



# T100+ Vector Impedance Analyzer

User Manual Ver. 2.1



T100+ is a state of the art portable Vector Impedance Analyzer. This powerful yet handy instrument is specifically designed for the advanced amateur radio experimenters working at the VHF and UHF bands.

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## **GENERAL DESCRIPTION**

T100+ Vector Impedance Analyzer is a device to measure complex impedance at VHF/UHF frequencies. This is accomplished by injecting an RF signal into the target under test connected to the SMA test port, and measuring the amplitude and phase of the reflected RF signal.

The reflected amplitude and phase are calibrated with industrial standard 3-term Open/Short/Load (OSL) calibration method.

T100+ Vector Impedance Analyzer can operate from 100MHz to 170MHz (VHF), and from 400MHz to 470MHz (UHF), with a 25KHz minimum step size.

# T100+ MENU STRUCTURE

## MAIN MENU

### SINGLE FREQ

- SWR
- IMPEDANCE (SERIES)
- IMPEDANCE (PARALLEL)
- S11 (RECTANGULAR & POLAR)

### SWEEP FREQ PLOT

- SWR
- IMPEDANCE (Z)
- RESISTANCE (R)
- REACTANCE (X)
- RETURN LOSS (S11)
- PHASE ANGLE

### CALIBRATE

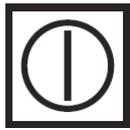
- CONNECT OPEN
- CONNECT SHORT
- CONNECT LOAD

### SETTINGS

- BACKLIGHT
  - AUTO
  - ON
  - OFF
- AUTO POWER OFF
  - ENABLE
  - DISABLE
- BATTERY
  - ALKALINE
  - NIMH
- CAL DATA PROTECT
  - LOCK CAL DATA
  - UNLOCK CAL DATA
- INFO

### PC MODE

## KEY DEFINITIONS



**POWER** : Press and hold this key for two seconds to turn on or off T100+ Vector Impedance Analyzer.



**CONFIRM** : Use this key to confirm the desired selections and frequencies entered.



**MODE** : In SINGLE FREQ, this key is used to switch between the following modes cyclically:

- SWR
- IMPEDANCE (SERIES)
- IMPEDANCE (PARALLEL)
- S11

In SWEEP FREQ PLOTS, this key is used to switch between the following functions cyclically:

- FREQUENCY
- Y SCALE
- ALIGNMENT
- STEP SIZE



**ARROWS** : These keys are used to select the desired menu items or options. They are also used to increase or decrease the



frequency. Keep holding the keys to increase or decrease the frequency automatically. In SINGLE FREQ, the step size is fixed at 25KHz. In SWEEP FREQ PLOT, the current step size can

be selected with the MODE key.



**NUMERICS** : Use these keys to enter the desired frequency directly. Frequencies within the valid operating range will automatically be aligned to the 25KHz steps. Frequencies outside the valid operating range will be ignored.



**BACK** : Cancel the current operation and/or go back to the previous menu.

## SINGLE FREQ

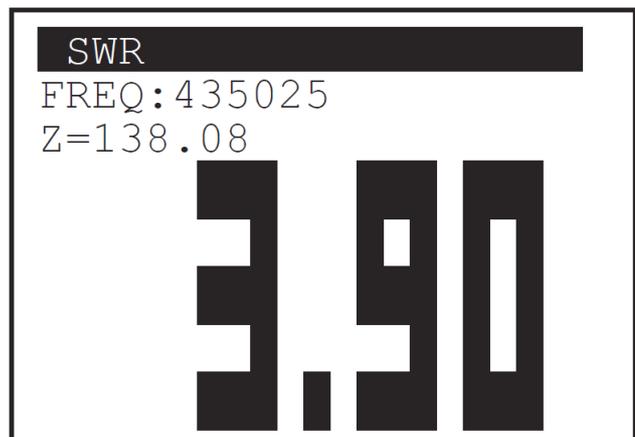
In this mode, T100+ can display the measured data in any of the following four representations.

You may switch cyclically through these representations with the MODE key.

- SWR
- IMPEDANCE (SERIES)
- IMPEDANCE (PARALLEL)
- S11 (RECTANGULAR & POLAR)

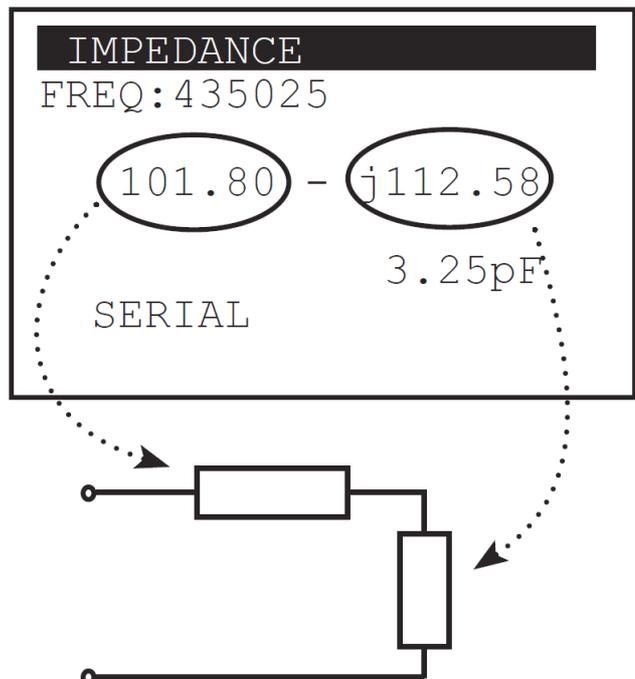
### SWR

This mode displays the Standing Wave Ratio in large font for easy reading. It also displays the impedance (Z) for your reference.



### IMPEDANCE (SERIES)

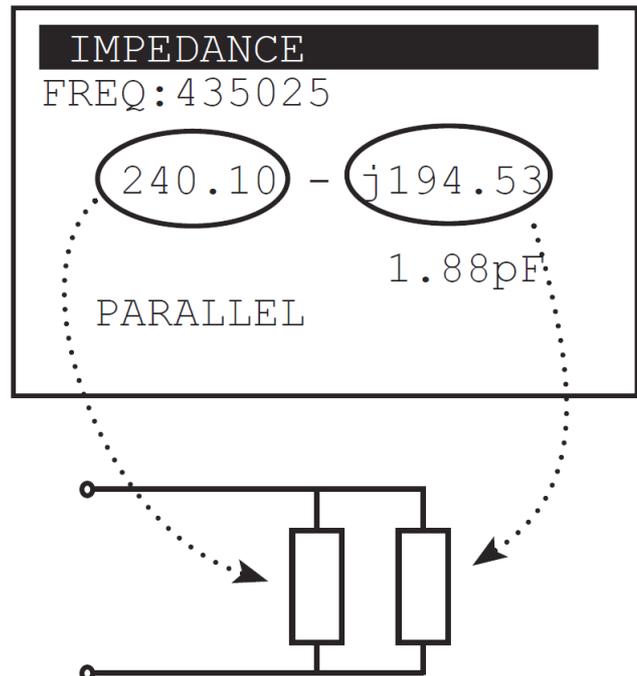
This mode displays the impedance seen from the test port. The impedance is resolved into the real (resistive) part and imaginary (reactive) part connected in series. The corresponding inductance or capacitance is also



displayed according to the sign of the reactance.

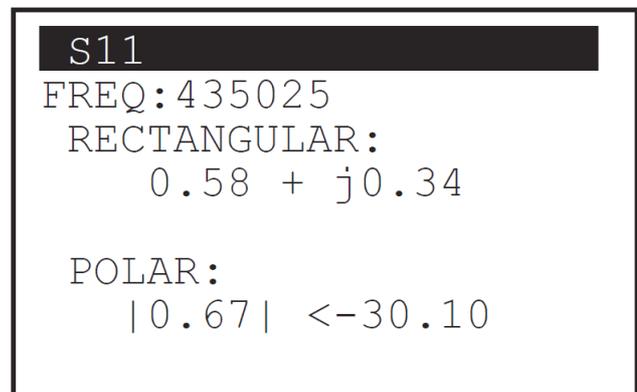
### **IMPEDANCE (PARALLEL)**

This mode displays the impedance seen from the test port. The impedance is resolved into the real (resistive) part and imaginary (reactive) part connected in parallel. The corresponding inductance or capacitance is also displayed according to the sign of the reactance.



### **S11**

This mode displays the rectangular and polar representations of the S11 measured.



## **SWEEP FREQ PLOT**

Under this menu, T100+ can plot any of the following measured data over the desired frequency range:

- SWR
- IMPEDANCE (Z)
- RESISTANCE (R)
- REACTANCE (X)
- RETURN LOSS (S11)
- PHASE ANGLE

Use the MODE key to switch cyclically between any of the following parameters to change their value.

• **FREQUENCY** - use the ARROW keys to increment or decrement the frequency by the value of STEP SIZE. The cursor on the plot will move accordingly. The frequency can also be entered directly using the numeric keys.

• **Y SCALE** - use the ARROW keys to select the maximum value on the Y axis. Possible values are 3, 10, 30, 100, 300, and 1000.

• **ALIGNMENT** - use the ARROW keys to select if the directly entered frequency should be aligned to the CURRENT position of the cursor, BEGIN (leftmost on the plot), CENTER (of the plot), or END (rightmost of the plot). Ranges outside the valid frequencies will be shaded.

• **STEP SIZE** - use the ARROW keys to select the desired frequency step size. Possible values are 25KHz, 100KHz, 500KHz, and 1MHz.

## CALIBRATION

T100+ Vector Impedance Analyzer employs industrial standard Open/Short/Load (OSL) calibration method to eliminate various system errors. To perform accurate measurements, T100+ needs to be calibrated against the OPEN, SHORT, and LOAD standards. Three high quality OPEN, SHORT, and LOAD SMA terminators are included for this purpose. Resulting calibration data to be used in computations will be stored in non-volatile memory in T100+.

Calibration data is locked upon power up of T100+ to avoid accidental erasure. It has to be unlocked in the SETTINGS menu, before CALIBRATION can be performed.

Connect the OPEN standard, and then press the Confirm key to start calibration. Likewise for the SHORT and LOAD standards in sequence to complete the calibration.

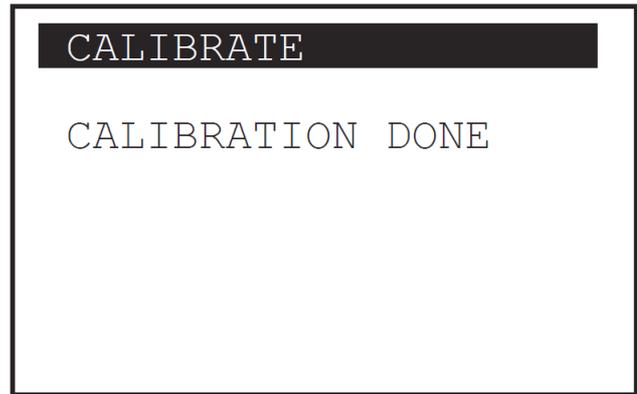
CALIBRATE

DATA LOCKED  
GOTO SETTINGS MENU  
TO UNLOCK DATA FIRST

CALIBRATE

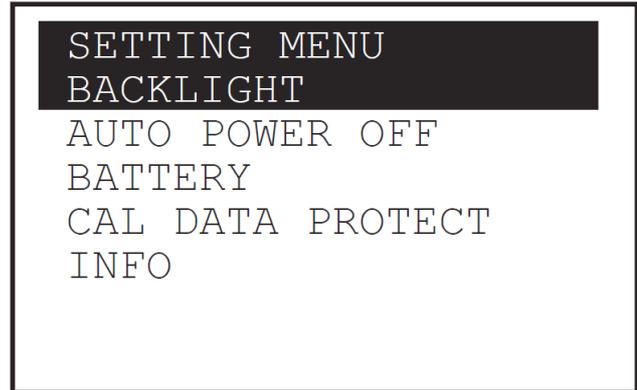
CONNECT OPEN

Calibration data will be locked again automatically after calibration. The instrument is now ready to use. If desired, T100+ can be re-calibrated at any time.



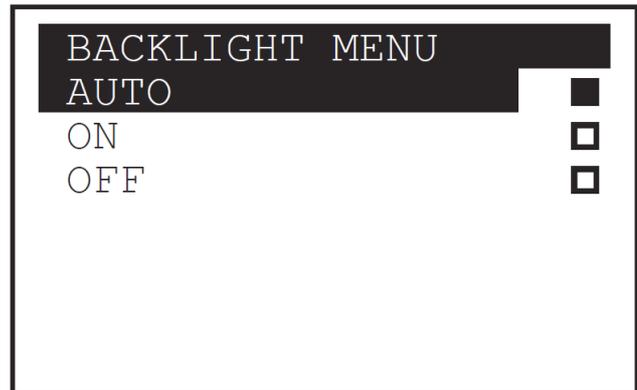
## SETTINGS

A number of general options and information are available in this menu.



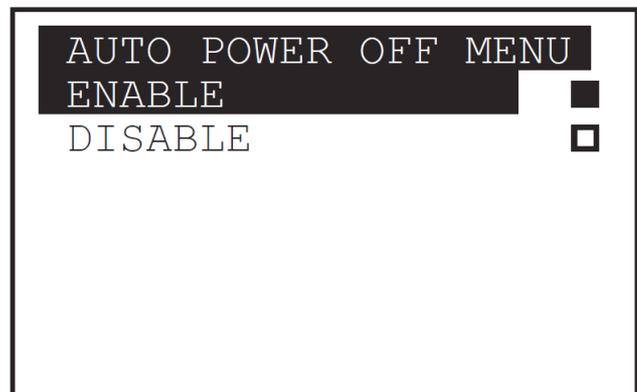
### BACKLIGHT

AUTO - Turn off backlight automatically if no key is pressed for 30 seconds.  
ON - Leave backlight always on  
OFF - Leave backlight always off



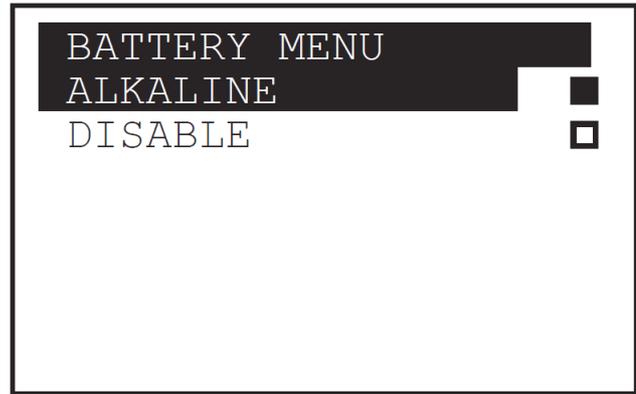
### AUTO POWER OFF

ENABLE - Automatic power off if no key is pressed for 5 minutes.  
DISABLE - No automatic power off.



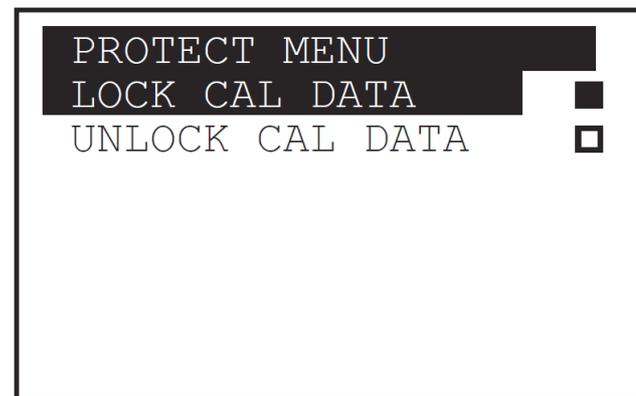
## BATTERY

Choose between ALKALINE and NIMH to reflect the type of batteries being used. It only affects the threshold voltage dictating when a low battery sign on the upper right hand corner of the display will appear.



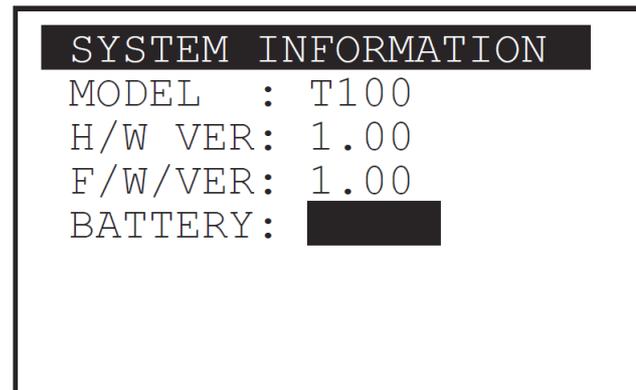
## CAL DATA PROTECT

Select UNLOCK CAL DATA before calibration. Calibration data will be locked automatically after a calibration. Alternatively, choose LOCK CAL DATA to lock calibration data manually if necessary.



## INFO

Display general information of the device, as well as the battery voltage. ( 5 blocks on the battery bar as battery full and 1 block as battery empty.)



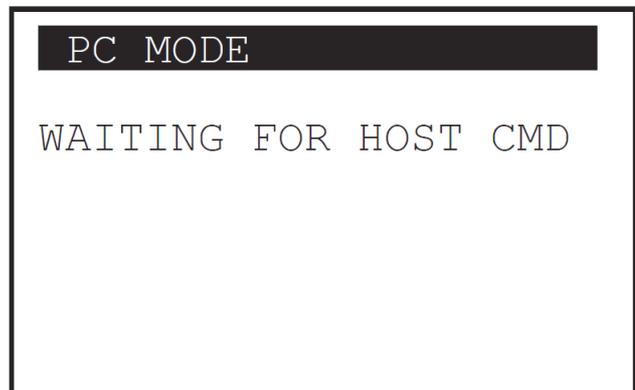
## PC MODE

T100+ has a build-in USB bridge (CP2102) by Silicon Labs (Silabs) and is capable of communicating with a PC via an emulated serial link over this USB connection. You will need to install a Virtual COM Port (VCP) driver before connecting your T100+ to a PC. Links to these VCP drivers for Windows are available on our web site <http://www.timestechnology.com.hk> or you may visit Silicon Labs' web site directly. A sample host program for Windows XP/Vista/7 is also included to demonstrate controlling T100+ from a PC, and displaying T100+ measured data.

The (virtual) serial communication between T100+ and the PC should be configured as follows:

```
Baud Rate = 115200 baud
Parity Bit = None
Data Bits = 8
Stop Bit = 1
```

On entering the PC MODE, T100+ will display the message "WAITING FOR HOST CMD" and listen to the serial port.



To command T100+ to tune to a specific frequency, the host program shall transmit a six-digit frequency in ASCII characters via the serial port.

```
PC MODE
FREQ : 144000
|S11|    <S11
0.9577   -14.72
```

To command T100+ to take a measurement, send an ASCII character 'S'. Then receive from the serial port a null terminated ASCII string. This is the measured magnitude and argument in degrees, separated by a comma. The same result will be displayed on T100+ at the same time.

Send another 'S' to repeat making a measurement at the same frequency, or issue another six-digit frequency to tune to a new frequency.

Sending an ASCII character 'D' will bring T100+ back to the initial state, displaying the "WAITING FOR HOST CMD" message and listen to the serial port.

## FIRMWARE UPDATE

T100+ firmware can be updated as new releases are available. Updated firmware file can be downloaded from our web site <http://www.timestechnology.com.hk> to a PC and be programmed to the T100+ via the USB interface.

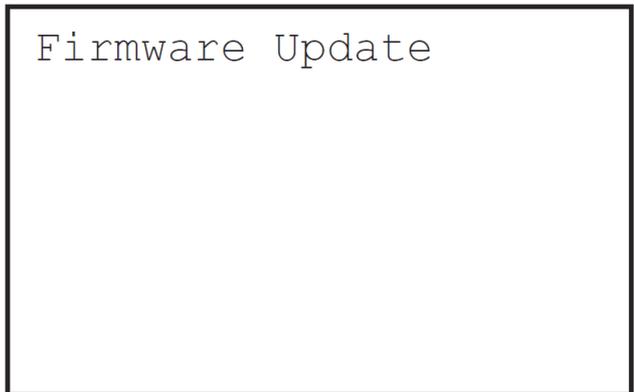
You will need to have the Virtual COM Port (VCP) driver installed before you can update the firmware via USB. Links to these VCP drivers for Windows are available on our web site or you may visit Silicon Labs' web site directly.

Follow these procedures to update the firmware:

### Caution

- 1. Please use fresh batteries when updating firmware.**
- 2. Do not turn power off or remove batteries during firmware updating.**

Hold down the "Mode" key while switching on T100+ to enter the "Firmware Update" Mode. T100+ will show the screen on the right.



Firmware Update

On a PC running Windows XP/Vista/7 operating system, open a Command Prompt in a directory with the two files *update.exe* and *firmware.ENC* (available on our web site <http://www.timestechnology.com.hk>)

*\*You may need to execute the Command Prompt as Administrator.*

Plug in the USB cable to connect the PC and T100+. Find out which USB emulated COM port T100+ is connected to from the Control Panel/System/Hardware/Device Manager on the PC.

With T100+ in "Firmware Update" mode, issue the following command in the Command Prompt to update the firmware with the firmware file "*firmware.ENC*":

***update firmware.ENC -COMx -115200***

where *x* is the number of the COM port your T100+ is connected to, and *firmware.ENC* is the name of your firmware file.

The screen on T100+ will stay displaying "Firmware Update". When updating is in progress, there will be a message like "Transferring.. xx% done." on the Command Prompt and T100+ will turn off automatically when the update completes.

## T100+ SPECIFICATIONS

<b>Frequency Range</b>	100MHz ~ 170MHz (VHF) 400MHz ~ 470MHz (UHF) All PLL Synthesized
<b>Frequency Resolution:</b>	25KHz
<b>Output Power :</b>	> 0dBm (typical)
<b>Harmonics :</b>	< -30dB (typical)
<b>Test Port Connector :</b>	SMA (female)
<b>Display :</b>	128 x 64 dots graphical LCD with backlight
<b>Physical Dimensions :</b>	140mm(length) x 68mm(width) x 25mm(thick)
<b>Net Weight :</b>	130 grams (without battery)
<b>Power :</b>	AA Size Battery x 2

## ACCESSORIES

SMA connector for OPEN Calibration: P/N  
202112

SMA connector for SHORT Calibration:P/N  
132331

SMA connector for LOAD Calibration: P/N  
132360

SMA male to BNC female adapter

SMA male to SO-239 adapter

USB A to mini-B cable



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