

***Four Quadrant Power Supply (GS610)  
for Function Test by APT-9411CE***

***Reference Manual***



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# Introduction

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This manual provides a brief explanation of the simple function test that the user can establish by using four-quadrant power supply Model GS610 (hereinafter called "GS610"). Please read through this User's manual before you get started using the GS610 as there are also important instructions and directions that you should know in advance.

For the details of the GS610 operation, please refer to the GS610 User's manual.

## (Notes)

% This manual describes the software Ver.1.1-5a of APT-9411CE system. But the figures and/or the screen shot giving in this manual may differ from those that actually appear on your screen.

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- The GS610 is one of the products manufactured by Yokogawa Electric Works, Ltd..
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# Safe Symbols & Labels

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## Description of keys and operation switches

1. The keyboard keys are put in angled bracket ( [ ] ). ex. [Enter]. Also, the space key is shown by [SP].
2. The operation panel switches are put in angled bracket ( [ ] ). ex. [TEST START].
3. When plural keys are operated in order, they are jointed together by right angle bracket ( > ). ex. [A] > [3].
4. When plural keys are operated at a time, they are jointed together by plus ( + ). ex. [Ctrl] + [Y],

## Symbols

Symbol	Explanation
	Calls attention to a procedure, practice, or condition that could possibly damage to the tester.
	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 tester.
	Calls attention to "One-point advice" which should be useful when you are at a loss to operate the tester.

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# About S610

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This chapter outlines the GS610 mainly for the application and its specifications. For more detail, refer to the GS610 User's manual provided with the GS610.

## Product outline

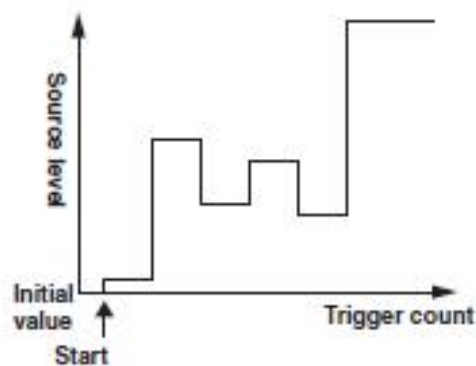
Four quadrant power supply GS610 : Source Measure unit with C10 option (Ethernet interface)

Manufacturer: YOKOGAWA ELECTRIC CORPORATION



When you run the IO/F step, naturally the assigned signal (current / voltage) is applied to the PC board. If you carelessly set the point and the signal wrong, there is a chance of damaging the components on the PC board, the measurement part in the tester and your external power supply unit. The user has to treat the GS610 with enough care.

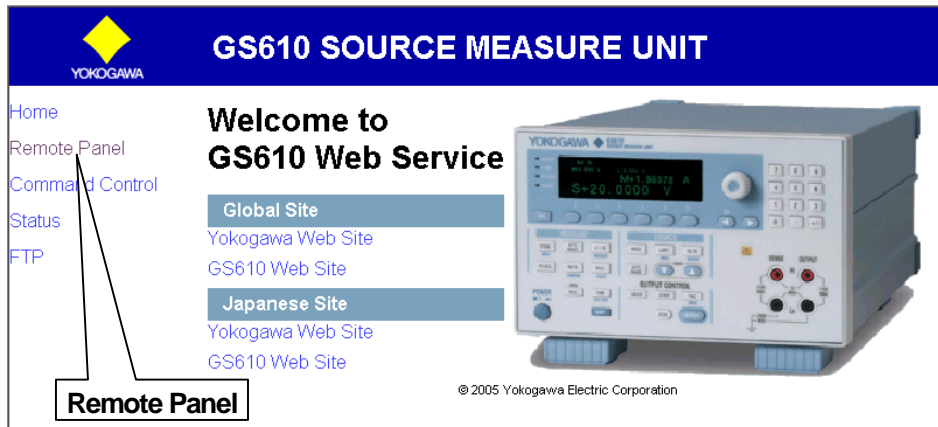
1. The GS610 ensures the current supply up to 110V/3.2A and four-quadrant operation by carrying out the constant current discharge ("Sink operation"). For example, if the GS610 is connected to the circuit instead of the motor, you can simulate such state that the circuit is loaded due to the sink operation.
2. The GS610 ensures Voltage generation (VS mode) and Current generation (IS mode).
3. Sweep pattern (Linear / Log / Arbitrary Sweep) is available in the operation mode. The Sweep pattern is able to change Voltage or Current which proceeds with time.



4. The file operation is possible by the USB storage function. The Sweep pattern program can be stored in the USB storage.
5. The GS610 ensures the remote control and the file transfer using the Web server function. The user cannot operate the GS610 directly as it is installed inside the tester. For this reason, the GS610 is designed to operate via the Web browser screen on the PC. Therefore, the Ethernet interface (/C10: Option) is always required.
6. After the output voltage was terminated, the GS610 can discharge the residual voltage to 0V if there is.

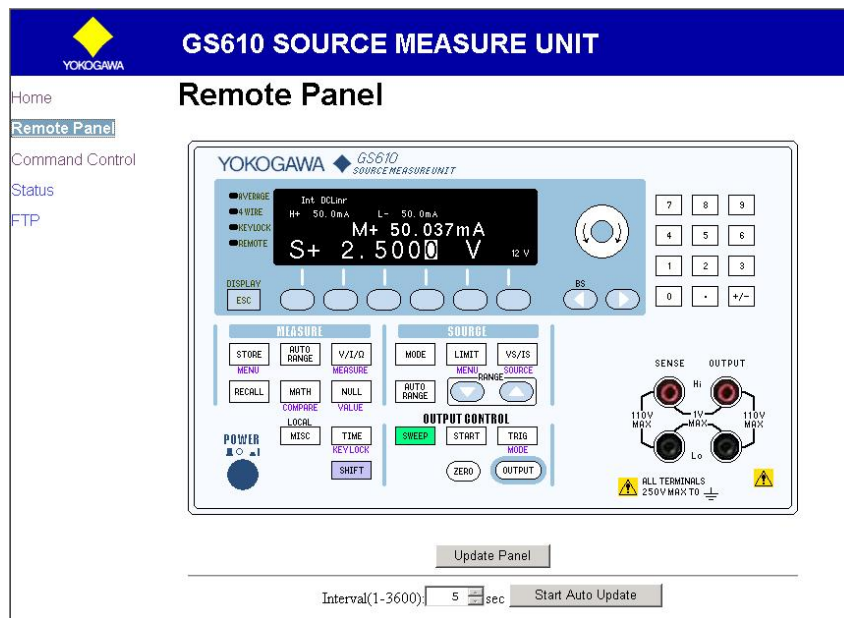
## Remote control of GS610

This section provides a simple explanation about the remote operation screen on the Web browser. See the GS610 User's manual for details. Below is the exclusive window on the Web browser.



Exclusive screen on the Web browser

Click [Remote Panel] on the screen, and the front panel of the GS610 is displayed. The GS610 is controllable indirectly by clicking the graphic panel with your mouse.



# Specifications

## Setting range and Measuring range of voltage/current

### Voltage generation (VS mode)

Voltage output range : -110V ~ +110

Range	Setting Range	Resolution	Current limit
200mV	±205.000mV	1uV	±3.2A
2V	±2.05000V	10uV	±3.2A
12V	±12.0000V	100uV	±3.2A
20V	±20.5000V	100uV	±2A
30V	±30.000V	1mV	±2A
60V	±60.000V	1mV	±1A
100V	±110.000V	1mV	±0.5A

Current measurement range : -3.2A ~ +3.2A

\* The current measurement is made using the most appropriate range according to the Current limit.

### Current generation (IS mode)

Current output range : -3.2A ~ +3.2A

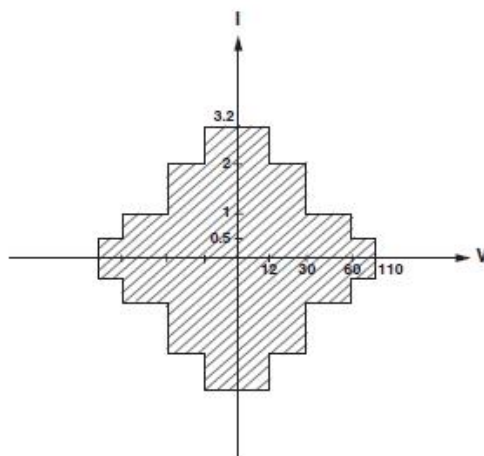
Range	Setting Range	Resolution	Voltage limit
20uA	±20.5000uA	100pA	±110V
200uA	±205.000uA	1nA	±110V
2mA	±2.05000mA	10nA	±110V
20mA	±20.5000mA	100nA	±110V
200mA	±20.5000mA	1uA	±110V
0.5A	±0.50000A	10uA	±110V
1A	±1.00000A	10uA	±60V
2A	±2.00000A	10uA	±30V
3A	±3.20000A	10uA	±12V

Voltage measurement range : -110V ~ +110V



\* The voltage measurement is made using the most appropriate range according to the Voltage limit.

The GS610 generates the voltage and the current within the shaded area of [Fig.1] in the next page. When the voltage is generated, the current is subjected to performance constraints. Meanwhile, when the current is generated, the voltage is subjected to performance constraints. For instance, when the current is generated, if you assign to "1.5A", the voltage is subjected to constraint of "30V" or less.


When the generation level of the voltage and the current is nearby the border of the generation range and is subjected to constraints, High limiter indicator (H) lights if it is plus but Low limiter indicator (L) lights if it is minus.



[Fig.1]

 <p><b>WARNING</b></p>	<p>&lt;Limiter&gt;</p> <p>Once a load exceeding the above range is connected to the GS610 (ex. a current source exceeding the Current limiter when generating voltage or a voltage source exceeding the Voltage limiter when generating current), abnormal load is detected so that the output will be terminated. Therefore, please never hook up any load exceeding the above-mentioned range to the GS610. This may cause possible damage to the GS610 and the AT-9411CE.</p>
 <p><b>HINT</b></p>	<p>The Limiter is used to restrict the generation range additionally. In addition, this helps preventing the APT-9411CE and the PCB from possible damages caused by the overcurrent and/or the overvoltage. When the voltage is generated, the Current limiter is selected automatically. And when the current is generated, the Voltage limiter is selected automatically. If the Limiter turns off, the generation range will be maximized regardless of the Limiter value.</p>

## Use with APT-9411CE

 <p><b>WARNING</b></p>	<p>The GS610 requires that the Programmable DC Power Supply Board Board (option) is installed in the APT-9411CE.</p>
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On the APT-9411CE integrated with the GS610, the following functions and the output control are feasible.

- ∅ Voltage generation (VS mode)
- ∅ Current generation (IS mode)
- ∅ Current measurement using the GS610 in VS mode (The Pass/Fail judge is made by the APT-9411CE)
- ∅ Voltage measurement using the GS610 in IS mode (The Pass/Fail judge is made by the APT-9411CE)
- ∅ Voltage generation or Current generation & measured by the APT-9411CE (The same application as the Programmable DC Power Supply option)
- ∅ The power supply to the flying probes and the bottom probes (It is not possible to output to the Tray side via the Coaxial Scanner option)
- ∅ Voltage generation or Current generation & concurrent use with the following options:
  - Programmable DC Power Supply Board (TVX-13)
  - Power Relay Board (TVX-47)
  - External power supplies (GPIB, Agilent)
  - Coaxial Scanner Board (TVX-12)
  - DDE Communication (BST command is acceptable)



Ø Call and execution of Setup data files

The user has to use the GS610 to generate the setup data files, instead of the APT-9411CE.

In order to operate following functions on the APT-9411CE, it is necessary to generate the setup data file in advance.

- Pulse output
- Linear / Log Sweep
- Program Sweep
- Other advanced settings

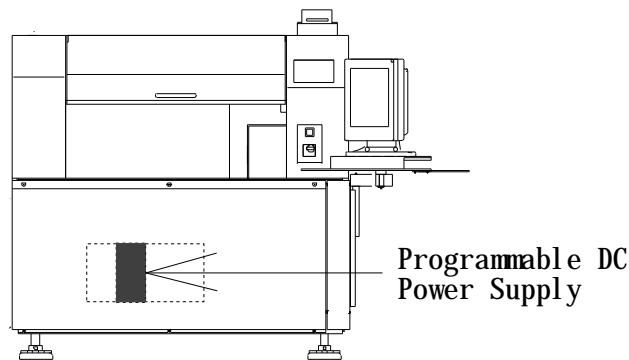
### Software

Install a driver for the GPIB Interface board.

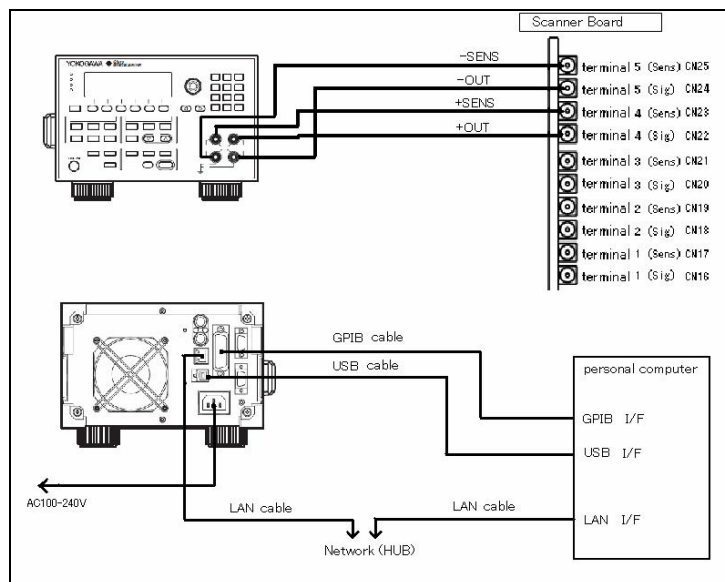
### Hardware

The GS610 is set up inside the APT-9411CE.

The GPIB Interface board is necessary to have the GPIB controlled. Use the GPIB Interface board (PCI type or USB type) made by National Instruments Company. In addition, it is necessary to install the Programmable DC Power Supply Board (TVX-13) in the APT-9411CE.



### Connection of the GS610 and the APT-9411CE



<LAN cable>

This cable is used for connecting to the network or installing a hub inside the APT-9411CE.

<GPIB cable>

This cable is used for connecting to the GPIB interface on the PC.

<USB cable>

This cable is used for connecting to the USB interface of the PC.

<Output cable>

This cable is used for connecting to Terminal 5 and Terminal 4 of the Scanner board (TAKAYA TVX-33) which is exclusive use for the GP610.

(Others)

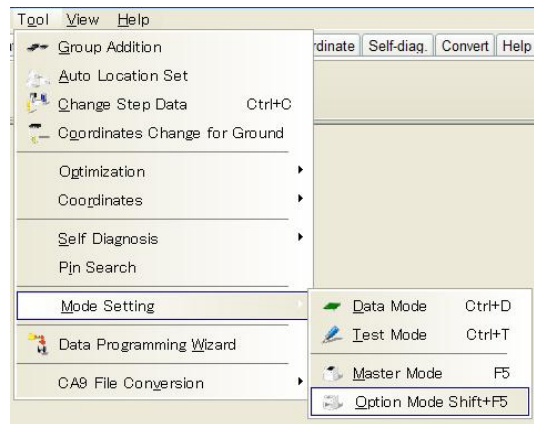
As Terminal 4 and Terminal 5 of the Scanner board are occupied when the GS610 is installed (refer to the cable connection in the previous page), the user is unable to specify these terminals in the following functions.

- Input/Output function of I/O step in Option mode
- BST steps (Loc. = "EXT ")
- IO/T and IO/M steps
- DDE steps

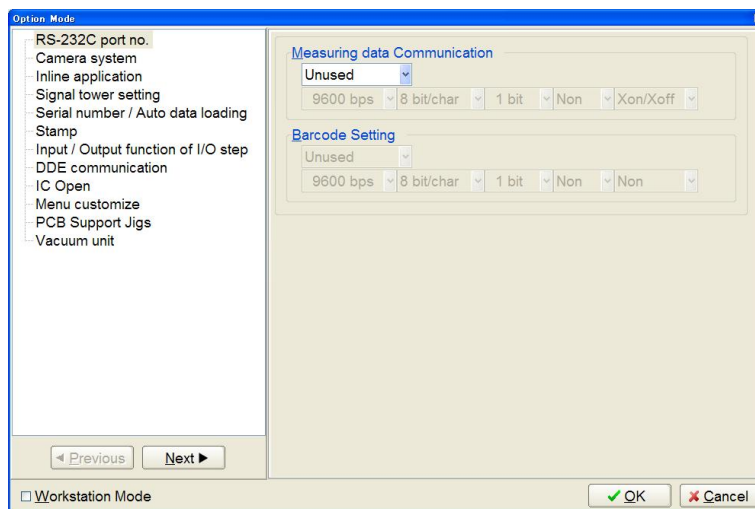
# Option mode setting

Go through the following steps to set up Option mode correctly at your first use of the GS610. This setting is preserved in Master mode file of your system directory.

- (1) Select **Tool > Mode Setting > Option Mode**, and Option mode screen appears. (Refer to Fig. 2. 3)

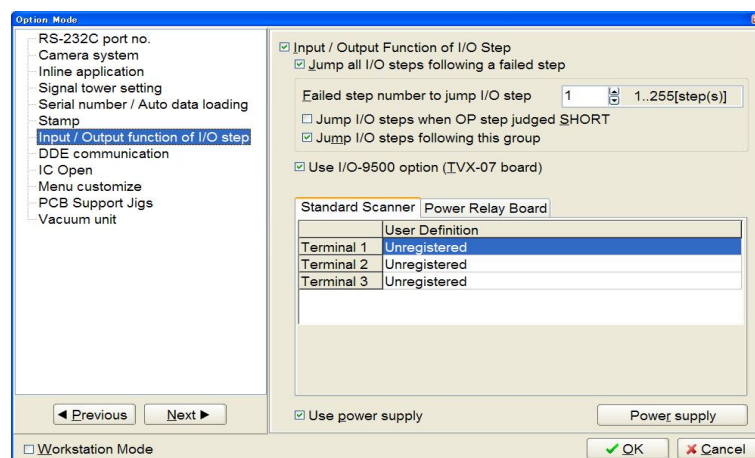


[Fig. 2]



[Fig. 3]

- (2) Open Input/Output function of I/O step screen and check the box "Input/Output Function of I/O Step". (Refer to Fig. 4)



[Fig. 4] Input / Output function of I/O step

**❑ Jump all I/O steps following a fail step**

Be sure to check the box "Jump all I/O steps following a fail step". When this box is checked, the I/O steps following the fail test step are handled based on the condition below.

When the box "Failed step number to jump I/O step" is specified;

If fail test steps reaches your specified numbers, any I/O step following them is not executed.

When the box "Jump I/O steps when OP step judged SHORT" is checked;

If test step which Function (F) is substituted by "OP" is judged fail, any I/O step following the step is not executed. Meanwhile, when this box is not checked, the I/O steps following fail test step, which Function (F) is substituted by "OP" are executed.

When the box "Jump I/O steps following this group" is checked;

All I/O steps following fail test steps are not executed. Meanwhile, when this box is not checked, the I/O steps in the same test group are not executed. (All other I/O steps included in the following test group are tested)

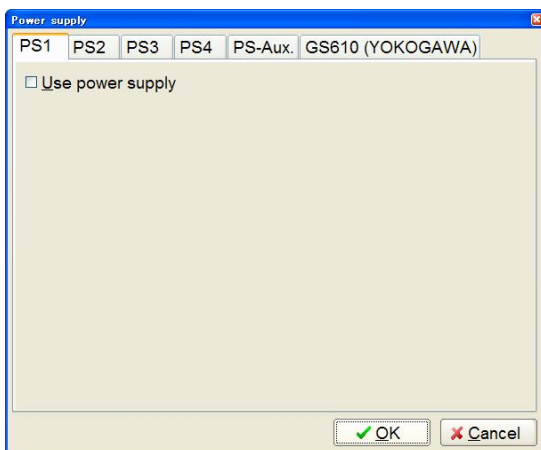
**❑ Use I/O-9500 option (TVX-07)**

Be sure to check the box "Use I/O-9500 option (TVX-07)" if the I/O-9500 board is installed in the tester to use "IO/O" and "IO/I" commands.

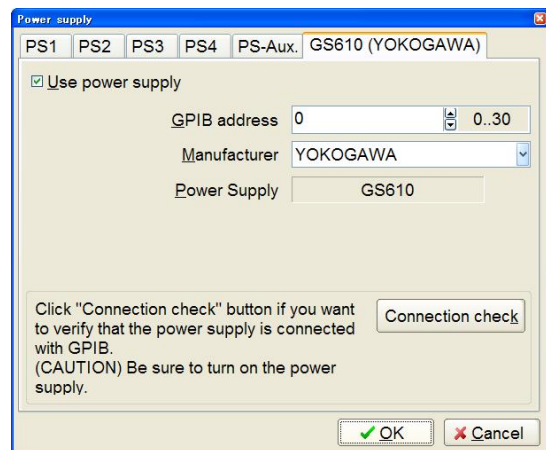
**❑ Use power supply**

Be sure to check the box "Use power supply", as the GS610 is installed in the tester. Then click the Power supply button to configure the GS610.

After clicked the Power supply button, it displays Power supply screen ([Fig. 5]). Then click "GS610 (YOKOGAWA)" tab and check the box "Use power supply" on Fig.6.



[Fig. 5]



[Fig.6]

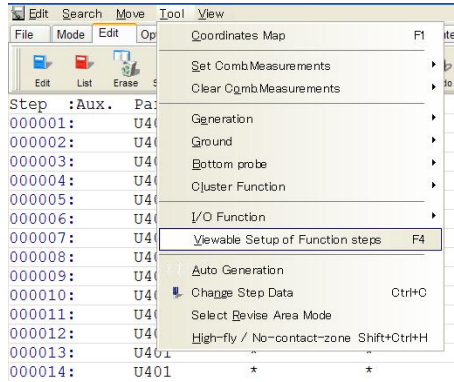
GPIB Address	This box is used for assigning GPIB address of the power supply to be used. Refer to the GS610 User's manual for the GPIB address.
Manufacturer	This box is used for assigning the manufacturer name of the power supply to be used. "YOKOGAWA" is set here automatically.
Power-Supply	This box is used for assigning the model number of the power supply unit to be used. "GS610" is set here automatically.

After every setting was finished, click [Connection check] button do confirm the connection. If the connection is correct, click [✓ OK ] button to move back to Option mode screen.

# Function test

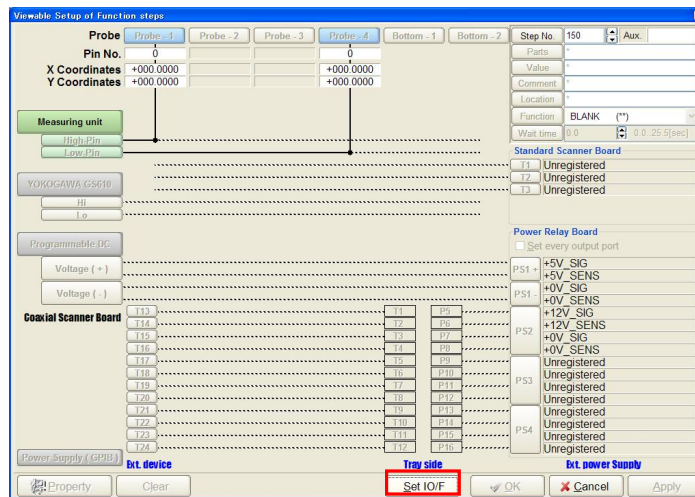
## Creation of Function step

The Viewable Setup of Function steps function (List menu > Tool) assists in programming function steps.



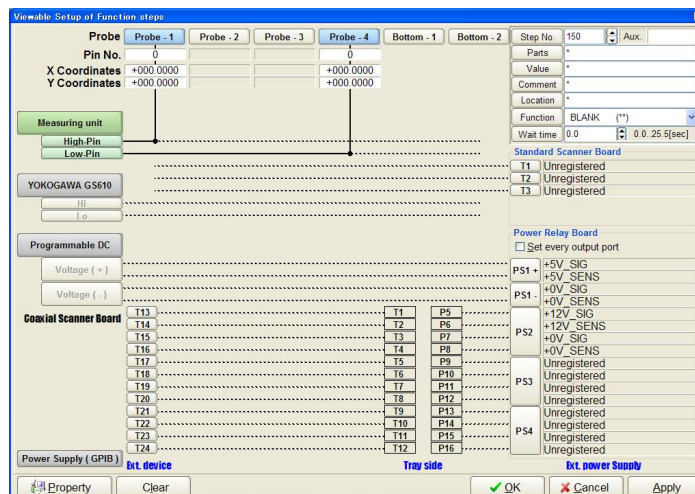
[Fig. 7] List menu > Tool

Fig. 8 shows the Viewable Setup of Function steps screen.



[Fig. 8] Viewable Setup of Function steps

Clicking [Set IO/F] button releases the gray -out menu to be user-settable.

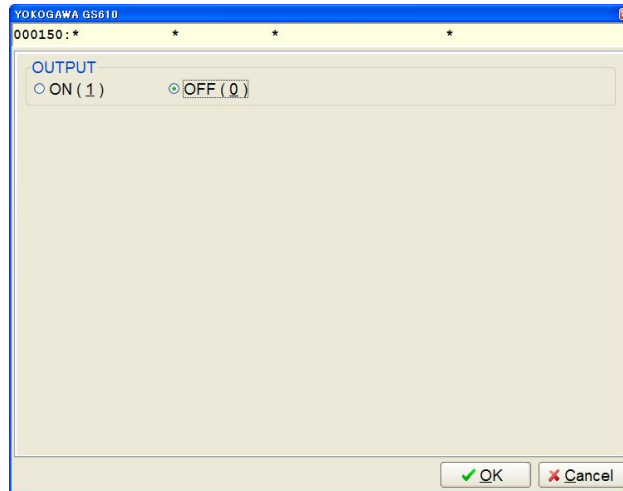


[Fig. 9] Viewable Setup of Function steps

## Function settings of GS610

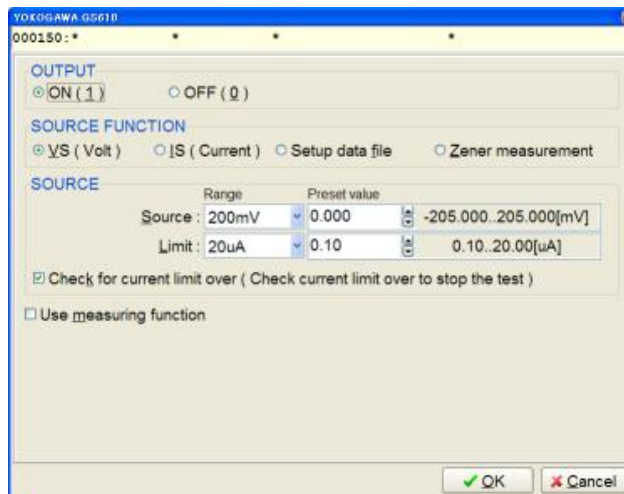
Hereinafter, the setting method of the GS610 on the Viewable Setup of Function steps screen is explained.

Clicking [YOKOGAWA GS610] button on the Viewable Setup of Function steps screen pops up Output setting screen (Fig. 10) on the display. Check the box "ON" if you want to have the GS610 configured to output the power. Meanwhile, check the box "OFF" if you want to have the GS610 configured to terminate the power output.



[Fig. 10]

If the box "ON" is checked, the GS610 setting screen (Fig. 11) appears on the display.

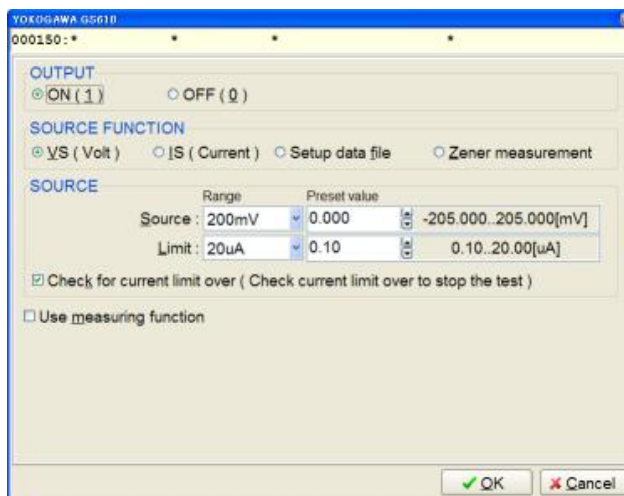


[Fig. 11]

Select any one of "VS (Volt)", "IS (Current)", "Setup data file" and "Zener measurement" available in "SOURCE FUNCTION" column as your preferable test. The contents of "SOURCE" changes depending your select in the SOURCE FUNCTION column.

## VS (Volt)

This enables to output the voltage in the range of “-110V - +110V ”.



[Fig. 12] VS (Volt)

### <Source>

The box “Range” is used for selecting the output range from 200mV, 2V, 12V, 20V, 30V, 60V and 110V. In this case, be sure to select the range which is not only bigger than your preferable output but also is the closest to. (ex. 1V - --> 2V) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable output directly in “Preset value” column. The unit of the Preset value is the same as displayed in the Range column.

### <Limit>

The box “Range” is used for selecting the current limit from 20uA, 200uA, 2mA, 20mA, 200mA, and 3A. In this case, be sure to select the range which is not only bigger than your preferable current limit but also is the closest to. (ex. 100uA - --> 200uA) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable current limit directly in “Preset value” column. The unit of the Preset value is the same as displayed in the Range column.

(Remark) The upper value of Limit may vary significantly according to the Source value above.

Source Range	Lower Limit	Upper Limit
200mV	-205.000 mV	205.000 mV
2V	-2.05000 V	2.0500 V
12V	-12.0000 V	12.0000 V
20V	-20.5000 V	20.5000 V
30V	-30.000 V	30.000 V
60V	-60.000 V	60.000 V
110V	-110.000 V	110.000 V

[Table 1] Source range and its allowance

Limit Range	Lower Limit	Upper Limit
20uA	0.10 uA	20.00 uA
200uA	20.1 uA	200.0 uA
2mA	0.201 mA	2.000 mA
20mA	2.01 mA	20.00 mA
200mA	20.1 mA	200.0 mA
3A	0.201 A	3.2 A

[Table 2] Limit range and its allowance

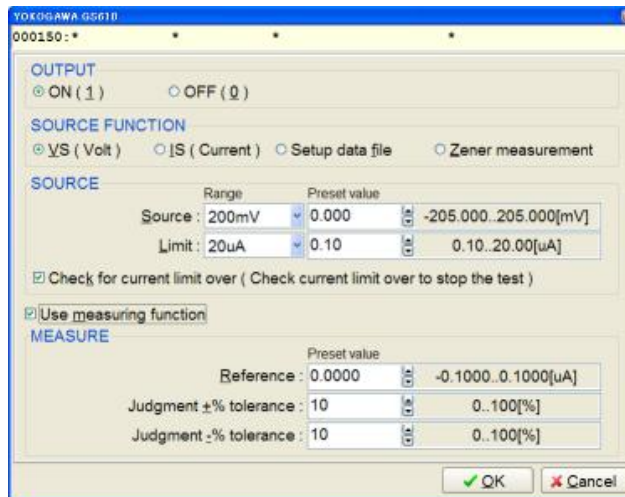
**Check for current limit over (Check current limit over to stop the test)**

When the box is checked, the test is suspended if the current output exceeds the Preset value. (The box is checked as default) On the contrary, when the box is unchecked, the test continues even if the current output exceeds the Preset value.

**Use measuring function**

When the box is checked, the screen changes as shown in Fig. 13 below. (Under this condition, the GS610 measures the current while applying the voltage and the measured result is transferred to the APT-9411CE to be judged either Pass or Fail. The box isn't checked as default.)

Error message (Fig. 14) appears when the Measuring unit is selected or when the Programmable DC Power Supply Board for the current measurement and/or DDE Communication is used.



[Fig. 13] MEASURE



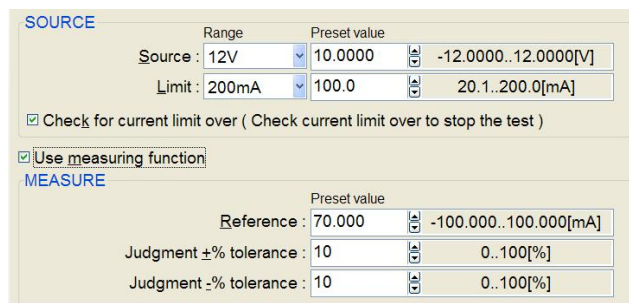
[Fig. 14] Error message

**<Reference>**

The box "Reference" has to be entered by the current value to be the reference value.

The Reference value that you can enter depends on the Present value of the Limit in the SOURCE column and is displayed in the right hand column.

For example, as shown in [Fig. 15], when the Present value of the Limit in the SOURCE column is set to "100mA", the Reference in the MEASURE column is determined to "-100.000mA ~ +100.000mA" automatically.





[Fig. 15] MEASURE (Reference)



<Judgment +% tolerance> <Judgment -% tolerance>

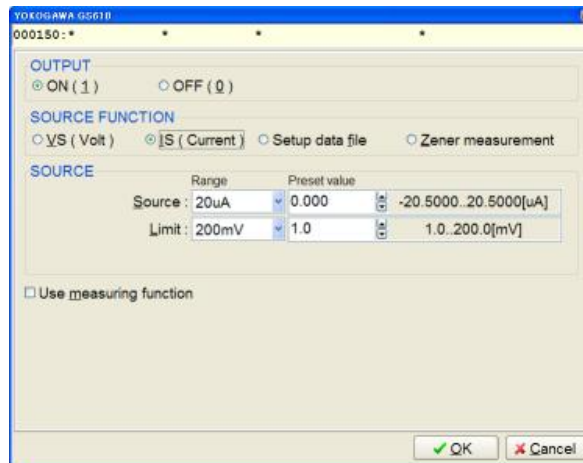
These boxes have to be entered by the threshold of Pass / Fail judgment, which is based on the reference value.

	<p>When the box "Check for current limit over" is checked, the test is suspended if the measured value exceeds the Preset value of the Limit, whether or not it's within the tolerance.</p> <p>In addition, the Preset value in the MEASURE column has to be determined in consideration of the relation between "Present value" and "Check for current limit over".</p>
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	<p>When the box "Use measuring function" is checked, the Function configurable on Step data is limited to "****" "JP" "D" "E" "F" "GJ".</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>BLANK</td><td>(**)</td></tr> <tr><td>JUMP</td><td>(JP)</td></tr> <tr><td>&gt; NG &lt;</td><td>(D)</td></tr> <tr><td>NG &gt; Ref.</td><td>(E)</td></tr> <tr><td>NG &lt; Ref.</td><td>(F)</td></tr> <tr><td>Group jump</td><td>(GJ)</td></tr> </table> <p style="text-align: center;">[Fig. 16]</p> <p>In addition, the Measure Mode of Step data should be substituted by "GS610".</p>	BLANK	(**)	JUMP	(JP)	> NG <	(D)	NG > Ref.	(E)	NG < Ref.	(F)	Group jump	(GJ)
BLANK	(**)												
JUMP	(JP)												
> NG <	(D)												
NG > Ref.	(E)												
NG < Ref.	(F)												
Group jump	(GJ)												

**IS (Current)**

This enables to output the current in the range of "-3.2A - +3.2A".



[Fig. 17] IS (Current)

**<Source>**

The box "Range" is used for selecting the output range from 20uA, 200uA, 2mA, 20mA, 200mA 0.5A, 1A, 2A and 3A. In this case, be sure to select the range which is not only bigger than your preferable output but also is the closest to. (ex. 1mA - --> 2mA) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable output directly in "Preset value" column. The unit of the Preset value is the same as displayed in the Range column.

**<Limit>**

The box "Range" is used for selecting the voltage limit from 200mV, 2V, 20V and 110V. In this case, be sure to select the range which is not only bigger than your preferable voltage limit but also is the closest to. (ex. 1V - --> 2V) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable voltage limit directly in "Preset value" column. The unit of the Preset value is the same as displayed in the Range column.

(Remark) The upper value of Limit may vary significantly according to the Source value above.

Source Range	Lower Limit	Upper Limit
20 $\mu$ A	-205.000	205.000
200 $\mu$ A	-205.000	205.000
2mA	-2.05000	2.05000
20mA	-20.5000	20.5000
200mA	-205.000	205.000
0.5A	-0.50000	0.50000
1A	-1.00000	1.00000
2A	-2.00000	2.00000
3A	-3.20000	3.20000

[Table 3] Source range and its allowance

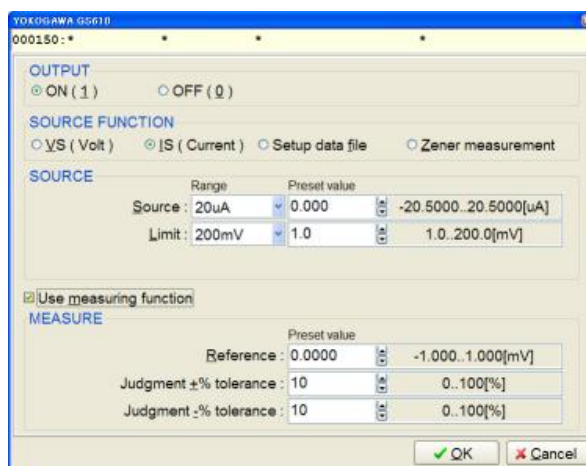
Limit Range	Lower Limit	Upper Limit
200mV	1.0	200.0
2V	0.201	2.000
20V	2.01	20.00
110V	2.01	110.0

[Table 4] Limit range and its allowance

#### Use masuring function

When the box is checked, the screen changes as shown in Fig. 18 below. (Under this condition, the GS610 measures the voltage while applying the current and the measured result is transferred to the APT-9411CE to be judged either Pass or Fail.)

Error message (Fig. 19) appears when the Measuring unit is selected or when the Programmable DC Power Supply Board for the current measurement and/or DDE Communication is used.



[Fig. 18] MEASURE



[Fig. 19] Error message

## <Reference>

The box "Reference" has to be entered by the voltage value to be the reference value.

The Reference value that you can enter depends on the Present value of the Limit in the SOURCE column and is displayed in the right hand column.

For example, as shown in [Fig. 20], when the Present value of the Limit in the SOURCE column is set to "10V", the Reference in the MEASURE column is determined to "-10.0000A ~ +10.0000V" automatically.

SOURCE		Range	Preset value
Source :	1A	0.80000	-1.00000..1.00000[A]
Limit :	20V	10.00	2.01..20.00[V]

Use measuring function

MEASURE		Preset value
Reference :	0.0000	-10.0000..10.0000[V]
Judgment ±% tolerance :	10	0..100[%]
Judgment -% tolerance :	10	0..100[%]

[Fig. 20] MEASURE (Reference)

## <Judgment +% tolerance> <Judgment -% tolerance>

These boxes have to be entered by the threshold of Pass / Fail judgment, which is based on the reference value.

If the Judgment +% tolerance and the Judgment -% tolerance was specified by the value that exceeds the Preset value of the Limit in the SOURCE column, the tolerance out of the Limit is ignored, because the GS610 cannot output over than the preset value of the Limit. So, be sure to specify the Judgment +% tolerance and the Judgment -% tolerance in consideration of the Present value of the Limit.

For example ; Present value of the Limit::1.8V

Reference: 1.8V

Judgment +% tolerance: +50% (Tolerance: 2.7V)

Judgment -% tolerance: -10% (Tolerance: 1.62V)



SOURCE		Range	Preset value
Source :	1A	0.80000	-1.00000..1.00000[A]
Limit :	2V	1.800	0.201..2.000[V]

Use measuring function

MEASURE		Preset value
Reference :	1.80000	-1.80000..1.80000[V]
Judgment ±% tolerance :	50	0..100[%]
Judgment -% tolerance :	10	0..100[%]

[Fig. 21]

In this case, the range of Tolerance over 1.8V is ignored, because output limit of GS610 is 1.8V.



When the box "Use measuring function" is checked, the Function configurable on Step data is limited to "\*\*\*\*" "JP" "D" "E" "F" "GJ".

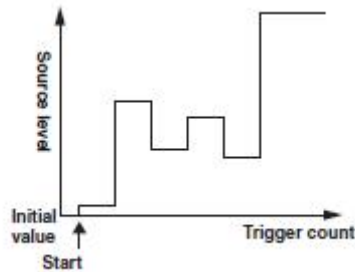
BLANK	(**)
JUMP	(JP)
> NG <	(D)
NG > Ref.	(E)
NG < Ref.	(F)
Group jump	(GJ)

[Fig. 22]

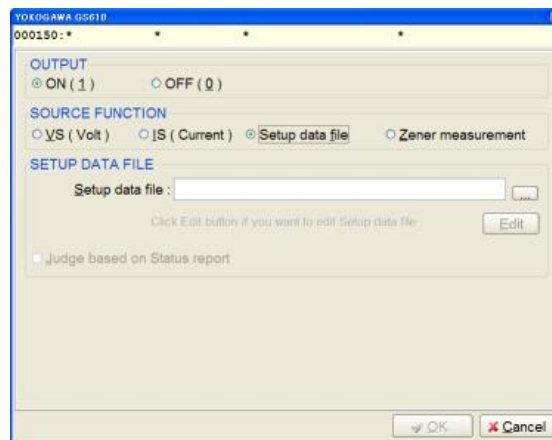
In addition, the Measure Mode of Step data should be substituted by "GS610".

## Setup data file

This enables to assign the setup data file stored in the GS610. The setup data file contains the source mode setting, the voltage/current settings, stc and is linked to any of Program sweep files. As shown below, the Sweep pattern information is a command that can change the output with time.



The setup data files are stored in the SETUP folder of the GS610ROM (USB storage) for the GS610. (The file name is "Setup1 - Setup4" and an extension is ".txt". The file can be renamed later if necessary.) The Program sweep files are stored in the PROGRAM folder of the GS610ROM (USB storage) for the GS610. (Extension ".csv")

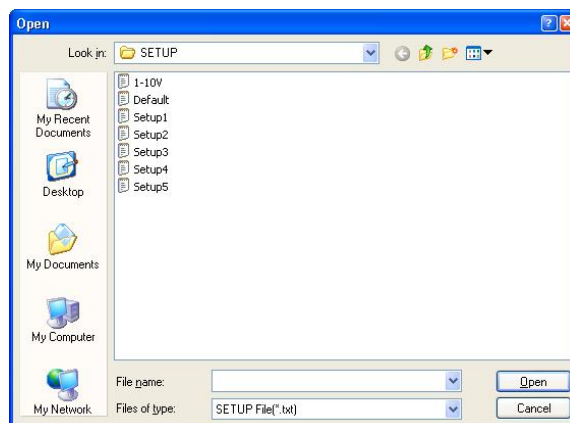


[Fig. 23] Setup data file

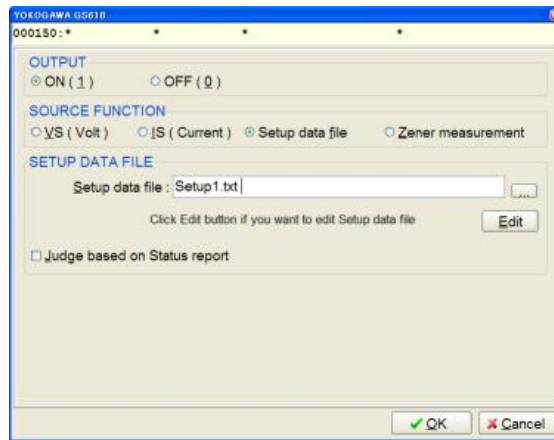
### <Setup data file>

Check the box "Setup data file" if you want to assign the Setup data file stored in the GS610.

Clicking the Reference button at the right hand of "Setup data file" lists the txt files stored in the SETUP folder of the GS610ROM (Refer to Fig. 24). After the file was specified, the display turns back to the Setup data file screen.



[Fig. 24] File list



[Fig. 25]

The error message below appears when the GS610 is not connected to the PC of the APT-9411CE or when the GS610 isn't tuned on yet.



[Fig. 26] Error message

### <Edit>

Clicking the Edit button opens "Notepad.exe" to display the setup data file. Here the user can configure the setup data file if necessary.

### Judge based on Status report

When the box is checked, the GS610 can measure to output Pass/Fail judgment as the test result.

The test result is stored in the Measurement event register of the GS610.

The APT-9411CE confirms the Pass/Fail judgment according to the following contents of the Measurement event register.

- It judges "LOW-NG" when the 0 bit of the Measurement event register is "1".
- It judges "UP-NG" when the 1 bit of the Measurement event register is "1".
- It judges "NG" when both the 0 bit and the 1 bit of the Measurement event register are "1".
- It judges "PASS" when both the 0 bit and the 1 bit of the Measurement event register are "0".

However, the box "Judge based on Status report" isn't displayed, in case of using [Measuring unit] and [Programmable DC] for current measurement and performing [DDE Communication].

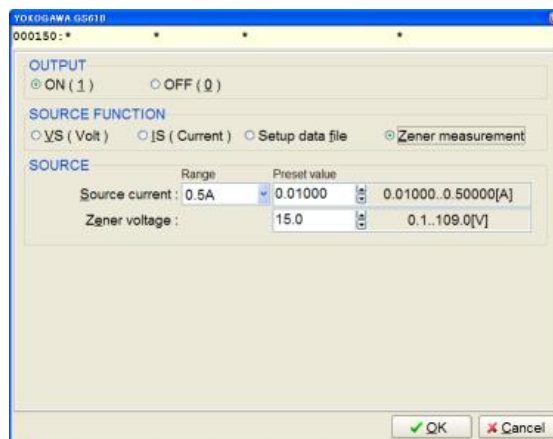
Unless the box is checked, it executes the Setup data file only.

	<p>When the box "Judge based on Status report" is checked, the Function of the step data that the user can use is only "*" and "JP".</p> <p>The Measure mode of the step data is automatically substituted by "GS610".</p>
--	--

## Zener measurement

When the box “Zener measurement” is checked, the GS610 applies the signal to measure the Zener diodes. The Zener voltage is measurable for "0.1V - 109.0V" and the Pass/Fail judgment is made by the APT-9411CE.

Error message (Fig. 28) appears when the Measuring unit is selected or when the Programmable DC Power Supply Board for the current measurement and/or DDE Communication is used.



[Fig. 27] Zener measurement



[Fig. 28] Error message

### < Source current >

The box “Range” is used for selecting the output range from 20mA, 200mA and 0.5A. In this case, be sure to select the range which is not only bigger than your preferable output but also is the closest to. (ex. 10mA--> 20mA) When the Range is determined, the right hand column indicates the allowance of the Range. The setting range is "0.1mA - 500mA". (Programmable by 0.1mA)

In reference to this display, you can enter your preferable Zener voltage directly in “Preset value” column.

$$\text{Limit voltage} = \text{Preset value} + (\text{Preset value} * \text{Judgment tolerance} + \%) + 1\text{V}$$

(For example) Let me suppose that Preset value is 10V and Judgment tolerance is +10%;

$$10 + (10 * 0.1) + 1 = 12\text{V}$$

Source range	Lower limit	Upper limit
20mA	0.1000mA	20.5000mA
200mA	1.000mA	205.000mA
0.5A	0.01000A	0.50000A

[Table 5]



For the Zener measurement, the Value field of the step data has to be substituted by the Zener voltage.



Once the Value filed was changed on the list menu or the Step date review, the Preset value of "Zener voltage" is changed accordingly. In addition, make sure to add "V" after the voltage value when the Value filed is changed on the list menu or the Step date review.

The Function on the step data is configurable to "\*\*\*" "JP" "HO" "D" "E" "F" "GJ".

BLANK	(**)
JUMP	(JP)
> NG <	(D)
NG > Ref.	(E)
NG < Ref.	(F)
Group jump	(G.J)

The Measure mode on the step data is automatically substituted by "PS-ZD".

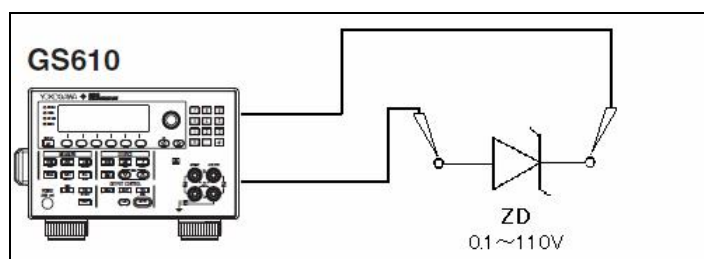
# Simple function test using GS610

## Measurement of Zener diode

The APT-9411CE enables to measure the Zener diodes up to 40V as standard and its impressed current is max. 50mA.

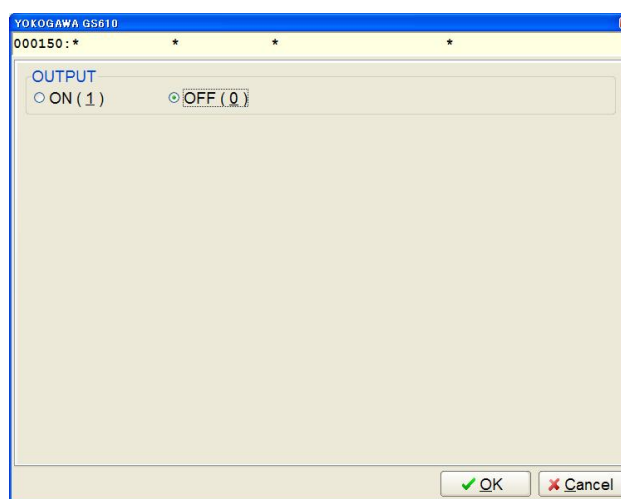
When the APT-9411CE is integrated with the GS610, the measurable Zener voltage is "0.1V - 109.0V". The impressed current is "0.1mA - 500mA" (Programmable by 0.1mA). The Pass/Fail judgment is made by the APT-9411CE.

After the Zener measurement step was executed, the GS610 stops outputting the voltage.



### 《Operation process》

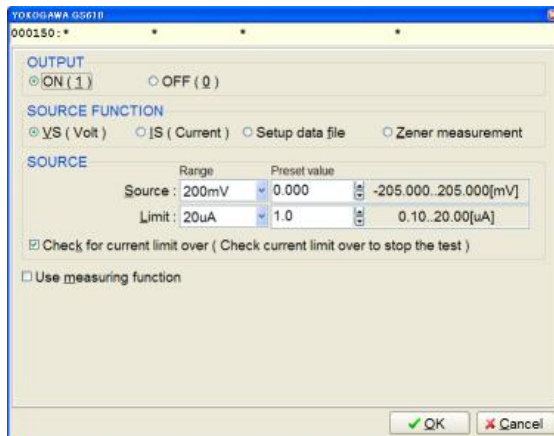
- (1) Open the Viewable Setup of function steps screen.
- (2) Clicking the Set IO/F button releases the gray-out menu to appear.
- (3) Clicking the Clear button releases the default connection between the Measuring unit (High-Pin / Low-Pin) and Probes. (The Zener measurement isn't available when the Measuring unit is connected.)
- (4) Clicking the YOKOGAWA GS610 button on the screen gets the GS610 setting screen (Fig. 29) to come out.



[Fig. 29] GS610 setting screen

- (5) Check the box "ON", and the GS610 setting screen changes to Fig. 30.



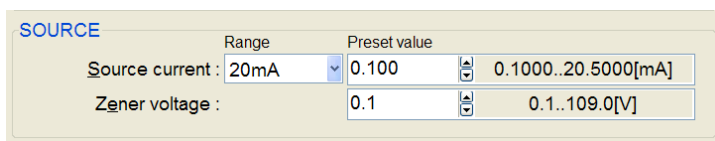


[Fig. 30] GS610 setting screen

**<SOURCE FUNCTION>**

Check the box “Zener measurement”.

**<SOURCE>**



[Fig. 31]

Set "Range" and "Preset value" of “Source current”.

(The current value has to be set based on careful study of the parts and the circuit conditions.)

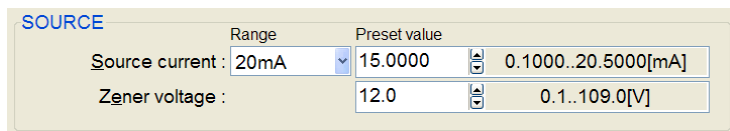
Set “Zener voltage”.

(Example) Let 's say, Zener voltage is 12V and Current: is 15mA;

Range of Source current: “20mA”

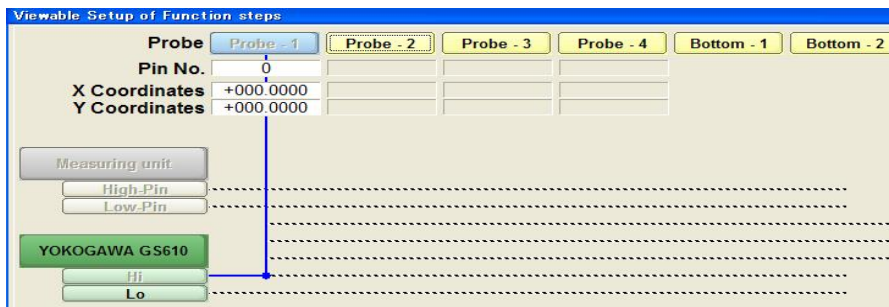
Preset value: “15 mA”

Zener voltage: “12V”



[Fig. 32]

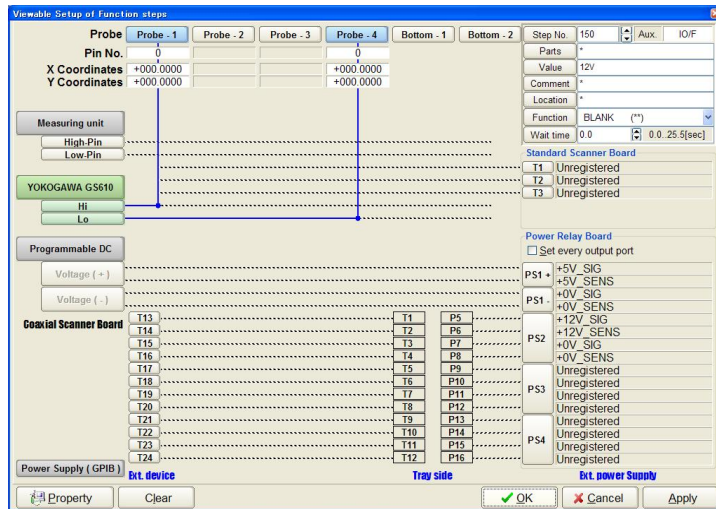
- (6) After everything was set correctly, click the OK button to put the display back to the Viewable Setup of Function steps screen.
- (7) [Lo] button under [YOKOGAWA GS610] is blinking and [Probe-1] ~ [Bottom-2] is blinking in yellow. Let's see that the destination of [Hi] is Probe-1. In this case, use the mouse to click the Probe-1 button, and [Hi] is connected to Probe-1 automatically with a blue line.



[Fig. 33]

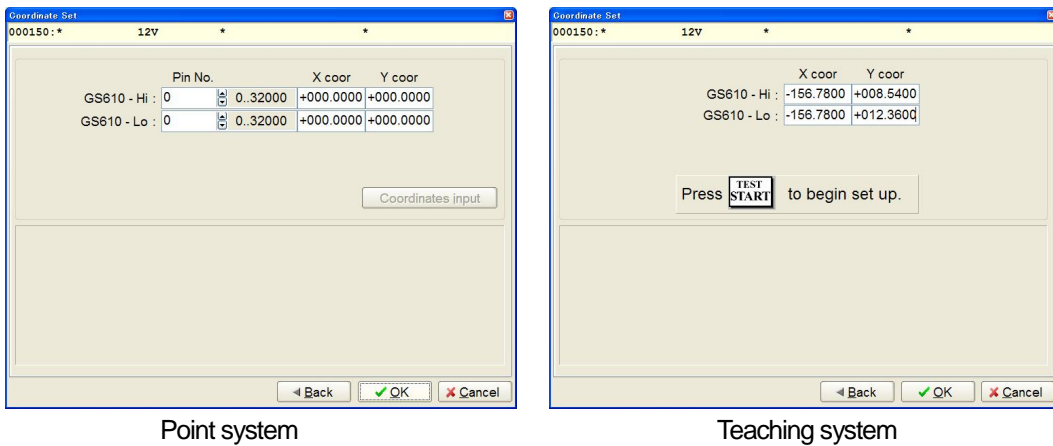
- (8) Now [Lo] button under [YOKOGAWA GS610] starts blinking.

Let's see that the destination of [Lo] is Probe-4. In this case, use the mouse to click the Probe-4 button, and [Lo] is connected to Probe-4 automatically with a blue line.



[Fig. 34]

- (9) Clicking the Property button gets the GS610 setting screen (Fig.30) to come out.
- (10) Click the Next button on the screen.
- When the Coordinates management (Data mode > Coordinates management) is set to Point system, the display shows the left screen in Fig. 35.
  - When the Coordinates management (Data mode > Coordinates management) is set to Teaching system, the display shows the right screen in Fig. 35.

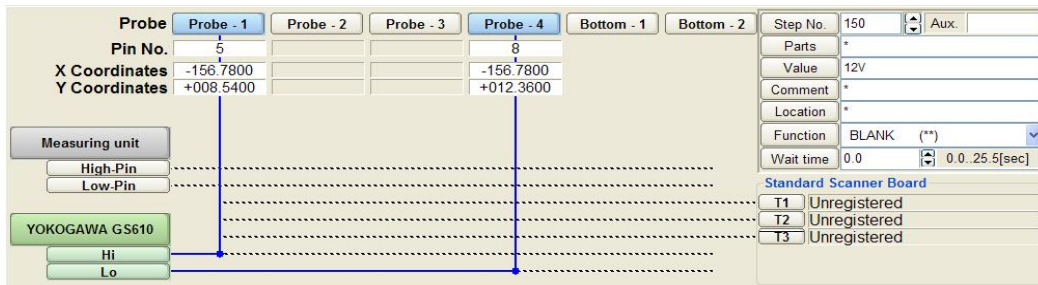


Point system

Teaching system

[Fig. 35] Coordinate set screen

- (11) Click the OK button to put the display back to the Viewable Setup of Function steps screen. Now the step information is displayed at the upper right corner of the Viewable Setup of Function steps screen.
- Enter the parts name in the box "Parts".
  - Enter the wait time in the box "Wait time". (In this case, the measurement gets started after the specified wait time)
  - Enter any comment in the box "Comment" if necessary.



[Fig. 36]

(12) Click the OK button to put the display back to the step list screen.

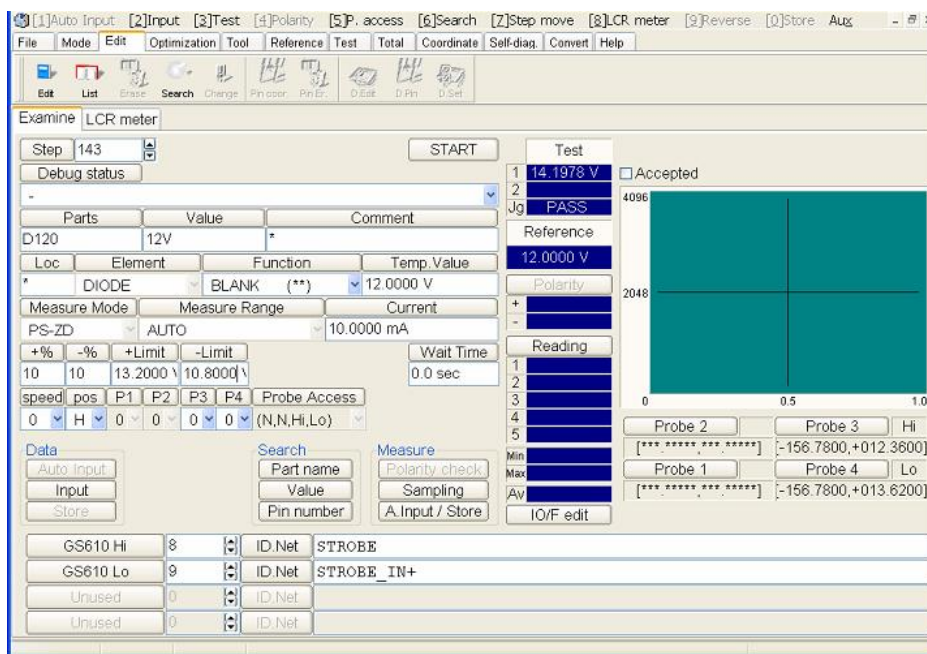
Step 000143 on Fig. 37 is the Zener measurement step where Mode is substituted by PS-DZ automatically.

Step	Aux.	Parts	Value	H-pin	L-pin	Comment	Loc	EL	F.	+%	-%
000140:		U401	P251-2	1155	243	11099	*	R	OP	10	10
000141:		U401	P252-2	243	649	11099	*	R	OP	10	10
000142:		U401	P253-2	649	1100	11099	*	R	OP	10	10
000143:IO/F		D120	12V	8	9	*	*	D	**	10	10
000144:		*	*	*	*	*	*	*	**	10	10

[Fig. 37] Zener measurement step (Step 000143)

(13) Input the reference value on the Step data review screen.

<Reference Input>



[Fig. 38] Step data review screen

Click the Input button at “Data” column on the Step data review screen to input the reference value.

The following functions are no longer operated on the Step data review screen.

< Menu bar >

- [1] Auto Input
- [4] Polarity
- [9] Reverse

- [Aux] "F1" Graphic Guard Search
- "D" Look Value
- "I" Image Point Set
- "K" Combination clear
- "N" Copy measuring condition
- "Q" Pin double search
- "R" +%,-% Range
- "W" Discharge
- "Ctrl+I" Scene Recycle

< Button >

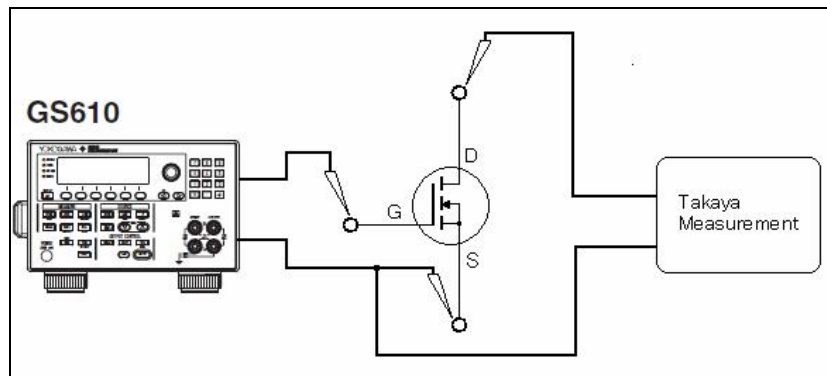
- Data > "Auto Input"
- Guard > "Input", "Delete", "Search"
- Measure > "Polarity check"

### Measurement of FET / Transistor

The APT-9411CE can apply up to 5.0V to conduct ON test of the FETs and the Transistors as standard. Even when the Programmable DC Power Supply Board (option) is integrated, the ON test covers limited components only. In addition, the FET types that can be measurable are "DT-NPN" and "FET-EN" only, not others.

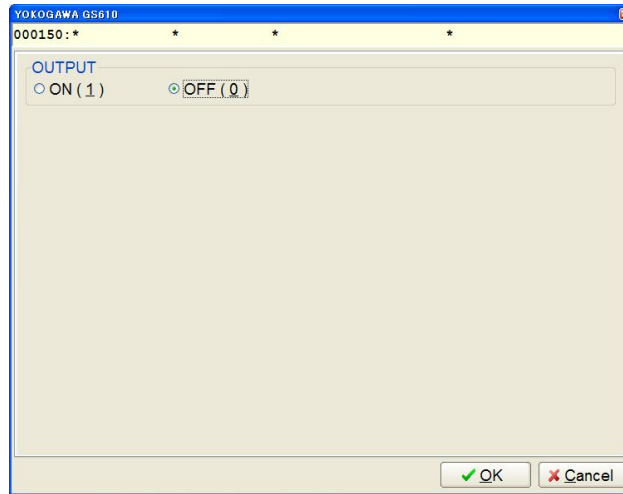
However, the GS610 ensures the ON test exceeding 5.0V. The ON test is applicable to all types of the Transistors and the FETs. The Triacs and the Thyristors are also possible.

For the FETs measurement, the measuring current (IS mode) from the GS610 is applied between "Gate" and "Source", the constant current from the APT-9411CE is applied to "Drain" and "Source".



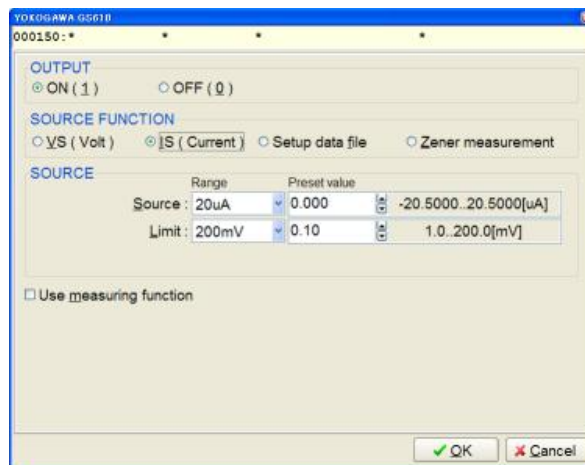
### **《Operation process》**

- (1) Open the Viewable Setup of Function steps screen.
- (2) Clicking the Set IO/F button releases the gray-out menu to appear.
- (3) Clicking the YOKOGAWA GS610 button on the screen gets the GS610 setting screen (Fig. 39) to come out.



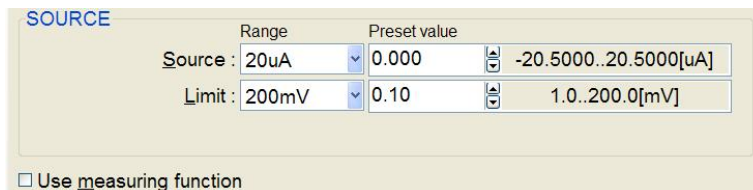
[Fig. 39] GS610 setting screen

- (4) Check the box "ON", and the GS610 setting screen changes to Fig. 40.  
Check the box "IS (Current)" at the SOURCE column.



[Fig. 40] GS610 setting screen

- (5) Specify impressed current value and limit voltage at the SOURCE column.  
(These values have to be set based on careful study of the parts and the circuit conditions.)



[Fig. 41]

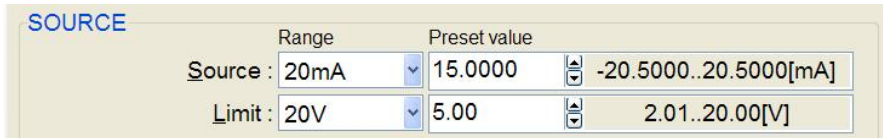
The box "Range" is used for selecting the output range from 20uA, 200uA, 2mA, 20mA, 200mA 0.5A, 1A, 2A and 3A. In this case, be sure to select the range which is not only bigger than your preferable output but also is the closest to. (ex. 1mA - --> 2mA) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable output directly in "Preset value" column. The unit of the Preset value is the same as displayed in the Range column.

The box "Range" is used for selecting the voltage limit from 200mV, 2V, 20V and 110V. In this case, be sure to select the range which is not only bigger than your preferable voltage limit but also is the closest to. (ex. 1V - --> 2V) When the Range is determined, the right hand column indicates the allowance of

the Range. In reference to this display, you can enter your preferable voltage limit directly in “Preset value” column. The unit of the Preset value is the same as displayed in the Range column.  
 (Remark) The upper value of Limit may vary significantly according to the Source value above.

For instance, let’s say, the current is 15mA and the limit voltage is 5.0V;

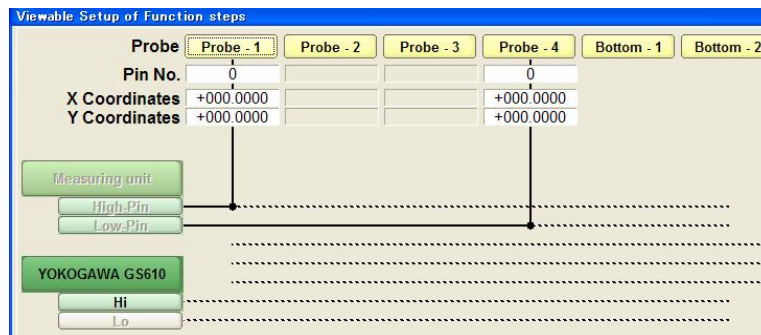
- Range of Source: “20mA”
- Preset value of Source: “15 mA”
- Range of Limit: “20V”
- Preset value of Limit: “5.0V”



[Fig. 42]

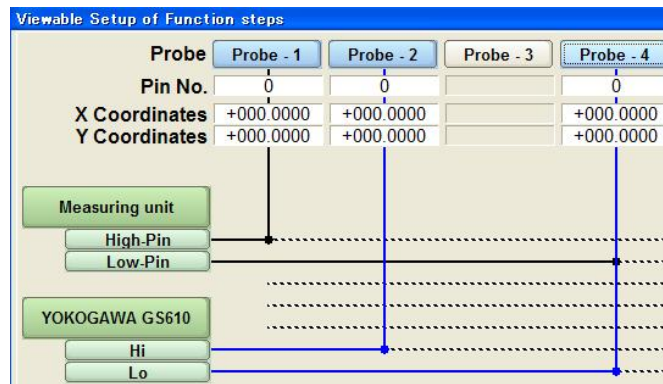
Don’t check the box “Use measuring function”.

- (6) After everything was set correctly, click the OK button to put the display back to the Viewable Setup of Function steps screen where [Hi] button under [YOKOGAWA GS610] and [Probe-1] ~ [Bottom-2] are blinking. Let’s see that the destination of [Hi] is Probe-2 (because Probe-1, 4 are already occupied for the Measuring unit).



[Fig. 43]

- (7) Use the mouse to click the Probe-2 button, and [Hi] is connected to Probe-2 automatically with a blue line.
- (8) [Lo] button under [YOKOGAWA GS610] is blinking. Use the mouse to click the Probe-4 button, which is already connected to Low-pin of the Measuring unit. Then [Lo] is connected to Probe-4 automatically with a blue line.



[Fig. 44]

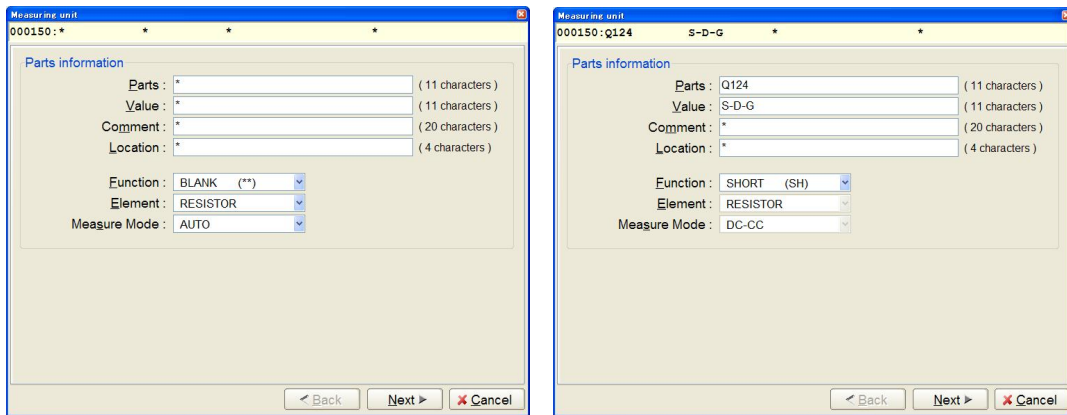
- (9) Click the Property button, and the left screen in Fig. 45 appears on the display.  
Type the parts name in "Parts" field from the keyboard. (Enter information in "Value", "Comment" and "Location" field if necessary.)

When "Function", "Element, and "Measure Mode" are already known, you should set them because the reference value input will be smoother.

You are also recommended to do the resistance measurement because the impedance between "Drain" - "Source" is low when FET turns on.

Left side screen in Fig. 45 is a setting example.

"Function : SHORT(SH)"  
"Element : RESISTOR"  
"Measure Mode : DC-CC"



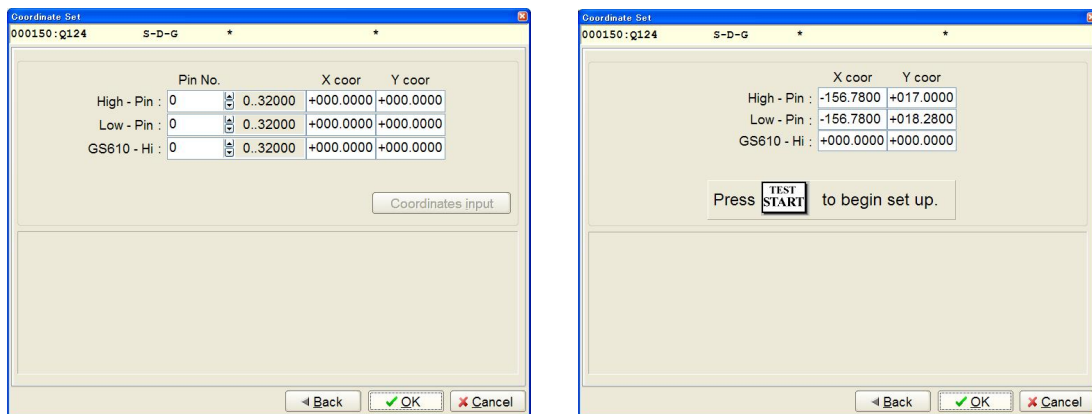
[Figure 45] Parts Information

- (10) Click the Next button, and the GS610 setting menu (Fig. 40) appears on the display.  
(11) Click the Next button.

At Point system, the Pin No. setting screen (the left screen in Fig. 46) appears.

At Teaching system, the Coordinate setting screen (the right screen in Fig. 46) appears.

(The direction of signal input differs according to the FET type. Refer to "Precaution of signal input" in the next page)



Point system

Teaching system

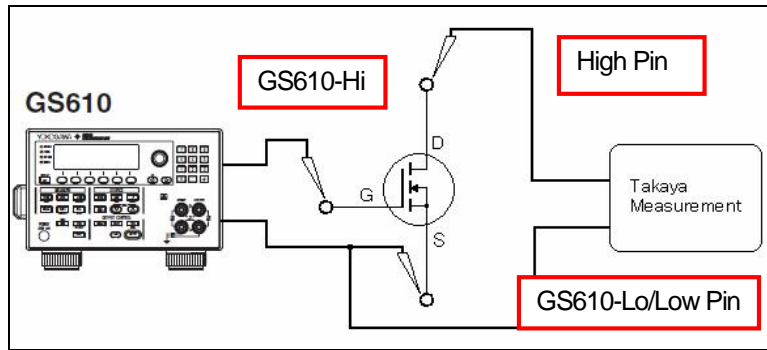
[Fig. 46] Coordinate setting screen

In case of the FET-EN type as shown in the next page:

Specify the pin number of "Drain" for High - Pin.

Specify the pin number of "Source" for Low-pin.

Specify the pin number of "Gate" for GS610 - Hi.



- (12) Click the OK button to put the display back to the Viewable Setup of Function steps screen.
- (13) Click the OK button. (Step 150 in Fig. 47 shows an example of the FET measurement)

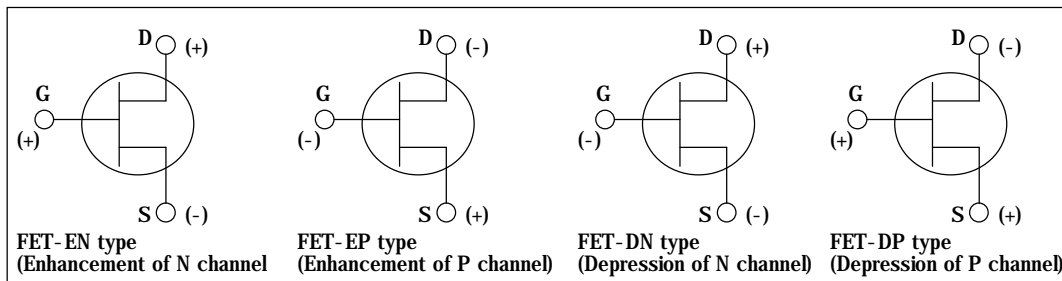
Step	Aux.	Parts	Value	H-pin	L-pin	Comment	Loc	EL	F.
000146:		U401	P250-2	361	1155	11099	*	R	OP
000147:		U401	P251-2	1155	243	11099	*	R	OP
000148:		U401	P252-2	243	649	11099	*	R	OP
000149:		U401	P253-2	649	1100	11099	*	R	OP
000150: IO/F		Q124	S-D-G	11	12	*	*	R	**

[Fig. 47] FET step ("000150" step)

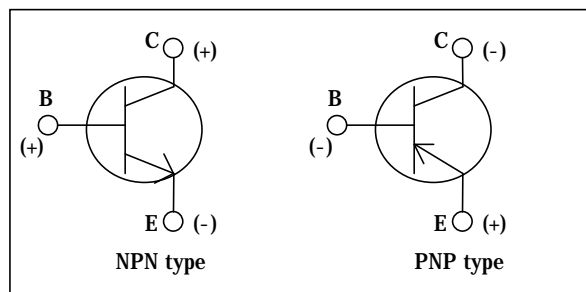
- (14) Input the reference value at the Step data review.

### Precaution of signal input

As shown in Fig 48 and Fig. 49, the signal to measure the FETs and the Transistors vary in direction with the type of the components.



[Fig. 48] FET

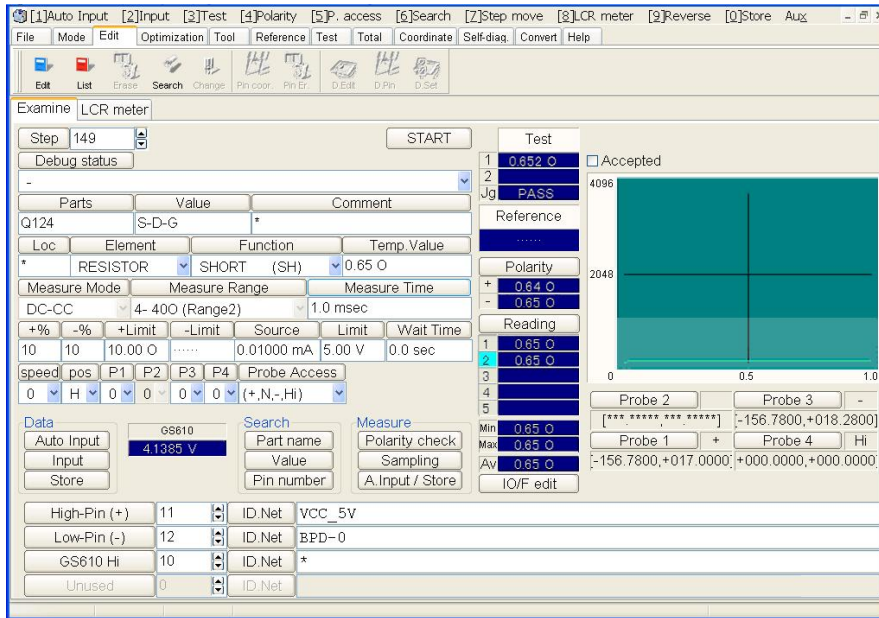


[Fig. 49] Transistor



## Reference value input

Input the reference value for the FET measurement step created by means of the Viewable Setup of function steps screen.



[Fig. 50] Step data review

Since the FET is measured with resistance, specify Element to "RESISTOR", Function to "SHORT (SH)" and Measure Mode to "DC-CC" manually. (If they were already entered at the Viewable Setup of function steps screen, this operation is not necessary)

Click the Input button at the Data column to enter the reference value.

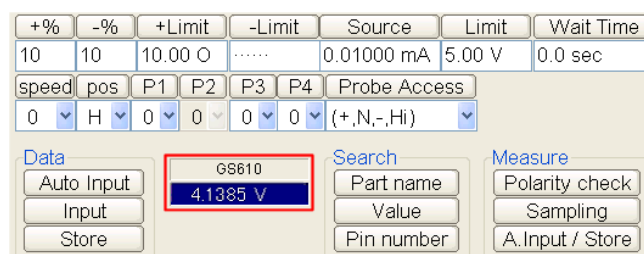
"Temp. Value" is displayed with the value of less 1Ω when the FET turns on correctly. (The resistance value between Drain-Source may differ according to the type of the components.)

Click the Store button at the Data column.

The reference value input of the FET measurement is completed.

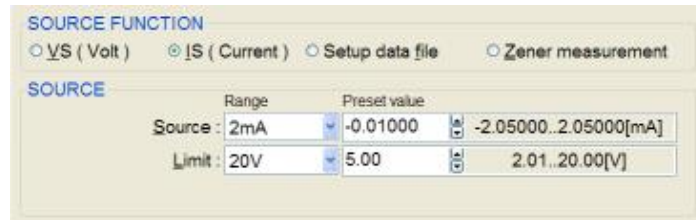
## Others

- I Click the Set IO/F button if you want to put the display back to the Viewable Setup of function steps screen and change the voltage and the current.
- I When you run the measurement, the output voltage is shown in the GS610 field. (Refer to Fig. 51)  
As shown in Fig. 51, for example, when the output voltage at the GS610 field is "4.1385V" and the limit voltage at the Limit field is "5V", it is safe to say that 5V is correct limit voltage. But if the limit voltage is far different from the value shown at the GS610 field, it is necessary to change the limit voltage to the proper value.

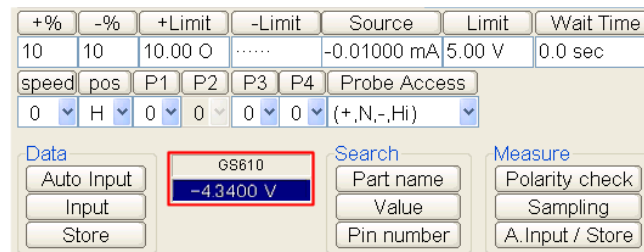


[Fig. 51] FET step

- I Since the FET turns by means of comparatively low current (Gate current), try to gradually lower the value (current) in the Source field on Fig. 51 to examine which value could set the reference value lower than  $1\Omega$ . Then set this value (current) in the Source field.  
(The lower the impressed signal, the fewer the load to the measured circuit is...)
- I In case that you found the measuring polarity was mistaken, there are two ways of setting the polarity in reverse.
  - Interchange two pin numbers of Gate and Source.
  - Click the Set IO/F button and add "-" to the top of Preset value of Source (Refer to Fig. 52).



[Fig. 52]



[Fig. 53]

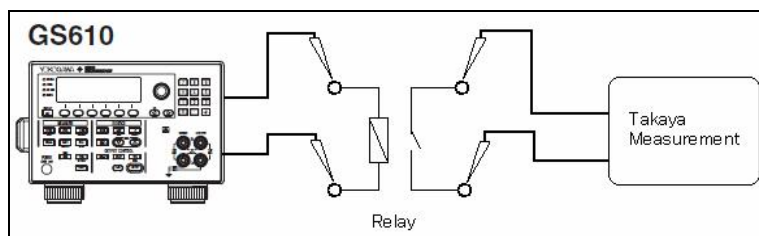
### In case of the Transistors

It is basically the same as the Viewable Setup of function steps and the Reference value input of the FET measurement.

## ON test of Relay

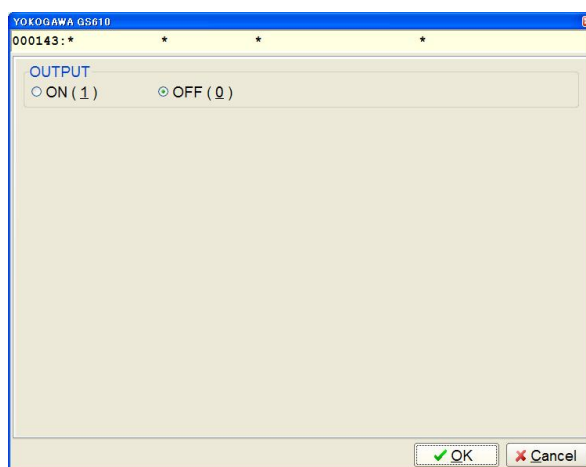
When the Programmable DC Power Supply Board (option) is integrated, the APT-9411CE can conduct On/Off test of the relays up to 25.0V.

In addition, the GS610 ensures the On/Off test up to 110V.



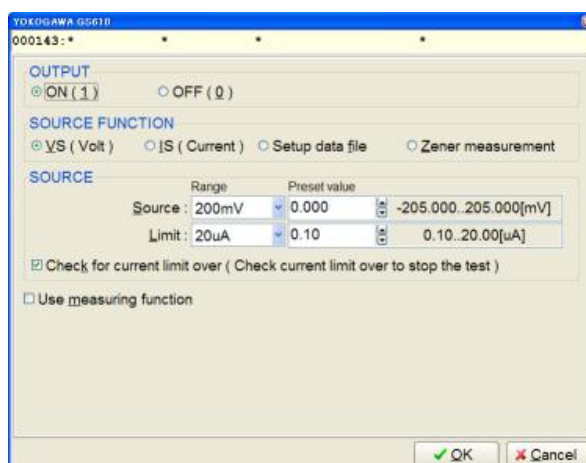
### 《Operation process》

- (1) Open the Viewable Setup of Function steps screen.
- (2) Clicking the Set IO/F button releases the gray-out menu to appear.
- (3) Clicking the YOKOGAWA GS610 button on the screen gets the GS610 setting screen (Fig. 54) to come out.



[Fig. 54] GS610 setting screen

- (4) Check the box "ON", and the GS610 setting screen changes to Fig. 55. Check the box "VS (Volt)" at the SOURCE column.



[Fig. 55] GS610 setting screen

- (5) Specify impressed current value and limit voltage at the SOURCE column.  
(These values have to be set based on careful study of the parts and the circuit conditions.)

In "Range" of Source, select the range which is not only bigger than the rated voltage but also is the closest to it. Then specify the rated voltage in "Preset value" of Source.

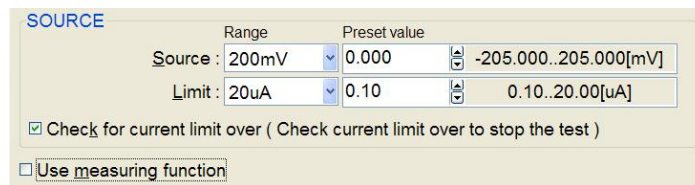
In "Range" of Limit, select the range which is not only bigger than the rated current but also is the closest to it. Then specify the rated current in "Preset value" of Limit.

**Check for current limit over**

Check the box if necessary.

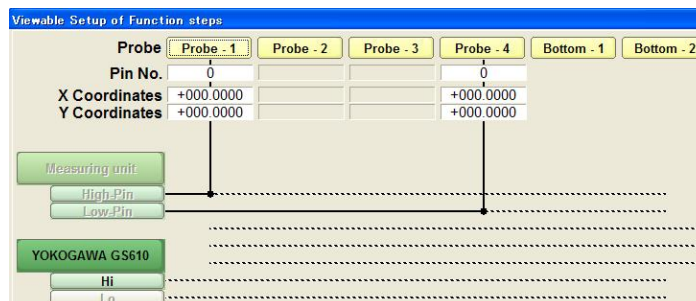
- (6)  **Use measuring function**

Don't check the box. It is measured by the APT-9411CE.



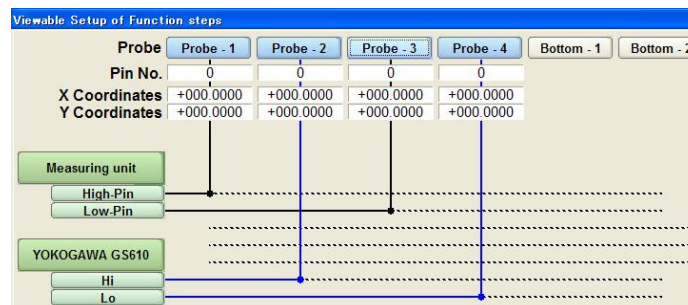
[Fig. 56]

- (7) After everything was set correctly, click the OK button to put the display back to the Viewable Setup of Function steps screen where [Hi] button under [YOKOGAWA GS610] and [Probe-1] ~ [Bottom-2] are blinking. Let's see that the destination of [Hi] is Probe-2 (because Probe-1, 4 are already occupied for the Measuring unit).



[Fig. 57]

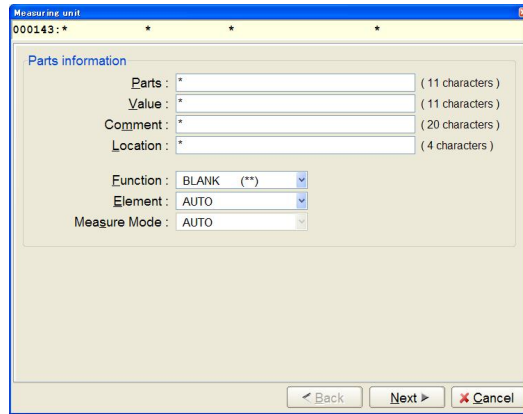
- (8) Use the mouse to click the Probe-2 button, and [Hi] is connected to Probe-2 automatically with a blue line.  
(9) [Lo] button under [YOKOGAWA GS610] is blinking. Use the mouse to click the Probe-4 button. Then [Lo] is connected to Probe-4 automatically with a blue line.



[Fig. 58]

- (10) Click the Property button, and Fig. 45 appears on the display.  
 Type the parts name in "Parts" field from the keyboard. (Enter information in "Value", "Comment" and "Location" field if necessary.)

When "Function", "Element, and "Measure Mode" are already known, you should set them because the reference value input will be smoother.

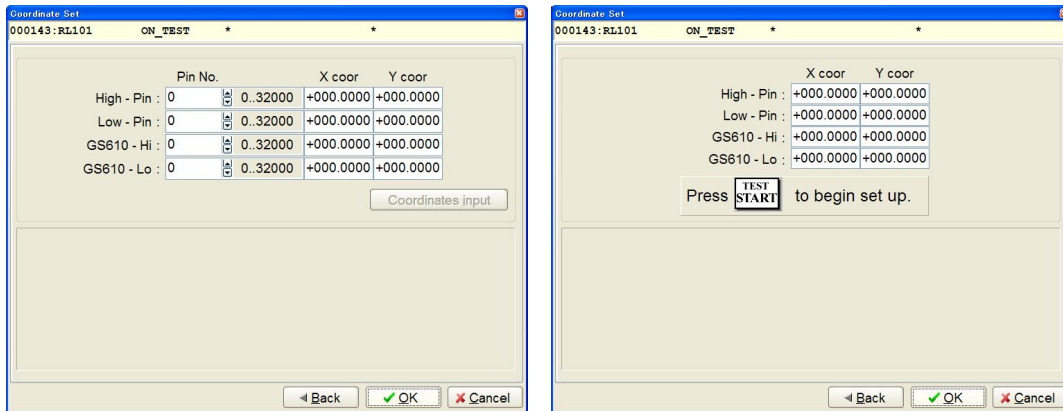


[Fig. 59] Parts information screen

- (11) Click the Next button, and the GS610 setting menu (Fig. 55) appears on the display.  
 (12) Click the Next button.

At Point system, the Pin No. setting screen (the left screen in Fig. 60) appears.

At Teaching system, the Coordinate setting screen (the right screen in Fig. 60) appears.

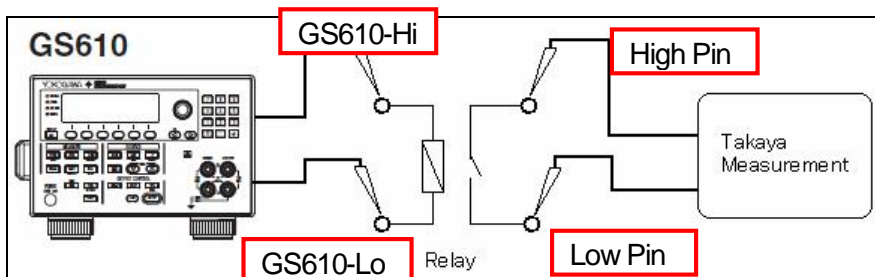


Point system

Teaching system

[Fig. 60] Coordinate setting screen

- In High-Pin and Low-Pin, enter the pin numbers of the contact point of the relay.  
 In GS610-Hi, enter the pin number of "+" side of the coil of the relay.  
 In GS610-Lo, enter the pin number of "-" side of the coil of the relay.



- (13) Click the OK button to put the display back to the Viewable Setup of Function steps screen.
- (14) Click the OK button. (Step 143 in Fig. 61 shows an example of the relay On/Off test)

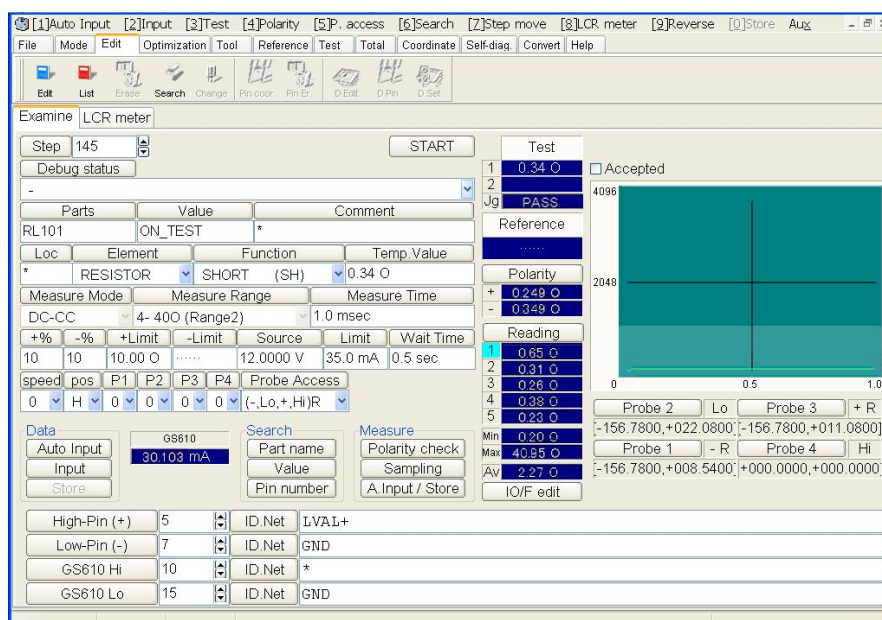
Step	Aux.	Parts	Value	H-pin	L-pin	Comment	Loc	EL	F.
000139:		U401	P250-2	361	1155	11099	*	R	OP
000140:		U401	P251-2	1155	243	11099	*	R	OP
000141:		U401	P252-2	243	649	11099	*	R	OP
000142:		U401	P253-2	649	1100	11099	*	R	OP
000143:	IO/F	RL101	ON_TEST	5	7	*	*	R	SH

[Fig. 61] ON test step ("000143"step)

- (15) Input the reference value at the Step data review.

### Reference value input

Input the reference value for the relay O/Off test step created by means of the Viewable Setup of function steps screen.



[Fig. 62] Step data review

Since the FET is measured with resistance, specify Element to "RESISTOR", Function to "SHORT (SH)" and Measure Mode to "DC-CC" manually. (If they were already entered at the Viewable Setup of function steps screen, this operation is not necessary)

Click the Input button at the Data column to enter the reference value.

"Temp. Value" is displayed with the value of less 1Ω when the relay turns on correctly.

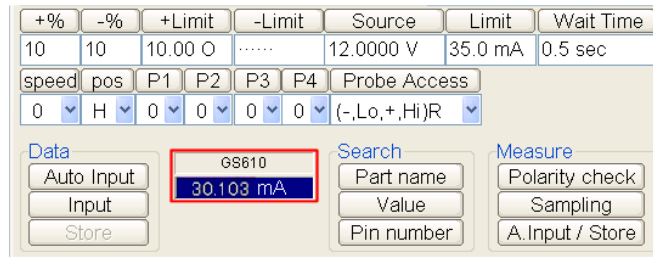
Click the Store button at the Data column.

The reference value input of the relay On/Off test is completed.

### Others

- I Click the Set IO/F button if you want to put the display back to the Viewable Setup of function steps screen and change the voltage and the current.
- I The error message "the Limit current over" may appear when the reference value is input. In this case, change the current limit at the Limit field to be a bit bigger.
- I When you run the measurement, the output current is shown in the GS610 field. (Refer to Fig. 63)  
As shown in Fig. 63, for example, when the output current at the GS610 field is "30.103mA" and the

limit current at the Limit field is "35mA", it is safe to say that 35mA is correct limit current. But if the limit current is far different from the value shown at the GS610 field, it is necessary to change the limit current to the proper value.

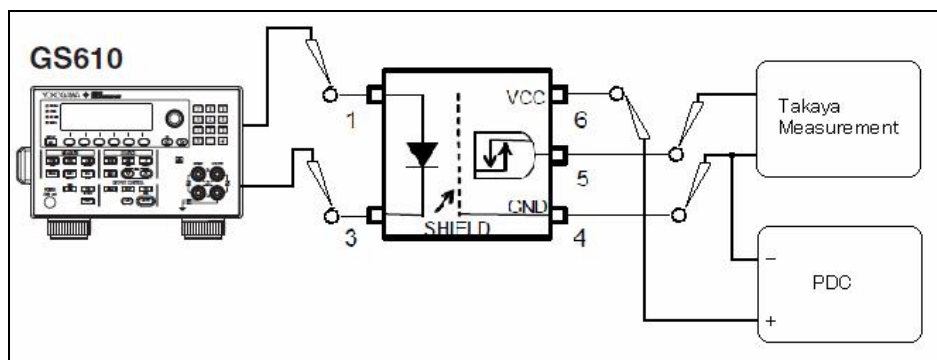


[Fig. 63]

## Photo Couple Measurement

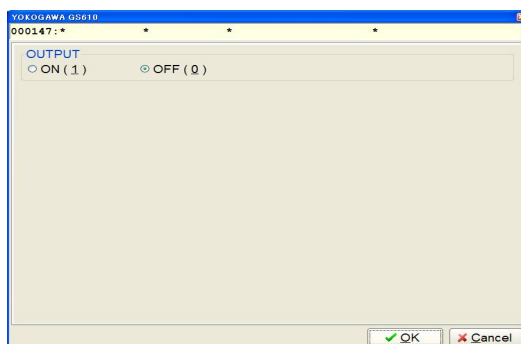
When both the GP610 and the Programmable DC Power Supply Board (option) are integrated, the APT-9411CE can conduct the function test of the Photo couplers as it is possible to supply the power to the VCC.

The APT-9411CE can measure the output while applying the power between Anode and Cathode by means of the GS610 and also between VCC and GND by means of the Programmable DC Power Supply Board. For this the bottom pins are used to apply the power from the Programmable DC Power Supply Board.



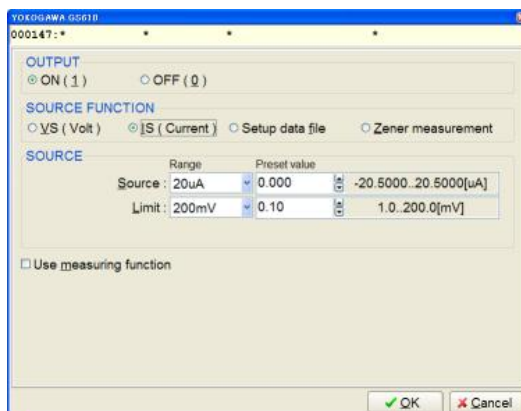
### 《Operation process》

- (1) Open the Viewable Setup of Function steps screen.
- (2) Clicking the Set IO/F button releases the gray-out menu to appear.
- (3) Clicking the YOKOGAWA GS610 button on the screen gets the GS610 setting screen (Fig. 64) to come out.



[Fig. 64] OUTPUT setting screen

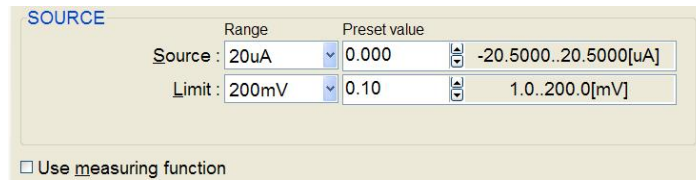
- (4) Check the box "ON", and the GS610 setting screen changes to Fig. 55. Check the box "IS (Current)" at the SOURCE column.



[Fig. 65] GS610 setting screen



- (5) Specify impressed current value and limit voltage at the SOURCE column.  
 (These values have to be set based on careful study of the parts and the circuit conditions.)



[Fig. 66]

The box “Range” is used for selecting the output range from 20uA, 200uA, 2mA, 20mA, 200mA 0.5A, 1A, 2A and 3A. In this case, be sure to select the range which is not only bigger than your preferable output but also is the closest to. (ex. 1mA - --> 2mA) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable output directly in “Preset value” column. The unit of the Preset value is the same as displayed in the Range column.

The box “Range” is used for selecting the voltage limit from 200mV, 2V, 20V and 110V. In this case, be sure to select the range which is not only bigger than your preferable voltage limit but also is the closest to. (ex. 1V - --> 2V) When the Range is determined, the right hand column indicates the allowance of the Range. In reference to this display, you can enter your preferable voltage limit directly in “Preset value” column. The unit of the Preset value is the same as displayed in the Range column.

(Remark) The upper value of Limit may vary significantly according to the Source value above.

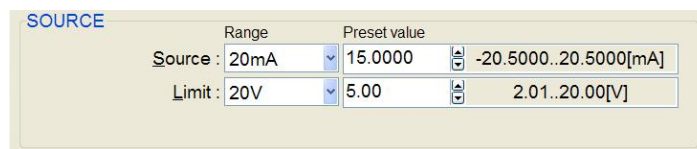
For instance, let’s say, the current is 15mA and the limit voltage is 5.0V;

Range of Source: “20mA”

Preset value of Source: “15 mA”

Range of Limit: “20V”

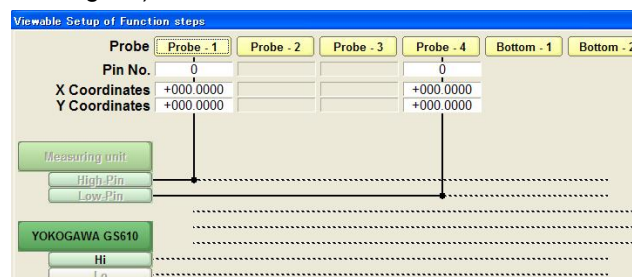
Preset value of Limit: “5.0V”



[Fig.67]

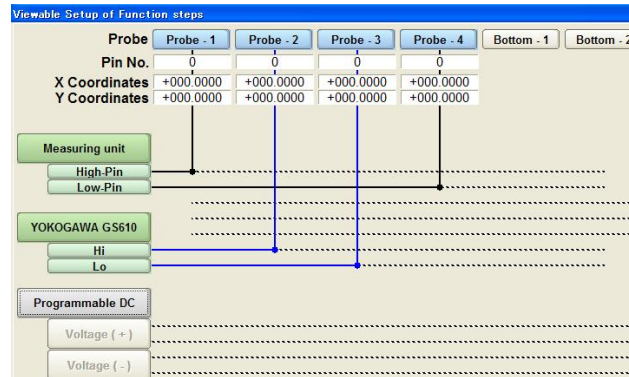
Don’t check the box “Use measuring function”.

- (6) After everything was set correctly, click the OK button to put the display back to the Viewable Setup of Function steps screen where [Hi] button under [YOKOGAWA GS610] and [Probe-1] ~ [Bottom-2] are blinking in yellow. Let’s see that the destination of [Hi] is Probe-2 (because Probe-1, 4 are already occupied for the Measuring unit).



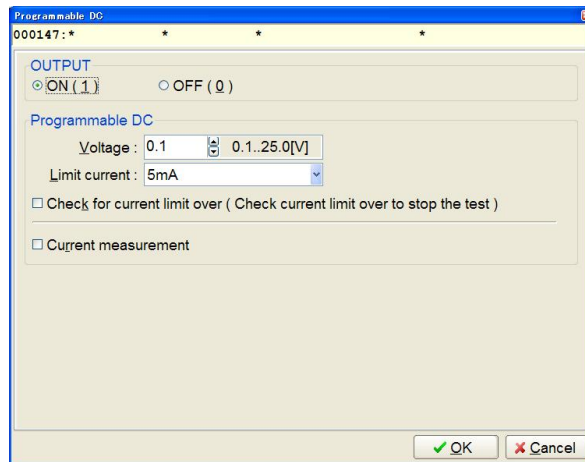
[Fig. 68]

- (7) Use the mouse to click the Probe-2 button, and [Hi] is connected to Probe-2 automatically with a blue line.
- (8) [Lo] button under [YOKOGAWA GS610] is blinking. Use the mouse to click the Probe-3 button. Then [Lo] is connected to Probe-3 automatically with a blue line.



[Fig. 69]

- (9) Clicking the Programmable DC button on the screen gets the GS610 setting screen (Fig. 64) to come out.
- (10) Specify impressed current value and limit voltage at the Programmable DC column.  
(These values have to be set based on careful study of the parts and the circuit conditions.)



[Fig. 70]

**Check for current limit over**

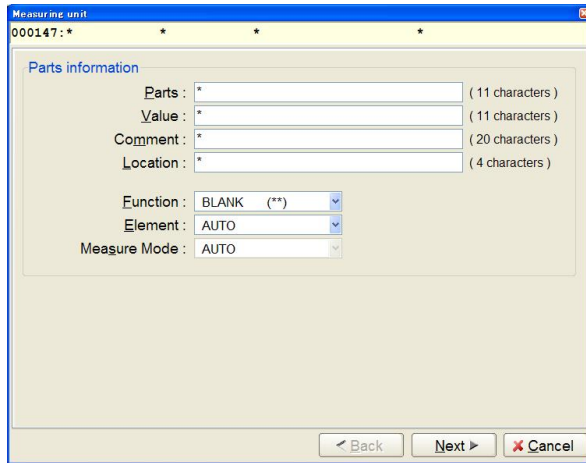
Check the box it if necessary.

(When the box is checked, the test will be suspended if the current limit is over.)

**Current measurement**

Don't check the box.

- (11) After everything was set correctly, click the OK button to put the display back to the Viewable Setup of Function steps screen where [Voltage (+)] under [Programmable DC and [Probe-1] ~ [Bottom-2] and [T1] ~ [T12] are blinking in yellow. Let's see that the destination of [Voltage (+)] is Bottom-1.
- (12) Use the mouse to click the Bottom-1 button, and [Voltage (+)] is connected to Bottom-1 automatically with a green line.
- (13) [Voltage (-)] under [Programmable DC] is blinking. Use the mouse to click the Probe-4 button, which is already connected to Low-pin of the Measuring unit. Then [Voltage (-)] is connected to Probe-4 automatically with a green line.
- (14) Click the Property button, and Fig. 71 appears on the display.  
Type the parts name in "Parts" field from the keyboard. (Enter information in "Value", "Comment" and "Location" field if necessary.

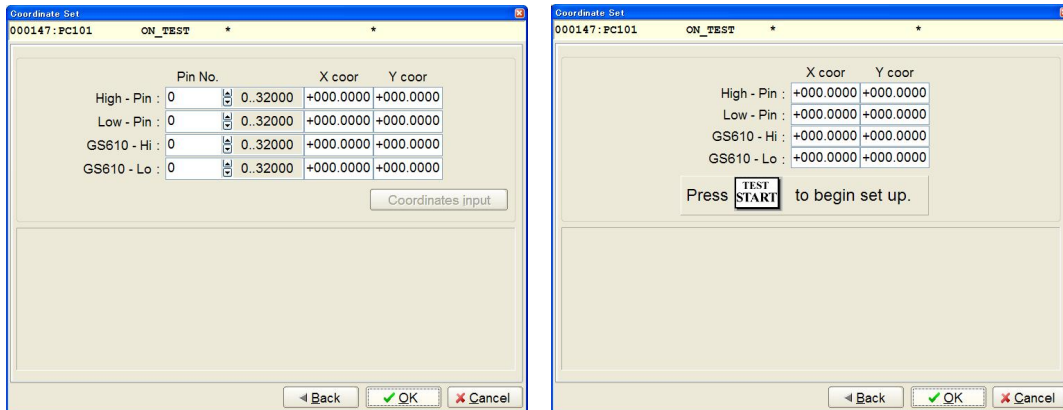


[Fig. 71] Parts information screen

- (15) Click the Property button, and the Fig. 65 appears on the display.
- (16) Click the Property button, and the Fig. 70 appears on the display.
- (17) Click the Next button.

At Point system, the Pin No. setting screen (the left screen in Fig. 72) appears.

At Teaching system, the Coordinate setting screen (the right screen in Fig. 72) appears.



Point system

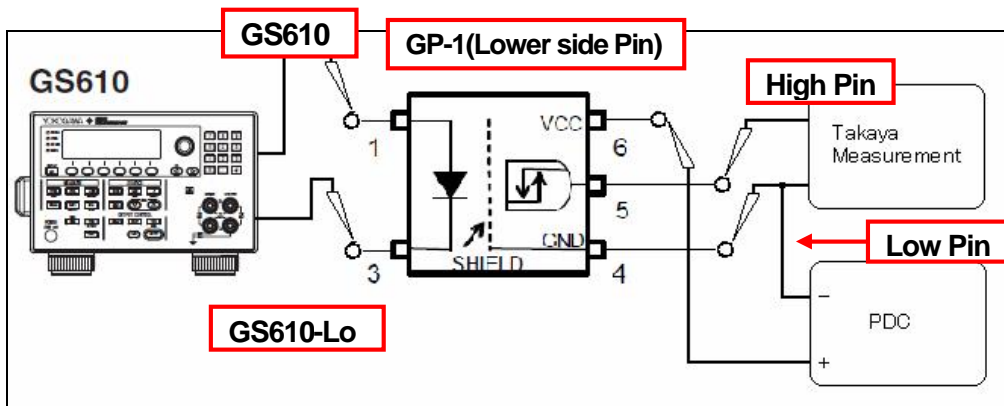
Teaching system

[Fig. 72] Coordinate setting screen

In High-Pin and Low-Pin, enter the pin numbers of the output terminal of the Photo coupler.

In GS610-Hi, enter the pin number of "Anode" of the Photo coupler.

In GS610-Lo, enter the pin number of "Cathode" of the Photo coupler.



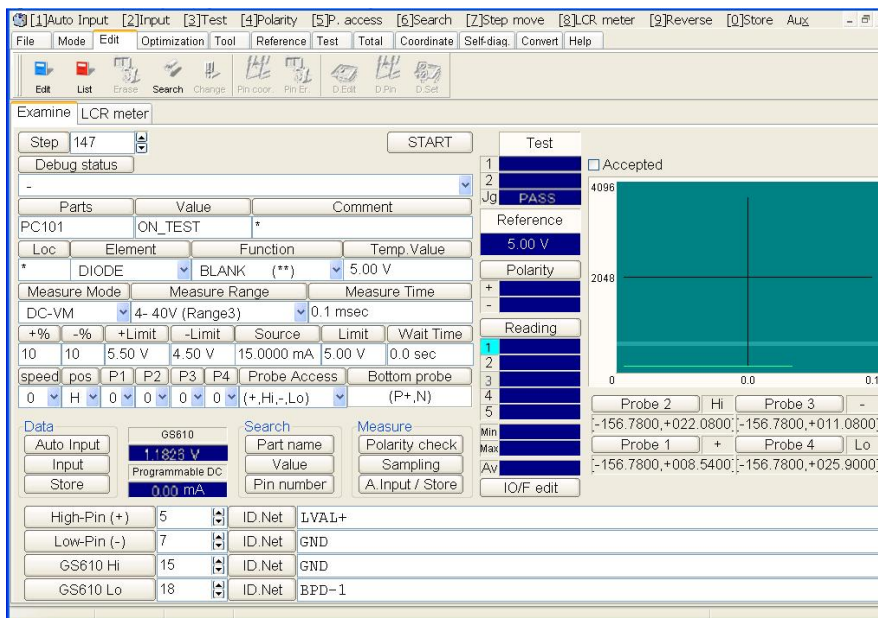
- (18) Click the OK button to put the display back to the Viewable Setup of Function steps screen.
- (19) Click the OK button to put the display back to the step list screen. (Step 147 in Fig. 73 shows an example of the Photo coupler measurement)

Step	Aux.	Parts	Value	H-pin	L-pin	Comment	Loc	EL	F.
000145:		U401	P252-2	243	649	11099	*	R	OP
000146:		U401	P253-2	649	1100	11099	*	R	OP
000147:IO/F		PC101	ON_TEST	5	7	*	*	D	**

[Fig. 73] Photo coupler Step

- (20) Input the reference value at the Step data review.

### Reference value input

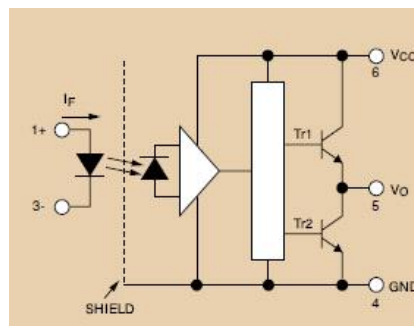


[Fig. 74] Step data review

Set the measurement conditions so that they match the output characteristics of the component to be measured. Let's suppose the following truth table and the internal constitution. In this case, if the power is applied to the Input (1 - 3 pin), the voltage from VCC is output to the Output (5 - 4 pin). Thus 5V is applied to the VCC, the output is 5V.

Input (1 - 3 pin)	Output (5 - 4 pin)
H	H

Truth table




Internal constitution


The measurement condition should be set as follows.

"Element ": DIODE

"Measure Mode ": DC-VM

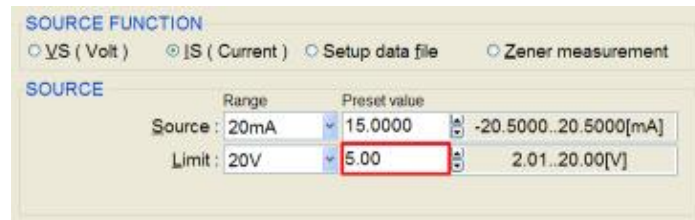
 CAUTION	Never select other than the DC-VM mode because it has to measure the DC voltage.
--	--

Click the Input button at "Data" column to input the reference value.

 CAUTION	Never use the Auto Input button to input the reference value. Otherwise, the measuring mode will be initialized and set to other than DC-VM mode automatically. As the result, the measuring section of the APT-9411CE may get damaged.
--	---

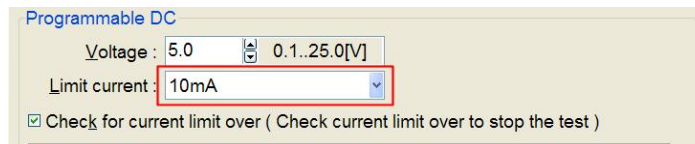
### Others

The value shown at the GA610 field on the Step data review screen indicates the output voltage between Anode and Cathode. If the limit current in the Preset value field is far different from the value shown at the GS610 field, it is necessary to lower the limit current to the proper value.



[Fig. 75]

The value shown at the Programmable DC field on the Step data review screen indicates the current flown between VCC and GND. If the limit current in the Limit current field is far different from the value shown at the Programmable DC field, it is necessary to lower the limit current to the proper value.



[Fig. 76]

### Consumption current measurement

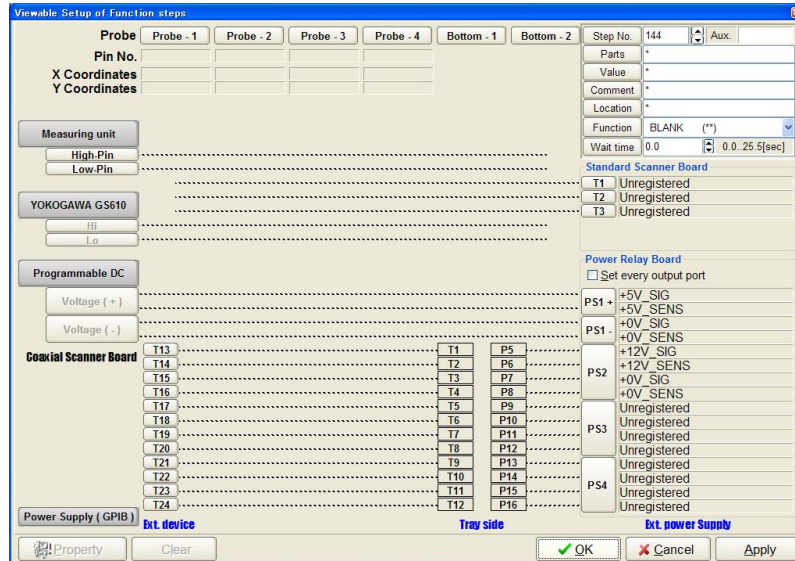
This is able to apply the voltage (maximum: 110V) on the PC board by means of the voltage output (CV mode) from the GS610 and measure the consumption current (maximum: 3.2A) with the GS610.

Below gives you a brief overview of the system setup for the consumption current measurement.

#### 《Operation process》

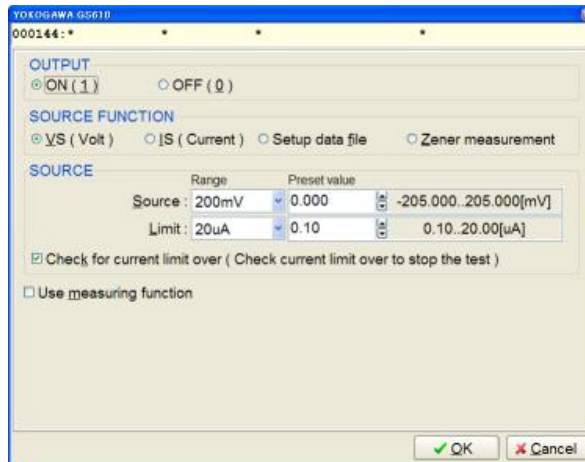
(1) Open the Viewable Setup of Function steps screen.

Since the measuring unit is connected to Probe-1 and Probe-4 as default, use the mouse to click the Set IO/F button and then the Clear button to cancel the connection. (Refer to [Fig. 77])



[Fig. 77] Consumption current measurement

- (2) Clicking the YOKOGAWA GS610 button on the screen gets the GS610 setting screen to come out.
- (3) Check the box "ON", and the GS610 setting screen changes to Fig. 78.  
Check the box "VS (Volt)" at the SOURCE column.



[Fig. 78] Consumption current measurement

### <SOURCE>

In "Range" of Source, select the range which is not only bigger than the impressed voltage but also is the closest to it. Then specify the impressed voltage in "Preset value" of Source.

In "Range" of Limit, select the range which is not only bigger than the measured current but also is the closest to it. Then specify the measured current in "Preset value" of Limit.

#### Check for current limit over

Check the box if necessary.

#### Use measuring function

Check the box, and the following screen (Fig. 79) is displayed.

Use measuring function

**MEASURE**

Preset value

Reference : 0.0000 -0.1000..0.1000[uA]

Judgment ±% tolerance : 10 0..100[%]

Judgment -% tolerance : 10 0..100[%]

[Fig. 79] Use measuring function (Consumption current measurement)

In Reference field, set the current value to measure.

In Judgment +% tolerance / Judgment -% tolerance, set the tolerance for the Pass/fail judgment.



For details of Reference and Judgment +% tolerance / Judgment -% tolerance, refer to page 13.

(4) Specify the output of the YOKOGAWA GS610. (Refer to Fig. 80)

[Fig. 80] Consumption current measurement

(5) Click the Property button to configure both the YOKOGAWA GS610 and the Coordinates Set screen.

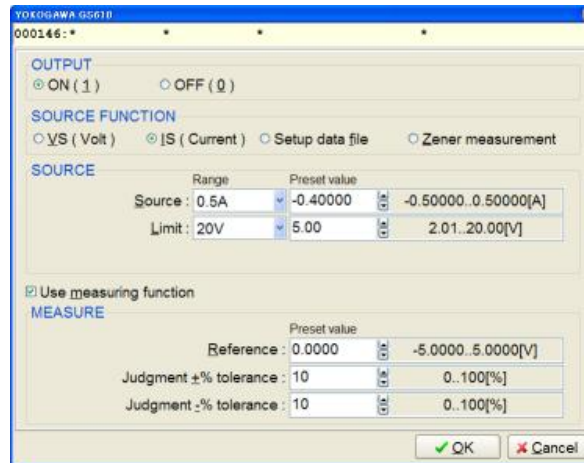
Setting YOKOGAWA GS610

Coordinate set

[Fig. 81]

## Sink operation

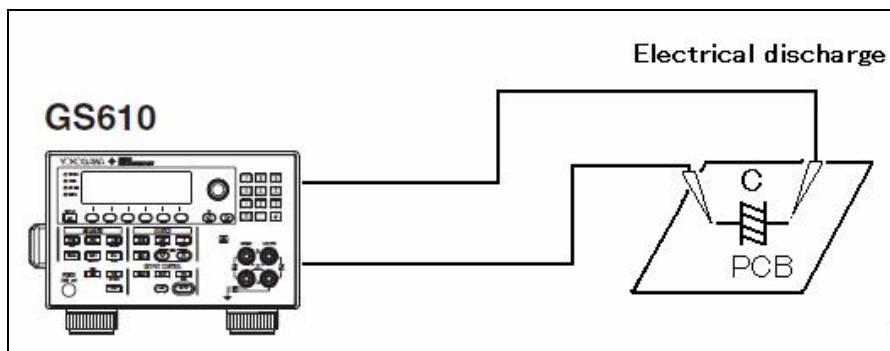
The voltage fluctuation can be tested by applying the power to the output terminal of the PC board by means of "IS (Current)" of the GS610 and carrying out the constant current discharge (Current sink operation).



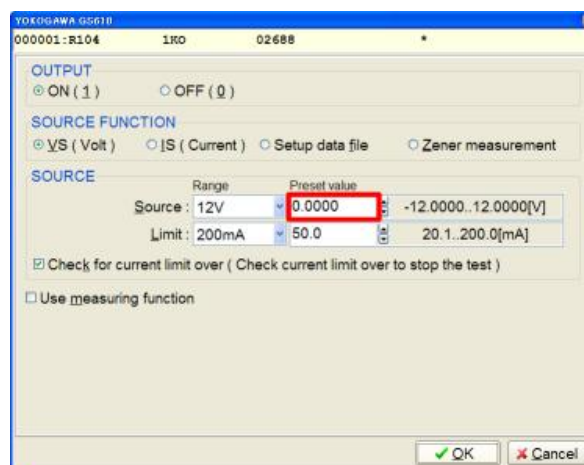
[Fig. 82]

## Discharge function

This is able to discharge the electrolysis capacitors charged with the voltages.



Let "VS (Volt)" output to the points to be discharged in the circuit and sink a constant current with 0V by setting the current limit. (Setting the voltage to 0V allows the GS610 to do the current sink operation so that the residual voltage is 0V)

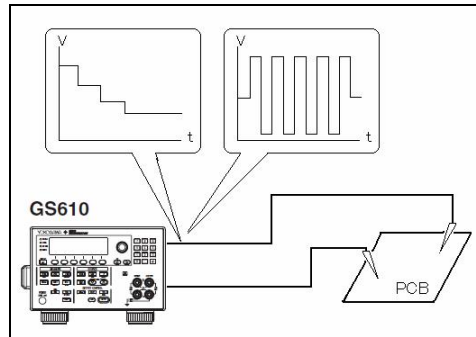


[Fig. 83] Discharge setting



## Setup data file

The setup data file is primarily used for testing the relay if it turned on correctly when the rated voltage is gradually lowered until the specified voltage (return voltage). In addition, it can be used for the voltage fluctuation test, the noise test and the pulse signal generation (Max. 5KHz), so on.



## Test examples by the Setup data file

### << Example 1 >>

Let's try to test the return voltage of the relay (Rated voltage: 24V, Return voltage: 5V).

First apply 24V to the relay and gradually lower it to the return voltage 5V by means of the program sweep of the GS610. At the point when the program sweep is complete, measure the contact point of the relay by the APT-9411 to see if it turns on correctly. When it measures 10 ohms or less, it judges PASS. Meanwhile, when it measures over 10ohms, it judges FAIL.

### 《Operation process》

- (1) Create a Program Sweep data.

Use either "Note pad" or "Universal spreadsheet" to make the list of voltages which are impressed to the relays and save it in the file with extension ".csv". (File name "Relay.csv")

24.0
20.0
16.0
12.0
8.0
7.0
6.0
5.0

- (2) The file is registered in "PROGRAM" folder of "GS610ROM" for the GS610.
- (3) Operate the GS610 (by remote control) to set as described below.

Refer to the GS610 User's manual for the concrete operation and the settings. The Item numbers in the list come from the GS610 User's manual.

Item	Contents
5.1	Switching the Source Function [ VS mode ]
5.2	Setting the Source Range Setting [ 30V ]
5.3	Setting the Limiter [ 50mA ]
6.2	Setting the Program Sweep [Setting "Relay.csv" file]
6.3	Selecting the Termination Mode [ Keep ]
6.4	Setting the Repeat Count [ 1 ]
4.1	Setting the Trigger [The Repeat Period of Trigger etc...]
11.1	Saving the Setup Data

[Table 6]

(Supplemental remarks)

### 6.3 Selecting the Termination Mode

Be sure to use "Keep" command to measure the contact point of the Coil while keeping 5V as the final voltage of the Programmable Sweep. If other command (Rtn) is assigned in the Termination mode, it may not measure the return voltage of the relay.

### 4.1 Setting the Trigger

The Setting of the Trigger is configured as the need arises, but we give a little bit of "Repeat Period of Trigger". This is a wait time of when the voltage is changed according to the Program Sweep data. If this isn't configured, the voltage is changed with the wait time of "50mA" (default).

### 11.1 Saving the Setup Data

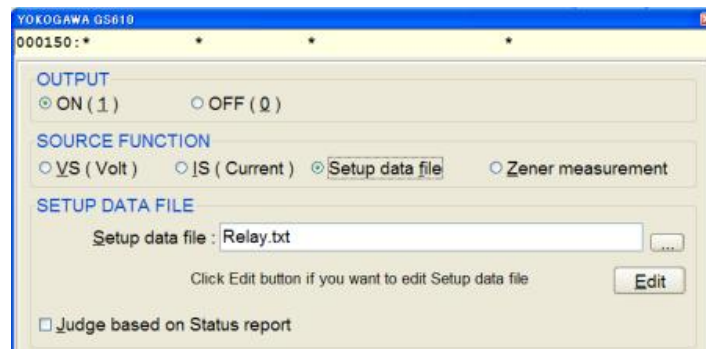
This file is registered in the SETUP folder of the GS610ROM but is written over the existing file because the GS610 doesn't have "Save as" function. Specify any one of Setup1 ~ Setup4 to save the file. After registered, use the Explorer to rename the file name.

(4) Make IO/F step by means of the Viewable Setup of function steps function of APT-9411CE software.

SOURCE FUNCTION column : "Setup data file"

SETUP DATA FILE column : "Relay.txt"

Box "Judge based on Status report" : Unchecked

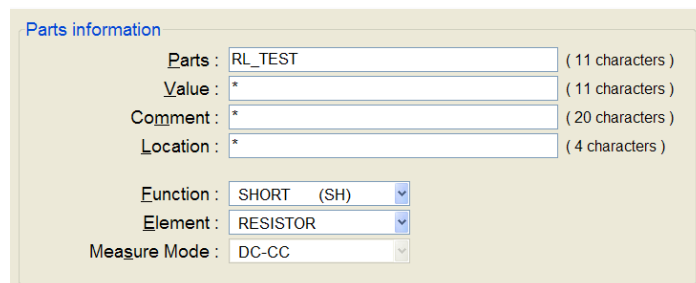


[Fig. 84]

Connect "Hi" of the GS610 to "+" side of the relay and "Lo" to "-" side.

"High Pin" and "Low Pin" of the measuring unit are connected to the contact point of the relay.

Function is set to "SHORT (SH)".

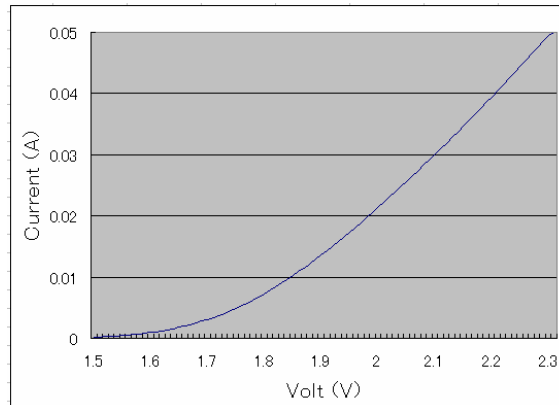


[Fig. 85]

(5) The setup data file is complete.

## << Example 2 >>

Let's try to test the current characteristic of the LED when the impressed current changes. As shown in the graph below, the current increases with increasing of the voltage to the LED. Use "Program Sweep", "Measurement Function", and "Comparison Operation" of the GS610 to judge Pass/Fail.



### 《Operation process》

- (1) Create a Program Sweep data.

In Program Sweep data, assign the impressed voltage and the upper/lower threshold of the current which flows when the voltage is impressed.

Use either "Note pad" or "Universal spreadsheet" to create the data and save it in the file with extension ".csv". (File name "Led.csv")

1.6,":CALC:LIM:UPP 1.2E-3;:CALC:LIM:LOW 0.6E-3
1.7,":CALC:LIM:UPP 3.3E-3;:CALC:LIM:LOW 2.7E-3
1.8,":CALC:LIM:UPP 7.6E-3;:CALC:LIM:LOW 7.0E-3
1.9,":CALC:LIM:UPP 13.9E-3;:CALC:LIM:LOW 13.3E-3
2.0,":CALC:LIM:UPP 21.6E-3;:CALC:LIM:LOW 21.0E-3
2.1,":CALC:LIM:UPP 30.3E-3;:CALC:LIM:LOW 29.7E-3
2.2,":CALC:LIM:UPP 39.7E-3;:CALC:LIM:LOW 39.1E-3
2.3,":CALC:LIM:UPP 49.7E-3;:CALC:LIM:LOW 49.1E-3

[Table 7] Program Sweep data

(Supplemental remarks)

"1.6": Impressed voltage

":CALC:LIM:UPP 1.2E-3": The upper threshold is set to "1.2mA"

":CALC:LIM:LOW 0.6E-3": The lower threshold is set to "0.6mA"

The judgment is "In" if it measures 1.2mA - 0.6mA when 1.6V is impressed. When the measured value is bigger than the Upper threshold, the judge result "high" is output to the Status report. Meanwhile, when the Lower threshold is bigger than the measured value, the judge result "Low" is output.

These judge results are written in the measurement event register of the GS610 each time when the voltage is output.

- (2) The file is registered in "PROGRAM" folder of "GS610ROM" for the GS610.
- (3) Operate the GS610 (by remote control) to set as described below.

Refer to the GS610 User's manual for the concrete operation and the settings. The Item numbers in the list come from the GS610 User's manual.

Item	Contents
5.1	Switching the Source Function [ VS mode ]
5.2	Setting the Source Range Setting [ 12V ]
5.3	Setting the Limiter [ 50mA ]
6.2	Setting the Program Sweep [Setting "Led.csv" file]
6.3	Selecting the Termination Mode [ Rtn ]
6.4	Setting the Repeat Count [ 1 ]
8.4	Comparison operation [ Compare ON ]
4.1	Setting the Trigger [The Repeat Period of Trigger etc···]
11.1	Saving the Setup Data

[Table 8]

(Supplemental remarks)

#### 6.3 Selecting the Termination Mode

Be sure to use "Rtn" command to terminate the step after impressed 2.3V and put back to the first voltage "1.6V".

#### 4.1 Setting the Trigger

The Setting of the Trigger is configured as the need arises, but we give a little bit of "Repeat Period of Trigger". This is a wait time of when the voltage is changed according to the Program Sweep data. If this isn't configured, the voltage is changed with the wait time of "50mA" (default).

#### 11.1 Saving the Setup Data

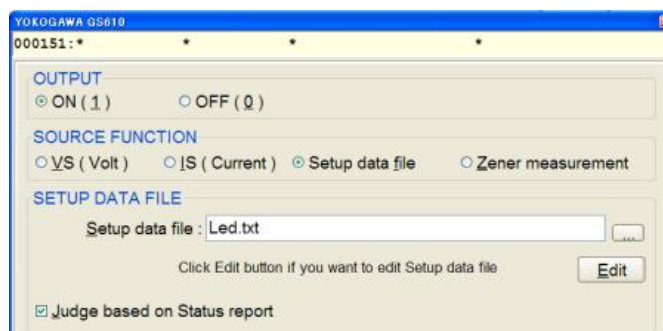
This file is registered in the SETUP folder of the GS610ROM but is written over the existing file because the GS610 doesn't have "Save as" function. Specify any one of Setup1 ~ Setup4 to save the file. After registered, use the Explorer to rename the file name.

(4) Make IO/F step by means of the Viewable Setup of function steps function of APT-9411CE software.

SOURCE FUNCTION column : "Setup data file"

SETUP DATA FILE column : "Led.txt"

Box "Judge based on Status report": Checked



[Fig. 86]

Connect "Hi" of the GS610 to "Anode" of the LED and "Lo" to "Cathode".  
The measuring unit isn't connected to anything. The GS610 takes place.

(5) The setup data file is complete.

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## Reference manual for Four Quadrant Power Supply (GS610)

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