HP 42851A PRECISION Q ADAPTER

Operation Manual

SERIAL NUMBERS

This manual applies directly to the HP 42851A with serial number prefix 3016J and the HP 4285A whose ROM-based firmware is version 02.00. For additional important information about serial numbers, read "Serial Number" in Chapter 1 of this Operation Manual.

HEWLETT PACKARD

HP Part No. 42851-90010
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Notice

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Manual Printing History

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

July 1990 .... First Edition

December 1995 .... Second Edition

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.
The Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

Note

HP 42851A complies with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. HP 42851A is INDOOR USE product.

Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings , such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Warning

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

Safety Symbols

General definitions of safety symbols used on equipment or in manuals are listed below.

⚠	Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.
∼	Alternating current.
⎓	Direct current.
I	On (Supply).
O	Off (Supply).
⏚ OR ⊥	Frame or chassis terminal.
Warning	This **Warning** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.
Caution	This **Caution** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.
Note	**Note** denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

HP 42851A Precision Q Adapter Documentation Map

The documentation for the HP 42851A has been separated into several manuals. Following is a brief description of each manual and its purpose.

- The *HP 4285A Getting Started Guide* walks you through system setup and initial power-up, shows how to make basic measurements and explains commonly used features.
- The *HP 42851A OPERATION MANUAL* (HP Part Number 42851-90010) provides general information, specifications, HP-IB programming information, and in depth reference information. Functional description is divided into Chapter 4, 5, and 6 depending upon MENU keys on the front panel.
- The *HP 4285A OPERATION MANUAL* (HP Part Number 04285-90000) provides reference information of Option 201 Handler Interface.
- The *HP 42851A MAINTENANCE MANUAL* (HP Part Number 42851-90030) explains how to verify conformance to published specifications.
- The *HP 42851A SERVICE MANUAL* (HP Part Number 42851-90031) explains how to adjust, troubleshoot, and repair the instrument. (Furnished Option 915 only.)

How To Use This Manual

This is the Operation Manual for the HP 42851A Precision Q Adapter including HP 4285A operation. This manual contains specifications, supplemental performance characteristics, installation, configuration, operation, and remote control commands in ten chapters.

Chapter 1 General Information

Chapter 1 provides the specifications, supplemental performance characteristics, and other general information on the HP 42851A.

Chapter 2 Installation

Chapter 2 provides unpacking, initial inspection, interconnecting units/cables, and preparation information necessary for you to know and do before applying AC power.

Chapter 3 Product Overview

Chapter 3 provides information including a product overview.

Chapter 4 DISPLAY FORMAT

Chapter 4 provides detailed information for the display format and measurement function, corresponding to the [DISPLAY FORMAT] menukey.

Chapter 5 MEAS SETUP

Chapter 5 provides detailed information for the measurement condition setup, corresponding to the [MEAS SETUP] menukey.

Chapter 6 CATALOG/SYSTEM CONFIGURATION

Chapter 6 provides detailed information for the internal/external memory and system configuration catalog of the HP 4285A combined with the HP 42851A, corresponding to the [CATALOG/SYSTEM] menukey.

Chapter 7 Measurement Basics

Chapter 7 provides the basic measurement procedure with the resonance method and measurement techniques.

Chapter 8 Remote Control

Chapter 8 provides information to control the HP 42851A combined with the HP 4285A using the HP-IB interface.

Chapter 9 Command Reference

Chapter 9 provides detailed information for each of the HP 42851A HP-IB commands when combined with the HP 4285A.

Appendix A Manual Changes

Appendix A contains Manual Changes and provides information for using this manual with an HP 42851As manufactured before the printing date of the manual.

Appendix B Error Message and System Message

Appendix B lists the HP 42851A's error messages when combined with the HP 4285A with brief descriptions and solutions, and system messages.

Appendix C Initial Settings and Internal Memory

Appendix C lists the HP 42851A's initial settings and functions whose status is stored in internal memory of the HP 4285A.

Appendix D Write Protection

Appendix D provides the procedure for write protecting all of the stored data in the HP 4285A's memory card and internal EEPROM memory.

Typeface Conventions

Bold — Boldface type is used when a term is defined. For example: **icons** are symbols.

Italics — Italic type is used for emphasis and for titles of manuals and other publications.

Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: `copy` *filename* means to type the word `copy`, to type a space, and then to type the name of a file such as `file1`.

`Computer` — Computer font is used for on-screen prompts and messages.

(HARDKEYS) — Labeled keys on the instrument front panel are enclosed in ( ).

SOFTKEYS	Softkeys located to the right of the Liquid Crystal Display (LCD) are enclosed in .

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST), to the extent allowed by the Institute's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, the warranty shall be for the specified period. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instruction when property installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environment specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. HP specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. HP shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Address are provided at the back of this manual.

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1

General Information

Introduction

This chapter describes specifications, supplemental performance characteristics, and other general information about the HP 42851A.

Serial Number

Hewlett-Packard uses a two-section, nine character serial number which is stamped on the serial number plate (Figure 1-1) attached to the instrument's rear panel. The first four digits and a letter are the serial number prefix, and the last five digits are the suffix. The letter placed between the two sections identifies the country where the instrument was manufactured. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under the serial numbers on the title page.

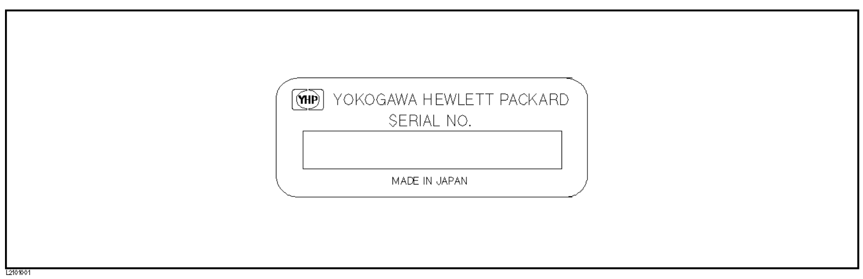


Figure 1-1. Serial Number Plate

An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument may be accompanied by a yellow Manual Change supplement or have a different manual part number. This sheet contains "change information" that explains how to adapt the manual to the newer instrument.

In addition to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified by this manual's printing date and its part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard. If the serial prefix or number of an instrument is lower than that on the title page of this manual, see Appendix A. For information concerning, a serial number prefix that is not listed on the title page or in the Manual Change supplement, contact the nearest Hewlett-Packard office.

Specifications

The complete HP 42851A specifications when it is used with the HP 4285A are listed below. These specifications are the performance standards or limits against which the instrument is tested. When shipped from the factory, the HP 42851A meets the specifications listed in this section. The specification test procedures are covered in *HP 42851A Maintenance Manual* (HP Part Number 42851-90030).

Measurement Functions

Measurement Parameters

Q : Quality factor
L : Inductance
C : Capacitance

Combinations of Measurement Parameters

Q-L
Q-C

Trigger

Internal, External, BUS (HP-IB), and Manual.

Measurement Terminals

Two-terminal configuration

Test Signal

Frequency

75 kHz to 30 MHz, 100 Hz resolution.

Frequency Accuracy

±0.01%

Test Signal Level

Variable, Maximum $1.0V_{rms}$ (at measurement terminals)

Test Signal Level Monitor Display Range

Parameter	Display Range
Voltage	$0.01\ mV_{rms} - 3.00\ V_{rms}$
Current	$0.001\ \mu A_{rms} - 99.9\ mA_{rms}$

Measurement Range

Q Measurement Range

5.00 – 999.99
(Q measurement range using the direct connection method)

Q Display Range

0.01 – 99999.9

Tuning Capacitor Characteristics

Capacitance Range

30 pF – 470 pF

Capacitance Monitor Accuracy (23°C±5°C)

±(3 % + 2 pF) at 1 MHz
Accuracy doubles for 0°C to 55°C.

Measurement Accuracy

Voltage Ratio Measurement Accuracy

Voltage ratio measurement accuracy, the voltage at the HIGH inductor terminal versus the voltage at the LOW inductor terminal, is defined instead of circuit Q.

The accuracy is specified when all of the following conditions are satisfied :

- Voltage at HIGH inductor terminal (resonant voltage : can be monitored at *V* monitor area.) is 100 mV – 1 V_{rms}.
- Short correction has been performed.
- Ambient temperature : 23°C ± 5°C

Voltage Ratio Measurement Accuracy	±5 %

Doubles the voltage ratio measurement accuracy for the temperature range of 0°C to 55°C.

The voltage measurement accuracy is the total accuracy of the following subdivisional accuracies :

- Voltage transmission linearity : ±2%
- SHORT correction error : ±1%
- Temperature induced error (at 23°C±5°C) : ±1%
- HP 4285A voltage ratio measurement accuracy : ±1%

- When the measurement frequency is identical to the transmitted interference signal frequency, refer to "EMC".

Correction Functions

Offset L/C/R

Subtracts the measurement errors due to residual inductance, resistance, and stray capacitance from the measured value by entering each component numeric value.

Short

Corrects measurement errors which are resident in the Q measurement circuit.

Load

Improves the Q measurement accuracy by using a device which Q value is accurately known (a working standard) as a reference at seven user specifiable frequencies.

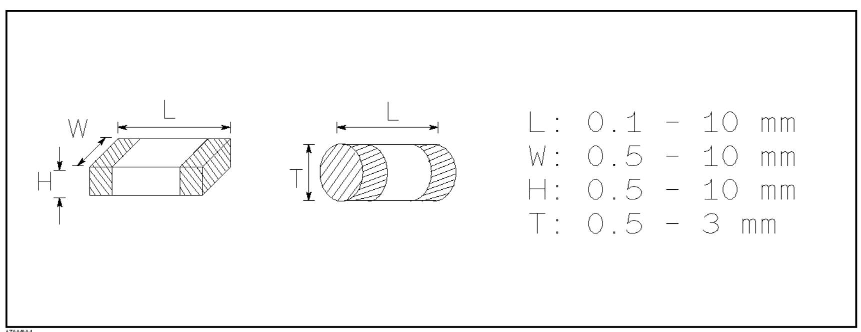
Options

Option 001 — SMD Test Fixture (HP Part Number 42851-61100)

Adds a chip component test fixture which can be connected directly to the HP 42851A binding post measurement terminals.

Dimensions	122(W) by 60(H) by 58(D) (mm)
Weight	Approximately 145 g

Dimensions of measurable components: see figure below.



A700D01

Dimesions of Measureable Components

Option 008	Add Japanese Operation Manual
Option 009	Delete Operation Manual
Option 910	Extra Operation Manual
Option 915	Add Service Manual
Option W30	Three Year Customer Return Repair Coverage
Option W32	Three Year Customer Return Calibration Coverage

Furnished Accessories

Operation Manual	HP Part Number 42851-90000
Maintenance Manual	HP Part Number 42851-90030
Accessory Interface Cable	HP Part Number 42841-61640
Power Cable	Depends on the country where the HP 42851A is being used. Refer to Figure 2-2 in Page 2-6.
Shorting Bar	HP Part Number 42851-00607

Accessories Available

Test Fixture / Test Leads

HP 10503A BNC to BNC Cable (122 cm long)

HP 16014A Series Loss Test Adapter

- Usable Frequency Range : $\leq$ 10 MHz
- Measurable Capacitance Range : 450 pF – 0.225 μF
- Stray Capacitance Between Measurement Terminals : Approx. 3 pF
- Insulation Resistance between Measurement Terminals : Approx. 10 MΩ at 1 MHz
- Residual Inductance : Approx. 30 nH

HP 16451A Dielectric Test Adapter

- Electrode Diameter : 38 mm
- Electrode Spacing : 0 – 10 mm variable
- Minimum vernier division : 0.02 mm
- Residual Parameters :
  C_o $\approx$ 5 pF
  G_o $<$ 0.4 μS (at 10 MHz)
  L_o $\approx$ 40 nH
- Minimum Measurable Loss Angle (tan δ) : Approx. 1×10^{-4}

Supplemental Inductor / Auxiliary Capacitor

HP 16462A Auxiliary Capacitor

- Capacitance Range : 300 pF to 2700 pF in steps of 300 pF. 10 ranges including OFF position.
- Capacitance Accuracy : ±1% on all ranges.
- Residual Inductance : Approx. 0.1 μH
- Residual Capacitance at OFF Position : Approx. 23 pF.

HP 16473A – Supplemental Inductors

HP 16481A – Supplemental Inductors (Excluding HP 16483B and HP 16486B)

HP 16470B Stable Inductors (A set of HP 16480B, HP 16483B, HP 16486B, and HP 16488B)

Supplemental Inductors Characteristics

Model	Approx. Inductance	Approx. Resonant Frequency for Tuning Capacitance of			Approx. Q
		400 pF	**100 pF**	**50 pF**	
16473A	25 mH	50	100	140 kHz	300
16474A	10 mH	80	160	220 kHz	300
16475A	5.2 mH	110	220	300 kHz	300
16476A	2.8 mH	150	300	420 kHz	300
16477A	1 mH	250	500	700 kHz	300
16478A	520 μH	350	700	1000 kHz	300
16479A	250 μH	500	1000	1400 kHz	300
16480A/B	100 μH	800	1600	2200 kHz	300
16481A	56 μH	1*	2.2	3.1 MHz	300
16482A	28 μH	1.5	3	4.2 MHz	300
16483A/B	10 μH	2.5	5	7 MHz	300
16484A	5.2 μH	3.5	7	10 MHz	300
16485A	2.5 μH	5	10	14 MHz	300
16486A/B	1 μH	8	16	22 MHz	300
		100 pF		**35 pF**	
16487A	0.52 μH	22 MHz		35 MHz	300
16488A/B	0.28 μH	30 MHz		50 MHz	300

* Approx. resonant frequency for tuning capacitance of 450 pF.

EMC

Complies with CISPR 11 (1990)/EN 55011(1991): Group 1, Class A

Complies with IEC 1000-3-3 (1994)/EN 61000-3-3 (1995)

Complies with IEC 801-2 (1991)/EN 55082-1(1992): 4 kV CD, 8 kV AD

Complies with IEC 801-3 (1984)/EN 55082-1(1992): 3 V/m

Complies with IEC 801-4 (1988)/EN 55082-1(1992): 1 kV / Main

Note: When tested at 3 V/m according to IEC 801-3/1984, the measurement value will be within specifications over the full immunity test frequency range of 26 to 1000 MHz.

Safety

Complies with IEC1010-1 (1990) + Amendment 1 (1992)/EN 61010-1(1993)

Certified with CSA-C22.2 No.231-M89

Power Requirements

Line Voltage

100, 120, 220, 240 Vac ±10%

Line Frequency

47 to 66 Hz

Power Consumption

100 VA max.

Operating Environment

Temperature

0°C to 55°C

Humidity

≤ 95% R.H. (at 40°C)

Altitude

0 to 2000 meters

Dimensions

180(W) by 166(H) by 290(D) (mm)

Weight

Approximately 4.1 kg (9 lb., standard)

Supplemental Performance Characteristics

The HP 42851A supplemental performance characteristics are listed below. These supplemental performance characteristics are not specifications but are typical characteristics included as supplemental information for the operator.

Q Measurement Accuracy

The HP 42851A Q measurement accuracy is applicable at the HP 42851A's measurement terminals when all of the following conditions are satisfied.

- Ambient temperature : 23°C ± 5°C
- Humidity : Less than 70% RH
- Automatic tuning mode is selected.
- Voltage at HIGH inductor terminal (resonant voltage : can be monitored at *V* monitor area) is 100 mV – 1 V_{rms}
- SHORT correction has been performed.

Q Range	Q Measurement Accuracy
5.00 – 100.00	±5%
100.01 – 300.00	±7%
300.01 – 600.00	±10%
600.01 – 999.99	±15%

If for $L_x < 10\ \mu$H, add $\frac{30\,nH}{L_x} \times 100$ [%] to the Q measurement accuracy.

Where, L_x is Measured Inductance Value

Incremental Q Measurement Error in FIXed-C Mode

Incremental Q measurement error due to FIXed-C measurement is applicable at the HP 42851A's measurement terminals when all of the following conditions are satisfied.

- Ambient temperature : 23°C ± 5°C
- Q < 100.
- Voltage at HIGH inductor terminal (resonant voltage : can be monitored at *V* monitor area) is 50 mV – 1 V_{rms}
- SHORT correction has been performed at the frequency where the measurements are made.
- The difference between tuned capacitance value in automatic tuning mode and setted value for fixed capacitance is within 10%.

Incremental Q measurement Error	±10%

Test Signal Level Monitor Accuracy

Frequency Range	Voltage Monitor Accuracy	Current Monitor Accuracy
75 kHz $\leq f_m \leq$ 10 MHz	$\pm$(15 % + 2 mV)	$\pm\{(18 + 2/C_x)\% + 4\pi f_m C_x \times 10^{-9} A\}$
10 MHz $< f_m \leq$ 30 MHz	$\pm$(20 % + 2 mV)	$\pm\{(23 + 2/C_x)\% + 4\pi f_m C_x \times 10^{-9} A\}$
f_m : frequency [MHz] C_x : Tuning Capacitance [pF]		

Inductance Measurement

Measurement Range

90 nH – 100 mH

Measurement Accuracy

Inductance measurement accuracy is applicable at the HP 42851A's measurement terminals when the ambient temperature is 23°C ± 5°C.

$$\pm\left[\left(2 + \frac{1.5}{C_x} \times 100\right) \% + 30\ nH\right]$$

Where,

C_x : Tuning Capacitance [pF]

Measurement Time

Typical measurement times from the trigger to the output of End Of Measurement (EOM) at the Handler Interface of the HP 4285A.

FIXed-C Mode	75 ms
AUTOmatic Tuning	75 ms – 1.5 s

Incremental Q Measurment Error of the SMD Test Fixture

The incremental Q measurement error of the SMD test fixture is applicable when all of the following conditions are satisfied.

- Ambient temperature : 23°C ± 5°C
- Automatic tuning mode is selected.
- Q < 100.
- Voltage at HIGH inductor terminal (resonant voltage : can be monitored at *V* monitor area) is 100 mV – 1 V_{rms}
- SHORT correction has been performed.
- OFFSET L/C/R functions have been performed.

Incremental Q Measurement Error of SMD Test Fixture	±10%

Residual Parameters of the SMD Test Fixture

The following table lists typical residual values of the SMD test fixture. The measurement error due to these residual parameters can be corrected by entering these values as offset L,C, and R values.

Parameter	Value
Residual Inductance	100.0 nH
Residual Resistance	Refer to Figure 1-2 shown below. $4 + 4f_m + 21\sqrt{f_m}$ [mΩ][1] gives good approximate value of the residual resistance. This approximation is useful when remotely control the HP 42851A.
Stray Capacitance	4.80 pF

1 f_m : measurement frequency [MHz]

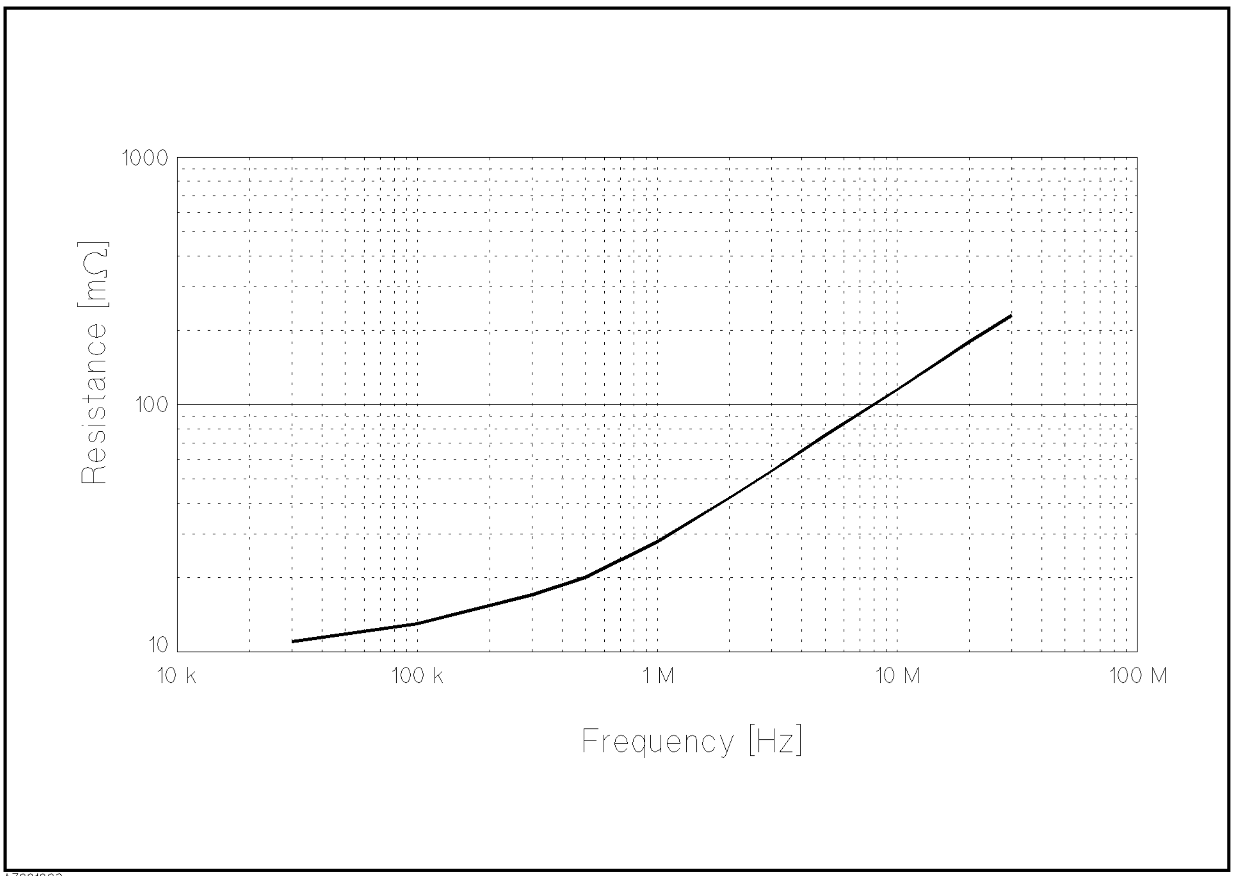


Figure 1-2. Series Resistance of SMD Test Fixture

Maintenance

Be careful not to contaminate the surface of the insulator (white Teflon® plate) around the binding post measurement terminals. Contamination may deteriorate the insulation performance and, produce measurement errors. If contaminated, clean it using a dry clean cloth or a cloth moistened with isopropyl alcohol.

2

Installation

Introduction

This chapter contains the information necessary for receiving, performing an incoming inspection, preparing for use, and setting up your HP 42851A.

The **Warning**s, **Caution**s, and **Note**s given throughout this document must be carefully followed to ensure the operator's safety and to maintain the HP 42851A's serviceability.

Incoming Inspection

Warning

To avoid hazardous electrical shock, do not turn on the HP 42851A when there are signs of shipping damage to any portion of the outer enclosure (for example, covers, panel, or display)

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the HP 42851A has been checked mechanically and electrically. The contents of the shipment should be as listed in Table 2-1. If the contents are incomplete, if there is mechanical damage or defect, or if the analyzer does not pass the power-on selftests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

Table 2-1. HP 42851A Contents

Description	Qty.	HP Part Number
HP 42851A		
Shorting Bar	1	42851-00607
Accessory Interface Cable	1	42841-61640
Power cable[1]	1	—
Operation Manual	1	42851-90010
Maintenance Manual	1	42851-90030
Option 001 Add Test Fixture		
SMD Test Fixture	1	42851-61100
Option 915 Add Service Manual		
Service Manual	1	42851-90031

1 Power Cable depends on where the instrument is used, see Figure 2-2.

Preparation for Use

Equipment Required

To perform precision Q measurement, the following equipment are required.

- HP 4285A Precision LCR Meter with Option 002
- HP 42851A Precision Q Adapter
- HP 10503A BNC Coaxial Cable (2 ea.)

Power Requirements

The HP 42851A requires a power source of 100, 120, 220, 240 VAC±10%, 47 Hz to 66 Hz, single phase; power consumption is 100 VA, maximum.

Line Voltage and Fuse Selection

Figure 2-1 illustrates the line voltage selection switch and fuseholder on the instrument's rear panel.

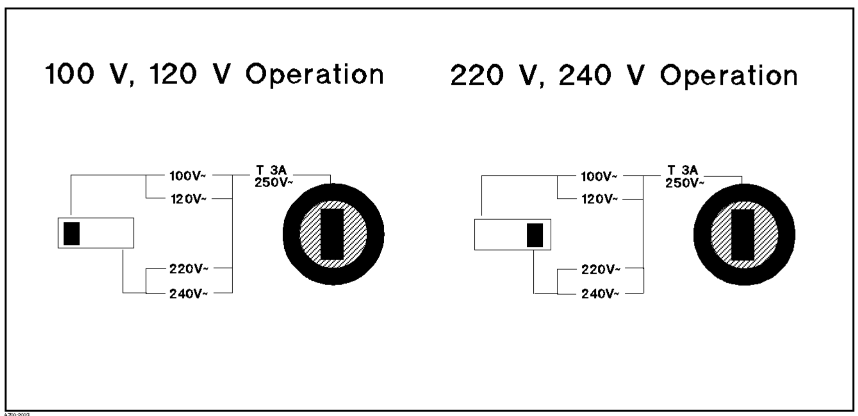


Figure 2-1. Line Voltage Selector

Caution

Before connecting the instrument to the power source, make sure that the correct fuse has been installed and the Line Voltage Selection Switch is correctly set.

Line Voltage Selection

Select the proper voltage selector according to the Table 2-2.

Table 2-2. Line Voltage Selection

Voltage Selector	Line Voltage/Frequency
100 V, 120 V	90–132 V, 47–66 Hz
220 V, 240 V	198–264 V, 47–66 Hz

⚠ Fuse Selection

Select proper fuse according to the Table 2-3. Current ratings for the fuse are printed under the fuseholder on the rear panel, and are listed, along with the fuse's HP part number, in Table 2-3.

Table 2-3. Fuse Selection

Operating Voltage	Fuse Rating/Type	Fuse Part Number
100 V 120 V 220 V 240 V	3 A, 250 V_{ac} UL/CSA type Time delay	2110-0381

If you need this fuse, contact your nearest Hewlett-Packard sales and service office.

To remove the fuse, turn the fuse holder counterclockwise until the fuse pops out.

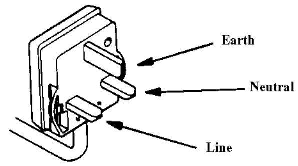
Power Cord

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame. The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 2-2 for the part numbers of the power cables available.

Warning

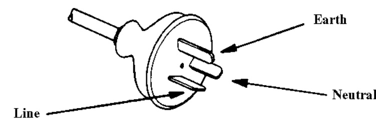
For protection from electrical shock, the power cable ground must not be defeated. The power plug must be plugged into an outlet that provides a protective earth ground connection.

OPTION 900 — United Kingdom



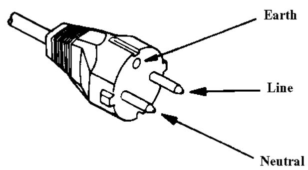
Plug : BS 1363A, 250V
Cable : HP 8120-1351

OPTION 901 — Australia / New Zealand



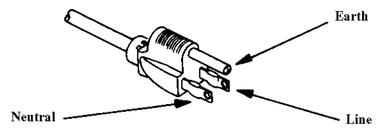
Plug : NZSS 198/AS C112, 250V
Cable : HP 8120-1369

OPTION 902 — European Continent



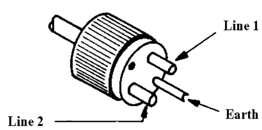
Plug : CEE-VII, 250V
Cable : HP 8120-1689

OPTION 903 — U.S. / Canada



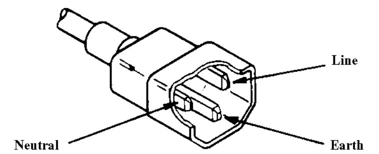
Plug : NEMA 5-15P, 125V, 15A
Cable : HP 8120-1378

OPTION 904 — U.S. / Canada



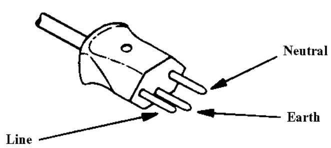
Plug : NEMA 6-15P, 250V, 15A
Cable : HP 8120-0698

OPTION 905* — Any country



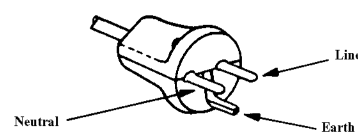
Plug : CEE 22-VI, 250V
Cable : HP 8123-1396

OPTION 906 — Switzerland



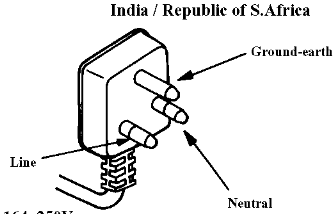
Plug : SEV 1011.1959-24507 Type 12, 250V
Cable : HP 8120-2104

OPTION 912 — Denmark



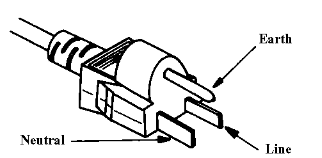
Plug : DHCR 107, 220V
Cable : HP 8120-2956

OPTION 917 — India / Republic of S.Africa



Plug : SABS 164, 250V
Cable : HP 8120-4211

OPTION 918 — Japan



Plug : JIS C 8303, 125V, 15A
Cable : HP 8120-4753

NOTE: Each option number includes a 'family' of cords and connectors of varoius materials and plug body configurations (straight, 90° etc.).

* Plug option 905 is frequently used for interconnecting system components and peripherals.

Figure 2-2. Power Cords Supplied

Ventilation Requirements

To ensure adequate ventilation, make sure that there is adequate clearance of at least 180 mm behind, 60 mm sides, 200 mm above and 15 mm below.

Instruction for Cleaning

For cleaning, wipe with soft cloth that is soaked with water and wrung tightly without undue pressure.

Power Requirements

HP 42851A requires a following poer source:

Voltage : 90 to 132 V_{ac}, 198 to 264 V_{ac}

Frequency : 47 to 63 Hz

Power : 400 VA maximum

Interconnecting the Units

Use the following procedure to connect the cables between the HP 4285A and the HP 42851A as shown in Figure 2-3.

1. Connect the *UNKNOWN* terminals of the HP 4285A and the *TO UNKNOWN* terminals of the HP 42851A using two HP 10503A BNC coaxial cables.
2. Connect the *ACCESSORY CONTROL INTERFACE* connector of the HP 4285A and the *CONTROL INPUT* connector of the HP 42851A using the furnished accessory control interface cable.

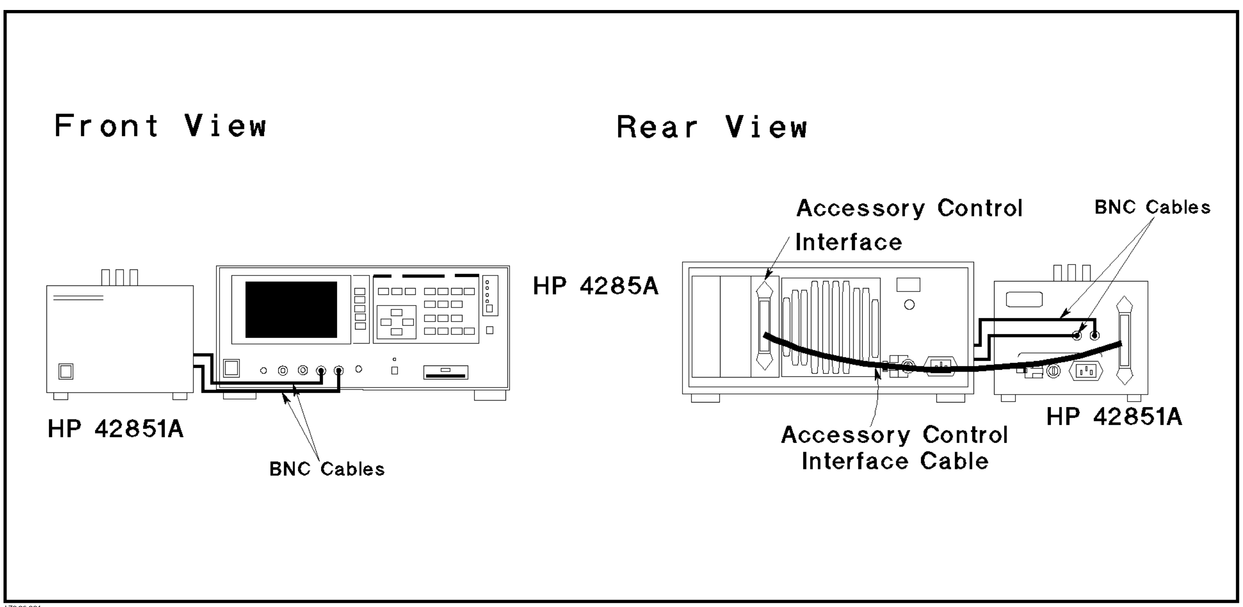


Figure 2-3. Q Measurement System Configuration

Connecting HP 4285A, HP 42841A, and HP 42851A

The HP 42841A and the HP 42851A use the same accessory control interface, and both of them can be connected to an HP 4285A. However, the HP 4285A can control either the HP 42841A or HP 42851A depending on the *CONFIG* field setting on the *SYSTEM CONFIG* page.

Equipment Required

The following equipment are required.

- HP 4285A Precision LCR Meter with Option 002
- HP 42841A Bias Current Source
- HP 42842C Bias Current Test Fixture
- HP 42851A Precision Q Adapter
- HP 16048A Test Leads
- HP 10503A BNC Coaxial Cable (2 ea.)

Interconnecting Cables

Connect the cables between the HP 4285A, the HP 42841A, and the HP 42851A as shown in Figure 2-4 using the following procedure.

1. Connect the *ACCESSORY CONTROL INTERFACE* connector of the HP 4285A and the *BIAS CONTROL INPUT A* connector of the HP 42841A using the furnished accessory control interface cable.
2. Connect the *BIAS CONTROL INPUT B* connector of the HP 42841A and the *CONTROL INPUT* connector of the HP 42851A using the furnished accessory control interface cable.
3. When you perform a high DC current bias measurement, connect the *UNKNOWN* terminals of the HP 4285A and the *TO UNKNOWN* terminals of the HP 42842C using the HP 16048A test leads.

   When you perform a precision Q measurement, connect the *UNKNOWN* terminals of the HP 4285A and the *TO UNKNOWN* terminals of the HP 42851A using two HP 10503A BNC coaxial cables.

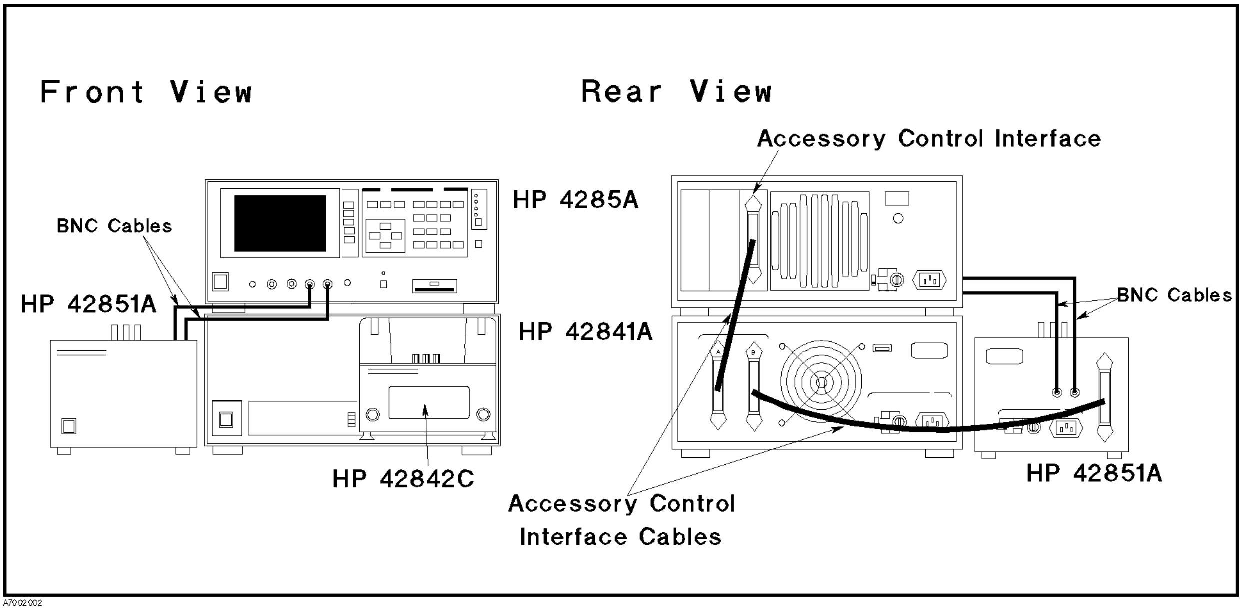


Figure 2-4. Chaining the HP 42841A and the HP 42851A

Operation Environment

The HP 42851A must be operated within the following environmental conditions, and sufficient space must be kept behind the HP 42851A to avoid obstructing the air flow of the cooling fans.

Temperature:	0°C to 55°C
Humidity:	$\leq$ 95% RH (at 40°C)
Altitude:	0 to 2,000 meters

Note

The HP 42851A must be protected from temperature extremes which could cause condensation within the instrument. Condensation may produce measuremnet errors. If condensationed, place the HP 42851A unit in a day environment until it is completely dried.

Storage and Repacking

This section describes the environment for storing or shipping the HP 42851A, and how to repackage the HP 42851A for shipment when necessary.

Environment

The HP 42851A should be stored in a clean, dry environment. The following environmental limitations apply for both storage and shipment.

Temperature:	−40 °C to 70 °C
Humidity:	≤ 90 % RH (at 65 °C)
Altitude:	0 to 2,000 meters

To prevent condensation from taking place on the inside of the HP 42851A, protect the instrument against temperature extremes.

Original Packaging

Containers and packing materials identical to those used in factory packaging are available through your closest Hewlett-Packard sales office. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the service required, the return address, the model number, and the full serial number. Mark the container *FRAGILE* to help ensure careful handling. In any correspondence, refer to the instrument by model number and its full serial number.

Other Packaging

The following general instructions should be used when repacking with commercially available materials:

1. Wrap the HP 42851A in heavy paper or plastic. When shipping to a Hewlett-Packard sales office or service center, attach a tag indicating the service required, return address, model number, and the full serial number.
2. Use a strong shipping container. A double-walled carton made of at least 350 pound test material is adequate.
3. Use enough shock absorbing material (3 to 4 inch layer) around all sides of the instrument to provide a firm cushion and to prevent movement inside the container.
4. Securely seal the shipping container.
5. Mark the shipping container *FRAGILE* to help ensure careful handling.
6. In any correspondence, refer to the HP 42851A by model number and by its full serial number.

3

Overview

Introduction

This chapter provides the information you will need to know before operating the Hewlett-Packard Model 42851A Precision Q Adapter with the HP 4285A Precision LCR Meter. Before using the HP 42851A, read through this chapter so you can quickly and efficiently learn the HP 42851A's operation.

Product Introduction

The HP 42851A Precision Q adapter combined with the HP 4285A with Option 002 accessory control interface realizes stable high Q measurement using the resonant measurement method and an automated tuning operation.

The HP 42851A is used for evaluating LCR components and materials over a wide range of frequencies (75 kHz to 30 MHz) and test signal levels (5 mV to 2 V_{rms}).

The HP 42851A measures L-Q with a basic accuracy of ± 5% (Q : supplemental performance characteristics) with maximum five digit resolution. With its built-in comparator, the HP 42851A can output comparison/decision results for sorting components into a maximum of ten bins via the handler interface (option) of the HP 4285A. By using the handler interface of the HP 4285A, the HP 42851A can easily be combined with a component handler and system controller to fully automate component testing, sorting, and quality control data acquisition and processing.

The HP 4285A's list sweep function permits entry of up to ten frequencies or test signal levels to be automatically measured.

The HP 42851A can be remotely controlled via the HP-IB interface which is equipped standard with the HP 4285A, and can be used to build an automatic test system to completely characterize new components and materials, and to fully automate production line testing.

Front Panel Description

Figure 3-1 shows the brief description of each key on the front panel of the HP 42851A and the HP 4285A.

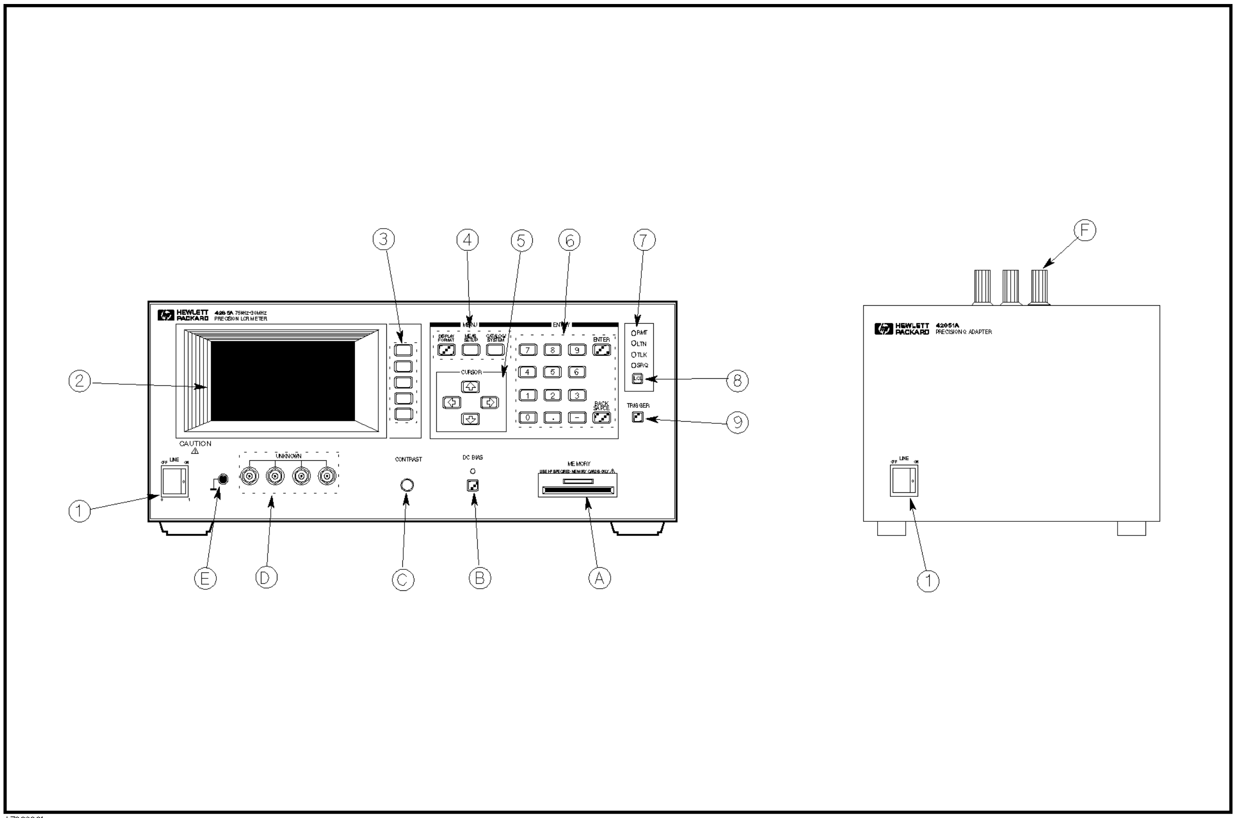


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Figure 3-1. Front Panel Overview

① LINE On/Off

Power on/off switch. In the ON position all operating voltages are applied to the instrument. In the OFF position NO operating voltages are applied to the instrument.

② LCD Panel

The Liquid Crystal Display (LCD) displays measurement results, test conditions, softkey labels, and other information.

③ SOFTKEYs

Five softkeys are used to select control and parameter functions. Each softkey has a softkey label along its left side.

④ MENU Keys

Menu selection keys. There are three menu keys, (DISPLAY FORMAT), (MEAS SETUP), and (CATALOG/SYSTEM). The menu keys are used to access the corresponding selection of instrument functions.

DRAFT
1/12/99 18:18

⑤ CURSOR Keys

The CURSOR arrow keys are used to move the field select cursor from field to field on the LCD display page. When the cursor is moved to a field, the field changes to an inverse video image of the original field. The cursor can only be moved to a field, it can't be moved into a monitor area.

⑥ ENTRY Keys

The ENTRY keys are used to enter numeric data into the HP 4285A. The ENTRY keys are composed of the digits [0] to [9], a period [.], a minus sign [-], [ENTER], and [BACK SPACE] keys. [ENTER] terminates numeric input data and enters the displayed value on the Input line (second line from the bottom of the LCD screen). [BACK SPACE] deletes one last character of the input value.

⑦ HP-IB Status Indicator

The HP-IB status indicators consist of the RMT (remote), TLK (talk), LTN (listen), and SRQ (service request) indicators. These indicators are used to show the HP 4285's HP-IB status when it is interfaced to a controller via HP-IB.

⑧ [LCL] Key

The Local (LCL) key returns the HP 4285A to local (front-panel) operation from the remote (computer controlled) operation state unless a Local Lockout command has been invoked from the computer. [LCL] is the only front-panel key activated while the HP 4285A is in the REMOTE state.

⑨ [TRIGGER] Key

This key is used to manually trigger the HP 4285A when it is set to the Manual Trigger mode.

Ⓐ MEMORY Card Slot and UNLOCK Button

The MEMORY card slot is where you insert a memory card. The UNLOCK button is used to eject a memory card.

Ⓑ [DC BIAS] Key

[DC BIAS] is used to enable or to disable the DC bias output in the normal LCR measurement mode. This key is not effective in the precision Q measurement mode.

Ⓒ CONTRAST Control Knob

This knob is used to adjust the LCD's CONTRAST.

Ⓓ UNKNOWN Terminals

Two of the four BNC terminals are used to connect the HP 42851A to the HP 4285A. Connect the H_C and H_P terminals to the HP 42851A's TO UNKNOWN terminals with two BNC-BNC cables.

Ⓔ GUARD Terminal

This Terminal is tied to the instrument's chassis and can be used for measurements that require guarding.

Ⓕ Measurement Terminals

These binding post terminals are used to connect the Device Under Test (DUT) and the various measurement aid accessories. A simplified terminal circuit schematic is illustrated on the top panel label.

Rear Panel Description

Figure 3-2 gives a brief description of the HP 4285A's and HP 42851A's rear panel.

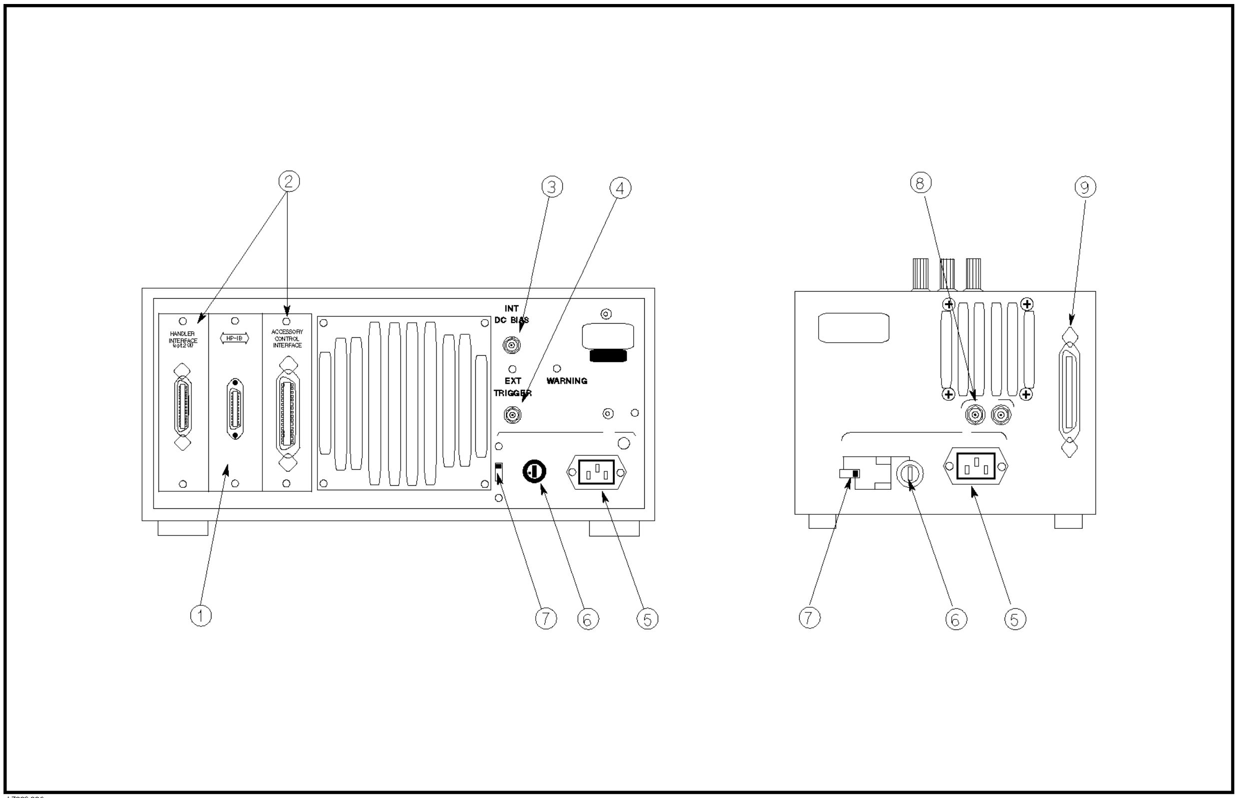


Figure 3-2. Rear Panel Overview

① HP-IB Interface Connector

The HP-IB interface connector allows interfacing with a controller and other HP-IB instruments.

② Interface Connectors

When interface options are installed, the interface connectors will be installed as shown in Figure 3-2. When the HP 4285A is not equipped with an interface option, blank covers are installed. For use with the HP 42851A, the Accessory Control Interface (HP 4285A Option 002) must be installed.

③ INT DC BIAS MONITOR Connector

This connector is not usable in the precision Q measurement mode.

④ EXT TRIGGER Connector

The HP 4285A combined with the HP 42851A is triggered by inputting a TTL active low to high going edge trigger pulse. The external trigger from this connector is only effective while the trigger mode is set to EXTernal. The trigger mode can be changed in the *Q MEAS SETUP* page.

⑤ ~LINE Input Receptacle

AC power cord receptacle.

⑥ ~LINE Fuse Holder

Fuse holder for the HP 4285A's line fuse. Refer to "⚠ Fuse Selection" in Chapter 2 to determine the correct line fuse rating.

⑦ ~LINE VOLTAGE SELECTOR

The switch used to match the HP 4285A to the AC operating voltage being used. Refer to "Line Voltage Selection" in Chapter 2 to determine the correct operating voltage.

⑧ TO UNKNOWN Terminals

These terminals are used to connect to the HP 4285A *UNKNOWN* terminals with two BNC-BNC cables.

⑨ CONTROL Input

This connector is used to connect to the HP 4285A Accessory Control Interface with the accessory control interface cable.

Display

The following paragraphs define the display areas and fields, and describes the LCD's display pages.

Display Area Definition

The HP 4285A uses a 40 character 16 line Liquid Crystal Display (LCD), and the display area on the LCD is divided into the blocks as shown in Figure 3-3.

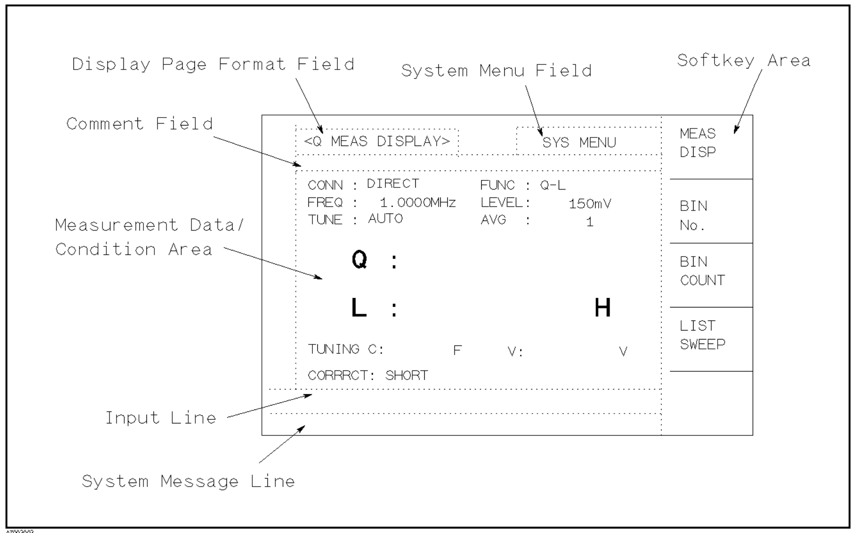


Figure 3-3. Display Area Definition

Display Page Format Field

This area identifies the current page displayed. The currently selected page name is displayed in this area enclosed in angle brackets.

System Menu Field

The system menu field is always displayed on the upper right corner of all pages (except for the *SELF TEST* page and the *CABLE CORRECTION* page). When the CURSOR is on the *SYS MENU* field, functions which are not displayed on the display pages (for example, STORE/LOAD, print, key lock, fixing decimal point, bin count, system reset, and clear page setup functions) are available.

Comment Field

The comment field is used to display comment messages. Alpha-numeric comment can be entered by moving the CURSOR to the *comment* field and pressing `COM-MENT` on the *Q MEAS SETUP* page. Up to 30 characters can be entered on the comment line. This comment line is stored to the internal non-volatile memory or external memory card with the instrument control settings when `STORE` is pressed in the *SYS MENU* field. The comment line area is displayed on the following pages.

- *Q MEAS DISPLAY*
- *Q BIN No. DISPLAY*

- *Q LIST SWEEP DISPLAY*
- *Q MEAS SETUP*
- *Q LIST SWEEP SETUP*
- *SYSTEM CONFIG*

The comment can be entered via HP-IB using the `DISPlay:LINE` command.

Softkey Area

The last six character positions of each line are reserved for softkey labels. The softkeys displayed correspond to the field at the cursor's position on the LCD.

Measurement Data/Conditions Area

This area is where measurement results and measurement conditions are displayed.

Note

Under certain conditions one of the following messages may be displayed instead of the measurement result.

"`UNBAL`": This message is displayed when the impedance of the device exceeds the range of the analog measurement circuit's capability.

"`ADC ERR`": This message is displayed when the A/D converter in the measurement circuit is not functioning.

"`------`": The "overflow" message is displayed when the analog measurement circuit can measure the device, but the data format used will not hold the calculated results.

"`INFINITY`": This message is displayed when an attempt is made to divide by zero during parameter calculation. For example, if you set the Δ % measurement function without setting the reference value, this message will be displayed.

"`Warning, Cannot find resonance`":
It is impossible to measure because the turning capacitor cannot resonate with the device under test (DUT) under the current operating conditions. Change the measurement frequency higher or lower, or change the measurement connection (DIRECT, SERIES, or PARALLEL) so that the measurement circuit satisfies the resonant equation ($\omega L = 1/\omega C$). Also, check if the DUT is properly connected to the HIGH and LOW terminals.

"`Waiting for trigger`":
Measurement has not yet been initiated. Press the TRIGGER key on the HP 4285A front panel, or change the TRIG field on the Q MEAS SETUP page to INT. If the TRIG field is set to EXT, check if a proper triggering signal is applied. Refer to Figure 5-10 for information on the triggering signal.

Input Line Area

This area is the input line where numeric input data entered using the front panel keys is displayed.

System Message Area

This area is where system messages, comments, and error messages are displayed.

MENU Keys and Display Page

The HP 4285A combined with the HP 42851A has three MENU keys which are used to define the LCD display pages.

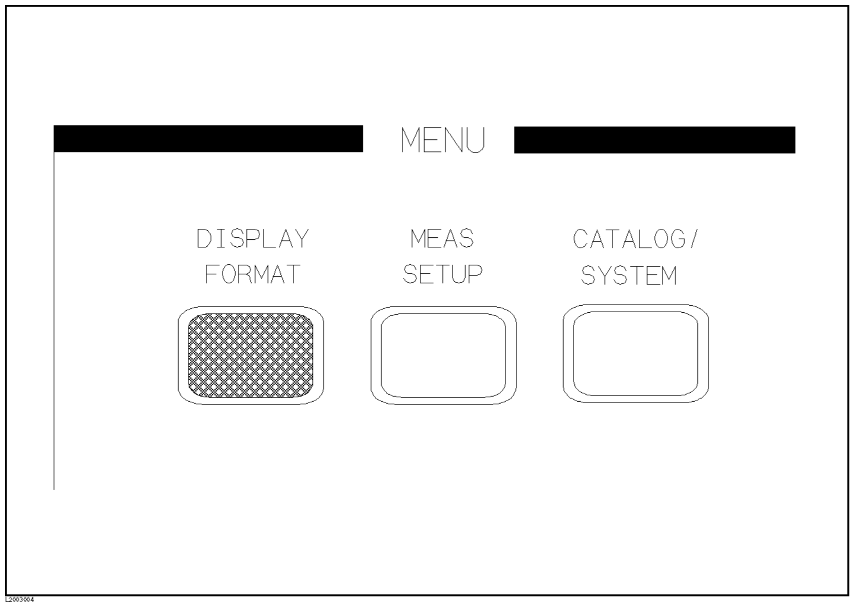


Figure 3-4. MENU keys

Each MENU key has four display pages as follows.

DISPLAY FORMAT

This MENU key provides access to the following four pages.

- *Q MEAS DISPLAY*
- *Q BIN No. DISPLAY*
- *Q BIN COUNT DISPLAY*
- *Q LIST SWEEP DISPLAY*

These display pages are used for displaying measurement and sorting results. Some controls for each display page can be set from the display page. Only from the above display pages can the HP 42851A combined with the HP 4285A measure a DUT. When DISPLAY FORMAT is pressed, the *Q MEAS DISPLAY* page will be displayed on the LCD screen, and the softkeys used to select the other three pages will be displayed. The CURSOR will be positioned at the *Q MEAS DISPLAY* field. The power-on default display page is the *Q MEAS DISPLAY* page. For more information under DISPLAY FORMAT, refer to Chapter 4.

MEAS SETUP

This MENU key provides access to the following four pages.

- *Q MEAS SETUP*
- *Q CORRECTION*
- *Q LIMIT TABLE SETUP*
- *Q LIST SWEEP SETUP*

These display pages are used for setting measurement conditions (including the correction function), or setting bin sorting limits. When one of these display pages are being displayed, the HP 42851A combined with the HP 4285A stops the measurement and bin sorting judgments. (The HP 42851A combined with the HP 4285A measures the DUT and performs the bin judgments only from the display pages under DISPLAY FORMAT.) When MEAS SETUP is pressed, the *Q MEAS SETUP* page is displayed and the softkeys to select the other three pages are displayed. The cursor will be positioned at the *Q MEAS SETUP* field. For more information about MEAS SETUP, refer to "Q MEAS SETUP Page" in Chapter 5.

CATALOG/SYSTEM

This MENU key provides access to the following four pages.

- *CATALOG*
- *SYSTEM CONFIGURATION*
- *CABLE CORRECTION*
- *SELF TEST*

These display pages are used to control functions which are not related to the main measurement controls. When CATALOG/SYSTEM is pressed, the *CATALOG* page will be displayed, and the softkeys to select the other two pages are displayed. The cursor will be positioned at the *CATALOG* field. For more information about CATALOG/SYSTEM, refer to Chapter 6.

A summary for each display page will be given starting from the next paragraph.

Summary of Pages

Figure 3-5 shows all display pages. A summary of each page is described below.

Q MEAS DISPLAY (under DISPLAY FORMAT)

This display page provides the measurement result information, and some control settings are entered from this page. The HP 42851A combined with the HP 4285A measures the DUT from this page, and displays the measurement results in large size characters.

Q BIN No. DISPLAY (under DISPLAY FORMAT)

This display page provides the bin sorting result information, the measurement results, and comparator function ON/OFF settings. The HP 42851A combined with the HP 4285A measures the DUT from this page. The bin number is displayed in large characters, and the measurement results are displayed in normal size characters.

Q BIN COUNT DISPLAY (under DISPLAY FORMAT)

This display page provides the limit table's conditions, and the comparator's bin counter results. The HP 42851A combined with the HP 4285A can measure the DUT from this page, but the measurement results will not be displayed.

Q LIST SWEEP DISPLAY (under DISPLAY FORMAT)

This display page provides the list sweep measurement results, and selection of the sweep mode (step/sequence). The HP 42851A combined with the HP 4285A measures the DUT according to the list sweep conditions in the *Q LIST SWEEP SETUP* page. An asterisk (*) shows the current measuring point in the list sweep points. The list sweep point cannot be set from this page. You must use the *Q LIST SWEEP SETUP* (in MEAS SETUP) page to set the list sweep points.

Q MEAS SETUP (under MEAS SETUP)

This display page provides all of the measurement control settings and offset functions. The HP 4285A halts the measurement when in this page. Some control settings also can be changed in the display page under DISPLAY FORMAT menu.

Q CORRECTION (under MEAS SETUP)

This display page provides the correction function. The correction function should be used to measure the DUT accurately. interpolated SHORT correction, and spot SHORT/LOAD correction are available in this page.

Q LIMIT TABLE SETUP (under MEAS SETUP)

This display page provides the limit table settings for bin sorting. The HP 42851A combined with the HP 4285A don't perform measurement from this page. To see the comparison results, either the *Q BIN No. DISPLAY* page (under DISPLAY FORMAT menu) or the *Q BIN COUNT DISPLAY* page (under DISPLAY FORMAT menu) should be used.

Q LIST SWEEP SETUP (under [MEAS SETUP])

This display page provides the control settings for the List Sweep measurement function. The HP 42851A combined with the HP 4285A don't measure the DUT from this page. To measure the DUT using the list sweep function, the *Q LIST SWEEP DISPLAY* page (under [DISPLAY FORMAT]) should be used.

CATALOG (under [CATALOG/SYSTEM])

This display page provides a list of the stored setups in the internal memory or the memory card.

SYSTEM CONFIG (under [CATALOG/SYSTEM])

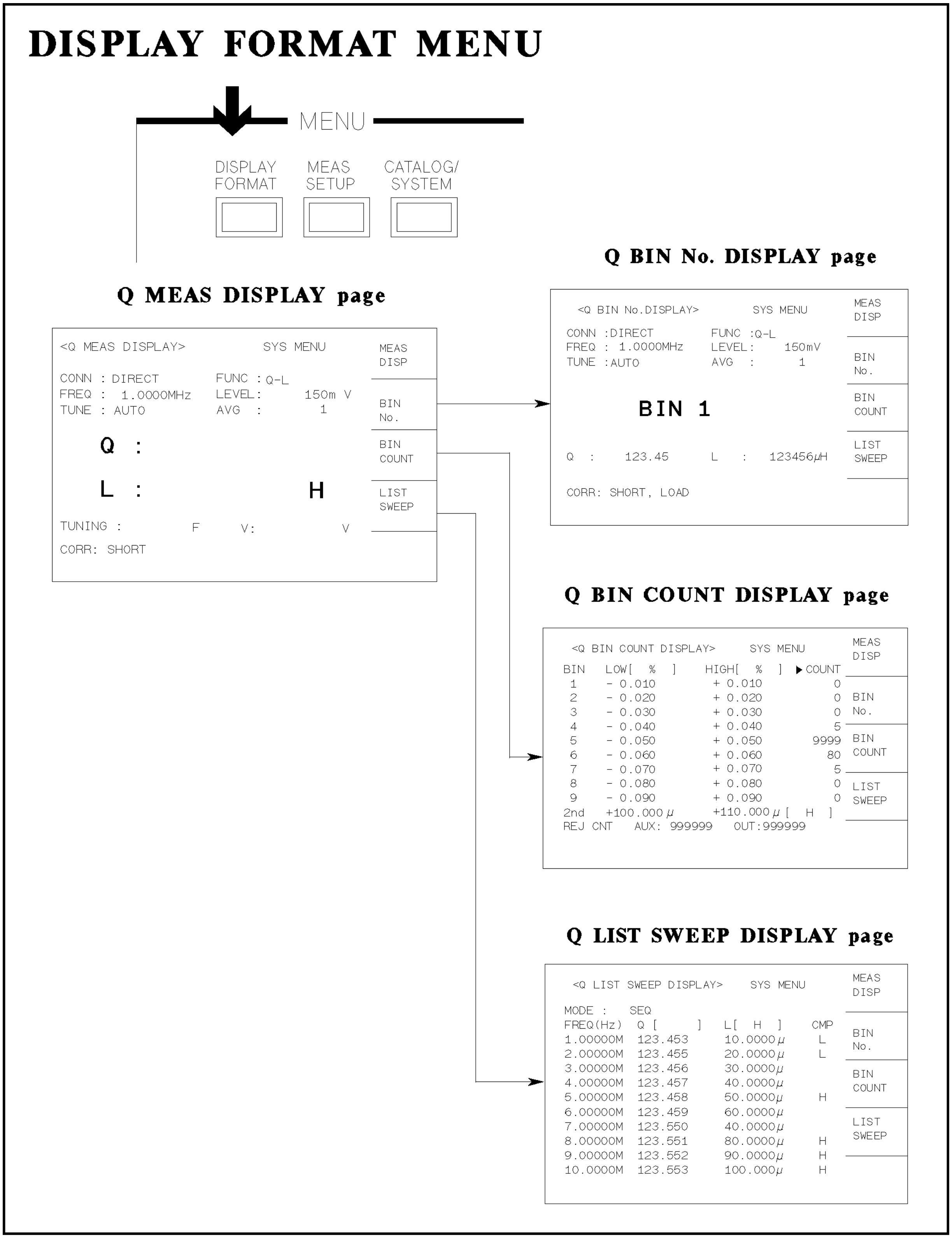
This display page enables operation of either the HP-IB interface or the HP 4285A's optional interfaces. Also, installed options are listed on this page. Precision Q measurement mode, normal LCR measurement mode, and high current bias measurement mode are selectable in this page.

CABLE CORRECTION (under [CATALOG/SYSTEM])

This display page provides the cable correction data measurement procedure to adopt the HP 4285A to your HP 16048A/D test leads. For details, refer to the *HP 4285A Operation Manual* (HP Part Number 04285-90000). This page is effective in normal LCR measurement mode only. Further operation will cause error `E75:Illegal Accessory config`.

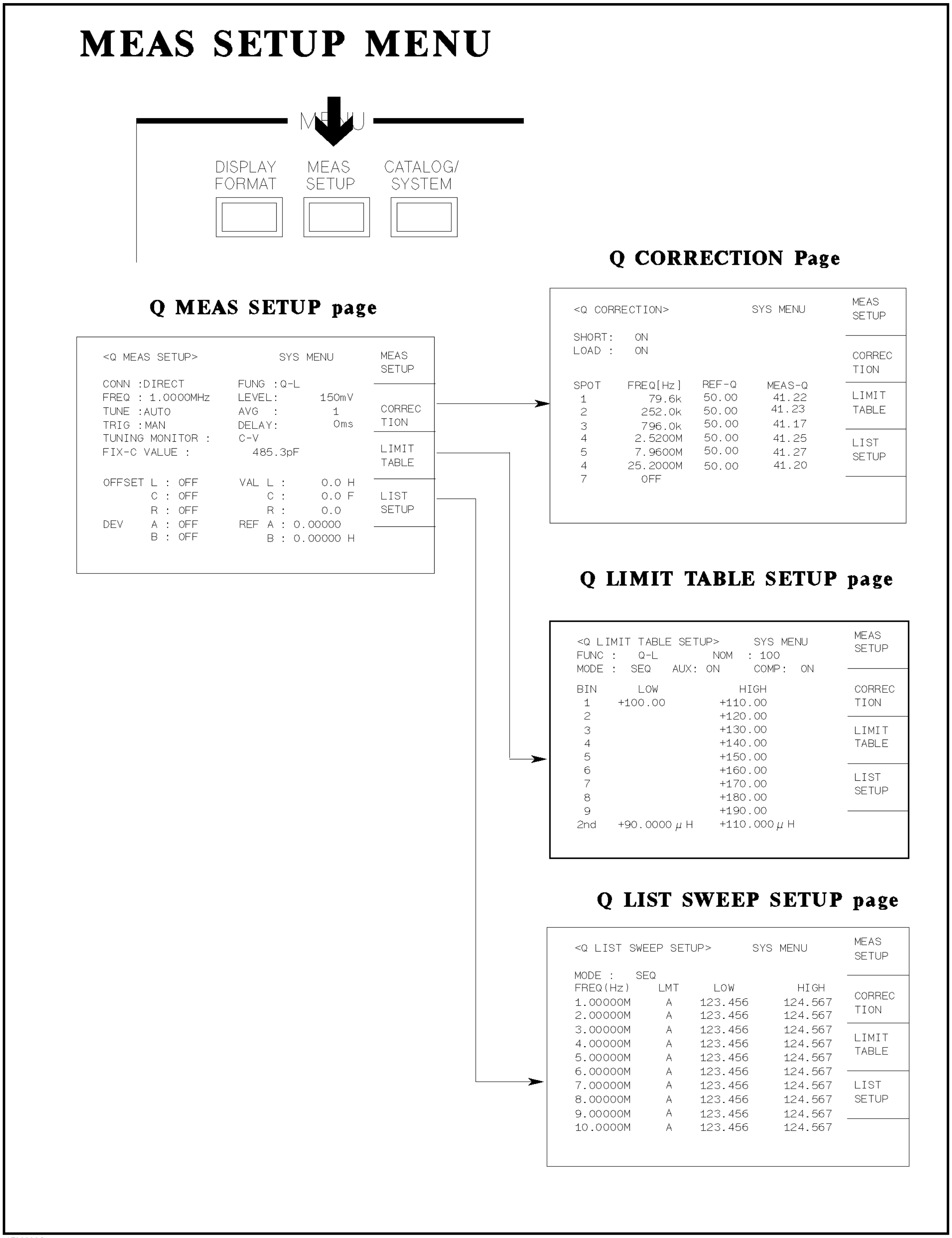
SELF TEST (under [CATALOG/SYSTEM])

This display page provides the HP 4285A's and HP 42851A's service functions.



A7003005

Figure 3-5. Display Pages (1/3)



A7003006

Figure 3-5. Display Pages (2/3)

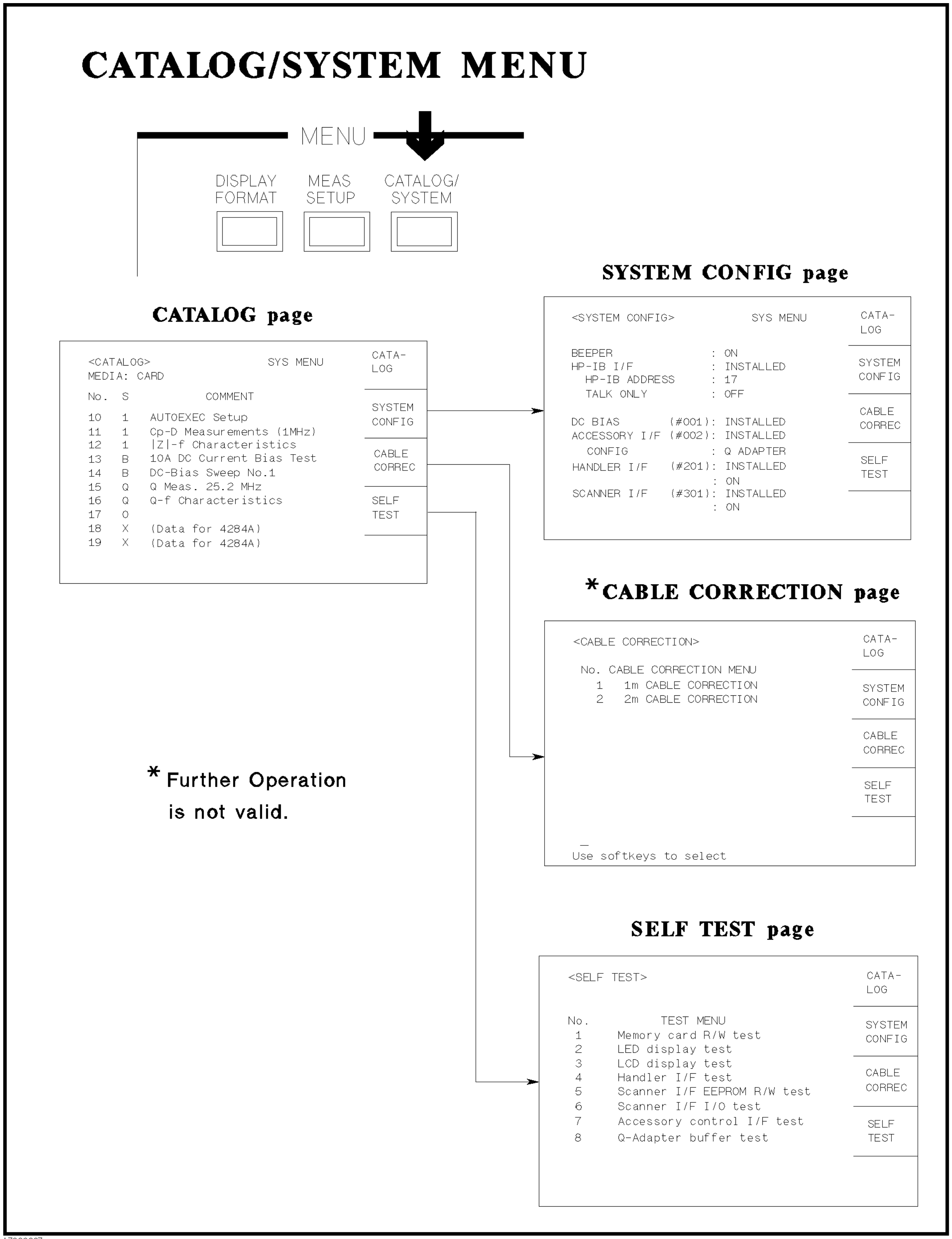


Figure 3-5. Display Pages (3/3)

Basic Operation

Basic operation of the HP 4285A is described in the following paragraphs.

1. Display the desired display page using the MENU keys and the softkeys. (Refer to Figure 3-5.)
2. Move the CURSOR to the field to be used using the CURSOR keys. The cursor will be an inverse video marker, and the field is an area at which you can set the CURSOR. (Refer to Figure 3-6.)

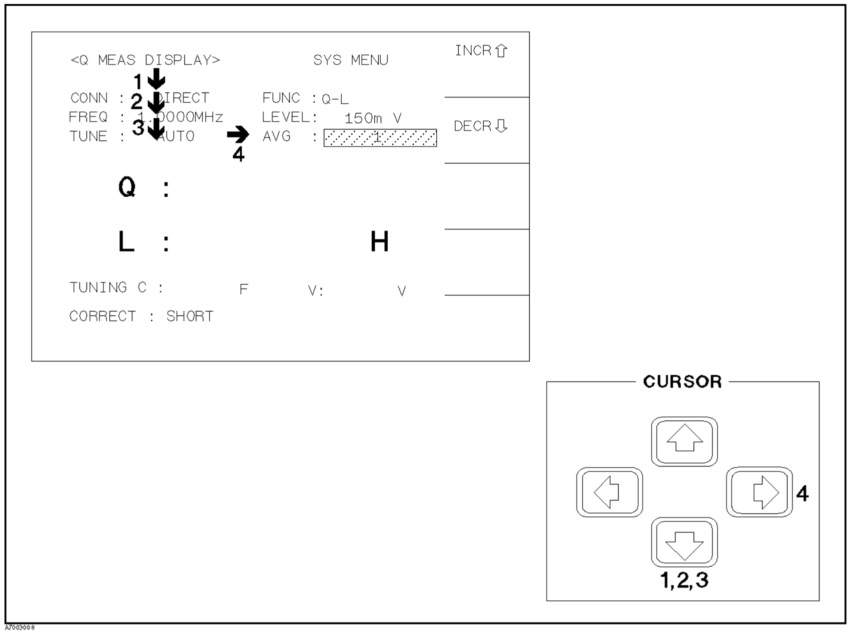


Figure 3-6. CURSOR Keys and Field Operation Example

3. The softkeys corresponding to the field pointed to by the CURSOR will be displayed. Select and press a softkey. (Refer to Figure 3-7.)

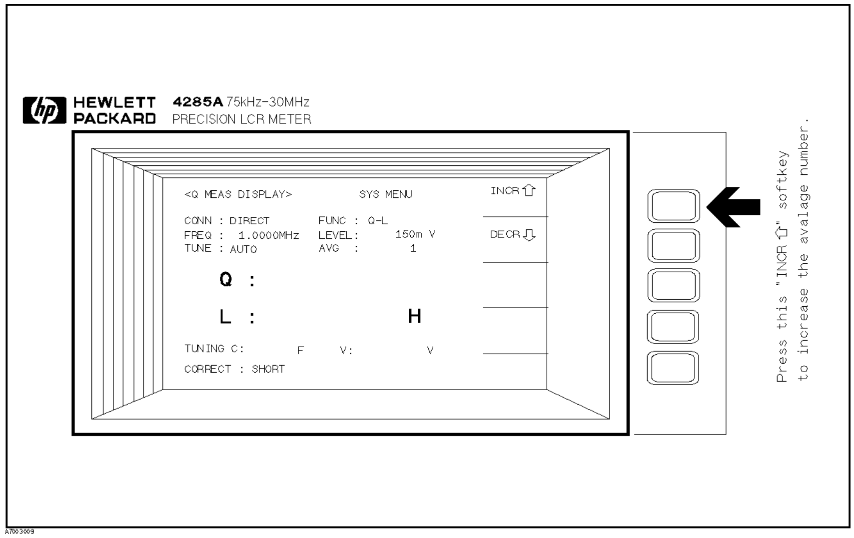


Figure 3-7. Softkey Selection Example

Note

The numeric entry keys and ENTER are used to enter numeric data. When one of the numeric entry keys is pressed, the softkeys will change to the available unit softkeys. You can use these unit softkeys instead of ENTER. When ENTER is used, the numeric data is entered with Hz, V, or A as the default unit depending on the cursor field selected, for example, the test frequency's unit will be Hz, etc.

4

DISPLAY FORMAT Menu

Introduction

The following four display pages are available under (DISPLAY FORMAT).

- Q MEAS DISPLAY
- Q BIN No. DISPLAY
- Q BIN COUNT DISPLAY
- Q LIST SWEEP DISPLAY

When the connection mode is set to SERIES or PARALLEL, only the *Q MEAS DISPLAY* page is available.

This chapter describes the functions on each page.

Note

For Q measurement using the HP 42851A, make sure that the HP 4285A is set to the precision Q measurement mode. To set this mode, goto the *SYSTEM CONFIG* page under (CATALOG/SYSTEM), and change *ACCESSORY I/F (#002)* field to Q ADAPTER.

Q MEAS DISPLAY Page

When you press (DISPLAY FORMAT), the *Q MEAS DISPLAY* page will be displayed. On the *Q MEAS DISPLAY* page, the measurement results are displayed in large characters, and the following measurement controls can be set. (The field in parenthesis is used to set the control function.)

- Display Page Format and HELP Page (<*Q MEAS DISPLAY*>)
- LOAD/STORE (*SYS MENU*)
- Decimal Point Fix (*SYS MENU*)
- Printout (*SYS MENU*)
- Key Lock Operation (*SYS MENU*)
- Selection of Connection Method (*CONN*)
- Selection of Displayed Impedance Parameters (*FUNC*)
- Test Frequency (*FREQ*)
- Oscillator Level (*LEVEL*)
- Tuning Method (*TUNE*)
- Averaging Rate (*AVG*)

The above fields except for the System Menu (*SYS MENU*) and Display Page Format (<*Q MEAS DISPLAY*>) are the same as the fields on the *Q MEAS SETUP* page. These fields are not described in this chapter, the other fields on the *Q MEAS DISPLAY* page are described in the following paragraphs.

The *Q MEAS DISPLAY* page also provides the following information in monitor areas on the displayed page.

—When the DIRECT connection mode is selected—

- Tuning Capacitance and Resonant Voltage or Current (*TUNING C* and *V/I*)
- SHORT, LOAD on/off setting (*CORRECT*)

These conditions can be set from the *Q MEAS SETUP* page or *Q CORRECTION* page. (For tuning capacitance and resonant voltage/current monitor value, refer to "Q MEAS SETUP Page" in Chapter 5 and for SHORT, LOAD correction setting, refer to "Q CORRECTION Page" in Chapter 5.)

—When the SERIES or PARALLEL connection mode is selected—

- Quality factor and tuning capacitance of measurement 1
- Quality factor and tuning capacitance of measuremnet 2

These are supplemental information for calculating the measurement result.

The available fields and the softkeys which correspond to the fields on this page are shown in Figure 4-1 and Figure 4-2 respectively.

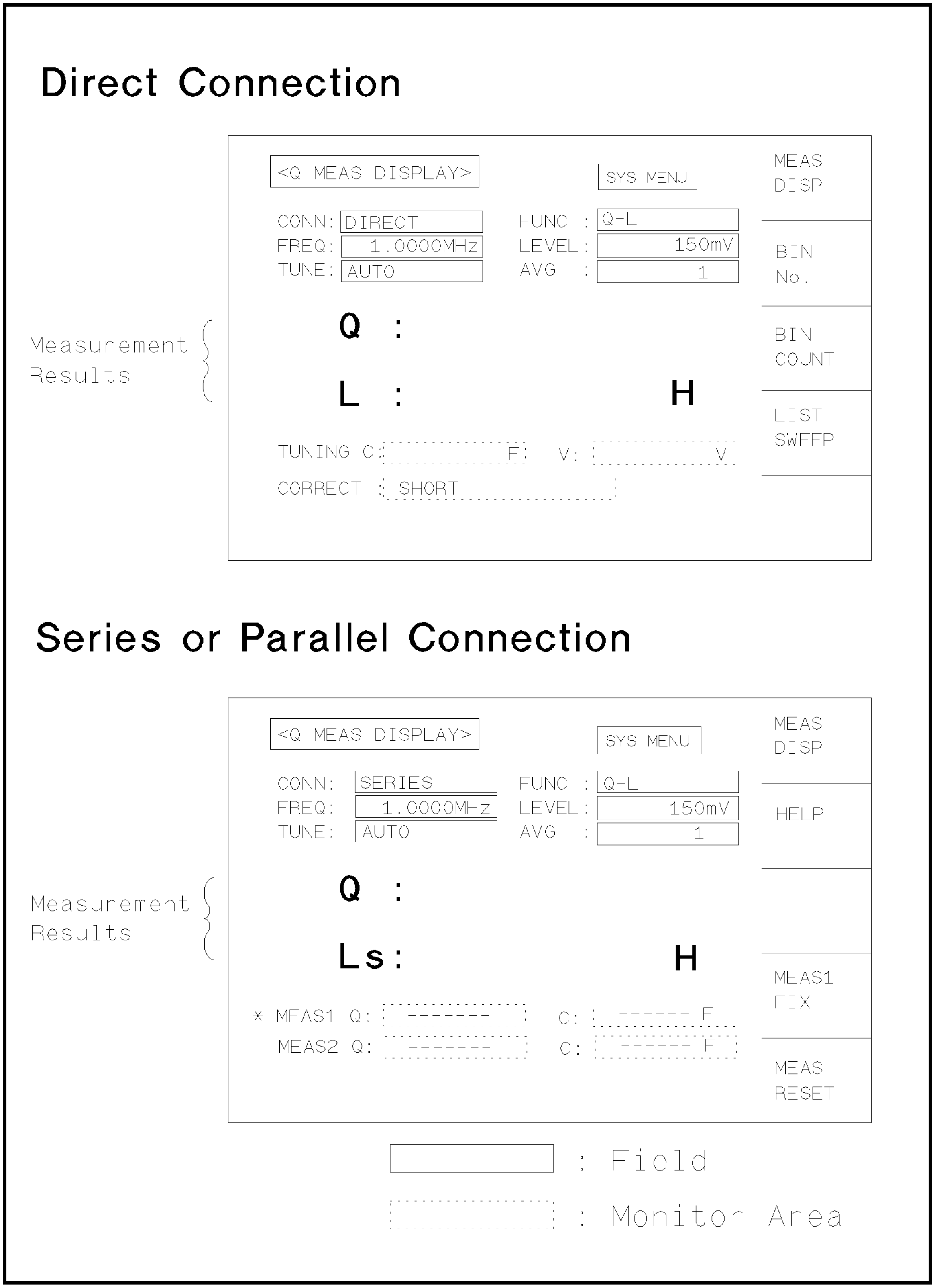


Figure 4-1. Available Fields on the Q MEAS DISPLAY Page

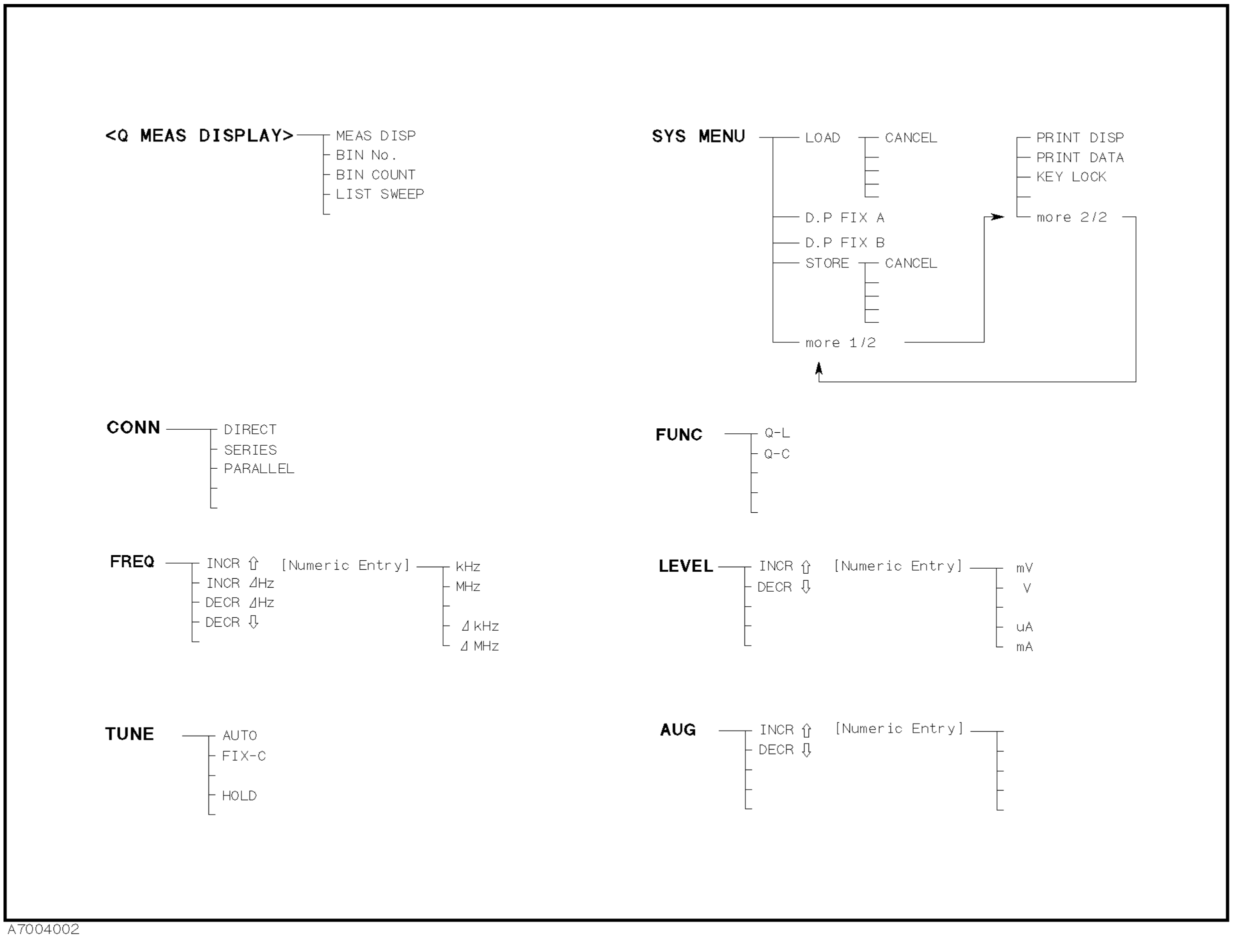


Figure 4-2. Available Softkeys on the Q MEAS DISPLAY Page

<Q MEAS DISPLAY> Field

Display page format allows you to choose the following page formats.

—When the DIRECT connection mode is selected—

- *MEAS DISP* page
- *BIN No.* page
- *BIN COUNT* page
- *LIST SWEEP* page

—When the SERIES or PARALLEL connection mode is selected—

- *MEAS DISP* page

Further information of each display page format is described lator in this chapter.

CONNection Field

There are three connection ways: DIRECT, SERIES, and PARALLEL. In this field, connection for Q measurement can be selected using the following softkeys. The operating procedure for each connection follows.

DIRECT Softkey

Most all inductors can be measured by using the direct connection. The operation procedure for the direct connection is simple. Connect the DUT to the HIGH and LOW inductor terminals of the HP 42851A. The HP 42851A will automatically control the tuning capacitor to display the Q measurement result.

Note

If the measurement result is not displayed on the LCD display, the trigger mode may be set to MANUAL. To restart the measurement, press the TRIGGER on the front panel or go to the *Q MEAS SETUP* page to change the TRIG mode to INTernal.

If UNBAL is displayed instead of data, the measured impedance may be not suitable for the currently set measurement conditions. Try changing the measurement frequency or check if the DUT is properly connected between the HIGH and LOW inductor terminals as shown in Figure 4-3.

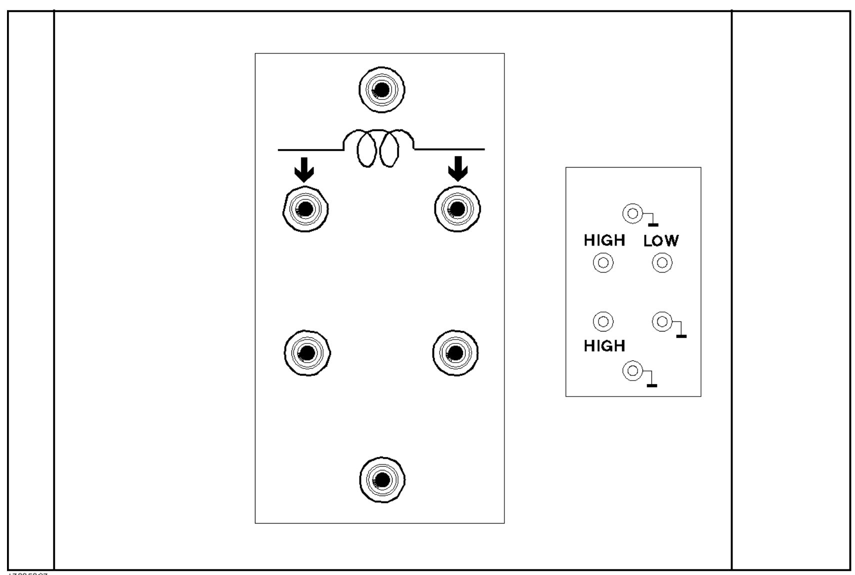


Figure 4-3. Direct Connection

SERIES Softkey

A series connection is suitable for measuring low impedance devices such as low value inductors and high value capacitors. For series connection use the following procedure.

1. Connect the reference inductor between the HIGH and LOW inductor terminals. If the HP 16014A Series Loss Test Adapter is available, connect as shown in Figure 4-4. The DUT should be shorted using the shorting strap on the HP 16014A.

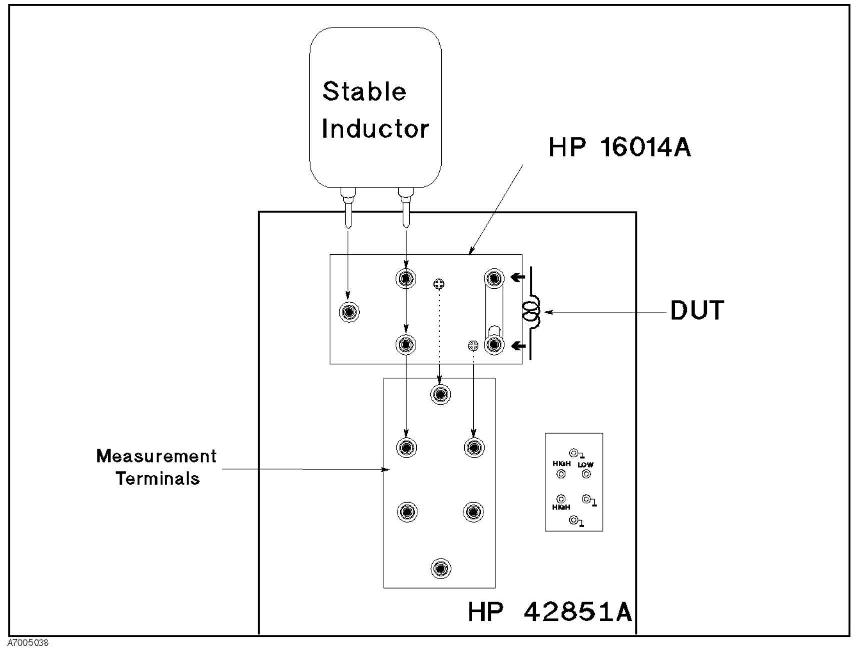


Figure 4-4. Series Connection

2. Press the (TRIGGER) on the front panel. This is for the reference measurement. Measured Q value and tuning capacitance value are displayed as MEAS1.
3. Connect the DUT in series with the reference inductor. On the HP 16014A, simply remove the shorting strap.
4. Press the (TRIGGER) again. The HP 4285A automatically calculates Q-L (or Q-C) values. The raw measurement data used for calculation is given as MEAS2.

After step 4, pressing the (TRIGGER) will restart from the reference measurement. For repetitive measurement, use MEAS1 FIX so as to not change the reference value. After MEAS1 is fixed, pressing the (TRIGGER) will update only MEAS2 and the calculated values.

PARALLEL Softkey

A parallel connection is suitable for measuring high impedance devices such as low value capacitors and high value inductors. For parallel connection, use the following procedure.

1. Connect the reference inductor between the HIGH and LOW inductor terminals.
2. Press the (TRIGGER) on the front panel. This is for the reference measurement. The measured Q value and the tuning capacitance value are displayed as MEAS1.
3. Connect the DUT between the HIGH and G terminals as shown in Figure 4-5. The DUT is in parallel with the tuning capacitor.

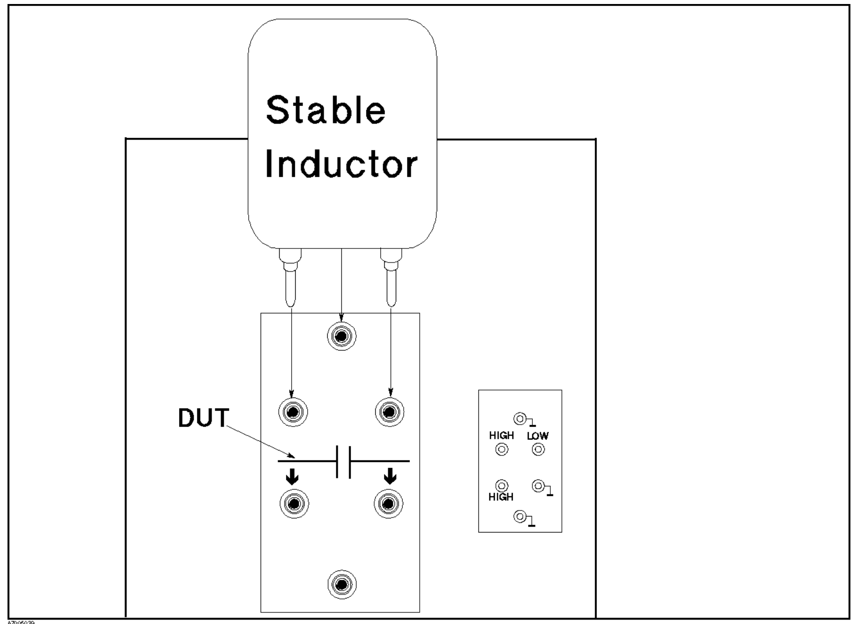


Figure 4-5. Parallel Connection

4. Press the [TRIGGER] again. The HP 4285A automatically calculates Q-C (or Q-L) values. The raw measurement data used for calculation is given as MEAS2.

After step 4, pressing the [TRIGGER] will restart from the reference measurement. For repetitive measurement, use `MEAS1 FIX` so as to not change the reference value. After MEAS1 is fixed, pressing the [TRIGGER] will update only MEAS2 and calculated values.

The following softkeys are available when the SERIES or PARALLEL connection is selected and when the cursor is at the *<Q MEAS DISPLAY>* field.

`HELP` Softkey

This softkey displays operation procedure for SERIES or PARALLEL connection. Press [MEAS DISP] to return to the *Q MEAS DISPLAY* page.

`MEAS1 FIX` Softkey

In the SERIES or PARALLEL connection mode, measurement result is calculated from difference of two measurements, with DUT and without DUT. However, when you measure a lot of same nomial value DUTs, same measurement 1 processes are redundant. `MEAS1 FIX` eliminates these troublesome operations.

Note

In the following cases the fixed measurement 1 is automatically cleared.

- When the CONNection method is changed.
- When the display page format is changed.

MEAS1 RESET Softkey

When you want to change the fixed *MEAS1* value, this softkey clears the fixed measurement 1 operation.

SYS MENU Field

The system menu allows you to perform the following functions.

- Load/Store
- Set decimal fixed point
- Printout
- Key lock

This paragraph describes each function.

LOAD/STORE Softkeys

The HP 4285A can store and load the instrument setups to and from its non-volatile memories: the internal memory and an external memory card. A combination of instrument control settings is stored in the memory as one record, and 10 records each are available for the internal or external memory. The following data will be stored in the memory for the record fields of each record.

- Control settings on *Q MEAS SETUP* page.
  - Connection Method
  - Measurement Function
  - Test Frequency
  - Oscillator Level
  - Tuning Method
  - Averaging Rate
  - Trigger Mode
  - Trigger Delay Time
  - Tuning Value Monitor Mode
  - Fixed Capacitance Value
  - Offset L/C/R Mode
  - Offset L/C/R Values
  - Deviation Measurement A/B (ΔABS/Δ%/OFF) Selection
  - Deviation Measurement A/B Reference Value
- Control settings on the *Q LIMIT TABLE* page.
  - Swap Parameter
  - Nominal Value
  - Limit Mode for the Primary Parameter
  - Auxiliary Bin ON/OFF Selection
  - Comparator Function ON/OFF Selection
  - Low/High Limit values for Each Bin and for secondary parameter
- Control setting on the *Q BIN COUNT DISPLAY* page.
  - Bin Count Function ON/OFF Selection
- Control settings on the *Q LIST SWEEP SETUP* page.
  - Sweep Mode
  - Sweep Parameter
  - All Sweep Points
  - All Low/High Limit values including the limit mode (A, B, or OFF)

- Comment Line
- Display page format

When the HP 4285A is turned on with the memory card inserted, the HP 4285A's Auto Load function will load the control settings stored in record number 10. If there are no control settings stored in record number 10, the power-on default settings will be used.

Note

The following items are not stored by the LOAD/STORE function. They are stored in the different area of internal memory when the function concerned has changed.

- Control settings on the *Q CORRECTION* page.
  - □ SHORT, LOAD correction ON/OFF selection
  - □ Interpolated SHORT correction data for all test frequencies.
  - □ SHORT, LOAD correction data for SPOT 1 to SPOT 7. (SHORT correction data at each frequency, and LOAD correction reference data and measurement data at each frequency.)
- Control settings on the *SYSTEM CONFIG* page.
  - □ Beeper ON/OFF
  - □ HP-IB address
  - □ Talk Only ON/OFF
  - □ Accessory control I/F configuration
  - □ Handler I/F ON/OFF
  - □ Scanner I/F ON/OFF

Storing the Control Settings

Perform the following steps to store the control settings to memory.

1. Move the CURSOR to the *SYS MENU* field.
2. If you want to store the data to the memory card, insert a memory card in the memory card slot until it locks into place.
3. Press `STORE`. The message `Enter record number to STORE` will be displayed on the system message line.
4. Enter a record number using the numeric entry keys and [ENTER] to store the current control settings. Use 0 to 9 for internal memory, and 10 to 19 for a memory card.

Loading the Control Settings

Perform the following steps to load the control settings from the internal non-volatile memory or from an external memory card.

1. Move the CURSOR to the *SYS MENU* field.
2. If you want to load the data from the memory card, insert the memory card into the MEMORY card slot.
3. Press `LOAD`. The message `Enter record number to LOAD` will be displayed on the system message line.
4. Enter the record number you want to load using the numeric entry keys and [ENTER].

D.P. FIX A/D.P.FIX B Softkeys

The HP 4285A displays the measurement data using a six digit floating point display format. These softkeys display the measurement data using a fixed point display format. These softkeys can be used to change the number of displayed digits.

Setting the Fixed Decimal Point Funciton

Perform the following steps to use the fixed decimal point function.

1. Move the CURSOR to the *SYS MENU* field.
2. Press D.P. FIX A to fix the decimal point for the primary parameter's data. The ▲ mark will be displayed at the decimal fixed point. Each time D.P. FIX A is pressed, the displayed value shifts by one digit to the right and the least significant digit is turned off. The displayed value is rounded off.
3. D.P. FIX B works for the secondary parameters' data and works the same as D.P. FIX A

Note

In the following cases the fixed decimal point function is automatically disabled.

- When the measurement function is changed.
- When a deviation measurement (which is set on the *Q MEAS SETUP* page) is performed, or the deviation measurement function (ΔABS, Δ%, and OFF) is changed.

PRINT DISP/PRINT DATA Softkeys

The HP 4285A's printer function is used to make a hardcopy of the displayed information (except for the softkey labels) or the measurement results without the need of an external controller. The HP 4285A must be set to the HP-IB talk only mode, and the printer must be set to the HP-IB listen only mode. There are two print modes: the PRINT DISPLAY mode and the PRINT DATA mode.

- PRINT DISPLAY mode

  The print display mode is used to print out all information on the displayed page by sending ASCII character strings to the printer. An example is shown below.

```
<QMEAS DISPLAY>         SYS MENU

CONN: DIRECT     FUNC : Q-L
FREQ:  4.0000MHZ LEVEL:    150mV
TUNE: AUTO       AVG  :      1

    Q   :       3 9 . 5 5


    L   :   1 0 . 4 0 3 8 u H

TUNING C:   152.2pF  V:  122.7mV
CORRECT :  SHORT
```

Figure 4-6. Q MEAS DISPLAY Page Printout Example

Note

The following characters are not recognized by the printer, so the character in brackets to the right of the character will be printed instead.

$\Delta \longrightarrow$ [d]
$\mu \longrightarrow$ [u]
▶ $\longrightarrow$ [>]
FIX $\longrightarrow$ [F]

- PRINT DATA mode

  The print data mode is used to print out the measurement results using the following format. This format is the same as the ASCII format used for data transfer via HP-IB. For details, refer to "ASCII Data Format" in Chapter 8.

  <DATA A>,<DATA B>,<STATUS>,<BIN No.><CR><LF>

  Where,

<DATA A>	The measurement results of the primary parameter (Q). 12 ASCII characters (SN.NNNNNESNN)
<DATA B>	The measurement results of the secondary parameter (L, L_s, L_p, C_s, C_p). 12 ASCII characters (SN.NNNNNESNN)
<STATUS>	0 : Normal measurement. 1 : Tuning is incomplete. 2 : A/D converter doesn't work.
<BIN No.>	0 : OUT OF BINS 1 : BIN 1 2 : BIN 2

3 : BIN 3

⋮

8 : BIN 8
9 : BIN 9
10: AUX BIN

Note

BIN number data is valid only when the comparator function is set to ON. When the comparator function is set to OFF, the BIN number data isn't output as shown below.

<DATA A>,<DATA B>,<STATUS><CR><LF>

In the talk only mode, the HP 4285A waits for the completion of the handshake before starting the next measurement. So the measurement cycle of the HP 4285A depends on the printer's speed.

When the <STATUS> is 1 or 2 the measurement data is `9.9E37`. When the <STATUS> is 0, the actual measurement data are output.

Dumping the LCD Screen to the Printer

Use the PRINT DISP mode and perform the following steps to print out all of information on the display page except for the softkey labels.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the listen only mode.
3. On the *SYSTEM CONFIG* page, set the talk only mode to ON.
4. Press the *Q DISPLAY FORMAT* to display the *Q MEAS DISPLAY* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP`.

Printing out the Measurement

Use the PRINT DATA mode and perform the following steps to print out the measurement results on the printer.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the listen only mode.
3. On the *SYSTEM CONFIG* page, set the talk only mode to ON.
4. Press (DISPLAY FORMAT) to display the *Q MEAS DISPLAY* page.
5. Move the CURSOR to the *SYS MENU*.
6. Press `more 1/2`.
7. Press `PRINT DATA`. The marker will appear at the side of `PRINT DATA`. The measurement results are sent to the printer on subsequent measurements.

KEY LOCK Softkey

The HP 4285A has keyboard lock-out capability that disables all front panel operation except for the power LINE switch, CONTRAST knob, (TRIGGER), and KEYLOCK. This is useful when you don't want the control settings changed.

Locking Out the Front Panel

Perform the following steps to disable all front panel operation on the *Q MEAS DISPLAY* page.

1. Move the CURSOR to the *SYS MENU* field.
2. Press more 1/2.
3. Press KEY LOCK (which is a toggled softkey). The icon of the key will be displayed on the left side of KEY LOCK, and the `Keys locked` message will be displayed on the system message line.
4. Press KEY LOCK again, when you want to re-enable all front panel keys again.

Q BIN No. DISPLAY Page

When you press DISPLAY FORMAT and BIN No., the *Q BIN No. DISPLAY* page will be displayed. The bin sorting results are displayed in large characters and the measurement results are displayed in normal size characters on the data area. The following measurement controls can be set from the *Q BIN No. DISPLAY* page. (The field in parenthesis is used when this control is set.)

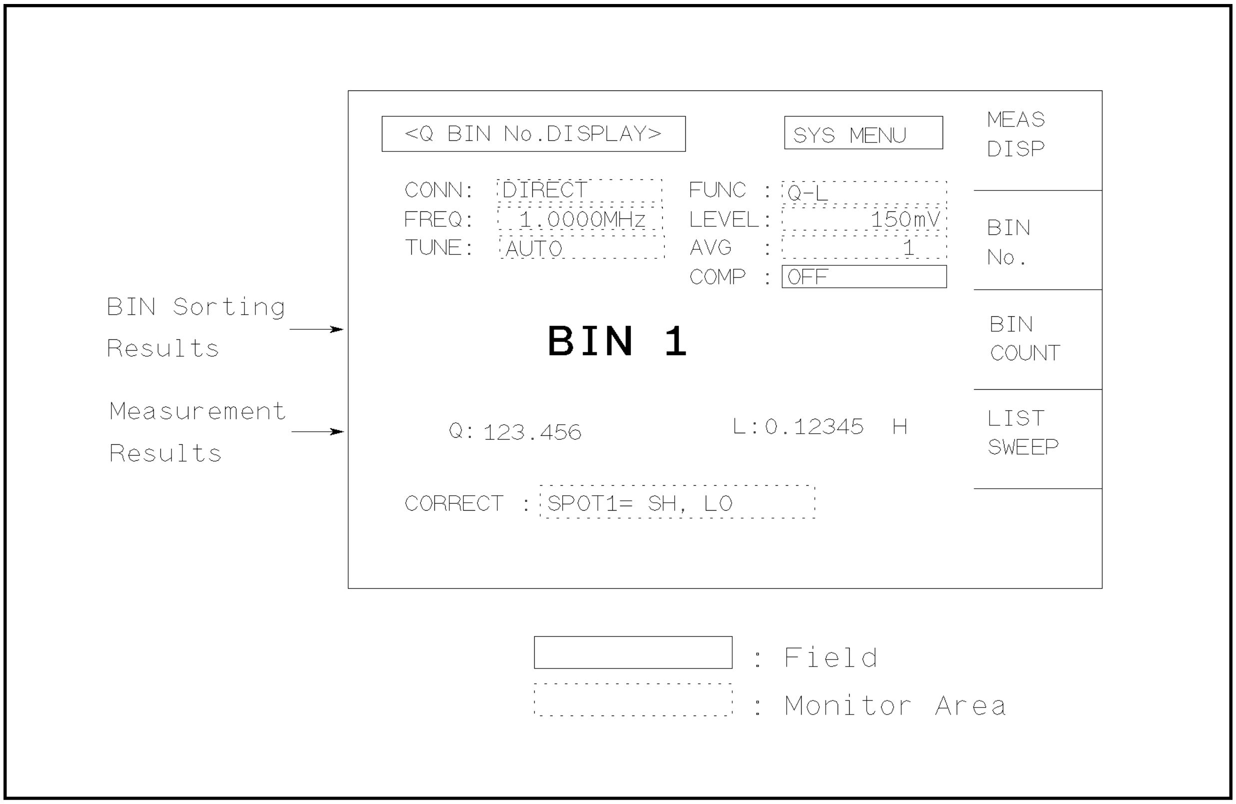
- LOAD/STORE (*SYS MENU*)
- Printout (*SYS MENU*)
- Key Lock (*SYS MENU*)
- Comparator Function ON/OFF Selection (*COMP*)

The *Q BIN No. DISPLAY* page also provides the following information in the monitor areas (a monitor area looks like a field, but it is not).

- Connection Method (*CONN*)
- Selection of Displayed Impedance Parameters (*FUNC*)
- Test Frequency (*FREQ*)
- Oscillator Level (*LEVEL*)
- Tuning Method (*TUNE*)
- Averaging Rate (*AVG*)

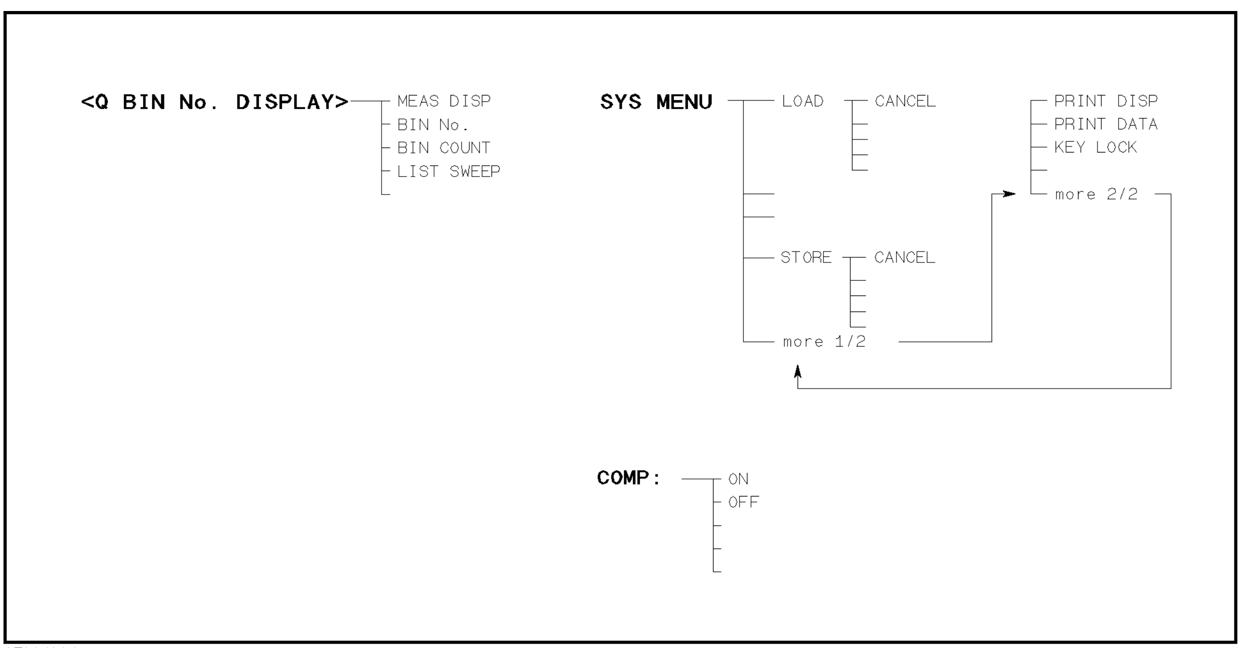
These conditions can be set from the *Q MEAS SETUP* page and the *Q MEAS DISPLAY* page.

The available fields and the softkeys which correspond to the fields on this page are shown in Figure 4-7 and Figure 4-8.



A7004003

Figure 4-7. Available Fields on the Q BIN No. DISPLAY Page



A7004004

Figure 4-8. Available Softkeys on the Q BIN No. DISPLAY Page

SYS MENU Field

The system menu on this page allows you to use the following functions.

- LOAD/STORE
- Printout
- Keylock

These functions are the same as the functions on the system menu on the *Q MEAS DISPLAY* page (The description of each function is given in "SYS MENU Field" on page 4-10.) The procedure for each function is given in the following paragraphs.

Loading or Storing the Control Settings

Perform the following steps to store the control settings to the internal non-volatile memory or the external memory card or load the control settings from the internal non-volatile memory or the external memory card.

1. On the *Q BIN No. DISPLAY* page move the CURSOR to the *SYS MENU* field using the CURSOR arrow keys.
2. If you want to store the data to the memory card, insert a memory card in the memory card slot until it locks into place.
3. Press `STORE` when you want to use the STORE function. The message `Enter record number to STORE` will be displayed on the system message line.

   Press `LOAD` when you want to use the LOAD function. Then the `Enter record number to LOAD` will be displayed on the system message line.
4. Use the numeric entry keys and [ENTER] to enter the record number at which the current control settings will be STORED to or LOADED from.

Printing the Measurement Result

Perform the following steps to print out the displayed page or the measurement data using the PRINT DISP mode or PRINT DATA mode.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the listen only mode.
3. On the *SYSTEM CONFIG* page set the talk only mode to ON.
4. Press [DISPLAY FORMAT] and `BIN No.` to display the *Q BIN No. DISPLAY* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP` when you want to print out the displayed page. The displayed page is printed out as shown in Figure 4-9.

   Press `PRINT DATA` when you want to print out the measurement data. The marker will appear beside `PRINT DATA`. The measurement results are printed out on subsequent measurements.

```
<Q BIN No. DISPLAY>      SYS MENU

CONN: DIRECT      FUNC : Q-L
FREQ:  4.0000MHZ  LEVEL:    150mV
TUNE: AUTO        AVG  :      1
                  COMP :



         B I N   1



 Q :   39.55      L : 10.4149uH

CORRECT : SHORT
```

Figure 4-9. Q BIN No. DISPLAY Page Printout Example

Locking Out the Front Panel

Perform the following steps from the *Q BIN No. DISPLAY* page to disable all front panel operation.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `more 1/2`.
3. Press `KEY LOCK` (which is a toggled softkey). The key mark will be displayed on the left side of `KEY LOCK`, and the `Keys locked` message will be displayed on the system message line.
4. Press `KEY LOCK` again to enable all front panel keys.

COMP Field

The *COMP* field allows you to only set the comparator function to ON or OFF. The HP 4285A's built-in comparator can sort devices into a maximum of ten bins (BIN 1 to BIN 9 and the OUT OF BINS bin) using a maximum of nine pairs of primary limits. Also the secondary parameter can be sorted using one pair of secondary parameter limits. A device whose primary parameter is within limits, but whose secondary parameter measurement result is not within limits can be sorted into an AUXiliary BIN. The comparator function is especially useful when the HP 4285A is used with a component handler (with handler interface option). These limit settings for bin sorting are set only on the *Q LIMIT TABLE* page under [MEAS SETUP] (refer to the "Q LIMIT TABLE SETUP Page" in Chapter 5).

Setting the Comparator Function to ON or OFF

Perform the following steps to set the comparator function to ON or OFF.

1. Move the CURSOR to the *COMP* field. The following softkeys will be displayed.
   - `ON`

- OFF

2. Press either softkey to turn the comparator function ON or OFF.

Q BIN COUNT DISPLAY Page

When you press (DISPLAY FORMAT) and BIN COUNT, the *Q BIN COUNT DISPLAY* page will be displayed. On the *Q BIN COUNT DISPLAY* page, the comparator's count results are displayed.

- BIN Counter (*SYS MENU*)
- LOAD/STORE (*SYS MENU*)
- Printout (*SYS MENU*)
- Key lock (*SYS MENU*)

This page also provides the following information in the monitor areas (monitor areas look like fields, but they are not). These conditions can be set from the *Q LIMIT TABLE* page. (For more details on the following controls, refer to "Q MEAS SETUP Page" in Chapter 5.)

- Nominal Value
- Selection of Displayed Impedance Parameter
- Bin Sorting Low/High Limits

The available fields and the softkeys which corresponded to each field on this page are shown in Figure 4-10 and Figure 4-11.

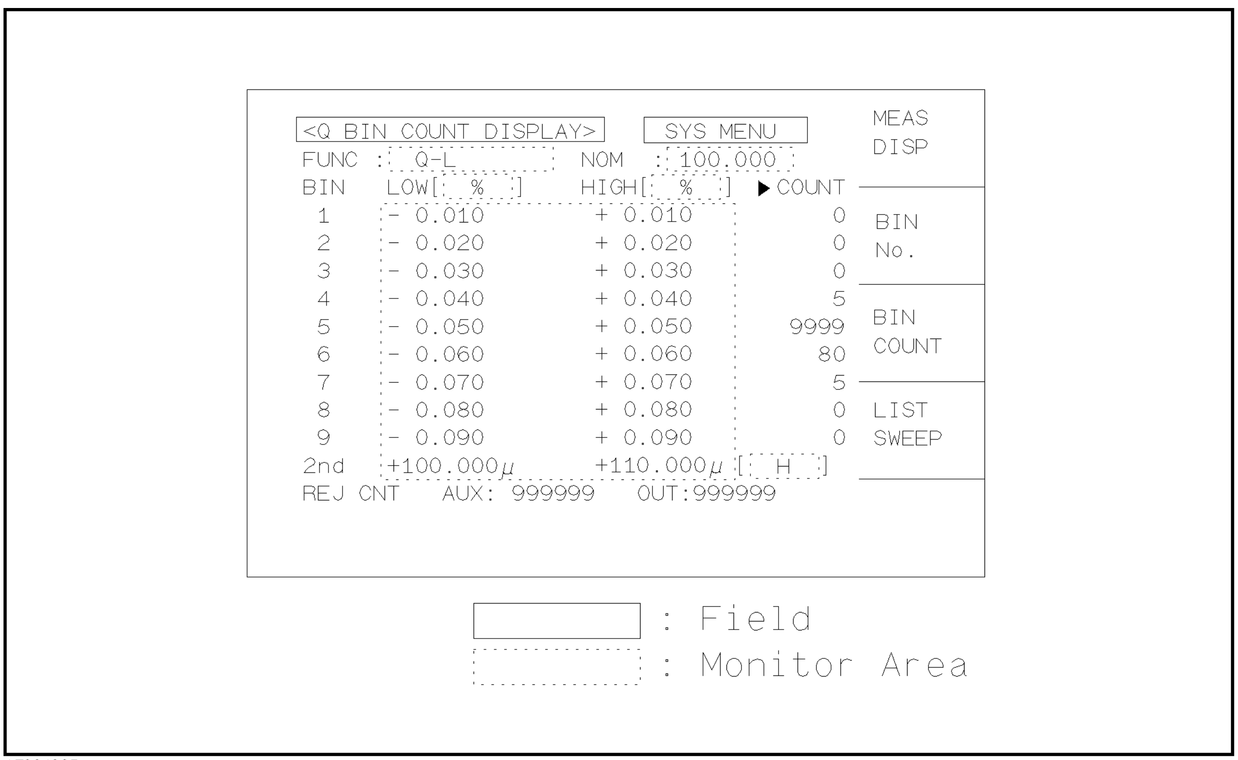


Figure 4-10. Available Fields on the Q BIN COUNT DISPLAY Page

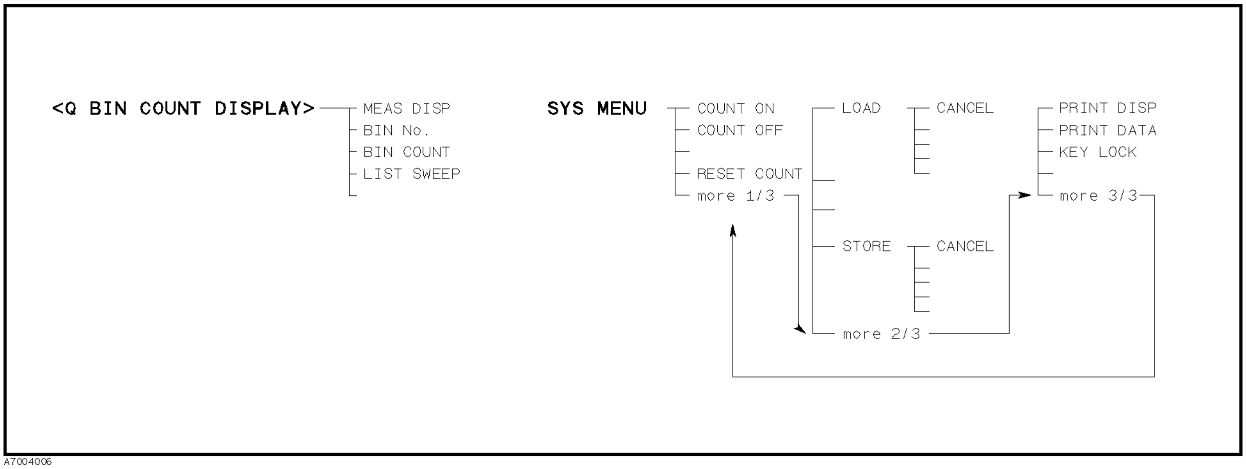


Figure 4-11. Available Softkeys on the Q BIN COUNT DISPLAY Page

SYS MENU Field

The system menu on this page allows you to perform the following functions.

- Bin Counter ON/OFF Selection
- LOAD/STORE
- Printer
- Keylock

These functions, except for the bin counter function, are the same as the functions displayed on the system menu of the *Q MEAS DISPLAY* page. (The description of each function is given in "SYS MENU Field" on page 4-10.)

COUNT ON / COUNT OFF Softkeys

The HP 4285A has bin counting capability. When the comparator function is used, the number of components sorted into each BIN is counted. The maximum count is 999999, the overflow message "----" will be displayed when this value is exceeded. In this case, the BIN counter will still be operating, and you can get the count data only via HP-IB.

Setting the Bin Counter ON or OFF

Perform the following steps to set the counter function to ON or OFF.

1. Set the COMParator to ON either on the *Q BIN No. DISPLAY* page or on the *Q LIMIT TABLE SETUP* page.
2. On the *Q BIN COUNT DISPLAY* page, move the CURSOR to *SYS MENU* field.
3. Press COUNT ON to set the counter function to ON.
4. Press COUNT OFF when you don't use the counter function. The number of count stops and the count value is retained. Counting starts from the retained count value when COUNT ON pressed again.

5. When RESET COUNT is pressed, all counts are reset to zero. The message `Resetting count. Are you sure?` will be displayed on the system message line, and softkey labels are changed to YES and NO. Press YES.

Loading or Storing the Control Settings

Perform the following steps to store the current control settings to the internal non-volatile memory or the external memory card, and to load the control settings from the internal non-volatile memory or the external memory card.

1. Move the CURSOR to the *SYS MENU* field on the *Q BIN COUNT DISPLAY* page.
2. Insert a memory card into the MEMORY card slot, if you are going to store or load the settings to or from a memory card.
3. Press more 1/3.
4. Press STORE when you want to use the STORE function. The message `Enter record number to STORE` will be displayed on the system message line. Press LOAD when you want to use the LOAD function. Then the `Enter record number to LOAD` will be displayed on the system message line.
5. Use the numeric entry keys and the [ENTER] to enter the record number at which the current control settings will be STORED to or LOADED from.

Printing the Measurement Result

Use the PRINT DISP or PRINT DATA mode and perform the following steps to print out the display page or the measurement data.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the listen only mode.
3. Set the talk only mode to ON on the *SYSTEM CONFIG* page.
4. Press [DISPLAY FORMAT] and BIN COUNT to display the *Q BIN COUNT DISPLAY* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press more 1/3 and then more 2/3.
7. Press PRINT DISP when you want to print out the displayed page. Figure 3-10 shows a sample print out of the display page.

   Press PRINT DATA when you want to print out the measurement results. The marker will appear beside PRINT DATA. The measurement results are printed out on subsequent measurements.

```
<Q BIN COUNT DISPLAY>   SYS MENU
FUNC : Q-L      NOM :   39.00
BIN  LOW [ % ]  HIGH[ % ] >COUNT
 1  - 5.000    +  5.000       71
 2  -10.000    + 10.000       15
 3  -15.000    + 15.000       11
 4  -20.000    + 20.000        3
 5                             0
 6                             0
 7                             0
 8                             0
 9                             0
2nd +10.0000u  +12.0000u [ H ]
REJ CNT  AUX: OFF    OUT: 2
```

Figure 4-12. Q BIN COUNT DISPLAY Page Printout Example

Locking Out the Front Panel

Perform the following steps to disable all front panel operations on the *Q BIN COUNT DISPLAY* page.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `more 1/3`, and `more 2/3`.
3. Press `KEY LOCK` (a toggled softkey). The key mark will be displayed on the left side of `KEY LOCK`, and the message `Keys locked` will be displayed on the system message line.
4. Press `KEY LOCK` again, if you want to enable the front panel keys.

Q LIST SWEEP DISPLAY Page

The HP 4285A's LIST SWEEP function permits entry of up to ten frequencies, signal levels, or dc bias levels, with the measurement limits. The list of values can be entered on the *Q LIST SWEEP SETUP* page under (MEAS SETUP). When you press (DISPLAY FORMAT) and LIST SWEEP, the *Q LIST SWEEP DISPLAY* page will be displayed. On the *Q LIST SWEEP DISPLAY* page, the HP 4285A automatically sweeps on the specified points and the measurement results are compared with the limit values. During a sweep, an asterisk mark (*) will appear on the left side of the current point being measured. The following measurement controls can be set from this page. (Each field in parenthesis is used when that control is set.)

- Sweep Mode of the List Sweep Measurement (*MODE*)
- LOAD/STORE (*SYS MENU*)
- Printout (*SYS MENU*)
- Keylock (*SYS MENU*)

The *Q LIST SWEEP DISPLAY* page also provides the following information in monitor areas (a monitor area looks like a field, but it is not).

- Sweep Parameter Selection (*FREQ [Hz]* or *LEVEL [V]*)
- Sweep Points Settings (*sweep points*)
- Limit Parameter Selection (*LMT*)
- Measurement Results (*Q* and *L*)
- Judgement Result (*CMP*)

The available fields and the softkeys which corresponded to each field on this page are shown in Figure 4-13 and Figure 4-14.

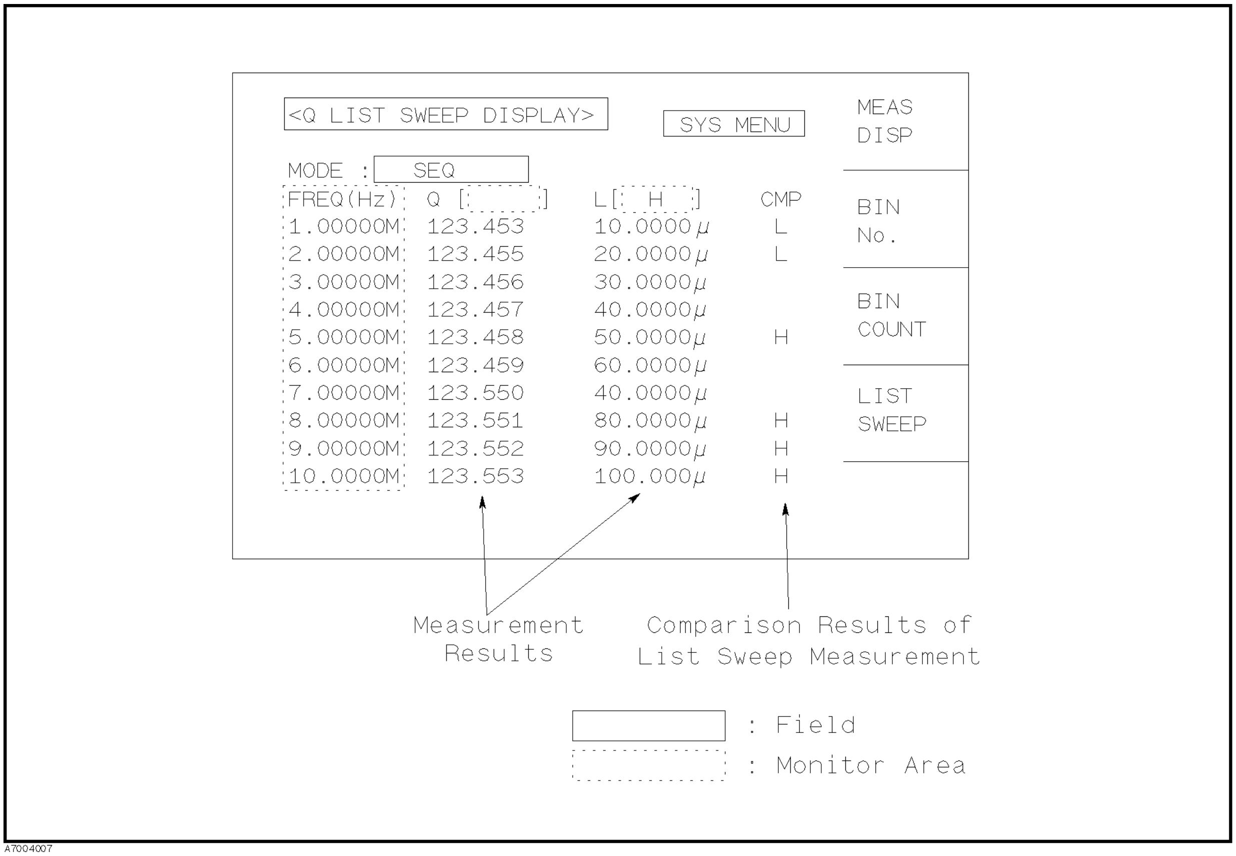


Figure 4-13. Available Fields on the Q LIST SWEEP DISPLAY Page

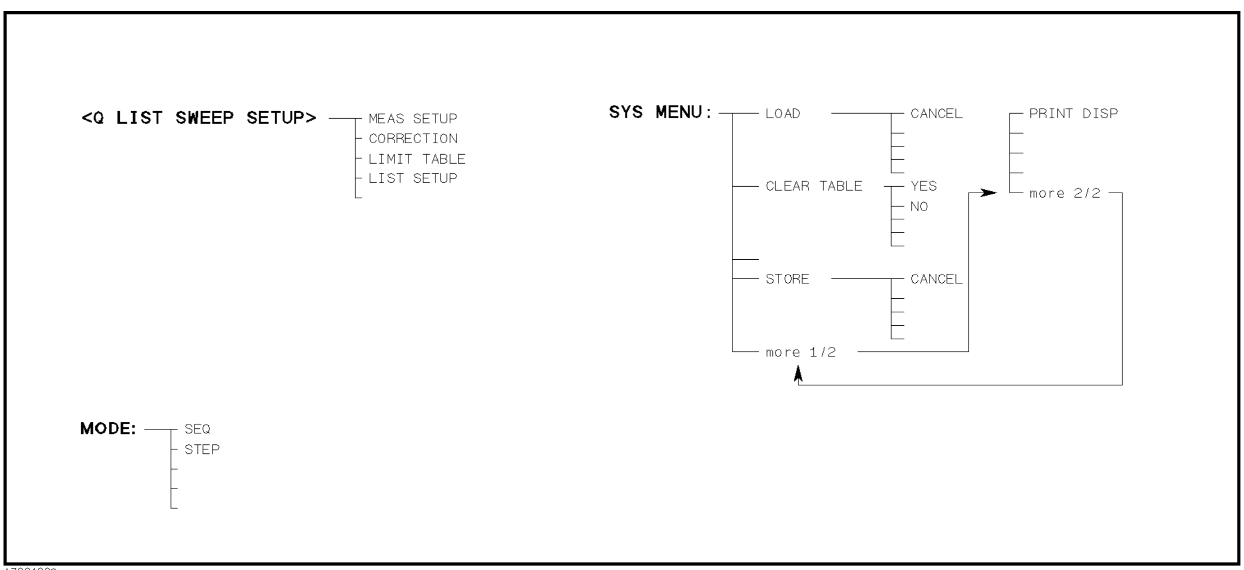


Figure 4-14. Available Softkeys on the Q LIST SWEEP DISPLAY Page

SYS MENU Field

The system menu on this page allows you to perform the following functions.

- LOAD/STORE
- Printout
- Key Lock

These functions are the same as the functions of the system menu on the *Q MEAS DISPLAY* page. (The description of each function is given in "SYS MENU Field" on page 4-10.)

Storing the Control Settings

Perform the following steps to store the control settings to memory.

1. Move the CURSOR to the *SYS MENU* field.
2. If you want to store the data to the memory card, insert a memory card to the MEMORY card slot until it locks into place.
3. Press `STORE`. The message `Enter record number to STORE` will be displayed on the system message line.
4. Enter a record number using the numeric entry keys and [ENTER] to store the current control settings. Use record number 0 to 9 for internal memory, and 10 to 19 for an external memory card.

Loading the Control Settings

Perform the following steps to load the control settings from the internal non-volatile memory or from an external memory card.

1. Move the CURSOR to the *SYS MENU* field.
2. If you want to load the data from the memory card, insert the memory card into the MEMORY card slot.
3. Press `LOAD`. The message `Enter record number to LOAD` will be displayed on the system message line.
4. Enter the record number using the numeric entry keys and [ENTER].

Printing the Measurement Result

Perform the following steps to printout the display page or to list sweep measurement results using the PRINT DISP mode or PRINT DATA mode.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the listen only mode.
3. On the *SYSTEM CONFIG* page, set the talk only mode to ON.
4. Press [DISPLAY FORMAT], and press `LIST SWEEP` to display the *Q LIST SWEEP DISPLAY* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP` to printout the display page. The displayed page will be printed out as shown in in Figure 4-15.

```
<Q LIST SWEEP DISPLAY>  SYS MENU

MODE : SEQ
 FREQ[Hz]   Q[   ]    L[ H ]  CMP
  3.0000M    36.57   10.1234u
  4.0000M    39.54   10.4146u
  5.0000M    40.78   10.6915u  H
  5.0000M    40.78   10.6915u
  6.0000M    40.79   11.1491u  H
  7.0000M    39.94   11.7851u
  8.0000M    38.51   12.6006u
  9.0000M    36.60   13.8365u
```

Figure 4-15. Q LIST SWEEP DISPLAY Page Printout Example

Press `PRINT DATA` to print out the measurement results. A marker will appear beside `PRINT DATA`. The measurement results will be printed out on subsequent measurements according to the following data format (This format is the same as the ASCII format of the data transfer via HP-IB. For more details, refer to "ASCII Data Format" in Chapter 8.)

Note

When the sequential sweep mode is used, the following format is repeated at each sweep point.

<DATA A>,<DATA B>,<STATUS>,<IN/OUT><CR><LF>

Where,

<DATA A>	The measurement results of the primary parameter (Q). 12 ASCII characters (SN.NNNNNESNN)
<DATA B>	Measurement results of the secondary parameter (L, L_s, L_p, C_s, C_p). 12 ASCII characters (SN.NNNNNESNN)
<STATUS>	0 : Normal Measurement. 1 : Tuning is incomplete. 2 : A/D converter doesn't work.
<IN/OUT>	−1 : LOW 0 : IN 1 : HIGH

Note

When the <STATUS> is 1 or 2, `9.9E37` is output as the measurement data. When the <STATUS> is 0, the actual measurement results are output.

Locking Out the Front Panel

Perform the following steps from the *Q LIST SWEEP DISPLAY* page to disable all front panel operation.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `more 1/2`.
3. Press `KEY LOCK` (a toggled softkey). The icon of a key will be displayed on the left side of `KEY LOCK`, and the `Keys locked` message will be displayed on the system message line.
4. Press `KEY LOCK` again, when you want to enable all front panel keys.

MODE Field

There are two measurement modes for list sweep measurements: sequential (SEQ) mode and step (STEP) mode. In the case of SEQ mode, when the HP 4285A is triggered once, all sweep points are automatically swept. In the case of the STEP mode, each time the HP 4285A is triggered the sweep point is incremented by one step.

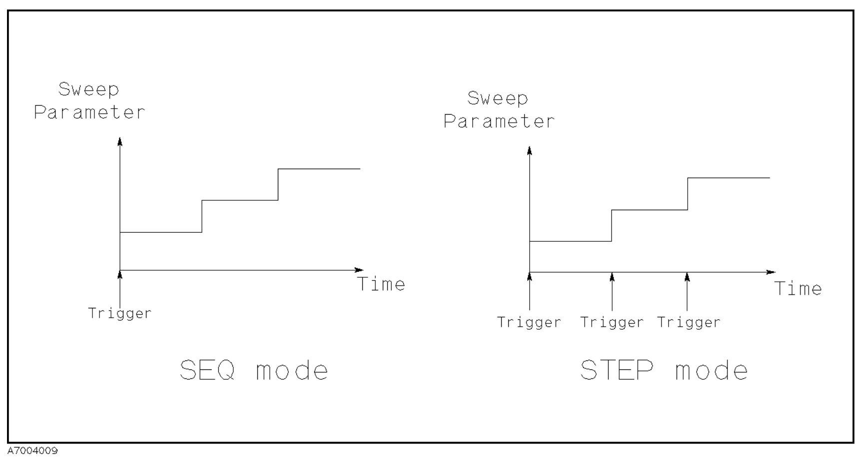


Figure 4-16. List Sweep Modes

Note

When two or more sweep points are the same and adjacent, the HP 4285A measures the device once, and then the measurement result is compared to limits set for each sweep point.

Setting the List Sweep Measurement Mode

Perform the following steps to set the list sweep measurement mode to the SEQ or STEP modes.

1. Move the CURSOR to the *MODE* field. The following softkeys will be displayed.
   - `SEQ`
   - `STEP`
2. Use the softkeys to select and set the list sweep measurement mode (SEQ or STEP mode).

5

Q MEAS SETUP Menu

Introduction

This chapter provides functional descriptions for the precision Q measurement listed on each page under (MEAS SETUP). This information includes the required front panel and softkey operations for correct setup.

The following four display pages are available under (MEAS SETUP).

- *Q MEAS SETUP*
- *Q CORRECTION*
- *Q LIMIT TABLE SETUP*
- *Q LIST SWEEP SETUP*

This chapter describes the function of each field on each page in the order listed above.

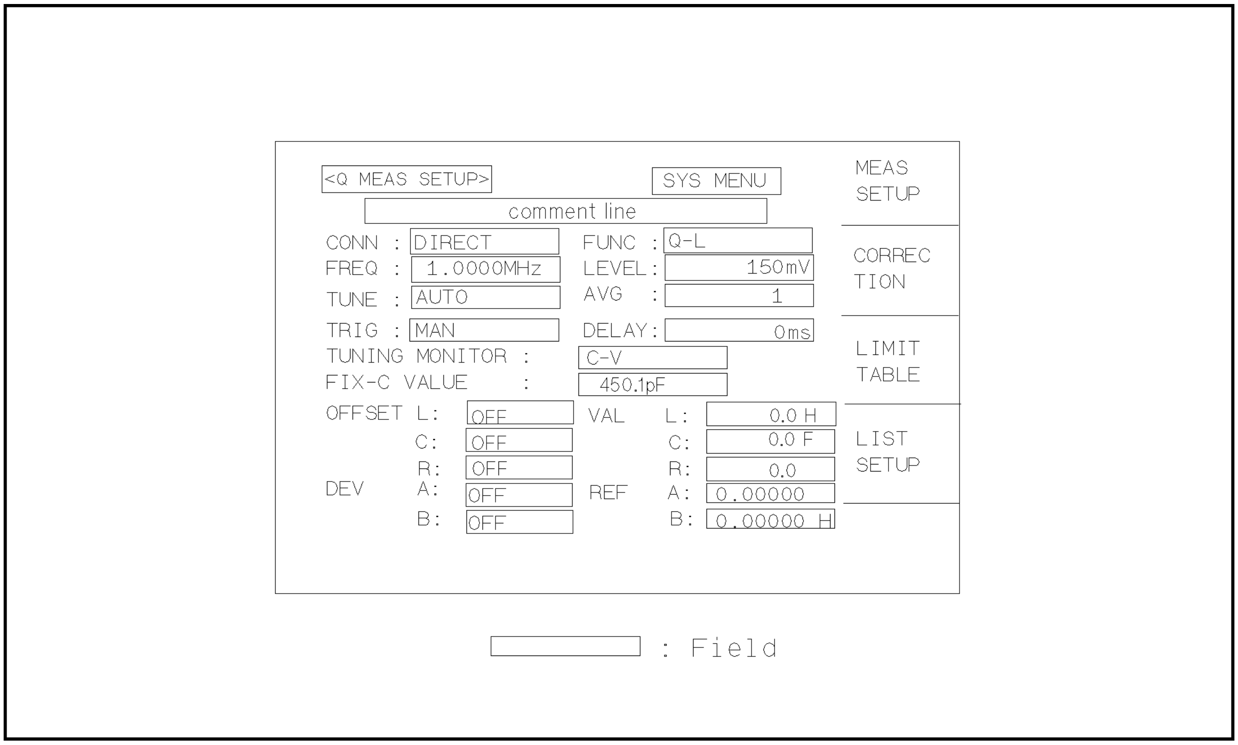
Q MEAS SETUP Page

When you press (MEAS SETUP), the *Q MEAS SETUP* page will be displayed. On the *Q MEAS SETUP* page, the following measurement control functions can be set. (The field in parenthesis is used to set the control function.)

- LOAD/STORE (*SYS MENU*)
- Clear Page Setup (*Sys Menu*)
- Printout (*SYS MENU*)
- System Reset (*SYS MENU*)
- Comment Line (*comment line*)
- Connection Method (*CONN*)
- Measurement Function (*FUNC*)
- Test Frequency (*FREQ*)
- Oscillator Level (*LEVEL*)
- Tuning Method (*TUNE*)
- Averaging Rate (*AVG*)
- Trigger Mode (*TRIG*)
- Trigger Delay Time (*DELAY*)
- Tuning Value Monitor Mode (*TUNING MONITOR*)
- Fixed Capacitance Value (*FIX-C VALUE*)
- Offset L Mode (*OFFSET L*)
- Offset L Value (*VAL L*)
- Offset C Mode (*(OFFSET) C*)
- Offset C Value (*(VAL) C*)
- Offset R Mode (*(OFFSET) R*)
- Offset R Value (*(VAL) R*)
- Deviation Measurement Mode for Primary Parameter (*DEV A*)
- Deviation Measurement Mode for Secondary Parameter (*B*)

- Reference Value for the deviation Measurement A (*REF A*)
- Reference Value for the Deviation Measurement B (*B*)

The available fields and the softkeys corresponding to each field on this page are shown in Figure 5-1 and Figure 5-2 respectively.



A7005001

Figure 5-1. Available Fields on the Q MEAS SETUP Page

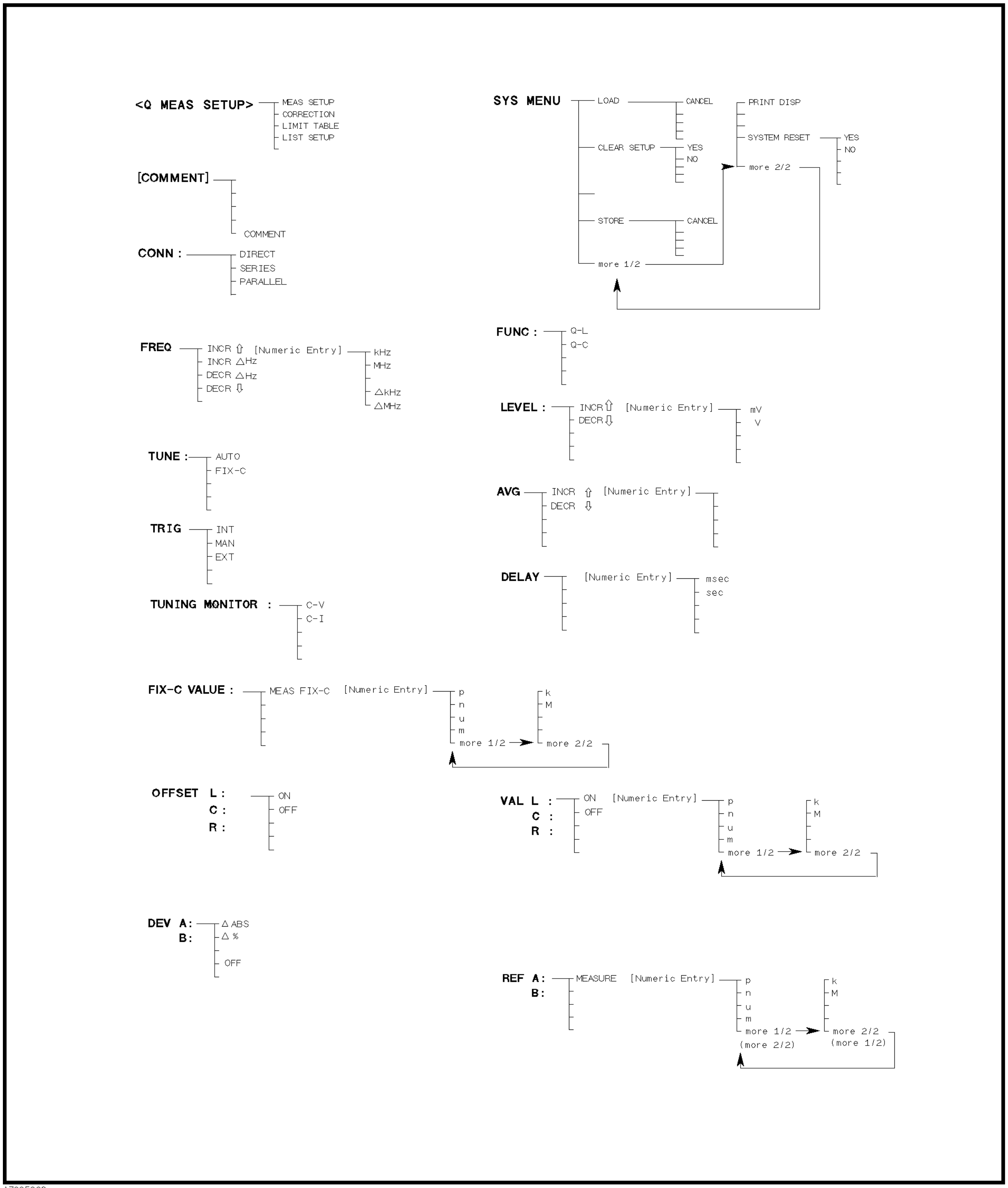


Figure 5-2. Available Softkeys on the Q MEAS SETUP Page

SYS MENU Field

The system menu on this page allows you to perform the following control functions.

- Load/Store
- Clear Setup
- Printout
- System Reset

The Load/Store function and Printout function are the same as on the *Q MEAS DISPLAY* page. (The description of each function is given in "SYS MENU Field" in Chapter 4 on page 4-10.) For the case of the CLEAR SETUP function and the SYSTEM RESET function, the description and setting procedure are given below.

LOAD / STORE Softkeys

Perform the following steps on the *Q MEAS SETUP* page to store the control settings to the internal non-volatile memory or an external memory card, or to load the control settings from the internal non-volatile memory or an external memory card.

1. Move the CURSOR to the *SYS MENU* field on the *Q MEAS SETUP* page.
2. If you want to load (store) the data from (to) the memory card, insert a memory card in the momory card slot until it locks into place.
3. Use the numeric entry keys and (ENTER) to enter the record number at which the current control settings will be stored to or loaded from.

CLEAR SETUP Softkey

This softkey allows you to return all of the control settings on the *Q MEAS SETUP* page to their power-on default settings. The control settings on other pages are not affected. Figure 5-3 shows the *Q MEAS SETUP* page after performing the clear setup function.

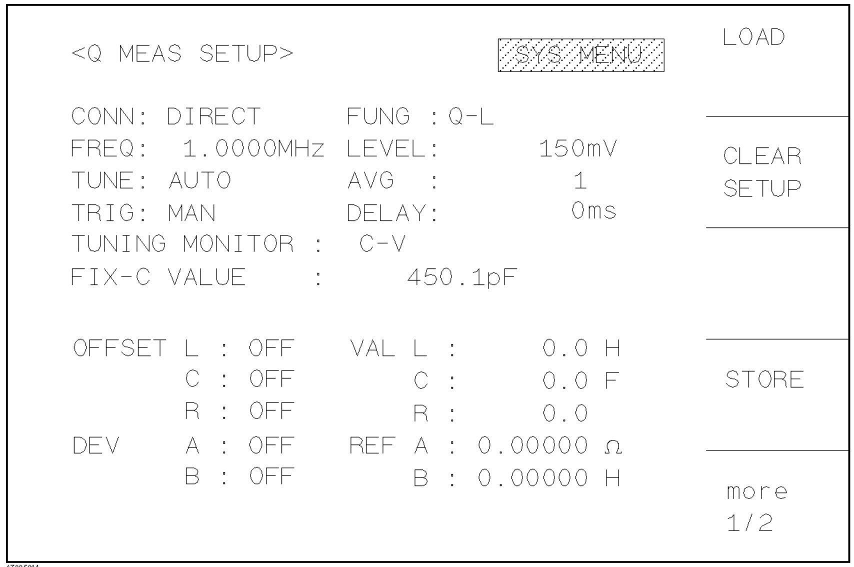


Figure 5-3. Q MEAS SETUP Page After Clearing the Setup

Resetting the Control Settings on the Q MEAS SETUP Page

Perform the following steps to reset control settings on the *Q MEAS SETUP* page to the power-on default settings.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `CLEAR SETUP`. The message `Clearing setup. Are you sure?` will be displayed, and the following softkeys will be displayed.
   - `YES`
   - `NO`
3. Press `YES` to confirm for clearing setup operation.

`PRINT DISP` Softkey

This softkey is used to print out the instrument control settings on the measurement setup page.

Dumping the Q MEAS SETUP Page

Perform the following steps to print out the *Q MEAS SETUP* page.

1. Connect a printer to the HP 4285A using an HP-IB cable.
2. Set the printer to the Listen-Only mode.
3. On the *SYSTEM CONFIG* page, set the Talk-Only mode to ON .
4. Press (MEAS SETUP) to display the *Q MEAS SETUP* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP`. The display page will be printed out by the printer as shown below.

```
<Q MEAS SETUP>          SYS MENU

CONN: DIRECT     FUNC : Q-L
FREQ:  5.0000MHz LEVEL:    150mV
TUNE: AUTO       AVG  :      1
TRIG: MAN        DELAY:      0ms
TUNING MONITOR : C-V
FIX-C VALUE    :   94.2pF

OFFSET L: ON    VAL L:   100.0nH
       C: ON        C:    4.80pF
       R: ON        R:   0.075
DEV    A: OFF   REF A: 0.00000
       B: OFF       B: 0.00000 H
```

Figure 5-4. Q MEAS SETUP Page Printout Example

SYSTEM RESET Softkey

This softkey resets all of the HP 4285A instrument control settings to their power-on default values. Other control settings on other pages are also returned to their default settings. For details of the default settings, refer to Appendix C.

Resetting the HP 4285A and the HP 42851A

Perform the following steps to execute the SYSTEM RESET function.

1. Move the CURSOR to the *SYS MENU* field on the *Q MEAS SETUP* page.
2. Press `more 1/2`.
3. Press `SYSTEM RESET`. The message `Resetting system. Are you sure?` will be displayed, and the following softkeys will be displayed.
   - `YES`
   - `NO`
4. Press `YES` to reset the HP 4285A.

Comment Field

Descriptive alpha-numeric string data, up to 30 ASCII characters, can be entered as a comment. The *comment* field is located on the second line of the LCD display and there is no default setting. This comment is stored to the internal non-volatile memory or to the external memory card along with the current HP 4285A control settings. Also this comment line is loaded from the internal non-volatile memory or from the external memory card with the control settings.

COM-MENT Softkey

When this softkey is pressed, the *COMMENT INPUT* page as shown in Figure 5-5 is displayed. A description of the softkeys on this page follows.

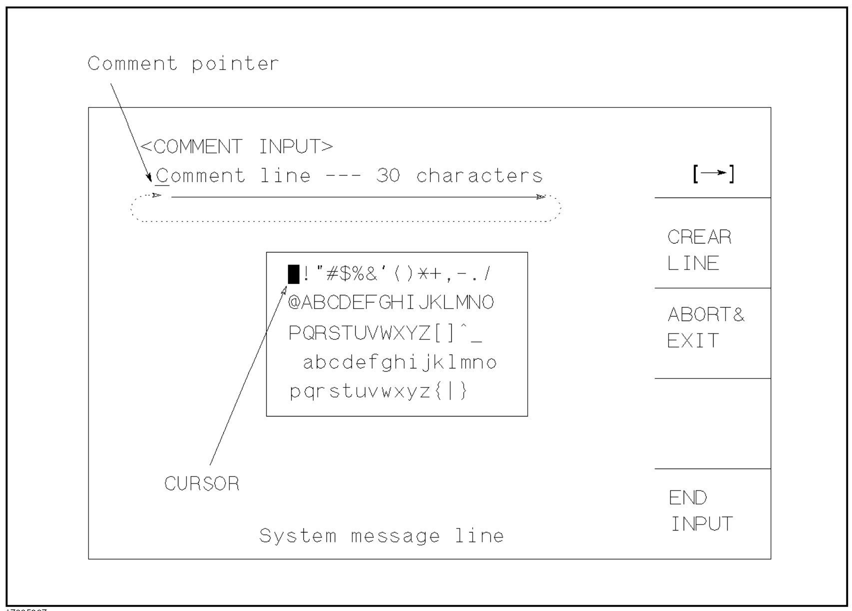


Figure 5-5. COMMENT INPUT Page Layout

[→] Softkey

This softkey moves the comment pointer to the right by one character.

CLEAR LINE Softkey

This softkey clears the current comment string.

ABORT& EXIT Softkey

This softkey abandons the current comment editing data and returns the display to the *Q MEAS SETUP* page. The comment previously stored before editing still remains.

END INPUT Softkey

This softkey terminates the comment input and returns the display to the *Q MEAS SETUP* page. The previously displayed comment data is replaced by the newly entered data.

Entering Comments

Perform the following steps to enter a comment.

1. Move the CURSOR to the *comment* field. The following softkeys will be displayed.
   - COM-MENT
2. Press COM-MENT to enter the *COMMENT INPUT* page. The following softkeys will be displayed.
   - [→]
   - CLEAR LINE
   - ABORT& EXIT
   - END INPUT
3. Position the CURSOR on the letter to be selected.
4. Press ENTER to select the letter. The numeric entry keys such as 0 – 9, - (minus), and . (period) can also be used.
5. Press either END INPUT or ABORT& EXIT to terminate the *COMMENT INPUT* page.

CONN Field

There are three methods for measuring the device under test (DUT) with the HP 42851A.

DIRECT Softkey

This softkey sets the direct measurement mode. Inductors can usually be measured by connecting them directly to the coil terminals as shown in Figure 5-6.

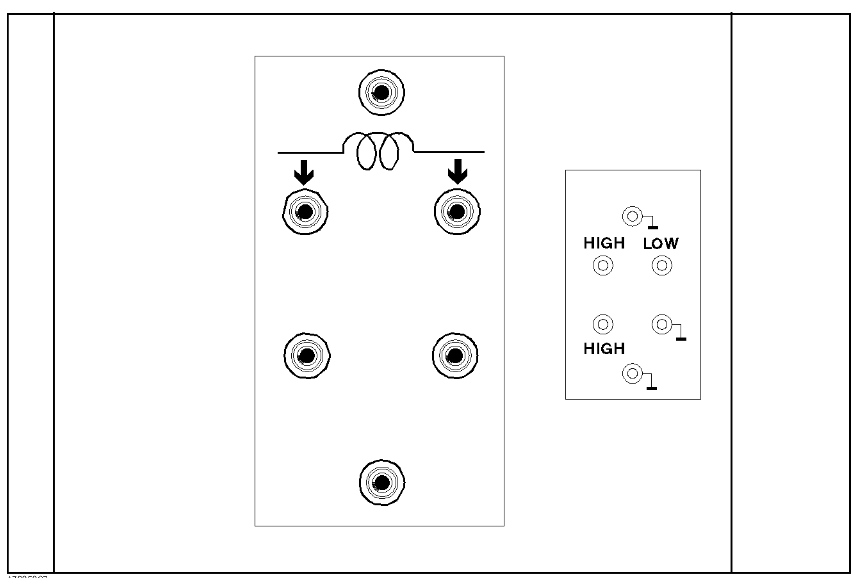


Figure 5-6. Direct Connection

SERIES Softkey

This softkey sets the series measurement mode which is suitable for low impedance measurement. When the series measurement mode is set, the following functions will be resetted.

Field	Resetted to
FUNCtion	Q-L
TUNE	AUTO
TRIG	MAN (When the current setting is INT)
Q1/Q2/C1/C2 data	*initialized*
DEV A/B	OFF

Low value inductors, low value resistors, and high value capacitors can be measured by connecting the DUT in series with a stable inductor as shown in Figure 5-7. The HP 16014A Series Loss Test Adapter is useful for making the series connection at the DUT.

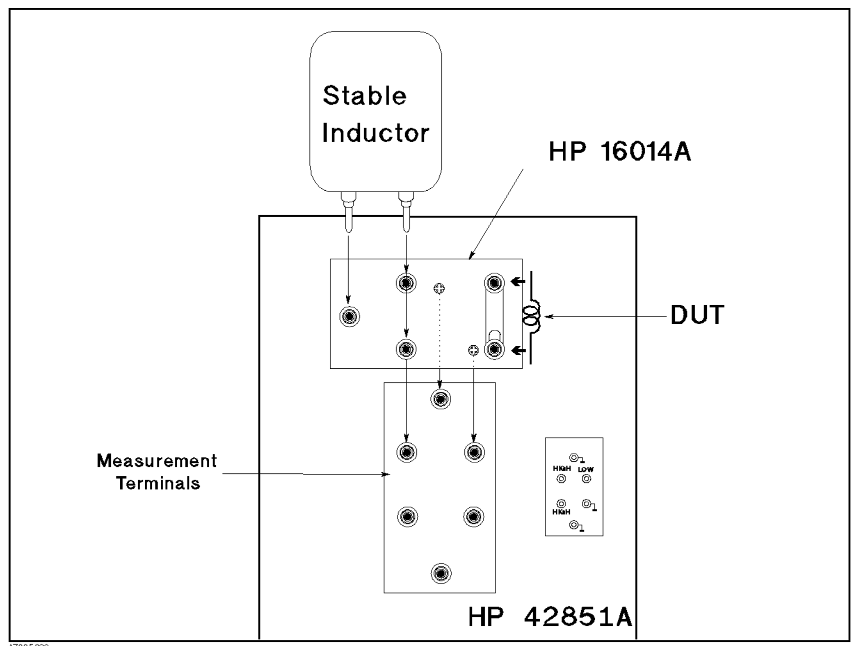


Figure 5-7. Series Connection

PARALLEL Softkey

This softkey sets the parallel measurement mode which is suitable for high impedance measurement. When the parallel measurement mode is set, the following functions will be resetted.

Field	Resetted to
FUNCtion	Q-C
TUNE	AUTO
TRIG	MAN (When the current setting is INT)
Q1/Q2/C1/C2 data	*initialized*
DEV A/B	OFF

High value inductors, high value resistors, and low value capacitors can be measured by connecting the DUT to the CAPACITOR terminals as shown in Figure 5-8.

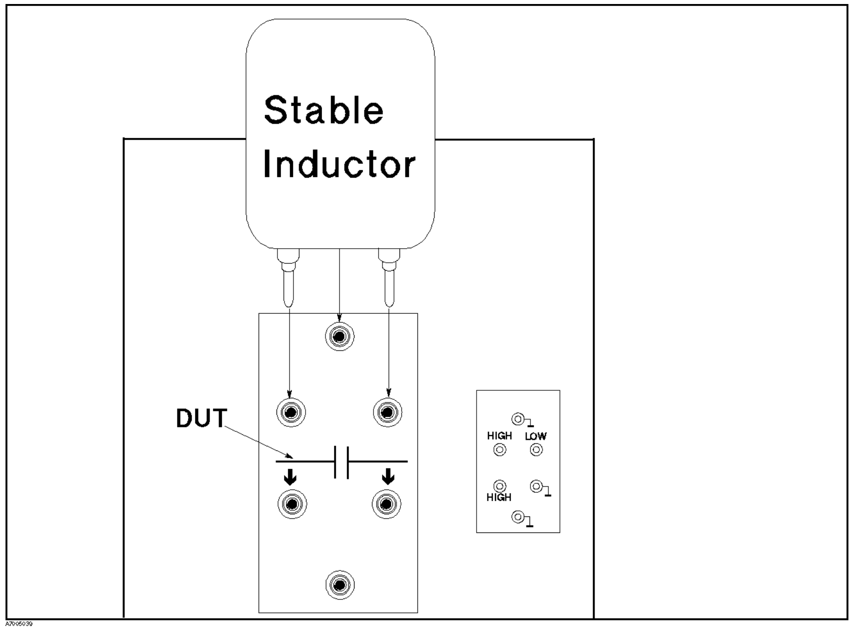


Figure 5-8. Parallel Connection

Setting the Connection Method

Perform the following procedure to set the connection method.

1. Move the CURSOR to the *CONN* field using the CURSOR keys. The following softkeys will be displayed.
   - `DIRECT`
   - `SERIES`
   - `PARALLEL`
2. Press the appropriate softkey to set the connection method.

FUNC Field

The HP 42851A combined with the HP 4285A simultaneously measures the two vector voltage during a measurement cycle, and calculates the following impedance parameters. These parameters combinations are chosen in the *FUNC* field.

- Primary Parameters

  Q (quality factor)

- Secondary Parameters

  L_s (equivalent series inductance)
  L_p (equivalent parallel inductance)
  C_s (equivalent series capacitance)
  C_p (equivalent parallel capacitance)

Choosing the Measurement Function

Perform the following steps to set the measurement function.

1. Move the CURSOR to the *FUNC* field using the CURSOR keys. The following softkeys will be displayed.
   - Q-L
   - Q-C
2. Press either softkey to select the measurement function.

FREQ Field

The measurement frequency of the HP 42851A can be set from 75 kHz to 30 MHz with 100 Hz resolution. To set the measurement frequency, enter the numeric value or use the INCR ⇑/DECR ⇓. When a numeric value smaller than the test frequency resolution is entered, the setting value is rounded to the nearest available frequency point.

INCR ⇑ Softkey

This softkey increments the current test frequency to the next sequentially higher frequency point. There are 10 frequency points between successive decade values. The sequential frequency points which can be set using this softkey are the following 28 points.

75 kHz	100 kHz	1 MHz	10 MHz
80 kHz	120 kHz	1.2 MHz	12 MHz
	150 kHz	1.5 MHz	15 MHz
	200 kHz	2 MHz	20 MHz
	250 kHz	2.5 MHz	25 MHz
	300 kHz	3 MHz	30 MHz
	400 kHz	4 MHz	
	500 kHz	5 MHz	
	600 kHz	6 MHz	
	800 kHz	8 MHz	

INCR ΔHz Softkey

This softkey increments the current test frequency by the specified step value. The default step is 100 Hz and this step can be changed with ΔkHz and ΔMHz. When the step value is entered from the entry keys, ΔkHz and ΔMHz will be displayed automatically.

DECR ΔHz Softkey

This softkey decrements the current test frequency by the specified step value. The default step is 100 Hz and this step can be changed by ΔkHz and ΔMHz. When the step value is enterd from the entry keys, ΔkHz and ΔMHz will be displayed automatically.

DECR ⇓ Softkey

This softkey decreases the test frequency to the next sequentially lower frequency point. There are ten frequency points between successive decade values. The frequency points set using this softkey are the same as set using INCR ⇑.

kHz / MHz Softkeys

These softkeys are not normally displayed, they are displayed when a numeric key is pressed. These softkeys are used to input the frequency unit.

ΔkHz / ΔMHz Softkeys

These softkeys are not normally displayed, they are displayed when a numeric key is pressed. These softkeys set the frequency step to INCR ΔHz and DECR ΔHz.

Setting the Test Frequency

There are two ways to set the test frequency. One is to use the softkeys, and the other is to use the numeric entry keys. Perform the following steps to set the test frequency.

1. Move the CURSOR to the *FREQ* field. The following softkeys will be displayed.
   - INCR ⇑
   - INCR ΔHz
   - DECR ΔHz
   - DECR ⇓
2. Select and set the test frequency using either the softkeys or the numeric entry keys. When the test frequency is entered using the numeric entry keys, kHz and MHz will be displayed. These softkeys can be used to enter the unit and to terminate the numeric data entry instead of using (ENTER). When (ENTER) is used, the numeric data is entered with the default unit Hz.

LEVEL Field

In the *LEVEL* field, the internal oscillator level of the HP 4285A can be set as an rms (root mean square) value. The actual oscillator level injected into the resonant circuit is reduced to one 50^{th} by the HP 42851A's injection transformer.

The oscillator voltage level can be set from 5 mV_{rms} to 2 V_{rms} with a resolution as listed in Table 5-1.

Table 5-1. Oscillator Level and Resolution

Mode	Oscillator Level	Resolution
Voltage	5 mV_{rms} to 200 mV_{rms} 210 mV_{rms} to 2 V_{rms}	1 mV_{rms} 10 mV_{rms}

Recommended Test Signal Level Setting

To make accurate Q measurements, the test signal voltage at the HIGH inductor terminal at resonance (resonant voltage : can be monitored at V monitor area) should be between $0.1V_{rms}$ and $1V_{rms}$. It is recommended that the test signal LEVEL of the HP 4285A be set depending on the measured Q values as shown in Figure 5-9. The test signal LEVEL of the HP 42851A is automatically set to 150 mV_{rms} when the instrument is turned on (default setting).

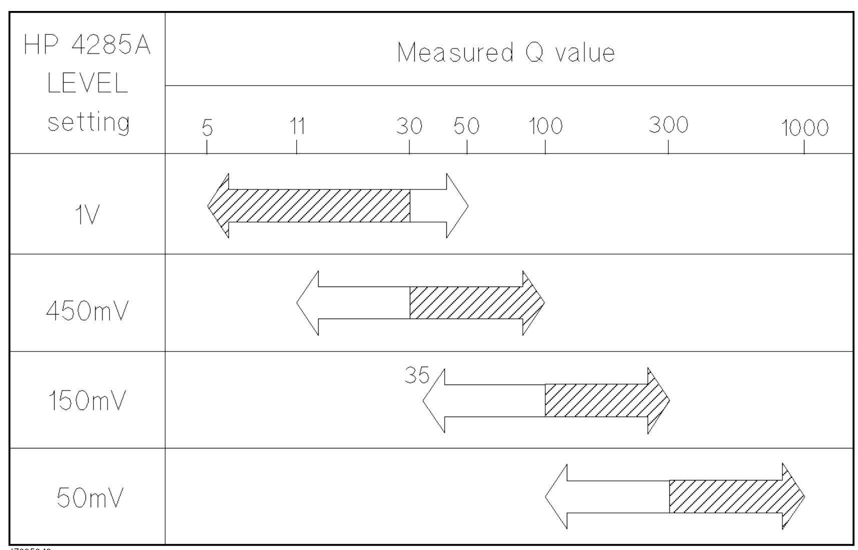


Figure 5-9. Recommended Test Signal Level Setting

⇔ represents the range of Q values where the Q accuracy is applied at the HP 4285A LEVEL setting listed at left in the figure. The shaded area ( ) represents the recommended Q measurement range.

When the measured Q value is in the right side of ⇔, the output voltage at the measurement terminals of the HP 42851A is over 1 V_{rms}. To avoid electric shock, set the output voltage below 30 V_{rms}. The output voltage is calculated by the following equation:

$$V_{out} = 0.02 \times Q \times V$$

where,

V_{out} :	Output voltage at the terminals of the HP 42851A. [V]
Q:	Q value of the inductor under the measurement
V:	Output voltage of the HP 4285A. [V]

INCR ⇑/DECR ⇓ Softkeys

These softkeys increment and decrement the current oscillator level by the specified step value listed in Table 5-1, Resolution.

mV and V Softkeys

These softkeys are not normally displayed, they are displayed when a numeric key is pressed. These softkeys are used to input the oscillator level unit.

Setting the Oscillator Level

There are two ways to set the oscillator level. One is to use the softkeys, and the other is to use the use the numeric entry keys. Perform the following steps to set the oscillator level.

1. Move the CURSOR to the *LEVEL* field. The following softkeys will be displayed.
   - INCR ⇑
   - DECR ⇓
2. Select and set the oscillator level using either the softkeys or the numeric entry keys. When the oscillator level is entered using the numeric entry keys, the softkey labels will change to the available units labels (mV and V). You can use these softkeys to enter the units and data instead of using (ENTER). When (ENTER) is used, the numeric data is entered with V as the default unit.

TUNE Field

There are two modes to set the tuning method, automatic and fixed capacitance modes.

AUTO Softkey

This softkey selects the automatic tuning mode. In this mode, the tuning operation is automatically performed each measurement cycle.

FIX-C Softkey

This softkey fixes the tuning capacitor to the specified capacitance value in *FIX-C VALUE* field. Also see the description for *FIX-C VALUE* field.

FIX-C mode is used only for the direct connection method and is useful especially when a large number of devices are measured and when they have almost the same values. Testing inductors at production outgoing inspection is the typical application for this mode. Once the tuning capacitor is fixed to resonate with the typical L value, the HP 4285A can calculate the Q value when another inductor connected. In this case, the tuning operation is not made and therefore the measurement speed is reduced when compared with the AUTO mode.

AVG Field

The HP 4285A's averaging function arithmetically averages the results of two or more A/D conversions results. The averaging rate can be set in the *AVG* field. Any number of averages can be set from 1 to 256.

The A/D conversion time can be set in the *INTEG* field. For the actual measurement time, refer to "Measurement Time" in Chapter 1)

INCR ⇑ and DECR ⇓ Softkeys

These softkeys increment and decrement the averaging rate in binary steps of 1, 2, 4, 8, 16, 32, 64, 128, and 256.

Setting the Averaging Rate

Perform the following steps to set the averaging rate.

1. Move the CURSOR to the *AVG* field. The following softkeys will be displayed.
   - INCR ⇑
   - DECR ⇓
2. Use the softkeys to set the averaging rate, or enter the averaging rate using the numeric entry keys, and press ENTER.

TRIG Field

The HP 42851A has four trigger modes: INTernal, EXTernal, MANual, and BUS. Except for BUS trigger mode, these trigger modes can be set in the *TRIG* field. The BUS trigger mode is used when the HP 42851A is controlled via HP-IB by the HP 4285A.

Note

When the HP 4285A is tuned on, the trigger mode is set to MAN (power-on default setting).

INT Softkey

When the trigger mode is set to INTernal trigger mode, the HP 42851A continuously repeats measurements on any display page under DISPLAY FORMAT and measurement function is set to Q-L mode. This trigger mode is effective only in DIRECT connection mode.

Note

When the *CONN* field is changed to SERIES or to PARALLEL from DIRECT while in the INTernal trigger mode, trigger mode is forced to MANual.

MAN Softkey

When the trigger mode is set to MANual trigger mode and display page set to any page under DISPLAY FORMAT, the HP 4285A performs a single measurement every time when TRIGGER on the front panel is pressed.

EXT Softkey

When the trigger mode is set to the EXTernal trigger mode and the display pages under (DISPLAY FORMAT), the HP 42851A performs a single measurement every time a low to high transition TTL level signal is applied to the *EXT TRIGGER* connector on the rear panel. External triggering can be also be achieved by momentarily connecting the center conductor of the *EXT TRIGGER* connector to chassis ground (center conductor circuit contains a pull-up resistor). Figure 5-10 shows the specifications required for the TTL pulse.

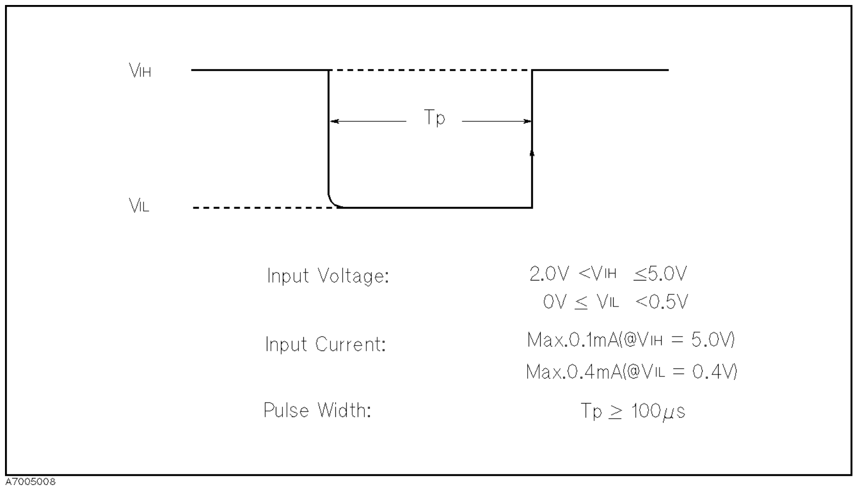


Figure 5-10. Required External Trigger Pulse Specification

Note

The HP 42851A ignores a re-trigger while a measurement is in progress. Trigger the HP 42851A after the measurement is completed.

Select the EXT trigger mode when the HP 42851A is triggered from an Option 201, 202, or 301 interface of the HP 4285A.

When the trigger mode is set to the BUS trigger mode, the HP 42851A performs a single measurement every time the `TRIGger` TMSL command, `*TRG` common command, or trigger (GET) bus command is sent to the HP 4285A via HP-IB. The BUS trigger mode cannot be set on the front panel of the HP 4285A. Send the `TRIGger:SOURce BUS` command via HP-IB to set the trigger mode to the BUS trigger mode. For detail of the trigger command, refer to "Trigger System" in Chapter 8.

Setting the Trigger Mode

Perform the following steps to set trigger modes except for the BUS trigger mode.

1. Move the CURSOR to the *TRIG* field. The following softkeys will be displayed.
   - INT (effective in direct connection mode only)
   - MAN
   - EXT

2. Set the trigger mode using the softkeys.

DELAY Field

The HP 4285A's delay time function allows you to set a trigger delay time which the HP 4285A delays the start of the measurement after it is triggered. The trigger delay time of the HP 4285A can be set from 0 s to 60 s in 1 ms steps. This function is useful when a component handler is used with the HP 4285A. The HP 4285A can wait to start the measurement until mechanical contact with the DUT becomes stable. When the list sweep measurement is performed, the HP 4285A will delay the start of the measurement at each sweep point using the trigger delay time.

msec and sec Softkeys

These softkeys are not normally displayed, they are displayed when a numeric key is pressed. These softkeys are used to input the delay time unit.

Setting the Delay Time

Perform the following steps to set the delay time.

1. Move the CURSOR to the *DELAY* field.
2. Enter the delay time using the numeric entry keys. When one of the numeric entry keys is pressed, the following unit softkeys will be displayed, these can be used instead of (ENTER).
   - msec
   - sec

TUNING MONITOR Field

When the DUT and the variable capacitor is in resonant, tuning capacitance value and either the resonant voltage or current applied to the variable capacitor can be monitored and seleceted on the *TUNING MONITOR* field

C-V Softkey

This softkey selects the tuning capacitance and resonant voltage monitor mode.

C-I Softkey

This softkey selects the tuning capacitance and resonant current monitor mode.

Setting the Tuning Value Monitor Function

Perform the following steps to set the tuning value monitor function.

1. Move the CURSOR to the *TUNING MONITOR* field. The following softkeys will be displayed.
   - C-V
   - C-I

2. Press C-V or C-I to set the tuning value monitor mode.

FIX-C VALUE Field

When the tuning method is set to the fixed capacitance mode, the tuning capacitor must be set to the value at which the DUT will resonate at. There are two ways to select the fixed capacitance value. One is to measure the reference DUT, and the other is to use the numeric entry keys. Perform the following steps to set the fixed capacitance value.

MEAS FIX-C Softkey

This softkey is used to measure the connected reference DUT, and the measurement result is entered as the setting value for the variable capacitor.

Setting the Fixed Capacitance Value

1. Move the CURSOR to the *FIX-C VALUE* field. The following softkey will be displayed.
   - MEAS FIX-C
2. Enter the value for the variable capacitor using the numeric entry keys or connect a reference DUT and press MEAS FIX-C.

OFFSET L/C/R Fields

Basically, measurement error due to the test fixture and the extension leads can't be corrected. But if these components are stable, the error value can be subtracted mathematically. The correction formula is as follows:

$$L = \frac{1}{\omega^2(C_v + C_{ofs})} - L_{ofs}$$

$$Q = \frac{1 + \dfrac{R_{ofs}}{\dfrac{\omega L_m}{Q_m} - R_{ofs}}}{1 + \dfrac{L_{ofs}}{L}}$$

Where,

L_m	Measured inductance value [H]
Q_m	Measured Q value
C_v	Tuning capacitance value [F]
L_{ofs}	Offset L value [H]
C_{ofs}	Offset C value [F]
R_{ofs}	Offset R value [Ω]
ω	$2 \times \pi \times$ Test frequency [Hz]

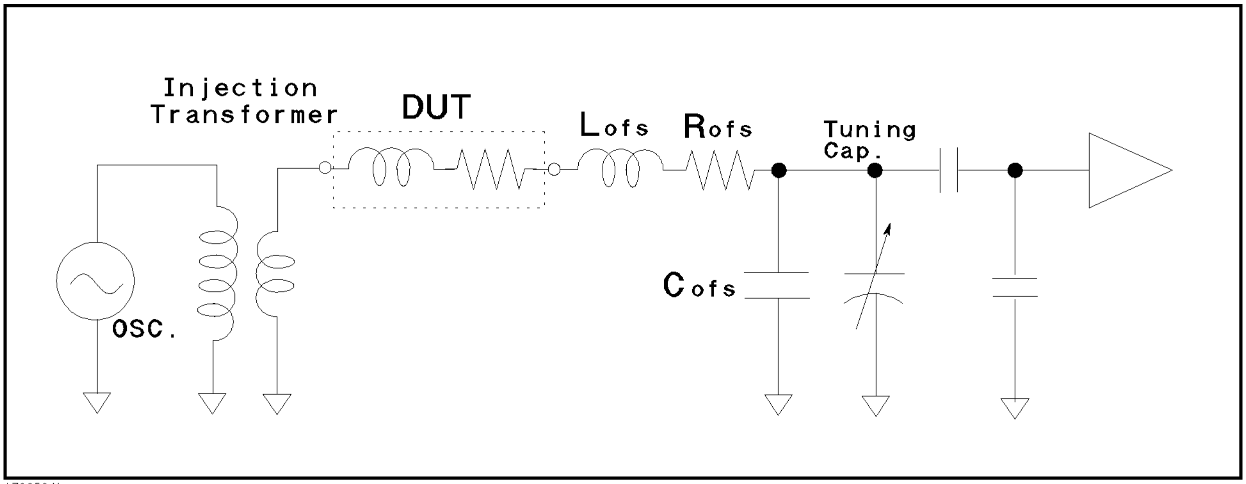


Figure 5-11. Fixture Residual Parameter Model

ON Softkey

This softkey enables the L/C/R offset functions.

OFF Softkey

This softkey disables the L/C/R offset functions.

VAL L/C/R Fields

The offset values can be entered in the *VAL L*, *C*, and *R* fields.

Note

Measurement error due to the SMD Test Fixture can be corrected by setting the residual parameters to the *VAL L/C/R* fields shown in "Residual Parameters of the SMD Test Fixture" in Chapter 1.

DEV A/B Fields

The deviation measurement function allows you to display the deviation value instead of the actual measurement value. The deviation measurement can be made for both primary (data A) and secondary (data B) parameters. It is activated or de-activated in the *DEV A* and *(DEV)B* field respectively. The deviation value is calculated by taking the difference between the actual measurement value and a previously stored reference value (*REF A/B* fields). This function is useful for evaluating temperature, frequency, and other characteristics of a DUT.

There are two types of deviation measurements. One is to represent the diviation by an absolute value and the other is by a percentage. These deviation measurements can be made for both primary and secondary parameter measurements.

Δ ABS Softkey

The difference between the measured value of the DUT and a previously stored reference value are displayed by absolute value. The formula used to calculate the deviation is as follows.

$$\Delta ABS = X - Y$$

Where, X: The measured value of the DUT
Y: The stored reference value

`Δ %` Softkey

The difference between the measured value of the DUT and a previously stored reference value are displayed as a percentage of the reference value. The formula used to calculate the percent deviation is as follows.

$$\Delta\% = \frac{X - Y}{Y \times 100} \quad [\%]$$

Where, X: The measured value of the DUT
Y: The stored reference value

`OFF` Softkey

This softkey turns the deviation measurement off.

REF A/B Fields

These fields are used to set reference value of the deviation measurement. The reference value can be set either by entering a numeric value using the ENTRY keys or by measuring reference DUT. When you perform the reference measurement in *REF A* or *(REF)B* fields, other reference values are also updated.

`MEA-SURE` Softkey

This softkey is used to measure the connected reference device, and the measurement results are entered as a reference value for REF A and REF B.

Performing the Deviation Measurement

Perform the following steps to perform a deviation measurement.

1. Move the CURSOR to *REF A* field to enter the reference value for the primary parameter. The following softkey will be displayed.
   - `MEA-SURE`
2. Enter the reference value for the primary parameter using the numeric entry keys or press `MEA-SURE` after connecting the DUT.
3. Move the CURSOR to the *(REF) B* field to enter the reference value for the secondary parameter using `MEA-SURE` or the numeric entry keys. If the reference values for A and B are entered using `MEA-SURE` in step 2, skip this step.
   - `MEA-SURE`
4. Move the CURSOR to the *DEV A* field. The following softkeys will be displayed.
   - `Δ ABS`
   - `Δ %`
   - `OFF`

5. Select and press a softkey to select the deviation mode for the primary parameter.
6. Move the CURSOR to the *(DEV) B* field. The following softkeys will be displayed.
   - Δ ABS
   - Δ %
   - OFF
7. Press the appropriate softkey to set the deviation mode for the secondary parameter.

Q CORRECTION Page

When you press (MEAS SETUP) and CORRECTION, the *Q CORRECTION* page will be displayed. On the *Q CORRECTION* page, the SHORT and LOAD correction can be performed.

The following operations can be performed from this page. (The field in parenthesis is used to set the control function.)

- LOAD/SAVE (*SYS MENU*)
- SHORT Correction (*SHORT*)
- LOAD Correction (*LOAD*)
- SHORT, LOAD Correction for individual 7 frequency points (*SPOT 1*, *SPOT 2*, . . . , *SPOT 7*)
- Reference Q Values at each of the 7 frequencies for LOAD Correction (*REF Q*)

These operations are described in the following paragraphs.

This page also provides the following monitor information (the monitor area looks like a field, but it is not).

- Actual Measurement Values for LOAD Correction

The actual Q values for LOAD Correction can be measured from the *SPOT1*, *SPOT2*, . . . , *SPOT7* fields on this page.

The available fields and the softkeys which correspond to each field on this page are shown in Figure 5-12 and Figure 5-13.

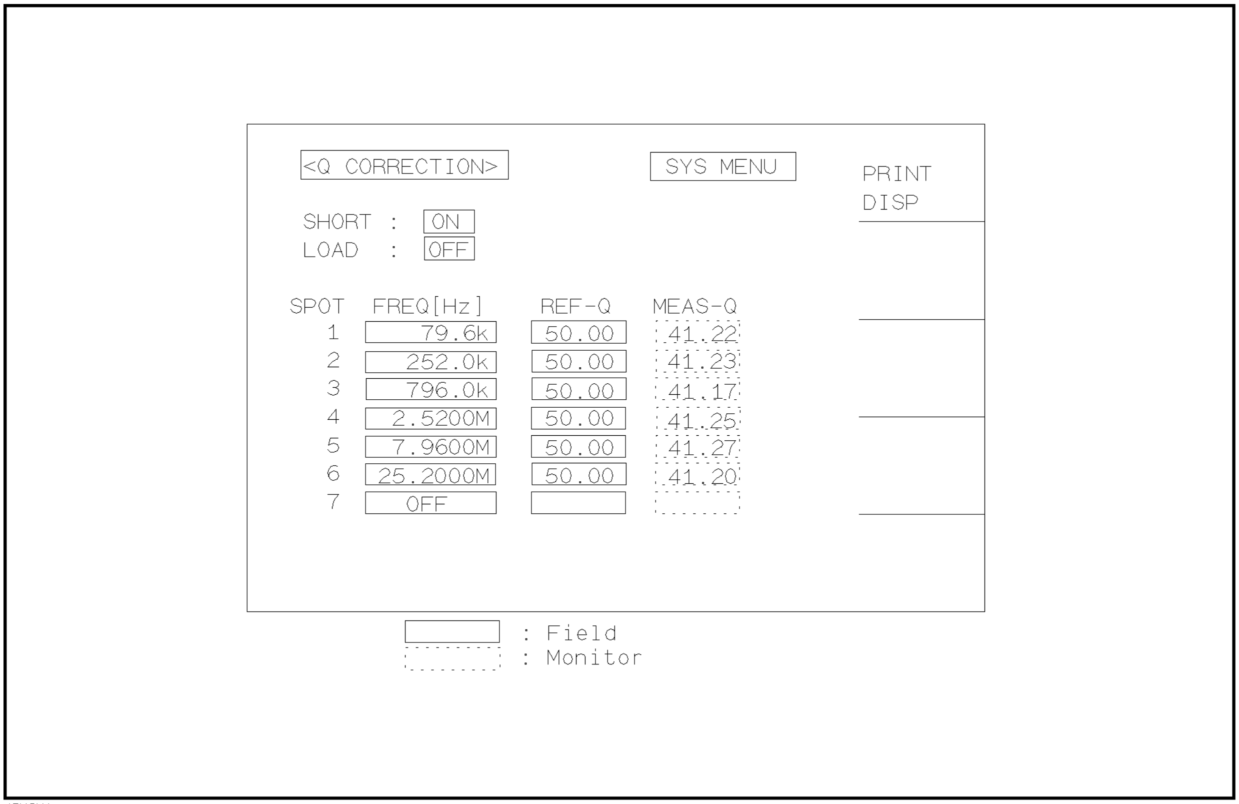


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Figure 5-12. Available Fields on the Q CORRECTION Page

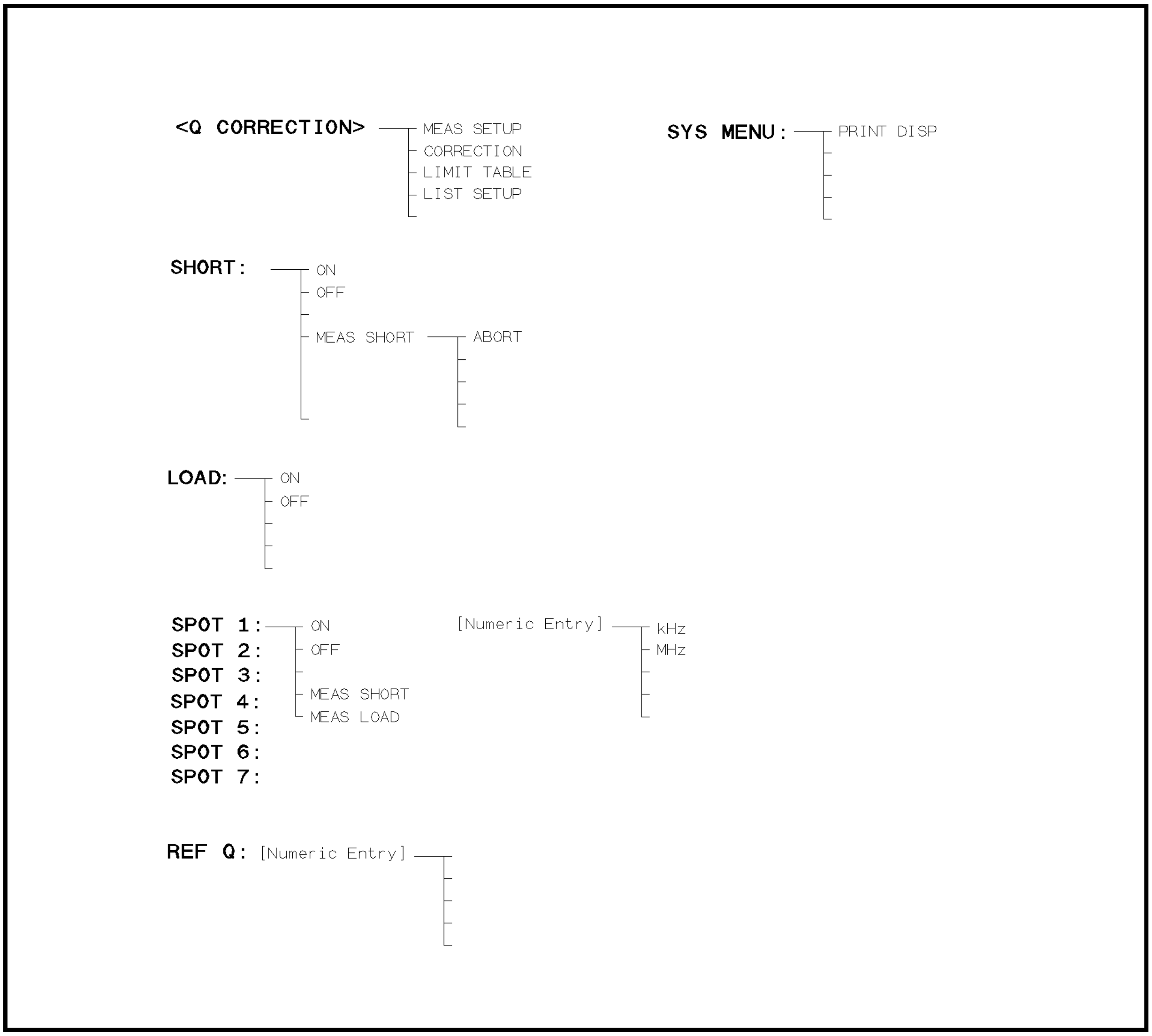


Figure 5-13. Available Softkeys on the Q CORRECTION Page

SHORT Field

The SHORT correction function corrects the tracking error due to the internal circuitry of the HP 42851A and the measurement cables. SHORT correction must have been performed before the measurement. There are two ways to perform the SHORT correction, interpolation and spot.

- Interpolation correction mode

  The SHORT correction data are taken at the preset 46 frequency points shown below, and are independent of the test frequency you set.

Preset Correction Frequency Points

75 kHz	500 kHz	3.5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
80 kHz	600 kHz	4 MHz	11 MHz	16 MHz	21 MHz	26 MHz
100 kHz	800 kHz	5 MHz	12 MHz	17 MHz	22 MHz	27 MHz
120 kHz	1 MHz	6 MHz	13 MHz	18 MHz	23 MHz	28 MHz
150 kHz	1.2 MHz	7 MHz	14 MHz	19 MHz	24 MHz	29 MHz
200 kHz	1.5 MHz	8 MHz				30 MHz
250 kHz	2 MHz	9 MHz				
300 kHz	2.5 MHz					
400 kHz	3 MHz					

SHORT correction data for each measurement point over the specified frequency points is calculated using the interpolation method (Refer to Figure 5-14).

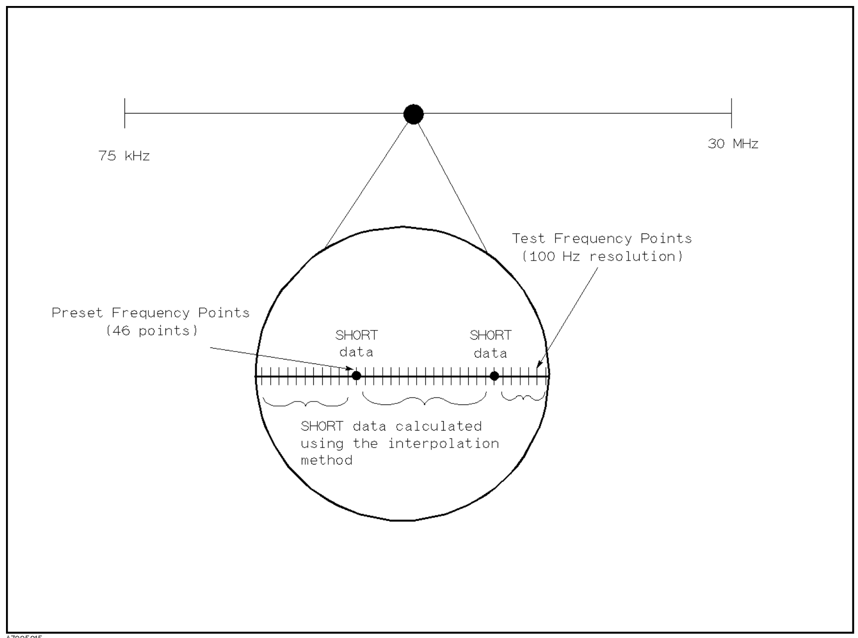


Figure 5-14. SHORT Correction Using The Interpolation Method

While the SHORT correction data measurement is being performed, the measurment conditions will be changed to the following:

Averaging rate : 4

- Spot correction mode

The spot SHORT correction data taken at the frequency points you specified allows you to set up to seven frequency points in the *SPOT 1*, *SPOT 2*, . . . , *SPOT 7* fields. To take the SHORT correction data at the frequency points you specify, `MEAS SHORT` displayed when the CURSOR is moved to the *SPOT 1*, *SPOT 2*, . . . , *SPOT 7* field, is used.

ON Softkey

This softkey enables SHORT correction.

OFF Softkey

This softkey disables SHORT correction.

MEAS SHORT Softkey

This softkey performs SHORT correction data measurements at the preset frequencies. The SHORT correction data measurement will take approximetory 20 seconds. And the message `SHORT measurement in progress` will be displayed on the system message line while the SHORT correction data measurement is being performed.

ABORT Softkey

This softkey is displayed while the SHORT correction data measurement is being performed and is used to stop the short correction data measurement. The previous SHORT correction data is retained.

Performing the SHORT Correction

There are two procedures: SHORT correction at all frequency points, and SHORT correction at user specified frequency points.

Perform the following steps to execute the SHORT correction for all frequency points. When you want to execute the short correction at the user specified frequency points, refer to the "Performing the SHORT/LOAD Correction".

Note

Perform the SHORT correction after warm-up.

As SHORT correction data is stored in the HP 42851A internal memory, once SHORT correction is performed, it is not required to perform SHORT correction again if the operating temperature is within 23 °C ±5 °C.

When the operating temperature is above 28 °C or below 18 °C, SHORT correction is required. And, if the temperature changes more than 3 °C from the temperature at which correction was performed, perform the SHORT correction again.

To keep accuracy high, it is recommended performing SHORT correction once a day.

1. Move the CURSOR to the *SHORT* field. The following softkeys will be displayed.
   - ON
   - OFF
   - MEAS SHORT
2. Connect the shorting bar to the coil terminals, and short the measurement contacts together.

3. Press MEAS SHORT. During the SHORT correction measurement, the following softkey will be displayed.
   - ABORT
4. Press ON to perform SHORT correction calculations on subsequent measurements when the *SPOT 1*, *SPOT 2*, . . . , *SPOT 7* fields are set to OFF.

   When the *SPOT 1*, *SPOT 2*, . . . , *SPOT 7* fields are set to ON, and the test frequency is equal to SPOT 1/2/ . . . /7, the SHORT correction data at SPOT 1/2/ . . . /7 is used.
5. Press OFF to halt SHORT correction calculations on subsequent measurements.

SPOT 1–7 Fields

The HP 4285A's LOAD correction function allows you to correct residual errors by using the transmission coefficient. The treansmission coefficient can be derived from the relationship between a working standard's (premeasured) reference value and the actual measurement value at the frequency points you specify (up to seven frequency points). The HP 4285A performs the SHORT/LOAD corrections at the frequency points you specify (Refer to Figure 5-15). The seven frequency points can be set in the *SPOT 1*,*SPOT 2*, . . . , *SPOT 7* fields.

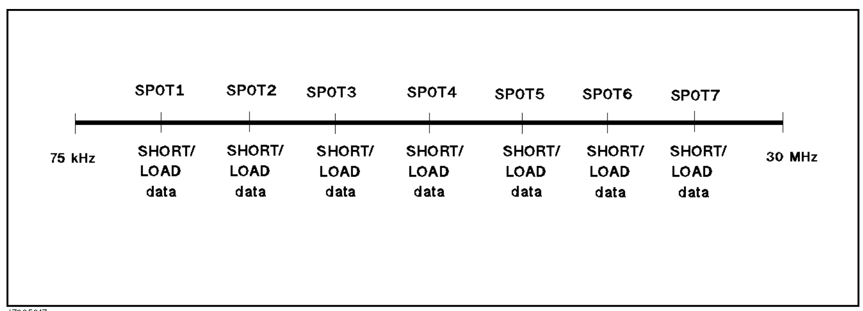


Figure 5-15. SHORT/LOAD Correction

Note

Perform a spot SHORT correction before performing the LOAD correction. If the spot SHORT correction is re-performed, also perform the LOAD correction. In case the correction procedure is reversed, the error correction function may not work properly.

ON Softkey

This softkey enables spot SHORT/LOAD correction at each specified correction frequency.

OFF Softkey

This softkey disables spot SHORT/LOAD correction at each specified correction frequency.

MEAS SHORT Softkey

This softkey is used to perform the spot SHORT correction data measurement at the specified spot frequency. The measuremnet result will be displayed on the system message line. While the SHORT correction data measurement is being performed, the measurement condition will be changed to the following.

Averaging rate : ≥ 4

MEAS LOAD Softkey

This softkey is used to perform the LOAD correction data measurement at the specified spot frequency. LOAD correction is especially useful for correlating the measurement result with the Q-Meter. While the LOAD correction data measurement is being performed, the measurement condition will be changed to the following:

Averaging rate : ≥ 4

REF-Q Field

The standard's reference values can be entered in the *REF-Q* field. *REF-Q* field is used to set the reference value for the Q factor. Before entering the standard's reference values, the measurement function for the standard must be set on the *FUNC* field in the *Q CORRECTION* page. The standard's value can be measured using MEAS LOAD, displayed on the *SPOT 1*, *SPOT 2*, ... , *SPOT 7* fields. LOAD correction is performed by the following equation.

$$Q = Q_{meas} \times \frac{Q_{ref}}{Q_{load}}$$

where,

Q_{meas} Measured Q value
Q_{ref} Entered standard's Q value
Q_{load} Measured standard's Q value

Performing the SHORT/LOAD Correction

Perform the following steps to perform the SHORT/LOAD correction at the frequency points you specify.

1. Move the CURSOR to the *SPOT1*, *SPOT2*, ... , *SPOT7* field to specify the frequency for the SHORT/LOAD correction. The following softkeys will be displayed.
   - ON
   - OFF
   - MEAS SHORT
   - MEAS LOAD
2. Press ON. The HP 4285A shows the previous frequency for the SHORT/LOAD correction.
3. Enter the frequency using the numeric entry keys. When pressing one of the numeric entry keys, the softkey labels are changed to the available units (kHz and MHz), so you can use these softkeys

to enter the unit and terminate the entry without hitting (ENTER). (When (ENTER) is used, the numeric data is entered in Hz.)

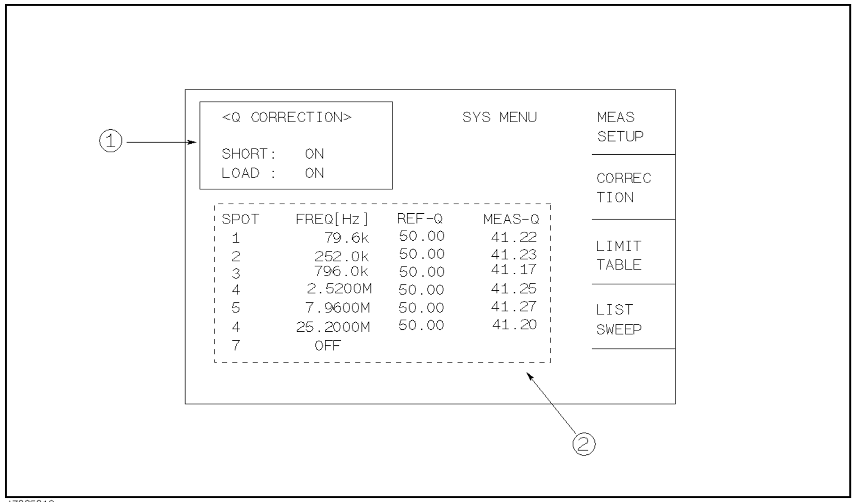
—SHORT correction—

4. Connect HIGH and LOW terminals using the shorting bar furnished with the HP 42851A.
5. Press MEAS SHORT. The HP 4285A will perform a SHORT correction measurement, and display the SHORT correction data on the system message line.
6. Move the CURSOR to the *SHORT* field.
7. Press ON to perform the SHORT correction calculations for subsequent measurements at the specified frequency points.

—LOAD correction—

8. Prepare the working standard.
9. Move the CURSOR to the *REF-Q* field of your specified frequency.
10. Enter the premeasured value of your standard's Q value using the numeric entry keys and the unit softkeys.
11. Move the CURSOR to the *SPOT1*, *SPOT2*, . . . , *SPOT7* field which you specified.
12. Connect the working standard to the measurement terminals.
13. Press MEAS LOAD. The HP 4285A will perform a LOAD correction measurement, and display the LOAD correction data on the *MEAS-Q* field.
14. Move the CURSOR to the *LOAD* field.
15. Press ON to enable the LOAD correction calculations for subsequent measurements at the specified frequency points.

Note The relationship between the *Q CORRECTION* page and SHORT/LOAD correction function are as follows.



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① This area is used as follows.

- To perform the SHORT/LOAD correction calculations using either the SHORT interpolation correction data or the SHORT/LOAD correction data at the spot frequency you specify. This correction data selection depends on the test frequency.
- To obtain the SHORT interpolation correction data.

② This area is used as follows.

- To obtain the SHORT/LOAD correction data at the spot frequencies you specify (FREQ1, FREQ2, ... , FREQ7).
- To make the SHORT/LOAD correction data at the spot frequencies you specify (FREQ1, FREQ2, ... , FREQ7) valid or invalid.

The correction data used depends on the test frequency as follows.

Correction Mode	**Test Frequency** $\neq$ *SPOT1–7*		**Test Frequency** = *SPOT1–7*	
	SPOT1–7 **OFF**	*SPOT1–7* **ON**	*SPOT1–7* **OFF**	*SPOT1–7* **ON**
SHORT: ON	INTPOL	INTPOL	INTPOL	SPOT
LOAD: ON	×	×	×	SPOT

Where,

SPOT: The correction data for the frequency points you specified is used.

INTPOL: Interpolation correction data is used.

X: Correction isn't performed even if the correction function is set to ON in the *SHORT* or *LOAD* fields.

When the specified frequency is equal to another spot frequency, the correction data is used in the following manner.

- Test Frequency = SPOT1 = SPOT2

  Correction data: Data at SPOT1
- Test Frequency = SPOT2 = SPOT3 =···= SPOT7

  Correction data: Data at SPOT2
- Test Frequency = SPOT1 = SPOT2 =···= SPOT7

  Correction data: Data at SPOT1

SYS MENU Field

The system menu on this page allows you to perform the following control functions.

- Printer

This function is the same as the functions on the system menu on the *MEAS DISPLAY* page. (A description of this function is given on "SYS MENU Field" in Chapter 4 on page 4-10.) So only the procedure is given in the following paragraphs.

PRINT DISP Softkey

This softkey is used to print the current correction page setup.

Printing the Q CORRECTION Page Setup

Perform the following steps to print out the *Q CORRECTION* page information using the PRINT DISP mode.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the Listen-Only mode.
3. Set the Talk-Only mode to ON from the *SYSTEM CONFIG* page.
4. Press [MEAS SETUP], and CORRECTION to display the *Q CORRECTION* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press PRINT DISP to print out the display page. LCD screen freezes for a moment and the displayed page is printed out by the printer as shown in Figure 5-16.

```
<Q CORRECTION>         SYS MENU
SHORT : ON
LOAD  : ON

SPOT FREQ[Hz]   REF-Q   MEAS-Q
 1      70.6k    40.00   41.22
 2     252.0k    40.00   41.23
 3     796.0k    40.00   41.17
 4    2.5000M    40.00   41.25
 5    7.9000M    40.00   44.34
 6    7.9600M    40.00   41.20
 7   25.2000M    65.00   67.94
```

Figure 5-16. Q CORRECTION Page Print Example

Effective Q mode

This mode corrects the error due to loss in the tuning capacitor inside of the HP 42851A and displays the corrected Q value. The obtained Q value is closer to the true Q value of the DUT. Generally, as shown in Figure 5-17, the resonant circuit contains a very small loss in the tuning capacitor. This loss, however, is not a simple resistance and is directly proportional to the measurement frequency. The effect of the loss becomes significant when the DUT's loss is small. For this reason, the measured value obtained by the resonant method is different from the DUT's true Q value. This difference becomes larger when the measurement frequency is high, or when the DUT's Q value is high, or when the tuning capacitance value is high. The EFFECTIVE mode calculates and corrects the error due to the loss in the turning capacitor. Thereby, the measured Q value becomes greater than the CIRCIUT Q mode. The correction is automatically done in the HP 4285A and also applies to PARALLEL connection method (in SERISES connection, calculation is not required because of its measurement principle). The Offset L/C/R function which corrects fixture residuals can also be sued in the same time. At the factory shipment, the HP 4285A is set to this mode. The attached tables give supplemental data for the EFFECTIVE Q mode. The data in the tables is the typical Q measurement error range referring to the DUT's true Q value.

CIRCIUT Q mode

This mode does not correct the error caused by loss in the turning capacitor. However, the displayed Q value is closer to the value that would be given by a Q meter. The Q value in this mode is also compatible with &85;s serial numbered lower than 3009J00275 which cannot select the Q mode. Q measurement accuracy described in this manual directly applies to the CIRCUIT Q mode. The accuracy, however, does not refer to the DUT's true Q value but to the circuit's Q value.

Q mode selection

EFFECTIVE Q mode and CIRCUIT Q mode can be selected on the Q-MODE field in the Q CORRECTION page. Once the mode is selected, it is retained in internal memory. When the EFFECTIVE Q mode is selected, "EF" is displayed on the COOR field on the Q MEAS DISPLAY page. Nothing is displayed in the CIRCUIT Q mode.

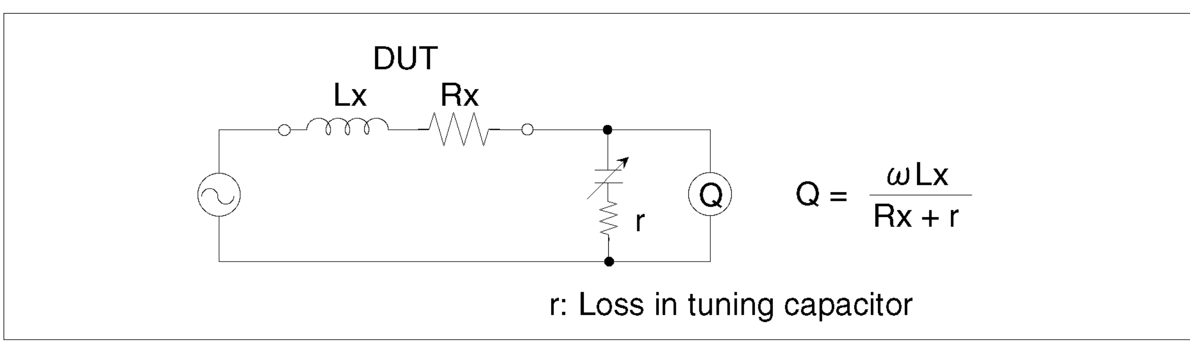

Figure 5-17. Resonant Circuit

Supplemental Data for the EFFECTIVE Mode

Typical Q measurement error range

ΔA_e (%) = ±[(Basic Accuracy) + (Additional Error) + 100 × 30 nH/L_{dut}]

where:

ΔQ_e : Q measurement Error using EFFECTIVE Q mode (typical)

Basic Accuracy:
Use the value given in Table 5-2.

Additional Error:
Determine one of the areas 0 through 3 given in the graph on the next page and then use the value given in the Table 5-3 through Table 5-5.

30 nH : Q measurement error caused by the measurement terminal residuals (at the binding post terminals). This value can be minimized if L OFFSET function is used.

L_{dut} : DUT's inductance value (nH)

Table 5-2. Basic Accuracy

Measured Q Value	Accuracy
5.00 to 100.00	5 %
100.01 to 300.00	7 %
300.01 to 600.00	10 %
600.01 to 999.99	15 %

Additional Error

Additional error value depends on the area specified by measurement frequency and turning capacitance value. Refer to the graph on the next page to determine the area.

Table 5-3. Error for AREA 1

Measured Q Value	Error
5.00 to 100.00	0 %
100.01 to 300.00	1 %
300.01 to 600.00	3 %
600.01 to 999.99	7 %

Table 5-4. Error for AREA 2

Measured Q Value	Error
5.00 to 100.00	1 %
100.01 to 300.00	3 %
300.01 to 600.00	9 %
600.01 to 999.99	20 %

Table 5-5. Error for AREA 3

Measured Q Value	Error
5.00 to 100.00	2 %
100.01 to 300.00	8 %
300.01 to 600.00	23 %

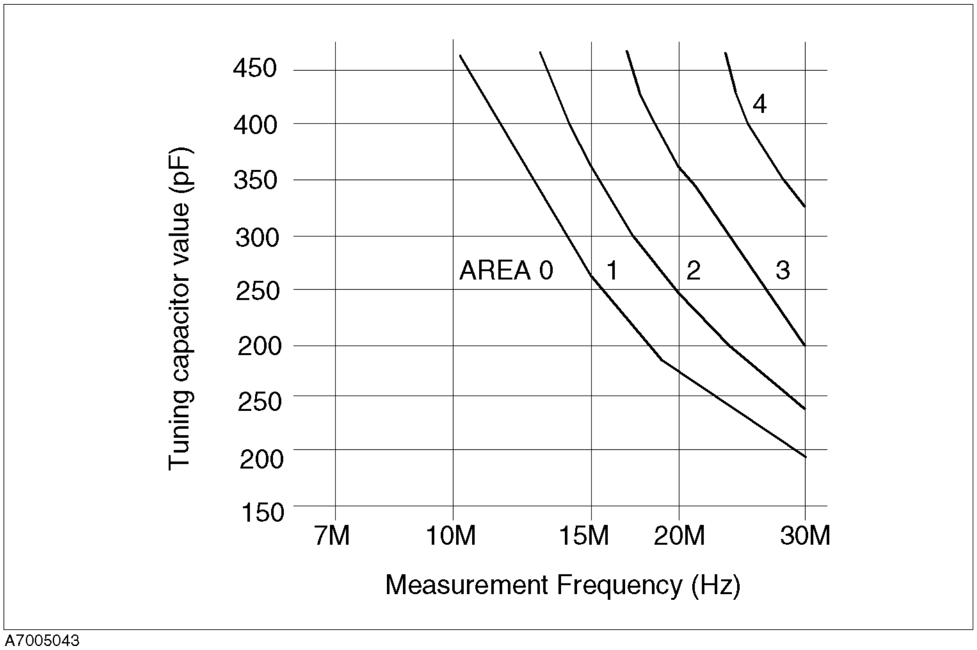

Figure 5-18. Additional Error

Note

AREA 4 in this graph is out of the effective measurement range so measurement accuracy does not apply in this area.

Q LIMIT TABLE SETUP Page

This page will be displayed by pressing (MEAS SETUP) and LIMIT TABLE. This page allows you to set the HP 4285A's built-in comparator function. The built-in comparator can sort devices into a maximum of ten bins (BIN 1 to BIN 9 and one OUT OF BINS bin) using a maximum of nine pairs of primary limits and one pair of secondary parameter limits. Also, the DUTs whose primary parameter is within limits, but whose secondary parameter measurement result not within limits, can be sorted into an AUXiliary BIN. This comparator function is especially useful when using the HP 4285A with a component handler (when the handler interface option is installed and turned on in the *SYSTEM CONFIG* page). The limit settings for bin sorting are only one set on this *Q LIMIT TABLE SETUP* page.

- LOAD/STORE (*SYS MENU*)
- Print Out (*SYS MENU*)
- Clear Table (*SYS MENU*)
- Swap parameter function (*FUNC*)
- Comparator function's limit mode (*MODE*)
- Nominal value for tolerance mode (*NOMINAL*)
- Auxiliary bin ON/OFF (*AUX*)
- Comparator function ON/OFF (*COMP*)
- Low limit value of each bin (*LOW*)
- High limit value of each bin (*HIGH*)

The function of each field is described in the following paragraphs. The available fields and the softkeys which correspond to the fields on this page are shown in Figure 5-19 and Figure 5-20.

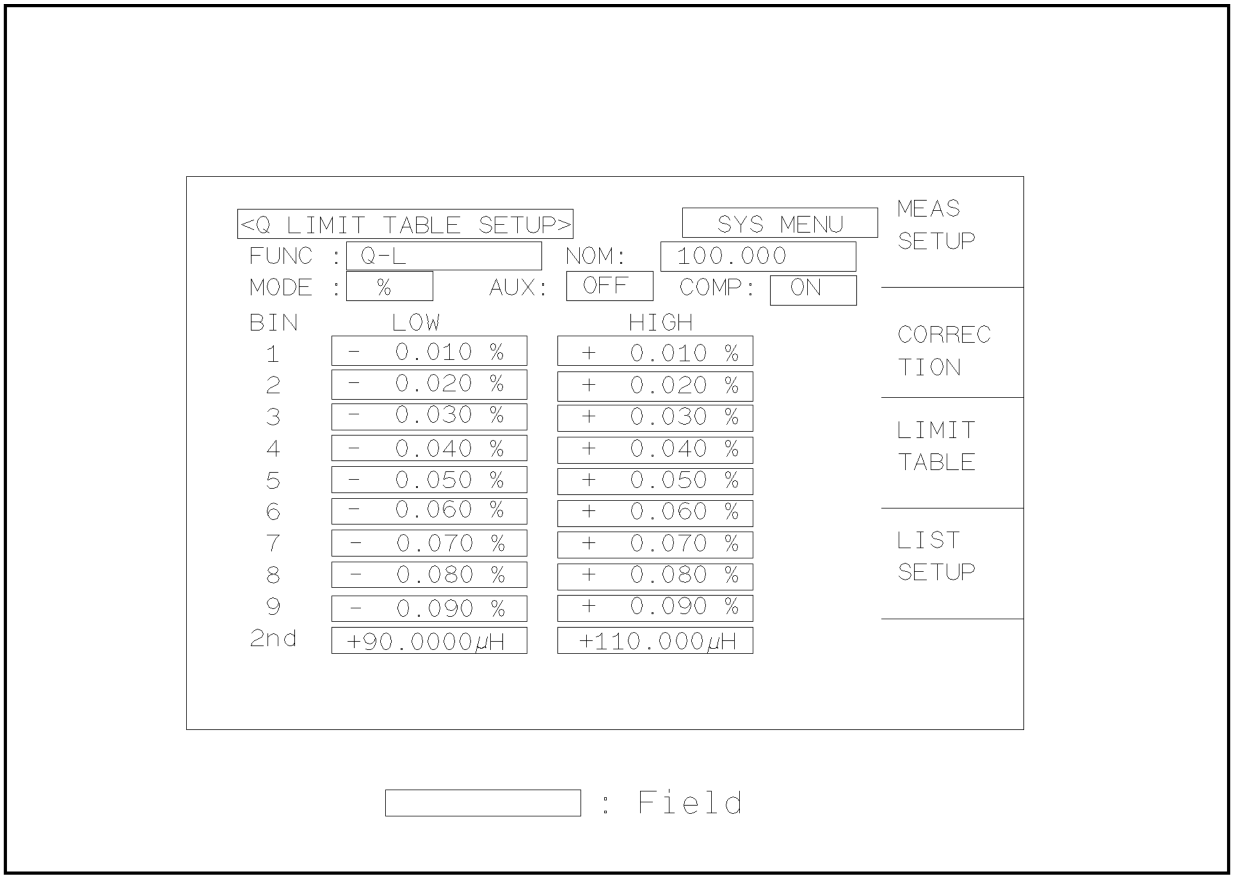

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Figure 5-19. Available Fields on the Q LIMIT TABLE SETUP Page

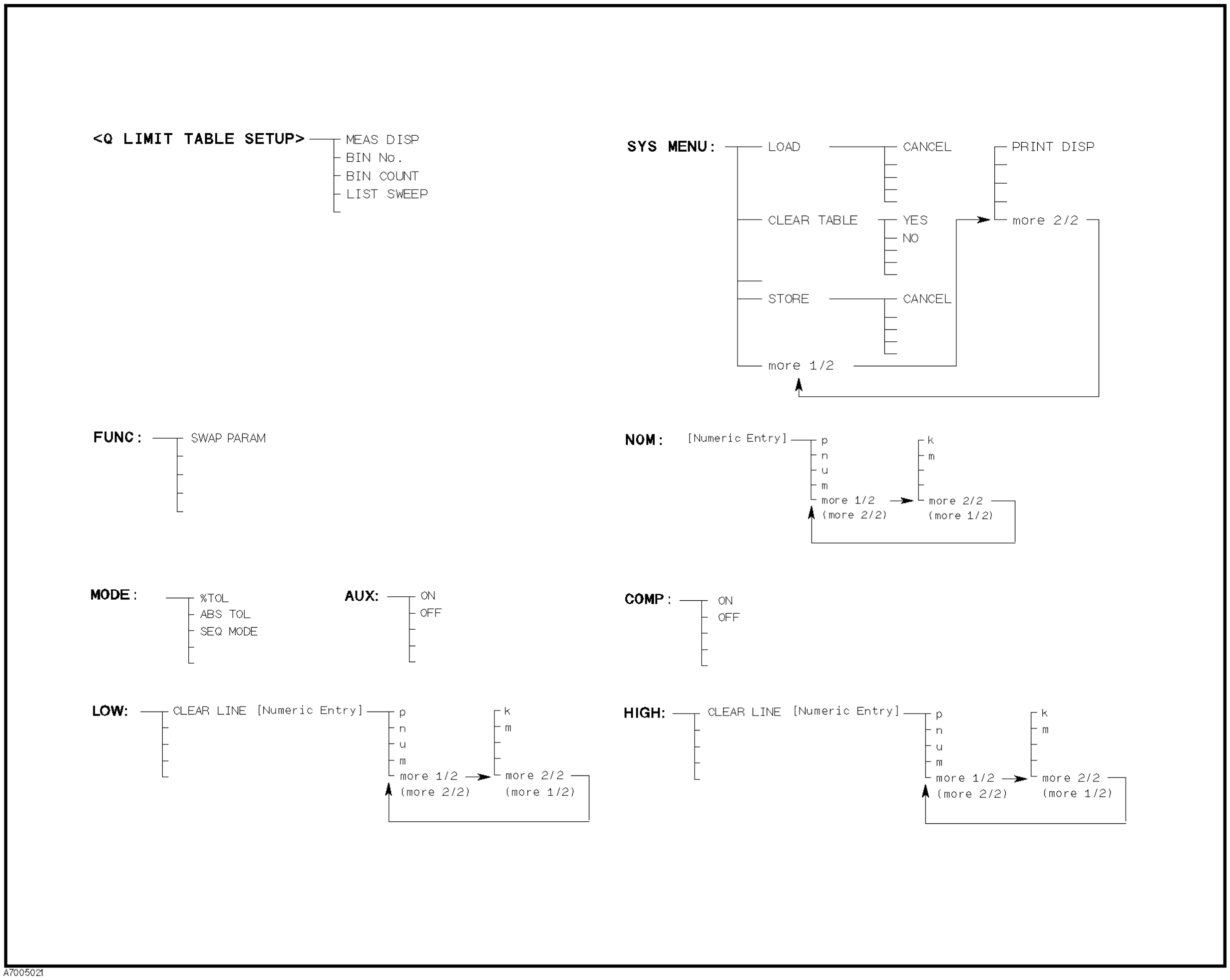


Figure 5-20. Available Softkeys on the Q LIMIT TABLE SETUP Page

FUNC Field

This field shows the currently selected primary and secondary parameters. The parameter combinations displayed in this field can be changed in the *FUNC* field on the *MEAS DISPLAY* page or the *Q MEAS SETUP* page.

`SWAP PARAM` Softkey

This softkey swaps the primary parameter and the secondary parameters. For example, when the measurement function is Q-L, the swap parameter function sets the measurement function to L-Q. In the L-Q mode, comparison limits for L can be set to a maximum of nine pairs of comparison limits, and the comparison limits for Q can be set to one pair.

Swapping the Primary and Secondary Parameters

Perform the following steps to swap the primary and secondary parameters.

1. Move the CURSOR to the *FUNC* field. The following softkey will be displayed.

- SWAP PARAM

2. Press SWAP PARAM to swap the primary and secondary parameter conbinations of the measurement function.
3. Press SWAP PARAM again to return the measurement function to the previous combination.

MODE Field

The HP 4285A uses two methods for specifying primary parameter limits, as shown in Figure 5-21.

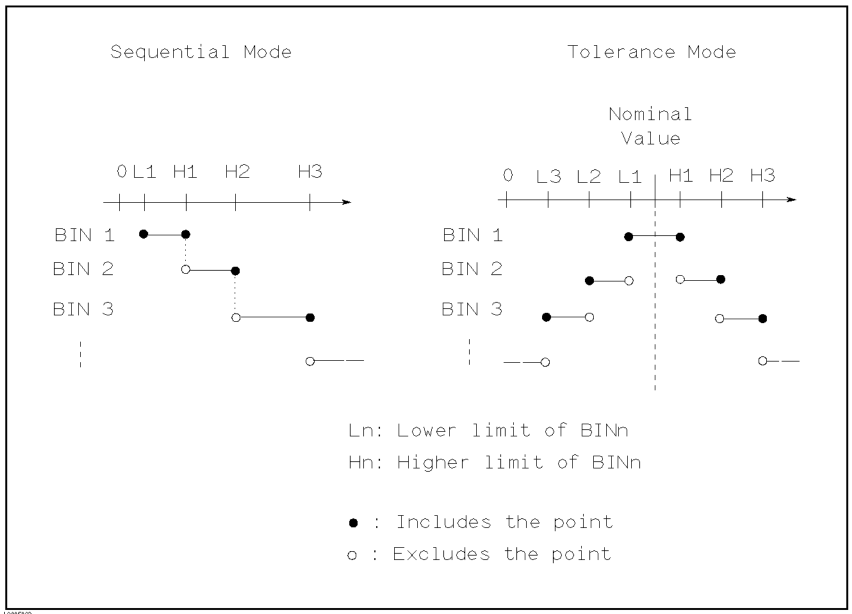


Figure 5-21. Tolerance Mode and Sequential Mode

- Tolerance Mode

  The tolerance mode specifies comparison limits by the deviation from a specified nominal value. The nominal value is specified in the *NOM* field. Generally, in this mode, symmetrical nested limits are used as shown in Figure 5-21. The HIGH limit value must be higher than the LOW limit value. If not, the warning message `Warning, Improper high/low limits`, (this isn't an error, only a warning), will be displayed, and the HP 4285A will not sort the DUTs into the specified BINs. The lower numbered bins must have narrower limits than the higher numbered ones. If BIN 1 has the widest limits, all of the DUTs will be sorted into BIN 1, and neither the error message nor the warning message will be displayed.

  In the tolerance mode, unsymmetrical unnested limits are also possible. If it is necessary to define bins with overlaps or gaps between limits, set the unsymmetrical unnested limit values as shown in Figure 5-22.

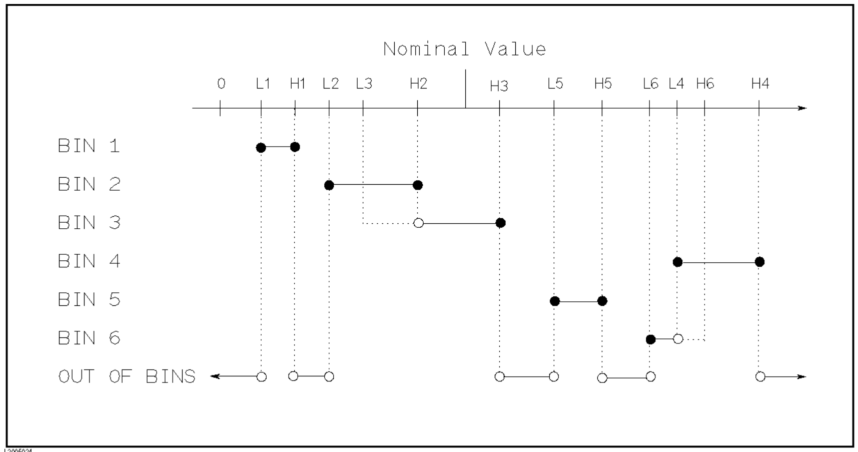


Figure 5-22. Tolerance Limit with Overlaps and Gaps

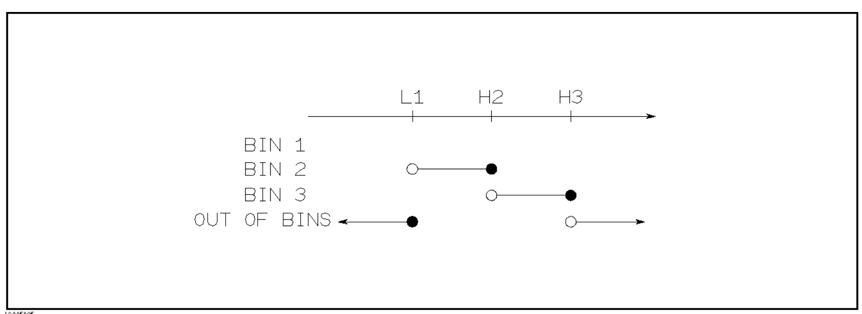
There are two methods to specify tolerance mode limits, the ratio in percent and by absolute parameter value.

- Sequential Mode

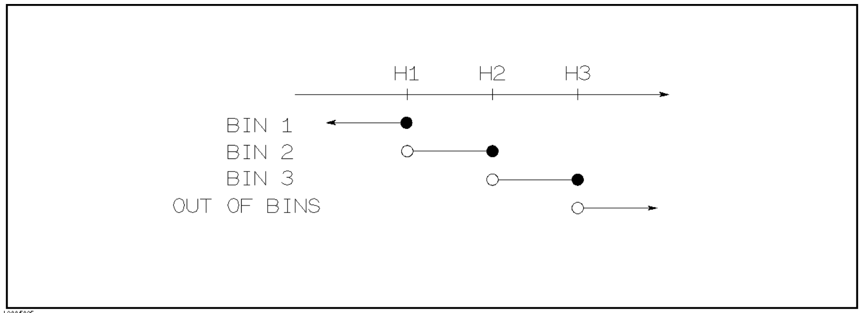
  The sequential mode specifies comparison limits as the absolute measurement value. The limits must be set in order from the smallest value to the largest value. If not, the warning message `Warning, Improper high/low limits`, (this isn't an error, only a warning), will be displayed, and the HP 4285A will not sort the DUTs into the specified BINs.

  The limit values for sequential mode sorting can be set without setting the lower/higher limits of BIN1. For example,

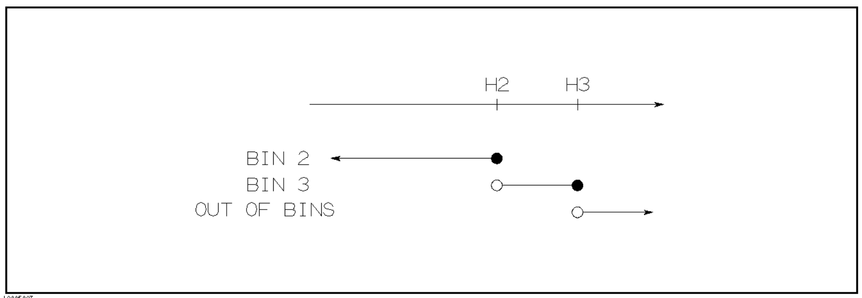
  - BIN 1: Low Limit (L1) only
    BIN 2: High Limit (H2)
    BIN 3: High Limit (H3)



  - BIN 1: High Limit (H1) only
    BIN 2: High Limit (H2)
    BIN 3: High Limit (H3)



- BIN 2: High Limit (H2)
  BIN 3: High Limit (H3)



`% TOL` Softkey

This softkey sets the limit mode to the tolerance mode (ratio in percent).

`ABS TOL` Softkey

This softkey sets the limit mode to the tolerance mode (parameter value).

`SEQ` Softkey

This softkey sets the limit mode to sequential.

Setting the Comparator Limit Mode

Perform the following steps to set the limit mode for the comparator.

1. Move the CURSOR to the *MODE* field. The following softkeys will be displayed.
   - `% TOL`
   - `ABS TOL`
   - `SEQ`
2. Select the appropriate limit mode using the softkeys.

NOM Field

When the tolerance mode is used as the limit mode for the primary parameter, a nominal value must be specified. The nominal value can be set within the range of the following measurement range of the primary parameter.

Primary Parameter and Display Range

Parameter	Range
C	0.00001 pF to 999.999 μF
L	0.001 nH to 99.9999 H
Q	0.01 to 99999.9

When the limit mode for the primary parameter is the sequential mode, a nominal value can be set, but this has no meaning in the sequential mode.

Setting the Nominal Value

Perform the following steps to set the nominal value.

1. Move the CURSOR to the *NOM* field.
2. Enter the nominal value using the numeric entry keys. When the numeric data is entered, the suffix softkeys (p, n, μ, m, k, and M) can be used instead of ENTER.

COMP Field

The HP 4285A's built-in comparator can sort DUTs into a maximum of ten bins (BIN 1 to BIN 9 and the OUT OF BINS bin) using a maximum of nine pairs of primary limits and one pair of secondary parameter limits. Also, a DUT whose primary parameter is within limits, but whose secondary parameter measurement result is not within limits can be sorted into the AUXiliary BIN. The comparator function is especially useful when using the HP 4285A with a component handler (handler interface option is installed).

ON Softkey

This softkey turns the built-in comparator function ON. Comparison takes approximetory 1 ms.

OFF Softkey

This softkey turns the built-in comparator function OFF.

Turning the Comparator Function to ON or OFF

Perform the following steps to set the comparator function to ON or OFF.

1. Move the CURSOR to the *COMP* field. The following softkeys will be displayed.
   - ON
   - OFF

2. Press appropriate softkey to set the comparator function to ON or OFF.

LOW/HIGH Fields

The HP 4285A's built-in comparator can sort DUTs into a maximum of ten bins (BIN 1 to BIN 9, and OUT OF BINS) using a maximum of nine pairs of primary parameter limits and one pair of secondary parameter limits. These primary parameter low/high limits can be set in the *BIN 1* to *BIN 9 LOW/HIGH* fields.

CLEAR LINE Softkey

This softkey clears a pair of LOW/HIGH limit fields where the CURSOR resides.

Entering the LOW/HIGH Limits

Perform the following steps to enter the bin sorting limits.

1. Set the measurement function for the comparator function in the *DISPLAY FORMAT* or *Q MEAS SETUP* pages.
2. Press (MEAS SETUP) and LIMIT TABLE to display the *Q LIMIT TABLE SETUP* page.
3. Move the CURSOR to the *SYS MENU* field, and press CLEAR TABLE and YES to perform the clear table function.
4. Move the CURSOR to the *MODE* field, and select the limit mode for the primary parameter.
5. When you choose the tolerance mode in the *MODE* field in the step 3, move the CURSOR to the *NOM* field, and set the nominal value.
6. Move the CURSOR to the *BIN 1 LOW* field. When you use the tolerance mode, perform step 6 . When you use the sequential mode, perform step 7.
7. *—In the Tolerance Mode—*
   a. Enter the limit value of the BIN 1 at *BIN 1 LOW* field using the numeric entry keys. When one of the numeric entry keys is pressed, the suffix softkeys (p , n , μ , m , k , and M) will be displayed, and you can use these softkeys to enter the unit and to terminate the entry instead of using (ENTER). When the limit value of BIN 1 is entered in the *BIN 1 LOW* field, the BIN 1 low limit becomes – (absolute input value), and the BIN 1 high limit becomes + (absolute input value).
   b. The CURSOR will be automatically moved to the *BIN 2 LOW* field. Repeat step (a.) until the limits of the BIN 9 are entered. After that, the CURSOR will be moved to the *2nd LOW* field.
   c. Enter the low limit value of the secondary parameter. After that, the CURSOR will move automatically to the *2nd HIGH* field.
   d. Enter the high limit value of the secondary parameter. Then the entry example using the tolerance mode is shown in Figure 5-19.
8. *—In the Sequential Mode—*

a. Enter the low limit of the BIN 1 using the numeric entry keys. When the one of the numeric entry keys is pressed, the suffix softkeys (p, n, μ, m, k, and M) will be displayed, so you can use these softkeys to enter the unit and terminate the entry instead of using (ENTER).

b. The CURSOR will be automatically moved to the *BIN 1 HIGH* field after entering the low limit of the BIN 1. Enter the high limit of the BIN 1.

c. The CURSOR will be automatically moved to the *BIN 2 HIGH* field. Because the BIN 2 low limit value is as same as the BIN 1 high limit value. Enter the high limit of the BIN 2.

d. Repeat step C until the BIN 9 limits are entered. After entering the BIN 9 high limit, the CURSOR will move automatically to the *2nd LOW* field. Enter the low limit value of the secondary parameter.

e. The CURSOR will be automatically moved to the *2nd HIGH* field. Enter the high limit value of the secondary parameter. The entry example using the sequential mode is shown below.

```
<Q LIMIT TABLE SETUP>      SYS MENU          MEAS
FUNC : Q-L        NOM :   100.00             SETUP
MODE : SEQ   AUX: ON     COMP:  ON
BIN     LOW              HIGH                CORREC
 1   + 100.00        + 110.00                TION
 2                   + 120.00
 3                   + 130.00                LIMIT
 4                   + 140.00                TABLE
 5                   + 150.00
 6                   + 160.00
 7                   + 170.00                LIST
 8                   + 180.00                SETUP
 9                   + 190.00
2nd  + 90.0000μH     +110.000μH
```

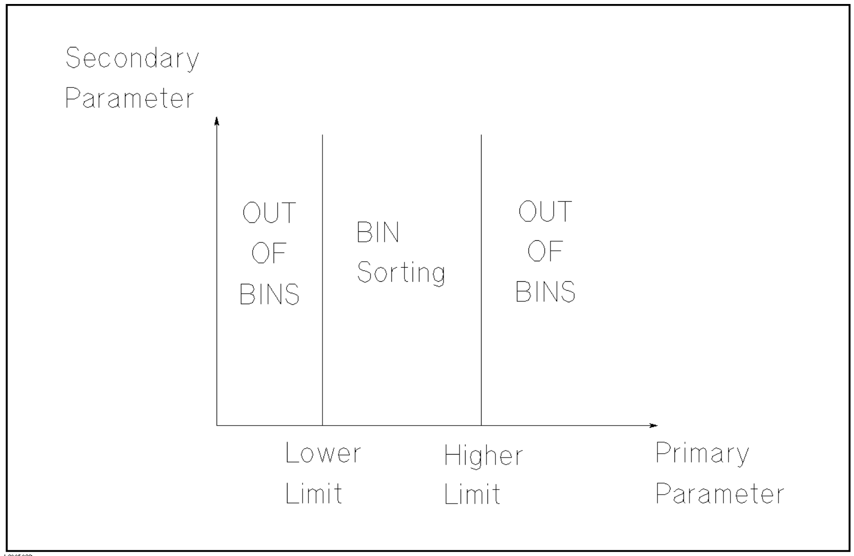
Figure 5-23. Limit Table Using the Sequential Mode

2nd LOW/HIGH Fields

The HP 4285A's built-in comparator allows sorting DUTs by the secondary parameter into three bins; low, in, and high. These 2nd LOW/HIGH limits can be set in the *2nd LOW/HIGH* fields

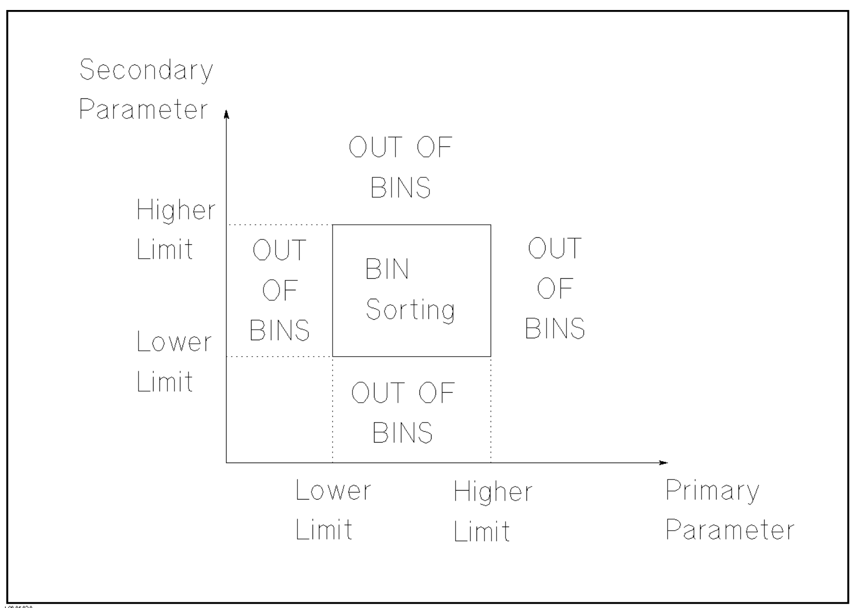
- When the secondary parameter limits are not specified on the *Q LIMIT TABLE SETUP* page.

  The DUTs will be sorted according to the primary parameter comparison results as shown below.



- When the secondary parameter limits are specified.

  DUTs with secondary limits are sorted by the primary parameter result. DUTs not within the secondary parameter limits are sorted OUT OF BINS even if the device's primary parameter is within limits.

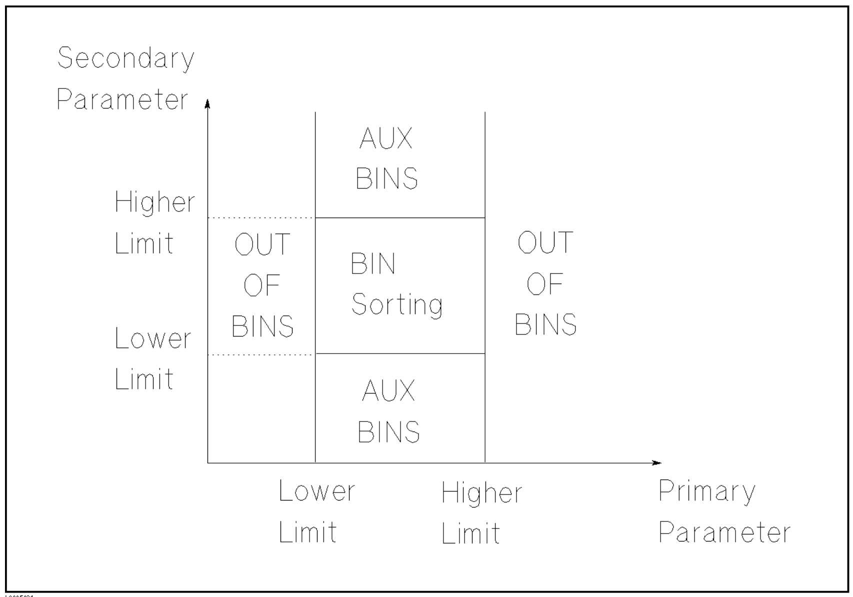


AUX Field

The HP 4285A's sorts DUTs which fail the secondary parameter separately from the OUT OF BINS DUTs, they are sorted into the AUX BIN. The *AUX* field allows you to set the AUXiliary bin to ON or OFF. The AUXiliary bin is available only when 2nd LOW/HIGH limits are specified.

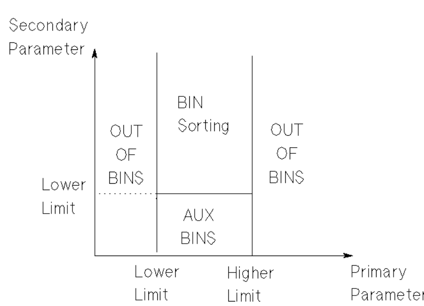
- When the secondary parameter limits are set and AUX BIN are set to ON.

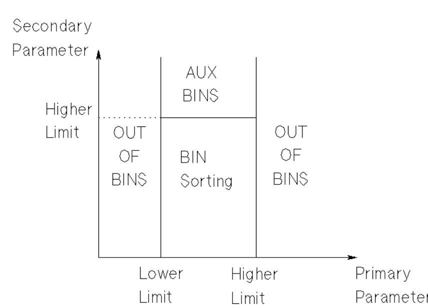
  The DUTs whose primary parameter is not within limits are sorted OUT OF BINS. DUTs whose primary parameter is within limits, but whose secondary parameter is out of limits are sorted into the AUX BIN.



Note

When only the lower limit of the secondary parameter is set and the AUX BIN are set to ON, the DUTs whose primary parameter is within limits, but whose secondary parameter is equal to or below the lower limit are sorted into the AUX BIN. Also when only the higher limit of the seconmeter is set and the AUX BIN are set to ON, the DUTs whose primary paramter is within limits, but whose secondary parameter is equal to or above the higher limit are sorted into the AUX BIN. (See below.)





Setting the AUX BIN to ON or OFF

Perform the following steps to set the AUX BIN to ON or OFF.

1. Move the CURSOR to the *AUX* field. The following softkeys will be displayed.
   - `ON`
   - `OFF`
2. Press either softkey to set AUX BIN to ON or OFF.

SYS MENU Field

The system menu on this page allows you to perform the following control functions.

- Load/Store
- Clear table
- Printer

These functions, except for the clear table function, are the same as the functions on the system menu on the *MEAS DISPLAY* page. (A description of each function is given in "SYS MENU Field" in Chapter 4 on page 4-10.) So, in the case of the clear table function, the description and procedure are given, and in the case of the other functions, only the procedure is given.

Loading or Storing the Control Settings

Perform the following steps on the *Q LIMIT TABLE SETUP* page to LOAD/STORE the control settings to the internal non-volatile memory or to the external memory card.

1. Set all controls.
2. Move the CURSOR to the *SYS MENU* field on the *Q LIMIT TABLE SETUP* page.
3. Insert the memory card to the MEMORY card slot, if you are using the memory card.
4. Press `STORE` when you want to use the STORE function. The message `Enter record number to STORE` will be displayed on the system message line.

   Press `LOAD` when you want to use the LOAD function. The message `Enter record number to LOAD` will be displayed on the system message line.
5. Enter the record number using the numeric entry keys and press `ENTER` to STORE the current control settings, or LOAD the control settings.

`CANCEL` Softkey

This softkey cancels the current LOAD/STORE operation.

`CLEAR TABLE` Softkey

This function allows you to clear the all limit values. So, when you change the limit mode, use this function.

Clearing the Limit Table

Perform the following steps to clear all of bin sorting limits on the *Q LIMIT TABLE SETUP* page.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `CLEAR TABLE`. The message `Clearing table, Are you sure?` will be displayed on the system message line, and the following softkeys will be displayed.
   - `YES`
   - `NO`
3. Press `YES` to confirm the limit table clear operation.

Printing the Q LIMIT TABLE SETUP Page

Perform the following steps to print out the display page using the PRINT DISP mode.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the Listen-Only mode.
3. Set the Talk-Only mode to ON on the *SYSTEM CONFIG* page.
4. Press (MEAS SETUP) and `LIMIT TABLE` to display the *Q LIMIT TABLE SETUP* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP`. The display page is printed out by the printer as shown in Figure 5-24.

```
<Q LIMIT TABLE SETUP>    SYS MENU
FUNC: Q-L          NOM:   40.00
MODE:  %      AUX: OFF  COMP: ON
BIN    LOW          HIGH
 1  -  5.000 %    +  5.000 %
 2  - 10.000 %    + 10.000 %
 3  - 15.000 %    + 15.000 %
 4  - 20.000 %    + 20.000 %
 5
 6
 7
 8
 9
2nd +10.0000uH    +12.0000uH
```

Figure 5-24. Q LIMIT TABLE SETUP Page Printout Example

Q LIST SWEEP SETUP Page

The LIST SWEEP function of the HP 4285A allows you to program up to ten sweep points and to automate the measurement process. When you press *Q MEAS SETUP* and LIST SETUP, the *Q LIST SWEEP SETUP* page will be displayed. The following two parameters can be swept by the LIST SWEEP.

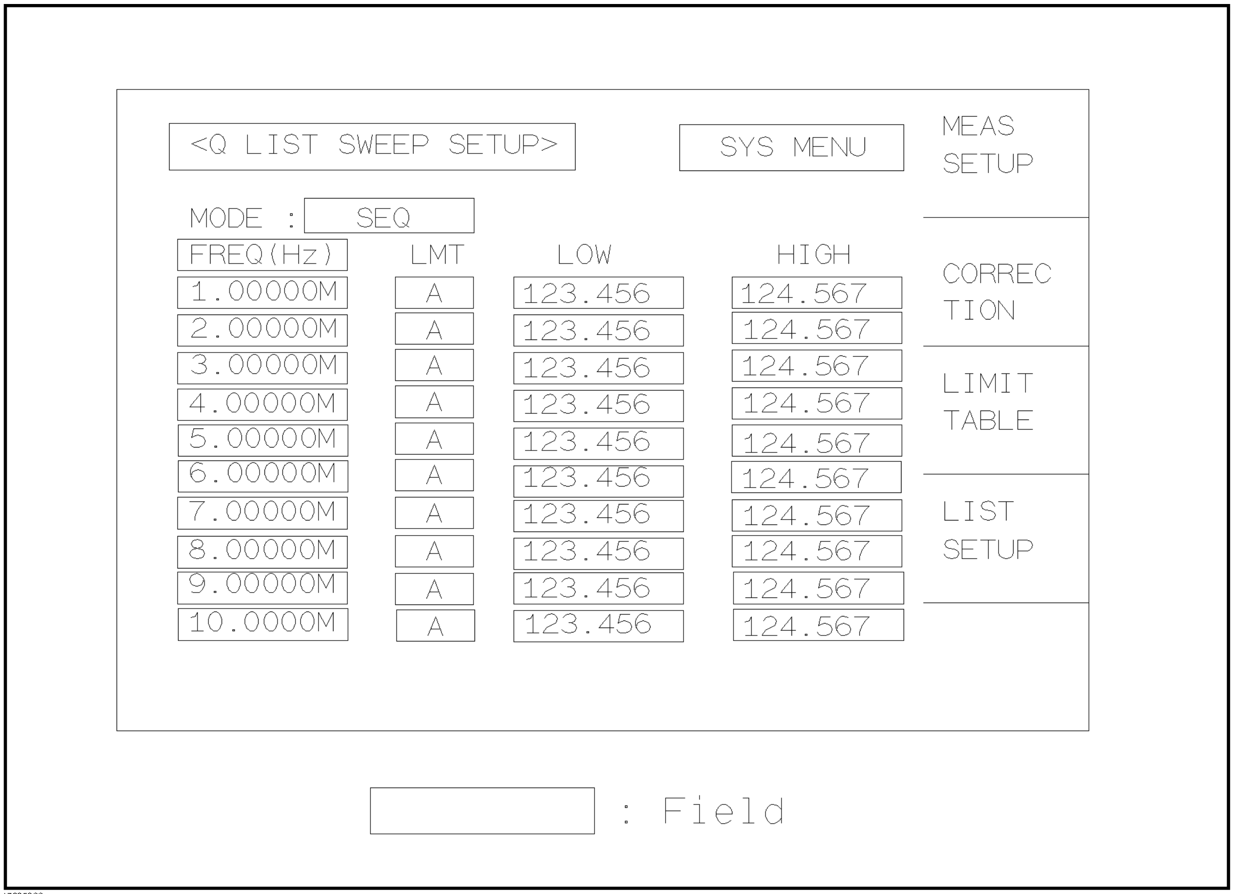
- Test frequency
- Oscillator level voltage

On the *Q LIST SWEEP SETUP* page, the following control settings of the list sweep measurement can be set. (Each field in parenthesis is used when that control is set.)

- LOAD/STORE (*SYS MENU*)
- Printout (*SYS MENU*)
- Clear Table (*SYS MENU*)
- Sweep Mode (*MODE*)
- Sweep Parameter Selection (*FREQ [Hz]* or *LEVEL [V]*)
- Sweep Point Settings (*sweep points*)
- Limit Parameter Selection (*LMT*)
- Low/High Limit Values (*LOW*, *HIGH*)

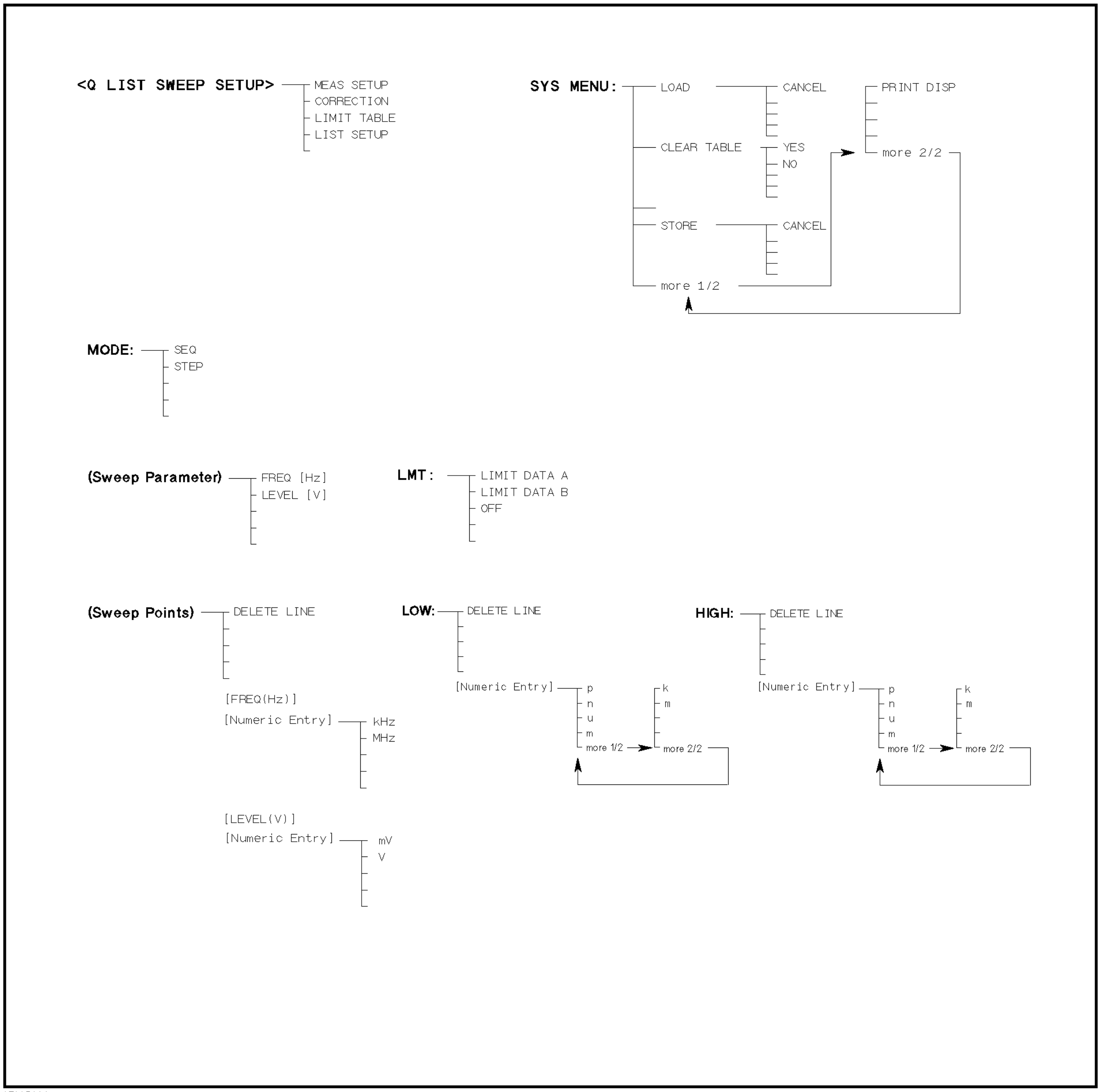
These functions are described in the following paragraphs.

The available fields and softkeys which corresponded to the fields on this page are shown in Figure 5-25 and Figure 5-26.



A7005033

Figure 5-25. Available Fields on the Q LIST SWEEP SETUP Page



A7005034

Figure 5-26. Available Softkeys on the Q LIST SWEEP SETUP Page

Mode Field

There are two sweep modes for list sweep measurements: sequential (SEQ) mode and step (STEP) mode. In the case of the sequential mode, when the HP 4285A is triggered once, the DUT is automatically measured at all sweep points. In the case of the step mode, the sweep point is incremented each time the HP 4285A is triggered.

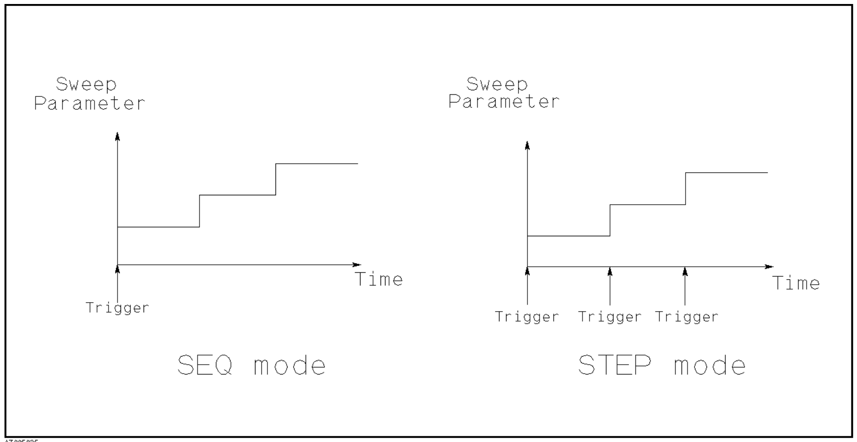


Figure 5-27. SEQ mode and STEP mode

Note When two or more sweep points are the same, and are adjacent, the HP 4285A measures the DUT once, and then the measurement result is compared to limits set for each sweep point.

Setting the List Sweep Measurement Mode

Perform the following steps to set the list sweep measurement mode to the sequential mode, or to the step mode.

1. Move the CURSOR to the *MODE* field. The following softkeys will be displayed.
   - SEQ
   - STEP
2. Choose appropriate softkey to set the list sweep measurement mode.

List Sweep Parameter Fields

The sweep point parameter for the list sweep measurement can be set to the test frequency and oscillator voltage level. This field allows you to set the parameter of the list sweep measurement.

Setting the List Sweep Parameter

Perform the following steps to set the list sweep parameter.

1. Move the CURSOR to the *FREQ*[Hz] (or *LEVEL* [V]) field. The following softkeys will be displayed.
   - FREQ [Hz]
   - LEVEL [V]
2. Choose appropriate softkey to set the list sweep measurement sweep parameter.

Sweep Points and Limit Fields

The list sweep function permits entry of up to 10 points and measurement limits. Figure 5-28 shows the available fields for setting the sweep points, the limit parameter, and the high/low limit values.

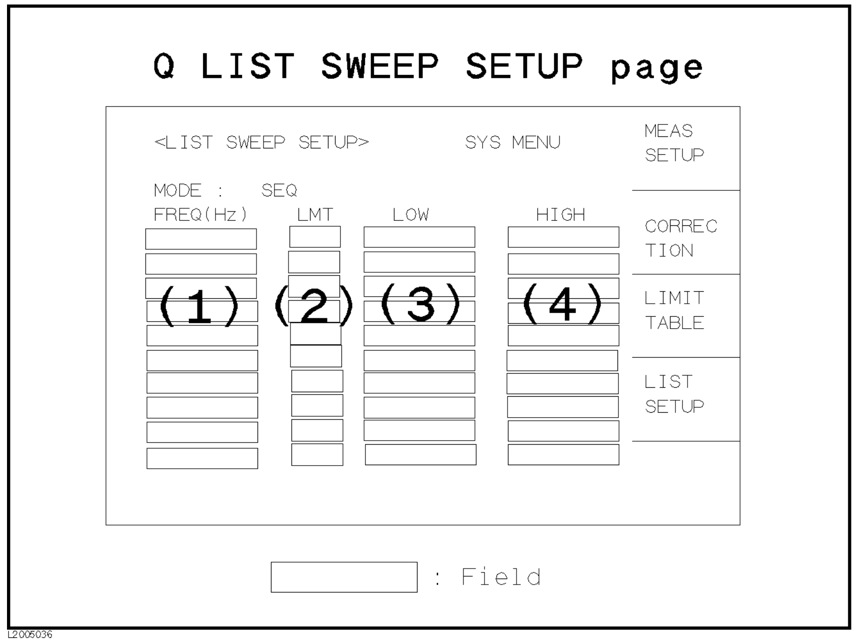


Figure 5-28. Q List Sweep Settings

Note

When only the low limits of the sweep points are set, DUTs' whose selected parameter's data are equal, or are above the low limits are sorted as IN. When only the high limits of the sweep points are set, DUTs' whose selected parameter's data are equal, or are below the high limits are sorted as IN.

Note

When the *LMT* field is set to `A` or `B`, if the low/high limit values aren't entered, the comparison results are always IN.

Note

The comparison results are always LOW under the following conditions (which are equal to the condition at <STATUS> $\neq$ 0 in the data format.)

- Tuning is incomplete.
- A/D converter isn't working.

Note

Do NOT enter a value which is lower than the LOW limit into the HIGH limit. If you do, the warning message `Warning, Improper high/low limits` will be displayed (this isn't an error, only a warning). The comparison results are as follows.

- Measurement results < LOW limit Result: LOW
- Measurement results $\geq$ LOW limit Result: HIGH

Setting the Sweep Points and Limits

Perform the following steps to set the sweep points and measurement limits.

1. Move the CURSOR to the *SWEEP PARAMETER* field and use a softkey to select the sweep parameter.
2. Move the CURSOR to the *SWEEP POINT* field.
3. Enter the sweep point using the numeric entry keys. When the one of the numeric entry keys is pressed, the unit softkeys are available, so you can use these softkeys to enter the unit and terminate the entry instead of using (ENTER).
4. The CURSOR will move automatically to the *LMT* field after you enter a sweep point. The following softkeys will be displayed.
   - `LIMIT DATA A`

     This softkey is used to set the limit parameter to the primary parameter of the measurement function. When this softkey is pressed, the CURSOR will automatically move to the *LOW* field.
   - `LIMIT DATA B`

     This softkey is used to set the limit parameter to the secondary parameter of the measurement function. When this softkey is pressed, the CURSOR will move automatically to the *LOW* field.
   - `OFF`

     This softkey is used to set the list sweep measurement's limit function to OFF for the sweep point. When this softkey is pressed, the CURSOR will move automatically to the next sweep point field.
5. Press the appropriate softkey to set the limit parameter.
6. The CURSOR will move automatically to the *LOW* field. (If you pressed `OFF` in the previous step, the CURSOR will move automatically to the next *sweep point* field.) Enter the low limit value.
7. The CURSOR will move automatically to the *HIGH* field. Enter the high limit value using the numeric entry keys. After entering the high limit value, the CURSOR will move automatically to the next sweep point field. Repeat steps 3 through 7 until the all sweep points are filled out.

SYS MENU Field

The system menu on this page allows you to perform the following control functions.

- Load/Store
- Clear Table
- Printer

These functions, except for the clear table function, are the same as the functions in the system menu on the *MEAS DISPLAY* page. (A description of each function is given in "SYS MENU Field" in Chapter 4, on page 4-10. So in the case of the clear table function, the description and procedure are given, and in the case of the other functions, only the procedure is given.

`LOAD/STORE` Softkey

Perform the following steps on the *Q LIST SWEEP SETUP* page to LOAD/STORE the control settings from/to internal non-volatile memory or an external memory card.

1. Set all controls.
2. Move the CURSOR to the *SYS MENU* field on the *Q LIST SWEEP SETUP* page.
3. If you are using a memory card, insert the memory card into the MEMORY card slot.
4. Press `STORE` when you want to use the store function. The message `Enter record number to STORE` will be displayed on the system message line.

   Press `LOAD` when you want to use the load function. The message `Enter record number to LOAD` will be displayed on the system message line.
5. Enter the record number using the numeric entry keys and (ENTER) to LOAD/STORE the current control settings.

Clear Table Function

This function allows you to clear all of the list sweep points and limits. When you change from the current sweep parameter to an other sweep parameter, use this function.

Perform the following steps to set all of the operations on the *Q LIST SWEEP SETUP* page to their power-on default settings.

1. Move the CURSOR to the *SYS MENU* field.
2. Press `CLEAR TABLE`. Then the message `Clearing table, Are you sure?` will be displayed, and the following softkeys will be displayed.
   - `YES`
   - `NO`
3. Press `YES` to confirm the clear the list sweep points and limits.

Printing the Q LIST SWEEP SETUP Page

Perform the following steps to print out the display page using the page dump function.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the Listen-Only mode.
3. Set the Talk-Only mode to ON on the *SYSTEM CONFIG* page.
4. Press (MEAS SETUP) and `LIST SETUP` to display the *Q LIST SWEEP SETUP* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press `more 1/2`.
7. Press `PRINT DISP`. The display page is printed out by the printer as shown in Figure 5-29.

```
<SYSTEM CONFIG>           SYS MENU

BEEPER              :ON
HP-IB I/F           :INSTALLED
  HP-IB ADDRESS     :17
  TALK ONLY         :ON

DC BIAS       (#001):INSTALLED
ACCESSORY I/F(#002):INSTALLED
  CONFIG
HANDLER I/F   (#201):NOT INSTALLED
                    :OFF
SCANNER I/F   (#301):INSTALLED
                    :OFF
```

Figure 5-29. Q LIST SWEEP SETUP Page Printout Example

6

CATALOG/SYSTEM Menu

Introduction

This chapter provides information on the function of each of the four pages under (CATALOG/SYSTEM).

- *CATALOG*
- *SYSTEM CONFIG*
- *CABLE CORRECTION*
- *SELF TEST*

This chapter describes the functions of each field on each page in the order listed above.

CATALOG Page

When you press (CATALOG/SYSTEM), the *CATALOG* page will be displayed. The *CATALOG* page shows the stored instrument control settings. The following control functions can be set from this page. (The field in parenthesis is used to set the control function.)

- LOAD/STORE (*SYS MENU*)
- Specify media (*SYS MENU*)
- Printout (*SYS MENU*)
- Purge record (*SYS MENU*)

The available fields and the softkeys which correspond to each field on this page are shown in Figure 6-1 and Figure 6-2.

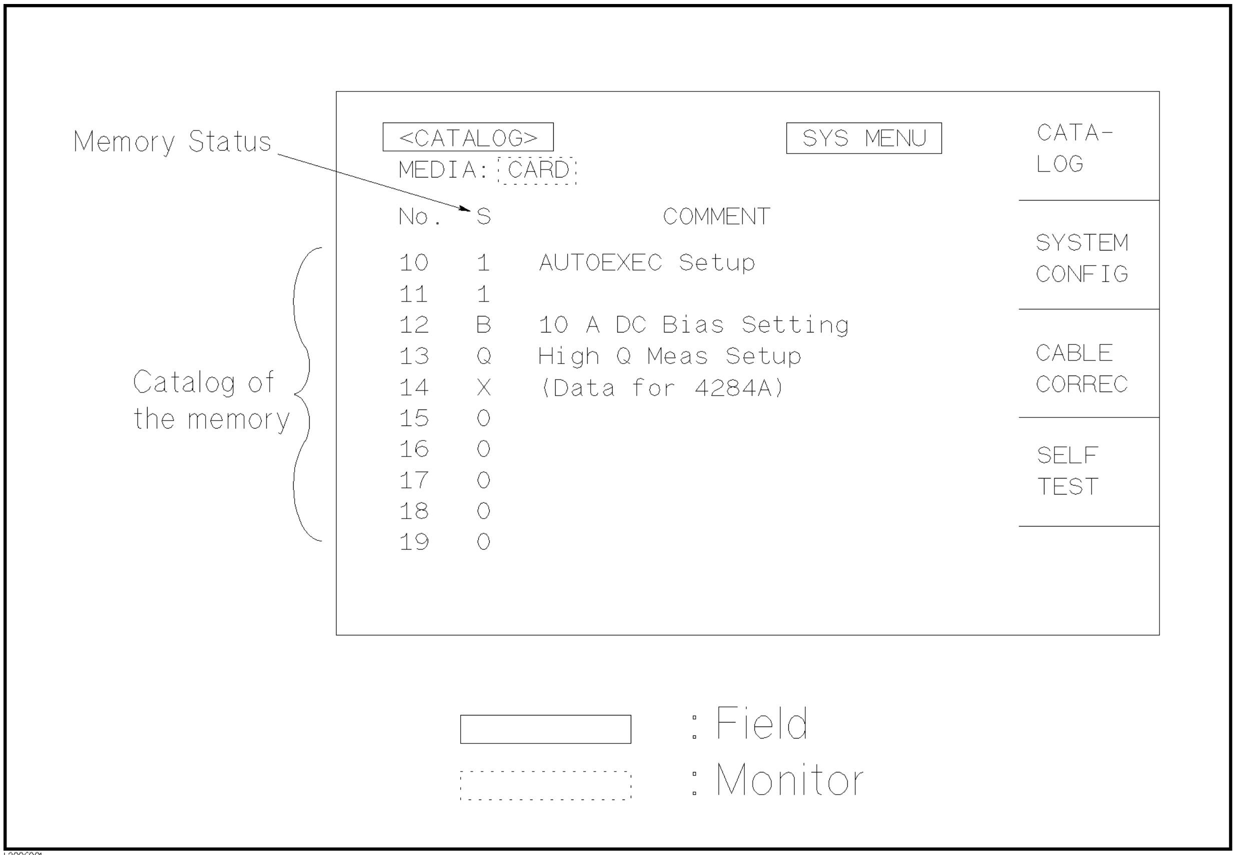


Figure 6-1. Available Fields on the CATALOG Page

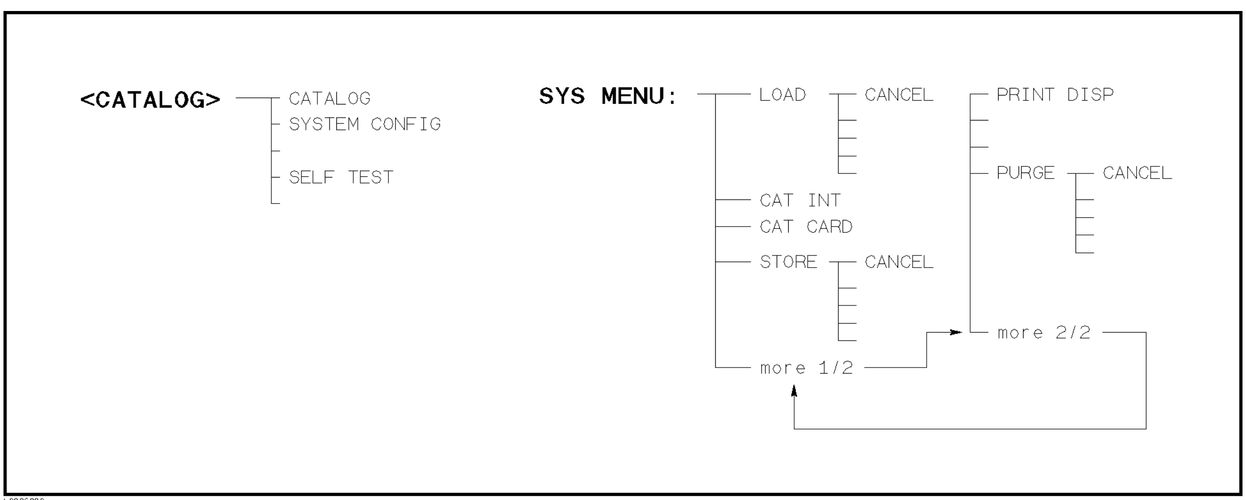


Figure 6-2. Available Softkeys on the CATALOG Page

DRAFT
1/12/99 18:18

In this page, the following information can be monitored.

- Media type
- Record number
- Record status
- Comment

Media Monitor Area

The HP 4285A supports two types of memory for storing the instrument control settings, internal memory (EEPROM) and an external memory card. Both memory media stores up to 10 records (instrument control settings). Current media type displayed on the LCD screen is displayed in the *MEDIA* monitor area. Media type can be changed by `CAT INT` and `CAT CARD` under the *SYS MENU* field.

Record Number Monitor Area

Instrument control settings stored in the memory are identified by record number. This number is displayed in the *No.* monitor area. Internal memory uses record numbers 0 to 9, and external memory card uses record numbers 10 to 19.

Record Status Monitor Area

The Control setting stored in a record can be identified by a one-digit alphanumeric character, called record status. The record status is displayed in the *S* monitor area. One of following five types is displayed.

`0` No valid setting is stored in this record.

`1` Normal LCR measurement mode setting is stored in this record.

`B` High current bias mode setting is stored in this record. Option 002 accessory control interface, HP 42841A bias current source, and HP 42842C bias current test fixtures are required.

`Q` Q adapter mode setting is stored in this record. Option 002 accessory control interface and HP 42851A Q adapter are required.

`X` HP 4284A setting is stored in this record. `(Data for 4284A)` will be displayed in the *COMMENT* monitor area.

Comment Monitor Area

The comment data of the stored control setting is displayed in this area. The first 26 characters of the comment can be monitored.

SYS MENU Field

The system menu on this page allows you to perform the following functions.

- Load/Store
- Media
- Printer
- Purge

The load/store function is the same as the functions displayed on the system menu of the *MEAS DISPLAY* page. The printer function performs the same function of PRINT DISP of the system menu on the *MEAS DISPLAY* page. (The description of each function is given in "SYS MENU Field" in Chapter 4 on page 4-10.) So, in the case of the MEDIA and the PURGE functions, the description and setting procedures are described in the following paragraphs, only the procedure is described for the other functions.

CAT INT/CAT CARD Softkey

On the *CATALOG* page, the record list of the HP 4285A's internal memory (EEPROM) or the external memory card are displayed, with memory status (records stored or no record in the memory) and the comments (displayed on the comment line) for each settings.

CAT INT displays the stored instrument control settings in the internal momory (EEPROM).

CAT CARD displays the stored instrument control settings in the external memory card.

Specifying the Media Type

Perform following steps to change the media memory type.

1. Move the CURSOR to the *SYS MENU* field using the CURSOR keys. The following softkeys will be displayed in the softkey label area.
   - CAT INT
   - CAT CARD
2. Press either softkey to select the records to be displayed.

Loading or Storing the Instrument Control Setting

Perform the following steps to store the current control settings to the internal non-volatile memory or to the external memory card, or to load the control settings from the internal non-volatile memory or from the external memory card.

1. Set all instrument control settings.
2. Move the CURSOR to the *SYS MENU* field on the *CATALOG* page.
3. If you are going to store or load the settings to or from a memory card, insert a memory card into the MEMORY card slot.
4. Press STORE when you want to use the STORE function. The message `Enter record number to STORE` will be displayed on the system message line.

Press LOAD when you want to use the LOAD function. The message `Enter record number to LOAD` will be displayed on the system message line.

5. Use the numeric entry keys and (ENTER) to enter the record number at which the current control settings will be stored to or loaded from.

Note

When the configuration mode of the stored setup data is different from the current configuration mode, it can't be load. Check the record status to be loaded and change the *CONFIG* field on the *SYSTEM CONFIG* page to the appropriate configuration mode.

Printing the CATALOG Page

Perform the following steps to print out the catalog page.

1. Connect the HP 4285A to the printer using an HP-IB cable.
2. Set the printer to the Listen-Only mode.
3. Set the Talk-Only mode to ON from the *SYSTEM CONFIG* page.
4. Press the *CATALOG/SYSTEM* menu key to display the *CATALOG* page.
5. Move the CURSOR to the *SYS MENU* field.
6. Press more 1/2 .
7. Press PRINT DISP . The catalog page will be printed out to the printer as shown below.

```
<CATALOG>                SYS MENU
MEDIA : CARD
No.  S         COMMENT
10   1  AUTOEXEC Test
11   1  |Z|-f Characteristics
12   B  10A DC Current Bias
13   1  DC-Bias Test No.1
14   Q
15   Q  Q_Meas 25.2MHz
16   0
17   0
18   X  (Data for 4284A)
19   X  (Data for 4284A)
```

Figure 6-3. CATALOG Page Example

PURGE Softkey

This softkey erases the specified instrument control setting. The record status of the specified record changes to 0.

CANCEL Softkey

This softkey cancels the PURGE operation.

Purging the Unused Record Settings

Perform the following steps to purge the control settings from the internal non-volatile memory or from the external memory card.

1. Move the CURSOR to the *SYS MENU* field on the *CATALOG* page.
2. Insert the memory card into the MEMORY card slot, if you are going to purge the settings from a memory card.
3. Press more 1/2 and PURGE. The message `Enter record number to PURGE` will be displayed on the system message line.
4. Use the numeric entry keys and (ENTER) to enter the record number at which the control settings will be PURGED.

SYSTEM CONFIG Page

When you press (CATALOG/SYSTEM) and SYSTEM CONFIG, the *SYSTEM CONFIG* page will be displayed. On this page, the status of the HP-IB interface and the options are displayed, and the following control functions can be set from this page. (The field in parenthesis is used to set the control function.)

- Printout (*SYS MENU*)
- Beeper function ON/OFF (*BEEPER*)
- HP-IB address (*HP-IB ADDRESS*)
- HP-IB Talk-Only mode ON/OFF (*TALK ONLY*)
- Accessory control interface (Option 002) configuration (*CONFIG*)
- Handler interface (Option 201 or 202) ON/OFF (*HANDLER I/F*)
- Scanner interface (Option 301) ON/OFF (*SCANNER I/F*)

Each control function is described in the following paragraphs. This page also provides the following information in monitor fields. These conditions are set depending on the status of the options installed in the instrument.

- HP-IB interface installed/not installed (*HP-IB I/F*)
- DC bias (Option 001) installed /not installed (*DC BIAS (#001)*)
- Accessory control interface (Option 002) installed / not installed (*ACCESSORY I/F (#002)*)
- Handler Interface (Option 201 or 202) installed / not installed (*HANDLER I/F (#201 or #202)*)
- Scanner Interface (Option 301) installed / not installed (*SCANNER I/F (#301)*)

The available fields and the softkeys which correspond to each field on this page are shown in Figure 6-4.

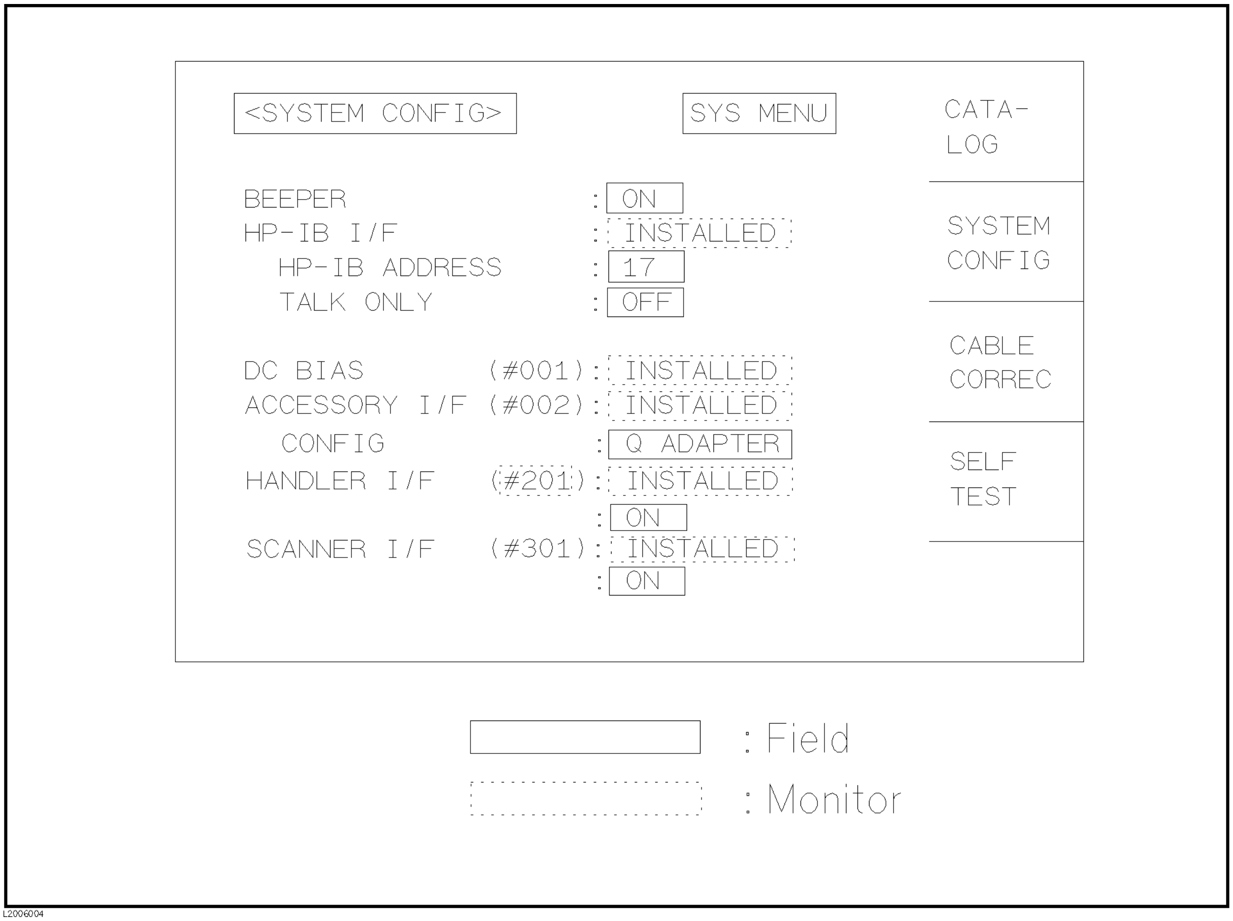


Figure 6-4. Available Fields on the SYSTEM CONFIG Page

BEEPER Field

The HP 4285A emits a beep if any of the following conditions occur. The beeper can be turned ON or OFF in the *BEEPER* field.

- ADCERR is displayed.
- An error has occurred.
- A warning message is displayed.
- Correction data measurement is completed.
- Comparison judgment result is out of bin.
- Failed sweep comparison judgment.
- Key lock ON/OFF is switched.

Turning the Beeper ON or OFF

Perform the following steps to set the beeper function to ON or OFF.

1. Move the CURSOR to the *BEEPER* field on the *SYSTEM CONFIG* page. The following softkeys will be displayed in the softkey label area.
   - ON
   - OFF
2. Use softkeys to set the beeper function to the ON or OFF.

HP-IB ADDRESS Field

All HP 4285As except for those with Option 109 Delete HP-IB Interface are remotely controlled via HP-IB. The HP 4285A can be linked to other instruments and computers to form an automated measurement system. When the HP-IB interface is installed, the *HP-IB ADDRESS* field changes the HP-IB address for the HP 4285A. Allowable HP-IB address values of the HP 4285A are 0 to 30. Address decimal 31 is not accessible. The factory set default address is 17.

Setting the HP-IB Address

Perform the following steps to set the HP-IB address.

1. Move the CURSOR to the *HP-IB ADDRESS* field on the *SYSTEM CONFIG* page.
2. Enter the HP-IB address using the numeric entry keys, and press [ENTER].

TALK ONLY Field

The HP 4285A can directly print out the display and measurement data to an HP-IB printer without connecting a controller (computer). To do so, the HP 4285A must be a Talk-Only device. The HP 4285A can be a Talk-Only device or addressable device by setting ON or OFF in the *TALK ONLY* field. When the Talk-Only mode is set to ON, TLK (talk) HP-IB status indicator on the front panel is lit.

Setting the Talk-Only Mode

Perform the following steps to set the HP 4285A to the talk-only mode (ON) or to the addressable mode (OFF).

1. Move the CURSOR to the *TALK ONLY* field on the *SYSTEM CONFIG* page. The following softkeys will be displayed in the softkey label area.

- ON
- OFF

2. Use the softkeys to set the Talk-Only mode to ON (Talk-Only), or to OFF (addressable).

CONFIG Field

When the HP 4285A is equipped with an Option 002 Accessory Control Interface and the accessories are connected to the 50-pin Amphenol connector on the rear panel, this field is used to specify the accessory to be controlled.

The status of the accessory control interface is monitored on this *SYSTEM CONFIG* page (*ACCESSORY I/F (#002)*).

I BIAS Softkey

This softkey is used for DC current biased measurement and enables the control of the HP 42841A via the accessory control interface on the rear panel (50-pin amphenol connector). Refer to the *HP 42841A Operation Manual* (HP Part Number 42841-90000) for details.

Q ADAPTER Softkey

This softkey enables the control of the HP 42851A via the accessory control interface on the rear panel (50-pin amphenol connector) and the following control settings are set.

- DC bias, Option 001 and Option 002 with the HP 42841A, are disabled.

OFF Softkey

This softkey disables the controls of the accessory control interface on the rear panel (50-pin amphenol connector).

Configuring the Precision Q Measurement System

To control the HP 42851A from the HP 4285A via the Option 002 accessory control interface, perform the following steps.

1. Move the CURSOR to the *CONFIG* field on the *SYSTEM CONFIG* page. The following softkeys will be displayed in the softkey label area.
   - I BIAS
   - Q ADAPER
   - OFF
2. Press Q ADAPTER to perform the precision Q measurement using the resonant method.

Configuring the Normal LCR Measurement System

To perform a normal LCR measurement, perform the following steps.

1. Move the CURSOR to the *CONFIG* field on the *SYSTEM CONFIG* page. The following softkeys will be displayed in the softkey label area.
   - `I BIAS`
   - `Q ADAPER`
   - `OFF`
2. Press `OFF` to perform a normal LCR measurement using the resonant method.
3. Further information for operating the HP 4285A in normal LCR mode, refer to *HP 4285A Operatin Manual* (HP Part Number 04285-90000).

HANDLER I/F (#201)/(#202) Field

When the HP 4285A is equipped with an Option 201 or 202 Handler Interface, the 36-pin Amphenol connector on the rear panel is used to interface between the HP 4285A and the handler to pass control input/output signals and the comparator function bin judgment results. For details refer to the *Option 201 Handler Interface OPERATION NOTE* or the *Option 202 Handler Interface OPERATION NOTE*.

The status of the handler interface installed/not installed is monitored on the *SYSTEM CONFIG* page (*HANDLER I/F (#201 or #202)*).

Setting the Handler Interface to ON or OFF

When the handler interface is set to ON, the handler interface signals through the interface connector are enabled. Perform the following steps to set the handler interface signal input/output to ON or OFF.

1. Move the CURSOR to the *HANDLER I/F (#201)* field (or the *HANDLER I/F (#202)* field) on the *SYSTEM CONFIG* page. The following softkeys will be displayed in the softkey label area.
   - `ON`
   - `OFF`
2. Use the softkeys to set the handler interface function to ON or OFF.

SCANNER I/F (#301) Field

This is not used with the HP 42851A Precision Q Adapter. Keep this field OFF.

SYS MENU Field

The system menu on this page allows you to print out the *SYSTEM CONFIG* page using the PRINT DISP mode.

```
<Q LIST SWEEP SETUP>    SYS MENU

MODE : SEQ
FREQ[Hz] LMT     LOW      HIGH
 3.0000M  A   30.0000   40.0000
 4.0000M  A   30.0000   40.0000
 5.0000M  A   30.0000   40.0000
 5.0000M  B   10.0000u  11.0000u
 6.0000M  A   30.0000   40.0000
 7.0000M  A   30.0000   40.0000
 8.0000M  A   30.0000   40.0000
 9.0000M  A   30.0000   40.0000
```

Figure 6-5. SYSTEM CONFIG Page Example

CABLE CORRECTION Page

When you press (CATALOG SYSTEM) and CABLE CORREC, the *CABLE CORRECTION* page will be displayed. In the precision Q measurement mode, further operation is not valid. For detailed operation of this page in the normal LCR measurement mode or high current biased mode, refer to *HP 4285A Operation Manual* (HP Part Number 04285-90000) or *HP 42841A Operation Manual* (HP Part Number 42841-90000) respectively.

SELF TEST Page

When you press (CATALOG/SYSTEM) and SELF TEST, the *SELF TEST* page will be displayed. This *SELF TEST* page is for service use only.

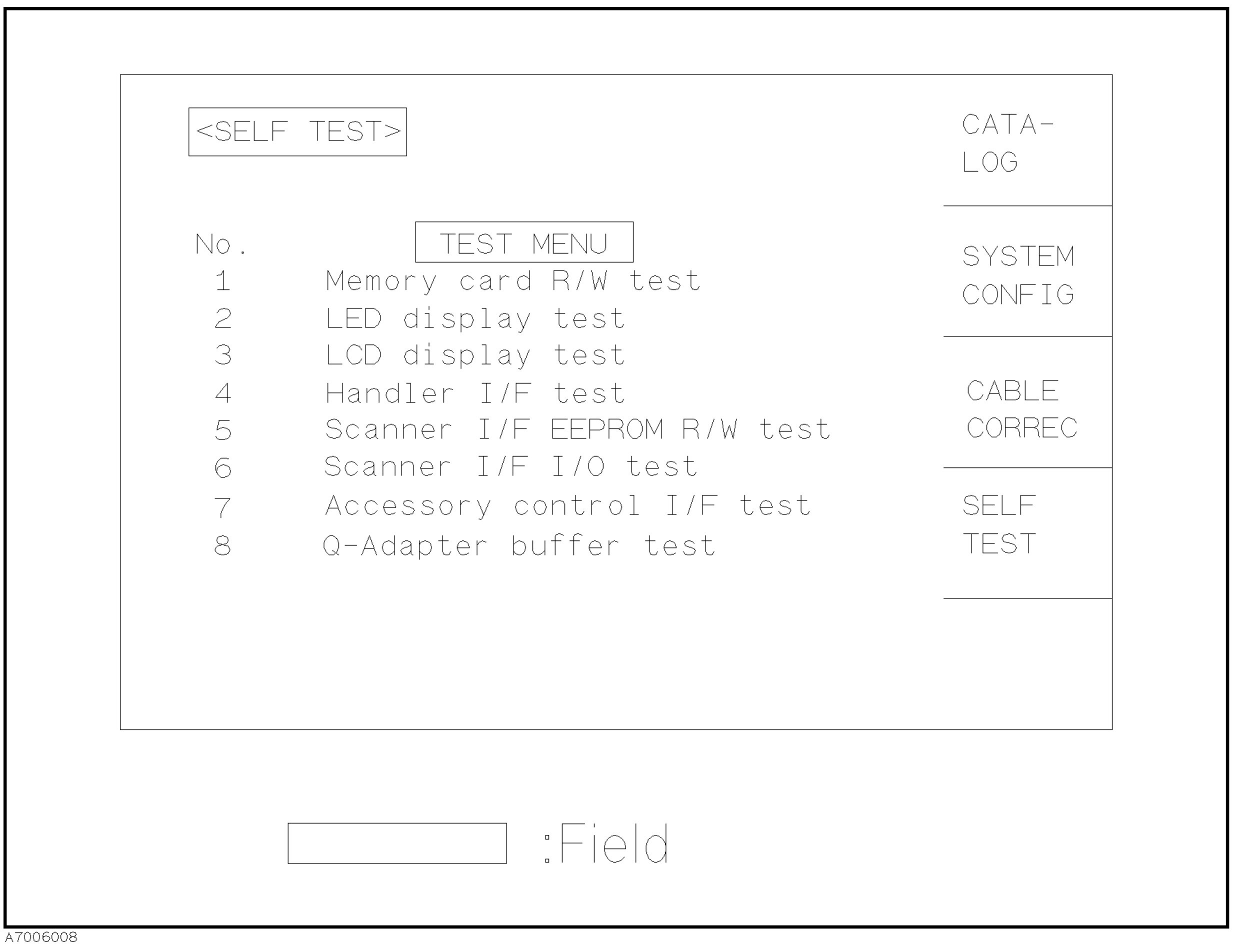


Figure 6-6. Available Fields on the SELF TEST Page

7

Q Measurement Basics

Introduction

This chapter provides basic measurement procedures, basic Q measurement theory, and measurement hints for achieving maximum performance with the HP 42851A combined with an HP 4285A.

Q Measurement by Resonant Method

Quality factor (Q) is used to evaluate the purity of the electric components or the circuitry. The HP 42851A employes the resonant measurement method which is basically the same as used in Q meters. Q measurement by the resonant measurement method has the advantage over the normal LCR mode (auto-balancing bridge method) especially in high Q measurement stability.

Figure 7-1 shows the principle of the resonant Q measurement method. The resonant method is basically configured by the signal source, voltmeter and a series LCR circuit. When C and L are in resonance, the Q value can be calculated from the voltmeter reading *Vc* and the known injected voltage *Vi*.

$$Q = \frac{|V_c|}{|V_i|}$$

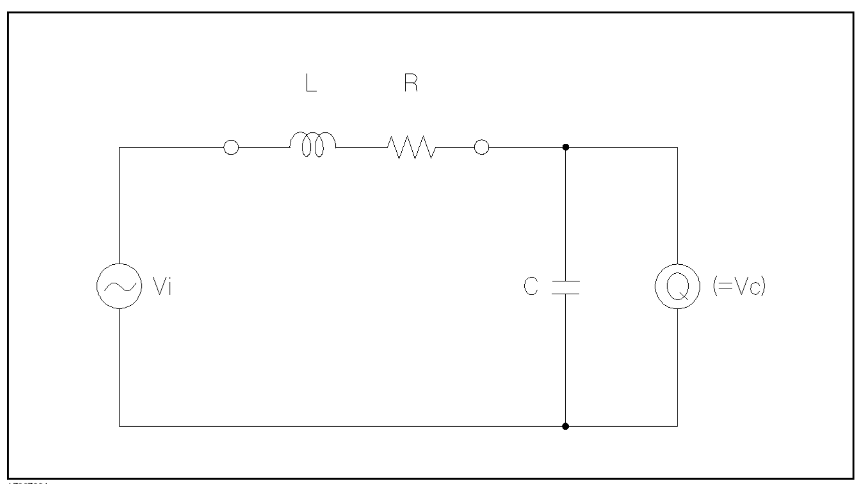


Figure 7-1. Q Measurement by the Resonant Method

Measurement Terminals

Six binding post terminals, including two shield terminals, mounted on the HP 42851A's top deck, facilitate connection of DUTs (Device Under Test) and accessories to the measuring circuit. The physical layout and size of these binding post terminals are compatible with the HP 4342A Q meter. Figure 7-2 illustrates the measurement terminals and the associated measurement circuit configuration. Ground terminals 3 and 6, and binding post 4 are directly connected to the instrument chassis ground. Binding posts 1 and 2 are the LOW and HIGH inductor terminals, respectively, in which an inductor is connected. The resonant circuit tuning capacitor is built into the HP 42851A. An inductor is measured by inserting it into the inductor terminals 1 and 2, and waiting for the automatic tuning operation. The oscillator signal is injected into the measuring circuit between LOW inductor terminal 1 and G (Ground) terminal 4. Binding posts 4 and 5 are the capacitor terminals which are used for setting up parallel connection measurements (outlined below). Ground terminals 3 and 6 are used for connection to the shield terminals.

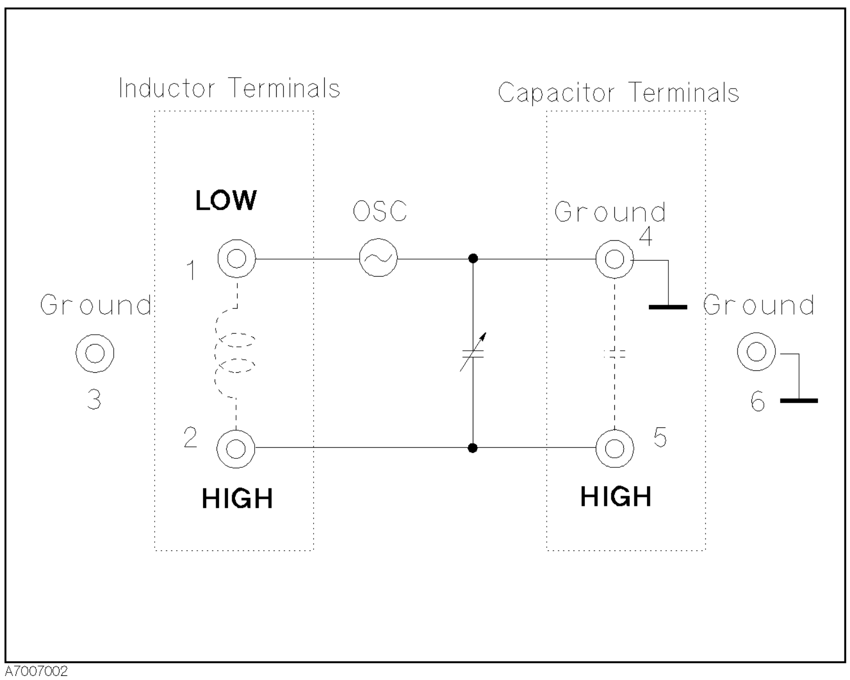


Figure 7-2. Measurement Terminal Circuit

How to Connect The Test Device

There are three basic methods of connecting a DUT to the measurement terminals. The characteristic of the DUT, the parameter value to be measured, and the measurement frequency are the factors which guide the selection of an appropriate connection method. The fundamental operating procedures for each connection method are outlined in the following paragraphs.

Direct Connection

Inductors can usually be measured by connecting them directly to the HIGH and LOW inductor terminals as shown in Figure 7-3.

The measuring circuit is resonated by adjusting the HP 42851A's internal tuning capacitor. The quality factor (indicated Q) of the sample is read on the HP 4285A.

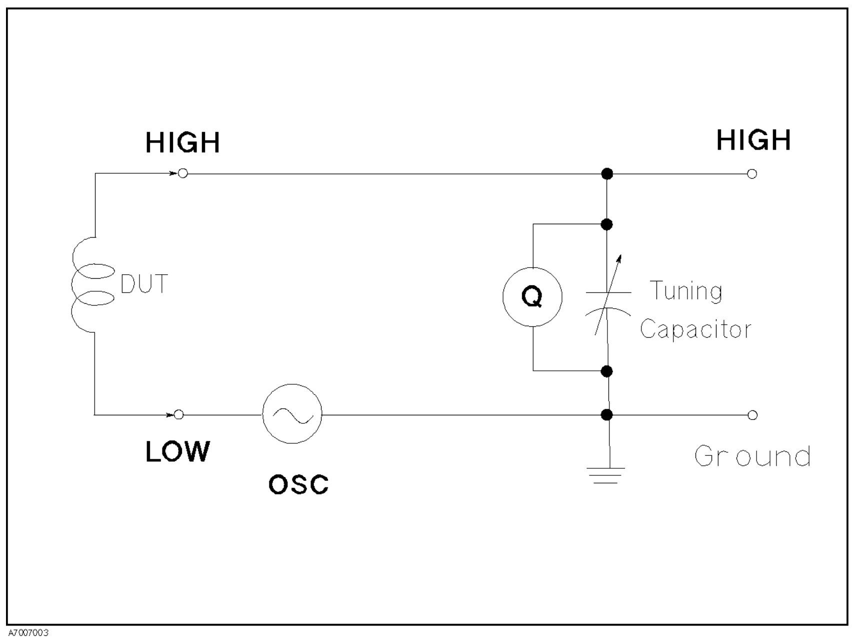


Figure 7-3. Direct Connection

Parallel Connection

The parallel connection is suitable for high impedance measurements. High inductances, high resistances, and small capacitances can be measured by connecting the DUTs to the capacitor terminals as shown in Figure 7-4.

Before connecting a DUT, the measuring circuit is resonated with a stable inductor (such as a HP 16470 series supplemental inductor) connected to the HIGH and LOW inductor terminals to obtain a reference Q reading and tuning capacitance reading. The measuring circuit is again resonated with the DUT connected to the capacitor terminals by re-adjusting the tuning capacitor for resonance. The parameter values of the DUT are automatically derived by the HP 4285A using values obtained before and after connecting the DUT. These operations are controlled by pressing the TRIGGER key on the HP 4285A's front panel.

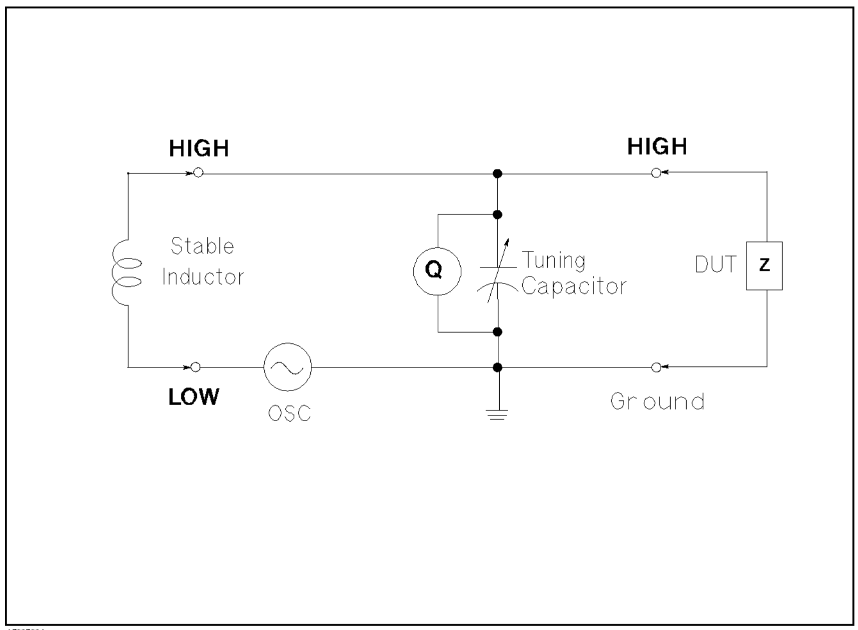


Figure 7-4. Parallel Connection

Series Connection

The Series connection is suitable for low impedance measurements. Low inductances, low resistances and high capacitances can be measured by connecting the DUT in series with a stable inductor as shown in Figure 7-5. The HP 16014A Test Adapter is useful for making the series connection to the DUT.

First, a shorting bar is attached to the unknown connection terminals in parallel with the DUT and the measuring circuit adjusted to resonance. The shorting bar is then disconnected (or removed) and resonance of the measuring circuit is again taken by adjusting the HP 42851A's internal tuning capacitor. The parameter values of the DUT can be automatically derived by the HP 4285A using values obtained before and after disconnecting the shorting bar. These operations are controlled by pressing the TRIGGER key on the HP 4285A's front panel.

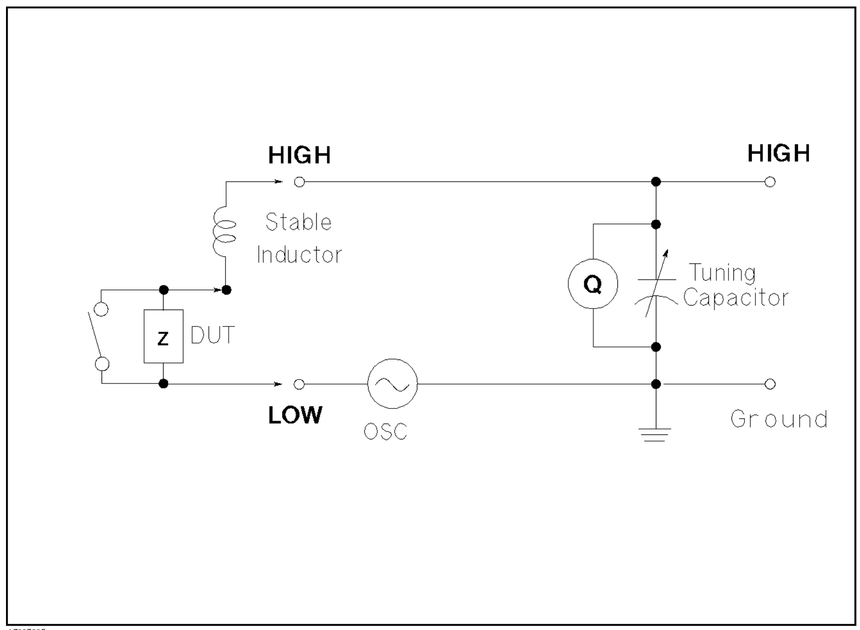


Figure 7-5. Series Connection

Direct Connection Method Limitations

The quality factor and the inductance measurement ranges covered by the direct connection method are dependent on the DUT's inductance and the measurement frequency. This is because the DUT value and the measuring frequency must satisfy the following mathematical relationship so as to resonate with the measuring circuit:

$$(2\pi f)^2 LC = 1$$

Where,

f: Measurement frequency
L: Inductance of DUT
C: Tuning capacitance (30 pF to 470 pF)

For example, if the measurement frequency is 1 MHz, the inductance range of a DUT which can be measured by the direct method is approximately 54 μH to 844 μH. If an inductance, the measurement frequency range is determined. For example, a 10 μH inductor can be measured over a frequency range of approximately 2.3 MHz to 9.2 MHz. Figure 7-6 shows the relationships between the measurement frequency and the inductance limits measurable with the direct method. In Figure 7-6, the shaded area denotes the applicable inductances and useable frequencies.

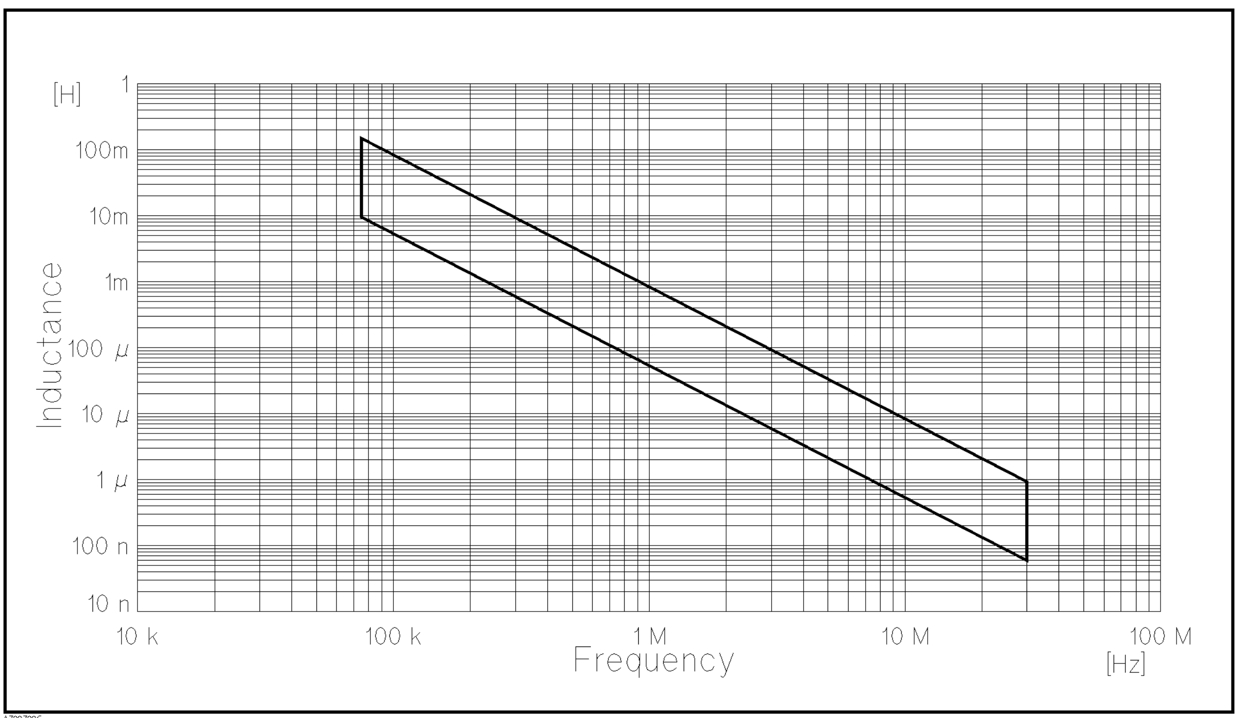


Figure 7-6. Inductance Measurement Ranges vs Frequency (direct method)

Expansion of Measurement Ranges

For higher or lower value inductances (above or below the shaded area in Figure 7-6), a parallel or series connection of the DUT to the measuring circuit enables the measurement to be made.

Capacitance Measurement

For capacitor samples, either a parallel or series connection method may be used when measuring either the capacitance or the Q value. The criteria for selecting the appropriate connection method concerns only the sample value irrespective of the measurement frequency. Capacitances higher than approximately 450 pF (up to approximately 0.2 μF) are normally measured by the series method and lower capacitances are easily measured by the parallel method. Generally, capacitors can be measured at the desired frequency by using an appropriate inductor as a measurement aid.

8

Remote Control

Introduction

This chapter provides the following information on remotely controlling the HP 42851A via the Hewlett-Packard Interface Bus (HP-IB) of the HP 4285A.

- Reference information for programming the HP 4285A
- Introduction to the Test and Measurement System Language (TMSL)
- Tutorial information for the programmer

Hewlett-Packard Interface Bus (HP-IB)

HP-IB is Hewlett-Packard's implementation of IEEE standard 488.1-1987. IEEE standard 488.1-1987 is identical to the original IEEE standard 488-1978.

HP-IB Connection

When configuring an HP-IB system, the following restrictions must be adhered to.

- The total length of cable in one bus system must be less than or equal to two meters times the number of devices connected on the bus (the HP-IB controller counts as one device) and the total length of cable must not exceed 20 meters.
- A maximum of 15 devices can be connected on one bus system.
- There are no restrictions on how the cables are connected together. However, it is recommended that no more than four piggyback connectors be stacked together on any one device. The resulting structure could exert enough force on the connector mounting to damage it.

For example, a system containing six devices can be connected together with cables that have a total length of less than or equal to 12 meters (six devices × 2m/device = 12 meters). The individual length of cable may be distributed in any manner desired as long as the total length does not exceed the allowed maximum. If more than ten devices are to be connected together, cables shorter than two meters must be used between some of the devices to keep the total cable length less than 20 meters.

Figure 8-1 shows an HP-IB interface connector. The HP 4285A uses all of the available HP-IB lines; therefore, damage to any connector pin will adversely affect its HP-IB operation.

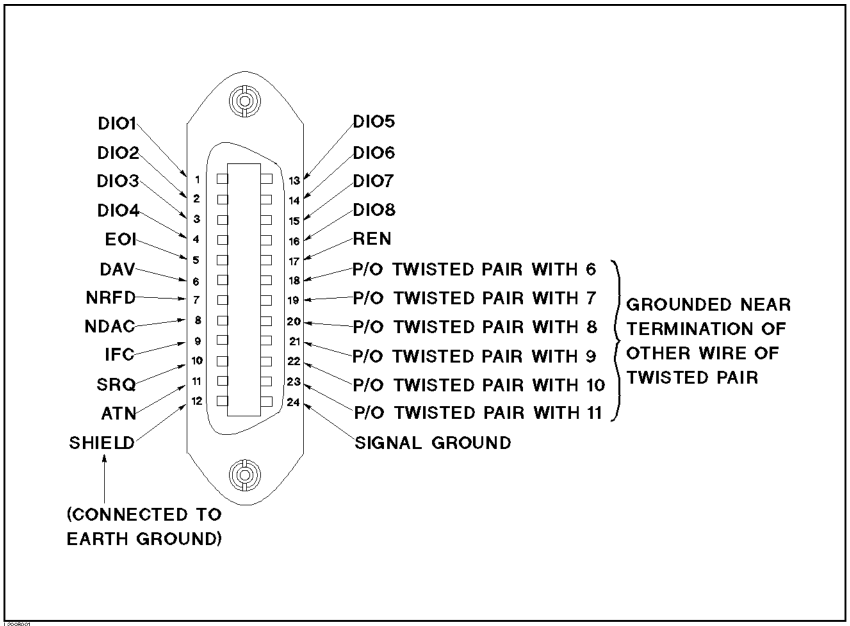


Figure 8-1. HP-IB Connector Signal/Pin Configuration

Table 8-1. HP-IB Interconnect Cables

HP Part Number	Length
10833A	1 m (3.3 ft)
10833B	2 m (6.6 ft)
10833C	4 m (13.2 ft)
10833D	0.5 m (1.6 ft)

Typical HP-IB system interconnection is shown in Figure 8-2. The HP-IB connector is firmly fastened using two bolts to keep it from working loose during use.

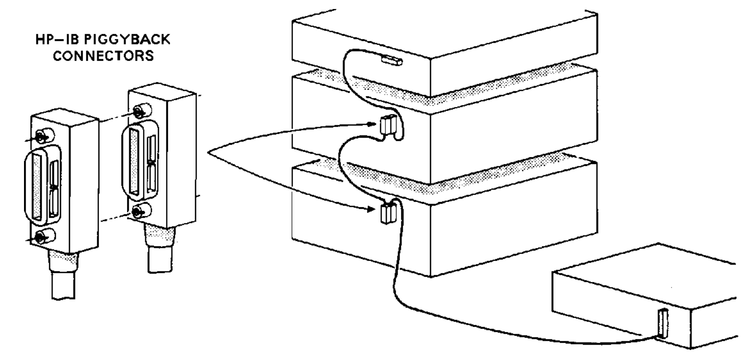


Figure 8-2. Typical HP-IB System Interconnection

HP-IB Capability

Table 8-2 lists the HP 4285A's HP-IB capabilities and functions. These functions provide the means for an instrument to receive, process, and transmit, commands, data, and status over the HP-IB bus.

Table 8-2. HP-IB Interface Capability

Code	Function
SH1	Complete Source Handshake capability
AH1	Complete Acceptor Handshake capability
T5	Basic Talker; serial poll; unaddressed if MLA; Talk-Only
L4	Basic Listener; unaddressed if MTA; no Listen Only
SR1	Service Request capability
RL1	Remote/Local capability
DC1	Device Clear capability
DT1	Device Trigger capability
C0	No Controller capability
E1	Drivers are open-collector

HP-IB Addressing

The HP 4285A's HP-IB address is stored in non-volatile memory and can be set to any address from 0 to 30 by front panel key entry in the *SYSTEM CONFIG* page. When the HP 4285A is shipped from the factory the default HP-IB address is 17.

HP-IB Bus Capability

The HP 4285A will respond to the following bus commands which are given as HP 9000 series 200/300 BASIC statements.

ABORT I/O (IFC)

ABORT I/O (IFC control line TRUE) halts all bus activity and de-selects the HP 4285A.

For example:

```
ABORT 7
```

CLEAR LOCKOUT/SET LOCAL

CLEAR LOCKOUT/SET LOCAL (REN control line false) releases devices on the bus from the lockout mode and returns them to local (front panel) control. The difference between CLEAR LOCKOUT/SET LOCAL, and LOCAL is in the addressing method used.

For example:

```
LOCAL 7
```

DEVICE CLEAR (SDC or DCL)

This command can be used with an address to clear a particular device (SDC : selected device clear) or used without an address (DCL : clears all devices). The HP 4285A will initialize the following items only when it receives this command. Then the:

- Input buffer is cleared
- Output data buffer is cleared
- Bit 4 (MAV bit) of the status byte is set to "0"

For example:

```
CLEAR 7
```

LOCAL (GTL)

LOCAL returns control of a listening device to front panel control.

For example:

```
LOCAL 717
```

LOCAL LOCKOUT (LLO)

LOCAL LOCKOUT disables the LOCAL operation (HP 4285A : Pressing (LCL)) of all devices on the bus. After this command is sent you will be unable to operate the HP 4285A from the front panel. Execute the LOCAL command to undo LOCAL LOCKOUT.

For example:

```
LOCAL LOCKOUT 7
```

REMOTE

REMOTE sets the HP 4285A to the remote mode. When this command is sent, front panel with the exception of (LCL) will be disabled.

For example:

```
REMOTE 717
```

SPOLL

SPOLL is the serial polling command. SPOLL is used to place the status byte of the addressed instrument on the bus. The eight bits of the status byte can be masked off and read to determine the HP 4285A's operating state.

For example:

```
Var=SPOLL(717)
```

SERVICE REQUEST

The HP 4285A can send an SRQ (Service Request) control signal when it requires the controller to perform a task. An SRQ can be thought of as an interrupt which informs the controller that information is ready to be transmitted, or that an error condition exists in the instrument. When the HP 4285A sends an SRQ it also sets Bit 6 of the status byte. Bit 6 is the RQS (Request Service) bit, sometimes referred to as the *status bit* in connection with polling. When the HP 4285A is serially polled, it clears the RQS bit and the SRQ line, one of the five management control lines of the system interface. Any bit in the status byte can initiate an SRQ. The status byte may be masked by the user to determine which bits caused the HP 4285A to set the SRQ line. For more information on the status byte, refer to "Status Byte".

TRIGGER (GET)

Enables the HP 4285A to the TRIGGER bus command. This command may be sent to a selected device or to all devices addressed as listeners on the HP-IB bus. The HP 4285A must first be addressed as a listener, second the trigger mode is set to the BUS trigger mode before the trigger message is sent.

For example:

```
SEND 7;UNL MTA LISTEN 17
TRIGGER 7
```

Test and Measurement Systems Language (TMSL)

Test and Measurement Systems Language (TMSL) is the new universal command set adopted by Hewlett-Packard for test and measurement instrumentation by extending IEEE 488.2-1987. This language uses standard HP-IB hardware and will be used in many future Hewlett-Packard Products. TMSL uses easy to learn, self explanatory commands, and is flexible for both beginners and expert programmers. Detailed TMSL command descriptions are given in Chapter 9.

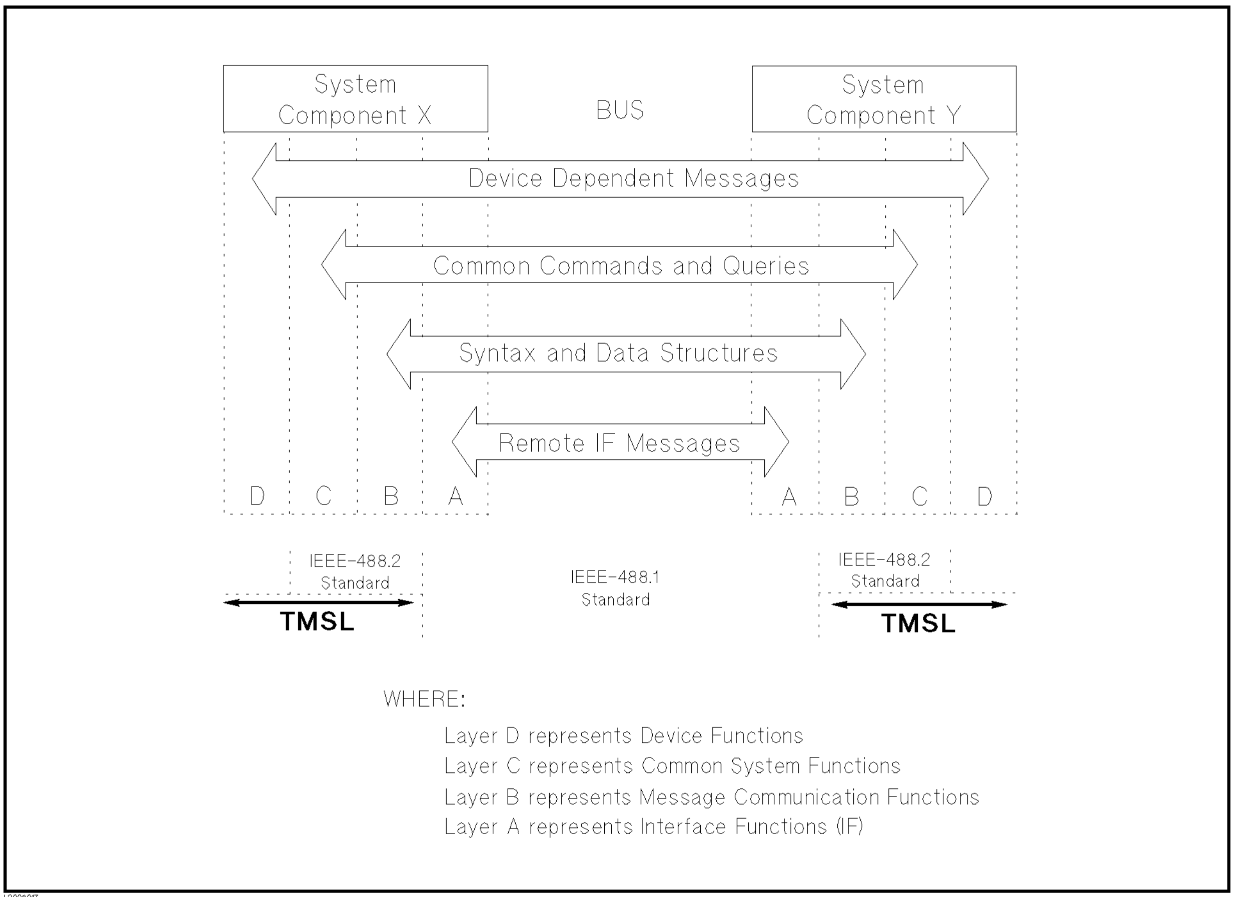


Figure 8-3. Functional Layers Diagram

Data Transfer

The HP 4285A offers two data formats for HP-IB data transfer to the controller, ASCII and BINARY. The data transfer rates for these data formats are different.

ASCII Data Format

The ASCII data format is the default output format. When the `FORMat:DATA ASCii` command is executed, the HP 4285A transfers data in the ASCII format. The ASCII data output format on the MEAS DISPLAY, BIN No. DISPLAY, or *BIN COUNT DISPLAY* page is described in Figure 8-4.

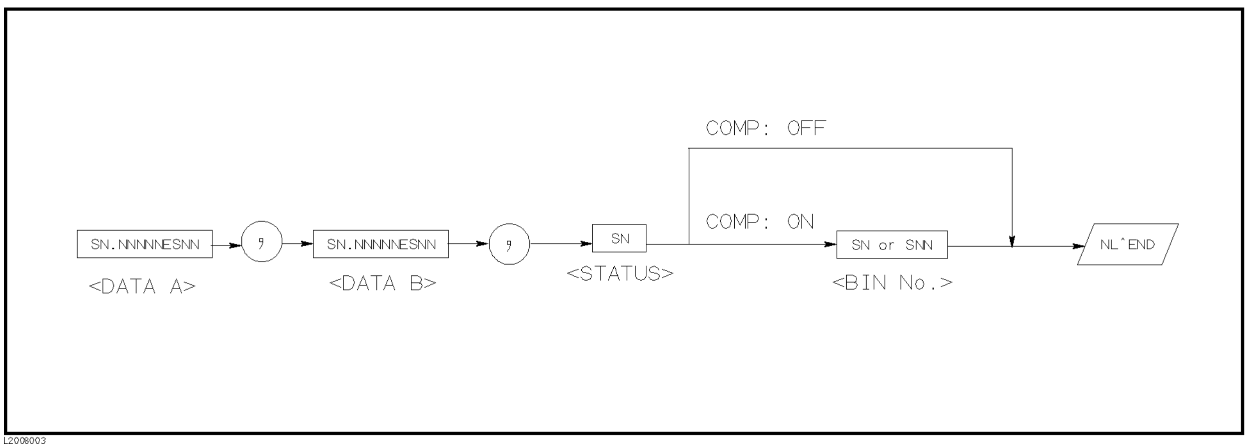


Figure 8-4. ASCII Format 1

The <DATA A>, <DATA B>, <STATUS>, and <BIN No.> formats are as follows.

- <DATA A> and <DATA B> format:

  The data output formats for <DATA A> (primary parameter's measurement data), and <DATA B> (secondary parameter's measurement data) uses the 12 ASCII character fixed length format as follows.

  SN.NNNNNESNN
  (S: +/−, N: 0 to 9, E: Exponent Sign)

- <STATUS> Format:

  The <STATUS> data shows the measurement status when getting the measurement data as follows.

Status	Description
−1	No data (in the data buffer memory)
0	Normal measurement data.
+1	Tuning is incomplete.
+2	A/D converter is not working.

  The data output formats for <STATUS> uses the 2 ASCII character fixed length format as follows.

  SN (S: +/−, N: 0 to 4)

Note When the <STATUS> is −1, 1, or 2, the measurement data is 9.9E37. When the <STATUS> is 0 the actual measurement data is output.

- <BIN No.> Format:

  The <BIN No.> data shows the bin sorting results as follows.

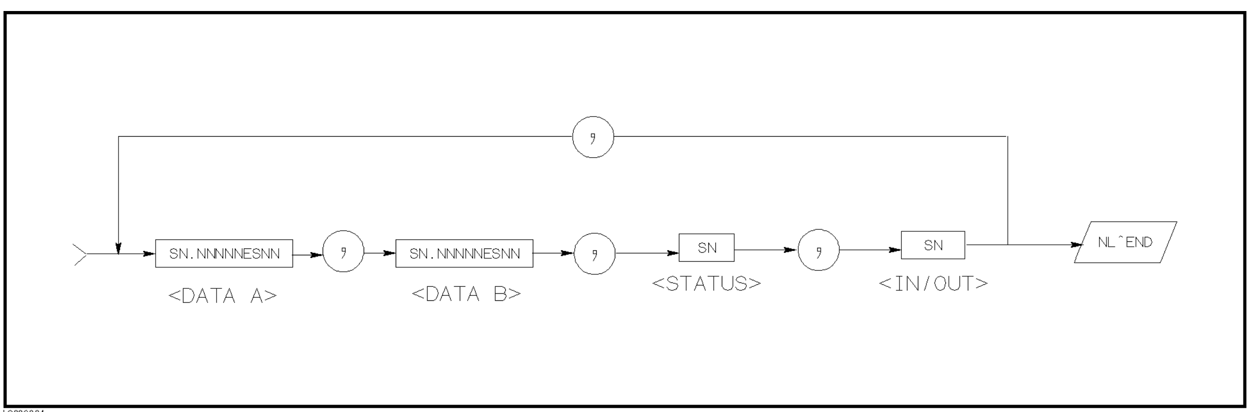
Data	Sorting Results
0	OUT_OF_BINS
+1	BIN 1
+2	BIN 2
+3	BIN 3
+4	BIN 4
+5	BIN 5
+6	BIN 6
+7	BIN 7
+8	BIN 8
+9	BIN 9
+10	AUX_BIN

  The <BIN No.> data is output with the measurement data only when the comparator function is set to ON.

  The data output formats for <BIN No.> uses a 2 or 3 ASCII character data length format as follows.

  SN or SNN (S: +/−, N: 0 to 9)

  The ASCII data output format on the *LIST SWEEP DISPLAY* page is described in Figure 8-5. The data loop is repeated for the number of the sweep points.



L2008004

Figure 8-5. ASCII Format 2 (List Sweep)

  The <DATA A>, <DATA B>, <STATUS> formats are the same as the formats on the MEAS DISPLAY, BIN No. DISPLAY, or *BIN COUNT DISPLAY* page. So the only the <IN/OUT> format will be described.

- <IN/OUT> format:

The <IN/OUT> data shows the result of the list sweep's comparator function.

Data	Result
−1	LOW
0	IN
+1	HIGH

When the comparator function of the list sweep measurement isn't used, the <IN/OUT> data output result is 0 (zero).

The data output formats for <IN/OUT> use the 2 ASCII character fixed length format as follows.

SN (S: +/−, N: 0 to 1)

Binary Data Format

When the `FORMat:DATA REAL,64` command is executed the HP 4285A transfers data in the BINARY format. The BINARY format is the 64-bit floating point binary format specified in IEEE Standard 754-1985. This is the same data format used by the HP Technical computers, such as the HP 9000 series 200/300 computers. The BINARY data output format on the MEAS DISPLAY, BIN No. DISPLAY, or *BIN COUNT DISPLAY* page is shown in Figure 8-6.

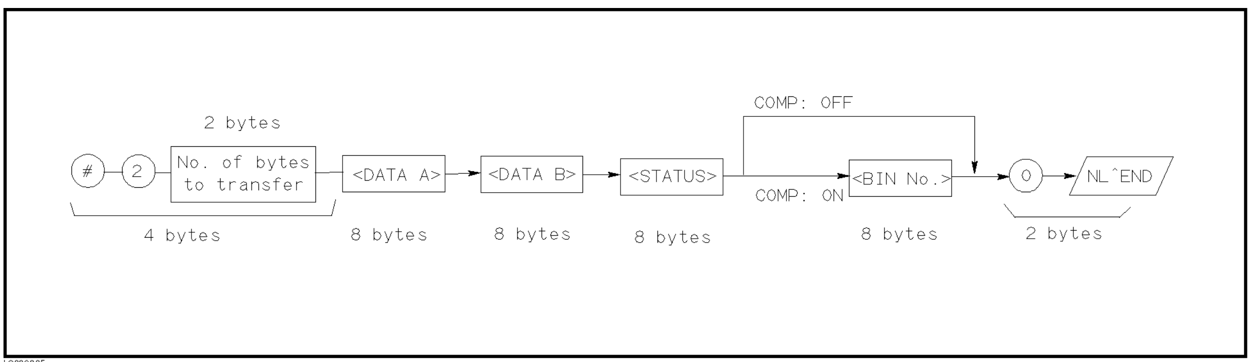


Figure 8-6. BINARY Format 1

This data field is initiated by a unique code, the number sign (#). A second byte, (2), designates the number of the bytes for the "No. of the bytes transfer". "No. of the bytes transfer" designates the data byte length. The last byte is zero (0), and has no meaning. The response message terminator is, the EOI line is asserted while the New Line (Line Feed) character (10 decimal) is being sent on the bus.

Floating Point Data Format

Each data format of the <DATA A>, <DATA B>, <STATUS>, and <BIN No.> are common formats (8 bytes, IEEE 754 floating point format) as follows. The meaning of each data is the same as the meaning of each data in the ASCII format.

IEEE 754 Floating Point Format

Bit No.	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
First byte sent	S	E_{msb}	E	E	E	E	E	E
Second byte sent	E	E	E	E_{lsb}	F_{msb}	F	F	F
Third – seventh byte sent	F ⋮	F ⋮	F ⋮	F ⋮	F ⋮	F ⋮	F ⋮	F ⋮
Last byte sent	F	F	F	F	F	F	F	F_{lsb}

Where,

E_{msb} : is the most significant bit of the exponent.
E_{lsb} : is the least significant bit of the exponent.
F_{msb} : is the most significant bit of the fractional part.
F_{lsb} : is the least significant bit of the fractional part.
S : is the sign bit.
E : is an exponent bit.
F : is a fraction bit.

The real number RN represented in floating point format are provided using the following formula. (EXP: Exponent part of number, f: Fractional part of number)

- When $0 < e < 11111111111$ (2047)

  $RN = (-1)^S \times 2^{(EXP-1023)} \times (1 + f/2^{52})$

- When $e = 0$

  $RN = (-1)^S \times 2^{-1022} \times (f/2^{52})$

- When $e = 0$, $f = 0$,

  $RN = 0$

For example,

$$S = 1$$

$$EXP = 01111111111 \text{ (1023 decimal)}$$

$$f = 1000\ 00000000\ 00000000\ 00000000\ 00000000\ 00000000\ 00000000\ (2^{51})$$

$$RN = (-1)^1 \times 2^{(1023-1023)} \times \left(1 + \frac{2^{51}}{2^{52}}\right)$$

$$= -1 \times 1 \times 1.5$$

$$= -1.5$$

When the list sweep measurement is performed, the binary data format is as follows. <DATA A>, <DATA B>, <STATUS>, and <IN/OUT> are repeated as many times as there are sweep points. Each data format is the same as the 8-byte data format described in the “Floating Point Data Format”. The meaning of each data is the same as each data in the ASCII format.

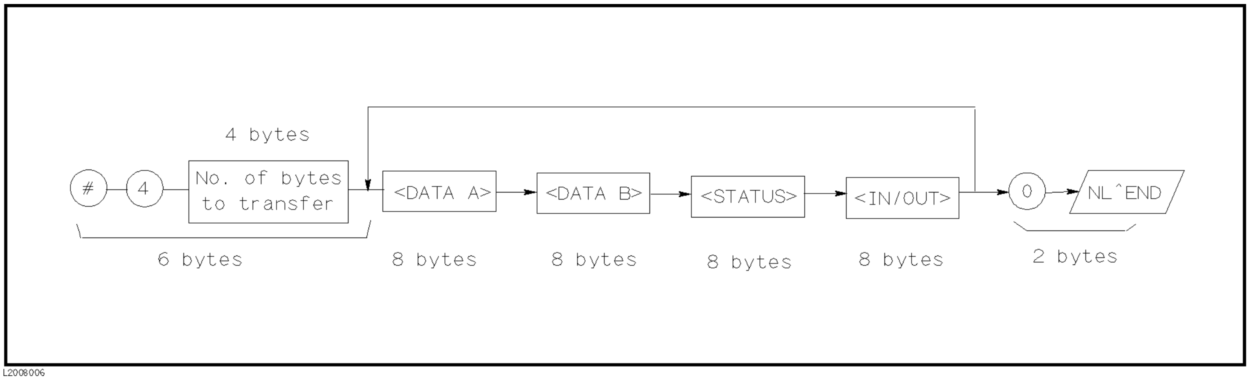


Figure 8-7. Binary Data Format For List Sweep Measurement

Trigger System

Figure 8-8 shows the HP 4285A trigger state diagram when in REMOTE.

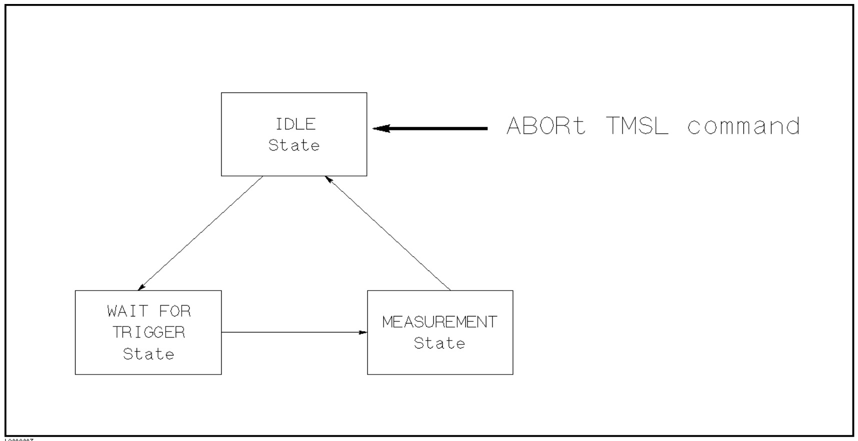


Figure 8-8. Trigger State Diagram

Each HP-IB trigger state is described in the following paragraphs.

- IDLE state

  During the IDLE state, the measurement data can be read by a controller via HP-IB using the `FETCh?` query. To change the IDLE state to the WAIT FOR TRIGGER state, the `INITiate` subsystem command must be used as shown in Figure 8-9.

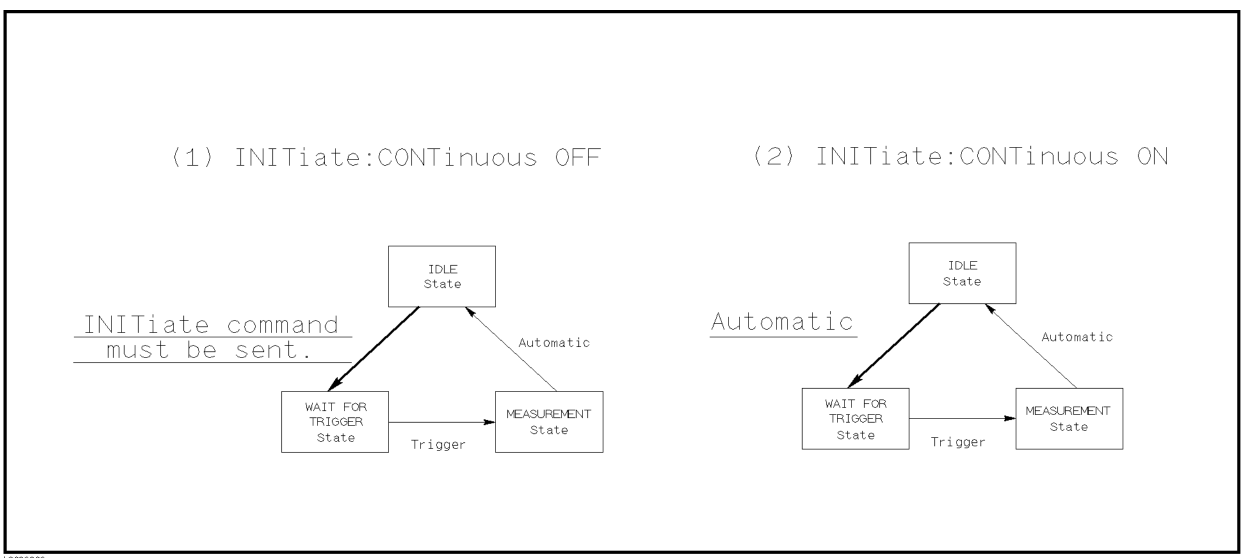


Figure 8-9. INITiate Subsystem Commands and Trigger System

There are the following two conditions for the `INITiate` subsystem commands.

1. `INITiate:CONTinuous OFF` condition

   In this condition, the `INITiate:IMMediate` command must be sent via HP-IB to change the IDLE state to the WAIT FOR TRIGGER state after reading the measurement data by a controller.

2. `INITiate:CONTinuous ON` condition

   In this condition, the IDLE state is automatically changed to the WAIT FOR TRIGGER state without using the `INITiate:IMMediate` command after reading the measurement data by a controller.

Note

When the `ABORt` command is sent under any state, the HP 4285A state is forced to the IDLE state. In this condition there are no data stored in the HP 4285A. If the `FETCh?` query is sent in this case, an error (error message −230: `"Data corrupt or stale"`) will occur.

- WAITING FOR TRIGGER state

  In this state, the HP 4285A can accept a trigger command while in the remote condition. When the trigger command is sent to the HP 4285A, the state is automatically changed to the MEASUREMENT state.

  There are three kinds of the trigger commands: `*TRG` common command, `Group Execution Trigger` (GET) bus command, and `TRIGger:IMMediate` TMSL command. These commands are divided into two types in this trigger system. (Refer to Figure 8-10.)

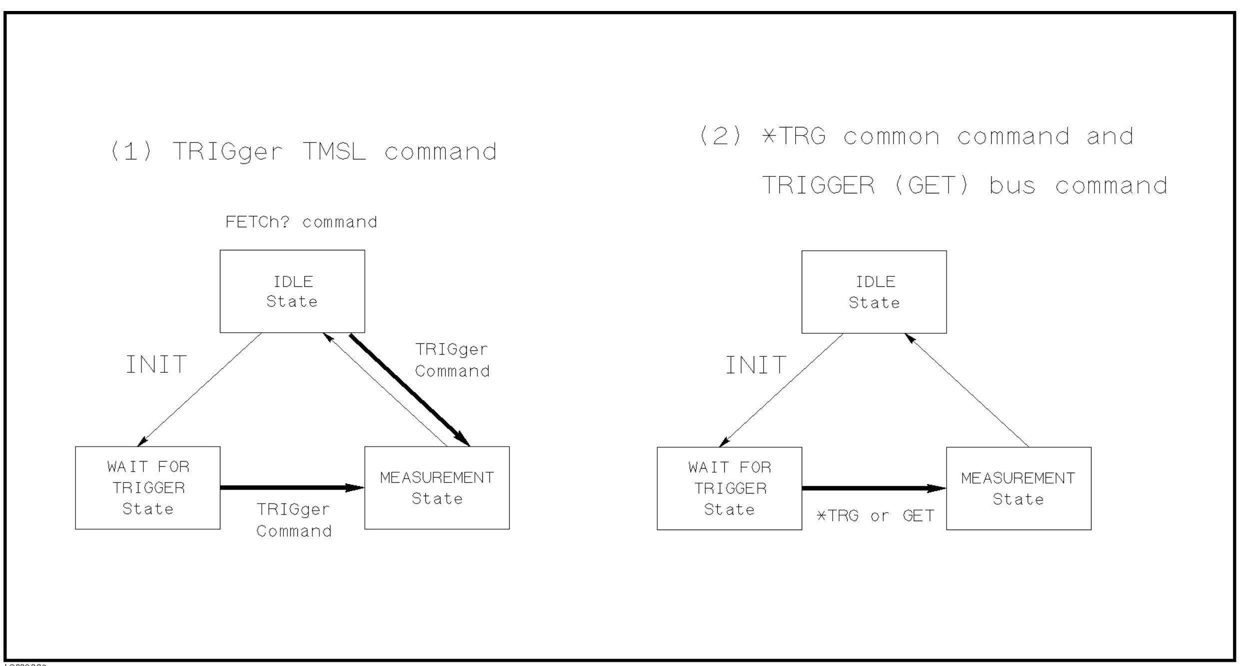


Figure 8-10. Trigger System and Trigger Commands

1. `TRIGger:IMMediate` TMSL command

   Either the WAIT FOR TRIGGER state or the IDLE state, the HP 4285A is triggered by sending the `TRIGger:IMMediate` command. When the measurement results can be read by a controller under the IDLE state, the `FETCh?` command must be used.

2. `*TRG` common command or `Group Execution Trigger` (`GET`) bus command

   In the WAIT FOR TRIGGER state, the HP 4285A is triggered by sending the `*TRG` common command or `GET` bus command, and the measurement results in one trigger sequence can be read without sending the `FETCh?` command under the IDLE state. Thus,

   "`*TRG`" = "`TRIGger:IMMediate;:FETCh?`"

Figure 8-11 and Figure 8-12 shows the difference between the `TRIGger:IMMediate` command and `*TRG` or `GET` command by using the sample programs.

```
10     ASSIGN @Meter TO 717
20     REMOTE @Meter
30     OUTPUT @Meter;"*RST;*CLS"
40     OUTPUT @Meter;"TRIG:SOUR BUS"
50     OUTPUT @Meter;"ABORT;:INIT"
60     OUTPUT @Meter;"TRIGGER:IMMEDIATE"
70     OUTPUT @Meter;"FETCH?"
80     ENTER @Meter;A,B,C
90     PRINT A,B,C
100    END
```

Figure 8-11. TRIGger:IMMediate Command Sample Program

```
10     ASSIGN @Meter TO 717
20     REMOTE @Meter
30     OUTPUT @Meter;"*RST;*CLS"
40     OUTPUT @Meter;"TRIG:SOUR BUS"
50     OUTPUT @Meter;"ABORT;:INIT"
60     OUTPUT @Meter;"*TRG"
70     ENTER @Meter;A,B,C
80     PRINT A,B,C
90     END
```

Figure 8-12. *TRG or GET Command Sample Program

Note

When the HP 4285A is set to the EXT TRIG mode, and is triggered via the EXT TRIGGER connector or an optional interface under the remote condition, this trigger signal has the same effect as the `TRIGger:IMMediate` TMSL command.

- MEASUREMENT state

  In this state, DUT measurement is being performed. After the DUT measurement is completed, trigger state automatically changes to the IDLE state.

Note

The HP 4285A can only measure a DUT on one page of the *MEAS DISPLAY*, *BIN No. DISPLAY*, *BIN COUNT DISPLAY*, and *LIST SWEEP DISPLAY* pages under the (DISPLAY FORMAT) even if the HP 4285A is in remote.

A typical flowchart of data transfer using the trigger system is shown below.

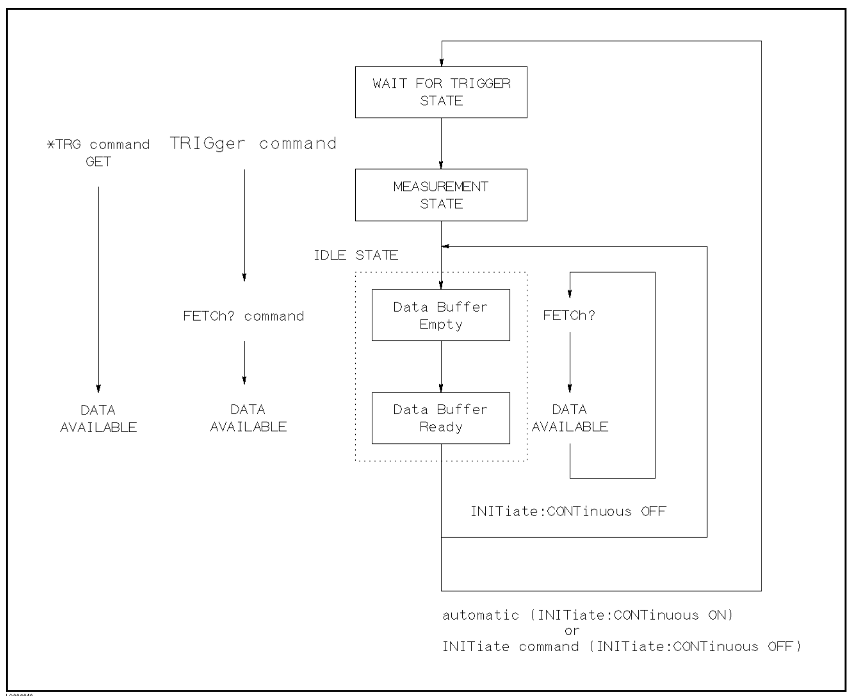


Figure 8-13. Triggering System and Data Transfer

Data Buffer Memory

The HP 4285A has data buffer memory capability. The data buffer memory can hold up to 128 sets of measurement results, and all buffered measurement results are transferred at once to the controller using the `MEMory:READ? DBUF` command as shown in Figure 8-14. So the overall data transmission time will be greatly reduced.

```
10    OPTION BASE 1
20    DIM D(5,4)
30    ASSIGN @Meter TO 717
40    REMOTE @Meter
50    OUTPUT @Meter;"*RST;*CLS"
60    OUTPUT @Meter;"FORM ASCII"
70    OUTPUT @Meter;"TRIG:SOUR BUS"
80    OUTPUT @Meter;"DISP:PAGE MEAS"
90    OUTPUT @Meter;"MEM:DIM DBUF,5"
100   OUTPUT @Meter;"MEM:FILL DBUF"
110   FOR I=1 TO 5
120     OUTPUT @Meter;"TRIGGER:IMMEDIATE"
130   NEXT I
140   OUTPUT @Meter;"MEM:READ? DBUF"
150   ENTER @Meter;D(*)
160   PRINT D(*)
170   OUTPUT @Meter;"MEM:CLE DBUF"
180   END
```

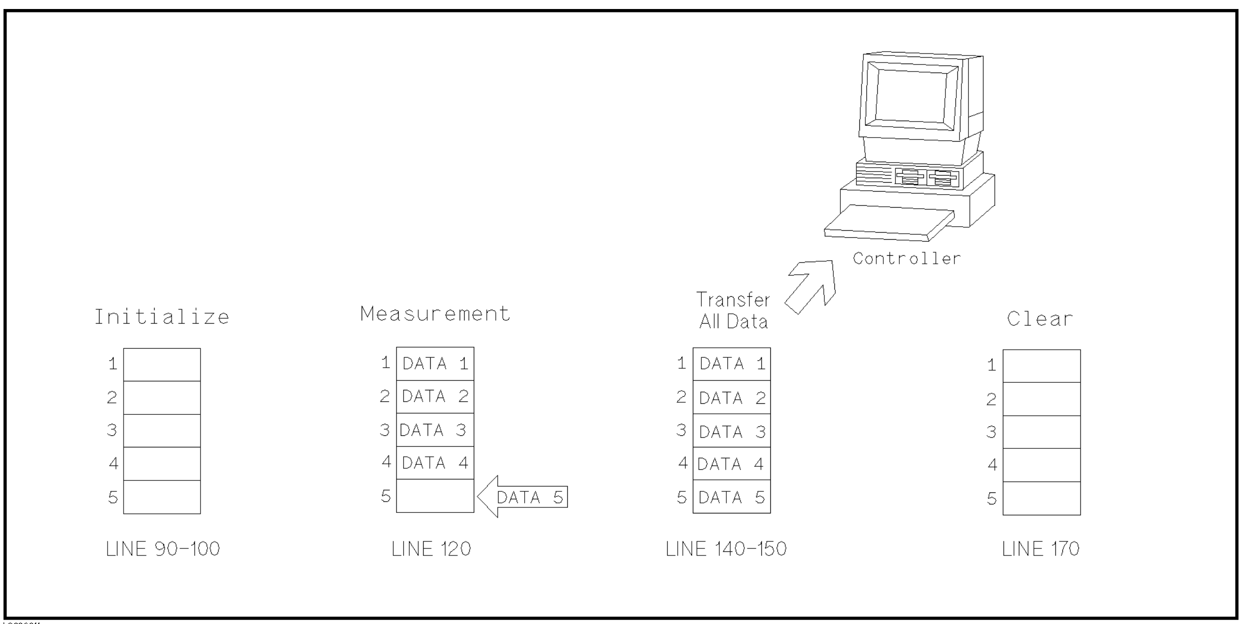


Figure 8-14. Buffered Data Transfer Sample Program and Description

Note

When the data buffer memory is used, use the following rules.

- The measurement data after sending the `MEMory:FILL DBUF` command to use the data buffer memory capabilities are stored into the data buffer memory in the order measured.
- When triggering the HP 4285A using the `TRIGger:IMMediate` command, the measurement results are entered only into the data buffer memory. So you don't have to clear the output buffer. When triggering using the `*TRG` or `Group Execution Trigger` (`GET`) command, the measurement results are entered into both the data buffer memory and the output buffer. So the output buffer must be cleared every time the HP 4285A's controller reads the measurement results. If you don't, error (−410, `"Query INTERRUPTED"`) will occur.
- When the number of sets of measurement data exceeds the capacity of the buffer memory, all of the overflowed measurement data are lost, error 90: `"Data Memory Overflow"` occurs, and bit 3 of the standard event status register is set to 1. If you enter new data into the data buffer memory, the data buffer memory should first be cleared using the `MEMory:CLEar DBUF` command.
- When the number of sets of measurement data is less than the capacity of the buffer memory, the following data, instead of the actual measurement data, are input to the unused protion of the data buffer memory.

<DATA A>:	9.9E37
<DATA B>:	9.9E37
<STATUS>:	−1
<BIN No.> or <IN/OUT>:	0

- When the data buffer memory capabilities are used during a list sweep measurement, the measurement result of one sweep point is stored as one set of measurement data. So when two or more sweep points are the same, and are adjacent, the HP 4285A measures the device once, but the number of data sets stored is equal to the number of sweep points.
- When the limit function of the list sweep measurement is set to OFF at a sweep point, <IN/OUT> is 0. Also when the comparator function is set to OFF, the <BIN No.> is 0.

There are two formats returned by `MEMory:READ? DBUF` query, ASCII and BINARY. Each format is described below. (The sample programs using the data buffer memory (returned format: ASCII and BINARY) are shown later in this chapter.)

- ASCII Format

  When the ASCII format is selected as a data format, the returned format is as follows. The <DATA A>, <DATA B>, <STATUS>, <BIN No.>, or <IN/OUT> data format and meaning are the same as the ASCII data format described in "ASCII Data Format".

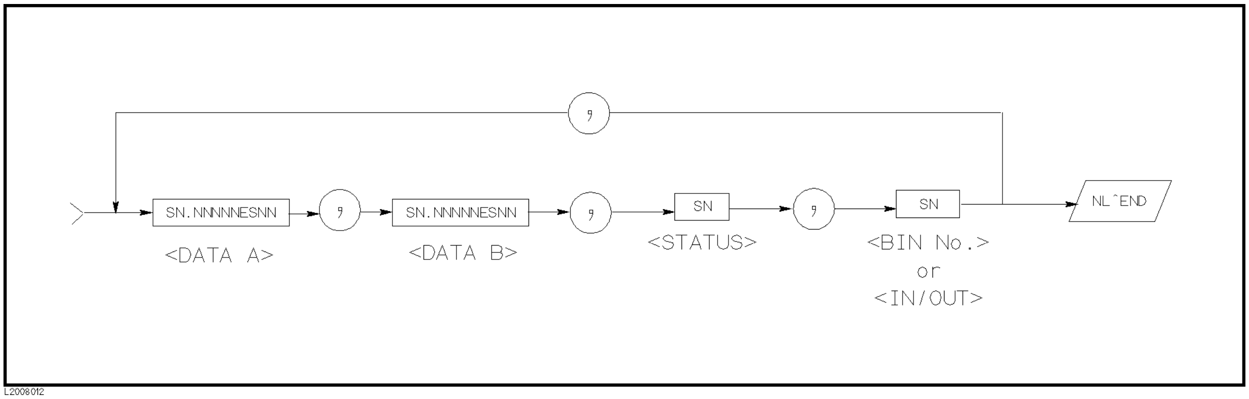


Figure 8-15. ASCII Format (Buffer Memory)

- BINARY Format

  When the BINARY format is selected as the data format, the returned format is as follows. The <DATA A>, <DATA B>, <STATUS>, <BIN No.>, or <IN/OUT> data format and meaning are the same as the BINARY data format described in "Binary Data Format".

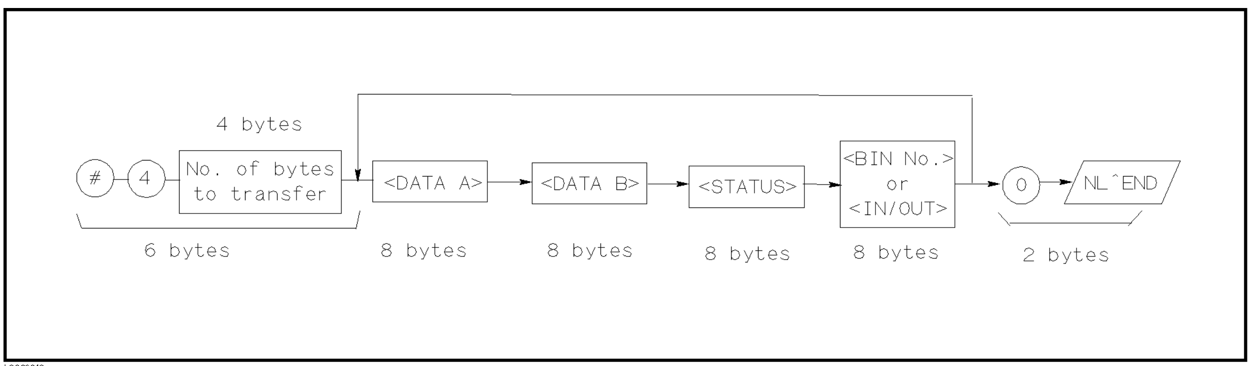


Figure 8-16. BINARY Format (Buffer Memory)

Each data format has a different data transfer rate. Table 8-3 shows the typical time required from sending the `FETCh?` command or the `MEM:READ? DBUF` command to enter the data using the ENTER command with an HP 9000 series 300 computer.

Table 8-3. Data Format and Data Transfer Time

Format	Data Type	Time
ASCII	Data without BIN No.	10 ms
	Data with BIN No.	11 ms
	List Sweep Data (10 points)	75 ms
	Data Buffer Memory (128 sets of data)	960 ms
BINARY	Data without BIN No.	8 ms
	Data with BIN No.	8.8 ms
	List Sweep Data (10 points)	34 ms
	Data Buffer Memory (128 sets of data)	406 ms

Status Byte

The status byte register contains an 8-bit word that the HP 4285A places on the HP-IB bus when it is serially polled.

The value of each bit indicates the status of an internal HP 4285A function, and two bits of the status byte are used as the summary bits of the registers (Refer to Figure 8-17). Bits are set to "1" and reset to "0".

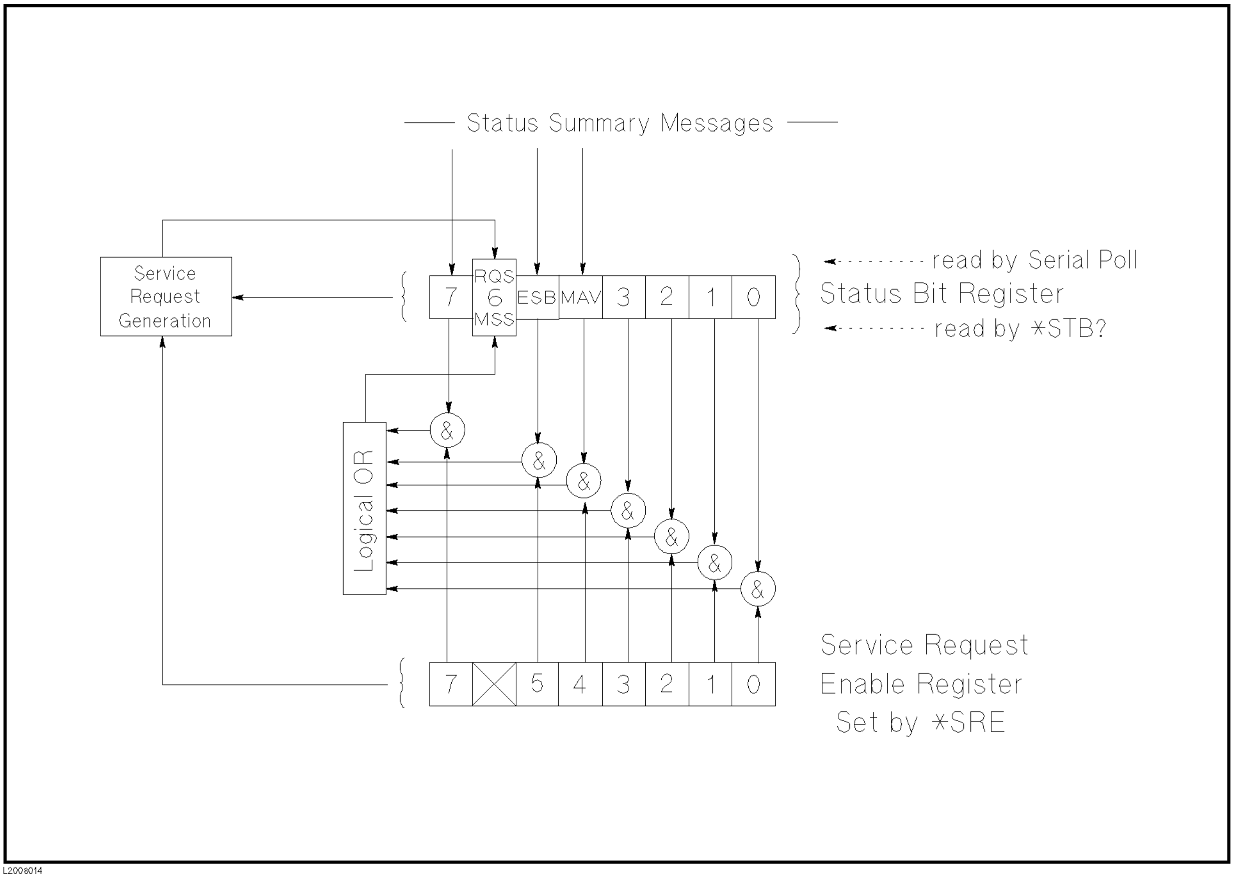


Figure 8-17. Status Byte Register

The individual bit assignments of the status byte and its bit weights are given in Table 8-4. When you read the status byte using HP-IB serial polling, the value is the sum of the total bit weights of all the high bits at the time you read the byte. After seriall polling the status byte, only bit 6 (RQS) is cleared.

Table 8-4. Status Byte Assignments

Bit No.	Bit Weight	Description
7	128	Operation Status Event Register Summary Bit This bit is set to "1" when one or more enabled bits of the operation status event register (discussed later in this chapter) has been set to "1". This bit is cleared when all bits of the operation status register are set to 0. (This bit isn't cleared by serial-polling.)
6	64	Bit 6 serves two functions RQS/MSS depending on how it is read. • RQS (Request Service) Bit If bit 6 is read in the serial polling process, it is treated as the RQS bit and is reset during the serial polling process. • MSS (Master Summary) Bit If bit 6 is read using the `*STB?` (status byte) query, it is treated as the MSS bit, and its value is not changed by the executing the `*STB?` query. To understand this operation think of the RQS and MSS bits as two inputs to a multiplexer (MUX) and the output of the MUX being bit 6 of the status byte register. During the serial polling operation the MUX path selected is from the service request generation circuit to bit 6, so bit 6 represents the RQS bit. During execution of the `*STB?` query the MUX path selected is from the master summary bit generation circuit to bit 6, so bit 6 represents the MSS bit. To clear the MSS bit, all bits of the original registers corresponding to the enabled summary bit in the status byte and the output buffer of the HP 4285A must be cleared. When you read the status byte including the MSS bit instead of the RQS bit, the `*STB?` query must be used. `*STB?` query clears neither the MSS bit nor the RQS bit.
5	32	Standard Event Status Register Summary Bit This bit is set to "1" when any enabled bits of the standard event status register (discussed later in this section) has been set to "1". This bit is cleared when all bits of the standard event status register are set to 0. (This bit isn't cleared by serial-polling.)
4	16	MAV (Message Available) Bit This bit is set to "1" whenever the HP 4285A has data available to output. This bit is cleared when the available data is read. (This bit isn't cleared by serial-polling.)
3	8	always 0 (zero)
2	4	always 0 (zero)
1	2	always 0 (zero)
0	1	always 0 (zero)

Enabling the Status Byte

A service request (SRQ) will be generated when any enable bit in the status byte register is set to “1”. So to enable/disable any bits of the status byte register, you can set bits in the service request enable register. These bits correspond to bits in the status byte. When a bit is set in the service request enable register it enables that bit in the status byte to request service. To set bits in the service request enable register, the `*SRE` command is used. The syntax of the `*SRE` command is :

`*SRE`<*n*>

Where, <*n*> : decimal number (0 to 255)

For example,

If <*n*> is equal to 34 (00100010 in binary), bit 1 and bit 5 are enabled, as follows.

Bit No. of Status Byte	**MSB LSB 7 6 5 4 3 2 1 0**
Bit Pattern for *SRE command	0 0 1 0 0 0 1 0

In this case, when either bit 1 or bit 5 of the status byte is set to “1”, a service request is generated.

The default setting is `*SRE 0` (all bits of the status byte are disabled).

Bit 6 (RQS) is non-maskable, and bits 0 to 3 are always 0 (zero). Thus, it is meaningless to mask these bits. (The `*SRE` command’s bit pattern for masking bit 6 is ignored, and the `*SRE` command’s bit pattern for masking bits 0 to 3 are accepted, but is meaningless.)

Operation Status Register Group

The operation status register structure provides operation status reporting by summarizing multiple events into a summary message (bit 7) of the status byte. The structure of the operation status register group is shown in Figure 8-18. The operation status register group consists of the standard operation status condition register, the standard operation status event register, and the standard operation status event enable register.

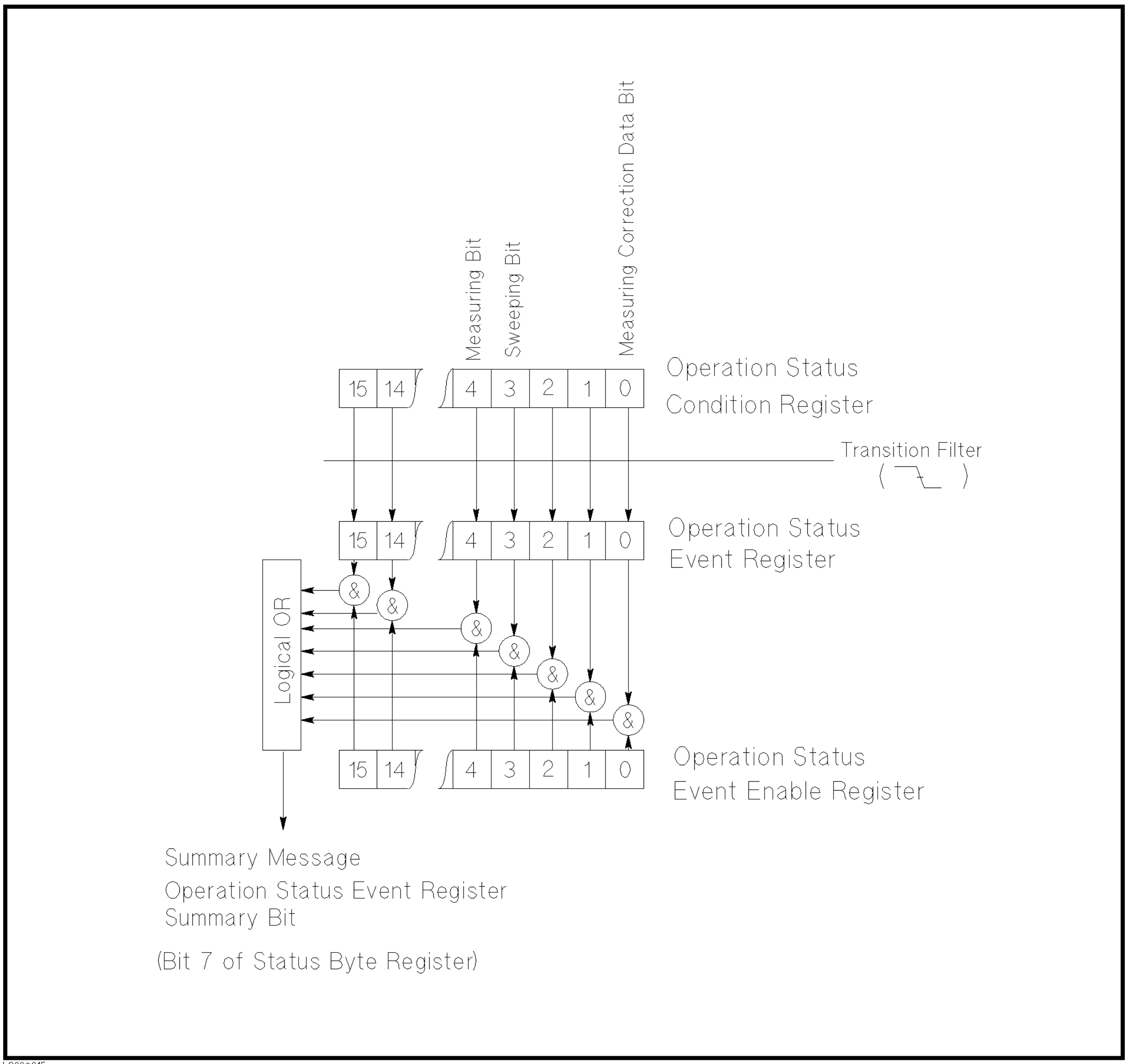


Figure 8-18. Operation Status Structure

Standard Operation Status Condition Register

The standard operation status condition register consists of 16-bits, and reflects these states in its condition bits. So each time the HP 4285A's condition is changed, its condition bit is changed from "0" to "1", or from "1" to "0". Each bit of the standard operation status condition register is shown below.

Table 8-5. Standard Operation Status Condition Register Assignments

Bit No.	Bit Weight	Description
15 – 5		always 0 (zero)
4	16	Measuring Bit 0 : Measurement not in progress 1 : Measurement in progress
3	8	Sweeping Bit 0 : List sweep measurement not in progress 1 : List sweep measurement in progress
2	4	always 0 (zero)
1	2	always 0 (zero)
0	1	Measuring Correction Data Bit 0 : Correction data measurement not in progress 1 : Correction data measurement in progress

When you read the contents of the standard operation status condition register using the `STATus:OPERation:CONDition?` query, the standard operation status condition register isn't cleared. To clear the standard operation status condition register, the device's condition state should only be changed by setting all bits to 0.

Standard Operation Status Event Register

The standard operation status event register consists of 16-bit registers, and each event bit in the event register corresponds to a condition bit in the standard operation status condition register. Each event bit is set to "1" when its corresponding bit in the condition register makes a "1" to "0" transition only, a negative transition filter is used.

Table 8-6.
Standard Operation Status Event Register Assignments

Bit No.	Bit Weight	Description
15 – 5		always 0 (zero)
4	16	Measurement Complete Bit This bit is set to "1" when a single point measurement is completed.
3	8	List Sweep Measurement Complete Bit This bit is set to "1" when a last sweep point measurement of the list sweep measurement is completed.
2	4	always 0 (zero)
1	2	always 0 (zero)
0	1	Correction Data Measurement Complete Bit This bit is set to "1" when the OPEN, SHORT, or LOAD correction data measurement is completed.

When you read the contents of the operation status event register using the `STATus:OPERation:EVENt?` query, the operation status event register is cleared, and bit 7 of the status byte is set to "0".

Standard Operation Status Event Enable Register

A operation status summary bit (bit 7 of the status byte) will be set when any enable bit in the operation status event register is set to "1". To enable/disable any bits of the operation status event register, the standard operation event enable register is used. The standard operation event enable register is the same length as the standard operation event register. When a bit is set in the operation status event register it enables the corresponding bit in the operation event register to request service. To set any bit in the operation status event enable register, The `STATus:OPERation:ENABle` command is used. The syntax of the `STATus:OPERation:ENABle` command is:

`STATus:OPERation:ENABle`*<n>*

Where, *<n>* : decimal number (0 to 65535)

For example,

If <*n*> is equal to 8 (0000000000001000 in binary), bit 3 is enabled, as follows.

Bit No. of Event Register	MSB 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	LSB 0
Event Enable Register	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

In this case, when either bit 3 of the operation status event register is set to "1", the operation status summary bit (bit 7 of the status byte) is set to "1".

The default setting is `STATus:OPERation:ENABle 0` (all bits of the operation status event register are disabled).

Bit 1, bit 2, and bits 5 to 15 are always 0 (zero). Thus, it is meaningless to mask these bits.

Standard Event Status Register

The standard event status register contains the 16-bits of the operation status report which is defined in IEEE 488.2-1987 as shown in Figure 8-19. If one or more enable bits of the standard event status register is set to "1", bit 5 (standard event status register summary bit) of the status byte is set to "1". Each bit of the standard event status register is shown on the next page.

When each error bit (bit 2, bit 3, bit 4, and bit 5) of the standard event status register is set to "1", an error message with the following error numbers is input to the error queue. For details, refer to "Error Messages" in Appendix B.

Bit No.	Error No.
5 (Command Error)	−100 to −178
4 (Execution Error)	−211 to −230
3 (Device Specific Error)	10 to 101, −310, −311
2 (Query Error)	−400 to −440

When you read the contents of the standard event status register using the `*ESR?` command, the standard event status register is cleared, and bit 5 of the status byte is set to "0".

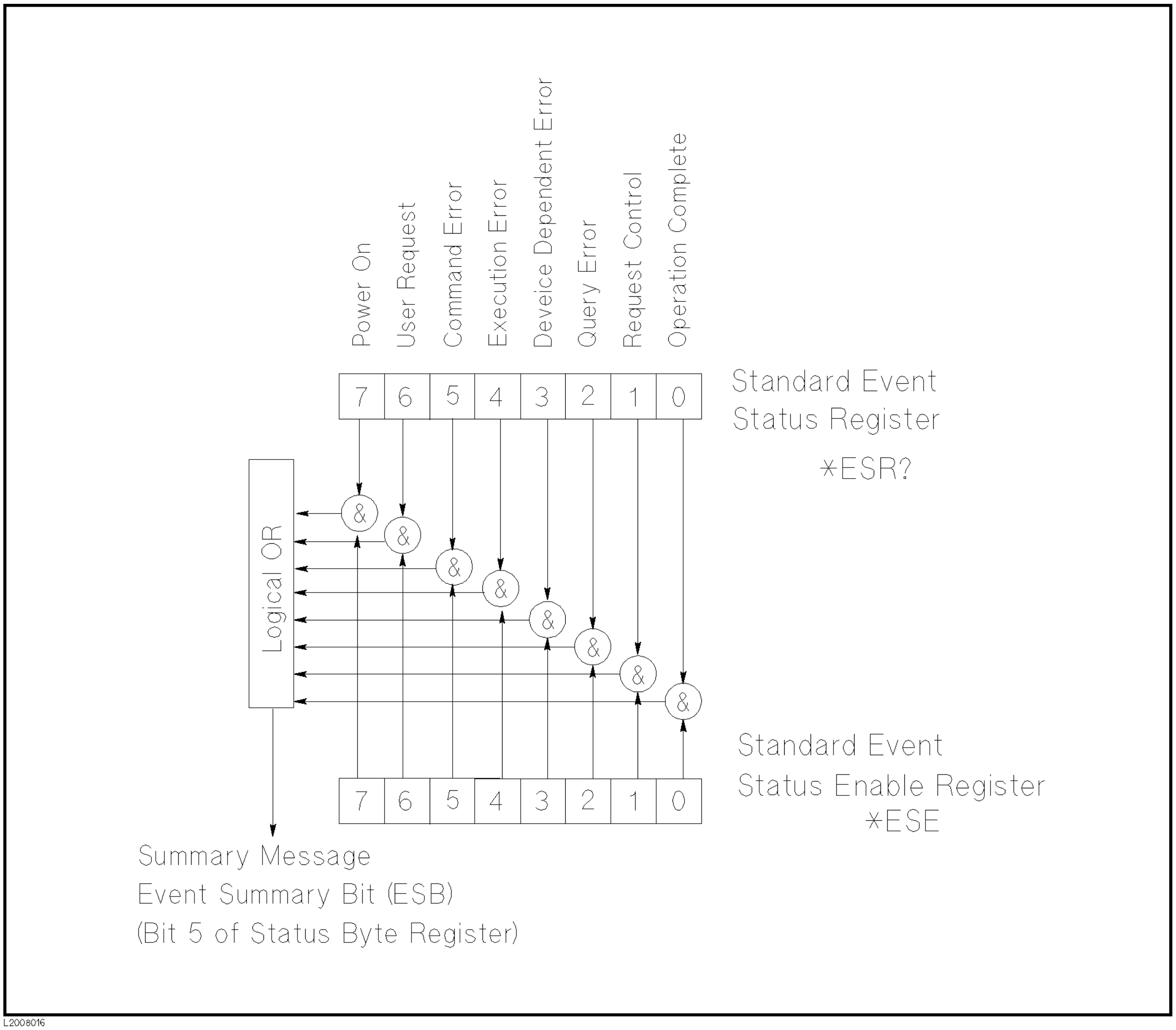


Figure 8-19. Standard Event Status Register

Table 8-7. Standard Event Status Register Assignments

Bit No.	Bit Weight	Description
7	128	Power On (PON) Bit This bit is set to “1” when the HP 4285A’s power supply has been turned OFF and then ON since the last time this register was read.
6	64	User Request (URQ) Bit always 0 (zero)
5	32	Command Error (CME) Bit This bit is set to “1” if the following the command errors occur. An IEEE 488.2 syntax error occurred. The device received a Group Execute Trigger (GET) inside a program message.
4	16	Execution Error (EXE) Bit This bit is set to “1” when a parameter following a header of a HP-IB command was evaluated by the HP 4285A as being outside of its legal input range or is otherwise inconsistent with the HP 4285A’s capabilities.
3	8	Device Specific Error (DDE) Bit This bit is set to “1” when a device dependent error (except for the command error, query error, and execution error) has occurred.
2	4	Query Error (QYE) Bit This bit is set to “1” when reading data from the output buffer and no data was present, or when the data was lost.
1	2	Request Control (RQC) Bit always 0 (zero)
0	1	Operation Complete (OPC) Bit This bit is set to “1” when the HP 4285A has completed all selected pending operations before sending the `*OPC` command.

Enabling the Event Status Register

An event status register summary bit (bit 6 of the status byte) will be set to "1" when any enable bit in the standard event status register is set to "1". To enable/disable any bits of the standard event status register, you can set the bits in the standard event status enable register. These bits correspond to bits in the standard event status enable register. When a bit is set in the standard event status enable register it enables the corresponding bit in the standard event status register and sets bit 6 of the status byte (event status register summary bit) to "1". To set any bit in the standard event status enable register, the `*ESE` command is used. The syntax of the `*ESE` command is:

`*ESE`<*n*>

Where, <*n*> : decimal number (0 to 255)

For example,

If <*n*> is equal to 34 (00100010), bit 1 and bit 5 are enabled, as follows.

Bit No. of Event Status Register	**MSB LSB 7 6 5 4 3 2 1 0**
Bit Pattern for *ESE command	0 0 1 0 0 0 1 0

When either bit 1 or 5 of the standard event status register is set to "1", the event status register summary bit (bit 6 of the status byte) is set to "1".

The default setting is `*ESE 0` (all bits of the standard event status byte are disabled).

Bits 1 and 6 of the event status register are always 0 (zero). Thus masking these bits has no meaning.

Sample Programs

This paragraph provides some sample programs for control setting and data transfer.

Control Settings

The HP 4285A in precision Q measurement mode has four control setting pages under the (MEAS SETUP) as follows.

- *Q MEAS SETUP*
- *Q CORRECTION*
- *Q LIMIT TABLE SETUP*
- *Q LIST SWEEP SETUP*

So, the control settings on each page should be set. The sample programs are shown in the order of the preceding list starting on the next page.

Note

In case of the front panel operation, the available control settings depends on the display page. But in the case of HP-IB operation, all of control settings can be set without concern to the page being displayed.

Note

When the HP 4285A measures a DUT, one of the following pages under the (DISPLAY FORMAT) must be used even if the HP 4285A is in the remote condition.

- *Q MEAS DISPLAY*
- *Q BIN No. DISPLAY*
- *Q BIN COUNT DISPLAY*
- *Q LIST SWEEP DISPLAY*

MEAS SETUP page

This sample program sets all of the setting controls on the *MEAS SETUP* page.

```
10    ASSIGN @Meter TO 717
20    REMOTE @Meter
30    OUTPUT @Meter;"DISP:PAGE MSET"
40    OUTPUT @Meter;"DISP:LINE ""Control Example"""
50    OUTPUT @Meter;"FUNC:IMP QL"
60    OUTPUT @Meter;"FREQ 1MHZ"
70    OUTPUT @Meter;"VOLT 150MV"
80    OUTPUT @Meter;"FUNC:IMP:Q:TUNE AUTO"
90    OUTPUT @Meter;"TRIG:SOUR BUS"
100   OUTPUT @Meter;"TRIG:DEL 1"
110   OUTPUT @Meter;"APER MED,4"
120   OUTPUT @Meter;"FUNC:SMON:VAC ON"
130   OUTPUT @Meter;"FUNC:IMP:Q:TUNE:VAL 200E-12"
140   OUTPUT @Meter;"FUNC:IMP:Q:OFFS:L ON;C OFF;R ON"
150   OUTPUT @Meter;"FUNC:IMP:Q:OFFS:R:VAL 0.1"
160   OUTPUT @Meter;"FUNC:IMP:Q:OFFS:L:VAL 100E-9"
170   OUTPUT @Meter;"FUNC:DEV1:MODE ABS"
180   OUTPUT @Meter;"FUNC:DEV2:MODE ABS"
190   OUTPUT @Meter;"FUNC:DEV1:REF 1000"
200   OUTPUT @Meter;"FUNC:DEV2:REF 1"
210   END
```

Figure 8-20. MEAS SETUP Page

CORRECTION page

This sample program sets the setting controls on the *CORRECTION* page after the correction data have already been stored.

```
10    ASSIGN @Meter TO 717
20    REMOTE @Meter
30    OUTPUT @Meter;"DISP:PAGE CSET"
40    OUTPUT @Meter;"CORR:SHOR:STAT ON"
50    OUTPUT @Meter;"CORR:LOAD:STAT ON"
60    OUTPUT @Meter;"CORR:SPOT1:STAT ON"
70    OUTPUT @Meter;"CORR:SPOT2:STAT ON"
80    OUTPUT @Meter;"CORR:SPOT3:STAT ON"
90    OUTPUT @Meter;"CORR:SPOT4:STAT ON"
100   OUTPUT @Meter;"CORR:SPOT5:STAT ON"
110   OUTPUT @Meter;"CORR:SPOT6:STAT ON"
120   OUTPUT @Meter;"CORR:SPOT7:STAT ON"
130   END
```

Figure 8-21. CORRECTION page

LIMIT TABLE SETUP page

This sample program sets all of the setting controls on the *LIMIT TABLE SETUP* page.

```
10    ASSIGN @Meter TO 717
20    REMOTE @Meter
30    OUTPUT @Meter;"DISP:PAGE LTAB"
40    OUTPUT @Meter;"FUNC:IMP QL"
50    OUTPUT @Meter;"COMP:TOL:NOM 100"
60    OUTPUT @Meter;"COMP ON"
70    OUTPUT @Meter;"COMP:ABIN ON"
80    OUTPUT @Meter;"COMP:MODE PTOL"
90    OUTPUT @Meter;"COMP:TOL:BIN1 -1,1"
100   OUTPUT @Meter;"COMP:TOL:BIN2 -2,2"
110   OUTPUT @Meter;"COMP:TOL:BIN3 -3,3"
120   OUTPUT @Meter;"COMP:TOL:BIN4 -4,4"
130   OUTPUT @Meter;"COMP:TOL:BIN5 -5,5"
140   OUTPUT @Meter;"COMP:TOL:BIN6 -6,6"
150   OUTPUT @Meter;"COMP:TOL:BIN7 -7,7"
160   OUTPUT @Meter;"COMP:TOL:BIN8 -8,8"
170   OUTPUT @Meter;"COMP:TOL:BIN9 -9,9"
180   OUTPUT @Meter;"COMP:SLIM 10E-6,11E-6"
190   END
```

Figure 8-22. LIMIT TABLE SETUP page

LIST SWEEP SETUP page

This sample program sets all of the setting controls on the *LIST SWEEP SETUP* page.

```
10    ASSIGN @Meter TO 717
20    REMOTE @Meter
30    OUTPUT @Meter;"DISP:PAGE LSET"
40    OUTPUT @Meter;"LIST:MODE SEQ"
50    OUTPUT @Meter;"LIST:FREQ 1MHZ,2MHZ,3MHZ,4MHZ,5MHZ,6MHZ,7MHZ,8MHZ,9MHZ,10MHZ"
60    OUTPUT @Meter;"LIST:BAND1 A,100,200"
70    OUTPUT @Meter;"LIST:BAND2 A,100,200"
80    OUTPUT @Meter;"LIST:BAND3 A,100,200"
90    OUTPUT @Meter;"LIST:BAND4 A,100,200"
100   OUTPUT @Meter;"LIST:BAND5 A,100,200"
110   OUTPUT @Meter;"LIST:BAND6 A,100,200"
120   OUTPUT @Meter;"LIST:BAND7 A,100,200"
130   OUTPUT @Meter;"LIST:BAND8 A,100,200"
140   OUTPUT @Meter;"LIST:BAND9 A,100,200"
150   OUTPUT @Meter;"LIST:BAND9 A,100,200"
160   OUTPUT @Meter;"LIST:BAND10 A,100,200"
170   END
```

Figure 8-23. LIST SWEEP SETUP

Data Transfer Examples

The HP 4285A has two data transfer formats, ASCII and BINARY. This paragraph includes sample programs for each.

ASCII Format

The sample programs using the ASCII data format are in the following three patterns.

- Measurement data transfer when the comparator function of the limit table is set to ON. (Figure 8-24)
- Measurement data transfer using the buffer memory function when the comparator function of the limit table is set to ON. (Figure 8-25)
- Measurement data transfer when the list sweep measurement is performed. (Figure 8-26)

```
10    ASSIGN @Meter TO 717
20    REMOTE @Meter
30    OUTPUT @Meter;"*RST;*CLS"          !\
40    OUTPUT @Meter;"FORM ASCII"         ! Setup
50    OUTPUT @Meter;"TRIG:SOUR BUS"      ! Measurement
60    OUTPUT @Meter;"COMP ON"            ! Condition
70    OUTPUT @Meter;"INIT:CONT ON"       !/
80    FOR I=0 TO 9
90      TRIGGER @Meter                   ! Perform measurement
100     ENTER @Meter;A,B,C,D             ! Transfer data to controller
110     PRINT A,B,C,D                    ! Print measurement result
120   NEXT I
130   END
```

Figure 8-24. Sample Program (Comparator) Using ASCII Format

```
10    DIM D(127,3)
20    ASSIGN @Meter TO 717
30    REMOTE @Meter
40    OUTPUT @Meter;"*RST;*CLS"         !\
50    OUTPUT @Meter;"FORM ASCII"        ! Setup
60    OUTPUT @Meter;"MEM:DIM DBUF,128"  ! Measurement
70    OUTPUT @Meter;"TRIG:SOUR BUS"     ! Condition
80    OUTPUT @Meter;"COMP ON"           !/
90    OUTPUT @Meter;"MEM:FILL DBUF"     ! Enable the buffer memory
100   FOR I=0 TO 127                    !\
110     OUTPUT @Meter;"TRIGGER"         ! Perform measurement 128 times
120   NEXT I                            !/
130   OUTPUT @Meter;"MEM:READ? DBUF"    !\
140   ENTER @Meter;D(*)                 !/Transfer the measurement result
150   PRINT D(*)                        ! Display the measurement result
160   OUTPUT @Meter;"MEM:CLE DBUF"      ! Disable the buffer memory
170   END
```

Figure 8-25. Sample Program (Buffer Memory) Using ASCII Format

```
10    DIM D(6,3)
20    ASSIGN @Meter TO 717
30    REMOTE @Meter
40    OUTPUT @Meter;"*RST;*CLS"          !\
50    OUTPUT @Meter;"FORM ASCII"         ! |
60    OUTPUT @Meter;"TRIG:SOUR BUS"      ! |
70    OUTPUT @Meter;"LIST:MODE SEQ"      ! |
80    OUTPUT @Meter;"LIST:FREQ 1MHZ,2MHZ,3MHZ,4MHZ,5MHZ,6MHZ,7MHZ"
90    OUTPUT @Meter;"LIST:BAND1 A,100,200"!  Setup
100   OUTPUT @Meter;"LIST:BAND2 A,100,200"!  Measurement
110   OUTPUT @Meter;"LIST:BAND3 A,100,200"!  Condition
120   OUTPUT @Meter;"LIST:BAND4 A,100,200"! |
130   OUTPUT @Meter;"LIST:BAND5 A,100,200"! |
140   OUTPUT @Meter;"LIST:BAND6 A,100,200"! |
150   OUTPUT @Meter;"LIST:BAND7 A,100,200"! |
160   OUTPUT @Meter;"DISP:PAGE LIST"     ! |
170   OUTPUT @Meter;"INIT:CONT ON"       !/
180   TRIGGER @Meter                     ! Perform measurement
190   ENTER @Meter;D(*)                  ! Transfer measurement data
200   PRINT D(*)                         ! Display measurement data
210   END
```

Figure 8-26. Sample Program (List Sweep) Using ASCII Format

BINARY Format

The sample programs using the BINARY data format are in the following three patterns. (The contents of the sample programs are same as the contents of the ASCII format's sample programs.)

- Measurement data transfer when the comparator function of the limit table is set to ON. (Figure 8-27)
- Measurement data transfer using the buffer memory function when the comparator function of the limit table is set to ON. (Figure 8-28)
- Measurement data transfer when the list sweep measurement is performed. (Figure 8-29)

```
10    INTEGER Header_1,Header_2,Term
20    ASSIGN @Meter TO 717;FORMAT ON
30    ASSIGN @Binary TO 717;FORMAT OFF
40    REMOTE @Meter
50    OUTPUT @Meter;"*RST;*CLS"          !\
60    OUTPUT @Meter;"FORM REAL,64"       ! Setup
70    OUTPUT @Meter;"TRIG:SOUR BUS"      ! Measurement
80    OUTPUT @Meter;"COMP ON"            ! Condition
90    OUTPUT @Meter;"INIT:CONT ON"       !/
100   FOR I=0 TO 9
110     TRIGGER @Meter                   ! Perform measurment
120     ENTER @Binary;Header_1,Header_2,A,B,C,D,Term! Transfer data
130     PRINT A,B,C,D                    ! Display measurement result
140   NEXT I
150   END
```

Figure 8-27. Sample Program (Comparator) Using BINARY Format

```
10    INTEGER Header_1,Header_2,Header_3,Term
20    DIM D(127,3)
30    ASSIGN @Meter TO 717;FORMAT ON
40    ASSIGN @Binary TO 717;FORMAT OFF
50    REMOTE @Meter
60    OUTPUT @Meter;"*RST;*CLS"           !\
70    OUTPUT @Meter;"FORM REAL,64"        ! Setup
80    OUTPUT @Meter;"MEM:DIM DBUF,128"    ! Measurement
90    OUTPUT @Meter;"TRIG:SOUR BUS"       ! Condition
100   OUTPUT @Meter;"COMP ON"             !/
110   OUTPUT @Meter;"MEM:FILL DBUF"       ! Enable the buffer memory
120   FOR I=0 TO 127
130     OUTPUT @Meter;"TRIGGER"           ! Perform the measurement 128 times
140   NEXT I
150   OUTPUT @Meter;"MEM:READ? DBUF"      ! Transfer data
160   ENTER @Binary;Header_1,Header_2,Header_3,D(*),Term
170   PRINT D(*)                          ! Display the measurement result
180   OUTPUT @Meter;"MEM:CLE DBUF"        ! Disable the buffer memory
190   END
```

Figure 8-28. Sample Program (Buffer Memory) Using BINARY Format

```
20    DIM D(6,3)
30    ASSIGN @Meter TO 717;FORMAT ON
40    ASSIGN @Binary TO 717;FORMAT OFF
50    REMOTE @Meter
60    OUTPUT @Meter;"*RST;*CLS"          !\
70    OUTPUT @Meter;"FORM REAL,64"       ! |
80    OUTPUT @Meter;"TRIG:SOUR BUS"      ! |
100   OUTPUT @Meter;"LIST:MODE SEQ"      ! |
110   OUTPUT @Meter;"LIST:FREQ 1MHZ,2MHZ,3MHZ,4MHZ,5MHZ,6MHZ,7MHZ"
120   OUTPUT @Meter;"LIST:BAND1 A,100,200"! Setup
130   OUTPUT @Meter;"LIST:BAND2 A,100,200"! List
140   OUTPUT @Meter;"LIST:BAND3 A,100,200"! Sweep
150   OUTPUT @Meter;"LIST:BAND4 A,100,200"! Table
160   OUTPUT @Meter;"LIST:BAND5 A,100,200"!|
170   OUTPUT @Meter;"LIST:BAND6 A,100,200"!|
180   OUTPUT @Meter;"LIST:BAND7 A,100,200"!|
190   OUTPUT @Meter;"DISP:PAGE LIST"     ! |
200   OUTPUT @Meter;"INIT:CONT ON"       !/
210   TRIGGER @Meter                     ! Perform measurement
220   ENTER @Binary;Header_1,Header_2,Header_3,D(*),Term! Transfer measurement data
230   PRINT D(*)                         ! Display measurement data
240   END
```

Figure 8-29. Sample Program (List Sweep) Using BINARY Format

9

Command Reference

Introduction

This chapter provides descriptions of all Test and Measurement Systems Language (TMSL) command sets, listed in functional subsystem order. Use this chapter as a reference. Each command description contains the following paragraphs:

Field — A field name corresponding to a TMSL command.

Command Syntax — The way you must type in the command, including all of the required and optional parameters.

Query Syntax — The way you must type in the query, including all of the required and optional parameters.

Query Response — HP 4285A's response data format.

Example — A case serving as a typical model for the more common uses of the command.

Notation Conventions and Definitions

The following conventions and definitions are used in this chapter to describe HP-IB operation.

< > — Angular brackets enclose words or characters that are used to symbolize a program code parameter or an HP-IB command.

[ ] — Square brackets indicates that the enclosed items are optional. The square brackets with the asterisk (for example, [,*<value>**]) means the enclosed item (*<value>*) repeats until the maximum counted number.

{ } — When several items are enclosed by braces, one and only one of these elements may be selected.

The following definitions are used:

<NL^END> — Terminators (the EOI line is asserted by New Line or ASCII Line Feed character (decimal 10))

White space — Single ASCII character (0–9, 11–32 decimal)
For example, Carriage Return (13 decimal) or Space (32 decimal)

Command Structure

The HP 4285A combined with the HP 42851A commands are divided into two types: HP-IB common commands and TMSL commands. The HP-IB common commands are defined in IEEE std. 488.2-1987, and these commands are common for all devices. The TMSL commands are used to control all of the HP 4285A's functions. The TMSL commands are tree structured three levels deep. (The highest level commands are called the subsystem commands in this manual.) So the lower level commands are legal only when the subsystem commands have been selected. A colon (:) is used to separate the higher level commands and the lower level commands. See Figure 9-1 for a sample.

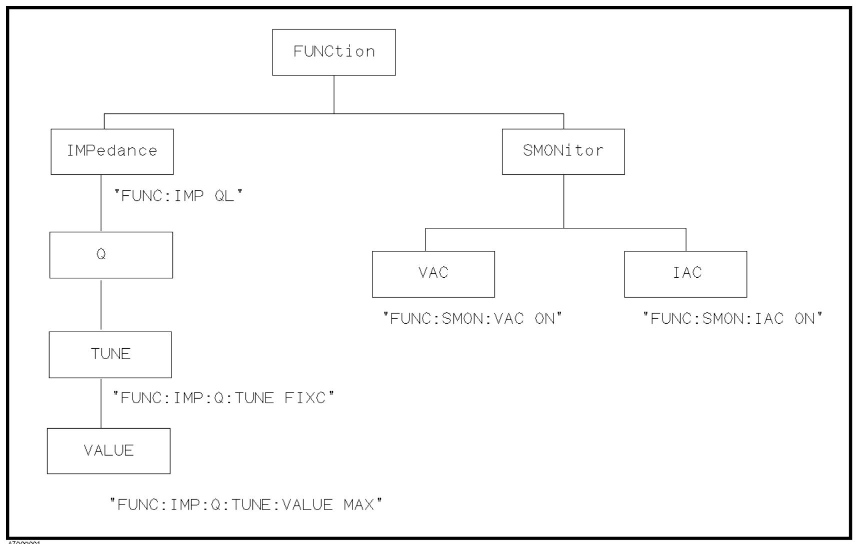


Figure 9-1. Command Tree Example

The basic rules of the command tree are as follows.

- Letter case (upper and lower) is ignored.

  For example,
  `FUNC:IMP QLS = func:imp qls = FuNc:IMp qLs`

- Spaces (␣ used to indicate a space) must not be placed before and/or after the colon.

  For example,
  (wrong) `FUNC␣:␣IMP QLS` → (right) `FUNC:IMP QLS`

- The command can be completely spelled out or in abbreviated. (The rules for command abbreviation are described later in this section)

  For example,
  `FUNCTION:IMPEDANCE QLS = FUNC:IMP QLS`

- The command header should be followed by a question mark (?) to generate a query for that command.

  For example,
  `FUNC:IMP?`

The semicolon (;) can be used to as a separator execute multiple commands on a single line. The multiple command rules are as follows.

- Commands at the same level and in the same subsystem command group can be separated by a semicolon (;) on a multiple command line.

  For example,
  `FUNC:IMP:Q:OFFS:L ON;C OFF;R ON`

- To restart commands from the highest level, a semicolon (;) must be used as the separator, and then a leading colon (:), which shows that the restarted command is a command at the top of the command tree, must follow.

  For example,
  `FUNC:IMP QLS;:FUNC:SMON:VAC ON`

- The HP-IB common commands can restart only after a semicolon on a multiple command line.

  For example,
  `FUNC:IMP QLS;*SRE 32`

- The HP-IB common commands keeps the previous commands level in a multiple command line.

  For example,
  `FUNC:IMP QLS;*SRE 32;SMON:IAC ON`

Command Abbreviations

Every command and character parameter has at least two forms, a short form and a long form. In some cases they will be the same. The short form is obtained using the following rules.

- If the long form has four characters or less, the long form and short form are the same.
- If the long form has more than 4 characters,
  - If the 4th character is a vowel, the short form is the first 3 characters of the long form.
  - If the 4th character is not a vowel, the short form is the first 4 characters.

  For example:

  `TRIGger` abbreviates to `TRIG`.
  `LEVel` abbreviates to `LEV`.
  `FREQuency` abbreviates to `FREQ`.
- If the long form mnemonic is defined as a phrase rather than a single word, then the long form mnemonic is the first character of the first word(s) followed by the entire last word. The above rules, when the long form mnemonic is a single word, are then applied to the resulting long form mnemonic to obtain the short form.

  For example:

  Percent TOLerance abbreviates to `PTOL`. (The long form is `PTOLERANCE`.)

Note The HP 4285A accepts the three forms of the same TMSL commands: all upper case, all lower case, and mixed upper and lower case.

Header and Parameters

The HP-IB control commands consists of a command header and parameters. (See the following.)

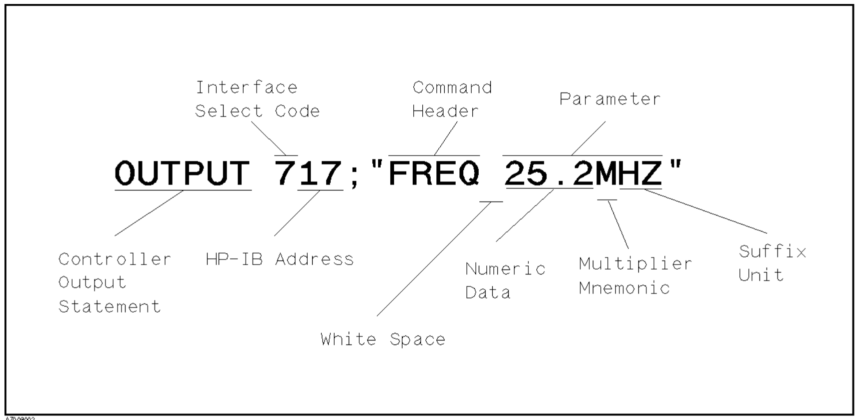


Figure 9-2. Command Header and Parameters

Headers can be of the long form or the short form. The long form allows easier understanding of the program code and the short form allows more efficient use of the computer. Parameters may be of two types as follows.

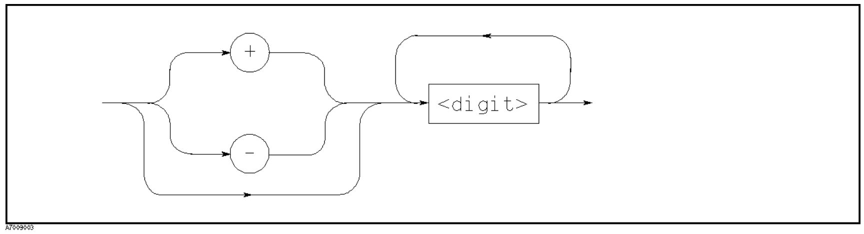
- Character Data and String Data

  Character data consists of ASCII characters. The abbreviation rules are the same as the rules for command headers. String data consists of ASCII characters enclosed by double quotes (" ").

- Numeric data

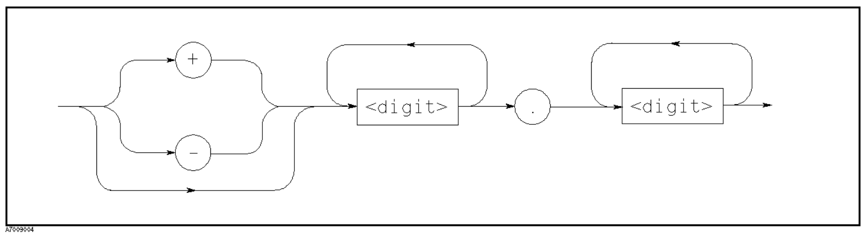
  Integer (NR1), fixed point (NR2), or floating point (NR3). These three numeric data types are defined in IEEE 488.2-1988. (Refer to the syntax diagrams on the next page.) The available range for numeric data is ± 9.9E37.

NR1



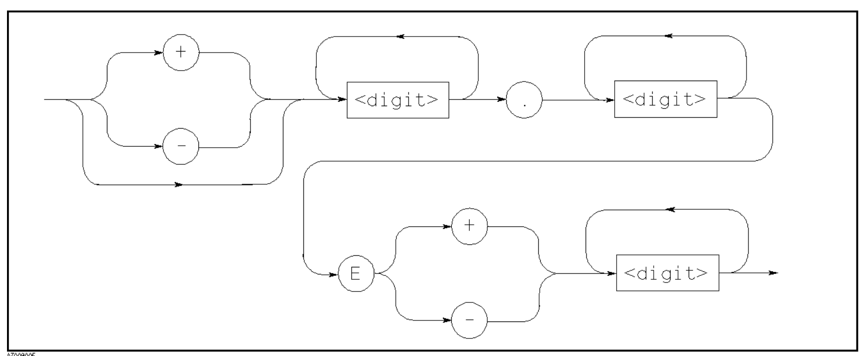
For example, 123
+123
−12345

NR2



For example, 12.3
+1.234
−123.4

NR3



For example, 1.23E+5
123.4E−56

When numeric data is used as a parameter, the suffix multiplier mnemonics and suffix units (The suffix multiplier must be used with the suffix unit.) can be used for some commands as follows.

Table 9-1. Multiplier Mnemonics

Definition		Mnemonic
1E18	(EXA)	EX
1E15	(PETA)	PE
1E12	(TERA)	T
1E9	(GIGA)	G
1E6	(MEGA)	MA[1]
1E3	(KILO)	K
1E−3	(MILLI)	M
1E−6	(MICRO)	U
1E−9	(NANO)	N
1E−12	(PICO)	P
1E−15	(FEMTO)	F
1E−18	(ATTO)	A

[1]: **M or MA is available only when the suffix unit is HZ.**

Table 9-2. Suffix Units and Available Commands

Suffix Unit	Available Command

HZ	`FREQuency`
	`LIST:FREQuency`
	`CORRection:SPOT<n>:FREQuency`

V	`VOLTage` `LIST:VOLTage`
S	`TRIGger:DELay`

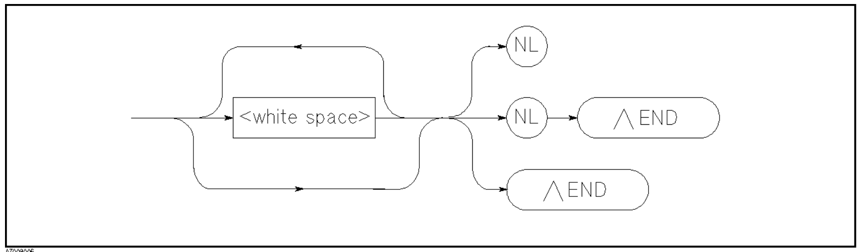
The header separator is placed between the header and its parameter. This is one white space which is defined as a single ASCII character in the range 0 through 9 or 11 through 32 decimal. This includes the ASCII space (32 decimal) code.

Terminators

There are two kinds of the terminators: program message terminators and response message terminators.

Program Message Terminators

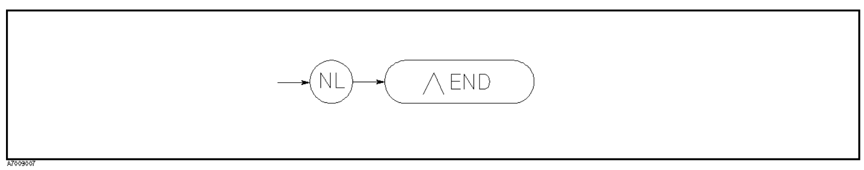
The HP 4285A responds to the input data message when it is in the remote mode (REN control line true) and is addressed to listen. The input data message contain a string of HP-IB commands and terminators. The HP-IB commands are executed after the terminators are received. The terminators defined as follows.



White Space	Single ASCII character (0 to 9, 11 to 32 decimal) For example, Carriage Return (13 decimal) or Space (32 decimal)
NL	New Line (Line Feed (10 decimal))
ˆEND	EOI is asserted with the last byte is sent.

Response Message Terminators

The HP 4285A can send an output data message when it is in the local or remote modes, when it is addressed to talk, or in the talk-only mode. The data message contains the message returned by the query command and the terminators. Terminators defined as follows.



The EOI line is asserted while the New Line or Line Freed character (10 decimal) is being sent on the bus.

Command Reference

All commands in this reference are fully explained and listed in the following functional command order.

HP 4285A Combined with HP 42851A Subsystem Commands

• DISPlay	• LIST	• FORMat	• SYSTem
• FREQuency	• APERture	• MEMmory	• STATus
• VOLTage	• INITiate	• CORRection	
• TRIGger	• FETCh?	• COMParator	
• FUNCtion	• ABORt	• Mass MEMory	

HP-IB Common Commands

• *CLS	• *SRE	• *OPC?	• *TST?
• *ESE	• *STB	• *WAI?	• *TRG
• *ESR?	• *IDN?	• *RST	• *LRN?
			• *OPT?

The explanation of each subsystem command is patterned as follows.

1. Subsystem command name
2. Command tree (Subsystem command only)
3. Compound command name
4. Command description
5. Command syntax
6. Example using the above command syntax
7. Query Syntax
8. Query Response
9. Example using the above query syntax

DISPlay Subsystem

The `DISPlay` subsystem command group sets the display page, and enters ASCII characters on the comment line. Figure 9-3 shows the command tree of the `DISPlay` subsystem command group.

```
DISPLAY ─┬─ :PAGE MEASurement
         │        Bin NUMber
         │        Bin COunt
         │        LIST
         │        Measurement SETup
         │        Correction SETup
         │        Limit TABle
         │        List SETup
         │        SYSTem
         │        CATalog
         │        SELFtest
         │
         └─ :LINE "<string>"
```

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Figure 9-3. DISPlay Subsystem Command Tree

:PAGE

The :PAGE command sets the display page. The :PAGE? query returns the abbreviated page name currently displayed on the LCD screen.

Command Syntax

```
DISPlay:PAGE <page name>
```

Where, *<page name>* is:

MEASurement	Sets display page to *Q MEAS DISPLAY*
BNUMber	Sets display page to *Q BIN No.DISPLAY*
BCOunt	Sets display page to *Q BIN COUNT DISPLAY*
LIST	Sets display page to *Q LIST SWEEP DISPLAY*
MSETup	Sets display page to *Q MEAS SETUP*
CSETup	Sets display page to *Q CORRECTION*
LTABle	Sets display page to *Q LIMIT TABLE SETUP*
LSETup	Sets display page to *Q LIST SWEEP SETUP*
CATalog	Sets display page to *CATALOG*
SYSTem	Sets display page to *SYSTEM CONFIG*
SELF	Sets display page to *SELF TEST*

Example

```
OUTPUT 717;"DISP:PAGE BCO"
! Set display page to the !!Q BIN COUNT DISPLAY!!
```

Query Syntax

```
DISPlay:PAGE?
```

Query Response

Returned data format is :

```
<page name><NL^END>
```

Example

```
10 OUTPUT 717;"DISP:PAGE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:LINE

The `:LINE` command enters an arbitrary comment line of up to 30 ASCII characters in the comment field. The `:LINE?` query returns the comment line characters.

Command Syntax

```
DISPlay:LINE "<string>"
```

Where,
<string> is ASCII character string (maximum of 30 characters)

Example

```
OUTPUT 717;"DISP:LINE ""This is a comment."""
```

Query Syntax

```
DISPlay:LINE?
```

Query Response

Returned data format is :

```
<string><NL^END>
```

Example

```
10 OUTPUT 717;"DISP:LINE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

FREQuency Subsystem

The `FREQuency` command sets the oscillator frequency. The `FREQuency?` query returns the current test frequency setting.

Command Syntax

$$\texttt{FREQuency}\left[\texttt{:CW}\right]\left\{\begin{array}{l}\textit{<value>}\\ \texttt{MIN}\\ \texttt{MAX}\end{array}\right\}$$

Where,

<value>	is the NR1, NR2, or NR3 format
`MIN`	Sets to the minimum value (`+7.50000E+04`)
`MAX`	Sets to the maximum value (`+3.00000E+07`)

Note

A suffix multiplier and a suffix unit, `HZ` (hertz), can be used with this command. Either `MAHZ` and `MHZ` can be used as the suffix multiplier for MHz (1E6 Hz).

Example

```
OUTPUT 717;"FREQ 1MHZ" ! Set to 1 MHz

OUTPUT 717;"FREQ MIN"  ! Set to 75 kHz

OUTPUT 717;"FREQ MAX"  ! Set to 30 MHz
```

Query Syntax

$$\texttt{FREQuency}\left[\texttt{:CW}\right]\texttt{?}\left[\begin{array}{l}\texttt{MIN}\\ \texttt{MAX}\end{array}\right]$$

Query Response

Returned Format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"FREQ? MIN"
20 ENTER 717;A
30 PRINT A
40 END
```

VOLTage Subsystem

The `VOLTage` command sets the oscillator's output voltage level. The `VOLTage?` query returns the current oscillator voltage level.

Command Syntax

$$\texttt{VOLTage}\left[\texttt{:LEVel}\right]\left\{\begin{array}{l} <\mathit{value}> \\ \texttt{MIN} \\ \texttt{MAX} \end{array}\right\}$$

Where,

<value>	is the NR1, NR2, or NR3 format
`MIN`	Sets to the minimum oscillator voltage level (`+5.00000E-03`)
`MAX`	Sets to the maximum oscillator voltage level (`+2.00000E+00`)

Note

A suffix multiplier and a suffix unit, `V` (volt), can be used with this command. If this query is received when the oscillator level set to a current level, error −230 `Data corrupt or stale` will occur.

Example

```
OUTPUT 717;"VOLT 100 MV" ! Set to 100 mV

OUTPUT 717;"VOLT MIN"    ! Set to 5 mV

OUTPUT 717;"VOLT MAX"    ! Set to 2 V
```

Query Syntax

$$\texttt{VOLTage}\left[\texttt{:LEVel}\right]\texttt{?}\left[\begin{array}{l} \texttt{MIN} \\ \texttt{MAX} \end{array}\right]$$

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"VOLT? MIN"
20 ENTER 717;A
30 PRINT A
40 END
```

FUNCtion Subsystem

The `FUNCtion` subsystem command group sets the measurement function, connection method, tuning mode, monitor parameter, and the deviation measurement control. Figure 9-4 shows the command tree of the `FUNCtion` subsystem command group.

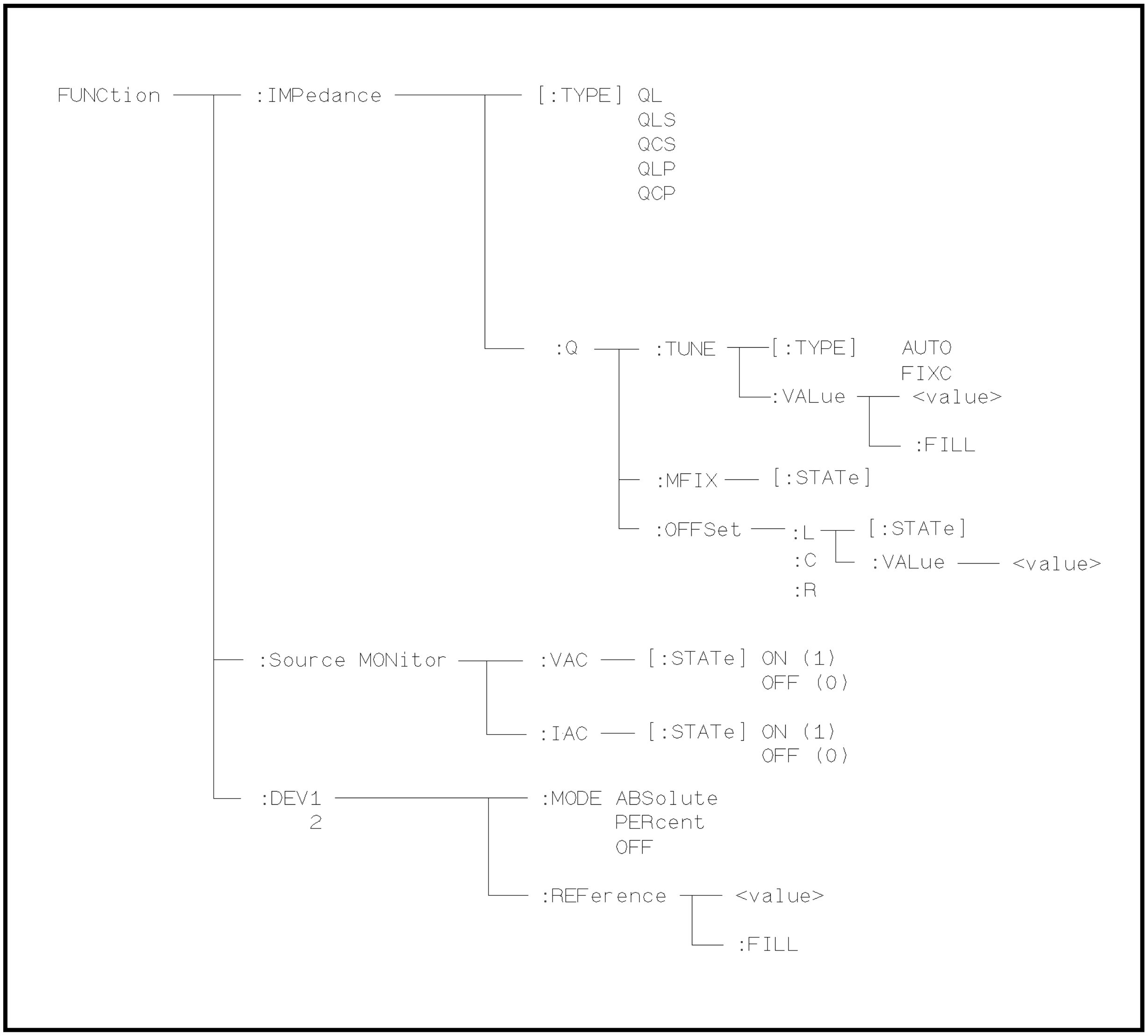

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Figure 9-4. FUNCtion Subsystem Command Tree

:IMPedance[:TYPE]

The `:IMPedance` command sets the measurement function. The `:IMPedance?` query returns the current measurement function.

Command Syntax

`FUNCtion:IMPedance[:TYPE]`<*function*>

Where, <*function*> is:

`QL`	Sets function to Q-L function and direct connection mode
`QLS`	Sets function to Q-L_s function and series connection mode
`QCS`	Sets function to Q-C_s function and series connection mode
`QLP`	Sets function to Q-L_p function and parallel connection mode
`QCP`	Sets function to Q-C_p function and parallel connection mode

Example

```
OUTPUT 717;"FUNC:IMP QLS"
! Set to the Q-Ls function and to the series connection mode
```

Query Syntax

`FUNCtion:IMPedance[:TYPE]?`

Query Response

Returned format is :

<*function*>`<NL^END>`

Example

```
10 OUTPUT 717;"FUNC:IMP?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:IMPedance:Q:TUNE[:TYPE]

The `:IMPedance:Q:TUNE` command sets the tuning mode of the tuning capacitor. The `:IMPedance:Q:TUNE?` query returns the current setting of the tuning mode.

Command Syntax

$$\texttt{FUNCtion:IMPedance:Q:TUNE}\left[\texttt{:TYPE}\right]\left\{\begin{array}{l}\texttt{AUTO}\\ \texttt{FIXC}\end{array}\right\}$$

Where,

`AUTO`	Sets to the automatic tuning mode.
`FIXC`	Sets to the fixed capacitance mode.

Example

```
OUTPUT 717;"FUNC:IMP:Q:TUNE FIXC"
```

Query Syntax

```
FUNCtion:IMPedance:Q:TUNE?
```

Query Response

Returned format is :

$$\left\{\begin{array}{l}\texttt{AUTO}\\ \texttt{FIXC}\end{array}\right\}\texttt{<NL\^{}END>}$$

Example

```
10 OUTPUT 717;"FUNC:IMP:Q:TUNE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:IMPedance:Q:TUNE:VALue

The `:IMPedance:Q:TUNE:VALue` command sets the fixed tuning capacitance value. The `:IMPedance:Q:TUNE:VALue?` query returns the current setting value of the fixed tuning capacitance.

Command Syntax

`FUNCtion:IMPedance:Q:TUNE:VALue` { *<value>* | `MIN` | `MAX` }

Where,

<value>	is the NR1?, NR2, or NR3 format
`MIN`	Sets to the minimum tuning capacitance value
`MAX`	Sets to the maximum tuning capacitance value

Example

```
OUTPUT 717;"FUNC:IMP:Q:TUNE:VAL 100E-12"

OUTPUT 717;"FUNC:IMP:Q:TUNE:VAL MAX"
```

Query Syntax

```
FUNCtion:IMPedance:Q:TUNE:VALue?
```

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:IMP:Q:TUNE:VAL?"
20 ENTER 717;A
30 PRINT A
40 END
```

:IMPedance:Q:TUNE:VALue:FILL

The `:IMPedance:Q:TUNE:VALue:FILL` command adjust the tuning capacitor to tune with the connected DUT and stores the current tuning capacitance value as the fixed tuning capacitance value. Measured Q and inductance values are displayed in the system message line.

Command Syntax

`FUNCtion:IMPedance:Q:TUNE:VALue:FILL`

Example

`OUTPUT 717;"FUNC:IMP:Q:TUNE:VAL:FILL"`

:IMPedance:Q:Measurement1 FIX[:STATe]

The `:IMPedance:Q:Measurement1 FIX` command sets the fixed capacitance measurement to the series or parallel connection method. The `:IMPedance:Q:Measurement1 FIX?` query returns the current status of the fixed capacitance measurement mode.

Command Syntax

```
FUNCtion:IMPedance:Q:MFIX[:STATe] {ON|OFF|1|0}
```

Where,

1 (decimal 49)	When the switch is ON
0 (decimal 48)	When the switch is OFF

Note

`FUNC:IMP:Q:MFIX` command must be executed after triggering Measurement 1 in the SERIES or PARALLEL connection mode. If the `FUNC:IMP:Q:MFIX` command is attempted while the DIRECT connection mode or the measurement 1 data is not set, error +115 `Illegal operation` or −222 `Data out of range` will occur respectively.

Example

```
OUTPUT 717;"FUNC:IMP:Q:MFIX ON"
```

Query Syntax

```
FUNCtion:IMPedance:Q:MFIX[:STATe]?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:IMP:Q:MFIX?"
20 ENTER 717;A
30 PRINT A
40 END
```

:IMPedance:Q:OFFSet:<parameter>[:STATe]

The `:IMPedance:Q:OFFSet:`<*parameter*> command sets the offset correction mode. The `:IMPedance:Q:OFFSet:`<*parameter*>`?` query returns the current status of the offset correction mode.

Command Syntax

$$\texttt{FUNCtion:IMPedance:Q:OFFSet:}\langle parameter\rangle\left[\texttt{:STATe}\right]\begin{Bmatrix}\texttt{ON}\\\texttt{OFF}\\\texttt{1}\\\texttt{0}\end{Bmatrix}$$

Where,

1 (decimal 49)	When the switch is ON
0 (decimal 48)	When the switch is OFF

<*parameter*> is

L	Offset function for the inductance component
C	Offset function for the capacitance component
R	Offset function for the resistance component

Example

```
OUTPUT 717;"FUNC:IMP:Q:OFFS:L ON; C OFF; R ON"
```

Query Suntax

$$\texttt{FUNCtion:IMPedance:Q:OFFSet:}\langle parameter\rangle\left[\texttt{:STATe}\right]\texttt{?}$$

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:IMP:Q:OFFS:L?; C?; R?"
20 ENTER 717;A,B,C
30 PRINT A,B,C
40 END
```

:IMPedance:Q:OFFSet:<parameter>:VALue

The `:IMPedance:Q:OFFSet:`*<parameter>*`:VALue` command sets the offset correction mode. The `:IMPedance:Q:OFFSet:`*<parameter>*`?` query returns the current status of the offset correction mode.

Command Syntax

`FUNCtion:IMPedance:Q:OFFSet:`*<parameter>*`:VALue` *<value>*

Where, *<parameter>* is

L	Offset function for the inductance component
C	Offset function for the capacitance component
R	Offset function for the resistance component

<value> is the NR1, NR2, or NR3 format

Example

```
OUTPUT 717;"FUNC:IMP:Q:OFFS:L:VAL 10E-9"
```

Query Syntax

`FUNCtion:IMPedance:Q:OFFSet:`*<parameter>*`:VALue?`

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:IMP:Q:OFFS:L:VAL?"
20 ENTER 717;A
30 PRINT A
40 END
```

:Source MONitor:VAC

The `:Source MONitor:VAC` command sets the level monitor mode to the voltage. The `:Source MONitor:VAC?` query returns the voltage level monitor ON/OFF condition.

Command Syntax

$$\texttt{FUNCtion:SMONitor:VAC}\left[\texttt{:STATe}\right]\left\{\begin{array}{l}\texttt{ON}\\ \texttt{OFF}\\ \texttt{1}\\ \texttt{0}\end{array}\right\}$$

Where,

1 (decimal 49)	When the switch is ON
0 (decimal 48)	When the switch is OFF

Example

```
OUTPUT 717;"FUNC:SMON:VAC ON"

OUTPUT 717;"FUNC:SMON:VAC 1"
```

Query Syntax

```
FUNCtion:SMONitor:VAC[:STATe]?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:SMON:VAC?"
20 ENTER 717;A
30 PRINT A
40 END
```

:Source MONitor:IAC

The `:Source MONitor:IAC` command sets the level monitor mode to current. The `:Source MONitor:IAC?` query returns the current ON/OFF condition of the current level monitor.

Command Syntax

$$\texttt{FUNCtion:SMONitor:IAC}\left[\texttt{:STATe}\right]\begin{Bmatrix}\texttt{ON}\\\texttt{OFF}\\\texttt{1}\\\texttt{0}\end{Bmatrix}$$

Where,

1 (decimal 49) When the switch is ON
0 (decimal 48) When the switch is OFF

Example

```
OUTPUT 717;"FUNC:SMON:IAC 1"
```

Query Syntax

```
FUNCtion:SMONitor:IAC[:STATe]?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:SMON:IAC?"
20 ENTER 717;A
30 PRINT A
40 END
```

:DEV<n>:MODE

The `:DEV<n>:MODE` command sets the deviation measurement mode. The `:DEV<n>:MODE?` query returns the current setting of the deviation measurement mode.

Command Syntax

$$\texttt{FUNCtion:DEV<}n\texttt{>:MODE} \left\{ \begin{array}{l} \texttt{ABSolute} \\ \texttt{PERCent} \\ \texttt{OFF} \end{array} \right\}$$

Where,

`ABSolute`	Δ ABSolute deviation mode
`PERCent`	Δ % deviation mode
`OFF`	Turn the deviation measurement mode OFF

<n> is :

1 (decimal 49)	Deviation mode setting for primary parameter
2 (decimal 50)	Deviation mode setting for secondary parameter

Example

```
OUTPUT 717;"FUNC:DEV1:MODE ABS"

OUTPUT 717;"FUNC:DEV2:MODE OFF"
```

Query Syntax

`FUNCtion:DEV<n>:MODE?`

Query Response

Returned format is :

$$\left\{ \begin{array}{l} \texttt{ABS} \\ \texttt{PERC} \\ \texttt{OFF} \end{array} \right\} \texttt{<NL\^{}END>}$$

Example

```
10 OUTPUT 717;"FUNC:DEV1:MODE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:DEV<n>:REFerence

The `:DEV<n>:REFerence` command sets the reference value for deviation measurement. The `:DEV<n>:REFerence?` query returns the current reference values.

Command Syntax

`FUNCtion:DEV<n>:REFerence<value>`

Where,

<value> is the NR1, NR2, or NR3 format

<n> is :

1 (decimal 49) Reference value setting for primary parameter
2 (decimal 50) Reference value setting for secondary parameter

Example

```
OUTPUT 717;"FUNC:DEV1:REF 10"

OUTPUT 717;"FUNC:DEV2:REF 2E-3"
```

Query Syntax

`FUNCtion:DEV<n>:REFerence?`

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"FUNC:DEV1:REF?"
20 ENTER 717;A
30 PRINT A
40 END
```

:DEV<n>:REFerence:FILL

The `:DEV<n>:REFerence:FILL` command executes a single measurement and enters two measured values (the primary and secondary parameters) into each of the reference values for the deviation measurement.

Command Syntax

```
FUNCtion:DEV<n>:REFerence:FILL
```

Where, *<n>* is

1 or 2 (Both reference values are measured simalteniously.)

Example

```
OUTPUT 717;"FUNC:DEV1:REF:FILL"
```

LIST Subsystem

The `LIST` subsystem command group sets the List Sweep measurement function, including the sweep point settings, the sweep mode and limit values for the limit function. Figure 9-5 shows the command tree of the `LIST` subsystem command group.

```
LIST ──┬── :FREQuency <sweep point>[,<sweep point>*]
       │
       ├── :VOLTage <sweep point>[,<sweep point>*]
       │
       ├── :MODE SEQuence
       │         STEPped
       └── :BAND<n> A[,<low limit n>,<high limit n>]
                    B
                    OFF
```

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Figure 9-5. LIST Subsystem Command Tree

:FREQuency

The `:FREQuency` command clears the previous List Sweep point table, and sets the frequency sweep points. The `:FREQuency?` query returns the current settings of the frequency sweep points.

Command Syntax

`LIST:FREQuency` *<value>* [`,`*<value>**]

*Repeat Max. 10 sweep points

Where,
<value> is the NR1, NR2, or NR3 format

Example

```
OUTPUT 717;"LIST:FREQ 1E6,2E6,3E6,4E6"
! Set 1 MHz to point 1, ..., 4 MHz to point 4
```

Note

A suffix multiplier and a suffix unit, `HZ` (hertz), can be used with this command. Either `MAHZ` and `MHZ` can be used as the suffix multiplier for MHz (1E6 Hz).

Query Syntax

`LIST:FREQuency?`

Query Response

Returned format is :

`<NR3>[,<NR3>*]<NL^END>`

Example

```
10 DIM A$[100]
20 OUTPUT 717;"LIST:FREQ?"
30 ENTER 717;A$
40 PRINT A$
50 END
```

Note

If this query is received when the List Sweep parameter is set to anything other than frequency, error −230 `Data corrupt or stale` will occur.

:VOLTage

The :VOLTage command clears the previous list sweep point table, and sets the oscillator voltage level sweep points. The :VOLTage? query returns the current settings of the voltage sweep points.

Command Syntax

LIST:VOLTage <*value*>[,<*value*>*]

*Max. 10 sweep points

Where,
<*value*> is the NR1, NR2, or NR3 format

Example

```
OUTPUT 717;"LIST:VOLT 1E-2,2E-2,3E-2,4E-2"
! Set 10 mV to point 1, .... 40 mV to point 4
```

Note

A suffix multiplier and a suffix unit, V (voltage), can be used with this command.

Query Syntax

LIST:VOLTage?

Query Response

Returned format is :

<NR3>[,<NR3>*]<NL^END>

Example

```
10 DIM A$[100]
20 OUTPUT 717;"LIST:VOLT?"
30 ENTER 717;A$
40 PRINT A$
50 END
```

Note

If this query is received when the List Sweep parameter is set to anything other than voltage, error −230 Data corrupt or stale will occur.

:MODE

The `:MODE` command sets the sweep mode of the List Sweep measurement function. The `:MODE?` query returns the current mode setting of the List Sweep measurement function.

Command Syntax

$$\texttt{LIST:MODE}\left\{\begin{array}{l}\texttt{SEQuence}\\ \texttt{STEPped}\end{array}\right\}$$

Where,

`SEQuence`	Sets to sequence mode
`STEPped`	Sets to stepped mode

Example

```
OUTPUT 717;"LIST:MODE SEQ"
```

Query Syntax

```
LIST:MODE?
```

Query Response

Returned format is :

$$\left\{\begin{array}{l}\texttt{SEQ}\\ \texttt{STEP}\end{array}\right\}\texttt{<NL\^{}END>}$$

Example

```
10 OUTPUT 717;"LIST:MODE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:BAND<n>

The `:BAND`<*n*> command sets the limit values of the limit function for the list sweep measurement. The `:BAND`<*n*>`?` query returns the current limit value settings.

Command Syntax

`LIST:BAND`<*n*><*parameter*>[,<*low limit n*>,<*high limit n*>]

Where,

<*n*>	1 to 10 (NR1) : Sweep point number	
<*parameter*> is :	A	Limit setting enable for primary parameter
	B	Limit setting enable for secondary parameter
	OFF	Limit setting disable
<*low limit n*>	NR1, NR2, or NR3 format : low limit for sweep point<*n*>	
<*high limit n*>	NR1, NR2, or NR3 format : high limit for sweep point<*n*>	

Example

```
OUTPUT 717;"LIST:BAND1 A,10,20"

OUTPUT 717;"LIST:BAND3 OFF"
```

Query Syntax

`LIST:BAND`<*n*>`?`

Query Response

Returned format is :

<*parameter*>,<*low limit n*>,<*high limit n*>

Example

```
10 DIM A$[30]
20 OUTPUT 717;"LIST:BAND3?"
30 ENTER 717;A$
40 PRINT A$
50 END
```

APERture Subsystem

The `APERture` command sets the averaging rate. The `APERture?` query returns the current averaging rate settings.

Command Syntax

`APERture MEDium[,`*<value>*`]`

Where,

<value> 1 to 256 (NR1) : Averaging rate

Example

```
OUTPUT 717;"APER MED,64"
```

Query Syntax

```
APERture?
```

Query Response

Returned format is :

```
MED,<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"APER?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

TRIGger Subsystem

The `TRIGger` subsystem command group is used to enable a measurement or a sweep measurement, and to set the trigger mode and the trigger delay time. Figure 9-6 shows the command tree of the `TRIGger` subsystem command group.

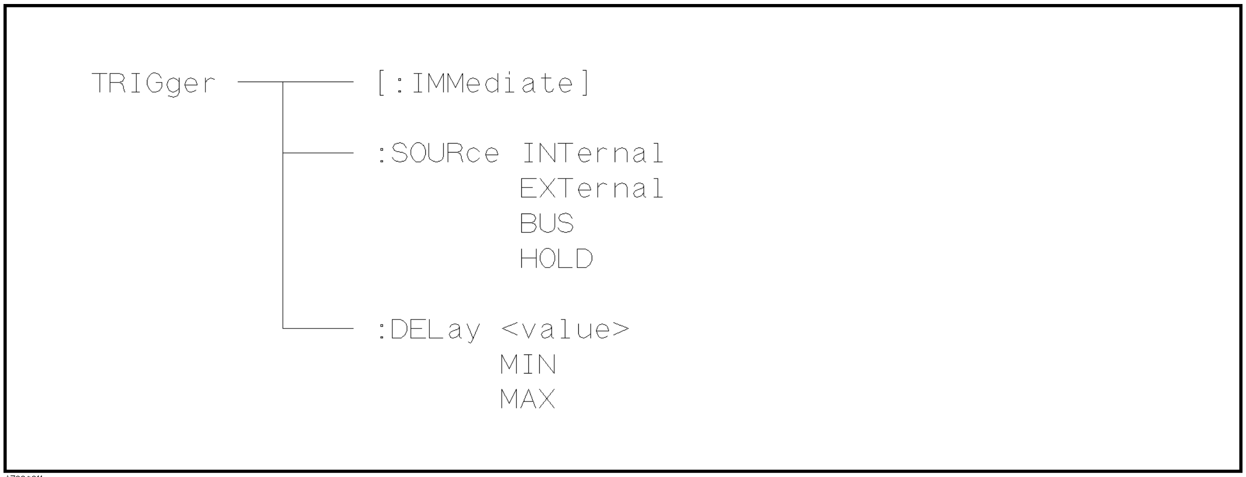

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Figure 9-6. TRIGger Subsystem Command Tree

:IMMediate

The `:IMMediate` command causes the trigger to execute a measurement or a sweep measurement, regardless of the trigger state. Refer to “Trigger System” in Chapter 8, for details.

Command Syntax

`TRIGger[:IMMediate]`

Example

```
OUTPUT 717;"TRIG"
```

```
OUTPUT 717;"TRIG:IMM"
```

:SOURce

The `:SOURce` command sets the trigger mode. The `:SOURce?` query returns the current trigger mode.

Command Syntax

```
               { INTernal }
               { EXTernal }
TRIGger:SOURce { BUS      }
               { HOLD     }
```

Where,

`INTernal`	Internal trigger mode
`EXTernal`	External trigger mode
`BUS`	Bus trigger mode
`HOLD`	Trigger hold (Manual trigger mode)

Example

```
OUTPUT 717;"TRIG:SOUR BUS"
```

Query Syntax

```
TRIGger:SOURce?
```

Query Response

Returned format is :

```
{ INT  }
{ EXT  }
{ BUS  }<NL^END>
{ HOLD }
```

Example

```
10 OUTPUT 717;"TRIG:SOUR?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:DELay

The :DELay command sets the trigger delay time. The :DELay? query returns the current delay time.

Command Syntax

```
TRIGger:DELay { <value> | MIN | MAX }
```

Where,

<value>	is the NR1, NR2, or NR3 format; 0 to 60 [s] in 1 ms resolution
MIN	Sets the minimum delay value (+0.00000E+00)
MAX	Sets the maximum delay value (+6.00000E+01)

Example

```
OUTPUT 717;"TRIG:DEL 5S"  ! Set delay time to 5 s

OUTPUT 717;"TRIG:DEL MIN" ! Set delay time to 0 s
```

Note

A suffix multiplier and a suffix unit, S (second), can be used with this command.

Query Syntax

```
TRIGger:DELay? [MIN | MAX]
```

Query Response

Returned Format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG:DEL?"
20 ENTER 717;A
30 PRINT A
40 END
```

INITiate Subsystem

The `INITiate` subsystem command group controls initiation of the triggering system. Figure 9-7 shows the command tree of the `INITiate` subsystem command group. For the better understanding of the INITiate subsystem, refer to “Trigger System” in Chapter 8.

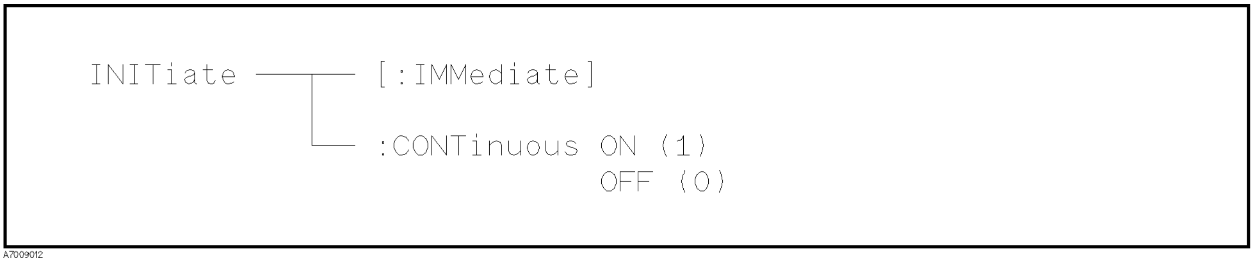

Figure 9-7. INITiate Subsystem Command Tree

[:IMMediate]

The `[:IMMediate]` command changes the trigger state to the IDLE STATE to the WAIT FOR TRIGGER STATE for one trigger sequence. For details, refer to “Trigger System” in Chapter 8.

Command Syntax

```
INITiate[IMMediate]
```

Example

```
OUTPUT 717;"INIT"

OUTPUT 717;"INIT:IMM"
```

:CONTinuous

The `:CONTinuous` command sets the trigger system to the CONTinuous ON or OFF condition. In the CONTinuous ON condition, after reading the measurement data by a controller, the IDLE STATE is automatically set to the WAIT FOR TRIGGER STATE. For details refer to "Trigger System" in Chapter 8. The `:CONTinuous?` query responds the current condition of the CONTinuous ON or OFF.

Command Syntax

$$\texttt{INITiate:CONTinuous} \left\{ \begin{array}{l} \texttt{ON} \\ \texttt{OFF} \\ \texttt{1} \\ \texttt{0} \end{array} \right\}$$

Where,

1 (decimal 49)	When the function is ON
0 (decimal 48)	When the function is OFF

Example

```
OUTPUT 717;"INIT:CONT ON"
```

Query Syntax

```
INITiate:CONTinuous?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"INIT:CONT?"
20 ENTER 717;A
30 PRINT A
40 END
```

FETCh? Subsystem

The `FETCh?` subsystem command group is a sensor-only command which retrieves the measurement data taken by measurement(s) initiated by a trigger, and places the data into the HP 4285A's output buffer.

Figure 9-8 shows the command tree of the `FETCh?` subsystem command group.

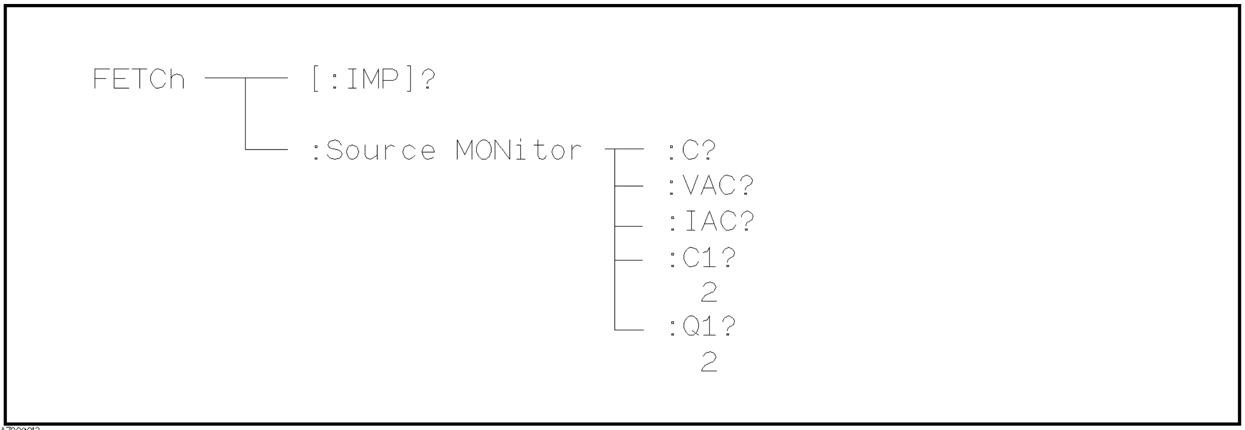

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Figure 9-8. FETCh? Subsystem Command Tree

[:IMP]?

The `[:IMP]?` query sets the latest measurement data of the primary and secondary parameters into the HP 4285A's output buffer, when the SERIES or PARALLEL connection mode is used, COMParator OFF mode is selected for the data output format. For details of the each returned data format, refer to "Data Transfer" in Chapter 8.

Query Syntax

`FETCh[:IMP]?`

Example

```
10 OUTPUT 717;"TRIG:SOUR BUS"
20 OUTPUT 717;"TRIG"
30 OUTPUT 717;"FETC?"
40 ENTER 717;A,B,C
50 PRINT A,B,C
60 END
```

:Source MONitor:C?

The `:Source MONitor:C?` query copys the latest tuned variable capacitance value into the HP 4285A's output buffer. For detail of the each returned data format, refer to "Data Transfer" in Chapter 8.

Query Syntax

```
FETCh:SMONitor:C?
```

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG:SOUR BUS"
30 OUTPUT 717;"TRIG"
40 OUTPUT 717;"FETC:SMON:C?"
50 ENTER 717;A
60 PRINT A
70 END
```

:Source MONitor:VAC?

The :Source MONitor:VAC? query copys the latest measured voltage monitor data into the HP 4285A's output buffer. For detail of the each returned data format, refer to "Data Transfer" in Chapter 8.

Query Syntax

```
FETCh:SMONitor:VAC?
```

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG:SOUR BUS"
20 OUTPUT 717;"INIT:CONT OFF"
30 OUTPUT 717;"INIT"
40 OUTPUT 717;"*TRG"   ! Perform measurement
50 ENTER 717;A,B,C     ! Read measurement result
60 OUTPUT 717;"FETC:SMON:VAC?"
70 ENTER 717;D         ! Get monitor value
50 PRINT D
60 END
```

Note

If this query is received when the voltage level monitor is set to OFF, returned data is 9.9E37.

:Source MONitor:IAC?

The :Source MONitor:IAC? query copys the latest measured current monitor data into the HP 4285A's output buffer.

Query Syntax

```
FETCh:SMONitor:IAC?
```

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG:SOUR BUS"
20 TRIGGER 717
30 OUTPUT 717;"FETC:SMON:IAC?"
40 ENTER 717;A
50 PRINT A
60 END
```

Note

If this query is received when the current level monitor is set to OFF, returned data is 9.9E37.

:Source MONitor:C<n>?

The `:Source MONitor:C<n>?` query copys the measurement <*n*> tuning capacitance value into the HP 4285A's output buffer.

Query Syntax

```
FETCh:SMONitor:C<n>?
```

Where,

<*n*> is 1 or 2.

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG"
20 OUTPUT 717;"FETC:SMON:C1?"
30 ENTER 717;A
40 PRINT A
50 END
```

Note

If this query is attempted when the DIRECT connection mode is selected or the measurement 1 is invalid, returned data is `9.9E37`.

:Source MONitor:Q<n>?

The :Source MONitor:Q<*n*>? query copys the measurement <*n*> Q value into the HP 4285A's output buffer.

Query Syntax

```
FETCh:SMONitor:Q<n>?
```

Where,

<*n*> is 1 or 2.

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"TRIG"
20 OUTPUT 717;"FETC:SMON:Q1?"
30 ENTER 717;A
40 PRINT A
50 END
```

Note

If this query is attempted when the DIRECT connection mode is selected or the measurement 1 is invalid, returned data is 9.9E37.

ABORt Subsystem

The `ABORt` command sets the trigger system to reset, and the trigger state is in the IDLE STATE on the state diagram. For details, refer to "Trigger System" in Chapter 8.

Command Syntax

```
ABORt
```

Example

```
OUTPUT 717;"ABOR"
```

FORMat Subsystem

The FORMat command sets the data output format. For details, refer to "Data Transfer" in Chapter 8. The FORmat? query returns the current data format setting.

Command Syntax

$$\texttt{FORMat}\left[\texttt{:DATA}\right]\left\{\begin{array}{l}\texttt{ASCii}\\ \texttt{REAL}\left[\texttt{,64}\right]\end{array}\right\}$$

Where,

ASCii	is set by the ASCII data format
REAL[,64]	is set by the IEEE-64 bit floating point data format

Example

```
OUTPUT 717;"FORM REAL"
```

Query Syntax

```
FORMat[:DATA]?
```

Query Response

Returned data format is :

$$\left\{\begin{array}{l}\texttt{ASC}\\ \texttt{REAL,64}\end{array}\right\}\texttt{<NL\^{}END>}$$

Example

```
10 OUTPUT 717;"FORM?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

MEMory Subsystem

The `MEMory` subsystem command group controls the HP 4285A's data buffer. Figure 9-9 shows the command tree of the `MEMory` subsystem command group.

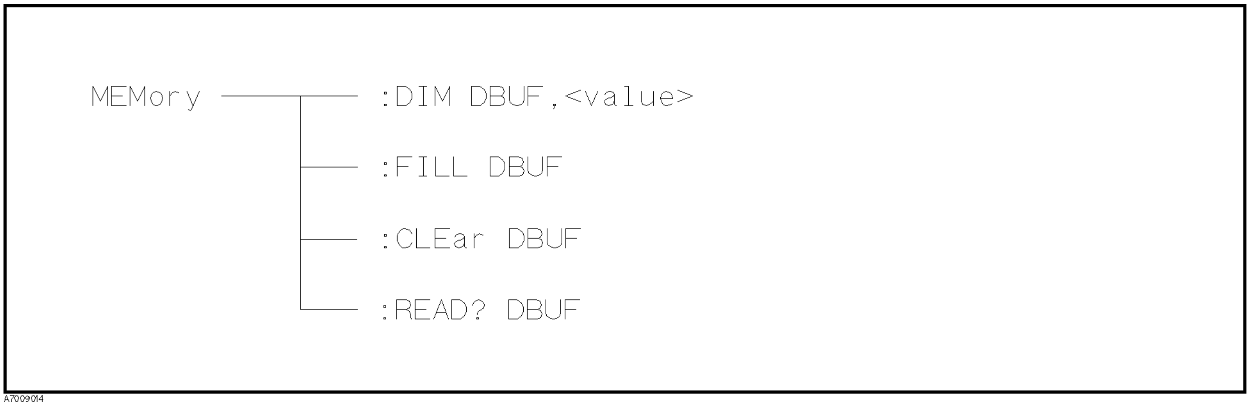

Figure 9-9. MEMory Subsystem Command Tree

:DIM

The `:DIM` command clears the data buffer memory, and sets the size of the data buffer memory. For details, refer to “Data Transfer” in Chapter 8.

Command Syntax

`MEMory:DIM DBUF,`<*value*>

Where,

<*value*> 1 to 128 (NR1) : Number of data sets

Example

```
OUTPUT 717;"MEM:DIM DBUF,3"
! Specify the DBUF size for 3 sets of measurement data
```

:FILL

The `:FILL` command enables the data buffer memory to store the measurement data. After execution of the `:FILL` command, all measurement data will be stored in the data buffer memory. For details, refer to “Data Transfer” in Chapter 8.

Command Syntax

```
MEMory:FILL DBUF
```

Example

```
OUTPUT 717;"MEM:FILL DBUF"
```

:CLEar

The `:CLEar` command clears the data buffer memory. After execution of this command, measurement data will not be stored in the data buffer memory until execution of the `:FILL` command. For details, refer to “Data Transfer” in Chapter 8.

Command Syntax

```
MEMory:CLEar DBUF
```

Example

```
OUTPUT 717;"MEM:CLE DBUF"
```

:READ?

The `:READ?` query places the data in the data buffer memory into the output buffer. If the data buffer memory is not filled to the specified size (specified by the `:DIM` command), the data locations in which data is not stored will be set to −1 (no data). For details of the returned data format, refer to "Data Transfer" in Chapter 8.

Query Syntax

```
MEMory:READ? DBUF
```

Example

```
OUTPUT 717;"MEM:READ? DBUF"
```

CORRection Subsystem

The `CORRection` subsystem command group sets the correction function, including the cable length correction settings, and the SHORT/LOAD correction settings. Figure 9-10 shows the command tree of the `CORRection` subsystem command group.

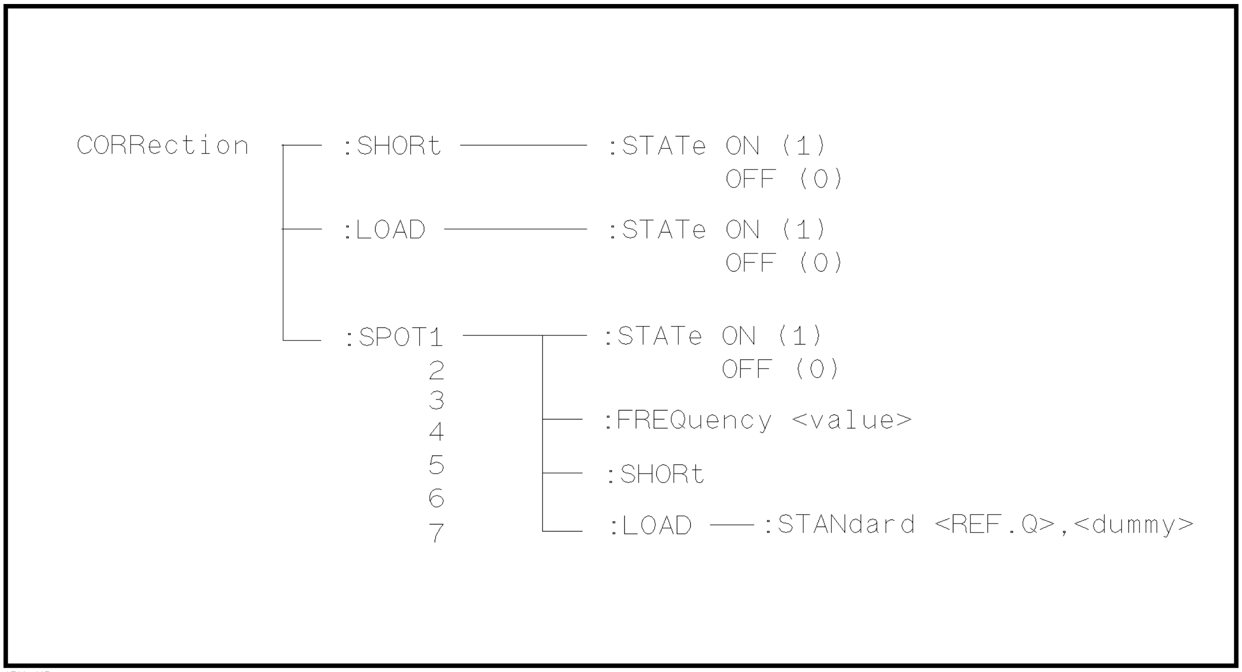

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Figure 9-10. CORRection Subsystem Command Tree

:LOAD:STATe

The `:LOAD:STATe` command sets the LOAD correction function to ON or OFF. The `:LOAD:STATe?` query responds the current ON/OFF condition of the LOAD correction.

Command Syntax

```
                          ⎧ ON  ⎫
CORRection:LOAD:STATe     ⎨ OFF ⎬
                          ⎪ 1   ⎪
                          ⎩ 0   ⎭
```

Where,

1 (decimal 49)	When the function is ON
0 (decimal 48)	When the function is OFF

Example

```
OUTPUT 717;"CORR:LOAD:STAT ON"
```

Query Syntax

```
CORRection:LOAD:STATe?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"CORR:LOAD:STAT?"
20 ENTER 717;A
30 PRINT A
40 END
```

:SPOT<n>:STATe

The `:SPOT<n>:STATe` command sets the specified frequency point correction (SPOT1–SPOT7) to ON or OFF. The `:SPOT<n>:STATe?` query responds the current ON/OFF setting of the specified frequency point correction.

Command Syntax

$$\texttt{CORRection:SPOT<}n\texttt{>:STATe}\left\{\begin{array}{l}\texttt{ON}\\ \texttt{OFF}\\ \texttt{1}\\ \texttt{0}\end{array}\right\}$$

Where,

1 (decimal 49)	When the function is ON
0 (decimal 48)	When the function is OFF

<n> is:

1	State setting for SPOT1 point
2	State setting for SPOT2 point
⋮	⋮
7	State setting for SPOT7 point

Example

```
OUTPUT 717;"CORR:SPOT1:STAT ON"
```

Query Syntax

```
CORRection:SPOT<n>:STATe?
```

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"CORR:SPOT1:STAT?"
20 ENTER 717;A
30 PRINT A
40 END
```

:SPOT<n>:FREQuency

The `:SPOT<n>:FREQuency` command sets the frequency points (SPOT1 – SPOT7) for the specified frequency point correction. The `:SPOT<n>:FREQuency?` query returns the current settings of the frequency points (SPOT1 – SPOT7).

Command Syntax

```
CORRection:SPOT<n>:FREQuency <value>
```

Where,

<value> is the NR1, NR2, or NR3 format

<n> is:

1	Frequency setting for SPOT1 point
2	Frequency setting for SPOT2 point
⋮	⋮
7	Frequency setting for SPOT7 point

Example

```
OUTPUT 717;"CORR:SPOT1:FREQ 2MAHZ"! Set 2 MHz to FREQ1
```

Note

A suffix multiplier and a suffix unit, `HZ` (hertz), can be used with this command. Either `MAHZ` and `MHZ` can be used as the suffix multiplier for MHz (1E6 Hz).

Query Syntax

```
CORRection:SPOT<n>:FREQuency?
```

Query Response

Returned format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"CORR:SPOT1:FREQ?"
20 ENTER 717;A
30 PRINT A
40 END
```

Note

If this query is received when the List Sweep parameter is set to anything other than frequency, error −230 `Data corrupt or stale` will occur.

:SPOT<n>:SHORt

The `:SPOT<n>:SHORt` command executes the SHORT correction data measurement for the specified frequency point (SPOT1 – SPOT7) correction.

Command Syntax

```
CORRection:SPOT<n>:SHORt
```

Where, <*n*> is:

1	State setting for SPOT1 point
2	State setting for SPOT2 point
⋮	⋮
7	State setting for SPOT7 point

Example

```
OUTPUT 717;"CORR:SPOT1:SHOR"
```

:SPOT<n>:LOAD

The `:SPOT<n>:LOAD` command executes the LOAD correction data measurement for the specified frequency point (SPOT1 – SPOT7) correction.

Command Syntax

```
CORRection:SPOT<n>:LOAD
```

Where,
<*n*> is :

1	State setting for SPOT1 point
2	State setting for SPOT2 point
⋮	⋮
7	State setting for SPOT7 point

Example

```
OUTPUT 717;"CORR:SPOT1:LOAD"
```

:SPOT<n>:LOAD:STANdard

The `:SPOT<n>:LOAD:STANdard` command sets the reference Q values of the standard at the specified frequency point (SPOT1 – SPOT7). The `:SPOT<n>:LOAD:STANdard?` query returns the current settings of the reference Q values for SPOT1 – SPOT7.

Command Syntax

```
CORRection:SPOT<n>:LOAD:STANdard <REF.Q>,<dummy>
```

Where,

<n>	1	Setting for SPOT1 point
	2	Setting for SPOT2 point
	⋮	⋮
	7	Setting for SPOT7 point

<REF.Q>	is the NR1, NR2, or NR3 format : reference Q value of the standard
<dummy>	is the NR1, NR2, or NR3 format : Dummy data must be specified, use zero, for example.

Example

```
OUTPUT 717;"CORR:SPOT1:LOAD:STAN 100,0"
```

Query Syntax

```
CORRection:SPOT<n>:LOAD:STANdard?
```

Query Response

Returned format is :

```
<NR3>,+0.00000E+00<NL^END>
```

Example

```
10 OUTPUT 717;"CORR:SPOT1:LOAD:STAN?"
20 ENTER 717;A,B
30 PRINT A,B
40 END
```

COMParator Subsystem

The `COMParator` subsystem command group sets the comparator function, including its ON/OFF setting, limit mode, and limit values. Figure 9-5 shows the command tree of the `COMParator` subsystem command group.

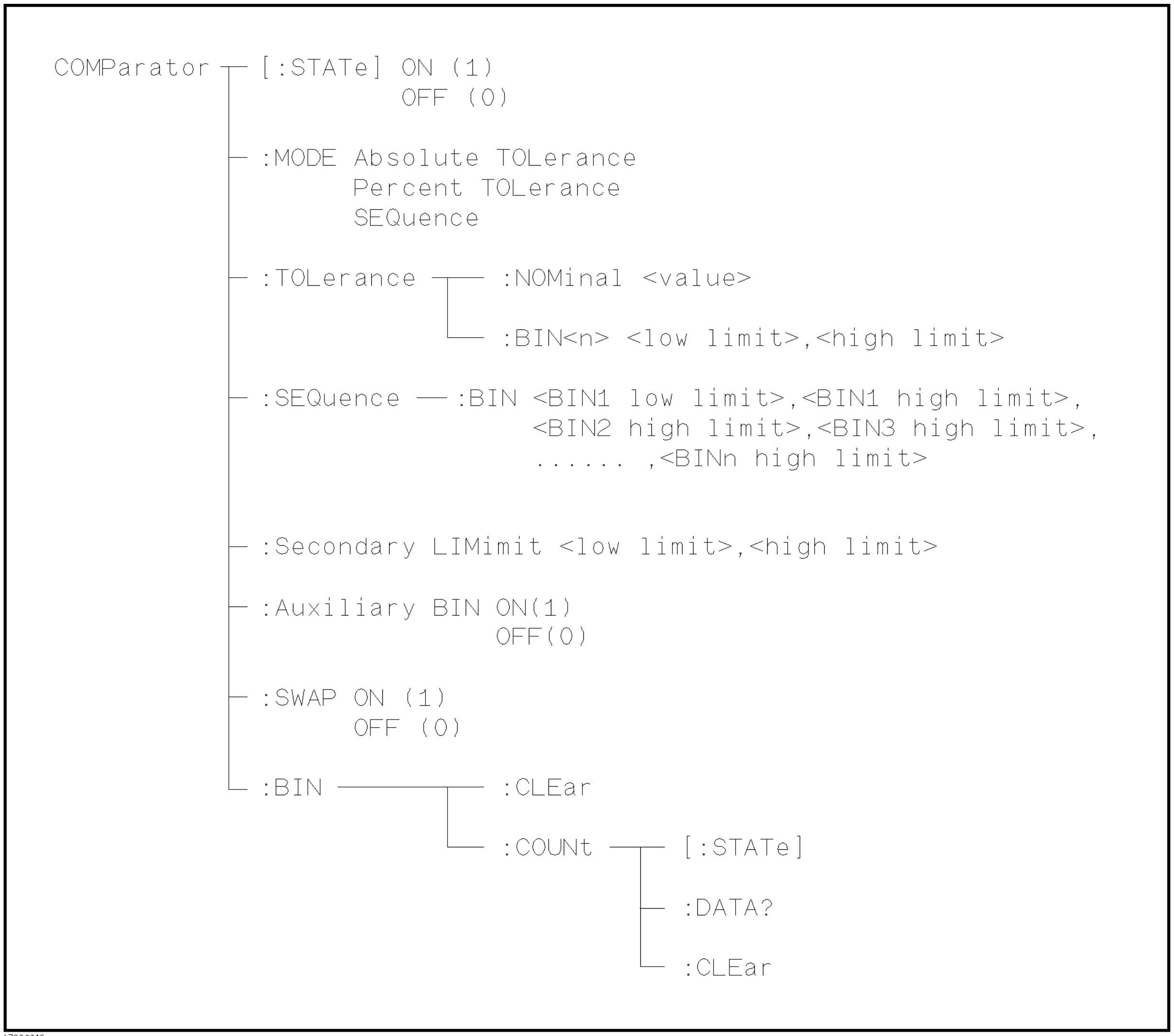

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Figure 9-11. COMParator Subsystem Command Tree

[:STATe]

The `[:STATe]` command sets the comparator function to ON or OFF. The `[:STATe]?` query responds the current ON/OFF condition of comparator function.

Command Syntax

$$\texttt{COMParator}\Big[\texttt{:STATe}\Big]\left\{\begin{array}{l}\texttt{ON}\\ \texttt{OFF}\\ \texttt{1}\\ \texttt{0}\end{array}\right\}$$

Where,

1 (decimal 49)	When the function is ON
0 (decimal 48)	When the function is OFF

Example

```
OUTPUT 717;"COMP ON"
```

Query Syntax

$$\texttt{COMParator}\Big[\texttt{:STATe}\Big]\texttt{?}$$

Query Response

Returned format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"COMP?"
20 ENTER 717;A
30 PRINT A
40 END
```

:MODE

The :MODE command sets the limit mode of the comparator function. The :MODE? query returns the current settings of the limit mode.

Command Syntax

$$\texttt{COMParator:MODE} \left\{ \begin{array}{l} \texttt{ATOLerance} \\ \texttt{PTOLerance} \\ \texttt{SEQuence} \end{array} \right\}$$

Where,

ATOLerance	Set the absolute tolerance mode (parameter value)
PTOLerance	Set the percent tolerance mode (the ratio in percent)
SEQuence	Set the sequential mode

Example

```
OUTPUT 717;"COMP:MODE ATOL"
```

Query Syntax

```
COMParator:MODE?
```

Query Response

Returned format is:

$$\left\{ \begin{array}{l} \texttt{ATOL} \\ \texttt{PTOL} \\ \texttt{SEQ} \end{array} \right\} \texttt{<NL\^{}END>}$$

Example

```
10 OUTPUT 717;"COMP:MODE?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

:TOLerance:NOMinal

The `:TOLerance:NOMinal` command sets the nominal value for the tolerance mode of the comparator function. This can be set only when the limit mode is set to the tolerance mode. The `:TOLerance:NOMinal?` query returns the current settings of the nominal value for the tolerance mode.

Command Syntax

```
COMParator:TOLerance:NOMinal <value>
```

Where,

<*value*>	is the NR1, NR2, or NR3 format : nominal value

Example

```
OUTPUT 717;"COMP:TOL:NOM 100E-12"
```

Query Syntax

```
COMParator:TOLerance:NOMinal?
```

Query Response

Returned Format is :

```
<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"CORR:TOL:NOM?"
20 ENTER 717;A
30 PRINT A
40 END
```

:TOLerance:BIN<n>

The `:TOLerance:BIN<n>` command sets the low/high limit values of each BIN for the comparator function tolerance mode. These limits can be set only when the limit mode is set to the tolerance mode. The `:TOLerance:BIN<n>` query returns the current settings of the low/high limit values of each of the BINs.

Command Syntax

`COMParator:TOLerance:BIN<n> <low limit>,<high limit>`

Where,

<n>	1 to 9 (NR1) : BIN number
<low limit>	NR1, NR2, or NR3 format : low limit value
<high limit>	NR1, NR2, or NR3 format : high limit value

Note

The low limit value should be lower than the high limit value. If the low limit value is set higher than the high limit, a warning message is displayed when this command is received (an error does not occur).

Example

```
OUTPUT 717;"COMP:TOL:BIN1 -5,5"

OUTPUT 717;"COMP:TOL:BIN2 -10,10"
```

Query Syntax

`COMParator:TOLerance:BIN<n>?`

Query Resopnse

Returned Format is :

<low limit>,*<high limit>*<NL^END>

Example

```
10 OUTPUT 717;"COMP:TOL:BIN1?"
20 ENTER 717;A,B
30 PRINT A,B
40 END
```

:SEQuence:BIN

The `:SEQuence:BIN` command sets the low/high limit values of the BINs for the sequence mode of the comparator function. These limits can be set only when the limit mode is set to the sequence mode. The `:SEQuence:BIN` query returns the current settings of the low/high limit values of the BINs.

Command Syntax

`COMParator:SEQuence:BIN` *<BIN1 low limit>*,*<BIN1 high limit>*,*<BIN2 high limit>*, ... , *<BINn high limit>*

Where,

<BIN1 low limit>	NR1, NR2, or NR3 format : low limit value for BIN1
<BIN1 high limit>	NR1, NR2, or NR3 format : high limit value for BIN1
<BINn high limit>	NR1, NR2, or NR3 format : high limit value for BINn (n : max. 9)

Note

The low limit value should be lower than the high limit value.

Example

```
OUTPUT 717;"COMP:SEQ:BIN 10,20,30,40,50"
```

Query Syntax

`COMParator:SEQuence:BIN?`

Query Response

Returned Format is :

<BIN1 low limit>,*<BIN1 high limit>*,*<BIN2 high limit>*, ... , *<BINn high limit>*`<NL^END>`

Example

```
10 DIM A$[200]
20 OUTPUT 717;"COMP:SEQ:BIN?"
30 ENTER 717;A$
40 PRINT A$
50 END
```

:Secondary LIMit

The `:Secondary LIMit` command sets the low/high limit values for the comparator function secondary parameter. The `:Secondary LIMit?` query returns the current settings of the secondary parameter low/high limit values.

Command Syntax

```
COMParator:SLIMit <low limit>,<high limit>
```

Where,

<*low limit*>	is the NR1, NR2, or NR3 format : low limit value
<*high limit*>	is the NR1, NR2, or NR3 format : high limit value

Note

The low limit value should be lower than the high limit value. If the low limit value is set higher than the high limit, a warning message is displayed when this command is received (an error does not occur).

Example

```
OUTPUT 717;"COMP:SLIM 0.001,0.002"
```

Query Syntax

```
COMParator:SLIMit?
```

Query Response

Returned Format is:

```
<NR3>,<NR3><NL^END>
```

Example

```
10 OUTPUT 717;"COMP:SLIM?"
20 ENTER 717;A,B
30 PRINT A,B
40 END
```

:Auxiliary BIN

The `:Auxiliary BIN` command sets the auxiliary BIN counting function of the comparator to ON or OFF. The `:Auxiliary BIN` query responds the current ON/OFF condition of the auxiliary BIN counting function.

Command Syntax

$$\texttt{COMParator:Auxiliary BIN} \begin{Bmatrix} \texttt{ON} \\ \texttt{OFF} \\ \texttt{1} \\ \texttt{0} \end{Bmatrix}$$

Where,

0 (decimal 48)	When the function is OFF
1 (decimal 49)	When he function is ON

Example

```
OUTPUT 717;"COMP:ABIN ON"
```

Query Syntax

```
COMParator:Auxiliary BIN?
```

Query Response

Returned Format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"COMP:ABIN?"
20 ENTER 717;A
30 PRINT A
40 END
```

:SWAP

The :SWAP command sets the swap parameter function to ON (9 BIN settings for secondary parameter) or OFF (9 BIN settings for primary parameter). The :SWAP? query responds the current ON/OFF condition of the auxiliary BIN counting function.

Command Syntax

$$\texttt{COMParator:SWAP} \begin{Bmatrix} \texttt{ON} \\ \texttt{OFF} \\ \texttt{1} \\ \texttt{0} \end{Bmatrix}$$

Where,

0 (decimal 48)	When the function is OFF
1 (decimal 49)	When the function is ON

Example

```
OUTPUT 717;"COMP:SWAP ON"
```

Query Syntax

```
COMParator:SWAP?
```

Query Response

Returned Format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"COMP:SWAP?"
20 ENTER 717;A
30 PRINT A
40 END
```

:BIN:CLEar

The :BIN:CLEar command clears all of the limit value settings.

Command Syntax

```
COMParator:BIN:CLEar
```

Example

```
OUTPUT 717;"COMP:BIN:CLE"
```

:BIN:COUNt[:STATe]

The `:BIN:COUNt[:STATe]` command sets the BIN count function to ON or OFF. The `:BIN:COUNt[:STATe]?` query responds with the current ON/OFF condition of the BIN count function.

Command Syntax

$$\texttt{COMParator:BIN:COUNt}\left[\texttt{:STATe}\right]\left\{\begin{array}{l}\texttt{ON}\\\texttt{OFF}\\\texttt{1}\\\texttt{0}\end{array}\right\}$$

Where,

0 (decimal 48)	When the function is OFF
1 (decimal 49)	When the function is ON

Example

```
OUTPUT 717;"COMP:BIN:COUN ON"
```

Query Syntax

```
COMParator:BIN:COUNt[:STATe]?
```

Query Response

Returned Format is :

```
<NR1><NL^END>
```

Example

```
10 OUTPUT 717;"COMP:BIN:COUN?"
20 ENTER 717;A
30 PRINT A
40 END
```

:BIN:COUNt:DATA?

The `:BIN:COUNt:DATA?` query returns the comparator BIN count results.

Query Syntax

```
COMParator:BIN:COUNt:DATA?
```

Query Response

Returned Format is :

<BIN1 count>,*<BIN2 count>*, ... , *<BIN9 count>*,*<OUT OF BIN count>*, *<AUX BIN count>*`<NL^END>`

Where,

<BIN1–9 count>	NR1 format : count result of BIN1–9
<OUT OF BINS count>	NR1 format : count result of OUT OF BINS
<AUX BIN count>	NR1 format : count result of AUX BIN

Example

```
10 OPTION BASE 1
20 DIM A(11)
30 OUTPUT 717;"COMP:BIN:COUN:DATA?"
40 ENTER 717;A(*)
50 PRINT A(*)
60 END
```

:BIN:COUNt:CLEar

The `:BIN:COUNt:CLEar` command clears all BIN counts.

Command Syntax

```
COMParator:BIN:COUNt:CLEar
```

Example

```
OUTPUT 717;"COMP:BIN:COUN:CLE"
```

Mass MEMory Subsystem

The `Mass MEMory` subsystem command group loads or stores setting data from/to the internal EEPROM and the external memory card. Figure 9-12 shows the command tree of the `Mass MEMory` subsystem command group.

```
Mass MEMory ─┬── :LOAD ───── :STATe <record number>
             │
             └── :STORe ──── :STATe <record number>
```

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Figure 9-12. Mass MEMory Subsystem Command Tree

:LOAD:STATe

The `:LOAD:STATe` command loads the setting data from the internal EEPROM or a memory card.

Command Syntax

`MMEMory:LOAD:STATe` *<value>*

Where,

<value>	0 to 9 (NR1) : record number for internal EEPROM 10 to 19 (NR1) : record number for memory card

Example

```
OUTPUT 717;"MMEM:LOAD:STAT 10"
```

:STORe:STATe

The `:STORe:STATe` command stores the setting data to the internal EEPROM or to the memory card.

Command Syntax

`MMEMory:STORe:STATe` *<value>*

Where,

<value>	0 to 9 (NR1) : record number for EEPROM 10 to 19 (NR1) : record number for memory card

Example

```
OUTPUT 717;"MMEM:STOR:STAT 5"
```

SYSTem:ERRor?

The `SYSTem:ERRor?` query returns the existing error numbers with the error messages for the errors in the HP 4285A's error queue.

The HP 4285A's error queue stores errors generated by the HP 4285A. As errors are generated, they are placed in the error queue which stores up to five errors. This is a first in, first out queue (FIFO).

If the error queue overflows, the last error in the queue is replaced with error −350, `"Too many errors"`. Anytime the queue overflows, the least recent errors remain in the queue, and the most recent errors are discarded.

When all errors have been read from the queue, further `SYSTem:ERRor?` queries will return error 0, `"no errors"`. Reading an error from the queue removes that error from the queue, opening a position in the queue for a new error, if one is subsequently generated.

Query Syntax

```
SYSTem:ERRor?
```

Query Response

Returned Format is :

<number>,"*<message>*"

Where,

<number>	NR1 format : error number
<message>	ASCII string : error message

Example

```
10 DIM A$[50]
20 FOR I=1 to 5
30   OUTPUT 717;"SYST:ERR?"
40   ENTER 717;A$
50   PRINT A$
60 NEXT I
70 END
```

STATus Subsystem

The STATus subsystem command group sets the Operation Status Registers which report events which are part of the HP 4285A's normal operation, including measuring and sweeping. Figure 9-13 shows the command tree of the STATus subsystem command group.

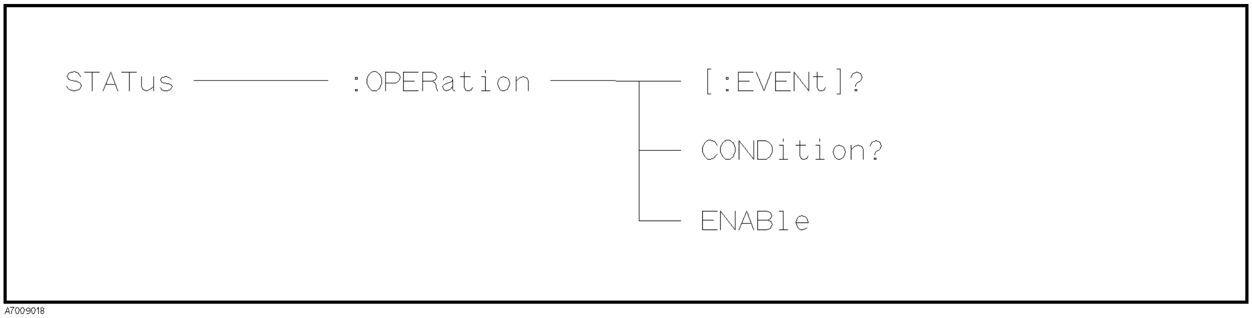

Figure 9-13. STATus Subsystem Command Tree

:OPERation[:EVENt]?

The `:OPERation[:EVENt]?` query returns the contents of the standard operation status event register. Reading the event register using this query has the effect of clearing its contents, but has no effect on the the operation status condition register.

Query Syntax

`STATus:OPERation[:EVENt]?`

Query Response

Returned Format is :

<value>`<NL^END>`

Where,

<value> NR1 format : decimal expression of the contents of the operation status event register

The definition of each bit of the operation status event register is as follows.

Bit No.	Description
15 – 5	Always 0 (zero)
4	Measurement Complete Bit
3	List Sweep Measurement Complete Bit
2, 1	Always 0 (zero)
0	Correction Data Measurement Complete Bit

Example

```
10 OUTPUT 717;"STAT:OPER?"
20 ENTER 717;A
30 PRINT A
40 END
```

:OPERation:CONDition?

The `:OPERation:CONDition?` query returns the contents of the standard operation status condition register. Reading a condition register using this query does not clear its contents.

Query Syntax

```
STATus:OPERation:CONDition?
```

Query Response

Returned Format is :

<value>`<NL^END>`

Where,

<value> NR1 format : decimal expression of the contents of the operation status condition register

The definition of each bit in the operation status condition register is as follows.

Bit No.	Description
15 – 5	Always 0 (zero)
4	Measuring Bit
3	Sweeping Bit
2, 1	Always 0 (zero)
0	Measuring Correction Data Bit

Example

```
10 OUTPUT 717;"STAT:OPER:COND?"
20 ENTER 717;A
30 PRINT A
40 END
```

:OPERation:ENABle

The `:OPERation:ENABle` command sets the enable bits of the standard operation status event register that allows true conditions in the event register to be reported in the summary bit of the status byte register. The `:OPERation:ENABle?` query returns the current setting of the enable bits of the operation status event register.

Command Syntax

`STATus:OPERation:ENABle` <*value*>

Where,

<*value*> NR1 format : decimal expression of enable bits of the operation status event register

The definition of each bit in the operation status event register is as follows.

Bit No.	Description
15 – 5	Always 0 (zero)
4	Measurement Complete Bit
3	List Sweep Measurement Complete Bit
2, 1	Always 0 (zero)
0	Correction Data Measurement Complete Bit

Example

```
OUTPUT 717;"STAT:OPER:ENAB 16"! Bit 4 enable
```

Query Syntax

`STATus:OPERation:ENABle?`

Query Response

Returned Format is:

<*value*>`<NL^END>`

Example

```
10 OUTPUT 717;"STAT:OPER:ENAB?"
20 ENTER 717;A
30 PRINT A
40 END
```

Common Commands

The HP-IB Common commands (from chapter 8) are defined as IEEE 488.2-1987, and are noninstrument specific HP-IB commands. A common command consists of an asterisk (*) and a header. The HP 4285A acceptable HP-IB common commands are as follows.

HP-IB Common Commands

• `*CLS`	• `*SRE`	• `*OPC?`	• `*TST?`
• `*ESE`	• `*STB`	• `*WAI?`	• `*TRG`
• `*ESR?`	• `*IDN?`	• `*RST`	• `*LRN?`
			• `*OPT?`

*CLS

The *CLS command (clear status command) clears the status byte resister, the event resister of the standard operation status register structure, and the standard event status register. It also clears the error queue (refer to the description of the SYSTem:ERRor? query).

Command Syntax

```
*CLS
```

Example

```
OUTPUT 717;"*CLS"
```

*ESE

The *ESE command (standard Event Status Enable command) sets the enable bits of the standard event status register. The *ESE? query returns the current setting of the enable bits of the event status register.

Command Syntax

*ESE <*value*>

Where,

<*value*> NR1 format : decimal expression of enable bits of the operation status register

The definition of each bit in the event status register is as follows.

Bit No.	Description
7	Power On (PON) Bit
6	User Request (URQ) Bit
5	Command Error (CME) Bit
4	Execution Error (EXE) Bit
3	Device Dependent Error (DDE) Bit
2	Query Error (QYE) Bit
1	Request Control (RQC) Bit
0	Operation Complete (OPC) Bit

Example

```
OUTPUT 717;"*ESE 36"! Bit 2 and 5 enabled
```

Query Syntax

*ESE?

Query Response

Returned format is :

<*value*><NL^END>

Example

```
10 OUTPUT 717;"*ESE?"
20 ENTER 717;A
30 PRINT A
40 END
```

*ESR?

The *ESR? query returns the contents of the standard event status register. Using the *ESR query command to read the standard event status register clears its contents.

Query Syntax

```
*ESR?
```

Query Response

Returned format is :

<value><NL^END>

Where,

<value> NR1 format : decimal expression of the contents of the event status register

The definition of each bit of the event status register is as follows.

Bit No.	Description
7	Power On (PON) Bit
6	User Request (URQ) Bit
5	Command Error (CME) Bit
4	Execution Error (EXE) Bit
3	Device Dependent Error (DDE) Bit
2	Query Error (QYE) Bit
1	Request Control (RQC) Bit
0	Operation Complete (OPC) Bit

Example

```
10 OUTPUT 717;"*ESR?"
20 ENTER 717;A
30 PRINT A
40 END
```

*SRE

The *SRE command (Service Request Enable command) sets the enable bits of the status byte register. The *SRE? query returns the current setting of the status byte register.

Command Syntax

*SRE <*value*>

Where,

<*value*> NR1 format : decimal expression of enable bits of the status byte register

The definition of each bit of the status byte register is as follows.

Bit No.	Description
7	Operation Status Register Summary Bit
6	RQS (Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV (Message Available) Bit
3 – 0	Always 0 (zero)

Example

```
OUTPUT 717;"*SRE 32"! Bit 5 enabled
```

Query Syntax

```
*SRE?
```

Query Response

Returned format is :

<*value*><NL^END>

Example

```
10 OUTPUT 717;"*SRE?"
20 ENTER 717;A
30 PRINT A
40 END
```

*STB?

The *STB? query reads the status byte by reading the master summary status (MSS) bit. These bits represent the contents of the status byte register. Execution of the *STB query command has no effect on the contents of the status byte register.

Query Syntax

```
*STB?
```

Query Response

Returned format is :

<value><NL^END>

Where,

<value> NR1 format : decimal expression of the contents of the status byte register

The definition of each bit of the status byte is as follows.

Bit No.	Description
7	Operation Status Register Summary Bit
6	RQS (Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV (Message Available) Bit
3 – 0	Always 0 (zero)

Example

```
10 OUTPUT 717;"*STB?"
20 ENTER 717;A
30 PRINT A
40 END
```

*IDN?

The `*IDN?` query returns the HP 4285A ID.

Query Syntax

```
*IDN?
```

Query Response

Returned format is :

<manufacturer>,*<model>*,*<serial no.>*,*<firmware>*`<NL^END>`

Where,

<manufacturer>	HEWLETT-PACKARD
<model>	4285A
<serial number>	0 (not available)
<firmware>	REVdd.dd dd.dd : ROM firmware revision number

Example

```
10 DIM A$[30]
20 OUTPUT 717;"*IDN?"
20 ENTER 717;A$
30 PRINT A$
40 END
```

Note

This string data is an arbitrary ASCII response. So, this command should not be sent before a normal query in a program message. (For example, `*IDN?;FREQ?` can not accepted, `FREQ?;*IDN?` should be sent.)

*OPC

The `*OPC` command (operation complete command) tells the HP 4285A to set bit 0 (OPC bit) in the standard event status register when it completes all pending operations. The `*OPC?` command tells the HP 4285A to place an ASCII "1" (decimal 49) in the HP 4285A's output buffer when it completes all pending operations.

Command Syntax

`*OPC`

Example

```
OUTPUT 717;"*OPC" ! Set the HP 4285A to set OPC bit
! when the operation executed by previous command is completed.
```

Query Syntax

`*OPC?`

Query Response

Returned format is :

`1<NL^END>`

Where,

1   1 (ASCII, decimal 49)

Example

```
10 OUTPUT 717;"CORR:OPEN" ! Perform OPEN correction measurement
20 OUTPUT 717;"*OPC?"     ! Wait for OPEN correction
30 ENTER 717;A            !    measurement completed
40 END
```

*WAI

The *WAI command (the wait to continue command) makes the HP 4285A wait until all previously sent commands are completed. The HP 4285A then continues executing the commands that follow the *WAI command.

Command Syntax

```
*WAI
```

Example

```
OUTPUT 717;"*WAI"
```

*RST

The *RST command (reset command) sets the HP 4285A to its initial settings. The initial settings set by the *RST command are given in Appendix C. When the HP 4285A receives an *RST command, it aborts all pending operations, and forgets about any previously received *OPC commands and *OPC? queries.

Command Syntax

```
*RST
```

Example

```
OUTPUT 717;"*RST"
```

*TST?

The *TST? query (self-test query) causes the device to execute an internal self-test and reports whether or not it detected any errors. In the case of the HP 4285A, the response to this query is always “0” (no error).

Query Syntax

```
*TST?
```

Query Response

Returned format is :

```
0<NL^END>
```

Where,

0 — 0 (NR1 format)

Example

```
10 OUTPUT 717;"*TST?"
20 ENTER 717;A
30 END
```

*TRG

The *TRG command (trigger command) performs the same function as the Group Execute Trigger command (refer to "Trigger System" in Chapter 8). This command also moves the primary and secondary parameter measurement data into the HP 4285A's output buffer.

Command Syntax

```
*TRG
```

Example

```
10 OUTPUT 717;"*TRG"
20 ENTER 717;A,B,C
30 PRINT A,B,C
40 END
```

*LRN?

The *LRN? query (learn device setup query) tells the HP 4285A to send a response that contains all the necessary commands to set the HP 4285A to its present state. The response can later be sent back to the HP 4285A to place it in this state. This provides the user with a means of setting up a device manually and then reading the device setting and storing the information for later use.

Query Syntax

```
*LRN?
```

Query Response

Returned format is :

```
:FREQ <NR3>;:VOLT <NR3>;
:CORR:SHOR:STAT {0|1};:CORR:LOAD:STAT {0|1};
:CORR:SPOT1:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT2:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT3:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT4:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT5:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT6:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:CORR:SPOT7:STAT {0|1};FREQ <NR3>; LOAD:STAN <REF.Q>,<dummy>;
:FUNC:IMP:TYPE <function>;
:FUNC:IMP:Q:TUNE:TYPE {AUTO|FIXC};VAL <NR3>;
:FUNC:IMP:Q:OFFS:L:STAT {0|1};VAL <NR3>;
:FUNC:IMP:Q:OFFS:C:STAT {0|1};VAL <NR3>;
:FUNC:IMP:Q:OFFS:R:STAT {0|1};VAL <NR3>;
:FUNC:SMON:VAC:STAT {0|1};
:FUNC:DEV1:MODE {ABS|PERC|OFF};REF <NR3>;
:FUNC:DEV2:MODE {ABS|PERC|OFF};REF <NR3>;
:APER MED,<NR1>;
:TRIG:SOUR {INT|EXT|BUS|HOLD};DEL <NR3>;
:DISP:PAGE <page name>;LINE "<string>";
:FORM {ASC|REAL}[,64];
:COMP:STAT {0|1};MODE {ATOL|PTOL|SEQ};
 (TOL:NOM <NR3>;BIN1 <low>,<high>;BIN2 <low>,<high>, ... ;)
or (:COMP:SEQ:BIN <BIN1 low>,<BIN2 high>,<BIN3 high>,..;)
:COMP:SLIM <low>,<high>;ABIN {0|1};SWAP {0|1};BIN:COUN {0|1};
:LIST:FREQ (or VOLT) <NR3> [,<NR3>*];
:LIST:MODE {SEQ|STEP};
BAND1 <parameter>,<low>,<high>;
BAND2 <parameter>,<low>,<high>; ... ;
BAND<n> <parameter>,<low>,<high>
```

For details, refer to each command reference page.

Example

```
10 DIM A$[1000]
20 OUTPUT 717;"*LRN?"
30 ENTER 717;A$
40 !
50 OUTPUT 717;A$
60 END
```

*OPT?

The *OPT? query (OPTion identification query) tells the HP 4285A to identify the options installed in the system interface.

Query Syntax

```
*OPT?
```

Query Response

Returned format is :

<DC bias>,*<accessory control I/F>*,*<handler I/F>*,*<scanner I/F>*<NL^END>

Where,

<DC bias> is :	001	(ASCII) :	Option 001 is installed
	0	(ASCII) :	Option 001 is not installed
<accessory control I/F> is :	002	(ASCII) :	Option 002 is installed
	0	(ASCII) :	Option 002 is not installed
<handler I/F> is :	201	(ASCII) :	Option 201 is installed
	202	(ASCII) :	Option 202 is installed
	0	(ASCII) :	Option 201 and 202 are not installed
<scanner I/F> is :	301	(ASCII) :	Option 301 is installed
	0	(ASCII) :	Option 301 is not installed

Note

This string data is the arbitrary ASCII response. So this command should not be sent before a normal query in a program message. (For example, *OPT?;FREQ? can not accepted, FREQ?;*OPT? should be sent.)

Example

```
10 OUTPUT 717;"*OPT?"
20 ENTER 717;A$
30 END
```

A

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the HP 42851A than the current printing date of this manual. The information in this manual applies directly to HP 4285A Precision Q Adapter whose serial number prefix is listed on the title page of this manual.

Manual Changes

To adapt this manual to your HP 42851A, refer to Table A-1 and Table A-2, and make all of the manual changes listed opposite your instrument's serial number and HP 4285A's ROM-based firmware version.

Instruments manufactured after the printing of this manual may be different than those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

Refer to the description of the `*IDN?` query in "*IDN?" in Chapter 9 for confirmation of the ROM-based firmware's version. For additional information on serial number coverage, refer to "Serial Number" in Chapter 1.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
3041J00275 and below	Change 1

Table A-2.
Manual Changes by HP 4285A's Firmware Version

Version	Make Manual Changes
1.xx	Change 1

Change 1

System messages

"Display" section in chapter 3

Delete the following system messages. These messages are not available.

- "`Warning, Cannot find resonance`"
- "`Waiting for trigger`"

HP-IB Commands

"CORRection Subsystem" section in chapter 9

Add the following HP-IB commands.

- CORRection:SHORt:STAT{ON|OFF}
- CORRection:SHORt:STAT?

:SHORt. The `:SHORt` command performs SHORT correction data measurement at 46 presetted frequency points.

Command Syntax.

```
CORRection:SHORt
```

:SHORt:STATe. The `:SHORt:STATe` command sets the SHORT correction function to ON or OFF. The `:SHORt:STATe?` query returns the current ON/OFF condition of the SHORT correction.

Command Syntax.

$$\texttt{CORRection:SHORt:STATe}\begin{Bmatrix}\texttt{ON}\\ \texttt{OFF}\\ \texttt{1}\\ \texttt{0}\end{Bmatrix}$$

Where,

`1` (decimal 49)	When the function is ON
`0` (decimal 48)	When the function is OFF

Query Syntax.

```
CORRection:SHORt:STATe?
```

Query Response. Returned format is :

```
<NR1><NL^END>
```

Effective Q Mode and Circuit Q mode

“Q CORRECTION Page” section in chapter 5

Delete the following sections These functions are not available.

- Effective Q Mode
- Circuit Q mode

B

Error and Warning Messages

Introduction

This appendix lists the HP 4285A's error and warning messages with brief descriptions and solutions when combining with the &851;.

Error Messages

The HP 4285A displays error messages on the System Message Line when a measurement error occurs or when an illegal operation is attempted. There are two categories of errors as follows.

Operation Errors

These errors occur while attempting an improper operation. If one of these errors occur, the HP 4285A displays the error number and a message on its system message line. There are two kinds of errors in this category.

- Device-Specific Error (error numbers 1 to 32767, −300 to −399)
  These errors will set the Device-Specific Error bit (bit 3) in the Event Status Register.
- Execution Error (error numbers −200 to −299)
  These errors will set the Execution Error bit (bit 4) in the Event Status Register.

HP-IB Errors

These errors occur when the HP 4285A received an improper command via HP-IB. If one of these errors occur, the HP 4285A displays the warning message, `HP-IB error occurred` on the system message line, check the command syntax. There are two kinds of errors in this category.

- Command Error (error numbers −100 to −199)
  These errors will set the Command Error bit (bit 5) in the Event Status Register.
- Query Error (error numbers −400 to −499)
  These errors will set the Query Error bit (bit 2) in the Event Status Register.

Sample Program to Detect the Error

When you write an HP-IB control program for the HP 4285A, the following sample program is a useful debugging tool (using the HP 4285A status bytes and the `SYST:ERRor?` query) for detecting the errors.

```
100   OUTPUT 717;"*ESE 60"        ! Event Status Resister enable
110                               !  (error bits enable)
120   OUTPUT 717;"*SRE 32"        ! Status Byte Resister enable
```

```
130                               !  (Event Status Summary bit enable)
140    ON INTR 7,2 CALL Errors
150    ENABLE INTR 7;2
           :
500    SUB Errors
510      DIM Err$[50]
520      Sp=SPOLL(717)
530      IF BIT(Sp,5) THEN
540        OUTPUT 717;"*ESR?"      ! Clear the Event Status Resister
550        ENTER 717;Esr
560        PRINT "Event Status Resister =";Esr
570        LOOP
580          OUTPUT 717;"SYST:ERR?"! Error No. & message query
590          ENTER 717;Err$
600          EXIT IF VAL(Err$)=0   ! Exit if no error
610          PRINT Err$
620        END LOOP
630      END IF
640      ENABLE INTR 7;2
650    SUBEND
```

The following is a list of the HP 4285A's error numbers and messages.

Operation Errors

Error No.	Displayed Message	• Description / → Solution
		→ **Solution**
Device-Specific Error		
12	DC bias ON/OFF ignored	• Illegal operation, (DC BIAS) is pressed while in the comment input mode.
		→ Press (DC BIAS) after exiting the comment input page.
14	V bias disabled	• Illegal operation, set to DC voltage bias while in the high current DC biased measurement mode.
		→ Set the *CONFIG* field to `OFF`, or change BIAS to a current value.
15	I bias not available	• Illegal operation, set to DC current bias when the accessory control interface cable or the HP 42842C are not properly connected.
		→ Properly connect the accessory control interface cable and HP 42842C.
16	Measurement aborted	• ΔREF data Measurement aborted.
		→ Re-measure.
18	DC bias Opt not installed	• Internal DC bias Option is not installed.
		→ Install Option 001.
19	Bias monitor disabled	• Illegal operation, set the DC bias monitor mode while in the high current DC biased measurement mode.
		→ Set *CONFIG* field to `OFF`.

Error No.	Displayed Message	• Description → Solution
20	DC bias unit powered down	• Illegal operation, set to DC current bias when an inoperative HP 42841A is connected to the HP 4285A. → Turn the HP 42841A on after checking the power cord connection and HP 42842C connection.
21	Fixture circuit defective	• Back-emf protection circuit of the HP 42842C is defective. → Contact your nearest Hewlett-Packard office.
22	Fixture over temperature	• Temperature of the HP 42842C bias current test fixture exceeded its limit. → Turn the DC BIAS off to let the HP 42842C cool down.
23	Fixture OPEN det. defective	• Fixture cover open detection wire is open. → Contact your nearest Hewlett-Packard office.
24	Fixture cover open	• The cover of the HP 42842C is open. → Close the cover of the HP 42842C.
25	DC bias I source overload	• The DC bias source current is overloaded. → If this message is displayed all the time when measuring a DUT which conforms to specifications, contact your nearest Hewlett-Packard office.
26	DC bias I sink overload	• The DC bias sink current is overloaded. → If this message is displayed all the time when measuring a DUT which conforms to specifications, contact your nearest Hewlett-Packard office.

Error No.	Displayed Message	• **Description** / → **Solution**
40	Scanner I/F disabled	• Illegal operation, MULTI channel correction mode set or `CORRection:USE` command is sent via HP-IB when the SCANNER I/F is not installed or to OFF.
		→ Install the SCANNER I/F and set it to ON.
41	Measurement aborted	• Correction data measurement aborted.
		→ Re-measure.
43	Measurement failed	• Measurement error, (for example, bridge unbalance), occurred during the correction data measurement.
		→ Confirm measurement condition and measurement contacts, then re-measure.
44	Correction data protected	• Correction data write protected by DIP switch A7SW3. (Refer to Appendix D)
		→ Set bit 6 of DIP switch A7SW3 to the OFF position, and retry.
45	Valid in single mode only	• Illegal operation, OPEN/SHORT correction data (for 51 frequency points) measured when the MULTI channel correction mode is set.
		→ Set to SINGLE mode first, or perform OPEN/SHORT data measurements at FREQ1–7.
46	Correction memory error	• Correction data write error.
		→ Contact your nearest Hewlett-Packard office.
47	1m cable only to I BIAS	• Illegal operation, cable length was changed while in the high current DC biased measurement mode.
		→ Set the *CONFIG* field to `OFF` or do not change *CABLE* field in the high current DC biased measurement mode.

Error No.	Displayed Message	• Description → Solution
50	Clear the table first	• Illegal operation, MODE of the LIMIT TABLE changed when the table exists. → Clear the table first.
51	Inconsistent limit setting	• Illegal operation, `COMParator:SEQuence` command sent when the TOLerance mode is set, or the `COMParator:TOLerance` command was sent when the SEQuence mode is set. → Set TOLerance or SEQuence mode appropriately.
55	REF measurement incomplete	• Illegal operation, attempted to save cable correction data, before performing the REF data measurement. → Perform the REF measurement first.
56	OPEN measurement incomplete	• Illegal operation, attempted to save cable correction data, before performing the OPEN data measurement. → Perform the OPEN measurement first.
57	SHORT measurement incomplete	• Illegal operation, attempted to save cable correction data, before performing the SHORT data measurement. → Perform the SHORT measurement first.
58	LOAD measurement incomplete	• Illegal operation, attempted to save cable correction data, before performing the LOAD data measurement. → Perform the LOAD measurement first.
59	Invalid command at 0m cable	• Illegal operation, attempted to measure cable correction data, when the cable length is set to 0m. → Set the cable length to 1m or 2m before performing `CORRection:COLLect OPEN/SHORT/LOAD` or `CORRection:COLLect:SAVE` HP-IB command.
60	No values in sweep list	• Illegal operation, LIST SWEEP measurement performed when no sweep point settings exist in the LIST SWEEP SETUP. → Set sweep points in the LIST SWEEP SETUP first.
61	Clear the table first	• Illegal operation, the sweep parameter of the LIST SWEEP SETUP is changed when the sweep list for other parameter exists. → Clear the existing list first.
62	Bias off, Turn bias on	• Illegal operation, DC bias sweep was attempted while the DC BIAS is OFF. → Press the (DC BIAS) to set DC bias to on.

Error No.	Displayed Message	• **Description** → **Solution**
70	Handler I/F not installed	• Illegal operation, HANDLER I/F set to ON when Option 201 or 202 was not installed.
		→ Install Option 201 or 202.
		• Illegal operation, HANDLER I/F test was performed when Option 201 or 202 were not installed.
		→ Install Option 201 or 202.
71	Scanner I/F not installed	• Illegal operation, SCANNER I/F set to ON when Option 301 was not installed.
		→ Install Option 301.
		• Illegal operation, Scanner I/F EEPROM R/W test or Scanner I/F I/O test were performed when Option 301 was not installed.
		→ Install Option 301.
72	HP-IB I/F not installed	• Illegal operation, HP-IB interface used when Option 109 was installed.
		→ Install the HP-IB interface.
73	Accessory I/F not installed	• Illegal operation, *CONFIG* field set to `I BIAS` or `Q ADAPTER` when Option 002 is not installed.
		→ Install the ACCESSORY CONTROL interface.
		• Illegal operation, Accessory control I/F test or Q-Adapter buffer test were performed when Option 002 was not installed.
		→ Install the ACCESSORY CONTROL interface.
74	Illegal test setup	• Illegal operation, ACCESSORY CONTROL I/F test performed when the HP 4285A and the HP 42841A, the HP 42851A, or both of them are connected with the accessory control interface cable.
		→ Disconnect the accessory control interface cable from the HP 42841A and the HP 42851A.
75	Illegal Accessory config	• Illegal operation, cable correction is attempted, while in the precision Q measurement mode.
		→ Set the *CONFIG* field to `I BIAS` (for 1m cable only) or `OFF`.

Error No.	Displayed Message	• Description → Solution
80	Setup data protected	• Setup data write protected by DIP switch A7SW3. (Refer to Appendix D.)
		→ Set bit 5 of DIP switch A7SW3 to the OFF position.
81	No memory card	• Illegal operation, attempted to store data in record No. 10 to 19 when a memory card was not inserted.
		→ Insert a memory card, or store to record No.0 to 9 (internal memory)
82	Store failed	• Memory card hardware failure (storing function) occurred.
		→ Use another memory card.
		• Internal EEPROM hardware failure (storing function) occurred.
		→ Contact your nearest Hewlett-Packard office.
83	No data to load	• Memory card is not inserted.
		→ Insert the memory card completely.
		• No setup data to load in the record number entered.
		→ Confirm the CATALOG, and retry.
84	Load failed	• Memory card hardware failure (loading function) occurred.
		→ Use another memory card.
		• Internal EEPROM hardware failure (loading function) occurred.
		→ Contact your nearest Hewlett-Packard office.
85	Different system recorded	• Current configuration mode and recorded configuration mode are different.
		→ Confirm the status of the target record and change the *CONFIG* field.

Error No.	Displayed Message	• **Description** / → **Solution**
90	Data buffer overflow	• The amount of data to be stored into the data buffer memory (DBUF) exceeded the defined data buffer size.
		→ Re-define the data buffer memory size, or clear DBUF.
100	Printer down	• Data sent to the output buffer when a printer was not connected to the HP 4285A with an HP-IB cable or the printer was turned OFF.
		→ Connect a printer to the HP 4285A with an HP-IB cable, or turn the printer ON.
		• Printing speed of printer cannot keep up with the HP 4285A's data output transfer rate.
		→ Set the HP 4285A's DELAY time appropriately or replace the printer with a higher speed printer that can match the HP 4285A's data transfer rate.
101	TALK ONLY disabled	• Data sent to the output buffer when the HP 4285A is addressable.
		→ Set the HP 4285A to the talk only mode, and set the printer to the listen only mode.
110	Connect Interface Cable	• Illegal operation, set to precision Q measurement mode when the accessory control interface cable is not properly connected.
		→ Connect the HP 4285A and the HP 42851A with the accessory control interface cable.

Error No.	Displayed Message	• Description → Solution
111	Q Adapter fan failure	• Cooling fan stopped. → Contact your nearest Hewlett-Packard office.
112	Q Adapter powered down	• Illegal operation, set to precision Q measurement mode when an inoperative HP 42851A is connected to the HP 4285A. → Check the power cord connection of the HP 42851A and turn it on.
113	EEPROM Read Status Error	• The HP 42851A internal EEPROM hardware failure occurred. → Re-store the data to the EEPROM. If this message is still displayed, Contact your nearest Hewlett-Packard office.
114	EEPROM Write Status Error	• An HP 42851A internal EEPROM hardware failure occurred. → Re-store the data to the EEPROM. If this message is still displayed, Contact your nearest Hewlett-Packard office.
115	Illegal operation	• Any illegal operation is attempted. (For example, INTernal trigger mode while in SERIES or PARALLEL connection modes.) → Perform the correct operation.
116	Q Adapter control failure	• General failure of the HP 42851A → Turn the HP 42851A and the HP 4285A OFF and few seconds later turn ON again. If this message is still displayed, contact your nearest Hewlett-Packard office.
−310	System error	• Severe error. → Contact your nearest Hewlett-Packard office.
−311	Memory error	• Severe error. → Contact your nearest Hewlett-Packard office.

Error No.	Displayed Message	• Description / → Solution
Execution Error		
−211	Trigger ignored	• The HP 4285A Triggered before the previous trigger was executed.
		→ Widen the time interval between triggers.
−222	Data out of range	• Data is out of the setting range.
		→ Enter a value within the available setting range.
−230	Data corrupt or stale	• `FETCh?` query received after the `ABORt` or the `*RST` command was received, or after the power on reset was performed.
		→ Send the `FETCh?` query during idle state and when the data is valid (after a measurement is performed).
		• `FETCh?` query received after `INITiate` command was received, and a trigger was not received.
		→ Send the `FETCh?` command after the trigger is received.
		• `FETCh?` query received after the trigger was received in the list sweep mode and the table was not setup.
		→ Setup the list sweep table.
		• Setting value query (for example, `VOLTage?`, `BIAS:CURRent?`, `LIST:VOLTage?`) received when the setting mode is mismatched.
		→ Send a setting value query command which matches the current setting mode.

HP-IB Errors

Error No.	Error Message String	• Description
Command Error		
−100	Command error	• Improper command.
−101	Invalid character	• Invalid character was received.
−102	Syntax error	• Unrecognized command or data type was received.
−103	Invalid message unit separator	• The message unit separator (for example, “;”, “,”) is improper.
−104	Data type error	• Improper data type used (for example, string data was expected, but numeric data was received).
−105	GET not allowed	• GET is not allowed inside a program message.
−108	Parameter not allowed	• Too many parameters for the command received.
−109	Missing parameter	• A command with improper number of parameters received.
−112	Program mnemonic too long	• Program mnemonic is too long (maximum length is 12 characters).
−113	Undefined header	• Undefined header or an unrecognized command was received (operation not allowed).
−121	Invalid character in number	• Invalid character in numeric data.
−123	Numeric overflow	• Numeric data value was too large (exponent magnitude >32k).
−124	Too many digits	• Numeric data length was too long (more than 255 digits received).
−128	Numeric data not allowed	• Numeric data not allowed for this operation.
−131	Invalid suffix	• Units are unrecognized, or the units are not appropriate.
−138	Suffix not allowed	• A suffix is not allowed for this operation.
−141	Invalid character data	• Bad character data or unrecognized character data was received.
−144	Character data too long	• Character data is too long (maximum length is 12 characters).
−148	Character data not allowed	• Character data not allowed for this operation.
−150	String data error	• String data is improper.

Error No.	Error Message String	• Description
−151	Invalid string data	• Invalid string data was received (for example, END received before close quote).
−158	String data not allowed	• String data is not allowed.
−160	Block data error	• Block data is improper.
−161	Invalid block data	• Invalid block data was received (for example, END received before length satisfied).
−168	Block data not allowed	• Block data is not allowed.
−170	Expression error	• Expression is improper.
−171	Invalid expression	• Invalid expression was received (for example, illegal character in expression).
−178	Expression data not allowed	• Expression data is not allowed.
Query Error		
−400	Query error	• Query is improper.
−410	Query INTERRUPTED	• Query is followed by DAB or GET before the response was completed.
−420	Query UNTERMINATED	• Addressed to talk, incomplete program message received.
−430	Query DEADLOCKED	• Input buffer and output buffer are full; cannot continue.
−440	Query UNTERMINATED error after indefinite response	• The query which requests arbitrary data response (`*IDN?` and `*OPT?` queries) is sent before usual queries in a program message. (for example, `FREQ?;*IDN?` was expected, but `*IDN?;FREQ?` is recieved.)

Warning Messages

The HP 4285A displays warning messages on the System Message Line when an inappropriate operation is attempted, or when the setting is changed automatically due to an inappropriate operation. The warning operation should not set an error bit. The following list describes the HP 4285A's warning messages.

Warning Message	Description
HP-IB error occurred	When the HP 4285A receives an illegal command via HP-IB, this warning message is displayed. To identify the error, use the sample program given in "Sample Program to Detect the Error".
Warning, ALC turned off	When the LEVEL setting is out of the ALC's available range, the ALC function is automatically turned OFF. Set the LEVEL to be within the ALC's available range, and then set ALC to ON.
Warning, ALC unable to regulate	When the LEVEL setting is inappropriate for use with the ALC function, the ALC function will not work, the operation will be the same as if the ALC function is turned OFF. (The data status is set to 4.) Set the LEVEL appropriate for the device.
Warning, Bias changed for fixture	When the SMD Test Fixture is connected to the HP 42842C and the BIAS setting is out of the available range, the BIAS setting value is reduced to be within the SMD Fixture's available range (2A).
Warning, Correction not effective	When the MULTI correction mode is used and the measurement frequency is not equal to FREQ1–7 (correction frequency), correction will not be performed.
Warning, Deviation measurement ON	The deviation measurement is set to ON when the display page is changed to the *BIN No. DISPLAY*, *BIN COUNT DISPLAY*, or *LIMIT TABLE SETUP* page.
Warning, I bias unit disconnected	This message is displayed when the status is changed after the current bias unit is disconnected.
Warning, Improper high/low limits	The high limit value is less than the low limit value of the limit table.
Warning, Level changed for ALC	When the ALC is turned on and the LEVEL setting is out of the ALC's available range, the LEVEL setting is changed to be within the ALC's available range.
Warning, Signal source overload	When the signal source is overloaded, the measurement data is not guaranteed to be valid. (The data status is set to 3.) Reduce the LEVEL.
Warning, Test voltage too high	In the precision Q measurement mode, resonant voltage of the DUT exceeds maximum allowable input voltage of the HP 4285A. The measurement data is not guaranteed to be valid. Reduce the LEVEL.

C

Initial Settings and System Memory

Introduction

This appendix lists the HP 4285A's initial settings and functions whose status is stored in system memory in the precision Q measurement mode.

There are three ways to initialize the HP 4285A combined with the HP 42851A:

- POWER ON
  Turn the LINE ON/OFF switch ON.
- *RST
  Press SYSTEM RESET in the *SYS MENU* field of *MEAS SETUP* page, or send the *RST common command via HP-IB.
- DEVICE CLEAR
  Send the device clear bus command (SDC:selected device clear or DCL:clears all devices) via HP-IB.

The following list indicates the differences between the three initialization methods on the functions to be initialized. Functions whose status are stored in internal system memory are indicated by "Sys. Memory" on the "POWER ON" column in the following list.

Functions		Initialize Method		
		Power ON	*RST	**Device Clear**
Settings				
Q MEAS SETUP	*CONN*	DIRECT	DIRECT	Not Affected
	FREQ	1 MHz	1 MHz	Not Affected
	TUNE	AUTO	AUTO	Not Affected
	TRIG	MAN	MAN	Not Affected
	FUNC	Q-L	Q-L	Not Affected
	LEVEL	1 V	1 V	Not Affected
	AVG	1	1	Not Affected
	DELAY	0 s	0 s	Not Affected
	TUNING MONITOR	C-V	C-V	Not Affected
	FIX-C VALUE	*Max. value*	*Max. value*	Not Affected
	OFFSET L	OFF	OFF	Not Affected
	OFFSET C	OFF	OFF	Not Affected
	OFFSET R	OFF	OFF	Not Affected
	DEV A	OFF	OFF	Not Affected
	DEV B	OFF	OFF	Not Affected
	VAL L	0	0	Not Affected
	VAL C	0	0	Not Affected
	VAL R	0	0	Not Affected
	REF A	0	0	Not Affected
	REF B	0	0	Not Affected

Functions		Initialize Method		
		Power ON	*RST	**Device Clear**
Q CORRECTION	*SHORT*	Sys. Memory	Not Affected	Not Affected
	LOAD	Sys. Memory	Not Affected	Not Affected
	SPOT1 – 7	Sys. Memory	Not Affected	Not Affected
	REF-Q	Sys. Memory	Not Affected	Not Affected
Q LIMIT TABLE SETUP	*NOM*	0	0	Not Affected
	MODE	% Tolerance	% Tolerance	Not Affected
	AUX	OFF	OFF	Not Affected
	COMP	OFF	OFF	Not Affected
	BIN 1 – 9 LOW	Cleared	Cleared	Not Affected
	BIN 1 – 9 HIGH	Cleared	Cleared	Not Affected
	2nd LOW	Cleared	Cleared	Not Affected
	2nd HIGH	Cleared	Cleared	Not Affected
Q BIN COUNT	*COUNT ON/OFF*	OFF	OFF	Not Affected
Q LIST SWEEP SETUP	*MODE*	SEQ	SEQ	Not Affected
	sweep parameter	FREQ [Hz]	FREQ [Hz]	Not Affected
	sweep points	Cleared	Cleared	Not Affected
SYSTEM CONFIG	*BEEPER*	Sys. Memory	Not Affected	Not Affected
	HP-IB ADDRESS	Sys. Memory	Not Affected	Not Affected
	TALK ONLY	Sys. Memory	Not Affected	Not Affected
	CONFIG	Sys. Memory	Not Affected	Not Affected
	HANDLER I/F	Sys. Memory	Not Affected	Not Affected
	SCANNER I/F	Sys. Memory	Not Affected	Not Affected
Display Control				
	<display page>	*MEAS DISPLAY*	*MEAS DISPLAY*	Not Affected
	D.P. FIX A	OFF	OFF	Not Affected
	D.P. FIX B	OFF	OFF	Not Affected
Measurement Data				
	Measurement Data	Cleared	Cleared	Not Affected
	List Sweep Data	Cleared	Cleared	Not Affected
	C-V Tuning Monitor	Cleared	Cleared	Not Affected
	BIN Count Data	Cleared	Cleared	Not Affected

Functions		Initialize Method		
		Power ON	*RST	Device Clear
HP-IB				
	Data Buffer Memory	Cleared	Cleared	Not Affected
	Data Format	ASCII	ASCII	Not Affected
	Input Buffer	Cleared	Not Affected	Cleared
	Output Buffer	Cleared	Not Affected	Cleared
	Error Queue	Cleared	Not Affected	Not Affected
Status Byte[1]	Bit 7	0	Not Affected	Not Affected
	Bit 6	0	Not Affected	Not Affected
	Bit 5	0	Not Affected	Not Affected
	Bit 4	0	Not Affected	0
	Enable Resister	0	Not Affected	Not Affected
Operation Status Register[1]	Bit 4	0	0	Not Affected
	Bit 3	0	0	Not Affected
	Bit 0	0	0	Not Affected
	Enable Resister	0	Not Affected	Not Affected
Standard Event Status Register[1]	Bit 7	1	Not Affected	Not Affected
	Bit 6	0	Not Affected	Not Affected
	Bit 5	0	Not Affected	Not Affected
	Bit 4	0	Not Affected	Not Affected
	Bit 3	0	Not Affected	Not Affected
	Bit 2	0	Not Affected	Not Affected
	Bit 0	0	Not Affected	Not Affected
	Enable Resister	0	Not Affected	Not Affected
Others				
	comment	Cleared	Cleared	Not Affected
	KEY LOCK	OFF	OFF	Not Affected

1 Any other bits described in this table are not used. (always 0)

Write Protection

Introduction

The HP 4285A is equipped with an internally mounted write-protect switch. This switch has two write protection features. One feature disables the STORE function for write protecting all of the stored data in the memory card and EEPROM internal memory, and the other feature prevents changing any of the previous correction settings on the *CORRECTION* page. This feature is useful when you want to retain specific HP 4285A control settings for everyday use, for example, on a production line where it is not necessary to store any information on a memory card, thereby making it impossible to accidentally erase or overwrite the stored data in the memory card or the EEPROM internal memory, and also making it impossible to accidentally erase or overwrite the correction settings.

Write Protection Procedure

The procedure for setting the write protection switch to ON is as follows.

1. Turn the HP 4285A off and remove the power cord. Allow a few minutes for the internal capacitors to discharge.

Warning

Dangerous voltage may be present in the HP 4285A even through the power switch is off. Be sure to wait a few minutes for the internal capacitors to discharge.

2. Remove the two feet at the back of the top cover.
3. Fully loosen the screw that secures the top cover.
4. Pull the top cover towards the rear of the HP 4285A and lift up to remove.
5. Loosen the five screws that secure the top shield plate (Larger one).
6. Slide the top shield forward then lift it off.
7. Remove the A7 board. Figure D-1 shows the A7 board's location.

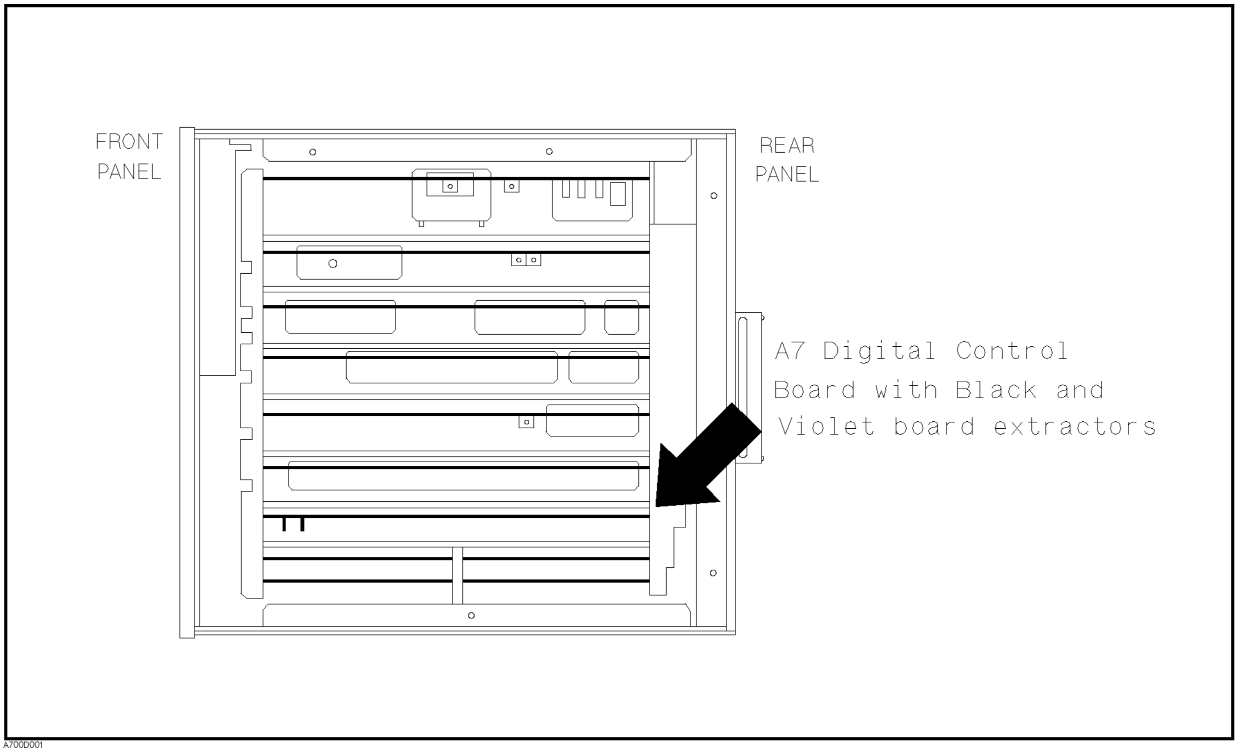

Figure D-1. A7 Digital Board Location

Caution

Semiconductor components are installed on the A7 board. When handling the A7 board, be aware that electrostatic discharge can damage these components.

8. Set A7S3-6 to the right-most position (ON) to disable HP 4285A's STORE function. Set A7S3-6 to the left-most position (OFF) to enable storing. Refer to Figure D-2.
9. Set A7S3-7 to the right-most position (ON) to disable to change all of the correction settings on the *CORRECTION* page. Set A7S3-7 to the left-most position (OFF) to enable to change all of the correction settings on the *CORRECTION* page. Refer to Figure D-2.

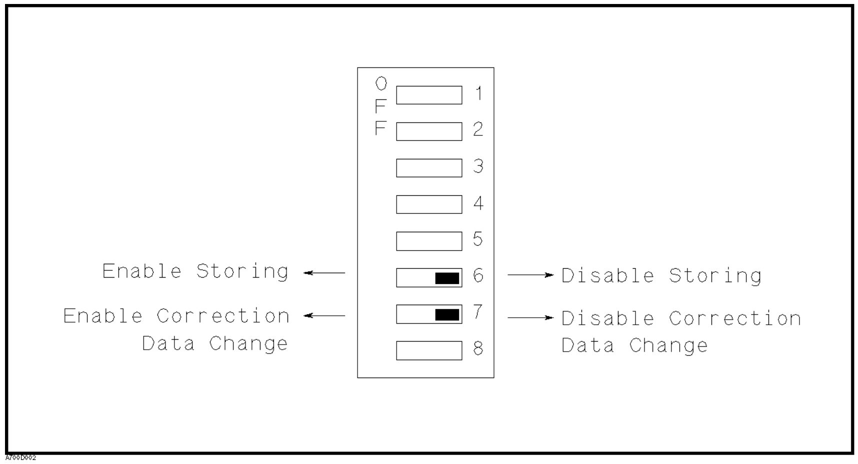

Figure D-2. Write Protection Switch

Note Do not change any of the other switch settings on the A7 board.

10. Install the configured A7 board into the HP 4285A.
11. Replace the top shield plate, top cover, and rear feet.