TEK 571 CURVE TRACER
OPERATORS MANUAL

571
CURVE TRACER

For Testing and Measuring
Semiconductors

Tektronix®
COMMITTED TO EXCELLENCE

INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument.Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc. Beaverton Oregon, U.S.A.
G100000	Tektronix Guernsey Ltd., Channel Islands
E200000	Tektronix United Kingdom Ltd., London
J300000	Sony / Tektronix, Japan
H700000	Tektronix Holland N.V., Heerenveen, The Netherlands

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571
CURVE TRACER

OPERATORS MANUAL

PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL

Tektronix Inc.
P. O. Box 500
Beaverton, Oregon 97077
USA

Serial Number _____

Product Group 48
Tektronix Part No. 070-7723-00

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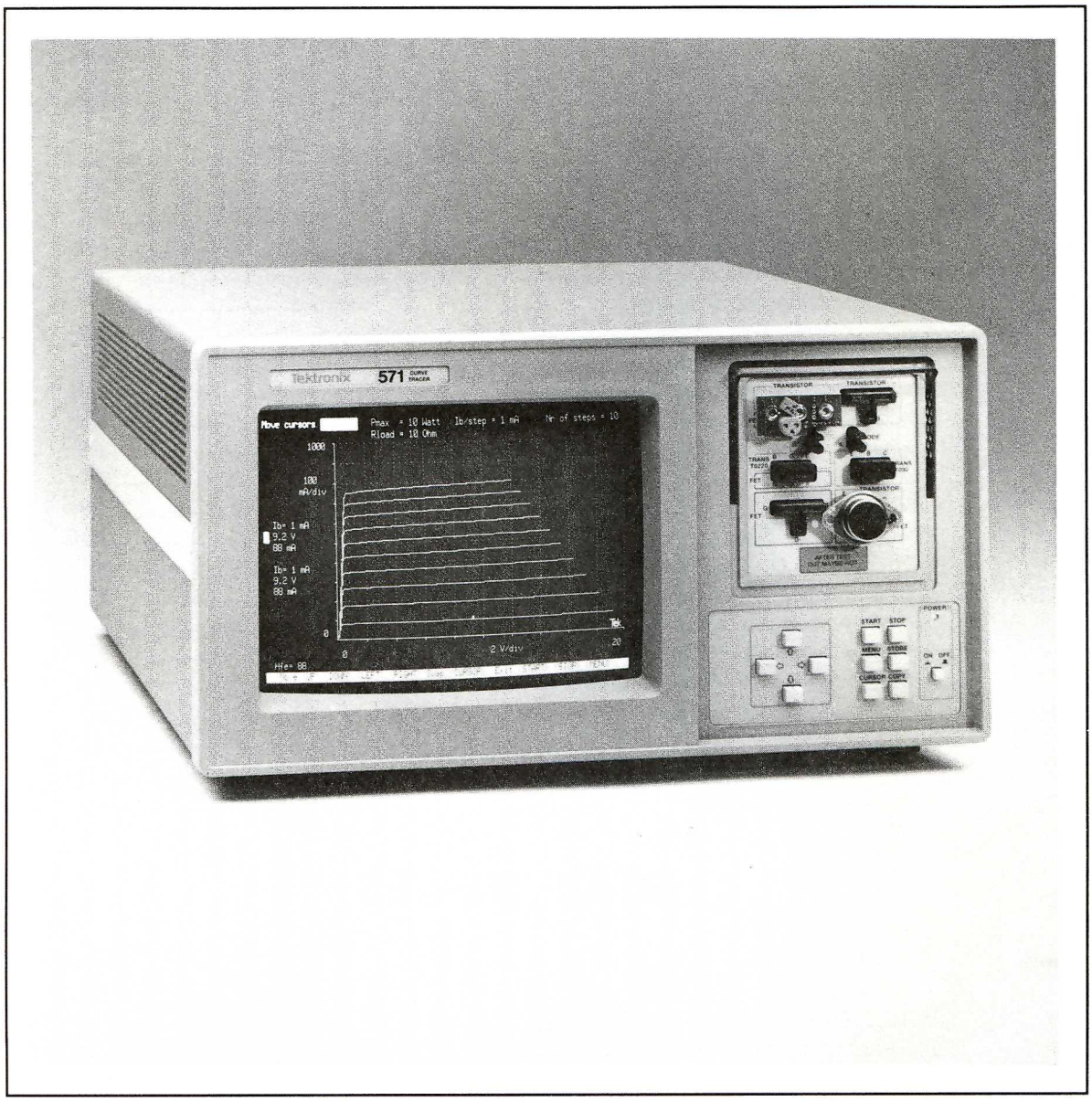


The TEKTRONIX 571 CURVE TRACER

Operators Safety Summary

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply and do not appear in this summary.

TERMS

In this manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of live.

As marked on equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property including the instrument itself.

DANGER indicates a personal injury hazard immediately as one reads the markings.

SYMBOLS

In this manual

This symbol indicates where applicable cautionary or other information is to be found.

This symbol indicates static sensitive devices, that are subject to be damaged by static electricity.

As marked on equipment

DANGER - High voltage

Protective ground (earth) terminal.

ATTENTION - Refer to manual.

Operators Safety Summary (cont.)

POWER CONDITIONS

Use the proper power Cord.

Use only the power cord and connector as specified for the instrument.

Power source

Use the proper power source. Before switching on, make sure the instrument is set to the voltage of the power source.This product is intended to operate from a power source that will not apply more than 250 Volts RMS between the supply connectors or between either supply connector and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.

Grounding the product

This product is grounded through the grounding connector of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any connections to the product input or output terminals. A protective ground connection by way of the ground connection is essential for safe operation.

Danger arising from loss of ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electrical shock.

Use the proper fuse

To avoid fire hazard, use only the fuse specified for the instrument in the instrument part list. A replacement fuse must meet the type, voltage rating, and current rating specifications for the fuse that it replaces.

GENERAL WARNINGS

Do not operate in explosive atmospheres

To avoid explosions, do not operate this instrument in an atmosphere of explosive gasses.

Do not remove covers or panels

To avoid personal injury, the instrument covers or panels should only be removed by qualified service personnel. Do not operate the instrument without covers and panels properly installed.

Heating of the DUT

Testing at high power settings can cause the device under test (DUT) to get hot enough to cause injury. Avoid touching the DUT until cooled.

CONSIGNES DE SECURITE

Ce rappel des consignes générales de secureté s'addresse à la fois aux utilisateurs et au personnel de maintenenance. Avertissements et précautions à respecter sont annotés au long de ce manuel à chaque fois que l'utilisation du 571 l'exige. Il est à noter que ceux-qui peuvent ne pas figurer dans cette rubrique de rappel.

TERMES

Dans ce manuel

Les paragrahpes intitulés
CAUTION (ATTENTION)
identificient les circonstaces ou opérations pouvant entraîner la détérioration de l'appareil ou de tout autre équipment.

Les paragraphes intitulés
WARNING (AVERTISSEMENT)
indiquent les circonstances dangereuses pour l'utilisateur (danger de mort ou risque de blessure).

Reperères gravés sur l'appareil

CAUTION (ATTENTION) : ce mot indtifie les zones de risque non immédiatement perceptibles ou un risque éventuel de détérioration de l'appareil.

DANGER (DANGER) : ce mot indique les zones de risque immédiat pouvant entraîner blessures ou mort.

SYMBOLES

Dans ce manuel

Ce symbole signifie «se reporter au manuel».

Gravés sur l'appareil

DANGER – Haute tension

Borne de masse de protection (terre)

ATTENTION – se reporter au manuel

Source d'alimentation

L'appareil est conçu pour fonctionner à partir d'une source d'alimentation maximale de 250 V efficace entre les conducteursd'alimentation ou entre chaque conducteur et la terre. Pour utiliser l'appareil en toute sécurité, une connexion àl a masse, realisée au moyen d'un conducteur prévu dans le cordon d'alimentation, est indispensable.

Mise à la masse de l'appareil

Une fois installé dans le châssis d'alimentation, l'appareil est relié à la masse à l'aide d'un conducteur du cordon d'alimentation. Pour eviter tout choc électrique, insérer la prise du cordon d'alimentation dans une prise de distribution correspondante, avant de connecter l'entrée ou les sorties de l'appareil. Pour utiliser l'appareil en tout sécurité, une connexion à la masse, réalisée au moyen d'un conducteur prévu dans le cordon d'alimentation, est indispensable.

Danger provoqué par la coupure de connection de masse

En cas de coupure de la connexion de masse, tous les élements conducteurs accessible (y compris boutons et commandes apparissant isolants) peuvent provoquer un choc électrique.

Utuliser le cordon d'alimentation approprié

N'utiliser que le cordon d'alimentation et la prise recommandés pour votre appareil.

Utiliser un cordon d'alimentationen parfait état.

Seul, un personnel qualifié peut procéder à un changement de cordon et prises.

Utiliser le fusible approprié

Pour éviter tout risque d'accident (incendie...) n'utiliser que le fusible recommandée pour votre apppareil.

Le fusible remplacement doit toujours correspondre au fusible remplacée: même type, même tension et même courant. Un remplacement de fusible ne doit être effetué que par personnel qualifié.

Ne pas utiliser l'appareil en atmosphères explosives

Pour éviter toute explosion, ne pas utiliser cet appareil dans un atmosphère de gaz explosifs.

Ne pas demonter les capots ou les panneaux

Pour éviter toute blessure, ne pas ôter les capots ou les panneaux. N'utiliser l'appareil que si ceux-ci ont été correctivement remis en place.

UNIQUEMENT DESTINEES AU PERSONNEL DE MAINTENANCE

Il est indispensable de se referer également aux consignes de sécurité à l'attention des utilisateurs.

Ne jamais être seul pour procéder à l'entretien de l'appareil.

Agir avec précaution si l'on effectue une réparation alors que l'appareil est sous tension

Des tensions dangereuses existent en divers points de l'appareil. Pour éviter tout risque de blessure corporelle, ne toucher ni aux connexions exposées ni aux composants alors que l'appareil est sous tension.Couper l'alimentation avant d'enlever les panneaux de protection, d'effctuer des soudures ou de remplacer des composants.

Source d'alimentation

Ce produit est conçu pour fonctionner à partir d'une source d'alimentation qui n'appliquera pas plus de 250 V efficaces entre les conducteurs d'alimentation ou entre chaque conducteur d'alimentation et la terre. Pour utiliser l'appareil en toute sécurité, une connexion à la masse au moyen d'un conducteur de masse dans le cordon d'alimentation est indispensable

GENERAL INFORMATION

INTRODUCTION

The 571 CurveTracer is a semiconductor tester with a set of attractive specifications.
It is a menu-driven, digital, microprocessor controlled instrument, designed to easily make DC-measurements on several types of semiconductors.
The 571 has the capability of testing the following types of semiconductors:

- Bipolar Transistors NPN and PNP
- Diodes
- F.E.T.'s
- Thyristors and Triac's

Product Description

The 571 consists of one unit. At the front panel there are :

- 1 9" C.R.T. screen monochrome green
- 10 Keys
- 7 Array test sockets with a protection cover
- 1 L.E.D. for power on indication
- 1 Power on switch

The C.R.T. is used for the presentation of the menu`s and the test results.
The 10 keys are used for selecting the desired function and parameters from the menu.
The functions of the keys are:

UP START CURSOR STORE MENU COPY
DOWN STOP
LEFT
RIGHT

In section 2 of this manual, the functions of the keys are explained in detail.
The device under test (DUT) is placed in the test socket during acquisition.
At test voltages that exceed 20 Volts, the protection cover must be in the closed position.
At the rear panel there are :

- 1 Power inlet with EMI filter / Fuseholder / Line Selector Switch.
- 1 Norm/Test switch
- 1 Printer output for an IBM® / EPSON® (compatible) printer.
- 1 Intensity Control

Functional Description

The 571 Curve Tracer consists of the following functional modules:

1. Vce power supply (stimulus for DUT)
2. Compensation amplifier/A.D. Converter
3. Basedrive/Gatedrive (stimulus for DUT)
4. DUT test socket`s and keypad
5. Micro controller
6. Video controller
7. Power supply
8. Video monitor

The units 2, 3, 5, 6 and 7 are located on the mainboard.
Unit 4 is located at the frontpanel.
Unit 1 is located on a separate board (electrical floating).
Unit 8 is a complete monitor.

Features

The 571 Curve Tracer offers a number of features, such as :

1. Acquisition of:

- NPN and PNP transistors.
- Diodes
- JFET`s, MOSFET`s, both N-channel and P-channel.
- Thyristors (and Triacs)

2. A Store mode that is capable of :

- Storing 1 picture of a tested device in the volatile memorl. (RAM)

3. An EEROM utility that is capable of :

- Storing 12 different menu setup`s in the non-volatile memory. (EEROM)

4. The intensity can be set by the intensity control on the rear panel.

5. A print-out of the screen can be made by connecting the Centronics parallel output at the rear to an IBM® / EPSON ® (compatible) printer.

6. A cursor mode, where two cursors can be moved along the displayed curves.
The x and y value of the cursor will be displayed on the left side of the screen.
This feature gives you the possibility of making accurate measurements (within 2.5%) in a set of displayed curves.

7. The possibility of making a verification test.
Diagnostic firmware is available in the standard ROM.
The function NORM or TEST is selectable by a switch on the rear panel.

POWER REQUIREMENTS

The instrument can be operated from an external power source of 100 VAC, 120 VAC, 220 VAC or 240 VAC.
The requirements for the power source are as follows:

Nominal Voltage	High Line Voltage	Low Line Voltage	Fuse 250 V type Slow Blow
100 V	110V	95 V	1 A
120 V	130 V	110 V	1 A
220 V	230 V	200 V	0.5 A
240 V	250 V	230 V	0.5 A

- Line frequency : 50 to 60 Hz ± 5%.
- Power input insulation : 1500 V RMS at 50 Hz for 3 seconds minimum duration.
- Power input ground continuity : Less than 0.1 Ω between safety ground and instrument.

Changing the Line Voltage

The procedure to change the line voltage is as follows:
- Remove the power cord.
- Open the cover of the lineselector.
- Pull-out the actuator.
- Reinstall the actuator in the desired position.
- Pull-out the fuseholde.
- Install a correct rated fuse. (See Table 1-1)
- Reinstall the fuseholder.
- Close the cover. The desired line voltage is readible now on the voltage selector.
- Reinstall the power cord.

ACCESSORIES and OPTIONS

Standard Accessories include :

- 1 Operators Manual 070-7723-00
- 1 Test Socket Board 671-1577-00

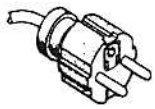
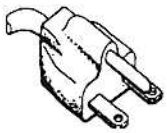
Optional Accessories include :

- Service Manual 070-7722-00
- Printer Cable 012-0555-00

Available power cord options :

- Option A 1 (see Table 1-1)
- Option A 2 (see Table 1-1)
- Option A 3 (see Table 1-1)
- Option A 4 (see Table 1-1)
- Option A 5 (see Table 1-1)

Table 1-1.
Voltage, Fuse, and Power-Cord Data

Plug Configuration	Category	Power Cord and Type	Line Voltage Selector Setting	Voltage Rating (AC)	Factory installed Instrument Fuse
	U.S. Domestic Standard	US 120 V 15 A	120 V	110 V to 130 V	1 A, 250 V Slow Blow
	Option A1	EURO 240 V 10-16 A	220 V	200 V to 230 V	0.5 A 250 V Slow Blow
	Option A2	UK 240 V 6 A	220 V	200 V to 230 V	0.5 A 250 V Slow Blow
	Option A3	Austra-lian 240 V 10 A	220 V	200 V to 230 V	0.5 A 250 V Slow Blow
	Option A4	North American 240 V 15 A	240 V	230 V to 250 V	0.5 A 250 V Slow Blow
	Option A5	Switzer-land 220 V 6 A	220 V	200 V to 230 V	0.5 A 250 V Slow Blow

PERFORMANCE CONDITIONS

The characteristics inTable 1-2 and Table 1-3 are valid under the following conditions:

- The instrument must have been calibrated at an ambient temperature between +22 °C and +24 °C.
- The instrument must be in a non-condensing environment whose limits are described under Environmental.
- Allow 30 minutes warm-up time for operation to the specified accuracy, and two hours after exposure to or storage in high huimidity (condensing) environment.
- Specifications are valid only with those connections to the instrument that are required to verify each specification.

Items listed in the Performance Requirement Column of the following tables (Table 1-2 and Table 1-3) are verified by completing the Performance Check in the Service Manual.

Items listed in the Supplemental Information column may not be verified in the manual; they are explainatory.

ELECTRICAL CHARACTERISTICS

Table 1 - 2
Electrical Characteristics

Characteristics	Performance Requirements				Supplemental Information
	Power transformer primary				
Nominal	100 V	120 V	220 V	240 V	
High line	110 V	130 V	230 V	250 V	
Low line	95 V	110 V	200 V	230 V	
Fuse	1 A slow blow	1 A slow blow	0.5 A slow blow	0.5 A slow blow	
Maximum power consumption	240 VA				
Line frequency	50 to 60 Hz, ± 5%.				
Power input insulation	1500 V RMS, at 50Hz for 3 seconds minimum duration.				
Power input ground continuity	≤ 0.1 Ω between safety ground and instrument.				

Table 1 - 2
(cont.)

Characteristics	Performance Requirements	Supplemental Information
	Vce Supply	
Voltage Range	0.5 Volt - 100 Volt both positive and negative	Selectable in 8 ranges (1-2-5 sequence).
Resolution	1/250 of the selected end value.	
Accuracy	Better than 2% over the entire range.	Temp. range 18°C to 28°C
Max. current	2 A in the 0.5V through 50V ranges. 1 A in the 100V range.	
Load resistor	Selectable at : 0.25 Ω ± 6%, 10 Ω ± 1%, 100 Ω ± 1% 1 kΩ ± 1% 10 kΩ ± 1%	Maximum power dissipation in D.U.T. can be programmed independent of the selected load resistor.
	Vce Display	
Accuracy	± (2.5 % of FS + 30 mV) In 2A scale of Ic ± (2.5 % of FS + 15 mV) In 1A scale of Ic ± (2.5 % of FS + 7.5 mV) In .5A scale of Ic ± (2.5 % of FS) In all other scales of Ic	Temp. range 18°C to 28°C Temp. range 18°C to 28°C Temp. range 18°C to 28°C Temp. range 18°C to 28°C
	Basedrive (Ib)	
Step Generator	0.5 µA / step - 20 mA / step (20 mA/step excluded in the 100 V range)	Source and sink, selectable in 15 ranges. (1-2-5 sequence)
Number of steps	1 to 10	Selectable
Resolution	1/100 of the selected end value.	
Accuracy	± 2% over entire range.	Temp. range 18°C to 28°C

Table 1 - 2
(cont.)

Characteristics	Performance Requirements						Supplemental Information
Gate drive (Vg)							
Step Generator	0.1V/step - 1 V/step positive and negative.						Selectable in 4 ranges. (1-2-5 sequence)
Offset		Vg/Step	0.1V	0.2V	0.5V	1V	
	P-FET	Offset min.	–3.75V	–7.5V	–5V	–5V	
		max.	+2.5V	+5V	+10V	+10V	
	N-FET	Offset min.	–2.5V	–5V	–10V	–10V	
		max.	+3.75V	+7.5V	+5V	+5V	
Offset Increment	25 mV, 50 mV, 100 mV						Depends on Vg/step
Output Resistance							50 Ω
Output accuracy	2% over the entire range						Temp. range 18°C to 28°C
Ic measure (Ic)							
Sensitivity	5 µA - 200 mA per division						Selectable in 15 ranges (1-2-5 sequence)
Resolution	8 bits.						
Accuracy	Better than 2% over the entire range.						
Overcurrent Protection							150 % 0f full scale
Power limits							Selectable from 0.1- 100 W in six ranges

Table 1 - 2
(cont.)

Characteristics	Performance Requirements	Supplemental Information
	Cursors	
Total Accuracy	≤ ± 2.5% of full scale	Temp. range 18°C to 28°C
Hfe accuracy	≤ ± 4% at center of the scale	Temp. range 18°C to 28°C
	Monitor	
Video Area		640 x 336 pixels
Line Rate		17.8 kHz
Frame Rate		50.6 Hz non interlaced.
Video Bandwidth		15 MHz
	Miscellaneous	
Net Weight		19.8 Lbs (9 kg)
Size		14.6 in. (37 cm) Width 13.8 in. (35 cm) Depth 8.1 in. (20.5 cm) Height
Shipping Carton Gross Weight Dimensions		 25 Lbs (11 kg) 18.5 in. (47 cm) Width 17.7 in. (45 cm) Depth 14.2 in. (36 cm) Height

ENVIRONMENTAL CHARACTERISTICS

Table 1 -3
Environmental Characteristics

Characteristics	Performance Requirements	Supplemental Information
Temperature		
Non-Operating	- 55 °C to +75 °C	
Operating	0 °C to +50 °C	
Humidity		
Operating/Non Operating	90% to 95% relative humidity	For 5 days and derated above 25 °C
Altitude		
Operating	to 15,000 feet (4.5 Km)	
Non-operating	to 50,000 feet (15 Km)	
Vibration	.38 mm(0.015 inch) P-P at resonance , during 10 min. at 3 axis. 2G at 55 Hz	Freq. 5 -55 Hz Mil T28800 D class 5, or better.
Shock	30 G, Half sine,11 ms duration,18 shocks	Mil T28800 D class 5, or better.
Bench handling	45 degrees or 4 " drop, or equilibrium, whichever occurs first.	Mil T28800 D class 5, or better.
Packaged product vibration and shock	Excursion of 1 " (25.4 mm) p.p. at 4.63 Hz (1.1 G) for 30 min..	
Packaged drop	91 cm (3 ft), 10 Drops	

Table 1 -3
(cont.)

Characteristics	Performance Requirements	Supplemental Information
Electrostatic immunity	Will withstand a discharge through 1 KΩ resistor of a 500 pF capacitor charged to 10 KV or less.	Charge applied to each protruding area of the frontpanel, except the input test sockets.
Electromagnetic compatibility	VDE 0871 class "B" CISPR 22	
Product conformance to safety standards	IEC 348 Class 1 UL 1244 CSA C22.2 no. 231	

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 mars 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 neccesary, 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.

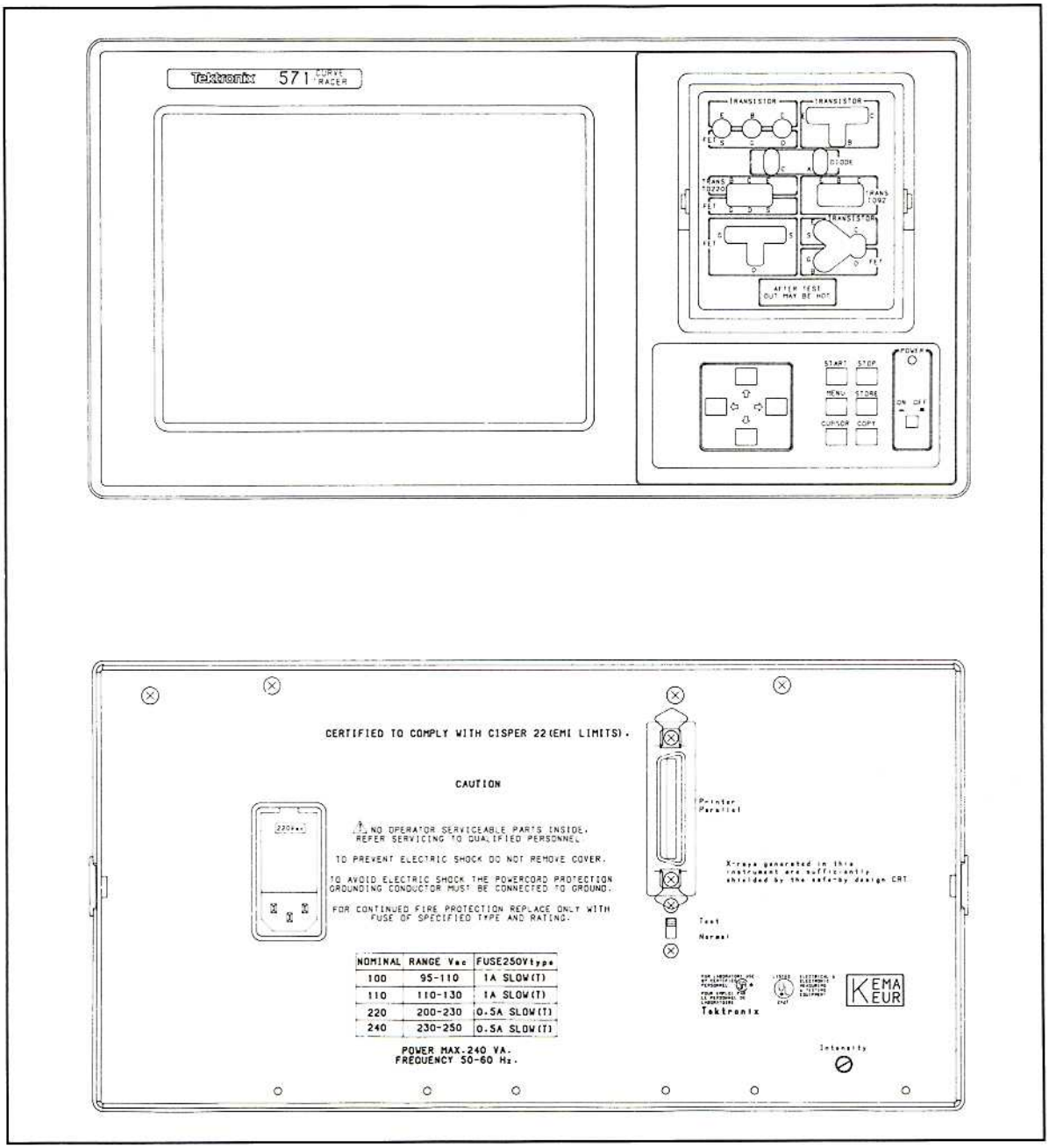
FRONT / REAR PANEL CONTROLS

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.



NOMINAL	RANGE Vac	FUSE250V type
100	95-110	1A SLOW(T)
110	110-130	1A SLOW(T)
220	200-230	0.5A SLOW(T)
240	230-250	0.5A SLOW(T)

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 folowing 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.

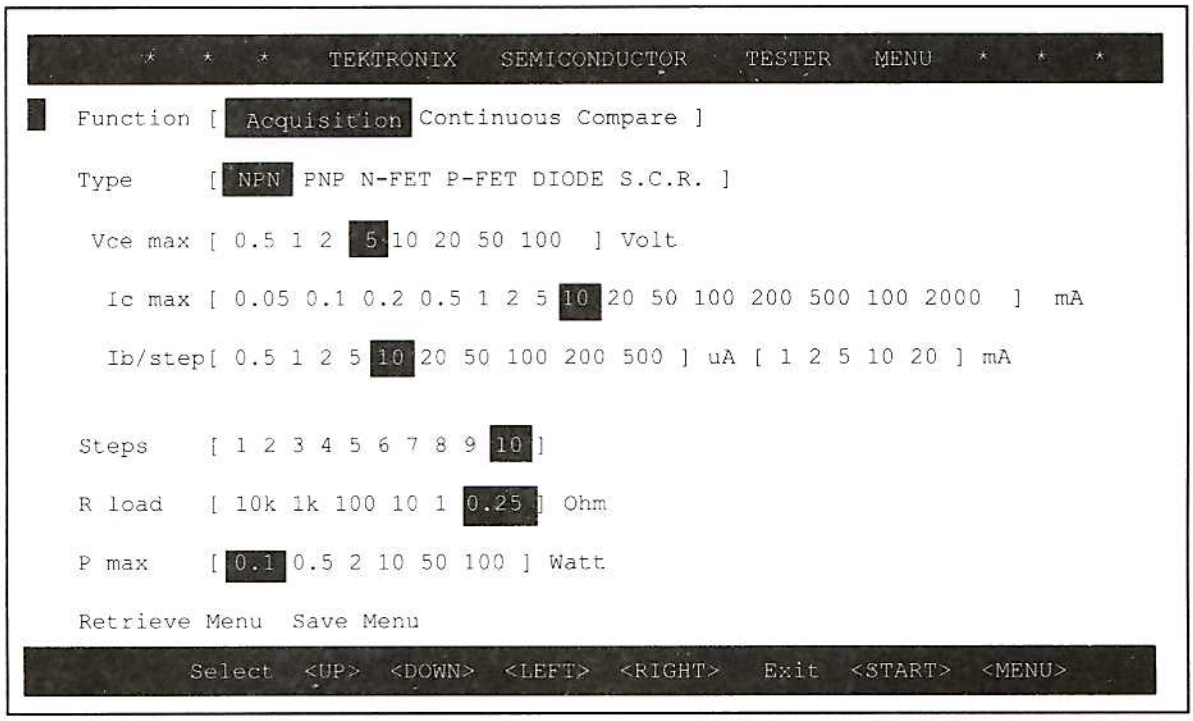


Fig. 2-2 Menu Screen at default.

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 wil 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 :
Vmax = 100 V and Imax = 2 A are mutually exclusive. Vmax 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 kΩ, 1 kΩ and 100 Ω) are available.

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

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.

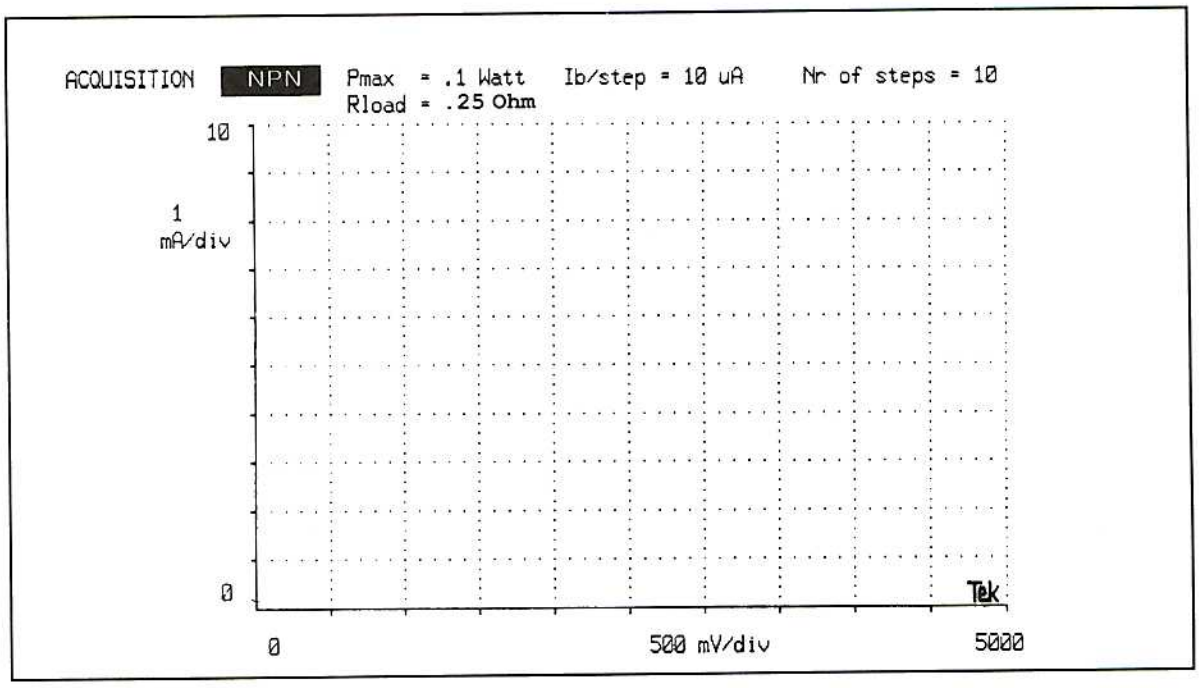


Fig. 2-3 Test screen default settings

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 Ix is greater than Vxx divided by Rload , only a small part of the Ix scale will be used. In this case the Ix scale is reduced, and the full Ix scale will be used.

3. " Ib/step reduced "

   The 571 tests the emitter current and calculates the collector current, as: Ic = Ie - Ib
   The maximum selected base current must fit within the selected Ic scale.
   If : Ib/step x (number of steps) exceeds the Ic scale, then the Ib/step is reduced.
   If the maximum Ib is about the same value as Ic, then the test is not very meaningful.

Changie scale parameters

In the test screen the Ix max. and Vxx 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 Hfe 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 (Vc, Vd or Va) 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, regardles 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 Ixx max or increase Rload.

- " Do acquisition first!! "

  Pressing the store or the cursor key without the minimun 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 Ixx is too high to generate a usable display, so the Ixx 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.

BASIC MEASUREMENTS

In this section of the manual basic procedures for making measurements on various devices are described.
Some examples and exceptions are also indicated.

NOTE:
The tests in the following pages are merely examples. Select the parameters in all the tests carefully for your specific device. Exceeding the limit values, as indicated in the component data sheet, may be destructive to the device. Especially the various breakdown voltage tests can be destructive.

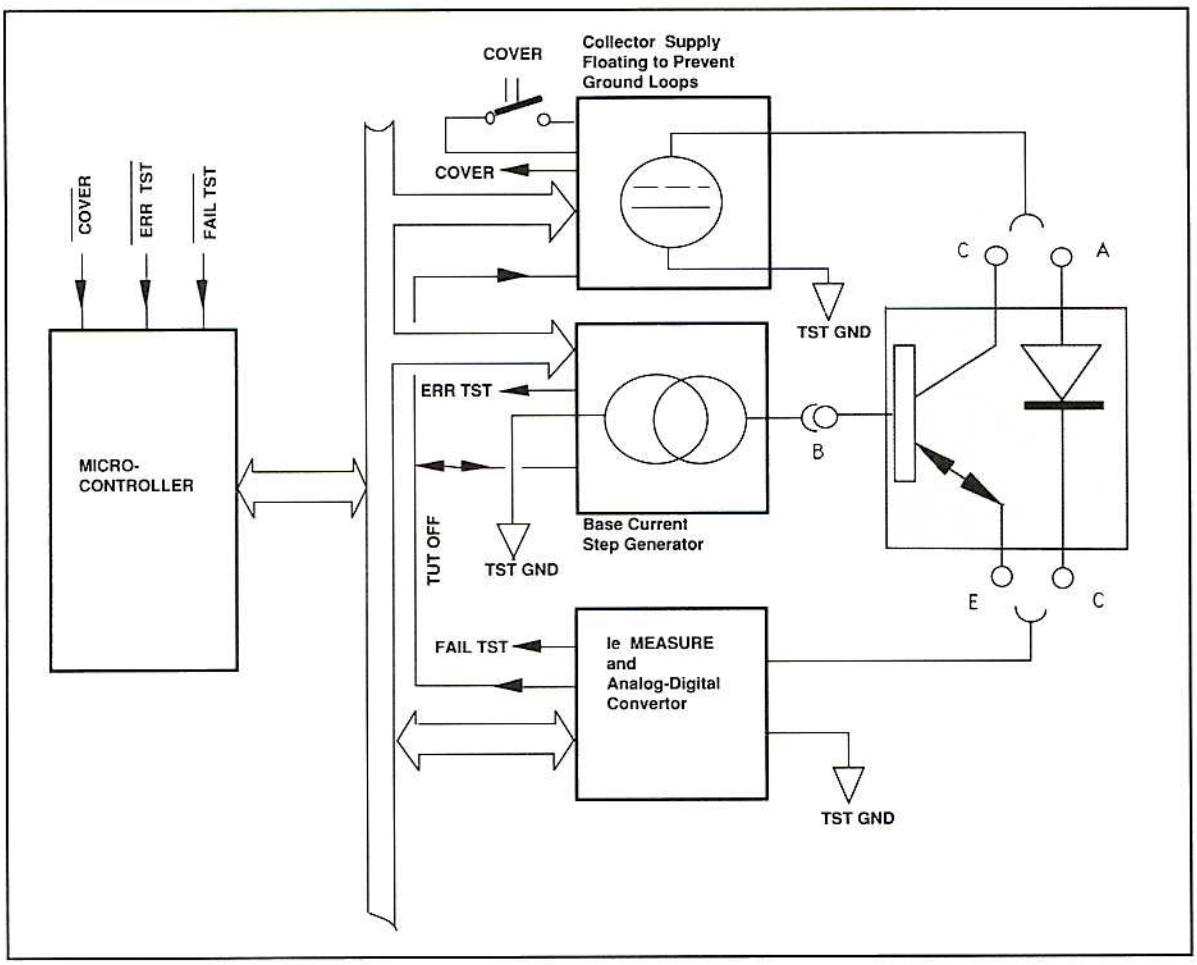


Fig. 3-1 Block diagram 571 Curve Tracer.

TRANSISTOR MEASUREMENTS

A NPN transistor, type 2N2219, is used in the following examples. (A type 2N3904 provides similar results.)
Put the transistor in the appropriate socket with the leads in the correct contact, as indicated on the front panel.

Press MENU and select the appropriate type and parameters on the menu page. In this example an NPN type is used, but a PNP (2N3906) provides similar results.
Pressing START will result in a set of Vce - Ic curves (Fig. 3-3) that gives a general indication of the transistor's performance.

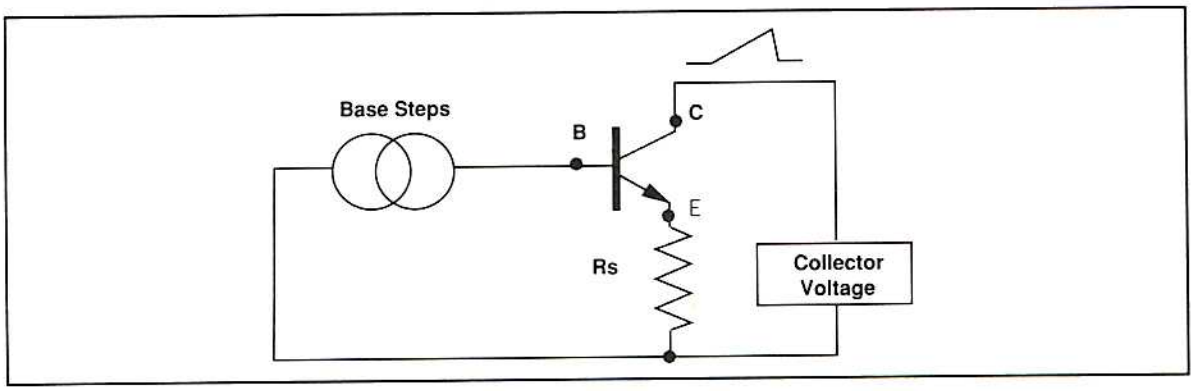


Fig. 3-2 Transistor Connection diagram.

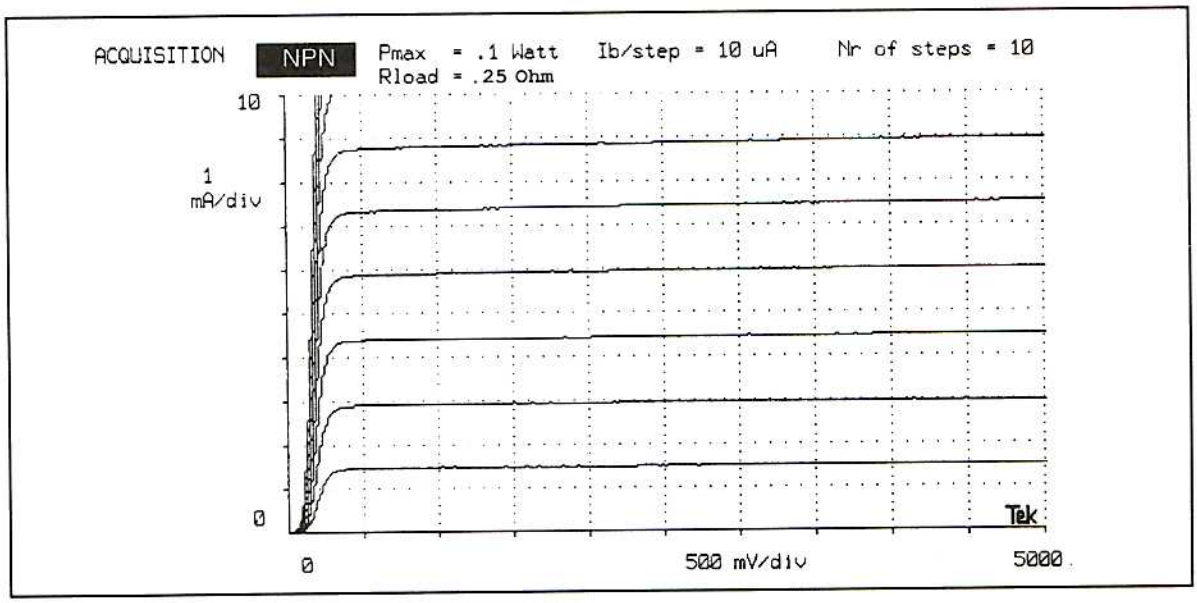


Fig. 3-3 Vce - Ic curves (NPN transistor).

SATURATION voltage [Vce (sat)].

Press MENU to return to the menu page. Change Vce max. to 0.5 V, Ib/step to 50 µA/step, and select Rload 10 Ohm using the arrow keys. Pressing START results in a set of curves in the saturation region of the transistor. Saturation voltages at a given current can be examined. (Fig. 3-4)

For closer readout of the saturation voltage press CURSOR and direct the active cursor to the required position. The position of the cursor is shown at the left of the graticule.

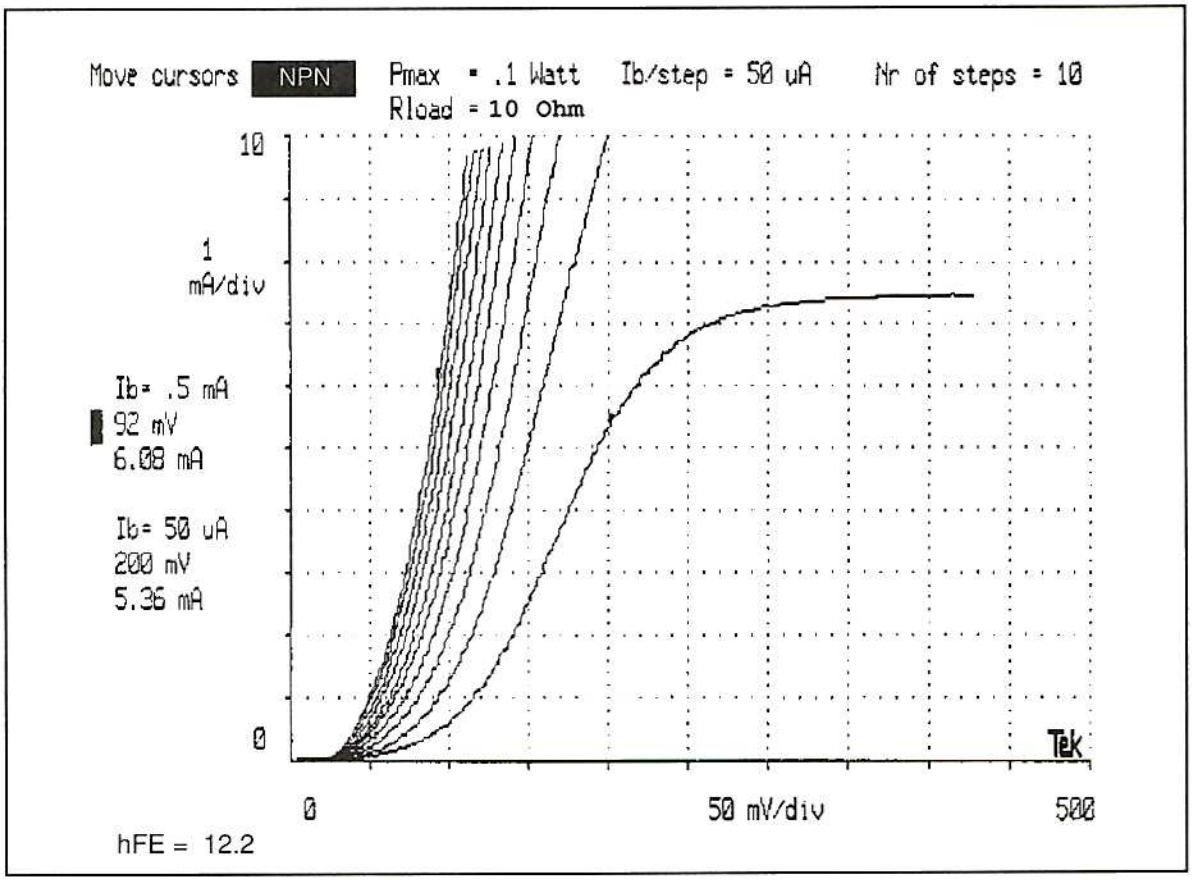


Fig. 3-4 Transistor Saturation area.

TRANSISTOR BREAKDOWN voltages

Generally, a breakdown of a reverse biased PN junction is the transition from a state of high dynamic resistance to a state of lower dynamic resistance for increasing magnitude of reverse current. The following types breakdown voltages are commonly used :

- V_{CEO} - Collector-to-emitter breakdown voltage, with base open.
- V_{CES} - Collector-to-emitter breakdown voltage, with base short circuited to emitter.
- V_{CBO} - Collector-to-base breakdown voltage, with emitter open.
- V_{EBO} - Emitter-to-base breakdown voltage, with collector open.

As an example of a transistor breakdown voltage, a set of curves on the 571 shows the Collector-Emittor break down voltages as a function of Ib in Fig. 3-5.

Press MENU to return to the menu page.
Select by using the arrow keys.:

Vce max.	100 V,
Ic max	10 mA,
Ib/step	5 µA,
Pmax	0.5 Watt

Press START. Notice that the collector-base breakdown voltage is at about 60 Volt at a given current. (Fig. 3-5)

NOTE:

Select the parameters carefully!! If not, this test can be destructive to the device. Refer to the component data sheet for more information.
Press the STOP button as soon as the current rises and the breakdown starts, to prevent damage to the device.

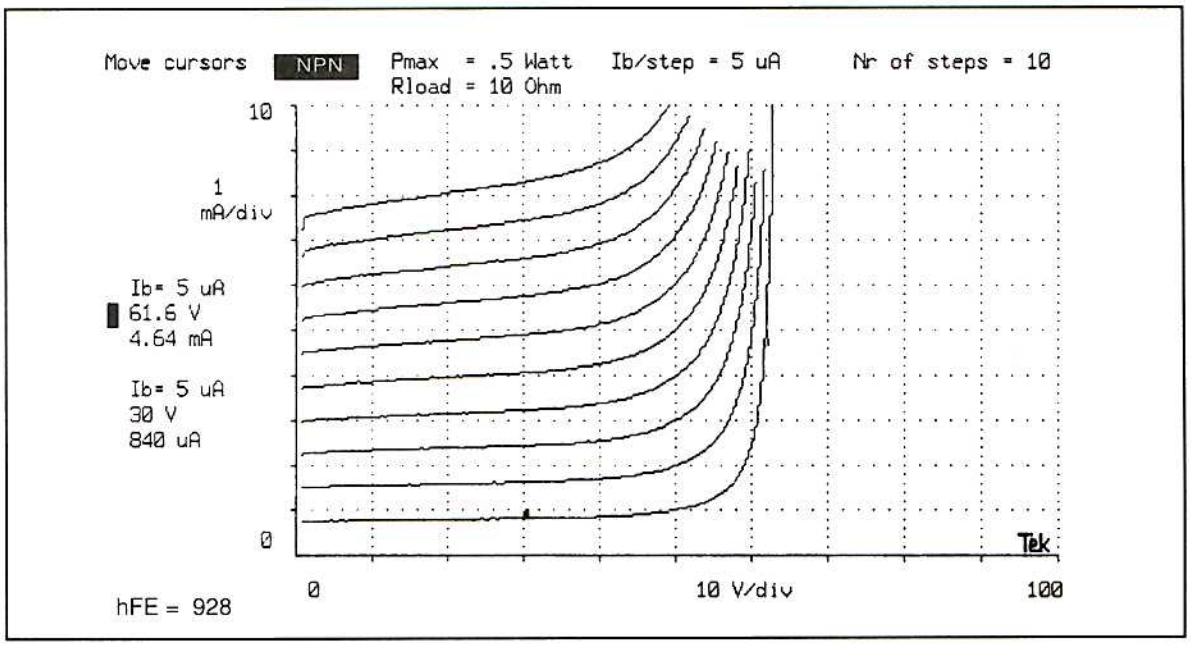


Fig. 3-5 Collector-base breakdown voltage curve.

TEMPERATURE DRIFT.

Press MENU to return to the menu page.
Select by using the arrow keys:

Function	acquisition continuous,
Vce max	20 V,
Ic max	100 mA,
Ib/step	200 µA,
Steps	3,
Pmax	2 Watt

Press START and watch the curves grow until they look like Fig. 3-6.
Press STOP to interrupt the acquisition.

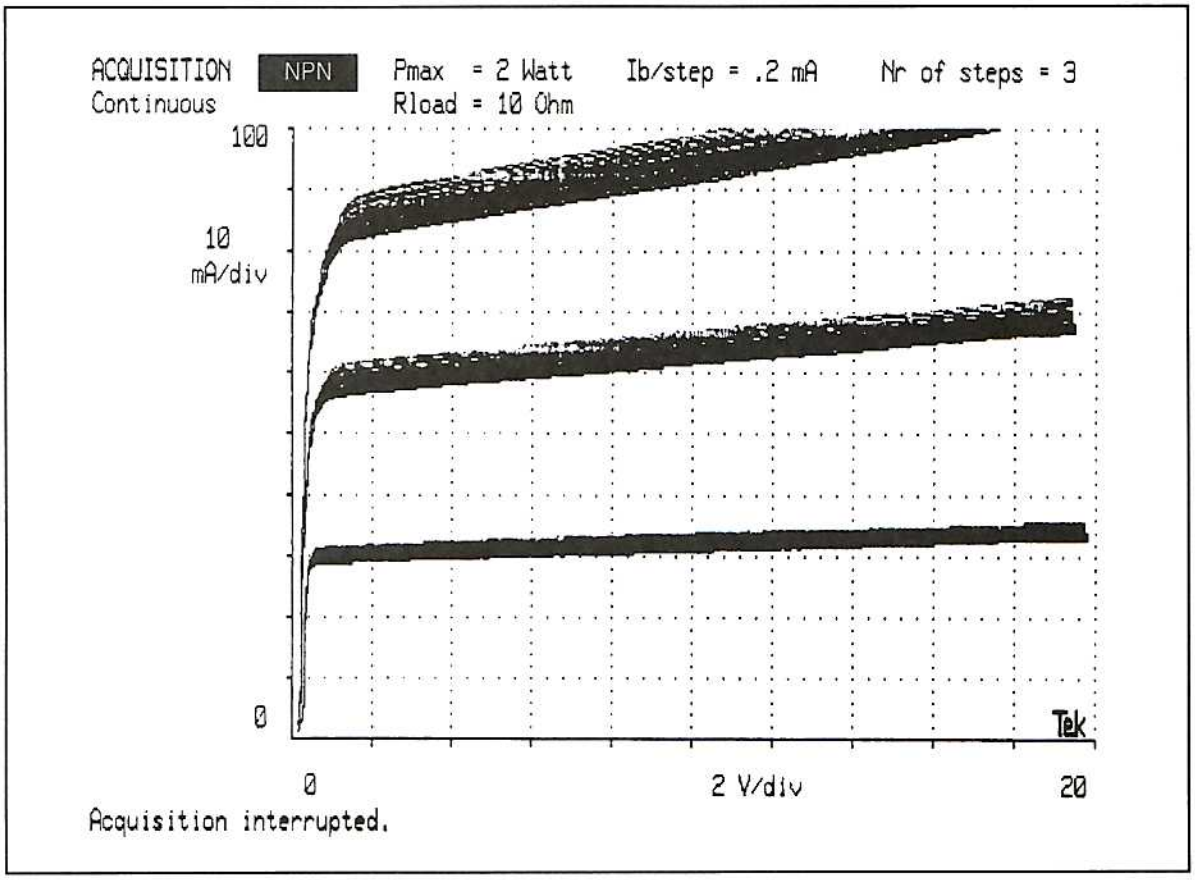


Fig. 3-6 Temperature drift curves.

LOADLINE measurement.

Press MENU to return to the menu page.
Select by using the arrow keys:

Function	acquisition,
Vce max	2 V,
Ic max	2 mA,
Ib/step	1 µA,
Steps	10,
Rload	1 kΩ,
Pmax	100 W

Press START . The curves will end along the loadline representing a load of 1 kΩ. (Fig. 3-7)

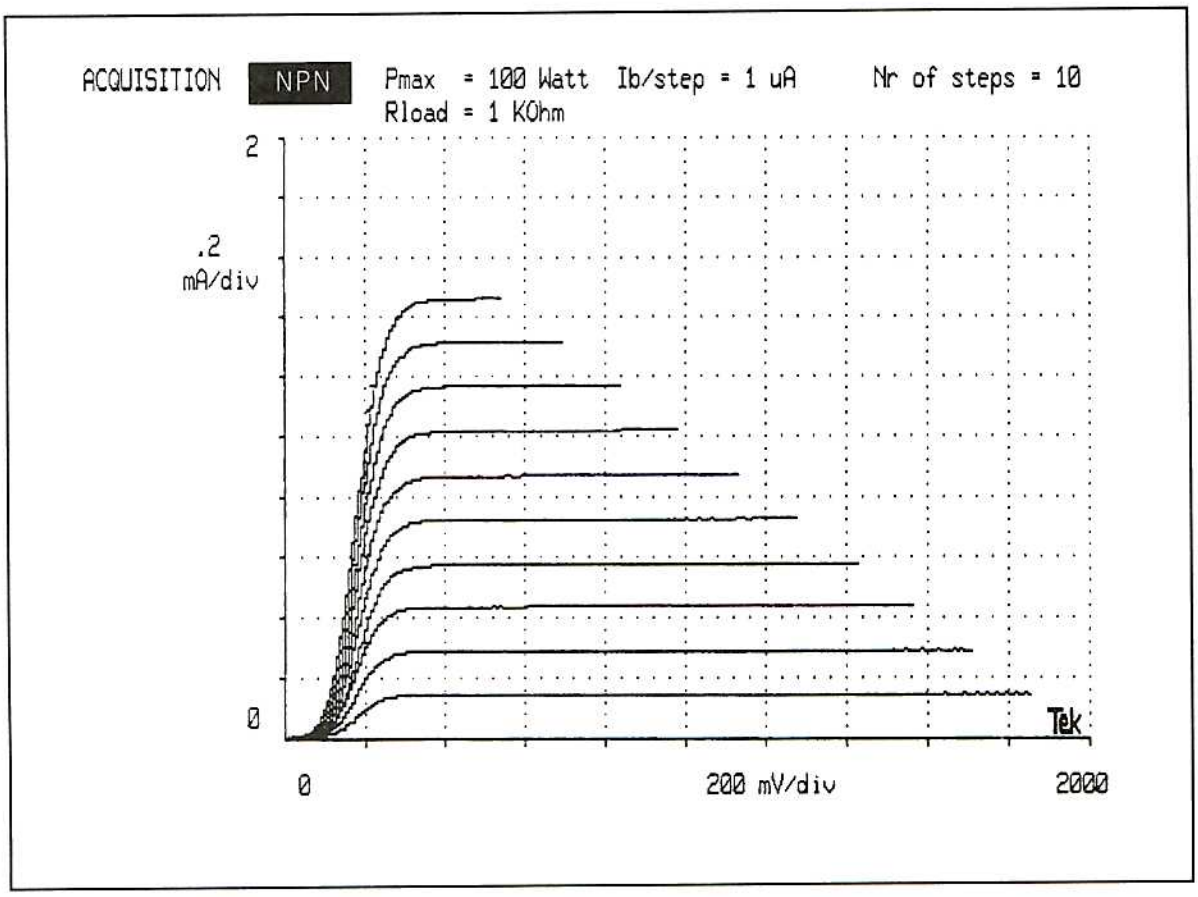


Fig. 3-7 Loadline.

POWERLIMIT measurement.

Press MENU to return to the menu page.
Select by using the arrow keys:

Function	acquisition,
Vce max .	50 V, (remember the cover!)
Ic max .	20 mA,
Ib/step	10 µA,
Steps	10,
Rload	0.25 Ω,
Pmax	0.1 Watt.

Press START and notice the curves end along a hyperbola. (Fig. 3-8)

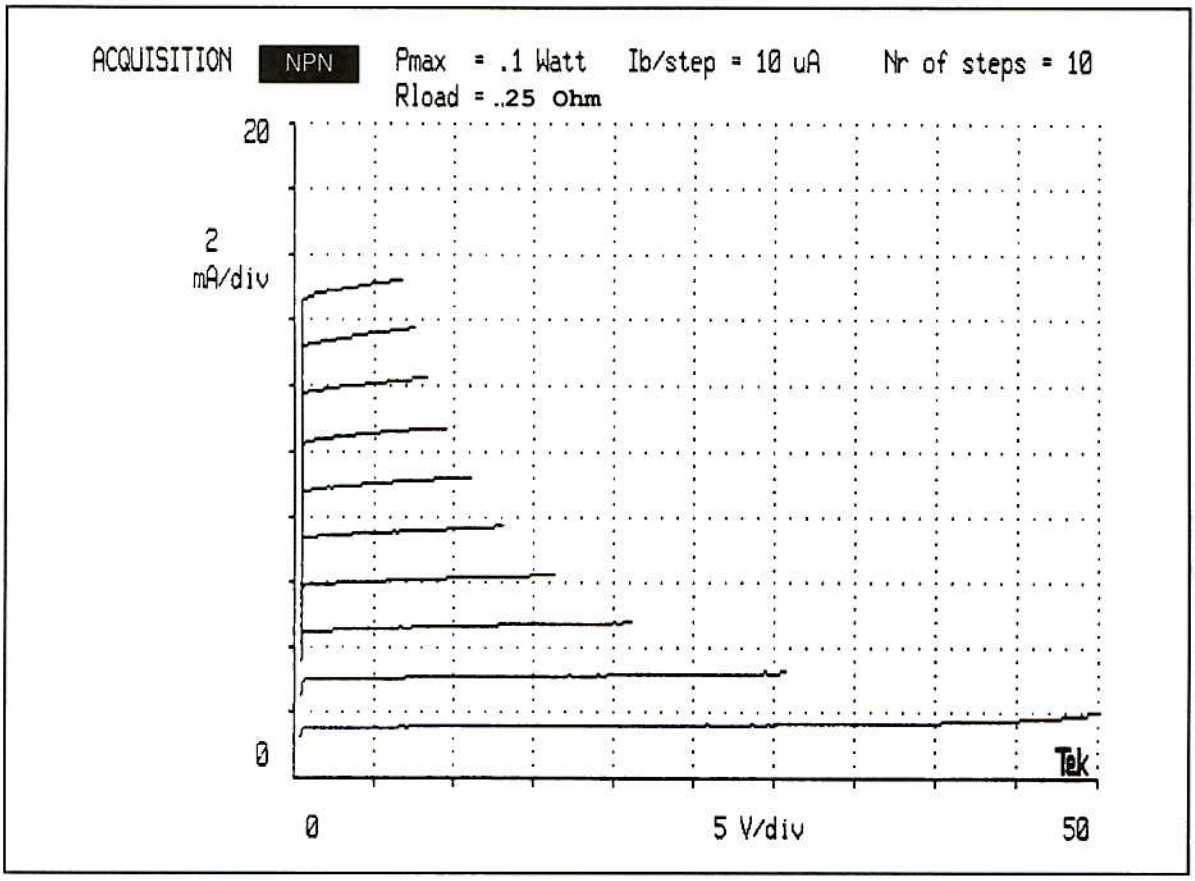


Fig. 3-8 Power curve.

H - PARAMETER measurements.
[hFE, hfe, hoe]

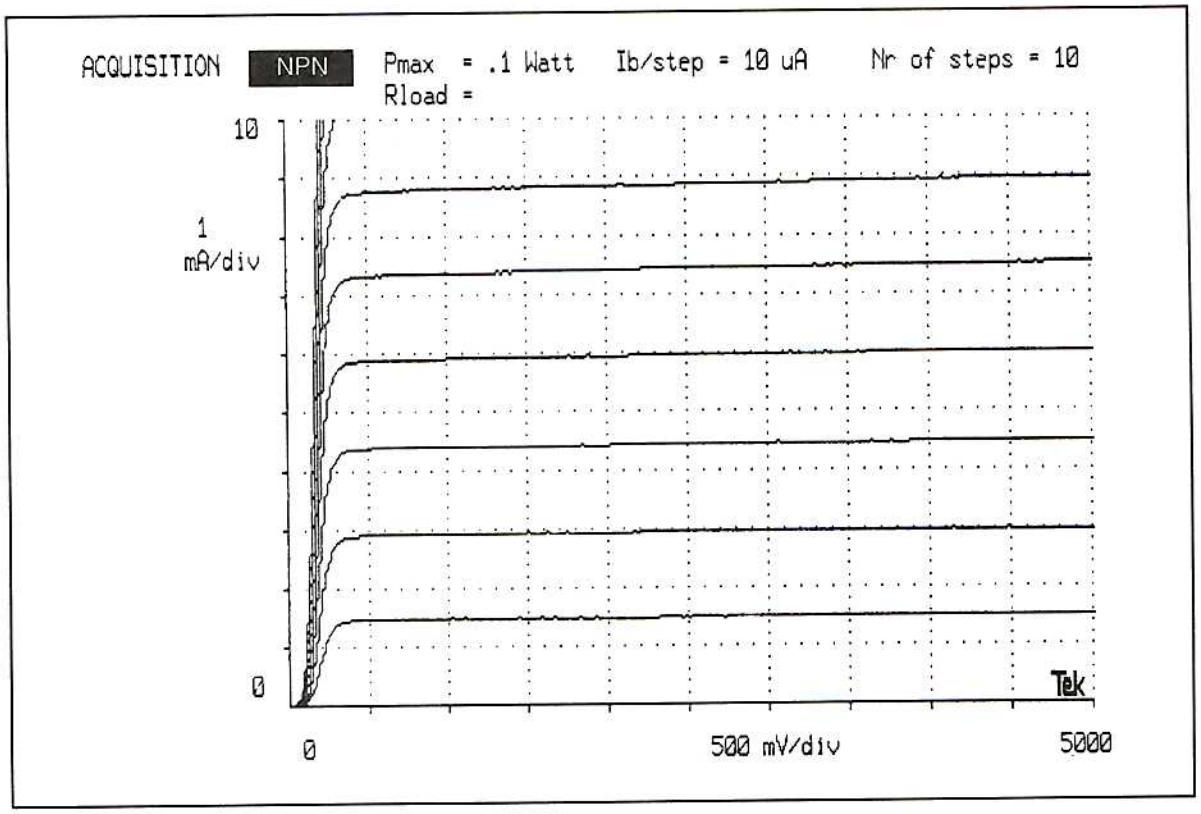
Static h-parameter measurement (h_{FE}).

h_{FE} - Create the curves according to the default settings, as indicated at the Vce - Ic test. (See figure below). Press CURSOR and notice the cursors appear in the middle of the lowest curve. The h_{FE} at the position of the blinking cursor is printed in the lower left corner of the display. The cursor can be moved by the horizontal arrow keys along the curve. After the arrow key is released, the h_{FE} is updated for the new cursor location.

Small signal h-parameter measurements (h_{fe}, h_{oe}).

h_{fe} - Move one cursor to a specific position, for instance the highest curve at 4 V. Press CURSOR to swap the activity and move the other cursor to the same voltage, one curve below. ΔIc divided by ΔIb gives the hfe under these specified conditions of collector current and collector voltage.

h_{oe} - Move both cursors to the same curve (with the vertical arrow keys). One for instance at 2 V , the other at 4 V. Δ Ic divided by ΔVce gives the hoe under these specified conditions of collector current and collector voltage.



Collector-Emitter Breakdown Voltage measurement [V ceo(br)]

Remove the base lead of the DUT from the socket. (For a PNP device, interchange the emitter and collector leads also.)
Press MENU to return to the menu page.
Select by using the arrow keys:

Type	DIODE
Va max .	100 V,
Ia max	1 mA,
Rload	1 kΩ
Pmax	0.1 Watt

Press START and observe a curve as in fig. 3-9.

NOTE:
Your picture may not look as clean as this example, try another Rload or other Ia max for better results.

Testing Vces has the same procedure, only the base lead of the DUT must be connected to the same contact as the emitter. For most devices Vces is above 100 V which is beyond the range of the 571.

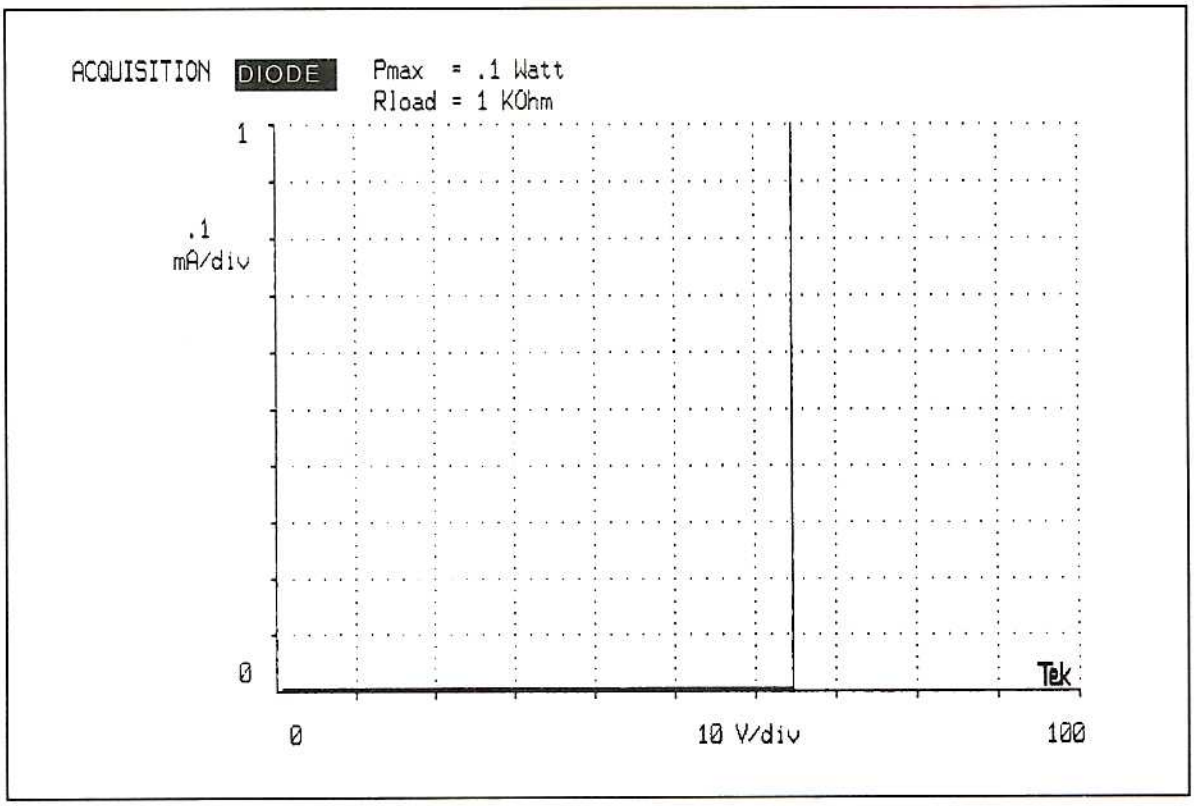


Fig. 3-9 Vceo curve.

FIELD EFFECT TRANSISTOR MEASUREMENTS

For this example a JFET type 2N4416 is used. (See Fig. 3-10 for proper connections.)
Connect the DUT in the appropriate socket on the front panel.
Go to the menu page and select:

Function	acquisition,
Type	N-FET,
Vds max.	10 V,
Id max .	20 mA,
Vg/step	200 mV,
Offset	–1.200 V,
Steps	10 ,
Rload	0.25 Ω,
Pmax .	0.1 W.

Press START and observe a set of curves as in Fig. 3-11.

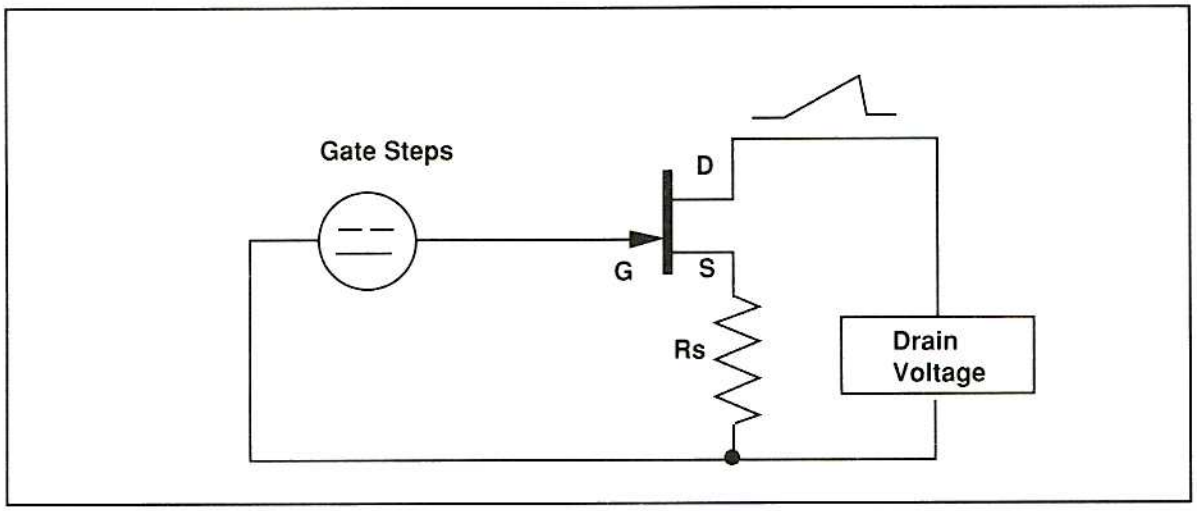


Fig. 3-10 FET Connection diagram.

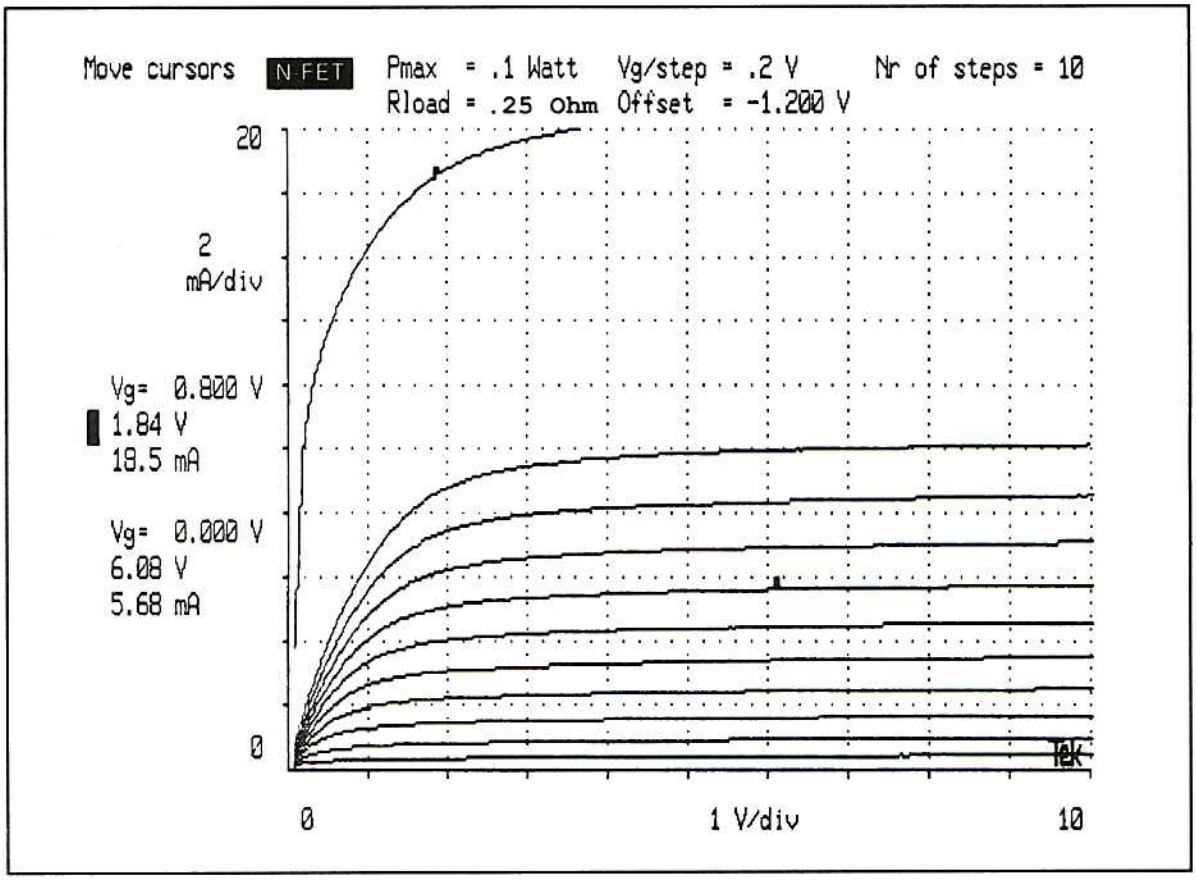


Fig. 3-11 JFET curves in depletion and enhancement mode.

The curves above the curve Vg = 0 V in Fig. 3-11 represent the enhancement mode, the curves below Vg = 0 V represent the depletion mode.
Notice the highest curve at Vg = 800 mV. At that drive voltage, the FET has the electrical properties of a good conductor.
In addition, at a drive voltage above about 600 mV the gate-channel diode opens so the gate current is changing from substantial zero to a few mA. (The driving source is a voltage source!)

This effect only happens with J-fet's. Usually, J-fet's are driven in depletion mode.
MOS-FET's can be driven as well in enhancement mode as in depletion mode, depending of the type and purpose.

DRAIN BREAKDOWN voltage.

Press MENU to return to the menu page.
Select by using the arrow keys:

Vds	100 V,
Id max.	10 mA,
Vg/step	0.2 V,
Offset	–1.400 V.

Press START and notice the Drain breakdown at about 60 V. (See Fig. 3-12)

There is another breakdown voltage: The gate-source breakdown. This is a destructive test so we will not discuss it here.

NOTE:
Select your parameters carefully!! If not, this test may be destructive to the device. Refer to your component data sheet.
Press STOP as soon as the current rises, and the break down starts, to prevent damage to the device.

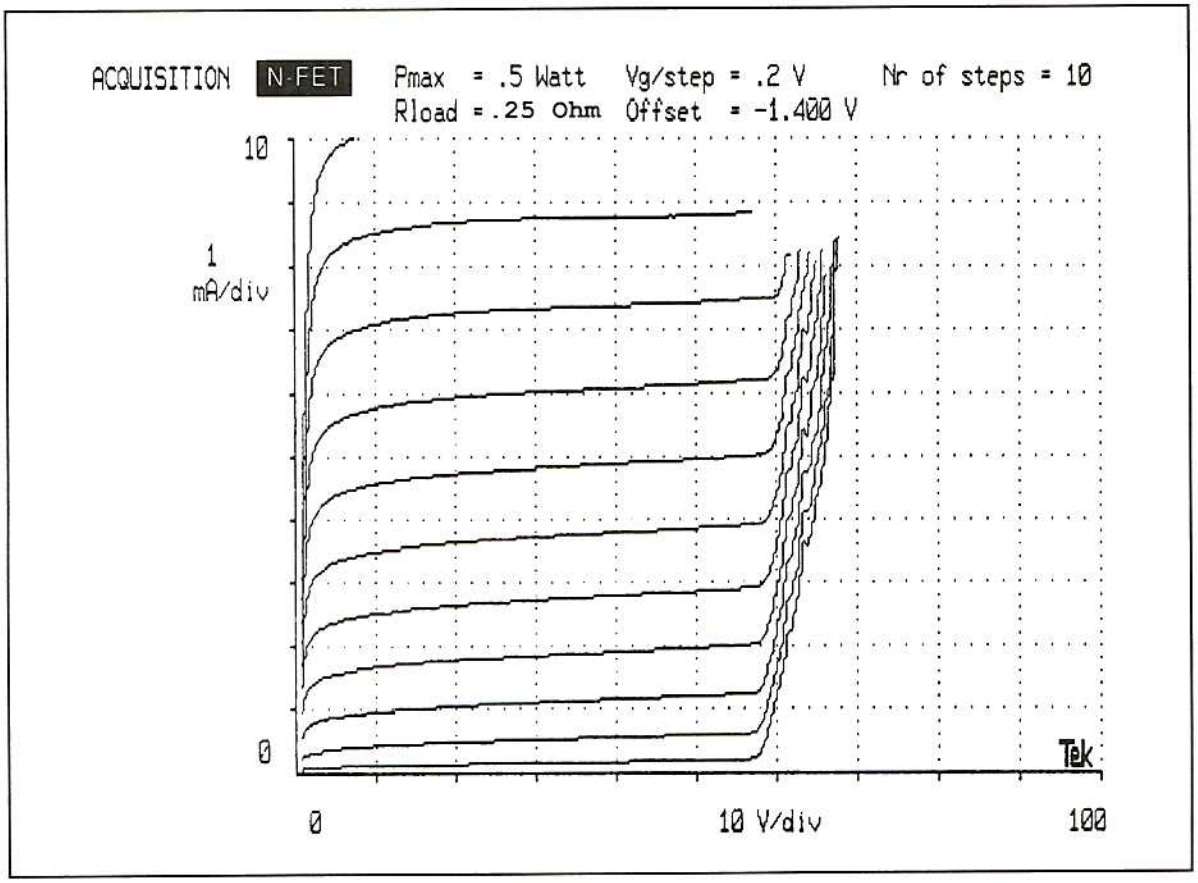


Fig. 3-12 Drain breakdown voltage curves.

PINCH OFF voltage.

Press MENU and select by using the arrow keys:

Vds max.	5 V,
Id max .	0.05 mA,
Vg/step	0.1 V,
Offset	– 2.150 V,
Rload	100 Ω

Press START. This will result in a picture of the pinch off region of the DUT. (Fig. 3-13)
Using the cursors, you can determine exactly at which curve the DUT starts to conduct. By changing the offset voltage, the pinch off voltage can be measured within 25 mV.

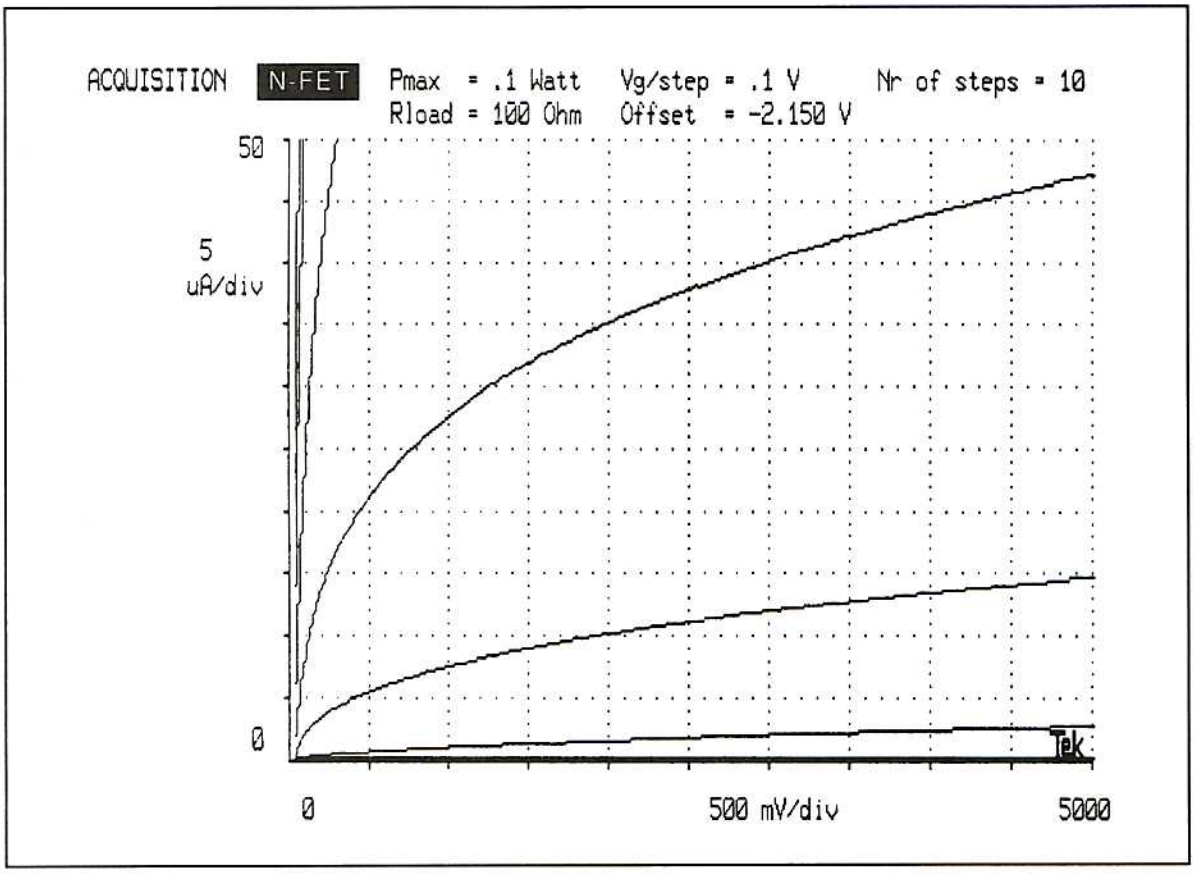


Fig. 3-13 Pinch off voltage curves.

DIODE MEASUREMENTS

FORWARD voltage.

Connect a diode in the diode socket on the front panel in forward direction.
Press MENU and select by using the arrow keys:

Type	diode,
Va max.	1 V,
Ia max.	1 mA,
Rload	100 Ω

Press START. This results in a curve as in Fig. 3-14.
To calculate Ri: Press CURSOR and direct the 2 cursors to any position you like.
Ri = ΔVa divided by ΔIa.
Press STOP to leave the cursor utility.

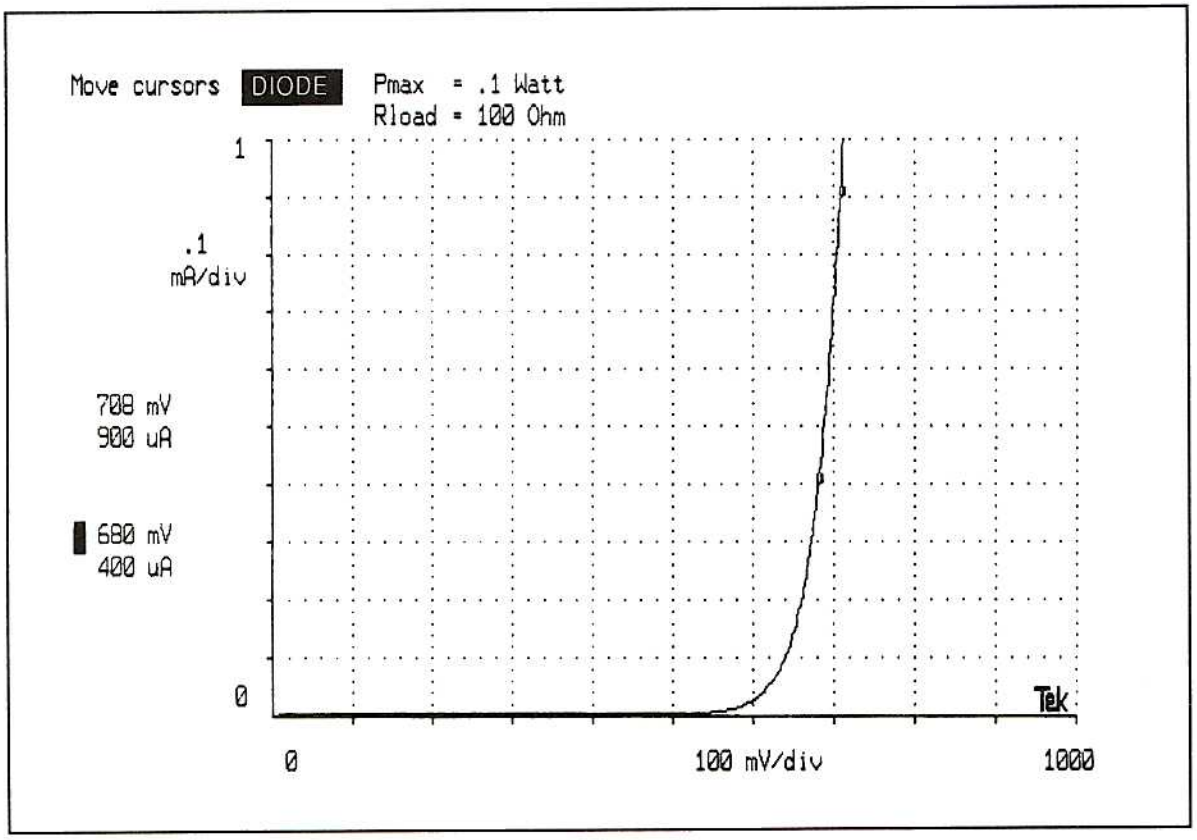


Fig. 3-14 Diode curve in forward direction.

REVERSED voltage.

Connect a zener diode in the diode socket in reversed direction. Change Va max. with the right arrow key to the appropriate value for the zener diode.
Press START.
After acquisition press STORE.

To measure the forward characteristic of the zener diode, connect the zener in forward direction.
Press START.
On one picture, the forward characteristic as well as the zener characteristic are presented. (Fig. 3-15)

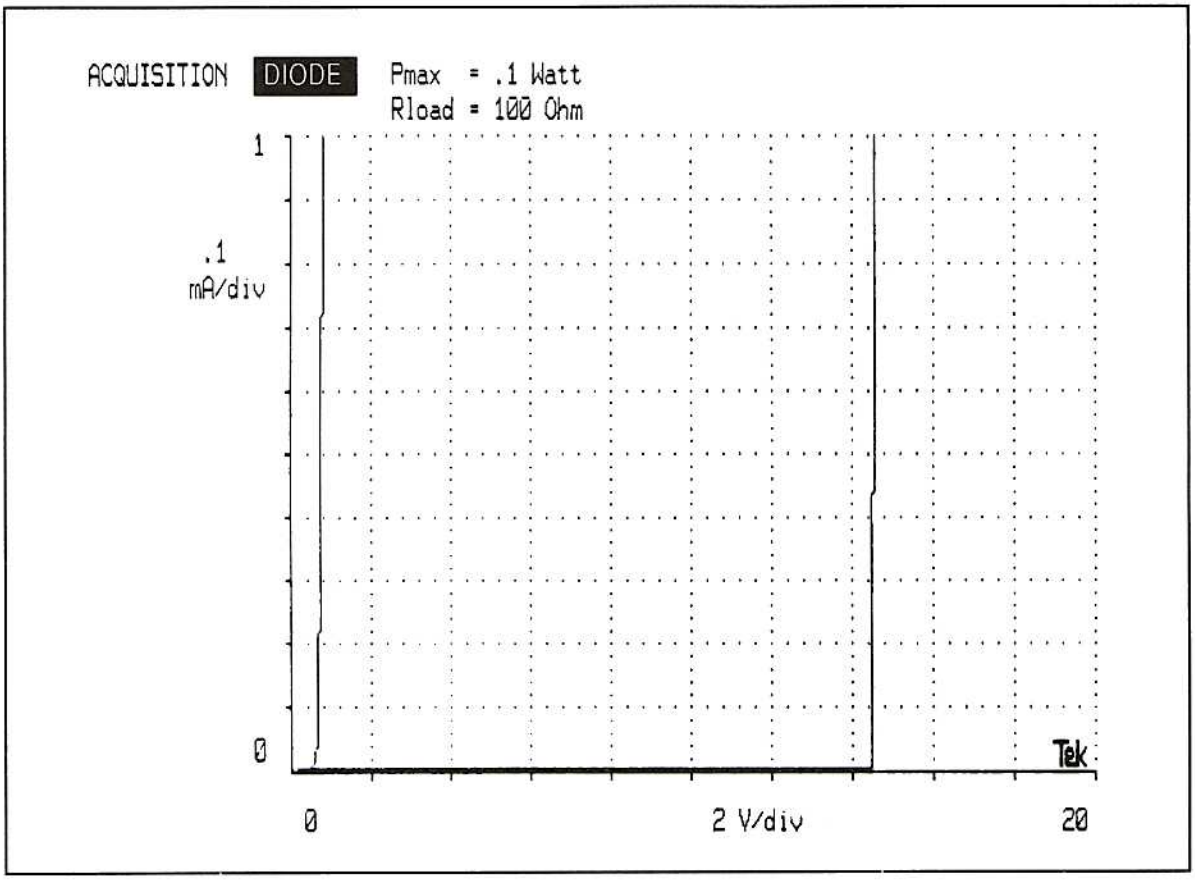


Fig. 3-15 Zener diode curve in forward and reversed direction.

THYRISTOR MEASUREMENTS

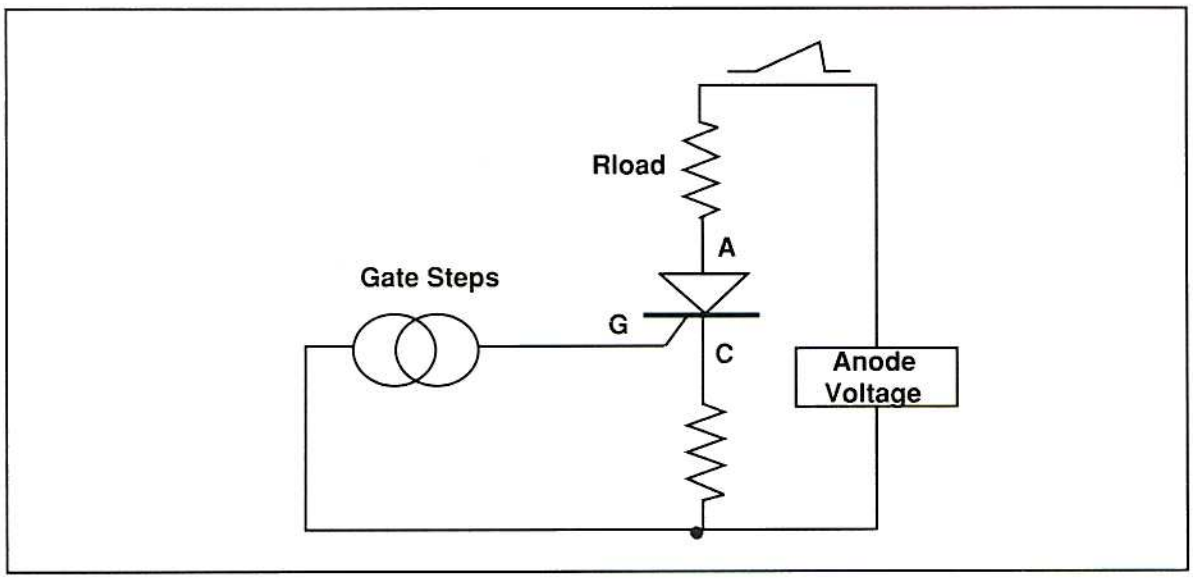


Fig. 3-16 Thyristor connection diagram.

Thyristors are tested the same way as NPN transistors, but a minimum Rload of 100 Ohm is required (See Fig. 3-16).
The 571 is performing this Rload selection automatically if an S.C.R. is selected. This measurement is executed with a BT151 type.
The 571 does not show vectors with negative ΔVxx.
Use the cursor utility to determine the range of the curve.

Select by using the arrow keys:

Type	SCR
Va max.	20 V
Ia max.	20 mA
Ig/step	0.2 mA
Steps	10
Rload	1 kΩ
Pmax.	0.1 W

Press START and notice a curve as in Fig. 3-17.

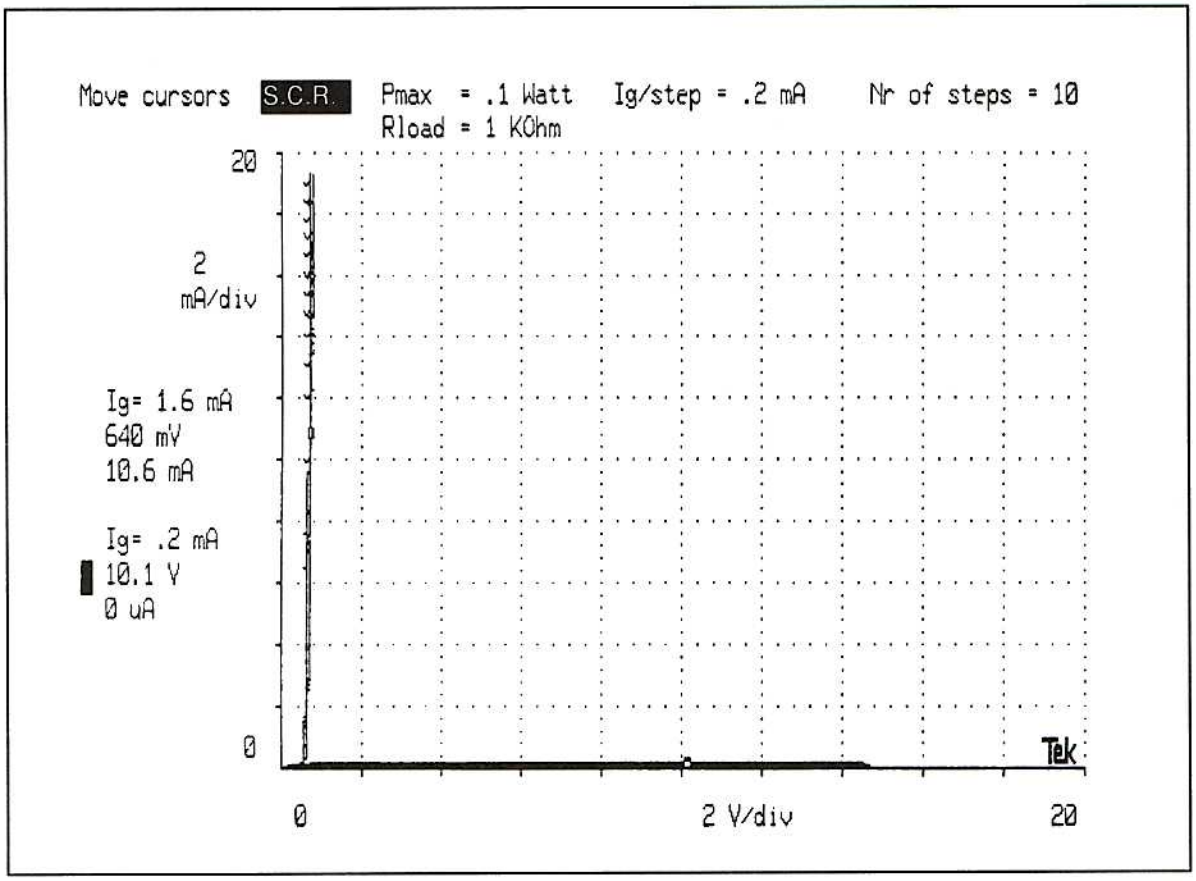


Fig. 3-17 Thyristor curves.

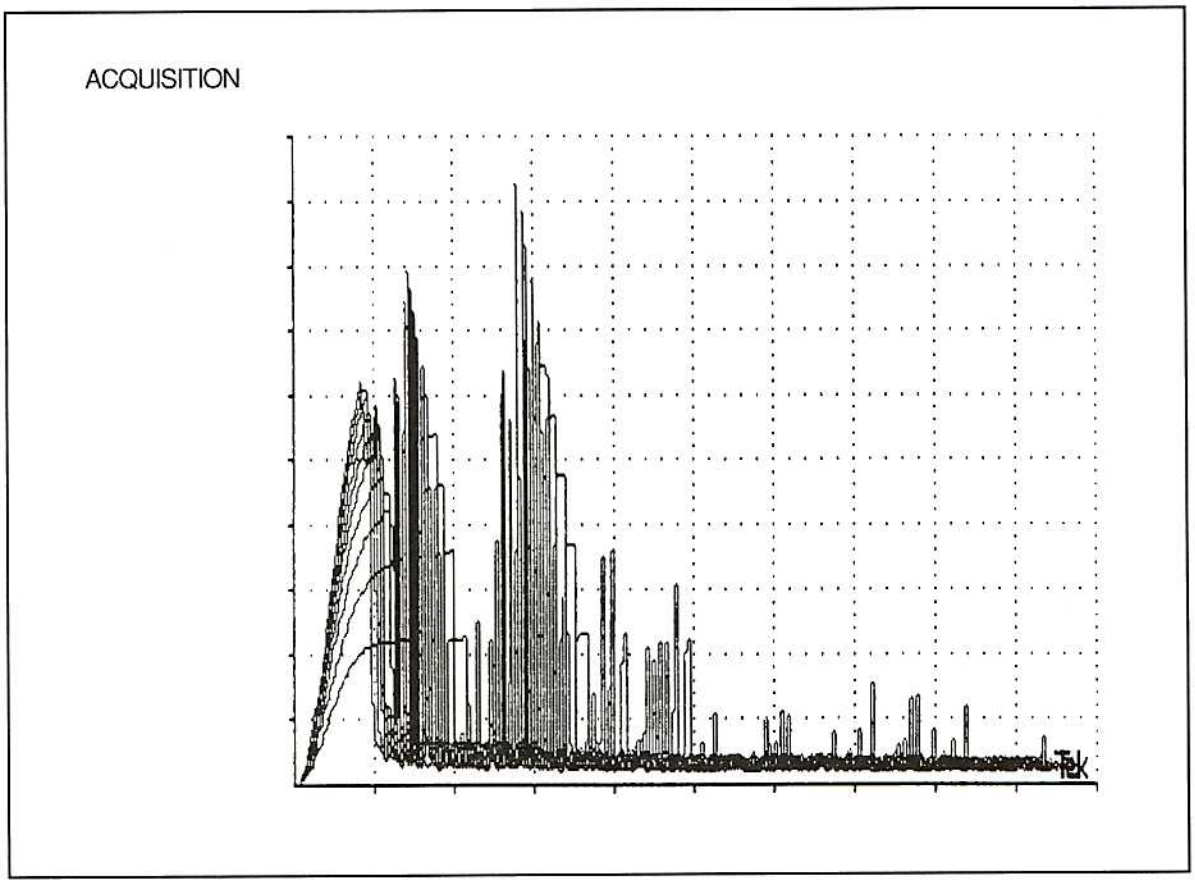


Fig. 3-18 Thermal protection curve.

A note for all measurements

Precautions have been taken inside the 571 to prevent oscillations inside the DUT.
Nevertheless it may happen that some special high frequency devices still have a tendency to oscillate. This can be noticed by a noisy display or the Hfe decreasing very suddenly in the curves. Adding a small capacitor (15 pF) between emitter and base, or a 1000 pF capacitor between collector and base of the DUT, in the same socket, will eliminate the oscillations.

Figures as shown may differ depending on types used. The 571 has a hardware overcurrent protection and a thermal protection. Trying to test a shortcircuit according to the parameters in Fig. 3-18 causes the internal thermal protection circuit to activate after a few seconds, resulting in the meaningless picture like Fig. 3-18 is.

⚠ Terminate the test quickly !

COMPARE MODE

The compare mode is intended to compare devices to a reference device (see page 2-6).
During a compare session two sets of curves will be displayed on the screen.
The high lighted curve is the reference; it will be retrieved from the memory each time an acquisition in compare mode is initiated. The second set of curves is in normal intensity. This is the set of curves of the device under test. The compare mode allows the comparison of :

1. Diodes to diodes
2. S.C.R.'s to S.C.R.'s.
3. Bipolar transistors of the same type (NPN or PNP)
4. Bipolar transistors of the complementary type (NPN to PNP and PNP to NPN)
5. FET's of the same type (P-FET's or N-FET's)
6. FET's of the complementary type (P-FET's to N-FET's and N-FET's to P-FET's)

For example :

Select : COMPARE mode,
NPN and
the desired test parameters.

Hook up a NPN transistor in the appropriate socket and press <START>.
After the acquisition the curves are stored as the reference.
Hook up another NPN transistor and press <START>.
Two sets of curves reflecting the two transistors are displayed.
Now hook up a PNP transistor and press the <UP> or <DOWN> button.
Before the acquisition starts, the absolute values of the test parameters are not altered, but ALL the polarities are inverted and the acquisition starts.

The reference device type is displayed below the word 'COMPARE' upper left on the screen, and the type of the device under test is displayed inverse in the top line on the screen.

During a compare session it is not possible to change scale factors. The scale factors used to sample the reference are also used to sample the devices under test.

The prompt bar at the bottom of the screen indicates the keys that are valid and how they affect the 571.

MAINTENANCE

General

This section of the manual provides information on recalibration of the instrument, on the verification procedure, the procedure for protection of information that is saved in the EEROM, and also general maintenance information of the 571 Curve Tracer.

To assure proper operation, execute the verification procedure of the instrument every 6 months or after 1000 hours of use, whichever occurs first.

Adjustments of internal circuits to specified accuracy, and / or calibration check should be performed at the factory or a Tektronix Service Center.
Before returning the instrument for any servicing, please contact your nearest Tektronix Service Center.

WARNING

To avoid fire hazard, use only the fuse of correct type, voltage rating, and current rating as specified on the instrument and in fuse replacing instructions.

VERIFICATION PROCEDURE

The 571 has a build in verification program, that is accessible to the user.
The test provides test patterns for the monitor, checks on the performance of the frontpanel keys, the hardware protection circuitry and the overall accuracy of the 571 analog hardware.
To test the accuracy of the hardware, a digital multimeter (for example a Tektronix DM 504 or DM 511) is required to do some external checks on the build in reference sources. This ensures the traceability of the references.
The 571 verification program offers these references on the testsockets during the verification test.
To start the verification test use the following procedure:

- Switch off the 571.
- Set the slide switch NORM/TEST on the rear panel to "TEST".
- Switch on the 571.
- The 571 starts testing successively the video part, the front panel keys, the EEROM and the references.
- Examine the patterns and follow the instructions on the screen..

Note:
If the slide switch on the rear is used by switching from "NORM" to "TEST" or "TEST" to "NORM", while the 571 is on, the software gets confused. An error message " `Contact your local Tek service office` " is being printed. Reset the 571 by switching the power off and on again.

- **Video Test**

The 571 displays a test pattern for checking CRT deflection linearity.
After evaluation of the deflection system, press any key to get the next test pattern. This allows checking the video attributes and the focus of the monitor. Again, press any key to get the next test pattern.

- **Front Panel Keys**

Any time a key is pressed, the corresponding word on the screen changes to inverse video.
The sequence of pressing a key is not essential. The keys may be pressed more than once.
As soon as all the keys, including the protect cover switch, have been activated at least once, the 571 goes on to the next test.

- **EEROM (Electrical Erasable Read Only Memory) test.**

The 571 checks the EEROM function.
Press any key to continue.

- **References.**

In this test the next two reference values are checked:

1. The 571 prompts for the collector voltage. Check the collector voltage according to the message on the screen with a DMM (connected to the banana jacks marked "E" and "C" on the front). "E" is the low output, "C" is the high output.

2. The 571 generates a current of 10 mA. When the 571 asks for it, connect the DMM in current mode between the banana jacks "E" and "B" on the frontpanel. "E" sinks the current, "B" sources the current.

- **Verification Test**

After the last instructions on the screen have been executed, the 571 indicates a complete selftest, using the two values you just verified, as its references.
The 571 prints the progress of the test procedure on the screen.
As soon as a test fails the 571 prints on the screen for instance:

```
TEST # 2 . 7 positive . XX
FAILED; READ YY EXPECTED ZZ +/- Z
```

The first number (the '2') indicates which part of the analog hardware was under test (also printed at top of the screen).
The second number (the '7') indicates which range of that part was under test.

XX is the sub test number. (Usually the stimulus that was written at the base drive or the collector supply digital to analog convertor (DAC)).
YY is the value that was read by the analog to digital convertor (ADC).
ZZ is the value that was expected.
Z is the tolerance in counts (1 count out of 250 full scale means 0.4%).

When the 571 detects an error it stops execution of the subsequent checks. If no errors are detected, the 571 displays " *** UNIT OK ! *** ".

After completing the verification test, switch off the 571, set the slide switch back to NORMAL, switch the 571 on again and resume the normal operation. If any of the tests fails, please contact your nearest local Tektronix Service Center for repair and/or calibration.

EEROM PROTECTION UTILITY

In section 2, page 2-7, the application of the EEROM was explained as part of the menu.
The write protect utility was not discussed there because it may be wise to restrict this information to just a few people who are authorized to make changes in the protected programs of the EEROM.

To activate the write protection, use the following procedure:

- Save all the menu settings you wish to have saved in the EEROM as described in section 2.
- Switch-off the 571. (Don't worry, the EEROM is non volatile, so all settings are save.)
- Press both the UP and DOWN arrow keys at the same time.
- Keep the keys pressed, while switching-on the 571 until the menu appears on the screen.

During power up initialization the write protect attribute will be stored in the EEROM. It will remain there until it is removed, (after de-activating the write protection) no matter how often the 571 is switched on and off.

To de-activate the write protection, use the following procedure:

- Switch-off the 571.
- Press both the LEFT and RIGHT arrow keys at the same time.
- Keep the arrow keys pressed while switching-on the 571, until the menu appears on the screen.

During power up initialization the 571 removes the write protect attribute from the EEROM.

CLEANING INSTRUCTIONS

This instrument should be cleaned as often as operation conditions require. Accumulation of dirt on components may act as an insulating blanket and prevents efficient heat dissipation that can cause overheating and component breakdown.
Use a non-residue type of cleaner; preferable isopropyl alcohol or denatured ethyl alcohol.
Before using any other type of cleaner consult your Tektronix Service Center or representative.

Exterior : Loose dust accumulated on the front can be removed by a soft cloth or a small brush.
Dirt that remains on the front can be removed with a soft cloth dampened with a mild detergent and water solution.

CAUTION

Do not use abrasive cleaners !!

Interior : It is recommended that in cleaning the interior, the accumulated dust be first blown off with dry low pressure air, then use a soft brush to remove any remaining dust.

CAUTION

This instrument contains electrical components that are susceptible to damage from static discharge. Discharge the static voltage from your body by wearing an approved wrist strap and pad connection while cleaning the interior of the instrument !!

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