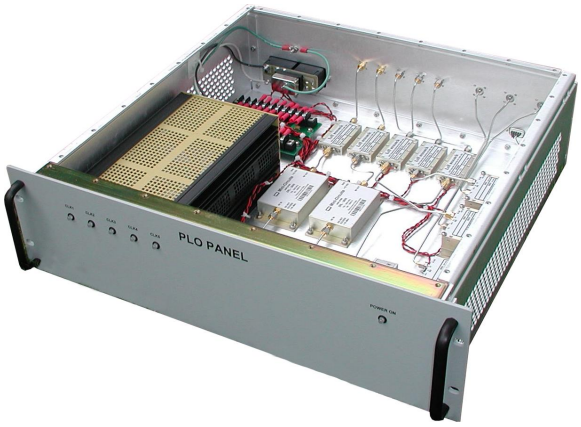
- High performance multi-loop fundamental designs up to 12 GHz
- Single loop designs up to 12 GHz
- Multiplied custom designs up to 24 GHz
- Custom designs to customer's specifications
- Customized interfaces for synthesizer control

PHASE-LOCKED OSCILLATORS

- Phase-locked dielectric resonator oscillators up to 15 GHz
- Phase-locked ceramic resonator oscillators up to 5 GHz
- Phase-locked high-Q LC oscillators up to 500 MHz
- Phase-locked crystal oscillators up to 130 MHz
- Custom designs up to 24 GHz

CUSTOM PRODUCTS and ASSEMBLIES

- We design and develop exception frequency sources in small to moderate quantities
- Multiple output frequency sources
- Phase noise clean-up loops
- Buffered C & X band VCOs



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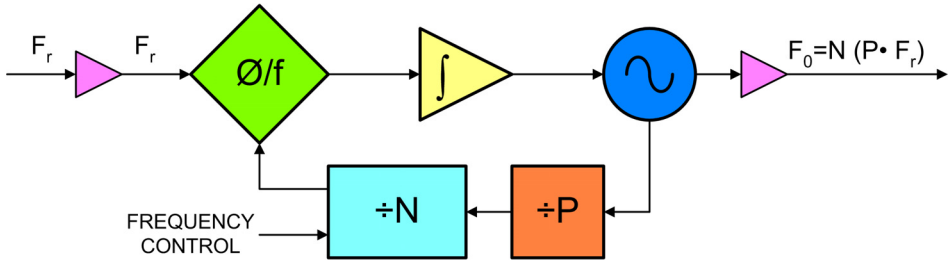
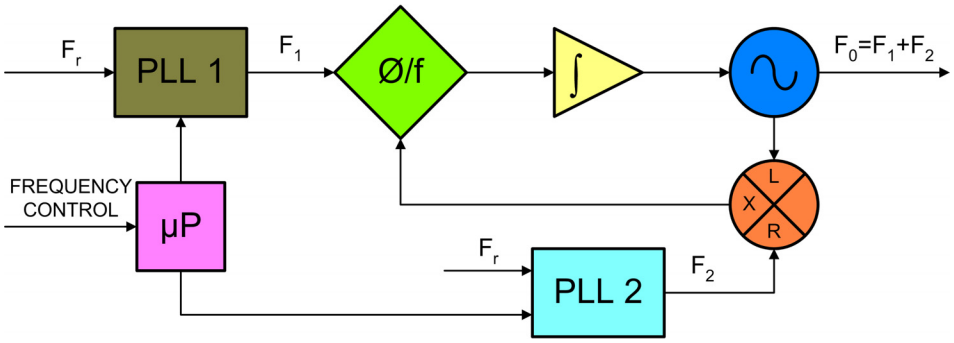
Standard Frequency Synthesizer Products

- **SLSM3, SLSM4 and the NEW SLSM5 - Single loop synthesizers that feature:**
  - Frequencies in band to 12 GHz
  - Broad band frequency coverage
  - Good phase noise and spectral quality
  - Low cost

- **Block Diagram**



- **TLS and the new TLSD - Triple loop synthesizers that feature:**
  - Frequencies in band to 12 GHz (to 24 GHz with X2 multiplier)
  - Broad band frequency coverage
  - Excellent phase noise and spectral quality
  - Moderate cost



Fundamental VCO based synthesizers are available up to 12 GHz. For frequencies above 12 GHz, frequency doublers can be supplied to extend the desired frequency range to 24 GHz.

We custom design frequency synthesizers to optimize a specific set of requirements.

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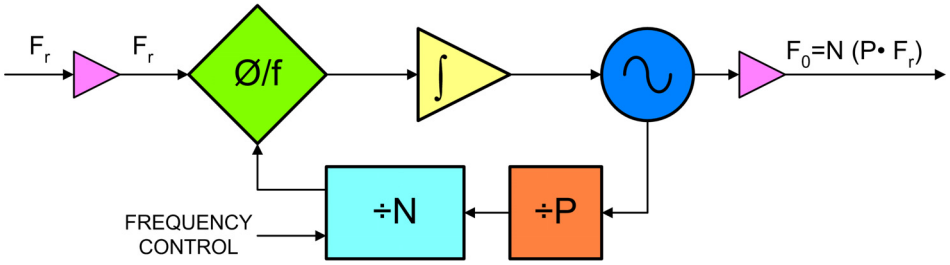
Model SLSM: Single Loop Configuration

Features

- In bands up to 12 GHz (fundamental)
- Wide frequency range per unit (up to octave bands)
- Frequency steps 1 kHz (typical)
- Good phase noise
- Good spectral purity
- Serial Interface
- Internal or external frequency reference
- Small size
- Low cost

SLSM3 / SLSM4 / SLSM5

Block Diagram



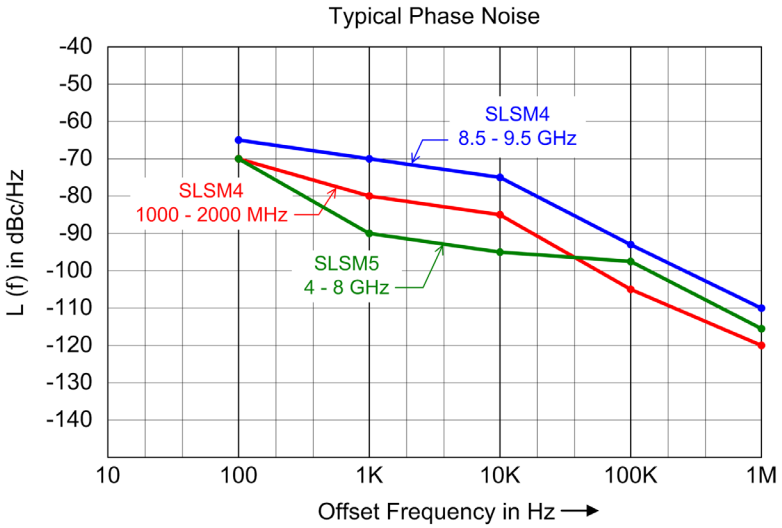
Description

The Luff SLSM models are advanced technology single phase-locked loop frequency synthesizer designs. These are self contained system level components. These units offer excellent performance for many applications.

In this basic architecture, a tradeoff between frequency resolution and phase noise performance needs to be made. These units are packaged in a miniature connectorized housing. The designs offer flexibility and easy customization for your specific requirement.

SLSM Key Specifications

Model:	SLSM3	SLSM4	SLSM5
Output Frequency:	up to 12 GHz	up to 12 GHz	up to 12 GHz
Output Resolution:	>.5 MHz @ 10 GHz (typical)	1 kHz (typical)	1 kHz (typical)
Spurious:	-60 dBc (min.)	-60 dBc (typ.)	-60 dBc
Harmonics (typical):	-20 dBc	-20 dBc	-20 dBc
Output Power (min.):	+13 dBm	+13 dBm	+13 dBm
Output Power Variation:	3 dB	3 dB	3 dB
External Reference:	10 MHz (typical) 0 dBm ±3 dB	10 MHz (typical) 0 dBm ±3 dB	10 MHz (typical) 0 dBm ±3 dB
or Internal Reference:	±1 PPM (-10ºC to +70ºC)	±1 PPM (-10ºC to +70ºC)	±1 PPM (-10ºC to +70ºC)
Frequency Control:	3 Wire Serial (TTL Input)	3 Wire Serial (TTL Input)	**Serial RS485**
Alarm:	Open Collector (high=lock)	Open Collector (high=lock)	Open Collector (high=lock)
Power Requirements:	+5.2 Vdc	+5.2 Vdc	+5.0 Vdc
Size:	2.50" x 2.50" x 0.60"	2.50" x 2.50" x 0.60"	2.50" x 2.50" x 0.60"



Samples of Specific Product Data Sheets (PDF)

- 6500 to 7500 MHz in 1 MHz steps - Model: SLSM3-65007500/1M
- 1000 to 2000 MHz in 1 kHz steps - Model: SLSM4-10002000/1K
- 8500 to 9500 MHz in 500 Hz steps - Model: SLSM4-85009500/500H
- 4000 to 8000 MHz in 1 kHz steps - Model: SLSM5-48

SPECIFICATIONS

Output Frequency

Tuning range:	6500 - 7500	MHz
Frequency step size:	1	MHz
Freq. stability and accuracy (Ext. Ref):	Same as Input	
Freq. stability and accuracy (Int. Ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz) -60	
	L(1 kHz) -70	
	L(10 kHz) -75	
	L(100 kHz) -85	
	L(1 MHz) -115	
Spurious (typ.):	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	+13	dBm
Output power variation (freq. & temp.):	2	dB
VSWR:	2:1	

Input Frequency

Input reference frequency:	10	MHz
Input level:	0 dBm ±3 dB	

Frequency Tuning / Alarm

Frequency control:	3 Wire Serial Input (TTL)
Acquisition time:	1 msec
Phase-lock indicator:	High = lock (TTL compatible)

DC Power

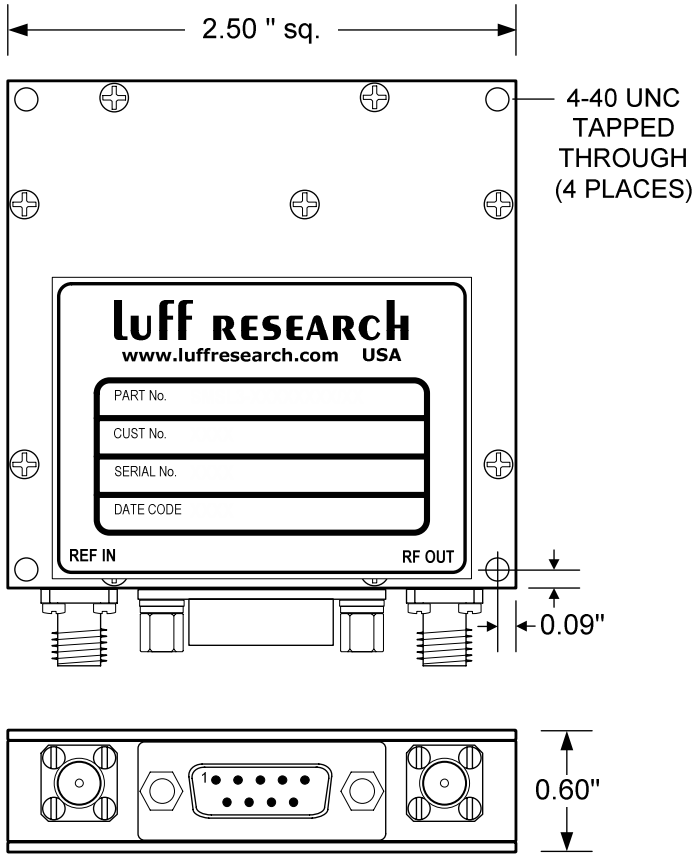
+5.2VDC (min.) to +6VDC (max.)	350	mA (max.)
Internal regulator		

Mechanical

RF connector:	SMA (F)
Digital & DC connection:	DB9 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. SLSM3-65007500/1M/INT)
2. The Frequency adjustment is located on the bottom of the unit and is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.

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PRODUCT DATA SHEET

SLSM3 FREQUENCY SYNTHESIZER

Model:SLSM3-65007500/1M		**06/02/08**

SPECIFICATIONS

Output Frequency

Tuning range:	1000 - 2000	MHz
Frequency step size:	1	kHz
Freq. stability and accuracy (Ext. Ref):	Same as Input	
Freq. stability and accuracy (Int. Ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz) -70	
	L(1 kHz) -80	
	L(10 kHz) -85	
	L(100 kHz) -105	
	L(1 MHz) -130	
Spurious (typ.):	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	+13	dBm
Output power variation (freq. & temp.):	2	dB
VSWR:	2:1	

Input Frequency

Input reference frequency:	10	MHz
Input level:	0 dBm ±3 dB	

Frequency Tuning / Alarm

Frequency control:	3 Wire Serial Input (TTL)
Acquisition time:	1 msec
Phase-lock indicator:	High = lock (TTL compatible)

DC Power

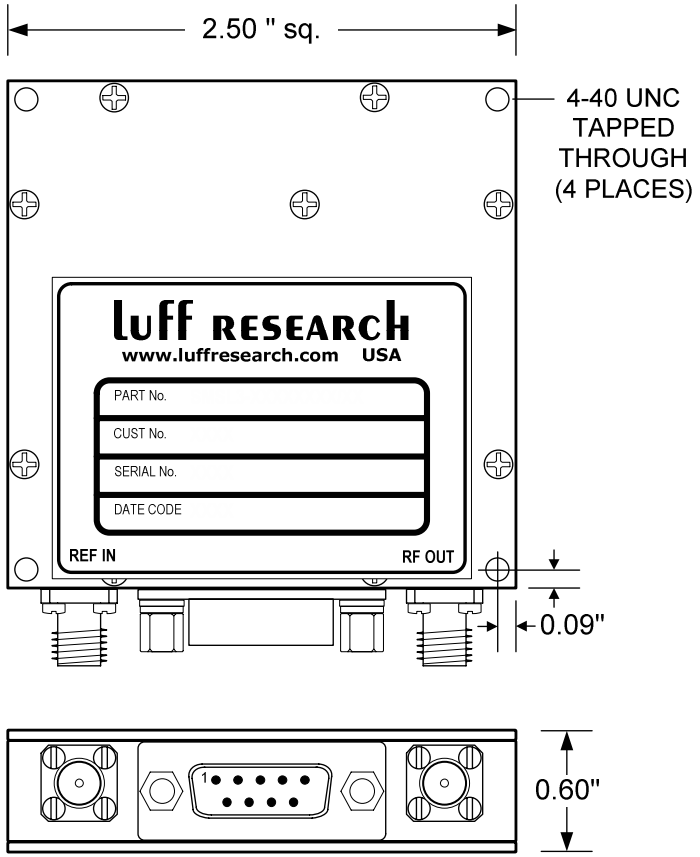
+5.2VDC (min.) to +6VDC (max.)	450	mA (max.)
Internal regulator		

Mechanical

RF connector:	SMA (F)
Digital & DC connection:	DB9 (M)

Environment

Operating temperature range (surface):	-1'0°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. SLSM4-10002000/1K/INT)
2. The Frequency adjustment is located on the bottom of the unit and is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.

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PRODUCT DATA SHEET

SLSM4 FREQUENCY SYNTHESIZER

Model:SLSM4-10002000/1K	**Rev. B**	**03/11/08**

SPECIFICATIONS

Output Frequency

Tuning range:	8500 - 9500	MHz
Frequency step size:	500	Hz
Freq. stability and accuracy (Ext. Ref):	Same as Input	
Freq. stability and accuracy (Int. Ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-65
	L(1 kHz)	-70
	L(10 kHz)	-75
	L(100 kHz)	-95
	L(1 MHz)	-120
Spurious (typ.):	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	+13	dBm
Output power variation (freq. & temp.):	2	dB (max)
VSWR:	2:1	

Input Frequency

Input reference frequency:	10	MHz
Input level:	0 dBm ±3 dB	

Frequency Tuning / Alarm

Frequency control:	3 Wire Serial Input (TTL)
Acquisition time:	1 msec
Phase-lock indicator:	High = lock (TTL compatible)

DC Power

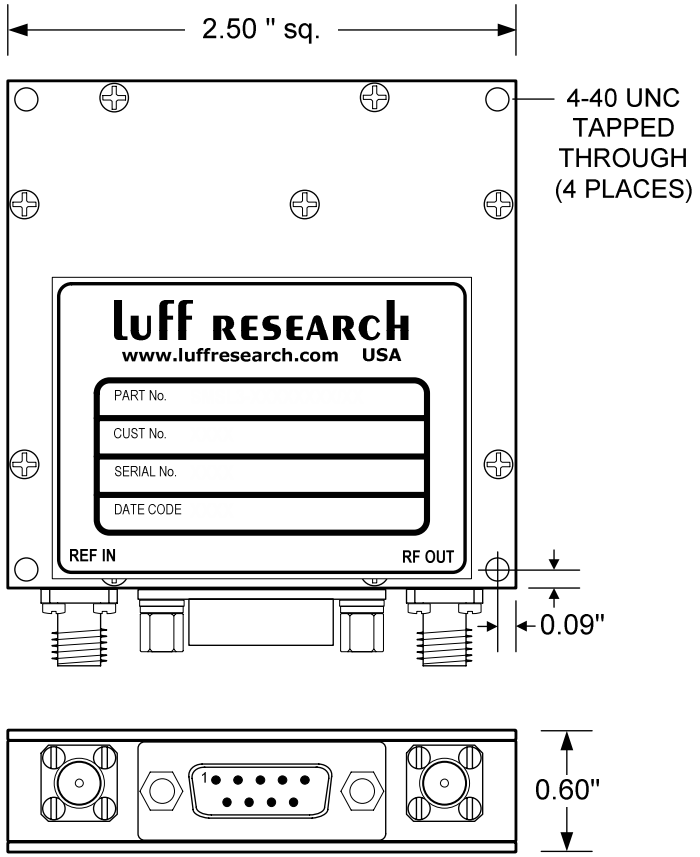
+5.2VDC (min.) to +6VDC (max.)	450	mA (max.)
Internal regulator		

Mechanical

RF connector:	SMA (F)
Digital & DC connection:	DB9 (M)

Environment

Operating temperature range (surface):	-1'0°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. SLSM4-85009500/500H/INT)
2. The Frequency adjustment is located on the bottom of the unit and is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.

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PRODUCT DATA SHEET

SLSM4 FREQUENCY SYNTHESIZER

Model:SLSM4-85009500/500H	Rev. A	06/02/08

SPECIFICATIONS

Output Frequency

Tuning range:		4 - 8 GHz
Frequency step size:		1 kHz
Freq. stability and accuracy (Ext. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-70
	L(1 kHz)	-90
	L(10 kHz)	-95
	L(100 kHz)	-95
	L(1 MHz)	-115
Spurious (typ.):		-60 dBc
Harmonics (min.):		-20 dBc
Power out:		+3 dBm
Output power variation (freq. & temp.):		2 dB (max)
VSWR:		2:1

Input Frequency

Input reference frequency:	10 MHz
Input level:	0 dBm ±3 dB

Frequency Tuning / Alarm

Frequency control:	RS-485
Acquisition time:	< 50 msec
Phase-lock indicator:	High = lock (TTL compatible)

DC Power

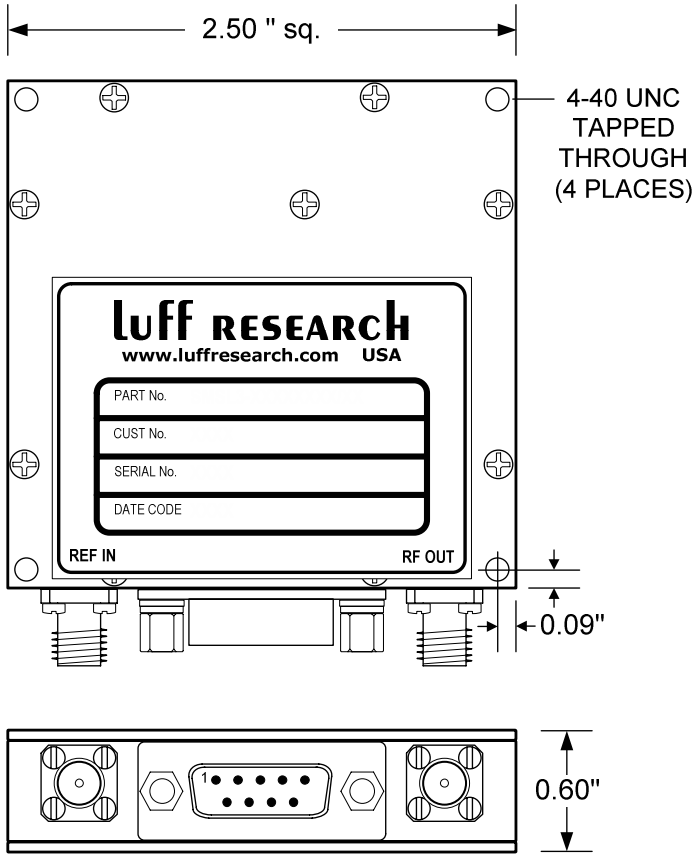
+5.2 Vdc (min.) to +6.0 Vdc (max.)	450 mA (max.)
Internal regulator	

Mechanical

RF connector:	SMA (F)
Digital & DC connection:	DB9 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. SLSM5-48-INT)
2. The Frequency adjustment is located on the bottom of the unit and is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.

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PRODUCT DATA SHEET

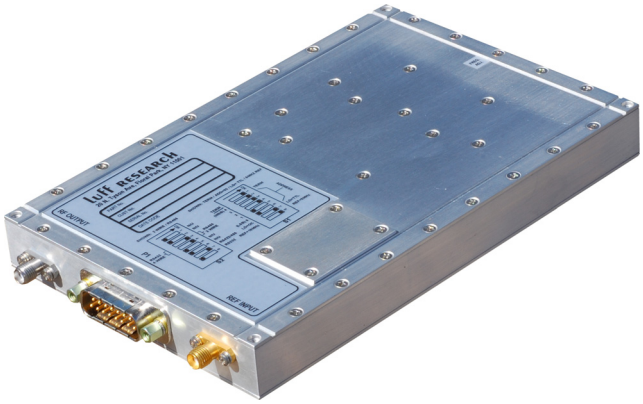
SLSM5 FREQUENCY SYNTHESIZER

Model:SLSM5-48		02/05/09

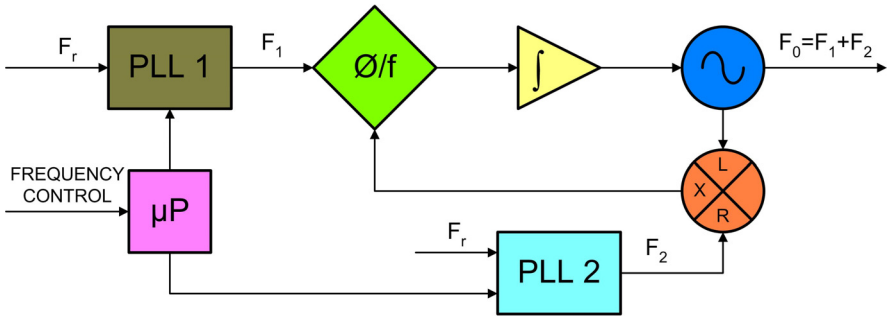
Model TLSD: New S & X Band Synthesizer

Features

- Output frequencies up to 12 GHz direct and 24 GHz with an X2 multiplier
- Low phase noise, low microphonics and no phase hits (over temperature)
- Low spurious
- All standard interface options selectable within the unit (RS232, RS422, RS485)
- Multi drop bus configurations
- Reference Frequency: 1, 5, 10, or 20 MHz or Internal ref (±1PPM)
- Rugged EMI shielded enclosure



Block Diagram



Description

This frequency synthesizer is designed for sensitive converter applications. The TLSD units operate from 1 to 12 GHz (in bands) and can operate in excess of octave bandwidths. The spectral quality is excellent, typically better than -90 dBc/Hz at X-band @10 kHz off the carrier.

This design is extremely flexible, providing customer selectable interfaces of RS232, RS422 and RS485. There is also a provision for multiple units on one buss. Operating several units within one draw is possible because the unit offers a multi-drop bus configuration and the units are housed in an EMI enclosure with filtered connectors for minimum radiation and interference.

This low cost frequency synthesizer offers high performance in a unit with proven quality and reliability.

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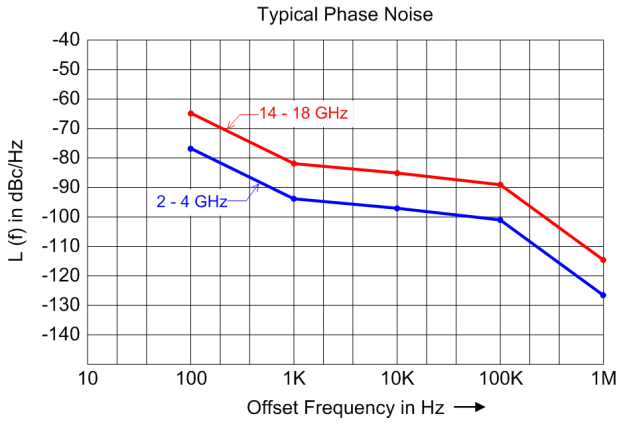
TLSD Key Specifications

Output Frequency:	1 - 12 GHz (Fundamental) to 24 GHz (with X2 multiplier)
Output Resolution:	100 kHz
Spurious:	-60 dBc
Harmonics (typ):	-20 dBc
Output Power (min.):	+13 dBm
Output Power Variation:	3 dB
External Reference:	10 MHz (typical) 0 dBm ±3 dB
Or Internal Reference:	±1 PPM (-10ºC to +70ºC)
Frequency Control:	RS-232, RS422 AND RS-485 (Selectable in unit)
Alarm:	Open Collector (high=lock)
EMI (typical):	-90 dBm
Power Requirements:	+5.2VDC (min.) +15.0VDC (min.)
Size:	6.80" x 4.40" x 0.80"



Specific Product Data Sheets (PDF)

- 2.0 to 4.0 GHz in 100 kHz steps - Model: TLSD20004000/100K
- 6.78 to 7.88 GHz in 100 kHz steps - Model: TLSD67807880/100K
- 8.0 to 12.0 GHz in 100 kHz steps - Model: TLSD800012000/100K
- 14.0 to 18.0 GHz in 200 kHz steps - Model: TLSD140001800/200K

Model TLS2:

The TLS2 is a smaller version of the TLSD which offers the same performance in a smaller (not EMI shielded) less costly unit.

Specific Product Data Sheets (PDF)

- 4.0 to 8.0 GHz in 100 kHz steps - Model: TLS2-40008000/100K

SPECIFICATIONS

Output Frequency

Tuning range:	2000 - 4000	MHz
Frequency step size:	100	kHz
Frequency stability and accuracy (Ext ref):	Same as input	
Frequency stability and accuracy (Int ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-80
	L(1 kHz)	-95
	L(10 kHz)	-100
	L(100 kHz)	-100
	L(1 MHz)	-125
Spurious:	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	13	dBm
Output power variation (freq. & temp.):	3	dB
Load VSWR:	2:1	

Input Frequency

Input reference frequency:	5 MHz, 10 MHz or Internal
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control:	Serial RS-232 / RS-422 / RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock
	(Open collector or CMOS / TTL)

DC Power

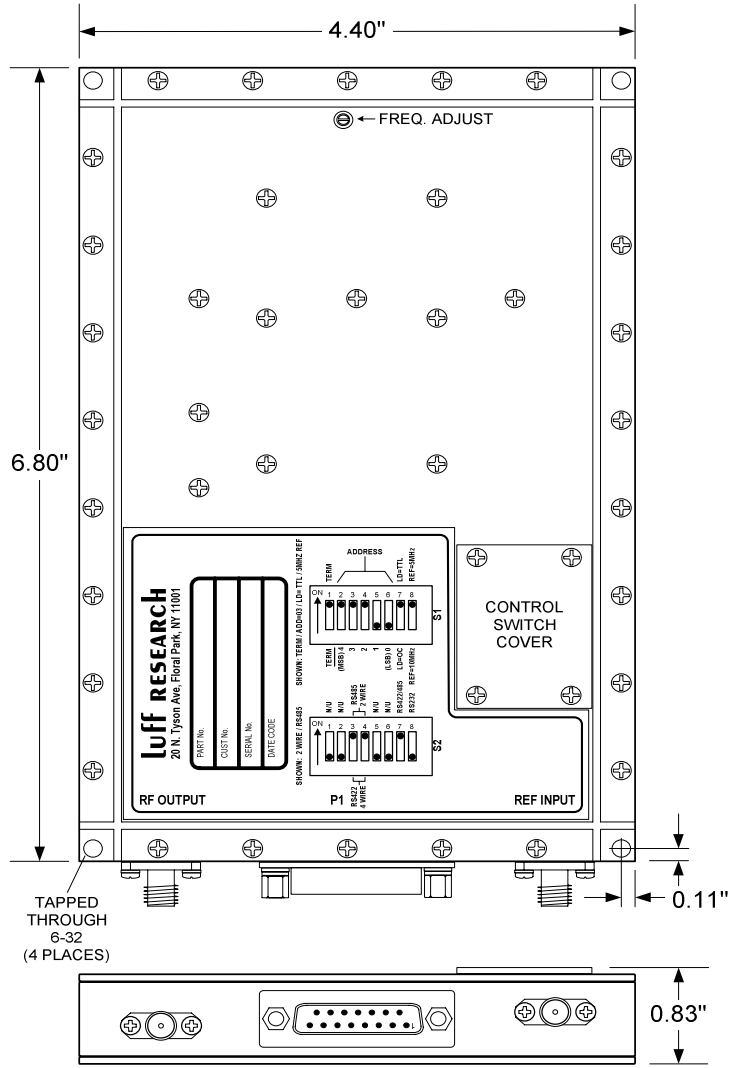
+5.2VDC (min) +7.0VDC (max)	800 mA
+15.0VDC (min) +17.0VDC (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB15 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz
EMI leakage:	-90 dBc



Notes:

1. This is an EMI gasketed package with a filtered DB15 connector.
2. Use Rev.K (11-14-07) of the Interface Definition for this unit.

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PRODUCT DATA SHEET

TLSD FREQUENCY SYNTHESIZER

Model: TLSD20004000/100K		**11/08/07**

SPECIFICATIONS

Output Frequency

Tuning range:	6780 - 7880	MHz
Frequency step size:	100	kHz
Frequency stability and accuracy (Ext ref):	Same as input	
Frequency stability and accuracy (Int ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-75
	L(1 kHz)	-85
	L(10 kHz)	-85
	L(100 kHz)	-93
	L(1 MHz)	-117
Spurious:	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	13	dBm
Output power variation (freq. & temp.):	3	dB
Load VSWR:	2:1	

Input Frequency

Input reference frequency:	5 MHz, 10 MHz or Internal
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control:	Serial RS-232 / RS-422 / RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock
	(Open collector or CMOS / TTL)

DC Power

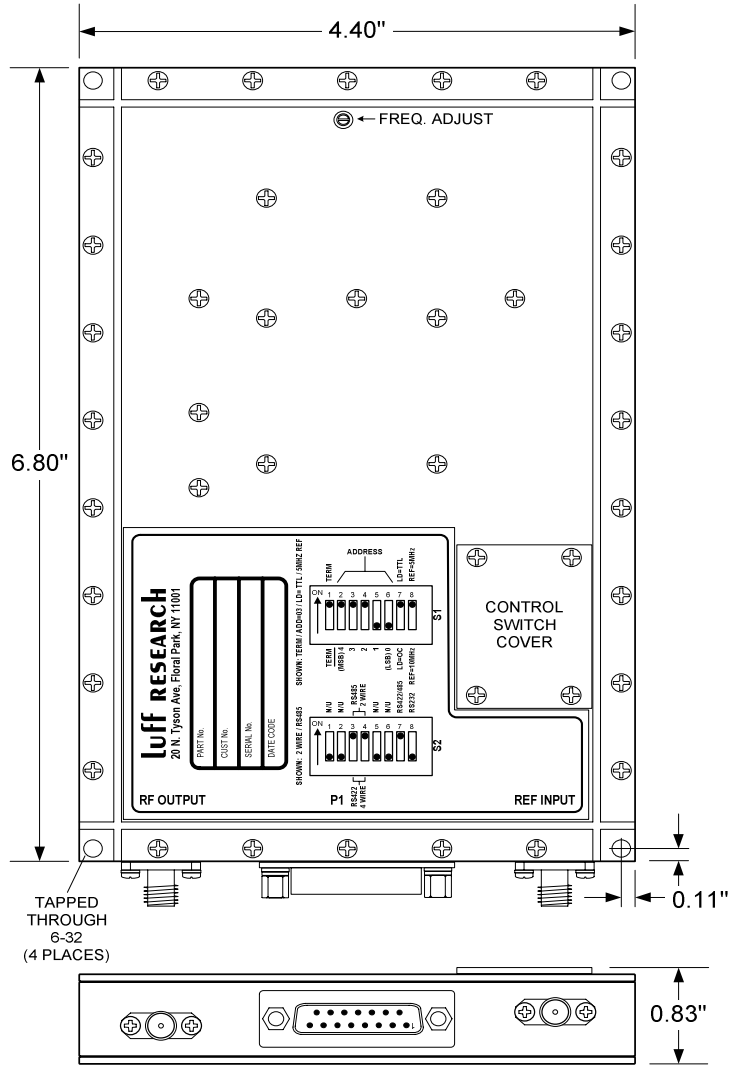
+5.2VDC (min) +7.0VDC (max)	750 mA
+15.0VDC (min) +17.0VDC (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB15 (M)

Environment

Operating temperature range (surface):	0°C to 60°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz
EMI leakage:	90 dBc



Notes:

1. This is an EMI gasketed package with a filtered DB15 connector.
2. Use Rev.K (11-14-07) of the Interface Definition for this unit.

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PRODUCT DATA SHEET

TLSD FREQUENCY SYNTHESIZER

Model: TLSD67807880/100K	Rev. C	01/11/08

SPECIFICATIONS

Output Frequency

Tuning range:		8 - 12 GHz
Frequency step size:		100 kHz
Frequency stability and accuracy (Ext ref):		Same as input
Frequency stability and accuracy (Int ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-73
	L(1 kHz)	-83
	L(10 kHz)	-83
	L(100 kHz)	-90
	L(1 MHz)	-115
Spurious:		-60 dBc
Harmonics (typ.):		-20 dBc
Power out (min.):		12 dBm
Output power variation (freq. & temp.):		3 dB
Load VSWR:		2:1

Input Frequency

Input reference frequency:	5 MHz, 10 MHz or Internal
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control:	Serial RS-232 / RS-422 / RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock
	(Open collector or CMOS / TTL)

DC Power

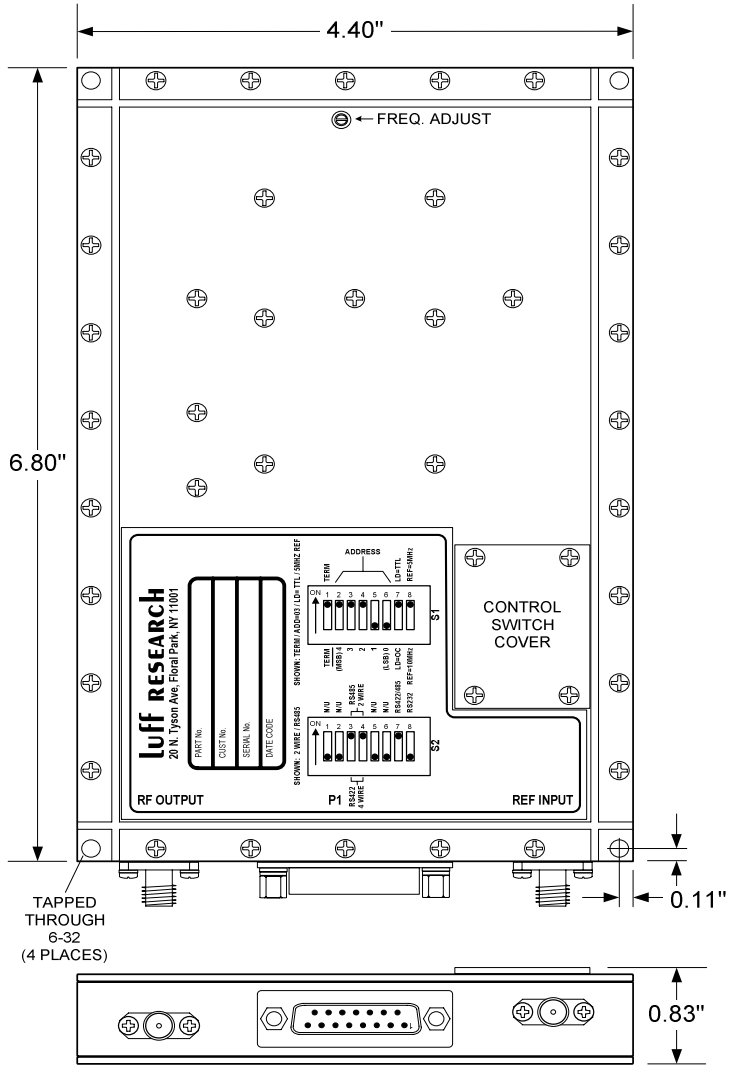
+5.2VDC (min) +7.0VDC (max)	800 mA
+15.0VDC (min) +17.0VDC (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB15 (M)

Environment

Operating temperature range (surface):	0°C to 60°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz
EMI leakage:	-90 dBc



Notes:

1. This is an EMI gasketed package with a filtered DB15 connector.
2. Use Rev.K (11-14-07) of the Interface Definition for this unit.

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PRODUCT DATA SHEET

TLSD FREQUENCY SYNTHESIZER

Model: TLSD800012000/100K		03/21/08

SPECIFICATIONS

Output Frequency

Tuning range:		14 - 18 GHz
Frequency step size:		200 kHz
Frequency stability and accuracy (Ext ref):		Same as input
Frequency stability and accuracy (Int ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-68
	L(1 kHz)	-80
	L(10 kHz)	-85
	L(100 kHz)	-85
	L(1 MHz)	-115
Spurious:		-60 dBc
Harmonics & Subharmonics (typ.):		-60 dBc
Power out (min.):		10 dBm
Output power variation (freq. & temp.):		±3 dB
Load VSWR:		1.5:1

Input Frequency

Input reference frequency:	5 MHz, 10 MHz or Internal
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control:	Serial RS-232 / RS-422 / RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock
	(Open collector or CMOS / TTL)

DC Power

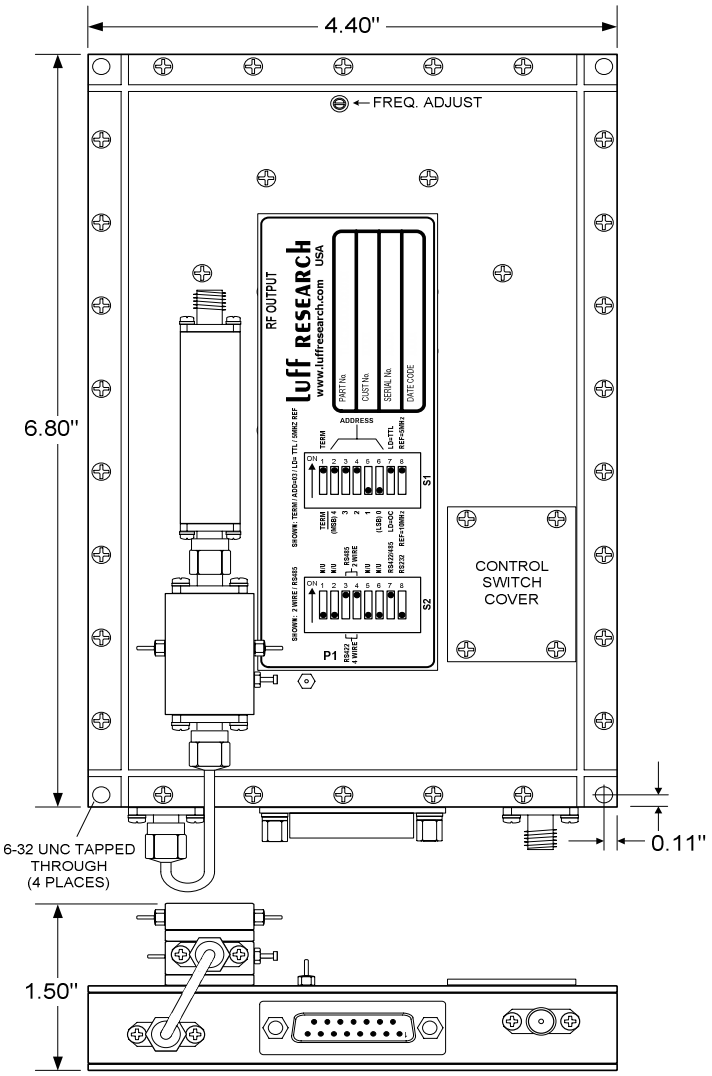
+5.2VDC (min) +7.0VDC (max)	900 mA
+15.0VDC (min) +17.0VDC (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB15 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz
EMI leakage:	-90 dBc



Notes:

1. This is an EMI gasketed package with a filtered DB15 connector (1000pF per pin).
2. Use Rev. K (11-14-07) of the Interface Definition for this unit.

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PRODUCT DATA SHEET

TLSD FREQUENCY SYNTHESIZER

Model: TLSD1400018000/200K		03/07/08

SPECIFICATIONS

Output Frequency

Tuning range:	4000 - 8000	MHz
Frequency step size:	100	kHz
Frequency stability and accuracy (Ext ref):	Same as input	
Frequency stability and accuracy (Int ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-75
	L(1 kHz)	-85
	L(10 kHz)	-90
	L(100 kHz)	-95
	L(1 MHz)	-120
Spurious:	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	13	dBm
Output power variation (freq. & temp.):	3	dB
Load VSWR:	2:1	

Input Frequency

Input reference frequency:	5 MHz, 10 MHz or Internal
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control:	Serial RS-232 / RS-422 / RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock
	(Open collector or CMOS / TTL)

DC Power

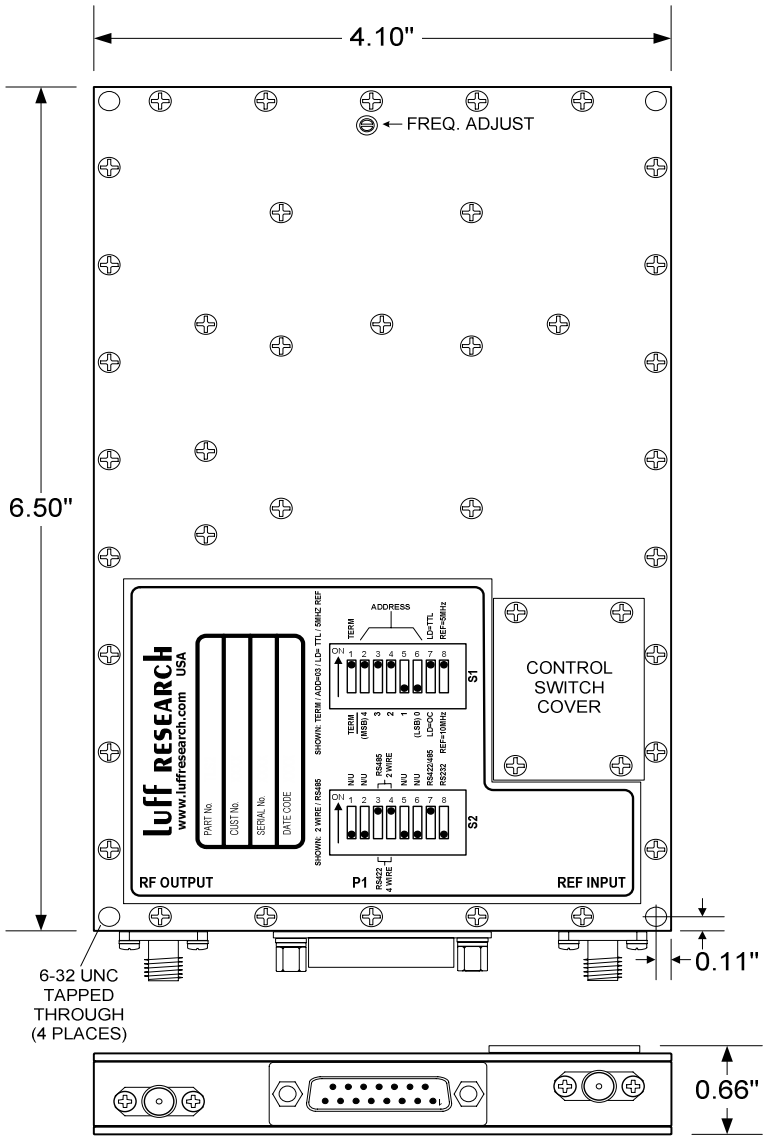
+5.2VDC (min) +7.0VDC (max)	800 mA
+15.0VDC (min) +17.0VDC (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB15 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



Notes:

1. Use Rev.K (11-14-07) of the Interface Definition for this unit.

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PRODUCT DATA SHEET

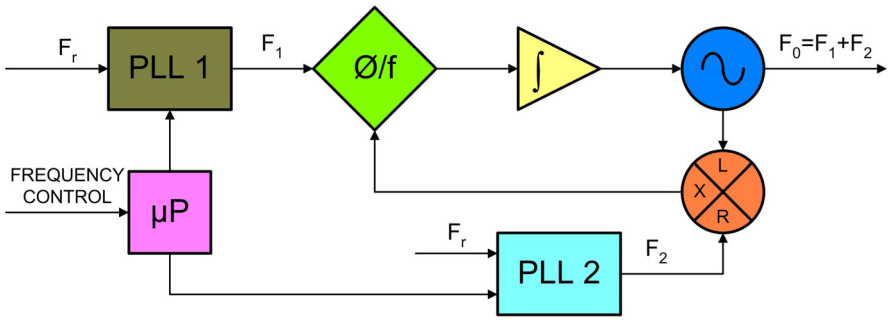
TLS2 FREQUENCY SYNTHESIZER

Model: TLS2-40008000/100K		**11/08/07**

Model TLS: Triple Loop Configuration

- **Features**
  - In bands up to 12 GHz
  - 100 kHz step resolution (typical)
  - Excellent phase noise
  - Excellent spectral purity
  - Parallel or serial RS485 frequency control
  - Internal or external frequency reference
  - Small size
  - Low cost

- **Block Diagram**



- **Description**

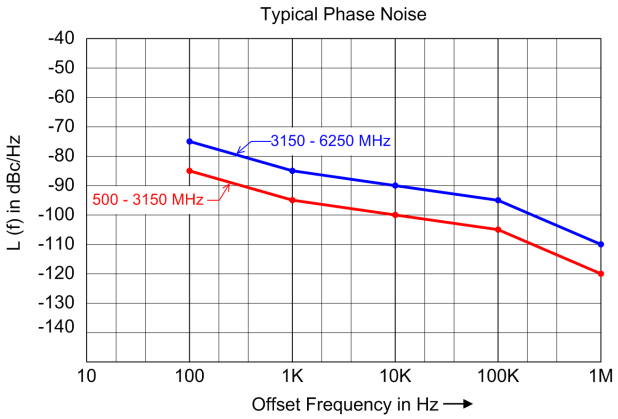
The TLS is an advanced frequency synthesizer design using a unique triple loop architecture in a miniature low profile package that offers either a serial RS485 or parallel frequency control.

This unit is ideal for applications requiring more demanding phase noise, spectral purity and resolution requirements then are offered by a single phase-locked loop frequency synthesizer configuration.

These units are easily customized to specific requirements and offer a great performance to cost factor.

TLS Key Specifications

Output Frequency:	1 - 12 GHz (Fundamental)
Output Resolution:	100 kHz
Spurious:	-60 dBc
Harmonics (typ):	-20 dBc
Output Power (min.):	+13 dBm
Output Power Variation:	3 dB
External Reference:	10 MHz (typical) 0 dBm ±3 dB
Or Internal Reference:	±1 PPM (-10ºC to +70ºC)
Frequency Control:	Parallel BCD Coded CMOS Input or Serial RS485
Alarm:	Open Collector (high=lock)
Power Requirements:	+5.2VDC (min.) +15.0VDC (min.)
Size:	6.50" x 4.10" x 0.60"



Specific Product Data Sheets (PDF)

- 500 to 3150 MHz in 100 kHz steps - Model: TLS05003150/100K
- 3150 to 6250 MHz in 100 kHz steps - Model: TLS31506250/100K
- 8000 to 12000 MHz in 100 kHz steps - Model: TLS800012000/100K

SPECIFICATIONS

Output Frequency

Tuning range:	500 - 3150	MHz
Frequency step size:	100	kHz
Frequency stability and accuracy (Ext ref):	Same as input	
Frequency stability and accuracy (Int ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-80
	L(1 kHz)	-95
	L(10 kHz)	-100
	L(100 kHz)	-100
	L(1 MHz)	-130
Spurious:	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	13	dBm
Output power variation (freq. & temp.):	3	dB
Load VSWR:	2:1	

Input Frequency

Input reference frequency:	10	MHz
Input ref. freq. level:	0 dBm ±3dB	

Frequency Tuning / Alarm

Frequency control: *(please specify required interface)*	Parallel BCD Coded CMOS Input or Serial RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock (open collector)

DC Power

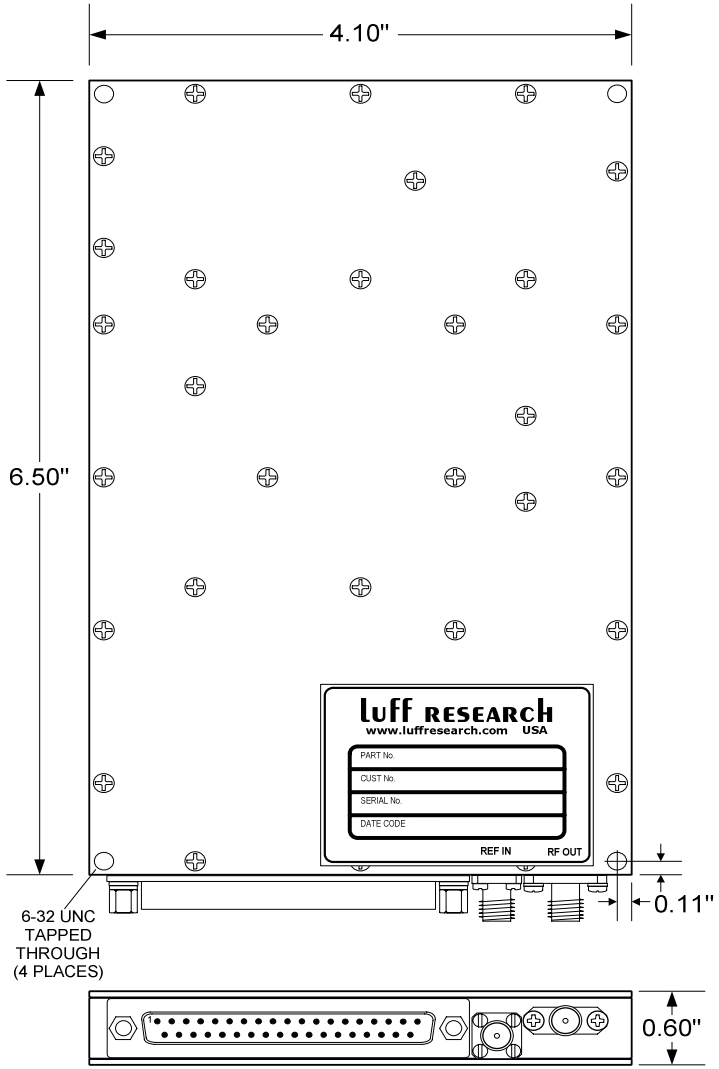
+5.2 Vdc (min) +7.0 Vdc (max)	600	mA
+15.0 Vdc (min) +17.0 Vdc (max)	200	mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB37 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 4 kHz



Notes:

1. These unit are available with an internal TCXO. (Model No. TLS05003150/100K/INT)
2. Units come standard with a serial interface. For Parallel units order Model No. TLS05003150/100K/P

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PRODUCT DATA SHEET

TLS FREQUENCY SYNTHESIZER

Model: TLS05003150/100K		**06/02/08**

SPECIFICATIONS

Output Frequency

Tuning range:	3150 - 6250	MHz
Frequency step size:	100	kHz
Frequency stability and accuracy (Ext ref):	Same as input	
Frequency stability and accuracy (Int ref):	±1 PPM (over temp range)	
Aging (After 2 months):	±1 PPM max per year @ 25°C	
Adjustability (typ.):	10 years	
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-75
	L(1 kHz)	-85
	L(10 kHz)	-90
	L(100 kHz)	-95
	L(1 MHz)	-120
Spurious:	-60	dBc
Harmonics (typ.):	-20	dBc
Power out (min.):	13	dBm
Output power variation (freq. & temp.):	3	dB
Load VSWR:	2:1	

Input Frequency

Input reference frequency:	10	MHz
Input ref. freq. level:	0 dBm ±3dB	

Frequency Tuning / Alarm

Frequency control: *(please specify required interface)*	Parallel BCD Coded CMOS Input or Serial RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock (open collector)

DC Power

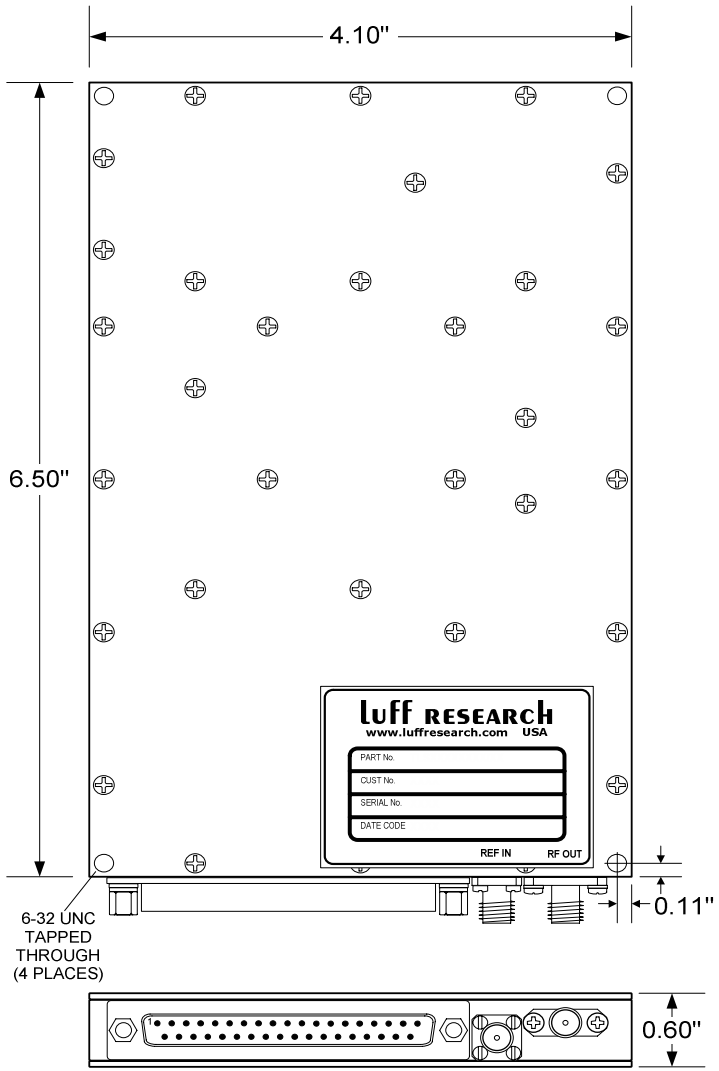
+5.2 Vdc (min) +7.0 Vdc (max)	600	mA
+15.0 Vdc (min) +17.0 Vdc (max)	200	mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB37 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



Notes:

1. These unit are available with an internal TCXO. (Model No. TLS31506250/100K/INT)
2. Units come standard with a serial interface. For Parallel units order Model No. TLS31506250/100K/P

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PRODUCT DATA SHEET

TLS FREQUENCY SYNTHESIZER

Model: TLS31506250/100K		**06/02/08**

SPECIFICATIONS

Output Frequency

Tuning range:		8 - 12 GHz
Frequency step size:		100 kHz
Frequency stability and accuracy (Ext ref):		Same as input
Frequency stability and accuracy (Int ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-75
	L(1 kHz)	-85
	L(10 kHz)	-85
	L(100 kHz)	-90
	L(1 MHz)	-115
Spurious:		-60 dBc
Harmonics (typ.):		-20 dBc
Power out (min.):		13 dBm
Output power variation (freq. & temp.):		3 dB
Load VSWR:		2:1

Input Frequency

Input reference frequency:	10 MHz
Input ref. freq. level:	0 dBm ±3dB

Frequency Tuning / Alarm

Frequency control: *(please specify required interface)*	Parallel BCD Coded CMOS Input or Serial RS-485
Acquisition time:	100 msec
Phase-lock indicator:	High = lock (open collector)

DC Power

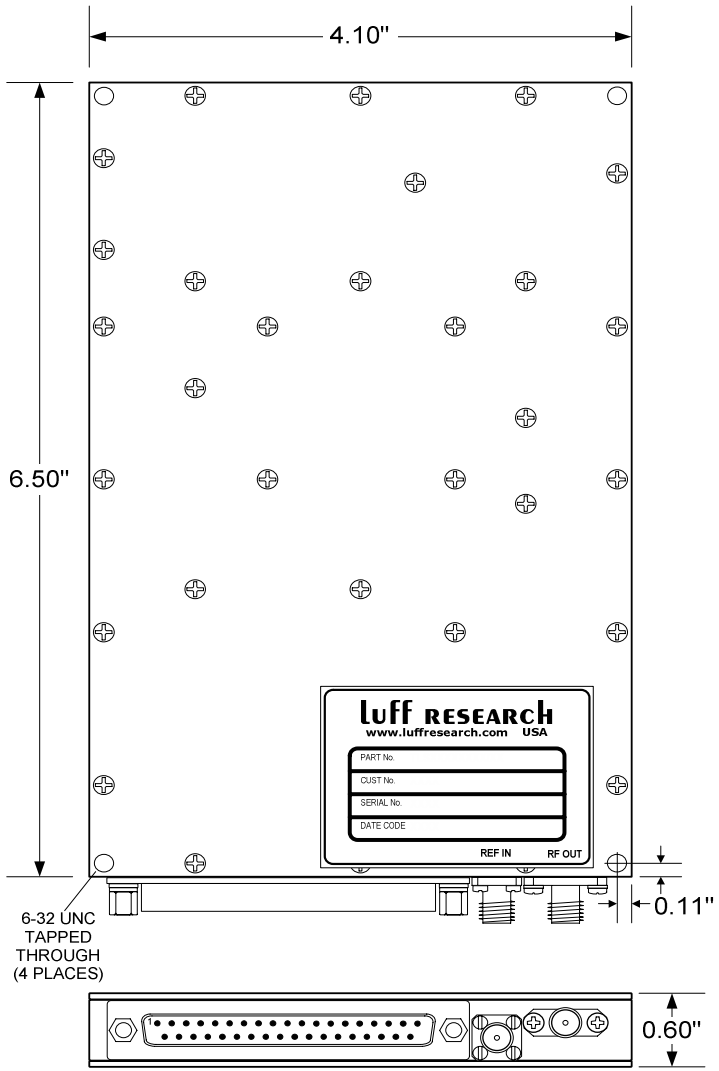
+5.2 Vdc (min) +7.0 Vdc (max)	850 mA
+15.0 Vdc (min) +17.0 Vdc (max)	150 mA

Mechanical

RF connectors:	SMA (F)
Digital & DC connection:	DB37 (M)

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 4 kHz



Notes:

1. These unit are available with an internal TCXO. (Model No. TLS800012000/100K/INT)
2. Units come standard with a serial interface. For Parallel units order Model No. TLS800012000/100K/P

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PRODUCT DATA SHEET

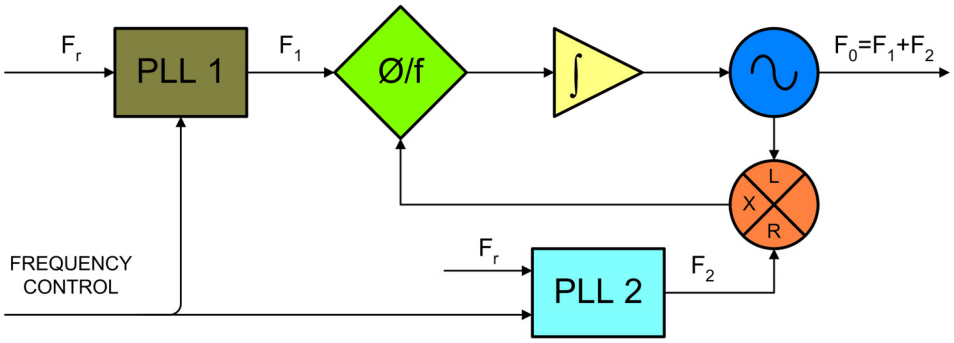
TLS FREQUENCY SYNTHESIZER

Model: TLS800012000/100K		**06/01/08**

Custom Configurations

- **Features:**
  - Fundamental operation in bands up to 20 GHz
  - 100 kHz step resolution (typical)
  - Excellent phase noise
  - Power output to 23 dBm
  - Excellent spectral purity
  - Serial frequency control
  - Internal (to ±1PPM) or external frequency reference
  - Small size
  - Low cost

- **Block Diagram**



- **Description**

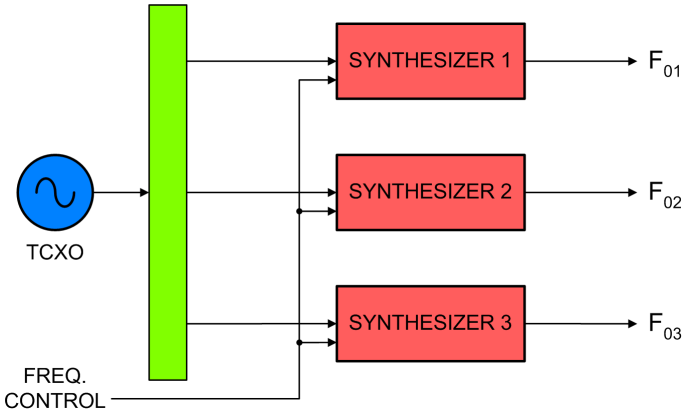
Fundamental units are available to 8 GHz. These units have a typical resolution of 100 kHz and offer high spectral quality. In addition, these units are serially programmable via an RS485 bus. The configuration can support up to 20 synthesizers on one bus. The units are EMI isolated and exhibit minimal RF radiation.

- **Specific Product Data Sheets** (PDF)
  - 8400 to 9700 MHz frequency synthesizer with 100 kHz steps, Internal reference, power output +23dBm and a RS484 interface - Model: TLSC84009700/100K/INT-1

Custom Assemblies

- **Features**
  - 3 independent miniature synthesizers operating in bands up to 12 GHz
  - Low phase noise
  - Low spurious
  - Internal reference TCXO (±1PPM)
  - Small size
  - Low cost

- **Block Diagram**



- **Description**

This small integrated assembly consists of 3 independent (SLSM4) X-Band synthesizers. There is an internal TCXO frequency reference providing ±1PPM accuracy and stability to the output signals. The synthesizer are controlled via a 3 wire bus. This is a rugged miniature EMI packaged assembly that provides a diverse function at a low cost.

- **Specific Product Data Sheets** (PDF)
  - Model FSC-033

20 N. Tyson Ave, Floral Park, NY 11001 Tel. (516) 358-2880 Fax (516) 358-2757 Email: sales@luffresearch.com Web: www.luffresearch.com

SPECIFICATIONS

Output Frequency

Tuning range (Three independent outputs):	Band1:	800 - 1000	MHz
	Band2:	1700 - 2700	MHz
Frequency step size:		200	kHz
Frequency stability and accuracy:		±1	PPM
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-65	
	L(1 kHz)	-70	
	L(10 kHz)	-75	
	L(100 kHz	-110	
	L(200 kHz	-120	
	L(1 MHz)	-130	
Spurious (typ.):		-60	dBc
Isolation between outputs:		-85	dBc
Harmonics (typ.):		-20	dBc
Power out (min.) (each output):		14	dBm
Output power variation (freq. & temp.):		2	dB
Output VSWR:		1.5:1	
Load VSWR:		3:1	

Output Frequency

Output reference frequency:	10 MHz
Output ref. freq. level:	TTL

*

Frequency Tuning / Alarm

Frequency control:	6 wire serial (TTL)
Acquisition time:	10 msec
Phase-lock indicator (for each output):	Lock = High (open collector)

DC Power (Total)

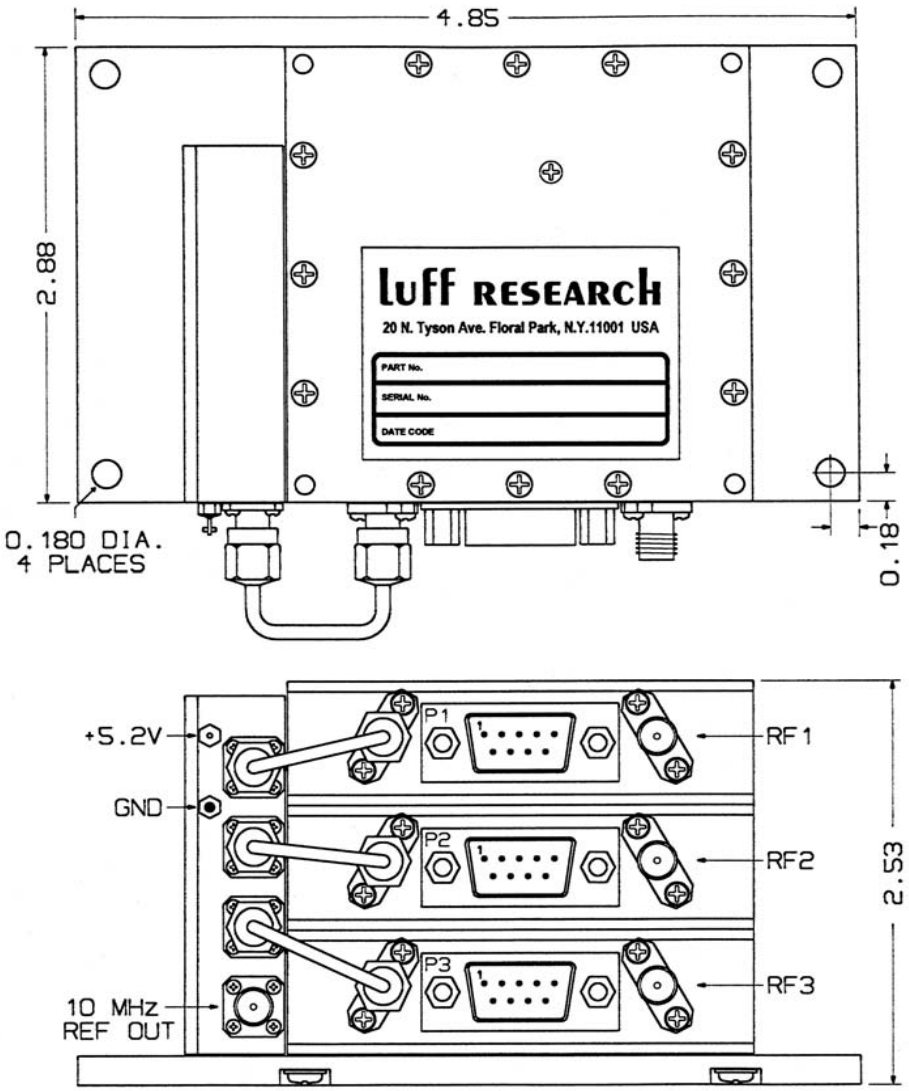
+5.2VDC (min) +7.0VDC (max)	1 A

Mechanical

RF connectors:	4 SMA (F)
Digital & DC connection:	3 DB9 (M) / Filtered Feedthru

Environment

Operating temperature range (surface):	0°C to 40°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz
EMI (max):	-95 dBm



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PRODUCT DATA SHEET

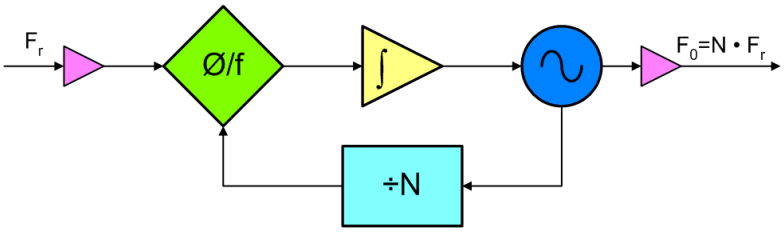
CUSTOM FREQUENCY SYNTHESIZER

Model: FSC-033		**07/29/06**

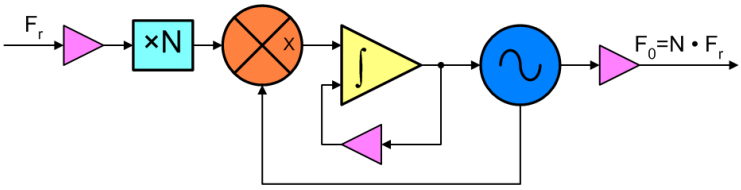
Standard Phase-Locked Oscillator Products

Luff Research offers phase-locked oscillators (PLO) that span the 10 MHz to 24 GHz frequency range. In most general implementation PLO's are realized in one of the four architectures show below:

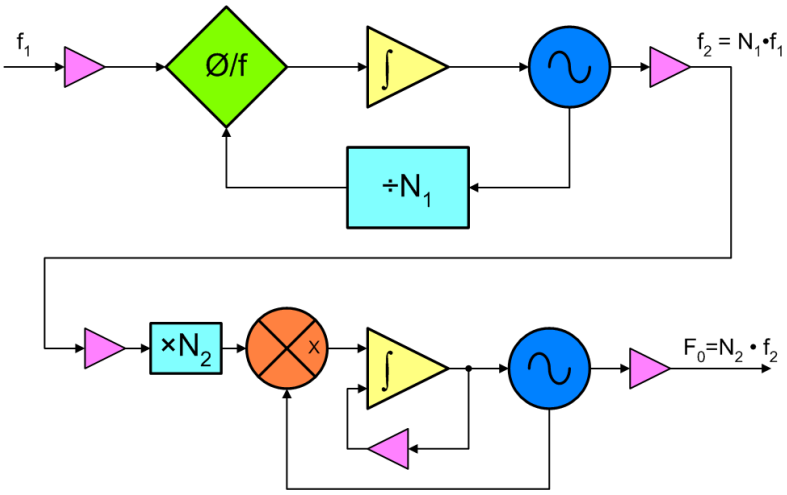
- **Phase-locked oscillators with digital dividers:**



- **Phase-locked oscillators with a harmonic multiplier:**



- **Dual loop phase-locked oscillators:**



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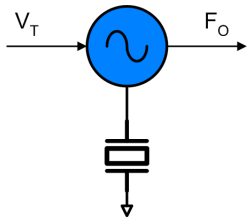
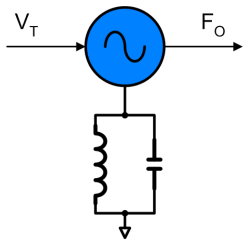
The implementation of a specific PLO depends on its specific set of requirements. These usually are; available reference (or no reference when an internal reference is required), the desired output frequency, the desired phase noise, output power level, etc.
The output frequency required will determine the selection of the appropriate fundamental oscillator to be used in the PLO.

- **PLXO - Crystal Oscillators 10 to 300 MHz frequency range:**



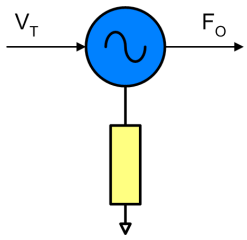
  - Very Stable
  - The best available phase noise
  - Moderate cost

- **PLLCO - LC Oscillators 10 MHz to 500 MHz frequency range:**



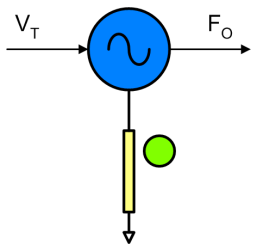
  - Moderate Stability
  - Phase noise 10-20 db greater then either the DRO or CRO
  - Very low cost

- **PLCRO - Ceramic Resonator Oscillators 500 to 6000 MHz frequency range:**

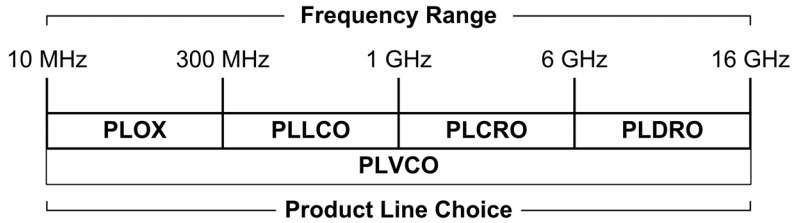


  - Very Stable
  - Excellent phase noise
  - Low cost

- **PLDRO - Dielectric Resonator Oscillators 5 to 12 GHz frequency range:**



  - Very stable
  - Excellent phase noise
  - Moderate cost



We have extensive experience with all aspects of phase-locked oscillator design and manufacture.

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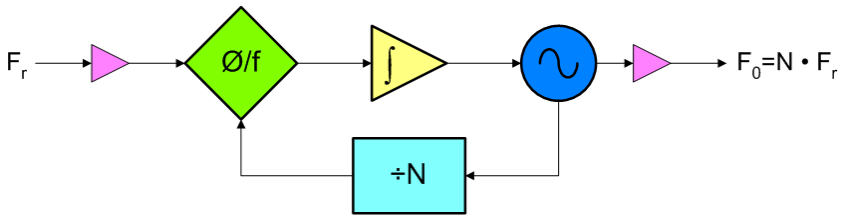
Phase-Locked Crystal Oscillator (PLXO)

Model PLOX:

- **Features**
  - Output frequencies up to 150 MHz (300 MHz with doubler)
  - Excellent phase noise
  - Typical resolution 100 kHz
  - Internal or external reference frequency
  - Small size (2.25" x 2.25" x 0.66")
  - Low cost

- **Block Diagram**

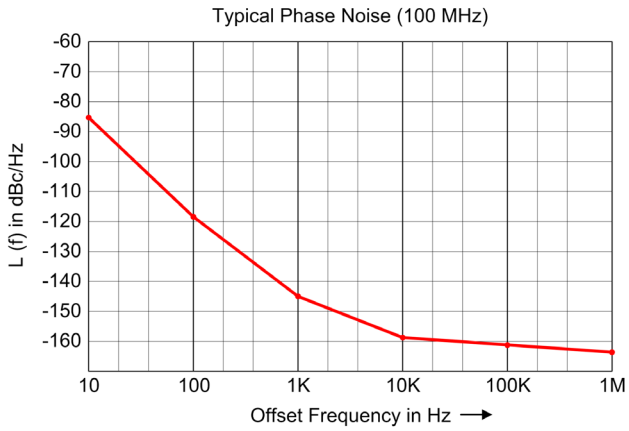


- **Description**

Model PLOX is a line of very low phase noise, phase-locked crystal oscillators. These units have been designed for a wide variety of demanding applications in communications and radar systems.

- **PLXO Key Specifications**

Output Frequency:	up to 150 MHz
with doubler:	up to 300 MHz
Spurious:	-70 dBc
Harmonics (typ):	-40 dBc
Output Power (min.):	+13 dBm
External Reference:	1 to 20 MHz (0 dBm ±3 dB)
or	
Internal Reference:	±1 PPM (-10ºC to +70ºC)
Alarm:	Open Collector
Power Requirements:	+5VDC
Size:	2.25" x 2.25" x 0.66"



- **Specific Product Data Sheets** (PDF)
  - 100 MHz PLO - 10 MHz external reference. Model: PLOX0100-10
  - Custom switchable crystal oscillators. Model: FSC-034-1

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SPECIFICATIONS

Output Frequency

Frequency:		100 MHz
Freq. stability and accuracy (IExt. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(10 Hz)	-85
	L(100 Hz)	-115
	L(1 kHz)	-140
	L(10 kHz)	-150
	L(100 kHz)	-155
	L(1 MHz)	-155
Spurious (min.):		-80 dBc
Harmonics (typ.):		-40 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	10 MHz
Input level:	0 dBm ±3 dB

DC Power

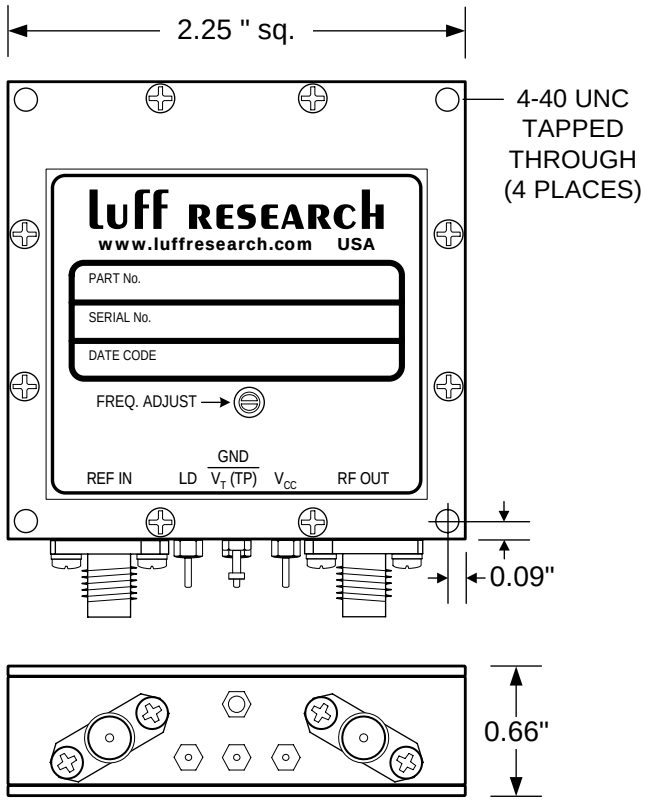
+5.0VDC (min.) +6VDC (nom.)	150 mA (max.)
Internal regulator	

Mechanical

RF connector:	SMA (F)
DC connection:	Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. PLODxxxx-INT)
2. The Frequency adjustment is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.
4. Model No. PLOD*xxxx -yy*
   xxxx = the output frequency in MHz and *yy* = the reference frequency in MHz.

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PRODUCT DATA SHEET

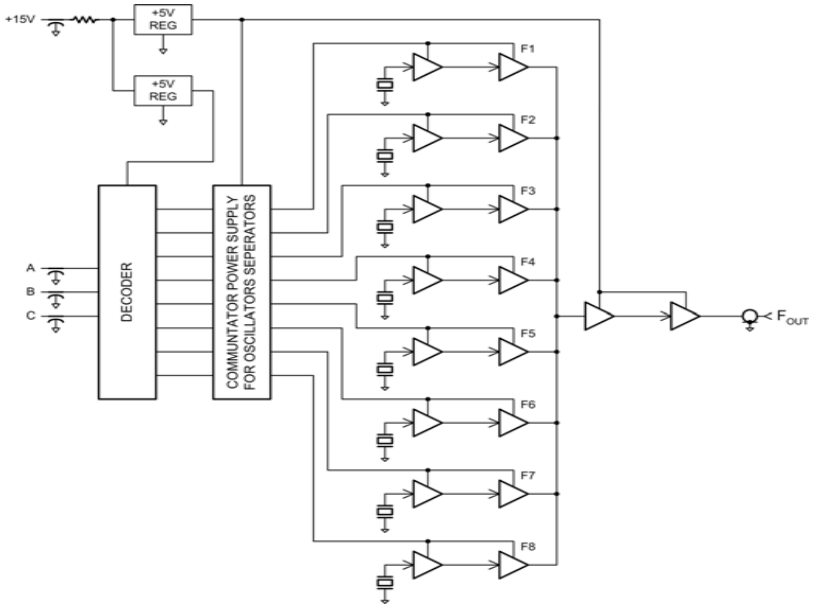
Phase-Locked Crystal Oscillator

Model: PLOX100-10		**01/18/08**

SPECIFICATIONS

FREQUENCY: SET OF 8 FREQUENCIES

FREQUENCY (MHz)	SWITCH C	B	A
F1 - 97.00	H	H	H
F2 - 98.00	H	H	L
F3 - 99.00	H	L	H
F4 - 100.00	H	L	L
F5 - 101.00	L	H	H
F6 - 102.00	L	H	L
F7 - 103.00	L	L	H
F8 - 104.00	L	L	L



FREQUENCY STABILITY

Vs. TEMPERATURE RANGE C1:	±20 ppm (MAX)
Vs. POWER SUPPLY:	±1 ppm (MAX)
Vs. LOAD:	±1 ppm (MAX)

OUTPUT SIGNAL WAVEFORM

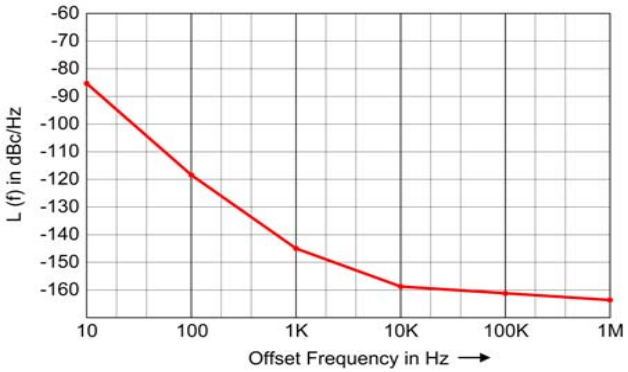
LEVEL:	4 to 10 dBm
HARMONICS / DUTY CYCLES:	-25 dBc (MIN.)
	-60 dBc (MIN.)
LOAD:	50 ±10% OHM (NOM.)

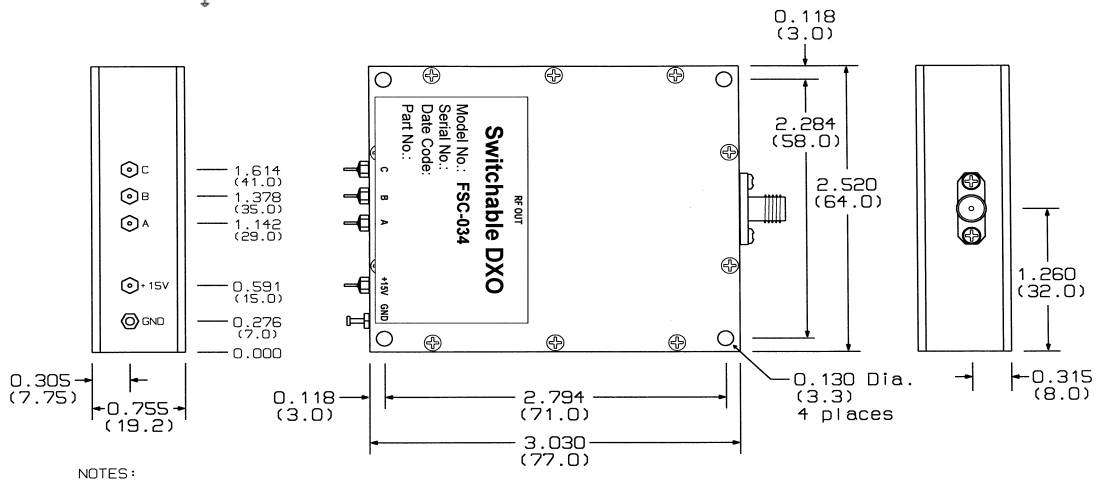
TEMPERATURE RANGE

OPERATING G1:	-40C to +71C
STORAGE G3:	-55C to +85C

POWER SUPPLY (Vcc): +6 to +15V @ 200 mA

Typical Phase Noise (100 MHz)





NOTES:

1. MATERIAL: ALUM ALLOY 6061-T6
2. FINISH: Chemical Conversion Coating: MIL-DTL-5541F Type II, Class 3, Clear (RoHS Compliant)
3. DIMENSIONS: INCHES (mm)
4. TOLERANCE INCHES: .xxx = +/-.005

PIN DESCRIPTION

A	TTL CONTROL	(3 BIT)
B	TTL CONTROL	
C	TTL CONTROL	
+15V	DC CONNECTOR	FILTERED SOLDER TERMINAL
RF	RF CONNECTOR	SMA (F)

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PRODUCT DATA SHEET

SWITCHABLE FREQUENCIES XO

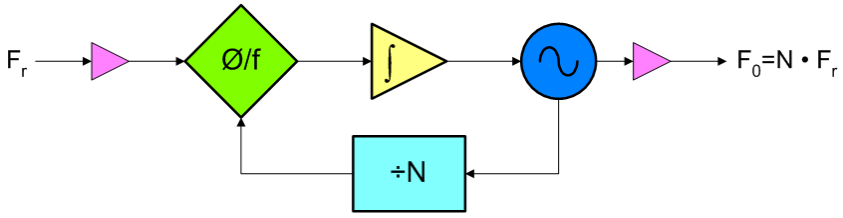
Model: FSC-034-1		**05/16/08**

Phase-Locked High-Q LC Oscillator (PLLCO)

Model PLOD:

- **Features**
  - Output frequencies up to 500 MHz
  - Good phase noise
  - Typical resolution 100 kHz
  - Internal or external reference frequency
  - Small size (2.25" x 2.25" x 0.66")
  - Low cost

- **Block Diagram**

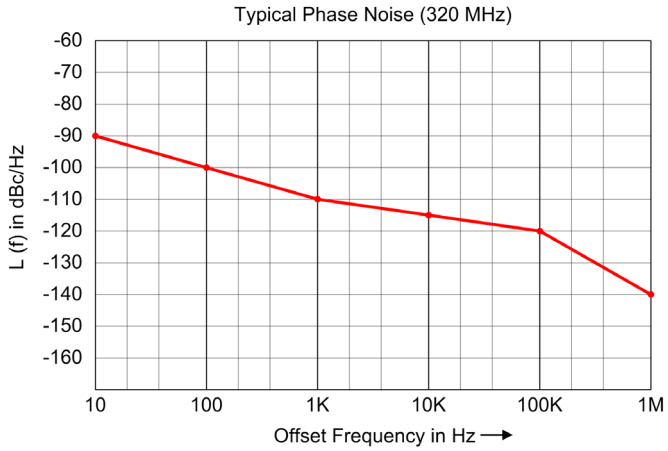


- **Description**

For requirements where the desired output frequencies are relatively low and the PLCRO can't be implemented practically, we offer our PLLCO line of products. These are phase-locked oscillators that use a high-Q LC resonator or a transmission line resonator. These units are very versatile and can be customized in many ways to fulfill a desired LO requirement for communications or instrumentation. Packaged in our standard housing these units yield excellent performance and value.

- **PLXO Key Specifications**

Output Frequency:	up to 500 MHz
Spurious:	-70 dBc
Harmonics (typ):	-40 dBc
Output Power (min.):	+13 dBm
External Reference:	1 to 20 MHz (0 dBm ±3 dB)
or	
Internal Reference:	±1 PPM (-10ºC to +70ºC)
Alarm:	Open Collector
Power Requirements:	+5VDC
Size:	2.25" x 2.25" x 0.66"



- **Specific Product Data Sheets** (PDF)
  - 320 MHz PLO - 10 MHz external reference input - Model: PLOD0320-10

SPECIFICATIONS

Output Frequency

Frequency:		320 MHz
Freq. stability and accuracy (Ext. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(10 Hz)	-90
	L(100 Hz)	-100
	L(1 kHz)	-110
	L(10 kHz)	-115
	L(100 kHz)	-120
	L(1 MHz)	-140
Spurious:		-60 dBc
Harmonics (typ.):		-40 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	10 MHz
Input level:	0 dBm ±3 dB

DC Power

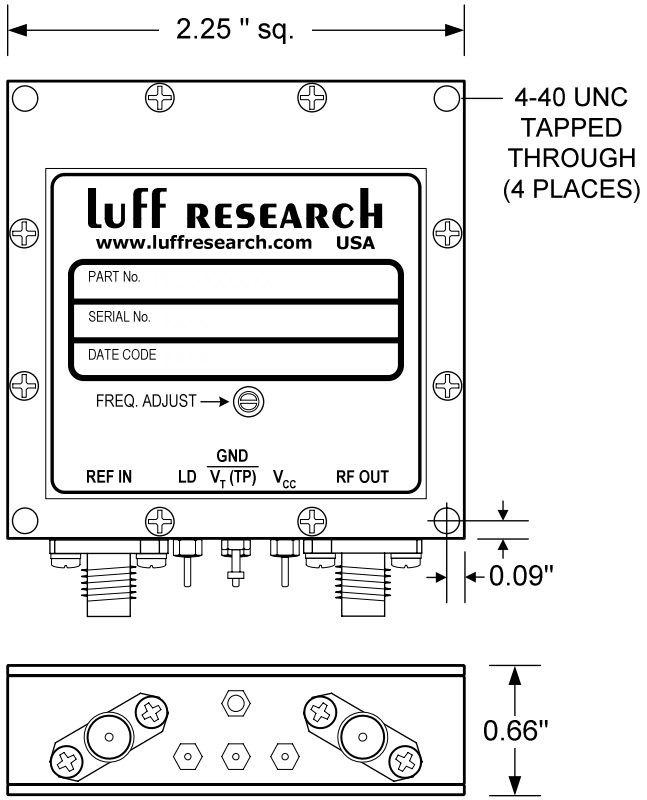
+5.0VDC (min.) +6.0VDC (max.)	250 mA (max.)
Internal regulator	

Mechanical

RF connector:	2 SMA (F)
DC connection:	3 Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. PLODxxxx-INT)
2. The Frequency adjustment is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.
4. Model No. PLOD*xxxx -yy*
   xxxx = the output frequency in MHz and *yy* = the reference frequency in MHz.

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PRODUCT DATA SHEET

Phase-Locked Hi-Q LC Oscillator

Model: PLOD0320-10		**06/02/08**

Phase-Locked Ceramic Resonator Oscillator (PLCRO)

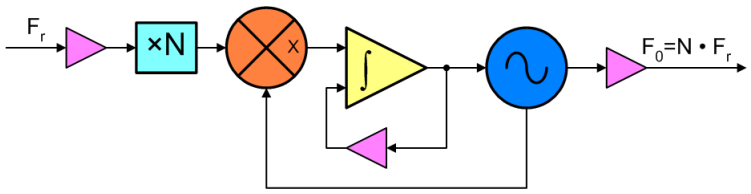
Model PLOA or PLOD:

Features

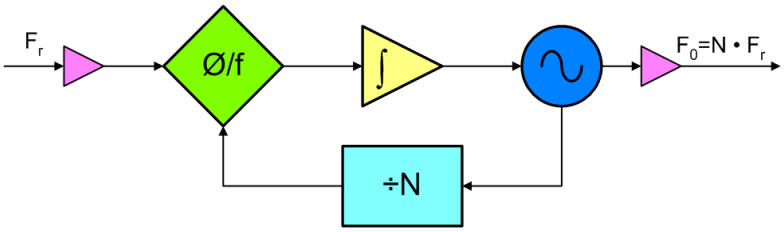
- Output frequencies from 500 to 6000 MHz
- Very low phase noise
- Full industrial temperature range -45° to +85°C
- Dual isolated output option
- Internal or external reference frequency
- Small size (2.25" x 2.25" x 0.66")
- Low cost

Block Diagram

PLOA



PLOD



Description

This is a line of fixed frequency phase-locked oscillators that use a high-Q ceramic resonator oscillator and either analog sampling phase detector techniques (Luff model PLOA) or digital techniques (Luff model PLOD) to establish phase lock to the reference.

The PLOA configuration is used when the best possible spectral quality is needed. The PLOA configuration has the limitation that the output frequency must be an integer factor of the input frequency.

The PLOD has a much more flexible frequency plan, however, the phase noise of the PLOD is not as low as that of the PLOA.

Both units are housed in a rugged low profile assembly and employ our unique manufacturing techniques that result in units of excellent value.

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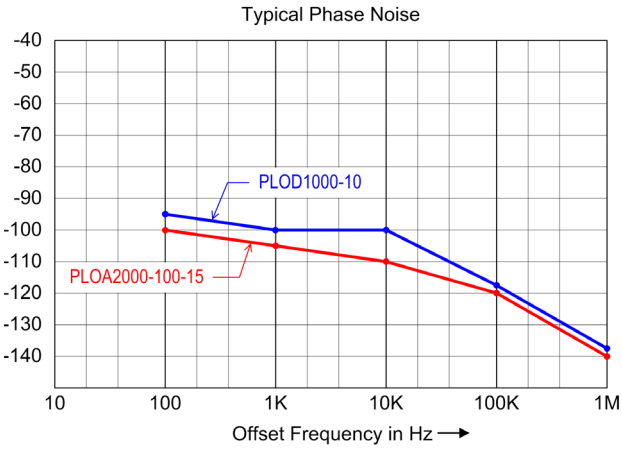
PLCRO Key Specifications

Output Frequency:	from 500 MHz to 6 GHz
Spurious:	-70 dBc
Harmonics (typ):	-40 dBc
Output Power (min.):	+13 dBm
External Reference:	1 to 200 MHz (0 dBm ±3 dB)
or	
Internal Reference:	±1 PPM (-10ºC to +70ºC)
Alarm:	Open Collector
Power Requirements:	+5VDC (PLOD) +12 or +15VDC (PLOA)
Size:	2.25" x 2.25" x 0.66"



Specific Product Data Sheets (PDF)

- 2000 MHz PLOA - 100 MHz external reference input - +12 volt operation - Model: PLOA2000/100/15
- 1000 MHz PLOD - 10 MHz external reference input - Model: PLOD1000-10

SPECIFICATIONS

Output Frequency

Frequency:		2,000 MHz
Freq. stability and accuracy (IExt. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-90
	L(1 kHz)	-100
	L(10 kHz)	-110
	L(100 kHz)	-115
	L(1 MHz)	-140
Spurious (min.):		-70 dBc
Harmonics (typ.):		-40 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (TTL)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	100 MHz
Input level:	0 dBm ±3 dB

DC Power

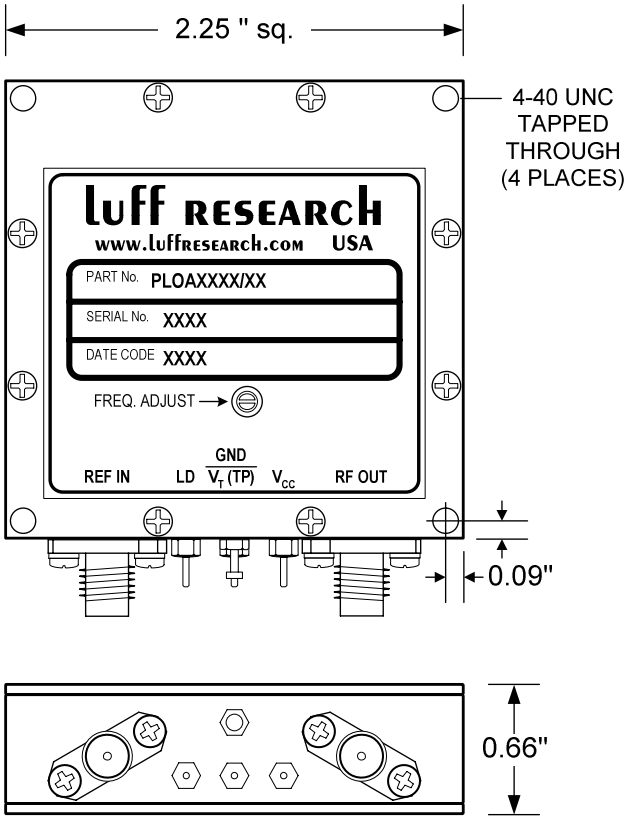
+15.0V ±0.5V	300 mA (max.)
Internal regulator	

Mechanical

RF connector:	SMA (F)
DC connection:	Filtered Feed Throughs

Environment

Operating temperature range (surface):	0°C to 60°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. PLOAxxxx/INT/zz)

2. The Frequency adjustment is only applicable on units with internal reference.

3. The 'REF IN' connector is not provided on units with internal reference.

4. Model No. PLOA*xxxx /yyy/zz*
   xxxx = the output frequency in MHz, *yyy* = the reference frequency in MHz
   zz = Vcc (+12V or +15V).

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PRODUCT DATA SHEET

Phase-Locked Ceramic Resonator Oscillator

Model: PLOA2000/100/15		**05/22/08**

SPECIFICATIONS

Output Frequency

Frequency:		1,000 MHz
Freq. stability and accuracy (Ext. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-85
	L(1 kHz)	-95
	L(10 kHz)	-100
	L(100 kHz)	-120
	L(1 MHz)	-140
Spurious:		-60 dBc
Harmonics (typ.):		-25 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	10 MHz
Input level:	0 dBm ±3 dB

DC Power

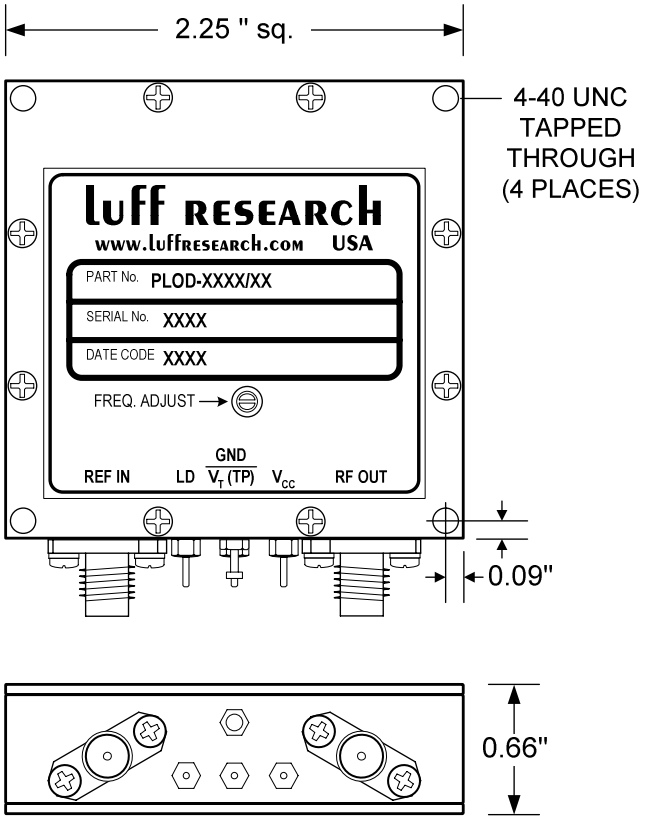
+5.0VDC (min.) +6VDC (nom.)	250 mA (max.)
Internal regulator	

Mechanical

RF connector:	2 SMA (F)
DC connection:	3 Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. PLODxxxx/INT)
2. The Frequency adjustment is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.
4. Model No. PLOD*xxxx /yy*
   xxxx = the output frequency in MHz and *yy* = the reference frequency in MHz.

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PRODUCT DATA SHEET

Phase-Locked Ceramic Resonator Oscillator

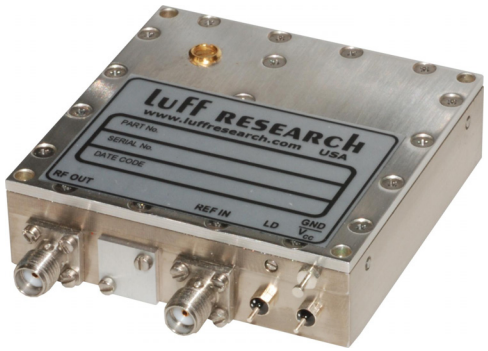
Model: PLOD1000-10		**11/01/07**

NEW! 10 MHz Reference Input Phase-Locked Dielectric Resonator Oscillator

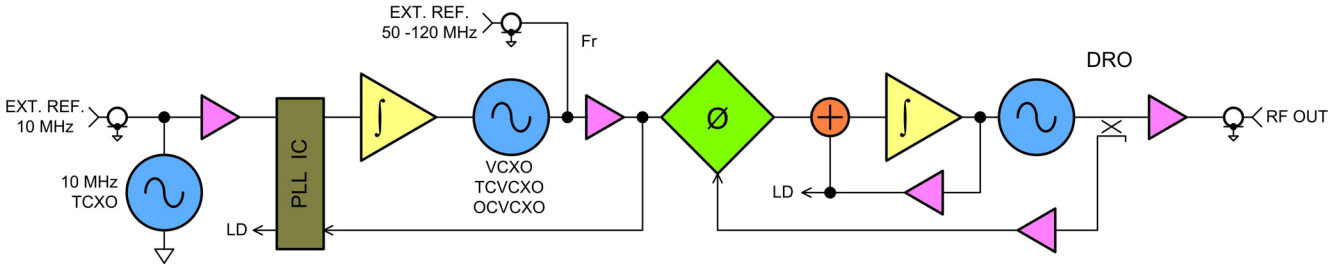
Model PLDRO:

Features

- Output frequencies from 8 to 16 GHz
- Reference Input - External 10 MHz or 50-120 MHz / Internal TCXO or OCXO
- Low Power Design +5VDC
- Load and drive insensitive
- Low cost



Block Diagram

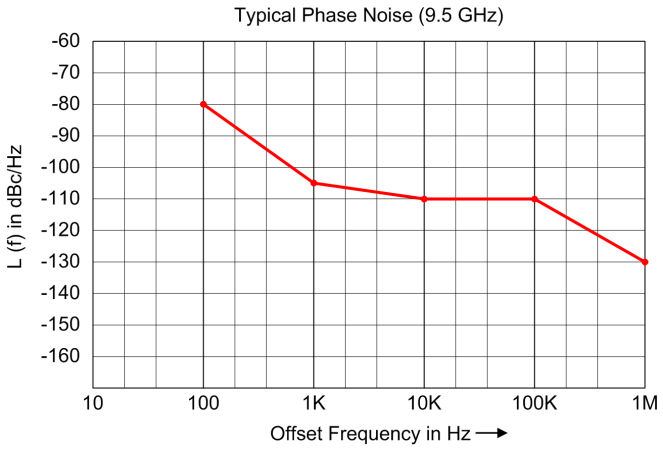


Description

This new PLDRO design incorporates many highly desirable features in a rugged low cost unit. This unit can be configured to operate with a reference frequency from one of the following sources: (1) external 10 MHz; (2) external input frequency in the 50 - 120 MHz range or (3) internal TCXO or OCXO. Another unique feature of this unit is its low power consumption and +5VDC operation. This highly reliable unit is thoroughly burned in and tested, guaranteeing the highest performance available.

PLDRO Key Specifications

Output Frequency:	8 - 16 GHz
Output Resolution:	N • F_r where N is an Integer
Spurious:	-70 dBc
Harmonics (typ):	-30 dBc
Output Power (min.):	+13 dBm
Output Power Variation:	3 dB
External Reference:	10 MHz or 50 - 120 MHz
Or Internal Reference:	±10 PPM (option A) ±1 PPM (option B) ±0.1 PPM (option C)
Alarm:	Open Collector
Power Requirements:	+5.0VDC @ 400 mA
Temperature Range:	-10° to +70°C
Size:	2.25" x 2.25" x 0.8"



Specific Product Data Sheets (PDF)

- 15 GHz PLDRO - 10 MHz external reference input - Model: PLDRO-15000-10

20 N. Tyson Ave, Floral Park, NY 11001 Tel. (516) 358-2880 Fax (516) 358-2757 Email: sales@luffresearch.com Web: www.luffresearch.com

SPECIFICATIONS

Output Frequency

Frequency:		15 GHz
Freq. stability and accuracy (Ext. Ref):		Same as Input
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-70
	L(1 kHz)	-100
	L(10 kHz)	-105
	L(100 kHz)	-110
	L(1 MHz)	-130
Spurious:		-75 dBc
Harmonics (typ.):		-30 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	10 MHz
Input level:	0 dBm ±3 dB

DC Power

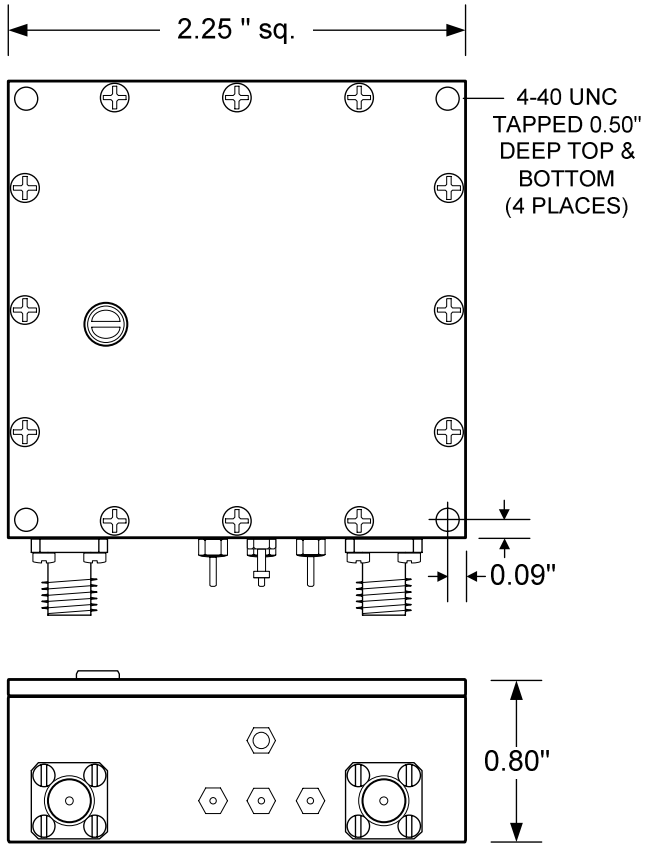
+5.0VDC (min.) +6.0VDC (max.)	500 mA (max.)
Internal regulator	

Mechanical

RF connector:	2 SMA (F)
DC connection:	3 Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



luff research, inc.

FLORAL PARK, NY

PHONE: (516) 358-2880 FAX: (516) 358-2757

PRODUCT DATA SHEET

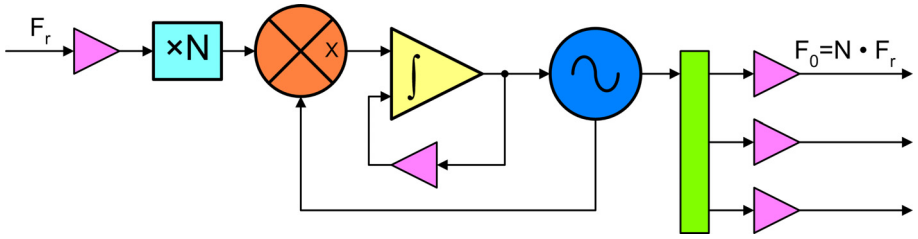
Phase-Locked Dielectric Resonator Oscillator

Model: PLDRO-15000-10		09/11/08

Ceramic Resonator Oscillator

- **Features:**
  - High performance PLCRO
  - Triple output
  - Very low phase noise
  - Buffered and isolated outputs.
  - Encapsulated for humidity.
  - Very low microphonics.

- **Block Diagram**



- **Description**

This is a unique triple output PLCRO. The outputs are heavily isolated and buffered. The unit uses a new RF encapsulating process making it virtually immune to moisture.

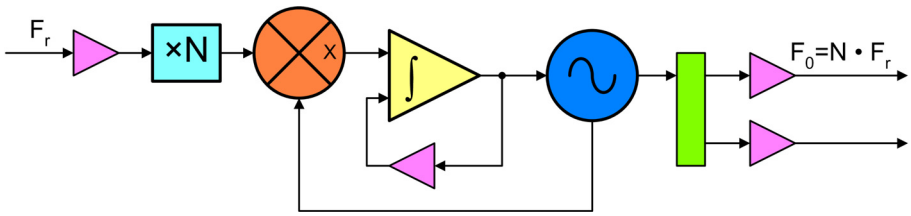
- **Specific Product Data Sheets** (PDF)
  - 3 Output 1.85 GHz PLO - 10 MHz external reference input - +12 volt operation - Model: PLOC1850/10/12

Custom Phase-Locked Dielectric Resonator Oscillator

Features

- High performance PLDRO
- Very low phase noise
- Full industrial temperature range -45° to +85°C
- Dual isolated output option

Block Diagram



Description

This is a unique PLDRO developed at Luff for a specialized system application. This unit uses our unique microwave manufacturing techniques and this unit represents unsurpassed performance and value.

Specific Product Data Sheets (PDF)

- Dual output 9.5 GHz PLDRO - 100 MHz reference input - +12 volt operation - Model: PLOC9500/100/12

20 N. Tyson Ave, Floral Park, NY 11001 Tel. (516) 358-2880 Fax (516) 358-2757 Email: sales@luffresearch.com Web: www.luffresearch.com

SPECIFICATIONS

Output Frequency

Frequency:		1850 MHz
Output frequency stability and accuracy:		Same as input
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-90
	L(1 kHz)	-100
	L(10 kHz)	-110
	L(100 kHz)	-130
	L(1 MHz)	-140
Spurious:		-75 dBc
Harmonics (typ.):		-20 dBc
Power out (min.) (each output):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)

Input Frequency

Input reference frequency:	10 MHz
Input ref. freq. level:	0 dBm ±3 dB

DC Power

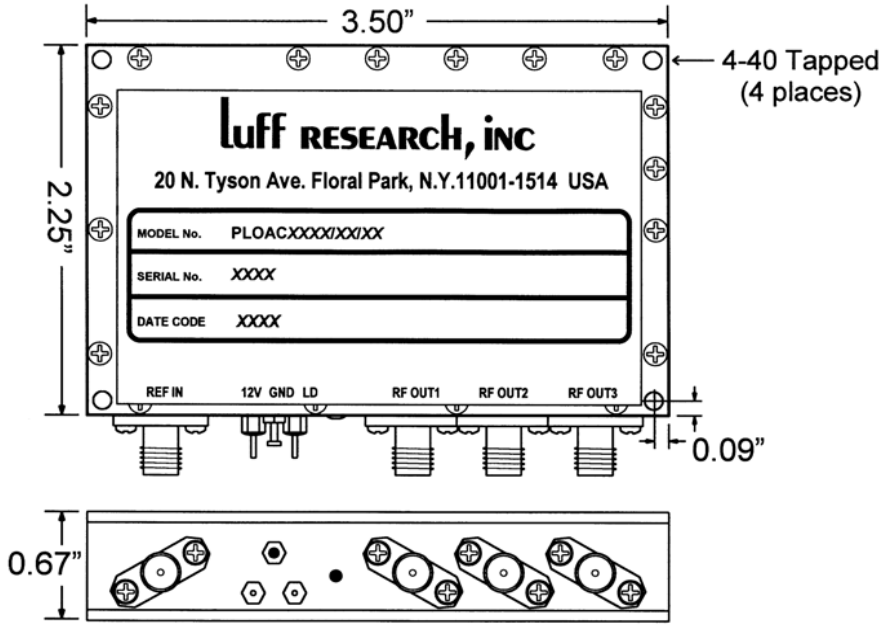
+12VDC	350 mA (max.)
Internal regulator	

Mechanical

RF connectors:	4 SMA (F)
DC connection:	2 Filtered Feed Throughs

Environment

Operating temperature range (surface):	0°C to 60°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



luff RESEARCH, INC.

FLORAL PARK, NY

PHONE: (516) 358-2880 FAX: (516) 358-2757

PRODUCT DATA SHEET

Phase-Locked Ceramic Resonator Oscillator

Model: PLOC1850/10/12	**Rev. A**	**11/19/01**

SPECIFICATIONS

Output Frequency

Frequency:		2,000 MHz
Freq. stability and accuracy (IExt. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-85
	L(1 kHz)	-95
	L(10 kHz)	-110
	L(100 kHz)	-120
	L(1 MHz)	-140
Spurious (min.):		-80 dBc
Harmonics (typ.):		-40 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	100 MHz
Input level:	0 dBm ±3 dB

DC Power

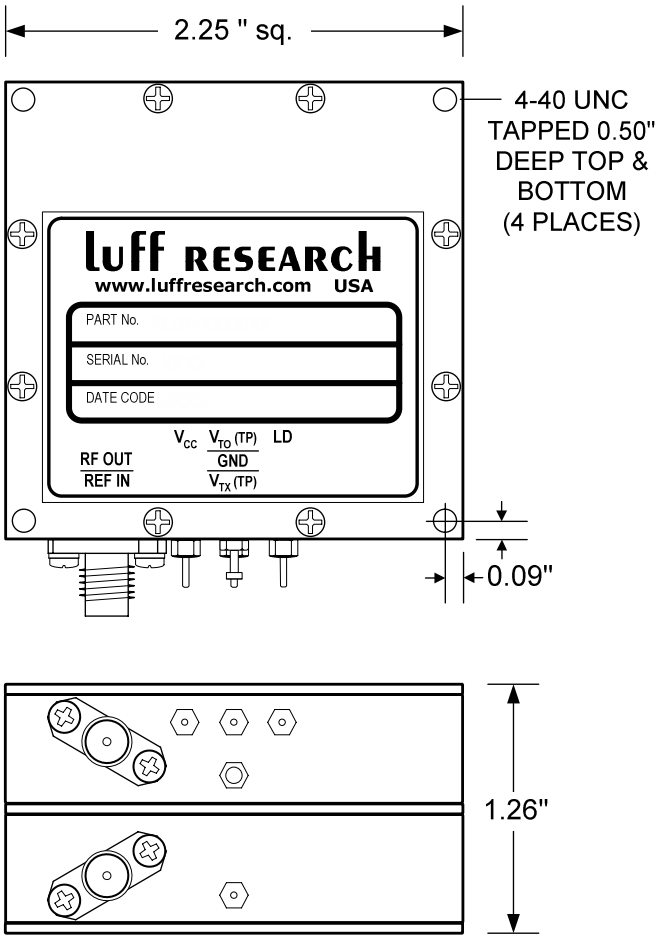
+12.0V ±0.5V	350 mA (max.)
Internal regulator	

Mechanical

RF connector:	SMA (F)
DC connection:	Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to 70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



NOTES:

1. These unit are available with an internal TCXO. (Model No. PLOC3000/INT/12)
2. The Frequency adjustment is only applicable on units with internal reference.
3. The 'REF IN' connector is not provided on units with internal reference.

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PRODUCT DATA SHEET

Phase-Locked Ceramic Resonator Oscillator

Model: PLOC3000/10/12		**06/02/08**

SPECIFICATIONS

Output Frequency

Frequency:		9500 MHz
Freq. stability and accuracy (IExt. Ref):		Same as Input
Freq. stability and accuracy (Int. Ref):		±1 PPM (over temp range)
Aging (After 2 months):		±1 PPM max per year @ 25°C
Adjustability (typ.):		10 years
Phase noise in dBc/Hz (typ.):	L(100 Hz)	-85
	L(1 kHz)	-95
	L(10 kHz)	-100
	L(100 kHz)	-115
	L(1 MHz)	-130
Spurious (min.):		-70 dBc
Harmonics (typ.):		-20 dBc
Power out (min.):		+13 dBm
Output power variation (freq. & temp.):		2 dB
VSWR:		1.5:1
Load VSWR (max.):		2:1
Phase-lock indicator:		High = lock (open collector)
VT Tuning Voltage (nom.):		+2.5V

Input Frequency

Input reference frequency:	100 MHz
Input level:	0 dBm ±3 dB

DC Power

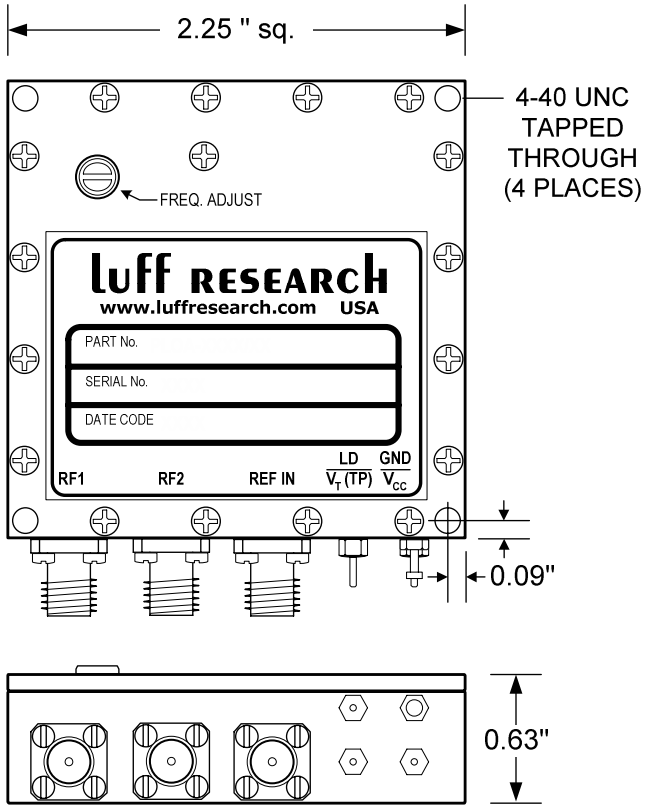
+12.0V ±0.5V	300 mA (max.)
Internal regulator	

Mechanical

RF connector:	SMA (F)
DC connection:	Filtered Feed Throughs

Environment

Operating temperature range (surface):	-10°C to +70°C
Storage temperature range:	-40°C to 85°C
Relative humidity (non-condensing):	90%RH @ 40°
Shock:	30 G / 10msec
Vibration:	4 G / 20 Hz - 20 kHz



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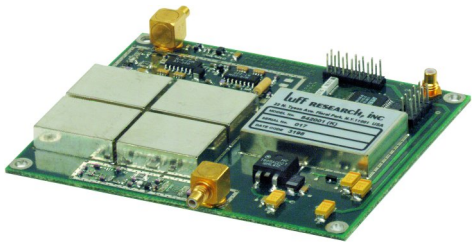
PRODUCT DATA SHEET

Phase-Locked Dielectric Resonator Oscillator

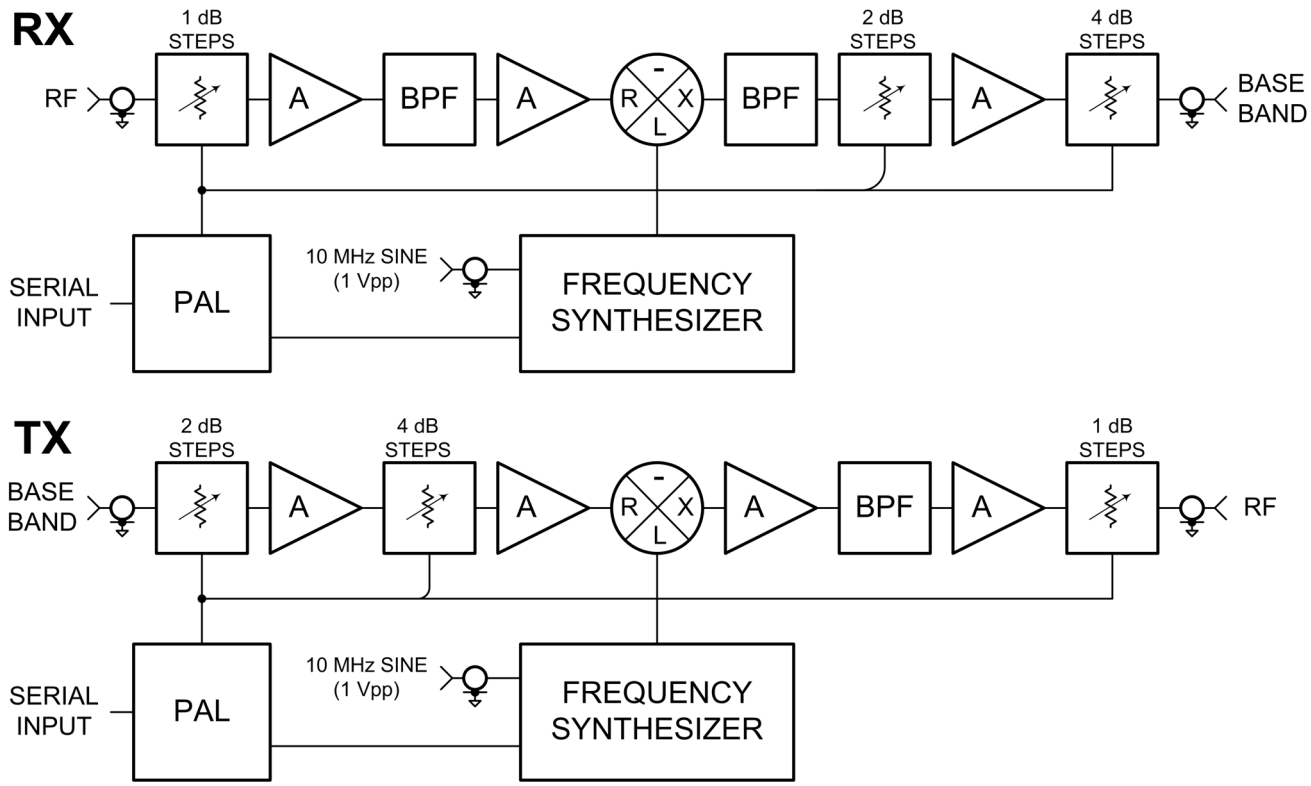
Model: PLOC9500/100/12		**06/02/08**

Ceramic Transceiver

- **Features:**
  - 2.5 GHz operation RX/TX
  - 250 kHz channel spacing
  - 70 dB AGC
  - Third order intermodulation products: -50 dBc
  - NF < 5 dB



- **Block Diagram**



- **Description**

Luff designs and develops custom transceivers for high performance communications. Our designs and products always represent the best performance for a given cost target.

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