



## Model 1152-A Phase Locked Oscillator



The Model 1152-A is a low Phase Noise PLL unit that can be used to replace your unstable microwave crystal oscillator chain with a stable constant frequency. With the Model 1152-A and a very accurate 10 MHz or 100 MHz reference, a frequency stability of 1 part in  $10^{-7}$  is possible with a TCXO (temperature controlled crystal oscillator), or using an OCXO (oven controlled crystal oscillator), stability's on the order of 1 part in  $10^{-10}$  are possible. Of course, using a Rubidium Oscillator can provide a stability of 1 part in  $10^{-12}$ . Using a standard off-the-shelf crystal oscillator can provide 1 part in  $10^{-6}$  if a careful circuit is designed, or purchased from a standard crystal oscillator manufacture. A built-in Reverse voltage protection is a standard feature used to protect the Model 1152-A from an improper voltage polarity. Each unit is in an RF tight enclosure to

provide the best possible suppression of stray RF leakage essential to quiet Local Oscillator operation.

Uses for this PLL are typically Local Oscillators for Microwave Receivers, Transmitters, Transverters, and Signal sources starting in the amateur radio 1296 MHz frequency band as indicated in Table 1 below.

**Table 1 - Model 1152-A Frequency Options**

<i>Frequency Option</i>	<i>Use</i>	<i>Frequency Band</i>	<i>IF Frequency</i>
1152 MHz	LO	1296 MHz	144 MHz
1268 MHz	LO	1296 MHz	28 MHz
1296.8 MHz	Beacon Source	1296 MHz	Signal Generator

Using frequency multipliers, the Model 1152-A can provide receive/transmit local oscillator frequencies for the following microwave bands and IF frequencies shown in Table 2 below.

**Table 2 – Multiplier Frequency Options**

<i>Frequency Option</i>	<i>Multiplier</i>	<i>LO Frequency</i>	<i>RF Frequency</i>	<i>IF Frequency</i>
1080 MHz	X2	2160 MHz	2304 MHz	144 MHz
1128 MHz	X2	2256 MHz	2400 MHz	144 MHz
1104 MHz	X3	3312 MHz	3456 MHz	144 MHz
1123.2 MHz	X5	5616 MHz	5760 MHz	144 MHz
1136 MHz	X9	10,224 MHz	10,368 MHz	144 MHz
1104 MHz	X9	9936 MHz	10,368 MHz	432 MHz

**NOTE:** Custom frequencies are available on special order. Consult JWM Engineering Group for information and pricing.

Another use for the Model 1152-A is to provide a very stable signal source using frequency multipliers as shown in Table 3 below.

**Table 3 – Low Power Microwave Frequency Source**

<i>1152 MHz</i>	<i>Output Frequency</i>
X2	2304 MHz
X3	3456 MHz
X5	5760 MHz
X9	10,368 MHz
X21	24,193 MHz

**Product Specifications**

Specification	Conditions	Values		
		MIN	TYP	MAX
Input Voltage		10.7V	13.5V	20.0V
Input Current			140 ma	160 ma
RF Impedance		50 ohms		
RF Output Power	Into a 50 ohm RF load	+17 dBm	+20 dBm	
Phase Noise (typical)	Measured using an HP 8568B and automated Phase Noise measuring software using IEEE-488 bus	-70 dBc/Hz @ 1 KHz -98 dBc/Hz @ 10 KHz -113 dBc/Hz @ 100 KHz		
Harmonic Output	2 <sup>nd</sup> and 3 <sup>rd</sup> order harmonics related to fundamental frequency		> -20 dBc	
Frequency Options		8 Selectable		
Reference Frequency	External. reference provided by customer	10 MHz 0.5 to 1 v p-p		
Lock Output Voltage (open circuit)	Unit in Phase Lock, current limited through internal 1K ohm series resistor	5 Volts		
Lock Output Current		2 ma		
Temperature Range	None condensing conditions	-20 C	--	+80 C
Factory Warranty	Under normal use, no intentional damage found	1 Year, Full Replacement if no intentional damage found		

**Power Supply Requirements**

The Model 1152-A is rated for a power supply voltage of between 10.7 Vdc and 20.0 Vdc, the typical voltage being 13.5Vdc. This supply voltage must be very clean in order that the PLL unit will operate correctly. If you find the Model 1152-A producing spurious noise or wideband noise after it is turned on, please examine your power supply lines with a high bandwidth oscilloscope. Make sure there is no noise above 100 millivolts, or there is no voltage dropout below 10.7 volts. If there is, please provide the proper filtering or extra voltage as needed to correct the problem. The Model 1152-A will only provide as clean a signal, as your supply voltage will allow. ***THIS IS VERY IMPORTANT.***

**Reference Frequency Requirements**

A word of caution regarding the input level to the Reference Input port on the Model 1152-A; if the input level is too high, meaning greater than 1.5 v p-p or higher, the phase locked oscillator may generate 20 KHz spurs due to over-clocking of the internal reference counter. You should measure the output level of your reference oscillator on an oscilloscope to verify that the output level, terminated into a 50 Ohm load, is between 0.5 to 1 volt peak to peak. Either a square wave or sine wave can be used. ***THIS IS VERY IMPORTANT.***

**Frequency Selection Information**

The Model 1152-A provides 8 selectable microwave oscillator output frequencies by selecting the appropriate frequency option jumper inside the unit. The frequencies are listed in Table 4 below.

**Table 4 – Freq Options**

Jumper			Output Frequency
“2”	“1”	“0”	
<b>O</b>	<b>O</b>	<b>O</b>	1152 MHz
<b>O</b>	<b>O</b>	<b>S</b>	1268 MHz
<b>O</b>	<b>S</b>	<b>O</b>	1296.8 MHz
<b>O</b>	<b>S</b>	<b>S</b>	1080 MHz
<b>S</b>	<b>O</b>	<b>O</b>	1128 MHz
<b>S</b>	<b>O</b>	<b>S</b>	1104 MHz
<b>S</b>	<b>S</b>	<b>O</b>	1123.2 MHz
<b>S</b>	<b>S</b>	<b>S</b>	1136 MHz

O = Jumper Removed, S = Jumper Installed

**Reference Frequency Selection Information**

The Model 1152-ALN will accept either a 10MHz or 100MHz external reference input by selecting the appropriate reference option jumper inside the unit. The jumper options are listed in Table 5 below.

**Table 5 – Reference Frequency Options**

Jumper – <b>JP2</b>	Reference Input Frequency
“4”	
<b>O</b>	10 MHz
<b>S</b>	100 MHz

O = Jumper Removed, S = Jumper Installed

Opening the Model 1152-A to change Reference or Frequency Options is accomplished by removing the six (6) 0-80 Phillips head screws from the top cover. These screws are very small so put them in a safe place until time to put them back. After the cover is opened, you will notice there are (4) four jumper options (JP2) in the upper left corner next to the reference-input port. *See figure 1 below.* There are four (4) jumper shunts included with the unit as shipped, and these shunts are used to select a frequency option using the settings shown in Table 4 above.

The Model 1152-A is shipped with JP2-4 OPEN for a 10MHz external reference input. To select the 100MHz external reference input option, place the jumper shunt provided onto jumper position #4, shorting it together as described in table 5.

Remember the “**O**” is for **OPEN** (no jumper installed), and “**S**” is for **SHORTED** (jumper installed). The jumper layout is shown in Figure 1 below. Changing a jumper

will automatically select the new reference frequency option and will not require the unit to be power cycled.

**NOTE:** The ISP jumper (JP1) is not for customer use and is only for programming the on-board microprocessor. **DO NOT PUT ANY JUMPERS ON JP1.**

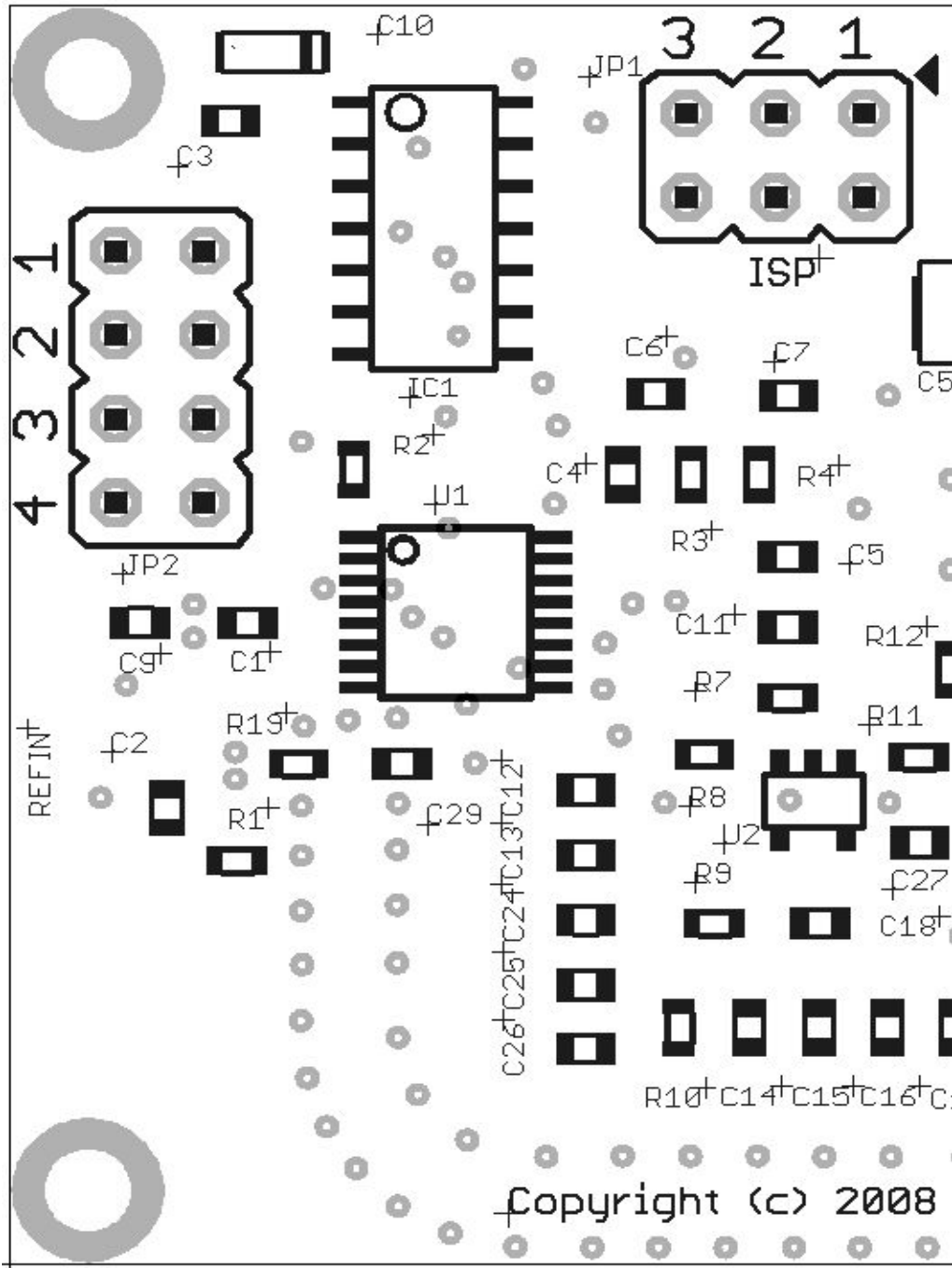


Figure 1

## Customer Connections

Connection	Function
RFout SMA	Oscillator RF Output port
REFin SMA	10 / 100 MHz Reference Oscillator input
Vin	+13.5 Vdc @ 140ma. typical ( <i>reverse voltage protected</i> )
GND	Chassis Ground Terminal
Lock	Lock Indicator output signal (Digital signal)

### Lock Indicator Output connection

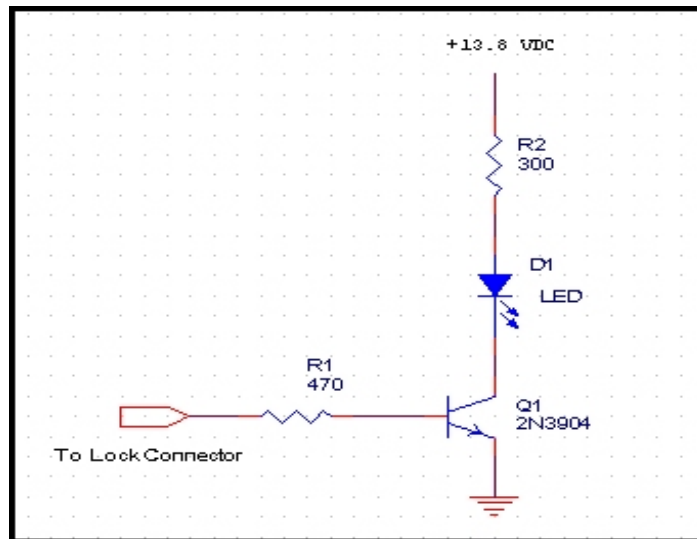
The Lock Output pin (Lock) connection can be used for several things. For example;

- 1.) Front panel indication that PLL is in locked or unlocked state.
- 2.) Signal switch for shutting down a Transmitter while an “out of lock” state exists.
- 3.) Signal switch for quieting a receiver audio section while an “out of lock” state exists.
- 4.) Both a front panel indication and a shutdown switch for a Receiver or Transmitter.

A lock condition is indicated by a “**High**” level on the Lock pin. A “**Low**” level indicates the unlocked condition.

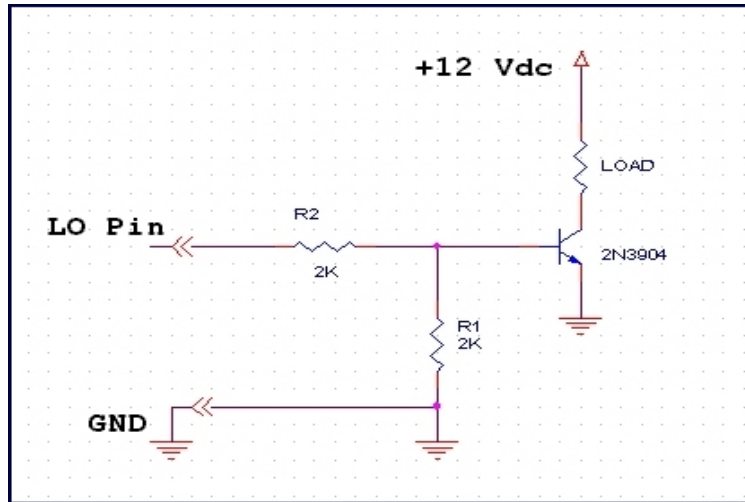
**Note:** *An external circuit is necessary to use the Lock Output signal, and can be a combination of Analog or Digital circuits. The Lock Output pin is capable of driving up to 2 digital 74LS TTL loads if needed.*

Example 1 shows how to utilize the Lock pin to control a front panel LED lock indicator.. The LED will light when in the locked state, and will be out when in the unlocked state.



**Example 1**

Example 2 shows an NPN transistor switch to control a load such as a relay or a circuit used to enable a transmitter section by grounding the transmit enable. The 2N3904 is a generic transistor, and any common transistor capable of operating safely in your circuit should work here.



**Example 2**

### **Warranty**

All JWM Engineering Group, Inc. products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. JWM Engineering Group, Inc. will repair or replace products that prove to be defective during the warranty period, provided they are returned to JWM Engineering Group, Inc. No other warranty is expressed or implied. JWM Engineering Group, Inc. is not liable for any consequential damages.

**A return material authorization (RMA) is required before returning a product for repair or replacement. Contact JWM Engineering Group, Inc. at the contact information provided below.**

### **Contact Information**

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### **Disclaimer**

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**Mounting Base Plate Information**

