

GETTING STARTED

This section provides installation and operating instructions for the 571 and describes the functions of the front and rear-panel controls and connectors.

The 571 is calibrated and ready for use when received.

The instrument is menu driven to select the required function and parameters. This is a pop up menu, and only relevant information is displayed on the screen.

There are 10 keys on the frontpanel to step through the menu for selecting functions and ranges.

The analog circuits are completely controlled by the micro processor.

PREPARATION FOR USE

This instrument was inspected both mechanically and electrically before shipment. It should be free of marks or scratches and should meet or exceed all electrical specifications.

Inspect the instrument for physical damage incurred in transit. If there is damage or deficiency, contact your local Tektronix Field Office or representative.

To assure that all functions work properly, use the VERIFICATION CHECK procedure, as stated in the MAINTENANCE section (Section 4) of this manual.

Power up

Before switching on the 571 check the line selector for matching line voltage.

If changing is necessary, see page 1-3.

NOTE:

Be sure that the NORMAL/TEST switch on the rear is in the NORMAL position.

Now you can switch on your 571 and the menu page appears on the display.

Connecting a printer

The 571 printer output connector at the rear is a Centronics ® type. To connect a printer use a Centronics ® cable.

An Epson® or IBM® printer, or at least a printer that is Epson® and/or IBM® compatible, is required.

NOTE:

The automatic linefeed option of the connected printer should be switched off.

For most printers this is the default position. Refer to your printer manual !

To make a hard-copy of the display use the following procedure:

- Switch on the printer and the 571.
- Push the copy key. A message appears in the lower left edge of the display.

If it says " Printer not ready! " check if your printer is functioning correctly. (Printer power-on, enough paper, on-line). When everything is correct, printing starts and a little marker at the left side of the display shows the printing progress.

FRONT / REAR PANEL CONTROLS

The front-panel of the 571 (see Fig. 2-1) has 10 keys that enable the operator to select functions and ranges of the curve tracer.

- 4 arrow keys, to select ranges, modes and control cursor position.
- Start key, to start execution of the menu setting.
- Menu key, to pass control to the selected menu-block.
- Stop key, to interrupt or stop a measurement.
- Store key, to store a set of test results.
- Cursor key, to activate the cursors.
- Copy key, to start passing information to a printer.

The following controls and connectors are located on the 571 rear panel (see Fig 2-1):

- Intensity Control, to set the intensity of the display.
- Printer-output connector. Connect an IBM® /EPSON® (compatible) printer to the Centronics ® output connector to make a hardcopy of the screen .
- Normal/Test switch. Selects between the normal mode and the test mode.
- Power connector /voltage range selector.

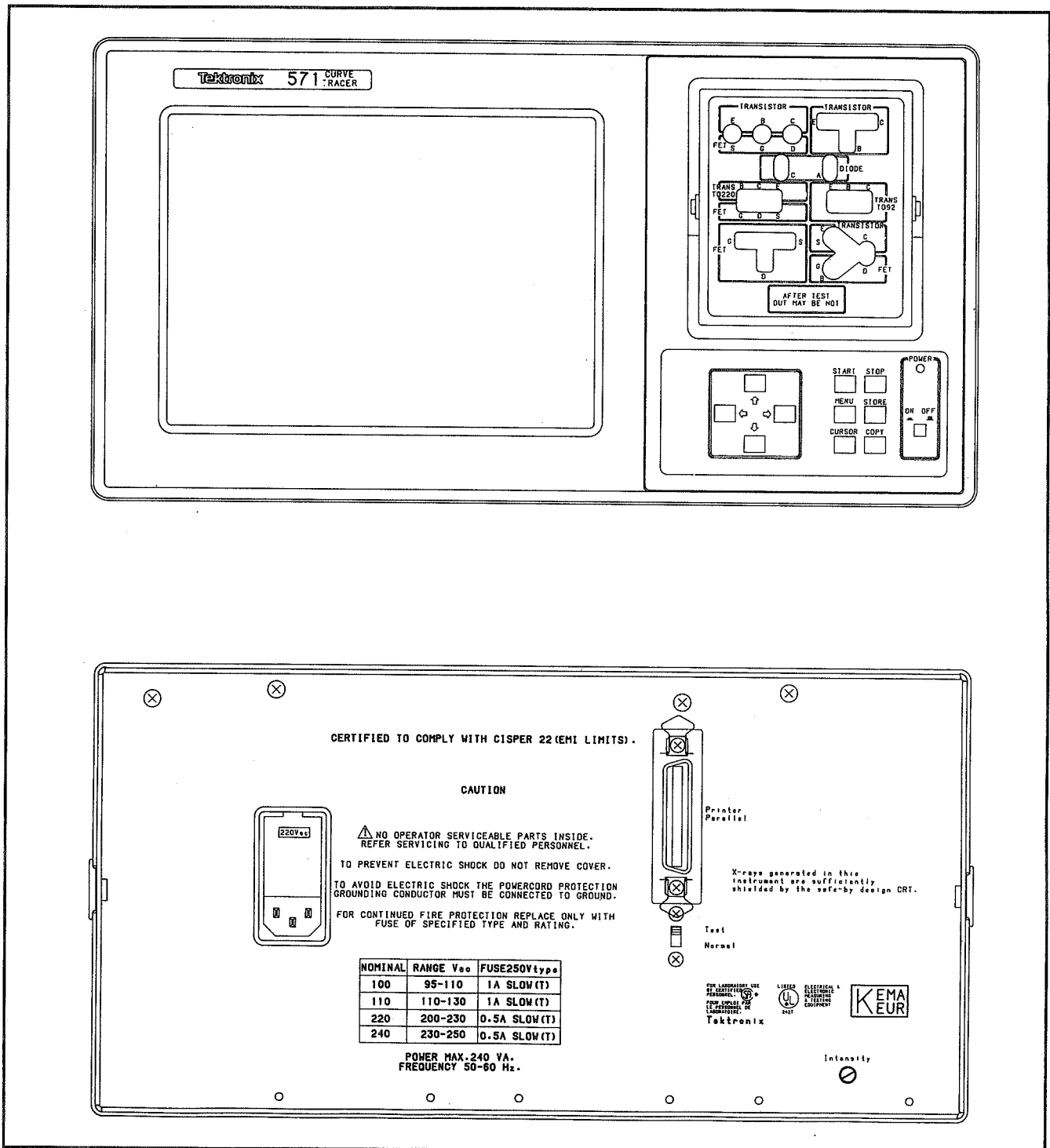


Fig. 2-1 Front and Rear panel 571

SCREENS

The 571 has two main screens, the TEST screen and MENU screen. Within the menu screen there are two sub-screens, the RETRIEVE MENU and the SAVE MENU.

In each screen the inverse top line shows which screen is currently selected.

The inverse bottom line (the prompt line) shows which keys are valid and how the 571 is going to test. Pressing a key that is not mentioned in the prompt line or pressing two keys at the same time are considered invalid commands. That kind of commands are neglected.

One exception is the copy key to print the screen data onto a printer. Pressing the copy key is always answered, unless otherwise stated in the prompt bar. In some cases no prompt bar is displayed. During that time no keys can be answered.

The line located above the prompt line is the message line. Messages are displayed here.

The main screens are:

- Test screen

This screen displays at least an axis with scale parameters and all other selected parameters. After the test (acquisition) of a device the screen displays the characteristic curves.

- Menu screen

This screen shows all the items that can be selected to test a device. After power up the 571 comes up with this screen and shows the default settings.

The first (not inverse) line is for selecting the function.

The second line is for selecting the DUT (Device Under Test) type.

Each subsequent line represents one test parameter, and for each parameter, a value can be selected.

The last line gives access to the sub-screens .

The menu sub-screens are:

- RETRIEVE MENU
- SAVE MENU

Both screens show 12 locations of non-volatile memory which are marked " Used " or " EMPTY " .

Each location can store the settings of a menu screen.

MENU SCREEN

The menu key will set the 571 to the test screen, waiting for the next command.

Pressing the start key will perform the same function and also starts an acquisition immediately.

However, when " Retrieve Menu " or " Save Menu " is selected, the menu or start key will show one of the sub-screens Save or Retrieve menu.

The 10 menu lines are described next.

The **bold / underlined** printed item per line is the default setting after power up.

1. Function

(Recall **Acquisition** Continuous Compare)

The following types of measurement can be selected from the function line:

- Recall

The 571 has the ability to store a set of curves in a RAM memory (volatile). If a set of curves is stored, the recall function becomes part of the menu. With the recall function, a set of curves can be retrieved from the memory, and displayed highlighted on the test screen.

Also all test parameters along with these curves become active.

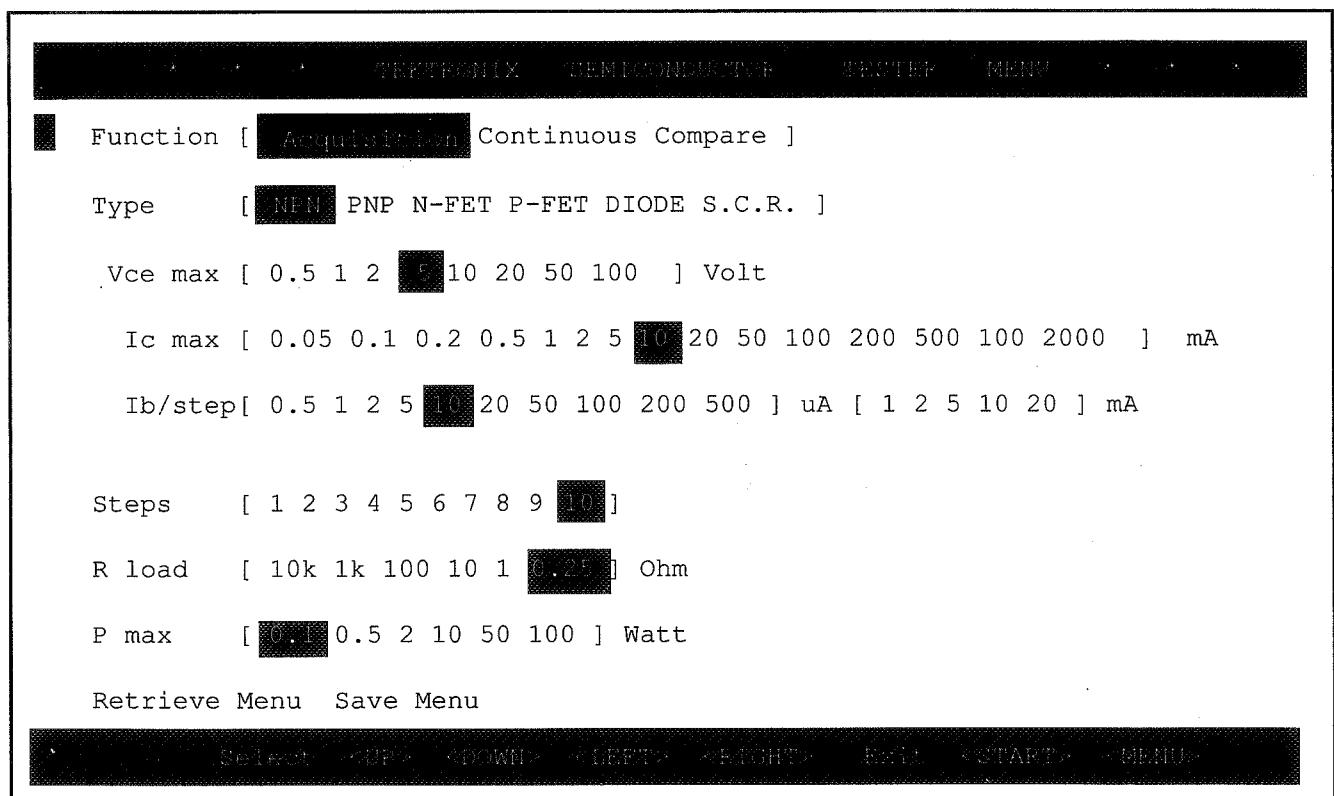


Fig. 2-2 Menu Screen at default.

NOTE:

At power up, there is no **RECALL** function on the menu screen.

- Acquisition

One acquisition (2500 samples max.) of the DUT's curves can be executed. After the acquisition the curves can be examined, even when the DUT is removed from the test socket.

- Acquisition Continuous

With this function acquisitions of the DUT can be executed continuously. After each acquisition the 571 waits for 2.5 seconds and starts a new acquisition without erasing the previous measurement. This is continuing until the stop key is pressed.

This measurement results in a picture in "envelope" mode permitting thermal drift or noise to be examined.

NOTE:

Only the latest acquisition can be used for RAM storage or cursor measurements.

- Compare

The 571 executes one acquisition, stores the test curves in the RAM memory and displays the curves high lighted. This set of curves is considered to be a reference. Each subsequent acquisition will be displayed together with this reference. Pressing the store key will make the latest acquisition the new reference.

2. Type

[**NPN** PNP N-FET P-FET DIODE S.C.R.]

The type of DUT (device under test) can be selected on this line. The 571 automatically updates the menu to the type of semiconductor that is selected.

NOTE:

The 571 doesn't recognize what type of device is inserted in its sockets. Inserting a different type of device or a defective component will give meaningless curves or at least an error message.

3. Vce max [0.5 1 2 **5** 10 20 50 100] Volt

The Vce max. determines the maximum test voltage (collector to emitter) across the DUT. The voltage is incremented from 0 to the selected maximum value during acquisition.

For PNP transistors the sign of Vce (collector to emitter) is changed to minus. For FETs Vce is changed to Vds (drain to source) and DIODE and S.C.R. displays Va (anode).

4. Ix max [0.05 0.1 0.2 0.5 1 2 5 **10** 20 50 100 200 500 1000 2000] mA

The Ix max. determines the current limit through the DUT.

If the limit is reached, that curve will be terminated. If the current exceeds the limit too much, or too fast, then the hardware protection circuit activates and generates "overcurrent" and the acquisition is terminated.

With NPN and PNP transistors Ix is Ic (collector). With N-FET and P-FET Ix is Id (drain) and for DIODE and S.C.R. it is Ia (anode).

With PNP and P-FET a minus sign appears before Ix.

NOTE :

$V_{max} = 100 V$ and $I_{max} = 2 A$ are mutually exclusive. V_{max} voltages above 20 V require the protection cover.

5. Ib/step [0.5 1 2 **5** 10 20 50 100 200 500] uA [1 2 5 10 20] mA

The Ib/step function determines the drive to the DUT. When NPN or PNP or SCR is selected, the drive is a current source.

When FET 's are selected, Ib (base current) is replaced by Vg (gate voltage) and the drive is a voltage source with a Ri = 50 ohm. The menu line for FET's looks like:

Vg/step [0.1 0.2 0.5 1] Volt

Polarities are automatically adapted to N- or P-devices.

For a S.C.R. it is Ig/step (gate current).

For DIODE this menu line is blanked.

6. Offset [-1.250] Volt

When type N-FET or P-FET is selected, an offset voltage can be selected with the left and right arrow keys. The amount of offset is linked to the Vg/step menu line.(For more information see Table 1-2 in Chapter 1 at Gate Drive.) The polarity is automatically changed when a P-FET is selected.

7. Steps [1 2 3 4 5 6 7 8 9 10]

The number of base/gate steps is set here. For FET's, the offset voltage is implemented and the curve at the offset voltage is also displayed. For type DIODE this line is blanked.

8. R load [10k 1k 100 10 0.25] Ohm

The load resistor in series with the DUT is selected on this line, causing the curves to end along a load line. If type S.C.R. is selected , three load resistors (10 k Ω , 1 k Ω and 100 Ω) are available.

NOTE:

Selecting S.C.R. sets the R load to at least 100 Ω .

9. P max [0.1 0.5 2 10 50 100] Watt

The maximum allowed dissipation in the DUT can be programmed. A curve that reaches the programmed maximum power will be terminated, resulting in curves that end along a hyperbola.

10. Retrieve Menu Save Menu

When this line is selected with the cursor, Retrieve Menu is displayed inverse. The right and left arrow keys toggle between Retrieve Menu and Save Menu.

Pressing the start or menu key, with Retrieve Menu inverse, activates the sub-screen RETRIEVE MENU FROM EEROM . In this menu one of the twelve locations in the non-volatile memory can be selected with the up and down keys.

Pressing the start key retrieves the data from the selected EEROM location.

The Main menu will be displayed with the function, type of DUT and test parameters retrieved from the EEROM location.

NOTE:

EEROM stands for Electrical Erasable Read Only Memory. This device is also writable as a Programmable ROM. After power off no information is lost.

Pressing the start or menu key with Save Menu inverse, activates the sub-screen SAVE MENU IN EEROM.

Pressing the start key again causes all the selections from the main menu to be saved in the selected EEROM location.

The 571 will stay in the EEROM menu, but the function will change from " SAVE MENU " to " RETRIEVE MENU ".

Pressing the stop key will erase the selected EEROM location, regardless of whether " SAVE MENU " or " RETRIEVE MENU " was selected.

Pressing the menu key within the save or retrieve menu function, causes the 571 to return to the main menu screen without changes.

NOTE:

The EEROM has a write protect utility. If write protect was enabled, save and erase commands will be denied. (For more information, see tsection 4)

TEST SCREEN

Introduction

The test screen consists of a graticule with the scale factors and a list of selected test parameters. (see Fig. 2-3). Each dot represents a minor division, which is 0.2 division. If an acquisition is performed, the graticule is filled with curves, representing the measured test data.

Acquisition

Press the start key to initiate an acquisition of the DUT. The 571 prepares itself according to the selected parameters and starts taking samples. The resulting curves are displayed immediately on the test screen. If there were curves displayed from a previous acquisition, the display will be cleared first. If the displayed curves were retrieved from the RAM memory, the display will not be cleared so that both sets of curves will be displayed.

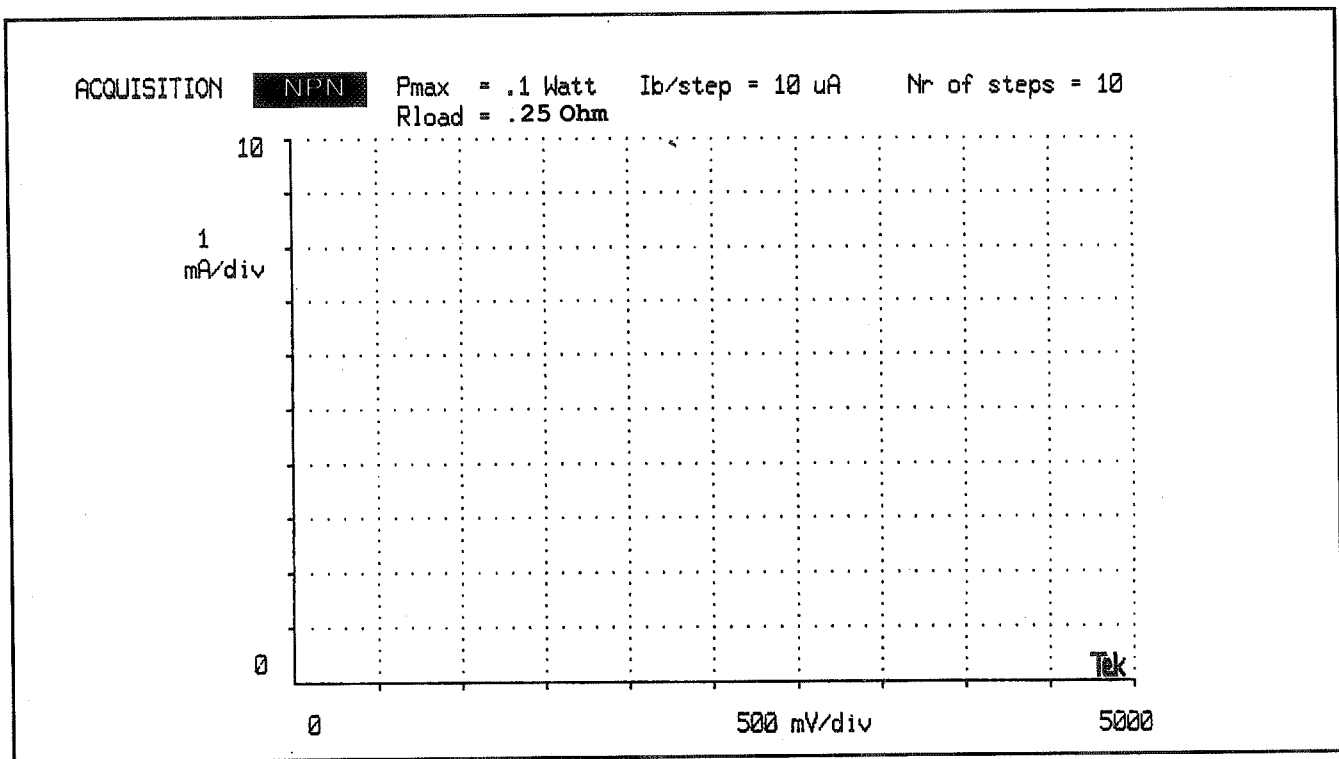


Fig. 2-3 Test screen default settings

Once the acquisition is started, it may be interrupted under the following conditions:

1. Overcurrent occurs.

Remedy: Change test parameters and retry.

Check your DUT, it may be defective!

Message line displays:

" Acquisition aborted :overcurrent! "

2. Base/gate drive out of range.

Check your DUT, it may be defective!

Check if the DUT was inserted in the test socket correctly!

The DUT may not be the type selected in the menu.

Message line:

"Acquisition aborted : base/gate drive out of range! "

3. Cover opened during acquisition.

Vce max. is set to > 20 V. Remedy: Close cover and press start key.

Message line:

" Acquisition aborted : cover open! "

4. Pressing the stop key.

Press the start key to resume or press the stop key to terminate.

Any other valid key terminates the acquisition function and activates the related function.

Message line:

" Acquisition interrupted "

Display Curves

After the acquisition has been executed the display is filled with curves.

The DUT may be removed unless Acquisition Continuous was selected.

The curves can be examined, referring to the graticule.

Automatic adaption of parameters

The 571 checks before the start of the acquisition, to determine if conflicting parameters are selected.

If so, the 571 adapts one or more parameters, prints a message on the screen and starts the acquisition.

There are three messages:

1. " Rload modified "

At very low voltages and very low currents a transistor may not function as a transistor, but as two conducting diodes. One connected to the emitter circuit and one to the collector supply.

The base current is shared between emitter and collector randomly resulting in a noisy image. To prevent this a minimum R load is selected. The resulting load line is still very steep so the final result is very close to the parameters originally selected.

2. " Current scale factor modified "

If the selected current scale I_x is greater than V_{xx} divided by Rload, only a small part of the I_x scale will be used. In this case the I_x scale is reduced, and the full I_x scale will be used.

3. " Ib/step reduced "

The 571 tests the emitter current and calculates the collector current, as: $I_c = I_e - I_b$
The maximum selected base current must fit within the selected I_c scale.

If: $I_b/\text{step} \times (\text{number of steps})$ exceeds the I_c scale, then the I_b/step is reduced.

If the maximum I_b is about the same value as I_c , then the test is not very meaningful.

Change scale parameters

In the test screen the I_x max. and V_{xx} max. can be changed without returning to the menu.

Changing these parameters affects the 571 the same as in the main menu;

- Press the left key to reduce the maximum test voltage, press the right key to increase the maximum test voltage.
- Press the down key to reduce the maximum test current, and the up key to increase the maximum test current.

Store

Press the store key to store a set of curves in the RAM memory .

After an acquisition has been executed, the set of curves may be stored in a RAM memory for later investigation or comparison with other devices.

The message line displays:

" Store display in RAM "

The curves are displayed high lighted in this situation. If the number of samples is too small , the command will be denied and the message:

" Do acquisition first!! "

is printed on the screen.

Cursors

If a set of displayed curves must be examined more closely than the graticule allows, the cursor mode is used.

Press the cursor key to evoke the cursor utility.

Two cursors will appear on the screen in the middle of the lowest curve. To the left of the graticule information will be printed on the screen, concerning:

- The base or gate drive
- The voltage and the current of the cursor positions.
- If the DUT is a NPN or PNP transistor, the H_{fe} at the location of the active (blinking) cursor is also printed.

The parameters of the blinking cursor are indicated with a pointer (the same as the cursor in the menu screen). This is the active cursor.

To move the active cursor along the curve press the left or right arrow key.

Press the up or down arrow key to jump to other curves.

To swap the cursor activity, press the cursor key .

To disable the cursor activity , press the stop key.

Pressing any other valid key disables the cursor activity and evokes the related function.

NOTE:

When there are insufficient samples, the cursor command will be denied. A message:

" Do acquisition first!!" is displayed.

SOCKETS

Socket description

There are several types of sockets on the front panel. All the pins of the sockets are connected in parallel to the electronic circuitry of the 571. Therefore, do not attempt to install more than one device at a time. Each socket has its own legend. Select the right socket for the device! See the manufactures data sheets for more information.

Auxiliary socket board

The auxiliar socket board fits into the three banana plug sockets on the front panel of the 571. Small devices are easy to insert on the socket board. Sometimes a device must be connected to the banana sockets by test leads. The maximum voltage (V_c , V_d or V_a) that can be applied is 20 Volts. (The protective cover must be closed if the maximum voltage is more than 20V.)

PRINTING

To make a hard copy of the display, press the copy key.

The 571 first check if a printer is connected *and* on-line (ready).

If not, a message " Printer not ready!" appears at the prompt line for about two seconds and the 571 resumes its normal operation.

When a printer is connected *and* on-line, the 571 starts passing data to the printer to reproduce a hard copy of the screen data.

A message " Printing... " appears at the prompt bar and a small marker shows the progress of printing. Once the activity of passing output data to the printer has been started, the 571 must complete the process. If an error situation occurs, such as paper empty, the 571 waits until the printer responds and asks for more data. In that situation the hardcopy activity will not be interrupted. After finishing the hardcopy, the 571 resumes its normal operation.

NOTE:

The prompt line is not sent to the printer.

NOTE:

*The automatic line feed option of the connected printer must be **OFF**. For most printers this is the default situation. Refer to your printer manual.*

MESSAGES

At the message line the following messages are possible:

- " Acquisition interrupted. "

Reason: During an acquisition the stop key has been pressed. Pressing the start key resumes the acquisition.

- " Close cover "

If the voltage to the DUT is set to > 20 Volts, and the cover is not closed, the 571 prints " Close cover " on the screen. The acquisition will stop until the cover is closed.

- " Acquisition aborted: cover open! "

The 571 stops acquisition unconditionally, regardless of the voltage. There is no opportunity to resume. Closing the cover and pressing the start key starts a new acquisition.

- " Acquisition aborted: base/gate drive out of range! "

No component inserted in a socket or a defective device is inserted.

- " Acquisition aborted: Overcurrent! "

The current through the DUT exceeds the maximum current.
Remedy: Decrease drive current, or increase lxx max or increase Rload.

- " Do acquisition first!! "

Pressing the store or the cursor key without the minimum required number of samples to form a curve, will activate this message.

- " Store display in RAM "

Pressing the store key displays this message until the curves are stored.

- " Ib/step reduced "

The current into the base is too high to generate a usable display, so it is automatically reduced.

- " Current scalefactor modified "

The lxx is too high to generate a usable display, so the lxx is automatically modified.

NOTE:

This message can be displayed together with " Ib/step reduced ".

- " Rload adapted "

Rload is increased in order to get a usable display.

NOTE:

This message can be displayed together with " Ib/step reduced ".

REPACKAGING FOR SHIPMENT

It is recommended that the original carton and packing material be saved in the event it is necessary for the instrument to be reshipped to a Tektronix Service Center, using a commercial transport carrier. If the original material is unfit or not available, then repackage the instrument using the following procedure :

1. Use a corrugated cardboard shipping carton having a test strength of at least 125 kilo and with an inside dimension of at least fifteen cm larger than the instrument dimensions.
2. If the instrument is going to be shipped to a Tektronix Service Center, enclose the following information:
 - The owners address, name, phone number of a contact person.
 - Type, option number and serial number of the instrument, reason for returning and a complete description of the service required.
3. Completely wrap the instrument with polyethylene sheeting or equivalent to protect the outside finish and prevent entry of harmful substances into the instrument.
4. Cushion the instrument on all sides using eight cm of padding material or urethane foam, tightly packed between the carton and the instrument.
5. Seal the carton with an industrial stapler or shipping tape.
6. Mark the address of the Tektronix Service Center and also your own address on the shipping carton in two prominent locations.