ITOCHU SysTech GmbH

Flying probe tester APT-9411 series

Programmable DC Power Supply Board

PDC-9500 Operator's Guide

TAKAYA

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Preface

The Programmable DC Power Supply Board PDC-9500 is an option integrated into the Takaya Fixtureless tester ***APT-9411 Series*** and the sister models to extend its capabilities.

Please read this manual thoroughly before using this option. Then keep this manual handy for answers to any questions you may have.

If you have any questions or thoughts you would like to share with us – we would like to hear from you.

(NOTE)

1) The design of the product and software are under constant review and while every effort is made to keep this manual up to date, we reserve the rights to change specifications and equipment at any time without prior notice.
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Introduction

Safety symbols

Symbol	Explanation
	Calls attention to a procedure, practice, or condition that could possibly cause serious accident or death.
	Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or damage to the product.
	Calls attention to a procedure, practice, or condition that could possibly damage to the product.
	Calls attention to general instruction. Failing to follow this could loss of data stored on disks causes possibly misjudge the unit under test, or damage to the product.
	Calls attention to “One-point advice” which should be useful when you are at a loss to operate the products.

Programming DC Power Supply Board

Outline

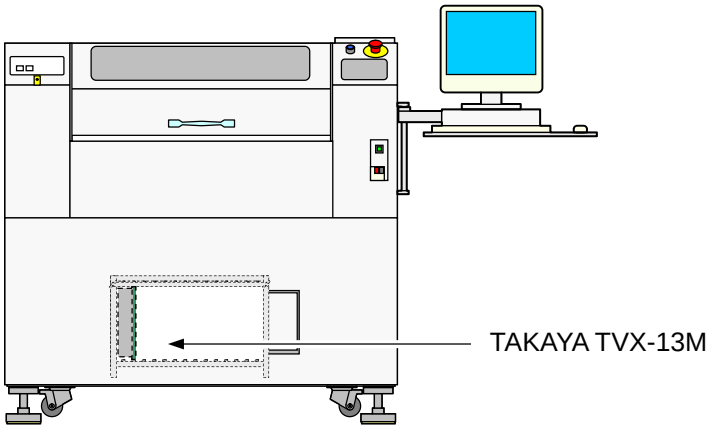
By integrating the Programming DC Power Supply Board PDC-9500 (hereinafter called “PDC-9500”) into the APT-9411 Series and the sister models, users can apply the specified voltage DC1.0V ~ 25.0V on the PC boards through the flying probes and/or bottom probes in order to conduct simple function test of:

1. Relay components (On test)
2. 3-terminal regulators
3. Small isolated circuits
4. Current consumption

System Configuration

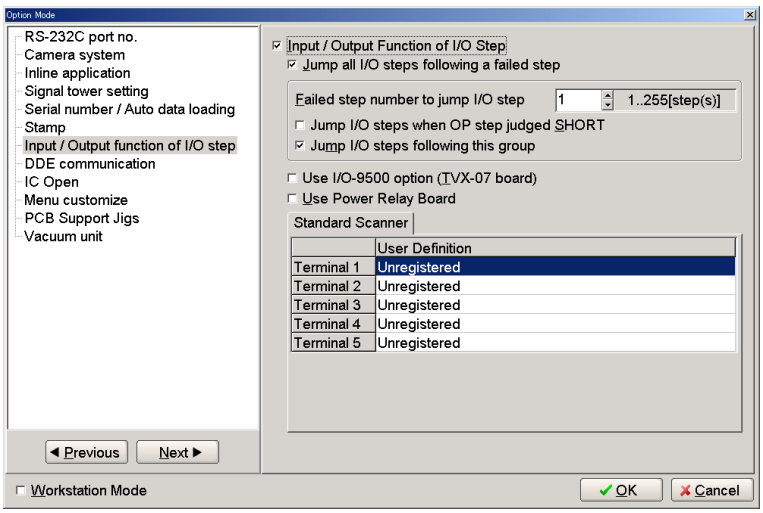
Hardware

The PDC-9500 consists of a PC board (TAKAYA TVX-13M) and the exclusive power supplies.



Software

To enable the PDC-9500 in the tester, select the box “Input/Output Function of I/O Step” in Option mode. (Refer to Fig.1)



[Fig.1] Input / Output Function of I/O Step

Specifications

The PDC-9500 enables two functions below.

1. Functional test by applying DC voltages

   The PDC-9500 is able to apply the user specified DC voltage (DC1.0V ~ 25.0V) to the UUT via the probes (including the bottom probes).

2. Current measurement

   Current measurement while applying DC voltage enables to test the small isolated circuits and measure current consumption.

Current and voltage specifications

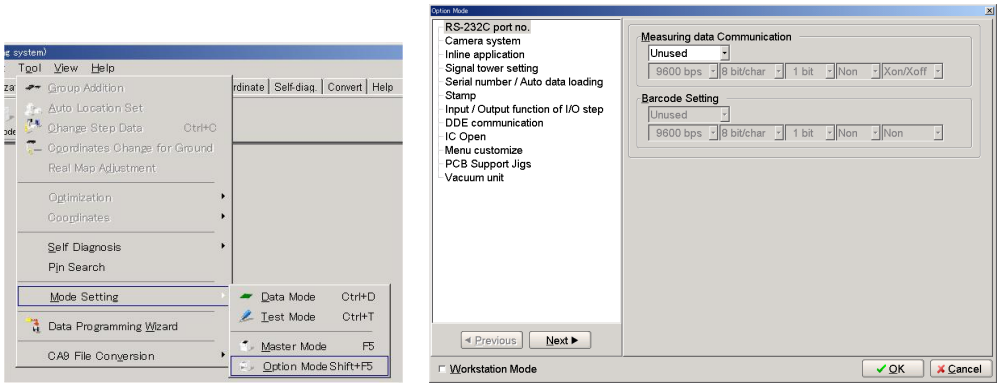
Applied voltage	DC constant voltage: 1.0 ~ 25.0V (Programmable by 0.1V)
Max. Current	1A (Current limit adjustable)
Current limit	8 ranges: 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA,1A
Ammeter	4 ranges: 0.1 ~ 1.0mA, 1 ~ 10mA , 10 ~ 100mA, 100 ~ 1000mA

Option mode setup

When the PDC-9500 is used for the first time, Option mode requires initial setup by users. This setting will be saved in Master.mdt file in the system directory.

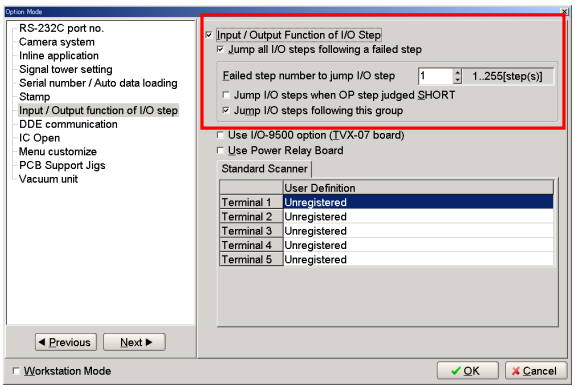
Setup procedure

1. Choose [Tool] > [Mode Setting] > [Option mode] to open Option mode window.



[Fig.2] Tool > Mode Setting > Option mode

2. Click on Input / Output function of I/O step and select the box “Input / Output Function of I/O step”.



[Fig.3] Input / Output Function of I/O Step

3. At this moment, the box “Jump all I/O steps following a failed step” is already selected as default. Be sure to hold this setting because it is preferred for most users to jump (skip) the I/O steps when some failure was detected in the previous test. In addition, the following parameters affect the treatment of I/O steps following the failed step, so users should configure them carefully;

Failed step number to jump I/O step

The I/O steps are not jumped (skipped) until the failed steps reach the specified numbers. But remember this box is specified by “1” as default. If this setting remains unchanged, the I/O steps are jumped (skipped) even if one failure was detected in the previous test.

☐ **Jump I/O steps when OP step judged SHORT**

When the Failed step numbers to jump I/O step is specified by other than 1 (let’s suppose “10”), the I/O steps are not jumped (skipped) until the failed steps reach the specifed numbers.
However, if the box “Jump I/O steps when OP step judged SHORT” is selected, the I/O steps are jumped (skipped) if any OP step (Function is substituted by OP) is judged fail even when the failed steps have not reached the specifed numbers yet.

☐ **Jump I/O steps following this group**

If the box is selected, the I/O steps to be jumped (skipped) are applied to other groups, not only the group where the failure was detected.

4. Click on the OK button to leave Option mode window.

Simple function test

To implement simple function test, users need to configure the I/O step by specifying I/O command, time and probe to apply signal and the applied voltage so on. Once the I/O step gets executed, the PDC-9500 applies voltage to the UUT in accordance with the established conditions.

There are two ways of configuring the I/O steps;

1. I/O Function (Edit list menu > Tool > I/O Function)

On the I/O Function window, users should select appropriate I/O command (IO/V, IO/P, or IO/C) in accordance with the intended use. The limitation of applying voltage and the measuring contents vary depending on the I/O commands. Users should understand the specification and the property of each I/O command in that way.

I/O command	General application
IO/V	This I/O command uses two probes to have the PDC-9500 apply DC voltage to the UUT and use another two probes to measure the output DC voltage.
IO/P	This I/O command uses two bottom probes to have the PDC-9500 apply DC voltage to the UUT and test multiple test tests by measuring the output voltage or current. (Power on test)
IO/C	This I/O command uses two probes to have the PDC-9500 apply DC voltage to the UUT and measure the output current at the same time.

2. Viewable Setup of Function steps (Edit list menu > Tool > Viewable Setup of Function steps)

Users don't have to select I/O command in accordance with the intended use, but he can use the mouse to simply specify necessary connection on a graphic setup window. Users can recognize the reality of whole connection with ease.

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Basic precautions of I/O steps

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

CAUTION	**Mentioned below are very important things to know. Be sure to read through them to fully understand in advance.**

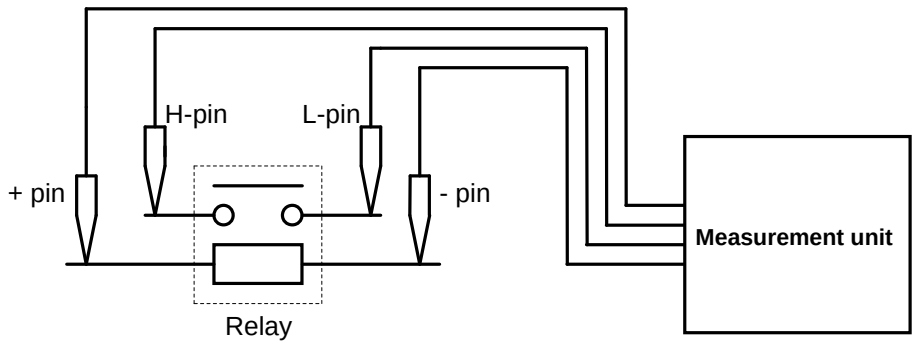
1. If other than DC-VM mode is used while the PCB is applied with the specified voltage, from time to time it shows “The PCB is charged with high voltage!” on the display. In this case, User should change to DC-VM mode or set “JP”.
2. The I/O steps must follow the normal RCLD measurement steps. In addition, be sure to select the box “Jump all I/O steps following a failed step” on the Select Input / Output function of I/O step window in Option mode. With this, users can prevent any I/O step following the fail step from execution.
3. In case of Point system, the maximum pin numbers is limited to 3,200.
4. The I/O command is not available in case of the following tests:
   - Optical steps
   - Combination test steps
   - Special generation steps (“CM-x” in Aux. filed)
   - IC Open test steps (“ICOP” in Aux. filed)- Coordinates revision steps
   - Kelvin measurement steps (“Kel.” in Aux. filed)
   - ZD (Zener diode) steps
   - Digital transistor steps (“DGTR” in Aux. filed)
   - FET steps (“FET” in Aux. filed)
   - Pattern open check test (“PT-x” in Aux. filed)
   - Photo coupler steps (“PC” in Aux. filed)
   - Zone set steps (“ZONE” in Aux. filed)
5. The I/O steps aren’t supported by Coordinates Sort function. If executed, it shows an error of “No execution possible due to I/O step existed!” on the display.
6. The I/O steps aren’t supported by Combination measurements.
7. If the I/O step is released, all other than “Parts”, “Value” and “Comment” column are initialized and put back to the normal step.
8. If the test program is converted to APT-8000 series, the I/O steps (IO/P, IO/V, IO/C) are released. Means, all other than “Parts”, “Value” and “Comment” column are initialized and put back to the normal step.
9. The reference value of the I/O steps cannot be input automatically during the Reference Value Input function. Users should input the reference value in the Step Review menu.
10. The Data Average function is unable to apply the voltage at the I/O steps (IO/P, IO/V, IO/C). In addition, neither the voltage nor the current is averaged.
11. The Reference Value Generation function does not create the reference value of the I/O steps (IO/P, IO/V, IO/C).
12. Location name of the I/O steps (IO/P, IO/V, IO/C) is not changeable at Change Step Data function.
13. Location name of the I/O steps (IO/P, IO/V, IO/C) is not changeable at Group Addition function.
14. Location name of the I/O steps (IO/P, IO/V, IO/C) is not changeable at Auto Location Set function.
15. When using either IO/P or IO/C command, the Fail retry test isn’t performed.

I/O Function window

This chapter describes the procedures to generate I/O steps (basic data programming and reference input) using the I/O Function window.

IO/V Command

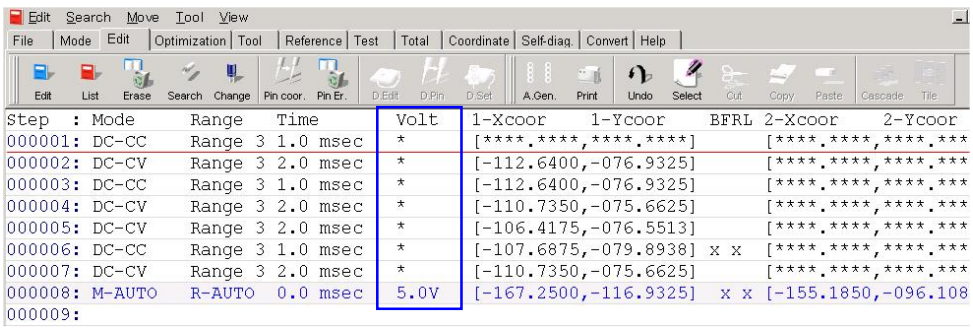
The IO/V command uses two probes to have the PDC-9500 apply DC voltage to the UUT and use another two probes to measure the output DC voltage. For example, users can perform On test of the relay's contact and test the output voltage from the 3-TERMINAL regulators. (Refer to Fig.1)



[Fig.1]

Basic knowledge of IO/V step

1. Users can select the probes to apply voltage and the measurement probes from the flying probes and the bottom probes.
2. To use the bottom probe, first of all users need to select the flying probe and move to Step data review to change it to the bottom probe.
3. No guard point can be set.
4. The Loc column of the IO/V step is substituted by "IO/V".
5. After the IO/V step was finished, the voltage output is suspended automatically.
6. The output voltage is shown in the Volt column on the Step Edit list. (Refer to Fig.2)



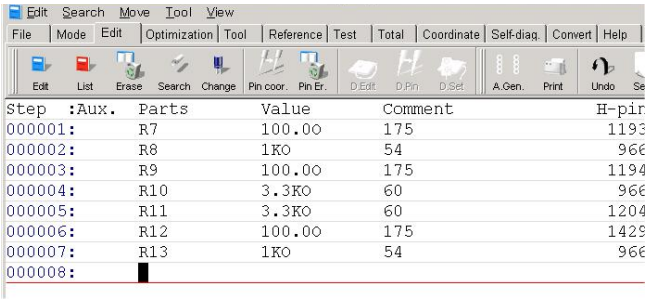
[Fig.2] IO/V command

Programming Steps

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

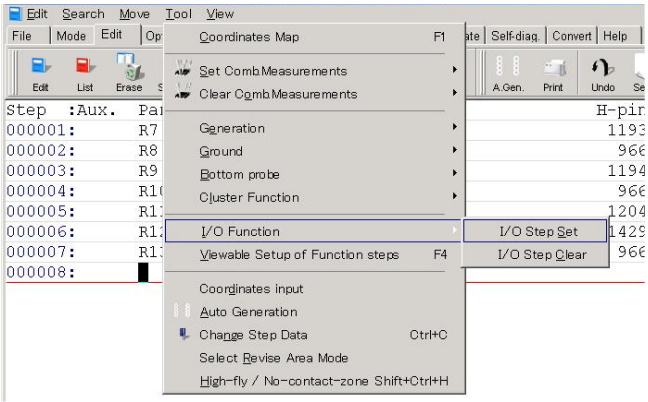
(2) It displays “Enter step number (1 – x)”.
Let’s put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.3)



[Fig.3] Step Edit list

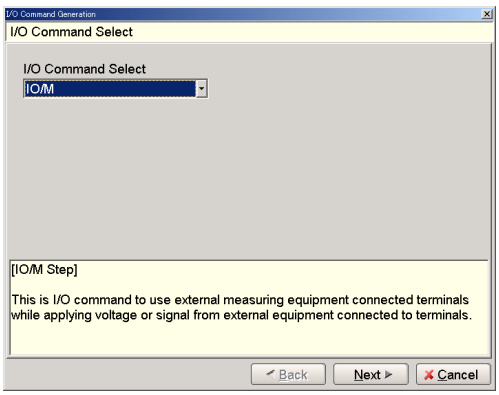
(4) Move to Tool > I/O function and click on “I/O Step Set”. (Refer to Fig.4)



[Fig.4] I/O Function > I/O Step Set

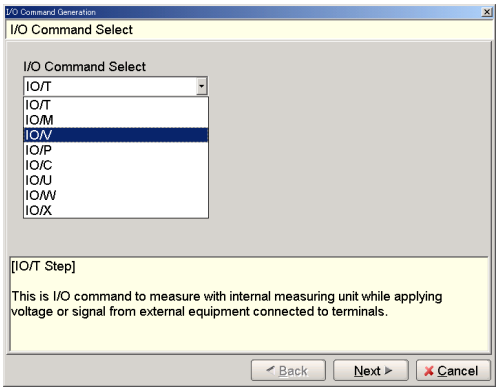
(5) It displays “Use board ref.point and aux.ref.point for alignment?”. Select Yes or No.

(6) It displays I/O Command Generation window. (Refer to Fig.5)



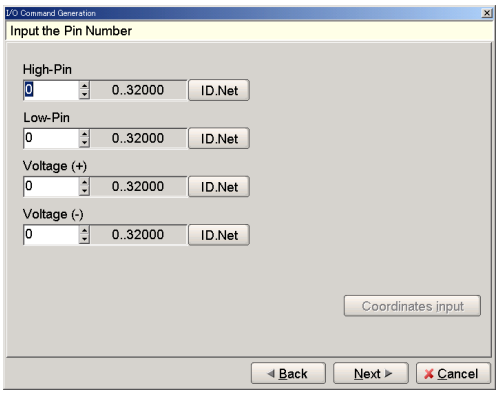
[Fig.5] I/O Command Generation

(7) Select “IO/V” from the right pull-down menu and click on the Next button. (Refer to Fig.6)



[Fig.6] I/O Command Select

(8) It displays the Coordinate Set window where enables to specify the pin number (in Point system).

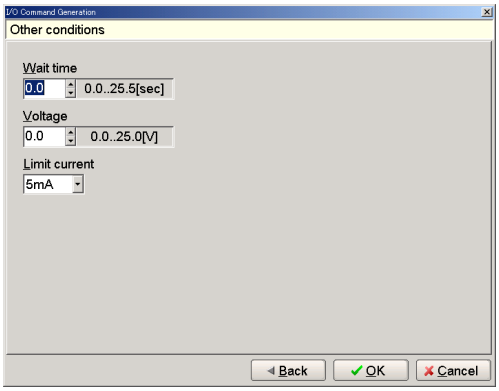


[Fig.7] Coordinate Set (Point system)

Specify High-Pin and Low-Pin by the XY coordinates or the pin numbers where is to output after the voltage was applied. In the example of Fig.1, it should be the contact point of the relay. Specify Voltage (+) and Voltage (-) by the XY coordinates or the pin numbers where the voltage is applied. In the example of Fig.1, it should be the coil of the relay.

After the XY coordinates or the pin numbers was specified, click on the Next button.

(9) It displays Other conditions windows. (Refer to Fig.8)

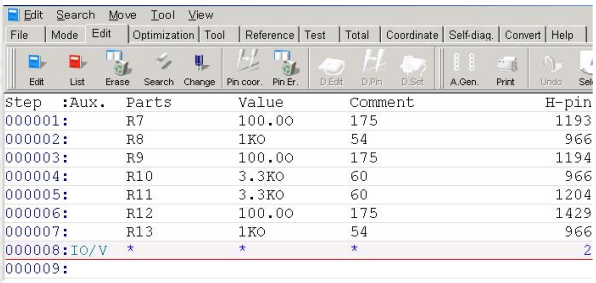


[Fig.8] Other conditions

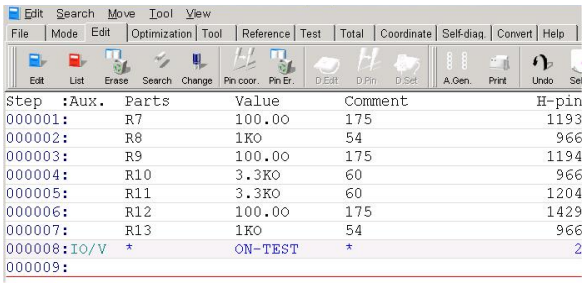
Wait time	Specify Wait time by [0.0]sec - [25.5]sec.
Voltage	Specify Voltage by [0.0]V - [25.5]V. (Here this should be the operating voltage of the relay)
Limit current	Specify Limit current by [5mA], [10mA], [25mA], [50mA], [100mA], [200mA], [500mA] or [1A]. (Here this should be the limit value of the current flown across the Coil of the relay. Refer to for the spec list of the relay)

(Remarks) Wait time, Voltage and Limit current are changeable also in Step data review.
After the conditions are set properly, click on the OK button.

(10) Move to Step Edit list. (Refer to Fig.9)
[AUX.] and [Loc] column is substituted by “IO/V”.
Enter remarks in [Parts] and [Value] column according to the test contents.
Enter something in [Comment] column if necessary.



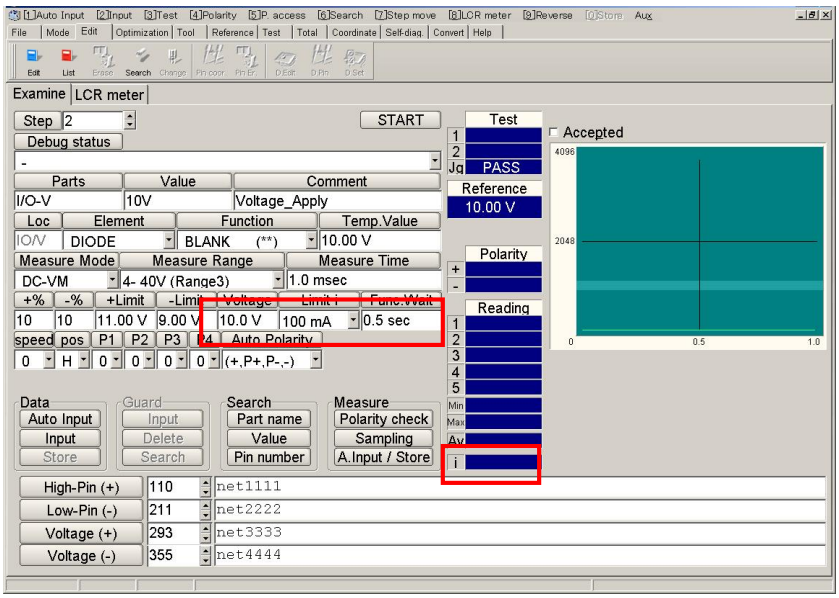
[Fig.9] Step Edit list (Point system)



[Fig.10] Step Edit list (Point system)

Step data review at IO/V step

Step data review window enables to input the reference value. In addition, it's also possible to change the measuring conditions (Voltage, Time etc). The measuring conditions should be changed after due consideration.



[Fig.11] IO/V step in Step data review (Point system)

(1) [Loc]
It displays I/O command name and is not configurable.

(2) [Element]
It displays type of the measurement.

RESISTOR → Resistor
CAPACITOR → Capacitor
COIL → Inductor
DIODE → VF measurement, DC voltage measurement

(3) [Function]
It displays the measurement function.

(4) [Temp. Value]
It displays the value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
This value is saved as Reference value if [Store] button is clicked.

(5) [Measure Mode]
It displays Measuring Mode.

(6) [Measure Range]
It displays Measuring Range.

(7) [Measure Time]
It displays Measuring Time. Specify within 1 ~ 999 (m sec).

(8) [+%] [-%]
It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%.

(9) [+Limit][-Limit]
It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].

(10) [Voltage]
It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(11) [Limit i]
Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

(12) [Func. Wait]
It displays Wait time (from applied voltage to measure).

(13) [Probe Access]
It indicates Probe 1,2,3,4 from the left.
[N] → Unused
[+] → H-pin
[-] → L-pin
[P+] → Probe to apply Voltage(+)
[P-] → Probe to apply Voltage(-)

(14) [i] (underneath [AV] field)
It displays the current value measured after the Wait time passed.

(15) [Pin number]
It displays the pin number of H-pin (High Pin), L-pin (Low Pin), G-P1 (Guard Pin1) and G-P2 (Guard Pin2). The Net name is also available at the right.

Reference input

Users should specify [Element] and [Measure Mode] column in case of components that is measured while applying the voltage.
When [Element] column is specified by RESISTOR, CAPACITOR or COIL, select “Auto” in [Measure Mode] column and click on the Auto Input button. The value obtained from the measurement is displayed in [Temp. Value] column. Also, specify [Function] and [Measure Time] as needed. If the Store is selected, the Temp. Value will be saved as the reference value.

When [Element] column is specified by DIODE to go for VF measurement, select “DC-CC” in [Measure Mode. On the other hand, when [Element] column is specified by DIODE to go for DC voltage measurement, select “DC-VM” in [Measure Mode]. In these cases, be sure to click the Input button to input the reference value. The value obtained from the measurement is displayed in [Temp. Value] column. If the Store is selected, the Temp. Value will be saved as the reference value.

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

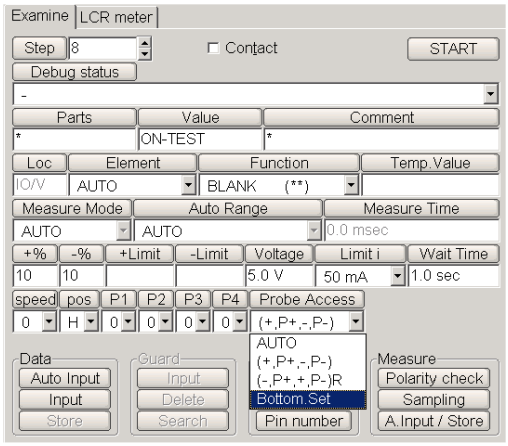
	1. To go for DC voltage measurement, be sure to select the Input button to input the reference value. If the Auto Input button was used by mistake, from time to time the Measuring Mode is initialized and an unintentional Measuring mode is set automatically. 2. If other Measuring mode than DC-VM mode is used while voltage is applied on the UUT, from time to time the error of “The PCB is charged with high voltage!” appears on the display. In this case, it’s no longer possible to use other Measuring mode than DC-VM mode.

About the error “Current limit over!”
There is a chance of getting the error “Current limit over!” during the reference value input. In this case, users should improve the Wait time to be longer.

Change to Bottom probes

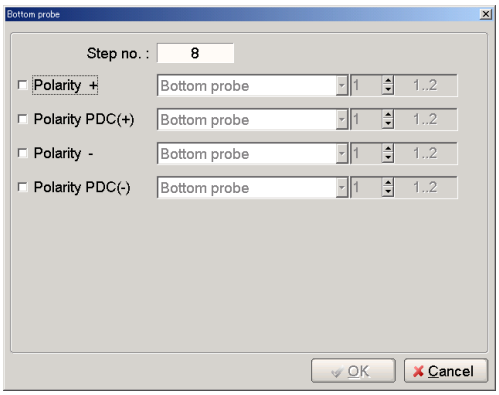
Go through the following steps to use the bottom probes in test.

(1) Click on [Probe Access] to select “Bottom Set” from the pull-down menu (Refer to Fig.12)



[Fig.12] Bottom Set

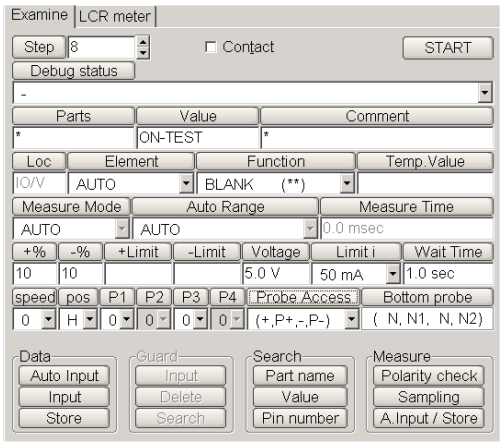
(2) It displays the Bottom probe window. Select the probes to be changed to the bottom probes and specify the bottom probe number. Then click on the OK button.



[Fig.13] Bottom Set

(3) Move back to Step data review window.

As shown in Fig.14 below, “Bottom probe” column appears to show the use of the bottom probes.



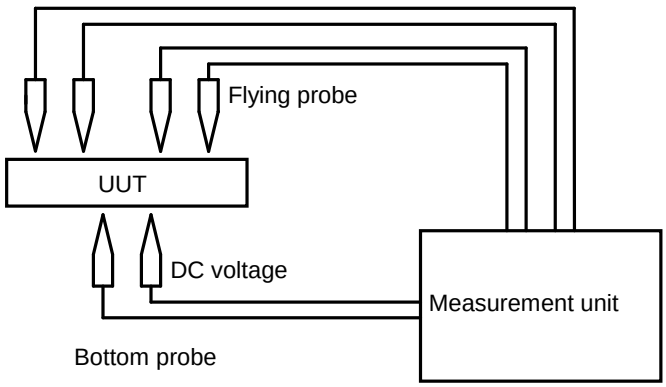
[Fig.14] Step data review

Fig.14 indicates that the bottom probe 1,2 are used for applying the voltage and the flying probes 1,3 are for the measurement at this step.

IO/P command

This I/O command uses two bottom probes to have the PDC-9500 apply DC voltage to the UUT and test multiple test steps by measuring the output voltage or current. The IO/P step is configured just to apply DC voltage to the UUT, so that users should program the measurement step following to the IO/P step.

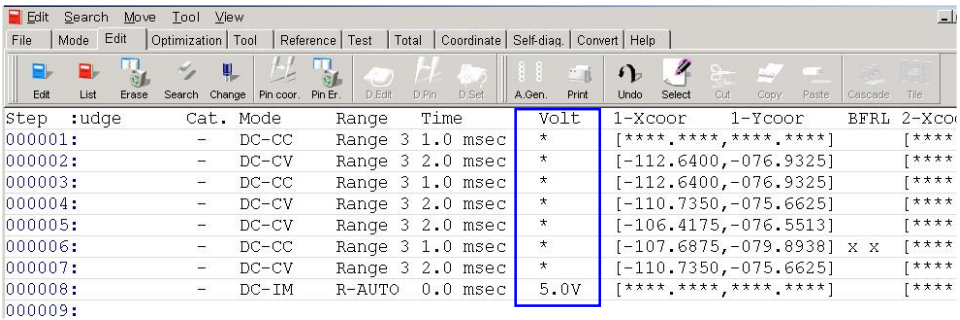
Users can measure DC current while applying DC voltage to the UUT. When this DC current is set by the tolerance, the DC voltage output to the UUT could be terminated if it measured out of the tolerance.



[Fig.15]

Basic knowledge of IO/P step

1. Listed below are conditions to terminate the voltage output to the UUT.
   * IO/P step configured by “0V” is executed.
   * At the end of test
   * The step using the bottom probe is executed.
   * Any of IO/M, IO/T, IO/V, IO/C or IO/U step is executed.
   * When the box “Current measurement” is selected, it measures out of the tolerance.
2. If the step using the bottom probe is changed to IO/P step, the Probe access using the bottom probe at the step is initialized.
3. The probe to apply voltage isn’t assignable to the flying probes.
4. The Loc column of the IO/P step is substituted by “IO/P”.
5. The Volt column on the Step Edit list displays the voltage specified by users. (Refer to Fig.16)



[Fig.16] Step Edit list

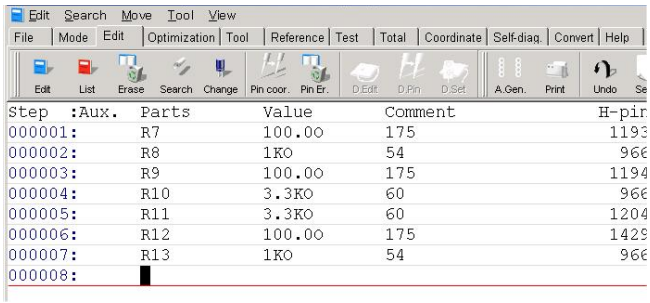
Programming Steps

The way of programming IO/P step is no difference between Teaching system and Point system.

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

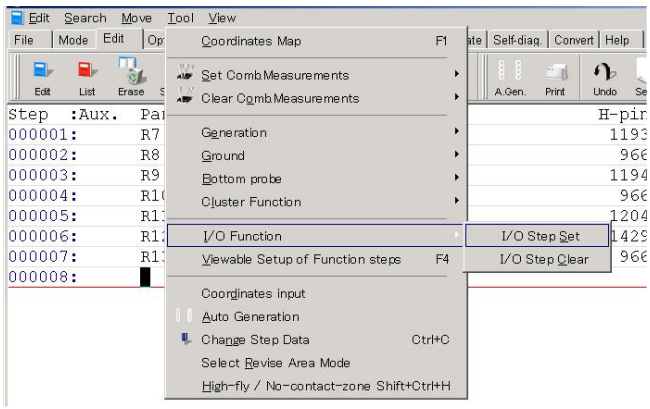
(2) It displays “Enter step number (1 – x)”.
Let’s put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.17)



[Fig.17] Step Edit list

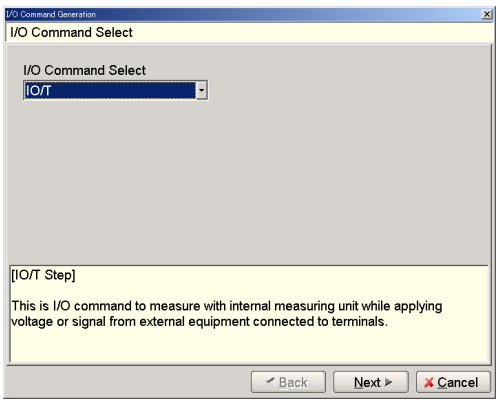
(4) Move to Tool > I/O function and click on “I/O Step Set”. (Refer to Fig.18)



[Fig.18] I/O Function > I/O Step Set

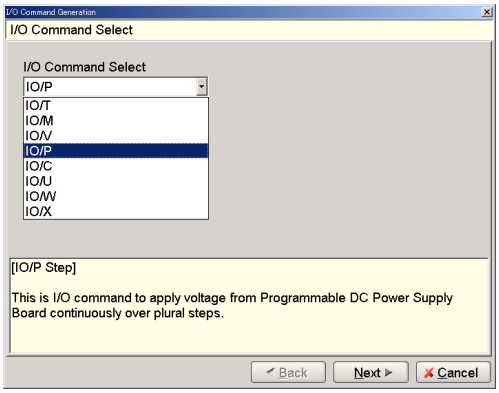
(5) It displays “Use board ref.point and aux.ref.point for alignment?”. Select Yes or No.

(6) It displays I/O Command Generation window. (Refer to Fig.19)



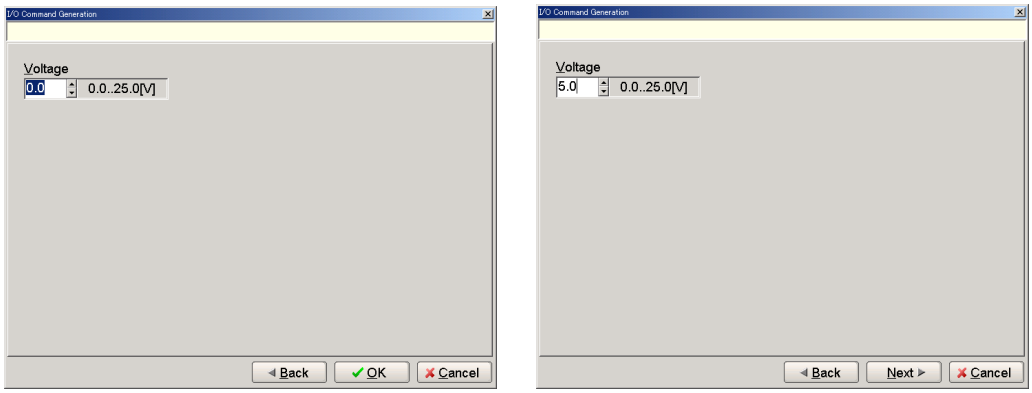
[Fig.19] I/O Command Generation

(7) Select “IO/P” from the right pull-down menu and click on the Next button. (Refer to Fig.20)



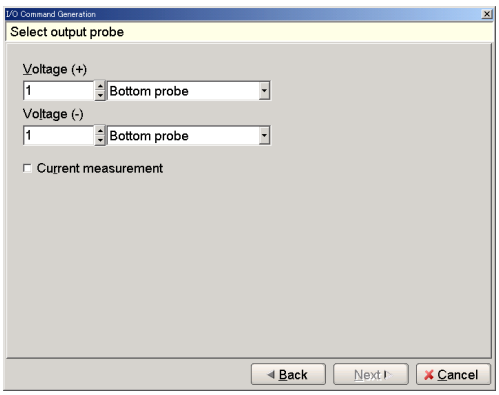
[Fig.20] I/O Command Select

(8) It displays the next window where allows to specify the voltage output to the UUT. (Refer to Fig.21) After specified the voltage, click on the Next button.



[Fig.21] I/O Command generation

(9) It displays the next window where allows to specify the bottom probe. (Refer to Fig.22)



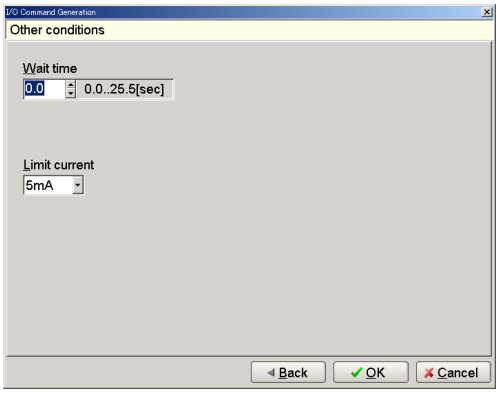
[Fig.22] Select output probe

Specify Voltage (+) and Voltage (-) by the bottom probe number.

Click the box “Current measurement” if the current measurement is required when the voltage is applied to the UUT. The DC voltage output to the UUT could be terminated if the current was measured out of the tolerance preset in the Step data review window.

Click on the Next button.

(10) It displays Other conditions windows. (Refer to Fig.23)

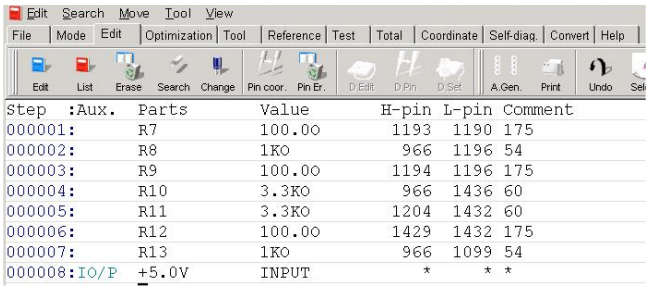


[Fig.23] Other conditions

Wait time	Specify Wait time by [0.0]sec ~ [25.5]sec.
Limit current	Specify Limit current by [5mA], [10mA], [25mA], [50mA], [100mA], [200mA], [500mA] or [1A]. (Here this should be the limit value of the current flown across the Coil of the relay. Refer to for the spec list of the relay)

(Remarks) Wait time and Limit current are changeable also in Step data review.
After the conditions are set properly, click on the OK button.

(11) Move to Step Edit list. (Refer to Fig.24) [AUX.] and [Loc] column is substituted by “IO/P”.
After this IO/P step, program a measurement step.

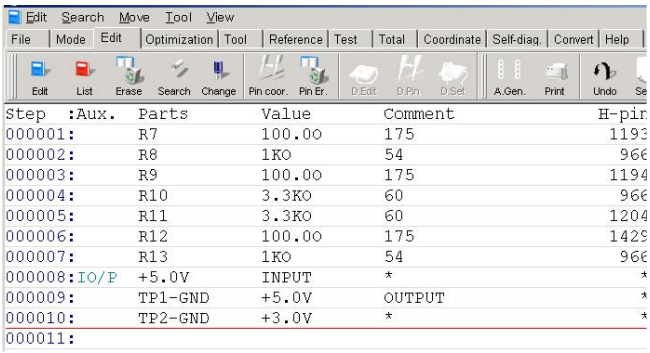


[Fig.24] Step Edit list

Programming the step to terminate the voltage output to the UUT

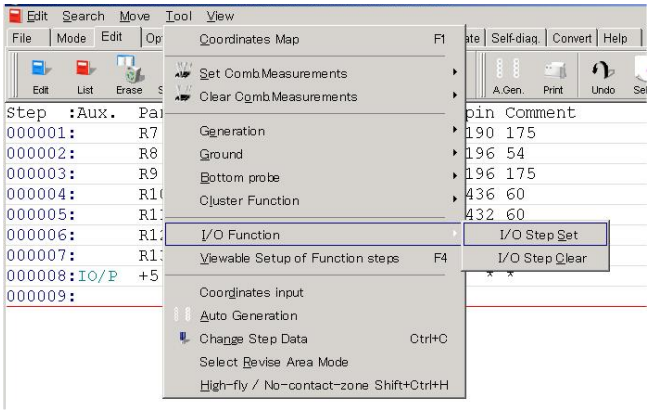
(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.
As the pop-up window “Enter step number (1 – x)” appeared, specify the step which is used to terminate the voltage output to the UUT and click on the OK button.

(2) Let’s make the step on the last step as shown in Fig.25 below.



[Fig.25] Step Edit list

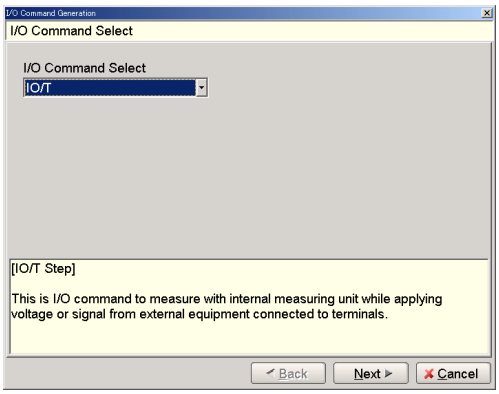
(3) Move to Tool > I/O function and click on “I/O Step Set”. (Refer to Fig.26)



[Fig.26] I/O Function > I/O Step Set

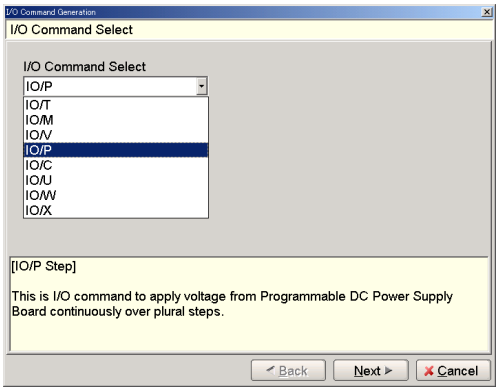
(4) It displays “Use board ref.point and aux.ref.point for alignment?”. Select Yes or No.

(5) It displays I/O Command Generation window. (Refer to Fig.27)



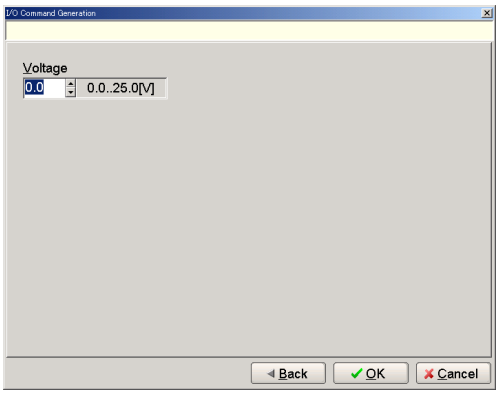
[Fig.27] I/O Command Generation

(6) Select “IO/P” from the right pull-down menu and click on the Next button. (Refer to Fig.28)



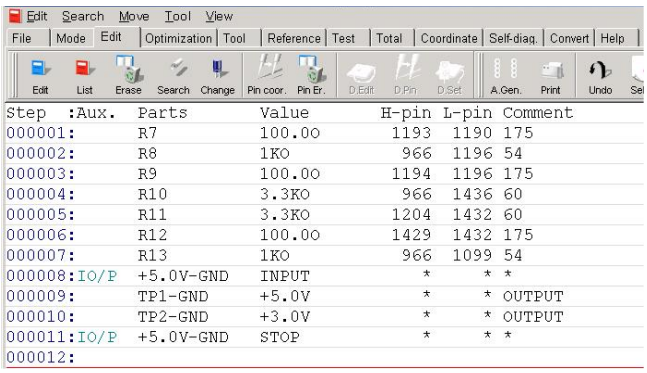
[Fig.27] I/O Command select

(7) It displays the next window where allows to specify the voltage output to the UUT. (Refer to Fig.28) Change nothing (“0,0V remains unchanged)” and click on the Next button.



[Fig.28] I/O Command select

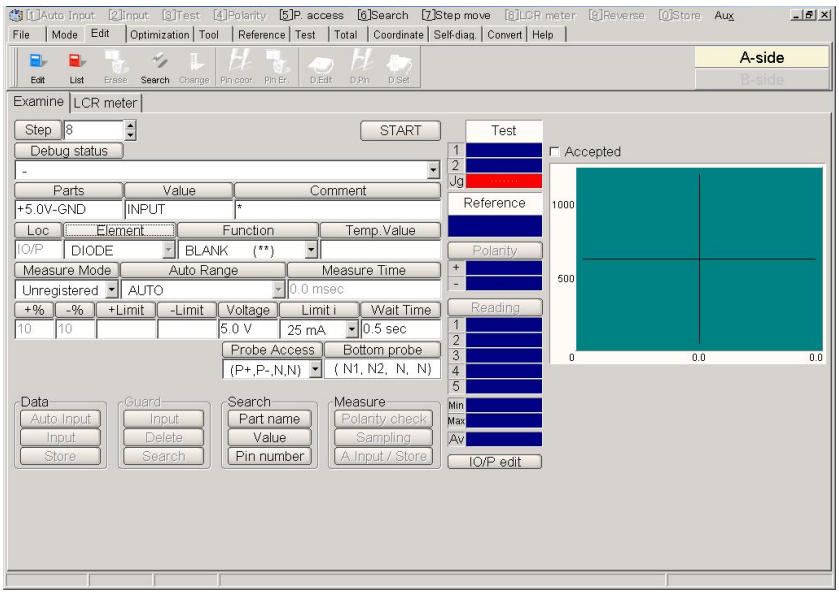
(8) Move to Step Edit list. (Refer to Fig.29)



[Fig.29] Step Edit list

Step data review at IO/P step

It's possible to change the measuring conditions (Voltage, Time etc) in the Step data review.



[Fig.30] Step data review

(1) [Loc]

It displays I/O command name. (not configurable)

(2) [Element]

It displays [DIODE]. (not configurable)

(3) [Function]

It displays the measuring conditions.

(4) [Temp. Value]

It displays the current value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
It appears when the Measuring Mode is specified by "DC-IM". (It means when the box "Current measure" is selected)

(5) [Measure Mode]

When "DC-IM" is in [Measure Mode], it performs the current measurement. The voltage output is terminated if the current was measured out of the tolerance. When "Unregistered" is in [Measure Mode], it doesn't performs the current measurement.

(6) [Measure Range]

It displays Measuring Range. Select from 1mA, 10mA and 100mA.
It appears when the Measuring Mode is specified by "DC-IM".

(7) [Measure Time]

This is unused.

(8) [+%] [-%]

It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%.
It appears when the Measuring Mode is specified by "DC-IM".

(9) [+Limit][-Limit]

It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].
It appears when the Measuring Mode is specified by "DC-IM".

(10) [Voltage]

It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(11) [Limit i]

Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

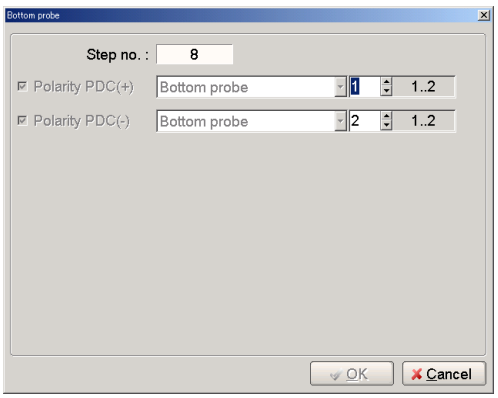
(12) [Func. Wait]

It displays Wait time (from applied voltage to move to the next step).

(13) [Probe Access]

[P+] → Probe to apply Voltage(+)
[P-] → Probe to apply Voltage(-)
[N] → Unused
[N] → Unused

Click on [Probe Access] to select “Bottom Set” from the pull-down menu. (Refer to Fig.31)
On this window, users can change the bottom probe number.(Fig.31 appears when IO/P command is selected)



[Fig.31] Bottom set

(14) Bottom probe

It displays the status of the bottom probes.

[N1] → Use of Bottom probe 1
[N2] → Use of Bottom probe 2
[N] → Unused
[N] → Unused

Reference input

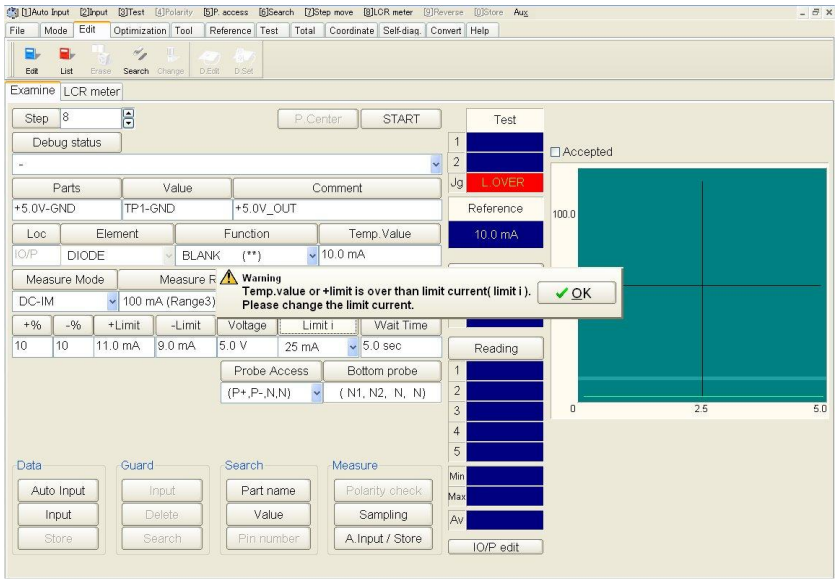
Users should input the reference value (Current) when the Measure Mode is specified by “DC-IM”.But the reference input is unnecessary when the Measure Mode is shown by “Unregistered”.

After verified [Voltage], [Limit i] and [Wait time], click on either the Auto Input button or the Input button on the Step data review window. Then the Temp Value column indicates a current value. If users found this current value is right, click on the Store button o save to the reference value.

When the Measure Range and the Measure Time are set in advance, click on the Input button. (If the Auto Input button was clicked by mistake, there is a chance the Measure Range and the Measure Time is initialized and in the worst case they will be set wrong!)

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

When the reference value is input or when [+%], [+Limit] are changed, there is a chance of displaying the error “Temp.value or +limit is over than limit current(limit i)”. (Refer to Fig.32) In this case, users should change the limit current setting (Limit i) after due consideration.

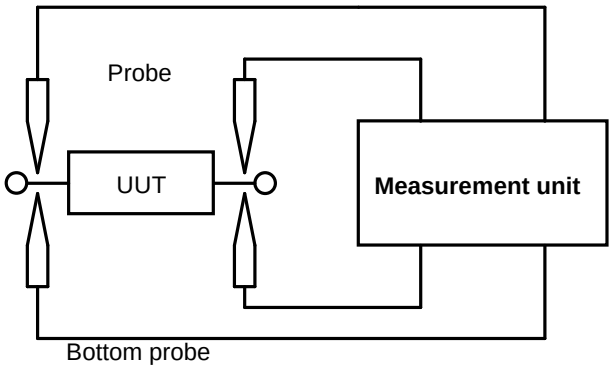


[Fig.32] Warning message at IO/P step in Step data review

In addition, users need to use the Step data review window to input the reference value for the measurement step following to the IO/P step as he isn’t allowed to do this in Auto reference input.

IO/C command

This I/O command uses two flying probes to have the PDC-9500 apply DC voltage to the UUT and measure the output current at the same time. The measured current is used to determine if the step is pass or fail. With the IO/C command, users can measure the consumption current while applying DC voltage to the device or the circuit and measure the current surge caused by faulty device inside the circuit.



[Fig.1]

Basic knowledge of IO/C step

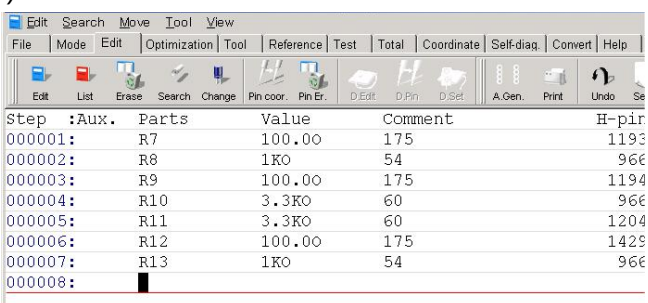
1. Use can specify either the flying probes or the bottom probes.
2. To use the bottom probe, first of all users need to select the flying probe and move to Step data review to change it to the bottom probe.
3. If the step using the bottom probe is changed to IO/C step, the Probe access using the bottom probe at the step is initialized.
4. The Loc column of the IO/C step is substituted by “IO/C”.
5. No guard point can be set.
6. After the IO/C step was finished, the voltage output is suspended automatically.

Programming Steps

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

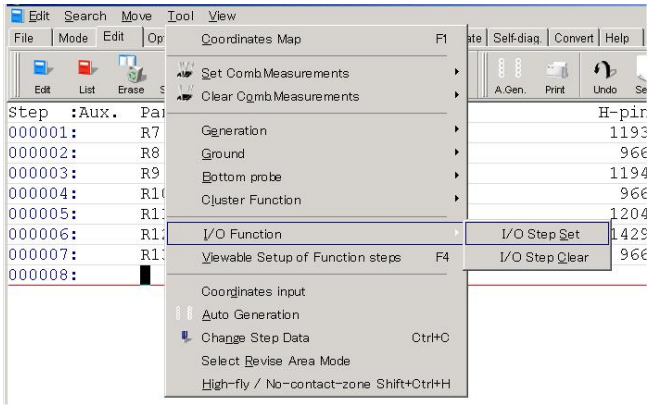
(2) It displays “Enter step number (1 – x)”.
Let’s put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.2)



[Fig.2] Step Edit list

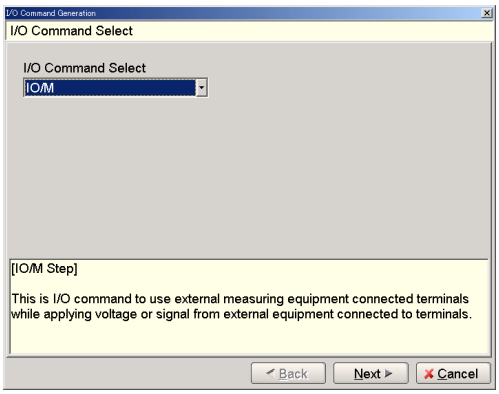
(4) Move to Tool > I/O function and click on “I/O Step Set”. (Refer to Fig.3)



[Fig.3] I/O Function > I/O Step Set

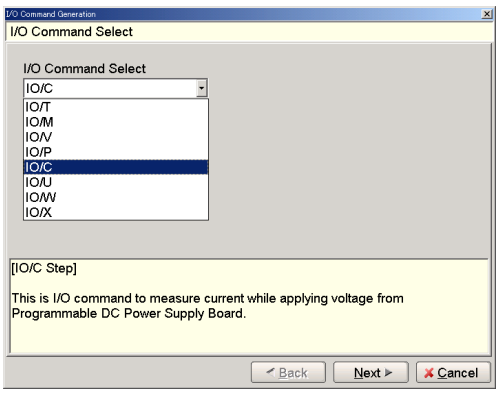
(5) It displays “Use board ref.point and aux.ref.point for alignment?”. Select Yes or No.

(6) It displays I/O Command Generation window. (Refer to Fig.4)



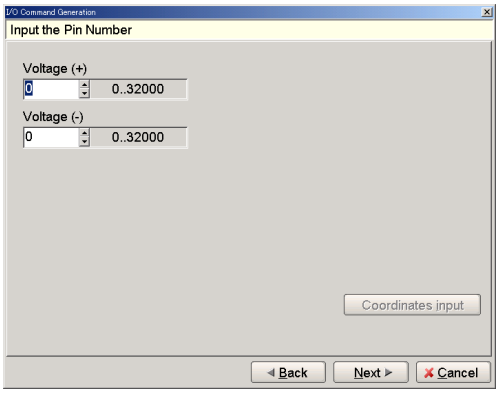
[Fig.4] I/O Command Generation

(7) Select “IO/C” from the right pull-down menu and click on the Next button. (Refer to Fig.5)



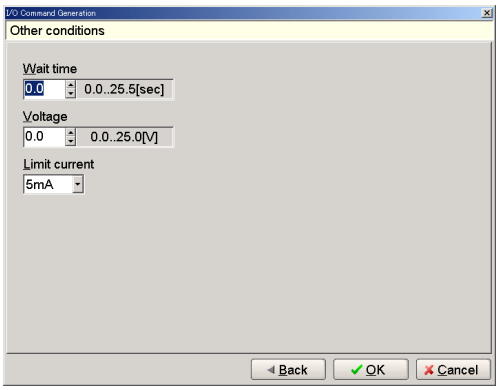
[Fig.5] I/O Command Select

(8) It displays the next window where allows to specify Pin numbers of Voltage (+) and Voltage (-).



[Fig.6]

(9) Click on the Next button, and it displays Other conditions windows. (Refer to Fig.7)

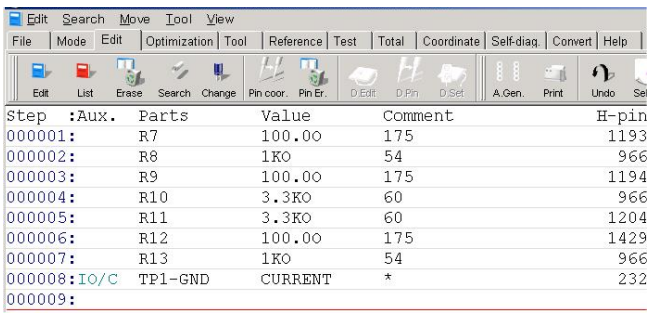


[Fig.7] Other conditions

Wait time	Specify Wait time by [0.0]sec - [25.5]sec.
Voltage	Specify Voltage by [0.0]V - [25.5]V.
Limit current	Specify Limit current by [5mA], [10mA], [25mA], [50mA], [100mA], [200mA], [500mA] or [1A].

(Remarks) Wait time, Voltage and Limit current are changeable also in Step data review.
After the conditions are set properly, click on the OK button.

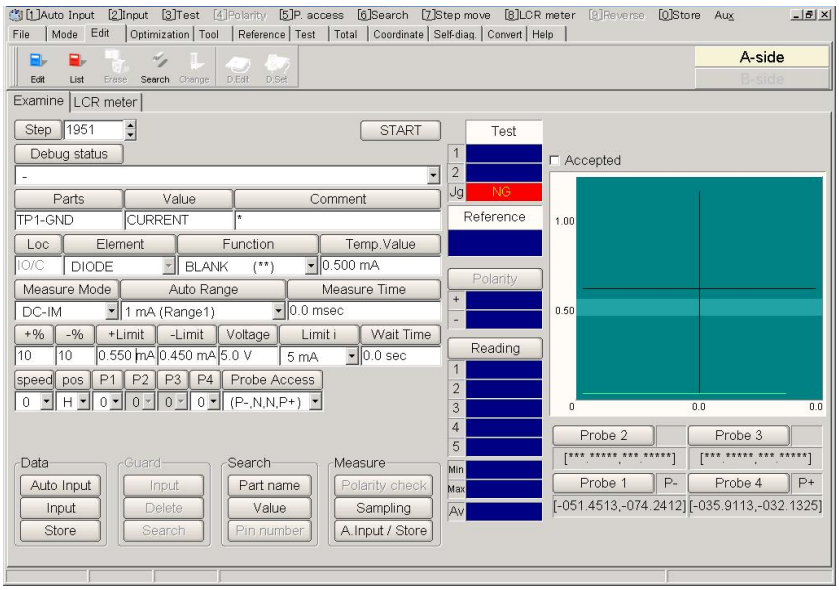
(10) Move to Step Edit list. (Refer to Fig.8)
[AUX.] and [Loc] column is substituted by “IO/C”.
Enter remarks in [Parts] and [Value] column according to the test contents.
Enter something in [Comment] column if necessary.



[Fig.8] Step Edit list

Step data review at IO/C step

Step data review window enables to input the reference value. In addition, it's also possible to change the measuring conditions (Voltage, Time etc). The measuring conditions should be changed after due consideration.



[Fig.9] IO/C step in Step data review (Point system)

(1) [Loc]
It displays I/O command name. (not configurable)

(2) [Element]
It displays [DIODE]. (not configurable)

(3) [Function]
It displays the measuring conditions.

(4) [Temp. Value]
It displays the current value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
This value is saved as Reference value if [Store] button is clicked.

(5) [Measure Mode]
When "DC-IM" is in [Measure Mode], it performs the current measurement.

(6) [Measure Range]
It displays Measuring Range. Select from 1mA, 10mA and 100mA.

(7) [Measure Time]
It displays Measuring Time. Specify within 1 ~ 999 (m sec).

(8) [+%] [-%]
It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%

(9) [+Limit][-Limit]
It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].

(10) [Voltage]
It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(11) [Limit i]

Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

(12) [Func. Wait time]

It displays Wait time (from applied voltage to move to the next step).

(13) [Probe Access]

[P+] → Probe to apply Voltage(+)
[P-] → Probe to apply Voltage(-)
[N] → Unused
[N] → Unused

(14) [Pin number]

It displays the pin number of H-pin (High Pin), L-pin (Low Pin), G-P1 (Guard Pin1) and G-P2 (Guard Pin2). The Net name is also available at the right.

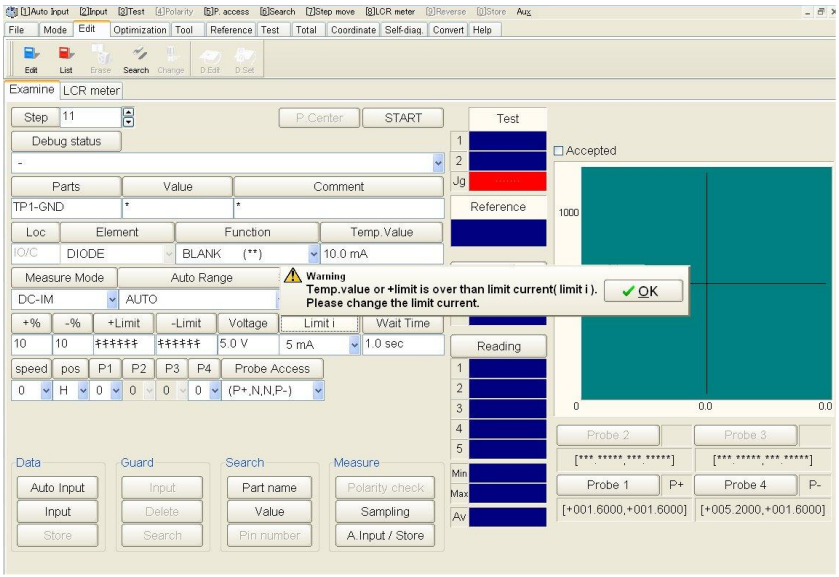
Reference input

After verified [Voltage], [Limit i] and [Wait time], click on either the Auto Input button or the Input button on the Step data review window. Then the Temp Value column indicates a current value. If users found this current value is right, Click on the Store button o save to the reference value.

When the Measure Range and the Measure Time are set in advance, click on the Input button. (If the Auto Input button was clicked by mistake, there is a chance the Measure Range and the Measure Time is initialized and in the worst case they will be set wrong!)

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

When the reference value is input or when [+%], [+Limit] are changed, there is a chance of displaying the error “Temp.value or +limit is over than limit current(limit i)”. (Refer to Fig.32) In this case, users should change the limit current setting (Limit i) after due consideration.

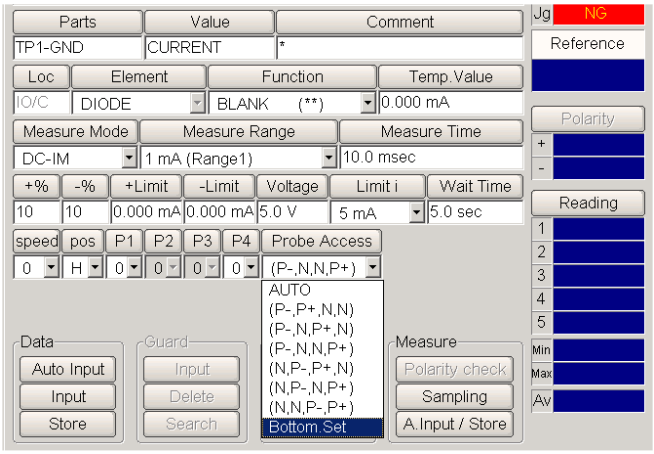


[Fig.10] Warning message at IO/C step in Step data review

Change to Bottom probes

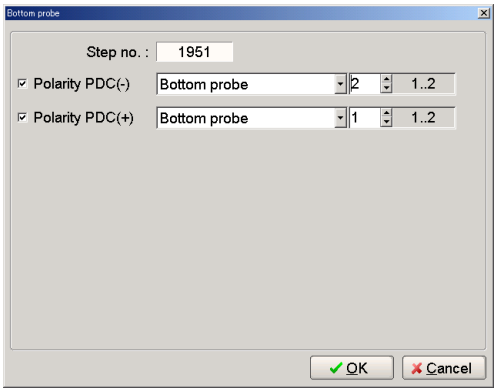
Go through the following steps to use the bottom probes in test.

(1) Click on [Probe Access] to select “Bottom Set” from the pull-down menu (Refer to Fig.11)



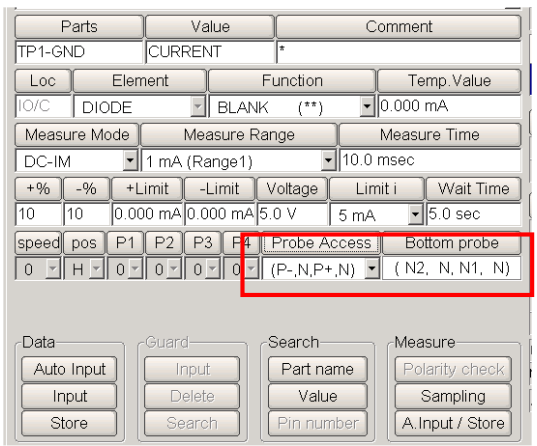
[Fig.11] Bottom Set

(2) It displays the Bottom probe window. Select the probes to be changed to the bottom probes and specify the bottom probe number. Then click on the OK button.



[Fig.12] Bottom Set

(3) Move back to Step data review window.
As shown in Fig.14 below, “Bottom probe” column appears to show the use of the bottom probes.



[Fig.13] Step data review

Fig.13 indicates that the bottom probe 1,2 are used for applying the voltage.

Viewable Setup of Function steps

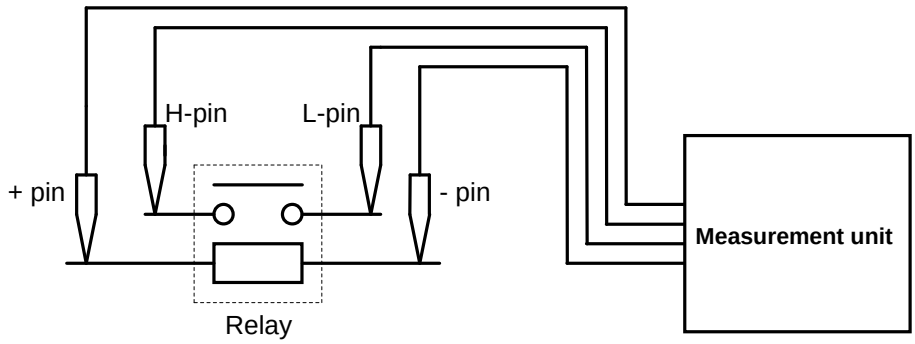
This chapter describes the procedures to generate I/O steps (basic data programming and reference input) using the Viewable Setup of Function steps window (Step Edit list > Tool > Viewable Setup of Function steps window).

Unlike the I/O Function Window (Step Edit list > Tool > I/O Function > I/O Step Set), users don't have to select I/O command according to his application but he can use the mouse to simply specify necessary connection from the tester to the PDC-9500 on a graphic setup window. Users can recognize the reality of whole connection with ease.

The Aux. column on the step configured on the Viewable Setup of Function steps window is substituted by [IO/F].

[Example 1] Relay On test

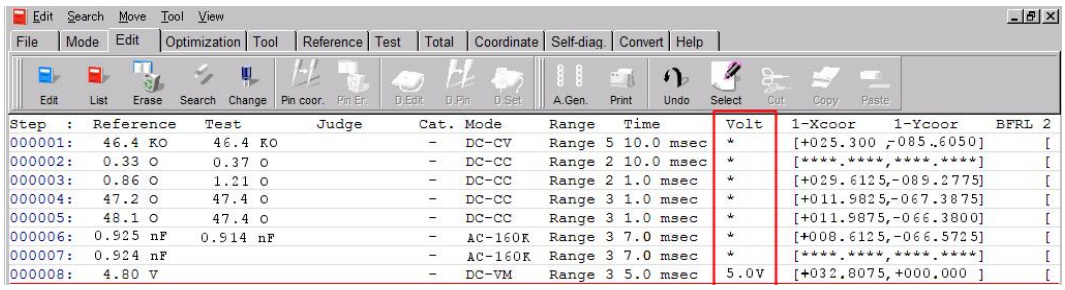
Users can have the PDC-9500 apply DC voltage to the Coil and conduct the On-test of the contact point of the relay.



[Fig.1]

Basic knowledge of IO/F step

1. Users can select the probes to apply voltage and the measurement probes from the flying probes and the bottom probes.
2. No guard point can be set.
3. The Loc column is substituted by "IO/F".
4. When the flying probes are used to apply the voltage, the voltage output is suspended automatically after the IO/F step is finished.
5. The output voltage is shown in the Volt column on the Step Edit list. (Refer to Fig.2)



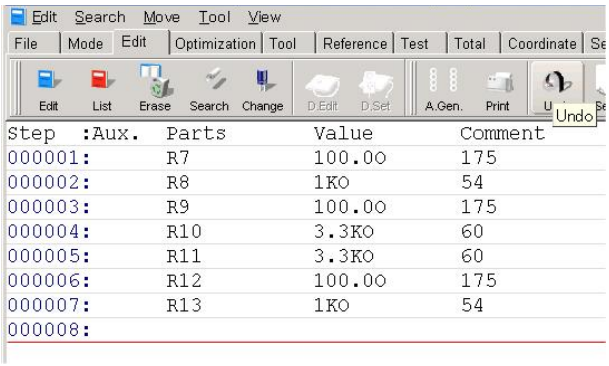
[Fig.2] IO/F step

Programming Steps

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

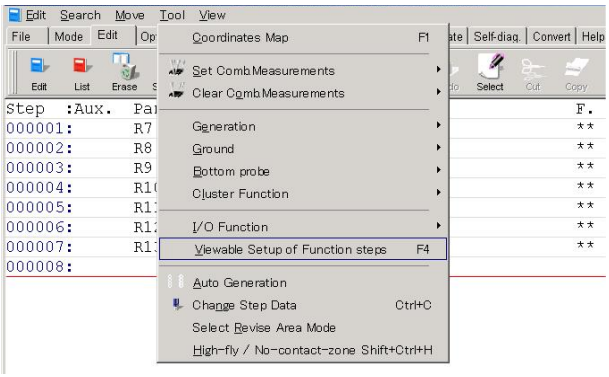
(2) It displays “Enter step number (1 – x)”.
Let’s put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.3)



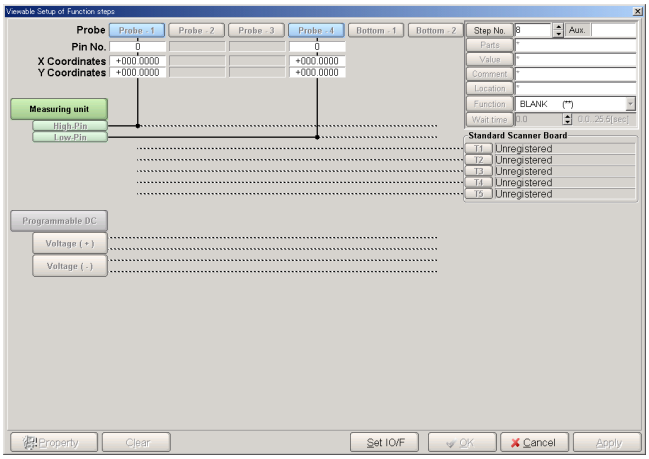
[Fig.3] Step Edit list

(4) Move to Tool and click on “Viewable Setup of Function steps”. (Refer to Fig.4)



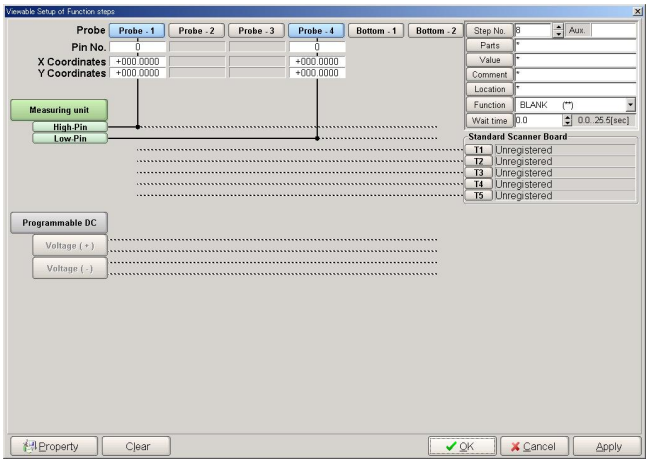
[Fig.4] Viewable Setup of Function steps

(5) It displays the Viewable Setup of Function steps window (Fig.5).



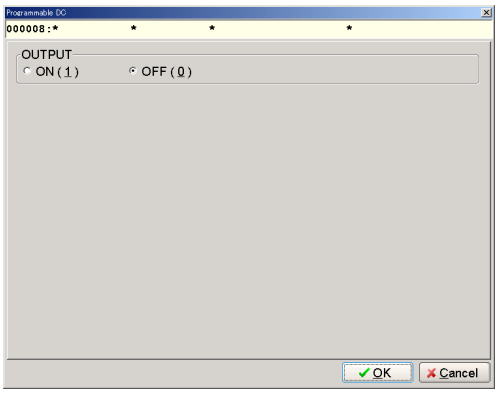
[Fig.5] Viewable Setup of Function steps (Point system)

(6) Click on [Set IO/F] button to activate each function on the window.



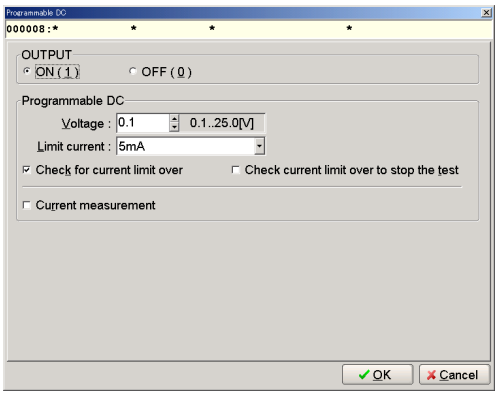
[Fig.6] Viewable Setup of Function steps (Point system)

(7) Click on [Programmable DC] button. After the Programmable DC On/Off window (Fig.7) appears on the display, select [ON].



[Fig.7] Programmable DC On/Off widow

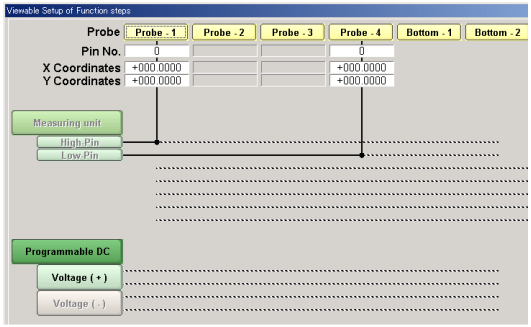
(8) It displays the Programmable DC Setup window (Fig.8).



[Fig.8] Programmable DC Setup widow

Voltage	Specify the operating voltage of the relay.
Limit current	Specify the limit value of the current flown across the Coil of the relay. Refer to for the spec list of the relay
Check for current limit over	Specify as needed.
Check current limit over to stop the test	When this box is selected, the test is suspended if it measured over the specified limit current.
Current measurement	Remain unselected.

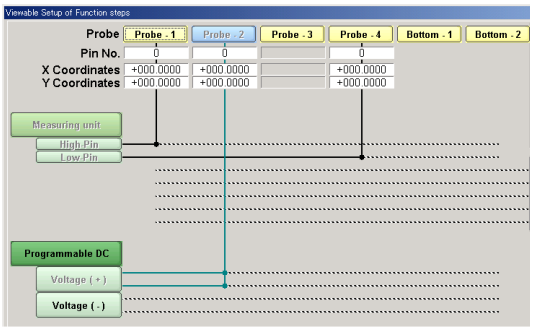
(9) After each setup was finished, click on the OK button. The display comes back to the Viewable Setup of Function steps window and [Voltage (+)] button of Programmable DC is flashing and [Probe-1] to [Bottom-2] buttons are flashing in yellow as well. (Now the Programmable DC is ready to connect to either probe)



[Fig.9] Viewable Setup of Function steps (Point system)

(10) Specify the connection of [Voltage (+)].

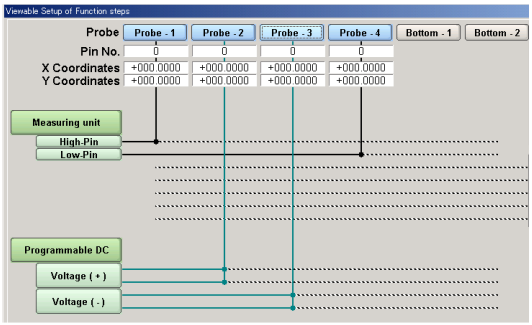
Specify other than [Probe-1] and [Probe-4] as they are already connected to the Measuring unit. Here let's select [Probe-2]. After this, [Voltage (+)] is connected to [Probe-2] with a green line. (Refer to Fig.10)



[Fig.10] Viewable Setup of Function steps (Point system)

(11) [Voltage (-)] button of Programmable DC is flashing.

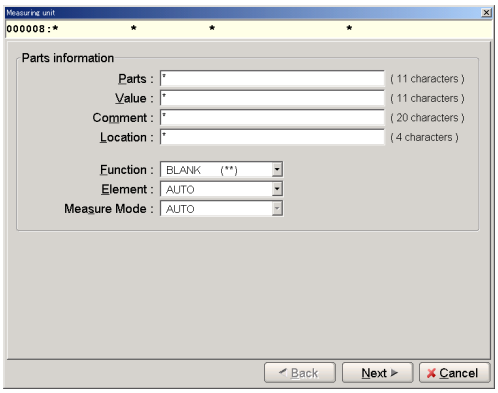
Here let's select [Probe-3]. After this, [Voltage (-)] is connected to [Probe-3] with a green line. (Refer to Fig.11)



[Fig.11] Viewable Setup of Function steps (Point system)

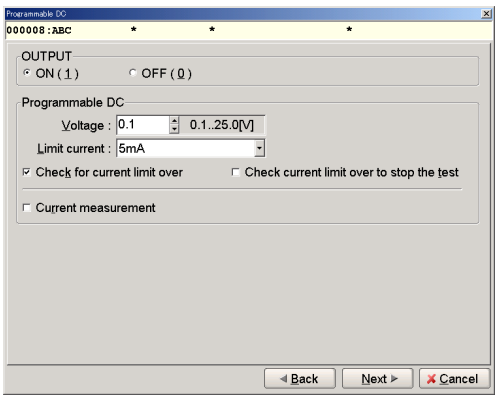
At this stage, the Measuring unit is connected to [Probe-1] and [Probe-4] and the Programmable DC is to [Probe-2] and [Probe-3]. But after the coordinate are input, their connection may be changed automatically according to the positional relation.

(12) Click on [Property] button on the window to display the Measuring unit window (Fig.12).
Use the keyboard to fill in the Parts column. In addition, enter the Value, Comment and Location column as needed.
Fill in the Function, Element and Measure Mode column if the measurement content is already determined as they will assist in inputting the reference value.



[Fig.12] Measuring unit

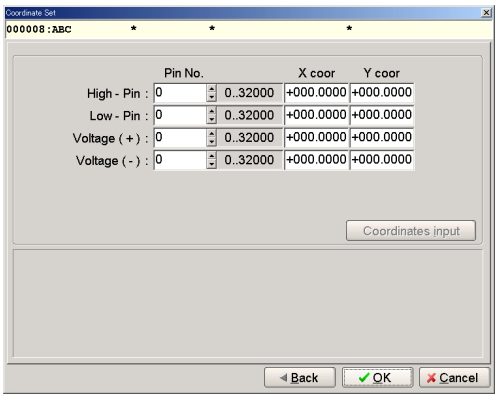
(13) Click on the Next button, and it displays the Programmable DC Setup window (Fig.13).
This is the same window as Fig.8 and enables to change the configuration.



[Fig.13] Programmable DC Setup

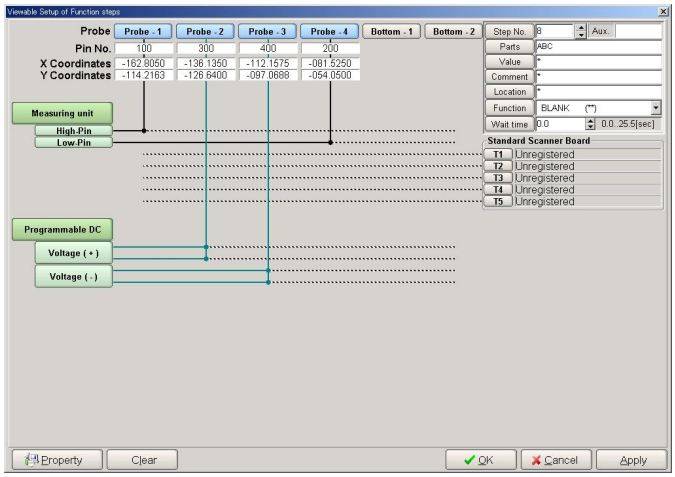
(14) Click on the Next button, and it displays the Coordinate set window (Fig.14).
Specify High-Pin and Low-Pin by the pin numbers where are to output after the voltage was applied. In the example of Fig.1, it should be the contact point of the relay.
Specify Voltage (+) and Voltage (-) by the XY coordinates or the pin numbers where the voltage is applied. In the example of Fig.1, it should be the coil of the relay.

After the pin numbers were specified, click on the Next button.



[Fig.14] Coordinate Set (Point system)

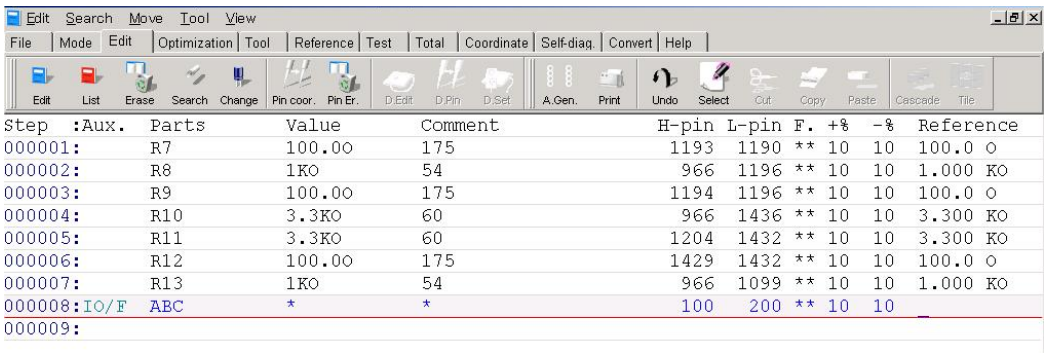
(15) Click on the OK button, and it displays the Viewable Setup of Function steps window.



[Fig.15] Viewable Setup of Function steps (Point system)

(16) Click on the OK button, and it displays the Step Edit list.

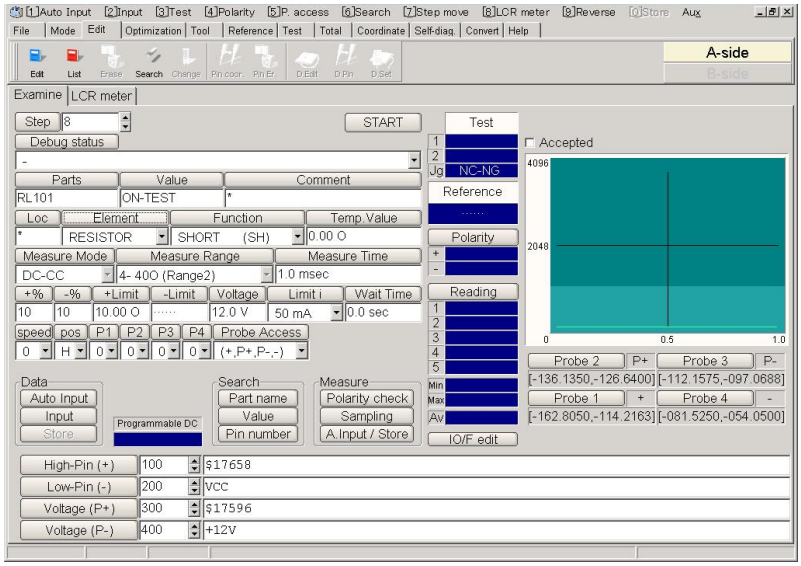
Now the AUX. column is substituted by “IO/F”.



[Fig.15] Step Edit list (Point system)

Step data review at IO/F step

Step data review window enables to input the reference value. In addition, it's also possible to change the measuring conditions (Voltage, Time etc). The measuring conditions should be changed after due consideration.



[Fig.16] IO/F step in Step data review (Point system)

(1) [Element]

It displays type of the measurement.

RESISTOR → Resistor
CAPACITOR → Capacitor
COIL → Inductor
DIODE → VF measurement, DC voltage measurement

(2) [Function]

It displays the measurement function.

(3) [Temp. Value]

It displays the value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
This value is saved as Reference value if [Store] button is clicked.

(4) [Measure Mode]

It displays Measuring Mode.

(5) [Measure Range]

It displays Measuring Range.

(6) [Measure Time]

It displays Measuring Time. Specify within 1 ~ 999 (m sec).

(7) [+%] [-%]

It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%.

(8) [+Limit][-Limit]

It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].

(9) [Voltage]

It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(10) [Limit i]

Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

(11) [Func. Wait]

It displays Wait time (from applied voltage to measure).

(12) [Probe Access]

It indicates Probe 1,2,3,4 from the left.

[N] → Unused
[+] → H-pin
[-] → L-pin
[P+] → Probe to apply Voltage(+)
[P-] → Probe to apply Voltage(-)

(13) [IO/F edit]

Click on the IO/F edit button, and it displays the Viewable Setup of Function steps window for verification or correction.

(14) [Programmable DC]

Clicking on either the Auto Input or Input button displays the current which is flown when the voltage is applied. This is displayed only at IO/F steps.

(15) [Pin number]

It displays the pin number of H-pin(High Pin), L-pin(Low Pin), G-P1(Guard Pin1) and G-P2(Guard Pin2). The Net name is also available at the right.

Reference input

Users should specify [Element] and [Measure Mode] column in case of components that is measured while applying the voltage.

When [Element] column is Specified by RESISTOR, CAPACITOR or COIL, select “Auto” in [Measure Mode] column and click on the Auto Input button. The value obtained from the measurement is displayed in [Temp. Value] column. Also, specify [Function] and [Measure Time] as needed. If the Store is selected, the Temp. Value will be saved as the reference value.

When [Element] column is specified by DIODE to go for VF measurement, select “DC-CC” in [Measure Mode. On the other hand, when [Element] column is specified by DIODE to go for DC voltage measurement, select “DC-VM” in [Measure Mode]. In these cases, be sure to click the Input button to input the reference value. The value obtained from the measurement is displayed in [Temp. Value] column. If the Store is selected, the Temp. Value will be saved as the reference value.

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

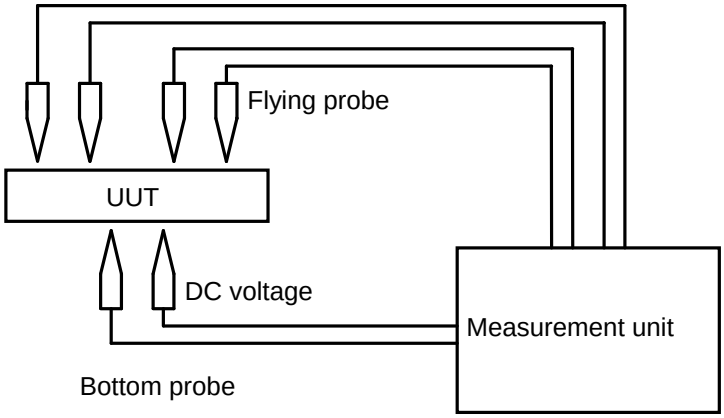
	1. To go for DC voltage measurement, be sure to select the Input button to input the reference value. If the Auto Input button was used by mistake, from time to time the Measuring Mode is initialized and an unintentional Measuring mode is set automatically. 2. If other Measuring mode than DC-VM mode is used while voltage is applied on the UUT, from time to time the error of “The PCB is charged with high voltage!” appears on the display. In this case, it’s no longer possible to use other Measuring mode than DC-VM mode.

About the error “Current limit over!”

There is a chance of getting the error “Current limit over!” during the reference value input. In this case, users should improve the Wait time to be longer.

[Example 2] Multiple test measurement by applying voltage

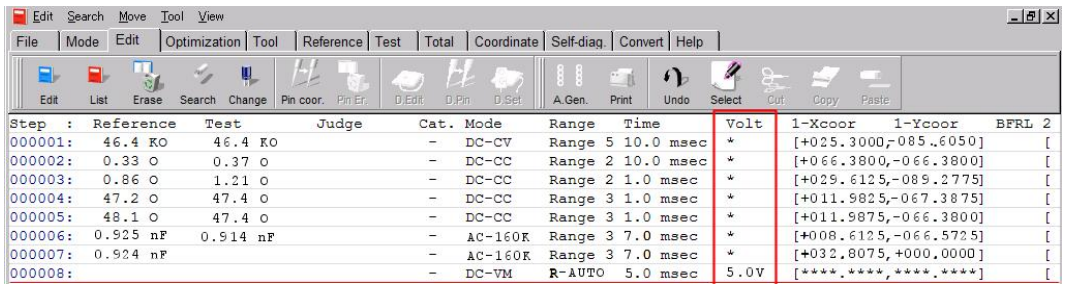
Users can use two bottom probes to have the PDC-9500 apply DC voltage to the UUT and test multiple test steps. But they cannot use any flying probes test multiple test steps while applying DC voltage. In addition, it's possible to measure DC current while applying DC voltage to the UUT. When DC current is set by the tolerance, DC voltage output to the UUT could be terminated if it measured out of the tolerance. When DC current is measured, users should program one step to apply DC voltage and measure DC current and then program the next step to measure after applied DC voltage. As for the programming process to apply DC voltage and measure DC current, refer to [Example 3] explained later.



[Fig.17]

Basic knowledge of IO/F step

1. Listed below are conditions to terminate the DC voltage output to the UUT.
   * IO/F step configured by "OFF" is executed.
   * At the end of test
   * The step using the bottom probe is executed.
2. If the step using the bottom probe was changed to IO/F step, the Probe access using the bottom probe at the step is initialized.
3. The Loc column is substituted by "IO/F".
4. The Volt column on the Step Edit list displays the voltage specified by users. (Refer to Fig.18)



[Fig.18] Step Edit list

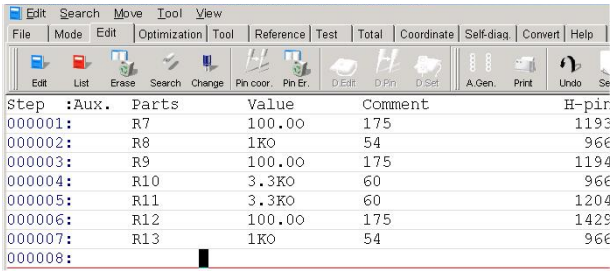
Programming Steps

The way of programming IO/F step below is explained in use of Point system. Also, the explanation is targeted at users who don't want to measure DC current. As for the way of measuring DC current, refer to [Example 3] explained later.

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

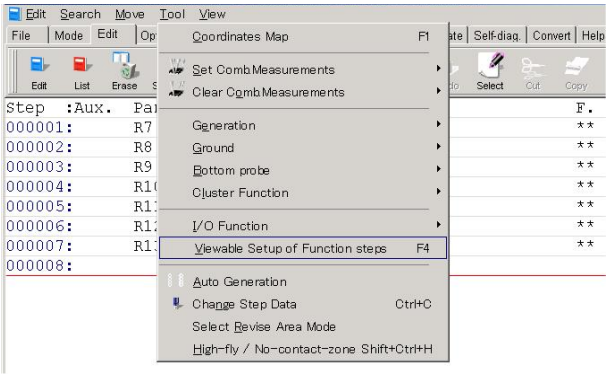
(2) It displays "Enter step number (1 – x)".
Let's put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.19)



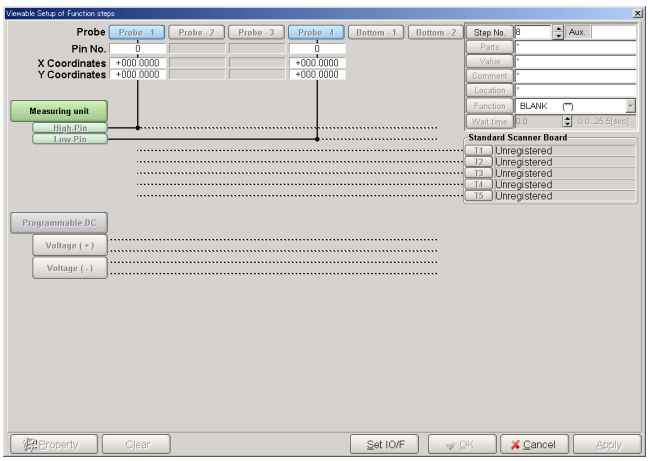
[Fig.19] Step Edit list

(4) Move to Tool and click on "Viewable Setup of Function steps". (Refer to Fig.20)



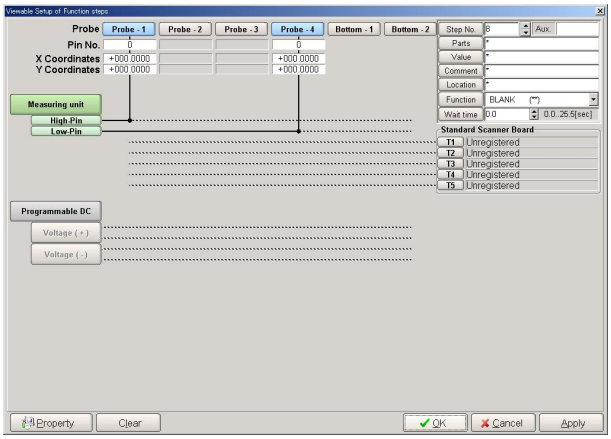
[Fig.20] Viewable Setup of Function steps

(5) It displays the Viewable Setup of Function steps window (Fig.21).



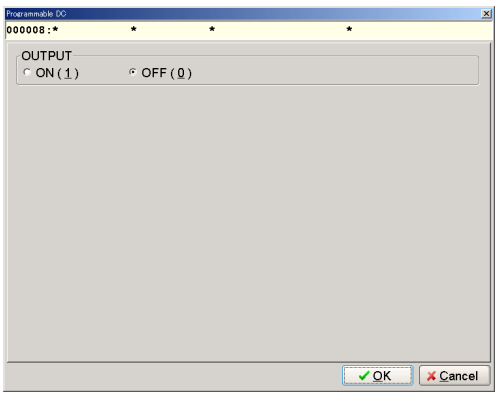
[Fig.21] Viewable Setup of Function steps (Point system)

(6) Click on [Set IO/F] button to activate each function on the window.



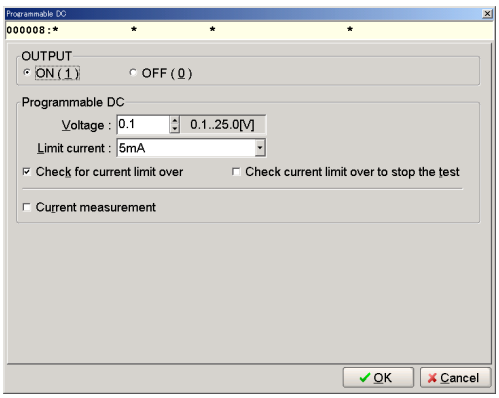
[Fig.22] Viewable Setup of Function steps (Point system)

(7) Click on [Programmable DC] button. After the Programmable DC On/Off window (Fig.23) appears on the display, select [ON].



[Fig.23] Programmable DC On/Off widow

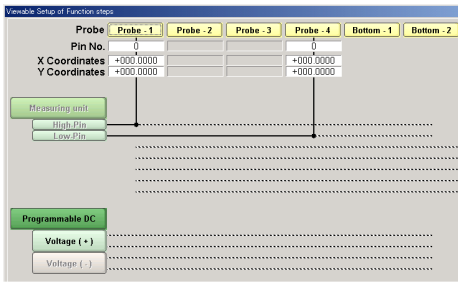
(8) It displays the Programmable DC Setup window (Fig.24).



[Fig.24] Programmable DC Setup widow

Voltage	Specify the voltage (0.0V~25.5V) applied to the UUT.
Limit current	Specify from [5mA], [10mA], [25mA], [50mA], [100mA], [200mA], [500mA] and [1A].
Check for current limit over	Specify as needed.
Check current limit over to stop the test	When this box is selected, the test is suspended if it measured over the specified limit current.
Current measurement	Remain unselected.

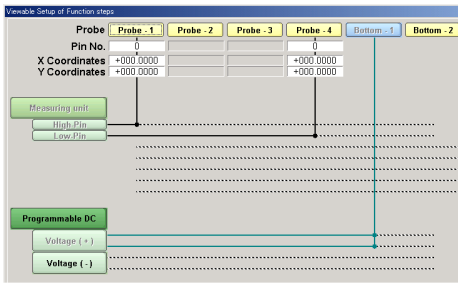
(9) After each setup was finished, click on the OK button. The display comes back to the Viewable Setup of Function steps window and [Voltage (+)] button of Programmable DC is flashing and [Probe-1] to [Bottom-2] buttons are flashing in yellow as well. (Now the Programmable DC is ready to connect to either probe)



[Fig.25] Viewable Setup of Function steps (Point system)

(10) Specify the connection of [Voltage (+)].

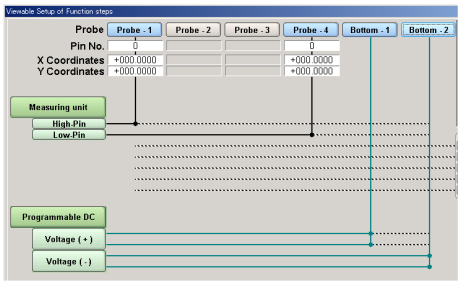
Specify other than [Probe-1] and [Probe-4] as they are already connected to the Measuring unit. Here let's select [Bottom-1]. After this, [Voltage (+)] is connected to [Bottom-1] with a green line.



[Fig.26] Viewable Setup of Function steps (Point system)

(11) [Voltage (-)] button of Programmable DC is flashing.

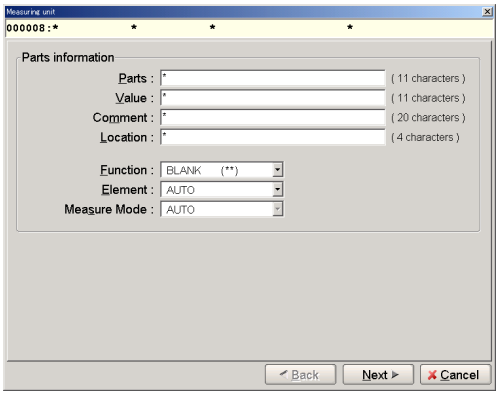
Here let's select [Bottom-2]. After this, [Voltage (-)] is connected to [Bottom-2] with a green line.



[Fig.27] Viewable Setup of Function steps (Point system)

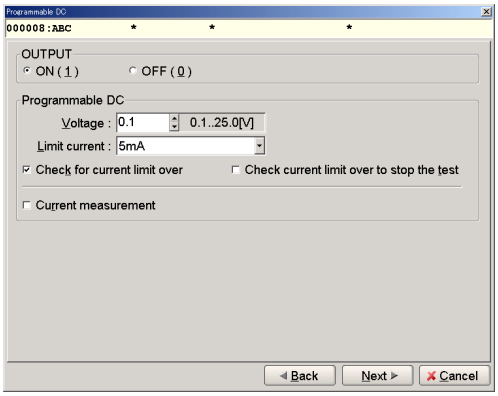
(12) Click on [Property] button on the window to display the Measuring unit window (Fig.28).

Use the keyboard to fill in the Parts column. In addition, enter the Value, Comment and Location column as needed. Fill in the Function, Element and Measure Mode column if the measurement content is already determined as they will assist in inputting the reference value.



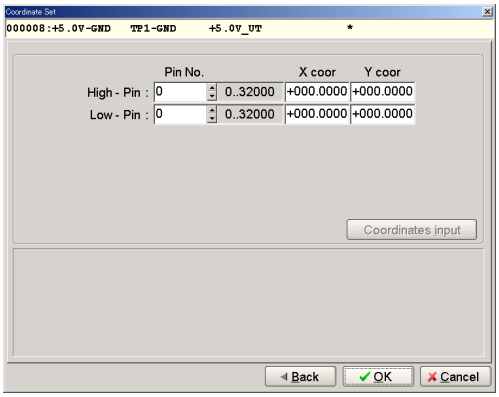
[Fig.28] Measuring unit

(13) Click on the Next button, and it displays the Programmable DC Setup window (Fig.29).
This is the same window as Fig.24 and enables to change the configuration.



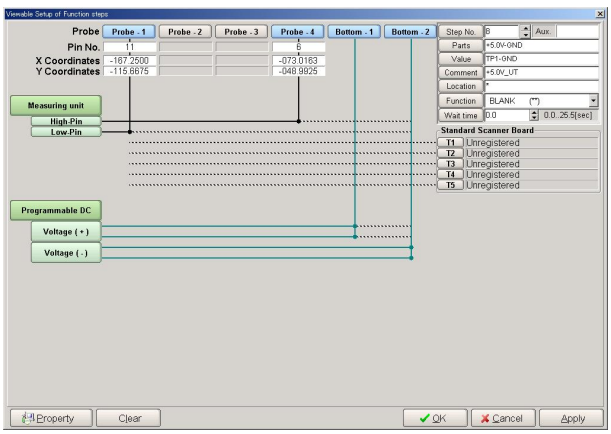
[Fig.29] Programmable DC Setup

(14) Click on the Next button, and it displays the Coordinate set window (Fig.30).
Specify High-Pin and Low-Pin by the pin numbers where are to output after the voltage was applied.
After the pin numbers were specified, click on the Next button.



[Fig.30] Coordinate Set (Point system)

(15) Click on the OK button, and it displays the Viewable Setup of Function steps window.

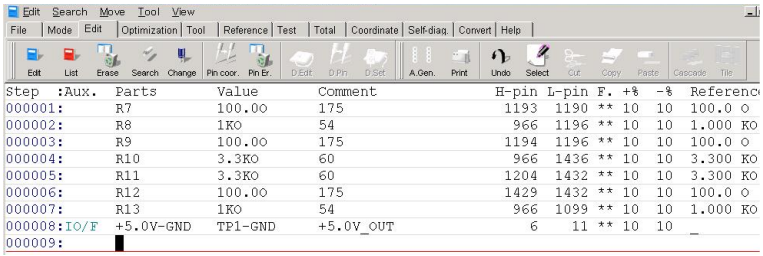


[Fig.31] Viewable Setup of Function steps (Point system)

(16) Click on the OK button, and it displays the Step Edit list.
Now the AUX. column is substituted by “IO/F”.

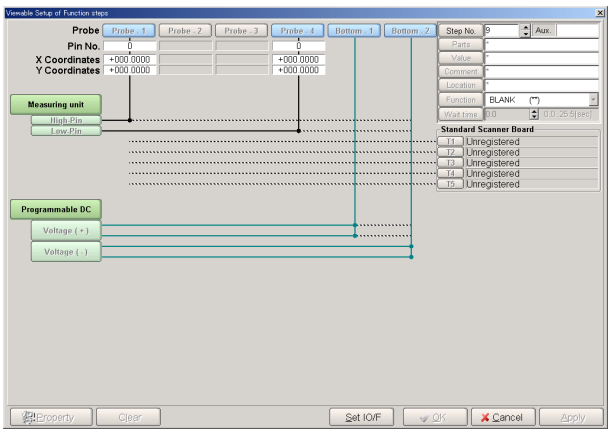
[Fig.32] Step Edit list (Point system)

(17) Press the Esc key to close the Step Edit list.Or, add other measuring steps after the above IO/F step if there is. In this case, use the down-arrow key to move the cursor to the next step.



[Fig.33] Step Edit list (Point system)

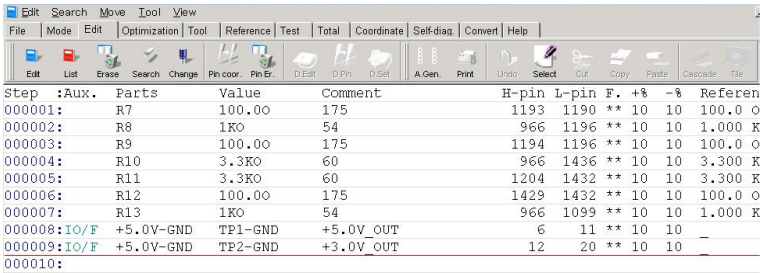
(18) Move to Tool and click on “Viewable Setup of Function steps”.
It displays the Viewable Setup of Function steps window (Fig.34) which indicates the existing configuration of the Programmable DC.



[Fig.34] Viewable Setup of Function steps (Point system)

(19) Click on [Set IO/F] button to activate each function on the window.
(Here users don’t have to configure the Programmable DC again as Step 000008 hold it)

(20) Click on [Property] button on the window to display the Measuring unit window.
Then repeat the same operation after Process #12 in order to program as shown in Fig.35.

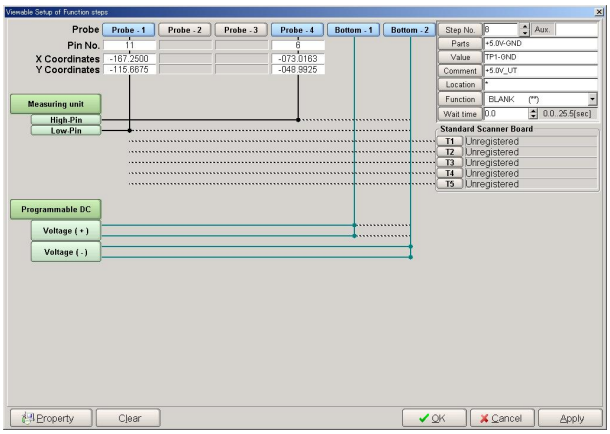


[Fig.35] Step Edit list

Programming the step to terminate the voltage output to the UUT

(1) After proceed with Process (1)~(4) in Page 40, move to Tool and click on “Viewable Setup of Function steps”.

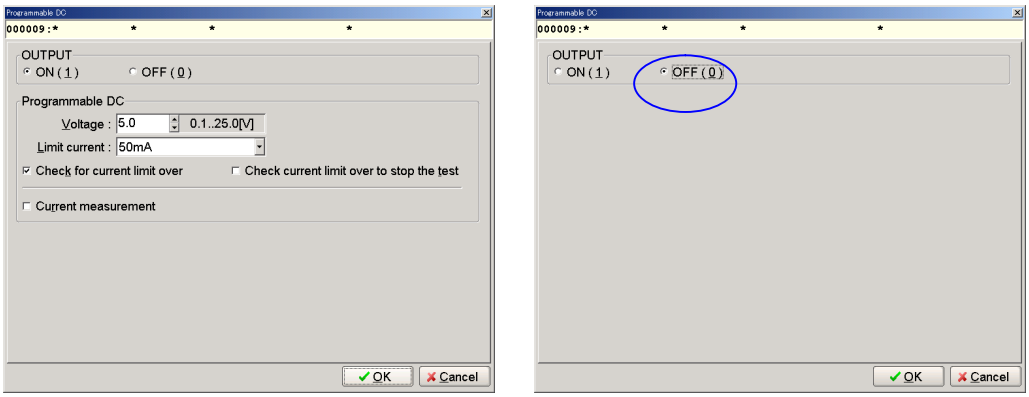
(2) Click on [Set IO/F] button to activate each function on the Viewable Setup of Function steps window.



[Fig.35] Viewable Setup of Function steps (Point system)

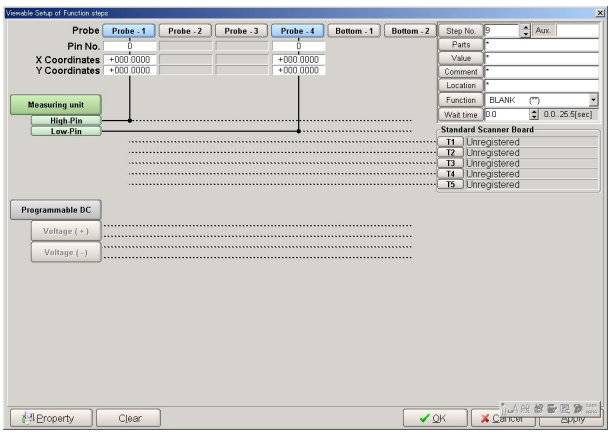
(3) Click on [Programmable DC] button.

After the Programmable DC On/Off window (the left window in Fig.36) appears on the display, select [**OFF**]. Then click on the OK button on the right window in Fig.36.



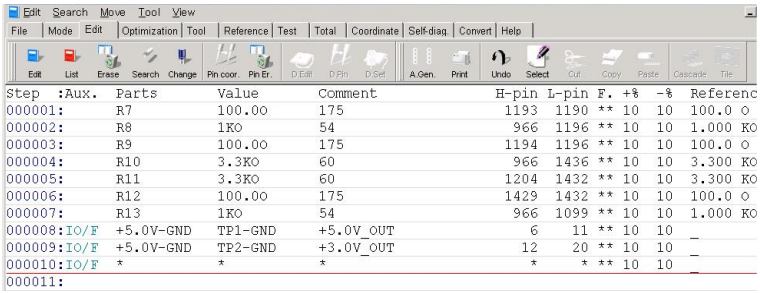
[Fig.36] Programmable DC On/Off widow

(4) The display moves back to the Viewable Setup of Function steps window.



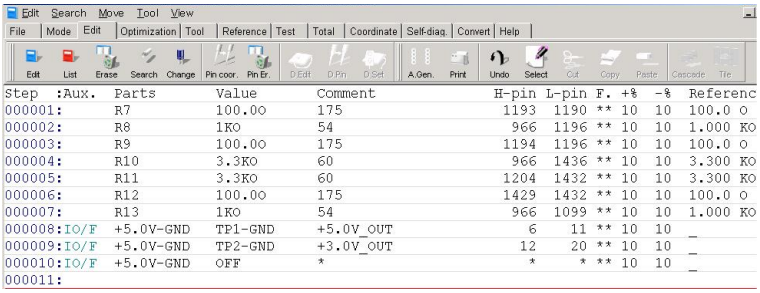
[Fig.37] Viewable Setup of Function steps (Point system)

(5) Click on the OK button, and the display moves back to the Step Edit list (Fig.38). For better understanding the step, users should fill in Parts column and Value column with some remarks as shown in Fig.39.



Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	+5.0V-GND	TP1-GND	+5.0V_OUT	6	11	**	10	10	_
000009:	IO/F	+5.0V-GND	TP2-GND	+3.0V_OUT	12	20	**	10	10	_
000010:	IO/F	*	*	*	*	*	**	10	10	_
000011:										

[Fig.38] Step Edit list

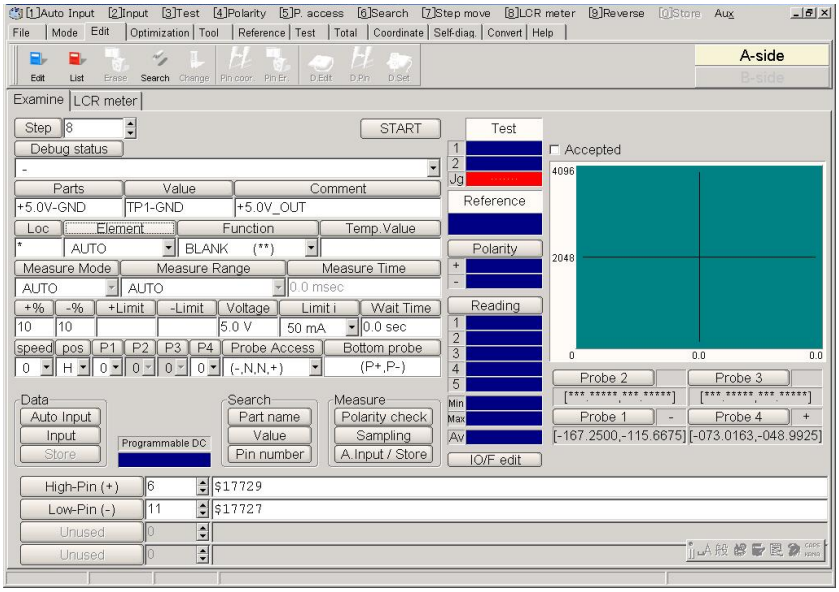


Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	+5.0V-GND	TP1-GND	+5.0V_OUT	6	11	**	10	10	_
000009:	IO/F	+5.0V-GND	TP2-GND	+3.0V_OUT	12	20	**	10	10	_
000010:	IO/F	+5.0V-GND	OFF	*	*	*	**	10	10	_
000011:										

[Fig.39] Step Edit list

Step data review at IO/F step

Step data review window enables to input the reference value. In addition, it's also possible to change the measuring conditions (Voltage, Time etc).



[Fig.40] Step data review

(1) [Element]

It displays type of the measurement.

RESISTOR → Resistor
CAPACITOR → Capacitor
COIL → Inductor
DIODE → VF measurement, DC voltage measurement

(2) [Function]

It displays the measurement function.

(3) [Temp. Value]

It displays the value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
This value is saved as Reference value if [Store] button is clicked.

(4) [Measure Mode]

It displays Measuring Mode.
(For example, it displays "DC-VM" when DC voltage is measure)

(5) [Measure Range]

It displays Measuring Range.

(6) [Measure Time]

It displays Measuring Time. Specify within 1 ~ 999 (m sec).

(7) [+%] [-%]

It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%.

(8) [+Limit][-Limit]

It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].

(9) [Voltage]

It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(10) [Limit i]
Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

(11) [Func. Wait]
It displays Wait time (from applied voltage to move to the next step).

(12) [Probe Access]
It displays the state of probe access.

(13) [Bottom probe]
It displays the state of bottom probe access. (P+,P-)
Bottom probe 1 is used for ”Voltage (+) of Programmable DC.
Bottom probe 2 is used for ”Voltage (-) of Programmable DC.

Reference input

Users should specify [Element] and [Measure Mode] column in case of components that is measured while applying the voltage.
When [Element] column is specified by RESISTOR, CAPACITOR or COIL, select “Auto” in [Measure Mode] column and click on the Auto Input button. The value obtained from the measurement is displayed in [Temp. Value] column. Also, specify [Function] and [Measure Time] as needed. If the Store is selected, the Temp. Value will be saved as the reference value.

When [Element] column is specified by DIODE to go for VF measurement, select “DC-CC” in [Measure Mode. On the other hand, when [Element] column is specified by DIODE to go for DC voltage measurement, select “DC-VM” in [Measure Mode]. In these cases, be sure to click the Input button to input the reference value. The value obtained from the measurement is displayed in [Temp. Value] column. If the Store is selected, the Temp. Value will be saved as the reference value.

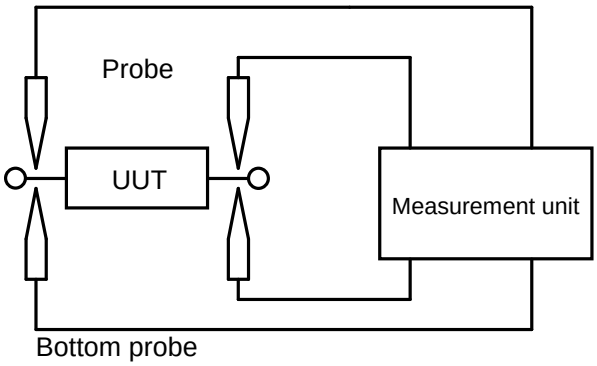
WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

	1. To go for DC voltage measurement, be sure to select the Input button to input the reference value. If the Auto Input button was used by mistake, from time to time the Measuring Mode is initialized and an unintentional Measuring mode is set automatically. 2. If other Measuring mode than DC-VM mode is used while voltage is applied on the UUT, from time to time the error of “The PCB is charged with high voltage!” appears on the display. In this case, it’s no longer possible to use other Measuring mode than DC-VM mode.

About the error “Current limit over!”
There is a chance of getting the error “Current limit over!” during the reference value input. In this case, users should improve the Wait time to be longer.

[Example 3] Multiple test measurement by applying voltage

This I/O command uses two flying probes to have the PDC-9500 apply DC voltage to the UUT and measure the output current at the same time. The measured current is used to determine if the step is pass or fail. With the IO/F command, users can measure the consumption current while applying DC voltage to the device or the circuit and measure the current surge caused by faulty device inside the circuit.



[Fig.41]

Basic knowledge of IO/F step

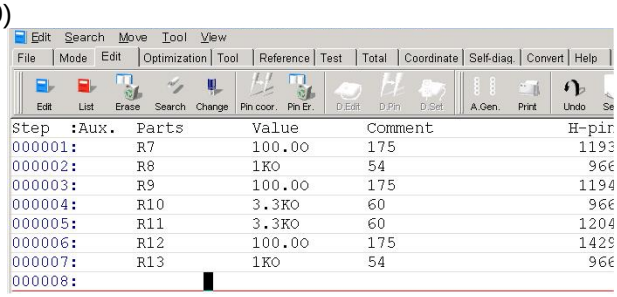
1. At the step where DC current is measured at the same time as applying DC voltage, user cannot execute any other measurement. Therefore, they should program other measuring steps following the IO/F step. In this case, the Programmable DC must be connected to the bottom probes. The voltage output to the UUT lasts until “OFF Step” is executed. (If the flying probes are specified, the voltage output to the UUT is terminated right after the IO/F step is executed.)
2. No guard point can be set.

Programming Steps

(1) Click on Step Edit (or Step List) from Edit menu on Menu bar.

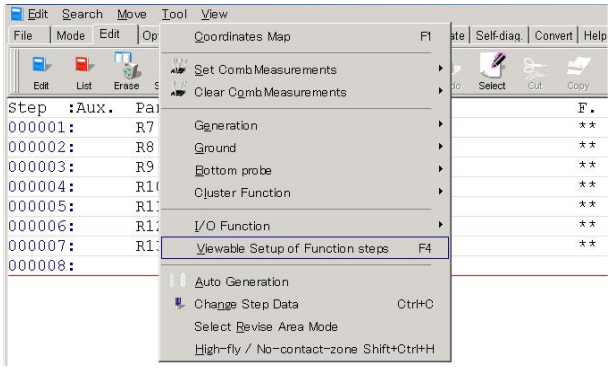
(2) It displays “Enter step number (1 – x)”.
Let’s put a new step on the last step. Use the keyboard to enter the last step number and click on the OK button.

(3) The cursor is flickering on the last step. Use the down-arrow key to move the cursor to the next step. (Refer to Fig.19)



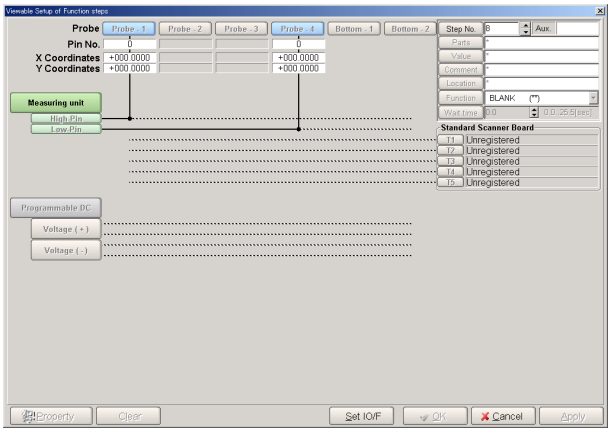
[Fig.42] Step Edit list

(4) Move to Tool and click on “Viewable Setup of Function steps”. (Refer to Fig.43)



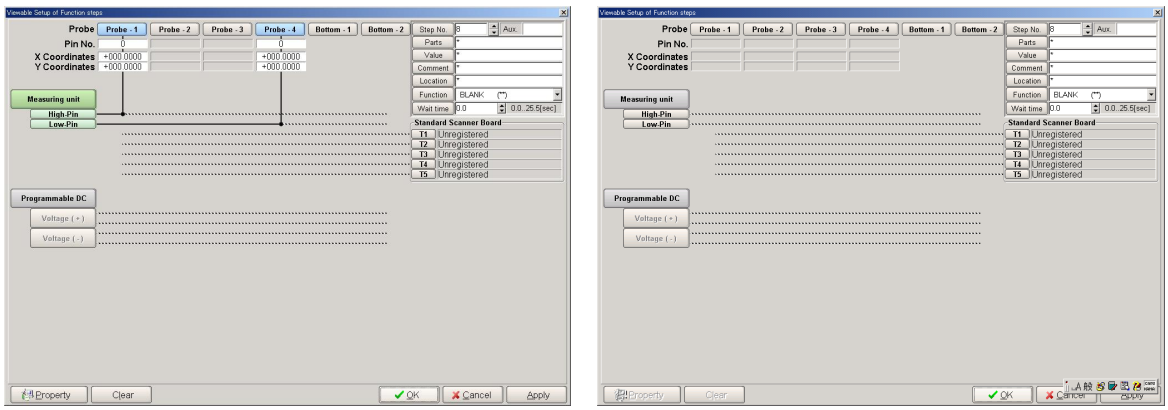
[Fig.43] Viewable Setup of Function steps

(5) It displays the Viewable Setup of Function steps window (Fig.44).



[Fig.44] Viewable Setup of Function steps (Point system)

(6) Click on [Set IO/F] button to activate each function on the window.



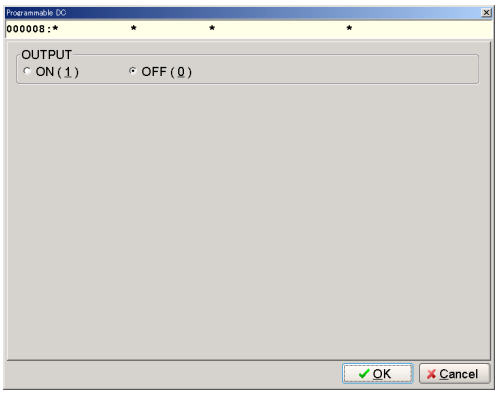
[Fig.45] Viewable Setup of Function steps (Point system)

Click on [Clear] button, and High-pin and Low-pin of [Measuring unit] is disconnected from [Probe-1] and [Probe-4].

When DC voltage is applied to the UUT, users are not allowed to measure the DC current while connecting High-pin and/or Low-pin of [Measuring unit] to [Probe-1] ~ [Bottom-2]. If they try to select the box “Current measurement” when High-pin and/or Low-pin of [Measuring unit] is connected to [Probe-1] ~ [Bottom-2], it shows an error message below;

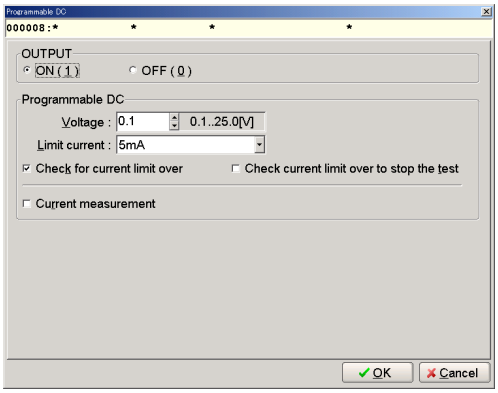
In this case users should click on the Clear button to disconnect High-pin and Low-pin of [Measuring unit] from [Probe-1] ~ [Bottom-2].

(7) Click on [Programmable DC] button. After the Programmable DC On/Off window (Fig.46) appears on the display, select [ON].



[Fig.46] Programmable DC On/Off widow

(8) It displays the Programmable DC Setup window (Fig.47).



[Fig.47] Programmable DC Setup widow

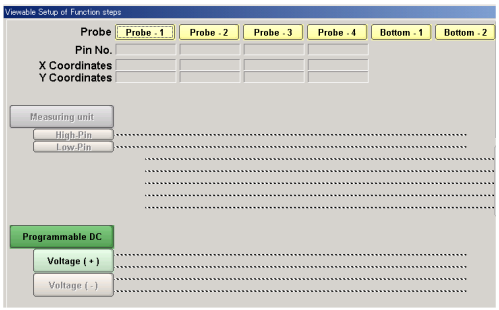
Voltage	Specify the voltage (0.0V~25.5V) applied to the UUT.
Limit current	Specify from [5mA], [10mA], [25mA], [50mA], [100mA], [200mA], [500mA] and [1A].
Check for current limit over	Select this check box.
Check current limit over to stop the test	When this box is selected, the test is suspended if it measured over the specified limit current.
Current measurement	Select this check box.

The error message appears if the box “Current measurement” is selected when High-pin and/or Low-pin of [Measuring unit] is disconnected to any of [Probe-1] ~ [Bottom-2] on Fig.45.

Move back to the Viewable Setup of Function steps (Fig.45) and click on the Clear button to disconnect High-pin and Low-pin of [Measuring unit] from [Probe-1] ~ [Bottom-2].

(9) After each setup was finished, click on the OK button. The display comes back to the Viewable Setup of Function steps window and [Voltage (+)] button of Programmable DC is flashing and [Probe-1] to [Bottom-2] buttons are flashing in yellow as well. (Now the Programmable DC is ready to connect to either probe)

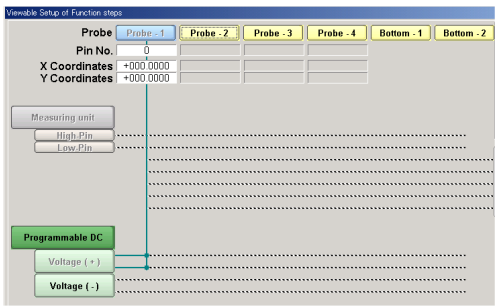
If the flying probes (Probe-1 ~ Probe-4) are specified, the voltage output to the UUT is terminated right after the IO/F step is executed.



[Fig.48] Viewable Setup of Function steps (Point system)

(10) Specify the connection of [Voltage (+)] from [Probe-1] ~ [Bottom-2].

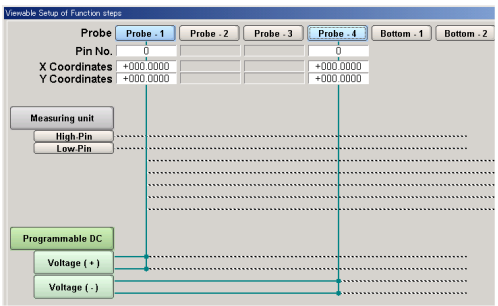
Here let's select [Probe-1]. After this, [Voltage (+)] is connected to [Probe-1] with a green line.



[Fig.49] Viewable Setup of Function steps (Point system)

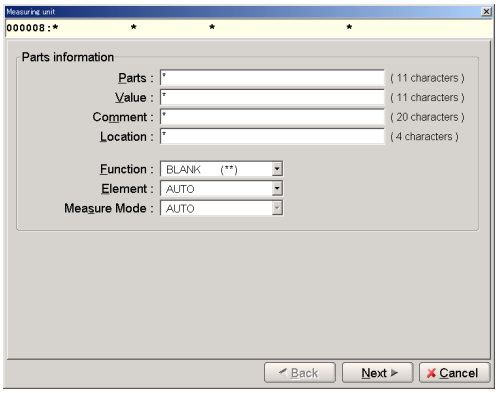
(11) [Voltage (-)] button of Programmable DC is flashing.

Here let's select [Probe-4]. After this, [Voltage (-)] is connected to [Probe-4] with a green line.



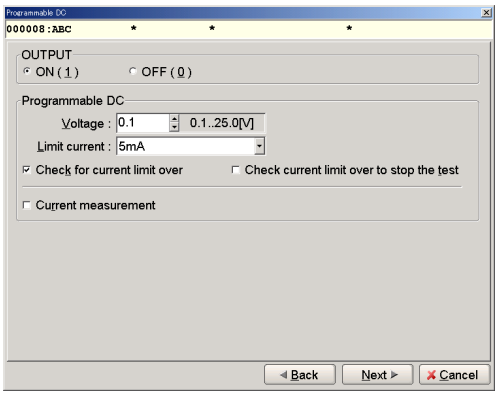
[Fig.50] Viewable Setup of Function steps (Point system)

(12) Click on [Property] button on the window to display the Measuring unit window (Fig.51).
Use the keyboard to fill in the Parts column. In addition, enter the Value, Comment and Location column as needed.
Fill in the Function, Element and Measure Mode column if the measurement content is already determined as they will assist in inputting the reference value.



[Fig.51] Measuring unit

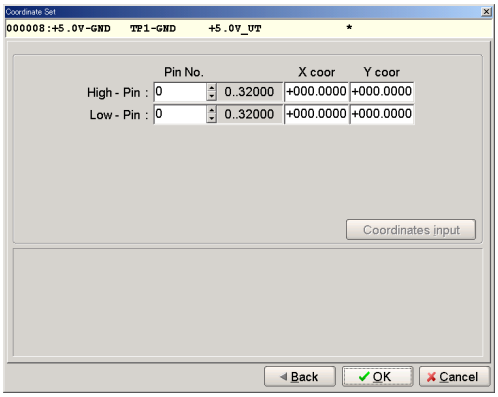
(13) Click on the Next button, and it displays the Programmable DC Setup window (Fig.52).
This is the same window as Fig.47 and enables to change the configuration.



[Fig.52] Programmable DC Setup

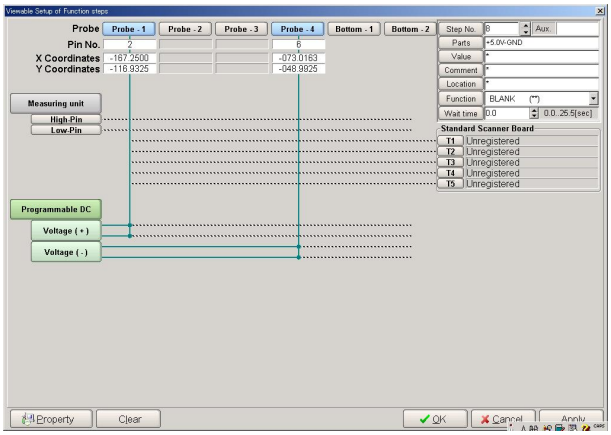
HINT	When the Programmable DC is connected to the bottom probes, the OK button is displayed in place of the Next button. In this case, click on the OK button after the setup on Fig.52 was complete.

(14) Click on the Next button, and it displays the Coordinate set window (Fig.53).
Specify High-Pin and Low-Pin by the pin numbers where the voltage is applied.



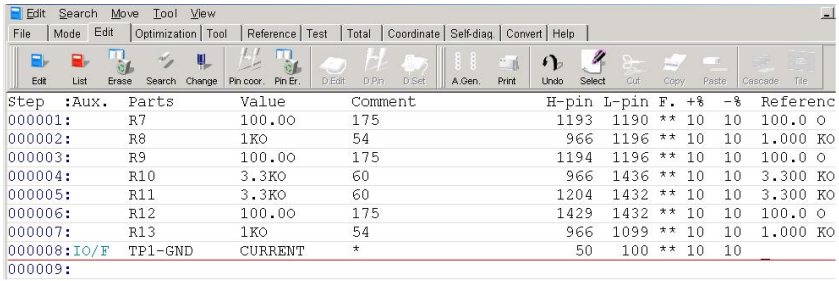
[Fig.53] Coordinate Set (Point system)

(15) Click on the OK button, and it displays the Viewable Setup of Function steps window.



[Fig.54] Viewable Setup of Function steps (Point system)

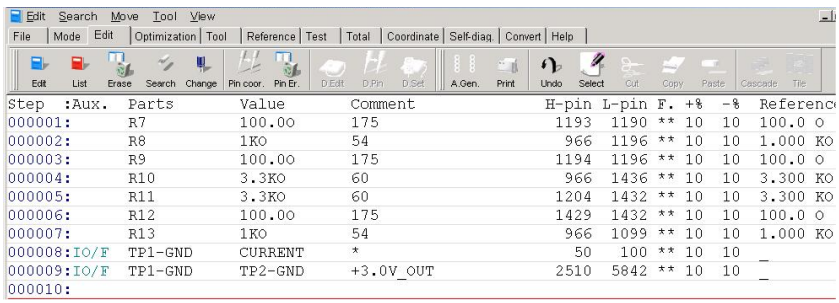
(16) Click on the OK button, and it displays the Step Edit list.
Now the AUX. column is substituted by “IO/F”.



Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	TP1-GND	CURRENT	*	50	100	**	10	10	_
000009:										

[Fig.55] Step Edit list

(17) When the Programmable DC is connected to the bottom probes to measure other points, program those steps following to this IO/F step. (Refer to Fig.56)



Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	TP1-GND	CURRENT	*	50	100	**	10	10	_
000009:	IO/F	TP1-GND	TP2-GND	+3.0V_OUT	2510	5842	**	10	10	_
000010:										

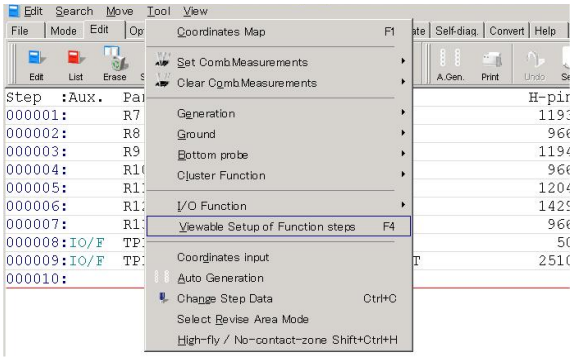
[Fig.56] Step Edit list

Programming the step to terminate the voltage output to the UUT

When the Programmable DC is connected to the bottom probes, users should program another step to terminate the voltage output to the UUT. The programming steps are described below.

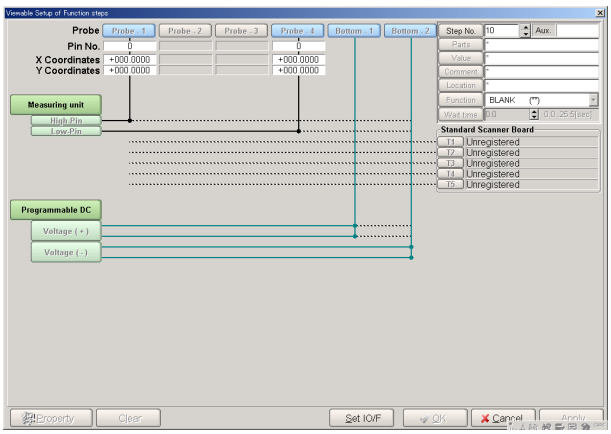
(1) Proceed with Process (1)~(3) in Page 50.

(2) Move to Tool and click on “Viewable Setup of Function steps”.



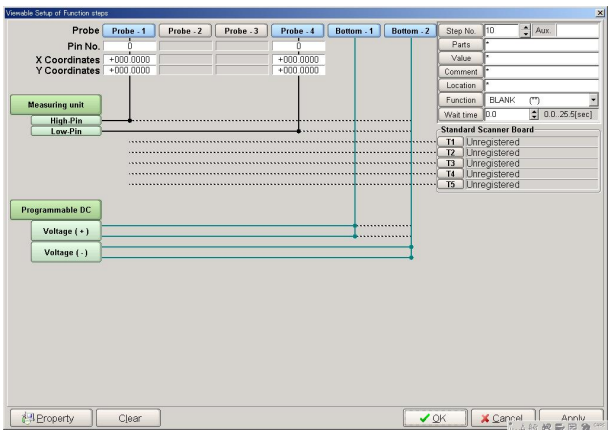
[Fig.57] Viewable Setup of Function steps

(3) It displays the Viewable Setup of Function steps window (Fig.58).



[Fig.58] Viewable Setup of Function steps (Point system)

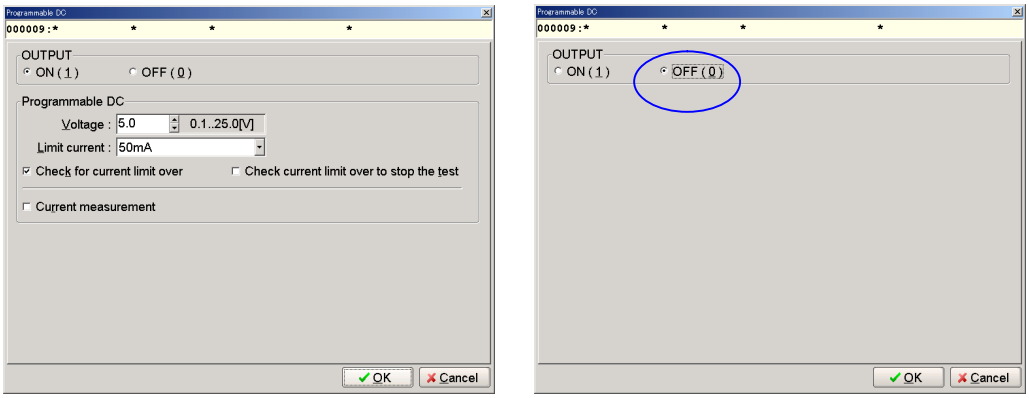
(4) Click on [Set IO/F] button to activate each function on the Viewable Setup of Function steps window.



[Fig.59] Viewable Setup of Function steps (Point system)

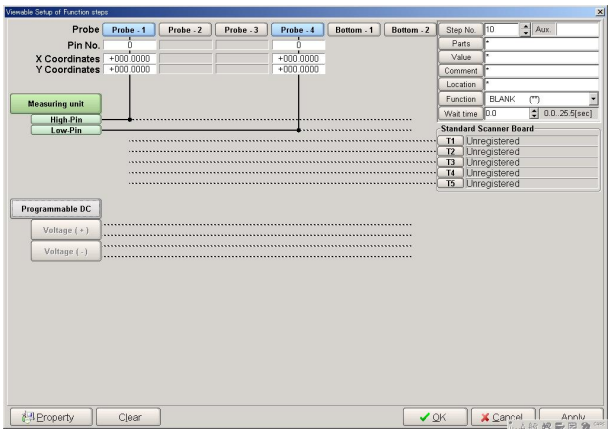
(5) Click on [Programmable DC] button.

After the Programmable DC On/Off window (the left window in Fig.60) appears on the display, select [**OFF**]. Then click on the OK button on the right window in Fig.60.



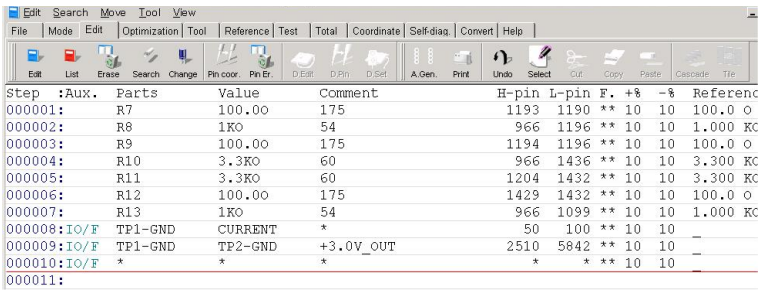
[Fig.60] Programmable DC On/Off widow

(6) The display moves back to the Viewable Setup of Function steps window.



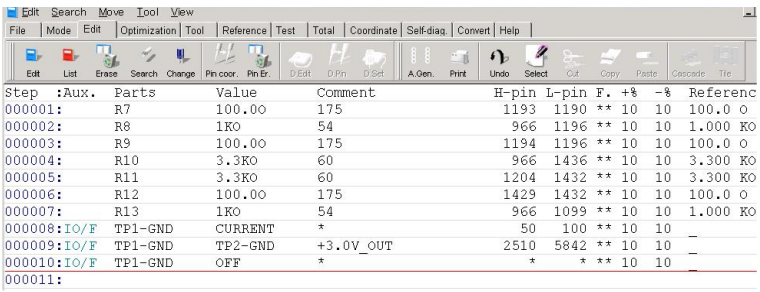
[Fig.61] Viewable Setup of Function steps (Point system)

(7) Click on the OK button, and the display moves back to the Step Edit list (Fig.62). For better understanding the step, users should fill in Parts column and Value column with some remarks as shown in Fig.63.



Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	TP1-GND	CURRENT	*	50	100	**	10	10	_
000009:	IO/F	TP1-GND	TP2-GND	+3.0V_OUT	2510	5842	**	10	10	_
000010:	IO/F	*	*	*	*	*	**	10	10	_
000011:										

[Fig.62] Step Edit list

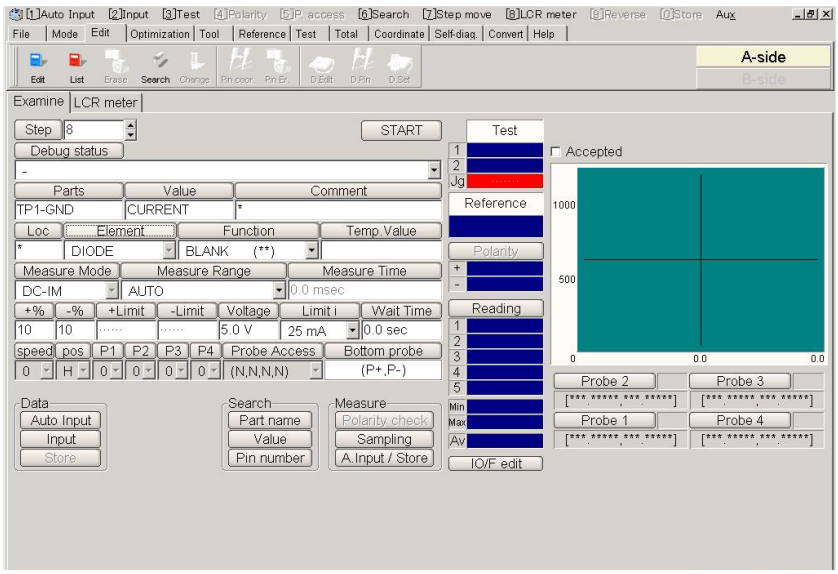


Step	:Aux.	Parts	Value	Comment	H-pin	L-pin	F.	+%	-%	Referenc
000001:		R7	100.00	175	1193	1190	**	10	10	100.0 O
000002:		R8	1KO	54	966	1196	**	10	10	1.000 KO
000003:		R9	100.00	175	1194	1196	**	10	10	100.0 O
000004:		R10	3.3KO	60	966	1436	**	10	10	3.300 KO
000005:		R11	3.3KO	60	1204	1432	**	10	10	3.300 KO
000006:		R12	100.00	175	1429	1432	**	10	10	100.0 O
000007:		R13	1KO	54	966	1099	**	10	10	1.000 KO
000008:	IO/F	TP1-GND	CURRENT	*	50	100	**	10	10	_
000009:	IO/F	TP1-GND	TP2-GND	+3.0V_OUT	2510	5842	**	10	10	_
000010:	IO/F	TP1-GND	OFF	*	*	*	**	10	10	_
000011:										

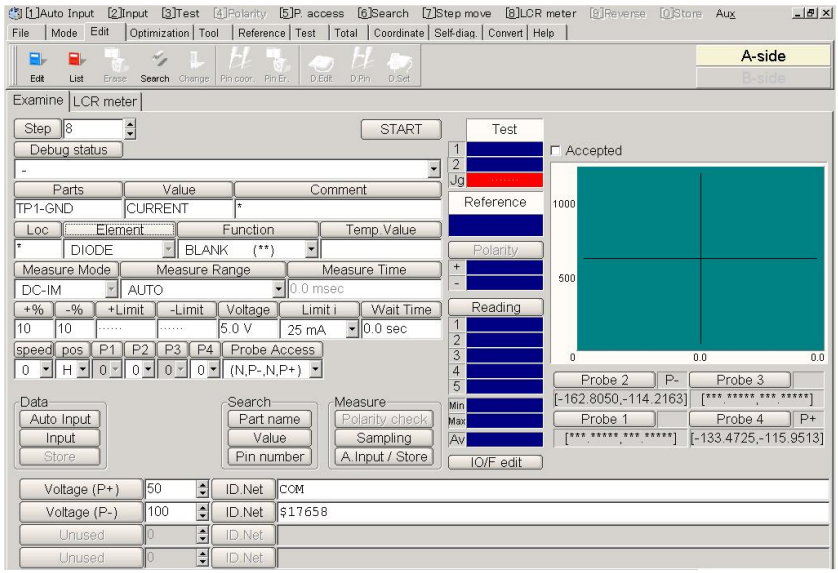
[Fig.63] Step Edit list

Step data review at IO/F step

Step data review window enables to input the reference value. In addition, it's also possible to change the measuring conditions (Voltage, Time etc).
(As shown in figures below, the Step data review differs depending on where the Programmable DC is connected.)



[Fig.64] Step data review (when using the bottom robes)



[Fig.64] Step data review (when using the flying robes)

(1) [Element]
It displays “DIODE” (This is not changeable)

(2) [Function]
It displays the measurement function.

(3) [Temp. Value]
It displays the value obtained by pressing either [Auto Input] or [Input].
This value is changeable in the same Measuring Mode and Range.
This value is saved as Reference value if [Store] button is clicked.

(4) [Measure Mode]
It displays “DC-IM” and measures the current value. (This is not changeable)

(5) [Measure Range]
It displays Measuring Range. Specify 1mA, 10mA or 100mA.

(6) [Measure Time]
It displays Measuring Time.

(7) [+%] [-%]
It displays upper/lower tolerance by percentage based on the reference value.
[+Limit] and [-Limit] change in sync with change of +%, -%.

(8) [+Limit][-Limit]
It displays upper/lower tolerance based on the reference value.
+% and -% change in sync with change of [+Limit], [-Limit].

(9) [Voltage]
It displays the applied voltage. Specify within 0.1 ~ 25.0V.

(10) [Limit i]
Use [Limit i] column to specify the current limit value.
Select from 5mA, 10mA, 25mA, 50mA, 100mA, 200mA, 500mA and 1A.

(11) [Func. Wait]
It displays Wait time (from applied voltage to move to the next step).

(12) [Probe Access]
N → Unused
P+ → Probe to apply Voltage(+)
P- → Probe to apply Voltage(-)

(13) [Bottom probe]
It displays the state of bottom probe access.
P+ → Probe to apply Voltage(+)
P- → Probe to apply Voltage(-)

Reference input

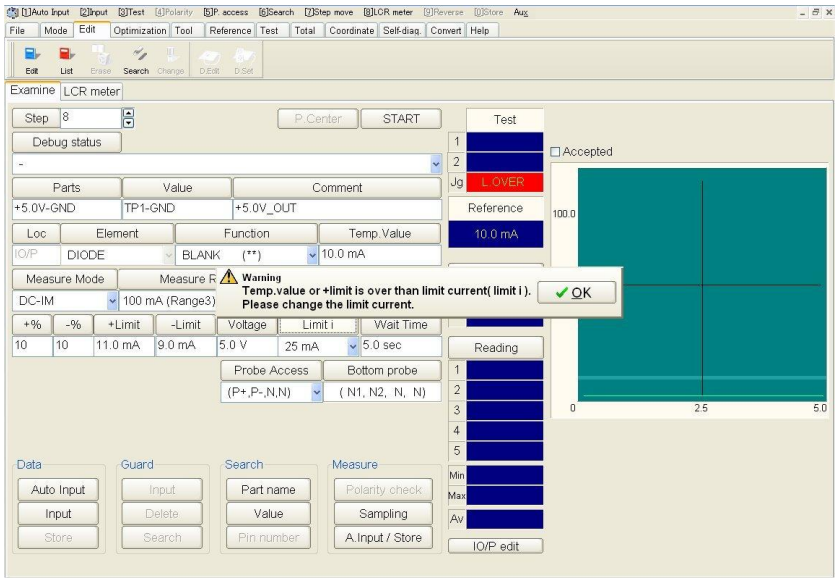
When the Measure Mode is specified by DC-IM, input the current value as the reference value.

After verified [Voltage], [Limit i] and [Wait time], click on either the Auto Input button or the Input button on the Step data review window. Then the Temp Value column indicates a current value. If users found this current value is right, click on the Store button o save to the reference value.

When the Measure Range and the Measure Time are set in advance, click on the Input button. (If the Auto Input button was clicked by mistake, there is a chance the Measure Range and the Measure Time is initialized and in the worst case they will be set wrong!)

WARNING	**The I/O step may cause serious damage to the PC boards and/or the measuring unit if users misuse it (ex. wrong location, polarity so on). The use of the I/O commands must be carried out under the responsibility of users.**

When the reference value is input or when [+%], [+Limit] are changed, there is a chance of displaying the error “Temp.value or +limit is over than limit current(limit i)”. (Refer to Fig.65) In this case, users should change the limit current setting (Limit i) after due consideration.



[Fig.65] Warning message at IO/F step in Step data review

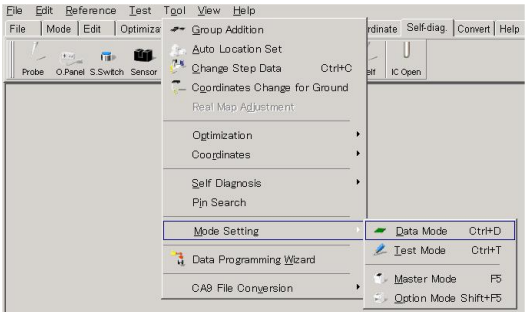
In addition, users need to use the Step data review window to input the reference value for the measurement step following to the IO/P step as he isn’t allowed to do this in Auto reference input.

Bottom probes setting

This chapter describes the procedures to set up the bottom probes. Put a bare (unpopulated) PCB on the tester prior to proceed with following operations.

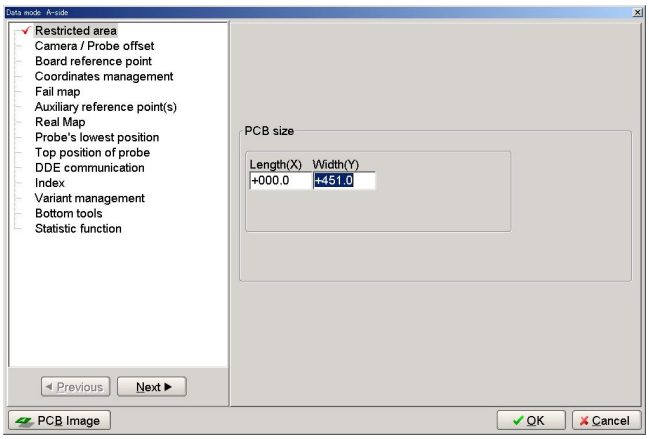
XY coordinates input for bottom probes

(1) Choose [Tool] > [Mode Setting] > [Data mode] to open Data mode window. (Refer to Fig.1)

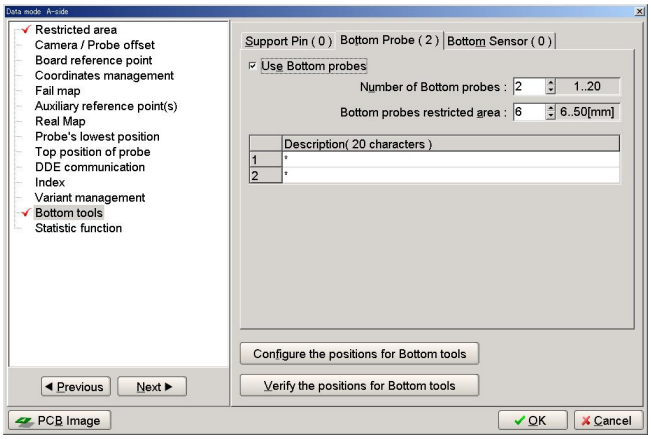


[Fig.1] Data mode > Mode Setting

(2) Select Bottom tool and select the box “Use Bottom tools”. (Refer to Fig.2, 3)



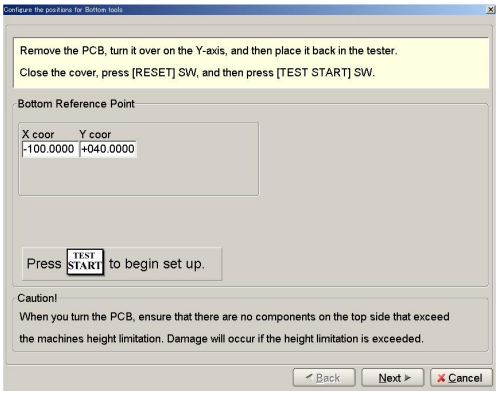
[Fig.2] Data mode



[Fig.2] Bottom tools

Then configure Number of Bottom Probes and Bottom probes restricted area.
(Usually, Number of Bottom Probes is set to “2” and Bottom probes restricted area is “6mm”.)
In addition, fill in the Description box as needed.

(3) Click on [Configure the positions for Bottom tools] button, and users are ready to input XY coordinates. Turn over the PCB in Y-direction to specify the reference point for the bottom probes.

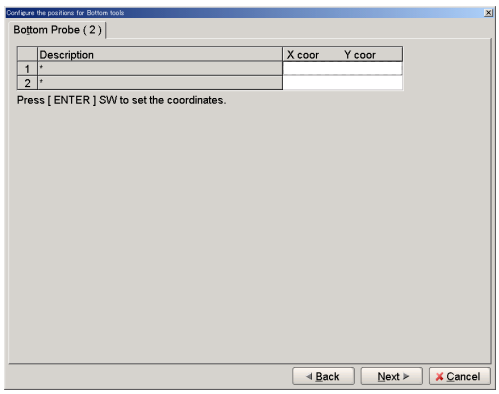


[Fig.4] Configure the positions for Bottom tools

	When the PCB loads some tall components (over 35mm), the camera and the flying probes are definitely hitting to them. So please be sure to use a bare (unpopulated) PCB.

(4) Depress the TEST START SW on the operation panel, and it displays the camera JOG window and Probe 4 moves to the Board reference point.
Users should set the Bottom reference point to the point which is visible from both sides.
(ex. a plated through hole)
Use the keypad arrow key on the operation panel to drive the camera and set the Target marker on the center of the Bottom reference point and depress the ENTER SW on the operation panel. Then Probe 4 moves back to the home position.

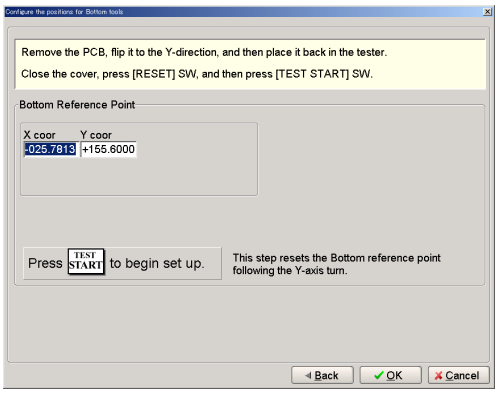
(5) It displays Fig.5 below.



[Fig.5]

Depress the ENTER SW on the operation panel, and the camera moves to the Bottom reference point.
Use the keypad arrow key on the operation panel to drive the camera to the XY coordinates of Bottom probe 1.
Depress the ENTER SW on the operation panel to determine the XY coordinates of Bottom probe 1.
Depress the ENTER SW on the operation panel, and it displays Fig.5 to enter the XY coordinates of Bottom probe 2.
Use the keypad arrow key on the operation panel to drive the camera to the XY coordinates of Bottom probe 2.
Depress the ENTER SW on the operation panel to determine the XY coordinates of Bottom probe 2.
Click on the Next button.

(6) It displays Fig. 6 below.



[Fig.6]

Use this window to specify the Bottom reference point from the probing side again.

Open the Safety cover and turn over the PCB in Y-direction. Then close the Safety cover and depress the RESET SW on the operation panel.

(7) Depress the START SW, and the camera moves to the Bottom reference point and the camera JOG window appears.

Use the keypad arrow key on the operation panel to set the Target marker to the Bottom reference point.

Depress the ENTER SW on the operation panel to determine the XY coordinates of the Bottom reference point.

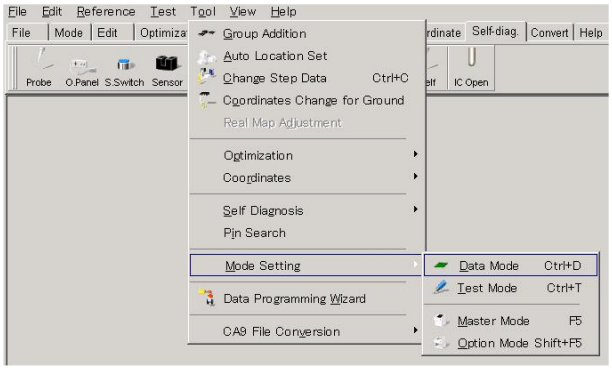
Click on the OK button.

The display moves back to Option mode (Fig.2) and now the XY coordinates input for bottom probes is finished.

Setup procedure of Bottom probes

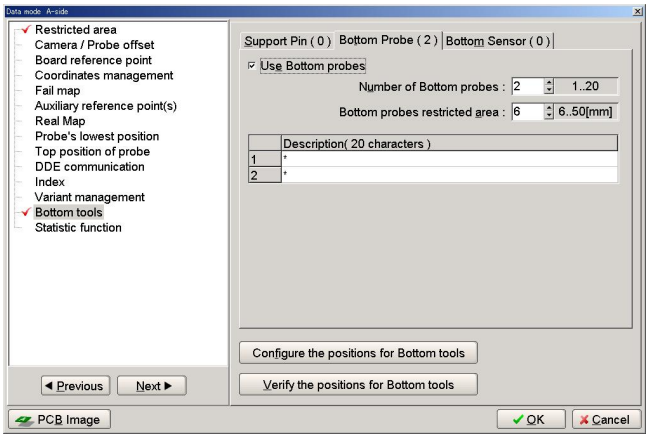
Put the loaded PCB on the tester prior to proceed with following operations.

(1) Choose [Tool] > [Mode Setting] > [Data mode] to open Data mode window. (Refer to Fig.8)



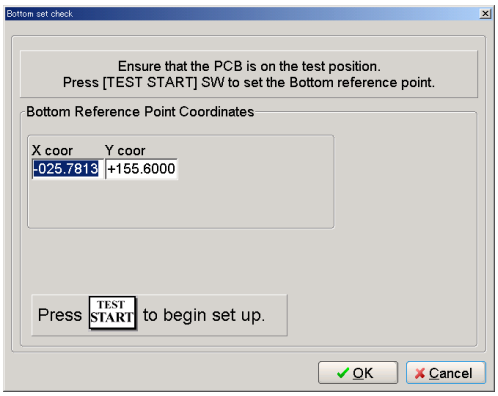
[Fig.8] Data mode > Mode Setting

(2) Select Bottom tool > Bottom Probe.



[Fig.9] Data mode > Bottom tools > Bottom Probe

(3) Click on [Verify the positions for Bottom tools], and it displays Fig.10.
Users are ready to specify the Bottom reference point.
Depress the TEST START SW on the operation panel after verified the PCB is put on the tester.

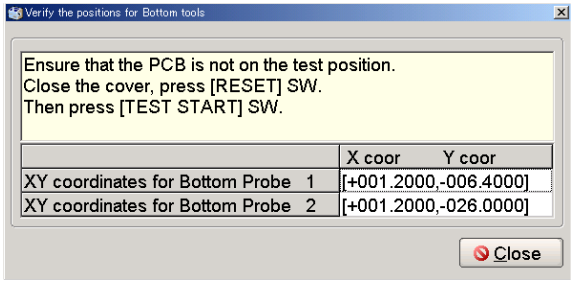


[Fig.10]

(4) It displays the camera JOG window and the camera moves to the front side.
Use the keypad arrow key on the operation panel to drive the camera and set the Target marker on the center of the Bottom reference point and depress the ENTER SW on the operation panel.

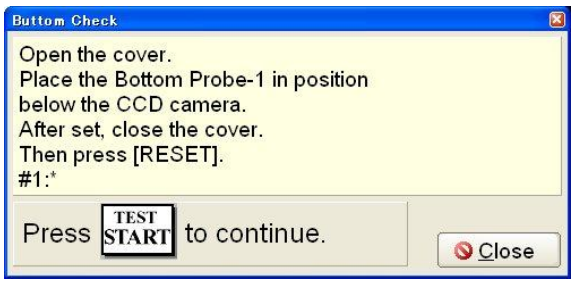
(5) It displays Fig.11 below.

Open the Safety cover to remove the PCB and close the Safety cover.



[Fig.11]

(6) Depress the RESET SW then the TEST START SW on the operation panel, and it displays Fig.12.



[Fig.12]

Open the Safety cover and place Bottom probe 1 on the location where the Target marker indicates.

Then close the Safety cover and depress the RESET SW then the TEST START SW on the operation panel.

Now it is possible to set Bottom probe 2.

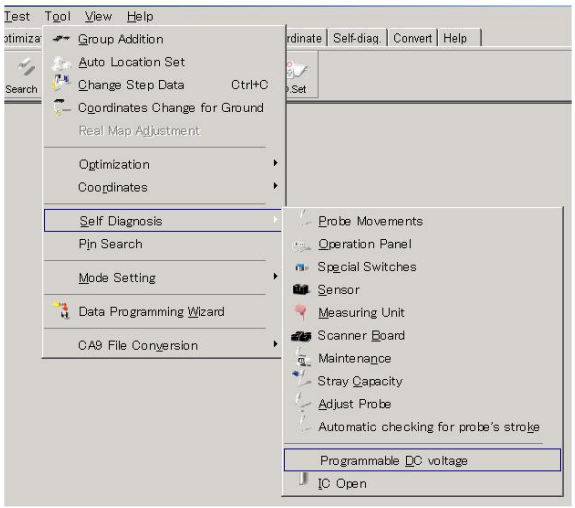
Open the Safety cover and place Bottom probe 2 on the location where the Target marker indicates.

Then close the Safety cover and depress the RESET SW then the TEST START SW on the operation panel.

Now all is finished.

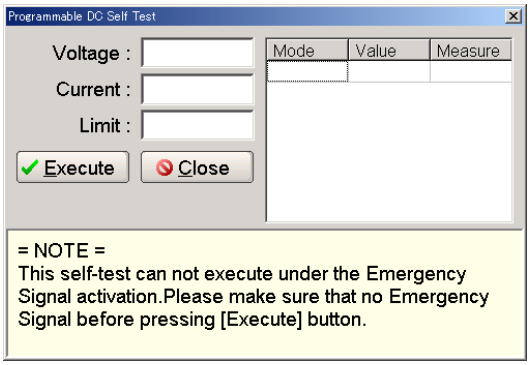
Self-diagnostic test

This chapter describes the Self-diagnostic test available fro the PDC-9500.
Choose [Tool] > [Self Diagnosis] and click on [Programmable DC voltage].



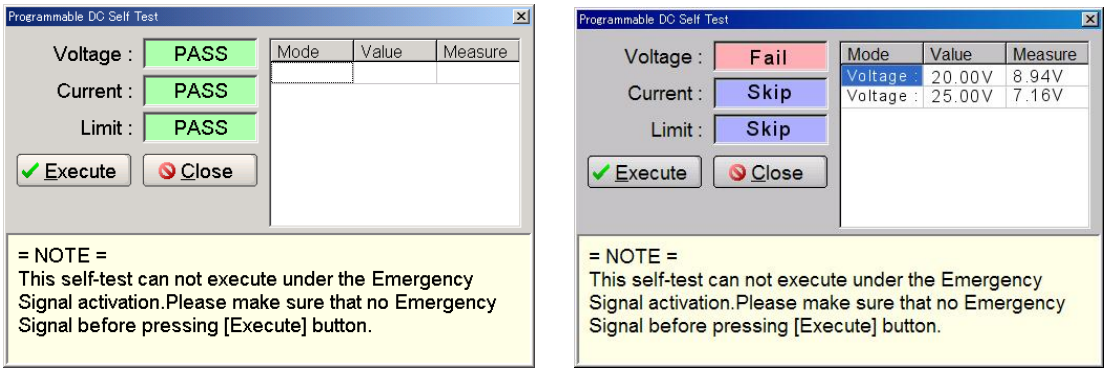
[Fig.1] Self Diagnosis

It displays the diagnostic menu for the PDC-9500. (Refer to Fig.2).



[Fig.2] Self Diagnosis

Clicking [Execute] button, it shows the diagnostic results.
(The left window in Fig.3 is at PASS, the right window is at FAIL)



[Fig.3 Diagnostic results (example)]

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