T101 Vector Impedance Analyzer

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User Manual Version 1.0

T101 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

T101 Vector Impedance Analyzer is a device for measuring the complex impedance presented on its type N test port. This is accomplished by injecting an RF signal generated by T101 into the target under test connected to the test port, and measuring the amplitude and phase of the RF signal reflected by the target under test.

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

T101 Vector Impedance Analyzer can operate from 88MHz to 228MHz (VHF), and from 390MHz to 600MHz (UHF), with a 25KHz minimum step size.

T101 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
        •SMITH CHART
    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
        •RESET TO DEFAULTS
    PC MODE
```

KEY DEFINITIONS

POWER : Press and hold this key for two seconds to turn on or off T101 Vector Impedance Analyzer.
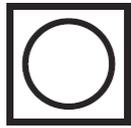
CONFIRM : Use this key to confirm the desired selections and frequencies entered.

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.

0 ~ **9**

NUMERIC : Use these keys to enter the desired frequency directly. Frequencies within the valid operating range will automatically be aligned to 25KHz boundaries. Frequencies outside the valid operating range will be ignored.
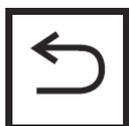
BACK : Cancel the current operation and/or go back to the previous menu.

SINGLE FREQ

In this mode, T101 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 reference.

```
 SWR
FREQ:435025
Z=138.08

3.90
```
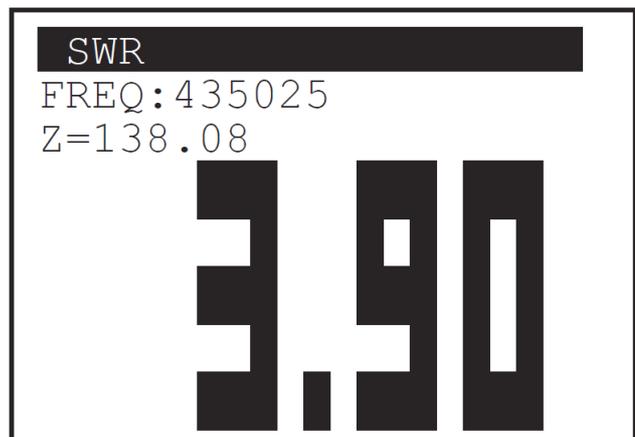
IMPEDANCE (SERIES)

This mode displays the impedance seen at 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
FREQ:435025

101.80 - j112.58
            3.25pF
  SERIAL
```
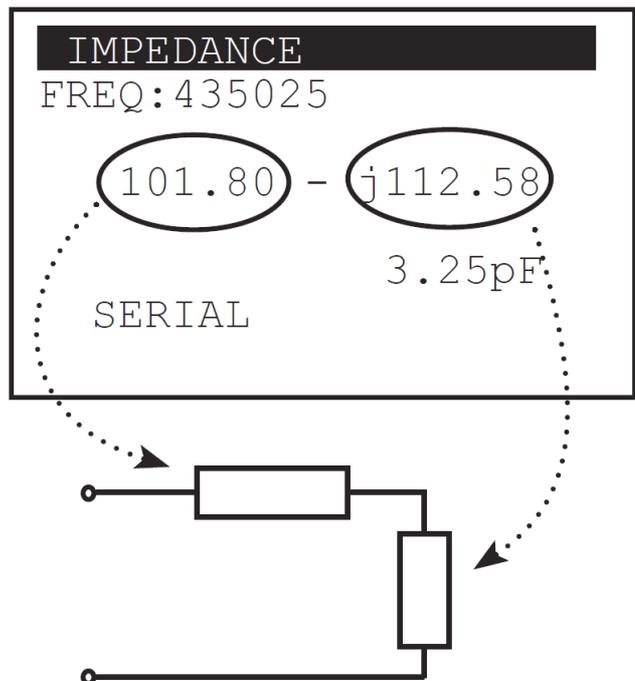
IMPEDANCE (PARALLEL)

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.

```
IMPEDANCE
FREQ:435025
     240.10 - j194.53

              1.88pF
   PARALLEL
```
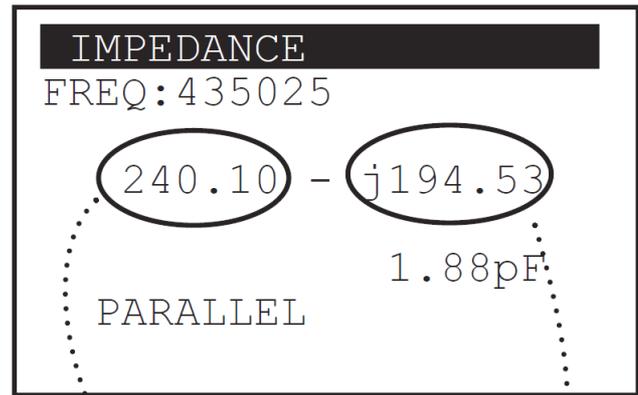
S11

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

```
S11
FREQ:435025
 RECTANGULAR:
    0.58 + j0.34

 POLAR:
    |0.67| <-30.10
```
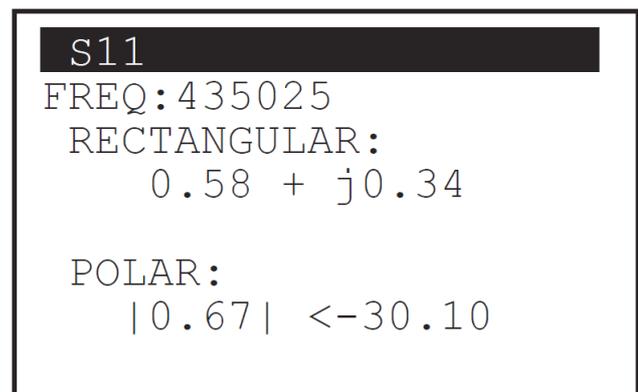
SWEEP FREQ PLOT

Under this menu, T101 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
- SMITH CHART

Within any of these sweep frequency plots, use the MODE key to switch cyclically between 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 will moves 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,1MHz, and 2MHz on the VHF band, while 3MHz frequency step size is also possible on the UHF band.

CALIBRATION

T101 Vector Impedance Analyzer employs the industrial standard Open/Short/Load (OSL) calibration method to eliminate various system errors. To perform accurate measurements, T101 needs to be calibrated against some OPEN, SHORT, and LOAD references. 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 T101.

Calibration data is locked by default to avoid accidental erasure. It has to be unlocked in the SETTINGS menu before a CALIBRATION can be performed.

```
 CALIBRATE

 DATA LOCKED
 GOTO SETTINGS MENU
 TO UNLOCK DATA FIRST
```

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

```
 CALIBRATE

 CONNECT OPEN
```

Calibration data will be locked again automatically after calibration. The instrument is now ready to use. If desired, T101 can be re-calibrated at any time.

CALIBRATE

CALIBRATION DONE

SETTINGS

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

```
SETTING MENU
BACKLIGHT
AUTO POWER OFF
BATTERY
CAL DATA PROTECT
INFO
```

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

```
BACKLIGHT MENU
AUTO          ■
ON            □
OFF           □
```

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

```
AUTO POWER OFF MENU
ENABLE         ■
DISABLE        □
```

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

```
BATTERY MENU
ALKALINE       ■
DISABLE        □
```
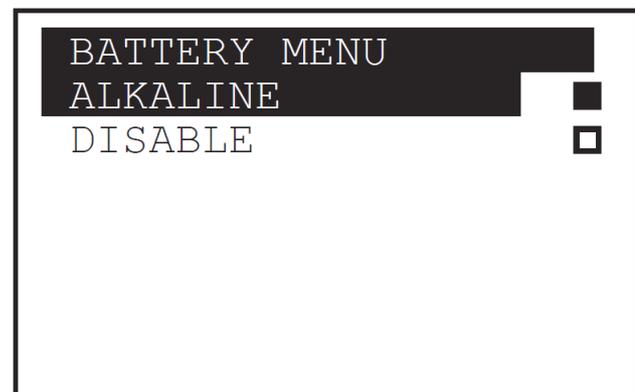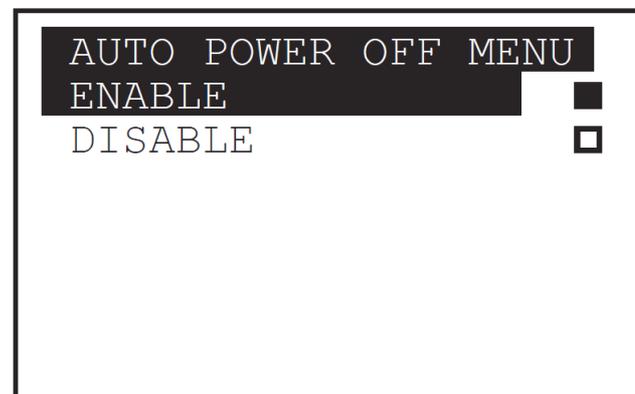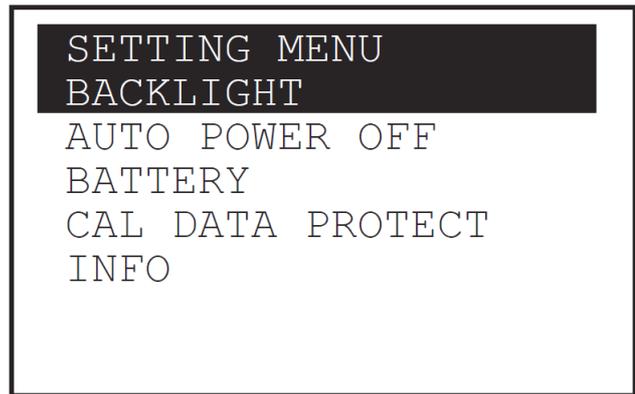
upper right hand corner of the display will appear.

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

```
PROTECT MENU
LOCK CAL DATA      ■
UNLOCK CAL DATA    □
```
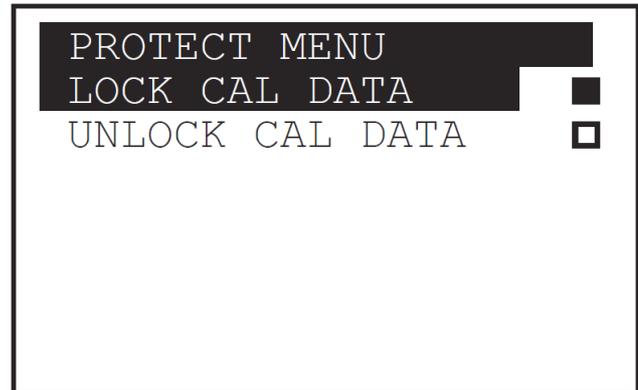
INFO
Display general information of the device, as well as the battery voltage. (5 blocks on the battery bar as battery full and 1 block as battery empty.)

```
SYSTEM INFORMATION
MODEL  : T101
H/W VER: 1.00
F/W/VER: 1.00
BATTERY:
```
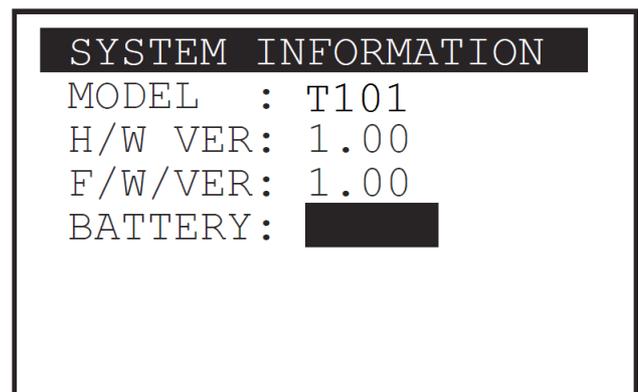
RESET TO DEFAULTS
Use this function to put your analyzer back to the default ex-factory settings. However, calibration data will not be changed.

```
RESET TO DEFAULTS

"O" to confirm
Other keys to abort
```
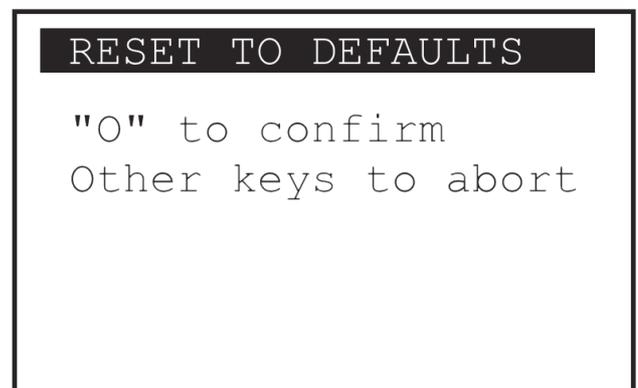
PC MODE

T101 is capable of communicating with a PC via an emulated serial link over the USB connection. A link to the virtual serial port driver for *Windows is available our our website at www.timestechnology.com.hk. It should be installed before connecting your T101 to a PC. A PC host program for *Windows is also available on our web site to control T101 from a PC and display the measured data.

The (virtual) serial communication between T101 and the PC should be configured as follows:

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

After entering the PC MODE, T101 will display the "WAITING FOR HOST CMD" message and listen to the serial port.

```
┌──────────────────────────────┐
│ ██████████████████████████   │
│  PC MODE                     │
│                              │
│ WAITING FOR HOST CMD         │
│                              │
│                              │
└──────────────────────────────┘
```
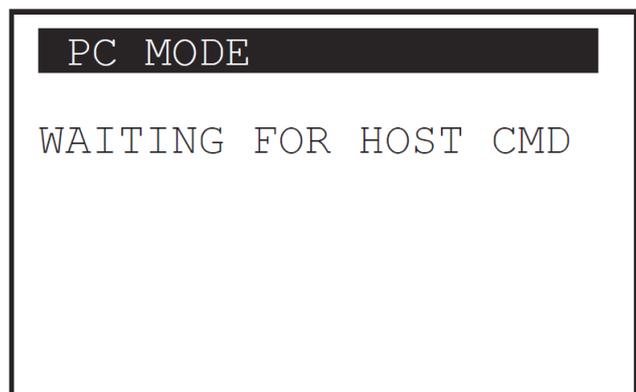
To command T101 to tune to a specific frequency, the host program shall transmit a six-digit frequency in ASCII characters via the serial port.

To command T101 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 T101 at the same time.

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

Sending an ASCII character 'D' will bring T101 back to the initial state, displaying the "WAITING FOR HOST CMD" message and listen to the serial port.

* *More commands will be available in future firmware releases. Please visit the T101 support page on our web site for any updates.*

FIRMWARE UPDATE

T101 firmware can be updated as new releases are available. Updated firmware file can be downloaded from the Internet to a PC and programmed to the T101 via the USB interface.

Caution
1. **Please use fresh batteries when updating firmware.**
2. **Do not power off the analyzer or remove batteries during firmware updating.**

Hold down the "Mode" key while switching on T101 to enter the "Firmware Update" Mode. T101 will show the screen on the.
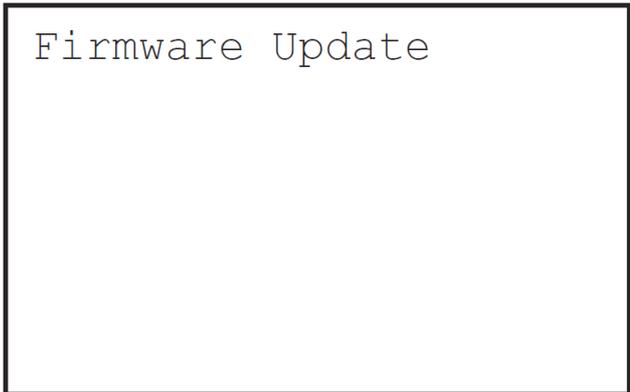
```
Firmware Update



```

Please download our Firmware Update Tools for Windows from our web site at www.timestechnology.com.hk.

Plug in the USB cable to connect T101 to your PC to update the firmware. Display on your T101 will not change while updating.

* Wait until T101 turns off automatically after firmware update, then UNPLUG the USB cable.

T101 SPECIFICATIONS

Frequency Range: 88MHz ~ 228MHz (VHF band)
390MHz ~ 600MHz (UHF band)
PLL Synthesized
Frequency Resolution : 25KHz
Test Port Connector : Type N
Output Power : > 0dBm (typical)
Harmonics : < -25dBc (typical)
Display :
128 x 64 dots graphical LCD with backlight
Physical Dimensions :
165mm(length) x 78mm(width) x 32mm(thick)
Net Weight : 215 gram (without batteries)
Power : AA Size Battery x 2 (not included)

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)

N type male to SMA female adapter
N type male to SO-239 adapter
USB A to mini-B cable