Agilent 4155C
Semiconductor Parameter Analyzer
Agilent 4156C
Precision Semiconductor Parameter Analyzer

Setup Screen Reference

Agilent Technologies

Notices

Manual Part Number

04156-90030

Edition

Edition 1, January 2001
Edition 2, March 2001
Edition 3, January 2003
Edition 4, March 2008

Agilent Technologies, Inc.
5301 Stevens Creek Blvd
Santa Clara, CA 95051 USA

Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

In This Manual

This manual is a reference for the setup screens of the Agilent 4155C/4156C Semiconductor Parameter Analyzers, and provides the following information:

- Screen Structure

  This chapter introduces the structure of the 4155C/4156C's setup screens.

- Screen Operation

  This chapter explains how to enter the setup values into the entry fields displayed on the setup screens, and explains the usage of the blue front-panel key and the green front-panel key.

- Setup Screens

  This chapter explains the entry fields and softkeys displayed on the screens used for the measurement setups.

- System Screens

  This chapter explains the entry fields and softkeys on the SYSTEM screens.

Text Conventions

The following text conventions are used in this manual:

Screen Text	Represents text that appears on screen of the 4155C/4156C.
Italic	Refers to a related document, or is used for emphasis.

Contents

Contents

Contents

Contents

1 Screen Structure

The 4155C/4156C has seven screen groups, as shown in the following table.

Screen Group	Display Screen
Channels	CHANNELS: CHANNEL DEFINITION
	CHANNELS: USER FUNCTION DEFINITION
	CHANNELS: USER VARIABLE DEFINITION
	CHANNELS: E5250A PROPERTIES
	CHANNELS: E5250A CONNECTION SETUP
Measure	MEASURE: SWEEP SETUP
	MEASURE: SAMPLING SETUP
	MEASURE: PGU SETUP
	MEASURE: MEASURE SETUP
	MEASURE: OUTPUT SEQUENCE
	MEASURE: QSCV SETUP
	MEASURE: QSCV MEASURE SETUP
Display	DISPLAY: DISPLAY SETUP
	DISPLAY: ANALYSIS SETUP
Graph/List	GRAPH/LIST: GRAPHICS
	GRAPH/LIST: LIST
Stress	STRESS: CHANNEL DEFINITION
	STRESS: STRESS SETUP
	STRESS: STRESS FORCE
System	SYSTEM: FILER
	SYSTEM: MISCELLANEOUS
	SYSTEM: CONFIGURATION
	SYSTEM: SELF-CALIBRATION/DIAGNOSTICS
	SYSTEM: PRINT/PLOT SETUP
	SYSTEM: COLOR SETUP
Knob Sweep	KNOB SWEEP

CHANNELS screen group	Defines the measurement modes, measurement channels, and user functions.
MEASURE screen group	Sets the measurement parameters.
DISPLAY screen group	Sets up the display of measurement results.
GRAPH/LIST screen group	Displays the measurement results.
STRESS screen group	Sets and monitors the stress force.
SYSTEM screen group	Controls mass storage, sets system parameters for the 4155C/4156C, sets the print/plot parameters, and so on.
KNOB SWEEP screen group	Displays the measurement results when the knob sweep function is used.

You can use the front-panel keys in the PAGE CONTROL key group to display the desired screen. The PAGE CONTROL key group has the following keys:

Chan	Displays the CHANNELS screen group.
Meas	Displays the MEASURE screen group.
Disp	Displays the DISPLAY screen group.
Graph/List	Displays the GRAPH/LIST screen group.
Stress	Displays the STRESS screen group.
System	Displays the SYSTEM screen group.

To display the KNOB SWEEP screen, press the green front-panel key and then Single key.

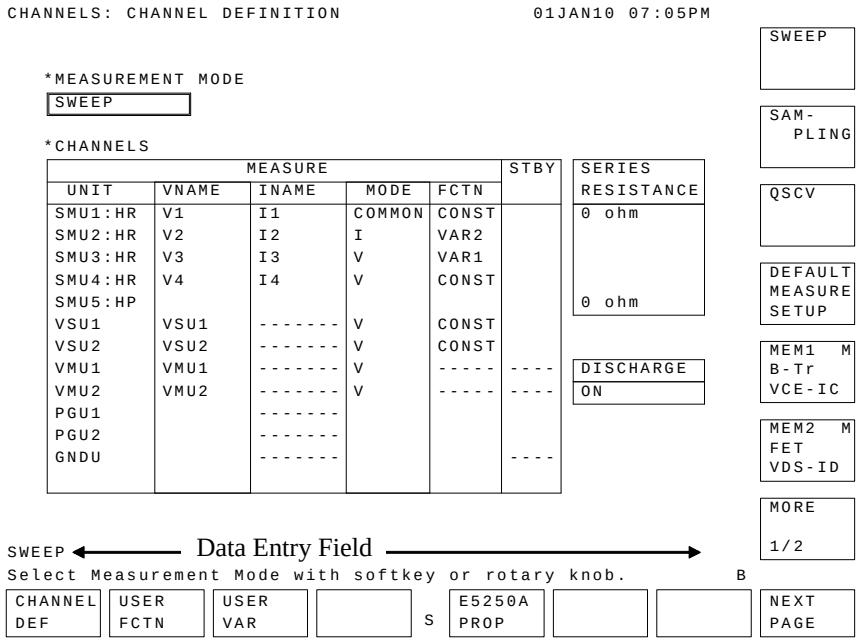
2 Screen Operation

This chapter explains how to fill in the entry fields on a screen, and the function of the blue, green and Edit front-panel keys. This chapter contains the following sections:

- “Data Input or Edit”
- “Blue front-panel key usage”
- “Green front-panel key usage”
- “Edit front-panel keys”
- “Status Indicators”

Data Input or Edit

When you move the pointer to a field on a setup screen, you can fill in the field by entering characters or selecting a softkey. See figure below. This figure shows an example which sets the current output mode for SMU2. Line above the primary softkeys is called as the *data entry field*. The line displays the value of the entry field the pointer specifies, or is used to enter the value.



The 4155C/4156C has three types of fields. The following describes the methods for entering or editing input data of these field types:

Option fields

When pointer is in an option field, selectable input items for field are displayed on secondary softkeys. You select desired softkey. The item appears in the field.

For example, when pointer is in the MODE field for SMU2 as shown in the above figure, V, I, VPULSE, IPULSE, COMMON, and DELETE ROW softkeys appear in secondary softkey area. Then select one you desire.

In the screens except for the CHANNEL DEFINITION screen, if pointer is located in a field that requires a variable name, all available variable names are displayed on secondary softkeys. So you can select desired variable name by using a secondary softkey. Available variable names are names you already set up as measurement variables or user function variables. If more than six variable names are available, MORE secondary softkey appears, which display more available variable names.

Comment and Name fields

When the pointer is located in a comment or name field, you input the desired characters by using the ENTRY front-panel key group. You press the desired characters. The characters appear in the **data entry area**.

For name fields, you can enter alphanumeric characters. For comment fields, you can also enter non-alphanumeric characters. You can enter uppercase or lowercase alphabet characters by using *blue* and *green* front-panel keys. You can enter special (non-alphanumeric) characters by using the *green* front-panel key.

If a comment or name is already entered in the field, it appears in the data entry area. You can edit it using Edit front-panel keys.

After editing or entering the comment or name, press the **Enter** front-panel key to enter the name or comment into the field at the pointer location.

Numeric data fields

When pointer is in a numeric data field, input numeric data as follows:

- Type the numeric value by pressing numeric front-panel keys (value appears in the data entry area). Then, press **Enter** front-panel key (value is entered into the numeric data field at the pointer location).
- Rotate the rotary knob to increase or decrease the value. Rotate clockwise to increase value. Rotate counterclockwise to decrease value.

Blue front-panel key usage

The blue front-panel key has three states:

Non-shift B, b, or G is not displayed in the lower-right corner of the screen. You can enter numeric values.

Uppercase shift B is displayed in the lower-right corner of the screen. G is not displayed. You can enter uppercase alphabet characters.

Lowercase shift b is displayed in the lower-right corner of the screen. You can enter lowercase alphabet characters.

To change between these states:

- toggle between the non-shift/shift state by pressing the blue key.
- toggle between the upper/lowercase shift state by pressing the green key, then the blue key.

The following is a detailed description about changing between these states:

Present Status	Next Status	Key to be pressed
non-shift	Uppercase blue-key shift	blue key
Uppercase blue-key shift	non-shift	blue key
non-shift	Lowercase blue-key shift	green key, then blue key
Lowercase blue-key shift	non-shift	blue key
Uppercase blue-key shift	Lowercase blue-key shift	green key, then blue key
Lowercase blue-key shift	Uppercase blue-key shift	green key, then blue key

Green front-panel key usage

You can use the green front-panel key to enter special (non-alphanumeric) characters, which are printed in green above the keys.

The green key action is momentary. That is, after you press the green key, only the next keystroke is effective. For example, to enter "#$", press the green key, 0, green key, and 1.

The green key mode has special functions for entering data, as shown in the following table.

The front-panel green key can also be used to perform dump (Plot/Print key), knob sweep (Single key), and zero offset cancel (Stop key) operations.

Keys	Label	Function
Green, ⇐	|⇐	Moves the cursor to the first character.
Green, ⇒	⇒|	Moves the cursor to the last character.
Green, Recall↓	Recall↑	Recalls the oldest input from the key buffer. The key buffer stores the 10 most recent entries in the data entry area.
Green, Clear	Clr→End	Clears the entered data from the present cursor position to the end.
Green, Enter	Calc	Calculates any expression entered in the data entry area.

Edit front-panel keys

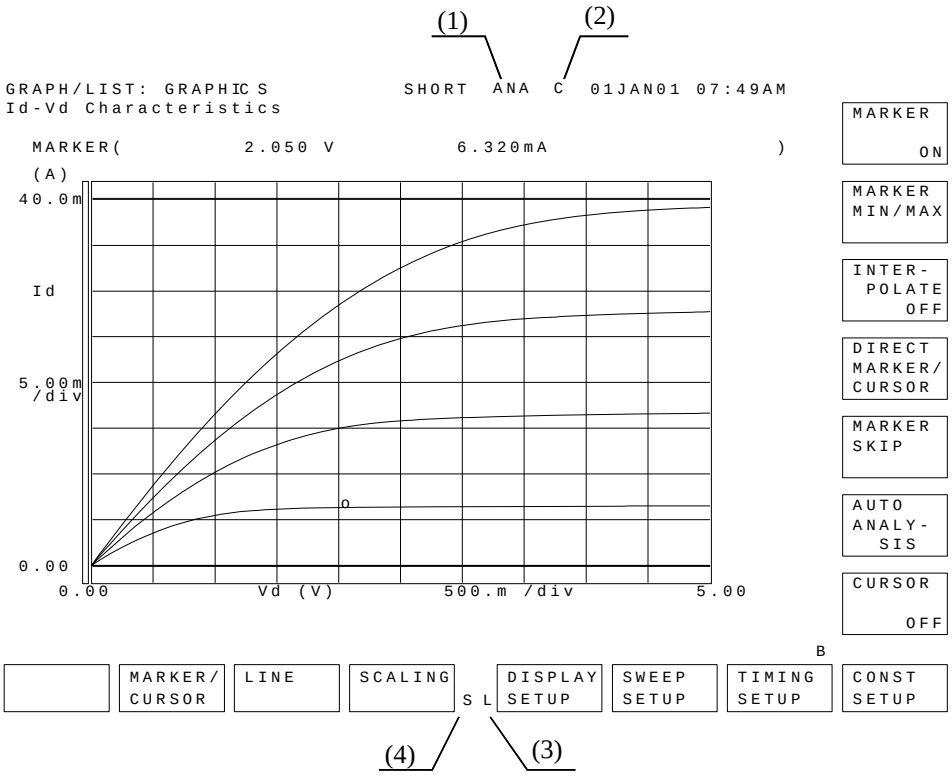
There are six keys in the Edit front-panel key group. Four of these keys also have other functions in the green-key shift mode. The following table shows the function of each key:

Key	Label	Functions
⇐		Moves the cursor left by one column in the data entry area.
⇒		Moves the cursor right by one column in the data entry area.
Delete		Deletes one character where the cursor is located.
Insert		Toggles the input mode in the data entry area between *insert* and *overtyping* modes.
Recall↓		Recalls the newest input from the key buffer.
Clear		Deletes all the characters in the data entry area.
Green, ⇐	|⇐	Moves the cursor to the first column in the data entry area.
Green, ⇒	⇒|	Moves the cursor to the last column of the present entry in the data entry area.
Green, Recall↓	Recall↑	Recalls the oldest input from the key buffer.
Green, Clear	Clr→End	Deletes the characters from the present cursor position to the end of the entry.

The key buffer stores the 10 most recent entries from the data entry area. You can recall the stored entries using Recall key, as described above.

Status Indicators

The status indicators indicates the present status of the 4155C/4156C. The display contains the following status indicators.



(1) indicates the following status:

TRG	The 4155C/4156C is waiting for trigger input from an external instrument.
DRW	The 4155C/4156C is drawing a measurement curve.
ANA	The 4155C/4156C is performing auto-analysis or regression calculation.

(2) indicates the following status:

C	The 4155C/4156C is performing auto-calibration.
Z	The 4155C/4156C is performing an offset measurement for the zero offset cancel function.

(3) displays L when the screen is locked by an GPIB command.

(4) indicates the following status:

S	The 4155C/4156C is in the SCPI command control mode.
F	The 4155C/4156C is in the FLEX command control mode.
4	The 4155C/4156C is in the 4145 syntax command control mode.

3 Setup Screens

This chapter is a reference for operating Agilent 4155C/4156C by using the front-panel controls. The 4155C/4156C is operated by setup screens and results screen displayed on the screen. The following sections explain these setup screen structure.

- “CHANNELS Screen Group”
- “MEASURE Screen Group”
- “DISPLAY Screen Group”
- “GRAPH/LIST Screen Group”
- “STRESS Screen Group”

CHANNELS Screen Group

CHANNELS screen group has the following screens:

Channel Definition:	For defining the measurement mode and measurement channels of the 4155C/4156C.
User Function Definition:	For defining the user functions.
User Variable Definition:	For defining the user variables.
E5250A Properties:	For defining the control mode of Agilent E5250A Low Leakage Switch Mainframe.
E5250A Setup:	For defining the input-output connection of the E5250A.

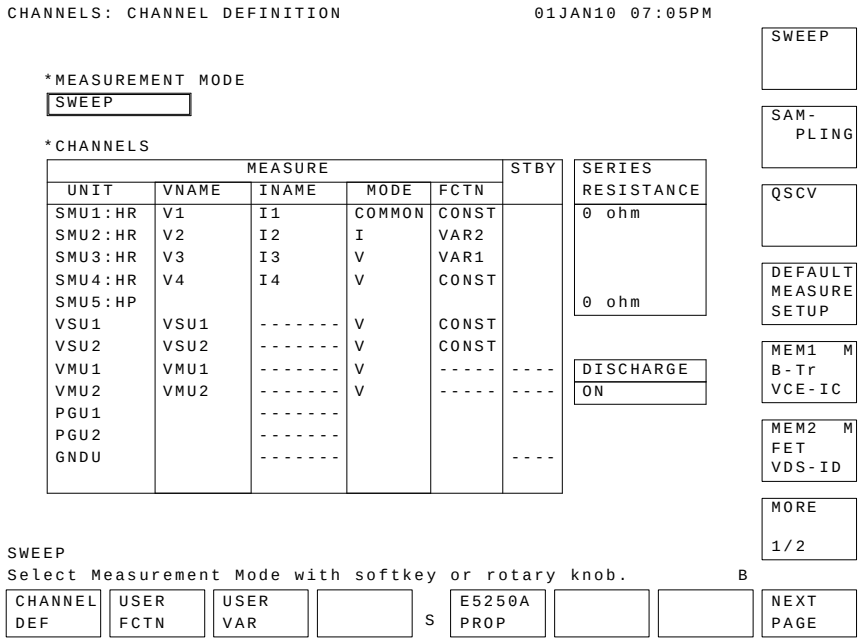
To move to the CHANNELS screen group, press Chan front-panel key.

The following primary softkeys are available for the CHANNELS screen group. where, E5250A SETUP softkey is displayed when the CONTROL field on the E5250A PROPERTIES screen is set to ON.

CHANNEL DEF	USER FCTN	USER VAR		E5250A PROP	E5250A SETUP	PREV PAGE	NEXT PAGE

- Select CHANNEL DEF softkey to move to CHANNELS: CHANNEL DEFINITION screen.
- Select USER FCTN softkey to move to CHANNELS: USER FUNCTION DEFINITION screen.
- Select USER VAR softkey to move to CHANNELS: USER VARIABLE DEFINITION screen.
- Select E5250A PROP softkey to move to CHANNELS: E5250A PROPERTIES screen. On this screen, PREV PAGE and NEXT PAGE softkeys are not available.
- Select E5250A SETUP softkey to move to CHANNELS: E5250A CONNECTION SETUP screen. On this screen, PREV PAGE and NEXT PAGE softkeys are not available.

CHANNELS: CHANNEL DEFINITION



On the "CHANNELS: CHANNEL DEFINITION" screen, you define the measurement mode and how to use each channel.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

MEASUREMENT MODE

MEASUREMENT MODE field sets measurement mode to sweep measurement mode, sampling measurement mode, or quasi-static CV measurement mode. In this field, select:

- SWEEP secondary softkey to set sweep measurement.
- SAMPLING secondary softkey to set sampling measurement.
- QSCV secondary softkey to set quasi-static CV measurement.

To change settings (except for system screen group) to default initial settings, select DEFAULT MEASURE SETUP secondary softkey.

NOTE

Application setup data in internal memories

MEM secondary softkeys indicate that setup or measurement result data is in the internal memory. When you turn on the 4155C/4156C without a diskette or network disk, the following secondary softkeys are displayed:

MEM1 M
B-Tr VCE-IC measurement setup data for bipolar transistor Vce-Ic characteristics.

MEM2 M
FET VDS-ID measurement setup data for FET (field effect transistor) Vds-Id characteristics.

MEM3 M
FET VGS-ID measurement setup data for FET (field effect transistor) Vgs-Id characteristics.

MEM4 M
DIODE VF-IF measurement setup data for diode Vf-If characteristics.

`M` on the softkey means measurement setup data.

Select softkey to get the desired application measurement setup data. This minimizes the time for setting up the measurement conditions.

See *User's Guide General Information*.

CHANNELS

UNIT.

This column lists all the units that are installed in the 4155C/4156C.

VNAME.

VNAME field assigns a variable name for voltage that will be forced or measured. You can use this name as a reference on the other screens. If channel does neither V force nor V measurement, you can omit VNAME.

In this field, enter a name by using the keyboard or front panel keys. where,

- VNAME must be 6 or less alphanumeric characters. First character must be alphabet character.
- Name must be different from other names.

The DELETE ROW softkey deletes the VNAME, INAME, MODE, FCTN, and STBY entries for the unit. Unit is disabled.

NOTE

To switch the unit definitions

To switch the VNAME, INAME, MODE, FCTN, and STBY assignment for units, do as follows:

1. Position pointer in top field of VNAME column. CHANNEL ASSIGN secondary softkey appears.
2. Select CHANNEL ASSIGN softkey. Pointer moves to the top field of UNIT column.
3. Use arrow keys in the MARKER/CURSOR key group to move pointer to desired row.
4. Select the secondary softkey of the desired unit. The selected unit appears at the pointer.

Perform steps 3 and 4 until you assign units as desired. Make sure that the same unit is not assigned to multiple rows. Then, select the EXIT CHANNEL ASSIGN softkey.

INAME.

INAME field assigns a variable name for current that will be forced or measured. You can use this name as a reference on the other screens. If channel does neither I force nor I measurement, you can omit INAME.

In this field, enter a name by using the keyboard or front panel keys. where,

- INAME must be 6 or less alphanumeric characters. First character must be alphabet character.
- Name must be different from other names.

The Select DELETE ROW softkey deletes the VNAME, INAME, MODE, FCTN, and STBY entries for the unit. Unit is disabled.

MODE.

You define an output mode for SMUs, VSUs, PGUs, and GNDU, and measurement mode for VMUs. When the pointer is located in this column, allowable modes appear in the secondary softkey area. You select a softkey to set a mode. The following table shows allowable modes for each unit:

	V	I	VPULSE	IPULSE	COMMON	DVOLT
SMU	Yes	Yes	Yes[a]	Yes[a]	Yes	
VSU	Yes					
PGU	Yes		Yes[b]			
GNDU					Yes	
VMU[b]	Yes					Yes

a. Only for sweep measurements. Not available for sampling and QSCV. Only one pulsed source SMU is available for a channel setup. If VPULSE is set to a SMU, IPULSE cannot be set to another SMU in the same setup.
b. Not available for QSCV.

To delete the VNAME, INAME, MODE, FCTN, and STBY entries for a unit, select the DELETE ROW secondary softkey. Unit is disabled.

FCTN.

This field defines an output function for SMUs, VSUs, PGUs, and GNDU. When the pointer is located in this column, allowable output functions appear in the secondary softkey area. You select a softkey to set an output function.

	Var1 [a]	Var1' [b]	Var2 [b]	CONST
SMU	Yes	Yes	Yes	Yes
VSU	Yes[b]	Yes	Yes	Yes
PGU				Yes
GNDU				Yes

a. Not available for sampling.
b. Only for sweep measurements. Not available for sampling and QSCV.

where,

- You can set multiple CONST in a channel setup.
  You *cannot* set multiple VAR1, VAR1', or VAR2 in a channel setup.
- VAR2 and VAR1' are available when VAR1 is set.
- The output modes of VAR1 and VAR1' must be same. That is, the MODE setting for both must be set to a voltage mode, or both must be set to a current mode. For example, you can set VAR1 to V and VAR1' to VPULSE.
- For QSCV measurements, only one V mode SMU can be set to VAR1.

STBY.

STBY field specifies which channels output source values in the standby state.

- If STBY is set to ON, the unit forces a specified output value when in the standby state.
- If STBY is blank, the unit outputs 0 V in the standby state.

For details about the standby state, see *User's Guide: Measurement and Analysis*.

where,

- If both PGUs are set to VPULSE, the STBY setting of both PGUs must be the same.
- For STBY=ON channel, SERIES RESISTANCE setting must be 0 ohm.

SERIES RESISTANCE

In the SERIES RESISTANCE fields, you select the value that you want to set in Agilent 16441A R-Box. When the pointer is located in this field, allowable resistance values are shown in the secondary softkey area. You select the desired series resistance.

Normally, SMU1 and SMU2 have SERIES RESISTANCE fields. However, if your 4155C/4156C is installed with the Agilent 41501 Expander equipped with the HPSMU (high power SMU), SMU1 and SMU5 have SERIES RESISTANCE fields.

where,

- If the 16441A R-box is not connected, you must set 0 ohm.
- To use Kelvin connection for HRSMU or HPSMU, you must set 0 ohm.
- For STBY channels, you can set 0 ohm only.
- For COMMON channels, you can set 0 ohm only.

The R-box cannot be used for the quasi-static CV measurement.

DISCHARGE

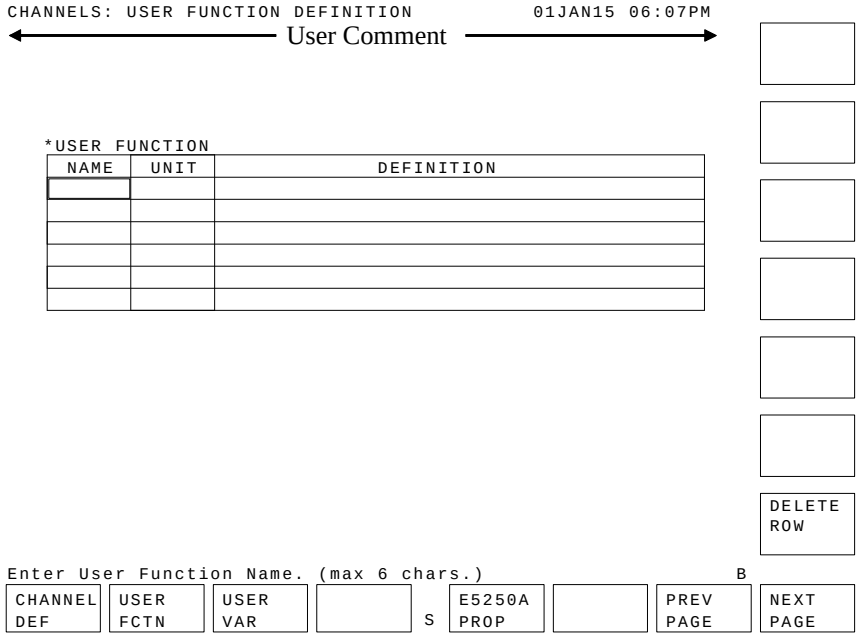
In the DISCHARGE field, you control the connection of the VMU input discharge resistor. The discharge resistor prevents the VMU inputs from becoming charged when the inputs are opened.

ON	connects the discharge resistors to VMU inputs immediately, and automatically breaks the connection only in the measurement state.
OFF	disconnects the discharge resistors from VMU inputs immediately.

When the auto-calibration is executed, the setting is not changed.

VMU and this function are not available for the quasi-static CV measurement.

CHANNELS: USER FUNCTION DEFINITION



On this screen, you define user functions. For details about user functions, refer to *User's Guide: Measurement and Analysis*.

User Comment

In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

NAME

NAME field defines the user function name. In this field, you can enter a name by using the keyboard or front panel keys. Or you can select variables that are shown on the secondary softkeys. where,

- NAME must be 6 or less alphanumeric characters. First character must be alphabet character.
- NAME must be different from other names. The alphabet characters are case sensitive. For example, HFE is different from Hfe.

To delete a user function, you can select DELETE ROW softkey to delete the NAME, UNIT, and DEFINITION entries.

After defining a user function, you can use this variable name for reference on other screens.

UNIT (optional)

UNIT defines the unit of the user function. This unit is used on the graph and list result screens. where, UNIT must be 6 or less alphanumeric characters.

To delete a user function, you can select DELETE ROW softkey to delete the NAME, UNIT, and DEFINITION entries.

DEFINITION

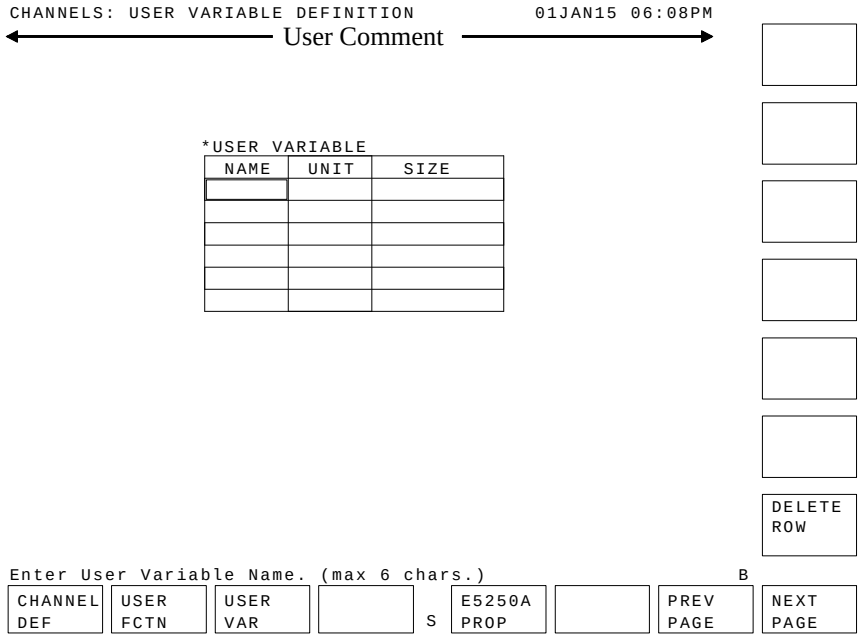
You enter an expression that defines the user function. The expression can consist of numerical operators, constants, variables, built-in functions, and other user-defined functions.

By selecting secondary softkeys, you can enter VNAMEs or INAMEs that are set on the CHANNELS: CHANNEL DEFINITION screen.

For syntax, see *User's Guide: Measurement and Analysis*.

CHANNELS: USER VARIABLE DEFINITION

On this screen, you register user variables that were defined by GPIB. To use a user variable, you must register it on this screen. For details about user variables, refer to *User's Guide: Measurement and Analysis*.



User Comment

In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

NAME

NAME field defines the user variable name. You can enter a name by using the keyboard or front-panel keys. After defining a user variable, you can use this variable name for reference on other screens. where,

- NAME must be 6 or less alphanumeric characters. First character must be alphabet character.
- NAME must be different from other names. The alphabet characters are case sensitive. For example, HFE is different from Hfe.

To delete a user variable, select DELETE ROW softkey to delete the NAME, UNIT, and SIZE entries.

UNIT (optional)

UNIT defines the unit of the user variable. This unit is used on the graph and list result screens. You can enter the unit by using the keyboard or front-panel keys. where, UNIT must be 6 or less alphanumeric characters.

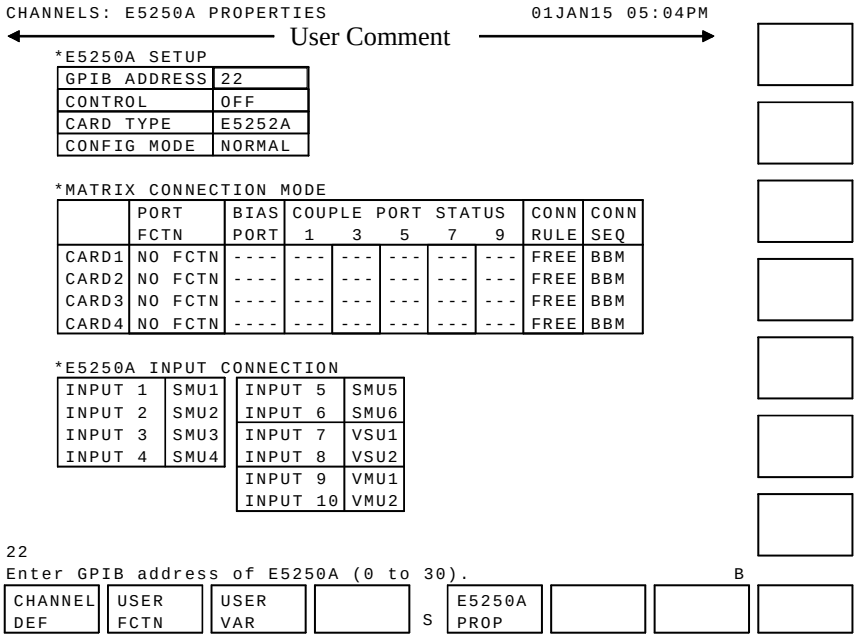
To delete a user variable, select DELETE ROW softkey to delete the NAME, UNIT, and SIZE entries.

SIZE

SIZE field sets the number of data for the user variable. The number of data must be 10001 or less (total for all measurement data and user variables). You can enter the size by using the keyboard or front-panel keys.

To delete a user variable, select DELETE ROW softkey to delete the NAME, UNIT, and SIZE entries.

CHANNELS: E5250A PROPERTIES



The 4155C/4156C can control the Agilent E5250A Low Leakage Switch Mainframe if it has an E5252A matrix card installed. On the "CHANNELS: E5250A PROPERTIES" screen, you can define the E5250A setup and the connection modes for the E5252A.

NOTE

The E5250A must have the E5252A matrix cards installed continuously from slot 1. Only E5252As installed continuously from slot 1 on can be controlled by the 4155C/4156C.

If a blank card or another card is in slot 2, 3, or 4, the 4155C/4156C ignores the cards installed in those slots as well as the cards in following slots.

User Comment

Use this field to enter a desired comment. The comment you enter here is also displayed on the CHANNELS: E5250A CONNECTION SETUP screen.

E5250A SETUP

GPIB ADDRESS.

This field is used to set the GPIB address of the E5250A connected to, and controlled by, the 4155C/4156C. Available values: 0 to 30.

CONTROL.

This field is used to select the E5250A control mode. You can select either ON or OFF using the secondary softkey.

- ON : enables the E5250A control from the 4155C/4156C.
- OFF : disables the E5250A control.

Before setting the field to ON, the E5250A must be connected to the 4155C/4156C and turned on. Also the 4155C/4156C must be the SYSTEM CONTROLLER.

When you turn the CONTROL ON, the 4155C/4156C sends a query for the present setup of the E5250A, and displays it. In the E5250A control ON status:

- The E5250A SETUP primary softkey appears. Selecting the softkey displays the CHANNELS: E5250A CONNECTION SETUP screen.
- You can save/get/copy/purge/rename the E5250A setup file (extension: MAT) using the filer function.

CARD TYPE.

This field displays “E5252A” which is the Agilent model number of the matrix card. If the matrix card is not installed in the E5250A slot 1, you cannot set the CONTROL to ON and this field displays “------”.

CONFIG MODE.

Use this field to select the E5250A configuration mode, either AUTO or NORMAL, and to initialize the E5250A, using the secondary softkey. Note that changing the mode resets the E5250A setup except for the configuration mode.

AUTO	Selects the auto configuration mode. In this mode, the installed cards are treated as one card. For example, if the E5252As are installed in slots 1 to 4, the E5250A works as a 48 output matrix.
NORMAL	Selects the normal configuration mode. Each card is considered independently. Each card works as a 12 output matrix. This is the default setting.
RESET E5250A	Initializes all of the E5250A setup including the configuration mode.

MATRIX CONNECTION MODE

CARD*n*.

Specifies the matrix card installed in the E5250A.

CARD1 Specifies the matrix card installed in the E5250A slot 1.

CARD2 Specifies the matrix card installed in the E5250A slot 2.

CARD3 Specifies the matrix card installed in the E5250A slot 3.

CARD4 Specifies the matrix card installed in the E5250A slot 4.

NOTE The card numbers displayed are for the cards installed continuously from slot 1.

PORT FCTN.

Use this field to select the port function using the following softkeys:

NO FCTN Disables the port function. This is the default setting.

BIAS PORT Enables the bias port function that connects the input bias port to all output ports that are disconnected from other input ports. select the bias port using the BIAS PORT field.

Ignores the COUPLE PORT STATUS field. You cannot use the Coupled Port function and the Bias Port function simultaneously.

COUPLE PORT Enables the couple port function that is effective for the kelvin connection. Select the coupled ports in the COUPLE PORT STATUS field.

Ignores the BIAS PORT field. You cannot use the Bias Port function and the Couple Port function simultaneously.

NOTE

Connection after the port function was changed

Changing the port function does not change the connection setup of the E5250A. However, by way of exception, changing the port function from the bias port function to the couple port function or no function will disconnect the output ports from the input port that has been used as the bias port.

BIAS PORT.

Use this field to specify the E5250A input port to be used as the bias port. Enter the input port number. Available values: 1 to 10. The default value is 10.

The input bias port is connected to all output ports that are disconnected from other input ports. If you try to connect an output port to another input port, the output port will be disconnected from the bias port, and connected to the specified input port.

NOTE **Connection after the input bias port was changed**

Changing the input port number of the bias port will disconnect the output bias ports from the previous input bias port and connect them to the new input bias port.

COUPLE PORT STATUS.

Use this field to select the coupled port. The following input ports can be coupled:

- INPUT1 and INPUT2 can be coupled port 1.
- INPUT3 and INPUT4 can be coupled port 3.
- INPUT5 and INPUT6 can be coupled port 5.
- INPUT7 and INPUT8 can be coupled port 7.
- INPUT9 and INPUT10 can be coupled port 9.

To select the coupled ports, select the ON or OFF secondary softkey for each coupled port (1, 3, 5, 7, or 9):

- ON : enables the coupled port.
- OFF : disables the coupled port. The default setting.

NOTE **Operation of the Couple Port**

Coupled ports work as described below:

- When the coupled port is opened, *coupled* input ports INPUT*m*-1 and INPUT*m* are disconnected from all output ports.
- When the coupled port is closed, *coupled* input ports INPUT*m*-1 and INPUT*m* are connected as follows:

  Input port INPUT*m*-1 is connected to output port *n*-1.
  Input port INPUT*m* is connected to output port *n*.

Where, *m* and *n* are integer (even numbers). The maximum value is 10 for *m*, and 48 for *n*.

CONN RULE.

Use this field to select the connection rule using the secondary softkey. The following setups are available:

SROU Selects the single route connection rule. Each input port can be connected to only one output port on a matrix card.

When making a new connection for an input port, the previous connection for the port is automatically disconnected and the new connection is made. But if the normal configuration mode has been specified, the connection on another card is not changed.

FREE Selects the free connection rule. Each input port can be connected to multiple output ports and each output port can be connected to multiple input ports. This is the default setting.

CAUTION **Do not connect multiple inputs to an output**

If the free connection rule has been specified, ensure multiple input ports are not connected to the same output port. Such configurations can cause damage to the instrument connected to the input terminals.

NOTE **Connection after the connection rule was changed**

Changing the connection rule does not change the connection setup of the E5250A. So you may find the unmatched connections for the single rule on the CHANNELS: E5250A CONNECTION SETUP screen after you change the connection rule from free to single. Then select the APPLY OPEN ALL softkey to apply the open to all connections on the E5250A.

CONN SEQ.

Use this field to select the connection sequence using the secondary softkey.The following setups are available. The initial value is BBM.

BBM Selects the break-before-make sequence. This connection sequence breaks the previous connection, waits for an open status, and makes the new connection.

MBBR Selects the make-before-break sequence. This connection sequence makes the new connection, waits for a close status, and breaks the previous connection.

NSEQ Selects no sequence. This connection sequence breaks the previous connection, and then makes the new connection.

E5250A INPUT CONNECTION

This table defines the unit name, device terminal name, or any identification. The definitions are used to classify the E5250A input ports on the E5250A CONNECTION SETUP screen.

To define the unit name, the secondary softkeys are available.

NOTE

Value of INPUT*n*

The INPUT*n* fields are labels used to classify the E5250A input ports. You can use another name instead of the unit name. Enter the name using the front-panel keys or keyboard. A maximum four alpha-numeric characters are available. The first character must be an alpha character.

NOTE

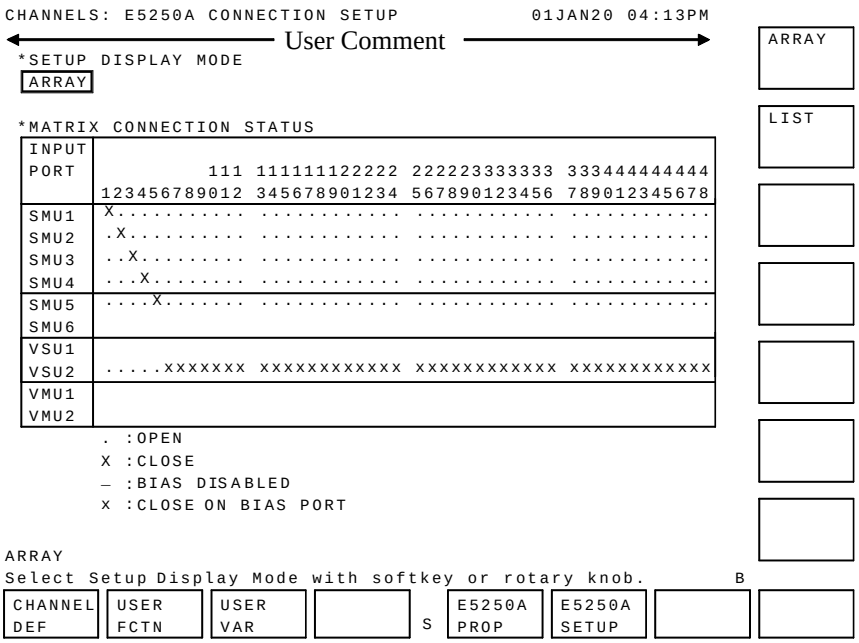
INPUT 5 to INPUT 10

These input ports are connected internally as shown below.

- INPUT 5, INPUT 7, and INPUT 9 are connected
- INPUT 6, INPUT 8, and INPUT 10 are connected

Do not use these ports at the same time.

CHANNELS: E5250A CONNECTION SETUP



On the "CHANNELS: E5250A CONNECTION SETUP" screen, you can define the connection information for the E5252A matrix card.

User Comment

Use this field to enter a desired comment. The comment you enter here is also displayed on the CHANNELS: E5250A PROPERTIES screen.

SETUP DISPLAY MODE

Use this field to select the display mode, either array or list, for the matrix connection setup. The following secondary softkeys are available:

ARRAY Selects the array display mode. You can define the matrix connections by selecting the softkeys.
The array displays · for opened status, X for closed status, _ for bias disabled output ports, or x for closed status on the bias port.

LIST Selects the list display mode. You can define the matrix connections by specifying the output port numbers.

CARD NUMBER

This field is displayed only when the CONFIG MODE is NORMAL and the SETUP DISPLAY MODE is LIST. Select the card for which you are going to set up the connection information on the screen. Use the secondary softkey to select the card.

MATRIX CONNECTION STATUS

ARRAY display mode.

Move the pointer to the specified point, then select the OPEN or CLOSE softkey to change the connection status.

In this display mode, the following softkeys are available. The OPEN/CLOSE and BIAS DISABLE/ENABLE softkeys only change the setup on the screen. To apply the setup to the E5250A, press the APPLY SETUP softkey.
The BIAS DISABLE/ENABLE softkeys are shown on the bias port instead of the OPEN/CLOSE softkeys.

OPEN	Defines an open at this point. Displays · .
CLOSE	Defines a close at this point. Displays X .
BIAS DISABLE	Disables the bias port function for the specified output port. Displays _ .
BIAS ENABLE	Enables the bias port function for the specified output port. Displays x or · .
APPLY SETUP	Applies the connection information to the E5250A.
APPLY OPEN ALL	Immediately opens all connections on the E5250A.
CANCEL SETUP CHANGE	Cancels the changes you made on the screen.
ENABLE PORT	Available for INPUTs 5 to 10. Selects the enabled input port. Not available for the enabled input ports, the bias port, and the input ports connected internally to the bias port.

NOTE

INPUT PORT

INPUT 1 to INPUT 4 are always enabled. INPUT 5 to INPUT 10 are selectable. You can select one from INPUT 5, 7, and 9 and you can also select one from INPUT 6, 8, and 10.

For example, if you select the ENABLE PORT softkey on INPUT 7, then INPUT 5 and INPUT 9 are disabled, and INPUT 7 is enabled. The information for the disabled ports is cleared.

NOTE

Output port numbers

The output port numbers available depend on the configuration mode. In the NORMAL mode, numbers 1 through 12 are available for each card. In the AUTO mode, numbers 1 through 12 (with 1 card), 1 through 24 (with 2 cards), 1 through 36 (with 3 cards), or 1 through 48 (with 4 cards) are available.

See Figure 3-1 for an example of the ARRAY display. In this example the E5250A controls four E5252As. Input port 6 (SMU6) is used as the bias port.

Figure 3-1 ARRAY Display

NORMAL configuration mode:

INPUT PORT	CARD1 111 123456789012	CARD2 111 123456789012	CARD3 111 123456789012	CARD4 111 123456789012
SMU1	X...........	.....	.....	.....
SMU2	.X..........	.....	.....	.....
SMU3	..X.........	.....	.....	.....
SMU4	.....	.....	.....	.....
SMU5	.....	.....	.....	.....
SMU6	...xxxxxx___	.....	.....	.....
VSU1				
VSU2				
VMU1				
VMU2				

AUTO configuration mode:

INPUT PORT	111 123456789012	111111122222 345678901234	222223333333 567890123456	333444444444 789012345678
SMU1	X...........	.....	.....	.....
SMU2	.X..........	.....	.....	.....
SMU3	..X.........	.....	.....	.....
SMU4	.....	.....	.....	.....
SMU5	.....	.....	.....	.....
SMU6	...xxxxxx___	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
VSU1				
VSU2				
VMU1				
VMU2				

Array displays: · for opened status, X for closed status, _ for the bias disabled output ports, and x for closed status on the bias port.

LIST display mode.

Enter the output port numbers to be connected. Use a comma to specify multiple numbers. Use a hyphen for a continuous range of numbers. For example, 1, 6 specifies the output ports 1 and 6, and 1-12 specifies output ports 1 through 12.

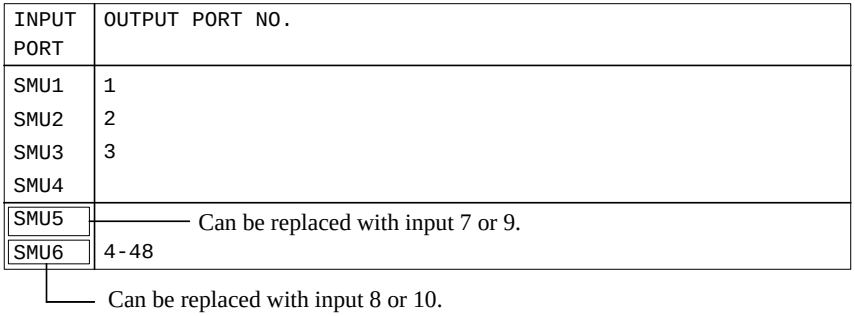
To apply the setup to the E5250A, select the APPLY SETUP softkey.

To apply the open to all connections, select the APPLY OPEN ALL softkey.

To cancel the changes you made, select the CANCEL SETUP CHANGE softkey.

See Figure 3-2 for an example of the LIST display. In this example the E5250A controls four E5252As in the AUTO configuration mode.

Figure 3-2 **LIST Display**



NOTE

INPUT PORT

INPUT 1 through INPUT 4 are always enabled. INPUT 5 through INPUT 10 are selectable. You can select one from INPUT 5, 7, and 9 and you can also select one from INPUT 6, 8, and 10.

To change the enable input port, move the pointer to the INPUT 5 or INPUT 6 field (SMU5 or SMU6 in Figure 3-2). Then select the softkey that specifies the input port you want to enable. The softkeys have the label you defined in the E5250A INPUT CONNECTION fields on the CHANNELS: E5250A PROPERTIES screen. For the bias port, only the softkey that specifies the bias port is available.

NOTE

Output port numbers

Output port numbers 1 through 12 are available in the NORMAL mode. In the AUTO mode, the available numbers are 1 through 12 (with 1 card), 1 through 24 (with 2 cards), 1 through 36 (with 3 cards), or 1 through 48 (with 4 cards).

MEASURE Screen Group

MEASURE screen group has the following screens:

Sweep Setup,
Sampling Setup, or
QSCV Setup: For setting the parameters for sweep, sampling, or quasi-static CV measurement, which was defined in the CHANNELS: CHANNEL DEFINITION screen.

PGU Setup: For setting the PGU parameters. This screen is available when PGU is installed and the MODE and FCTN field of PGUs are set on the CHANNELS: CHANNEL DEFINITION screen.

Measure Setup: For setting the measurement range, integration time, zero cancel, and wait time.

Output Sequence: For setting the output sequence and triggering.

To move into the MEASURE screen group, press Meas front-panel key. The MEASURE: SWEEP SETUP, SAMPLING SETUP, or QSCV SETUP screen is displayed. And the following primary softkeys appear:

SWEEP SETUP	PGU SETUP	MEASURE SETUP	OUTPUT SEQ			PREV PAGE	NEXT PAGE

or

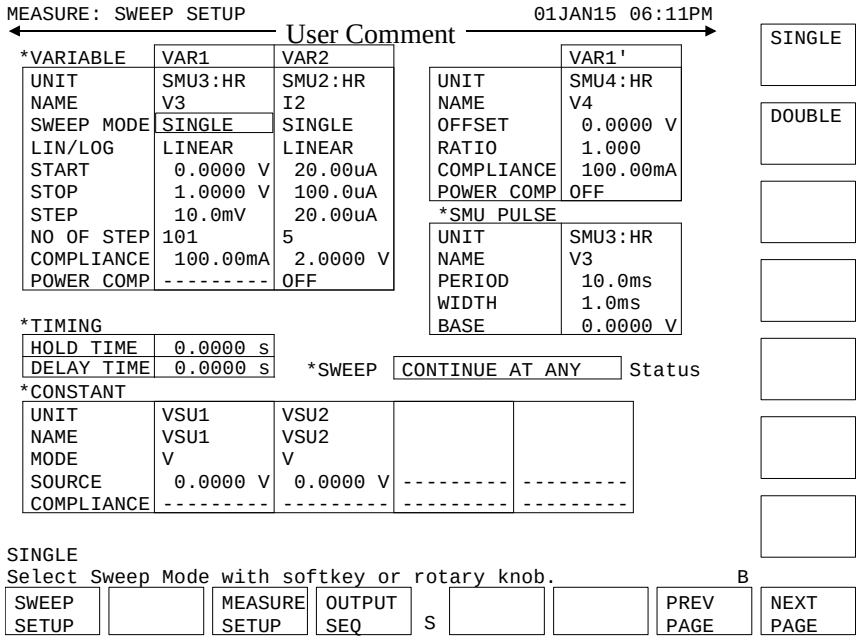
SAMPLNG SETUP	PGU SETUP	MEASURE SETUP	OUTPUT SEQ			PREV PAGE	NEXT PAGE

or

QSCV SETUP	PGU SETUP	MEASURE SETUP	OUTPUT SEQ			PREV PAGE	NEXT PAGE

- Select SWEEP SETUP to move to MEASURE: SWEEP SETUP screen.
- Select SAMPLNG SETUP to move to MEASURE: SAMPLING SETUP screen.
- Select QSCV SETUP to move to MEASURE: QSCV SETUP screen.
- Select PGU SETUP to move to MEASURE: PGU SETUP screen.
- Select MEASURE SETUP to move to MEASURE: MEASURE SETUP screen.
- Select OUTPUT SEQ to move to MEASURE: OUTPUT SEQUENCE screen.

MEASURE: SWEEP SETUP



On this screen, you set output parameters for each unit.

User Comment In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

VAR1 parameters In this column, you set up output parameters for primary sweep unit. UNIT and NAME are defined on CHANNELS: CHANNEL DEFINITION screen.

- SWEEP MODE

  SWEEP MODE field sets **single** or **double sweep mode**. In this field, select:

  - SINGLE secondary softkey to specify the single sweep mode.
  - DOUBLE secondary softkey to specify the double sweep mode.

- LIN/LOG

  LIN/LOG field sets **linear** or **logarithmic sweep mode**. In this field, select:

  - LINEAR secondary softkey to set linear sweep mode.
  - LOG10, LOG25, or LOG50 secondary softkey to set logarithmic sweep mode. The number specifies the sweep points per decade.

- START, STOP, and STEP

  In the START, STOP, and STEP fields, you specify the **start**, **stop**, and **step values**. The step value is used for the linear sweep mode *only*.

  The following applies to logarithmic sweep mode only:

  - STEP field has no meaning, so "`------`" is shown in the STEP field.
  - Start and stop values must be the same polarity.
  - If you specify `0` (zero) for the start or stop value, the minimum output value for the unit is used.
  - You specify the number of steps per decade in the LIN/LOG field.

- NO. OF STEP

  For the linear sweep mode, the number of steps is calculated from the start, stop, and step values, and appears in the NO. OF STEP field.

  For the logarithmic sweep mode, the number of steps is calculated from the start, stop, and LIN/LOG values, and appears in the NO. OF STEP field.

- COMPLIANCE

  In the COMPLIANCE field, you set the **compliance value**. If a VSU is used for the VAR1 unit, this field *cannot* be set: compliance value is fixed to 100 mA.

- POWER COMP

  In the POWER COMP field, you can set a **power compliance value** for SMUs. To disable the power compliance function, select the OFF secondary softkey. If *an* SMU is set to VPULSE or IPULSE mode and if the SMU is set to VAR1, you *cannot* set power compliance for the VAR1 SMU.

VAR2 parameters

In this column, you set up the output parameters for the secondary sweep unit. UNIT and NAME are defined on the CHANNELS: CHANNEL DEFINITION screen.

SWEEP MODE and LIN/LOG fields are fixed to SINGLE and LINEAR.

- START, STEP, and NO. OF STEP

  In the START, STEP, and NO OF STEP fields, you specify the start value, step value, and number of steps. The stop value is calculated from these values, and is shown in the STOP field.

- COMPLIANCE

  In COMPLIANCE field, you set compliance value. If a VSU is used for VAR2 unit, this field *cannot* be set: compliance value is fixed to approximately 100 mA.

- POWER COMP

  In POWER COMP field, you can set power compliance value for SMUs. To disable power compliance function, select OFF secondary softkey.

VAR1' parameters

In this column, you set up the output parameters for the synchronous sweep unit. This VAR1' table is displayed only when VAR1' is set in the FCTN field on the CHANNELS: CHANNEL DEFINITION screen.

UNIT and NAME are defined on CHANNELS: CHANNEL DEFINITION screen.

- OFFSET and RATIO

  In the OFFSET and RATIO fields, you specify the *offset* and *ratio* values. The offset and ratio values determine the VAR1' value as follows:

  $$\text{VAR1'} \text{ output} = \text{VAR1 output} \times \textit{ratio} + \textit{offset}$$

- COMPLIANCE

  In COMPLIANCE field, you set compliance value. If a VSU is used for VAR1' unit, this field *cannot* be set: compliance value is fixed to 100 mA.

- POWER COMP

  In the POWER COMP field, you can set the power compliance value. To disable the power compliance function, select OFF secondary softkey. If *an* SMU is set to VPULSE or IPULSE mode and if the SMU is set to VAR1', you *cannot* set power compliance for the VAR1' SMU.

TIMING

- HOLD TIME

  In the HOLD TIME field, you set the **hold time**. The output unit waits this time after forcing the start value. Range: 0 to 655.35 s. Resolution: 10 ms.

- DELAY TIME In DELAY TIME field, you set the **delay time**. The output unit waits this time after each step, then starts measurement. If an SMU is set up to be a pulse source, DELAY TIME field is not displayed because each step is synchronized with pulse output. Range: 0 to 65.535s. Resolution: 100 μs.

SWEEP Status

- Select CONT AT ANY secondary softkey (sweep will continue even if an abnormal status occurs). Abnormal status means the following:
  - SMU reaches its compliance setting.
  - Current of VSU exceeds approximately ±100 mA.
  - SMU or VSU oscillates.
  - A/D converter overflow occurs.
  - Average current of PGU exceeds ±100 mA.
- Select STOP AT ANY ABNORM secondary softkey (sweep will stop if any abnormal status occurs).
- Select STOP AT COMPLIANCE secondary softkey (sweep will stop only if SMU reaches its compliance setting).

`STOP AT COMPLIANCE` is automatically set when power compliance is set for SMUs, or when `10k ohm`, `100k ohm`, or `1M ohm` is selected in the SERIES RESISTANCE field. If power compliance is set for an SMU, the CONT AT ANY secondary softkey is not displayed.

SMU PULSE

These parameters set the SMU pulsed source (IPULSE or VPULSE). The SMU pulsed source is defined on the CHANNELS: CHANNEL DEFINITION screen, so the UNIT and NAME fields are already set.

In the PERIOD, WIDTH, and BASE fields, you specify the pulse period, pulse width, and pulse base value. The pulse peak value is determined by the settings in the VAR1, VAR2, VAR1', or CONSTANT field.

Be aware that if any of following are true, pulsed SMU channel may not output the pulse period and pulse width you specified:

- Measurement range differs from compliance range (lowest range that includes compliance).
- Ranging mode is set to auto range or limited auto range.
- Multi-channel measurement is set.

CONSTANT

These parameters set the constant source units. UNIT, NAME, and MODE are defined on the CHANNELS: CHANNEL DEFINITION screen.

- SOURCE

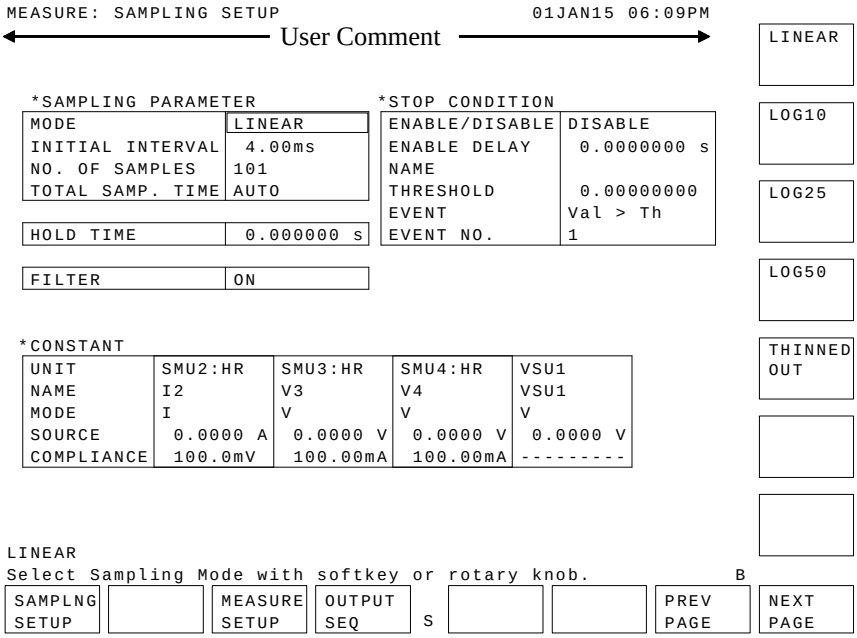
  In the SOURCE field, you specify the output value.

- COMPLIANCE

  In this field, you set compliance value. If VSU is used for constant output unit, this field cannot be set: compliance value is fixed to 100 mA.

If you define more than four constant output units, the first four units appear in the CONSTANT fields. To show other units, select NEXT UNIT secondary softkey. To scroll the units, put field pointer in most right or left column, then press the right arrow or left arrow MARKER/CURSOR front-panel key.

MEASURE: SAMPLING SETUP



On this screen, you set sampling parameters for each unit. For details, see *User's Guide: Measurement and Analysis*.

User Comment

In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

SAMPLING PARAMETER

- MODE

  MODE field sets the **sampling mode**. In this field, select:

  - LINEAR secondary softkey to specify the linear sampling mode.
  - LOG10, LOG25, or LOG50 secondary softkey to specify the logarithmic sampling mode. The number specifies how many samples to take per decade.
  - Select THINNED-OUT softkey to specify the thinned-out sampling mode, which discards less recent samples.

- INITIAL INTERVAL

  In the INITIAL INTERVAL field, you set the **initial interval** which is the interval of measurement trigger. Not measurement interval. Measurement unit executes measurement if it is ready to measure at the trigger. If the unit is busy or in measurement, the unit waits for the next trigger.

- NO. OF SAMPLES

  This field sets the **number of samples**. The number of samples must be 10001 or less (total for all units that make measurements plus size of all registered user variables). The number of units that make measurements is determined by the DISPLAY: DISPLAY SETUP screen.

- TOTAL SAMP. TIME (for linear and thinned-out sampling mode)

  TOTAL SAMP. TIME field sets the **total sampling time**. The total sampling time must satisfy the following condition:

  $$\textit{total sampling time} \geq \textit{initial interval} \times (\textit{number of samples} - 1)$$

  In this field, enter a value or select:

  - NO LIMIT secondary softkey to continue the sampling until sampling completion condition is satisfied. For linear sampling mode, **initial interval** must be more than 480 μs.
  - (for linear sampling mode only) AUTO secondary softkey to set the total sampling time to *initial interval* × (*number of samples* −1).

- HOLD TIME

  HOLD TIME field sets the **hold time**. The unit waits this time after forcing the specified constant value, then sampling starts.

  Range: (for *initial interval* < 2 ms) −30ms to 655.35s with 100 μs resolution.

  (for *initial interval* ≥ 2 ms) 0 to 655.35s with 100 μs resolution.

- FILTER This field specifies SMU filter to `ON` or `OFF`. If this field is set to `ON`, overshoot is decreased, but settling time takes several ms. Be aware of this if you set initial interval to a short time.

STOP CONDITION

- ENABLE/DISABLE

  This field defines whether the **stop conditions** are enabled. Cannot ENABLE if INITIAL INTERVAL < 2 ms. In this field, select:

  - ENABLE secondary softkey to enable the stop conditions.
  - DISABLE secondary softkey to disable the stop conditions.

- ENABLE DELAY

  This field sets the **enable delay** time. The stop condition is ignored for the enable delay time after the sampling starts. The resolution of enable delay time is the initial interval time.

- NAME

  NAME field sets the variable name or user function name that you want to monitor for the stop conditions. Allowable variable names and user function names are shown in the secondary softkey area.

- THRESHOLD

  In the THRESHOLD field, you set the **threshold value**.

- EVENT

  In the EVENT field, you set the event type as follows:

  Val>Th event occurs when NAME value is greater than THRESHOLD.

  Val<Th event occurs when NAME value is less than THRESHOLD.

  |Val|>|Th| event occurs when absolute NAME value is greater than absolute THRESHOLD value.

  |Val|<|Th| event occurs when absolute NAME value is less than absolute THRESHOLD value.

- EVENT NO.

  EVENT NO. specifies sampling to stop if event occurs EVENT NO. times. EVENT NO. can be an integer from 1 to 200.

CONSTANT

This is for setting the output parameters of the constant source units. UNIT, NAME, and MODE are defined on the CHANNELS: CHANNEL DEFINITION screen.

- SOURCE

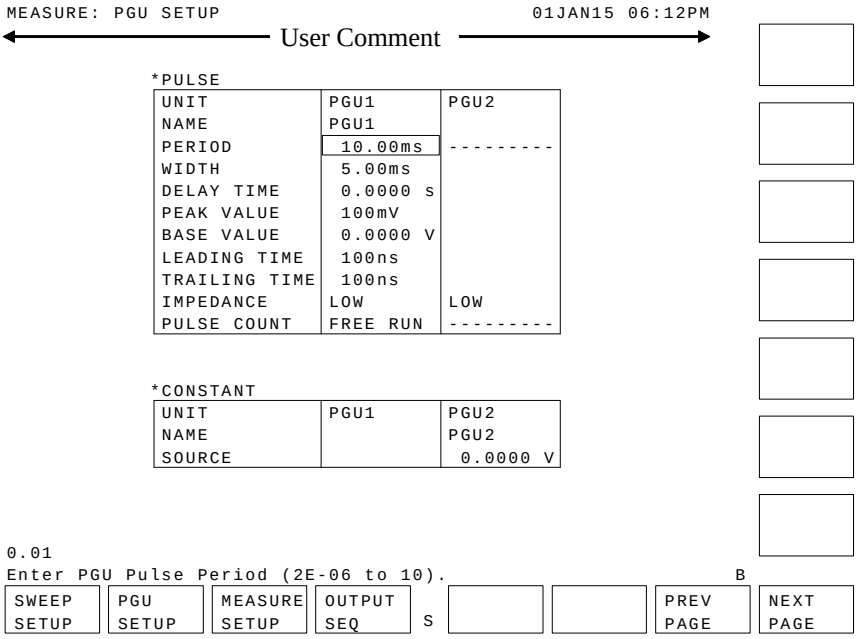
  In the SOURCE field, you specify the output value.

- COMPLIANCE

  In the COMPLIANCE field, you specify the compliance value. If a VSU is used for the constant output unit, this field cannot be set: compliance value is fixed to 100 mA.

If you define more than four constant output units, first four units appear in CONSTANT fields. To show other units, select NEXT UNIT secondary softkey. To scroll units, put field pointer in most right or left column, then press the right arrow or left arrow MARKER/CURSOR front-panel key.

MEASURE: PGU SETUP



On the "MEASURE: PGU SETUP" screen, you set output parameters for each PGU. For more information about PGUs, see *User's Guide: Measurement and Analysis*.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

PULSE

You set the pulse output parameters in the PULSE area.

UNIT and NAME are defined on the CHANNELS: CHANNEL DEFINITION screen.

- PERIOD

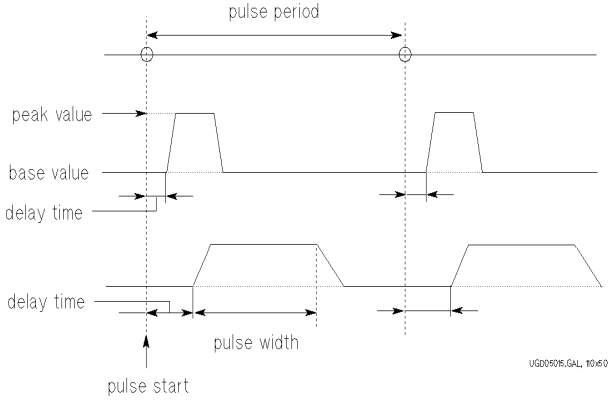
  PERIOD field specifies the pulse period of the PGU. Note that the pulse period of PGUs is independent from that of the SMUs.

- WIDTH

  WIDTH field specifies the pulse width. The pulse width must be less than the pulse period.

- DELAY TIME

  DELAY TIME field specifies the delay time from the pulse period start time. The delay time must be less than or equal to the pulse period.



- PEAK VALUE and BASE VALUE

  PEAK VALUE and BASE VALUE fields specify the pulse peak and pulse base values.

- LEADING TIME and TRAILING TIME

  LEADING TIME and TRAILING TIME fields specify the transition time of leading and trailing edges, which is time for pulse to change from 10% to 90% of pulse amplitude.

- IMPEDANCE

  IMPEDANCE field specifies the PGU output impedance. In this field, select:

  - LOW secondary softkey to set output impedance to about 0 Ω.
  - 50 ohm secondary softkey to set output impedance to 50 Ω.

- PULSE COUNT

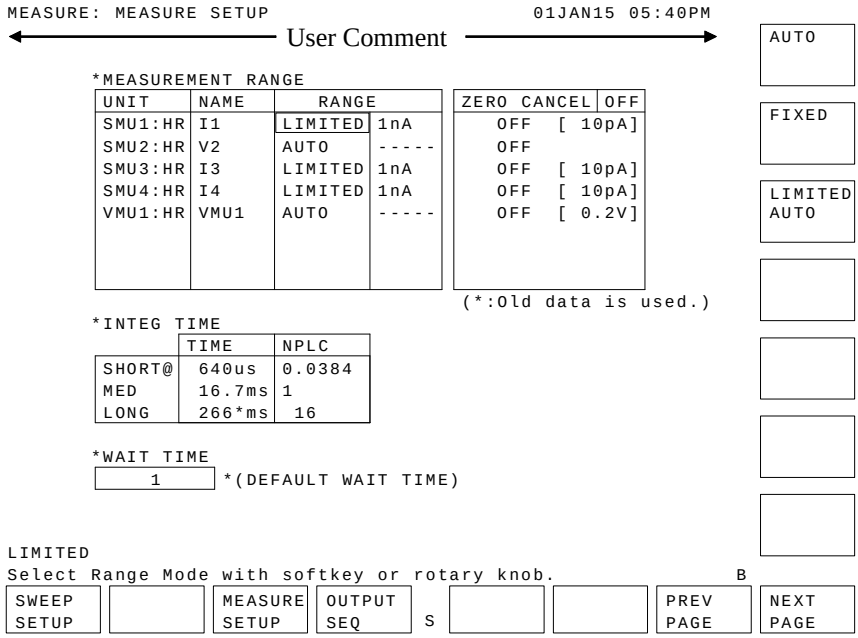
  PULSE COUNT field specifies the number of pulses for the sampling measurement (for sweep measurements, only FREE RUN is available).

  - Enter a pulse count value (only for sampling measurements).
  - Select FREE RUN or enter 0 (zero) to set continuous pulse output. If either PGU1, PGU2, or both are set to standby ON on the CHANNELS: CHANNEL DEFINITION screen, this field is automatically set to *free run* mode.

CONSTANT UNIT and NAME are defined on CHANNELS: CHANNEL DEFINITION screen.

In the SOURCE field, you specify the output value.

MEASURE: MEASURE SETUP



On the "MEASURE: MEASURE SETUP" screen, you set measurement range, zero cancel, integration time, and wait time.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

MEASUREMENT RANGE

You can set the measurement range for each unit.

- UNIT

  The UNIT field shows all the installed measurement units. Only measurement units are shown, so VSU, PGU, and GNDU are not shown.

- NAME

  The NAME field shows all names for the measurement units, which you defined on the CHANNELS: CHANNEL DEFINITION screen. For example, when the SMU1 is set to V mode, current value is measured. So the current name (INAME) is shown in the NAME field.

- RANGE

  The left field of RANGE specifies the **ranging mode**. In this field, select:

  - AUTO secondary softkey to set **auto-ranging** mode.
  - FIXED secondary softkey to set **fixed-ranging** mode.
  - LIMITED AUTO secondary softkey to set **limited auto-ranging** mode.

  The right field of RANGE specifies the **range value**. For auto-ranging mode, "`------`" appears. For the fixed-ranging and limited auto-ranging modes, allowable range values are shown in the secondary softkey area. You select a softkey to set the range value.

  For details, see *User's Guide: Measurement and Analysis*.

- ZERO CANCEL

  ZERO CANCEL field specifies **zero offset cancel mode**. Select ZERO CANCEL ON/OFF to toggle the zero offset cancel mode between on and off.

  If the zero offset cancel mode is set to OFF, then `OFF` appears in all the ZERO CANCEL fields. If zero offset cancel mode is set to ON, then `ON` or `OFF` appear automatically in each field depending on the measurement range.

  For details, see *User's Guide: Measurement and Analysis*.

INTEG TIME

INTEG TIME area shows integration time and corresponding number of power line cycles (NPLC) for short, medium, and long modes. You can change integration time for short and long modes, but not for medium mode.

The selected integration time is indicated by @, and is used for all measurement units. You select the integration time by using the Short, Medium, or Long front panel keys from any screen.

- SHORT

  The TIME field for SHORT shows the integration time of the short mode. You can change this integration time. NPLC value is calculated from the integration time and power line frequency.

- MED

  The TIME field for MED shows the integration time of the medium mode, which is calculated from the power line frequency and NPLC value. NPLC value is always 1. You cannot change it.

- LONG

  The TIME field for LONG shows the integration time of the long mode, which is calculated from the NPLC and power line frequency. You can change the NPLC value.

For details, see *User's Guide: Measurement and Analysis*.

WAIT TIME

Wait time is the time the source channel waits at least after it starts output and until it changes the output value, or the time the measurement channel always waits after the source channel starts output until the measurement channel starts measurement, and given by the following formula.

$wait\ time = N \times initial\ wait\ time$

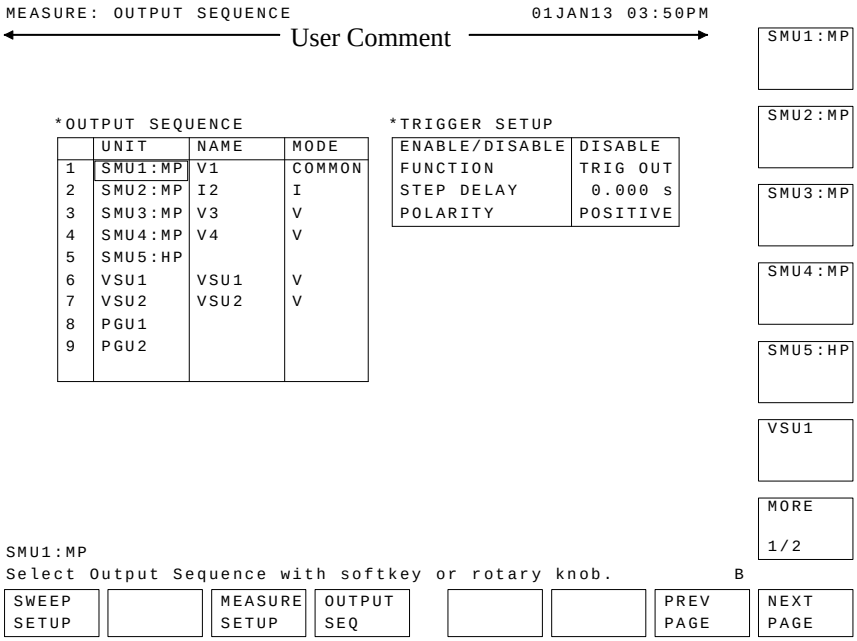
where, *initial wait time* is the time the 4155C/4156C automatically set and you cannot change. And *N* is the value you set into the WAIT TIME field. Available values are 0.0 to 10.0 with 0.1 step.

N=1.0 is recommended. It is not easy to determine the best wait time. If you specify it too short, the measurement may start during setup. If too long, time will be wasted.

NOTE

The wait time can be ignored if the delay time is longer than the wait time.

MEASURE: OUTPUT SEQUENCE



On this screen, you set the output sequence and triggering parameters for measurement state.

The output sequence set on this screen is also used when the state changes from idle state to stress force state.

For trigger setup for stress force state, see *User's Guide: Measurement and Analysis*.

User Comment

In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

OUTPUT SEQUENCE

In the UNIT column, allowable units are shown in output sequence order. Only output units are shown, so VMU and GNDU are not shown. In the NAME and MODE fields, the output names and mode that you set up on the CHANNELS: CHANNEL DEFINITION screen are shown.

To change the output order of the units, enter unit names in desired order by selecting secondary softkeys.

TRIGGER SETUP

- ENABLE/DISABLE

  ENABLE/DISABLE field defines whether the triggering function is used or not. In this field, select:

  - ENABLE secondary softkey to enable the triggering function.
  - DISABLE secondary softkey to disable the triggering function.

- FUNCTION

  FUNCTION field sets the triggering mode.

  - Select TRIG OUT secondary softkey to enable the following functions:

    For a normal (non-pulse) sweep measurement, the 4155C/4156C outputs an edge-trigger signal when a measurement starts for each step.

    For a pulsed sweep measurement, the 4155C/4156C outputs an edge-trigger signal synchronized with the pulse leading edge.

  - Select TRIG IN to enable the following function:

    Sweep measurement or sampling measurement starts when the 4155C/4156C receives a trigger signal from an external instrument.

- STEP DELAY

  STEP DELAY field is available only for the SWEEP measurement mode. The step delay time is the time from when the trigger is output to when the next step occurs. For details about setup delay time, refer to *User's Guide: Measurement and Analysis*.

  When you set `TRIG IN` in the FUNCTION field, this field has no meaning, so "`-----`" is displayed.

- TRIG OUT DELAY

  TRIG OUT DELAY field is displayed when you set pulse sweep measurement. The trigger output delay time specifies how much to delay the trigger after the leading edge. For details about trigger output delay time, refer to *User's Guide: Measurement and Analysis*. When you set `TRIG IN` in the FUNCTION field, this field has no meaning, so "`-----`" is displayed.

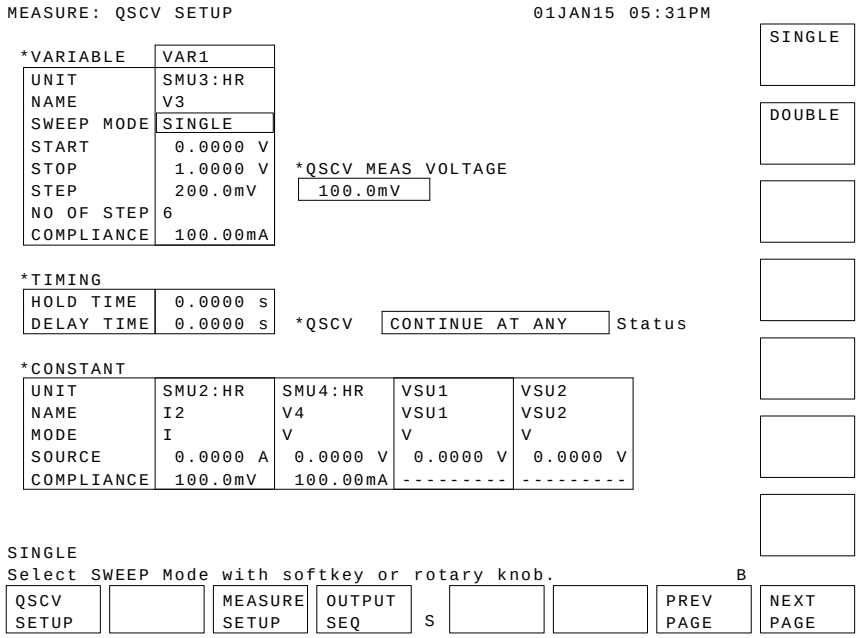
- POLARITY

  In the POLARITY field, select secondary softkeys to select trigger polarity as follows: POSITIVE or NEGATIVE.

OUTPUT SEQUENCE MODE OF SAMPLING

For a sampling measurement, you can set the output sequence to **sequential mode** or **simultaneous mode**. This field is displayed only when sampling mode is selected on the CHANNELS: CHANNEL DEFINITION screen. If you select sequential mode, OUTPUT SEQUENCE table determines the output order. If you select simultaneous mode, all the units force at the same time.

MEASURE: QSCV SETUP



On this screen, you set the output parameters for each unit used in the quasi-static CV measurements.

User Comment Use this field to enter a desired comment, which is also displayed on the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screens.

VAR1 parameters In this column, you set the output parameters for the sweep unit. The UNIT and NAME are defined on the CHANNELS: CHANNEL DEFINITION screen.

- SWEEP MODE

  Use this field to select the sweep mode using the following secondary softkeys.

  SINGLE Sweeps from the start value to the stop value.

  DOUBLE Sweeps from the start value to the stop value to the start value.

- START, STOP, and STEP

  Use the fields to set the sweep *start*, *stop*, and *step* values respectively. Minimum value of *step* is double the resolution of the output range.

  In the QSCV measurement, the 4155C/4156C executes the capacitance measurement at the sweep steps except for the sweep start voltage and stop voltage. At each sweep step, the capacitance measurement is executed over the voltage range: output voltage ± QSCV MEAS VOLTAGE/2.

- NO. OF STEP

  The number of sweep steps is calculated from the equation (fractions below decimal point are rounded down): |START−STOP| / |STEP| −1, and appears in this field. 1 to 1001. If the calculation result is 0, this value is set to 1.

  If this value is set to 1, the measurement unit executes a one-point capacitance measurement between the START and STOP values.

- COMPLIANCE

  Use this field to set the current compliance value of the sweep source.

QSCV MEAS VOLTAGE

Use this field to define the capacitance measurement voltage. Minimum value is double the resolution of the output range, and maximum value is 10 V. The value must be ≤ |STEP|. If you enter a value greater than the |STEP| value, this value is automatically set to the same value as the |STEP| value.

If you enter the value ≥ |START−STOP|, the measurement unit executes a one-point capacitance measurement between the START and STOP values.

NOTE

If you set the START, STOP, STEP, and QSCV MEAS VOLTAGE as shown below, the capacitance measurement is executed over the following voltage range.

START=0, STOP=5, STEP=1 (NO. OF STEP=4), QSCV MEAS VOLTAGE=1

Sweep Step	Voltage Range of capacitance measurement	Measurement Data (Vn,Cn)
first step	0.5 to 1.5 V	(1, C1)
second step	1.5 to 2.5 V	(2, C2)
third step	2.5 to 3.5 V	(3, C3)
fourth step	3.5 to 4.5 V	(4, C4)

Vn is the voltage data, and Cn is the capacitance data at the nth sweep step.

TIMING

- HOLD TIME

  Enter the hold time that is the time from the start of the first sweep step to the beginning of the delay time. Values: 0 to 655.35 s, 10 ms resolution.

- DELAY TIME

  Enter the delay time that is the time from the start of each sweep step to the start of the measurement. Values: 0 to 65.535s, 100 μs resolution.

QSCV Status

- Select the CONT AT ANY secondary softkey. The sweep will continue even if an abnormal status occurs.
- Select the STOP AT ANY ABNORM secondary softkey. The sweep will stop if an abnormal status occurs.
- Select the STOP AT COMPLIANCE secondary softkey. The sweep will stop if an abnormal status 2 or 3 occurs.

An abnormal status is defined as follows:

1. Compliance on the non-measurement unit.
2. Compliance on the leakage current measurement unit.
3. Integration time too short at the capacitance measurement.
4. Overflow on ADC.
5. Oscillation on any unit.

CONSTANT

- SOURCES

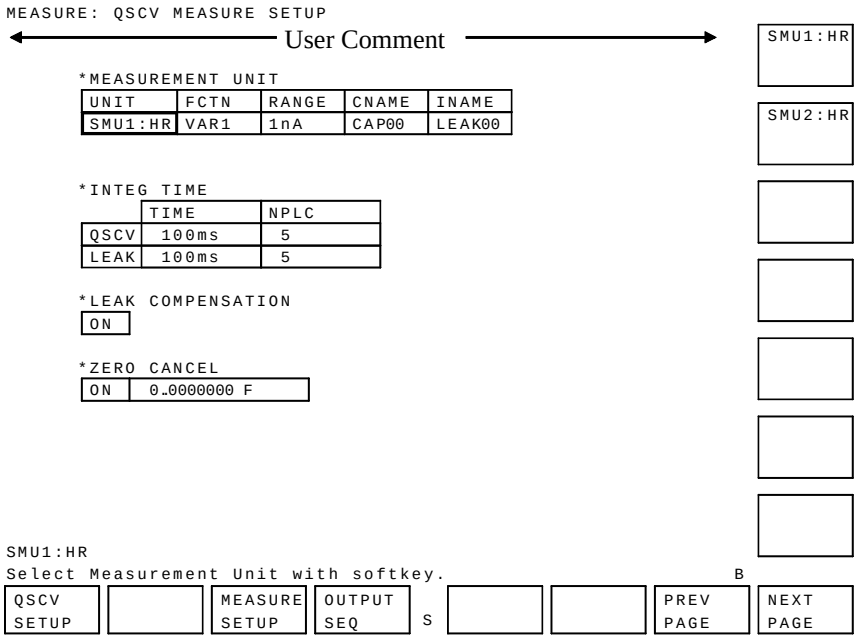
  Use this field to set the constant source output value.

- COMPLIANCE

  Use this field to set the compliance value. If a VSU is used as the constant output unit, this field cannot be set. The compliance value is fixed to 100 mA.

If you define more than four constant output units, the first four units appear in the fields. To show other units, select the NEXT UNIT secondary softkey. To scroll through the units, use the right arrow or left arrow MARKER/CURSOR front-panel key.

MEASURE: QSCV MEASURE SETUP



On the "MEASURE: QSCV MEASURE SETUP" screen, you select the measurement units, range, integration time, leakage current compensation, and QSCV zero cancel.

User Comment

Use this field to enter a desired comment. The comment you enter here is also displayed on the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screens.

MEASUREMENT UNIT

You can select the measurement units, measurement range, capacitance measurement data name, and leakage current measurement data name.

- UNIT

  Use this field to select the measurement units for the quasi-static CV measurement using the secondary softkey.

- FCTN

  This field shows the function of the unit. VAR1 or CONST is displayed.

- RANGE

  Use this field to set the measurement range using the secondary softkey. The range is used by both the capacitance and leakage current measurements.

- CNAME

  The CNAME field assigns a variable name for the capacitance measurement data. You can use this name as a reference on other screens.

- INAME

  The INAME field assigns a variable name for the leakage current measurement data. You can use this name as a reference on other screens.

NOTE **CNAME and INAME**

CNAME and INAME must be six or less alphanumeric characters. The first character must be an alpha character. The name must be unique.

INTEG TIME

Use the fields to set the integration time.

- QSCV sets the integration time for the capacitance measurement. in seconds. 0.04 to 400 for 50 Hz, 0.033333 to 333.33 for 60 Hz.
- LEAK sets the integration time for the leakage current measurement. in seconds. 0.02 to 2 for 50 Hz, 0.016667 to 1.6667 for 60 Hz.

The value is rounded to the value calculated from NPLC/selected line frequency. where NPLC is integer in the range: 2 to 20000 for QSCV, and 1 to 100 for LEAK. NPLC means the number of power line cycle.

The **Short**, **Medium**, and **Long** front-panel keys have no effect for the quasi-static CV measurement.

LEAK COMPENSATION

Use this field to turn the leakage current compensation on or off using the softkey.

ZERO CANCEL

Use this field to turn the offset capacitance cancel function on or off using the secondary softkey. The measurement setup must be completed before executing the offset measurement. The offset data is also displayed in the right field after the offset measurement.

If you change the UNIT or RANGE setting, the offset data will be deemed invalid. Then execute the offset measurement again. If you do not do it again, the old data will be used for the offset cancel.

DISPLAY Screen Group

DISPLAY screen group has the following screens:

Display Setup:	For setting the graphics/list display mode, the parameters for graphics/list screen, and measurement channels.
Analysis Setup:	For defining where to automatically display lines and marker after a measurement.

To move into the DISPLAY screen group, do one of the following:

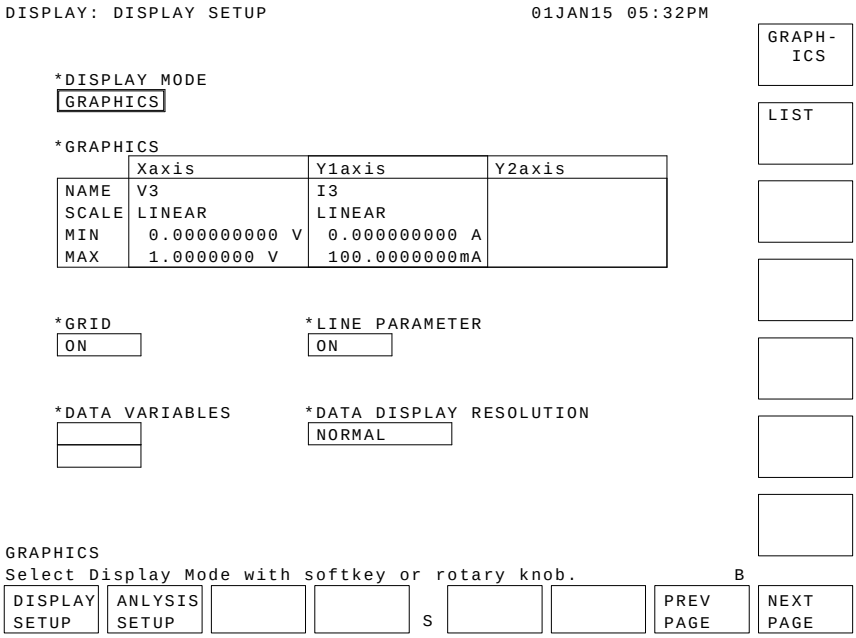
- Press Display front-panel key in the PAGE CONTROL key group.
- Select NEXT PAGE primary softkey in the MEASURE: OUTPUT SEQUENCE screen.

Then, the following primary softkeys appear:

DISPLAY SETUP	ANLYSIS SETUP					PREV PAGE	NEXT PAGE

- Select DISPLAY SETUP softkey to move to the DISPLAY: DISPLAY SETUP screen.
- Select ANLYSIS SETUP softkey to move to DISPLAY: ANALYSIS SETUP screen.

DISPLAY: DISPLAY SETUP for graphic results



On the "DISPLAY: DISPLAY SETUP" screen for graphics results, you set axes, grid, and data variable names for the "GRAPHICS" screen. The channels that actually perform measurements are determined by the axis names and data variables that you set on this screen.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

DISPLAY MODE

This field specifies display mode. If present display mode is list mode, then select the GRAPHICS secondary softkey to change to graphics mode.

GRAPHICS

In the GRAPHICS area, you set up the X, Y1, and Y2 axes. You must set up the X and Y1 axes. Y2 axis is optional.

- NAME

  NAME fields specify the variable names that you want to assign to the axes, which will be plotted on the GRAPHICS screen. In this field, you can select the desired variable names in the secondary softkey area. The entries in these fields and the data variable fields determine which channels will actually make measurements.

- SCALE

  The SCALE fields specify linear or logarithmic scale for the axis by selecting LINEAR or LOG secondary softkey.

- MIN and MAX

  MIN and MAX fields specify the minimum and maximum values for the axis. The minimum and maximum values are automatically set according to the NAME and SCALE settings. You can modify these values if desired.

GRID

In the GRID field, you can specify whether to display the grid on the plotting area by selecting ON or OFF secondary softkey.

LINE PARAMETER

In the LINE PARAMETER field, you can specify whether to display X and Y intercepts and gradients of lines on the plotting area by selecting ON or OFF secondary softkey.

OFF The line parameters are not displayed.

ON The line parameters are displayed when lines are displayed on the graph.

DATA VARIABLES

In the DATA VARIABLES fields, you can enter two variable names. The numerical values of these variables will be shown on the GRAPHICS screen according to the marker position. In this field, you can select the desired variable names in the secondary softkey area.

Even if the setup data variables are defined using variables that are not set in the NAME field of the GRAPHICS table, the variables are automatically measured after pressing a measurement front-panel key.

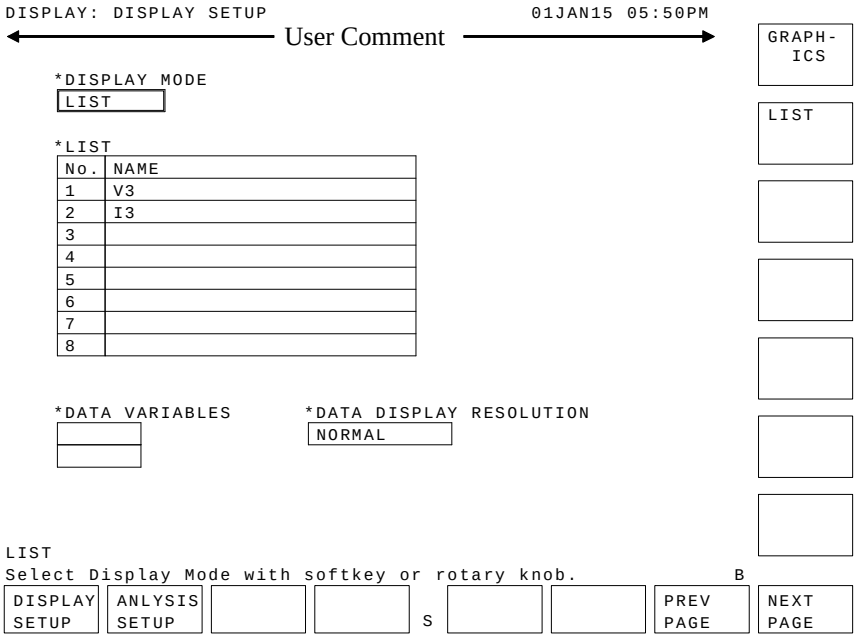
DATA DISPLAY RESOLUTION

In this field, you set the resolution of the measurement data displayed on the screen by using the secondary softkey. In extend mode, 10 aA resolution at 10 pA range.

NORMAL resolution depends on the specifications. 1 fA resolution at 10 pA range.

EXTEND resolution is extended up to the full scale of the internal A/D converter.

DISPLAY: DISPLAY SETUP for list results



On the "DISPLAY: DISPLAY SETUP" screen for list results, you enter variable names for which you want results to be displayed numerically. The measurement channels are determined by the variable names that you set on this screen.

User Comment In this field, you can enter a desired comment, which is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

DISPLAY MODE This field specifies display mode. If present mode is graphics mode, select LIST secondary softkey to change to list mode. LIST table is displayed.

LIST NAME fields of LIST area specify variables that you want to display on LIST screen. You can enter the desired variable names. Entries in this area and data variable area determine which channels will actually make measurements. You can enter up to eight variable names. When the pointer is located in NAME field, you can select desired variable names in secondary softkey area.

DATA VARIABLES

DATA VARIABLES fields specify the variable names that you want to display on the GRAPH/LIST: LIST screen. The numerical values of these variables will be shown on the LIST screen according to the marker position. In this field, you can select the desired variable names in the secondary softkey area.

Even if the setup data variables are defined using variables that are not set in the NAME field of the LIST table, the variables are automatically measured after pressing a measurement front-panel key.

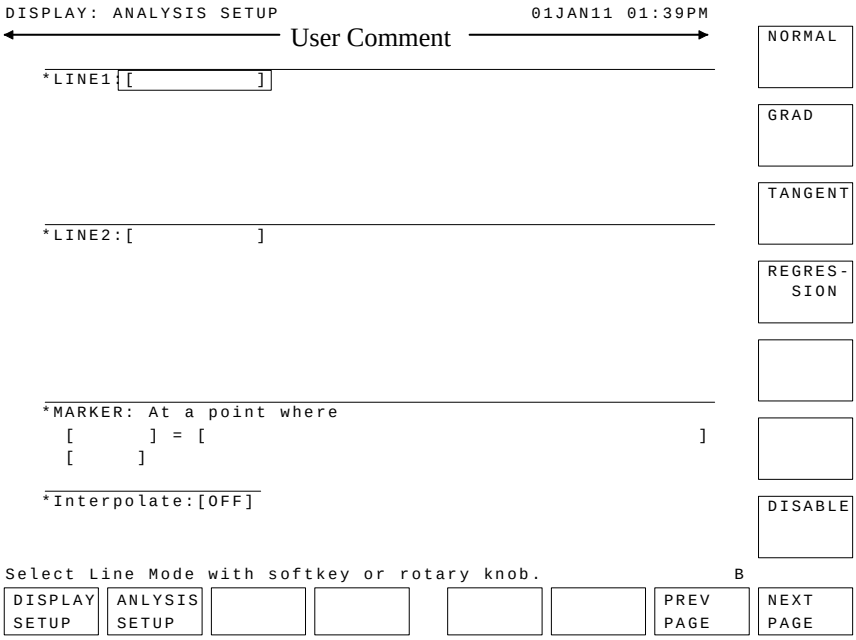
DATA DISPLAY RESOLUTION

In this field, you set the resolution of the measurement data displayed on the screen by using the secondary softkey. In extend mode, 10 aA resolution at 10 pA range.

NORMAL resolution depends on the specifications. 1 fA resolution at 10 pA range.

EXTEND resolution is extended up to the full scale of the internal A/D converter.

DISPLAY: ANALYSIS SETUP



On the "DISPLAY: ANALYSIS SETUP" screen, you set up the automatic analysis function. When a measurement finishes, the function automatically draws lines, a marker, or both as specified on this screen.

You can set up two lines and one marker for the automatic analysis function. In the LINE1 and LINE2 fields, you can set up the lines to be drawn. In the MARKER field, you set up the marker.

For the automatic analysis function and the manual analysis function, four line modes can be used:

- Normal mode: drawing a line between *any two* points.
- Grad mode: drawing a line through *any point* with a specified gradient.
- Tangent mode: drawing a tangent to a *measurement* point.
- Regression mode: drawing a regression line for the area specified by *any two* points.

The following explains how to set up the lines and marker. For details about line modes, refer to *User's Guide: Measurement and Analysis*.

User Comment

In this field, you can enter a desired comment. This comment is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

Normal mode line

In the first bracketed field after LINE1 or LINE2, you select the line mode. Select the NORMAL secondary softkey to set the normal line mode. The pointer moves to the second bracketed field as shown:

```
LINE1: [NORMAL   ] LINE ON [Y1] between a point [AT  ]
```

In the second bracketed field, you specify which measurement curve you want to analyze by selecting the related axis: Y1 or Y2 secondary softkey.

In the third bracketed field, you specify how to select a point:

- Select BY X-Y COORDINATE. "AT" is displayed. Then, you enter the desired X-Y coordinate values or expressions in the X: and Y: fields.
- Select BY DATA CONDITION. "WHERE" is displayed. Then, you enter a variable name and condition expression to specify a measurement point.

```
LINE1: [NORMAL   ] LINE ON [Y1] between a point [AT   ]
 X: [0                                                 ]
 Y: [0                                                 ]
and a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                             ]
 [     ]
```

In addition, you can specify another condition if you position the pointer in the last bracketed field shown above. Select the AFTER secondary softkey. AFTER is displayed, and you can enter a second variable and condition expression. This sets up a search start condition for finding specified point. (This setup is optional.)

For example, you can specify the following expressions to search for a measurement point that satisfies the first condition after the second condition is satisfied.

```
LINE1: [NORMAL   ] LINE ON [Y1] between a point [AT   ]
 X: [0                                                 ]
 Y: [0                                                 ]
and a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                             ]
 [AFTER] [DGM   ] = [MAX(DGM)                          ]
```

On GRAPH/LIST: GRAPHICS screen, LINE *secondary* softkey must be ON.

Gradient mode line

In the first bracketed field after LINE1 or LINE2, you select the line mode. Select the GRAD secondary softkey to set the gradient line mode. The pointer moves to the second bracketed field as shown:

```
LINE1: [GRAD     ] LINE ON [Y1] between a point [     ]


Gradient: [                                             ]
```

In the second bracketed field, you specify which measurement curve you want to analyze by selecting the related axis: Y1 or Y2 secondary softkey.

In the third bracketed field, you specify how to select a point:

- Select BY X-Y COORDINATE. "AT" is displayed. Then, you enter the desired X-Y coordinate values or expressions in the X: and Y: fields.
- Select BY DATA CONDITION. "WHERE" is displayed. Then, you enter a variable name and condition expression to specify a measurement point.

```
LINE1: [GRAD     ] LINE ON [Y1] between a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                              ]
 [     ]
Gradient: [                                             ]
```

In addition, you can specify another condition if you position the pointer in the bracketed field above Gradient. Select the AFTER secondary softkey. AFTER is displayed, and you can enter a second variable and condition expression. This sets up a search start condition for finding specified point. (This setup is optional.)

For example, you can specify the following expressions to search for a measurement point that satisfies the first condition after the second condition is satisfied.

```
LINE1: [GRAD     ] LINE ON [Y1] between a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                              ]
 [AFTER] [DGM   ] = [MAX(DGM)                           ]
Gradient: [                                             ]
```

In a field after Gradient:, you enter a gradient value or expression.

On GRAPH/LIST: GRAPHICS screen, LINE *secondary* softkey must be ON.

Tangent mode line

In the first bracketed field after LINE1 or LINE2, you select the line mode. Select the TANGENT secondary softkey to set the tangent line mode. The pointer moves to the second bracketed field as shown:

```
LINE1: [TANGENT  ] LINE ON [Y1] between a point where
 [      ] = [                                        ]
 [     ] [      ] = [                                 ]
```

In the second bracketed field, you specify which measurement curve you want to analyze by selecting the related axis: Y1 or Y2 secondary softkey.

Enter a variable name and condition expression to specify the measurement point for which you want to draw a tangent line.

```
LINE1: [TANGENT  ] LINE ON [Y1] between a point where
 [DGM   ] = [MAX(DGM)*0.01                           ]
 [     ] [      ] = [                                 ]
```

In addition, you can specify another condition if you position the pointer in the last bracketed field shown above. Select the AFTER secondary softkey. AFTER is displayed, and you can enter a second variable and condition expression. This sets up a search start condition for finding specified point. (This setup is optional.)

For example, you can specify the following expressions to search for a measurement point that satisfies the first condition after the second condition is satisfied.

```
LINE1: [TANGENT  ] LINE ON [Y1] between a point where
 [DGM   ] = [MAX(DGM)*0.01                           ]
 [AFTER] [DGM   ] = [MAX(DGM)                        ]
```

On GRAPH/LIST: GRAPHICS screen, LINE *secondary* softkey must be ON.

Regression mode line

In the first bracketed field after LINE1 or LINE2, you select the line mode. Select the REGRESSION secondary softkey to set the regression line mode. For details about regression calculation range, see *User's Guide: Measurement and Analysis*.

The pointer moves to second bracketed field as shown:

```
LINE1: [REGRESSION] LINE ON [Y1] between a point [AT   ]
 X: [                                                  ]
 Y: [                                                  ]
and a point [AT   ]
 X: [                                                  ]
 Y: [                                                  ]
```

In the second bracketed field, you specify which measurement curve you want to analyze by selecting the related axis: Y1 or Y2 secondary softkey.

In the third bracketed field, you specify how to select a point:

- Select BY X-Y COORDINATE. "AT" is displayed. Then, you enter the desired X-Y coordinate values or expressions in the X: and Y: fields.
- Select BY DATA CONDITION. "WHERE" is displayed. Then, you enter a variable name and condition expression to specify a measurement point.

```
LINE1: [REGRESSION] LINE ON [Y1] between a point [AT   ]
 X: [0                                                 ]
 Y: [0                                                 ]
and a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                             ]
 [     ]
```

In addition, you can specify another condition if you position the pointer in the last bracketed field shown above. Select the AFTER secondary softkey. AFTER is displayed, and you can enter a second variable and condition expression. This sets up a search start condition for finding specified point. (This setup is optional.)

For example, you can specify the following expressions to search for a measurement point that satisfies the first condition after the second condition is satisfied.

```
LINE1: [REGRESSION] LINE ON [Y1] between a point [AT   ]
 X: [0                                                 ]
 Y: [0                                                 ]
and a point [WHERE]
 [DGM   ] = [MAX(DGM)*0.01                             ]
 [AFTER] [DGM   ] = [MAX(DGM)                          ]
```

On GRAPH/LIST: GRAPHICS screen, LINE *secondary* softkey must be ON.

Marker

In the next line after `MARKER: At a point where`, you enter a variable name and a condition expression to specify where you want the marker to appear as shown in the following example:

```
MARKER: At a point where
 [DGM   ] = [MAX(DGM)*0.01                                    ]
 [     ]
```

In addition, you can specify another condition if you position the pointer in the last bracketed field shown above. Select the AFTER secondary softkey. `AFTER` is displayed, and you can enter a second variable and condition expression. This sets up a search start condition for finding specified point. (This setup is optional.)

For example, you can specify the following expressions to search for a measurement point that satisfies the first condition after the second condition is satisfied.

```
MARKER: At a point where
 [DGM   ] = [MAX(DGM)*0.01                                    ]
 [AFTER] [DGM   ] = [MAX(DGM)                                 ]
```

Disabling entries

In the field after `LINE1`, `LINE2`, or `MARKER`, you can select the DISABLE secondary softkey to clear the entries, which disables the item for the automatic analysis function.

Interpolation mode

You can also use the interpolation mode for the automatic analysis function by selecting the ON secondary softkey in the `Interpolate` field. When interpolation mode is on, you can position marker between measurement points. Select OFF to turn interpolation mode to off.

GRAPH/LIST Screen Group

GRAPH/LIST screen group has the following screens:

Graphic Results: For displaying the measurement results graphically. You can use lines or a marker on the graphics screen to analyze the measurement results graphically.

List Results: For listing the measurement results.

To move into the GRAPH/LIST screen group, do one of the following:

- Press Graph/List front-panel key in the PAGE CONTROL key group (if present screen is not GRAPHICS or LIST screen).
- Press Single, Repeat, or Append front-panel key (if present screen is not GRAPHICS or LIST screen). Measurement is performed.

If the present screen is the GRAPHICS or LIST screen, you can toggle between these screens by pressing the Graph/List front-panel key.

The following softkeys are available for the GRAPHICS result screen:

For sweep measurements:

AXIS Y2	MARKER/ CURSOR	LINE	SCALING	DISPLAY SETUP	SWEEP SETUP	TIMING SETUP	CONST SETUP

For sampling measurements:

AXIS Y2	MARKER/ CURSOR	LINE	SCALING	DISPLAY SETUP	SAMPLNG SETUP	STOP COND	CONST SETUP

The following softkeys are available for the LIST result screen:

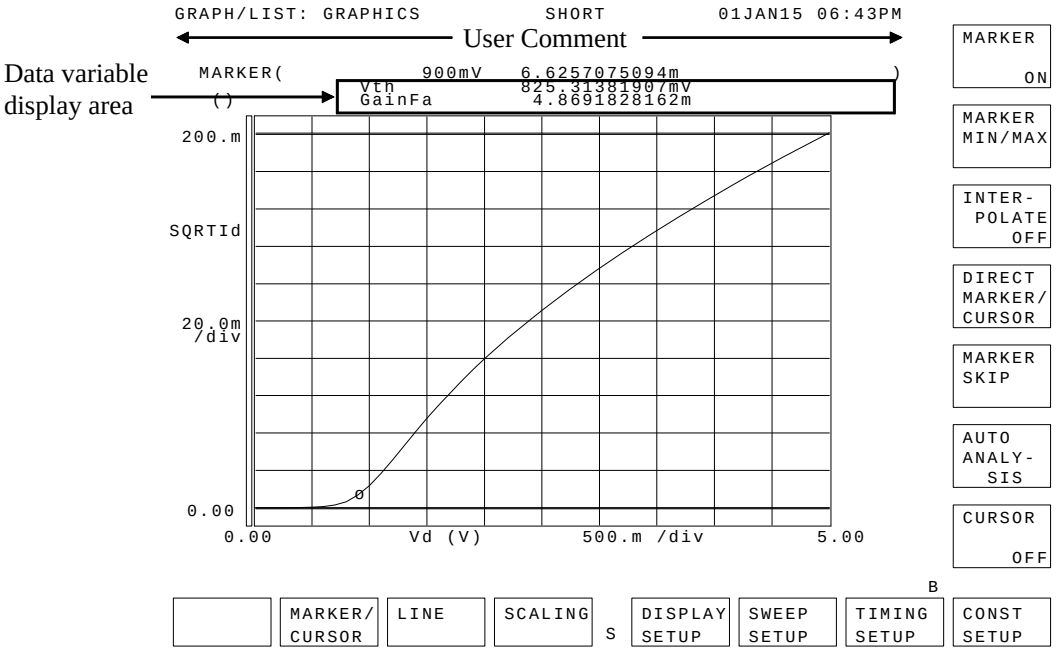
For sweep measurements:

AXIS Y2	MARKER		SPREAD SHEET	RE- SETUP	SWEEP SETUP	TIMING SETUP	CONST SETUP

For sampling measurements:

AXIS Y2	MARKER		SPREAD SHEET	RE- SETUP	SAMPLNG SETUP	STOP COND	CONST SETUP

GRAPH/LIST: GRAPHICS



On the "GRAPH/LIST: GRAPHICS" screen, measurement results are displayed, and you can analyze the measurement results graphically.

User Comment

In this field, you can enter a desired comment. This comment is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

Cursor/marker indicator

In these fields, the coordinate values of the cursor and marker locations are displayed. If cursor or marker is not displayed, these fields are blank. The three fields are for X, Y1, and Y2 coordinate values, respectively.

Data variable display

This area displays the numerical value of up to two variables that you set up on DISPLAY: DISPLAY SETUP screen. These are values at the marker position.

Plotting area

In this area, measurement curves are drawn according to measurement results.

You can analyze measurement results by using lines or marker in this area. If you use lines, the X and Y intercept points and gradient are displayed.

AXIS Y1 softkey

Select AXIS primary softkey to toggle active axis between the Y1 and Y2 axes (this softkey is displayed only if Y2 axis is used). The active axis name is displayed on the AXIS primary softkey.

For tangent or regression lines, the active line selected by LINE SELECT softkey is independent for each axis.

MARKER/CURSOR softkey

Select MARKER/CURSOR primary softkey to display secondary softkeys for performing analysis with marker and cursor.

- MARKER softkey

  Select MARKER secondary softkey to toggle the marker on and off. Marker status is displayed on MARKER secondary softkey. If on, marker is displayed in the plotting area. If off, marker is not displayed.

  For Y1 axis, marker is a circle (o). For Y2 axis, marker is an asterisk (*). Active marker is highlighted for the axis that is selected by AXIS softkey.

  The 4155C/4156C remembers the location of marker. That is, when marker is turned off, then redisplayed, it appears at its previous location.

- MARKER MIN/MAX softkey

  Select MARKER MIN/MAX secondary softkey to move the marker to the maximum or minimum measurement point. If this softkey moves the marker to the maximum point, pressing the softkey again moves it to the minimum point.

- INTERPOLATE softkey

  Select INTERPOLATE secondary softkey to toggle the interpolation mode. If interpolation mode is on, marker can move on line between adjacent measurement points. If interpolation mode is off, marker can be positioned on measurement points only (not between measurement points).

- DIRECT MARKER/CURSOR softkey

  Select DIRECT MARKER/CURSOR secondary softkey to display secondary softkeys for positioning the marker and cursor. A pointer appears in the CURSOR and MARKER coordinate fields. These fields are displayed only if cursor and marker are displayed in the plotting area.

  You can move the pointer to the desired field by using the left arrow, upper arrow, right arrow and down arrow MARKER/CURSOR keys. To move marker and cursors to desired position, enter coordinate values into corresponding fields as follows:

  - Enter the value by using numeric keys.
  - Change the value by rotating rotary knob.

  Select CANCEL primary softkey to move marker and cursor back to original position, and exit the direct marker and cursor function. Select EXIT primary softkey to exit the direct marker and cursor function.

  The marker can move on the measurement curve *only*, so changing the X value automatically changes the Y value, and vice versa. If the interpolation mode is off, the marker moves to the measurement point that is closest to the specified coordinate.

  If the pointer is in a MARKER coordinate field, the following softkeys appear:

  - Select MIN/MAX secondary softkey to move marker to minimum measurement value. If marker is at minimum value, marker moves to maximum value.
  - Select INTERPOLATE secondary softkey to toggle the interpolation mode on or off. The present mode is displayed on the INTERPOLATE softkey.
  - Select SEARCH MORE secondary softkey to move marker to the next candidate (when more than one measurement point satisfies the specified value).
  - Select MARKER SKIP secondary softkey to move the marker to the next measurement curve that was added by VAR2 variable or append measurement.

  If the pointer is in a CURSOR coordinate field, the following softkey appears:

  - Select MIN/MAX secondary softkey to move cursor to minimum axis point. If cursor is at minimum point, cursor moves to maximum point.

NOTE

When a specified value is inappropriate, marker or cursor is located as follows:

- marker
  - If the specified value for marker is greater or less than the maximum or minimum measurement value, the marker moves to the maximum or minimum *measurement point*.
- cursor
  - If a specified value for cursor is greater or less than maximum or minimum scale value, cursor moves to the maximum or minimum *axis point*.

- MARKER SKIP softkey

  Select MARKER SKIP secondary softkey to move the marker to the next measurement curve that was added by VAR2 variable or append measurement.

- CURSOR softkey

  Select CURSOR secondary softkey to toggle the cursor display. The cursor status changes between `OFF`, `SHORT`, and `LONG`, which is shown on the CURSOR softkey.

- AUTO ANALYSIS softkey

  Select AUTO ANALYSIS secondary softkey to redisplay the auto-analysis that was originally displayed after the measurement was finished.

LINE softkey

Select LINE primary softkey to display the secondary softkeys for performing manual analysis that uses lines.

- CURSOR TO MARKER softkey

  Select CURSOR TO MARKER secondary softkey to move the cursor to the marker position.

- LINE SELECT softkey

  Selecting this secondary toggles as follows:

  1 line 1 is selected, and can be operated on.

  2 line 2 is selected, and can be operated on.

  NONE no lines are selected. The line secondary softkeys disappear.

  You use the following softkeys to operate on each line. LINE SELECT setting is not changed by auto-analysis function.

- LINE softkey

  Select LINE secondary softkey to toggle the line mode between OFF and ON. You can set line on/off for line 1 and line 2 independently.

  OFF Line selected by LINE SELECT softkey disappears.

  ON Line selected by LINE SELECT softkey is displayed.

  If ON is displayed on this softkey, and OFF is displayed on GRAD MODE, TANGENT MODE, and REGRESS MODE softkeys, the line mode is normal.

  If you display lines by auto-analysis functions, you need to set LINE softkey to ON in advance.

- GRAD MODE softkey

  Select GRAD MODE secondary softkey to change the line mode to gradient mode. If present mode is gradient mode, ON is displayed on the GRAD MODE softkey.

  For gradient line mode, GRAD VALUE secondary softkey is displayed. If line mode is gradient mode, selecting GRAD MODE softkey changes to normal mode.

- TANGENT MODE softkey

  Select TANGENT MODE secondary softkey to change the line mode to tangent mode. If present mode is tangent mode, `ON` is displayed on the TANGENT MODE softkey.

  For tangent line mode, MARKER SKIP secondary softkey is displayed. When line mode is tangent mode, selecting TANGENT MODE softkey changes to normal mode.

- REGRESS MODE softkey

  Select REGRESS MODE secondary softkey to change the line mode to regression mode. If present mode is regression mode, `ON` is displayed on the REGRESS MODE softkey.

  For regression line mode, SELECT CURSOR secondary softkey is displayed. When line mode is regression mode, selecting REGRESS MODE softkey changes to normal mode.

- SELECT CURSOR softkey

  Select SELECT CURSOR secondary softkey to exchange the active and non-active cursors. Active cursor is highlighted. This softkey is displayed only when line mode is normal or regression.

- GRAD VALUE softkey

  Select GRAD VALUE secondary softkey to change the gradient value. The present gradient value is shown on this softkey and in the data entry area. This softkey is displayed only when line mode is gradient. You can change the value as follows:

  - Enter number by using numeric keys.
  - Change number by rotating rotary knob.

- MARKER SKIP softkey

  Select MARKER SKIP secondary softkey to move the marker to the next measurement curve that was added by VAR2 variable or append measurement. This softkey is displayed only when line mode is tangent.

SCALING softkey

Select SCALING primary softkey to display secondary softkeys for enlarging or reducing the plotting area.

- AUTO SCALING softkey

  Select AUTO SCALING secondary softkey to change the X and Y scaling to fit the measurement curve in the plotting area. If Y2 axis is used, the measurement curve selected by AXIS primary softkey is auto scaled.

- ZOOM IN softkey

  Select ZOOM IN secondary softkey to change the X and Y scaling to half the present scaling. This enlarges measurement curve on the plot area. If the cursor is not displayed, long cursor appears at the center, then zoom is performed.

- ZOOM OUT softkey

  Select ZOOM OUT secondary softkey to change the X and Y scaling to double the present scaling. This reduces measurement curve on the plot area. If the cursor is not displayed, long cursor appears at the center, then zoom is performed.

- CENTER AT CURSOR softkey

  Select CENTER AT CURSOR secondary softkey to center the display around the cursor at the same resolution. If a cursor is not displayed, a long cursor appears at the center.

- CURSOR TO MARKER softkey

  Select CURSOR TO MARKER secondary softkey to move the cursor to the marker position. Both marker and cursor must be displayed.

- CANCEL SCALING softkey

  Select CANCEL SCALING secondary softkey to redraw the plotting area with the original settings (most recent DISPLAY: DISPLAY SETUP screen settings or RE-SETUP GRAPH settings).

DISPLAY SETUP softkey

Select DISPLAY SETUP primary softkey to display secondary softkeys for setting or changing the display.

- RE-SETUP GRAPH softkey

  Select RE-SETUP GRAPH secondary softkey to change the user comments, variable name for each axis, minimum and maximum values for each axis, scale mode of each axis, and displayed data variables.

  After you select this softkey, a pointer (highlight) appears on a setup parameter of the graph. You can move the pointer to the desired parameter by using the left arrow, upper arrow, right arrow and down arrow MARKER/CURSOR keys.

  When the pointer is located in the user comment field, the present user comment is displayed in the data entry area, which you can edit by using the front panel keys.

  When the pointer is located in the variable name field for X, Y1, or Y2 axis, allowable variable names are shown in the secondary softkey area. You can select secondary softkey to change the variable name for each axis. Measurement units change automatically according to variable you select.

  When the pointer is located in the maximum or minimum value field for an axis, the present maximum or minimum value is displayed in the data entry area, which you can change by using rotary knob, arrow keys, or numeric keys of the front panel.

  When the pointer is located in the scale value field for an axis, LINEAR and LOG secondary softkeys are displayed. So, you can select linear or logarithmic axis mode.

  When the pointer is located in the variable name field of the data variable display area, allowable variable names are shown in the secondary softkey area. Measurement units change automatically according to variable you select.

- GRID softkey

  Select GRID secondary softkey to toggle the grid on or off in the plotting area. The present status of the grid is shown on the GRID softkey.

- DATA VAR softkey

  Select DATA VAR secondary softkey to toggle on or off the display of data variable values. The present status of the display of the data variable display is shown on the DATA VAR softkey.

- LINE PRMTRS softkey

  Select LINE PRMTRS secondary softkey to toggle on or off the display of line parameters (X and Y intercepts and gradients). Line parameters are displayed when *both* of the following are true:

  - ON is set on this softkey
  - line is displayed in the plotting area.

- OVERLAY PLANE softkey

  Select OVERLAY PLANE to control which internal memory measurement curve is overlaid. This softkey toggles the internal memory number as follows:

  $$\text{OFF} \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow \text{OFF}$$

- SHOW OVERLAY INFO softkey

  Select SHOW OVERLAY INFO secondary softkey to display the following for the overlay plane: axes, cursor, marker, line, and data variables. Select EXIT primary softkey to remove information.

- SCALE TO OVERLAY softkey

  Select SCALE TO OVERLAY secondary softkey to force the present scaling values to that of overlaid plane even if unit of axis is different.

SWEEP SETUP softkey

Select SWEEP SETUP primary softkey to display secondary softkeys for changing the sweep source parameters. This softkey is displayed only when SWEEP is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- VAR1 START softkey

  Select VAR1 START secondary softkey to change the start value of the primary sweep VAR1. The present start value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR1 STOP softkey

  Select VAR1 STOP secondary softkey to change the stop value of the primary sweep VAR1. The present stop value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR1 STEP softkey

  Select VAR1 STEP secondary softkey to change the step value of the primary sweep VAR1. The present step value is shown on this softkey and in the data entry area. Then you can change the value.

- COMP softkey

  Select COMP secondary softkey to change the compliance and power compliance values of the primary sweep VAR1. The present V or I compliance value is shown on the middle line of this softkey, and the present power compliance value is shown on the last line of this softkey.

  Selecting COMP softkey highlights this softkey, and the present I or V compliance value appears in the data entry area. Then you can change the value.

  Then selecting COMP softkey *again* displays the present power compliance value in data entry area. Then you can change the value. To disable power compliance, you enter 0 (zero) or OFF.

- VAR2 START softkey (displayed only if VAR2 is defined)

  Select VAR2 START secondary softkey to change the start value of the secondary sweep VAR2. The present start value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR2 STEP softkey (displayed only if VAR2 is defined)

  Select VAR2 STEP secondary softkey to change the step value of the secondary sweep VAR2. The present step value is shown on this softkey and in the data entry area. Then you can change the value.

- COMP softkey (displayed only if VAR2 is defined)

  Select COMP secondary softkey to change the compliance and power compliance values of the secondary sweep VAR2. The present V or I compliance value is shown on the middle line of this softkey, and the present power compliance value is shown on the last line of this softkey.

  Selecting COMP softkey highlights this softkey, and the present I or V compliance value appears in the data entry area. Then you can change the value.

  Then selecting COMP softkey *again* displays the power compliance value in the data entry area. You can change the value. To disable the power compliance, enter 0 (zero) or OFF.

TIMING SETUP softkey

Select TIMING SETUP primary softkey to display secondary softkeys for changing the hold time, delay time, and SMU pulse parameters. This softkey is displayed only when SWEEP is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- HOLD TIME softkey

  Select HOLD TIME secondary softkey to change the hold time for the sweep measurement. The present hold time is shown on this softkey and in the data entry area. Then you can change the value. You can change the hold time while measurement is being performed.

- DELAY TIME softkey

  Select DELAY TIME secondary softkey to change the delay time for the sweep measurement. The present delay time is shown on this softkey and in the data entry area. Then you can change the value. You can change the delay time while measurement is being performed. This softkey is not displayed when an SMU is set to VPULSE or IPULSE in the MODE field on the CHANNELS: CHANNEL DEFINITION screen.

- PULSE BASE softkey (displayed only if SMU pulse source is defined)

  Select PULSE BASE secondary softkey to change the base value of SMU pulse. The present base value is shown on this softkey and in the data entry area. Then you can change the value.

- PULSE PERIOD softkey (displayed only if SMU pulse source is defined)

  Select PULSE PERIOD secondary softkey to change the period of SMU pulse. The present period is shown on this softkey and in the data entry area. Then you can change the value.

- PULSE WIDTH softkey (displayed only if SMU pulse source is defined)

  Select PULSE WIDTH secondary softkey to change the pulse width of SMU pulse. The present pulse width is shown on this softkey and in the data entry area. Then you can change the value.

SAMPLNG SETUP softkey

Select SAMPLNG SETUP primary softkey to display secondary softkeys for changing the sampling parameters. This softkey is displayed only when SAMPLING is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- SAMPLNG MODE softkey

  Select SAMPLNG MODE secondary softkey to change the sampling mode. Selecting this softkey changes the sampling mode in the following order:

  LINEAR → LOG10 → LOG25 → LOG50 → THINNED → LINEAR

- INITIAL INTRVAL softkey

  Select INITIAL INTRVAL secondary softkey to change the initial interval time for sampling measurements. The present initial interval time is shown on this softkey and in the data entry area. You can change the value.

- NO. OF SAMPLES softkey

  Select NO. OF SAMPLES secondary softkey to change number of samples. Present number of samples is shown on this softkey and in data entry area. Then you can change the value.

- TOT SAM TIME softkey

  Select TOT SAM TIME secondary softkey to change the total sampling time for the sampling measurements. The present total sampling time is shown on this softkey and in the data entry area. Then you can change the value.

- HOLD TIME softkey

  Select HOLD TIME secondary softkey to change the hold time for sampling measurements. The present hold time is shown on this softkey and in the data entry area. Then you can change the value. You can change the hold time while measurement is being performed.

STOP COND softkey

Select STOP COND primary softkey to display secondary softkeys for changing the sampling parameters. This softkey is displayed only when SAMPLING is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- STOP COND softkey

  Select STOP COND secondary softkey to enable or disable the stop condition. Selecting this softkey toggles between `ENABLE` and `DISABLE`.

- ENABLE DELAY softkey

  Select ENABLE DELAY secondary softkey to change the enable delay time for the stop condition. The present enable delay time is shown on this softkey and in the data entry area. Then you can change the value.

- THRESHOLD softkey

  Select THRESHOLD secondary softkey to change threshold value of the stop condition. The present threshold value is shown on this softkey and in the data entry area. Then you can change the value.

  You can change the threshold value while measurement is being performed.

- EVENT TYPE softkey

  Select EVENT TYPE secondary softkey to change the event type. Selecting this softkey changes the event type in the following order:

  `Val>Th` → `Val<Th` → `|Val|>|Th|` → `|Val|<|Th|` → `Val>Th`

- EVENT NUMBER softkey

  Select EVENT NUMBER secondary softkey to change the event number of stop condition. The present event number is shown on this softkey and in the data entry area. Then you can change the value.

CONST SETUP setup

Select CONST SETUP primary softkey to display secondary softkeys for changing the constant source parameters. This softkey is displayed only when CONST is set in the FCTN field on CHANNELS: CHANNEL DEFINITION screen.

Output source names appear on the secondary softkeys, and the present output value and compliance also appears. For example, when a output source named "Vce" is defined "5.0 V output with 100 mA compliance," the following softkey appears:

```
Vce
 5.00 V
 100.mA
```

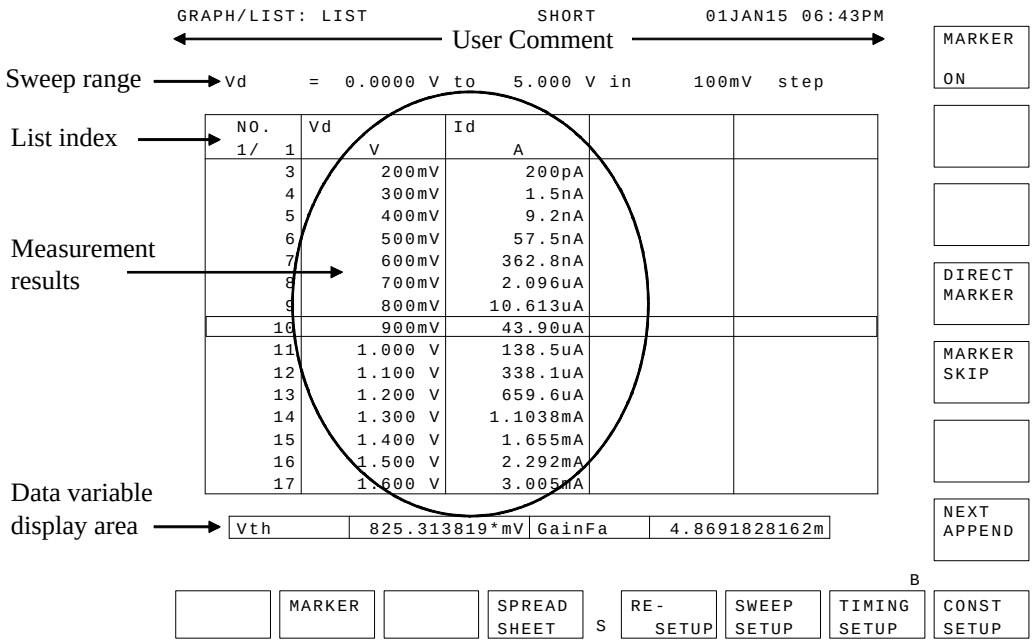
Select the secondary softkey that you want to change. The selected softkey is highlighted, and the present output value appears in the data entry area. You can change the value.

Then selecting the same softkey *again* displays the present compliance in the data entry area. You can change the compliance.

Use the following methods to change the value:

- Enter number by using numeric keys.
- Change number by rotating rotary knob.

GRAPH/LIST: LIST



On the "GRAPH/LIST: LIST" screen, measurement results are displayed.

User Comment In this field, you can enter a desired comment. This comment is also displayed in the CHANNELS, MEASURE, DISPLAY, and GRAPH/LIST screen groups.

Sweep Range This field displays sweep start, stop, and step values of VAR1 primary sweep and VAR2 secondary sweep (if VAR2 sweep is selected).

List Index Number This column displays index number of each measurement point. Index number is assigned from 1 in increasing order.

For a VAR2 secondary sweep, the index continues to increase for each VAR2 step, that is, each VAR2 measurement does *not* start at index 1. For example, if VAR1 has 5 steps, then the first VAR2 step is index 1 to 5, second VAR2 step is index 6 to 10, and so on.

If you have appended measurements, index number for each append measurement starts at 1.

In this column head, you can confirm how many append measurements you have executed and which append you are currently viewing. Refer to the following example:

```
2/4
```

If the above appears in the column head, it means you have appended three measurements to the original measurement (total four measurements), and you are currently viewing the second measurement (first append measurement).

Measurement Results

These columns display measurement result data for the variables that you set up in the LIST area on the DISPLAY: DISPLAY SETUP screen. The GRAPH/LIST: LIST screen shows only four columns for the data. If you have defined more than four variable values, you can scroll right or left by using the left arrow or right arrow front-panel key.

Data Variable Display

This area displays the numerical value for the variables that you set up in the DATA VARIABLES area on DISPLAY: DISPLAY SETUP screen. This is the value of the variable at the marker position.

AXIS Y1 softkey

For GRAPH/LIST: GRAPHICS screen, this softkey is used to toggle active axis to analyze between the Y1 and Y2 axis.

For GRAPH/LIST: LIST screen, this softkey only has meaning for the data variable fields, which are just above the primary softkeys. If you set up a data variable that uses a line or marker read-out function, selecting this softkey changes displayed data variable value according to read-out function.

This softkey is displayed only if Y2 axis is set up.

MARKER softkey

Select MARKER primary softkey to display secondary softkeys for operation with marker.

- MARKER softkey

  Select MARKER secondary softkey to toggle marker display between ON and OFF. When ON is displayed on this softkey, the row at marker location is highlighted. When OFF is displayed on this softkey, no row is highlighted.

  The marker on the GRAPH/LIST: LIST screen is linked to marker on the GRAPH/LIST: GRAPHICS screen. So, if marker is moved on the GRAPH/LIST: GRAPHICS screen, the marker also moves on the GRAPH/LIST: LIST screen.

  The 4155C/4156C remembers the location of marker. So, if you turn marker display OFF, then the marker appears at the same location when you turn marker ON again.

- DIRECT MARKER softkey

  Select DIRECT MARKER secondary softkey to move the marker to the specified value directly. When you select this softkey, a cell marker is displayed in the row of the marker, and the primary and secondary softkeys change as follows:

  Primary softkeys:

EXIT							CANCEL

  Secondary softkeys:

	MARKER MIN/MAX		SEARCH MORE	MARKER SKIP			

  In this mode, you can move the marker to a specified value. You enter the value in the data entry area, then the marker moves to the value in list that is closest to the specified value. If you have executed append measurement, the marker moves within the append measurement you refer to.

  You use the cell marker to specify the target variable (column). You can move this marker by using the left arrow, up arrow, right arrow, and down arrow MARKER/CURSOR keys.

  Selecting EXIT primary softkey exits the DIRECT MARKER function.

Selecting CANCEL primary softkey returns the marker to the same position as before selecting the DIRECT MARKER secondary softkey.

- MARKER MIN/MAX softkey

  Select MARKER MIN/MAX secondary softkey to move the marker to where the measured value is maximum or minimum value. If the marker is on the minimum value, selecting this softkey moves to the maximum value. Otherwise, selecting this softkey moves to the minimum value.

- SEARCH MORE softkey

  Select SEARCH MORE secondary softkey to move marker to next candidate that satisfies specified value. If consecutive values also satisfy specified value, the next search starts after the consecutive values.

- MARKER SKIP softkey

  Select MARKER SKIP secondary softkey to move the marker to the next VAR2 value or to the next appended measurement data.

- MARKER SKIP softkey

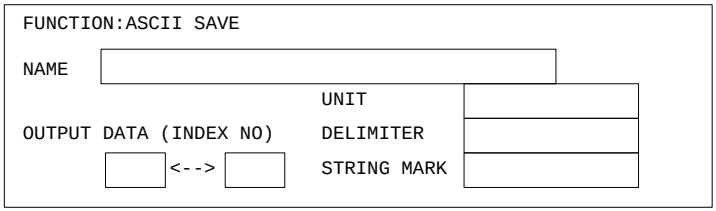
  Select MARKER SKIP secondary softkey to move the marker to the next VAR2 value or to the next appended measurement data.

- NEXT APPEND softkey

  Select NEXT APPEND secondary softkey to move the marker to the next appended measurement data.

SPREADSHEET softkey

Select SPREAD SHEET primary softkey to display ASCII SAVE window. The following entry fields appear:



Also, the following softkeys appear:

- Select EXECUTE softkey to store result data to diskette file or network disk.
- Select EXIT softkey to exit the ASCII SAVE window.
- Select FILE CATALOG secondary softkey to list the names of all files that are on diskette or network disk. You can select a file name from the list.

ASCII SAVE function automatically adds `TXT` extension to specified file name.

- NAME

  Enter the name of file (without extension) to which you want to save the result data.

- OUTPUT DATA

  Enter numbers to specify range of data you want to save. These numbers correspond to `NO.` column of LIST screen.

  - right field: upper limit
  - left field: lower limit

  Select ALL secondary softkey to specify all result data.

- UNIT

  Specify whether to include units (for example, `V` or `ms`).

  - ON secondary softkey to include units.
  - OFF secondary softkey to not include units.

  For ON, result data is saved as string data, not numeric data. So result data is saved with specified string marker. For string marker, see description of STRING MARK field. Ineffective value (`----`) is treated as string, even if you set this field to `OFF`.

- DELIMITER

  Specify the data delimiter:

  - SPACE secondary softkey to specify space.
  - TAB secondary softkey to specify tab.
  - COMMA secondary softkey to specify comma.

- STRING MARK

  Specify the string marker:

  - NONE secondary softkey to specify no string marker.
  - " " secondary softkey to specify double quotes string marker.
  - ' ' secondary softkey to specify single quotes string marker.

RE-SETUP softkey

Select RE-SETUP primary softkey to change the user comments, variable name for each column, and displayed data variables.

After you select this softkey, a pointer (highlight) appears on the variable name of the first column. You can move the pointer to the desired parameter by using the left arrow, up arrow, right arrow, and down arrow MARKER/CURSOR keys.

When the pointer is located in the user comment field, the present user comment appears in the data entry area, and you can edit it using edit keys.

When the pointer is located in the variable name field, allowable variable names are shown in the secondary softkey area. Measurement units change automatically according to variable you select.

When the pointer is located in the data variable display area, allowable variable names are shown in the secondary softkey area. Measurement units change automatically according to variable you select.

SWEEP SETUP softkey

Select SWEEP SETUP primary softkey to display secondary softkeys for changing the sweep source parameters. This softkey is displayed only when SWEEP is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- VAR1 START softkey

  Select VAR1 START secondary softkey to change the start value of the primary sweep VAR1. The present start value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR1 STOP softkey

  Select VAR1 STOP secondary softkey to change the stop value of the primary sweep VAR1. The present stop value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR1 STEP softkey

  Select VAR1 STEP secondary softkey to change the step value of the primary sweep VAR1. The present step value is shown on this softkey and in the data entry area. Then you can change the value.

- COMP softkey

  Select COMP secondary softkey to change the compliance and power compliance values of the primary sweep VAR1. The present V or I compliance value is shown on the middle line of this softkey, and the present power compliance value is shown on the last line of this softkey.

  Selecting COMP softkey highlights this softkey, and the present I or V compliance value appears in the data entry area. You can change the value.

  Then selecting COMP softkey *again* displays the present power compliance value in the data entry area. You can change the value. To disable the power compliance, enter 0 (zero) or OFF.

- VAR2 START softkey (displayed only if VAR2 is defined)

  Select VAR2 START secondary softkey to change the start value of the secondary sweep VAR2. The present start value is shown on this softkey and in the data entry area. Then you can change the value.

- VAR2 STEP softkey (displayed only if VAR2 is defined)

  Select VAR2 STEP secondary softkey to change the step value of the secondary sweep VAR2. The present step value is shown on this softkey and in the data entry area. Then you can change the value.

- COMP softkey (displayed only if VAR2 is defined)

  Select COMP secondary softkey to change the compliance and power compliance values of the secondary sweep VAR2. The present V or I compliance value is shown on the middle line of this softkey, and the present power compliance value is shown on the last line of this softkey.

Selecting COMP softkey highlights this softkey, and the present I or V compliance value appears in the data entry area. You can change the value.

Then selecting COMP softkey *again* displays the power compliance value in the data entry area. You can change the value. To disable the power compliance, enter 0 (zero) or OFF.

TIMING SETUP softkey

Select TIMING SETUP primary softkey to display secondary softkeys for changing the hold and delay time and SMU pulse parameters. This softkey is displayed only when SWEEP is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

To change the values on the secondary softkeys: enter number by *using numeric keys* or change number by *rotating rotary knob*.

- HOLD TIME softkey

  Select HOLD TIME secondary softkey to change the hold time for the sweep measurement. The present hold time is shown on this softkey and in the data entry area. Then you can change the value. You can change the hold time while measurement is being performed.

- DELAY TIME softkey

  Select DELAY TIME secondary softkey to change the delay time for the sweep measurement. The present delay time is shown on this softkey and in the data entry area. Then you can change the value. You can change the delay time while measurement is being performed. This softkey is not displayed when an SMU is set to VPULSE or IPULSE in the FCTN field on the CHANNELS: CHANNEL DEFINITION screen.

- PULSE BASE softkey (displayed only if SMU pulse source is defined)

  Select PULSE BASE secondary softkey to change the base value of SMU pulse. The present base value is shown on this softkey and in the data entry area. Then you can change the value.

- PULSE PERIOD softkey (displayed only if SMU pulse source is defined)

  Select PULSE PERIOD secondary softkey to change the period of SMU pulse. The present period is shown on this softkey and in the data entry area. Then you can change the value.

- PULSE WIDTH softkey (displayed only if SMU pulse source is defined)

  Select PULSE WIDTH secondary softkey to change the pulse width of SMU pulse. The present pulse width is shown on this softkey and in the data entry area. Then you can change the value.

SAMPLNG SETUP softkey

Select SAMPLNG SETUP primary softkey to display secondary softkeys for changing the sampling parameters. This softkey is displayed only when SAMPLING is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

- SAMPLNG MODE softkey

  Select SAMPLNG MODE secondary softkey to change the sampling mode. Selecting this softkey changes the sampling mode in the following order:

  LINEAR → LOG10 → LOG25 → LOG50 → THINNED → LINEAR

- INITIAL INTRVAL softkey

  Select INITIAL INTRVAL secondary softkey to change the initial interval time for sampling measurements. The present initial interval time is shown on this softkey and in the data entry area. Then you can change the value.

- NO. OF SAMPLES softkey

  Select NO. OF SAMPLES secondary softkey to change the number of samples. The present number of samples is shown on this softkey and in the data entry area. Then you can change the value.

- TOT SAM TIME softkey

  Select TOT SAM TIME secondary softkey to change the total sampling time for the sampling measurements. The present total sampling time is shown on this softkey and in the data entry area. Then you can change the value.

- HOLD TIME softkey

  Select HOLD TIME secondary softkey to change the hold time for sampling measurements. The present hold time is shown on this softkey and in the data entry area. Then you can change the value.

  You can change the hold time while measurement is being performed.

STOP COND softkey

Select STOP COND primary softkey to display secondary softkeys for changing the sampling parameters. This softkey is displayed only when SAMPLING is selected in the MEASUREMENT MODE field on the CHANNELS: CHANNEL DEFINITION screen.

- STOP COND softkey

  Select STOP COND secondary softkey to enable or disable the stop condition. Selecting this softkey toggles between `ENABLE` and `DISABLE`.

- ENABLE DELAY softkey

  Select ENABLE DELAY secondary softkey to change the enable delay time for the stop condition. The present enable delay time is shown on this softkey and in the data entry area. Then you can change the value.

- THRESHOLD softkey

  Select THRESHOLD secondary softkey to change threshold value of the stop condition. The present threshold value is shown on this softkey and in the data entry area. Then you can change the value.

  You can change the threshold value while measurement is being performed.

- EVENT TYPE softkey

  Select EVENT TYPE secondary softkey to change the event type. Selecting this softkey changes the event type in the following order:

  `Val>Th` → `Val<Th` → `|Val|>|Th|` → `|Val|<|Th|` → `Val>Th`

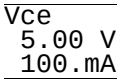
- EVENT NUMBER softkey

  Select EVENT NUMBER secondary softkey to change the event number of stop condition. The present event number is shown on this softkey and in the data entry area. Then you can change the value.

CONST SETUP softkey

Select CONST SETUP primary softkey to display secondary softkeys for changing the constant source parameters. This softkey is displayed only when CONST is set in the FCTN field on CHANNELS: CHANNEL DEFINITION screen.

Output source names appear on the secondary softkeys, and the present output value and compliance also appears. For example, when a output source named "Vce" is defined "5.0 V output with 100 mA compliance," the following softkey appears:



Select the secondary softkey that you want to change. The selected softkey and is highlighted, and the present output value appears in the data entry area. You can change the value.

Then selecting the same softkey *again* displays the compliance value in the data entry area. You can change the compliance.

Use the following methods to change the value:

- Enter number by using numeric keys.
- Change number by rotating rotary knob.

STRESS Screen Group

STRESS screen group has the following screens:

Stress channel definition:	For defining the stress channels of the 4155C/4156C, setting up SMU/PG selector, and setting up the trigger.
Stress setup:	For setting the stress parameters.
Stress force:	For monitoring the progress of stress forcing.

To move into the STRESS screen group, do the following:

- Press Stress front-panel key in the PAGE CONTROL key group.

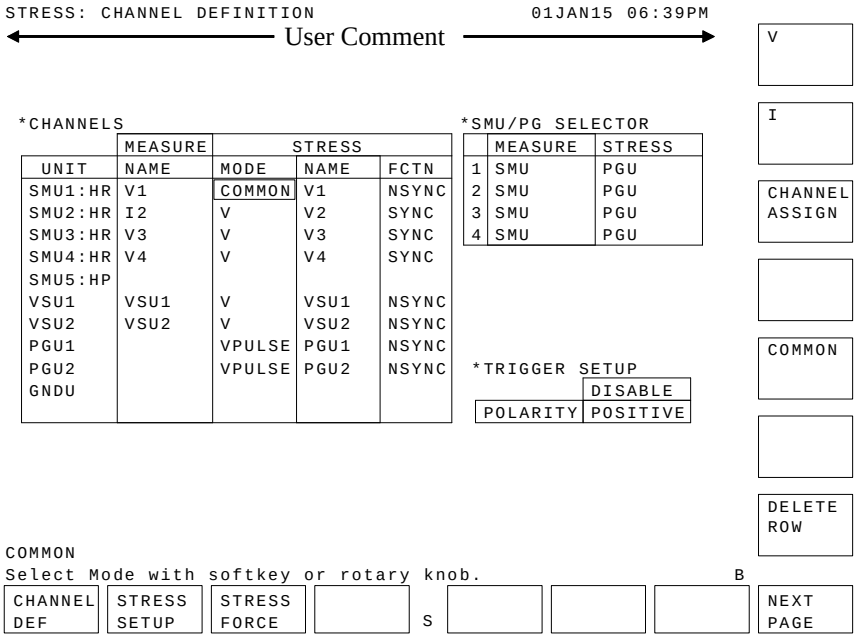
Then the following softkeys appear in the primary softkey area:

CHANNEL DEF	STRESS SETUP	STRESS FORCE				PREV PAGE	NEXT PAGE

- Select CHANNEL DEF softkey to move to the STRESS: CHANNEL DEFINITION screen.
- Select STRESS SETUP softkey to move to the STRESS: STRESS SETUP screen.
- Select STRESS FORCE softkey to move to the STRESS: STRESS FORCE screen.

When you press the **Stress** front-panel key in the MEASUREMENT key group, the STRESS: STRESS FORCE screen appears and stress forcing starts.

STRESS: CHANNEL DEFINITION



On the "STRESS: CHANNEL DEFINITION" screen, you define how to use the channels for stress force, how to control the SMU/PG selector, and trigger usage in the stress force state.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed on the other STRESS screens.

CHANNELS

CHANNELS table defines the mode, name, and function for the stress state.

- UNIT

  This column lists all the source units that are installed in the 4155C/4156C.

- NAME of MEASURE

  Source name that was defined for the measurement state (on CHANNELS: CHANNEL DEFINITION screen). For example, if the unit is set to V source mode, the specified VNAME is shown here.

- MODE of STRESS

  Output mode for each unit that will be used during stress force state. In the MODE column, allowable modes are shown in the secondary softkey area as follows, and you select a softkey to set an output mode.

V	dc voltage source
I	dc current source
VPULSE	ac voltage source
COMMON	circuit common
DELETE ROW	Deletes all entries in row of unit, so unit is not used during stress force. Output switch of unit is open.

  Allowable modes for each unit are shown in the following table:

	V	I	VPULSE	COMMON	DELETE ROW
SMU	yes	yes		yes	yes
VSU	yes				yes
PGU	yes		yes		yes
GNDU				yes	yes

  When pointer is at *top of this column*, CHANNEL ASSIGN softkey appears:

- NAME of STRESS (optional)

  Defines stress name that is used as a reference on STRESS: STRESS SETUP screen. In this column, enter a desired name by using alphanumeric keys.

  When pointer is in field of this column, DELETE ROW softkey is shown in secondary softkey area: clears all the entries for a unit where the pointer is located, and disables that unit.

  Restriction:

  - NAME must be 6 or less alphanumeric characters. First character must be alphabet character.

- FCTN of STRESS

  This field defines channels to be stress force channels or non-stress force channels. In this field, select:

  - SYNC secondary softkey to set channel to stress force channel.
  - NSYNC secondary softkey to set channel to non-stress force channel.

  The output timing is different for stress force channels and non-stress force channels:

  - Non-stress force channels output the source values in the order specified on the MEASURE: OUTPUT SEQUENCE screen *when state changes from idle to stress*.
  - Stress force channels output the stress source values simultaneously *when the stress start trigger is received.*

  For details about output sequence, see *User's Guide: Measurement and Analysis*.

  Restrictions:

  - At least *one* channel must be set to SYNC.
  - Up to four channels can be set to SYNC.
  - If both PGUs are set to pulsed source (VPULSE), you cannot set one PGU to SYNC and other PGU to NSYNC. Both must be set to SYNC or both to NSYNC.

NOTE

Switching units

To switch the STRESS MODE, NAME, and FCTN assignments for two units, do as follows:

1. Position pointer in top field of STRESS MODE column. CHANNEL ASSIGN softkey appears.
2. Select CHANNEL ASSIGN. Pointer moves to the top field of UNIT column.
3. Use arrow keys in the MARKER/CURSOR key group to move pointer to desired row.
4. Select the secondary softkey of the desired unit. The selected unit appears at the pointer.

Perform steps 3 and 4 until you assign units as desired. Make sure that the same unit is not assigned to multiple rows. Then select EXIT CHANNEL ASSIGN softkey.

SMU/PG SELECTOR

Agilent 16440A SMU/PG selector's operation is defined in the SMU/PG SELECTOR table. Switches in the SMU/PG selector are controlled as defined in these fields. MEASURE column sets the switch connections for measurement state. STRESS column sets the switch connections for stress force state.

When the pointer is located in this table, the following softkeys appear:

SMU Will connect DUT to SMU.

PGU Will connect DUT to PGU.

OPEN Will disconnect DUT from both SMU and PGU.

PGU OPEN Will disconnect DUT from both PGU and SMU. But PGU is disconnected by using semiconductor switch. The normal relay switch for PGU stays closed. This is used to prevent the normal relay switch from being damaged. Semiconductor switch has longer life than normal relay switch. Note that CH2 and CH4 do not have this function.

For details about the SMU/PG selector, refer to *Agilent 16440A User's Guide*.

TRIGGER SETUP

In the TRIGGER SETUP table, you can set how to use the trigger function during the stress force state.

- ENABLE/DISABLE

  In the ENABLE or DISABLE field, select:

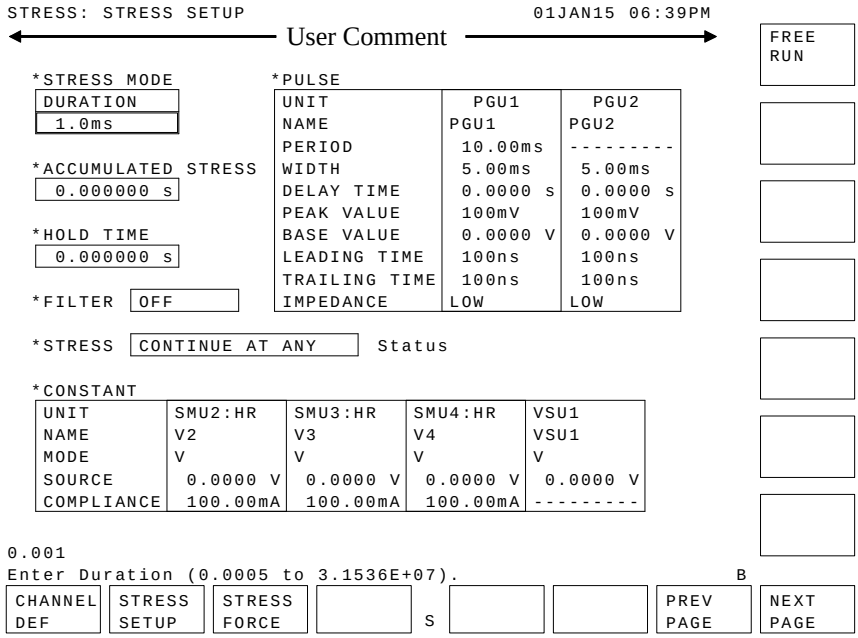
  - ENABLE secondary softkey to enable the trigger function.
  - DISABLE secondary softkey to disable the trigger function.

- POLARITY

  In this field, select:

  - POSITIVE secondary softkey to set positive logic for the output trigger.
  - NEGATIVE secondary softkey to set negative logic for the output trigger.

STRESS: STRESS SETUP



On the "STRESS: STRESS SETUP" screen, you set the stress parameters.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed on the other STRESS screens.

STRESS MODE

STRESS MODE table specifies the stress mode. When the stress mode is pulse count mode, you specify the number of pulse counts, and when the stress mode is duration mode, you specify the stress duration in seconds. For details of stress mode, refer to *User's Guide: Measurement and Analysis*. In the first field, select:

- DURATION secondary softkey to set the duration mode. Then, enter the pulse stress duration in the next field by using numeric keys.
- PULSE COUNT secondary softkey to set the pulse count mode. Then, enter the pulse count in the next field by using numeric keys. This softkey appears only for ac stress: PGU set to VPULSE and SYNC.

In the next field, FREE RUN secondary softkey appears. Select the FREE RUN softkey to force stress *continuously*. Entering 0 (zero) also sets to free run mode.

ACCUMULATED STRESS

The ACCUMULATED STRESS field on this screen and on STRESS: STRESS FORCE screen are linked. So, if value is changed on this screen, value is changed to same value on STRESS: STRESS FORCE screen and vice versa.

To change the displayed accumulated stress time, enter the time in this field. Selecting RESET ACCUM STRESS secondary softkey resets the displayed accumulated stress time to 0 (zero).

HOLD TIME

In the HOLD TIME, you can set the hold time. After the stress force state starts, the stress force channels wait the specified hold time, then start forcing stress at the same time.

For details about hold time, see *User's Guide: Measurement and Analysis*.

FILTER

FILTER field specifies SMU filter to `ON` or `OFF`. If this field is set to `ON`, overshoot decreases, but settling time takes several ms. If you set dc stress to short stress force time, set `OFF` in this field if you want the stress signal to be more pulse shaped.

STRESS Status

- Select CONT AT ANY secondary softkey (stress will continue even if an abnormal status occurs). Abnormal status means the following:
  - SMU reaches its compliance setting.
  - Current of VSU exceeds ±100 mA.
  - SMU or VSU oscillates.
  - A/D converter overflow occurs.
  - Average current of PGU exceeds ±100 mA.
- Select STOP AT ANY ABNORM secondary softkey (stress will stop if any abnormal status occurs).
- Select STOP AT COMPLIANCE secondary softkey (stress will stop only if SMU reaches its compliance setting).

STOP AT ANY ABNORM and STOP AT COMPLIANCE secondary softkeys are displayed only when specified duration is more than 10 s. If you set pulse count mode, these secondary softkeys are displayed only when *pulse period* × *pulse count* is more than 10 s.

Stress stop function is not effective until stress has been forced for 10 s.

CONSTANT

The UNIT, NAME, and MODE are defined on STRESS: CHANNEL DEFINITION screen.

On the STRESS: CHANNEL DEFINITION screen you set the SMUs and VSUs as follows:

- dc stress: `MODE= I` (SMUs only) or `V`, `FCTN=SYNC`
- dc non-stress: `MODE=I` (SMUs only) or `V`, `FCTN=NSYNC`

CONSTANT table is for setting the output parameters of SMUs, VSUs, and PGUs (V mode):

- SOURCE

  In the SOURCE field, you specify the output value.

- COMPLIANCE

  In the COMPLIANCE field, you specify the compliance value. For a VSU, this field cannot be set: compliance value is fixed to 100 mA.

If you define more than four VSUs, SMUs, and PGUs to be constant stress or non-stress units on the CHANNELS: CHANNEL DEFINITION screen, first four units appear in this table. To show other units, select NEXT UNIT secondary softkey. To scroll units, put field pointer in most right or left column, then press the left arrow or right arrow MARKER/CURSOR front-panel keys.

PULSE

UNIT and NAME are defined on STRESS: CHANNEL DEFINITION screen.

On the STRESS: CHANNEL DEFINITION screen you set the PGUs as follows:

- ac stress: `MODE=VPULSE`, `FCTN=SYNC`
- ac non-stress: `MODE=VPULSE`, `FCTN=NSYNC`
- dc stress: `MODE=V`, `FCTN=SYNC`
- dc non-stress: `MODE=V`, `FCTN=NSYNC`

PULSE table is for setting the pulse output parameters of PGUs:

- PERIOD

  This field specifies the pulse period of the PGU. Both PGUs are set to same value.

- WIDTH

  This field specifies pulse width, which must be less than pulse period.

- DELAY TIME

  This field specifies the delay time from the pulse start time. The delay time must be less than or equal to the pulse period.

- PEAK VALUE and BASE VALUE

  These fields specify pulse peak and base values.

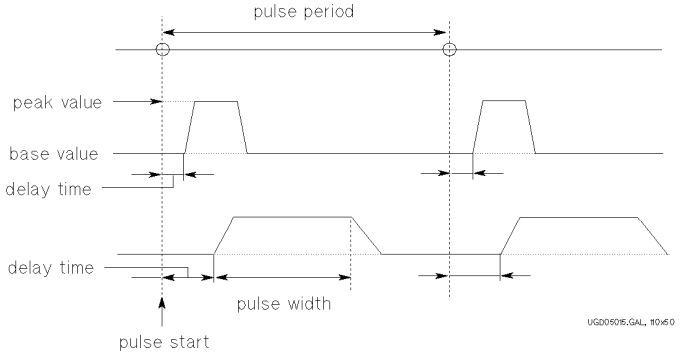
- LEADING TIME and TRAILING TIME

  These specify transition time (10 to 90%) of leading and trailing edges.

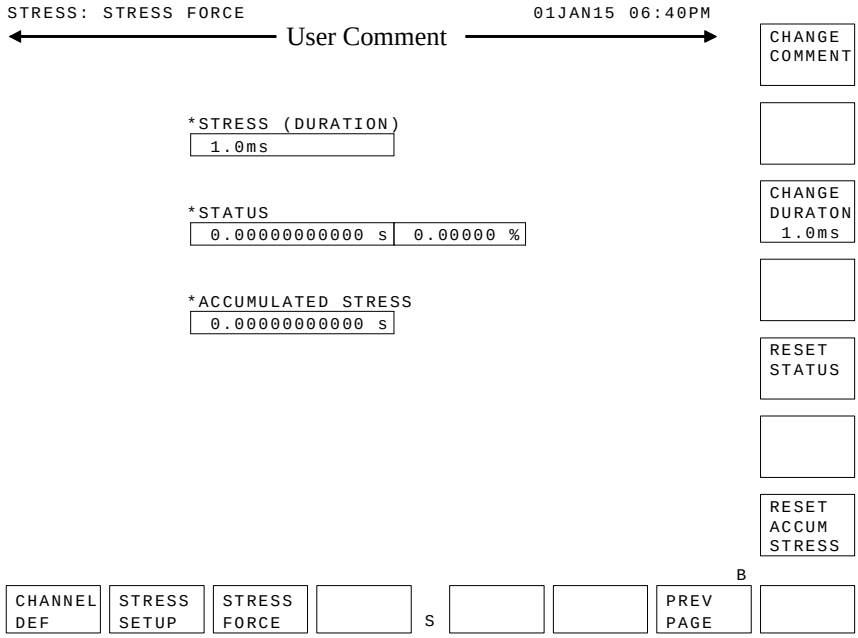
- IMPEDANCE

  This field specifies the PGU output impedance. In this field, select:

  - LOW secondary softkey to set output impedance to about 0 Ω.
  - 50 ohm secondary softkey to set output impedance to 50 Ω.



STRESS: STRESS FORCE



On the "STRESS: STRESS FORCE" screen, you can monitor the stress status.

User Comment

In this field, you can enter a desired comment. The comment you enter here is also displayed on the other STRESS screens.

Select CHANGE COMMENT secondary softkey to enter or edit the comment in this field. When you select this softkey, you can enter or edit the comment in the data entry area.

STRESS (DURATION)

STRESS (DURATION) field shows duration setting specified on the STRESS: STRESS SETUP screen. If the STRESS MODE is set to pulse count mode in the STRESS: STRESS SETUP screen, the duration is calculated by multiplying the pulse count by the pulse period.

Depending on the stress mode, select one of the following:

- CHANGE DURATON secondary softkey to change the stress duration.
- CHANGE PLS CNT secondary softkey to change the pulse count.

The stress mode and duration or pulse count were originally set on the STRESS: STRESS SETUP screen. The present stress duration or pulse count is shown on the softkey. When you select the softkey, the present value appears in the data entry area. You change the value as follows:

- Enter number by using numeric and edit keys.
- Change number by rotating rotary knob.

STATUS

In the STATUS field, the time that stress has been forced is displayed in seconds. And the percent completion is also displayed.

To reset stress status to 0, select RESET STATUS secondary softkey. Then, when you press the Stress front-panel key in the MEASUREMENT key group, the stress is forced for the specified duration.

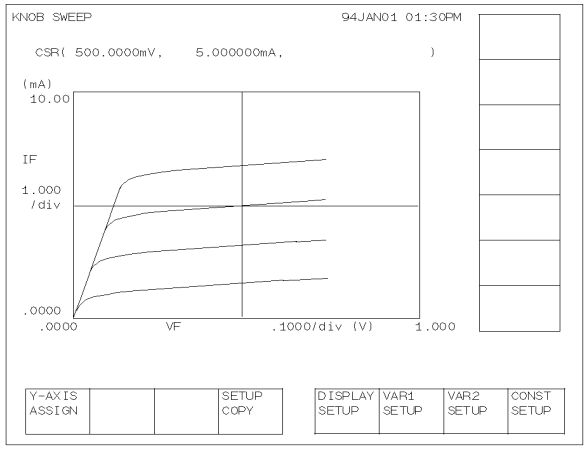
If you press the Stress key after aborting the stress (pressing the Stop front-panel key), the stress is forced starting at the present status, that is, stress status is not reset to 0.

ACCUMULATED STRESS

As the time in the STATUS field increases, the time in the ACCUMULATED STRESS field on this screen and also on STRESS: STRESS SETUP screen increases by the same amount.

To reset accumulated stress on both screens to 0, select RESET ACCUM STRESS secondary softkey. To change to non-zero value, change accumulated stress on STRESS: STRESS SETUP screen.

KNOB SWEEP Screen



UGD04007

To start the knob sweep measurement, press the green key and then the Single front-panel key. The 4155C/4156C displays KNOB SWEEP screen, and starts measurements. To stop the knob sweep measurement, press the Stop front-panel key or a PAGE CONTROL group key.

Cursor

On the KNOB SWEEP screen, the long cursor is always displayed, and you cannot turn it off. In the CURSOR field, coordinate values of the cursor are displayed in X, Y order.

X axis setting

X axis always plots the VAR1 source value. Maximum value of X axis is the setting value of the VAR1 RANGE secondary softkey of VAR1 SETUP softkey group.

Y axis setting

Y axis always plots the measurement data of the measurement channel. You can select the measurement channel by using the secondary softkeys of the Y-AXIS ASSIGN softkey group. Maximum value of Y axis scale is the compliance value of the measurement channel.

Y-AXIS ASSIGN Softkey

This softkey is used to change the measurement channel. Before selecting this softkey, the knob sweep measurement must be stopped. So press the Stop front-panel key to change the measurement channel. To restart measurement, press the Single front-panel key.

If you connect R-box to the VAR1 channel, and set the VAR1 to V force mode, the measurement channel is automatically decided to the VAR1 channel. In this setup, this softkey is not be displayed.

Y-AXIS ASSIGN primary softkey displays secondary softkeys used to select the measurement channel. The measurement variable names of measurement channels are labeled on the softkeys. User function is not available for the knob sweep function. So there is no user function variable in the softkey label.

When you select a secondary softkey, the maximum absolute value(s) of the Y axis are changed to compliance value of the selected measurement channel.

SETUP COPY Softkey

This softkey is used to memorize measurement setups used in the knob sweep measurement mode. This function allows you to copy and use the setups in the normal-sweep measurement mode.

1. Select this softkey to memorize the measurement setups.
2. Quit the knob sweep measurement mode using a PAGE CONTROL group key. Then the measurement setups are copied to the normal-sweep setup screens.

The information memorized and copied is as following:

- Axis variables, axis values, and GRID settings:

  copied to the DISPLAY: DISPLAY SETUP screen.

- Settings of VAR1, VAR2, CONST:

  copied to the MEASURE: SWEEP SETUP screen.

Knob sweep measurement setup cannot be directly stored into a file. This function allows you to save the setup as a normal-sweep measurement setup file. But the setup data cannot be retrieved to the knob sweep mode.

DISPLAY SETUP Softkey

This softkey displays secondary softkeys for setting the display format of graphics.

X-AXIS REGION + Selects polarity of X-axis region displayed on the screen. This softkey displays present setting.

- setting

  Pressing this softkey toggles polarity as follows:

  + → − → +/− → +

- default

  If polarity of VAR1 stop and start value on MEASURE: SWEEP SETUP screen are same, default value is same as polarity of stop and start value.

  If polarity of VAR1 stop and start value on MEASURE: SWEEP SETUP screen are different, default value is `+/-`.

Y-AXIS REGION + Selects polarity of Y-axis region displayed on the screen. This softkey displays present setting.

- setting

  Pressing this softkey toggles the polarity in the following order:

  + → − → +/− → +

- default

  polarity of VAR1 compliance value on the MEASURE: SWEEP SETUP screen

X-AXIS DISPLAY NORMAL

Selects direction of the X-axis. This softkey displays present setting.

- setting

  Selecting this softkey toggles NORMAL or REVERSE.

  When NORMAL is selected:

  - *Minimum* axis value is at *left* end of X-axis.
  - *Maximum* axis value is at *right* end of X-axis.

  When REVERSE is selected:

  - *Minimum* axis value is at *right* end of X-axis.
  - *Maximum* axis value is at *left* end of X-axis.
- default : NORMAL

Y-AXIS DISPLAY NORMAL

Selects direction of the Y-axis. This softkey displays present setting.

- setting

  Selecting this softkey toggles NORMAL or REVERSE.

  When NORMAL is selected:

  - *Minimum* axis value is at *bottom* of Y-axis.
  - *Maximum* axis value is at *top* of Y-axis.

  When REVERSE is selected:

  - *Minimum* axis value is at *top* of Y-axis.
  - *Maximum* axis value is at *bottom* of Y-axis.
- default : NORMAL

GRID ON

Selects grit on or off. This softkey displays present setting.

- setting

  Pressing this softkey toggles the grid on or off in the plotting area.
- default : ON

VAR1 SETUP Softkey

This softkey displays secondary softkeys for setting the primary sweep source (VAR1) parameters.

SWEEP MODE SINGLE

Selects sweep mode. This softkey displays present setting.

- setting

  Pressing this softkey toggles the sweep mode in the following order:

  SINGLE → DOUBLE → SINGLE

- default

  setting of the SWEEP MODE field on the MEASURE: SWEEP SETUP screen

POLAR- ITY POS

Selects polarity of sweep source. Changing the setting resets the sweep step to 0, so the sweep measurement curve goes back to 0 on the screen. This softkey displays present setting.

- setting

  Pressing this softkey toggles the polarity of VAR1 channel in the following order:

  POS → NEG → BIPOLAR → POS

- default

  If polarity of VAR1 stop and start value on MEASURE: SWEEP SETUP screen are same, default value is same as polarity of stop and start value.

  If polarity of VAR1 stop and start value on MEASURE: SWEEP SETUP screen are different, default value is `BIPOLAR`.

VAR1 RANGE 2V

Sets sweep range of VAR1 channel. This setting defines the maximum sweep range and resolution of VAR1 channel. This softkey displays present setting.

- setting

  Select this softkey to display the VAR1 sweep range value in the data entry area, then rotate the knob to change the value. Setting value will be changed by 1-2-5 steps as shown below:

  0.1 V → 0.2 V → 0.5 V → ... → 100 V → 200 V → 0.1 V

- setting range

  The allowed sweep range (1-2-5) values depend on the output range of the measurement unit.

- default

  Minimum value that includes *VAR1 start and stop value* that is set on the MEASURE: SWEEP SETUP screen. However the value must be 1-2-5 steps. For example, if start value is 0 V and stop value is 30 V on the MEASURE: SWEEP SETUP screen, default VAR1 range is 50 V.

NUM OF STEPS 101

Sets number of steps for VAR1 channel. For knob sweep, NO OF STEP setting on MEASURE: SWEEP SETUP screen has no meaning. This softkey displays present setting.

- setting

  Press this softkey to display the number of steps in the data entry area, then you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range : 2 to 1001
- default : 101

COMPLI- ANCE 100.mA

Sets compliance value for VAR1 channel. This softkey displays present setting.

- setting

  Press this softkey to display the compliance value in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range

  Compliance range depends on measurement unit.

- default

  VAR1 compliance value on the MEASURE: SWEEP SETUP screen

HOLD TIME 0.00s Sets hold time. This softkey displays present setting.

- setting

  Press this softkey to display the hold time in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range : 0 to 655.35 s with 10 ms resolution
- default : hold time on the MEASURE: SWEEP SETUP screen

STEP TIME 500us Sets step time which is the time width of each sweep step. This softkey displays present setting.

- setting

  Press this softkey to display the step time in the data entry area, then you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range : 500 μs to 100 ms with 100 μs resolution
- default : 500 μs

VAR2 SETUP Softkey

This softkey displays secondary softkeys for setting the secondary sweep source (VAR2) parameters.

If VAR2 is not set for any channel on the CHANNELS: CHANNEL DEFINITION screen, this softkey is not displayed.

VAR2 START 20.0uA Sets VAR2 start value. This softkey displays present setting.

- setting

  Press this softkey to display the VAR2 start value in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range

  Depends on the measurement unit.

- default

  VAR2 start value on MEASURE: SWEEP SETUP screen

VAR2 STEP 20.0uA Sets VAR2 step value. This softkey displays present setting.

- setting

  Press this softkey to display the VAR2 step value in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range

  Depends on the measurement unit.

- default

  VAR2 step value on MEASURE: SWEEP SETUP screen

VAR2 POINTS 5 Sets Number of steps for VAR2 channel. This softkey displays present setting.

- setting

  Press this softkey to display the VAR2 number of steps in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range : 1 to 128

- default

  VAR2 number of steps on MEASURE: SWEEP SETUP screen

COMPLI-ANCE 2.00 V

Sets compliance value for VAR2 channel. This softkey displays present setting.

- setting

  Press this softkey to display the VAR2 compliance value in the data entry area. Then, you can change the setting value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range

  Setting range depends on the measurement unit.

- default

  VAR2 compliance value on MEASURE: SWEEP SETUP screen

CONST SETUP Softkey

This softkey displays the secondary softkeys for setting the constant voltage source parameter or the constant current source parameters. Secondary softkeys for PGUs set to V mode are also displayed.

If CONST is not set for any channel on the CHANNELS: CHANNEL DEFINITION screen, this softkey is not displayed.

If more than six constant channels are defined, press the MORE softkey to display softkeys for the other constant channels.

Secondary softkeys

The first line of each secondary softkey displays the variable name of the constant source. The second line displays *source output value*. For SMUs, the third line displays *compliance value*. For other units, the third line is blank.

- Example. If an SMU is set as follows, the following softkey appears:

  ```
  Vce
    5.00V
   10.0mA
  ```

  - Voltage source mode.
  - Variable name (VNAME): "Vce".
  - Output voltage value: 5.0 V.
  - Compliance value: 10 mA.

- source output value

  Pressing the secondary softkey displays the source output value in the data entry area. You can change the value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- compliance value (only for SMU)

  Pressing the secondary softkey twice displays the compliance value in the data entry area. You can change the compliance value by using the rotary knob, numeric keys, or arrow keys in the Edit key group.

- setting range

  Each setting range depends on the measurement unit.

4 System Screens

This chapter describes the SYSTEM screen group.

The SYSTEM screen group contains the following screens:

- “SYSTEM: FILER”

  Executes the file operations (such as saving and getting files) on a diskette, in the internal memory, or on a network file system. This screen is displayed by pressing System key, or by selecting FILER softkey on a SYSTEM sub-screen.

- “SYSTEM: MISCELLANEOUS”

  Miscellaneous system settings, such as GPIB addresses, the built-in clock, and network setup. This screen is displayed by selecting MISCELLANEOUS softkey on a SYSTEM sub-screen.

- “SYSTEM: CONFIGURATION”

  Displays the software revision and units configuration. This screen is displayed by selecting CONFIG softkey on a SYSTEM sub-screen.

- “SYSTEM: SELF-CALIBRATION/DIAGNOSTICS”

  Executes calibration and diagnostics. This screen is displayed by selecting CALIB/DIAG softkey on a SYSTEM sub-screen.

- “SYSTEM: PRINT/PLOT SETUP”

  Sets the print/plot parameters. This screen is displayed by selecting PRINT SETUP softkey on a SYSTEM sub-screen.

- “SYSTEM: COLOR SETUP”

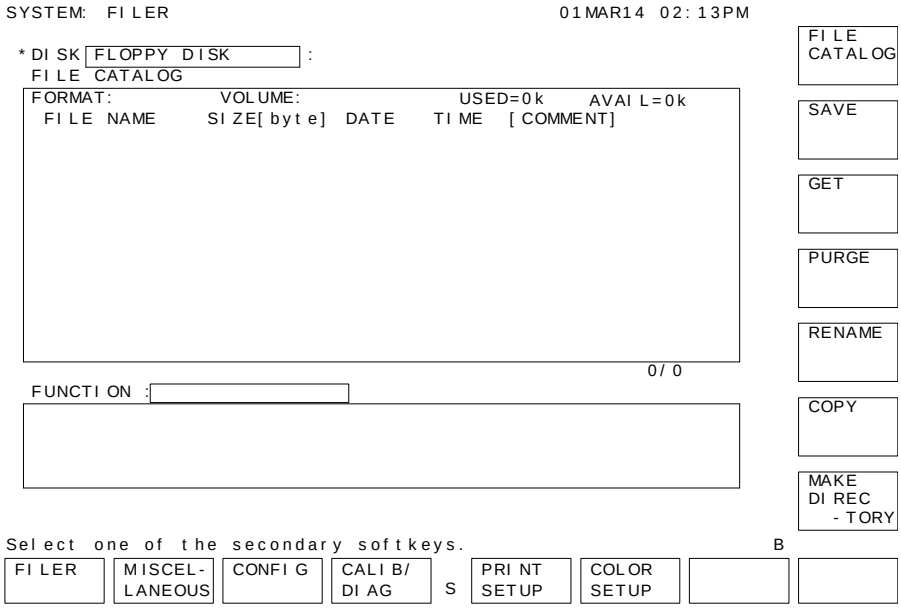
  Sets the screen colors. This screen is displayed by selecting COLOR SETUP softkey on a SYSTEM sub-screen.

To move to the SYSTEM screen group, press the System key. FILER screen is displayed, and the following primary softkeys are available.

FILER	MISCEL-LANEOUS	CONFIG	CALIB/ DIAG	PRINT SETUP	COLOR SETUP		

To start the save and get functions of the filer (SYSTEM: FILER) screen, press the Save key or Get key.

SYSTEM: FILER



On the "SYSTEM: FILER" screen, you can execute file operations from a diskette, internal memory, or the network file system.

The 4155C/4156C filer *cannot* operate on files that are created by another system. However, if the files satisfy the file name restrictions of the 4155C/4156C file system, you can use the following functions:

- purge
- rename
- copy from one diskette to another diskette

DISK

The DISK field specifies the mass storage device for the file operation. Choose the device by selecting one of the following:

FLOPPY Specifies a diskette inserted in the built-in flexible disk drive.

drive name The softkey label is not “drive name”, but the strings entered into the LABEL field of the NETWORK DRIVE SETUP table on the SYSTEM:MISCELLANEOUS screen. See “NETWORK DRIVE SETUP” on page 4-26.

When this softkey is selected, the 4155C/4156C mounts a directory on the NFS server, and displays a file catalog in the FILE CATALOG area. The directory is specified by the DIRECTORY field of the NETWORK DRIVE SETUP table. The name will be displayed in the area next to the DISK field.

Before selecting this softkey, confirm that the NFS server has already exported the directory for the 4155C/4156C.

To unmount the network file system, select the FLOPPY softkey, or turn off the 4155C/4156C.

FILE CATALOG

The FILE CATALOG field displays the file catalog (a maximum of 199 files) of the diskette or the network file system, and shows the following file information:

FORMAT	DOS or HP LIF format (diskette).
VOLUME	The volume name (diskette).
USED	The disk space occupied by the files (diskette).
AVAIL	The free disk space for data storage (diskette).
DIR	The name of the directory mounted by the 4155C/4156C (NFS).
FILE NAME	The file name used to identify the data.
SIZE	The file size (in bytes for DOS, in blocks for HP LIF).
DATE and TIME	The date and time when the file was created or last modified.
COMMENT	An optional comment, up to 16 characters long.

To scroll the catalog, use the rotary knob, or press the up or down arrow key.

When using the SAVE, GET, PURGE, RENAME, or COPY functions, you can specify a file name from the FILE CATALOG area. Move the pointer to the desired filename using the rotary knob or arrow keys, then press SELECT softkey.

To search for a specific file name, press the alphanumeric key for the first character of the file name. The field pointer moves to the first file name that starts with the character selected.

File Type

The following are file types (file suffixes) used by the 4155C/4156C:

MES	Measurement setup data file
STR	Stress setup data file
DAT	Measurement setup and result data file
MAT	E5250A setup data file
CST	Customized file (consists of settings from the SYSTEM screen group and the ASCII SAVE window)
PRO	4145B setup data file
PCL	Hard copy file for PCL format
PGL	Hard copy file for HP-GL format
TIF	Hard copy file for TIFF format
TXT	Measurement result data file for spreadsheets

FUNCTION

The FUNCTION field specifies the file operation. When the field pointer is on this field, the following softkeys, shown in Menu 1 and Menu 2, are available.

Menu 1:

FILE CATALOG	Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.
SAVE	Saves the specified file.
GET	Gets the specified file.
PURGE	Purges the specified file/directory.
RENAME	Renames the specified file.
COPY	Copies the specified file.
MAKE DIRECTORY	Creates a new directory under the directory mounted by the 4155C/4156C (NFS only).
DISK OPERATION	Opens the Disk Operation screen used to initialize or copy the diskette (diskette only).

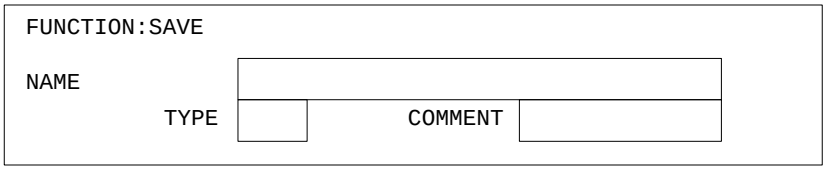
Menu 2:

FILE CATALOG	Reads and displays the file catalog. A maximum of 199 files can be listed.
EXIT FILE CATALOG	Changes the secondary softkeys to those shown in Menu 1.
CHANGE DIR	Changes the current directory to the directory specified by the pointer (NFS only).
UPPER DIR	Changes the current directory to one level higher than the current directory (NFS only).
ROOT DIR	Changes the current directory to the root directory. The root directory is always the directory specified by the NETWORK DRIVE SETUP table on the MISCELLANEOUS screen (NFS only).
READ COMMENT	Reads the COMMENT field for the specified file (diskette only).
READ COMMENT ALL	Reads the COMMENT field for all files on the diskette (diskette only).

SAVE

To start the save function, press the SAVE softkey or the Save key. Either key displays the following entry box and softkeys.

- Entry box:



- Softkeys:

  EXECUTE Saves the data.

  EXIT Exits the SAVE function.

TYPE field

The TYPE field specifies the data type. In this field, select:

MES Specifies the measurement setup data.

STR Specifies the stress setup data.

DAT Specifies the measurement setup and result data.

MAT Specifies the E5250A setup data.

CST Specifies the customized system data. This softkey is *not* available for internal memory (MEM*).

For internal memory (MEM*), the first character of the TYPE (M, S or D) will be displayed in the upper-right corner of the MEM* softkey.

COMMENT field

The COMMENT field is used to enter file comments, which will be displayed in the FILE CATALOG area. A maximum of 16 characters are allowed.

For internal memory (MEM*), the comments are displayed on the MEM* softkey. A maximum of 14 characters are allowed.

NAME field

The NAME field specifies the file name of data to be saved. The file name must be:

- 6 characters (maximum) for HP LIF format. Do not use "_" as the last character of the filename.
- 8 characters (maximum) for DOS format.
- 36 characters (maximum) for a network file system, and 58 characters (maximum) including the directory path.

When the pointer is in the NAME field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

FILE CATALOG	Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.
MEM*	Selects the internal memory MEM1, MEM2, MEM3, or MEM4 for saving data.

- Menu 2:

FILE CATALOG	Reads and displays the file catalog. A maximum of 199 files can be listed.
EXIT FILE CATALOG	Changes the secondary softkeys to those shown in Menu 1.
SELECT	Selects a file name from the FILE CATALOG area. Used to update data in an existing file. The file name (NAME, TYPE and COMMENT) is specified by the pointer in the FILE CATALOG area.

Setup items that are saved to the customize (CST) file

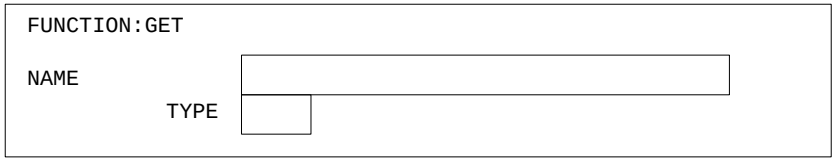
The following setup items are stored when you set CST in the TYPE field.

- SYSTEM: PRINT/PLOT SETUP screen
  - DESTINATION
  - LANGUAGE
  - FORM FEED
  - COLOR/ B/W
  - LINE
  - COLUMN
  - RESOLUTION
  - PAPER
  - OUTPUT ITEM
  - INIT STRING
  - TRAILER STRING
- SYSTEM: COLOR SETUP screen
  - HUE
  - SATURATION
  - LUMINOSITY
  - PLOTTER PEN NO.
  - BRIGHTNESS
- SYSTEM: MISCELLANEOUS screen
  - REMOTE CONTROL
  - BEEP
  - NETWORK PRINTER SETUP
  - NETWORK DRIVE SETUP
- ASCII SAVE WINDOW
  - UNIT
  - DELIMITER
  - STRING MARK
- hard copy setup window
  - DESTINATION
  - FILE NAME
  - OUTPUT REGION
  - PRINT/PLOT COMMENT
  - OUTPUT PAGE
  - GRAPH TRACE ONLY
  - OUTPUT DATA
  - PRINT SETUP DATA
- INIT file start screen displayed after getting the INIT file

GET

To start the get function, press the GET softkey or the Get key. Either key will display the following entry box and primary softkeys.

- Entry box:



- Softkeys:

EXECUTE Gets (retrieves) the specified data.

EXIT Exits the GET function.

TYPE field

The TYPE field specifies the data type. In this field, select:

MES Specifies the measurement setup data.

STR Specifies the stress setup data.

DAT Specifies the measurement setup and result data.

MAT Specifies the E5250A setup data.

CST Specifies the customized system data.

PRO Specifies the 4145B setup data.

NOTE

Number of Sweep Steps

The 4155C/4156C can also read the DAT file saved by the 4145B. When the 4155C/4156C reads the 4145B data file, if the number of primary sweep steps is more than 1001, the 4155C/4156C sets the number of sweep steps to 1001, and discards the corresponding measurement results.

NAME field

The NAME field specifies the file name to get. When the pointer is in this field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the softkeys to those shown in Menu 2.

  MEM* — Selects the internal memory MEM1, MEM2, MEM3, or MEM4 for getting data.

  On the softkey label, a notation in the upper-right corner shows the data type:

  `M:` MES data or PRO data

  `S:` STR data

  `D:` DAT data

- Menu 2:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed.

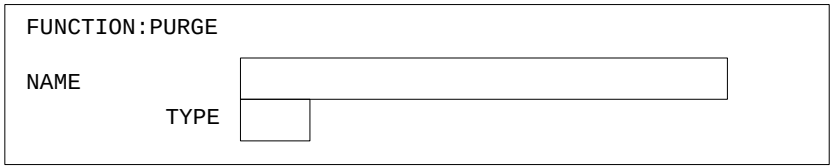
  EXIT FILE CATALOG — Changes the secondary softkeys to those shown in Menu 1.

  SELECT — Selects the file to get. The file is specified by the pointer in the FILE CATALOG area.

PURGE

To start the purge function, press PURGE. The following entry box and softkeys are displayed.

- Entry box:



- Softkeys:

EXECUTE	Purges (deletes) the specified data.
EXIT	Exits the PURGE function.

TYPE field

The TYPE field specifies the data type. In this field, select:

*****	Specifies all types of data.
MES	Specifies the measurement setup data.
STR	Specifies the stress setup data.
DAT	Specifies the measurement setup and result data.
MAT	Specifies the E5250A setup data.
CST	Specifies the customized system data.
PRO	Specifies the 4145B setup data.

NAME field

The NAME field specifies the file name or directory name to purge (delete). The directory to be purged must be empty. When the pointer is in this field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.

  MEM* — Selects the internal memory MEM1, MEM2, MEM3, or MEM4 for deleting data.

  On the softkey label, a notation in the upper-right corner shows the data type:

  - `M:` MES data or PRO data
  - `S:` STR data
  - `D:` DAT data

- Menu 2:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed.

  EXIT FILE CATALOG — Changes the secondary softkeys to those shown in Menu 1.

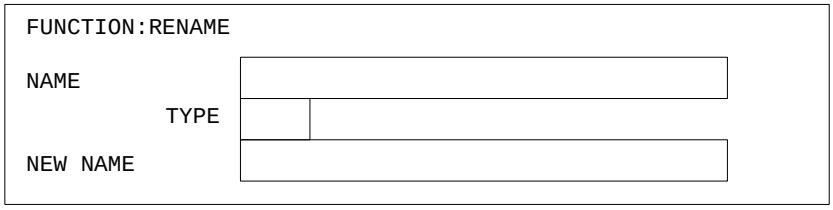
  SELECT — Selects the file or directory to be purged. The file or directory is specified by the pointer in the FILE CATALOG area.

RENAME

This function is available for a file on the diskette or on the network file system mounted by the 4155C/4156C. This function is *not* available for the directory on the network file system.

The following entry box and primary softkeys are displayed.

- Entry box:



- Softkeys:

  EXECUTE Renames the file.

  EXIT Exits the RENAME function.

TYPE field

The TYPE field specifies the data type. In this field, select:

MES Specifies the measurement setup data.

STR Specifies the stress setup data.

DAT Specifies the measurement setup and result data.

MAT Specifies the E5250A setup data.

CST Specifies the customized system data.

PRO Specifies the 4145B setup data.

NAME field

The NAME field specifies the file to rename. The NEW NAME field specifies a new file name. The file name must be:

- 6 characters (maximum) for HP LIF format. Do not use "_" as the last character of the filename.
- 8 characters (maximum) for DOS format.
- 36 characters (maximum) to store on a network file system, and a total of 58 characters including the directory path.

When the pointer is in the NAME field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.

- Menu 2:

  FILE CATALOG — Reads and displays the file catalog. A maximum of 199 files can be listed.

  EXIT FILE CATALOG — Changes the secondary softkeys to those shown in Menu 1.

  SELECT SOURCE — Selects the file to be renamed. The file name (NAME and TYPE) is specified by the pointer in the FILE CATALOG area.

  SELECT TARGET — Selects the new file name from the FILE CATALOG area. The file name (NEW NAME) is specified by the pointer in the FILE CATALOG area.

  READ COMMENT — Reads the comments for the file specified by the pointer in the FILE CATALOG area (diskette only).

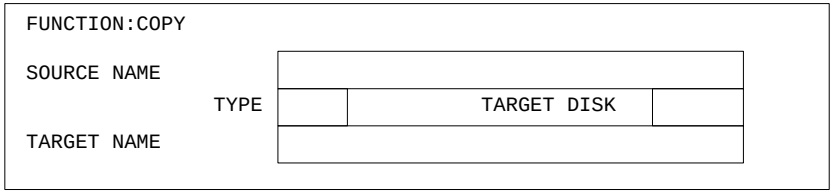
  READ COMMENT ALL — Reads the comments for all files listed in the FILE CATALOG area (diskette only).

COPY

This function is used to copy files between a diskette and internal memory, between two diskettes, within a diskette, within the network file system the 4155C/4156C mounts, or between the network file system and internal memory.

The following entry box and primary softkeys will be displayed.

- Entry box:



- Softkeys:

  EXECUTE Copies the data.

  EXIT Exits the COPY function.

TYPE field

The TYPE field specifies the data type. In this field, select:

*****	Specifies all types of data.
MES	Specifies the measurement setup data.
STR	Specifies the stress setup data.
DAT	Specifies the measurement setup and result data.
MAT	Specifies the E5250A setup data.
CST	Specifies the customized system data.
PRO	Specifies the 4145B setup data.

TARGET DISK field

The TARGET DISK field specifies whether the source and target files are on the same diskette or different diskettes. The following secondary softkeys are available:

SAME	The target file is on the same diskette as the source file.
OTHER	The target file is on a different diskette than the source file.

SOURCE NAME, TARGET NAME fields

The SOURCE NAME field specifies the file name to be copied. The TARGET NAME field specifies the new name for the file.

The file name must be:

- 6 characters (maximum) for HP LIF format. Do not use "_" as the last character of the filename.
- 8 characters (maximum) for DOS format.
- 36 characters (maximum) to store on a network file system, and a total of 58 characters including the directory path.

When the pointer is in this field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

  FILE CATALOG Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.

  MEM* Specifies data in internal memory MEM1, MEM2, MEM3, or MEM4.

- Menu 2:

  FILE CATALOG Reads and displays the file catalog. A maximum of 199 files can be listed.

  EXIT FILE CATALOG Changes the secondary softkeys to those shown in Menu 1.

  SELECT SOURCE Selects the file to be copied. The file name (SOURCE NAME and TYPE) is specified by the pointer in the FILE CATALOG area.

  SELECT TARGET Selects the new file name from the FILE CATALOG area. The file name (TARGET NAME) is specified by the pointer in the FILE CATALOG area.

  READ COMMENT Reads the comment for the file specified by the pointer on the FILE CATALOG area (diskette only).

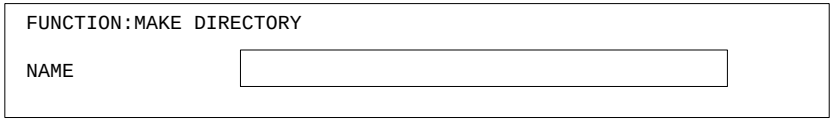
  READ COMMENT ALL Reads the comments for all files listed in the FILE CATALOG area (diskette only).

MAKE DIRECTORY

This function creates a subdirectory on the NFS server. The subdirectory will be under the directory mounted by the 4155C/4156C.

The following entry box and primary softkeys will be displayed.

- Entry box:



- Softkeys:

EXECUTE Makes a directory with the specified name.

EXIT Exits the MAKE DIRECTORY function.

NAME field

The NAME field specifies the new directory name.

The directory name can be up to 36 characters, and 58 characters when including the directory path.

When the pointer is in this field, the softkeys shown in Menu 1 and Menu 2 are available.

- Menu 1:

FILE CATALOG Reads and displays the file catalog. A maximum of 199 files can be listed. This softkey also changes the secondary softkeys to those shown in Menu 2.

- Menu 2:

FILE CATALOG Reads and displays the file catalog. A maximum of 199 files can be listed.

EXIT FILE CATALOG Changes the secondary softkeys to those shown in Menu 1.

SELECT Selects the directory name. The directory is specified by the pointer in the FILE CATALOG area.

DISK OPERATION

This function allows you to initialize a diskette or to copy all the files on a diskette, and is available when the DISK field is set to FLOPPY DISK.

This softkey displays the disk operation function screen, which displays the following softkeys and fields.

EXECUTE Executes the specified operation for the diskette.

EXIT Exits the disk operation screen.

DISK OPERATION field

The DISK OPERATION field selects the desired operation by using the following secondary softkeys.

DISK INIT Initializes the diskette. Initialization prepares the diskette so that the 4155C/4156C can use it for storing data.

DISK COPY Copies the entire contents of one diskette to another. This is typically used to make a backup copy. The diskettes must have the same format and capacity.

FORMAT field

The FORMAT field (only for DISK INIT) selects the DOS or HP LIF format.

VOLUME LABEL field

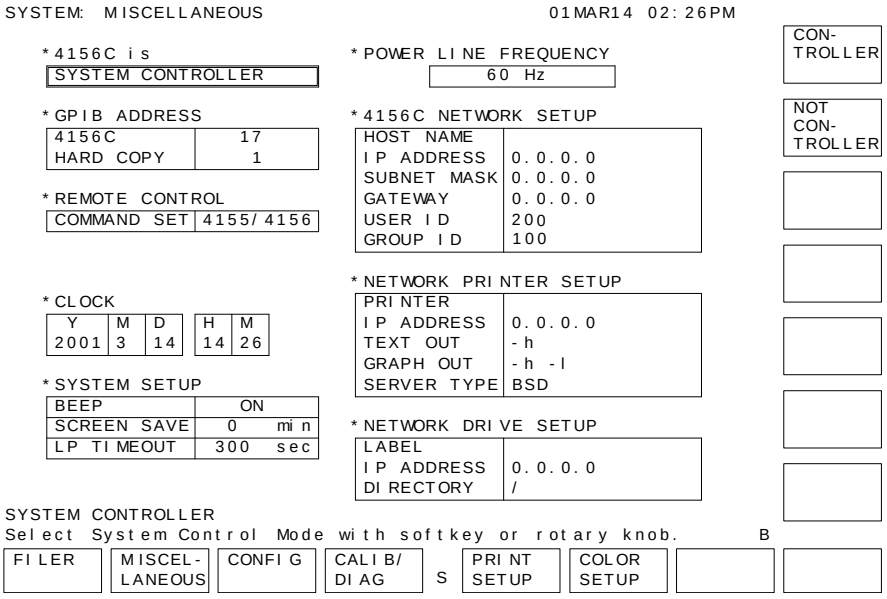
The VOLUME LABEL field (only for DISK INIT) specifies a volume label for the diskette. The default volume name is "4155" or "4156". You *cannot* specify a blank label.

The volume name can be up to 8 characters for DOS format or up to 6 characters for HP LIF format.

PROGRESS STATUS field

The PROGRESS STATUS field displays the progress of the initialization or copy operation.

SYSTEM: MISCELLANEOUS



The SYSTEM: MISCELLANEOUS screen contains miscellaneous settings for the 4155C/4156C.

4155C is, 4156C is

This field specifies the GPIB operation mode for the 4155C/4156C. The following softkeys appear:

SYSTEM CONTROLLER Selects the 4155C/4156C as the system controller. If you use IBASIC, select this softkey.

NOT SYSTEM CONTROLLER Sets the 4155C/4156C for use with an external system controller.

GPIB ADDRESS

This field specifies the addresses of the 4155C/4156C and the output device.

4155C/4156C Enter the GPIB address of the 4155C/4156C.

HARD COPY Enter the GPIB address of the printer or plotter connected to the 4155C/4156C.

REMOTE CONTROL

This table specifies the remote control command set as follows. The DELIMITER and EOI entry fields are available for the 4145 command set.

COMMAND SET Select the 4155/4156 or 4145 command set.

DELIMITER Select a comma or a carriage return and line feed (CR/LF).

EOI Set EOI on or off.

NOTE

Changing the COMMAND SET Field

If you change the COMMAND SET field, the 4155C/4156C will be reset, and the setup data will be lost.

CLOCK

This table sets the present date and time. Change the date and time using the number keys, or UP/DOWN softkeys. Then press the SET softkey to apply the change.

POWER LINE FREQUENCY

This field selects the power line frequency. The selectable frequencies are 50 or 60 Hz.

SYSTEM SETUP

This table specifies the following parameters.

BEEP This field turns the beep sound ON or OFF.

SCREEN SAVE This field sets the time interval before the screen saver is activated (the screen does not display anything). The time interval can be 0 to 60 minutes. To release the screen saver, touch any key or the rotary knob.

To disable the screen saver, enter 0 (zero).

LP TIMEOUT This field sets the maximum time to confirm the connection with the printer server defined in the NETWORK PRINTER SETUP table. The 4155C/4156C waits for a response from the printer server when a hard copy is requested. If the 4155C/4156C does not receive a response within the time specified by this setting, a time-out error will occur.

The time-out can be set from 1 to 32767 seconds.

NETWORK SETUP

This setup table specifies the network setup parameters. If you connect the 4155C/4156C to your local network, you must complete this table.

The 4155C/4156C stores the setup in its internal memory and keeps the setup data until you change it, even if you turn off the unit.

NOTE

Network Function

The 4155C/4156C can be an NFS client, and can use a remote printer to make hard copies. This allows you to access a file on a network file system on your NFS server, and to make hard copies using the remote printer via your printer server.

- To use the 4155C/4156C as an NFS client:
  1. Fill in the NETWORK SETUP table.
  2. Fill in the NETWORK DRIVE SETUP table.
  3. Access the file using the SYSTEM: FILER screen.
- To use a remote printer:
  1. Fill in the NETWORK SETUP table.
  2. Fill in the NETWORK PRINTER SETUP table.
  3. Fill in the SYSTEM: PRINT/PLOT SETUP screen.
  4. Make hard copies using the PRINT/PLOT dialog box.

NOTE

Network Setup

If you are uncertain as to your local network configuration, or have questions concerning the network setup parameters, contact your network system administrator.

HOST NAME The host name of the 4155C/4156C. A maximum of 15 characters is allowed.

IP ADDRESS The IP address of the 4155C/4156C. String of up to 15 characters. The default setting is ‘0.0.0.0’, which is an invalid number for the IP ADDRESS.

SUBNET MASK The subnet mask of the network the 4155C/4156C connects. String of up to 15 characters. The value 255.255.255.255 is invalid.

The string 0.0.0.0 automatically sets the default value of the class specified by the IP ADDRESS value. The default value is 255.0.0.0 for class A, 255.255.0.0 for class B, or 255.255.255.0 for class C.

You cannot set the subnet mask to a higher class value than the class the 4155C/4156C belongs to.

GATEWAY If you access a network out of the subnet, enter the IP address of the gateway. A string of up to 15 characters. If you access the network within the subnet, enter 0.0.0.0.

USER ID Your user ID. This must be a positive integer, 0 (zero) is not allowed. The default setting is 200.

GROUP ID Your group ID. The default setting is 100.

After you enter the HOST NAME, the 4155C/4156C displays two secondary softkeys for the HOST NAME field:

DISABLE Disables the network function.

[ ] Enables the network function and recalls the setup from memory. This softkey will be labeled with the HOST NAME you entered.

For example, if you entered ‘analyzer1’ into the HOST NAME field, a softkey labeled analyzer1 will be displayed.

NETWORK PRINTER SETUP

This setup table specifies the setup parameters for a printer server and a printer connected to the server. After filling in this table, the setup must be stored in the internal memory. To store the setup in memory, press ADD softkey. The 4155C/4156C will use this printer as the remote printer.

The 4155C/4156C can store a maximum of four setups, and keeps the setup data until you update or delete the setup, even if the instrument is turned off.

PRINTER The printer name assigned to the remote printer, and defined on the printer server. A maximum of 15 characters is allowed.

IP ADDRESS The IP address assigned to the printer server. The default setting is '0.0.0.0', which is an invalid number for the IP ADDRESS.

TEXT OUT The text output option of the lp command. The default setting is '-h'.

For BSD servers, this parameter must be entered as '*-option*', where *option* indicates the filtering option.

For SystemV servers, this parameter must be entered as '*-ooption*', where *option* indicates the printer option.

For more information regarding *option*, see the network operating and service manual.

GRAPH OUT The graphics output option of the lp command. The default setting is '-h -l'.

See the TEXT OUT section above for more information.

SERVER TYPE The server type, BSD or SystemV. The default setting is BSD.

The NETWORK PRINTER SETUP table has the following softkeys available:

ADD Adds the printer setup information to the internal memory. A softkey will be created and labeled with the printer name. For example, if you enter 'printer1', and then press the ADD softkey, a printer1 softkey will be created. This key is used to call the setup information.

DELETE Deletes the setup information (on the screen and in the internal memory) specified by the PRINTER field.

UPDATE Updates the setup data in the internal memory. The setup data currently in memory is replaced with the new information in the NETWORK PRINTER SETUP table.

NETWORK DRIVE SETUP

This setup table specifies the IP address of the NFS server and the directory mounted by the 4155C/4156C. After filling in this table, the setup must be stored in the internal memory, by selecting the ADD softkey.

The 4155C/4156C can store a maximum of four setups, and keeps the data until you update or delete the setup, even if the instrument is turned off.

LABEL The label or name of the setup information in the NETWORK DRIVE SETUP table. A maximum of 15 characters is allowed.

IP ADDRESS The IP address of the NFS server. The default setting is '0.0.0.0', which is an invalid number for the IP ADDRESS.

DIRECTORY The name of the directory mounted by the 4155C/4156C. A maximum of 58 characters are allowed. The default setting is '/' (the root directory). The 4155C/4156C mounts this directory and uses it as the root directory. Confirm that the NFS server has exported the directory to the 4155C/4156C.

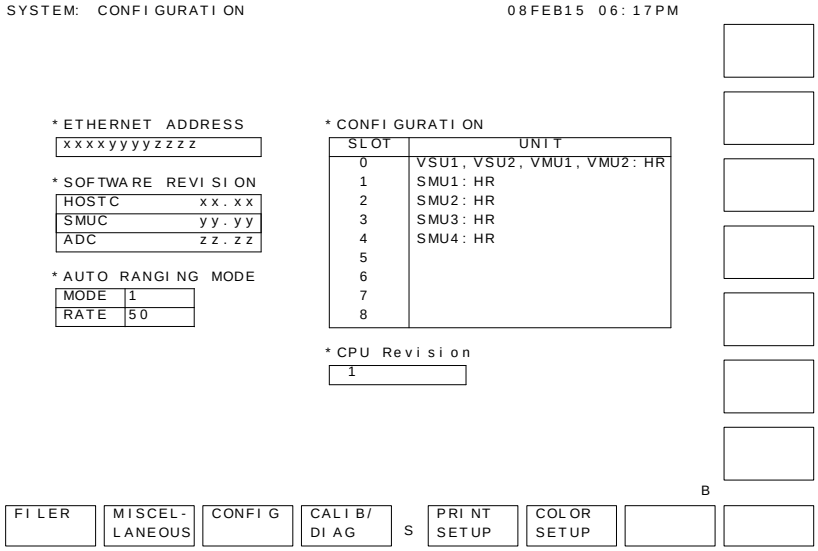
The NETWORK DRIVE SETUP table has the following softkeys:

ADD Adds the setup to the internal memory. After completing this table, press the ADD softkey to register the information in the internal memory. A softkey will be created and labeled. For example, if you enter 'mydir1' into the LABEL field, and then press the ADD softkey, the mydir1 softkey will be created. This softkey is used to call the setup information.

DELETE Deletes the setup information (on the screen and in the internal memory) specified by the LABEL field.

UPDATE Updates the setup data in the internal memory. The setup data currently in memory is replaced with the new information in the NETWORK DRIVE SETUP table.

SYSTEM: CONFIGURATION



The SYSTEM: CONFIGURATION screen contains the system firmware revision and hardware configuration for the 4155C/4156C.

ETHERNET ADDRESS

This field shows the ethernet address of the 4155C/4156C.

SOFTWARE REVISION

This table displays the following software revisions:

- host controller
- SMU controller
- A/D converter controller

CONFIGURATION

This table displays the hardware configuration for the 4155C/4156C.

CPU REVISION

This field shows the revision number of the 4155C/4156C CPU board.

AUTO RANGING MODE

This table specifies the auto range operation for the current measurement. This setting is effective for all of the current measurement SMU.

MODE Auto range operation mode. 1, 2 or 3. See Table 4-1. Initial setting is 1.

RATE Value used to calculate the *current* value shown below. 11 to 100. Initial setting is 50.

Table 4-1 Auto Range Operation

MODE	Description
1	Normal auto range operation. The range change operation is automatically controlled by the instrument.
2	If measured data ≥ *current1*, the range changes up after measurement.
3	If measured data ≤ *current2*, the range changes down immediately, and if measured data ≥ *current1*, the range changes up after measurement.

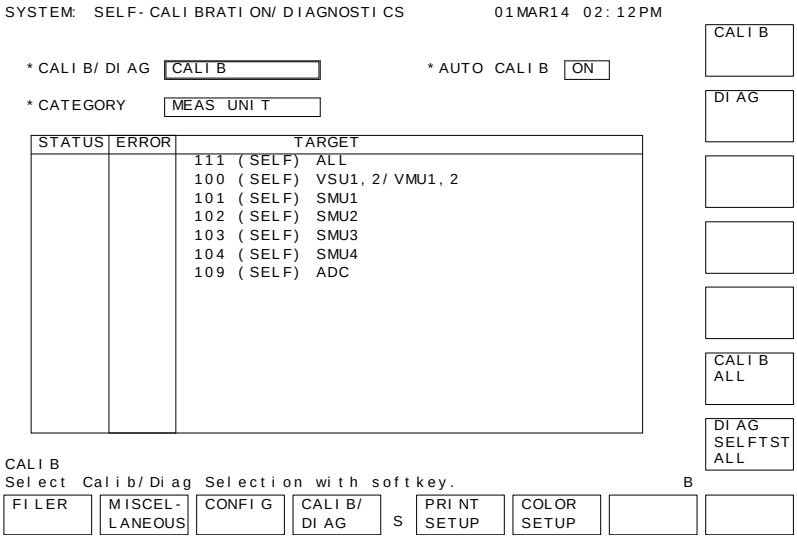
where *current1* and *current2* are given by the following formula:

current1 = *measurement range* × *RATE* /100
current2 = *measurement range* × *RATE* /1000

For example, if *measurement range*=10 mA and *RATE*=90, these values are as follows:

current1 = 9 mA
current2 = 0.9 mA

SYSTEM: SELF-CALIBRATION/DIAGNOSTICS



The SYSTEM: SELF-CALIBRATION/DIAGNOSTICS screen is used to execute self-calibration and diagnostics.

While executing self-calibration or diagnostics, you *cannot* perform measurements.

CALIB/DIAG

This field allows you to choose self-calibration or diagnostics, by selecting CALIB or DIAG softkey.

The self-calibration tests are part of the `MEAS UNIT` diagnostics tests.

AUTO CALIB

This field determines if self-calibration will be executed automatically, by selecting ON or OFF softkey.

If this field is set to `ON`, self-calibration is performed automatically every 30 minutes. Self-calibration is performed only when the 4155C/4156C state is idle. Automatic self-calibration will *not* execute when performing extended stress forcing or measurements, or when using the standby state.

CATEGORY

When CALIB softkey is selected in the CALIB/DIAG field, the CATEGORY field is automatically set to `MEAS UNIT`.

When DIAG softkey is selected in the CALIB/DIAG field, the following choices may be selected:

MEAS UNIT	Displays tests for measurement units.
LCD	Displays test items for the LCD.
CPU	Displays test items for the CPU.
I/O PERIPH	Displays tests for the I/O and peripherals.
MATRIX	Displays tests for the E5250A connected to the 4155C/4156C via GPIB.

The columns in the table contain the following information.

STATUS

The STATUS column displays the following test results:

- Where the 4155C/4156C can detect whether the test passes or fails:

`FAIL`	Executed test failed.
`PASS`	Executed test passed.
blank	The test has not been performed.

- Where the 4155C/4156C cannot detect whether the test passes or fails:

`DONE`	Executed test is finished.
blank	Executed test is not finished.

ERROR

The ERROR column displays an error code if the executed test failed. Only the first error code is displayed in this field. To see if more errors have occurred, move the pointer to the test line. Up to seven error codes are displayed in the data entry field. For more information regarding error codes, see *If You Have a Problem* manual.

TARGET

The TARGET column displays the following information:

- test number

  This number is used to execute the test by remote command. For more information, see *SCPI Command Reference* manual.

- `(SELF)` or `(INT.)`

  `(SELF)` is displayed if the test can be executed automatically.

  `(INT.)` is displayed if the test must be executed interactively, that is, the operator must connect cables or make decisions during the test.

- test items

  Name of the tests.

Executing the Tests

You can execute the tests as shown below:

1. Move the pointer to the desired test item.
2. Select the EXECUTE softkey.

If the pointer is at a `(SELF)` test, you can repeat the test continuously by selecting REPEAT TEST softkey. You can stop executing the test by selecting STOP softkey. The REPEAT TEST softkey is available for the diagnostics, not for self-calibration.

If you want to execute all tests automatically, select:

- CALIB ALL softkey to execute all self-calibration tests.
- DIAG SELFTST ALL softkey to execute all tests displaying `(SELF)` in the TARGET field.

If you execute the MATRIX tests, notify that:

- Test No. 801 executes all of the MATRIX test items (802 to 807).
- Front panel test (803) waits for pressing the Local/Self Test key on the E5250A front panel. Confirm that the LEDs on the E5250A front panel is blinking, and press the Local/Self Test key. If you do not press the key within 10 seconds, you get FAIL status.
- Relay test (804 to 807) needs the relay test adapter. The adapter must be attached to the E5250A input terminals.

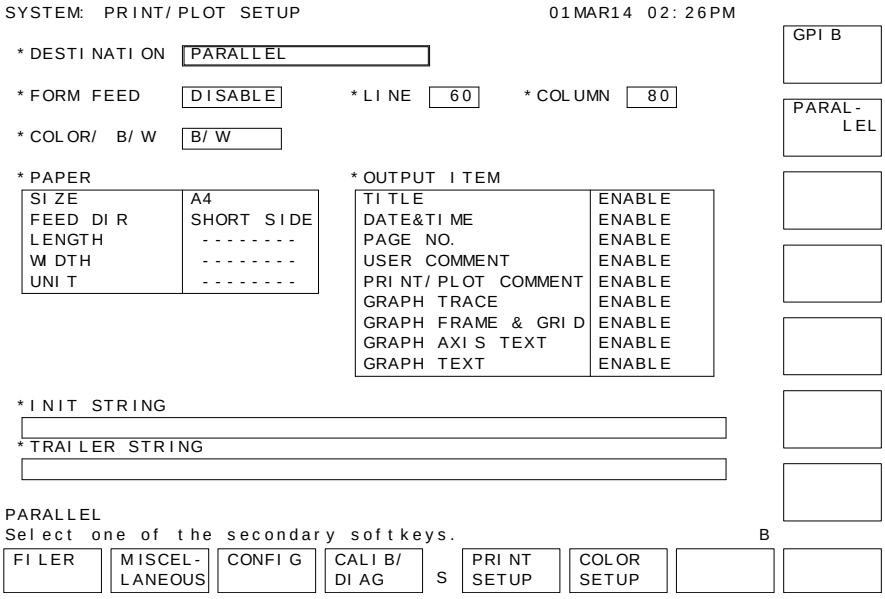
To stop executing tests, select STOP softkey.

Test Adapter

The following tests require the following test adapters.

Test Item	Adapter
Test No. 312 (LAN interface test)	LAN Test Adapter (Agilent Part Number 04155-61631)
Test No. 401 (parallel I/F test)	Parallel Test Adapter (Agilent Part Number 04155-61632)
Test No. 801, 804 to 807 (E5250A/E5252A relay test)	Relay Test Adapter (Agilent Part Number E5250-60002)

SYSTEM: PRINT/PLOT SETUP



The SYSTEM: PRINT/PLOT SETUP screen is used to set the parameters of the printer or plotter. For more information regarding the print/plot functions, see *User's Guide: General Information*.

DESTINATION

This field sets the interface used to connect your printer or plotter. The following parameters (softkeys) are available:

PARALLEL Selects the parallel interface.

GPIB Selects the GPIB interface. The GPIB address is set on the SYSTEM: MISCELLANEOUS screen.

network printer The softkey label is not "network printer", but the strings entered into the PRINTER field of the NETWORK PRINTER SETUP table on the SYSTEM:MISCELLANEOUS screen. See "NETWORK PRINTER SETUP" on page 4-25.

This softkey selects a printer connected to your printer server.

FORM FEED

This field is used to select whether the printer or plotter formfeeds a sheet of paper after printing.

ENABLE Enables the formfeed function.

DISABLE Disables the formfeed function.

LINE

The LINE field sets the number of lines on a page.

COLUMN

The COLUMN field sets the number of characters in a line.

COLOR/ B/W

This field sets the color, fixed color, or monochrome (black/white) mode.

COLOR Sets the color mode. This mode is available only for HP-GL or PCL printers that have 16 color capability.

FIX CLR Sets the fixed color mode. This mode is for HP-GL pen plotters and PCL color printers that have 8 color capability. The assignment of colors are defined by COLOR PEN NO. on the SYSTEM: COLOR SETUP screen. For more information, see “SYSTEM: COLOR SETUP” on page 4-38.

B/W Sets the monochrome (black/white) mode.

PAPER

This table contains the paper settings, such as paper size, orientation, and so on. The paper settings consists of:

SIZE Sets the paper size. Available sizes are:

- CUSTOM
- A3 (297 × 420 mm)
- A4 (210 × 297 mm)
- B4 (257 × 364 mm)
- B5 (182 × 257 mm)
- A (letter: 8.5 × 11 inch)
- B (11 × 17 inch)

FEED DIR Sets the feed direction of the paper.

- SHORT SIDE: for portrait (width < length)
- LONG SIDE: for landscape (width > length).

This is not available for the CUSTOM paper size setting.

LENGTH Sets the vertical length of the paper. This is available for the CUSTOM paper size setting only.

WIDTH The horizontal width of the paper. This is available for the CUSTOM paper size setting only.

UNIT The units for the paper size. Select either inch or millimeter.

OUTPUT ITEM

This table is used to select the items to be printed. For HP-GL, you can enable or disable all items. For PCL, the GRAPH items are always enabled.

TITLE The title of the printout. This title is determined automatically according to the type of output information.

- `*** Agilent 4156C SETUP DATA ***`
- `*** Agilent 4156C DATA LIST ***`
- `*** Agilent 4156C GRAPH PLOT ***`

DATE&TIME The current date and time from the built-in clock.

PAGE NO. The page number of the printout.

USER COMMENT The user-defined comments from the MEASURE or STRESS screens.

PRINT/PLOT COMMENT The user-defined comments from the PRINT/PLOT SETUP DATA, PRINT/PLOT DATA LIST, or GRAPH PLOT screens.

GRAPH TRACE The graphics plot curve from the GRAPH/LIST: GRAPH screen (for HP-GL, HR PCL, HR TIFF).

GRAPH FRAME & GRID The frame and grid from the GRAPH/LIST: GRAPH screen (for HP-GL, HR PCL, HR TIFF).

GRAPH AXIS TEXT The names, units, and scale of the graph axis (for HP-GL, HR PCL, HR TIFF).

GRAPH TEXT The marker and cursor coordinate fields, data variables, and gradient and intercept line parameters (for HP-GL, HR PCL, HR TIFF).

In the above fields, the following softkeys are available:

ENABLE Enables the item specified by the pointer.

DISABLE Disables the item specified by the pointer.

INIT STRING / TRAILER STRING

To send an initialization command to the printer or plotter, enter the printer/plotter command in the INIT STRING field.

To send a command after printing or plotting is finished, enter the printer/plotter command in the TRAILER STRING field.

To enter commands, use the keyboard or ENTRY keys on the front panel. To enter an escape character (`\0033`), use ENTER ESCAPE CHAR softkey. For a list of available commands, see your printer/plotter user's manual.

Setup Examples:

- To print PCL data in landscape mode, enter the following commands:

*INIT STRING	\0033&l1O\0033*r0F
*TRAILER STRING	\0033&l0O

  The INIT STRING sets the printer orientation to landscape and rotates the graphic images. The TRAILER STRING sets the orientation to portrait.

- To print HP-GL data in portrait mode, enter the following commands:

*INIT STRING	\0033%0B
*TRAILER STRING	\0033%A

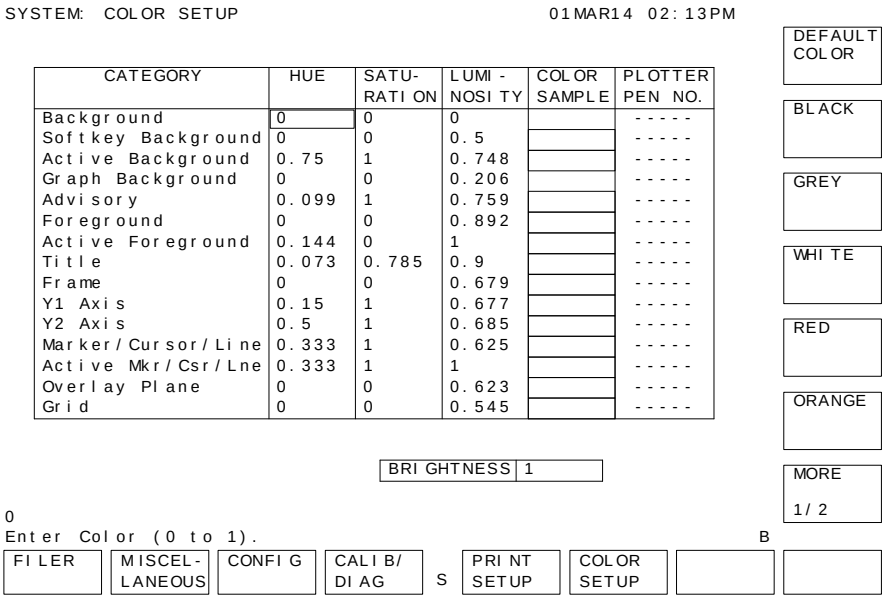
  The INIT STRING sets the printer to HP-GL/2 mode. The TRAILER STRING sets the printer to PCL5 mode.

- To print HP-GL data in landscape mode, enter the following commands:

*INIT STRING	\0033&l1O\0033%0B
*TRAILER STRING	\0033%A\0033&l0O

  The INIT STRING sets the printer orientation to landscape and sets the printer to HP-GL/2 mode. The TRAILER STRING sets the printer to PCL5 mode and sets the printer orientation to portrait.

SYSTEM: COLOR SETUP



The SYSTEM: COLOR SETUP screen is used to set the screen colors, and to set colors for plotting or printing.

BRIGHTNESS

This field is used for the brightness of the entire screen. You can specify a value from 0.15 to 1.

CATEGORY

The CATEGORY field lists the screen items for which you can specify color.

Background Background color of the screen. If the Background and Graph Background are set to different colors, the graphic drawing speed will be slower.

Softkey Background Softkey background color.

Active Background Background color of a selected softkey or field.

Graph Background Background color of a graph. If the Graph Background and Background are set to different colors, the graphic drawing speed will be slower.

Foreground Color of the text (except titles and text related to Y1 and Y2 axes).

Active Foreground Color of the text in a selected field.

Title Color of the screen/table titles and the selected Y axis.

Frame Color of the frames (table and graph plotting area).

Advisory Background color of boxes that pop up (for example, to flag an incorrect setting).

Y1 Axis Color of the Y1 axis text and curve.

Y2 Axis Color of the Y2 axis text and curve.

Marker/Cursor/ Line Color of an inactive marker, cursor, or line.

Active Mkr/Csr/Lne Color of an active marker, cursor, or line.

Overlay Plane Color of an overlay plane.

Grid Color of the grid.

HUE, SATURATION, LUMINOSITY

The HUE, SATURATION, and LUMINOSITY fields set the color value. You can specify a value from 0 to 1 in each field.

HUE	Pure color. As you change this value from 0 to 1, the color changes from red through orange, yellow, green, cyan (greenish blue), blue, magenta (purplish red), then back to red again (0 and 1 are both red).
SATURATION	Ratio of pure color to white, where 0 is no pure color (all white), and 1 is 100% pure color (no white). If this field is set to 0, the color is always white.
LUMINOSITY	Brightness, where 0 is no brightness, 1 is 100% brightness. If this field is set to 0, the color is always black.

To set a row to the desired color, select one of the following softkeys:

- **DEFAULT COLOR** sets all rows in the table to the default colors.
- **BLACK**
- **GREY**
- **WHITE**
- **RED**
- **ORANGE**
- **YELLOW**
- **GREEN**
- **CYAN** (greenish blue)
- **BLUE**
- **MAGENTA** (purplish red)

COLOR SAMPLE

This field displays the color the item will appear according to the selected HUE, SATURATION, and LUMINOSITY fields.

PLOTTER PEN NO.

This field is used for fixed-color mode hard copies only. See the COLOR/ B/W field in “SYSTEM: PRINT/PLOT SETUP” on page 4-33.

- For an HP-GL pen plotter, this field specifies which pen the plotter uses to draw each screen item. The appropriate pens should be loaded in the pen carousel.
- For a color printer, this field specifies which color the printer uses to print each screen item. The values and corresponding colors available are:

1	Black
2	Red
3	Green
4	Yellow
5	Blue
6	Magenta
7	Cyan
8	White