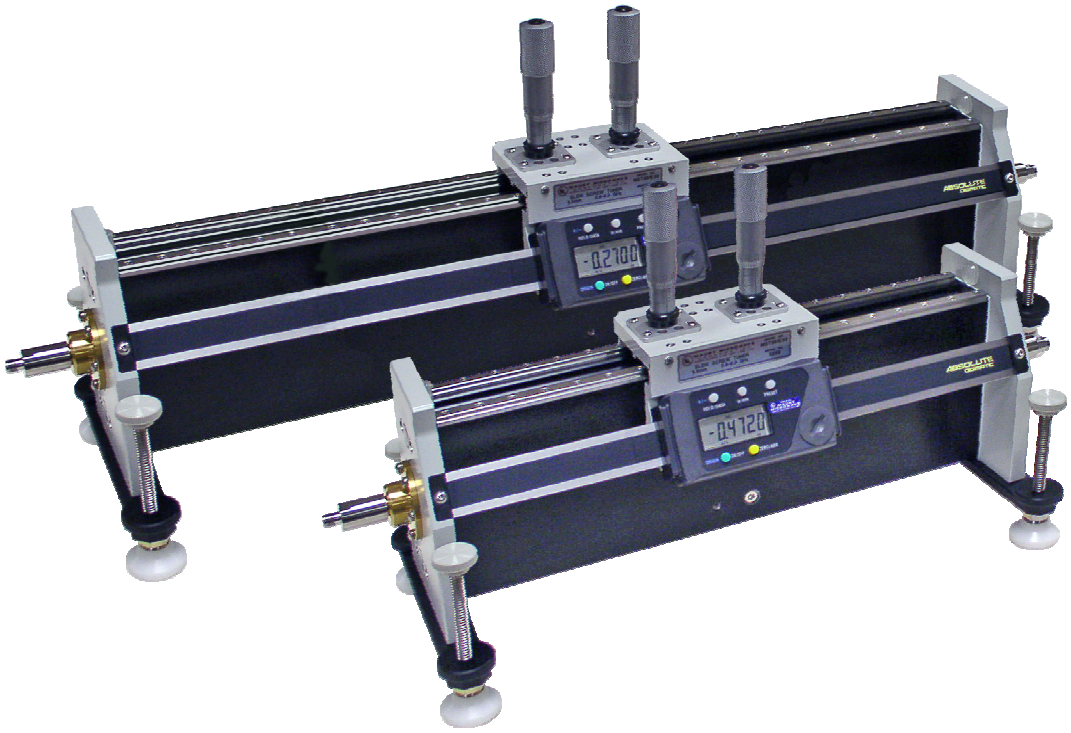
Maury Microwave

User Guide

Coaxial Manual Tuners

Model MST981E & MST981B Series



MST981-7 (Rev A) 4/14

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Maury Microwave

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General Information

MST981E & MST981B Series Manual Tuners

The MST981E & MST981B Series Manual Tuners are high performance precision manual slide screw tuners that achieve low through line VSWR and excellent matching values. They are available with 3.5mm and Type N connectors and cover a variety of frequency ranges. They feature micrometers for controlling matching level and a digital display for indicating carriage (phase) position. The tuners serve as a matching network for reducing reflections caused by mismatches present in a transmission line, or to introduce a controlled mismatch into an otherwise matched transmission line.

Each tuner uses two probes to cover the operational frequency range. The low frequency probe covers the range from the lowest frequency to the crossover frequency listed in Table 1, and the high frequency probe covers the range from the crossover frequency to the tuner's maximum rated frequency. The optimum crossover frequency will vary some from tuner to tuner. Each probe induces a mismatch in its frequency range as it is inserted into the tuner transmission line, and should generally be used only in its designated frequency range. Each probe will meet its specifications over its rated frequency range, and typically has considerably higher matching capability in the middle of its band. Figure 1 shows an example of typical response of a low frequency and high frequency probe.

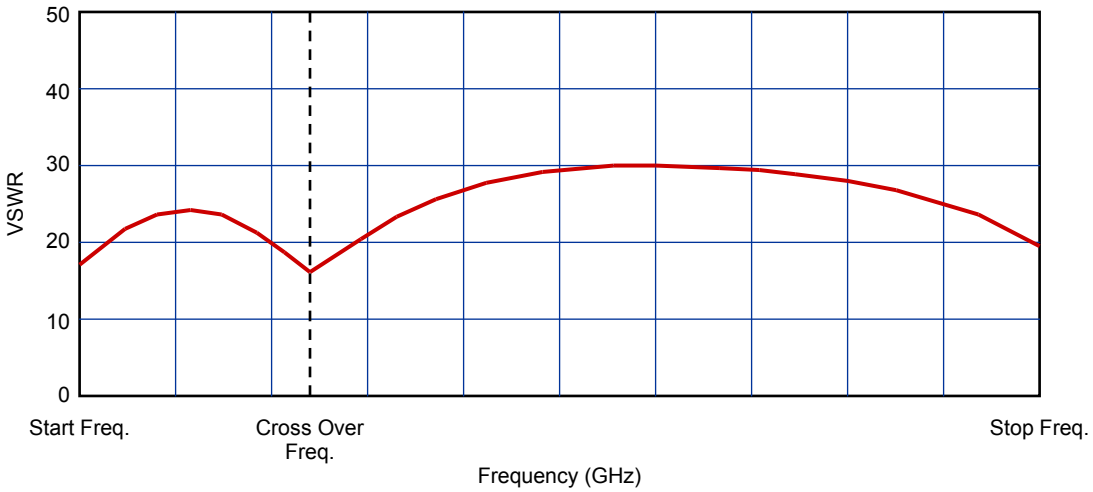

Figure 1. Typical VSWR Response

Specifications

Table 1. Tuner Electrical Specifications

Model	Connector Type	Frequency Range (GHz)	Cross Over Frequency (GHz)	Matching Range (min)	Insertion Loss [1] (max)	Power Capability [2] (Ave/Pk Watts)
MST981E35	3.5mm	0.8 – 8.0	2.8	35:1	0.1 dB	250/2500
MST981EN	Type N					
MST981B35	3.5mm	0.4 – 4.0	1.4	25:1		
MST981BN	Type N					

[1] With probes fully retracted.

[2] Power rated at maximum VSWR.

Description of Components

Please refer to Figure 2 for the various components of your tuner. The number to the left of each paragraph below corresponds to the item number shown in the Figure.

1. **Low Frequency Probe Micrometer:** This micrometer controls the position of the low frequency probe. Turning the micrometer counterclockwise retracts the probe (moves the impedance towards 50 ohms); clockwise rotation inserts the probe and increases mismatch. The micrometer locking ring (item number 4) must always be released before turning the micrometer or the tuner can be damaged. Care must be used to ensure that the micrometer is not turned beyond its upper or lower mechanical limits. If it is, the tuner will be damaged.
2. **High Frequency Probe Micrometer:** This micrometer controls the position of the high frequency probe. Turning the micrometer counterclockwise retracts the probe (moves the impedance towards 50 ohms); clockwise rotation inserts the probe and increases mismatch. The micrometer locking ring (item number 4) must always be released before turning the micrometer or the tuner can be damaged. Care must be used to ensure that the micrometer is not turned beyond its upper or lower mechanical limits. If it is, the tuner will be damaged.
3. **Micrometer Scales:** The micrometer scale shows relative position of the probe and is primarily used to repeat locations previously set. It is not intended to show actual distance of the probe away from the center conductor or an impedance value. The micrometer will reach its limit and be at its maximum matching position while the micrometer is still far from its zero position.
4. **Micrometer Locking Rings:** Each micrometer has a black knurled locking ring that, when turned clockwise, will lock the micrometer so that it will not easily rotate. This ring must be unlocked (turned counterclockwise) before the micrometer is rotated or the tuner may be damaged. With the ring in the unlocked position, the micrometer thimble will turn easily with little or no resistance. This allows the user to feel the mechanical stops and avoid applying undue rotational pressure. Please see Figure 3 for an illustration of the micrometer locking ring operation.
5. **Digital Scale Output Connector Cover:** The connector under this cover is not used in this application.
6. **Battery Compartment Cover and Battery:** This cover slides down so that the battery that powers the digital scale read out can be changed. The battery should be replaced only with an SR44 button-type silver oxide cell, or its direct equivalent. This is a common battery often used for watches and can be purchased at many stores. It should be installed with its positive side facing up. After battery replacement, the digital scale origin can be restored by moving the carriage (item 10) fully to the left, and then holding the Origin switch (item 16) down for more than one second. When the digital display (item 14) shows the letter “B” in

the display the battery voltage is low and the battery should be replaced as soon as possible. Under normal use (turned off when not in use) the battery should last about three years.

7. **Digital Scale Unit Scale:** The digital scale uses this surface to determine its location. This surface should be kept clean and protected from severe scratches.
8. **Tuner Connectors:** The connectors provided on the tuner will vary with different tuner model numbers and may not match the picture shown. The connectors should always be covered with the dust covers provided with the tuner when the tuner is not in use. To protect your tuner and the devices connected to it, all connectors should be checked with a connector gage prior to use.
9. **Tuner Base:** The tuner is designed to be set on or supported by its base.
10. **Tuner Carriage:** The tuner carriage can be moved left and right along the transmission line to vary the phase of the reflected signal. Before moving the carriage, the carriage lock (item 11) must be released by pushing the knurled knob to the left (turning it clockwise when viewed from the top). The carriage will need to be moved nearly its full length to make a complete 360 degree phase rotation at the tuner's lowest operating frequency. At higher frequencies the carriage will need to be moved only a small amount to cover all phase angles, and can achieve a required phase at multiple carriage positions. For maximum matching range, the carriage should generally be positioned at the point that gives the desired response that is as close to the part to be matched as possible.
11. **Carriage Lock:** Turning the knurled knob clockwise (when viewed from the back) locks the carriage in position. The knob can be adjusted to set a slight amount of tension so that the carriage still moves smoothly, but will not drift when let go. For maximum repeatability of previously set positions, the carriage lock should be set approximately the same as it was the previous time.
12. **ON/ZERO Switch:** The digital display will show measurements from the relative origin set when it is first turned on. The display can be zero set at any desired position by pressing the ON/ZERO switch. When the display is off, pressing the ON/ZERO switch will turn the digital scale unit on and reset zero. It is not necessary to have the digital display turned on when the carriage is moved. Pressing the ON/ZERO switch will reset the relative origin for the digital scale display to zero at its present location. For normal use, you will want to slide the carriage fully to the left before setting the origin. The origin will need to be reset whenever the unit has been turned off.
13. **OFF Switch:** When the display is on, pressing the OFF switch will turn the unit off.
14. **Digital Scale Display:** This window will display the position of the carriage along the transmission line in either inches or millimeters. It reads relative position from the left side of the scale from any chosen carriage position (see description for item 12). The letter "B" is displayed when the battery is weak.
15. **in/mm Switch:** This switch selects whether the display reads in inches or millimeters. The display will indicate "in" to the right of the numbers displayed when in the inch mode, and "mm" when in the millimeter mode. Changing modes does not affect the zero set.

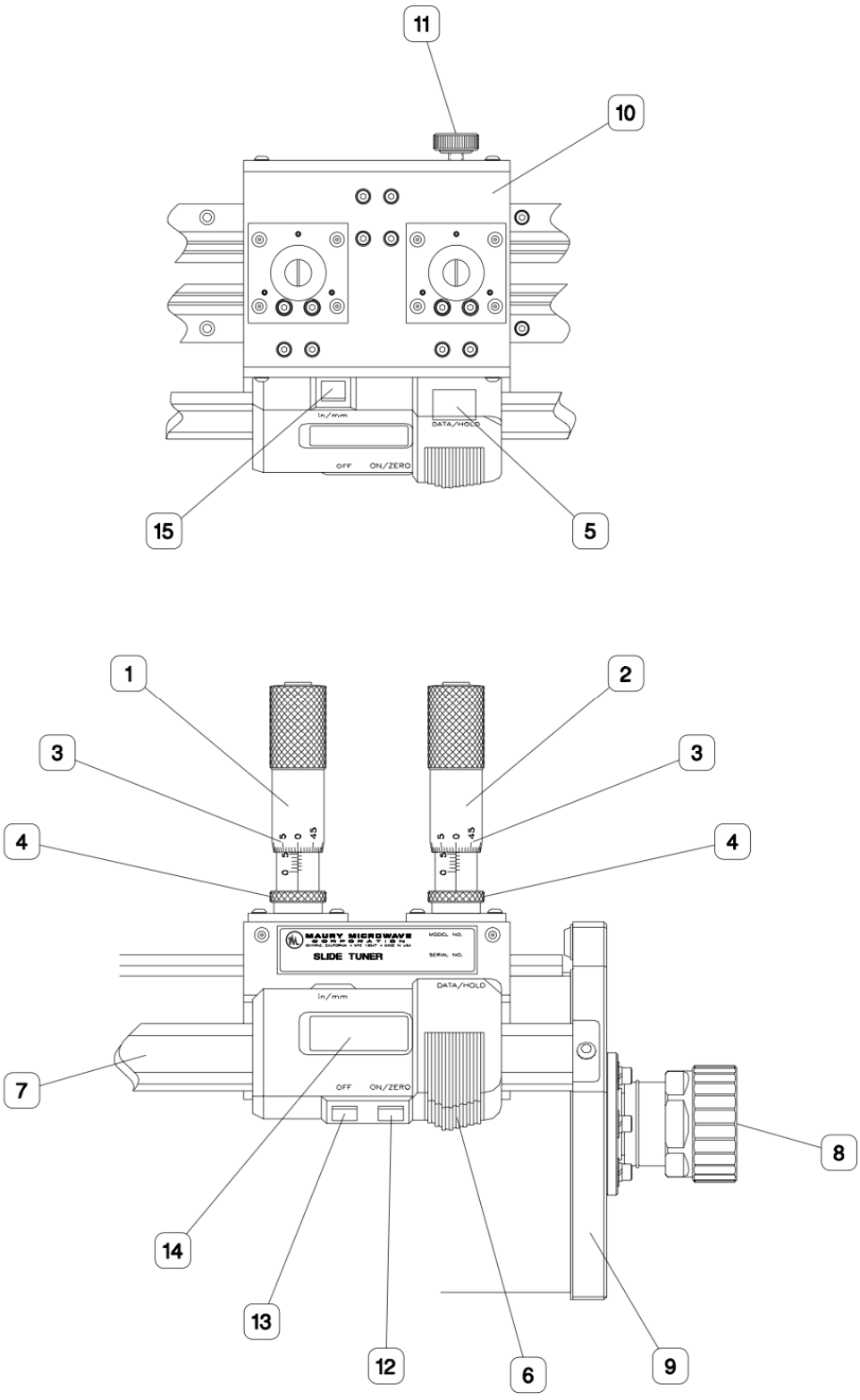

Figure 2. Tuner Components

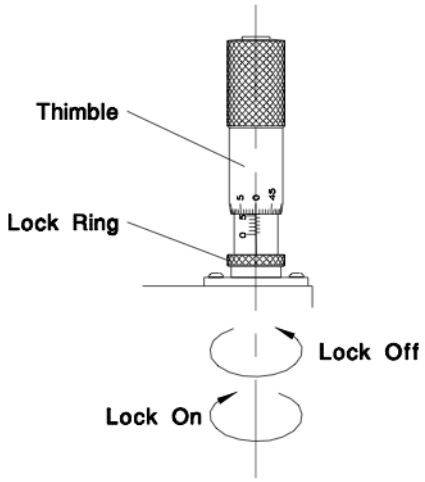

Figure 3. Micrometer Locking Ring Operation

Operation

Initial Set Up

If the battery has not been installed in your tuner, you should install it following the instructions previously given under *Description of Components,* item 6. If you press the ON/ZERO switch and the display stays blank, then a battery needs to be installed.

In order to have the digital scale display work correctly, the relative origin for the display must be set. This is set by following the instructions under *Description of Components,* item 12. This will set the display so that when the carriage is to the far left, the display will read zero. Movement of the carriage to the right will increase the display reading. The display can be set to read in inches or millimeters.

Before connecting your tuner to other components, the connectors on the tuner and the components to be mated to the tuner should be checked for damage and cleanliness, and their interface dimensions should be checked with a connector gage. The Maury data sheets listed at the back of this user guide detail various connector gages that are suggested for use.

Setting Impedances

Any impedance up to the maximum matching range of the tuner can be set by varying the position of either the low frequency or high frequency probe, and the carriage position. The probes vary the magnitude, and the carriage position varies the phase. The micrometer scales for the probe positions and the digital display for the carriage position allow accurate resetting of previously set impedances. To achieve maximum repeatability between settings, the probe position and carriage position should always be approached from the same direction each time, and the carriage lock should be tightened with the same tension.

The low frequency probe should be used for frequencies between the tuner's lowest rated frequency and the crossover frequency listed in Table 1. The high frequency probe should be used for frequencies above the crossover frequency. The tuner is designed to meet its specifications using just the low frequency or high frequency probe, not both at one time. Using both probes at one time will not harm the tuner, and in some cases may result in higher matching range.

When setting probe positions using the micrometers, the black knurled locking ring on the micrometer must be released before turning the micrometer. This is necessary so that the user can feel when a position limit is reached. Under normal use, the micrometer thimble will rotate very easily when unlocked, which makes it easy to feel when a limit is reached.

WARNING: If the micrometer is turned beyond its preset limit, the tuner will be damaged.

The digital display that indicates the carriage position should be turned off when not in use to maximize battery life. Under normal use the battery should last three years. The carriage position digital display and the probe micrometers are designed to read relative physical positions. The positions do not indicate an absolute position of the probes. The probe micrometers will reach their lower limit before the micrometer scale reads zero.

Appendix

Data Sheet Resources

2G-035 – Slide Screw Tuners
http://www.maurymw.com/pdf/datasheets/2G-035.pdf

2Z-059 – 3.5mm VNA Calibration Kits
www.maurymw.com/pdf/datasheets/2Z-059.pdf

2Z-061 – Type N VNA Calibration Kits
http://www.maurymw.com/pdf/datasheets/2Z-061.pdf

2Y-049 - "Metrology Grade" 2.92/3.5mm Connector Gage Kit
http://www.maurymw.com/pdf/datasheets/2Y-049.pdf

2Y-032A – "Metrology Grade" Type N Connector Gage Kit
http://www.maurymw.com/pdf/datasheets/2Y-032A.pdf

2Y-050A – Torque Wrenches – Coaxial Connector
http://maurymw.com/pdf/datasheets/2Y-050A.pdf

Table 2. Tuner Model Cross Reference

Model	
New	Old (obsolete)
MST981E35	2440B
MST981EN	2740B
MST981B35	2440C
MST981BN	2740C

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Web Resources

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