Vector Network Analyzer

DZV-1

User's Manual

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1. Overview

DZV-1 is a vector network analyzer that can measure the impedance and VSWR of the antenna, and S-Parameter of RF components and devices. It is small and low-priced. Therefore, it is suitable for the production line, laboratory use, various testing applications, and educational use. The communication between the DZV-1 unit and PC is done via USB, which is also used for power supply. The LOG-MAG characteristics, the phase characteristic, the group delay frequency characteristics, the Smith chart, the polar coordinates, and the SWR characteristics can be displayed on PC.

2. The installation procedure for the driver software
2.1 The compatible Windows OSs are as follows.

Windows 7 Home 32-bits

Windows 7 Pro 32-bits, 64-bits

Windows 8.1 64-bits (Note)

Windows 10 Home 32-bits

Windows 10 Pro 32-bits and 64-bits

Note: For installation on Windows 8 (64bit version) and higher, the driver software needs digital signature.

We are preparing an approved digital signature for the driver software now.

2.2 Preparation for installation
2.2.1 Driver software download

The USB driver software and the PC application (ziVNAu.exe) can be downloaded as a compressed file at the following site.

http://www.rf-world.jp/go/3501/

2.2.2 Condition to use Driver software

When the files are decompressed, read "Software License Agreement" on page 2 of MCHPESUSB Library Help.pdf.

Driver software can be used on the condition that you understand this content.

2.2.3 List of files

The following files in the extracted files are necessary to start the program.

1. "Driver and inf" folder

- mchpusb.cat
- mchpusb.inf
- mchpusb.sys
- mchpusb64.sys（Only needed for 64-bits OS)

  2. "ziVNAu" folder

- ziVNAu.exe（executable PC application software)
- mpusbapi.dll

2.3 USB driver software

2.3.1 Windows 10（32-bit OS)

The following procedure describes driver software installation for Windows 10 Pro(32-bits)

1. Connect the DZV-1 unit and PC with a USB cable.
2. When you click on Start, the start menu pops up. Then select the device manger icon in the pop-up menu.
3. Double click "Microchip Custom USB Device" in the device manager window.
4. Click "Update Driver" in "Microchip Custom USB Device Properties."
5. In the "Update Driver Software" windows, select "Browse my computer for driver software"
6. Click the Browse button, then choose the path or the "Driver and inf" folder, where the driver software is located. Then click the "Next" button.
7. The message "Windows has successfully updated your driver software" appears and the

installation is completed. Then the LED on the DZV-1 unit is supposed to light up.

2.3.2 Windows 7（32-bits OS)，Windows 8（32-bit OS)

 Installation procedure for Windows 7(32-bit) Windows 7 (64-bit), and Windows 8 (32-bit) installation
 is very similar to the procedure for Windows10 above.

1. Open the device manager window.
2. Double click "Microchip Custom USB Device"
3. Select "Driver and inf" folder.
4. Select "Install this driver software anyway" in the Windows Security dialog box.
5. Then the LED on the DZV-1 unit will light up.

2.4 Set up and start-up of the PC application

2.4.1 Set up

Place ziVNAu.exe and mpusbapi.dll in the same folder, so that the setup is easily completed.

ziVNAu.exe is an executable file of the PC application.

2.4.2 Start-up of the PC application

1. Connect the DZV-1 unit and PC with a USB cable, then ensure that LED(D6) is lit up.
2. Double-click "ziVNA.exe", so that the PC application starts as shown in Figure 3.1
   (Note) If the "mpsbapi.dll" not found" error pops up, make sure that
         "mpsbapi.dll" is in the same folder.

3. The explanation for each button

3.1.1 Main Window

Connect the DZV-1 unit and PC with a USB cable, and double-click ziVNAu.exe to start the PC application. Figure 3.1 shows the main window that shows up immediately after the application starts. To change setting and measurement mode, use the buttons available on the right side.

The main window is composed of the RUN/HOLD button, the main button group, the function button group, the numeric button group, the input-field, and the graphic area.

When you click a button in the main button group, the feature that relates to the button is displayed in the function button group. The figure button group is used to input numbers such as frequency and the point number. Additionally, it is possible to enter numbers using the key board.
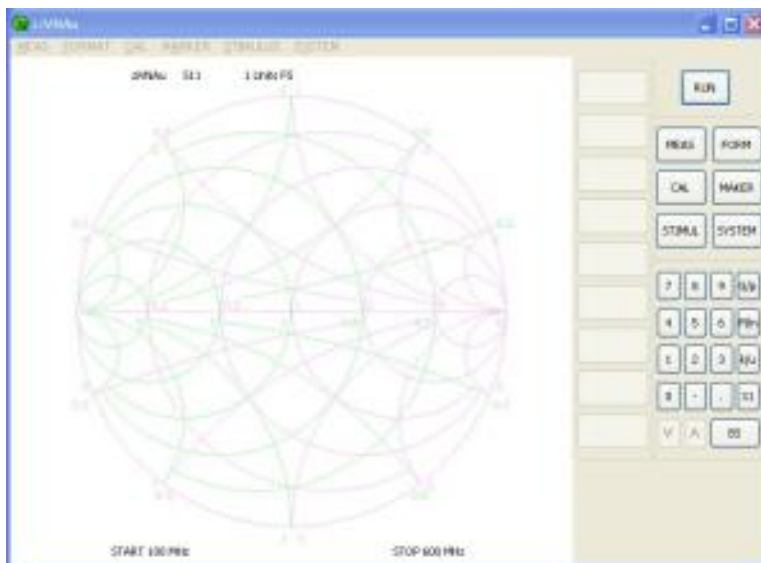

Figure 3.1

3.1.2 RUN/HOLD button

This is the button to start and stop the measurement. The measurement stops if any other button is mistakenly clicked. Additionally, the measurement stops by clicking left button of the mouse when the mouse cursor is in the graphic area.

3.1.3 Main button group

The main button group is composed of the following six kinds of buttons.

MEAS button: used to choose S_{11}, S_{21}, S_{12}, S_{22}

FORM button: used to choose the type of graphics

CAL button: used to choose the type of calibration

MAKER button: used to choose the marker

STIMUL button: used to choose the measurement parameters(frequency, the point, etc.)

SYSTEM button: used for features other than the above

3.1.4 MEAS button

Select S_{11}, S_{21}, S_{12}, S_{22} for S-parameter.

When S11 or S12 is selected, PORT1(LED) is lit up. When S_{22} or S_{12} is chosen, PORT2 (LED) is lit up.

A signal is output from the port where the LED is lit up.

3.1.5 FORM button

Select the type of graphics to display, LOG-MAG, phase, the group delay, the Smith chart, the polar Coordinates, and the SWR.

3.1.6 CAL button

Press this button to start calibration with a Cal Kit. Figure 3.2 shows the function buttons of calibration menu.

Figure 3.2

Calibration menu

Button	Name	Calibration kit to use	S-parameter	Error to compensate
RESP	Response calibration	Open	S11 or S22	Reflection tracking(E_R)
		Short		
		Thru	S21 or S12	Transmission tracking(E_T)
RES ISO	Response & Isolation calibration	Open / Load	S11 or S22	Reflection tracking(E_R) Direction(E_D)
		Short / Load		
		Thru / Load	S21 or S12	Transmission tracking(E_T) Isolation(E_X)
ENH-RESP	Enhanced & response Calibration	Open / Short / Load / Thru	S11＋S21	Reflection tracking(E_R) Direction(E_D) Source match(E_S)
			S22＋S12	Transmission tracking(E_T) Isolation(E_X)
1-PORT	1-port calibration	Open / Short / Load / Thru	S11 or S22	Reflection tracking(E_R) Direction(E_D) Source match(E_S)
FULL 2-PORT	Full 2-port Calibration	Open / Short / Load / Thru	S11＋S21＋S12＋S22	Reflection tracking(E_{RF}) Direction(E_{DF}) Source match(E_{SF}) Transmission tracking(E_{TF}) Isolation(E_{XF}) ** Reflection tracking(E_{RR}) Direction(E_{DR}) Source match(E_{SR}) Transmission tracking (E_{TR}) Isolation(E_{XR})※

** When the isolation calibration has been done.

Table 3.1

CORR OFF

This button is used to correct the measured value with the calibration data. The display of the button

changes to CORR ON automatically when the calibration is completed.

If this button is clicked when it displays CORR OFF, the data that was calibrated last time is retrieved.

It is convenient when measuring using the last calibration data immediately after restarting a PC application.

RESP

When calibrating S11 or S22, use Open or Short Cal Kit. For S21 or S12, use Thru Cal Kit.

Not only Amplitude, but phase can also be calibrated. The phase reference is adjusted to 0 degree at the connecting point of THRU CAL KIT.

RES ISO

When calibrating S11 or S22, use OPEN or SHORT CAL Kit and LOAD CAL Kit(ISOL'N). For S21 or S12 calibration, use THRU and LOAD CAL Kit. Connect LOAD CAL Kit to the port where LED is not lit up.

ENH－RESP

When calibrating S11,S21 or S22,S12 use OPEN, SHORT, and THRU CAL Kit.

Additionally, use LOAD CAL kit for ISO calibration.

1-PORT

Use OPEN, SHORT, and LOAD CAL Kit to calibrate S11 or S22.

Full 2 port calibration

This is quite effective for 4 kinds of S-parameter. Use OPEN, SHORT, LOAD and THRU(through connection) CAL Kit. The ISO calibration can be done with an additional LOAD CAL kit.

SAVE CAL

Use this button to save the calibration result.

LOAD CAL

The stored data can be loaded with this button.

3.1.7 MARKER(MAKER)

It can be used to show the measured waveform of the frequency with numeric value and to examine its position on the graph. There are five markers altogether. Click the [MAKER] button in the main

button group, and the marker buttons from 1 to 5 are displayed in the function button group. When you click each marker, it shows with light blue color(it shows black in this manual) Light blue color indicates that the marker is active.

Move the marker by pressing down the left button of the mouse, as shown in figure 3.3. When the marker is active, the input field appears under the figure button group.

Both inputting numeric value using the key board and clicking the figure button in the figure button group are effective ways to move the marker. This operation is especially suitable for the graph of the group delay frequency characteristics.
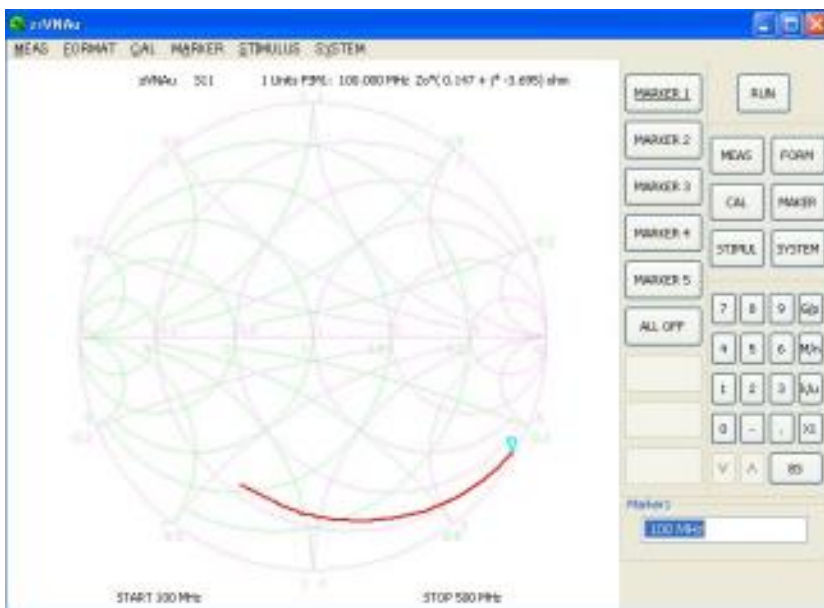

Figure3.3

3.1.8 STIMUL

The measurement conditions such as frequency, the measurement points, the choice of FIR filter for signal processing, the measurement frequency span (LIN, LOG, DE) can be set here. Figure 3.4 shows the function button group as it appears on clicking the [STIMUL] button. By clicking [MORE] button, the second function button group shows up.

| Figure 3.4a | Figure 3.4b(second one) |

START, STOP, CENT, and SPAN

Set the range of measured frequency with these buttons. CENT means the center frequency and SPAN means its width. Input field appears by clicking each button. Set the frequency using the buttons on the figure button group or with the key board.

POINTS

Set the number of frequencies to be measured in the input field. Maximum 801 can be input. The correction made with calibration data is cancelled when setting is changed.

DSP

Choose the FIR filter to remove unnecessary components from the received signal and the number of data to pass through the FIR filter, compromising between the noise in the wave form and the measurement speed. Click the DSP button in the function buttons, and the setting window will appear (Figure 3.5). Normal, Heavy, Maximum, and Custom radio buttons are ready for the combinations of number of data and the RIR filter becomes more than the total taps of FIR filter and Hilbert transformation. Normal is set as the initial value that is optimized for measurement speed.
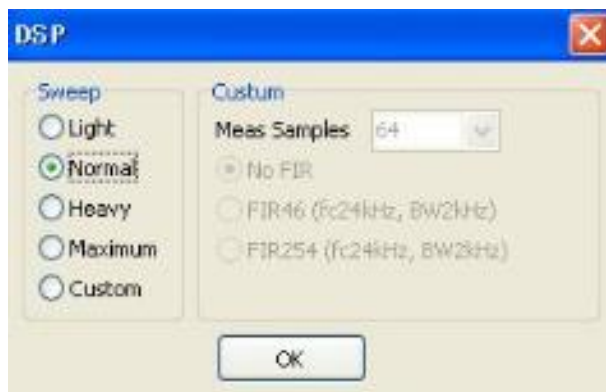
Figure 3.5

The FIR filter and data number can be set separately in 16 steps(Meas Samples) by selecting the
Custom button.

The calibration can't be cancelled even if setting is changed.

The accuracy of the calibration improves with the Heavy button, although it takes a little more time. In
case of measuring DUT, select the Normal button to save time.

RF ATT

Use RF ATT to attenuate signal level from port 1 or 2. Do not input a different value at port 1 and 2.
The initial value is 0dB. In the range of 300KHz – 100MHz frequency, the output level is about
-17dBm in case the attenuator is 0dB. The calibration is cancelled when setting is changed

TRIGGER

This function has two modes to choose. One is the mode to measure only once when the RUN button
is clicked. Another is the mode to measure repeatedly until the HOLD button is clicked.

FREQ   TYPE

This is the function to set the interval of the frequency. The frequency axis becomes a log scale when
choosing LOG and DEC. DEC means decade. It is useful when measuring at constant intervals.
(e.g.10MHz, 20MHz, 30MHz)

3.1.9 SYSTEM

When SYSTEM is clicked, other functions appear as shown in figure 3.6.

Figure 3.6

Load S2P

The function is used to display information on each graph by reading the file of the Touchstone format
of 2- PORT. It is useful to display on the graph the past works or the S2P file downloaded from
maker's homepage. The calibration is cancelled if the S2P file is read.

SAVE   S2P

The function is used to save measured data in the file of the Touchstone format. All data can be saved
in Touchstone 2-PORT format. When measured only by S11, the other S parameter data is dummy
data.

COPY to CLIPBOARD

The function is used to save the measured graphs as meta files in the clipboard on Windows OS.
It is useful to paste them on Word or Excel files.

SERVICE

Various other functions are shown here to check the performance of the DZV-1 unit and for debugging
the PC application. Click the SERVICE button, and the display appears as it is shown in figure 3.7.

Figure 3.7

The scale color of the Smith chart can be changed by checking OUTLINE, SMITH, and IMMIT under the OPTIONS tab. When the check on IMMIT is removed, the drawing speed goes up. To initialize the items other than the Smith chart, delete ziVNAu.ini from the same folder where ziVNA.exe is saved. Then, when ziVNAu.exe is started, all items are initialized.

3.1.10 Other functions
RETURN button
This function is used to return to the previous page.
MORE button
This function is used to continue to the next page.
Underline
The active buttons appear underlined.

3.2 Mouse operation

3.2.1   Failure of measurement
The measurement stops when the left button of the mouse is clicked with the mouse cursor in the graphic area or when any button is clicked in the main window.
3.2.2   The change of vertical scale of LOG MAG, PHASE, DELAY, and SWR
The change of scale for the vertical axis of graph can be done only with a mouse.
Move the mouse cursor up and down in the graphic area while pressing the right button of the mouse. By turning the mouse wheel, the top and bottom scale of the vertical axis can be changed according to the position of the mouse cursor. For the change of scale for the horizontal axis, use START, STOP,

CENT, and SPAN at the STIMUL button. The calibration is cancelled when this operation is complete
.

3.2.3   The change of scale for SMITH and POLAR graph

The change of scale for SMITH and POLAR graph can be done only with a mouse.

Move the mouse cursor up and down in the graphic area while pressing the right button of the mouse. When turning the mouse wheel with the mouse cursor in the graphic area, the scale can be changed according to the position of the mouse cursor.

3.3   Input with a keyboard

The Frequency setting, the measurement point setting, and the marker frequency setting can be input in the field under the figure button group with a keyboard. Make an input-field active with the mouse cursor and input the value in it. Then press the ENTER key.

(e.g., When inputting 100MHz,

100M + ENTER key or 100e6 + ENTER key)

4. Calibration Procedure

Necessary items (Calibration kit, a coaxial cable with SAM connector at one or both ends, SMA male/female feed thru connector, SMA male/male fed thru connector) (Figure 4.1). For 1-PORT calibration, OPEN, SHORT and LOAD types of CAL KIT are used. To connect DZV-1 and DCAL-1(Calibration kit), SMA male/male fed thru connector is used.(Figure 4.2)

Figure 4.1

Figure 4.2

4.1 1-PORT Calibration

CAL1: Select 1-PORT cal mode

Click the CAL button(Figure 4.3) in the Main button group and click the 1-PORT button in the function button group.

CAL2: OPEN type of calibration kit

Connect OPEN type of calibration kit (Figure 4.5) to PORT 1 and click the OPEN button in the function button group. When the OPEN button appears underlined, the measurement is over.

Figure 4.3   Figure 4.4

Photo 4.5

CAL3: SHORT type of calibration kit

Connect SHORT type of calibration kit to PORT 1 and click the SHORT button (figure 4.4) in the function button group. When the SHORT button appears underlined, the measurement is over.

CAL4: LOAD type of calibration kit and the completion

Connect LOAD type of calibration kit to PORT 1 and click the LOAD button in the function button group. When the LOAD button appears underlined, the measurement is over.

When the measurements of OPEN, SHORT, LOAD are over, the DONE button (Figure4.4)becomes active. Click the DONE button.

Figure 4.6   Figure 4.7

CAL5: Confirmation of the calibration

Click the DONE button, holding the connection with LOAD type of calibration kit to PORT 1, and the results of measurement gather to the center of the Smith chart. (Figure 4.8)

When the calibration is complete, the upper button in the function button group turns to CORR ON 1-POINT(Figure 4.9)
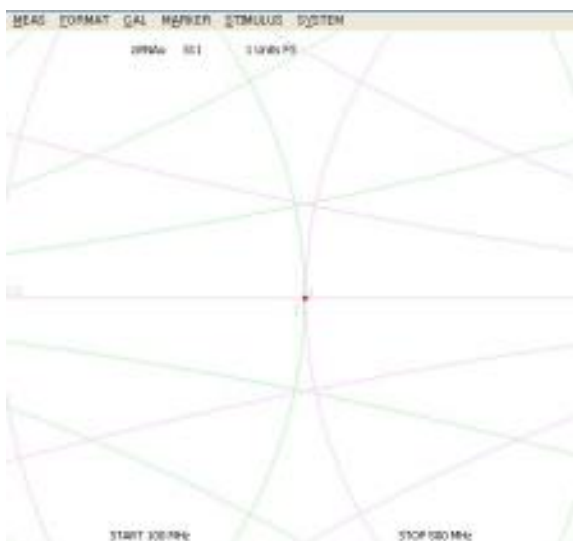

Figure 4.8   Figure 4.9

4.2   Response calibration(S21)

The LOG MAG graph is recommended because it allows the connection fault to be detected.

CAL1

Click the MEAS button(Figure 4.10) in the main button group and then click S21 in the function button group.

CAL2

Click the CAL button(Figure 4.11) in the main button group and then click the RESP button in the function button group.

Figure 4.10   Figure 4.11

CAL3: Measurement of THRU on Calibration kit

Connect PORT-1 to PORT-2 with SMA male-female feed thru connector, Thru on Cal kit, and a coaxial cable as shown Figure4.12. Click the THRU button(figure 4.13) in the function button group.

CAL4: Complete of the Calibration

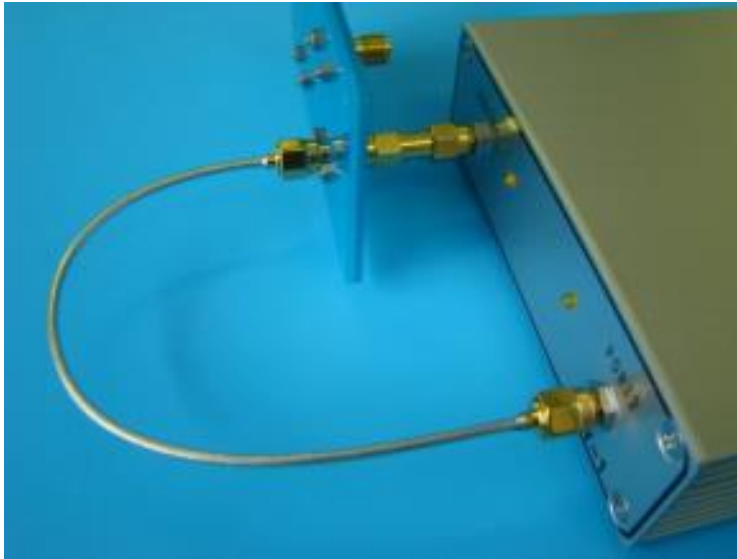Click the DONE button(figure 4.13).

Figure 4.12

Figure 4.13

4.3 Response and Isolation Calibration (S21)

The LOG MAG graph is recommended because it allows the connection fault to be detected.

CAL1

Click the MEAS button in the main button group and then click S21 button in the function button group.

CAL2

Click the CAL button in the main button group and then click the RES ISO button in the function button group(figure 4.14)

Figure 4.14

CAL3: Measurement for THRU of calibration kit

Connect PORT-1 to PORT-2 with SMA male-male feed thru connector, THRU of Calibration kit, and a coaxial cable. Click the THRU button in the function button group.
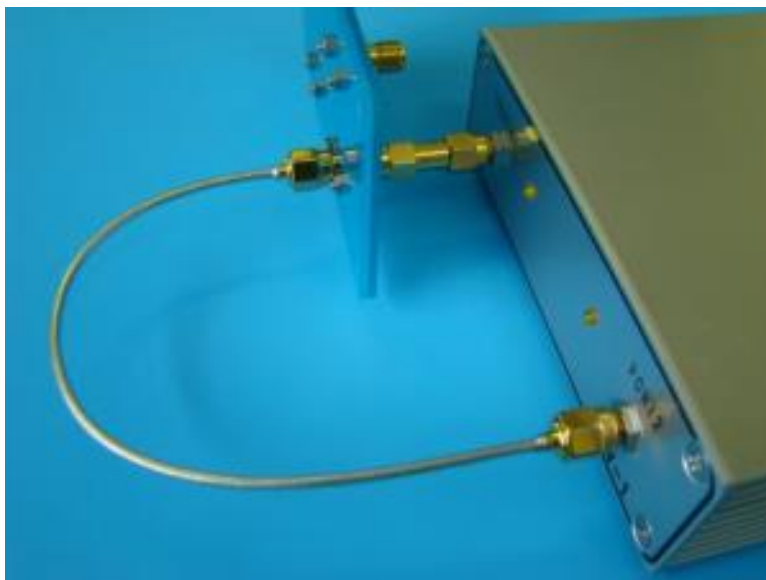

Figure 4.15

Figure 4.16

CAL4 : Measurement of isolation

Connect LOAD of calibration kit to PORT-2 (Figure 4.17) and click the ISOL'N button in the function button group (Figure 4.18).

CAL5 : Completion of calibration

Click the DONE button. (Figure 4.18)

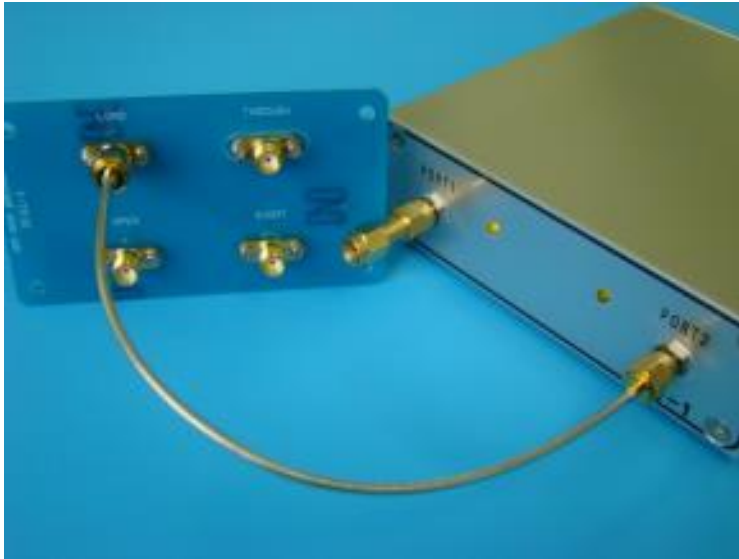Figure 4.17   Figure 4.18

Enhanced response calibration for S11, S21

The Smith chart is recommended because it allows the connection fault to be detected. A coaxial cable is needed with SMA male connecter because PORT-1 and PORT-2 are connected through the THRU calibration kit.

CAL1 : Select S11

Click the MEAS button in the main button group and click the S11 button in the function button group.

CAL2 : Select ENH-RESP

Click the CAL button in the main button group and click the ENH-RESP button in the function button group (Figure 4.19)

Figure 4.19

CAL3: Measurement for OPEN of calibration kit

Connect OPEN of calibration kit to PORT-1 as shown Figure4.20. And click OPEN in the function button group(Figure 4.21). Once the OPEN button appears underlined, the measurement is completed.

Figure 4.20

Figure 4.21

CAL4: Measurement for SHORT of calibration kit

Connect SHORT of calibration kit to PORT-1 and click the SHORT button.

CAL5: Measurement for Load of calibration kit

Connect LOAD of calibration kit to PORT-1 and click the LOAD button.

CAL6: Measurement for THRU of calibration kit

Connect THRU of calibration kit to PORT-1 and connect it to PORT-2 with the coaxial cable as shown on Figure 4.22). Finally click the THRU button.
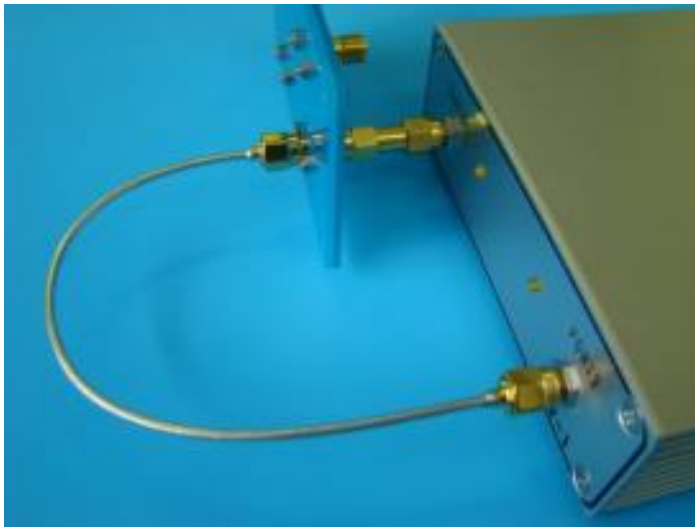

Figure 4.22

CAL7: Measurement of Isolation

Connect LOAD type of calibration kit to PORT 2 as shown on Figure 4.23. Click ISOL'N button(Figure 4.24)

CAL8: Completion of calibration

Click DONE button(Figure 4.24). The measurement is completed.
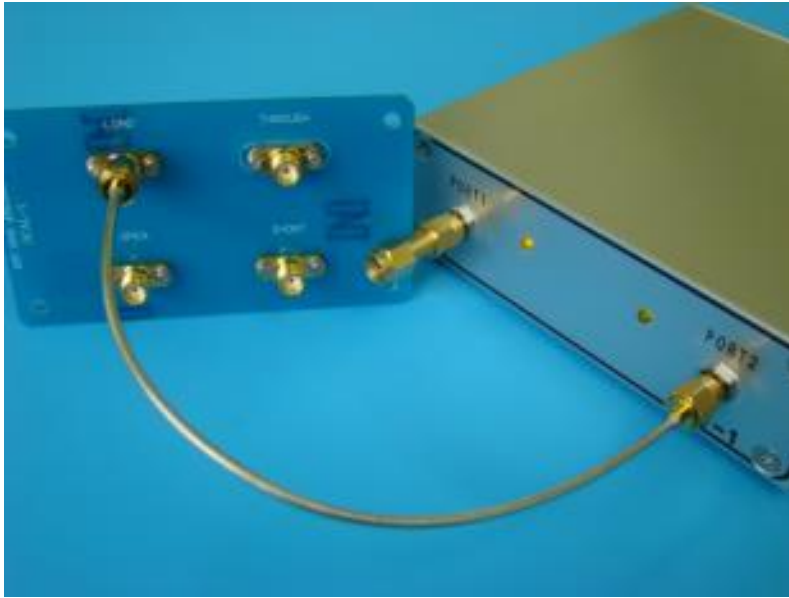
Figure 4.23   Figure 4.24

4.5 Enhanced Full 2 port calibration for S11, S21, S12, and S22

The Smith chart is recommended because it allows the connection fault to be detected. A coaxial cable is needed with SMA male connecter because PORT 1 and PORT 2 are connected through THRU calibration kit. Select S11 for S parameter.

CAL1: Select FULL 2-PORT for calibration

Click the CAL button in the main button group(Figure 4.25) and then click the FULL2-PORT button in the function button group. Finally, click the REFLECT'N button in the function button group.

Figure 4.25a   Figure 4.25b

CAL2: Measurement for FWD Open of Calibration kit

Connect OPEN type of calibration kit to PORT 1. (Figure 4.26) and click FED OPEN (Figure 4.27).
Once FED OPEN appears underlined, the measurement is completed.

Figure 4.26   Figure 4.27

CAL3: Measurement for FWD Short, and FWD Load of calibration kit

Connect SHORT type of calibration kit to PORT 1 and click the FWD SHORT button.

Next connect FWD LOAD of calibration kit to PORT 1 and click the FWD LOAD button.

CAL4: Measurement for REV OPEN, SHORT, and LOAD type of calibration kit

Connect OPEN type of calibration kit to PORT 2 as shown in Figure 4.28 and click REV OPEN button.

Next, connect SHORT type of calibration kit to PORT 2 and click REV SHORT. Finally connect LOAD type of calibration kit to PORT 2 and click REV LOAD.

Figure 4.28

CAL5: Completion of REFLECTIO'N measurement

Once all the six measurements from FWD OPEN to LOAD are finished, REFR DONE becomes active (Figure 4.29). Click the REFR DONE button, and the measurement is completed.

Figure 4.29

CAL6: Connection for THRU of calibration kit

Click the TRANSM'NISOL'N button in the function button group (Figure 4.31).

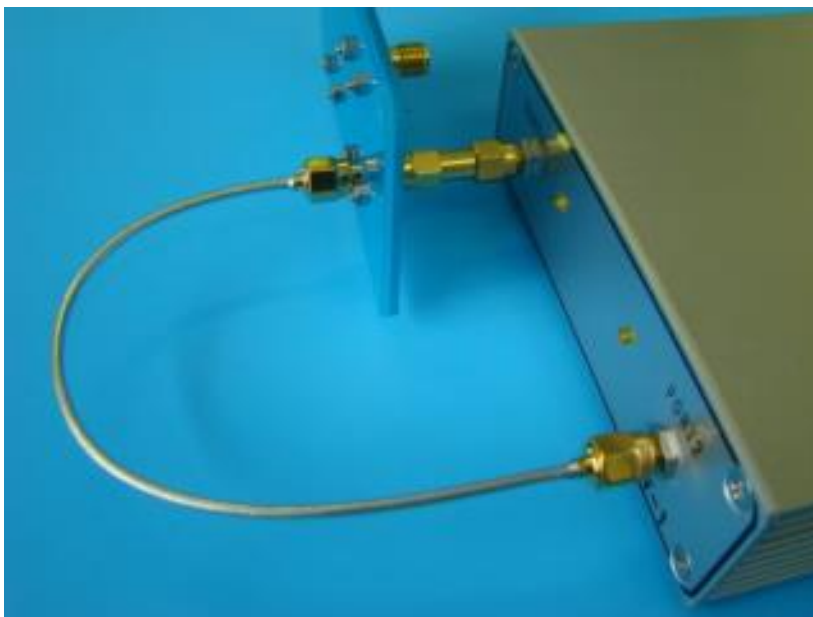Connect THRU type of calibration kit between PORT 1 and PORT 2 as shown in Figure 4.30.

Figure 4.30

Figure 4.31

CAL7: Measurement for THRU of calibration kit

Click FWD TRANS THRU and FWD MATCH THRU in the function button group (Figure 4.33). Next, click the REV TRANS THRU button. Finally, click the REV MATCH THRU button, and the TRAN DONE button becomes active.

　**In case the measurement of isolation is not needed, click the TRAN DONE button.

CAL8: Measurement of Isolation

Connect LOAD of calibration kit to PORT 2 as shown in Figure 4.32. and click the FWD ISOL'N button. Next, connect LOAD of calibration kit to PORT 1 (Figure 4.34). Finally click the REV ISOL'N button.

CAL9: Completion of TRANSM'NISOL'N calibration

Click the TRAN DONE button, and the measurement of TRANSM'NISOL'N is completed.
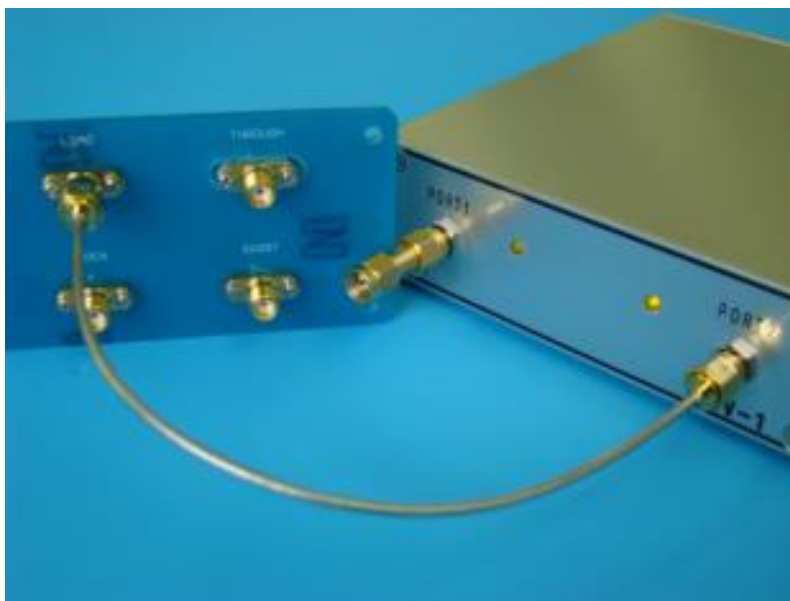

Figure 4.32   Figure 4.33

Figure 4.34

CAL10: Completion of full 2 port calibration

Click the FULL2 DONE button (Figure 4.35) and the calibration is completed.

Figure 4.35

4.6   Supplementary explanation for calibration

Tips for choosing calibration

(1)Isolation calibration

The dynamic range becomes better if the isolation calibration could be chosen.

(2)S11 or S22 response calibration and 1 port calibration g

1 port calibration is recommended if S11 or S22 response calibration is insufficient.

(3)Full 2 port calibration and enhanced response calibration

Full 2 port calibration takes time because of a few procedures. Therefore, enhanced response calibration is recommended in case of only S11 or S21 measurement.

Graph to choose during calibration

Any graph can be displayed during calibration. Even if the graph is not an appropriate one, there is no problem in switching to the objective graph after calibration g.

(1) In case of S11, or S22

The Smith chart is recommended because it allows the connection fault of calibration kit to be detected by a measured graph. (e.g., The result should be displayed on the right side of the Smith chart in case of the measurement of OPEN type of calibration kit. If not, the connection fault can be figured out.)

(2) In case of S21, or S12

The LOG MAG graph is recommended. Because S21 and S12 proofreading is measured around transfer loss 0dB, a broken wire can be figured out.

(caution) Do not change the graph during calibration because the measured accumulated data will be lost.

Do not click the RETURN button during calibration because the measured accumulated data will be lost.

5. Cautions to avoid damage to the unit

5.1 PORT 1 and PORT 2

(1) Do not supply over 0 dBm, or the DZV-1 unit will be damaged.

(2) The DZV-1 unit may be easily damaged by static electricity. Beware of static electricity when connecting a big sized antenna (HF band ones and so on) to the port.

(3) DC cut is strictly recommended beforehand when connecting to the port.

5.2 Be cautious in the polarity of USB 5V

6 Warranty

If any defect is found due to the manufacturer's improper production or design within one year of delivery, repair or replacement shall be performed under the manufacturer's responsibility. But Digital Signal Technology assumes no liability for damages that may occur as the result of handling by users even during the warranty period.

7 Others

7.1. This product, which employs a CMOS device, may be easily damaged by static electricity.

7-2. Do not supply over voltage power supply, or the DZV-1 unit may be damaged.

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