TH2828 Series
Precision LCR Meter
Automatic Component Analyzer

OPERATION MANUAL

Manual Print History

The manual print history shown below lists all the printing dates and editions. The printing date changes when a new edition is released. The latest editions can be downloaded from our website.

March 2006 ………………………………… First Edition

November 2007 …………………………… Second Edition

Warranty

This Tonghui instrument product is warranted against defects in material and workmanship for a period of two years from the date of shipment. Other items such as test fixtures, test cables are warranted for 90 days from the date of shipment. During the warranty period, we will, at our 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 Tonghui. Purchaser shall prepay shipping charges to Tonghui and Tonghui shall pay for the return of the product to Buyer. However, Buyer shall pay all shipping charges, duties, taxes, and any other charges for products returned to Tonghui from another country.

Limitation of Warranty

This warranty does not apply to defects resulting from improper or inadequate maintenance and care by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. Tonghui specially disclaims the implied warranties of merchantability and fitness for a particular use.

Tonghui's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. Tonghui shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Safety Precautions

The following safety precautions must be observed to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, read the operating information carefully before using the product and use this product only as specified.

NOTE   This product complies with INSTALLATION CATEGORY I as well as POLLUTION DEGREE 2. This product is an INDOOR USE product.

● Ground the Instrument

Before operating the instrument, make sure the instrument chassis is grounded with the 3-pole power cable.

● Don't operate in an explosive atmosphere

To prevent explosion or file, don't operate the instrument in the presence of inflammable gases or fumes.

● Use the proper fuse

Replace the broken fuse with the same type and rating for continuous protection against fire hazard.

● Keep away from live circuits

Don't remove the instrument covers when operating the instrument. Component replacement and internal adjustment can only be done by qualified personnel. Don't replace components with the power cable connected. Dangerous voltage may remain even after the power cable has been disconnected. Always remove the power cable from the instrument and discharge circuits before touching them.

Contents

Chapter 1 Overview

This chapter introduces the basic procedures for operating TH2828 series instruments and describes the front panel, rear panel and LCD screen display.

1.1   Product Introduction

TH2828 series instruments comprise three models:

- TH2828A Precision LCR Meter

- TH2828 Precision LCR Meter

- TH2828S Automatic Component Analyzer

Table 1-1   TH2828 Series Instruments Comparison

Items	TH2828A	TH2828	TH2828S
Frequency	50Hz to 1MHz	20 Hz to 1MHz	20Hz to 1MHz
	44 frequency points	About 6936 frequency points	1mHz resolution
Basic accuracy	0.1%	0.05%	0.05%
USB	N/A	Standard	Standard
GPIB	Optional	Standard	Standard
Handler	Optional	Optional	Optional

TH2828 series can be used to measure LCR components, materials and semiconductor devices for incoming inspection, quality control or laboratory use.

With the built-in comparator, the TH2828 series can sort the components into up to ten bins. By using the optional handler interface, TH2828 series can easily be combined with a system controller to constitute a fully automatic component test system.

The GPIB interface (optional for TH2828A, standard for TH2828/TH2828S) can be used to build an automatic test system.

With option TH10301, TH2828 series expands its test signal level up to 20 Vrms and 100 mA. Also option TH10301 enhances the DC bias level up to ±40 V or ±100 mA. So, current biased inductance measurement of coils or transformers can be performed easily and efficiently.

TH2828 series provides the list sweep function which can automatically measure and display up to ten frequencies, test signal levels, or bias level points.

With its 1 mHz frequency resolution, TH2828S also provides the sweep function which can draw curves of the current measured parameters versus a range of frequency, test signal level or DC bias level.

1.2 Front Panel

Following Figure 1-1 shows the brief description of the TH2828 series' front panel.
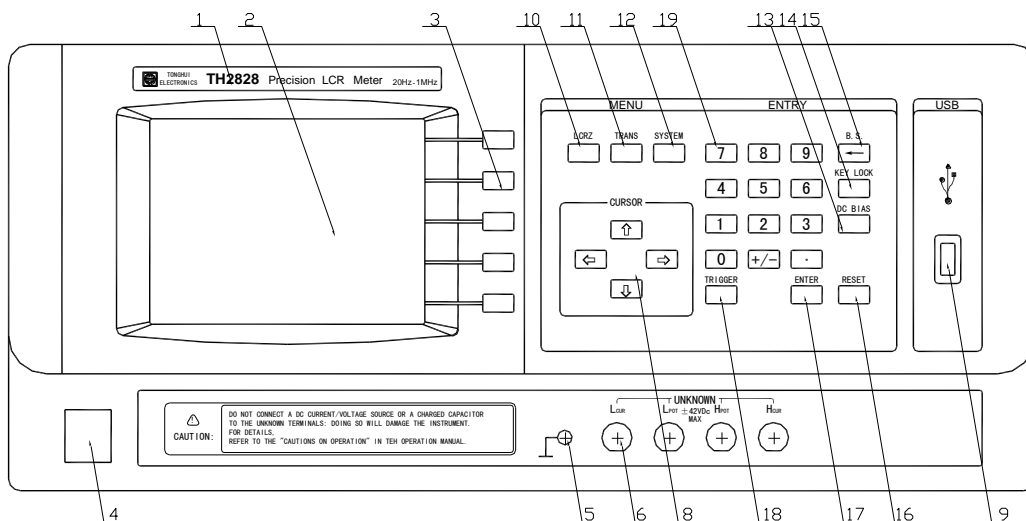
Figure 1-1   Front Panel

1) Brand and Model
   The brand and model name of the instrument are printed.

2) LCD
   320*240 dot-matrix LCD displays measurement results, test conditions, etc.

3) SOFTKEYs
   Five softkeys are used to select control and parameter functions. Each softkey
   has a softkey definition along its left side.

4) Power 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.

5) FRAME Terminal
   This is the FRAME Terminal which is tied to the instrument's chassis and which
   can be used for measurements that require shielding.

6) UNKNOWN Terminals
   These are the UNKNOWN Terminals used to connect a four-terminal pair test fixture or test leads for measuring the DUT.
   - Hcur: High current drive
   - Hpot: High potential sense
   - Lpot: Low potential sense
   - Lcur: Low current drive

7) CURSOR Keys
   The CURSOR 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.

8) USB Interface
   The USB interface is used to connect an USB disk. All the setup parameters can be stored to a setup file in the USB disk.

9) Manufacturer
   The manufacturer name of this product is printed.

10) **LCRZ** menu key
   The pages in menu key **LCRZ** are used for displaying the LCRZ measurement results, and measurement setup. When **LCRZ** is pressed, the <**LCR MEAS DISP**> page will be displayed on the LCD screen. The cursor will be positioned at the **LCR MEAS DISP** field. The power-on default display page is the <**LCR MEAS DISP**> page.

11) **SETUP** menu key
   The pages in menu key **SETUP** are used for measurement setup. When **SETUP** is pressed, the <**MEAS SETUP**> page will be displayed on the LCD screen.

12) **SYSTEM** menu key
   The pages in menu key **SYSTEM** are used for system setup. When **SYSTEM** is pressed, the <**SYSTEM SETUP**> page will be displayed.

13) **BACKSPACE** key
   BACKSPACE key deletes one last character of the input value.

14) **KEYLOCK** key

KEYLOCK key is used to lock and unlock the keyboard. When the key is pressed, "Keys locked" message will be displayed on the system information line at the bottom of LCD which means that the keys except **KEYLOCK** on the front panel are locked. And you can press **KEYLOCK** key again to unlock these keys. (The correct password must be input, if the keyboard is locked with a password.)

15) **DC BIAS** key

This **DC BIAS** key is used to enable the DC bias output. The DC BIAS ON/OFF information and indicator are displayed in the system information line. When DC BIAS is set to ON, the DC BIAS ON/OFF indicator is ON, "! Bias turn on" message will be displayed. When DC BIAS is set to OFF, the DC BIAS ON/OFF indicator is OFF. "! Bias turn off" message will be displayed. If DC BIAS is set to OFF, even though the BIAS level is set to a value according to the **BIAS** display field, the DC bias will not be output.

16) **RESET** key

Not used.

17) **ENTER** key

ENTER terminates numeric input data and enters the displayed value on the system information line.

18) **TRIGGER** key

This is the **TRIGGER** key used to manually trigger the instrument when it is set to the Manual Trigger mode.

19) NUMBER keys

The NUMBER keys comprise the digits **0** to **9**, a period **.** , a plus/minus sign **+/-** , these keys are used to enter numeric data into the instrument.

1.3 Rear Panel
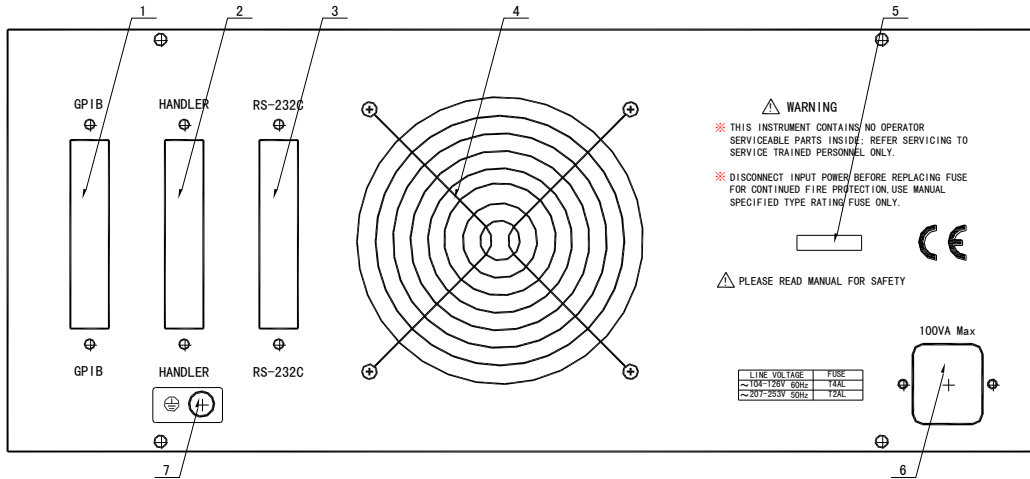
Figure 1-2   Rear Panel

1) IEEE488 Interface Connector (Optional for TH2828A)
   This is the IEEE488 interface connector used when operating on the General Purpose Interface Bus.

2) HANDLER Interface Connector (Optional)
   This is the HANDLER interface connector used when operating with an automatic test system.

3) RS232C Interface Connector
   This is the RS232C interface connector used when operating on the serial interface bus.

4) Serial Number Plate
   This plate is used to provide the serial number of the product.

5) Window of Cooling Fan
   This window is used to provide a way for the airflow of the cooling fan.

6) LINE Input Receptacle and fuse holder
   AC power cord receptacle and fuse holder for line fuse, 230Vac, 2A or 110Vac, 4A.

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

1.4   Display Area Definition
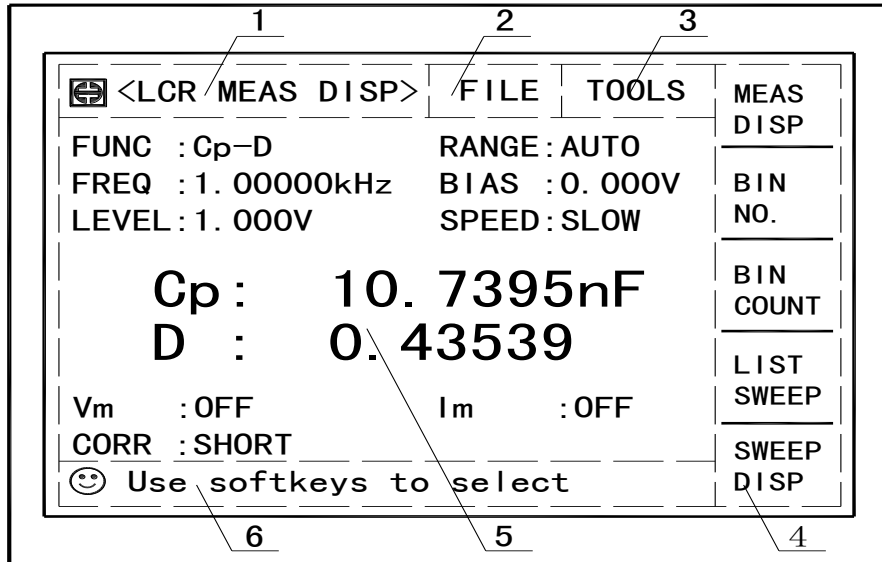
Figure 1-3   Display Area Definition

1)   Display Page Area
This is the display page area. This area identifies the current display page.

2)   File Field
When the cursor is on the **FILE** field, **FILE Manage** softkey is displayed. Select FILE Manage function, common file functions such as LOAD, STORE, DEL and COPY are available.

3)   TOOLS Field
Some special controls which cannot be set on a display page's fields are made available.

4)   Softkey Area
The last six character positions of each line are reserved for softkey labels. The softkeys displayed correspond to the current selected field on the LCD.

5)   Measurement Data/Conditions Area
Measurement results and measurement conditions are displayed in this area.

6)   Input and Information Line
This line is where system information and numeric input data are displayed.

1.5   Menu Keys and Display Page

1)   **LCRZ** Menu key
     This menu key has the following pages:
     - LCR MEAS DISP
     - BIN No. DISP
     - BIN COUNT DISP
     - LIST SWEEP DISP
     - SWEEP DISP

     This group of five display pages is used for displaying the measurement results, displaying the sorting results and displaying the sweep curves.

2)   **SETUP** Menu key
     This menu key has the following pages.
     - MEAS SETUP
     - CORRECTION
     - LIMIT TABLE SETUP
     - LIST SWEEP SETUP
     - SWEEP SETUP

     This group of five display pages is used for setting the measurement conditions (including the correction function), setting the bin sorting limits and setting the sweep conditions.

3)   **SYSTEM** Menu key
     This menu has the following page.
     - SYSTEM SETUP

     This page is used for setting operating conditions other than main measurement control.
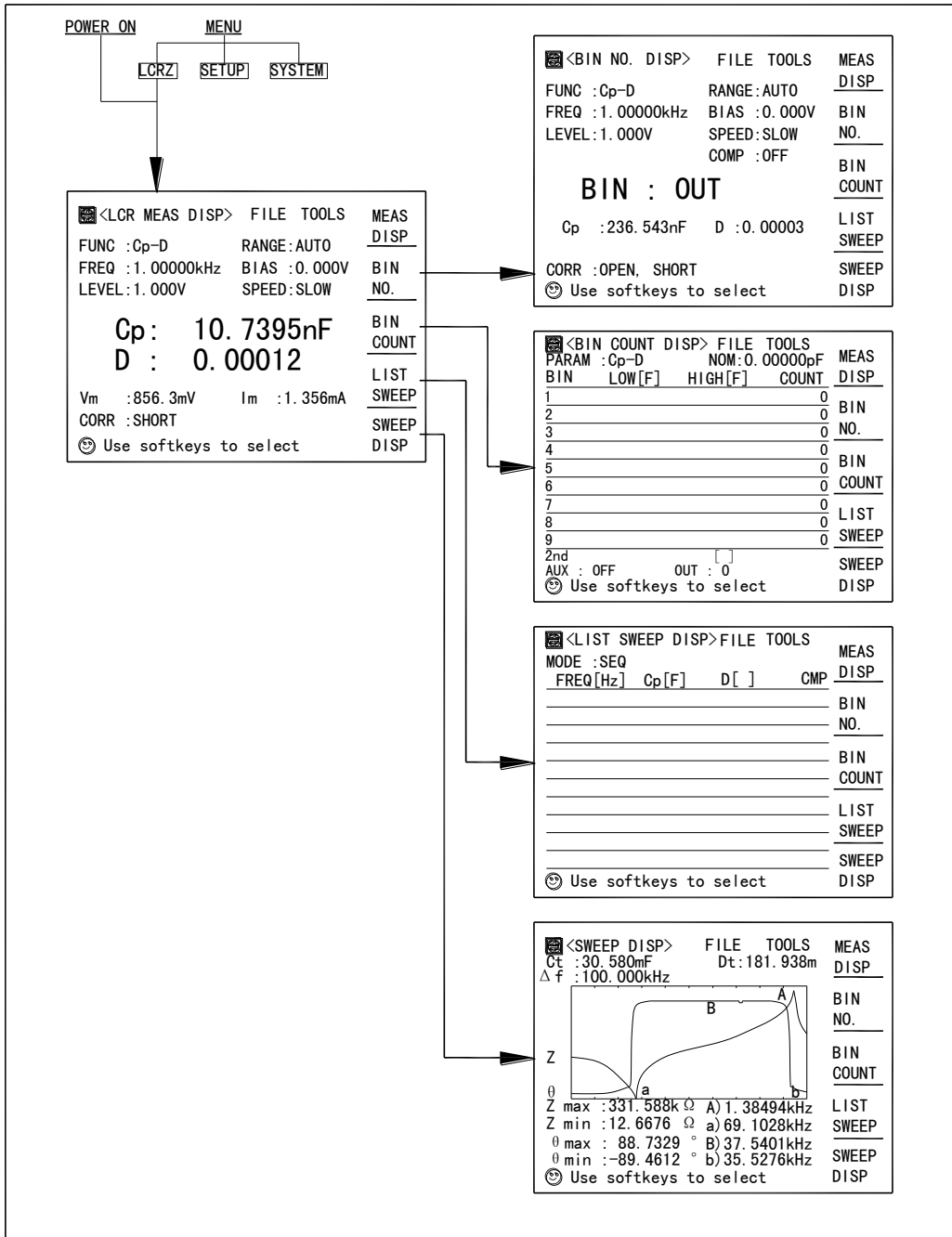
Figure 1-4   Display Pages (1/3)

Figure 1-4   Display Pages (2/3)

```
                    MENU
                     │
        ┌────────────┼────────────┐
     ┌─────┐     ┌──────┐     ┌───────┐
     │LCRZ │     │SETUP │     │SYSTEM │
     └─────┘     └──────┘     └───────┘
                                  │
                                  ▼

  ┌──────────────────────────────────────────┐
  │ ⊕ <SYSTEM SETUP>      FILE   TOOLS  SYSTEM │
  │                                     SETUP  │
  │    LCD CONST:20                     ─────  │
  │    BEEPER   :MASTER                        │
  │    PASS BEEP:TWO SHORT                      │
  │    FAIL BEEP:HIGH LONG                      │
  │    LANGUAGE :ENGLISH                ─────   │
  │    PASS WORD:OFF                            │
  │    BUS  MODE:RS232C                         │
  │    BUS  ADDR:8                      ─────   │
  │    Talk Only:OFF                            │
  │    BiasSourc:INT                            │
  │    Baud Rate:38.4000k               ─────   │
  │                                            │
  │  ☺ Use softkeys to select                   │
  └──────────────────────────────────────────┘
```
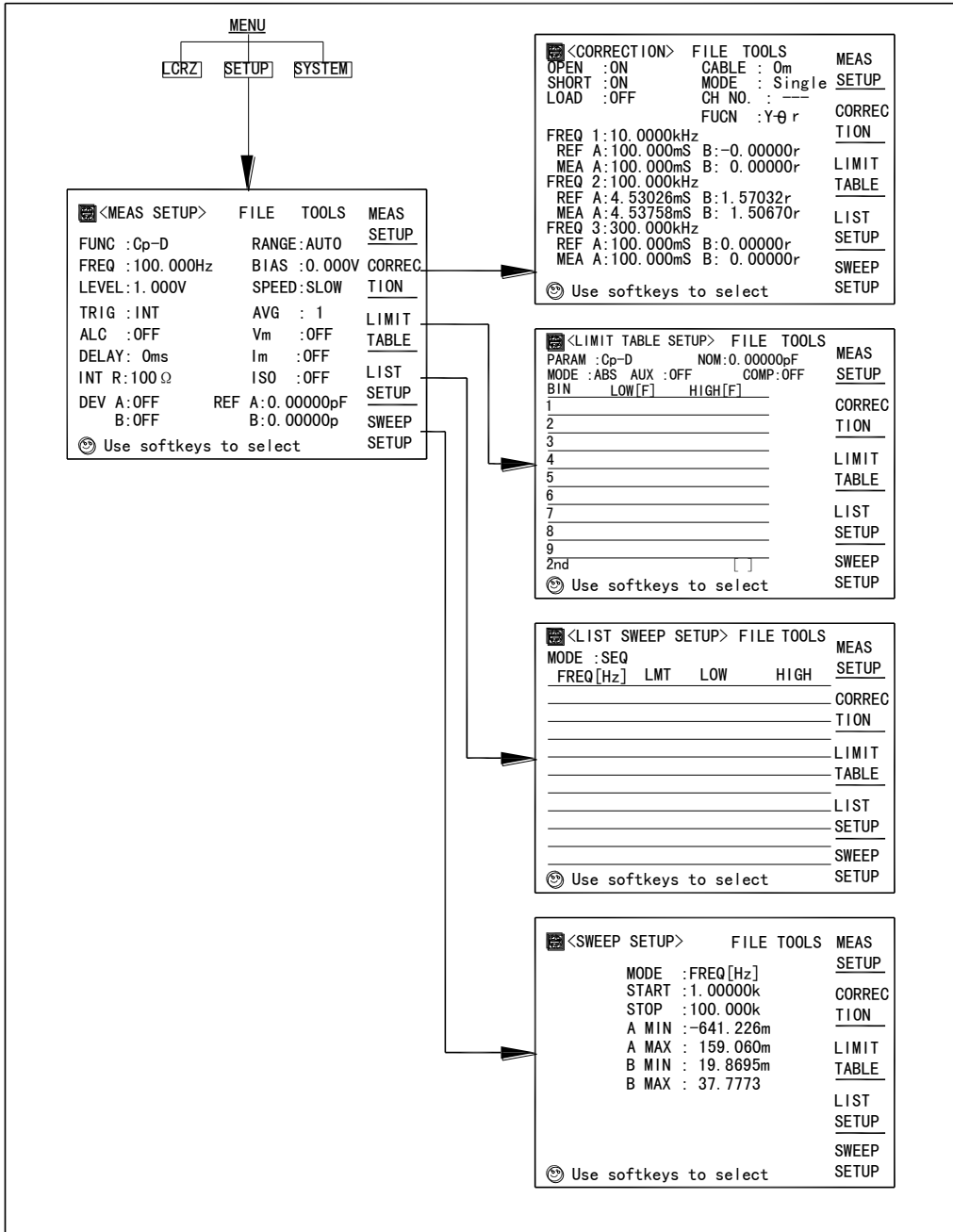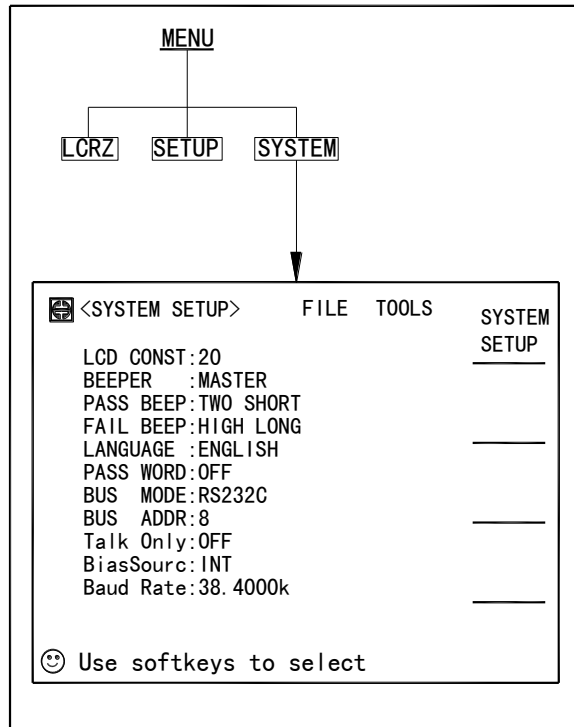
Figure 1-4   Display Pages (3/3)

1.6 Basic Operation

TH2828 series' basic operation is described below.

1) Display the desired display page using both the MENU keys and the softkeys.

2) Move the cursor to the desired field using the CURSOR keys. When the cursor is moved to a field, the field changes to an inverse video image of the original field, and the field is the area to which you can set the cursor.

3) The softkey definitions corresponding to the field will be displayed automatically. Select and press a softkey. 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** to terminate numeric input. 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, test frequency's unit will be Hz.

Chapter 2 Display Pages

This chapter describes all the display pages in the $\boxed{\text{LCRZ}}$ menu key.

2.1 LCR MEAS DISP page

When you press $\boxed{\text{LCRZ}}$ menu key, the <**LCR MEAS DISP**> page will be displayed. On this page, the measurement results are displayed in large characters, and the following measurement controls can be set from this page.

- Measurement Function (**FUNC**)
- Measurement Range (**RANGE**)
- Test Frequency (**FREQ**)
- Oscillator Level (**LEVEL**)
- DC Bias (**BIAS**)
- Measurement Speed (**SPEED**)
- File Manage (**FILE**)
- Useful Tools (**TOOLS**)

There are nine fields on this page: **LCR MEAS DISPLAY**, **FUNC**, **RANGE**, **FREQ**, **LEVEL**, **BIAS**, **SPEED**, **FILE** and **TOOLS**. Each control function is described in the following paragraphs.

This page also provides the following information in measurement data and condition area on the displayed page. These conditions can be set from the <**MEAS SETUP**> page or <**CORRECTION**> page.

- Oscillator Level Voltage/Current Monitor value (**Vm**, **Im**)
- OPEN, SHORT, LOAD on/off setting conditions (**CORR**)

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

```
┌─────────────────────────────────────────────────────────┐
│  ┌───────────────────────────────────────────────┐      │
│  │ ⊕ ‹LCR MEAS DISP›  FILE  TOOLS     MEAS        │      │
│  │                                   DISP         │      │
│  │ FUNC :Cp-D       RANGE:AUTO       ─────        │      │
│  │ FREQ :1.00000kHz BIAS :0.000V     BIN          │      │
│  │ LEVEL:1.000V     SPEED:SLOW       NO.          │      │
│  │                                   ─────        │      │
│  │   Cp:    256.765nF                BIN          │      │
│  │   D :    0.00003                  COUNT        │      │
│  │                                   ─────        │      │
│  │                                   LIST         │      │
│  │ Vm   :876.4mV      Im  :1.365mA   SWEEP        │      │
│  │                                   ─────        │      │
│  │ CORR :SHORT                       SWEEP        │      │
│  │ ☺ Use softkeys to select         DISP         │      │
│  └───────────────────────────────────────────────┘      │
│         ┌──────────────┐                                 │
│         │              │ : Field                         │
│         └──────────────┘                                 │
│         ┌ ─ ─ ─ ─ ─ ─ ┐                                  │
│         ┊              ┊ : Monitor                       │
│         └ ─ ─ ─ ─ ─ ─ ┘                                  │
└─────────────────────────────────────────────────────────┘
```

Figure 2-1   Available Fields on the LCR MEAS DISP Page

<LCR MEAS DISP>
 — MEAS DISP
 — BIN NO.
 — BIN COUNT
 — LIST SWEEP
 — SWEEP DISP

FILE
 — FILE Manage — LOAD
 —   — STORE
 —   — DEL
 —   — COPY
 —   — ESC

TOOLS
 — D.P.FIX A
 — D.P.FIX B
 — BIG FONT

FUNC — Cp-D   Cs-D   Lp-D   Ls-D   R-X
     — Cp-Q   Cs-Q   Lp-Q   Ls-Q   Z-θ°
     — Cp-G   Cs-Rs   Lp-G   Ls-Rs   Z-θ r
     — Cp-Rp   Lp-Rp   Rs-Q
     — MORE 1/6 — MORE 2/6 — MORE 3/6 — MORE 4/6 — MORE 5/6 —

                                        G-B
                                      Y-θ°
                                      Y-θ r
                                        Rp-Q
                            MORE 6/6 ◄

FREQ — ↑ (++)   LEVEL — ↑ (+)
     — ↑ (+)   — ↓ (-)
     — ↓ (-)
     — ↓ (—)

     [NUMERIC ENTRY] — Hz   [NUMERIC ENTRY] — mV
                     — KHz   — V
                     — MHz   — μA
                                                   — mA
                                                   — A

BIAS — ↑ (+)   SPEED — FAST   RANGE — AUTO
     — ↓ (-)   — MED   — HOLD
                          — SLOW   — ↑ (+)
                                                — ↓ (-)

     [NUMERIC ENTRY] — mV
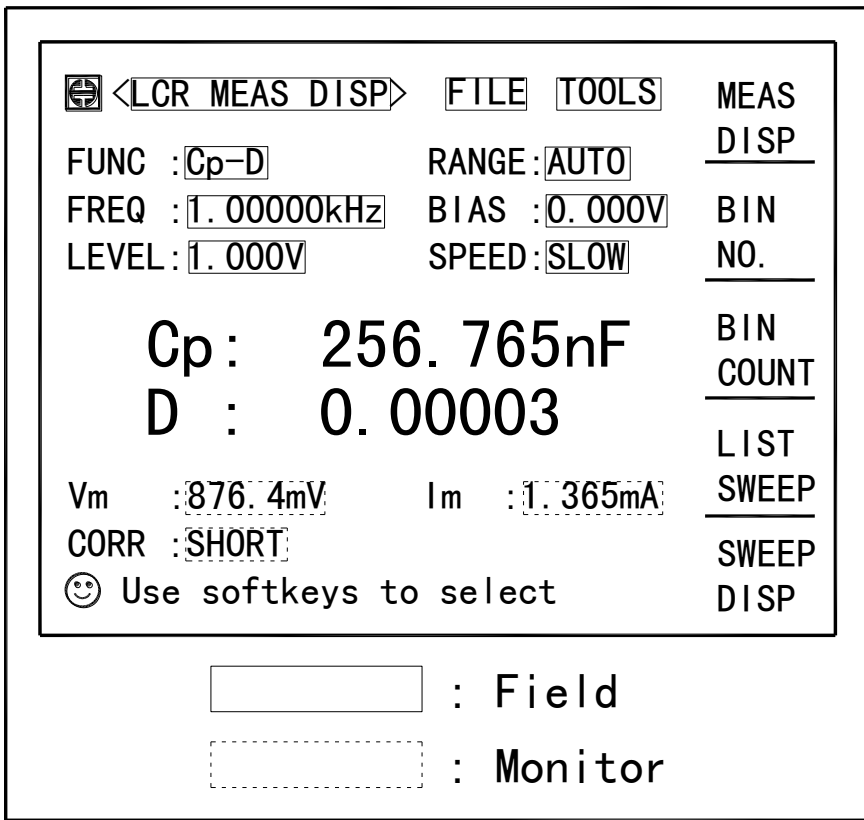   — V
                     — μA
                     — mA
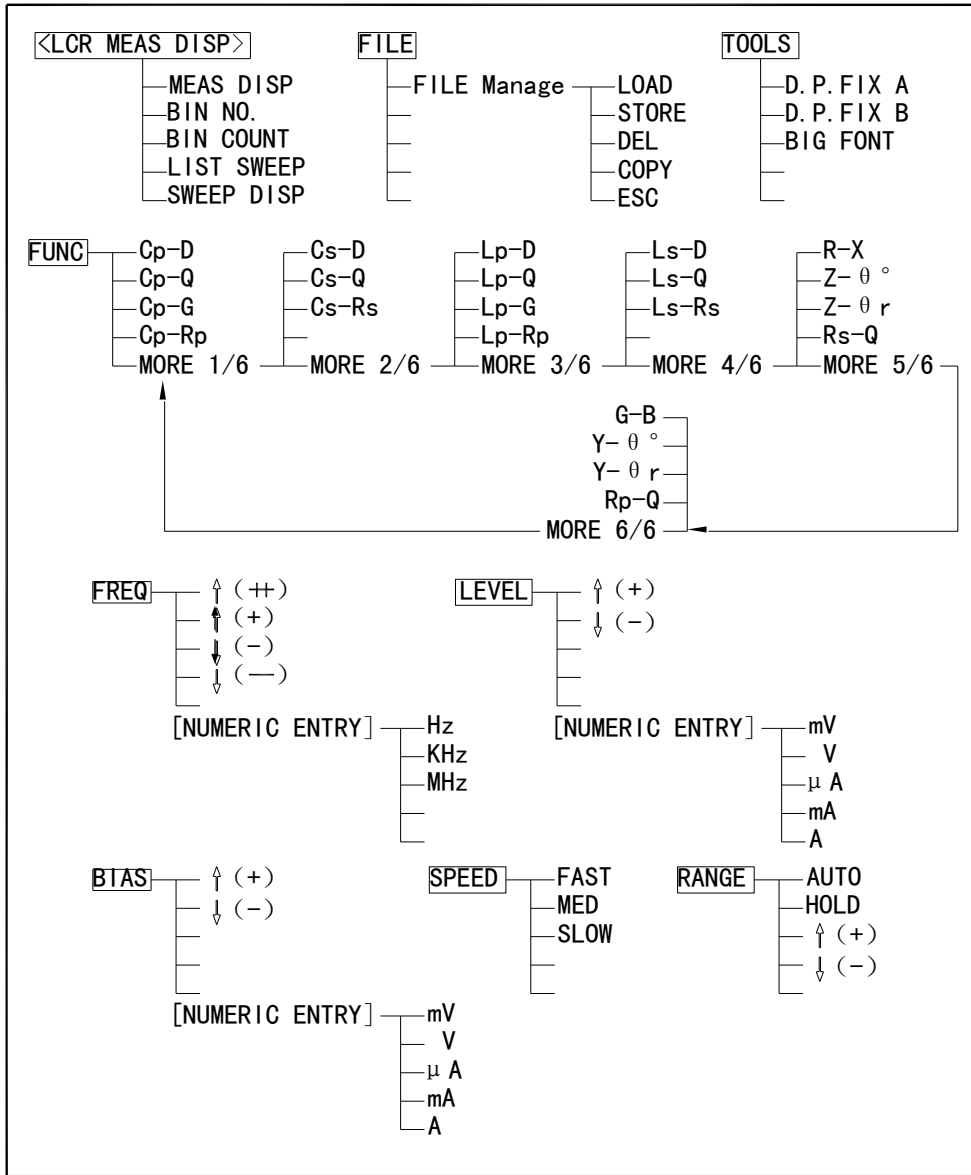   — A

Figure 2-2   Available Softkeys on the LCR MEAS DISP Page

2.1.1   Measurement Function

TH2828 series measures two components of the complex impedance (parameters) at the same time in a measurement cycle. The measurement parameters are listed as follows.

Primary Parameters
- |Z| (absolute value of impedance)
- |Y| (absolute value of admittance)
- L   (inductance)
- C   (capacitance)
- R   (resistance)
- G   (conductance)

Secondary Parameters
- D   (dissipation factor)
- Q   (quality factor)
- Rs   (equivalent series resistance)
- Rp   (equivalent parallel resistance)
- X   (reactance)
- B   (susceptance)
- Θ   (phase angle)

The primary parameter measurement result is located on the upper line and the secondary parameter measurement result is located on the lower line on this page.

Front Panel Operation for Setting the Measurement Function
Perform the following steps to set the measurement function.

1)   Use the CURSOR arrow keys to move the cursor to the **FUNC** field. The following softkeys will be displayed.
- Cp-D
- Cp-Q
- Cp-G
- Cp-Rp
- MORE 1/6

2)   Select and press a softkey to set the measurement function. If the softkey you want is not displayed, press MORE 1/6 to display the following set of softkeys.
- Cs-D
- Cs-Q
- Cs-Rs
- MORE 2/6

3) Select and press a softkey to set the measurement function. If the softkey you want is not displayed, press MORE 2/6 to display the following set of softkeys.
  - Lp-D
  - Lp-Q
  - Lp-G
  - Lp-Rp
  - MORE 3/6
4) Select and press a softkey to set the measurement function. If the softkey you want is not displayed, press MORE 3/6 to display the following set of softkeys.
  - Ls-D
  - Ls-Q
  - Ls-Rs
  - MORE 4/6
5) Select and press a softkey to set the measurement function. If the softkey you want is not displayed, press MORE 4/6 to display the following set of softkeys.
  - R-X
  - Z-θ°
  - Z-θ$_r$
  - Rs-Q
  - MORE 5/6
6) Select and press a softkey to set the measurement function. If the softkey you want is not displayed, press MORE 5/6 to display the following set of softkeys.
  - G-B
  - Y-θ°
  - Y-θ$_r$
  - Rp-Q
  - MORE 6/6
7) Select and press a softkey to set the measurement function. When MORE 6/6 is pressed, the softkeys shown in step 1 will be displayed. Retry steps 1 through 7 if you missed the function you were looking for.

2.1.2 Measurement Range

Th2828 series has nine measurement ranges: 10 Ω, 30 Ω, 100 Ω, 300 Ω, 1 kΩ, 3 kΩ, 10 kΩ, 30 kΩ, and 100 kΩ. The measurement range should be selected according to the DUT's impedance even if measurement parameter is capacitance or inductance.

Front Panel Operation for Setting the Measurement Range
Perform the following procedure to set the measurement range.

1) Move the cursor to the RANGE Field using the CURSOR keys. The following softkeys will be displayed.
  - AUTO   This softkey is used to set the measurement range to AUTO mode.

- ■ HOLD   This softkey is used to set the measurement range to HOLD mode. When the measurement range is set to the HOLD mode, the impedance range is fixed at the current range setting, and the impedance range is displayed in the **RANGE** field.
- ■ ⇑ (+)   This softkey is used to increase the measurement range in the HOLD mode.
- ■ ⇓ (-)   This softkey is used to decrease the measurement range in the HOLD mode.

2) Use the above softkeys to set the measurement range.

2.1.3 Test Frequency

TH2828's frequency can be set in the range from 20 Hz to 1MHz with 6936 frequency points available. All the test frequency points are integer quotient values using the following formula.

F = m/n [kHz], where m = 62500 or 75000, n = 13 to 3750.

TH2828A's frequency can be set in the range from 50 Hz to 1 MHz with 44 frequency points available as listed below.

	100 Hz	1 kHz	10 kHz	100 kHz	1MHz
	120 Hz	1.2 kHz	12 kHz	120 kHz	
	150 Hz	1.5 kHz	15 kHz	150 kHz	
	200 Hz	2 kHz	20 kHz	200 kHz	
	250 Hz	2.5 kHz	25 kHz	250 kHz	
	300 Hz	3 kHz	30 kHz	300 kHz	
	400 Hz	4 kHz	40 kHz	400 kHz	
50 Hz	500 Hz	5 kHz	50 kHz	500 kHz	
60 Hz	600 Hz	6 kHz	60 kHz	600 kHz	
80 Hz	800 Hz	8 kHz	80 kHz	800 kHz	

TH2828S's frequency can be set in the range from 20Hz to 1MHz with a resolution of 1mHz.

Front Panel Operation for 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.

- ■ ⇑ (++)

This softkey is the coarse frequency increment softkey used to increment the test frequency to the next sequentially higher tenfold value after 20 Hz (50Hz for TH2828A). The frequency points set using this softkey are as follows.

20 Hz (50Hz for TH2828A), 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1MHz

■   ⇧ (+)

This softkey is the fine frequency increment softkey used to increment 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 as follows.

	100 Hz	1 kHz	10 kHz	100 kHz	1MHz
	120 Hz	1.2 kHz	12 kHz	120 kHz	
	150 Hz	1.5 kHz	15 kHz	150 kHz	
20 Hz	200 Hz	2 kHz	20 kHz	200 kHz	
25 Hz	250 Hz	2.5 kHz	25 kHz	250 kHz	
30 Hz	300 Hz	3 kHz	30 kHz	300 kHz	
40 Hz	400 Hz	4 kHz	40 kHz	400 kHz	
50 Hz	500 Hz	5 kHz	50 kHz	500 kHz	
60 Hz	600 Hz	6 kHz	60 kHz	600 kHz	
80 Hz	800 Hz	8 kHz	80 kHz	800 kHz	

■   ⇩ (-)

This softkey is the fine frequency decrement softkey used to decrease 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 values as set using ⇧ (+) .

■   ⇩ (--)

This softkey is the coarse frequency decrement softkey which is used to decrement the test frequency to the next sequentially lower tenth value. The frequency points set using this softkey are the same as the frequency points set using ⇧ (++).

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, the softkey labels are changed to the available units (Hz, kHz, and MHz), and so you can use these softkeys instead of **ENTER** to enter the units and the data. When **ENTER** is used, the numeric data is entered with Hz as the default unit.

NOTE: When an unavailable frequency is entered, the nearest test frequency point available will be automatically set.

2.1.4 Test Signal Level

TH2828 series' test signal level can be set as the effective value (RMS value) of a sine wave of the test frequency from the instrument's internal oscillator. You can set either the oscillator voltage level or the oscillator current level. The output impedance is 100 Ω or 30 Ω selectable.

NOTE: The set value of the oscillator current level is the value set when the measurement contacts (UNKNOWN Terminals) are shorted together. The set value of the oscillator voltage level is the value set when the measurement contacts (UNKNOWN Terminals) are opened.

The oscillator voltage level can be set from 5mVrms to 2 Vrms with a resolution as listed in the following table, or the oscillator current level can be set from 50µArms to 20 mArms with a resolution as listed in the following table.

Mode	Oscillator Level	Resolution
Voltage	5 mVrms to 200 mVrms	1 mVrms
	200 mVrms to 2 Vrms	10 mVrms
Level	50 µArms to 2 mArms	10 µArms
	2 mArms to 20 mArms	100 µArms

TH2828 series can measure a device using a constant voltage or current level by using the automatic level control function. (The automatic level control function (**ALC** field) can be set to ON from the <**MEAS SETUP**> page.) When a constant voltage or current level measurement is performed, the asterisk mark (*) is displayed at the end of the oscillator level value. For more information about the automatic level control function, refer to <**MEAS SETUP**> page.

Front Panel Operation for Setting the Oscillator Level
There are two ways to set the oscillator level. One is to use the softkeys, another is to 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.

■   ⇑ (+)

Press this softkey to increases the oscillator's output level.

■   ⇓ (-)

Press this softkey to decreases the oscillator's output level.
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 are changed to the available units labels (mV, V, µA, mA, and A), and you can use these softkeys to enter the units and enter the data instead of **ENTER**. When **ENTER** is used, the numeric data is entered with V or A as the default unit.

NOTE: When you want to change the oscillator level from voltage to current or from current to voltage, the numeric entry keys and unit softkeys must be used.

2.1.5   DC Bias

TH2828 series has internal DC bias voltage selections of 0 V, 1.5 V, and 2.0 V.

Front Panel Operation for Setting the DC Bias
There are two ways to set the DC bias, one is to use the softkeys, and the other is to use the numeric entry keys.

Perform the following steps to set the DC bias.
1)   Move the cursor to the BIAS field. The following softkeys will be displayed.

   ■   ⇑ (+)

   Press this softkey to increase the DC bias level.

   ■   ⇓ (-)

   Press this softkey to decrease the DC bias level.
2)   Set the DC bias to your desired bias using either the softkeys or the numeric entry keys. When the DC bias is entered using the numeric entry keys, the softkey labels are changed to the available units (mV, V, μA, mA, and A), and so you can use these softkeys instead of ENTER. When ENTER is used, the numeric data is entered with V or A as the default unit.

Note: When you want to change the DC bias from voltage to current or from current to voltage, you must use the numeric entry keys and the unit softkeys.

---

3)   Set DC BIAS on the front panel to ON to output the dc bias. When DC Bias is set to ON, the DC Bias indicator will be displayed on the system information line.

2.1.6   Measurement Speed

TH2828 series' measurement Speed is determined by the following conditions.
■   Integration Time (A/D conversion)
■   Averaging Rate (number of measurement averaged)
■   Delay Time (time delay between the trigger and the start of the measurement)
■   Measurement result's display time.
Generally, a slow measurement speed will result in more stable and accurate measurement results. SLOW, MED, or FAST measurement speed can be selected.

Front Panel Operation for Setting the Measurement Speed
Perform the following steps to set the measurement speed.
1)   Move the cursor to the **SPEED** field. The following softkeys will be displayed.
   ■   FAST
   ■   MED
   ■   SLOW
2)   Use the preceding softkeys to select and set the measurement speed.
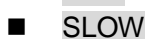
2.1.7 File Manage

TH2828 series uses the internal EEPROM or an USB disk for storing and retrieving a maximum of 520 sets of instrument control settings (*.LCR). The first 20 files from No. 1 to No. 20 will be stored inside the instrument; other files from No. 21 to No. 520 will be stored in the USB disk.

The following data will be stored in the non-volatile memory as one file.

- ■ Control settings on the <**MEAS SETUP**> page.
  - □ Measurement Function
  - □ Test Frequency
  - □ Measurement Range
  - □ Oscillator Level
  - □ DC Bias
  - □ Measurement Speed
  - □ Averaging Rate
  - □ Delay Time
  - □ Trigger Mode
  - □ ALC on/off
  - □ Internal Resistance
  - □ Bias Current Isolation on/off
  - □ V Monitor on/off
  - □ I Monitor on/off
  - □ Deviation Measurement A/B
  - □ Deviation Measurement A/B Reference Value
- ■ Control settings on the <**LIMIT TABLE SETUP**> page.
  - □ Measurement Parameter
  - □ Nominal Value
  - □ Limit Mode for the Primary Parameter
  - □ Auxiliary Bin on/off
  - □ Comparator Function on/off
  - □ Low/High Limits for Each Bin
- ■ Control setting on the <**BIN COUNT DISP**> page
  - □ Bin Count on/off
- ■ Control settings on the <**LIST SWEEP SETUP**> page
  - □ Sweep Mode
  - □ All Sweep Points
  - □ All Low/High Limits including the limit mode (A or B)
- ■ Current Display page
- ■ Control settings on the <**SWEEP SETUP**> page
  - □ Sweep Mode
  - □ Start Frequency
  - □ Stop Frequency
  - □ A/B Max and Min Scale

■ Control settings on the <**SWEEP DISP**> page
  □ Scale Mode
  □ Sweep Points
  □ Trigger Mode
  □ Sweep Speed

NOTE: The following settings are stored in the internal non-volatile memory but not included in the setup file.

■ Control settings on the CORRECTION page
  □ OPEN, SHORT, LOAD correction on/off
  □ OPEN, SHORT correction data for all test frequencies
  □ OPEN, SHORT, LOAD correction data at FREQ1, FREQ2, and FREQ3.
■ Control settings on the SYSTEM SETUP page
  □ LCD CONTRAST
  □ BEEPER on/off
  □ BEEPER mode
  □ LANGUAGE
  □ PASSWORD on/off
  □ BUS mode
  □ BUS Address
  □ TALK ONLY on/off
  □ BIAS SOURCE mode
  □ BAUD RATE

Front Panel Operation for File Manage
Perform the following steps to store the control settings.
1) Select and set all control settings.
2) Move the cursor to the **FILE** field, the following softkey will be displayed.
   ■ FILE Manage
3) Press FILE Manage, The following softkeys will be displayed with the file list.
   ■ LOAD
   ■ STORE
   ■ DEL
   ■ ESC
4) Select a file No. from 1 to 520 using the cursor keys.
5) Press STORE. The following softkeys will be displayed.
   ■ YES
   ■ NO
6) Press NO to return to Step 3.
7) Press YES, the message "FILE name:_" will be displayed on the system message line.
8) Enter a record number using the numeric entry keys and press **ENTER** to store the current control settings.

Perform the following steps to load the control settings.
1) Move the cursor to the **FILE** field, the following softkey will be displayed.
   - ■ FILE Manage
2) Press FILE Manage, The following softkeys will be displayed with the file list.
   - ■ LOAD
   - ■ STORE
   - ■ DEL
   - ■ ESC
3) Select a stored file from No.1 to 20, and Press LOAD. The following softkeys will be displayed.
   - ■ YES
   - ■ NO
4) Press NO to return to Step 2.
5) Press YES to load the file.

2.1.8 Useful Tools

TH2828 series displays the measurement data using a six digit floating point display format. The fixed decimal point function is used to display the measurement data using a fixed point display format. This function can also be used to change the number of digits displayed. The display character of measurement display digits can be changed between big font and tiny font.

Front Panel Operation for Useful Tools
Perform the following steps to set fixed decimal point and set measurement display digits font.
1) Move the cursor to the **TOOLS** field. The following softkeys will be displayed.
   - ■ D.P. FIX A
   - ■ D.P. FIX B
   - ■ TINY FONT
2) Press D.P. FIX A to fix the decimal point for the main parameter's data. The ▲ mark will be displayed at the decimal fixed point. Each time D.P. FIX A is pressed, the last digit is dropped, the value is rounded off.
3) Press D.P. FIX B to fix the decimal point for the sub parameter's data. The ▲ mark will be displayed at the decimal fixed point. Each time D.P.FIX B is pressed, the last digit is dropped, the value is rounded off.
4) Press TINY FONT to change the measurement display digits from big font to tiny font. The softkey TINY FONT will change to BIG FONT.
5) Press BIG FONT to change the measurement display digits from tiny font to big font. The softkey BIG FONT will change to TINY FONT.

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

- The measurement function is changed.
- When the deviation measurement (which is set on the MEAS SETUP page) is performed, the deviation measurement function (ΔABS, Δ%, OFF) is changed.

2.2 BIN No. DISP page

When you press LCRZ, and BIN No., the <**BIN No. DISP**> page will be displayed. The bin sorting results are displayed in large characters and the measurement results are displayed in normal characters on the <**BIN No. DISP**> page, and the following measurement controls can be set from the <**BIN No. DISP**> page. (The field in parenthesis is used when this control is set.)

■ Comparator Function ON/OFF (**COMP**)
■ File Manage (**FILE**)
■ Useful Tools (**TOOLS**)

There are four fields on this page: **BIN No. DISP**, **COMP**, **FILE** and **TOOLS** fields. Each control is described in the following paragraphs. This page also provides the following information in the monitor areas (each monitor area looks like a field, but is not). These conditions can be set from the <**MEAS SETUP**> page, and most conditions can be set from the <**MEAS DISP**> page.

■ Measurement Function (**FUNC**)
■ Measurement Range (**RANGE**)
■ Test Frequency (**FREQ**)
■ Oscillator Level (**LEVEL**)
■ DC Bias (**BIAS**)
■ Measurement Speed (**SPEED**)
■ OPEN, SHORT, LOAD on/off setting conditions (**CORR**)

The available fields and the softkeys which correspond to each field on this page are shown in Figure 2-3 and Figure 2-4.

Figure 2-3　Available Fields on the BIN No. DISPLAY Page
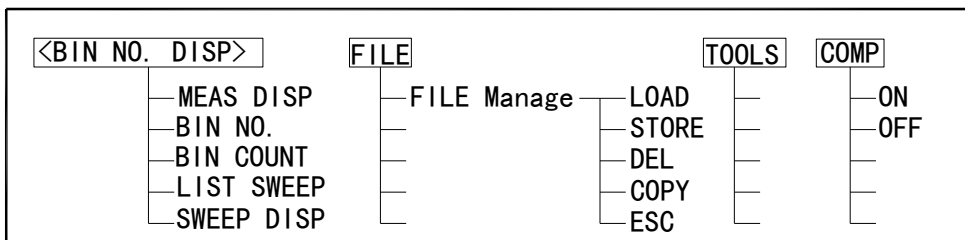
Figure 2-4　Available Softkeys on the BIN No. DISPLAY Page

2.2.1 Comparator Function ON/OFF Description

TH2828 series' 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 and one pair of secondary parameter limits. Also, 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 using TH2828 series is used with a component handler (handler interface option is installed). These limit settings for bin sorting are only set on the <**LIMIT TABLE SETUP**> page. So this **COMP** field allows you to only set the comparator function to ON or OFF.

Front Panel Operation for 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) Use the softkeys to set the comparator function to ON or OFF.

2.2.2 File Manage

Refer to **2.1.7 File Manage**.

2.2.3 Useful Tools

This <**Bin No. DISP**> page provides no tools operation.

2.3   BIN COUNT DISP page

When you press **LCRZ** and BIN COUNT, the <**BIN COUNT DISP**> page will be displayed. On the <**BIN COUNT DISP**> page, the comparator's count results are displayed, and the following measurement controls can be set.

- File Manage (**FILE**)
- Useful Tools (**TOOLS**)

So there are three fields on this page: **BIN COUNT DISP**, **FILE** and **TOOLS** fields. This page also provides the following information in monitor areas (the monitor areas look like fields, but they are not). These conditions can be set from the <**LIMIT TABLE SETUP**> page.

- Nominal Value
- Measurement Function
- Bin Sorting Low/High Limits

The available fields and the softkeys which corresponded to each field on this page are shown in Figure 2-5 and Figure 2-6.
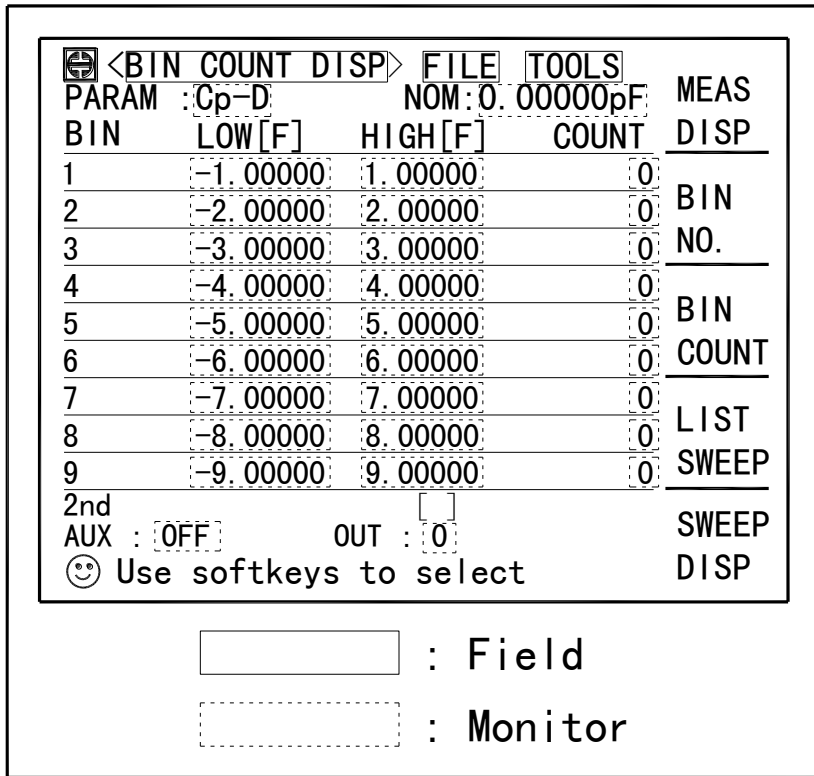
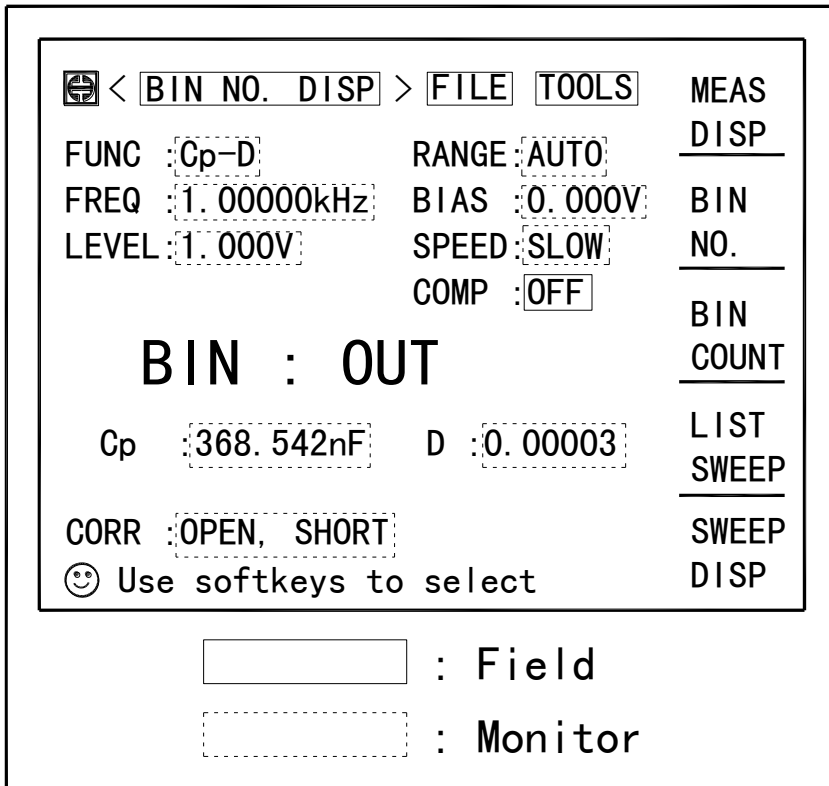**Figure 2-5   Available Fields on the BIN COUNT DISPLAY Page**
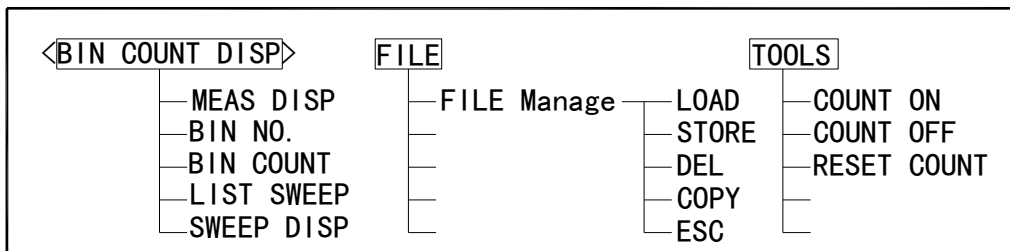
Figure 2-6   Available Softkeys on the BIN COUNT DISPLAY Page

2.3.1 File Manage

Refer to **2.1.7 File Manage.**

2.3.2 Useful Tools

TH2828 series has bin counting capability. When many devices are being sorted into bins using the comparator function, the number of devices sorted into each bin is counted. The maximum count is 999999, the overflow message "----" will be displayed when this value is exceeded. The bin counter will still be operating, so you can only get the count data via GPIB.

Perform the following steps to set the counter function to ON or OFF from the <**BIN COUNT DISP**> page.

1) Move the cursor to **TOOLS** field on the <**BIN COUNT DISP**> page. The following softkeys will be displayed.
   - COUNT ON
   - COUNT OFF
   - RESET COUNT
2) Press COUNT ON to set the counter function to ON. An arrow ► will be displayed at the left of COUNT.
3) Press COUNT OFF when you want to set the counter function to OFF. The arrow ► will disappear.
4) Press RESET COUNT to reset all counts to zero. The message "Resetting count. Sure?" will be displayed on the system message line, and YES and NO softkeys will be displayed. Press YES.

2.4　LIST SWEEP DISP Page

TH2828 series' LIST SWEEP function permits entry of up to ten frequencies, signal levels, or DC bias levels, and the measurement limits on the <**LIST SWEEP SETUP** >page.

When you press **LCRZ** and LIST SWEEP, the <**LIST SWEEP DISP**> page will be displayed. On the <**LIST SWEEP DISP**> page, the sweep points are swept and the measurement results are compared to the limits. During a sweep, an arrow ► will appears on the left side of the current measuring list sweep point. 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**)
- File Manage (**FILE**)
- Useful Tools (**TOOLS**)

So there are four fields on this page: **LIST SWEEP DISP**, **MODE**, **FILE** and **TOOLS** fields. The list sweep point cannot be set from this page, but can only be set from the <**LIST SWEEP SETUP**> page.
The available fields and the softkeys which corresponded to each field on this page are shown in Figure 2-7 and Figure 2-8.

```
⊕ <LIST SWEEP DISP> FILE TOOLS      MEAS
MODE :SEQ                           DISP
  FREQ[Hz]   Cp[F]      D[ ]    CMP
  1.00000k  -17.4665p  0.19743   L   BIN
  2.00000k  -13.2563p  0.45142   L   NO.
  3.00000k   -6.62862p 0.09372   L
  4.00000k   -3.08588p 0.82864   L   BIN
  5.00000k   -2.94303p 0.58971   L   COUNT
  6.00000k    4.52808p 1.15149   L
  7.00000k    5.50717p 0.30216   L   LIST
  8.00000k    4.15299p 0.21701   L   SWEEP
  9.00000k    4.80234p 0.20403   L
 10.0000k    1.31484p 2.12675   L   SWEEP
 ☺ Use softkeys to select           DISP
```

```
┌──────────┐ : Field
└──────────┘
┌ ─ ─ ─ ─ ─┐ : Monitor
└ ─ ─ ─ ─ ─┘
```

Figure 2-7   Available Fields on the LIST SWEEP DISP Page

```
<LIST SWEEP DISP>    FILE                    MODE
       ─MEAS DISP       ─FILE Manage─LOAD       ─SEQ
       ─BIN NO.         ─            ─STORE      ─STEP
       ─BIN COUNT       ─            ─DEL
       ─LIST SWEEP      ─            ─COPY
       ─SWEEP DISP      └            └ESC
```

Figure 2-8   Available Softkeys on the LIST SWEEP DISP Page

2.4.1   List Sweep Mode

TH2828 List Sweep Measurement function permits up to 10 test frequencies, oscillator levels, or DC bias points to be automatically measured. There are two measurement modes for list sweep measurements: sequential (SEQ) mode and step (STEP) mode. In the case of SEQ mode, when TH2828 series is triggered once, all sweep points are automatically swept. In the case of the STEP mode, each time the TH2828 series is triggered the sweep point is swept by one step.

Front Panel Operation for Setting the Sweep 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).

2.4.2   File Manage
Refer to **2.1.7 File Manage**.

2.4.3   Useful Tools
There are no tools on this <**LIST SWEEP DISP**> page.

2.5 SWEEP DISP Page

When you press **LCRZ**, and SWEEP DISP, the <**SWEEP DISP**> page will be displayed. TH2828S has a sweep analysis function which permits up to 960 test frequency, signal level, or bias level points. These sweep points are automatically measured and the measurement results are displayed with double curves of measurement parameter. On the <**SWEEP DISP**> page, the following control settings of the sweep analysis can be set. (Each field in parenthesis is used when that control is set.)

■ File Manage (**FILE**)
■ Useful Tools (**TOOLS**)

There are following fields on this page: <**SWEEP DISP**>, **FILE** and **TOOLS** fields. 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 2-9 and Figure 2-10.

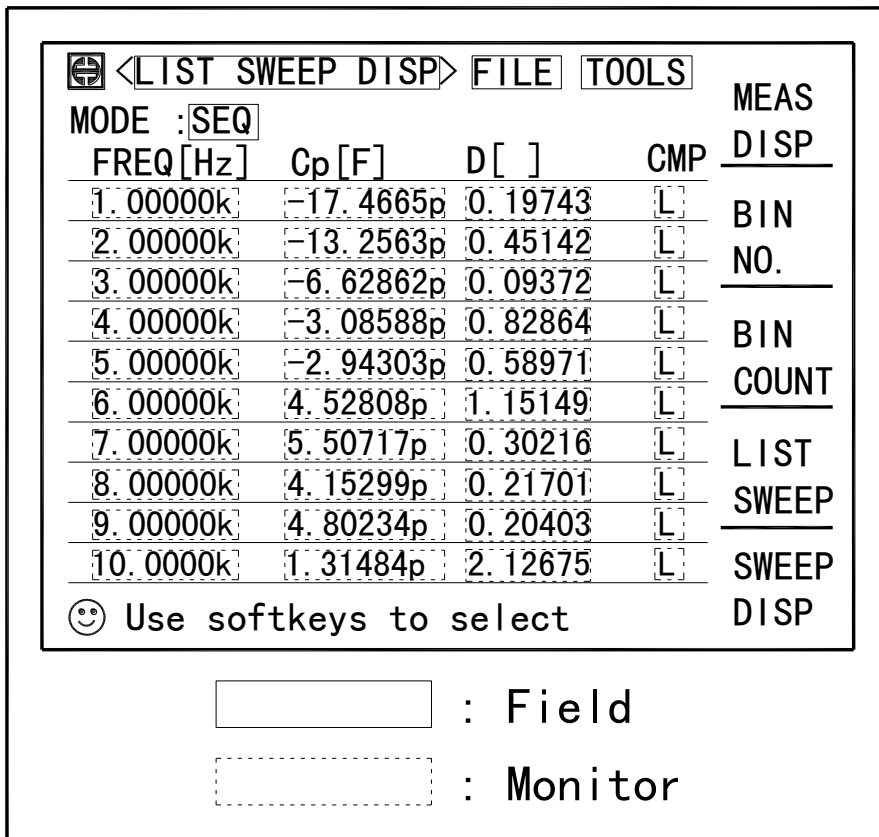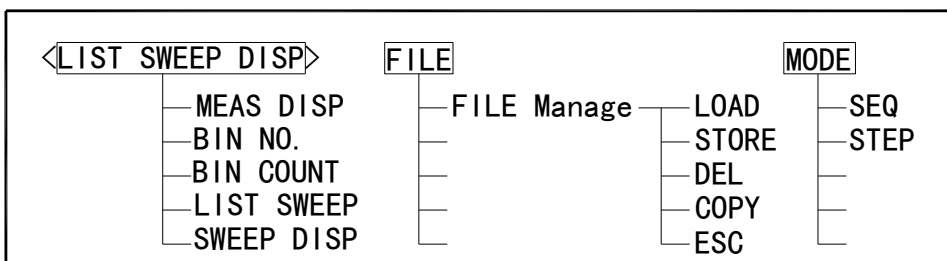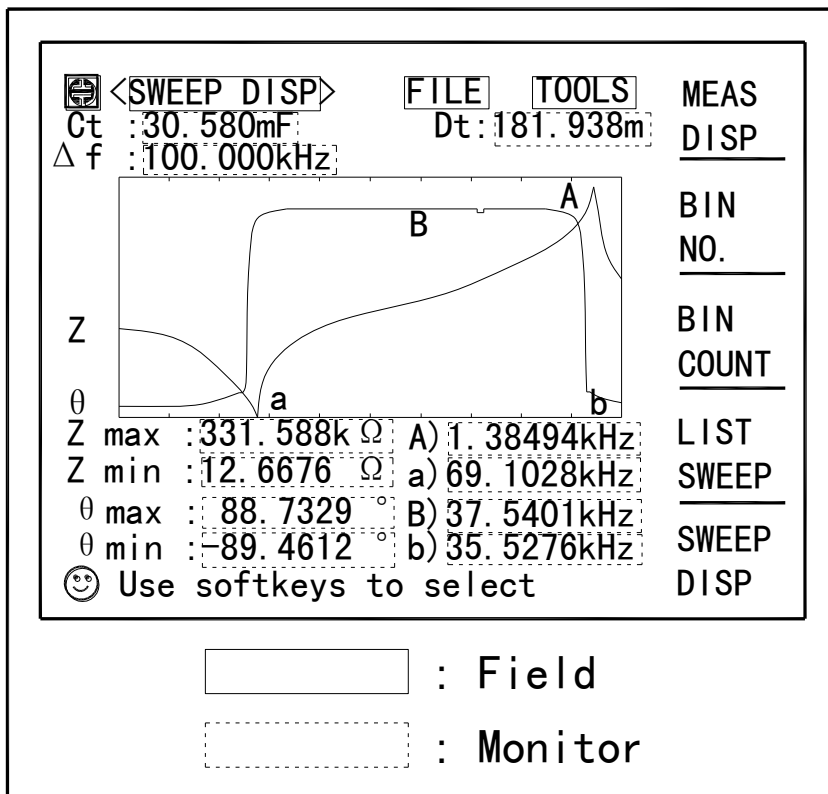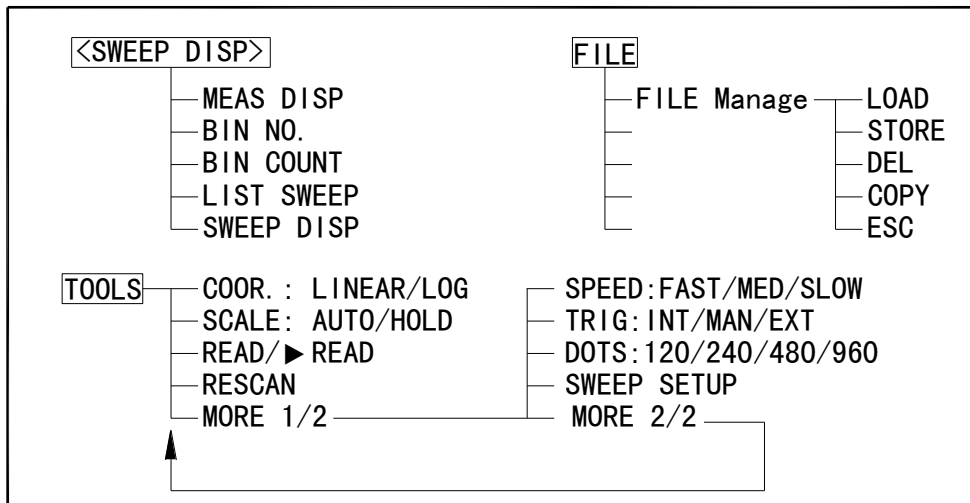**Figure 2-9   Available Fields on the SWEEP DISP Page**

```
┌─────────────────────────────────────────────────────────────────────┐
│  <SWEEP DISP>                      FILE                              │
│              ─ MEAS DISP                   ─ FILE Manage ─ LOAD      │
│              ─ BIN NO.                      ─               ─ STORE  │
│              ─ BIN COUNT                    ─               ─ DEL    │
│              ─ LIST SWEEP                   ─               ─ COPY   │
│              ─ SWEEP DISP                   ─               ─ ESC    │
│                                                                     │
│  TOOLS ─ COOR. : LINEAR/LOG       ─ SPEED:FAST/MED/SLOW             │
│        ─ SCALE: AUTO/HOLD         ─ TRIG:INT/MAN/EXT               │
│        ─ READ/▶READ               ─ DOTS:120/240/480/960           │
│        ─ RESCAN                   ─ SWEEP SETUP                    │
│        ─ MORE 1/2 ─────           ─ MORE 2/2 ─                     │
│             ▲                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 2-10 Available Softkeys on the SWEEP DISP Page

2.5.1   File Manage

Refer to **2.1.7 File Manage**.

2.5.2   Useful Tools

Perform the following steps to set the control functions on the <**SWEEP DISP**> page.

1) Move the cursor to the **TOOLS** field. The following softkeys will be displayed.
   - ■ COOR.
     This softkey is used to switch the coordinates between LOG and LINEAR.
   - ■ SCALE
     This softkey is used to switch the scale mode between AUTO and HOLD. In the AUTO scale mode, the Maximum/Minimum value for Primary/Secondary parameter will be updated according to the actual Maximum/Minimum measured results. You can inspect the current updated Maximum/Minimum value for Primary/Secondary parameter on the <**SWEEP SETUP**> page. In the HOLD scale mode, the preset Maximum/Minimum value for Primary/Secondary parameter on the <**SWEEP SETUP**> page will be used.
   - ■ READ
     Press READ, a ▶ marker will be displayed on the left of READ. The instrument halts the current scan, and you can use the cursor arrow keys to read the measurement results. UP/DOWN key provides a skip of 8 sweep points; LEFT/RIGHT key provides a skip of 1 sweep point. Press READ again, the ▶ marker disappears, and the scan goes on.

■ RESCAN
   Press this softkey to stop and clear the current scan, and start a new scan.
■ MORE 1/2

2) Press MORE 1/2 to display the following softkeys.
   ■ SPEED
      Press this softkey to select the sweep speed, FAST, MED and SLOW can be selected.
   ■ TRIG
      Press this softkey to set the trigger mode to INT, MAN, or EXT.
   ■ DOTS
      Press this softkey to set the sweep points to be scanned, 120, 240, 480 and 960 can be selected.
   ■ SWEEP SETUP
      This softkey is used as a shortcut to display the <**SWEEP SETUP**> page.
   ■ MORE 2/2
      Press this softkey to return to the previous menu.

Chapter 3 SETUP Pages

This chapter describes all the setup pages in the **SETUP** menu key.

3.1   MEAS SETUP page

When you press **SETUP**, the <**MEAS SETUP**> page will be displayed. On this <**MEAS SETUP**> page, all of the following measurement control functions can be set. (Each field in parenthesis is used when each control is set.)

- Measurement Function (**FUNC**)
- Measurement Range (**RANGE**)
- Test Frequency (**FREQ**)
- Oscillator Level (**LEVEL**)
- DC Bias (**BIAS**)
- Measurement Speed (**SPEED**)
- Trigger Mode (**TRIG**)
- Automatic Level Control (**ALC**)
- Bias Current Isolation Mode ON/OFF (**ISO**)
- Averaging Rate (**AVG**)
- Voltage Level Monitor ON/OFF (**Vm**)
- Current Level Monitor ON/OFF (**Im**)
- Delay Time (**DELAY**)
- Internal Resistance (**OUT-R**)
- File Manage (**FILE**)
- Useful Tools (**TOOLS**)
- Deviation Measurement A Mode (**DEV A**)
- Deviation Measurement B Mode (**(DEV) B**)
- Reference Value for the Deviation Measurement A (**REF A**)
- Reference Value for the Deviation Measurement B (**(REF) B**)

Some fields on the <**MEAS SETUP**> page are the same as the fields on the <**MEAS DISP**> page as follows. So, these fields are not described in this Chapter, and the other functions on the <**MEAS SETUP**> page are described in the following paragraphs.
- Measurement Function (**FUNC**)
- Measurement Range (**RANGE**)
- Test Frequency (**FREQ**)
- Oscillator Level (**LEVEL**)
- DC Bias (**BIAS**)
- Measurement Speed (**SPEED**)

The available fields and the softkeys which corresponded to each field on this page are shown in Figure 3-1 and Figure 3-2.
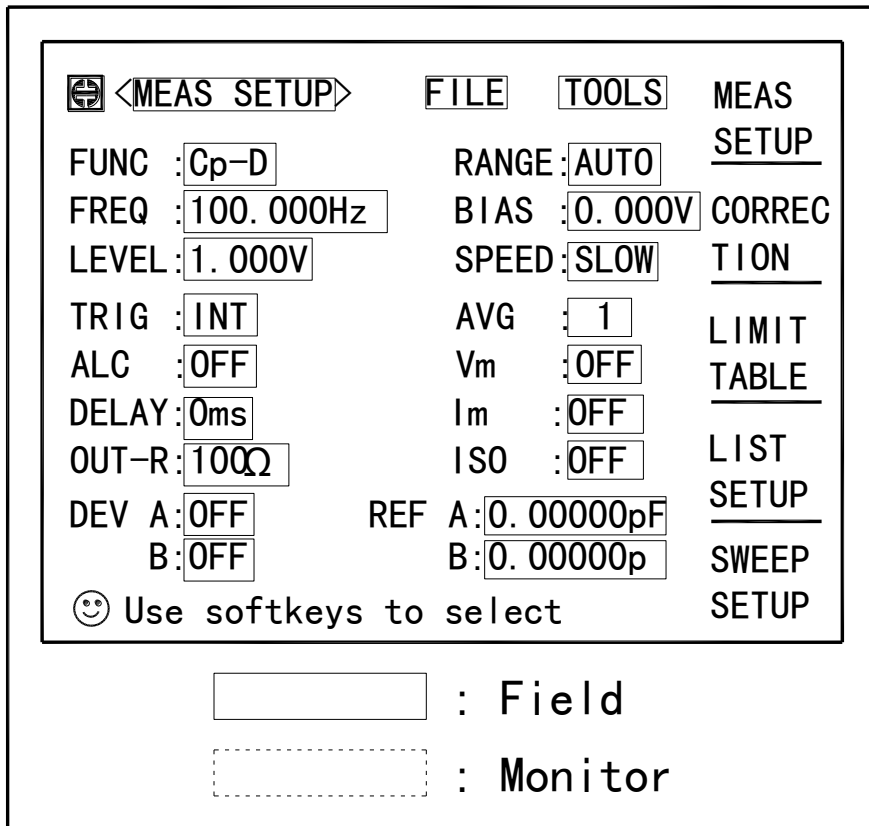

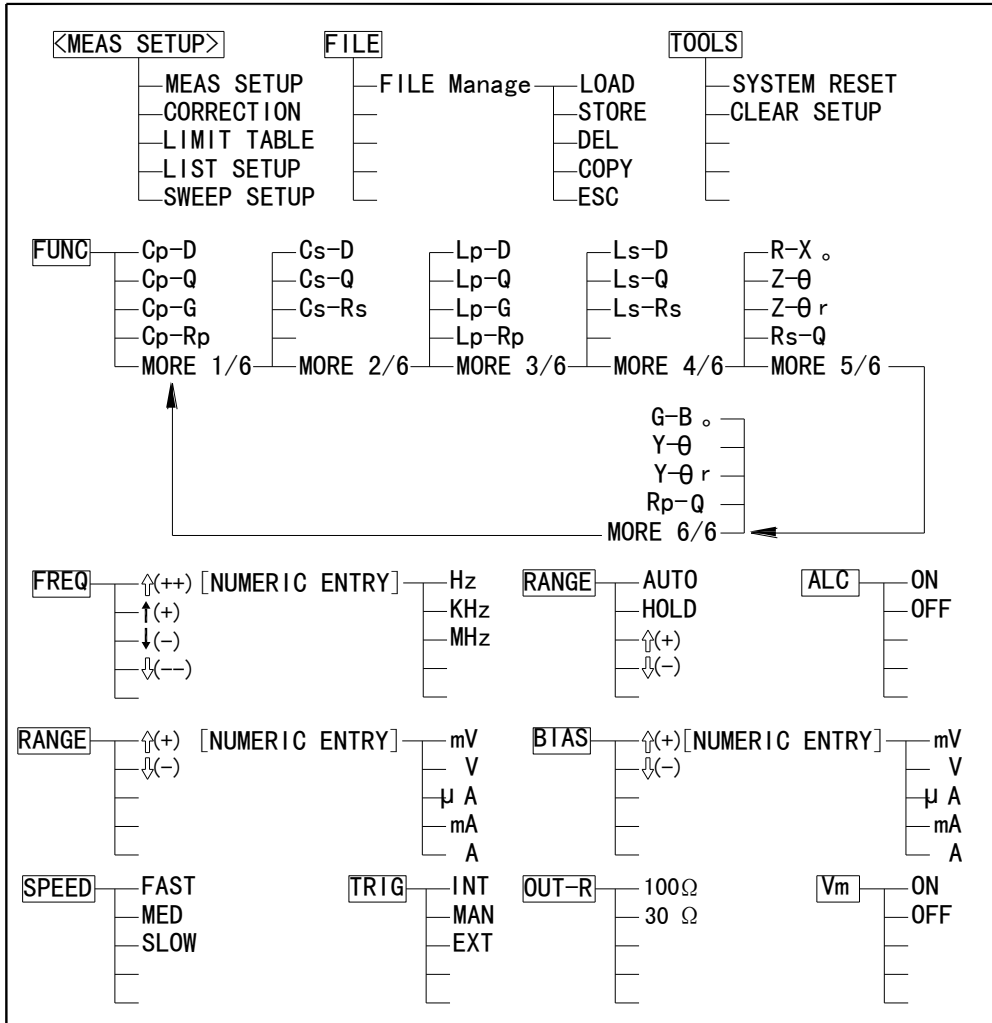**Figure 3-1   Available Fields on the MEAS SETUP Page**

```
⟨MEAS SETUP⟩           FILE                        TOOLS
        ─MEAS SETUP       ─FILE Manage─LOAD          ─SYSTEM RESET
        ─CORRECTION       ─            ─STORE        ─CLEAR SETUP
        ─LIMIT TABLE      ─            ─DEL          ─
        ─LIST SETUP       ─            ─COPY         ─
        ─SWEEP SETUP      ─            ─ESC          ─

FUNC─  ─Cp-D         ─Cs-D         ─Lp-D         ─Ls-D         ─R-X 。
       ─Cp-Q         ─Cs-Q         ─Lp-Q         ─Ls-Q         ─Z-θ
       ─Cp-G         ─Cs-Rs        ─Lp-G         ─Ls-Rs        ─Z-θ r
       ─Cp-Rp        ─             ─Lp-Rp        ─             ─Rs-Q
       ─MORE 1/6    ─MORE 2/6     ─MORE 3/6     ─MORE 4/6     ─MORE 5/6─

                                        G-B 。 ─
                                        Y-θ    ─
                                        Y-θ r  ─
                                        Rp-Q   ─
                                        MORE 6/6 ◄

FREQ─  ─⇧(++) [NUMERIC ENTRY]─Hz      RANGE─AUTO        ALC─ON
       ─↑(+)                  ─KHz         ─HOLD           ─OFF
       ─↓(-)                  ─MHz         ─⇧(+)
       ─⇩(--)                              ─⇩(-)

RANGE─ ─⇧(+)  [NUMERIC ENTRY]─mV      BIAS─⇧(+)[NUMERIC ENTRY]─mV
       ─⇩(-)                  ─V           ─⇩(-)              ─V
                              ─μ A                            ─μ A
                              ─mA                             ─mA
                              ─A                              ─A

SPEED─ ─FAST          TRIG─INT       OUT-R─100Ω         Vm─ON
       ─MED               ─MAN            ─30 Ω            ─OFF
       ─SLOW              ─EXT
```

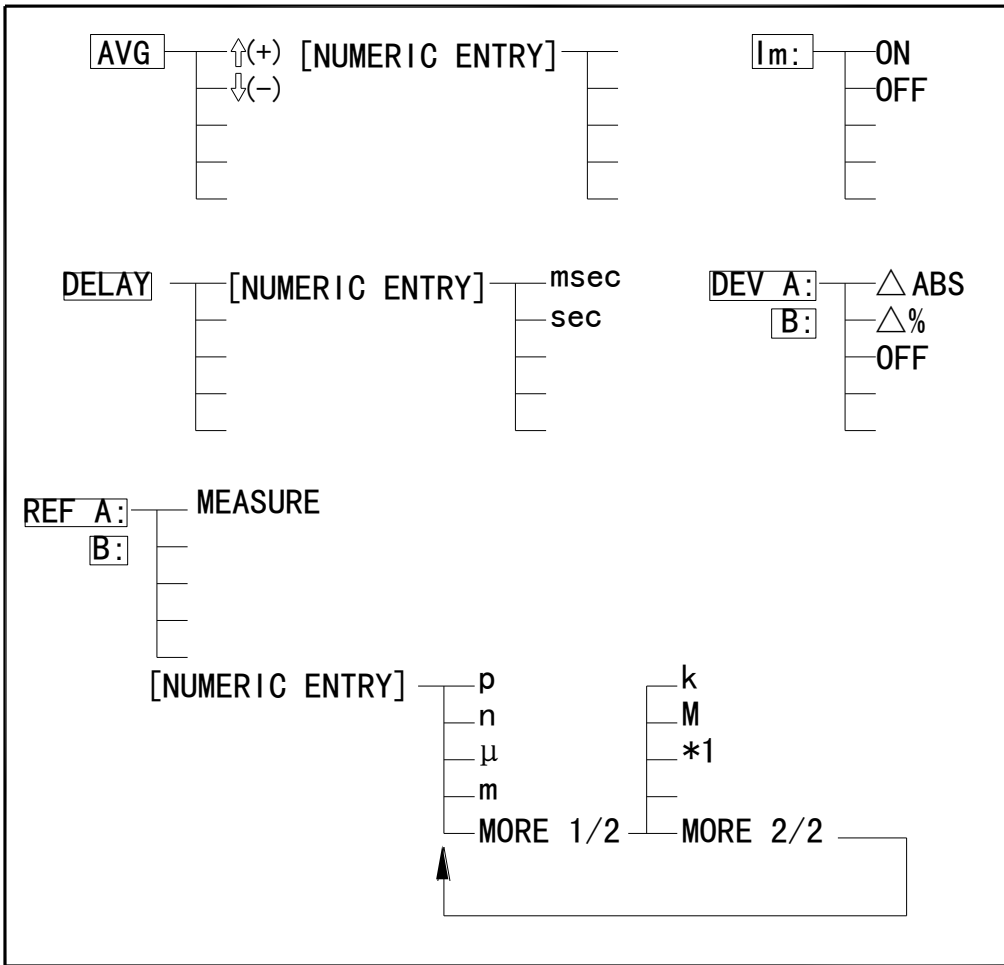**Figure 3-2   Available Softkeys on the MEAS SETUP Page (1/2)**

Figure 3-2   Available Softkeys on the MEAS SETUP Page (2/2)

3.1.1 Trigger Mode

TH2828 series has four trigger modes: INTernal, EXTernal, MANual, and BUS.
When the trigger mode is set to INT trigger mode, TH2828 series continuously repeats measurements.

When the trigger mode is set to MAN trigger mode, TH2828 series performs a single measurement every time 〔**TRIGGER**〕 on the front panel is pressed.
When the trigger mode is set to EXT trigger mode, TH2828 series performs a single measurement every time a positive going TTL pulse is applied to the Handler Interface connector on the rear panel.

When the trigger mode is set to BUS trigger mode, TH2828 series performs a single measurement every time the TRIGGER command is sent to TH2828 series via GPIB. Then the BUS trigger mode cannot be set on the front panel.

NOTE: TH2828 series ignores triggers that are applied while a measurement is in progress. Trigger TH2828 series after the measurement is completed. Select the EXT trigger mode when TH2828 series is triggered via an optional interface.

Front Panel Operation for Setting the Trigger Mode

Perform the following steps to set the trigger mode except for in the BUS TRIG mode. To set the trigger mode in the BUS TRIG mode, the **TRIGger:SOURce BUS** command should be sent via GPIB.
1) Move the cursor to the **TRIG** field. The following softkeys will be displayed.
   - ■ INT
   - ■ MAN
   - ■ EXT
2) Set the trigger mode using the softkeys.

3.1.2 Automatic Level Control Function

The automatic level control (ALC) function regulates the actual test level (voltage across the DUT, or current through the DUT) to your desired level. So by using this function, the test signal voltage or current level at the DUT can be held constant.

When the automatic level control function is used, the oscillator level settings are limited as follows.
Voltage Level: 10 mV$_{rms}$ to 1 V$_{rms}$
Current Level: 100 μA$_{rms}$ to 10 mA$_{rms}$

Note: When the ALC function is active, if the oscillator level setting exceeds the above limits, the ALC function is automatically set to OFF and the setting value is entered as a normal oscillator level.

Front Panel Operation for Setting the Automatic Level Control Function

Perform the following steps to set the automatic level control function to ON or OFF.
1) Move the cursor to the **ALC** field. The following softkeys will be displayed.
   ■ ON
   ■ OFF
2) Press ON to set the automatic level control function to ON. Press OFF to set the automatic level control function to OFF.

3.1.3   Bias Current Isolation Function

This bias current isolation function prevents the DC current from affecting the measurement input circuit. The ISO field allows you to set the bias current isolation function to ON or OFF. When the bias current isolation function is set to ON, the bias current through the device can be up to 100 mA; When the bias current isolation function is set to OFF, the current through the device can be set to the values listed in Table3-1. When the current through a device exceeds the values listed in Table, normal measurement can't be performed.

Table 3-1   Maximum DC Bias Current

Measurement Range	10Ω	30Ω	100 Ω	300 Ω	1 kΩ	3 kΩ	10 kΩ	30 kΩ	100 kΩ
Max. current	2 mA	2 mA	2 mA	2 mA	1 mA	300µA	100µA	30µA	10µA

Note: The bias current isolation function influences the measurement accuracy. So when measuring a high impedance device at low frequency with low bias current, the bias current isolation function should be set to OFF.

Front Panel Operation for Setting the Bias Current Isolation Function

Perform the following steps to set the bias current isolation function to ON or OFF when high power mode is set to ON.
1) Move the cursor to the **ISO** field. The following softkeys will be displayed.
   ■ ON
   ■ OFF
2) Press ON to set the bias current isolation function to ON. Press OFF to set the bias current isolation function to OFF.

3.1.4   Averaging Rate

TH2828 series' averaging rate function arithmetically averages the results of two or more A/D conversions. The number of conversions averaged can be set from 1 to 255, in steps of 1.

Front Panel Operation for 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.
   ■   ⇧ (+)

   This softkey is used to increase the averaging rate.

   ■   ⇩ (-)

   This softkey is used to decrease the averaging rate.
2)   Use the softkeys to set the averaging rate, or enter the averaging rate using the numeric entry keys, and **ENTER**.

3.1.5   Level Monitor Function

The level monitor function allows you to monitor the actual voltage level across the device under test or the actual current level though the device under test. The voltage monitor value is only displayed on the <**MEAS DISP**> page at **Vm** monitor area. The current monitor value is only displayed on the <**MEAS DISPLAY**> page at **Im** monitor area.

NOTE: The correction function interacts with the level monitor function. So the monitor value may be changed by the correction data change or the OPEN/SHORT/LOAD correction ON/OFF condition change**.**

Front Panel Operation for Setting the Level Monitor Function
Perform the following steps to set the level monitor function to ON or OFF.
1)   Move the cursor to the **Vm** field. The following softkeys will be displayed.
   ■   ON
   ■   OFF
2)   Press ON to set the voltage level monitor function to ON. Press OFF to set the voltage level monitor function to off.
3)   Move the cursor to the **Im** field. The following softkeys will be displayed.
   ■   ON
   ■   OFF
4)   Press ON to set the current level monitor function to ON. Press OFF to set the current level monitor function to OFF.

3.1.6 Delay Time

TH2828 series' delay time function allows you to set a trigger delay so TH2828 series will delay the start of the measurement after it is triggered. (When the list sweep measurement is performed, TH2828 series will delay the start of the measurement at each sweep point using the trigger delay time.) The trigger delay time can be set from 0 s to 60 s in 1 ms steps. This function is useful if a component handler triggers the TH2828 series before stable contact is made with the device under test.

Front Panel Operation for 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

3.1.7 Output Resistance

TH2828 series has two kinds of output resistances (or output impedances) for choice 100 Ω and 30 Ω. It is useful to make it compatible with other instrument when an inductor is measured.

Front Panel Operation for Setting the Output Resistance
Perform the following steps to set the output resistance.
1) Move the cursor to the **OUT-R** field. The following softkeys will be displayed.
    - ■ 100 Ω
    - ■ 30 Ω
2) Press 100 Ω to select the 100 Ω output impedance and press 30 Ω to select the 30Ω output impedance.

3.1.8 Deviation Measurement Functions

The deviation measurement function allows you to display the deviation value instead of the actual measurement value. The deviation value is the value calculated by taking the difference between the actual measurement value and a previously stored reference value. This function is useful when the change of a component's value versus changes in temperature, frequency, bias, etc. are being observed. Deviation measurements can be made for either or both primary parameter and/or secondary parameter measurements. There are two types of deviation measurements.

- ■ ΔABS (Delta ABSolute) deviation measurement
  The difference between the measured value of the DUT and a previously stored reference value are displayed. The formula used to calculate the deviation is as follows.

ΔABS = X－Y

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

■   Δ% (Delta percent) deviation measurement
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.

Δ% = (X－Y) / Y ×100 [%]

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

Front Panel Operation for the Deviation Measurement Function

Perform the following steps to execute the deviation measurement function.
1) Move the cursor to the **REF A** field to enter the reference value for the primary parameter. The following softkey will be displayed.
    ■   MEASURE
    When the device is to be used as the reference value is connected, pressing this   MEASURE, TH2828 series measures the device, and the measurement results are entered as a reference value for REF A and REF B values.
2) Enter the reference value for the primary parameter using MEASURE or the numeric entry keys.
3) Move the cursor to the **(REF) B** field to enter the reference value for the secondary parameter. The following softkey will be displayed.
    ■   MEASURE
    When the device is to be used as the reference value is connected, pressing MEASURE, TH2828 series measures the device, and the measurement results are entered as a reference value for REF A and REF B values.
4) Enter the reference value for the secondary parameter using MEASURE or the numeric entry keys. If the reference values for A and B are entered using MEASURE in step 2, skip this step.
5) Move the cursor to the **DEV A** field. The following softkeys will be displayed.
    ■   ΔABS
    ■   Δ%
    ■   OFF
6) Select and press a softkey to select the deviation mode for the primary parameter.

7) Move the cursor to the **(DEV) B** field. The following softkeys will be displayed.
   - ΔABS
   - Δ%
   - OFF
8) Select and press a softkey to select the deviation mode for the secondary parameter.

3.1.9 File Manage
Refer to **2.1.7 File Manage**.

3.1.10 Useful Tools
The SYSTEM RESET function allows you to reset TH2828 series, the CLEAR SETUP function allows you to set all of the operation on the <**MEAS SETUP**> page to the power on default settings.

Front Panel Operation for the SYSTEM RESET and CLEAR SETUP Function

Perform the following steps to reset the system or load the power on default settings on the <**MEAS SETUP PAGE**>.
1) Move the cursor to the **TOOLS** field. The following softkeys will be displayed.
   - SYSTEM RESET
   - CLEAR SETUP
2) Press SYSTEM RESET to reset TH2828 series and press CLEAR SETUP to set all of the control settings on the <**MEAS SETUP**> page to the power-on default settings.

3.2　CORRECTION Page

When you press **SETUP**, and CORRECTION, the <**CORRECTION**> page will be displayed. On the <**CORRECTION**> page, the OPEN, SHORT, LOAD correction for correcting the stray admittance, the residual impedance, and the other errors can be performed. The correction function has two kinds of correction methods. In one method the open and short correction can be performed at all of the frequency points using the interpolation method, and in the other method the open, short, and load correction can be performed at the frequency points you specify.

The following operations can be performed from this page. The field is in parenthesis.
- OPEN Correction (**OPEN**)
- SHORT Correction (**SHORT**)
- LOAD Correction (**LOAD**)
- Cable Length Selection (**CABLE**)
- Multi/Single Correction Mode Selection (**MODE**)
- Measurement Function for LOAD Correction (**FUNC**)
- Frequency 1, 2, 3 for OPEN, SHORT, LOAD Correction (**FREQ1**, **FREQ2**, and **FREQ3**)
- Reference Values (A, B) at each three frequencies for LOAD Correction (**REF A**, **B**)
- File Manage (**FILE**)
- Useful Tools (**TOOLS**)

There are eighteen available fields on this page: <**CORRECTION**>, **FILE**, **TOOLS**, **OPEN**, **SHORT**, **LOAD**, **CABLE**, **MODE**, **FUNC**, **FREQ1**, **REF A**, **B**, **FREQ2**, **REF A**, **B**, **FREQ3**, **REF A**, and **B**.

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
- Channel Number on the MULTI Correction Mode

The actual measurement values for LOAD Correction can be measured from the FREQ1, FREQ2, or FREQ3 fields on this page.

The available fields and the softkeys which are corresponded with each field on this page are shown in Figure 3-3 and Figure 3-4.

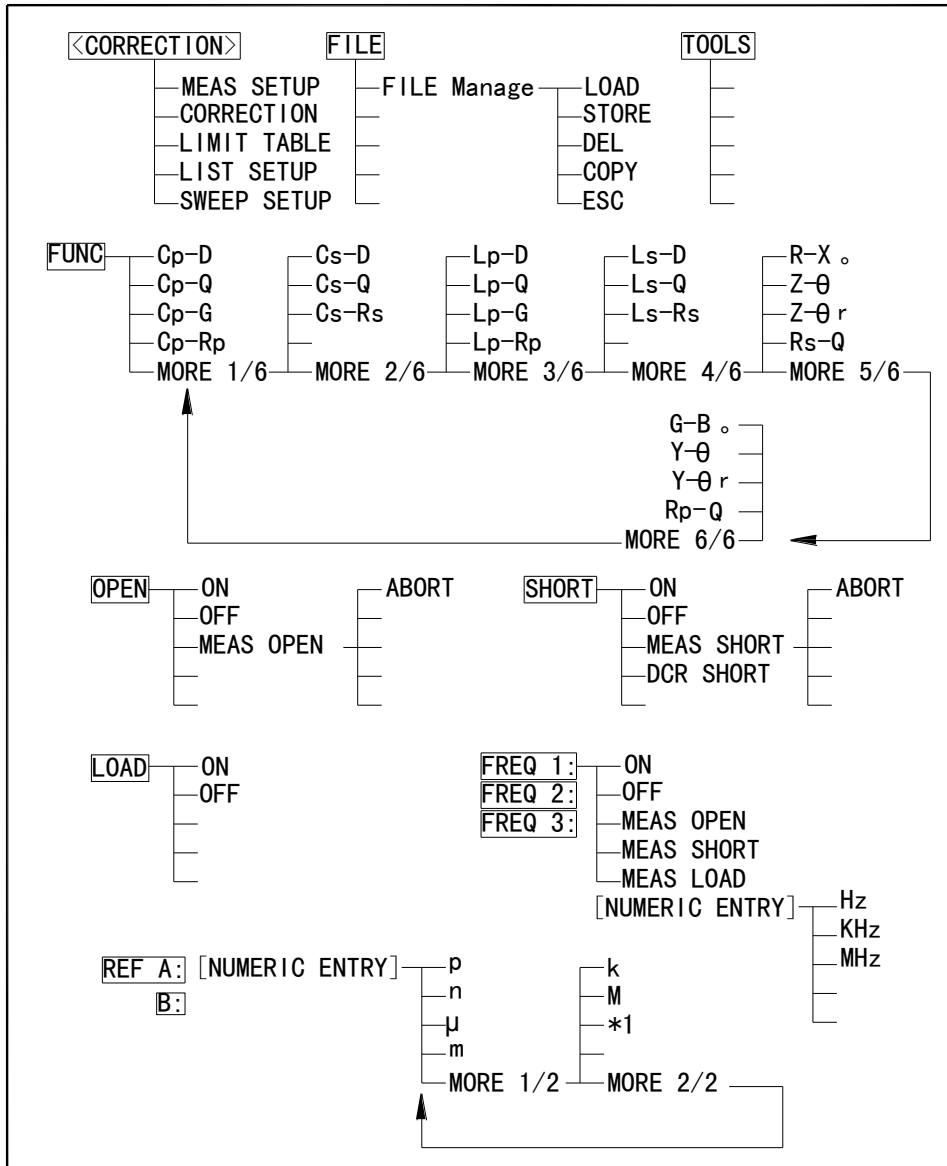**Figure 3-3   Available Fields on the CORRECTION Page**

Figure 3-4   Available Softkeys on the CORRECTION Page

3.2.1 OPEN Correction

TH2828 series' OPEN correction capability cancels errors due to the stray admittance (G, B) in parallel with the device under test (Refer to Figure 3-5).
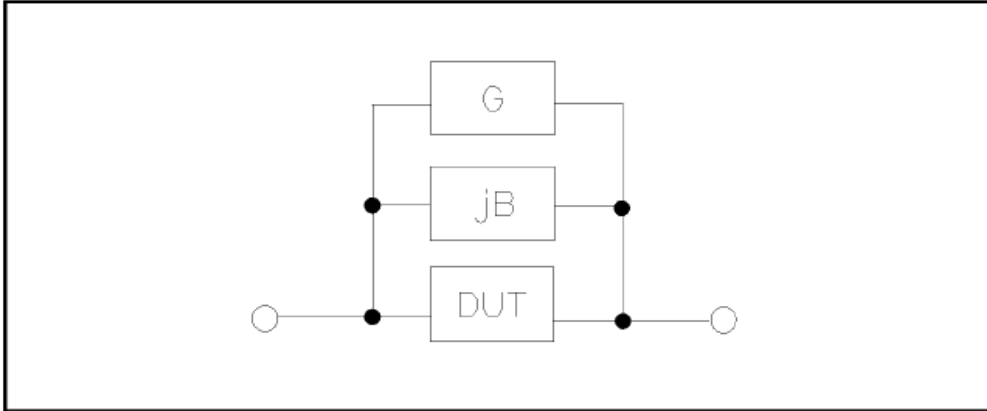

Figure 3-5   Stray Admittance

TH2828 series uses two kinds of OPEN correction data as follows.

■ The OPEN correction data is taken at all 48 preset frequency points, independent of the test frequency you set. Except for those 48 frequency points, the OPEN correction data for each measurement point over the specified range is calculated using the interpolation method. The following is a list of the 48 preset frequency points. To take the OPEN correction data at the preset frequencies, MEAS OPEN displayed when the cursor is moved to the OPEN field, is used.

		100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
		120 Hz	1.2 kHz	12 kHz	120 kHz	
		150 Hz	1.5 kHz	15 kHz	150 kHz	
20	Hz	200 Hz	2 kHz	20 kHz	200 kHz	
25	Hz	250 Hz	2.5 kHz	25 kHz	250 kHz	
30	Hz	300 Hz	3 kHz	30 kHz	300 kHz	
40	Hz	400 Hz	4 kHz	40 kHz	400 kHz	
50	Hz	500 Hz	5 kHz	50 kHz	500 kHz	
60	Hz	600 Hz	6 kHz	60 kHz	600 kHz	
80	Hz	800 Hz	8 kHz	80 kHz	800 kHz	

■ The OPEN correction data which is taken at the frequency points you specify allows you to set up to three frequency points in the **FREQ1**, **FREQ2**, and **FREQ3** fields. To take the OPEN correction data at the frequency points you specify, MEAS OPEN displayed when the cursor is moved to the **FREQ1**, **FREQ2**, or **FREQ3** field, is used.

Front Panel Operation for the Open Correction

There are two procedures: OPEN correction using the interpolation method, and OPEN correction at the frequency points you specify.

Perform the following steps to execute the OPEN correction at all frequency points using the interpolation method. When you want to execute the OPEN correction at a single frequency point, refer to "LOAD Correction".

1) Move the cursor to the **OPEN** field. The following softkeys will be displayed.
   - ON
   - OFF
   - MEAS OPEN
2) Connect your test fixture to the UNKNOWN Terminals without connecting the device under test.
3) Press MEAS OPEN. TH2828 series will measure the OPEN admittance (capacitance, and inductance) at the preset frequency points. The time required to measure the open correction data is approximately 75 s. During the OPEN correction measurement, the following softkey is available.
   - ABORT

   This softkey is used to stop an OPEN correction data measurement. The previous OPEN correction data will still be stored.
4) Press ON to enable and perform the OPEN correction calculations on subsequent measurements using the OPEN interpolation correction data when the **FREQ1**, **FREQ2**, and **FREQ3** fields are set to OFF. When the **FREQ1**, **FREQ2**, and **FREQ3** fields are set to ON, and the test frequency is equal to FREQ1/2/3, the OPEN correction data at FREQ1/2/3 is used.
5) Press OFF to disable the OPEN correction calculations on subsequent measurements.

3.2.2 SHORT Correction

TH2828 series' SHORT correction capability corrects for the residual impedance (R, X) in serial with the device under test (Refer to Figure 3-6).
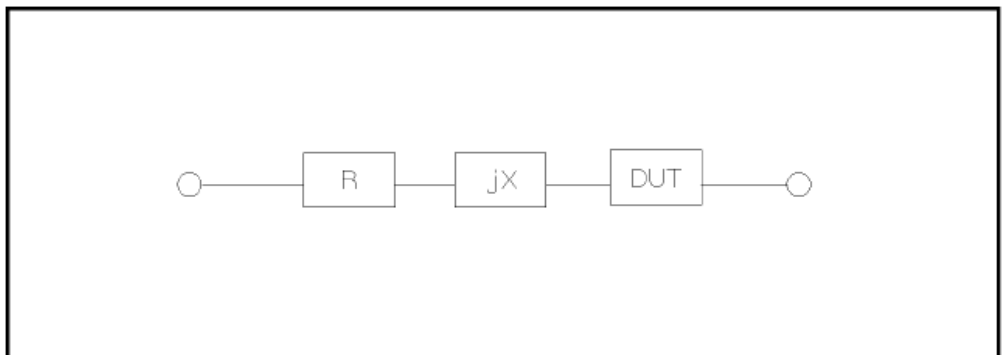

Figure 3-6   Residual Impedance

TH2828 uses the following two kinds of SHORT correction data.

■ The SHORT correction data is taken at all 48 preset frequency points independent of the test frequency you set, and the SHORT correction data for each measurement point other than those present frequency points are calculated using the interpolation method. All preset frequency points (48 frequency points) are as same as the preset frequencies for the OPEN correction using the interpolation method.

To take the SHORT correction data at the preset frequency points, MEAS SHORT, which is displayed when the cursor is moved to the **SHORT** field, is used.

■ The SHORT correction data which is taken at the frequency points you specify. You can set up to three frequency points in the **FREQ1**, **FREQ2**, and **FREQ3** fields.

To take the SHORT correction data at the frequency points you specify, MEAS SHORT, which is displayed when the cursor is moved to the **FREQ1**, **FREQ2**, or **FREQ3** field, is used.

Front Panel Operation for 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 "LOAD Correction".

1) Move the cursor to the **SHORT** field. The following softkeys will be displayed.
   - ■ ON
   - ■ OFF
   - ■ MEAS SHORT
2) Connect the test fixture to the UNKNOWN Terminals, and short the measurement contacts together.
3) Press MEAS SHORT. TH2828 series will measure the short impedance (inductance and resistance) at the preset frequency points. The time required to measure the short correction data is approximately 75 s. During the SHORT correction measure cycle, the following softkey is available.
   - ■ ABORT

   This softkey is used to stop the short correction data measurement. The previous SHORT correction data is still stored.
4) Press ON to perform the SHORT correction calculations on subsequent measurements when the **FREQ1**, **FREQ2**, and **FREQ3** fields are set to OFF. When the **FREQ1**, **FREQ2**, and **FREQ3** fields are set to ON, and the test frequency is equal to FREQ1/2/3, the SHORT correction data at FREQ1/2/3 is used.
5) Press OFF to halt SHORT correction calculations on subsequent measurements.

3.2.3   LOAD Correction

TH2828 series' LOAD correction capability corrects for the other errors by using the transmission coefficient derived from the relationship between a standard's (pre-measured) reference value to the actual measurement value at the frequency points you specify (up to three frequency points). So, OPEN/SHORT/LOAD corrections can be performed at the frequency points you specify. The three frequency points can be set in the **FREQ1**, **FREQ2**, and **FREQ3** fields. The standard's reference values are set in the **REF A**, and **B** fields. Before entering the standard's reference values, the measurement function for the standard must be set in the **FUNC** field. The standard's value can be measured using MEAS LOAD, which is displayed when the cursor is moved to the **FREQ1**, **FREQ2**, or **FREQ3** fields.

Front Panel Operation for the OPEN/SHORT/LOAD Correction
Perform the following steps to perform the OPEN/ SHORT/LOAD correction at the frequency points you want to specify.

1)   Move the cursor to the **FREQ1**, **FREQ2**, or **FREQ3** field to specify the frequency for the OPEN/SHORT/LOAD correction. The following softkeys will be displayed.
    ■   ON
    This softkey is used to make the OPEN/SHORT/LOAD correction data at the FREQ1, FREQ2, or FREQ3 frequency point valid.
    ■   OFF
    This softkey is used to make the OPEN/SHORT/LOAD correction data at the FREQ1, FREQ2, or FREQ3 frequency point invalid.
    ■   MEAS OPEN
    This softkey is used to perform an OPEN correction measurement at the FREQ1, FREQ2, or FREQ3 frequency points.
    ■   MEAS SHORT
    This softkey is used to perform a SHORT correction measurement at the FREQ1, FREQ2, or FREQ3 frequency points.
    ■   MEAS LOAD
    This softkey is used to perform a LOAD correction measurement at the FREQ1, FREQ2, or FREQ3 frequency points.

2)   Press ON to show and validate the previous frequency for the OPEN/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 (Hz, 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 with Hz.)

4) Connect the test fixture to the UNKNOWN Terminals.

5) Leave the connection contacts open.

6) Press MEAS OPEN. TH2828 series performs an OPEN correction measurement at the frequency points you specified. After which, the OPEN correction measurement data are displayed on the system message line.

7) Move the cursor to the **OPEN** field.

8) Press ON to perform the OPEN correction calculations for subsequent measurements at the specified frequency points.

9) Move the cursor to the **FREQ1**, **FREQ2**, or **FREQ3** field at which you specified the frequency.

10) Short the connection contacts together.

11) Press MEAS SHORT. TH2828 series will perform a SHORT correction measurement, and display the SHORT correction data on the system message line.

12) Move the cursor to the **SHORT** field.

13) Press ON to perform the SHORT correction calculations for subsequent measurements at the specified frequency points.

14) Prepare the standard for measurement.

15) Move the cursor to the **FUNC** field.

16) Set the measurement function for your standard.

17) Move the cursor to the **REF A** field of your specified frequency.

18) Enter the pre-measured value of your standard's primary parameter using the numeric entry keys and the unit softkeys.

19) Move the cursor to the **B** field on the right side of your set **REF A** field.

20) Enter your standard's pre-measured secondary parameter value using the numeric entry keys and the unit softkeys.

21) Move the cursor to the **FREQ1**, **FREQ2** or **FREQ3** field at which you specified the frequency.

22) Connect the standard to the measurement contacts.

23) Press MEAS LOAD. TH2828 series will perform a LOAD correction measurement, and display the LOAD correction data on the system message line.

24) Move the cursor to the **LOAD** field.

25) Press ON to enable the LOAD correction calculations for subsequent measurements at the specified frequency points.

3.2.4 Cable Length Selection

TH2828 series has four kinds of cable length for choice 0m, 1m, 2m (optional), and 4m (optional).

Front Panel Operation for Select the cable length.

Perform the following steps to select the cable length.

1) Move the cursor to the **CABLE** field. The following softkeys will be displayed.
   - 0 m
   - 1 m
   - 2 m
   - 4 m
2) Select and press a softkey to select the cable length.

3.2.5 Multi/Single Correction Mode Selection

Refer to Scanner Interface option Manual.

3.2.6 File Manage

Refer to **2.1.7 File Manage**.

3.2.7 Useful Tools

No tool is provided on this <**CORRECTION**> page.

3.3   LIMIT TABLE SETUP Page

When you press **SETUP**, and LIMIT TABLE, the <**LIMIT TABLE SETUP**> page will be displayed. The <**LIMIT TABLE SETUP**> page allows you to set TH2828 series' comparator. TH2828 series' built-in comparator can sort devices into a maximum of ten bins (BIN 1 to BIN 9 and one OUT BINS) using a maximum of nine pairs of primary limits and one pair of secondary parameter limits. Also, devices whose primary parameter is within limits, but whose secondary parameter measurement result not within limits, can be sorted into an AUXiliary BIN. The comparator function is especially useful when using TH2828 series with a component handler. These limit settings for bin sorting are only set on this <**LIMIT TABLE SETUP**> page.

- Measurement Parameter (**PARAM**)
- Comparator Function's Limit Mode (**MODE**)
- Nominal Value for tolerance mode (**NOM**)
- 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 available fields and the softkeys which correspond to the fields on this page are shown in Figure 3-7 and Figure 3-8.

```
⊕ <LIMIT TABLE SETUP>  FILE  TOOLS        MEAS
PARAM :Cp-D          NOM:0.00000pF         SETUP
MODE :ABS  AUX :OFF      COMP:OFF
BIN    LOW[F]       HIGH[F]                CORREC
1     -1.00000    1.00000                  TION
2     -2.00000    2.00000
3     -3.00000    3.00000                  LIMIT
4     -4.00000    4.00000                  TABLE
5     -5.00000    5.00000
6     -6.00000    6.00000                  LIST
7     -7.00000    7.00000                  SETUP
8     -8.00000    8.00000
9     -9.00000    9.00000                  SWEEP
2nd    0.00000    0.10000  [ ]             SETUP
☺ Use softkeys to select
```

☐ : Field

Figure 3-7 Available Fields on the LIMIT TABLE SETUP Page

Figure 3-8   Available Softkeys on the LIMIT TABLE SETUP Page

3.3.1 Swap Parameter

The swap parameter function is used to swap the primary parameter for the secondary parameter in the **PARAM** field. For example, when the measurement function is Cp-D, the swap parameter function sets the measurement function to D-Cp. Then the comparison limits for D are a maximum of nine pairs of comparison limits, and the comparison limits for Cp are now one pair.

Front Panel Operation for Swapping the Primary for the Secondary Parameter.
Perform the following steps to swap the primary for the secondary parameter.
1) Move the cursor to the **PARAM** field. The following softkey will be displayed.
   - SWAP PARAM
2) Press SWAP PARAM to swap the primary parameter for the secondary parameter.
3) Press SWAP PARAM again to return the measurement function to the previous combination.

3.3.2 Limit Mode for Comparator

There are two methods for specifying primary parameter limits, as follows. (Refer to Figure 3-9)

- Tolerance Mode
  The tolerance mode specifies comparison limits by the deviation from the specified nominal value. (The nominal value is specified at NOM field.) There are two methods used to specify the tolerance mode limits, the ratio in percent and by 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.
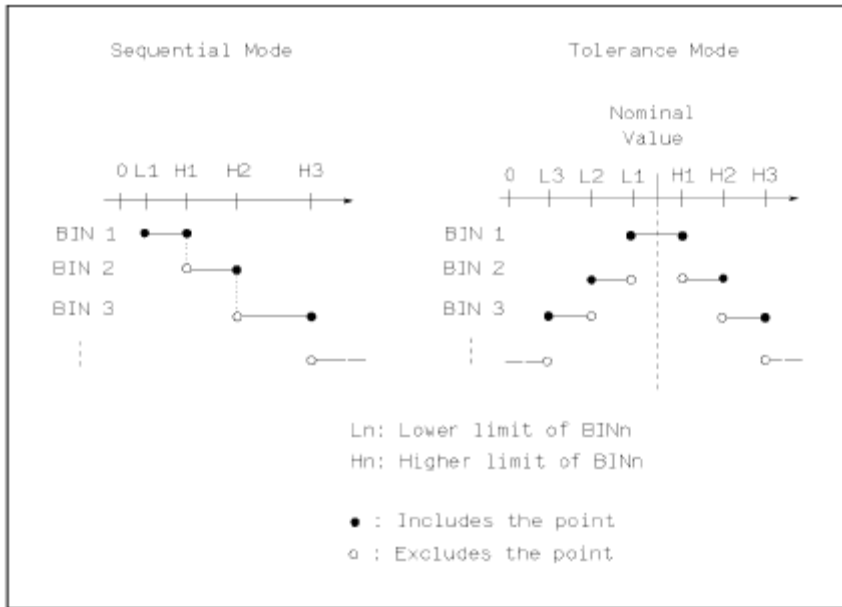
Figure 3-9   Tolerance Mode and Sequential Mode

NOTE: The limit values for tolerance mode sorting must be placed in the order of the narrower limits to the wider limits. If BIN 1 has the widest limits, all of the DUTs will be sorted into BIN 1.

In tolerance mode sorting, the lower limit doesn't have to be less than the nominal value, and the upper limit doesn't have to be greater than the nominal value. There can be openings and there can be duplications.

Front Panel Operation for Setting the Limit Mode for the Comparator

Perform the following steps to set the limit mode for the comparator.
1) Move the cursor to the **MODE** field. Then the following softkeys will be displayed.
   - ■ % TOL

   This softkey is used to set the limit mode to the tolerance mode (the ratio in percent).
   - ■ ABS TOL

   This softkey is used to set the limit mode to the tolerance mode (parameter value).
   - ■ SEQ

   This softkey is used to set the limit mode to the sequential mode.
2) Select and set the limit mode using the softkeys.

3.3.3 Nominal Value for Tolerance Mode

When the tolerance mode is used as a limit mode for the primary parameter, the nominal value must be set. The nominal value can be set within the range of the display range. When the limit mode for the primary parameter is the sequential mode, the nominal value can be set, but this has no meaning in the sequential mode.

Front Panel Operation for 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, M, *1) can be used instead of **ENTER**. When **ENTER** is pressed, the numeric data is entered with the same unit selected last time. When *1 is pressed, the numeric data is entered with the F, H and Ω as the default unit.

3.3.4 Comparator Function ON/OFF

Front Panel Operation for 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) Use the softkeys to set the comparator function to ON or OFF.

3.3.5 Auxiliary Bin ON/OFF

When the secondary parameters affect the sorting results, the limits for the secondary parameter can be set in 2nd LOW/HIGH fields.

So there are three patterns for the sorting area of the secondary parameter.

■ When the secondary parameter limits are not specified on the <**LIMIT TABLE SETUP**> page.
Devices will be sorted according to primary parameter comparison results.

■ When the secondary parameter limits are set and AUX BIN are set to OFF.
Only devices within secondary limits are sorted by the primary parameter result. Devices not within the secondary parameter limits are sorted OUT OF BINS even if the device's primary parameter is within limits.

■ When the secondary parameter limits are set and AUX BIN are set to ON.
Devices whose primary parameter is not within limits are sorted into OUT OF BINS. Devices 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 devices 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 secondary parameter is set and the AUX BIN are set to ON, the devices whose primary parameter is within limits, but whose secondary parameter is equal or above the higher limit are sorted into the AUX BIN.

Front Panel Operation for 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) Select and press a softkey to set AUX BIN to ON or OFF.

3.3.6 Low/High Limits

TH2828 series' built-in comparator can sort devices 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, and the secondary parameter low/high limits can be set in the 2nd LOW/HIGH fields.

Front Panel Operation for Setting the Low/High Limits

Perform the following steps to set the bin sorting limits.

1) Set the measurement function for the comparator function, the nominal value, and the limit mode for the primary parameter.

2) Move the cursor to the **TOOLS** field, and perform the clear table function.

3) Move the cursor to the BIN 1 **LOW** field. When you use the tolerance mode, perform steps 4 through 7. When you use the sequential mode, perform steps 8 through 12.

4) 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, M, *1) can be used instead of ENTER. When ENTER is pressed, the numeric data is entered with the same unit selected last time. When *1 is pressed, the numeric data is entered with the F, H and Ω as the default unit. 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).

5) The cursor will be automatically moved to the BIN 2 **LOW** field. Repeat step 4 until the limits of the BIN 9 is entered. After that, the cursor will be moved to the 2nd **LOW** field.

6) Enter the low limit value of the secondary parameter. After that, the cursor will be automatically moved to the 2nd **HIGH** field.

7) Enter the high limit value of the secondary parameter.

8) 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, M,*1) can be used instead of ENTER. When ENTER is pressed, the numeric data is entered with the same unit selected last time. When *1 is pressed, the numeric data is entered with the F, H and Ω as the default unit.

9) 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.

10) 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.

11) Repeat step 10 until the BIN 9 limits are entered. After entering the BIN 9 high limit, the cursor will be automatically moved to the 2nd **LOW** field. Enter the low limit value of the secondary parameter.

12) The cursor will be automatically moved to the 2nd **HIGH** field. Enter the high limit value of the secondary parameter.

3.3.7 File Manage

Refer to **2.1.7 File Manage**.

3.3.8 Useful Tools

Clear Table Function allows you to clear all of the limit values. So, when you change the limit mode, this function must be used.

Perform the following steps to clear all of bin sorting limits on the <**LIMIT TABLE SETUP**> page.
1)   Move the cursor to the **TOOLS** field.
2)   Press CLEAR TABLE to clear all of the bin sorting limits.

3.4 LIST SWEEP SETUP page

When you press **SETUP** and LIST SETUP, the <**LIST SWEEP SETUP**> page will be displayed. TH2828 series has a list sweep measurement function which permits up to ten test frequencies, oscillator levels, or DC bias points to be automatically measured. On the <**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.)

- Sweep Mode (**MODE**)
- Sweep Parameter (**FREQ [Hz]**, **LEVEL [V]**, **LEVEL [A]**, **BIAS [V]**, or **BIAS [A]**)
- Sweep Point Settings (sweep points)
- Limit Parameter Selection (**LMT**)
- Low/High Limit Values (**LOW**, **HIGH**)

There are following fields on this page: <**LIST SWEEP SETUP**>, **MODE**, **FREQ [Hz]** (**LEVEL [V]**, **LEVEL [A]**, **BIAS [V]**, or **BIAS [A]**), **LMT**, **LOW**, **HIGH**, **FILE**, **TOOLS** and sweep points.
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 3-10 and Figure 3-11.
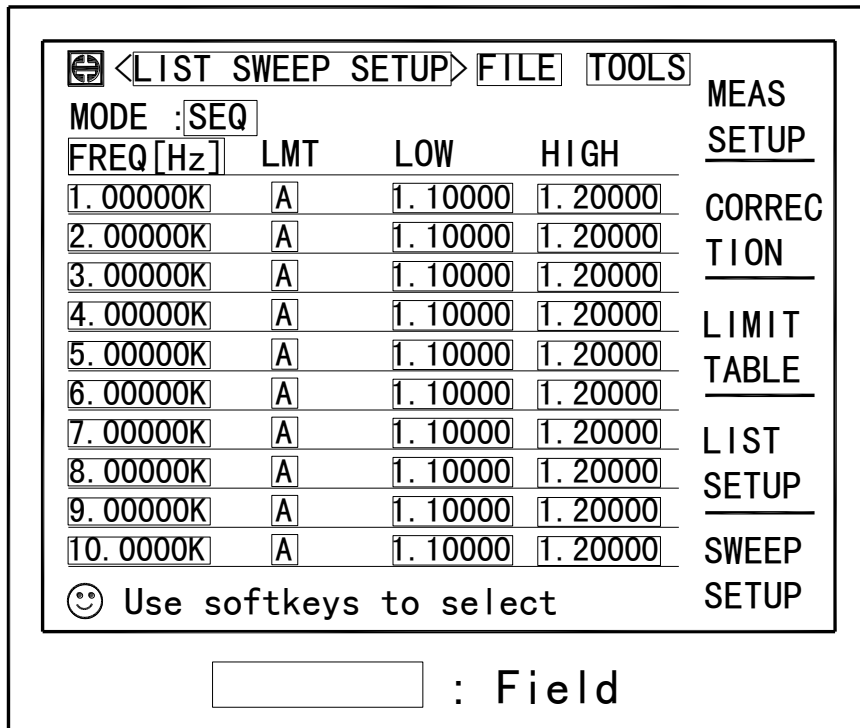
Figure 3-10 Available Fields on the LIST SWEEP SETUP Page

〈LIST SWEEP SETUP〉
— MEAS SETUP
— CORRECTION
— LIMIT TABLE
— LIST SETUP
— SWEEP SETUP

FILE
— FILE Manage — LOAD
—   — STORE
—   — DEL
—   — COPY
—   — ESC

LOW — DELETE LINE
HIGH

(SWEEP PARAMETER)
— FREQ[Hz]
— LEVEL[V]
— LEVEL[A]
— BIAS[V]
— BIAS[A]

[NUMERIC ENTRY] — p   — k
                — n   — M
                — μ   — *1
                — m
                — MORE 1/2 — MORE 2/2

(SWEEP POINTS)
— DELETE LINE

[FREQ(Hz)]
[NUMERIC ENTRY] — Hz
                — kHz
                — MHz

MODE
— SEQ
— STEP

[BIAS(V)/LEVEL(V)]
[NUMERIC ENTRY] — mV
                — V

LMT
— LIMIT DATA A
— LIMIT DATA B
— OFF

[BIAS(V)/LEVEL(A)]
[NUMERIC ENTRY] — μA
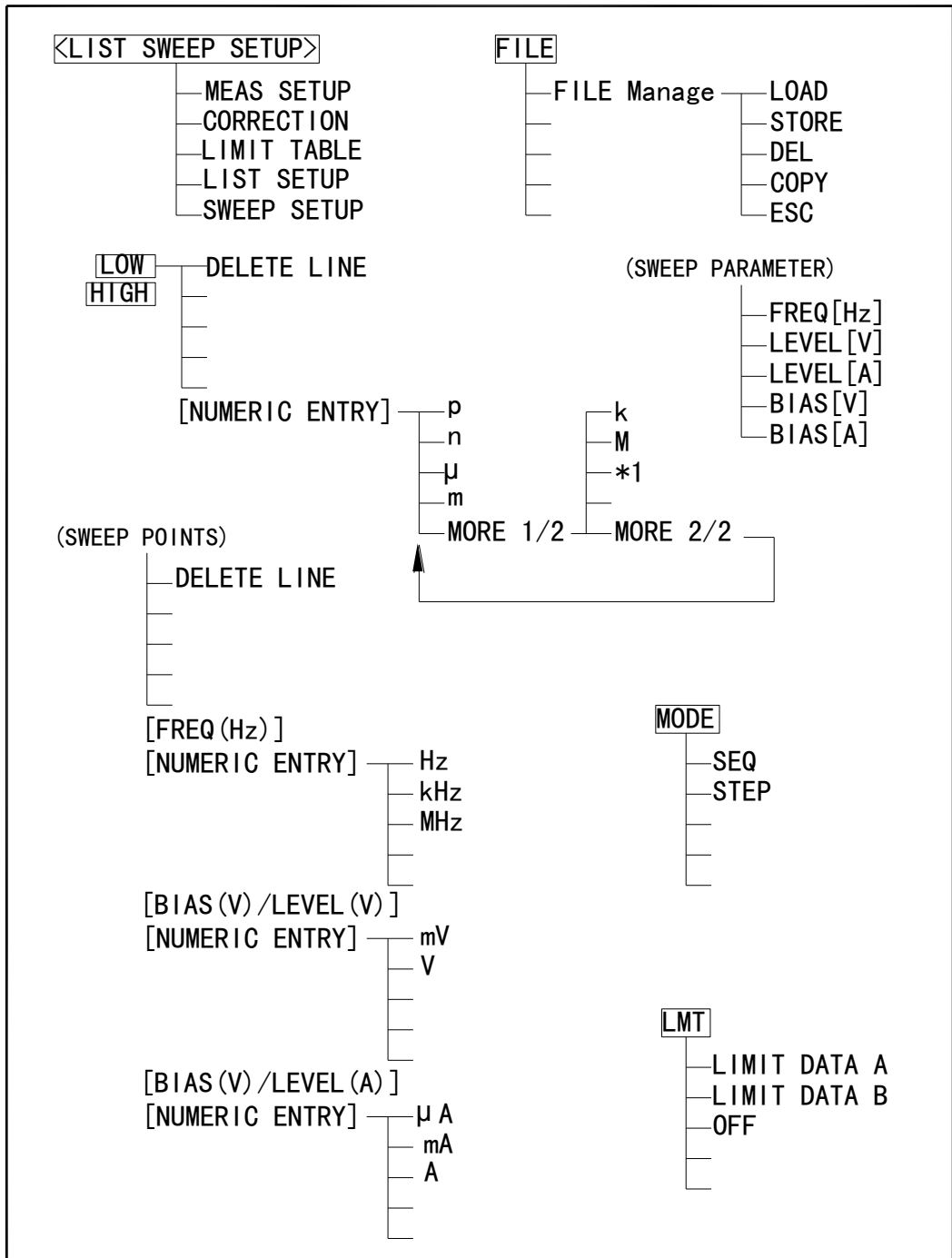   — mA
                — A

Figure 3-11 Available Softkeys on the LIST SWEEP SETUP Page

3.4.1 Sweep Mode

Th2828 series has a List Sweep measurement function which permits up to 10 test frequencies, oscillator levels, or DC bias points to be automatically measured. There are two sweep modes for the list sweep measurements: sequential (SEQ) mode and step (STEP) mode. In the case of the sequential mode, when TH2828 series is triggered once, the device is automatically measured at all sweep points. In the case of the step mode, the sweep point is increased each time TH2828 series is triggered.

Front Panel Operation for 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) Select and press a softkey to set the list sweep measurement mode.

3.4.2 List Sweep Parameter

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

Front Panel Operation for Setting the List Sweep Parameter
Perform the following steps to set the list sweep parameter.
1) Move the cursor to the **FREQ [Hz]** (**LEVEL [V]**, **LEVEL [A]**, **BIAS [V]**, or **BIAS [A]**) field. The following softkeys will be displayed.
   - FREQ [Hz]
   - LEVEL [V]
   - LEVEL [A]
   - BIAS [V]
   - BIAS [A]
2) Select and press a softkey to set the list sweep measurement sweep parameter.

3.4.3 Sweep Points and Limit Mode

The list sweep function permits entry of up to 10 points and measurement limits.

Front Panel Operation for Setting the Sweep Points
Perform the following steps to set the sweep points and measurement limits.
1) Move the cursor to the sweep parameter field and set 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 can be used instead of **ENTER**. When **ENTER** is pressed, the numeric data is entered with the Hz, V and A as the default unit.

4) Move the cursor 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 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.
8) Repeat steps 3 through 7 to finish all the list sweep setup.

3.4.4 File Manage
Refer to **2.1.7 File Manage**.

3.4.5 Useful Tools
No tool is provided on this <**LIST SWEEP SETUP**> page.

3.5   SWEEP SETUP Page

When you press **SETUP**, and SWEEP SETUP, the <**SWEEP SETUP**> page will be displayed. TH2828S has a sweep analysis function which permits up to 960 frequency, signal level, or bias level points. These measurement points are automatically measured and the measurement results are displayed with double curves of current measurement parameters. On the <**SWEEP SETUP**> page, the following control settings of the sweep analysis can be set. (Each field in parenthesis is used when that control is set.)

- Sweep Parameter(**MODE**)
- Start Point (**START**)
- End Point (**STOP**)
- Minimum Value for Primary Parameter (**A MIN**)
- Maximum Value for Primary Parameter (**A MAX**)
- Minimum Value for Secondary Parameter (**B MIN**)
- Maximum Value for Secondary Parameter (**B MAX**)
- File Manage (**FILE**)
- Useful Tools (**TOOLS**)

There are following fields on this page: <**SWEEP SETUP**>, **MODE**, **START**, **STOP**, **A MIN**, **A MAX**, **B MIN**, **B MAX**, **FILE** and **TOOLS** fields.
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 3-12 and Figure 3-13.

```
⊕ <SWEEP SETUP>          FILE TOOLS  MEAS
                                     SETUP

        MODE   :FREQ[Hz]
        START  :1.00000k            CORREC
        STOP   :100.000k            TION
        A MIN  :-641.226m
        A MAX  : 159.060m           LIMIT
        B MIN  : 19.8695m           TABLE
        B MAX  : 37.7773
                                    LIST
                                    SETUP

   ☺ Use softkeys to select        SWEEP
                                    SETUP


        ┌──────────┐ : Field
        └──────────┘

        ┌----------┐ : Monitor
        └----------┘
```

Figure 3-12 Available Fields on the FREQ RESP SETUP Page

```
⟨SWEEP SETUP⟩                      FILE
        ┌─MEAS SETUP               ┌─FILE Manage ─┬─LOAD
        ├─CORRECTION               │              ├─STORE
        ├─LIMIT TABLE              │              ├─DEL
        ├─LIST SETUP               │              ├─COPY
        └─SWEEP SETUP              │              └─ESC
                                   │
A MIN┤                             │
A MAX┤                                        START┐
B MIN┤                                         STOP├
B MAX┤                                             │
     └─SWEEP DISP                        └─SWEEP DISP
      [NUMERIC ENTRY]─┬─p      ┬─k        [FREQ(Hz)]
                      ├─n      ├─M         [NUMERIC ENTRY]─┬─Hz
                      ├─μ      ├─*1                        ├─kHz
                      ├─m      │                           ├─MHz
                      └─MORE 1/2─MORE 2/2─┘                │
                      ↑
                                          [BIAS(V)/LEVEL(V)]
                                           [NUMERIC ENTRY]─┬─mV
                                                           ├─V
                                                           │

                                          [BIAS(V)/LEVEL(A)]
                                           [NUMERIC ENTRY]─┬─μA
                                                           ├─mA
                                                           ├─A
                                                           │
```
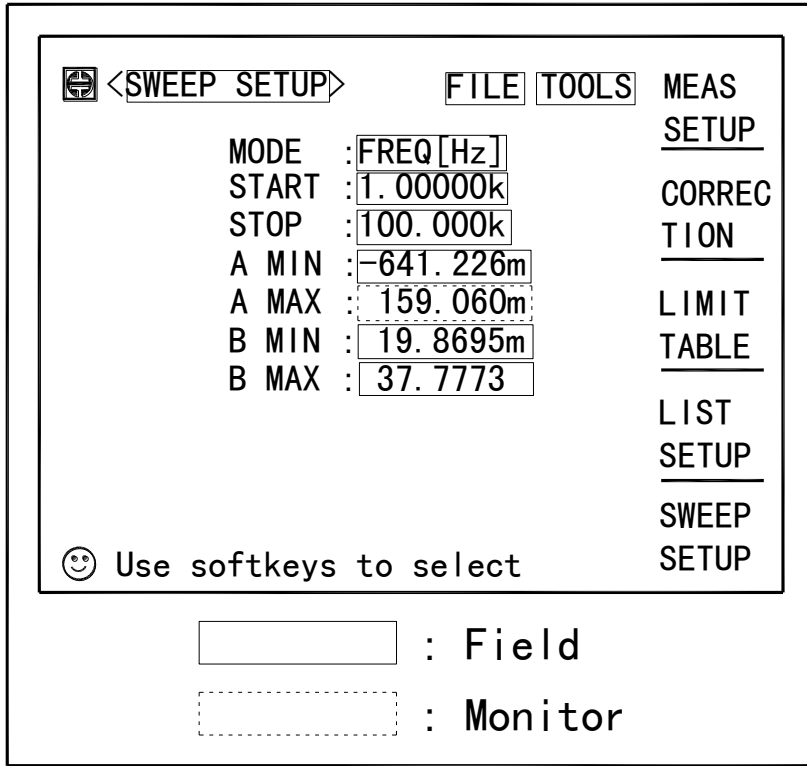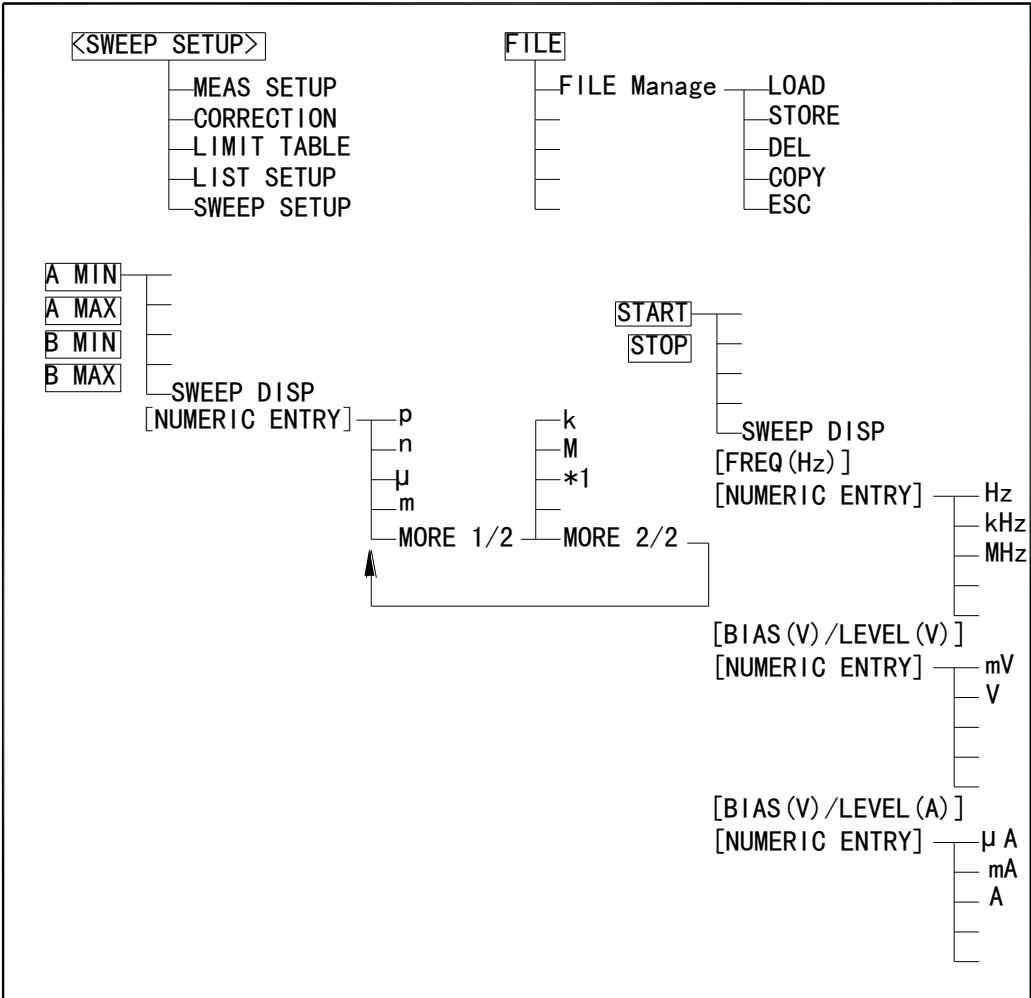
Figure 3-13 Available Softkeys on the FREQ RESP SETUP Page

3.5.1   Measurement Parameters

Refer to **2.1.1 Measurement Function** to set the measurement parameters for sweep.

3.5.2   Sweep Parameters

TH2828S can sweep the measurement parameters by frequency, signal level, or bias level.

Front Panel Operation for Setting the Sweep Parameter.
Perform the following steps to set the sweep parameter.
1)   Move the cursor to the **MODE** field and the following softkeys will be displayed.
   - ■   FREQ [Hz]
   - ■   LEVEL [V]
   - ■   LEVEL [A]
   - ■   BIAS [V]
   - ■   BIAS [A]
2)   Select and press a softkey to set the sweep parameter.

3.5.3   Start Sweep Point

Front Panel Operation for Setting the Start Sweep Point.
Perform the following steps to set the Start sweep point.
1)   Use the CURSOR arrow keys to move the cursor to the **START** field. Enter the frequency, signal level, or bias level using the numeric keys and the corresponding unit softkeys will be displayed for different sweep parameter.
   - ■   Hz
   - ■   kHz
   - ■   MHz

   - ■   mV
   - ■   V

   - ■   μA
   - ■   mA
   - ■   A
2)   Use these softkeys to enter the units and enter the data instead of $\boxed{\text{ENTER}}$. When $\boxed{\text{ENTER}}$ is used the numeric data is entered with Hz, V, or A as the default unit.

3.5.4 Stop Sweep Point

Front Panel Operation for Setting the Stop Sweep Point.
Perform the following steps to set the Stop sweep point.
1) Use the CURSOR arrow keys to move the cursor to the **STOP** field. Enter the frequency, signal level, or bias level using the numeric keys and the corresponding unit softkeys will be displayed for different sweep parameter.
   - Hz
   - kHz
   - MHz

   - mV
   - V

   - μA
   - mA
   - A
2) Use these softkeys to enter the units and enter the data instead of **ENTER**. When **ENTER** is used the numeric data is entered with Hz, V, or A as the default unit.

3.5.5 Minimum Value for Primary Parameter

Front Panel Operation for Setting the Minimum Value for Primary Parameter.
Perform the following steps to set the Minimum Value for Primary Parameter.
1) Use the CURSOR arrow keys to move the cursor to the **A MIN** field. Enter the Minimum Value using the numeric keys; the following suffix softkeys will be displayed.
   - p
   - n
   - μ
   - m
   - More 1/2
2) Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed, the numeric data is entered with the F, H and Ω as the default unit. If the softkeys you want are not displayed, press More 1/2 to display the following softkeys.
   - k
   - M
   - *1
   - More 2/2
3) Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed is pressed, the numeric data is entered with the F, H and Ω as the default unit.

3.5.6   Maximum Value for Primary Parameter

Front Panel Operation for Setting the Maximum Value for Primary Parameter.
Perform the following steps to set the Maximum Value for Primary Parameter.
1)   Use the CURSOR arrow keys to move the cursor to the **A MAX** field. Enter the Maximum Value using the numeric keys; the following suffix softkeys will be displayed.
   - p
   - n
   - µ
   - m
   - More 1/2
2)   Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed, the numeric data is entered with the F, H and Ω as the default unit. If the softkeys you want are not displayed, press More 1/2 to display the following softkeys.
   - k
   - M
   - *1
   - More 2/2
3)   Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed is pressed, the numeric data is entered with the F, H and Ω as the default unit.

3.5.7   Minimum Value for Secondary Parameter
Front Panel Operation for Setting the Minimum Value for Secondary Parameter.
Perform the following steps to set the Minimum Value for Secondary Parameter.
1)   Use the CURSOR arrow keys to move the cursor to the **B MIN** field. Enter the Minimum Value using the numeric keys; the following suffix softkeys will be displayed.
   - p
   - n
   - µ
   - m
   - More 1/2
2)   Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed, the numeric data is entered with the F, H and Ω as the default unit. If the softkeys you want are not displayed, press More 1/2 to display the following softkeys.
   - k
   - M
   - *1
   - More 2/2

3) Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed is pressed, the numeric data is entered with the F, H and Ω as the default unit.

3.5.8 Maximum Value for Secondary Parameter

Front Panel Operation for Setting the Maximum Value for Secondary Parameter.
Perform the following steps to set the Maximum Value for Secondary Parameter.

1) Use the CURSOR arrow keys to move the cursor to the **B MAX** field. Enter the Maximum Value using the numeric keys; the following suffix softkeys will be displayed.
   - p
   - n
   - µ
   - m
   - More 1/2

2) Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed, the numeric data is entered with the F, H and Ω as the default unit. If the softkeys you want are not displayed, press More 1/2 to display the following softkeys.
   - k
   - M
   - *1
   - More 2/2

3) Use these softkeys to enter the units and terminate the entry without **ENTER**. When **ENTER** is pressed is pressed, the numeric data is entered with the F, H and Ω as the default unit.

3.5.9 File Manage
Refer to **2.1.7 File Manage**.

3.5.10 Useful Tools
No tool is provided on this <**SWEEP SETUP**> page

Chapter 4 SYSTEM Page

When you press **SYSTEM**, the <**SYSTEM SETUP**> Page will be displayed. On this <**SYSTEM SETUP**> page, the following control functions can be set from this page. (The field in parenthesis is used to set the control function.)

- LCD Contrast adjustment (**LCD CONST**)
- BEEPER function ON/OFF (**BEEPER**)
- PASS BEEP mode (**PASS BEEP**)
- FAIL BEEP mode (**FAIL BEEP**)
- LANGUAGE selection (**LANGUAGE**)
- PASS WORD function (**PASS WORD**)
- BUS MODE selection (**BUS MODE**)
- BUS Address setup (**BUS ADDR**)
- Talk only mode ON/OFF (**TALK ONLY**)
- DC Bias Source mode (**BiasSourc**)
- BAUD RATE setup (**Baud Rate**)

So there are twelve fields on this page: **SYSTEM SETUP**, **FILE**, **TOOLS**, **LCD CONST**, **BEEPER**, **PASS BEEP**, **FAIL BEEP, LANGUAGE**, **PASS WORD**, **BUS MODE**, **BUS ADDR**, **TALK ONLY** and **Bias Sourc** fields. Each field is described in the following paragraphs.

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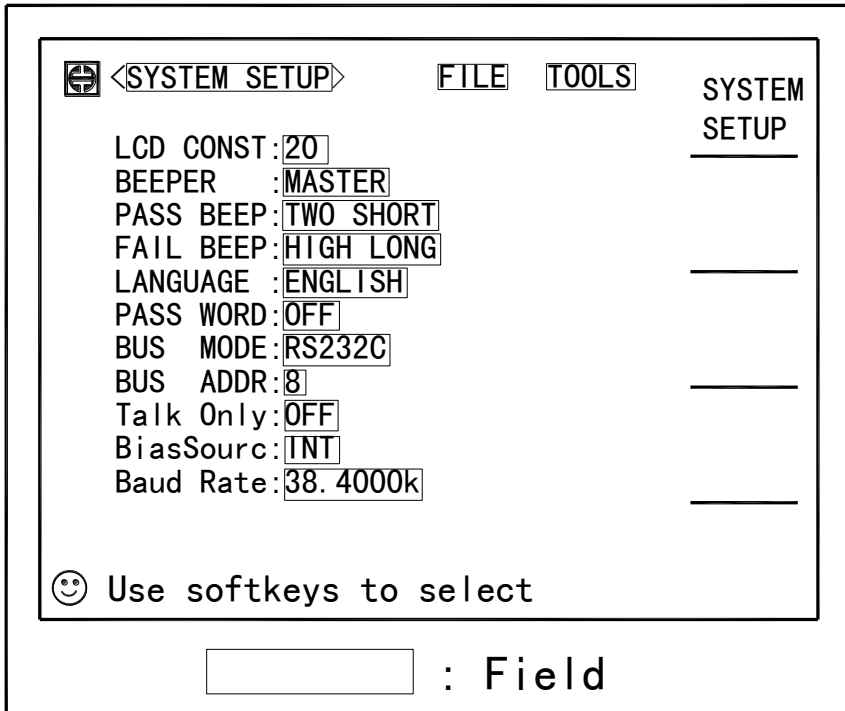
SYSTEM SETUP

```
╔════════════════════════════════════════════════╗
║  ⊕ ‹SYSTEM SETUP›        FILE  TOOLS    SYSTEM   ║
║                                         SETUP    ║
║     LCD CONST:│20│                      ────     ║
║     BEEPER   :│MASTER│                            ║
║     PASS BEEP:│TWO SHORT│                         ║
║     FAIL BEEP:│HIGH LONG│               ────     ║
║     LANGUAGE :│ENGLISH│                           ║
║     PASS WORD:│OFF│                               ║
║     BUS  MODE:│RS232C│                            ║
║     BUS  ADDR:│8│                       ────     ║
║     Talk Only:│OFF│                              ║
║     BiasSourc:│INT│                              ║
║     Baud Rate:│38.4000k│                         ║
║                                         ────     ║
║  ☺ Use softkeys to select                        ║
║                                                  ║
║          │          │ : Field                    ║
╚════════════════════════════════════════════════╝
```

Figure 4-1   Available Fields on the SYSTEM SETUP Page

⟨SYSTEM SETUP⟩　　FILE　　　　　　TOOLS
　　├─SYSTEM SETUP　├─FILE Manage─┬─LOAD　├─SYSTEM RESET
　　├─　　　　　　　├─　　　　　　├─STORE　├─SAVE SET
　　├─　　　　　　　├─　　　　　　├─DEL　　├─
　　├─　　　　　　　├─　　　　　　├─COPY　├─
　　├─　　　　　　　├─　　　　　　└─ESC　　├─

LCD CONST　　　　　　BEEPER　　　　　　PASS BEEP
　├─⇧(+)　　　　　　├─MASTER　　　　　├─HIGH LONG
　├─⇩(−)　　　　　　├─SCAN BOX　　　　├─HIGH SHORT
　├─　　　　　　　　├─ALL　　　　　　├─LOW LONG
　├─　　　　　　　　├─　　　　　　　├─TWO SHORT
　├─　　　　　　　　├─　　　　　　　└─OFF

FAIL BEEP　　　　　　LANGUAGE　　　　　PASS WORD
　├─HIGH LONG　　　　├─ENGLISH　　　　├─OFF
　├─HIGH SHORT　　　　├─中文　　　　　├─LOCK SYSTEM
　├─LOW LONG　　　　├─　　　　　　　├─LOCK FILE
　├─TWO SHORT　　　　├─　　　　　　　├─MODIFY
　└─OFF

BUS MODE　　　　　　BUS ADDR　　　　　Talk Only
　├─RS232C　　　　　├─⇧(+)　　　　　├─ON
　├─GPIB　　　　　　├─⇩(−)　　　　　├─OFF
　├─　　　　　　　　├─　　　　　　　├─
　├─　　　　　　　　├─　　　　　　　├─

Bias Sourc　　　　　Baud Rate
　├─INT　　　　　　├─⇧(+)
　├─OPT　　　　　　├─⇩(−)
　├─EXT　　　　　　├─
　├─　　　　　　　　├─

Figure 4-2　　Available Softkeys on the SYSTEM SETUP Page

4.1   LCD Contrast adjustment

Perform the following steps to adjust the LCD's CONTRAST.
1)   Move the cursor to the **LCD CONST** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.

- ⇧ (+)

- ⇩ (-)

2)   Use the softkeys to adjust the LCD's contrast from 1 to 31 until you get the suitable contrast effect.

4.2   BEEPER Function Setup

TH2828 series has a beeper which it beeps if any of the following conditions occur.
- An error has occurred.
- Warning message is displayed.
- Correction data measurement at 48 preset frequencies is completed.
- Comparison judgment Result is consistent with the PASS/FAIL BEEP mode.
- Key lock ON/OFF is switched.
- DC BIAS ON/OFF is switched.

Front Panel Operation for Setting the Beeper Function.
Perform the following steps to set the beeper function.
1)   Move the cursor to the **BEEPER** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
- MASTER
  When MASTER is selected, the beeper inside MASTER instrument is selected.
- SCAN BOX
  When SCAN BOX is selected, the beeper inside the SCAN BOX is selected.
- ALL
  When ALL is selected, both beepers inside the MASTER and SCAN BOX are selected
2)   Select and press a softkey to set the beeper function.

4.3 PASS BEEP Mode

Front Panel Operation for Setting the PASS BEEP Mode.
Perform the following steps to set PASS BEEP Mode.
1) Move the cursor to the **PASS BEEP** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
 - ■ HIGH LONG
 - ■ HIGH SHORT
 - ■ LOW LONG
 - ■ LOW SHORT
 - ■ TWO SHORT
 - ■ OFF
2) Select and press a softkey to set the beep mode when comparison result is IN or PASS.

4.4 FAIL BEEP Mode

Front Panel Operation for Setting the FAIL BEEP Mode.
Perform the following steps to set FAIL BEEP Mode.
1) Move the cursor to the **FAIL BEEP** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
 - ■ HIGH LONG
 - ■ HIGH SHORT
 - ■ LOW LONG
 - ■ LOW SHORT
 - ■ TWO SHORT
 - ■ OFF
2) Select and press a softkey to set the beep mode when comparison result is OUT or FAIL.

4.5 LANGUAGE Selection

Front Panel Operation for Setting the System LANGUAGE.
Perform the following steps to select display language.
1) Move the cursor to the **LANGUAGE** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
 - ■ English
 - ■ 中文
2) Use the softkeys to set the display language.

4.6　PASS WORD function

TH2828 series needs a pass word in the following conditions.

- Turn on the instrument (if pass word is ON)
- To cancel the key lock function (if pass word is ON)
- Set the pass word function to OFF
- STORE/DEL/COPY the SETUP files
- Modify the pass word

NOTE:　The default pass word for TH2828 series is "2828".

Front Panel Operation for Operate the PASS WORD.
Perform the following steps to Operate the PASS WORD.

1) Move the cursor to the **PASS WORD** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
   - OFF
   - LOCK SYSTEM
   - LOCK FILE
   - MODIFY
2) Press OFF, message "Input password:" will be displayed on the system information line. Input the correct password, the password function is set to OFF.
3) Press LOCK SYSTEM, message "Input password:" will be displayed on the system information line.
4) Input the correct password, then all the conditions listed above will be protected with a password.
5) Press LOCK FILE, message "Input password:" will be displayed on the system information line.
6) Input the correct password, then the file STORE/DEL/COPY operation will be protected with a password.
7) Press MODIFY, message "Input password:" will be displayed on the system information line.
8) Input the correct password, "New password:" will be displayed on the system information line.
9) Input the new password, "Confirm new password:" will be displayed on the system information line.
10) Input the new password again, "Password modify ok" will be displayed on the system information line.
11) If the new password is wrongly entered, "Password modify fail" will be displayed.

4.7   BUS MODE Selection

TH2828 series provides two types of bus mode: RS232C and GPIB.

Perform the following steps to set the bus mode.

1) Move the cursor to the **BUS MODE** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
   - RS232C
   - GPIB
2) Select and press a softkey to set the bus mode.

4.8   GPIB BUS Address Setup

TH2828 series provides the GPIB bus address range from 1 to 31.

Perform the following steps to set the GPIB bus address.

1) Move the cursor to the **BUS ADDR** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
   - ⇧ (+)
   - ⇩ (-)
2) Use the softkeys to set the GPIB bus address.

4.9   Talk only mode ON/OFF

Perform the following steps to set TH2828 to the Talk Only mode (ON). To set TH2828 to the addressable mode, perform the following steps to set the Talk Only mode to OFF.

1) Move the cursor to the **TALK ONLY** field on the <**SYSTEM SETUP**> 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).

4.10   DC Bias Source mode

TH2828 series provides three types of DC Bias Source mode INT (internal), OPT (option) and EXT (external).

Perform the following steps to set the DC Bias Source mode.

1) Move the cursor to the **BiasSourc** field on the <**SYSTEM SETUP**> page. The following softkeys will be displayed in the softkey label area.
   - INT
   - OPT (available when optional bias board is fixed.)
   - EXT
2) Use the softkeys to set the DC Bias Source mode.

4.11   BAUD Rate Setup

TH2828 series provides a wide range of baud rates from 9.6k to 115.2k.
Perform the following steps to set the baud rate for RS232C interface.
1)   Move the cursor to the **Baud Rate** field on the <S**YSTEM SETUP**> page. The
     following softkeys will be displayed in the softkey label area.
     ■   ⇑ (+)
     ■   ⇓ (-)
2)   Use the softkeys to set the Baud Rate for the RS232C interface.

4.12   File Manage

Refer to **2.1.7 File Manage**.

4.13   Useful Tools

Front Panel Operation for Useful Tools
Perform the following steps to reset TH2828 and save the system setup.
1)   Move the cursor to the **TOOLS** field on the <**SYSTEM SETUP**> page. The
     following softkeys will be displayed.
     ■   SYSTEM RESET
     ■   SAVE SET
2)   Press SYSTEM RESET to reset TH2828 series.
3)   Press SAVE SET to save the system setup to the no-volatile memory.

Chapter 5 Handler Interface

5.1 General Information

The optional handler interface outputs signals that indicate the end of measurement, bin sorting judgments of the comparator function, and Go/No-Go judgments of the list sweep comparator function. The handler interface also has an input for an external trigger signal and a key-lock signal. Using these signals, TH2828 series can easily be combined with a component handler or a system controller to fully automate component testing, sorting, and quality control data processing to increase production efficiency. Table 5-1 lists the handler interface specifications.

Table 5-1   Specifications of Handler Interface

Output signal (Negative true, open collector, opto-isolated)	Comparator	Bin number
		Out of bins
		Rejection status signals
	List sweep comparator	IN/OUT at each list sweep point
		Pass/Fail for the result of sequential comparison
	/INDEX	End of analog measurement
	/EOM	End of full measurement
	/ALARM	Instantaneous power failure was detected.
Input Signal (Opto-isolated)	/EXT_TRIG	External Trigger, Pulse width≥1μs
	/KEY_LOCK	External key lock signal

5.2 Signal Line definition

The handler interface uses three kinds of signals: comparison output, control input and control output. The signal lines for the Comparator Function and the List Sweep Comparator Function are defined separately for comparison output signals and control input signals.

5.2.1 Signal Line Used for Comparator Function

The signal definitions used for the Comparator Function are listed below.
1) Comparison Output Signals:
- /BIN1 to /BIN9
- /AUX
- /OUT
- /PHI   primary parameter high reject signal
- /PLO   primary parameter low reject signal
- /SREJ   secondary parameter reject signal

2) Control Output Signals:
- /INDEX   analog measurement completed signal
- /EOM   end of measurement and comparison data valid signal
- /ALARM   Instantaneous power failure alarm signal

3) Control Input Signal:
- /EXT_TRIG external trigger signal
- /KEY_LOCK key lock signal

The pin assignments and a brief description of each signal used for the comparator function are given in Table 5-2 and Figure 5-2. The timing diagram is shown in Figure 5-3.

NOTE: The / (back slash) in the signal name means that the signal is asserted when low.

Table 5-2   Pin Assignments for Comparator Function

Pin	Name	Description
1	/BIN1	
2	/BIN2	
3	/BIN3	
4	/BIN4	
5	/BIN5	Bin sorting judgments.
6	/BIN6	All bin sorting signal outputs are opto-isolated open collector.
7	BIN7	
8	BIN8	
9	BIN9	
10	/OUT	
11	/AUX	
12	/EXT_TRIG	External Trigger:
13	/EXT_TRIG	TH2828 series is triggered on the rising edge of a pulse applied to this pin when the trigger mode is set to EXT mode.
14	EXT_DCV2	External DC voltage 2: DC voltage supply pins for DC isolated control signals (/EXT_TRIG, /KEY_LOCK, /ALARM, /INDEX, /EOM). Setting of
15	EXT_DCV2	internal jumpers on the handler interface board must be changed when using an internal voltage supply.
16		Internal +5V voltage supply (maximum 300 mA)
17	+5V	Setting of internal jumpers must be changed when using an
18		internal voltage supply.
19	/PHI	Primary Parameter High Reject: The measurement value is greater than the high limit value of BIN1–BIN9. (See Figure 5-1)
20	/PLO	Primary Parameter Low Reject: The measurement value is less than the low limit value of BIN1-BIN9. (See Figure 5-1)
21	/SREJ	Secondary Parameter Reject: The measurement value is not within the range of the secondary parameter limit. (See Figure 5-1)
22	NC	No Connection
23	NC	No Connection
24	NC	No Connection
25	/KEY_LOCK	Key lock signal When this signal is low, TH2828 series' front panel keys are disabled.
26	NC	No Connection

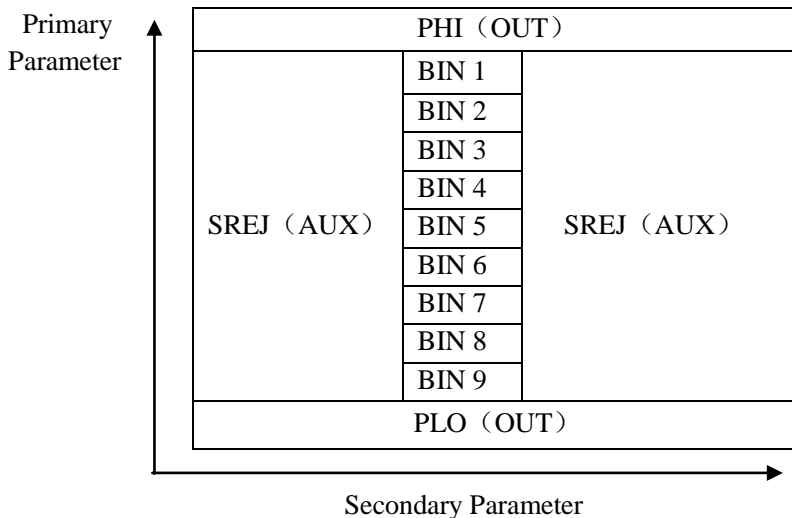| 27 28	EXT_DCV1 EXT_DCV1	External DC voltage 1: DC voltage supply pins for DC isolated open collector outputs, /BIN1-/BIN9, /AUX, /OUT, /PHI, /PLO, /SREJ. The setting of internal jumpers on the handler interface board must be changed when using the internal voltage supply.
29	/ALARM	This signal will be asserted when an instantaneous power failure is detected.
30	/INDEX	/INDEX signal is asserted when an analog measurement is completed and TH2828 series is ready for the next DUT to be connected to the UNKNOWN terminals. The measurement data, however, is not valid until /EOM is asserted. (See Figure 5-3)
31	/EOM	End of Measurement: This signal is asserted when the measurement data and comparison results are all valid. (See Figure 5-3)
32 33	COM2 COM2	Common for EXT_DCV2
34 35 36	COM1 COM1 COM1	Common for EXT_DCV1

Primary Parameter

PHI（OUT）		
SREJ（AUX）	BIN 1	SREJ（AUX）
	BIN 2	
	BIN 3	
	BIN 4	
	BIN 5	
	BIN 6	
	BIN 7	
	BIN 8	
	BIN 9	
PLO（OUT）		

Secondary Parameter

Figure 5-1   /PHI, /PLO, /SREJ Signal's Area Example

BIN 1	1	19	/PHI
BIN 2	2	20	/PLO
BIN 3	3	21	/SREJ
BIN 4	4	22	NC
BIN 5	5	23	NC
BIN 6	6	24	NC
BIN 7	7	25	/KEYLOCK
BIN 8	8	26	NC
BIN 9	9	27	EXT DCV1
OUT	10	28	EXT DCV1
AUX	11	29	/ALARM
EXT TRIG	12	30	/INDEX
EXT TRIG	13	31	/EOM
EXT DCV2	14	32	COM2
EXT DCV2	15	33	COM2
+5V	16	34	COM1
+5V	17	35	COM1
+5V	18	36	COM1
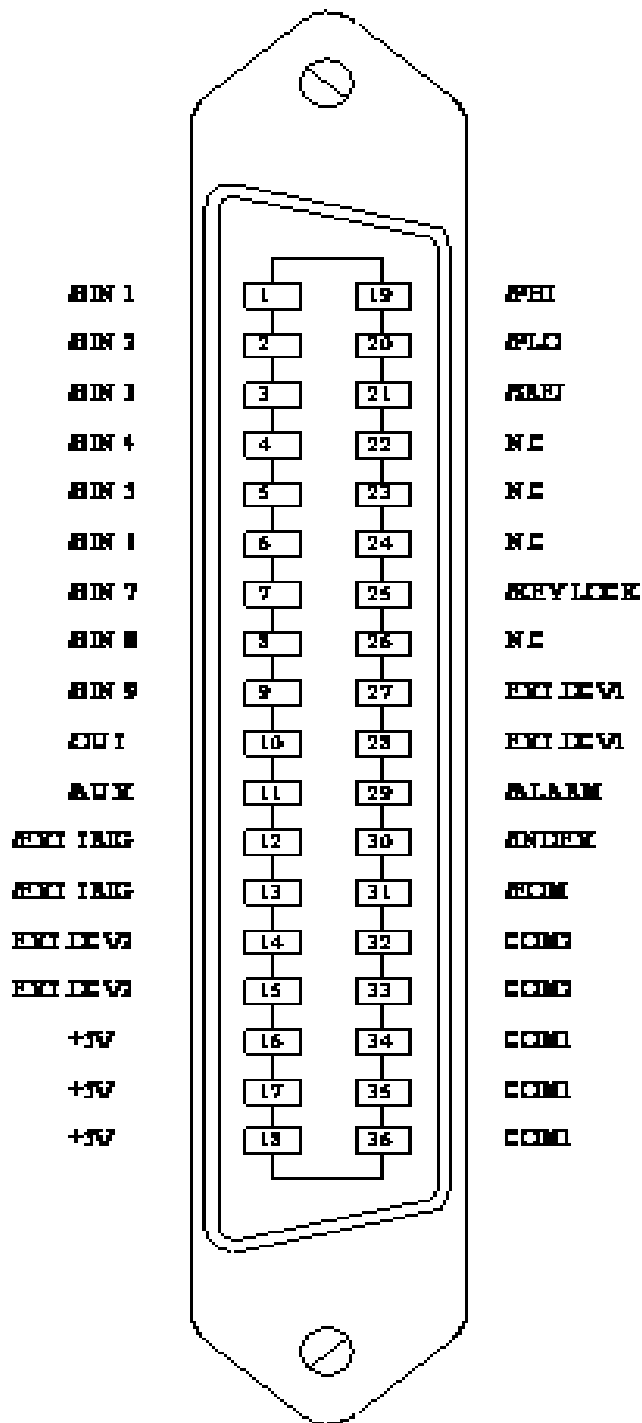
Figure 5-2   Pin Assignment for Handler Interface Connector

Time	Minimum Value	Maximum Value
T₁ Trigger Pulse Width	1 μ S	---
T₂ Measurement Start Delay Time	200 μ S	Display Time +200μ S
T₃ Trigger Wait Time After /EOM Output	0 μ S	---

1   Typical calculation and comparison time is 2ms;

2   Typical display time for each display format is as follows.
        MeasDisplay page:

          Large Character Display :   approx. 50ms
          Normal Character Display :   approx. 3ms
          Vm/Im Monitor ON :   Plus 2ms
        BinNo. Disp page   approx. 8ms
        Bin Count page   approx. 5ms

Figure 5-3   Timing Diagram

5.2.2 Signal Line Used for List Sweep Comparator Function

Signal definition used for the list sweep comparator function is different from that used for the comparator function. Signal definition used for the list sweep comparator function is as follows.

1) Comparison Output Signals:
/BIN1-BIN9 and /OUT indicate IN/OUT judgments for each sweep point (refer to Figure 5-4). /AUX indicates pass/fail judgment (one or more failed judgments of steps 1 to 10 occurred during a single sweep).
These signals are output when the sweep measurement is completed.

2) Control Output Signals:
/INDEX (analog measurement completed signal) and /EOM (end of measurement signal). The timing when /INDEX and /EOM are asserted is as follows: (different from that used for the comparator function).

■   In the SEQ sweep mode:
/INDEX is asserted when the last step of an analog measurement of a sweep measurement is completed. /EOM is asserted when all of the comparison results are valid after a sweep measurement.

■   In the STEP sweep mode:
/INDEX is asserted after each step of analog measurement in a seep measurement is completed. /EOM is asserted after each step measurement, including comparison time, is completed.

The pin assignments and a brief description of signals used for the list sweep function are given in Table 5-3 and Figure 5-2 (pin assignments for the list sweep comparator function are the same as for the comparator function). The timing diagram is shown in Figure 5-5.
The / (back slash) in the signal name means that the signal is asserted when LOW.

Table 5-3   Pin Assignments for List Sweep Comparator Function

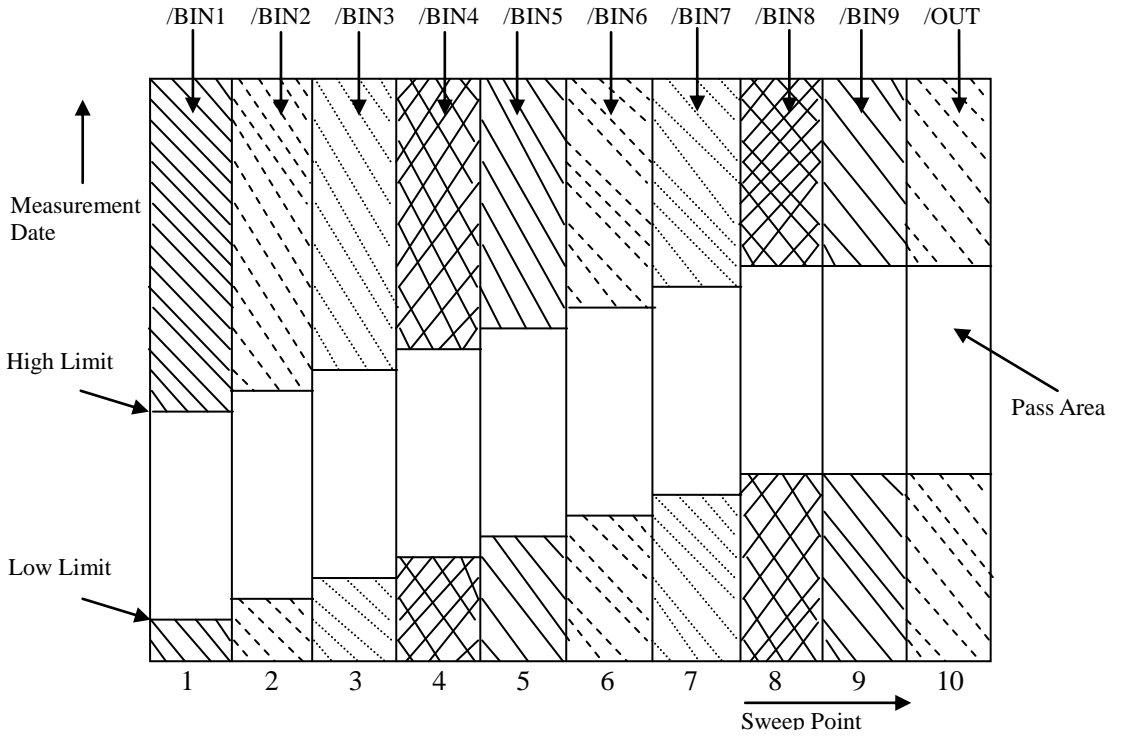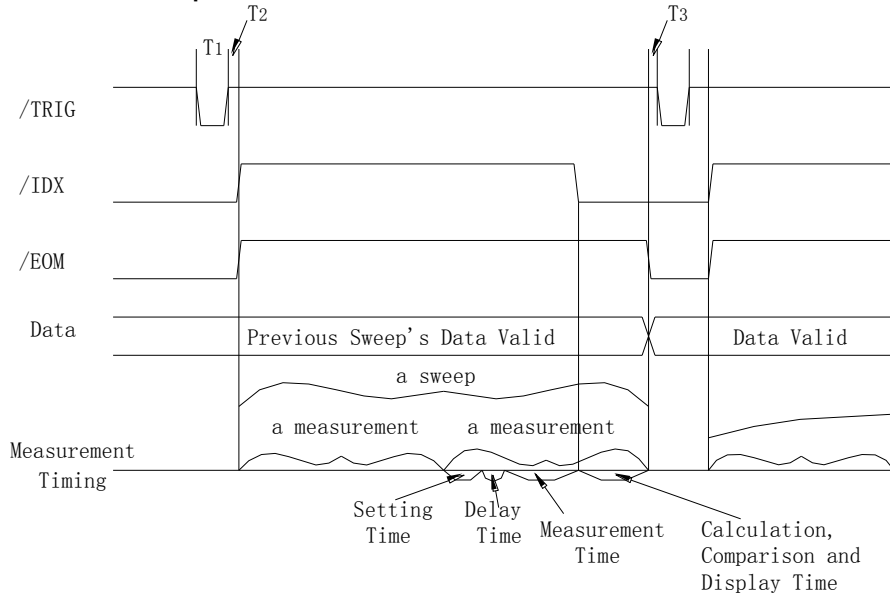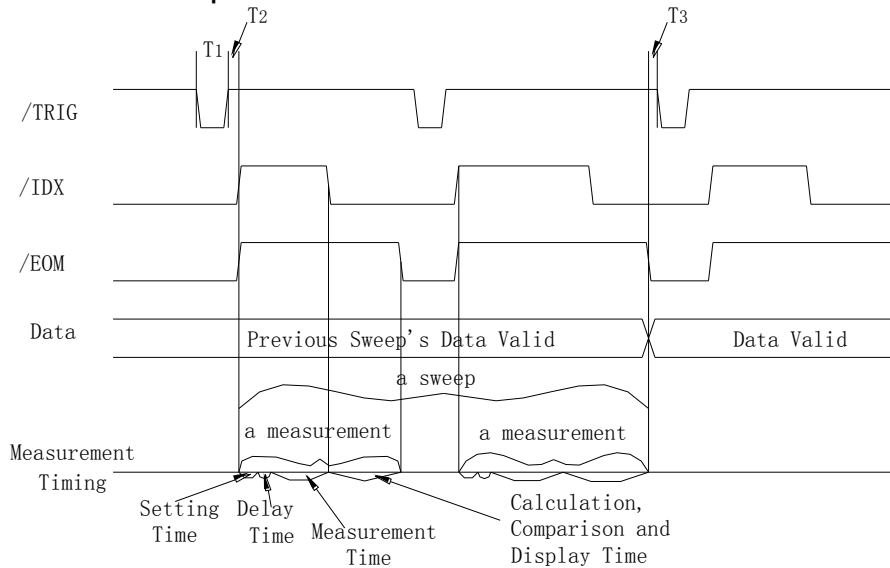| Pin	Signal Name	Description
1	/BIN1	Failed (out of limit) at sweep Point 1
2	/BIN2	Failed (out of limit) at sweep Point 2
3	/BIN3	Failed (out of limit) at sweep Point 3
4	/BIN4	Failed (out of limit) at sweep Point 4
5	/BIN5	Failed (out of limit) at sweep Point 5
6	/BIN6	Failed (out of limit) at sweep Point 6
7	/BIN7	Failed (out of limit) at sweep Point 7
8	/BIN8	Failed (out of limit) at sweep Point 8
9	/BIN9	Failed (out of limit) at sweep Point 9
10	/OUT	Failed (out of limit) at sweep Point 10
11	/AUX	This signal is asserted when any of the sweep points from 1 to 10 is failed during one sweep cycle.
12-18		Same as the assignments for the comparator function (Refer to Table 5-2).
19-21	N.U	Not Used (Off state, HIGH level)
22-29		Same as the assignments for the comparator function (Refer to Table 5-2).
30	/INDEX	In the SEQ sweep mode: /IDX is asserted when an analog measurement of the last sweep step is completed, and TH2828 series is ready for the next DUT to be connected to the UNKNOWN terminals. The measurement data, however, is not valid until/EOM is asserted. (See Figure 5-5) In the STEP sweep mode: /INDEX is asserted when each analog measurement is complete and TH2828 series is ready for the next sweep step. The measurement data, however, is not valid until /EOM is asserted (See Figure 5-5).
31	/EOM	End of Measurement In the SEQ sweep mode : /EOM is asserted when the measurement data and comparison results are valid after the last step measurement is completed. (See Figure 5-5.) In the STEP sweep mode: /EOM is asserted when each step measurement, including the comparison times, is completed and the measurement data is valid. The comparison results are valid after the /EOM signal of the last sweep point is asserted. (See figure 5-5)
32-36		Same as the assignments for the comparator function (Refer to Table 5-2).

Figure 5-4 Signal Area Example
(For The List Sweep Comparator Function)

SEQ Sweep Mode:

/TRIG

/IDX

/EOM

Data — Previous Sweep's Data Valid — Data Valid

a sweep

a measurement   a measurement

Measurement
Timing

Setting   Delay   Measurement   Calculation,
Time   Time   Time   Comparison and
Display Time

STEP Sweep Mode:

/TRIG

/IDX

/EOM

Data — Previous Sweep's Data Valid — Data Valid

a sweep

a measurement   a measurement

Measurement
Timing

Setting   Delay   Calculation,
Time   Time   Measurement   Comparison and
Time   Display Time

NOTE

1. Setting Time includes Correction Data Switching Time.
2. Calculation, Comparison and Display Time is approx. 5ms.
   Refer to Figure 7-3 for information of T1, T2, T3.

Figure 5-5   Timing Diagram for List Sweep Comparator Function

5.3 Electrical Characteristics

As mentioned in the previous paragraph, the meaning of some of the signals is different for the comparator function and the list sweep comparator function. However, the electrical characteristics of these signals are identical for the two operations. The following descriptions apply to both the comparator function and the list sweep comparator function.

5.3.1 DC Isolated Outputs

Each DC output (pins 1 through 11, pins 19 through 21, pins 29 through 31) is isolated using an open collector output photocoupler. The output voltage of each line is set by a pull-up resistor on the handler interface board. The pull-up resistors can be connected to the internally supplied voltage (+5V), or to an externally applied voltage (EXTV: +5V to +24V) by setting jumpers.

The electrical characteristics of the DC isolated outputs are divided into two types. (See Table 5-4)

Since the power source for the Comparison Output and Control Output signals are different, two circuit commons (COM1, COM2) are made available.

Table 5-4   DC Isolated Output Electrical Characteristics

Output Signals	Voltage Output Rating		Maximum Current	Circuit Common
	Low	High		
Comparison Signals /BIN1 to /BIN9 /OUT /AUX /PHI /PLO /SREJ	≤0.5V	+5V to +24V	6mA	Internal pull-up voltage: TH2828 series circuit common (GND) External voltage (EXTV1): COM1
Control Signals /INDEX /EOM /ALARM	≤0.5V	+5V to +24V	6mA	Internal pull-up voltage: TH2828 series circuit common (GND) External voltage (EXTV2): COM2

A simplified diagram of the output signals in shown in Figure 5-6 (Comparison Signals) and Figure 5-7 (Control Signals).
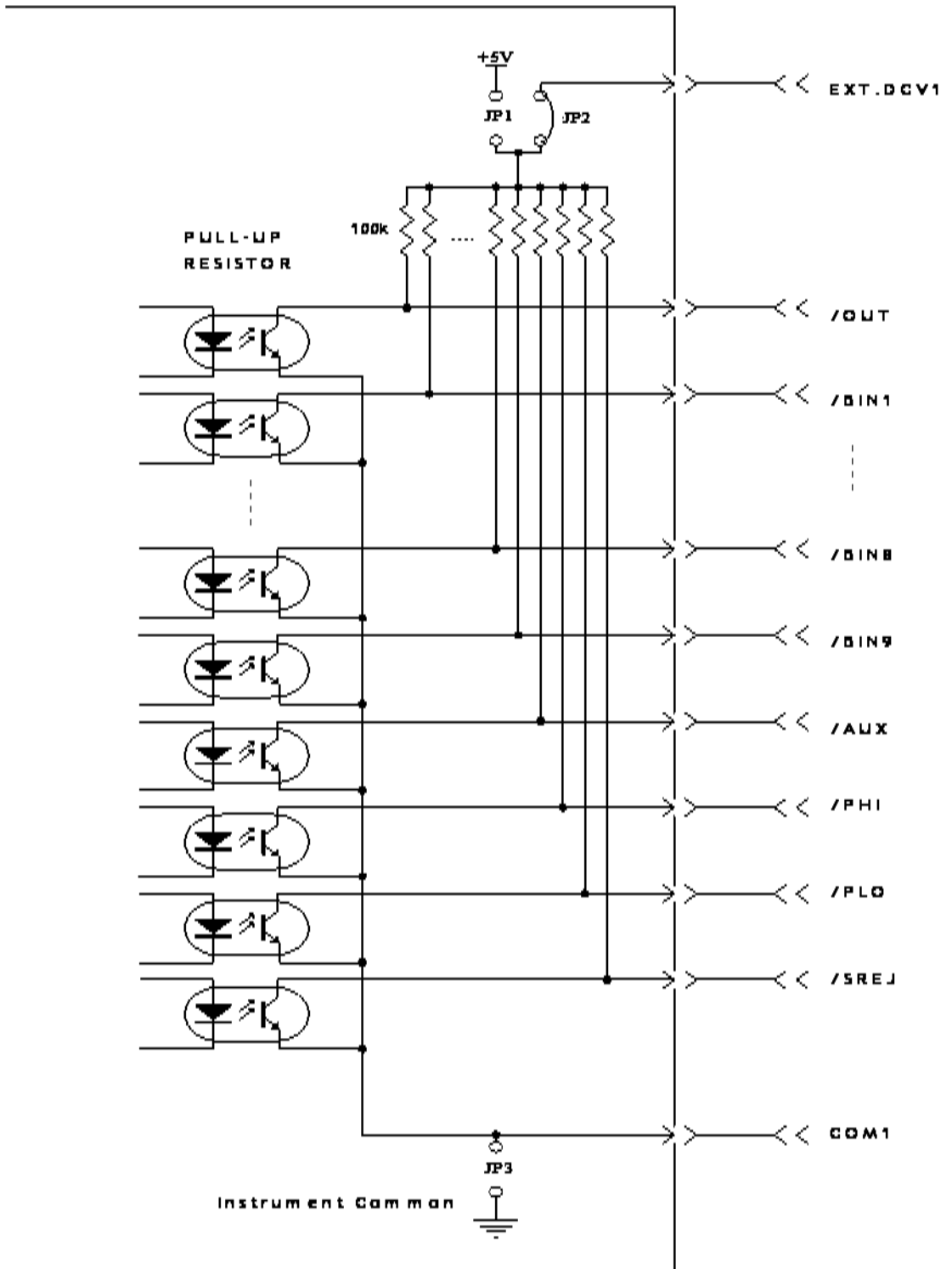

Figure 5-6   Simplified Diagram of the Comparison Output Signals
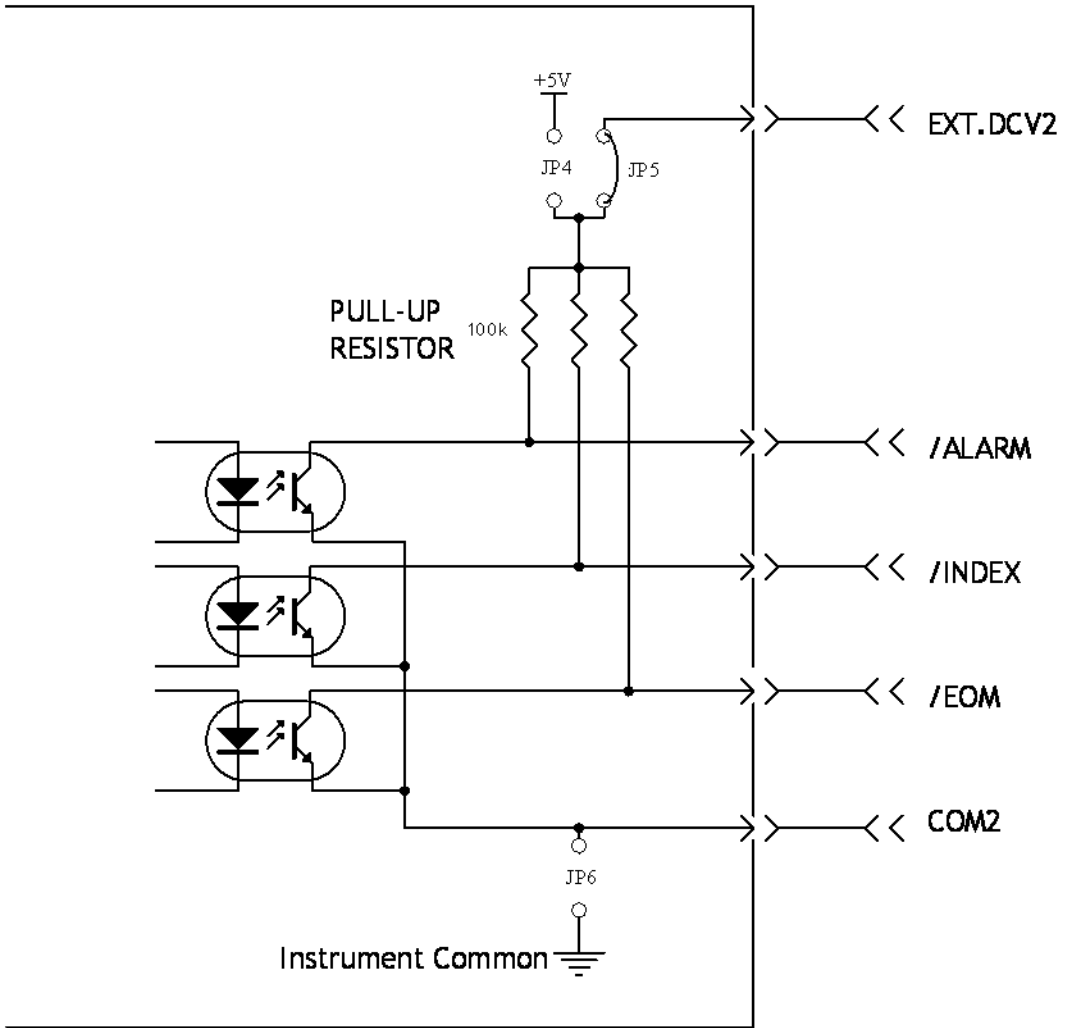
Figure 5-7 Simplified Diagram of the Control Output Signals

5.3.2 DC Isolated Input

The /TRIG signal (pin 12 and 13) is connected to the cathode of the LED in a photocoupler. TH2828 series is triggered on the rising edge of the /TRIG pulse. The anode of the LED can be powered from the internal +5 V, or by an external voltage source EXT_DCV2, which is connected to pin 14 and pin15.
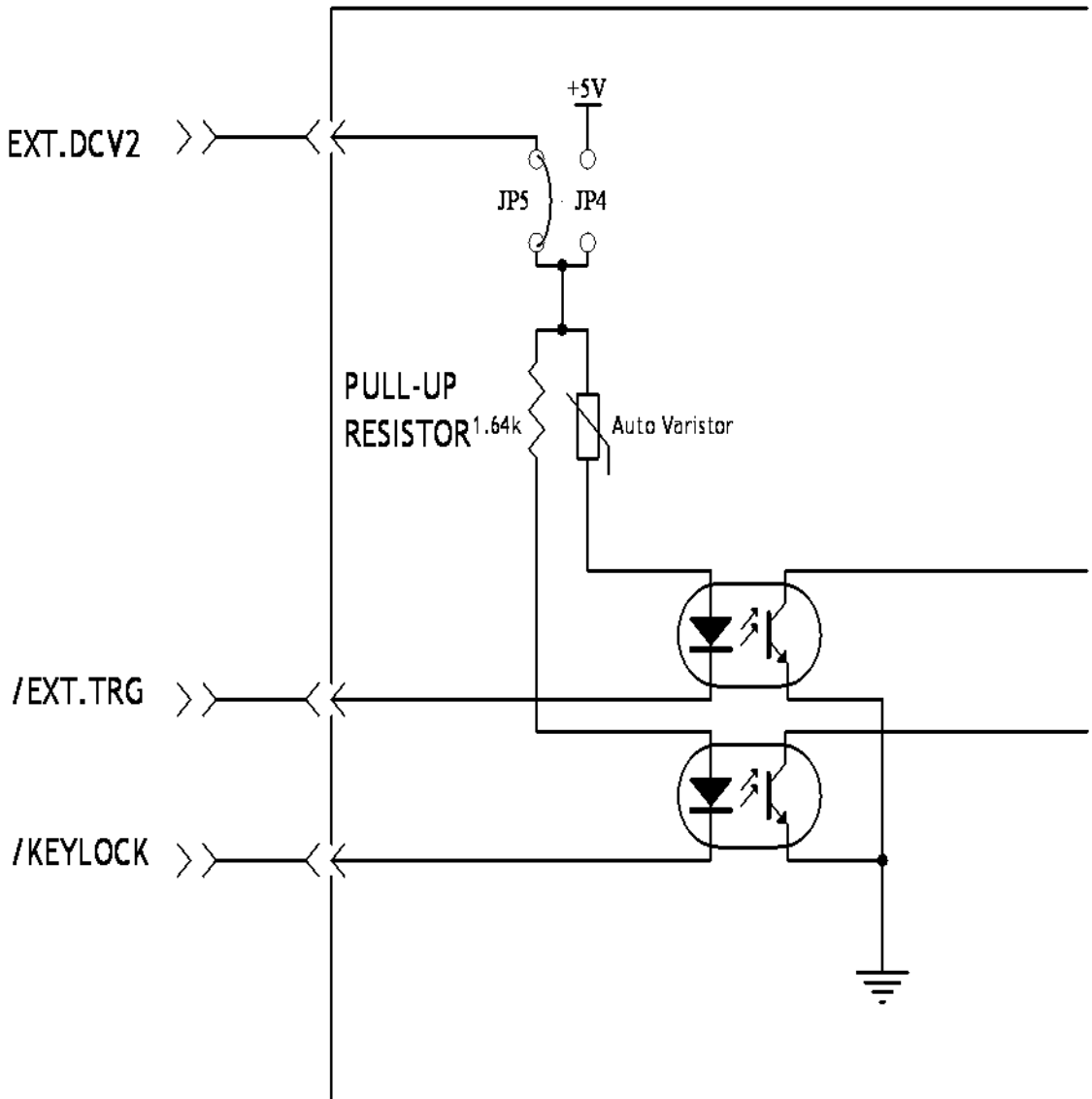
The /KEY_LOCK signal (pin 25) is connected to the cathode of the LED in a photocoupler. All front panel keys will be disabled when the /KEY_LOCK signal is asserted. The anode of the LED can be powered from the internal +5V, or by an external voltage source EXT_DCV2, which is connected to pin 14 and pin15.

Figure 5-8 Handler Interface Input Signal Diagram

5.4   Setting Up the Handler Interface Board

Jumpers on the Handler Interface board must be set to select the signal outputs (Open collector, internal voltage outputs, or External voltage outputs). A description of each jumper is given in Table 5-5, and their locations are shown in Figure 5-9.

When shipped from the factory, each jumper is set to the default position as shown in Figure 5-6, Figure 5-7 and Figure 5-8.

Jumper J1, J2 and J3 are used to select the pull up voltage for output signals.

Jumper J4, J5 and J6 are used to select the pull up voltage for control signals and drive voltage for input signals.

Table 5-5   Internal Jumper Settings

| No.	Description	Signals
J1	Set the pull up voltage for output signals to internal +5V.	/BIN1-/BIN9 /AUX /OUT /PHI /PLO /SREJ
J2	Set the pull up voltage for output signals to external voltage EXT_DCV1 (+5V to +24V).	
J3	COM1 is connected to TH2828 series circuit common.	
J4	Set the pull up voltage for output signals and the drive voltage for input signals to internal voltage +5V.	/ALARM /INDEX /EOM /EXT_TRIG /KEY_LOCK
J5	Set the pull up voltage for output signals and drive voltage for input signals to external voltage EXT_DCV2 (+5V to 24V).	
J6	COM2 is connected to TH2828 series circuit common.	
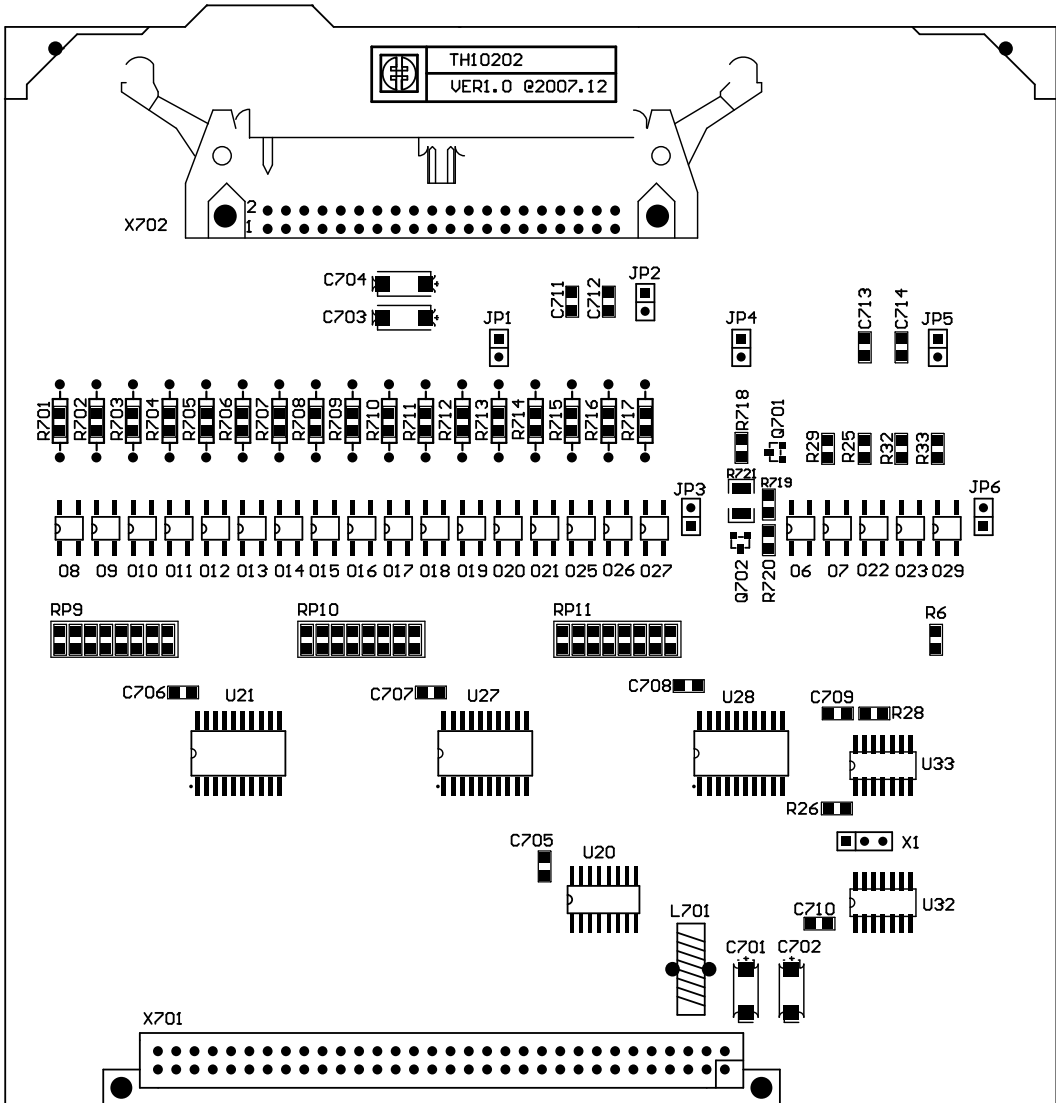
Figure 5-9. Jumper Locations on the Handler Interface

5.5   Operation

To use the handler interface, after setting up the handler interface board, setup the limit table for using the comparator function or the list sweep setup table for using the list sweep comparator function. Then set the handler interface to be enabled to output/input the signals. The following procedures are for using the handler interface with the comparator function or the list sweep comparator function.

5.5.1   Setting Procedure for Comparator Function

The following operation procedures are for using the handler interface with the comparator function.

1) Press the **SETUP** menu key, and the LIMIT TABLE softkey. The <**LIMIT TABLE SETUP**> page will be displayed.
2) Setup the limit table refer to **3.3 LIMIT TABLE SETUP Page**.
3) Move the cursor to the **COMP** field, and press softkey ON to enable the comparator function.
4) Press **LCRZ** menu key. To perform a measurement, select the MEAS DISP, BIN NO, BIN COUNT softkey.
5) If you want to save the limit table setup to a file. Move the cursor to the **FILE** field, press FILE Manage and use the STORE softkey to save the current control settings and limit table to a file.

5.5.2 Setting Procedure for List Sweep Comparator function

The following operation procedures are for using the handler interface with the list sweep comparator function.

1) Press the **SETUP** menu key, and the LIST SETUP softkey. The <**LIST SWEEP SETUP**> page will be displayed.

2) Setup the list table including sweep steps and high/low limits for list sweep measurement; refer to **3.4　LIST SWEEP SETUP Page**.

3) Press **LCRZ** menu key. To perform list sweep measurements, select the LIST SWEEP softkey.

4) If you want to save the limit table setup to a file. Move the cursor to the **FILE** field, press FILE Manage and use the STORE softkey to save the current control settings and limit table to a file.