HIOKI

INSTRUCTION MANUAL

DSM-8103

DIGITAL SUPER MEGOHMMETER

HIOKI E. E. CORPORATION

Content

1. Outline

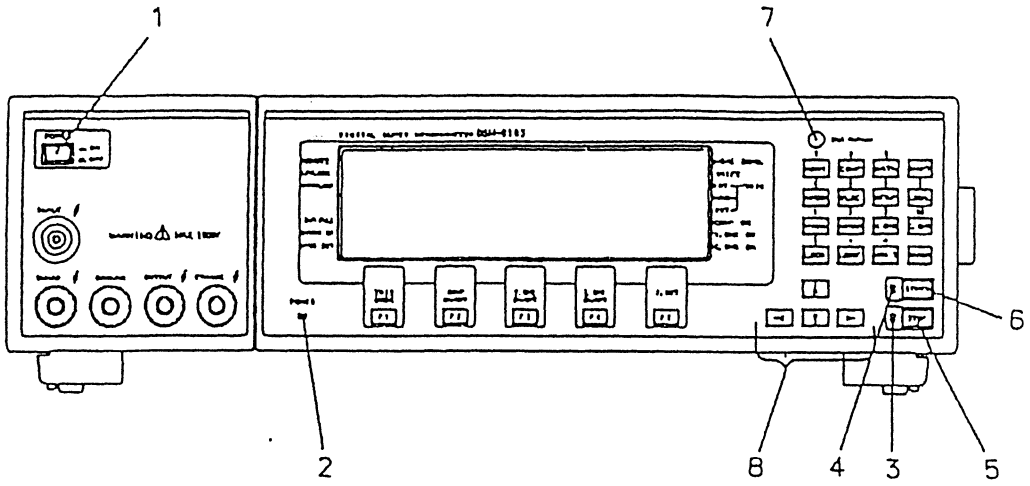
This Digital megohm Meter Model DSM－8103 is a super megohm checker with Low－Noise Power source and High－Sensitive Current Meter installed.
This unit has resistance value and measuring range is $1x10^4$ $－3\times10^{16}$ Ω, 30fA－10μA.
With adoption of Low－Noise Power Source, it is suitable for insulation measurement of insulation with high－voltage volume capacitive.
And also with LDC Display Module〔240×64 dots〕, it is easier to view necessary information & operate this unit.

(Main Features)

Test Voltage Range : 0.1 －1,000VDC
Current Measurement Range : 30fA－10μA
Resistance Measurement Range : $1\times10^4－3\times10^{16}$Ω
Current Limit Setting: 5mA,10mA, 50mA (0.1－250V)
5mA,10mA, 50mA (251－1,000V)
Integral Time Setting : 2mS－300mS
Trigger Delay Setting : 0－9,999mS
Auto Average Measurement
Current Check
Contact Check
Self-Calibration
Computing for Comparison, Volume Resistivity & Surface Resitivity
Data Saving & Detectim
Histogram Display
Sequence Program
Interlock
GP-IB Interface (STD)
Handler Interface (STD)
RS－232C (option)

2.Name and Function of Each Section

2-1 Front Panel



1. "POWER" switch

Power switch to turn power on/off. Upon pressing once, it will be inside and powered. Pressing again it will be come out and power off.

2."POWER" Display

When Power switch is turned on, it is on.

3."STOP" Display

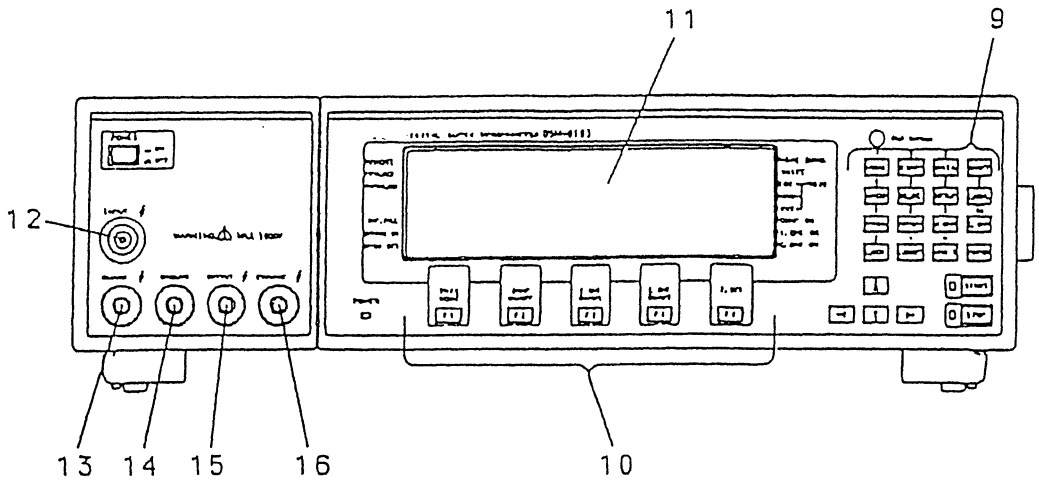
Upon pressing Stop key, it is on and with pressing Start key it will be off.
While "Stop" Display is on, Output voltage is 0 and Trigger input can not be accepted.

4. "Start" Display

Upon pressing Start key, it is on and with pressing Stop key it will be off.
While "Start" Display is on, Setting Voltage is output and Trigger Input cannot be accepted.

5. 〔Stop〕 key

Stop measurement and make Voltage Output to 0V. Since this key has most priority, it can be accepted even while key is locked.



6. 〔Start〕 key

Output Setting Voltage, enables trigger input to accept. When Trigger Mode In "INT", measurement is started.

7."High Voltage" Display

Indicates high voltage is output. When voltage of approx. more than 30V is Output, it is on.

8.Cursol Movement key

Shifts cursor position on monitor or scroll screen.

9.Command/Value input key

Uses pressing 〔Shift〕 key, it is to be value input key.

10.〔F1〕/"Trig. Mode ", 〔F2〕/ "Comp ON/OFF, 〔F3〕 /"V.CHK ON/OFF, 〔F4〕/ "C.CHK ON/OFF", 〔F5〕 /"P.SET" function keys

Function of each key display on LCD screen above each key. On Measurement screen, upon 〔Shift〕 key is pressed, Function will be the one indicated in " ". At this point, function is displayed in the screen.

11.Display Unit

LCD Display Module with 240 x 64 dots. Measurement result, Measurement condition and every setting status are given in display.

12. "Input" Connector

Measurement input connector consists of Conductive Center with Conductive Outer. Conductive Center is connected with Measurement Input, while Conductive Outer to "Guard" terminal.

13."Guard" Terminal

Guard terminal on measurement input section

14."Ground" Terminal

Ground Terminal connected to Main Unit Frame

15."Output" Terminal

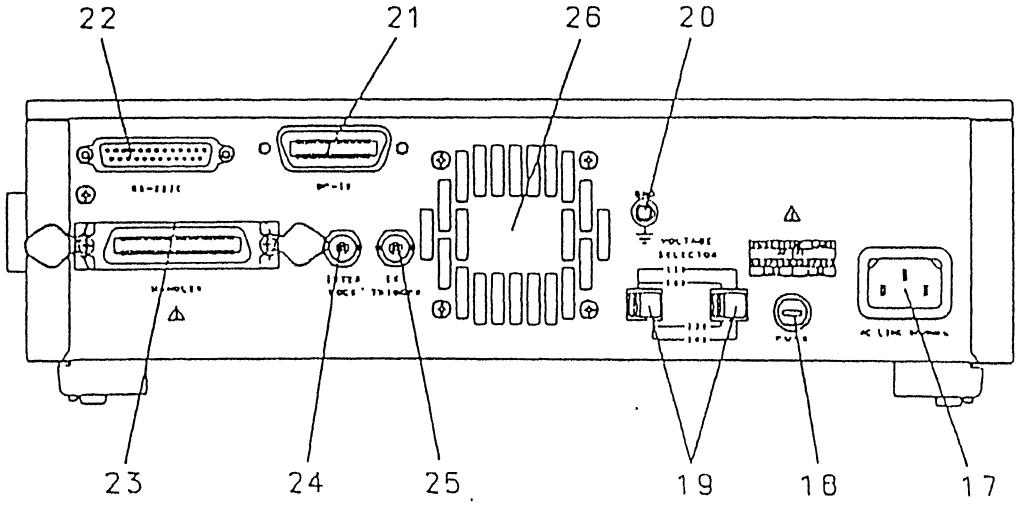
Voltage output terminal. Measurement of Resistance is made between "Output" terminal and "Input".

16."Charge" Terminal

Output terminal for pre-changing

Between "Charge" terminal and "Output" terminal same voltage with measured one is output.

2-2 Rear Panel



17."AC line 50/60Hz" Connector

Input connector for power supply

18."Fuse"

Fuse holder for power supply

19."Voltage Selector" Switch

With this switch, voltage is changeable to 100V, 115V, 220V & 240V

20."GND" Terminal

Ground Terminal, which is connected with main unit frame

21."GP-IB" Connector

Connector for GP-IB Interface

22."RS-232C" Connector [optional]

Connector for RS-232C Interface

23."Handler" Connector

24."Interlock" Connector

When using Interlock function, this is input connector for signal from fixture.

25."EXT. Trigger" Connector

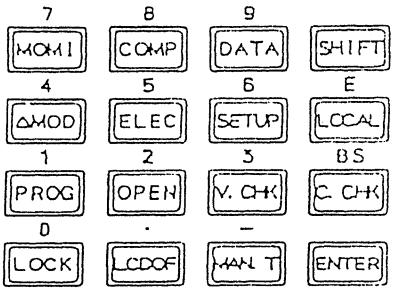
Outer trigger connector, we use on setting "EXT" of trigger mode.

26.Cooling Fan

Fan for cooling main unit inside

2-3 Command/Numeric Value Input key

Command/Numeric value input key



〔Shift〕 : Shift

Key for changing command or numeric input and switching functions of function on Measurement display command/numeric value input key is command input mode without pressing 〔Shit〕 key, and numeric value input mode upon pressing 〔Shift〕 key. 〔Shift〕 key is alternately switched one pressing. Upon pressing 〔Shift〕 key, next to 〔Shift〕 key side mark 〔▸〕 is displayed.

〔Enter〕 : Enter

Define input result

Setting execution on measurement display / setting display is all done by this key.

〔Lock〕 / "0" : Key lock

Key stopping key input. Upon this key pressed, key rather than 〔Stop〕 key or 〔Lock〕 key is not accepted. Upon pressing 〔Lock〕 key again, key lock status is released on key lock status, next to "Key lock" side mark 〔◂〕 is displayed. On numeric value input mode with 〔Shift〕 key pressed, this is "0" input key.

〔LCDOF〕 / "." : LCD off

Pressing this key, display on monitor is stopped and back light is off. This display off status is released upon pressing any key on numeric value input mode, this key is "." radix input key.

〔MAN. T〕 / "-": Manual Trigger

With "Man" 〔Manual trigger mode〕 in Trigger mode, generates trigger and start Measurement. On numeric value input mode, this "-" minus polarity input key.

〔PROC〕 / "1" : Program

Key is one transferring into sequence program implementation display.
Please refer to "Operation for Sequence program implementation display.
On numeric value input mode, this is "1" input key.

〔Open〕 / "2" : Open adjustment

Transfer into display setting reference value of contact check. Please refer to "Operation for Open setting display". On numeric value input mode, this is "2" input key.

〔V.CHK〕 / "3" : Voltage check

Executes one time check of measuring voltage between "output" and "Guard".
On numeric value input model, this is "3" input key.

〔C.CHK〕 / "BS" :Contact Check

Executes one time contact check. On numeric value input mode, this is "BS 〔Back Space〕 " key deleting input characters.

〔MOD〕 / "4" : Deviation measuring mode

Transfers into "Deviation display screen". Please refer to "Operation of deviation display screen". This is "4" input key on numeric value input mode.

〔ELEC〕 / "5" : Electrode

Transfers into "Electrode parameter setting display". Please refer to "Operation of electrode setting". This is "5" input key on numeric value input mode,

〔Setup〕 / "6" :Setup

Transfers into operating environment setting display. Please refer to "Operation Of operating environment setting" on numeric value input mode, this key is "6" input key.

〔Local〕 /"E" :Local

Release remote status. On numerical value input mode, this is "E" exponential input key.

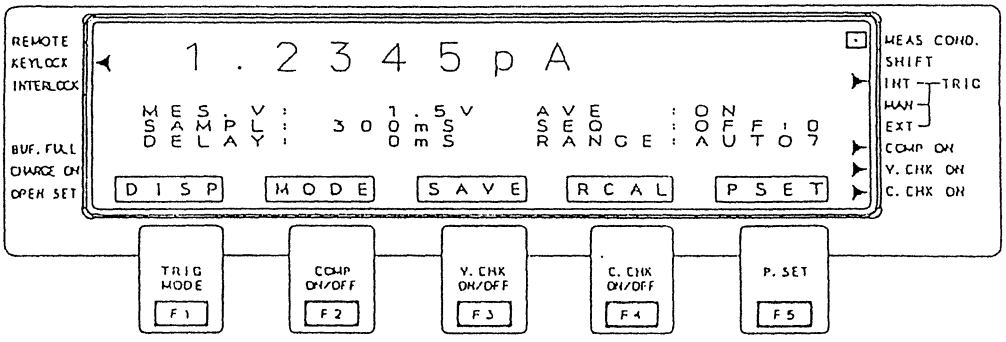
〔COMP〕 /"8" :Compare

Transfer into comparison measurement display. On numeric value input mode, this is "8" input key.

〔Data〕 /"9" : Data

Transfers into measured data display assembling data. This is "9" input key on numeric value input mode.

2-4 Display indication



"Remote" indicates remote operation by GPIB / RS232C with side mark 〔◂〕 on display.

"Key lock" indicates key-lock status with side mark 〔◂〕 on display.

"Interlock" indicates interlock unction is on 〔effective〕 with side mark 〔◂〕 on display.

"Buf.Full" with 1,000 data buffering function in case saved data exceed 1,000 side mark 〔◂〕 is on. The measured data after this indication is gone without buffering

"Charge On"

When "Charge" terminal is usable, side mark 〔◂〕 is on. Without this mark, "Charge" terminal cannot be used.

"Open Set"

Upon open adjustment is executed, side mark 〔◂〕 is on when contact check can be done. If contact check is executed without this mark, error is indicated.

"MEAS COND"

Status of under measurement is indicated with side mark 〔□〕 .

"Shift"

Shift key status is indicated with side mark 〔▸〕 .

"Trig-INT"

Status of internal trigger mode is indicated with side mark 〔▸〕 .

"Trig-MAN"

Manual trigger mode status is indicated with side mark 〔▸〕 .

"Trig-EXT"

External trigger mode is indicated with side mark 〔▸〕 .

"COMP ON"

ON/OFF status of judgment function is indicated with side mark 〔▸〕 . If it is not on, judgment is off. In case of NG by judgment result, side mark goes on.

"V.CHK ON"

ON/OFF status of voltage check function is indicated with side mark 〔▸〕 . Without this mark, function is off. In case of NG by voltage check result, side mark goes on & off.

"C.CHK ON"

ON/OFF status of contact check function is indicated with side mark 〔▸〕 .

Without this mark, function is off. In case of NG by contact check result,

Side mark goes on & off.

3. Operation

3-1.1 Terminal Function

Function as follows:

"Input" Measurement input terminal. This is shield construction and outer electrode [shield side] is connected to "Guard" terminal.

"Guard" Guard terminal. This is common side of current measurement section, This is used to connect to "Guard" terminal when measurement of non-contact samples.

"Ground" Grounding terminal. It is used to lesson noise influence and also decrease electric shock.

"Output" Measurement voltage output terminal. Measurement is made between "Output" terminal and "Input" terminal.

"Charge" Charged voltage output terminal. It is used to pre-charge samples prior to measurement. Pre-charge voltage is output between "Output" & "Charge" terminal. Connection of short-bar & measurement equivalent circuit shows in figure 3.1 & 3.2, respectively.

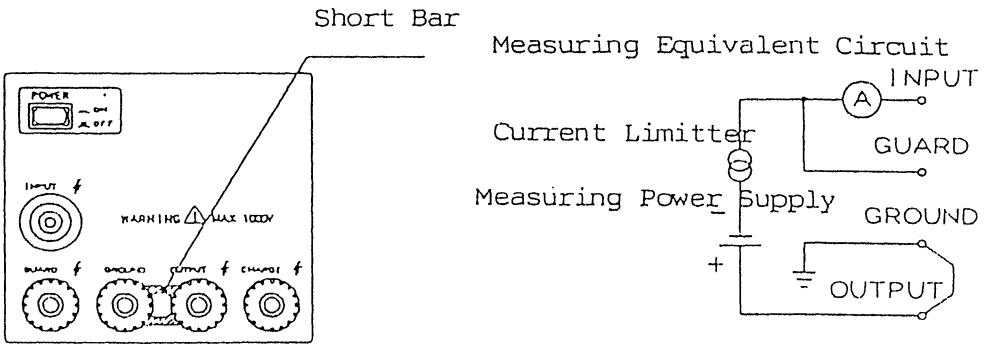


Figure 3.1 Connection for grounded sample measurement(earth "Output" side)

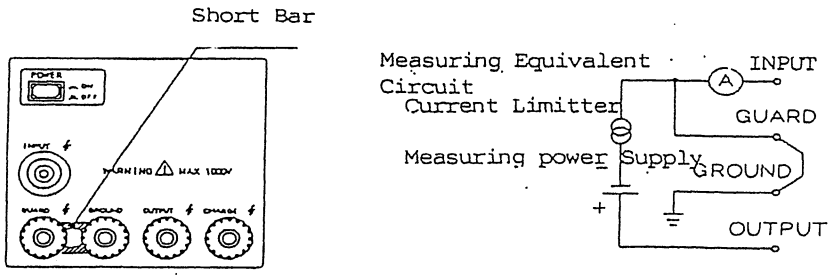


Figure 3.2 Connection for ungrounded sample measurement (earth "Ground" side)

3-1-2 Connection for measuring grounded samples

(1) In case of measuring grounded samples, connect "Output" terminal to "Ground" terminal with short bar. (Refer to Figure 3.3)

(2) Samples to be measured is connected between "Input" and "output".

Remark

In case of high resistance measurement, stable measurement may not be taken caused by noise generated by measurement cable.

For stable measurement cable connect to sample from "Input" please use out specified Low-noise shield cable.

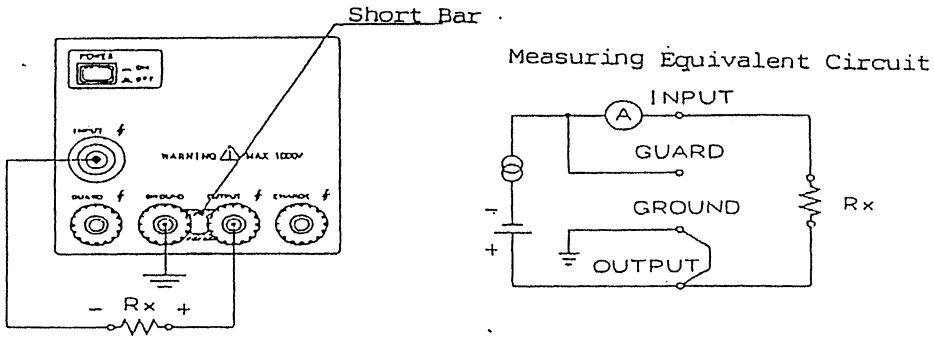


Figure 3-3 Grounded sample measurement

WARNING

In case of grounded sample measurement, "Ground" terminal is connected with "Output" terminal and Max. 1000V measurement voltage is output at "Guard" terminal and Outer Electrode of "Input" terminal 〔Measurement cable shield〕. Please e careful of electric shock.

NOTICE

When switching measurement terminal by relay with measurement voltage is output, Please insert protective resistance which value should not exceed max. permissible current at relay point in parallel with the circuit.

Protective Resistance Value≧ 〔Measured Voltage〕 / 〔Max. Permissible Current〕

3-1-3 Connection for measuring un-ground samples

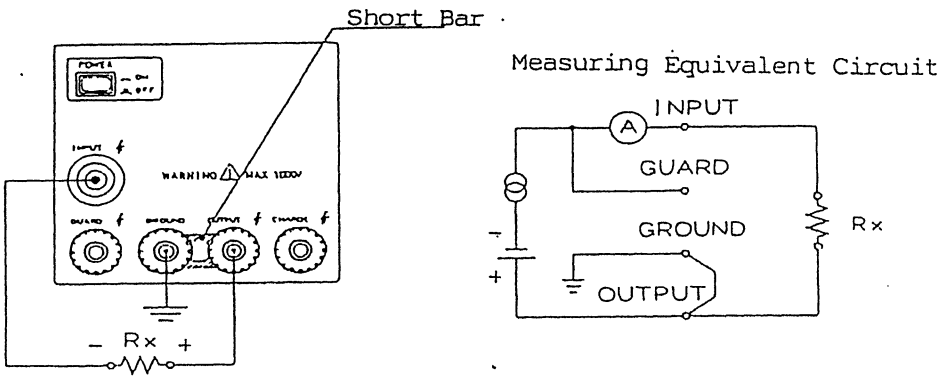


Figure 3.4 Ungrounded sample measurement

While measuring high resistance, because of high-sensitive current measurement
It happens that you can't get stable measurement by the noise around or earth leakage current.
It is necessary that sample is put into shield box to measure high resistance sample.

Connection example as follows:

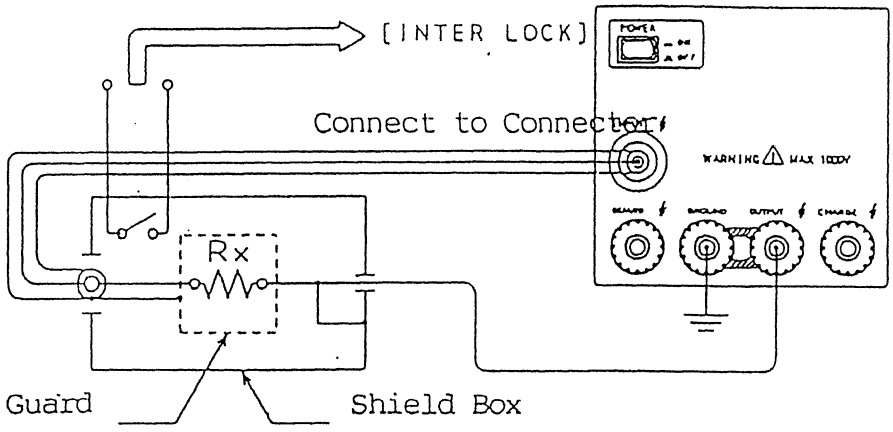


Figure 3.5 Example for grounded samples

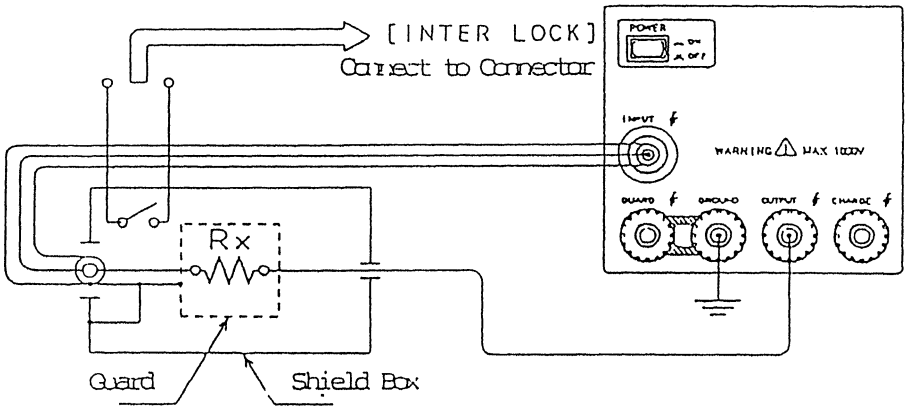


Figure 3.6 Example for ungrounded samples

NOTICE

With short-bar connection Max.1,000V measured voltage is output at "Guard" terminal or "Output" terminal. Outer case of shield box should be connected to "Ground" terminal to prevent electric-shock accident, please use interlock function

3-1-5 Charge Terminal Connection

In case measuring high capactive samples, measurement after charging sample In advance [pre-charging] can shorten measurement time. This unit has a fixture of Charging voltage output terminal ["Charge" terminal] for this purpose. "Charge" Terminal should be connected with manner of Figure 3.7 [Grounded sample] or Figure 3.8 [Under-grounded sample] .

NOTICE

In order to use "Charge" terminal, setting on the display is necessary. On the "Power source select" display entered with [Setup] [F5] [Power], set 10 or 50mA for current limit setting value "CURL:" and on for charging voltage output terminal setting.

"CURL: C:".

With setting "ON", side mark left side of "Charge ON" is on. In this case, current limiter of "Input" terminal side is fixed with 5mA regardless of CURL:" setting and at "Charge" terminal 5mA or 45mA changing current is output.

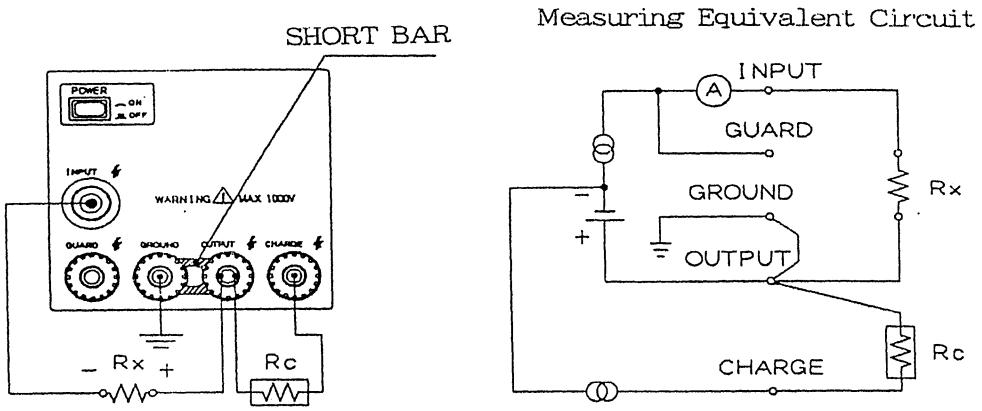


Figure 3.7 Charge terminal connection (grounded sample)

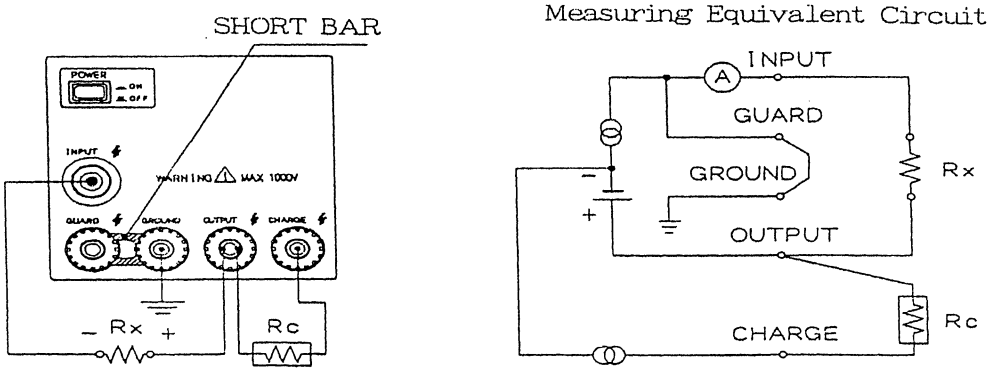


Figure 3.8 Charge terminal connection (ungrounded sample)

NOTICE

When switching measurement-terminal by relay with measurement voltage is output, please insert protective resistance which value should not exceed max. permissible current at relay point in parallel with the circuit.

Protective resistance value ≧ [measured voltage] / [Max. permissible current]

3-2 Power-On

Unit is to be powered as follows:

(1) Confirm "Power" switch on front panel to be "Off".

(2) Make sure that "Voltage Selector" at rear and "Fuse" is set to using power supply Voltage.

(3) Connect supplied power cable with Main unit power connector, thin plug into AC receptacle with earth. If receptacle is not 3P, utilize 3P-2P adapter and connect earth-lead wire of adapter with near earth line.

(4) Press "Power" switch in front to power "ON". LED of "Power" in front panel is ON.

(5) After approx. 7 seconds format setting, normally measurement display comes up. Then, measurement condition setting such as measurement voltage, sampling time etc. is set to the status of the previous just before turning power off by resume function.

Warning

Before turning power on, confirm that "Voltage Selector" setting in rear equals to AC power supply voltage. Otherwise, it may cause fire, defect.

Warning

Make sure that earth-pin of power cable to be on earth for danger protection, In case earth-pin of power cable can't be grounded, earth the ground terminal at rear.

3-3 Setting of measurement Parameter

3-3.1 Measurement Mode Switching

This unit has 4 types of measurement mode, Resistance Measurement 〔RV〕, Current Measurement 〔CM〕, Surface Resistivity Measurement 〔SRM〕 & volumetric Resistivity Measurement 〔VRM〕.

(1) Key Operation

a. 〔F2〕 Mode Select by pressing key

b. 〔F2〕 Mode Upon pressing key, mode of in turn RV, Cm, SRM & TRM comes

(2)Display of each mode unit

Measurement Mode	Unit in display
RV	Ω
CM	A
SRM	ΩRS
VRM	ΩRV

*Actual unit of surface resistivity measurement is 〔Ω〕 and volumetric resistivity measurement is 〔Ω・cm〕.

3-3.2 Trigger Mode Trigger

This unit has 3-type of trigger mode: Internal Trigger 〔INT〕, Manual Trigger & External Trigger.

(1) Action of Each Trigger

Mode	Action
〔INT〕	Continuous measurement with timing generated inside of the unit
〔MAN〕	One time measurement upon pressing 〔MAN.T〕 key on panel
〔EXT〕	One time measurement with trigger input through "EXT Trigger" From outside

(2)Key Operation

a. Press 〔Shift〕 key to go to shift function. 〔F1〕 key switches to TROG.

b. 〔F1〕 Upon pressing TRIG key, mode switches 〔INT〕, 〔MAN〕 & 〔EXT〕 in turn.

3-3.3 Measuring Voltage Setting

(1) Key Operation

a. 〔F5〕 Press PSET key to go to measuring parameter setting mode

b. Using cursor moving to set "MES.V" column, put voltage value putting voltage Value has 2 types of method.

c. In measurement parameter setting mode, 〔F2〕 & 〔F3〕 key are changed to Down & Up function, which switches pre-fixed value in turn. Pre-fixed value is 12 kind of 〔0.1V, 0.5V, 1V, 2.5V, 5V, 10V, 25V, 50V, 100V, 250V, 500V & 1,000V〕

3-3.4 Integral Time 〔Sampling Time〕 Setting

There is a case which stable measurement can't be given because of noise influence infinities input current while high sensitive current measurement.
This unit has A/D conversion after integration of input current to make stable measurement without noise elements. Noise reduction rate is higher with integral time longer and power frequency noise 〔Hum〕 can be reduced more, with integral time's multiplication of power frequency cycle. Integral time longer, measurement time is also longer suitable integral time is to set taking consideration of measurement time and measuring resistance value 〔Current Value〕. In this regard, this unit has unit has setting of 1mS or 1 PLC unit for integral time.

(1) Key operation

a. 〔F5〕 PSET Enter measuring parameter setting mode by pressing PSET key.

b. Move the cursor key to "SAMPL" column and put integral time.

c. 〔F4〕, 〔F5〕 keys become selection key of m.s. ,PLC.
〔F2〕, 〔F3〕 keys change to Down, Up function, respectively

d. 〔F4〕 ms key pressing gives ms unit input
And 〔F5〕 PLC key for PLC unit input with range of 2mS – 300mS or 1-15 PLC.

* PLC indicates 1 power frequency cycle, so in 60Hz it is approx. 17mS, in 50Hz it is 20mS.

* With integral time setting, full-scale sensitivity of current measurement section change.

3-3.5 Average Function Setting

Average function has effect to lessen dispersion of measured value by averaging measured results. This function is effective with 〔INT〕 Internal trigger mode.

(1) Key operation

Enter to measuring parameter setting mode by pressing

a. 〔F5〕 PSET key
In this mode, 〔F4〕 / 〔F5〕 key is ON/OFF selecting key.

b. Use the cursor key 〔← 〕 〔→〕 〔↑〕 〔↓〕 to "AVE: " column and set with 〔F4〕 ON / 〔F5〕 OFF key

3-3.6 Measuring Range Setting

This unit consists of high-sensitive current measurement section and measuring voltage output section and calculates resistance through measured current value and measured voltage. Range speculated here is for current measurement level, not full-scale sensitivity of each range determined by integral time setting.

Full-scale current value almost equals to next formula:
〔In case of Max. 200 A〕

$$1_{FS} = 3 \times 10^{-(2+R)} / T$$

Where 1_{FS} : Full-scale current R: Range T: Integral time

Figure 3.1 shows typical relation of integral time & full-scale sense, switching of range has both automatic & range-field.

1. Key Operation

a. Enter to condition setting mode by pressing 〔F%〕 PSET key.
b. Move the cursor (〔←〕 〔→〕 〔↑〕 〔↓〕) to "Range" column.
c. Set Auto/Hold with 〔F4〕 / 〔F5〕 key.
d. ON hold setting, set the range with 〔F2〕 Down/ 〔F3〕 Up key.

Table 3.1 Integral Time & Full-scale current of each range

Range code	Integral Time				
	2m s	10ms	20ms	100ms	300ms
1	200μA	200μA	150μA	30μA	10μA
2	100μA	27μA	15μA	3μA	1μA
3	10μA	2.7μA	1.5μA	300A	100nA
4	1μA	270nA	150nA	30nA	10nA
5	100nA	27nA	15nA	3nA	1nA
6	10nA	2.7A	1.5nA	300pA	100pA
7	1pA	270pA	150pA	30pA	10pA

3-3.7 Current Limit Setting

This unit has current limiter to control current into the measured circuit in order not only to fasten charge the circuit but also to prevent break-down of it. And to separate measuring circuit and charge circuit, " Charge" terminal also has current limiter. Setting of limiter is done by 〔Power Source Select〕 by 〔Set UP〕 key.

NOTE

Current limiter controls steady current, but switching of load side by relay gives transient current with several 10μS width. Therefore switching terminal relay with measured voltage on, insert the preventive resistance which value does not exceed max. Permissible current at point in parallel with the circuit. This can apply to changing circuit also.

Preventive Resistance≧ 〔Measuring Voltage〕 / 〔Max. Permissible Current〕

(1) Key operation

a. Enter to setting display by pressing 〔Set Up〕 key
b. Enter "Power Source Select〕 display by pressing 〔F4〕 power.
c. Use the cursor key 〔↑〕〔↓〕 to move "Curl*" column, then use the cursor key 〔←〕〔→〕 to select limit value.
d. Use the cursor key to move "Curl. C:" then use the cursor key to set (Use / Non-use) of "Change" terminal.

(2) Limit Value Setting Range

Measuring Voltage 0.1 – 250V 5mA/10mA/50mA
250 – 1,000V 5mA/10mA

(3) Selection of "Charge" terminal

"Charge" terminal can be used when setting on for "Curl.:C:" column, 10 or 50 for "Curl:" column, then side mark for "Charge On" on panel is on.
And control current pf limiter for measuring side "Input" or "Guard" and changing side 〔"Charge" is set as Table 3.2〕

Table 3.2 Current limit setting value

「CURL * 」 Setting		5mA	10mA	50mA
「CURL.C:」 OFF	『INPUT』 side	5mA	10mA	50mA
	『CHARGE』 side	0	0	0
「CURL.C:」 ON	『INPUT』 side	5mA	5mA	5mA
	『CHARGE』 side	0	5mA	45mA

WARNING

Upon pressing 〔START〕 key, Max. 1,000V measured voltage is output at measuring terminal. Please make sure that nobody touches cable or fixture etc. to avoid shock-hazard, the press 〔Start〕 key.

3-4 Measurement start

3-4.1 In case of Internal Trigger Mode 〔"INT" Mark on the right〕

1. Upon pressing 〔Start〕 key measuring voltage is output, measurement begins with trigger cycle generated internally.

3-4.2 In case of Manual Trigger Mode "MAN" Mark on the right]

1. Upon pressing [START] key measuring voltage is output, it becomes Trigger waiting.

2. A measurement starts when pressing [MAN.T] key.

3-4.3 In case of External Trigger Mode ["EXT" Mark on the right]

1. Upon setting [Start] key measuring voltage is output, it becomes trigger waiting.

2. Giving trigger signal from outside to "EXT Trigger" connector [rear] measurement starts with cycled trigger signal.

NOTE

[Start] key is to output the measuring voltage and accept trigger. Please note that in case of "INT"ernal mode, measuring starts with [Start] key pressing but in case of "MAN" or "EXT", with pressing "MAN.T" key or trigger input into "EXT Trigger" gives measurement start.

NOTE

External trigger signals should as follows:
Pulse Width : 100 μ S
Signal Logic : negative [low active]
Drive Output : open collector or TTL
Drive Current : sink current with more than 1mA

3-5 Measurement End

To end the measurement, press [STOP] key. With [Stop] key pressing, [Stop] display next to key is on. In this [Stop] status, measurement voltage output is 0V and trigger Input can't be done. Status between "Output" terminal & "Input" terminal is discharged (discharged status with current limiter connection). ("Charge" terminal is also same condition)

WARNING

Measuring voltage may remain on the sample even after pressing [Stop] key, keep away from the metallic part which has been charged until final discharging for shock-hazard.

4. Key Operation & Function

4-1 Outline of Key Operation Procedure

4-1.1 Display

There are 2 kinds of display:

1. Measured value indication display
2. Setting display to set measuring parameters

On measured value indication display, you can set measuring parameter with 〔F5〕 PSET key.

Measuring parameters to be set are already pre-specified to be selected by function key 〔F1〕 through 〔F5〕. Carriage return after setting is done by 〔Enter〕 key. Setting display has own display has own display by each setting column. Carriage return to measured value indication display is done with 〔Enter〕 key.

Table 4.1 Display Type

Type	Contents	Unit Status
Measured Value Indication Display	Normal measuring Display	Under measuring
		Wait foe key entry
	Sequence Measuring Monitor Display	Under measuring
		Wait for key entry
Setting Display	Comparison measurement Setting display	Wait for key entry
	Gained data display	Wait for key entry
	Histogram indication display	Wait for key entry
	Threshold value setting of histogram display	Wait for key entry
	Data buffering indication display	Wait for key entry/ indication
	Data buffer erase display	

Type	Contents	Unit Status
Setting Display	Deviation indication Setting display	Wait for key entry
	Electrode setting display	Wait for key entry
	Environment Setting Outer interface setting Self-diagnostic test execution display Self-calibration setting display Power supply setting for measurement display	Wait for key entry Wait for key entry Wait for key entry Wait for key entry Wait for key entry
	Programming display	Wait for key entry
	Open setting display	Done/ Wait for key entry

4-1.2 Measuring Value Indication Display

This display indicates measured result and measuring parameters measured value is shown. Measuring value indication display has normal measuring display and sequence measuring monitor display, where you can monitor sequence process condition. You can confirm sequence process condition along with following columns downward:

Discharging time before measurement "DCHG1"
Charging time before measurement "CHARG"
Measuring time "MEAS"
Discharging time after measurement "DCHG2"

Switching between 〔Normal measuring display〕 & 〔Sequence Measuring monitor display〕 is done by 〔MONI〕 key.

Measuring Condition

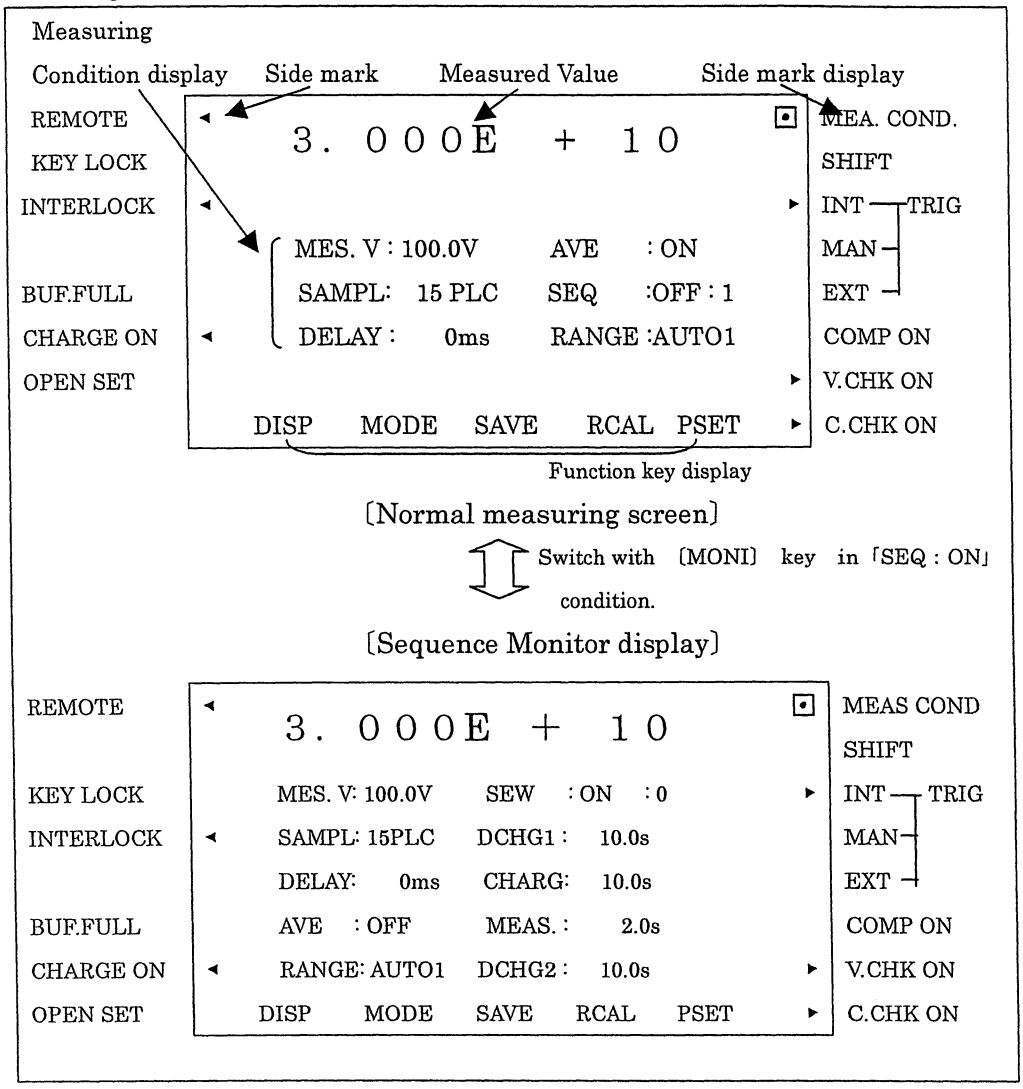


Figure 4.1 Normal Measurement Display and Measurement Monitor Display

4.1.3. Explanation of a measured value display screen

Table 4.2 Measured Value Indication

Class	Indication Content	Setting Procedure
Type	by unit by index	〔F1〕 DISP, 〔F1〕 UNIT 〔F1〕 DISP, 〔F2〕 EXP
Effective Digit Measuring Mode	2 – 5 Numbers Ω: Resistance measurement A: Current measurement Ω_{RS}: Surface resistivity Measurement Ω_{RV}: Volumetric resistivity measurement	〔F1〕 DISP, 〔F3〕 FIG Select with 〔F2〕 mode key in turn $\Omega \rightarrow A \rightarrow \Omega_{RS} \rightarrow \Omega_{RV} \rightarrow \Omega$

Deviation Indication	Measured value-Reference value Measured Value- Ref. Value / Ref.Value x100%	Select 〔ΔMOD〕 or Dev Select 〔ΔMOD〕 or Dev
Error Indication	Range Over: Current Measurement Range Over	

Table 4.3 Side Mark

Panel Character	Mark	Condition
Remote	◂	Under remote
Key lock	◂	Under key-locked
Interlock	◂	Under interlock action 〔〔Start 〕 Non〕
Buf. Full	◂	Full of Data Buffer
Charge ON	◂	"Charge" terminal usable
Open Set	◂	Open adjustment executed
MEAS COND.	◘	Under measurement
Shift	▸	Under key shift 〔Number key non-input〕
TRIG INT	▸	Internal trigger selected
MAN	▸	Manual trigger selected
EXT	▸	External trigger selected
COMP ON	▸	Comparison measurement selected In case of NG result, mark goes on and off. *2
D.CHK ON	▸	Automatically execute voltage check In case of NG, mark goes on and off. *2
C.CHK ON	▸	Automatically, execute contact check In case of NG, mark goes on and off. *2

*2 While NG mark goes on & off, this is remained until next check or judgment.

4-1.4 Measuring Condition Setting on H.V.I Display

Following is setting procedures:

1. Press 〔F5〕 PSET key.
2. Move the cursor to setting column with key (〔←〕 〔→〕 〔↑〕 〔↓〕) selected column indication is contra-rotated.
3. After setting with function key or number key, press 〔Enter〕 key to define. To cancel setting, erase figure by 〔BS〕 key, then press 〔Enter〕 key back to the previous data. Function keys are scroll key for fixed value 〔F2〕 , F3 or condition setting key 〔F4〕 , 〔F5〕 . Refer to Table 4.4.

〔Example〕 To set voltage to 75.5V

1. Press 〔F5〕 PSET key.
2. Move the cursor to MES.V.
3. Input voltage value 〔75.5〕 with number key.
4. Press 〔MONI〕 "7", 〔ELEC〕 "5", 〔LCDOF〕 ".", 〔ELEC〕 "5", then 〔Enter〕.

Table 4.4 Measuring Condition Table

Parameter	Content	Range	Resolution	Function key
MES.V	Setting Voltage	0.1 – 250V 251 – 1,000V (0.1, 0.5, 2.5, 5, 10, 25, 50, 100, 250, 500, 1000)	0.1V 1V	〔F2〕 Down 〔F3〕 Up
SAMPL	Integral	Time setting 2-300mS (2,4,8,16,20,40,80 160,300) Cycle setting 1- 15 PLC (1,2,3,8,15) *1	1mS 1PLC	〔F$〕 Down 〔F3〕 Up 〔F4〕 mS 〔F5〕 PLC
DELAY	Trigger delay time	0 – 999ms (0.5, 10, 50, 100, 500, 1000, 5000, 9999)	1ms	〔F2〕 Down 〔F3〕 Up
AVE RANGE	Averaging Current Range	On/Off Range 1-7 Auto/Hold		〔F4〕 On/ 〔F5〕 Off 〔F2〕 Down 〔F3〕 Up 〔F4〕 Auto 〔F5〕 Hold
SEQ	Sequence Measurement	Program Number0-9 On/Off		〔F2〕Down/〔F3〕 Up 〔F4〕 On/ 〔F5〕 Off
DCHG1	Discharging Time –1	0 – 999.9s (0,10,20,30,40,50,60, 600, 900)	0.1S	〔F2〕 Down 〔F3〕 Up
CHARGE	Changing Time	0 – 999.9s (0,10,20,30,40,50,60, 600, 900)	0.1S	〔F2〕 Down 〔F3〕 Up

Range	Capacitive value
1	1 F
2	100nF
3	10nF
4	1nF
5	100pF
6	10pF
7	10pA *2

Parameter	Content	Range	Resolution	Function key
MEAS	Measuring Time	0 – 999.9s (0,10,20,30,40,50,60, 600, 900)	0.1s	〔F2〕 Down 〔F3〕 Up
DCHG2	Discharging Time-2	0 – 999.9s (0,10,20,30,40,50,60, 600, 900)	0.1s	〔F2〕 Down 〔F3〕 Up

*1 1PLC, means 1 power line cycle

*2 At range 7, gain multiple 10 times with 10pF capacitance.

4-2 Key Operation & Display Movement

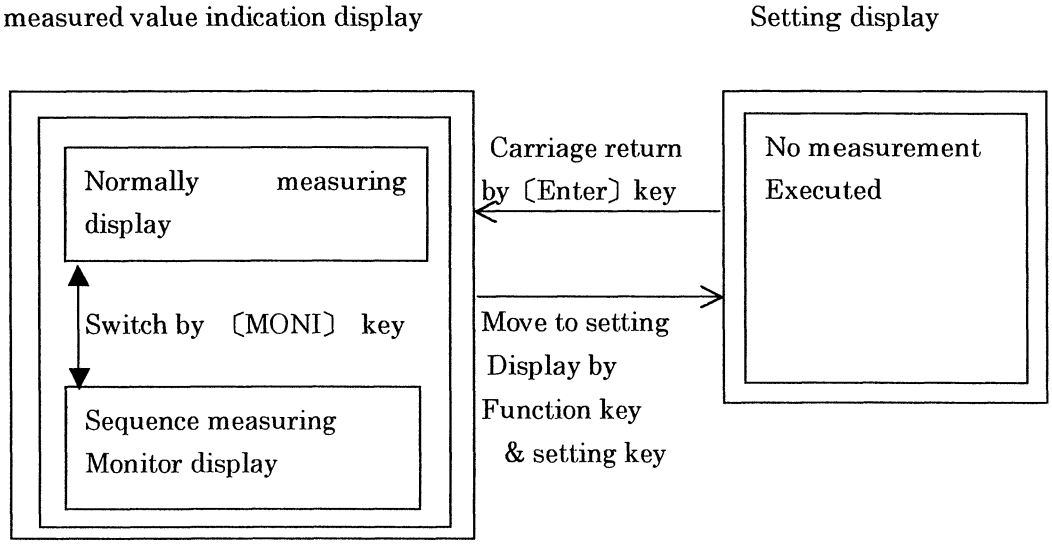


Figure 4.2 Key Operation & Display movement

Table 4.5 Setting key & Function key

Setting key	Function key	Setting display
〔COMP〕		Comparison Measuring Setting Display (Refer to 4-3.1)
〔DATA〕		Data display (Refer to 4-3.2)
	〔F1〕 HIS	Histogram indication display
	〔F2〕 SETH	Threshold value setting display
	〔F3〕 CLRH	Histogram counter clear display
	〔F4〕 CLRD	Data buffer clear display
	〔F5〕 ROLL	Data buffer indication display

Setting key	Function key	Setting display
〔ΔMOD〕		Deviation indication setting display
		Electrode setting display 〔Refer to 4-3.5〕
〔Setup〕		Environment setting display
	〔F1〕 CONF	External I/F setting display
	〔F2〕 SELF	Self-diagnostic execution display
	〔F3〕 CAL	Self-adjustment setting display
	〔F4〕 POWR	Power setting display
〔PROG〕		Program setting display
〔Open〕		Open setting display 〔Refer to 4-3.12〕

4-2.1 Operation on measured value indication display

1. Function operation ("Resistance measuring mode" display)

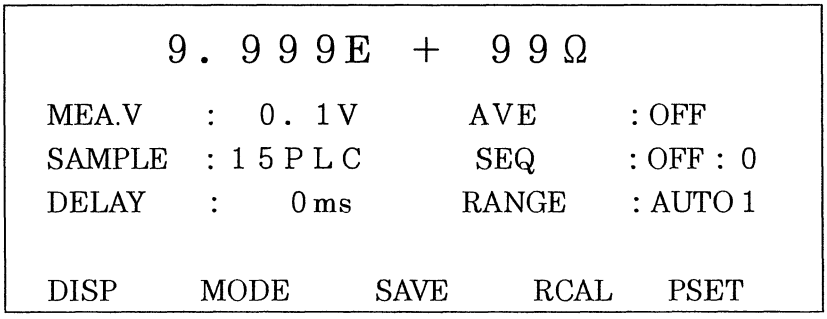


Figure 4.3 Display at power on

a. Indication mode change 〔F1〕 DISP (Display)
Switch indication value by unit
UNIT EXP. FIG.
Indicate measured value by unit 〔F1〕 UNIT (Unit)
Indicate measured value by exponent 〔F2〕 EXP(Exponent)
Indicate digit numbers of measured value 〔F3〕 FIG (Figure)
Indicate guide message 〔Enter significant figure〕 under display
Input digit number 〔2 to 5〕 with number key. Then press (Enter) key to decide.

b. Measuring Mode Change 〔F2〕 MODE (Mode)

Upon pressing Mode key, Resistance measurement →Current Measurement A → Surface resistivity measurement RS → Volumetric resistivity measurement RV → Resistance Measuring in turn

c. Measuring condition save 〔F3〕 SAVE (Save)

Indicate guide message Enter save environment No. under the display

d. Recall measuring condition 〔F4〕 RCAL (Recall)

Indicate guide message Enter recall environment No. under the display

e. Measuring parameter setting 〔F5〕 PSET(Parameter Set)

Select setting parameter with the cursor (〔←〕 〔→〕 〔↑〕 〔↓〕) . Input Setting value with function key or number key. Then press 〔Enter〕 key To decide and after all parameters' setting, press 〔Enter〕 key to carriage return to measuring display.

2. Function key operation at shift condition

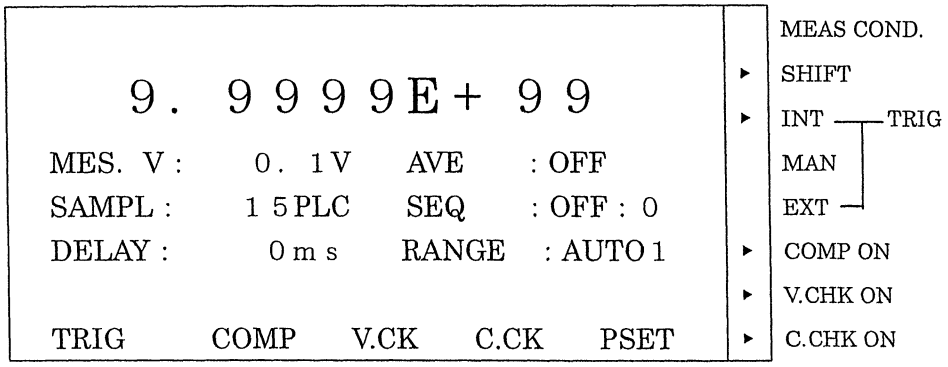


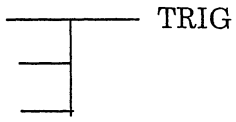
Fig.4.4 Display at shift condition 〔Resistance measuring mode〕

a. Trigger mode change 〔F1〕 TRIG (Trigger)

Upon pressing TRIG key, changes Internal trigger → Manual trigger → External trigger in turn.

Side mark shows trigger mode status.

Internal Trigger	INT	TRIG
Manual Trigger	MAN	
External Trigger	EXT	



b. Comparison measuring selection 〔F2〕 COMP (Compare Active)

Select comparison measurement 〔Execute, Not Execute〕 with side mark. In case of NG result, side mark goes on and off.

c. Setting of voltage automatic check 〔F3〕 V.CK (Voltage Check Active)

Select measured voltage automatic check 〔Execute, Not execute〕 With side mark. In case of NG result, side mark goes on and off.

d. Setting of contact automatic check 〔F4〕 C.CK (Contact Check Active)

Select contact check 〔Execute, Not execute〕 while measuring with side mark. In case of NG result, side mark goes on and off.

4-3 Operation method at setting display

4-3.1 Comparison measurement function operation 〔〔COMP〕〕

Set comparison method, upper limit & lower limit.

1. Press 〔Comp〕 〔Set compare parameter〕 key.
   Move to parameter setting display for comparing measurement 〔Refer to 4.5〕. This function gives judgment of measured result against limit 〔bigger/smaller/in the range〕 with indication of side mark and through external interface.
   In case of NG result, side mark blinks.

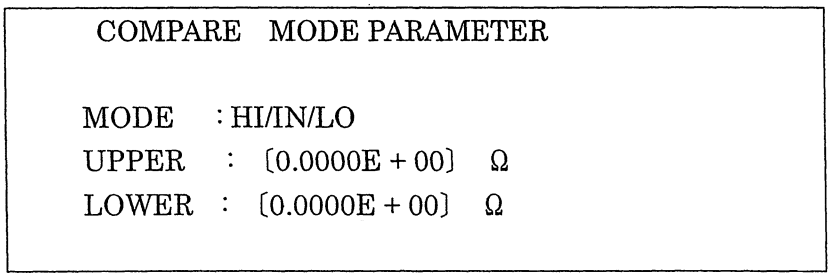


Fig. 4.5 Comparison setting display

   Select parameter with 〔↑〕〔↓〕 key on this display. Mode selection on HI/IN/LO is done with 〔↑〕〔↓〕 key. To set upper limit and/or lower limit, input figure by number key. Then press 〔Enter〕 key to set and return to measuring display.

2. Operation method mode setting
   Select the range of Go(Pass)(HI/IN/LO) in result with 〔←〕〔→〕 key and/or 〔Enter〕 key.

Figure 4.6 Setting Range

	HI	IN	LO
UPPER	GO	NO	NO
	NO	GO	NO
LOWER	NO	NO	GO

3. Setting Upper limit & Lower limit

Input figures to be set and press 〔Enter〕 key to column. At end of Setting press 〔Enter〕 key to return to measuring display. Setting range of this is limited and refer to Table 4.7.

Table 4.7 Setting range by mode

Measuring mode	Setting range
Resistance measurement	1.0000E + 04 – 3.0000E +16Ω
Current measurement	3.0000E +14 – 1.0000E-05A
Surface resistivity measurement	1.0000E +04 – 3.0000E +16Ω RS
Volumetric resistivity measurement	1.0000E +04- 3.0000E + 16Ω RV

NOTE

Please make sure that for this upper/lower setting without setting condition of (upper) > (lower) it always be error, and 〔Enter〕 key is not accepted. Consider setting order.

4. Result indication

In case judgment result is <NG>, side mark right side "Comp ON" blinks. And <GO> result is output at Handler interface connector at rear side.

4-3.2 Histogram Function Operation 〔[Data]〕

1. Press 〔Data〕 (Measured Result Data) key
   Display for data assembling function setting (Histogram data Counter measured data buffer) (Refer to Figure 4.6)

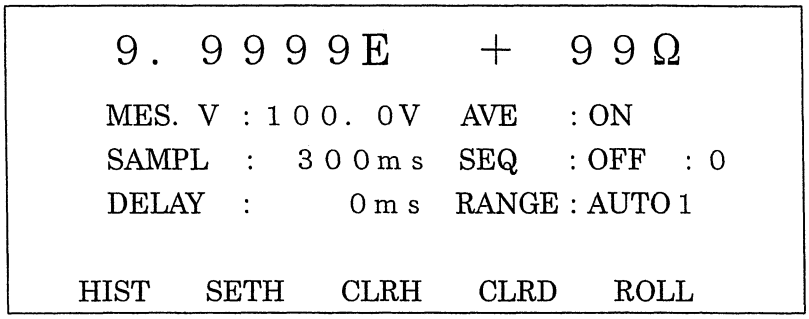


Figure 4.6 Function Selection Display

Select condition setting of histogram making, data buffer indication and data buffer clearing with function key, then move to execution display. From this selection display, press 〔Enter〕 key to back to measuring display.

2. Histogram Threshold Value setting Method ("Data" SETH)
   On function selection display, press 〔F2〕 SETH (Set Histogram) to move to threshold setting display

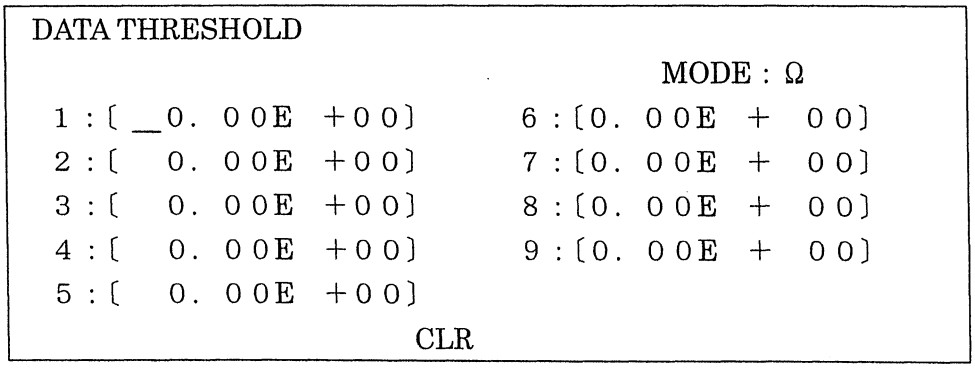


Figure 4.7 Histogram Threshold Value Setting Display

On this display 〔F3〕 key gives CLR to clear all setting values. Input threshold Values are automatically lined up in bid number's order.
〔1:Big 9:small〕 Therefore to change values in big, it is better & efficiency to clear all set values with 〔F3〕 CLR key move to "9", and input new threshold value from big one. Press 〔Enter〕 key to confirm input threshold value. Press 〔Enter〕 key

again returns to previous function section display.

3. Histogram Counter Clearing ("Data", CLRH)
   On function selection display, press 〔F3〕 CLRH 〔Clear Histogram Counter〕 to move to histogram counter clearing display.

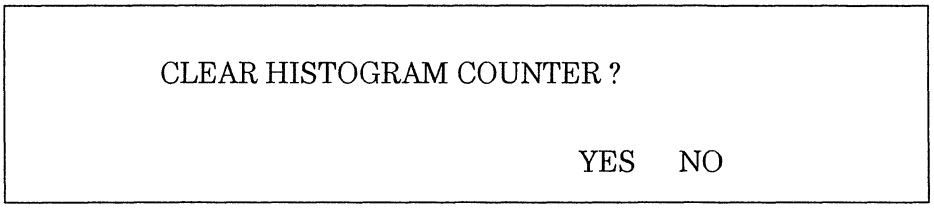


Figure 4.8 Histogram Counter Clearing Display

On this display, 〔F4〕 key is for Yes to clear counter and back to function selection display and 〔F5〕 key is for No to back to function selection display without clearing.

4. Histogram Indication (〔Data, HIST〕
   Press 〔F1〕 HIST (Histogram) to move to Histogram indication display

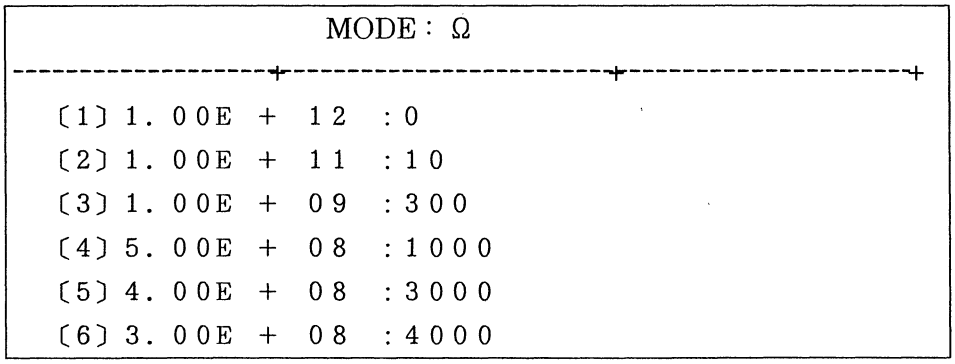


Figure 4.9 Histogram Indication Display 1

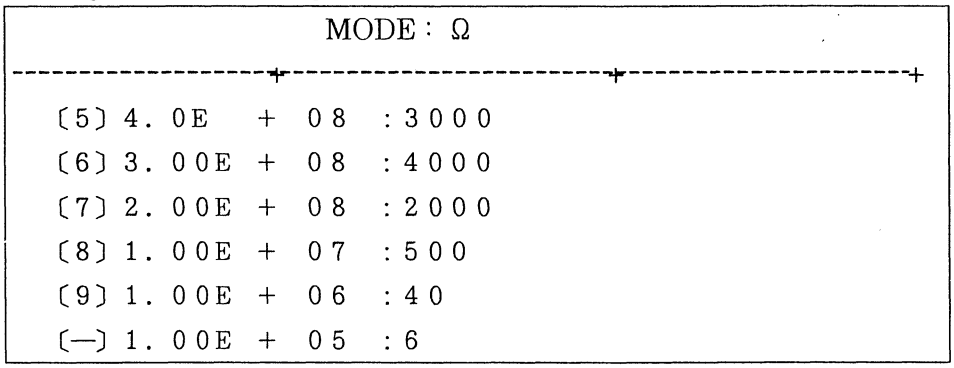


Figure 4.10 Histogram Indication Display 2

Indicates data numbers with 10 ranges divided by 9 threshold value set at SETH by tabular graph. Number indicated at 〔1〕 is data number which value is above "1:" of threshold value 〔2〕 is one between "2:" and "1:", and so on. 〔—〕 is one below "9:" of value. Length of tubular graph shows full-scale at max. Point and others at logarithm ratio.
Tubular graph is indicated in 2 displays to scroll with 〔↑〕 〔↓〕 keys.

4-3.3 Measured Data Buffer Function Operation

1. Press 〔Data〕 (Measured result data) to move to data assembling function (Histogram data counter, Measured data buffer) selection display.
(Refer to Figure 4.6)

2. Data buffer indication (〔Data〕 , Roll)
Press 〔F5〕 Roll (Scroll data buffer) key to move to data buffer indication display.

```
MODE   :                 000 : 0. 0000E + 00
ROLL : LINE/PAGE         001 : 0. 0000E + 00
                         002 : 0. 0000E + 00
                         003 : 0. 0000E + 00
                         004 : 0. 0000E + 00
                         005 : 0. 0000E + 00
                         006 : 0. 0000E + 00
          DOWN      UP       TOP      END
```

Figure 4.11 Data Buffer Indication Display

Indicates measured value in newest at first. Number attached measured Value shows bigger, newer. On this display, function of each key 〔F2〕 , 〔F3〕 , 〔F4〕 , 〔F5〕 switch to Down, Up, Top & End. Without data at data buffer, it indicates "... none...".

a. 〔←〕 〔→〕 key

Switches scroll line number 〔Roll: Line/Page〕
Line : per 1 line
Page: per 1 page 〔7 lines〕

b. 〔F2〕 Down key
Scrolls Down to smaller

c. 〔F3〕 Up key
Scrolls up to bigger

d. 〔F4〕 Down key
Moves to top data

e. 〔F5〕 End key
Moves to end data

f. 〔Enter〕 key
End data indication and move to function selection display.

3. Data Buffer Clearance 〔〔Data〕 , CLRD〕
Press 〔F4〕 CLRD key on function selection display to move to data buffer Clearance display.

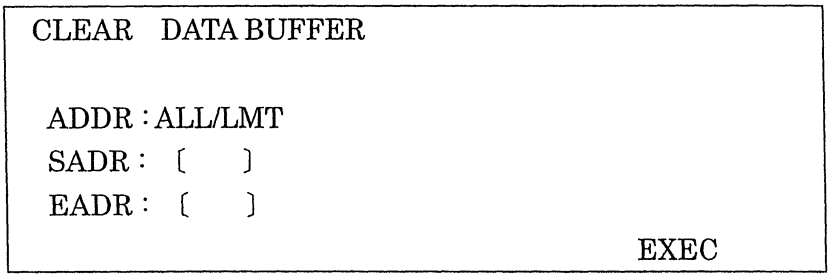


Figure 4.12 Data Buffer Clearance Display

Function key 〔F5〕 is for EXEC to execution of data clearance.

a. 〔←〕 〔→〕 key
Set data clearance range.
ACC : All data clearance
LMT : Clear within specified range only

b. 〔↑〕 〔↓〕 key
In case of LMT clearing range, select column of starting address SADR & Ending address EADE> Input data number of specified range to set SADR

& EADR with number key and press 〔Enter〕 to decide.

a. Upon pressing 〔F5〕 EXEC key data clearance is done.
b. Press 〔Enter〕 key to move function selection display.

4. Method of Data Buffer

It is useful to analyzer data after measuring and it takes time when getting Data through interface one by one. So buffering after all measurement gives quicker measurement. File using data buffer, start to measure after clear Buffer. Without clearing data pause is not identified unless you save data next day continuously. Data in buffer are saved with measured current values and indicated after adopting to mode suits to measuring mode, therefore while indication if the measuring mode is different with the one of measuring time, correct value may not be given.

4-3.4 Operation for Deviation Value Indication Setting Display (〔Δ MOD〕)

1. Press (〔Δ MOD〕) 〔Set deviation mode parameter〕 n setting display to move to deviation (Difference or ratio) Indication Setting Display.

Deviation Mode Parameter

Mode : OFF/DEV/PAR

REF : 〔0.0000E + 00〕 Ω

DEVIATION MODE PARAMETER
MODE : OFF/DEV/PAR
REF : 〔 0.0000E + 00〕 Ω

Figure 4.13 Deviation 〔Difference or ratio〕 Indication Setting Display

2. Deviation Mode 〔MODE〕 Setting

Select parameter with 〔↑〕 〔↓〕 key and setting mode by 〔←〕 〔→〕 keys.

Earth mode gives following:

OFF: Doesn't indicate deviation

DEV: Indicates 〔Measured Value – Reference Value〕

PAR: Indicates 〔Measured Value – Reference Value〕 x100/Reference Value(%)

3. Reference Value Setting
   Select REF with 〔↑〕〔↓〕 and input reference value with number key.
   Press 〔Enter〕 key to define input reference value.

4. End of Setting
   Press 〔Enter〕 key upon setting to back to measuring display.

NOTE

Deviation indication is on display only and output to interface normal measured value

4-3.5 Operation for Electrode Coefficient Setting Function 〔ELEC〕

Set electrode size to be used for measurement surface resistivity and "Rv" as Volumetric resistivity and "Rs" as surface resistivity.

1. Press 〔ELEC〕 (Set Electrode size) key on the setting display to move to electrode size setting display.

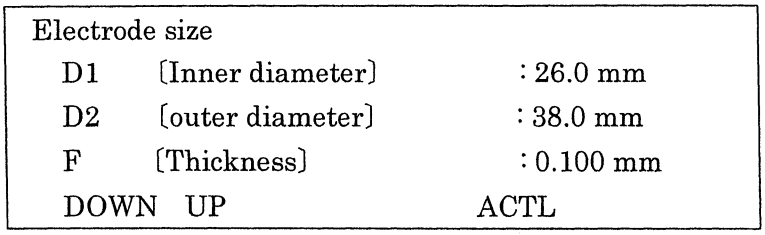


Figure 4.14 Electrode coefficient Setting Display (Electrode Disk)

On this display function key 〔F2〕, 〔F3〕 & 〔F5〕 becomes to Down, Up and ACTL, Respectively. 〔F2〕 Down & 〔F3〕 Up key for selection of coefficient fixed value. 〔F5〕 ACTL is used for liquid which coefficient is set directly.

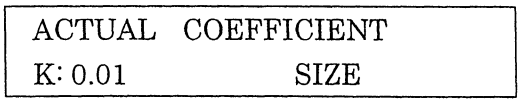


Figure 4.15 Electrode Coefficient Setting Display

NOTE

Upon pressing 〔Enter〕 key, previous coefficient just before returning to measuring display.

2. Each coefficient setting

a. Selection of parameter

Select parameter with 〔↑〕 〔↓〕 key.

b. Value setting

Input electrode coefficient with number key and press 〔Enter〕 key to confirm.

And at this unit has several fixed values for standard electrode sizes, you can select from fixed value with 〔F2〕 Down/ 〔F3〕 Up keys.

c. Parameters

D1 (In diameter)	: Set inner diameter of electrode in mm unit
D2 (Out diameter)	: Set outer diameter of electrode in mm unit
T (Thickness)	: Set sample thickness in mm unit
K	: Set any value

3. Fixed value of coefficient

This unit has following values as fixed ones.:

D1 D2 Diameter fixed
D1 = 26 → D2 =38
50 → D2=70
70 → D2=90
76 → D2=88

F Thickness fixed	
F= 0.010	F=2.000
0.100	5.000
0.200	10.000
0.500	20.000
1.000	30.000

4.Surface resistivity and Volumetric resistivity

$$\text{Volumetric resistivity} \quad \rho v = \frac{\pi \cdot D1^2}{4t} \times \frac{\text{Measured value}}{10}$$

Where as : ρv : Ω・cm

π : 3.14

D1 : mm (Inner diameter of electrode)

t : mm (Thickness of sample)

$$\text{Surface resistivity} \quad \rho s = \frac{\pi \cdot (D2 + D1)}{D2 - D1} \times \text{Measured Value}$$

Where as : ρs : Ω・cm

π : 3.14

D1 : mm

D2 : mm (Outer diameter of electrode)

5. Electrode for measurement 〔option〕

SEM-8301	Electrode for surface resistivity measurement
8310	Electrode fro flat sample
8320	Weight electrode
8322	Ag electrode
8330	Ag electrode for liquid time
8335	Ag electrode for continuous liquid type
8350	Shield box

4-3.6 Environment parameter setting operation (〔Setup〕)

1. Press 〔Set up〕 key on setting display to move to environment setting display.

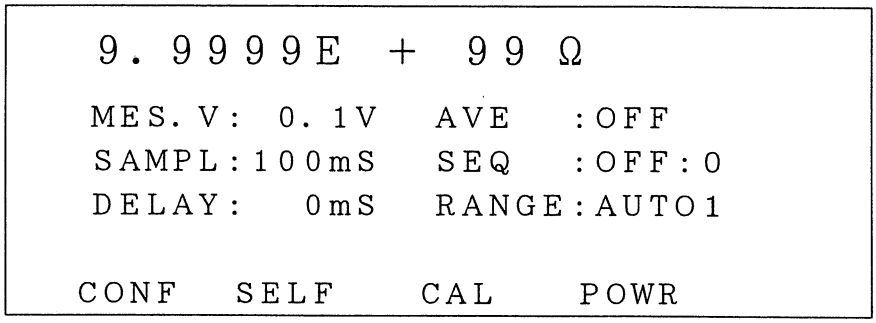


Figure 4.16 Environment Setting Display

Function of Each function key are as follows:

〔F1〕 CONF Outer interface parameter setting
〔F2〕 SELF Self-diagnosis function
〔F3〕 CAL Self-calibration function
〔F4〕 POWR Measurement power supply setting

Upon pressing each function key display to move setting display

4-3.7 Outer interface setting (〔Setup〕, COF)

You can set following parameters:

Interlock function setting
Beep sound setting
Key click sound setting
Analog output setting 〔Only available with option〕
GP-IB address setting
RS-232C Baud rate setting
RS-232C Character length setting
RS-232C Parity check setting
RS-232C Stop bit length setting

1. Press [F1] CONF (Configuration) key to move to outer interface Parameter setting display, which is divided in 2 pages

```
CONFIGURATION  PAGE  -  1/2

  INTERLOCK      :  CONECT/CUTOFF
  BEEP           :  OFF/ON
  BEEP           :  NO/GO
  CLICK          :  OFF/ON
  ANALOGFOUT     :  OFF/ON
                                                    PAGE
```

Figure 4.17 Outer Interface Parameter Setting Display 1/2

```
CONFIGURATION   PAGE - 2/2
   GPIB  ADDR     :  [1]
   232C  BAUD : 1200/2400/4800/9600
   232C  DATA : 7BIT/8BIT
   232C  PARI : NON/ODD/EVN
   232C  STOP : 1BIT/2BIT
                                                    PAGE
```

Figure 4.18 Outer Interface Parameter Setting Display 2/2

[F5] key becomes PAGE (Page) function, with pressing one time, page switches alternatively. Select parameter to be set with ([←] [→] [↑] [↓]) key.

2. Inter-lock function setting

Set Interlock: parameter for the following function:

Connect: to effect interlock function

When shorting "Interlock" input at rear panel, this can output measured voltage [low level input] and when opening output of measured voltage [high level input] is stopped. When stopped, you cannot use [Start] key and "Interlock" display at left side of LCD display have side mark [◂] .

CUTOFF : To stop interlock function

Output of measured voltage can be done anytime.

3. Beep sound setting

Set the following parameters:

OFF: Stops beep sound

ON: Gives beep sound

NO: On NG judgment

GO: On good judgment

4. Key click sound setting

OFF: Gives click sound

ON: Stops click sound

5. Analog output setting (Only available with option)

OFF: Stops analog output

ON: Gives analog output

6. GP-IB Address setting

You can set Max. 30 addresses.

Input value with number key and press 〔Enter〕 key to set.

7. RS-232C Communication setting

232C Baud rate setting

1200	1200 BPS
2400	2400 BPS
4800	4800 BPS
9600	9600 BPS

232C Data RS-232C Chamber length setting

7 BIT	7 BIT/Word
8 BIT	8 BIT/Word

232C Parity check setting

NON	Stops parity check
ODD	Check odd parity
EVE	Check even parity

232C Stop bit length setting

1 BIT	1 Bit
2 BIT	2 Bit

4-3.8 Self-Diagnostic Function Execution

1. Press [F2] SELF [Self check] key on environment setting display to move to self-diagnostic execution display.

```
SELF CHECK EXECUTE
  1. MEMORY CHECK   - - -
  2. A/D CAL.     - - - - -
  3. RANGE CAL.     - - - -


                                  EXEC
```

Figure 4.19 Self-diagnostic execution display

```
SELF CHECK EXECUTE
1. MEMORY CHECK   - - - OK
2. A/D CAL.     - - - - - OK
3. RANGE CAL.     - - - - OK


                                  EXEC
```

Figure 4.20 Self-diagnostic execution display

Function [F5] key becomes EXEC (Execute) an upon pressing self-check Starts. Self-check test executes memory check, self-adjustment check for A/D converter, self-adjustment range check automatically and shows OK (Pass) Or NG (Fail) on display. Figure 4.20 shows OK display.
At ending, press [Enter] key to return to measurement display.

4-3.9 Self-Calibration Setting ([Setup] , CAL)

1. Press [F3] Cal.(Calibration key on environment setting display) to move to self-calibration setting display.

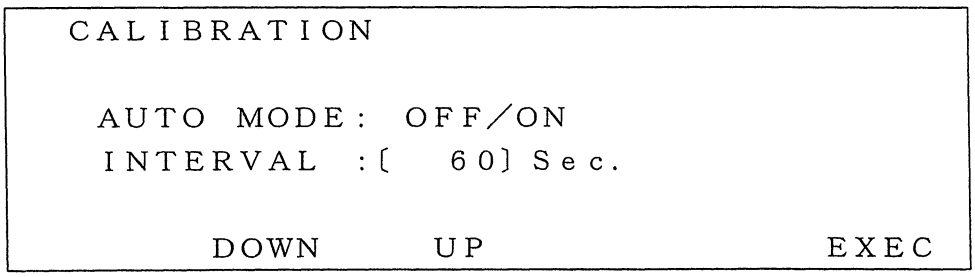


Figure 4.21 Self- Calibration Setting Display

2. "Auto Mode" setting

This is the function to execute automatic self-calibration (for A/D converter & Range check) with certain period.

OFF: don't execute automatic self-calibration

ON : execute automatic self-calibration

3. "Internal" setting

You can set time interval of automatic self-calibration. Input value with number Key and press [Enter] key to define. Otherwise this has pre-fixed value, from which you can select with [F2] Down/ [F3] Up key. Value to be able to set is from 10 to 9,999 seconds and at time of shipment this is set at 60 sec. The pre-fixed values are 10, 60, 300, 900, 1,800, 3,600, 7,200 and 9,999 sec.

4. Execution of Self-calibration

Press [F5] EXEC (Execute) key.

This function executes self-calibration on self-calibration display. No matter how all modes are correct.

NOTE

1. As self-collaboration is on, measuring time is extended because of self-check executing time (Approx. 2 sec.)

2. At sequence measurement is On, even if self-execution is on, you can't get automatic self-check.

4-3.10 Measurement Power Supply Setting (〔Setup〕 , POWR)

1. Press 〔F4〕 POWR (Power) key on environment setting display to move to current limit setting display for measurement power supply.

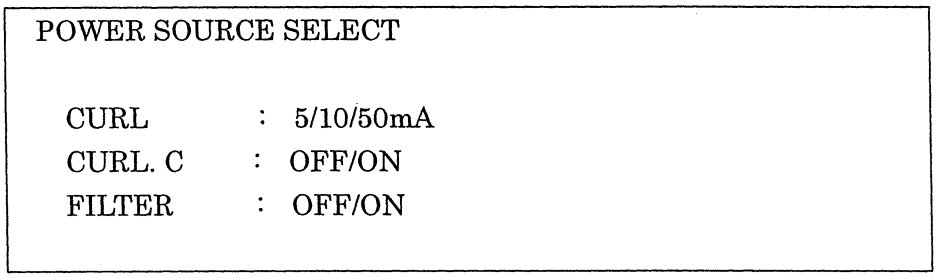


Figure 4.22 Current Limit Setting Display

Parameter has total current limit setting charge terminal. 〔"Charge" terminal at front pane〕 function setting and power noise filter function. Select parameter with (〔←〕 〔→〕 〔↑〕 〔↓〕) . Press 〔Enter〕 key to return to measuring display.

2. Total Current Limit Setting

You can set total current value of measuring side & charging side at "CURL:5/10/20mA". At "CURL:C" on setting, measuring side current is certain 5mA and charging current is 5mA/45mA.

3.Charging terminal function setting

You can set "Charge" terminal function at front panel at "CURL.C: off/on" parameter. In case of off, "Charge" terminal is off. In case of on, "Charge" terminal is on, with 10mA setting at "CURL:" 5mA and with 50mA setting 45mA is output. IF"CURL:" setting is 5mA, you can't use "Charge" terminal even if on setting.

Table 4.8 Current Limit Setting Table

Charging side Current limit	Setting Voltage Range	Current Limit		
		Total	Measuring side	Charging side
ON	0.1 – 250V	50mA	5mA	45mA
	250 – 1,000V	10mA	5mA	5mA
		5mA	5mA	0mA
OFF	0.1 – 250V	50mA	50mA	0mA
	250 – 1,000V	10mA	10mA	0mA
		5mA	5mA	0mA

4. Power Noise Filter Setting

OFF : Filter is not used 〔High speed switch mode : high〕

ON : Filter is used 〔low noise mode : Low〕 Standard setting

P.S.

When measuring much capacitance value sample such as capacitor etc. nose of measured voltage output influences the measuring accuracy. In order to lessen this measured voltage output noise, this unit has a filter.

On normal measurement, you can have stable measurement with Filter-on status, which is called low noise mode. On this low-noise mode, noiseless stable measurement

Can be done, but because of filter response time, switching speed of measured voltage

Becomes longer. For the measurement needs to switch measured voltage at high speed, use high speed switch mode to filter off. At time of shipment, low noise mode (Filter-on) is set.

4-3.11 Program Making Display Operation 〔PROG〕

1. Press 〔PROG〕 〔Program〕 key on measuring display to move to sequence program making display.

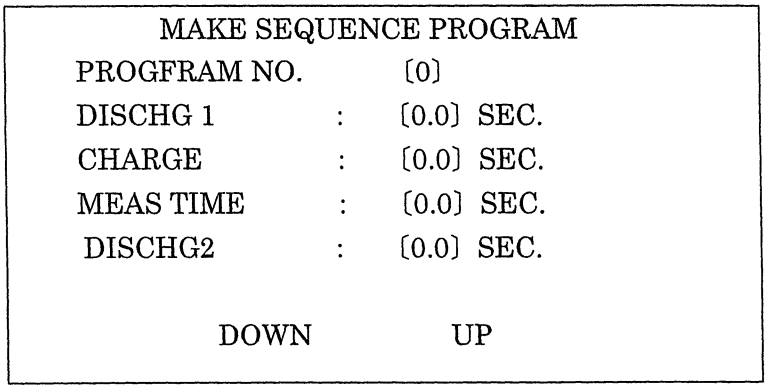


Figure 4.23 Sequence Program Making Display

Function key 〔F2〕 , 〔F3〕 become to Down, Up function. You can input value directly with number key or select preset value with down or up key.
At the end of setting, press 〔Enter〕 key to return to measuring display.

2. Program Number Setting
Input program number through 0 to 9.

3. Setting for Charging measuring time & discharging time
Turn of DISCHG 1 – CHARG – MEAS TIME – DISCHG 2 can not be altered.

a. Setting of discharging time before measurement (DISCHG 1) through 0 to 999.9 sec. setting can be done.

b. Setting of charging time before measurement (CHARGE) through 0 to 999.9 Sec. setting can be done.

c. Measuring time setting (MEAS TIME)
Through 0 to 999.9 sec. setting can be done.

d. Setting for discharging time after measurement (DISCHG 2) through 0 to 999.9 sec. setting can be done.

4-3.12 Open Adjustment Value Setting Operation

This execute judgment value setting at contact check.

NOTE

When you use contact check function, always this setting is required, without Executing this contact check gives an error. With one open adjustment, "Open Set" display at below-left of front panel has side mark 〔◂〕 .

1. Press 〔Open〕 (Set open check parameter) key on measuring display to move to reference value setting display for contact check.

```
OPEN OFFSET VALUE
  OPEN  =  2.5pF  work :  〔  0.5  〕  pF
                                          RTRY
```

Figure 4.24 Open Adjustment Setting Display

With this display, this measures open capacitance value of measuring circuit and display

OPEN = XX pF work

Function key 〔F5〕 becomes RTRY(Retry) function to retry measurement of open capacitance value.

2. Judgment reference value setting

Minimum capacitance value through 0.5 to 99.9 is set with number key. Contact judgment adds measured as judged value half value of minimum capacitance as judged value. If less capacitance value, judgment is contact NG, minimum capacitance value to be set is bigger one which is either 1/10 of measured jig capacitance or 0.5pF.

Contact Check Function

This function, a typical feature of the instrument, measures the capacitance of the instrument when a capacitor is measured to determine the validity by comparing the measured capacitance value with the minimum sample capacitance setting for checking whether the sample is connected to the instrument.

When the Open Capacitance Setting is smaller than that for the instrument capacitance setting, CONTACT ERROR (sample not connected) is displayed. In this time, check the instrument main body and its meters.

【Warning】

Open Adjustment outputs momentarily the measurement voltage on the measurement terminal.

Be sure to carefully verify that no instrument part and measurement circuit touches the human bodies before depressing the [OPEN] key.

Otherwise, the operator may be at risk of electric shock because of max. 1000V being generated.

4.4 Other functions

4.4.1 Voltage Check Function

Voltage Check Function checks the output status of measured voltages for any error. Since the accuracy setting for Voltage Check is ±3%, the accuracy of the measured voltages cannot be checked. It is mainly used for detecting any failure in a voltage circuit or the operating status of a current limitter.

When the voltage is 10V or lower, it may not determined whether the measured voltage is correct. Accordingly, it is recommended that the function is used when the measured voltage is 10V or higher.

Voltage Check may be executed either in each measurement automatically or using the front panel key or interface command if necessary. For more information on how to execute automatically Voltage Check, see Section 4.2.1.

4.4.2 Contact Check Function

Contact Check Function is mainly used for determining whether the sample is reliably in contact with the check terminal in inspecting high-capacitance samples such as a capacitor.

Since this function measures the capacitance of a sample, it cannot be used for the small-capacitance samples such as a simple resistor.

The length of a cable has been defined so that the capacitance of a measurement cable is in parallel inserted in the capacitance of the instrument. When shipped, the measurement cable has been set to 1 m. If any longer cable is required, you must adjust the cable length again. Note that the accuracy of detection is ensured up to 2 m of cable length. When the capacitance of the sample is several thousands of pF or higher, you may use up to 4 m of cable. The matching of the capacitance values between the sample and the instrument is deteriorated, leading to a error of 50% or higher. (In case of 1 m cable, ±20% or lower)

Contact Check Function provides the auto execution mode, which enables the automatic inspection for each measurement, and the manual mode, which allows us to execute the inspection using panel keys or interface commands. See Section 4.2.1.

4.4.3 Sequential Measurement Function

Sequential Measurement Function is used when the time for applying the measurement voltage to the sample should be correctly controlled.

Discharge 1: Set the time for discharging prior to voltage application.
Charge : Set the time for applying voltage prior to measurement.
Measurement : Set the time period for measurement.
The system outputs the values measured when the times set here pass.
Discharge 2: Set the time for discharging after measurement completed.

【Warning】

When a high voltage is applied in manual measurement, do not pull out the sample immediately after the measurement completed because a constant voltage remains in the sample. Or, you may get an electric shock. To avoid such a risk, be sure to set an appropriate value for Discharge 2 to fully discharge any dangerous voltage and pull out the sample after the remaining voltage is fully discharged.

【Note】

1. DSM-8103 is always in the discharge mode when stopped. Set the value for Discharge 1 if necessary depending on the external instrument or scanner to be connected. When the system is independently used with no other external devices connected, it is not needed to set the value.

2. Between the measurement input terminal in the Discharge mode (or the Stop mode) and the [OUTPUT] terminal, a circuit with a current limitter and an about 1kΩ input resistor in the current measurement part connected in series bridges.

5. GP-IB Interface

5.1 Outline

DSM-8103 is equipped with standard GP-IB interface as communications faculty. Remote control by GP-IB controller and various data transmission are possible.

5.2 Specifications

Mechanical electric specification : IEEE –std. 488-1,987
Using cord : ASCII cord
Address setting : 0-30 of talker listener address setting is possible.
Remote condition cancellation: It can be cleared by pushing (LOCAL) key on the panel.

Table 5.1 Interface function and the faulty

Function	Contents
SH1 (Source Hand shake)	Full function
AH1(Acceptor Hand shake)	Full function
T6 (Talker)	Basic taker function
	Serial port function
	Talker cancellation by listener
	Appointing (MLA)
L4 (Listener)	Basic listener function
	Listener cancellation by talker
	Appointing (MTA)
SR1 (Service Request)	Full function
RL1(Remote Local)	Full function
PP0(Parallel Port)	NO function
DC1(Device Clear)	Full function
DT1(Device Trigger)	Full function
C0(Controller)	No function
E2(Bus buffer)	Tristate output

5.3 Talker faculty

Output data formatting

Output data format of measurement data can be selected by "DFM" command from the following 4 kinds.

(1) Base form

±d.ddddE±dd,d, d LF<E01>

① ② ③ ④

① Measurement value

Measured value is set 11 bytes of in the index form.

±d.ddddE±dd D: As for output data on figure

In case of range over all figure in resistance measurement is set to 0

And in the case of current measuring it becomes to 9.

+0.0000E+00	Resistance measurement
+9.9,999E+99	Current measurement

② Status

Result of voltage checking, contact check and range over is set to 0-4 in value.

Each result is assigned to bit 0-2 of status and logic sum is output.

Bit 0 : Voltage check NG (the result of automatic execution)

Bit 1 : Contact check NG (the result of automatic execution)

Bit 2 : Range over occurrence

③ Comparison result

Comparison measurement is set to (0-2) in the case of comparison measurement is on.

0 : HI "Measured value exceeded upper limit standard value"

1 : IN "Within range a measured value of top and bottom limit value"

2 : LO "Measured value is less than minimum standard value."

NOTE

This data can't be added in case of comparison measurement is off.)

④ Delimiter

Output message delimiter is assigned from the following 3 kinds by "DLM" command.

L_F <E01> .....Default

$C_R L_F$ <E01>

<E01>

NOTE: It becomes to be default at the time of power supply investment.

(2) The form of only a measured value

Data status and comparative result is not added.

Other details are same base form.

(3) A form of only comparative result

d <L_F E01>

① ②

① Comparison result

The details is same base form.

② Delimiter

The details are same base form.

(4) Data sending back none

Data sending back as an answer of Trigger is done, when this formatting is designated. This format used only data is buffered at buffer, then all readings are done.

Data Separator

On each data field, it is divided by "," .

5.4 An answer to query program message

It answers to query program message at NR1, NR2, NR3 form, optional ASCII Letter line form and binary form with length specification.

Please refer to table 5.3 program message look what form to use.

NR1 form

Correspondence data : Integer (It is main setting type, status)

-dddd^{L_F} <E01>

NR2 form

Correspondence data : Fixed decimal point number (Mainly setting value)

-ddd.d^{L_F} <E01>

NR3 form

Correspondence data : Floating decimal point number (It is mainly setting value, Measured value)

±d.ddddE±dd^{L_F} <E01>

ASCII letter line form

Correspondence data : Optional ASCII letter line (Mainly device ID)

XXXXXXXXX^{L_F} <E01> XASCII letter

Binary data (It uses in reading of Data Buffer.)

4 nnnn bbbbb .....^{L_F}<E01>

① ② ③ ④ ⑤

① It expresses binary format.

② It expresses a cipher the following of nnnn. It is 4 fixation.

③ It is 4 units of the value that after this will show byte number of second series binary data.

④ It is binary data.

⑤ It is a delimiter.

The form of data is 32 bit floating decimal point form that conformed to IEEE754,
Index section of binary data and formal number section become in the case of range over to all bit 1, too. (non-number)
Output message delimiter can be specified from the following 3 kinds of "DLM" command.

L_F <E01> .... Default

$C_R L_F$ <E01>

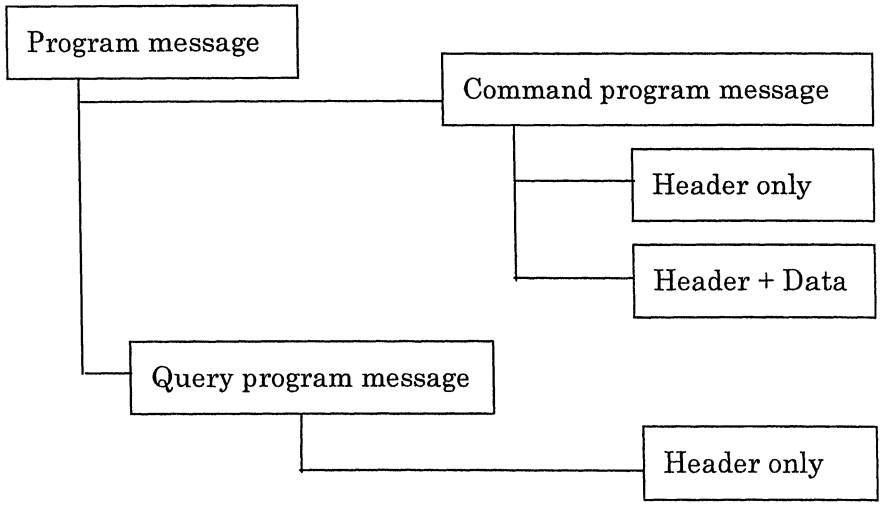
<E01>

NOTE: It becomes to default at the time of power supply investment.

5.5 Listener faculty

DSM-8103 receives program message of ASCII letter line. Program message Is classified in the following manner.

Table 5.2 Program message classification



Command program message

It uses to a commencement of the setting of device, measurement.

Query Program message

It uses to condition inquiry of device.

Construction of Program message

① Only header

② One data divided by header & header separator

③ Plural data divided by data

④ Plural message divided by message separator

①	XXX <delimiter>
②	XXX dddddd delimiter
③	XXX ddd, ddd, ddd, ddd delimiter
④	XXX ddd; XXX ddd delimiter

Separator

The following letter is used as for each separator.

① Header separator	Space
② Data separator	(,) Comma
③ Message separator	(;) Semicolon

The following 6 kinds of input message delimiter are received as an effective.

②$^{C_R}L_F$ <E01> ---- $^{C_R}+^{L_F}$ E01 at the same time as ^{L_F}
②^{L_F} <E01> ---- ^{L_F} E01 at the same time as ^{L_F}
②^{C_R} <E01> ---- ^{C_R} E01 at the same time as ^{C_R}
②<E01> at the same time as final data byte
②$^{C_R}L_F$ ---- $^{C_R}+^{L_F}$
①^{L_F} -----^{L_F}

5.6 Device clear faculty

DCL and SDC command clear input buffer and output queue. If it is start condition (ON voltage output or during measurement) Also, stop processing will be carried out.

5.7 Device trigger faculty

GET command acts the same as *TRG command message.

5.8 Remote local faculty

It prohibits a key of panel in remote condition except 〔LOCAL〕, 〔STOP〕 and 〔LCDOF〕 key. 〔LOCAL〕 key is pushed in returning to 〔LOCAL〕.

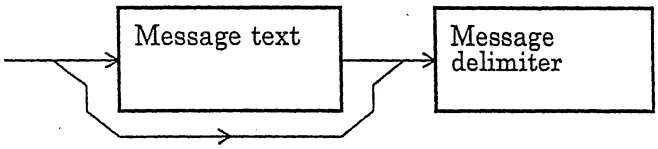
When local lockout 〔LLO〕 command is carried out from interface, 〔LOCAL〕 key is prohibited, too.

〔STOP〕 key and 〔LCDOF〕 keys are effective even in local lockout condition.

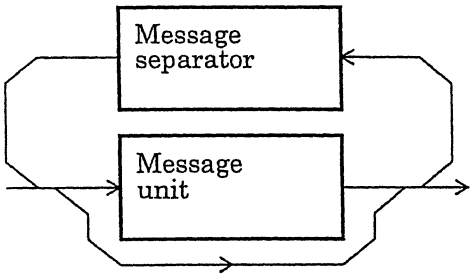
Syntax Diagram

Figure 5.1 Message Syntax Diagram

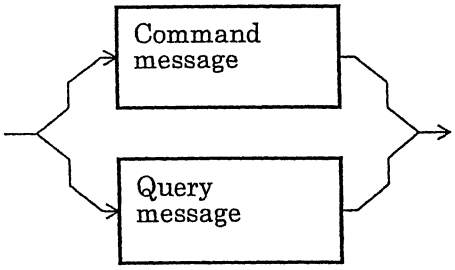
Whole message



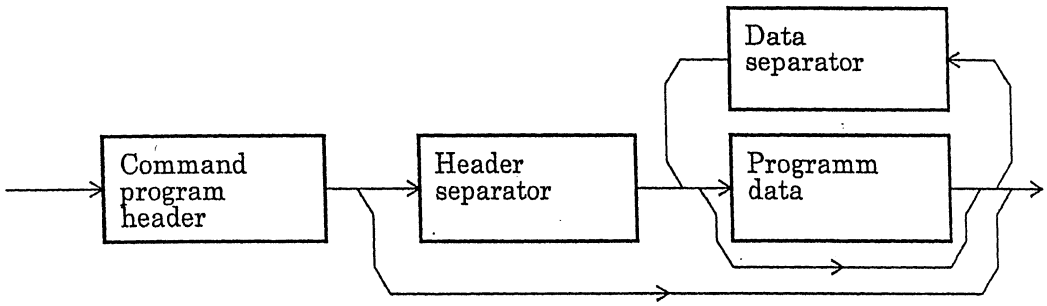
Message text



Message unit



Command message



Query message

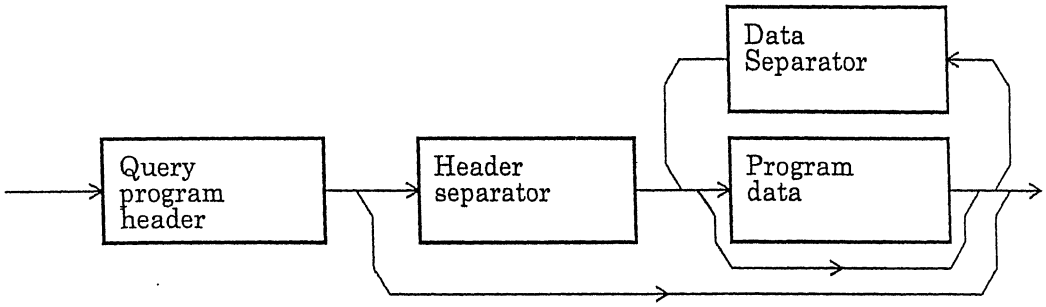
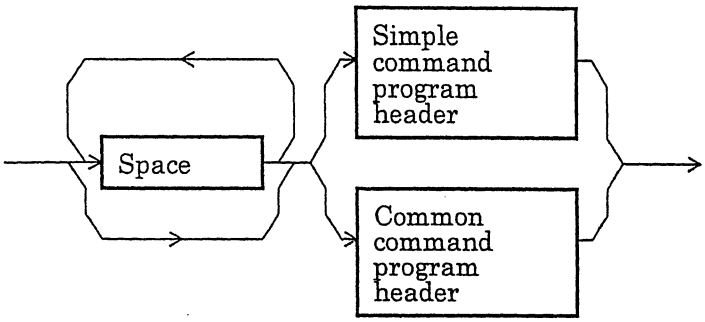
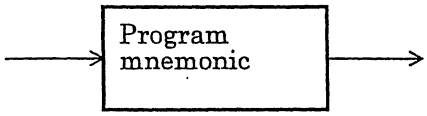


Figure 5.2 Program Header Syntax Diagram

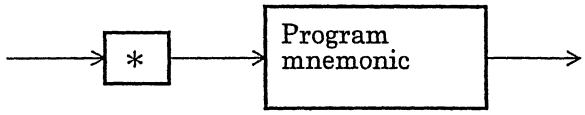
Command program header



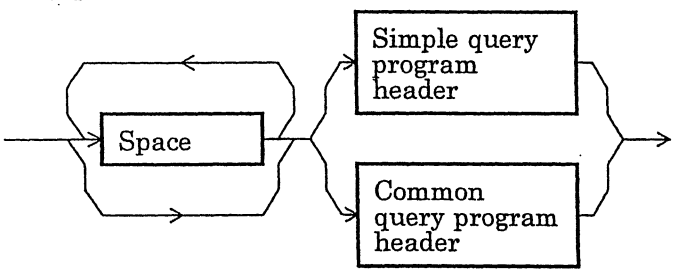
Simple command program header



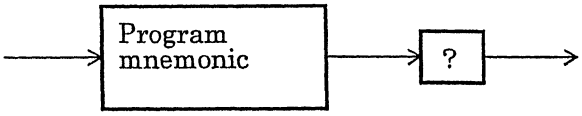
Common command program header



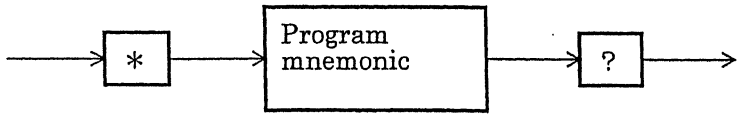
Query program header



Simple query program header



Common query program header



Program mnemonic

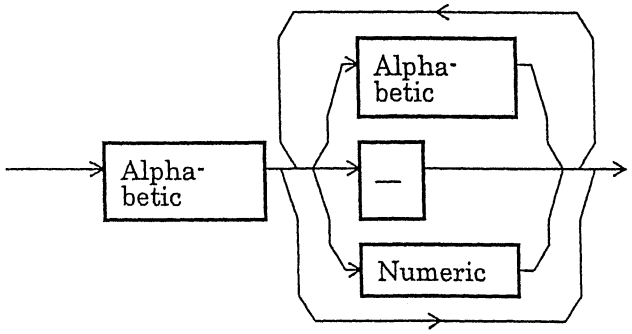
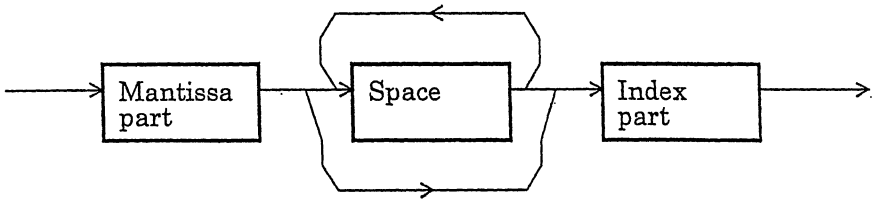
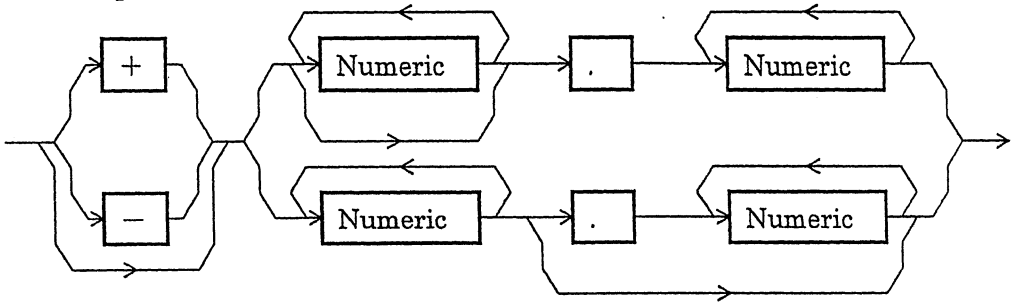


Figure 5. 3 Syntax Diagram of Data Parts

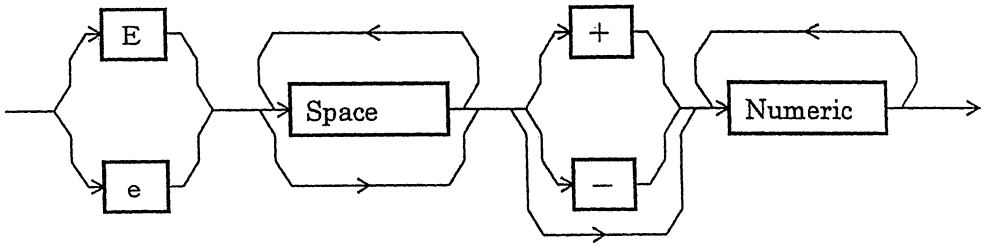
NRf format



Mantissa part



Index part



5.9 Program Message

5.9.1 List of Program Message

Table 5.3 List of Setting Control Program Messages (1/7)

Mnemonic	Description	Format
DLM	Specify a delimiter in Talker mode. d1(delimiter : 0~2) 0: $^{L}_{F}$<EOI> ..... default 1: $^{C\,L}_{R\,F}$<EOI> 2: <EOI> At power On, returns to default.	[syntax] DLM d1 d1: NR1 format
DLM?	Queries the delimiter. The response is the same as the setting.	[syntax] DLM? [response] d1
DFM	Specify an output data format. d1(format : 0~3) 0: standard format ..... default 1: outputs measured values. 2: outputs comparison results. 3: No data output At power On, returns to default.	[syntax] DFM d1 d1: NR1 format
DFM?	Queries the data format specified for Output 1. The response is the same as the setting.	[syntax] DFM? [response] d1
MON	Switches between the Common Measurement and Sequence Monitor screens. d1(screen: 0~1) 0: Common Measurement 1: Sequence Monitor	[syntax] MON d1 d1: NR1 format
MON?	Queries screen status. The response is the same as the setting.	[syntax] MON? [response] d1
MOD	Sets the measurement mode. d1(mode: 0~3) 0: Resistance 1: Current 2: Surface Resistivity 3: Volume Resistivity	[syntax] MOD d1 d1: NR1 format
MOD?	Queries the measurement mode. The response is the same as the setting.	[syntax] MOD? [response] d1

Table 5.3 List of Setting Control Program Messages (2/7)

Mnemonic	Description	Format
SPL	Sets an integral time(unit, settings). d1(unit: 0~1) 0: PLC 1:ms d2(settings) PLC: 1~15 ms : 2~300	[syntax] SPL d1,d2 d1: NR1 format d2: NR1 format
SPL?	Queries the integral time(unit, settings). The response is thesame as the setting.	[syntax] SPL? [response] d1,d2
DLY	Sets a trigger delay time (ms). d1(time: 0~9999)	[syntax] DLY d1 d1: NR1 format
DLY?	Queries the trigger delay time. The response is the same as the setting.	[syntax] DLY? [response] d1
AVE	Sets averaging. d1(selection: 0~1) 0: OFF(enabled) 1: ON (disabled)	[syntax] AVE d1 d1: NR1 format
AVE?	Queries whether avaraging is On/Off. The response is the same as the setting.	[syntax] AVE? [response] d1
FIG	Sets the number of effective digits for measured value display. d1(digits: 2~5)	[syntax] FIG d1 d1: NR1 format
FIG?	Queries the number of effective digits for measured value display. The response is the same as the setting.	[syntax] FIG? [response] d1
RNG	Sets a current range. Selects AUTO/HOLD and sets a current range in the HOLD mode. d1(selection: 0~1) 0: HOLD 1: AUTO d2(range in HOLD: 1~7) 1: 1μF 5: 100pF 2: 100nF 6: 10pF 3: 10nF 7: 1pF 4: 1nF To switch between ranges, set the capacitance of an integral capacitor.	[syntax] SEQ d1,d2 d1: NR1 format d2: NR1 format
RNG?	Queries the current range. The response is the same as the setting.	[syntax] RNG? [response] d1,d2

Table 5.3 List of Setting Control Program Messages (3/7)

Mnemonic	Description	Format
TGM	Sets the trigger mode. d1(mode: 0~2) 0: internal 1: manual 2: external	[syntax] TGM d1 d1: NR1 format
TGM?	Queries the triger mode. The response is the same as the setting.	[syntax] TGM? [response] d1
VCM	Selects/deselects the Voltage Check Execution mode. d1(selection: 0~1) 0: OFF 1: ON	[syntax] VCM d1 d1: NR1 format
VCM?	Queries the Voltage Monitor Auto Execution mode. The response is the same as the setting.	[syntax] VCM? [response] d1
CCM	Selects/deselects the Contact Check Auto Execution mode. d1(selection: 0~1) 0: OFF 1: ON	[syntax] CCM d1 d1:NR1 format
CCM?	Queries the Contact Check Auto Execution mode. The response is the same as the setting.	[syntax] CCM? [response] d1
LCD	Sets the LCD display mode. d1(display mode: 0~1) 0: OFF LED Off 1: ON LED On The same as depressing the [LCDOF] key.	[syntax] LCD d1 d1:NR1 format
LCD?	Queries the LCD display mode. The response is the same as the setting.	[syntax] LCD? [response] d1
DSP	Sets the display mode. d1(0~1) 0: index 1: in unit symbol	[syntax] DSP d1 d1: NR1 format
DSP?	Queries the Display mode. The response is the same as the setting.	[syntax] DSP? [response] d1

Table 5.3 List of Setting Control Program Messages (4/7)

Mnemonic	Description	Format
ELC	Sets electrode data. d1(select SIZE/ACTL) (0:ACTUAL,1:SIZE) d2(inner diameter SIZE) (0.0~999.9mm) d3(outer diameter SIZE) (0.1~1199.9mm) d4(sample thickness SIZE) (0.001~30.000mm) d5(any coefficient ACTUAL) (0.01~999.99) 【Note】 Be sure to set (inner diameter<outer diameter). Otherwise, the setting is neglected and only valid part is set.	[syntax] ELC d1,d2, d3,d4,d5 d1: NR1 format d2: NR2 format d3: NR2 format d4: NR2 format d5: NR2 format
ELC?	Queries electriode data. The response is the same as the setting.	[syntax] ELC? [response] d1,d2,d3 d4,d5
IVS	Sets a measurement voltage. d1(voltage: 0.1~1000.0)V	[syntax] IVS d1 d1: NR2 format
IVS?	Queries the measurement voltage. The response is the same as the setting.	[syntax] IVS? [response] d1
CNF	Sets the operating environment. d1(interlock control enable/disable: 0~1) 0: CONNECT 1: CUTOFF d2(BEEP sound enable/disable: 0~1) 0: OFF 1: ON d3(BEEP sound NO/GO: 0~1) 0: NO 1: GO d4(ckick sound enable/disable: 0~1) 0: OFF 1: ON d5(analog output:0~1) 0: OFF 1: ON 【Note】 The analog output is optional.	[syntax] CNF d1,d2 ,d3,d4,d5 d1: NR1 format d2: NR1 format d3: NR1 format d4: NR1 format d5: NR1 format
CNF?	Queries the operating environment. The response is the same as the setting.	[syntax] CNF? [response] d1,d2,d3, d4,d5

Table 5.3 List of Setting Control Program Messages (5/7)

Mnemonic	Description	Format
SEQ	Sets the sequence mode. d1(mode: 0~1) 0: OFF 1: ON d2(program number: 0~9) The number of program executed when the sequence mode is truned ON. d3(pre-measurement discharging time) (0.0~999.9 sec.) d4(charging time) (0.0~999.9 sec.) d5(measurement time) (0.0~999.9 sec.) d6(post-measurement discharging time) (0.0~999.9 sec.) 【Note】 The folowing parameters remain valid when the sequence mode is turned OFF. (They remain as current settings.)	[syntax] SEQ d1, d2,d3,d4, d5,d6 d1: NR1 format d2: NR1 format d3: NR2 format d4: NR2 format d5: NR2 format d6: NR2 format
SEQ?	Queries the sequence mode status. The same as the settings for the SEQ command message. Returns the current settings. d1(mode: 0~1) d2(program number: 0~9) d3(pre-measurement discharging time) d4(charging time) d5(mesurement time) d6(post-measurement discharging time)	[syntax] SEQ? [response] d1,d2,d3,d4,d5,d6
DEV	Sets the deviation display mode. d1(mode:0~2) 0:OFF 1:DEV 2:PAR d2(reference deviation value) (-9.9999E+30~9.9999E+30) 【Note】 Mode: d2 is effective even when OFF. (They remain as the current setting.)	[syntax] DEV d1,d2 d1: NR1 format d2: NR3 format
DEV?	Queries the deviaion display mode. The response is the same as the setting.	[syntax] DEV? [response] d1,d2

Table 5.3 List of Setting Control Program Messages (6/7)

Mnemonic	Description	Format
CMP	Sets the comparative measurement mode. d1(comparision execution: 0~1) 0: OFF 1: ON d2(mode: 0~2) 0: HI 1: IN 2: LO d3(upper limit comparison value) (-9.9999E+30~9.9999E+30) d4(lower limit comparison value) (-9.9999E+30~9.9999E+30) 【Note】 1. be sure to set(d3>d4). Otherwise, the current settings remain effective. 2. Comparison execution: d2,d3,d4 remain effective even when OFF. (They remain as the current settings.)	[syntax] CMP d1,d2,d3,d4 d1: NR1 format d2: NR1 format d3: NR3 format d4: NR3 format
CMP?	Queries the comparative measurement mode. The response is the same as the setting.	[syntax] CMP? [response] d1, d2, d3, d4
WCP	Sets the caoacitance of the DUT (workpiece). The DUT capacitance for calculating open adjustment values. d1(0.5~99.9)pF	[syntax] WCP d1
WCP?	Queries the DUT (workpiece) capacitance. The response is the same as the setting.	[syntax] WCP? [response] d1
ACL	Sets Auto-calibration (current range calibration). d1(auto-calibration enable/disable: 0~1) 0: OFF 1: ON d2(auto-calibration time interval) (10~9999 sec.)	[syntax] ACL d1,d2 d1: NR1 format d2: NR1 format
ACL?	Queries Auto-calibration (current range calibration). The response is the same as the setting.	[syntax] ACL? [response] d1,d2

Table 5.3 List of Setting Control Program Messages (7/7)

Mnemonic	Description	Format
PWS	Sets a power source for measurement. d1(Total current limit: 0~2) 0: 5mA 1: 10mA 2: 50mA d2(sets the charge output: 0~1) 0:OFF 1:ON d3(noise filter: 0~1) 0: OFF high-speed switching mode 1: ON low noise mode	[syntax] PWS d1, d2,d3 d1: NR1 format d2: NR1 format d3: NR1 format
PWS?	Queries the power source for measurement. The response is the same as the setting.	[syntax] PWS? [response] d1,d2 ,d3
THL	Sets thresholds for histogram diaply. d1~d9: shresholds1~9 【Note】 1. d1~d9 may be set in any order because they are automatically sorted. Note that be sure to set d1>d 2. 2. If all the d1~d9 are not always necessary, fill in 0s, instead. Example) "THL 1E12,5E11,1E11,5E10,0,0,0, 0,0"	[syntax] THL d1,d2 ,d3,d4,d5 ,d6,d7,d8 ,d9 d1~d9 : NR3 format
THL?	Queries the threshld. The response is the same as the setting.	[syntax] THL? [response] d1,d2,d3,d4,d5,d6, d 7,d8,d9

Table 5.4 List of Program Messages for Executing Commands and Getting Results (1/4)

Mnemonic	Description	Format
SRT	The function associated with turning measurement voltage ON or the measurement start SRART] key.	[syntax] SRT
STP	The function associated with the measurement stop (measurement vltage turned OFF) [STOP] key.	[syntax] STP
MTG	Generates a manual trigger. Enabled when the trigger mode is Manual.	[syntax] MTG
VCK?	Executes voltage check once and returns its result as a response. d1(0~1) 0: NO 1: GO	[syntax] VCK? [response] d1
CCK?	Executes contact check once and returns its result as a response. d1(0~1) 0: NO 1: GO	[syntax] CCK? [response] d1
OST?	Executes open adjustment once and returns the measured capacitance as a response. If any errror, 999.9 is returned. d1(instrument capacitance: 0~99.9) When an error occurred: 999.9 【Note】 Before contact check can be executed, you have done open adjustment once.	[syntax] OST? [response] d1: NR2 format
RHS?	Reads data out from a histogram counter. Returns the counts as a response in the 10 divided bar chart on the screen. d1~d2 are output in the descending order of thresholds.	[syntax] RHS? [response] d1,d2,d3,...,d10 d1~d10 : NR1 format
CHS	Clears the histogram counter. The same as entering [DATA] CLRH YES	[syntax] CHS
BSZ?	Reads data count out from a measured data buffer.	[syntax] BSZ? [response] d1: NR1 format
RBF?	Reads data out from a measured data buffer. d1(formar: 0~1) 0: ASCII 1: Binary All the contents from the data buffer are continuously read out starting from the oldest one.	[syntax] RBF? d1 [response] ASCII: d1,d2,d3.....,dn Binary: Binary response data with its length specieid

Table 5.4 List of Program Messages for Executing Commands and Getting Results (2/4)

Mnemonic	Description	Format
CBF	Clears the measured data buffer. The same as entering [DATA] CLRD ALL	[syntax] CBF
RDT?	Queries the measured data. d1(format: 0~2) 0: standard format 1: measured values only 2: comparison results only Reads out the latest measured data. The comand is used for reading out data measured in the Internal Trigger mode. In the Manual, External, or Sequntial Trigger mode, it is not nneccesary.	[syntax] RDT? d1 d1: NR1 format [response] (see Section 5.3.)
ERR?	Queries error information, if any. d1(error information: 0~255) (See Tbale 5.8.)	[syntax] ERR? [response] d1: NR1 format
DSE	Sets the Device Event Status Enable register. d1(0~255) (See Section Figure 5.7.)	[syntax] DSE d1 d1: NR1 format
DSE?	Queries the contents of the Device Event Status Enable register. The response is the same as the setting.	[syntax] DSE? [response] d1: NR1 format
DSR?	Queries the contents of the Device Event Status register. d1(0~255) (See Figures 5.7 and Table 5.7.) 【Note】 The contents are cleared when the respose is sent out.	[syntax] DSR? [response] d1: NR1 format
*SAV	Saves configuration data. d1(configuration data number: 0~9)	[syntax] *SAV d1 d1: NR1 format
*RCL	Recalls configuration data. d1(configuration data number: 0~9)	[syntax] *RCL d1 d1: NR1 format
*IDN?	Queries the instrument nuber. Returns the DSM instrument number as a response. d1(TOA,DSM8103,0,01.00)	[syntax] *IDN? [response] d1
*CAL?	Executes auto-calibration (current range calibration) once and retiurns its result as a response. response d1 0: NG 1: OK	[syntax] *CAL? [response] d1: NR1 format

Table 5.4 List of Program messages for Executing Commands and Getting Results (3/4)

Mnemonic	Description	Format
*TST?	Queries the auto-disgnosis result. Executes auto-diagnosis once and returns its result. d1(auto-diadnosis result: 0~1) 0: NG 1: OK	[syntax] *TST? [response] d1: NR1 format
*TRG	The same function as the GET message. The comman provides the following functions. When the sequence is OFF, works depending on the trigger mode setting. TRIG-INT : neglected -MAN : generates a trigger once only in the Start mode. -EXT : the same as for -MAN When the sequence is turned ON, starts the sequence.	[syntax] *TRG
*CLS	Clears the Status register. (See Figure 5.4.)	[syntax] *CLS
*SRE	Sets the Service Enable register. d1(0~255) (See Figure 5.5 and Table 5.5.)	[syntax] *SRE d1 d1: NR1 format
*SRE?	Queries the contsnts of the Service Enable register. d1(0~63, 128~191) 【Note】 The bit 6 is not set with *SRE.	[syntax] *SRE? [response] d1: NR1 format
*STB?	Queries the contents of the Status Byte register. d1(0~255) (See Table 5.5.)	[syntax] *STB? [response] d1: NR1 format
*ESE	Sets the Standard Event Status Enable register. d1(0~255) (See Table 5.)	[syntax] *ESE d1 d1: NR1 format
*ESE?	Queries the contents of the Standard Enable Status Enable register. The response is the same as the setting.	[syntax] *ESE? [response] d1: NR1 format
*ESR?	Queries the contents of the Standard Event Status regitser. d1(0~255) (See Table 5.6.) 【Note】 The contents are cleared when the response is sent out.	[syntax] *ESR? [response] d1: NR1 format

Table 5.4 List of Porgram Messages for Executing Commands and Getting Results (4/4)

Mnemonic	Description	Format
*RST	Initializes the DSM. Initializes all the settings to defaults. Stops in the Start mode.	[syntax] *RST
*OPC	After all the operations being executed have been finished, sets the OPC bit in the Standard Event Status register. The cmmnad is used for detecting the completion of the command execution requiring a long time.	[syntax] *OPC
*OPC?	After all the operations being executed have been completed, returns "1". response d1: 1	[syntax] *OPC? [response] d1: NR1 format

5.9.2 Using Program Messages

This section describes the program messages, which must be carefully used, and some tips useful in message programming. Hereafter, program messages are simply referred to as commands.

(1) "DFM" command (Sets output data formats.)

If omitted, by default, data is output in the standard format. To reduce a small amount of time for data communication, only the measured values or the comparison results only are specified to cut off unnecessary data if needed.

(2) "FIG" and "DSP" commands (Sets display formats.)

This affects only the data displayed on the screen but not the output data.

(3) "ELC" command (Sets electrode coefficients.)

Set the electrode's inner diameter (d2) and outer diameter (d3) so that the condition for the settings (d2 < d3) may be satisfied. If the condition is not satisfied, the settings are overriden.

(4) "CMP" command (Sets measurement conditions.)

Set the upper comparison limit (d3) and lower comparison limit (d4) so that the condition for the settings (d3 > d4) may be satisfied. If the condition is not satisfied,the settings are overriden.

(5) "THL" command (Sets the thresholds for histogram counters.)

When this command is used, be sure to specify program data.

For the commands with more than one input field, unneccesary data is omitted. However, since this command provides the function for automatically sorting the values d1 to d9, different settings from those you initially intended may become effective. To avoid this problem, set a value 0 for the unnecessary data.

(6) "MTG" command (Generates a manual trigger.)

This command is accepted only when "SRT" began.

While in the Stop mode, it is not accepted.

(7) "RHS?" command (Reads values out from histogram counters.)

Before you use Histogram Function, you must have cleared the counters using the "CHS" command. Otherwise, the measured values are accumulated on the previous values.

Note that in the Internal Trigger mode, Histogram Function cannot be used.

(8) "RBF?" command (Reads data out from buffer.)

Buffered measured data is stored and kept for about two weeks. In some cases, you must use the "CBF" command to clear previous data from the buffer.

Pay attention to use the buffer because it stores all the measured values even in the Internal Trigger mode.

Switching between the measurement modes during measurements (e.g.resistance / current) does not affect buffering.

Note that the measured data buffer discards further data when the counter reads out 1000.

[Note] See 4.3.3 Measured Data Buffer Function Operation for more information.

(9) "RDT?" command (Reads out the current data.)

This command is mainly used in reading out the measured values during measurement in the Internal Trigger mode. In other Trigger mode and Sequantial Measurement mode, it is not needed to use.

(10) "*STB?" command (Reads status bytes out from register.)

This command cannot be used for detecting the completion of measurement because of being a query command.

For example, If "MTG" is sent followed by "*STB?", the result of the measurement by "MTG" is overwritten onto the next resonse data issued by "*STB?" and the measured value cannot be read out.

(11) "*OPC" command (Sets the OPC bits after the whole process completed.)

This command is used for detecting the end of the process executed by the command with no response data.

For example, when "*SAV" is executed, "*ESE 1" is used to clear the mask for the OPC bit in the standard event status register and "*SRE 32" to clear the mask for the EBS bit in the status byte register and then "*SAV 1;*OPC" is executed to generate SQR when the SAVE process is complete.

Since the OPC bit is not automatically cleared, the register must have been cleared with the "*CLS" command before it can be used.

(12) Detecting End of Command Process Waiting for Response

Since the Query and Trigger commands wait for response data, you had better monitor the MAV bit in the status byte register to detect the snd of the process.

The MAV bit is not cleared while output data is in the output queue. If the mask has been cleared with "*SRE 16", SQR is first generated when the MAV bit is set.

The MEC bit can be used only in the Manual Trigger, External Trigger, or Sequential Measurement mode for detecting the end of measurement. Note that you must clear the mask with "*SRE 1" and monitor the measurement process with SRQ. The MEC bit merely indicates Under Measurement/Out of Measurement and the end of measurement cannot be detected simply by polling to read the status byte. Since the MEC bit causes SRQ to generate at the point when the MEC bit changes upon the completion of measurement, allowing SRQ to setect the end of measurement.

(13) Detecting End of Command Process Without Waiting for Response

For the commands without waiting for responce data, follow the step (11)""*OPC" command" to detect the end of measurement.

(14) Reading out Response to Query(Reading out Output Queue)

More than one Query or Trigger command may be set by sending them continuously in the following form. In this case, the response data associated with the commnads is put in the queue in the execution order of commands.

To read out response data, use the following procedure.

Example 1: To read out all the contents from the mask register:

Send "DSE? ; *SRE? ; *ESE?".

Read in data three times. Alternately, repeat data read-in until the MAV bit is cleared.

Example 2: To read in data after measurement is repeated three times in the Manual Trigger mode:

Send "MTG ; MTG ; MTG" .

Read in data three times. Alternately, repeat data read-in until the MAV bit is cleared.

【Note】

1. Consideration in reading out from the output queue:

When data is read out from the output queue, all the data cannot be read out at a time on the DSM-8103 side because a delimiter is added to each data. To address this problem, you must read in data required times by checking the number of times or the MAV bit for any further data.

When a single command has been executed, no special consideration is required because of only one output data.

2. Consideration in executing more than one command continuously:

To execute more than one commnad waiting for response data, delimit between comands with a ";" as shown above for sending. Sending three consecutive "MTG" causes an error, leading to only the last result being received.

3. Why the end of command execution need to be detected

DSM-8103 cannot receive the next commnad while executing the received command. If a comand is sent in the unready-to-receive state, it locks NRFD to Unready and keeps the talker waiting until the state changes to Ready. This causes the system to slow down because the bus is occupied until DSM-8103 has finished its own process. This is because the end of comand execution must be detected.

5.10 Considerations in Listener Specification

5.10.1 Input buffer size

More than one command message can be sent at a time by delimiting between them with a message separator.
Because of its input buffer size being 128 bytes, DSM-8103 cannot receive any message string containing more than 127 characters, which is neglected (discarded). In this case, the MLE (Message Length Error) bit is set in the error register.

5.10.2 Executing input command messages and accepting messages

The next message can be accepted only when the received command or command string has been executed.
The command messages are not case-sensitive.

5.10.3 Command parameter error

When an error is detected in a command message, the command is neglected and the DRE (Data Range Error) bit is set in the error register.

5.10.4 Limiting command message execution

The next command message can be executed only in the Start state.
If an attempt is made to execute in the Stop state, it is not executed and instead, the result of the previous command execution is returned.

VCK?, CCK?

The next command message can be executed only in the Stop state.
If an attempt is made to execute in the Start state, it is not executed.
If an attempt to execute, for example, OST?, the result of the previous command execution is returned.

OST?, *SAV, *RCL, SEQ, *TST?, RBF?

When any program message not to be executed is received, the CNE bit is set in the error register.

RBF?, a command for reading data out from the measured data buffer, should be executed individually. Be sure to execute it alone.

5.10.5 Reading data out from output buffer

Data is read out from the output buffer sequentially starting at the oldest one because of its FIFO buffer type. This may result in any value different from its expected value, for example, when no response has not been taken in after an query was issued.
If an attempt is made to write data containing more than 511 bytes into the buffer, the data is discarded and the QOF (Queue Over Flow) bit is set in the error register because of the buffer size.

5.11 Status Bytes and Events

DSM-8103 supports the Service Request function and can request an active controller to supply services for various types of events and status.

The status byte, which is essential to the Service Request function, is briefly described below.

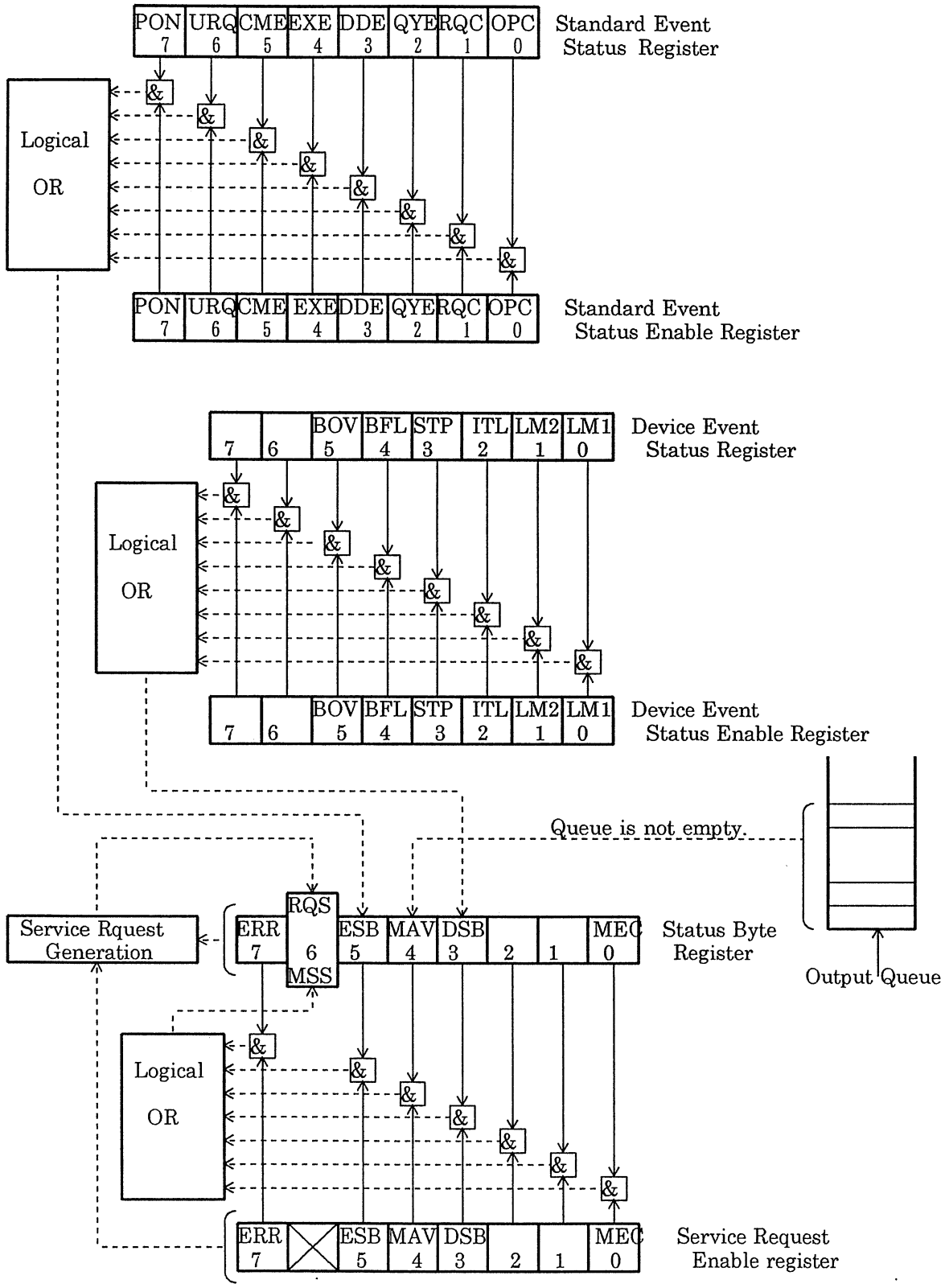
The bits of the status byte are individualy associated with the events or indicate the status summary (logical OR) value.

If a bit indicates more than one event or status, each of events or status must have been masked (permitted or suppressed) using the enable register before they can be logically ORed.

The bit of DIO Position 7, the MSS (Master Summary Status) bit, is the value, which is obtained by logically ORing other seven bits.
These seven bits must have been masked before they can be logically ORe using SRER (Service Request Enable Register).
Data can be written into with the *SRE command and read out from SRER with *SRE? Query command.

MSS generates the rsv local message, which in turn, generates RQS.
Executing Serial Poll allows the status byte to be read, RQS being cleared by the SR function but not MSS.
Thus, the Serial Poll function does not allow MSS to be read and instead * STB? Query should be used.

Figure 5.4 Status Data Structure

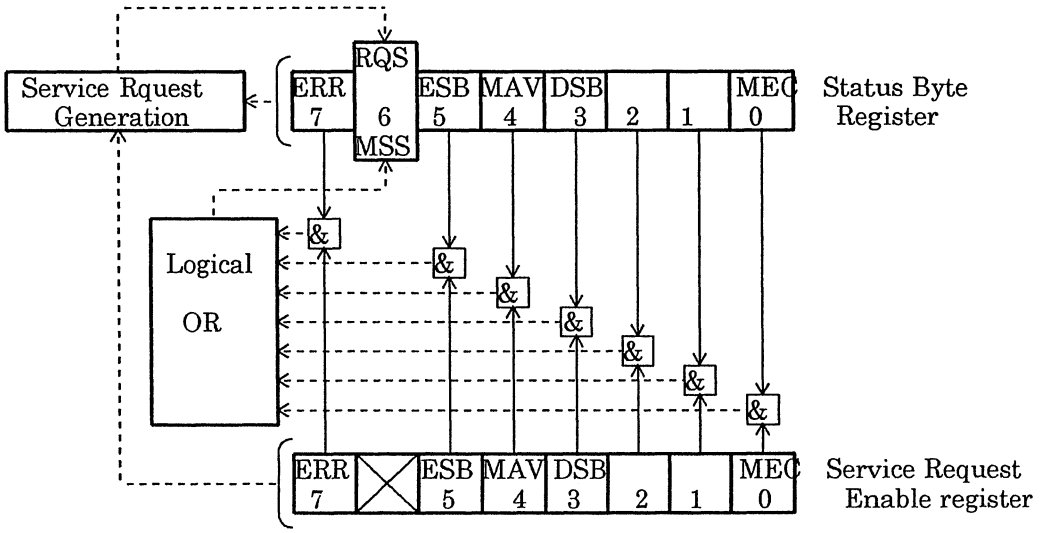


Status Byte Register

This is a register funcitoning as a center of Servcie Request, and all the Status and Event Informations are gathered to this registar. The messages relating to the Status byte Register are as listed below.

*CLS	Clears the following Registers · Status Byte Register · Standard Event Status Register · Device Event Status Register · Error Register
*SRE	Sets Service Request Enable Register
*SRE?	Query of Service Request Enable Register
*STB?	Query of Status Byte Register

Figure 5.5 Structure of Status Byte Register



ERR : ERROR
RQS : Request Service
ESB : Event Summary Bit
DSB : Device Event Summary Bit
MSS : Master Summary Status
MAV : Message Available
MEC : Measure Complete

Table 5.5 Status Byte Register

Bit No. and Name	Event/Status to be indicated when the bit has a value
bit7 : ERR Error	An unrecoverable error takes place. The memory of EEPROM was crushed. Failure in writing to EEPROM Error in reading from and writing to RAM Failure in calibrating the current range Failure in calibrating the A/D converter Internal communication error (Retry Over) No A/D interruption
bit6 : RQS (MSS) Request Service (Master summary Status)	Service request takes place. Any bit has been set out of 7 bits where Enable was set. RQS can be cleared by the SR function (reading the Status Byte at the time of Serial Pole) but MSS cannot be cleared.
bit5 : ESB Event Summary Bit	Standard Event takes place. Either bit for Standard Event or Status Register where Enable was set has been set.
bit4 : MAV Message Available	There is a message for output. Output data has been set for output queue. When the output queue becomes vacant, it is reset.
bit3 : DSB Device Event Summary bit	Device Event takes place. Either bit for Device Event or Status Register where Enable was set has been set. It is reset by releasing its cause.
bit2 :	Not used
bit1 :	Not used
bit0 : MEC Measure Complete	Staus of running measurements This setting is made when your measurement has been finished. It is reset when your next measurement begins.

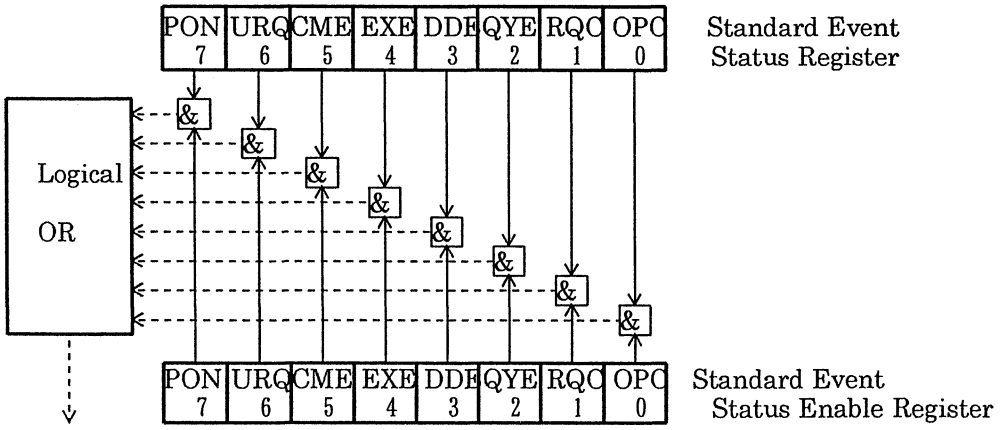
Standard Event Status Register

After masking by Standard Event Status Enable Register, all the Status and Event Informations are concentrated to the ESB bit of Status Byte Register.

The messages relating to the Standard Event Status Register are liseted as follows.

*CLS	Clears the following Registers. · Status Byte Register · Standard Event Status Register · Device Event Status Register · Error Register
*ESE	Sets Standard Event Status Enable Register.
*ESE ?	Query of Standard Event Status Enable Register
*ESR ?	Query and clearing of Standard Event Status Register

Figure 5.6 Structure of Standard Event Status Register



ESB of Status Byte Register

PON : Power On
URQ :User Request
CME : Command Error
EXE : Execution Error
DDE : Device Dependent Error
QYE : Query Error
RQC : Request Control
OPC : Operation Complete

Figure 5.6 Standard Event Status Register

Bit No. and Name	Event/Status to be indicated when the bit has a value.
bit7 : PON Power On	Turn on the power After turning on the power, it is first read out.
bit6 : URQ User Request	Not used
bit5 : CME Command Error	Command Error Abnormality has been detected in the received message. As actual cases as below, these are the concentrated bits of each MLE, HDE and DFE of Error Regsiter. · DSM has received the message with excessive length beyond the limit. · DSM has received the message header that cannot be recognized and processed. · There was an abnormality in the format of data that follows the message. (abnormality of data format and excessive numbers of parameters) Note) If there is any data format error, the relevant command is ignored and executed with the parameters stored in the memory. The excessive rows of parameters are ignoed for this command execution.
bit4 : EXE Execution Error	Error in execution The received message cannot be currently executed or the parameter setting is beyond the set range. These are the concentrated bits of each DRE and CNE of Error Register. Note) If the parameter setting is beyond the set range, the relevant command is ignored and executed with the parameters stored in the memory.
bit3 : DDE Device Dependent Error	Error caused by the device itself Internal errors except Command Error, Query Error and Execution Error have been detected. These are the concentrated bits of ISE and RAM of Error Register. It is reset by releasing the cause of error.
bit2 : QYE Query Error	Query Error Data was lost because of overflow of putput queue. Reading out was done while the output queue was vacant. Talker was set before finishing the data reception. Listener was set before finishing the data transmission.
bit1 : RQC Request Control	Not used
bit0 : OPC Operation Complete	Operation is complete. All the operations undere running are complete and it is now available to have a command for next operation. * This is set as a response to the OPC command.

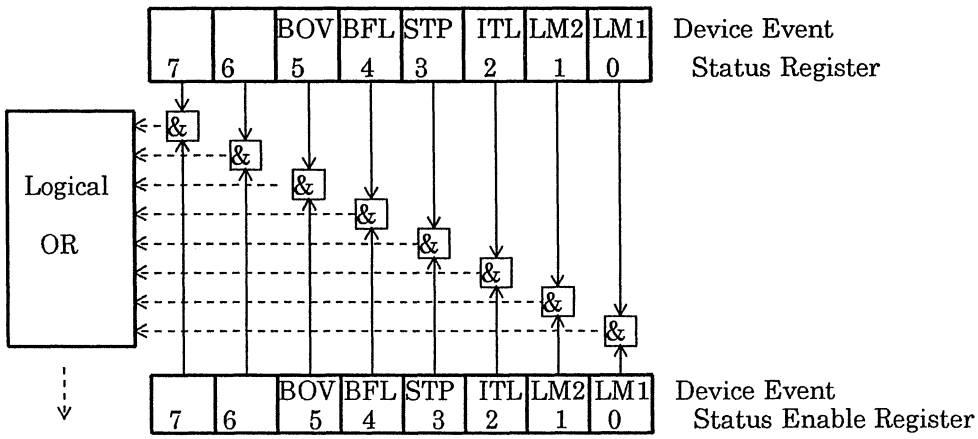
Device Event Status Register

This is a register to control the Event and Status that are proper for DSM. After masking by Device Event Status Enable Register, all the Status and Event Informations are concentrated to the DSB bit of Status Byte Registar.

The messages relating to Device Event Status Register are listed as follows:

* CLS	Clears the following Registers. · Status Byte Register · Standard Event Status Register · Device Event Status Register · Error Register
DSE	Sets Device Event Status Enable Register
DSE ?	Query of Device Event Status Enable Register
DSR ?	Query of Device Event Status Register

Figure 5.7 Structure of Device Event Status Register



DSB of Status Byte Register

BOV : Measure Buffer Over Flow
BFL : Measure Buffer Full
STP : Get Stop Event
ITL : InterLock Condition
LM2 : Charge Current Limit
LM1 : Measure Current Limit

Figure 5.7 Device Event Status Register

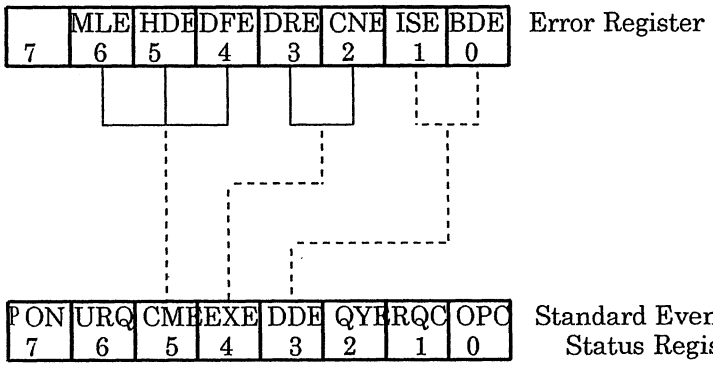
Bit No. and Name	Event/Status to be indicated when the bit has a value
bit7 :	Not used
bit6 :	Not used
bit5 : BOV Measure Buffer Over Flow	Overflow of measured data buffer Reset is done when the measured data was lost by the over flow of data buffer. It is reset by reading out this register.
bit4 : BFL Measure Buffer Full	Measured data buffer is full. This setting is made when the measured data buffer becomes full. It is reset when the buffer becomes vacant.
bit3 : STP Get Stop Event	Event to stop measurements. This setting is made depending on any of the following factors : - STOP key was pressed. - Interlocking function was activated. - The STOP input was made from Handler interface. It is reset by reading out this register.
bit2 : ITL Interlock Condition	Condition of interlocking This setting is made when starting is prohibited while interlocking fucntion is enabled. It is reset when starting becomes available.
bit1 : LM2 Charge Current Limit	Reserved bit
bit0 : LM1 Measure Current Limit	Reserved bit

Error Register

This is a register to control Error Informations and consists of 8 bits.
The contents of this register are concentrated to CME, EXE, DDE and QYE bits of Standard Event Status Register.(No masking is done.)
The messages relating to the Error Register are listed as follows :

* CLS	Clears the following Registers. · Status Byte Register · Standard Event Status Register · Device Event Status Register · Error Register
ERR ?	Query and Clearing of Error Register

Figure 5.1.6 Structure of Error Register



MLE : Message Length Error
HDE : Header Error
DFE : Data Format Error
DRE : Data Range Error
CNE : Can Not Execute
REQ : Read Empty Queue
QOF : Queue Overflow
ISE : Internal communication Error

Figure 5.8 Error Register

Bit No. and Name	Event/Status to be indicated when the bit has a true value
bit7 :	Not used
bit6 : MLE Message Length Error	The message length is abnormal. This setting is made when the message length is beyond the limit. It is reset by reading out this register.
bit5 : HDE Header Error	The message header is abnormal. This setting is made when receiving the message header that cannot be recognized. It is reset after reading out this register.
bit4 : DFE Data Format Error	Data format is abnormal. The numbers of parameters are beyond the set limit. There are some parameters that cannot be recognized. It is reset by reading out this register.
bit3 : DRE Data Range Error	Data range is abnormal. This setting is made when the parameter values are beyon d the set range. It is reset by reading out this register.
bit2 : CNE Can Not Execute	Commands that cannot be executed This setting is made when receiving the commands that cannot be executed. It is reset by reading out this register.
bit1 : ISE Internal Serial Communication Error	Internal communication error This setting is made when internal serial communication error takes place. It is reset by reading out this register.
bit0 : BDE Environment Backup was Damaged	Environmental data was crushed. This setting is made when the backup RAM data was crushed. It is reset by reading out this register.

5. 12 Default values by *RST message

The *RST message makes all the setting of this instrument to its default values.
Here below, the default values by the *RST message and the initial setting at the factory before shipment are shown. The parts shown as ---- in the "Default values by *RST" do not affect the settings whatsoever.

Figure 5.9 Initital setting at the factory before shipment and default values by *RST

Item	GP-IB message	Initial setting at the factory before shipment	Default values by *RST
Measuring mode	MOD	Resistance measurement	Resistance measurement
Trigger mode	TGM	Internal trigger	Internal trigger
Measuring voltage	IVS	0.1 V	0.1 V
Integrated time	SPL	300ms	300 ms
Average	AVE	ON	ON
Measuring range	RNG	AUTO	AUTO
Trigger delay time	DLY	0 ms	0 ms
Sequence mode SEQ : ON/OFF PROG no.	SEQ	 OFF 0	 OFF 0
Sequence program PROGRAM No. DISCHG1 CHARGE MEAS TIME DISCHG2	SEQ	 0 to 9 common 0.0 s 0.0 s 0.1 s 0.0 s	 ---- ---- ---- ----
Display mode	DSP	Index number	Index number
Display digit	FIG	5 digits	5 digits
Deviation display MODE REF	DEV	 OFF [0.0000E+00] Ω	 OFF ----
Comparative measurement MODE UPPER LOWER	CMP	 HI [0.0000E+00] Ω [0.0000E+00] Ω	 ---- ---- ----
Automatic comparative measurement	CMP	OFF	----
Automatic voltage check	VCM	OFF	OFF
Automatic contact check	CCM	OFF	OFF

Item	GP-IB message	Initial setting at the factory before shipment	Default values by *RST
Histogram counter	RHS?	Cleared state	----
Histogram threshold value	THL	All 0	----
Data buffer	RBF?	Unfixed	----
Electrode coefficient D1 (IN Diameter) D2 (OUT Diameter) t (Thickness) K	ELC	 [50.0]mm [70.0]mm [0.1]mm [0.01]	 ---- ---- ---- ----
Interface INTERLOCK BEEP ON/OFF BEEP NO/GO CLICK GP-IB ADRS 232C BAUD 232C DATA 232C PARI 232C STOP	CNF	 CUTOFF ON NO ON [1] 1200 7BIT NON 1BIT	 ---- ---- ---- ---- ---- ---- ---- ---- ----
Automatic calibration AUTO MODE INTERVAL	ACL	 ON 60 sec	 ---- ----
Power condition CURL CURL.C FILTER	PWS	 5 mA OFF ON	 5 mA OFF ON
Setting for open compensation	WCP	0.5 pF	0.5 pF
Saving for environmental setting	*SAV	0 to 9 common The contents for saving are at the cleared state.	----

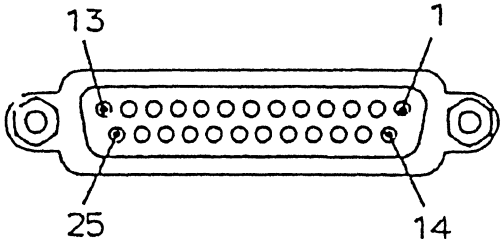
6. RS-232C Interface

6.1 Outline

There is RS-232C interface option as for DSM-8103 as communications faculty. Although Data format of RS-232C interface and Program message are basically same GP-IB interface, there is the message part, from necessity which become from the difference of hardware. Here, please refer to GP-IB interface of chapter 5 as for a part except this, since only a part which differs GP-IB interface is mentioned.

6.2 Using connector and signal name

A connector of RS-232C interface is D Sub female connector of 25 pins.



Pin arrangement

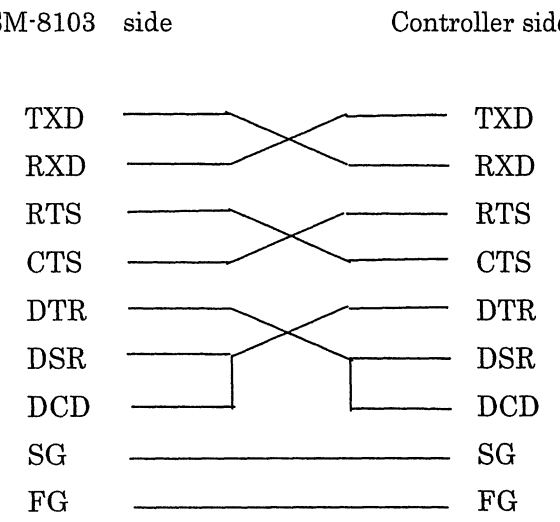
Table 6.1 Pin number and Signal name

Pin number	Signal name	Signal direction	Function
1	FG	--	Preservation of pubic peace grounding (Frame ground)
2	TXD	Output	Transmission data
3	RXD	Input	Reception data
4	RTS	Output	Transmission demand
5	CTS	Input	Transmission permission
6	DSR	Input	Data set ready
7	SG	--	Signal grounding (Signal ground)
8	DCD	Input	Reception career detection
20	DTR	Output	Data terminal ready

A pin except this is non use.

6.3 Connection of control signal and flow control

Flow control of data transmission is carried out in this unit by control of RTS signal.
Please control by the following connection to controller terminal.



After command reception DSM-8103 turns off RTS. When processing is finished,
In the case of query command or Trigger command, a response is sent.
Command reception is not accepted until response sending finish and RTS is still Off. Upon ending set RTS to on. CTS and DSR are checked and if it is on, transmission is continued.
During data transmission, a transmission is stopped in the case of off.
Please pay attention that CTS or DSR discontinues a transmission above 1 second of off status.
Flow control by XON/XOFF cord does not support in this unit.

NOTE When flow control by control signal is not carried out, data is Sometimes lost. Proper waiting must be made in the case of command message without a response. The time of this case must be confirmed by a test.
In the case of command message, please transmit next command Message after receiving a response.

6.4 Transmission data specification

Data format is same with talker faculty of GP-IB. Please refer to 5.3 clause.
But binary format in reading out of Data buffer can not be used.

Transmission data form

Data content
Measurement value
Response to query

Measured value

±d.ddddE±dd, d, d C_R L_F

Response to query

Query answer data $C_R L_F$

Delimiter

Default at power on is CR LF, but it can be switched by "DLM" command.
<E01> on GP-IB is not available at RS-232C.

6.5 Reception data specification

Receiving data form

It is similar to listener faculty of GP-IB interface.

But there are addition and deletion in a message.

Table 6.2 Addition message

Pneumonic	Content	Format
RMT	Remote exchange demand	〔Form〕 RMT

This device becomes remote condition with receiving this RMT command in controlling at RS-232C and control from RS-232C becomes possible.
Please transmit this command first. Please push 〔LOCAL〕 key of a panel to return from remote condition to local condition.

Table 6.3 Invalidity message

Pneumonic	Content
*OPC	Set of OPC bit at process completion
*OPC	Return 1 at action completion

In RS-232C reception of next command message becomes possible after receiving A response, when command message that demands a response is sent. Therefore, the command of purpose which confirms action completion becomes invalid. (Actually, there is not acceptation to use in spite of receiving)

Attention of RBF command use

Reading out command of data buffer ,"RBF " is to be used of "RBF ". Even if "RBF" is designated, output would be ASCII format.

Delimiter at receiving

Please use C_R L_F as delimiter in the case sending delimiter command message.

6.6 Status byte and the event

The following even becomes in effective as unlike as GP-IB interface.

Status byte : Bit 3 of register (MAV)
Standard event status : Bit of 2 register bit (QYE)

7. External interface

7.1 Handler interface

7.1.1 Using connector

Pin arrangement

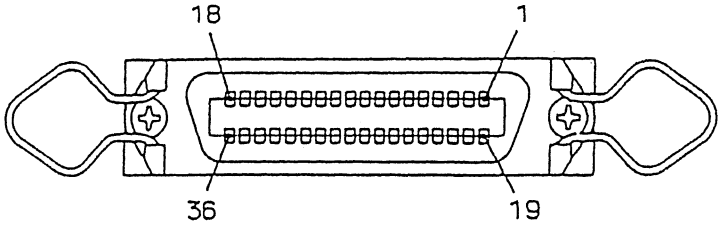


Table 7.1 Pin number and signal name

Pin Number	Signal Name	Input-Output	Pin Number	Signal Name	Input-Output
1	OUTCOM		19	OUTCOM	COMMON
2	INCOM		20	INCOM	COMMON
3			21		
4	/TRIGGER	Input	22	/V.CHECK	Input
5	/C.CHECK	Input	23	/OPEN	Input
6	/START	Input	24	/STOP	Input
7	/INTERLOCK	Input	25	/KEYLOCK	Input
8			26		
9	/V.CHECK GO	Output	27		
10	/C.CHECK GO	Output	28		
11			29		
12	/OPEN GO	Output	30		
13			31		
14	/COMP GO	Output	32		
15			33		
16	/EOM	Output	34	/INDEX	Output
17	/SRT.E	Output	35	/VON	Output
18	/ERROR	Output	36		

Attention 1. Connector of main body side 57LE-40360 (made in DKK)

2. Blank column in the table is reserved pin.

Please do not connect other signal lines etc. from the outside.

7.1.2 Faculty of each signal

(1) Input signal

INCOM:

It is common of input signal.

It is isolated with common of output signal.

/TRIGGER:

It is external trigger input signal.

It is connected with "EXT TRIGGER" input at a rear panel.

/INTERLOCK:

It is interlock input signal.

It is connected with "INTERLOCK" input at rear panel.

At setup screen setting of interlock faculty is necessary.

/KEYLOCK:

It is key lock input signal.

If this signal is set to LOW level, all panel keys are invalid.

/START:

It is start input.

It is the same faculty as 〔Start〕 key of a panel.

On normal measurement voltage is output and it can accept trigger input.

At internal 〔INT〕 of trigger mode, it begins measurement.

Sequence measurement begins in the case of on with sequence mode.

/STOP:

It is stop input.

It is the same faculty as 〔STOP〕 key of a panel.

After power off of voltage output, stop the measurement.

Stop input can be done at anytime. 〔It is not prohibited for /KEYLOCK and remote status.〕

/OPEN:

It is open adjusting input.

Opening adjustment is carried out 1 time.

It works in only stop condition.

/V.CHECK:

It is voltage check input.

It is the same faculty as 〔V.CH〕 key of a panel.

Voltage check is carried out 1 time.

Sequence measurement functions only with off at start condition.

/C.CHECK:

It is contact check input.

It is the same faculty as 〔C.CHK〕 key of a panel.

Sequence measurement works only with off at start condition.

(2) Output signal

OUTCOM:

It is common of output signal.

It is isolated with common of output signal.

/V.CHECK GO:

It is quality determination output of voltage check.

If determination is good, output is active.

/C.CHECK GO:

It is quality determination output of contact check.

If determination is good, output is active.

/OPEN GO:

It is quality determination output of open adjustment.

If determination is good, output is active.

/COMP GO:

It is quality determination output of comparative measurement.

If measurement result is good, output is active.

/EOM:

It is output signal showing that measurement data can be output.

Data are input when timing that becomes to LOW level.

/INDEX:

It is output signal showing exchange possibility of sample.

This signal carries out sample change in timing that becomes to LOW level.

/SRT.E:

It is a signal shows start (voltage output possible).

It is HIGH level on start prohibition condition and it becomes to LOW level

On start condition by interlock faculty.

/VON:

It is a signal which shows, while measurement voltage outputs.

/ERROR:

It is output signal that an irregularity occurs at main body.

7.1.3 Electric characteristics each signal

(1) Signal logic level

Input-output signal is all negative logic (active low).

(2) Handler output signal

Output signal is photo coupler output of open collector.

It is necessary to connect the power supply and pull-up resistance at the handler side.

Common terminal of output signal is isolated with D.C. circuit in series.

Equivalent circuit of output circuit is shown on Figure 7.1.

Output signal character

Output voltage		Max. Output current
LOW	HIGH	
≦0.5V	5V - 24V	2mA

NOTE : Output voltage HIGH depends on power supply voltage that Connects the handler side. Output voltage LOW comes out When load resistance is connected for output current to be under max. output current.

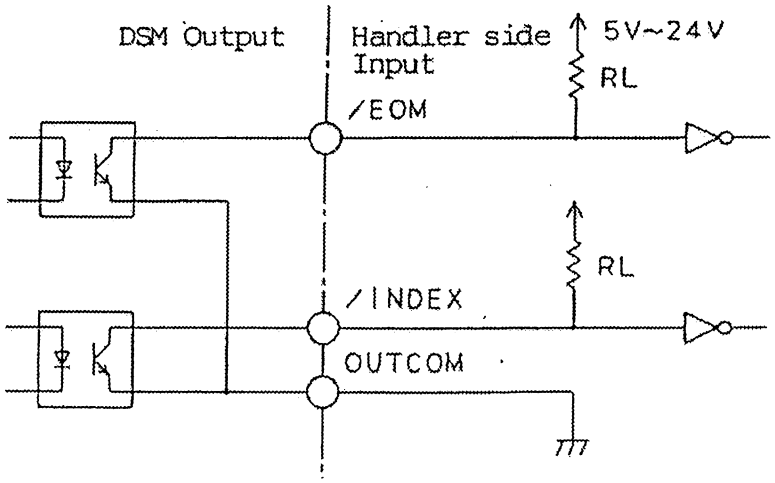


Figure 7.1 Handler output circuit

(3) Handler input signal

The cathode of photo coupler LED as input signal is out through current Limit resistance.

Anode side of LED is connected with 5V power supply of the inner part.

Please output to handler side output by open collector or TTL output.

Common terminal of input signal is isolated with inner in D.C.

Equivalent circuit of input circuit is shown to Figure 7.2.

Input character

Max. Input voltage		Max. Input current
LOW	HIGH	
0.5V	5V	1.2mA

NOTE Please output to handler side output by open collector or TTL Output.

Please do not supply voltage above 5V for input signal.

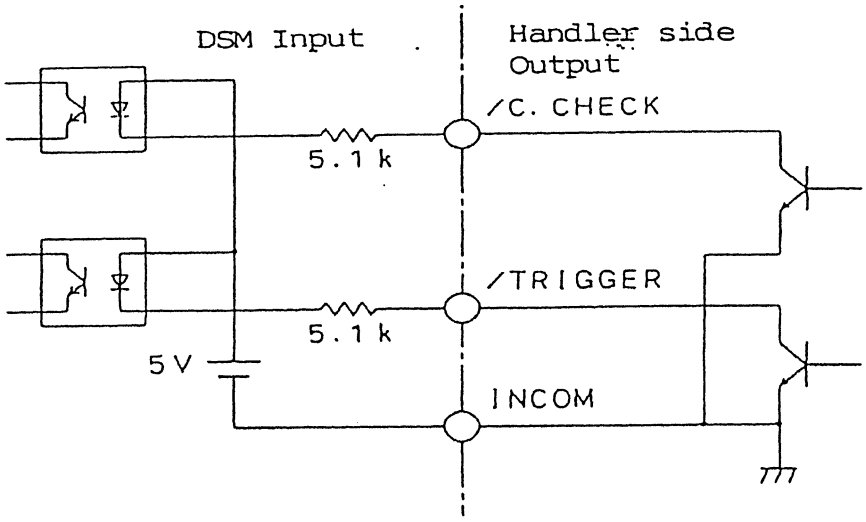


Figure 7.2 Handler input circuit

NOTE Input signal common terminal [Pin NO.2 and 20] of handler Interface and external trigger of back panel ["EXT TRIGGER"] and common of [outside conductor of a connector] of interlock input ["INTER LOCK"] are all connected.

7.2 External trigger terminal

It is the "EXT TRIGGER" connector on the back.

7-2.1 Using connector

BNC connector is used as a connector

7-2.2 Electric characteristics

The cathode of photo coupler LED as trigger signal is out through current limit resistance.

Anode side of LED is connected with 5V power supply of the inner part.

Common side (outside conductor of connector) is isolated with inner circuit in D.C.

And common is connected with input signal common terminal (Pin No. 2 and 20) of handler interface.

Equivalent circuit of input circuit is shown to Figure 7.3.

(1) Signal logic level

External trigger input is negative logic (active low).

It detects at down edge of input signal.

(2) Electric characteristics

Minimum pulse width 100uS

Input characteristics

Max. Input voltage		Max. Input current
LOW	HIGH	
0.5V	5V	1.2mA

Note Please output to control side output by open collector or TTL output.

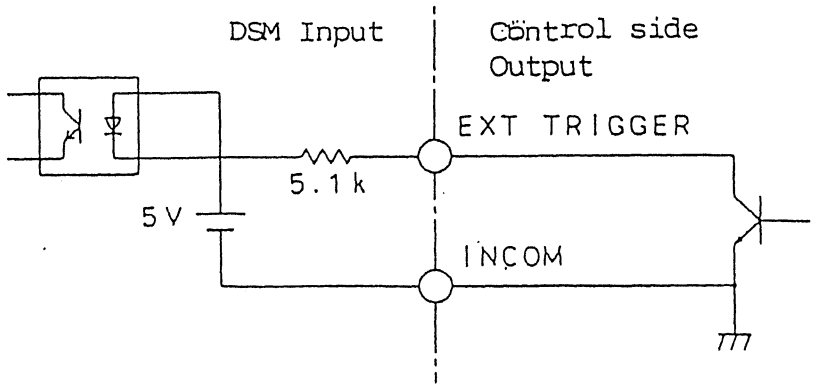


Figure 7.3 Trigger input circuit

7.3 Interlock terminal

It is "INTERLOCK" connector at rear panel.
It utilizes in order to detect open status of fixture cover and prohibit measured Voltage output for operator's safely when opened.
"USE" condition must be set on interlock faculty at setup screen for using interlock faculty.

7.3.1 Using connector

BNC connector is used as for a connector.

7.3.2. Electric characteristics

The cathode of LED of photo coupler is out through current limit resistance for Interlock signal.
Anode of LED is connected with 5V power supply of the inner part.
Please output to control side output by open collector or TTL output.
The side of common (Outside conductor of a connector) of interlock signal is isolated with inner circuit in D.C.
And common side is connected with input signal common terminal (Pin No.2 and 20) Of handler interface.
Equivalent circuit of input is shown to Figure 7.4.

(1) Logic signal level
Interlock input can be outputted as measurement voltage at the time of LOW level.
Measurement voltage output is prohibited in the case of HIGH level.
(〔START〕 key is invalid.)

(2) Electric characteristics

Input characteristics

Max. Input voltage		Max. Input current
LOW	HIGH	
0.5V	5V	1.2mA

NOTE Please output to control side output by open collector or TTL output.
Please do not supply voltage above 5V for input signal.

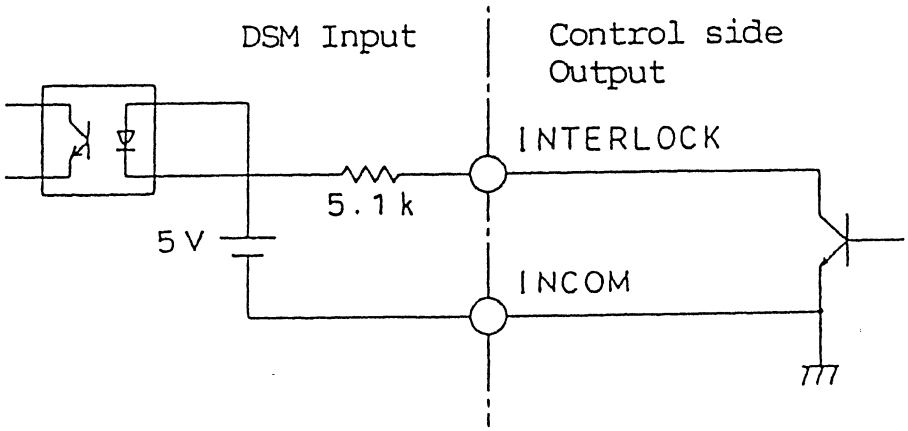
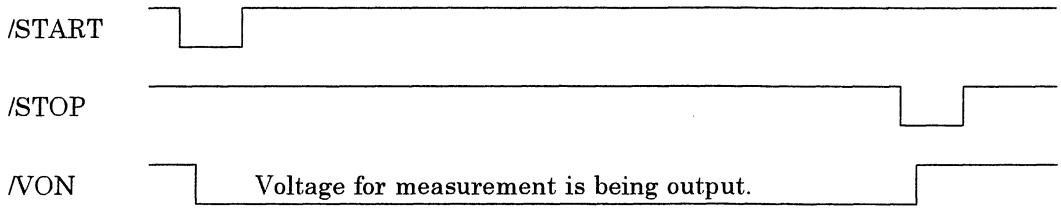


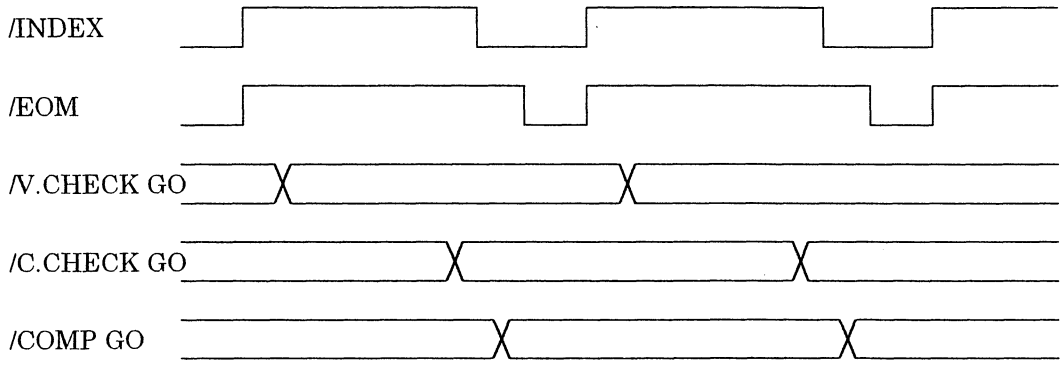
Figure 7.4 Interlock input circuit

7.4 Timming of each signal

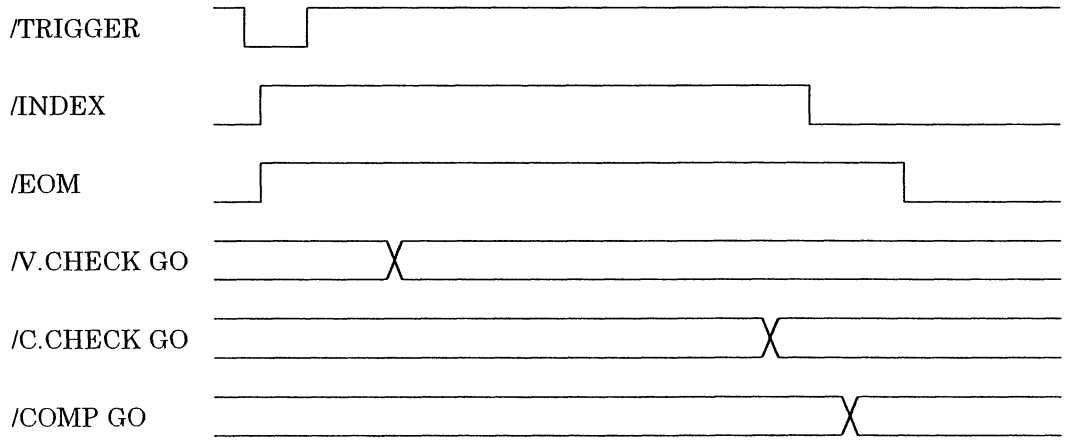
(1) Voltage output



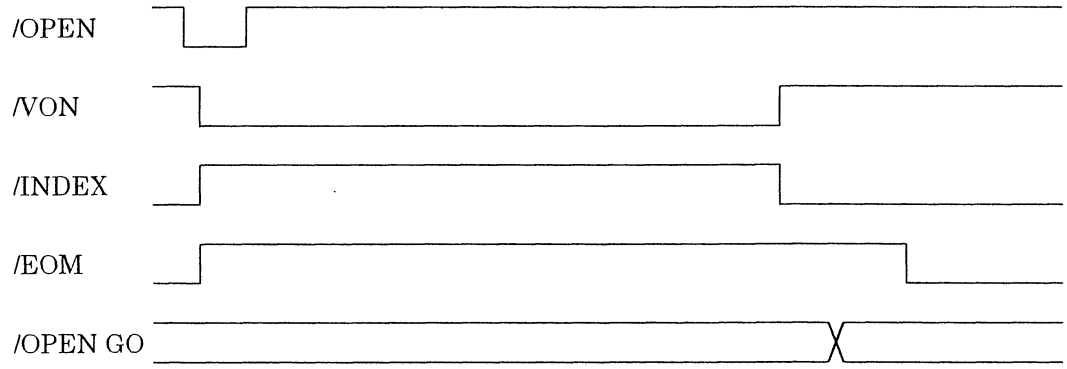
(2) Normal measurement (Internal trigger)



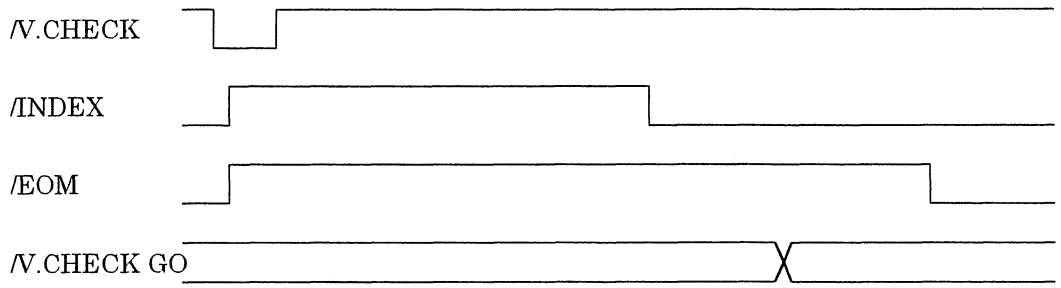
(3) Normal measurement (Sequence off, External trigger mode)



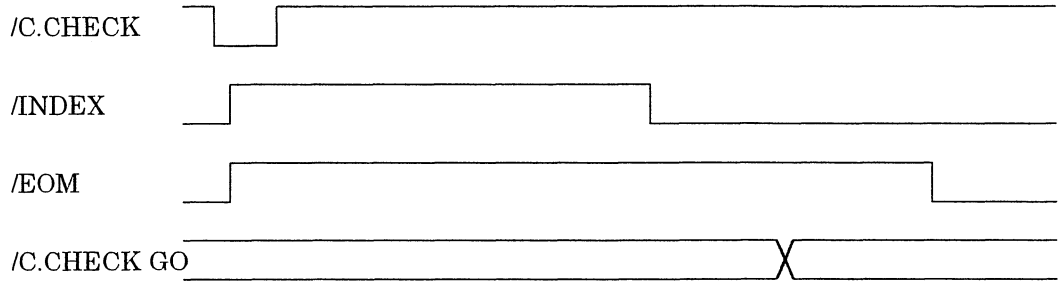
(4) Open compensation



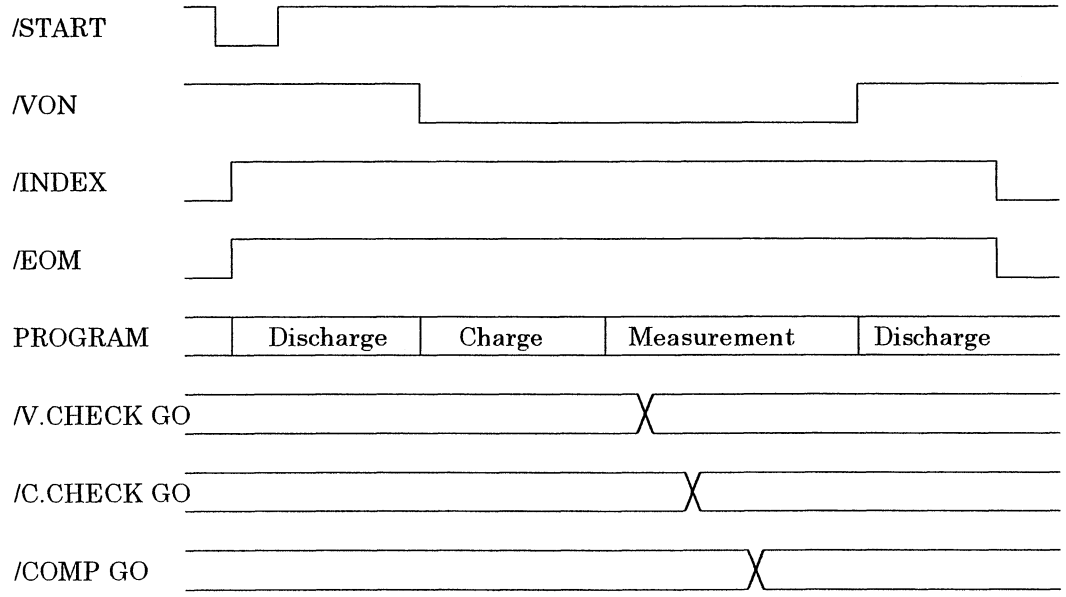
(5) Voltage check as single operation



(6) Contact check as single operation



(7) Sequence measurement



8. Maintenance

It is recommended that the scheduled inspection and calibration are regularly performed to ensure that test data has high reliability and prevent any accident from occurring.
We provide with the inspection/repair and calibration services.

8.1 Regular Inspection

(1) Visually check the measurement terminals and panel for any damage.
Since up to 1000V voltage is applied to the instrument, any damage of measurement terminals and others may be at risk of an accident.

(2) Wipe out the front panel surface, rear panel terminals, and the perimeters of connectors with a soft cloth.

(3) Visually verify that the display is clear.

(4) Verify that keys and switches work smoothly and correctly.

(5) Measure the measurement voltage output with a voltmeter and verify that the error is within the setting value ±3%.
Measure the measurement voltage output between the 「OUTPUT」 terminal and the 「GUARD」 terminal.

8.2 Calibration

The instrument calculates the insulation resistance of the sample from the value of voltage applied to the sample and the measured voltage value.
Accordingly, for the instrument, the resistance output accuracy is calibrated by calibrating the output voltage accuracy and the current measurement accuracy.
First, calibrate the output voltage with a voltmeter of 0.01% or higher accuracy and then the current measurement accuracy by connecting the calibrated reference resistance.
The calibration results should be as shown in 10.1.1. If your results are not so, contact us to request the service.

8.2.1 Hardware requirement for calibration

Prepare the following instrument and tool.
Voltmeter Measurement accuracy 0.1% or higher
Reference resistance 1MΩ, 10MΩ, 100MΩ, 1GΩ, 10GΩ, 100GΩ
Shielding box

8.2.2 Calibrating measurement voltage

Measure the voltage between the 「OUTPUT」 terminal and the 「GUARD」 terminal.

8.2.3 Calibrating current measurement

Configure the current measurement by setting an integral time of 300ms, the Internal

Trigger mode, Average ON, and 60 sec. self-calibration.
To minimize the effect of noise, the reference resistance should be sealed in the shielding box.

(1) Use the following settings for the instrument.
- ○ Integral time (SAMPL) 300ms
- ○ Trigger mode (TRIG) Internal (INT)
- ○ Average (AVE) ON
- ○ Self-calibration (CALIBRATION), Auto execution (AUTO MODE: ON) (INTERVAL) 60 sec.
- ○ Measurement voltage (MES.V) 10V
- ○ Measurement mode (MODE) Current measurement

(2) Connect a 1MΩ reference resistance between the 「INPUT」 and 「OUTPUT」.

(3) Connect a voltmeter between the 「OUTPUT」 terminal and the 「GUARD」 terminal.

(4) Set the measurement voltage to 10V.

(5) Set the measurement mode to the Current Measurement mode.

(6) Set the measurement range to 10μA range ("HOLD1").

(7) Make measurements and calibrate the 10μA range.

(8) Change the reference resistance to 10MΩ and the current measurement range to 1μA range "HOLD2" to calibrate the 1μA range in the same manner.

(9) Repeat the above steps for range calibration with the reference resistance and the range varied. Calibrate the 10pA range to its maximum sensitivity under the condition, 100GΩ reference resistance and 1V measurement voltage.

The correspondence between the reference resistance and the current measurement range is shown in the following table.

Measurement voltage	Reference resistance	Current range
10V	1MΩ	10μA ("HOLD1")
10V	10MΩ	1μA("HOLD2")
10V	100MΩ	100nA("HOLD3")
10V	1GΩ	10nA("HOLD4")
10V	10GΩ	1nA("HOLD5")
10V	100GΩ	100pA("HOLD6")

1V	100GΩ	10pA("HOLD7")

[Note] The full scale value for the current measurement range may vary with an integral time. (See 3.1.5 "Measurement Range Setting")

8.3 Self-calibration Function

The instrument provides the self-calibration function, allowing self-calibration to be executed at an given time interval, if it is turned ON. Turning the function ON keeps the high measurement accuracy for a long period.

By default, self-calibration ON and 60 sec. calibration interval have been set in the manufacturing factory.

With an internal reference voltage source and reference resistance, the instrument measures the offset current and gain to calibrate the measured values.

It takes about two seconds to execute self-calibration, which may cause a problem in executing auto-measurement. In this case, turn the self-calibration function OFF and use the interface command or depress the key regularly on the panel to execute self-calibration.

[Note]

Turning sequential measurement ON disables auto execution even the self-calibration function has been turned ON. To execute sequential measurement, regularly depress the panel key or use the interface command to perform self-calibration.

8.4 Self-diagnosis Function

The Self-diagnosis function includes two features; one executing self-diagnosis when the panel key is depressed or the interface command is received and the other monitoring always internal operation.

For more information on the self-diagnosis function executed by depressing the key, see Section 4.7.3.

If the monitoring feature detects any malfuntion in the instrument, the following message appears and the instrument stops.

In this case, since it is suspected that any part of the instrument has been at fault, contact our office nearest to you.

Error Messages

"ERROR: xxx Call Service] Center"

xxx indicates an error code having any of the following meanings.

Error code	Description of error
001	Memory contents disrupted
002	Memory write-in operation failed
003	Memory read/write error
004	Calibration failed at current measurement part
005	Calibration failed at A/D converter

006	Error in internal communication with measurement part
007	Error in internal communication with voltage output part
008	A/D data read-in operation failed
009	Error in source frequency detection
010	Malfunction of voltage output part

9. Operational Principle

9.1 Operational principle

The instrument has a stable measurement voltage source and a high-sensitive current measurement part. It calculates an insulation resistance value from the value of measurement voltage applied to the DUT and the measured value. The instrument may be used as a high-sensitive ammeter with an internal voltage source as well as an insulation meter because it also outputs a current value.

A 16-bit CPU has been mounted in the control part for calculating resistance values performing various functions.

In the current measurement part, the current/voltage conversion is made by measuring charges for performing integral culculation on input current. This method allows a long integral time, that is, minute current may be measured at a high accuracy.

The output from the current/voltage conversion part is converted into digital data by an A/D converter and insulated by a photo-isolator to send to the memory of control part.

In the control part, the measured data read in memory is calculated and output onto the display screen or interface.

The measurement voltage source is of variable type, which can output up to 1000V/10mA or 250V/50mA, and supplies stable measurement voltage. Since the maximum output current from the measurement voltage source of the instrument may be set to a larger value, the measurement time can be reduced by shortening the charging time even when the large-capacitance samples such as capacitors.

In addition, the instrument has its own voltage output for charging (charge terminal). The use of the charge terminal to pre-charge itself increases measurement throughput.

Since the measurement voltage output and the charging output are separated by a current limiter, measurement can continue without being affected even when the sample has shorted on the charging output side.

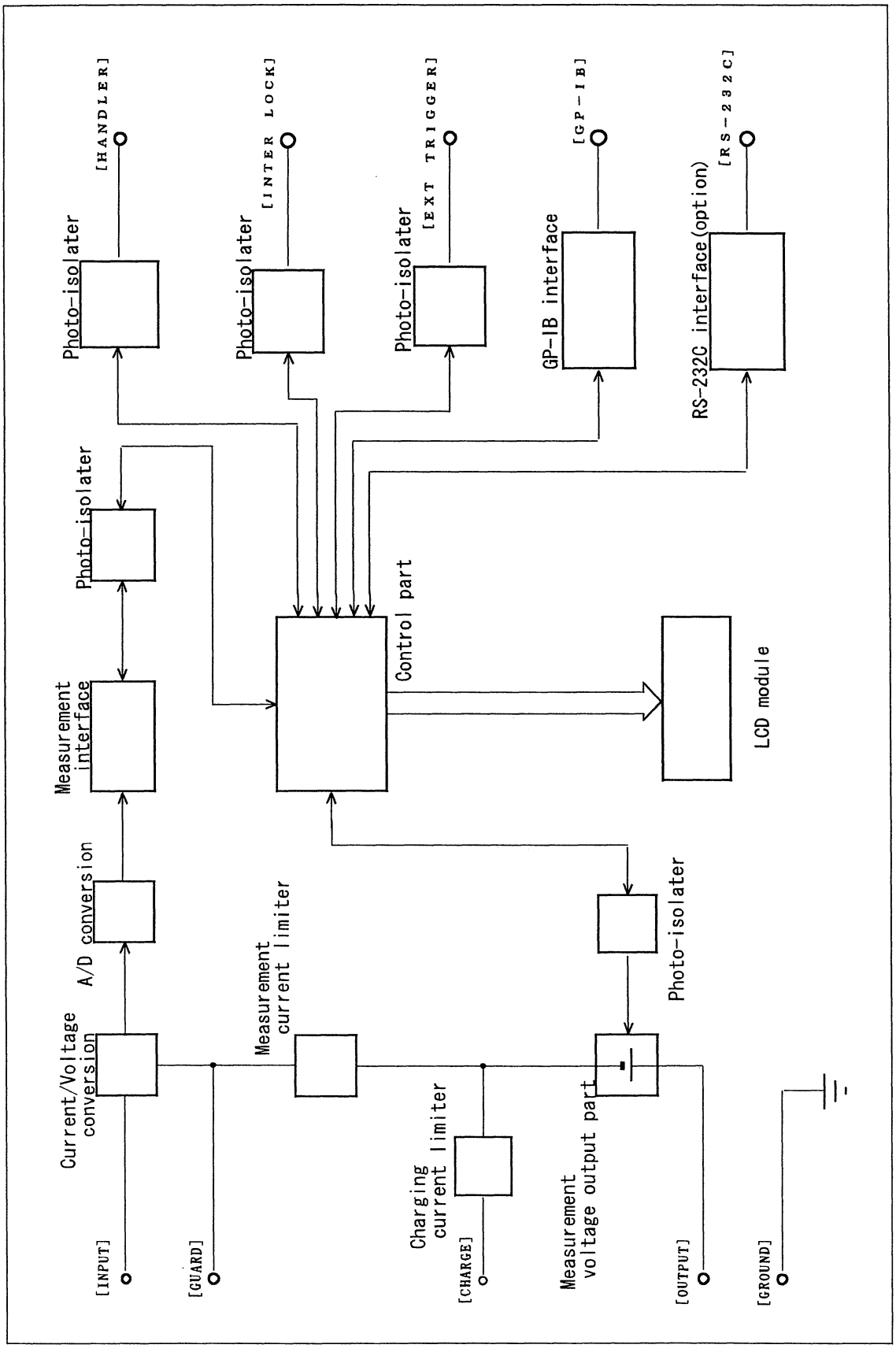
Such external interfaces have been incorporated as an isolated handler interface, which can be connected to the contact signal, and IEEE-488 standard compliant GP-IP interface as standard euipment.

Optional RS-232C interface is provided.

Depending on how to connect the panel short bar, either a grounded sample or a non-grounded sample may be connected for measurement.

It can be used as a separate ammeter when current is measured between the INPUT and GUARD terminals. Note that in this case, since the measurement voltage is output at the start of measurement, set the measurement voltage to the minimum value.

9.2 Block Diagram



10. Specification

10.1 Measurement Performance

10.1.1 DC measurement

Current measurement			
Range	Maximum	Res.	Accuracy
10pA	9.9999 pA	0.1fA	± (3.0% + 1.2(% of full scale))
100pA	99.999 pA	1.0fA	± (1.5% + 0.6(% of full scale))
1nA	999.99 pA	10fA	± (0.6% + 0.6(% of full scale))
10nA	9.9999 nA	100fA	± (0.4% + 0.5(% of full scale))
100nA	99.999 nA	1pA	± (0.4% + 0.5(% of full scale))
1μA	999.99 nA	10pA	± (0.4% + 0.5(% of full scale))
10μA	9.9999 μA	100pA	± (0.4% + 0.5(% of full scale))

1) Measurement time 300ms
2) Temperature range 23±5 ℃ relative humidity 85% or less
3) Auto-execution of self-calibration (at an interval of one minute) ON
4) Averaging ON

10.1.2 Resistance measurement

Resistance measurement		
Range (Ω/100V measurement)	Current range	Reference accuracy
1×10^{13} ～	10pA	±4.0%
1×10^{12} ～ 1×10^{13}	100pA	±4.0%
1×10^{11} ～ 1×10^{12}	1nA	±2.0%
1×10^{10} ～ 1×10^{11}	10nA	±0.8%
1×10^{9} ～ 1×10^{10}	100nA	±0.6%
1×10^{8} ～ 1×10^{9}	1μA	±0.6%
1×10^{7} ～ 1×10^{8}	10μA	±0.6%

1) Measurement time 300ms
2) Temperature range 23±5 ℃ relative humidity 85% or less
3) Auto-execution of self-calibration (at an interval of one minute) ON
4) Averaging ON
5) Measurement voltage 100V

The reference accuracy indicates the basic part of the measurement accuracy.
It depends on the voltage value and resistance value.

10.1.3 Measurement voltage output

(1) Set voltage accuracy, resolution

Voltage range	Res.	Accuracy
0.1 ~ 250.0 V	100 mV	±(0.1% + 150mV)
251 ~ 1000 V	1 V	±(0.1% + 400mV)

(2) Current limitter

	Voltage range	Settings	Total	Measured	Charged
Charge ON	0.1 ~ 250.0V	50mA	±50mA	± 5mA	±45mA
		10mA	±10mA	± 5mA	± 5mA
		5mA	± 5mA	± 5mA	± 0mA
	251 ~ 1000 V	10mA	±10mA	± 5mA	± 5mA
		5mA	± 5mA	± 5mA	± 0mA
Charge OFF	0.1 ~ 250.0V	50mA	±50mA	±50mA	± 0mA
		10mA	±10mA	±10mA	± 0mA
		5mA	± 5mA	± 5mA	± 0mA
	251 ~ 1000 V	10mA	±10mA	±10mA	± 0mA
		5mA	± 5mA	± 5mA	± 0mA

1) Two voltage sources have been incorporated; one for measurement and the other for charging. Each of current values may be given by;

Total current = measured current + charged current

The source on the charging side may be turned ON/OFF.

2) Allowed error in setting current values ±10 %

10. 2 Functional specification

10.2.1 Measurement time

Item	Setting range
Delay time	0 ~ 9999 ms
Average count	Auto setting
Sampling Time setting	2 ~ 300 ms
Power cycle	1 ~ 15 PLC

10.2.2 Voltage monitor (checks voltage)

Measures the output voltage, compares it the set voltage, and if the output value is out of a given range, blinks its associated side mark.

10.2.3 Contact Check function

To verify that the DUT has been connected to the instrument, measures the capacitance with a high-frequency signal and compares it with the capacitance in the Open state.

Item	Description
1. Capacitance range, in which contact may be detected	Min. 0.5pF. Note that 1/10 of instrument capacitance
3. Capacitance offset on instrument	Max. 100pF (0.1pF resolution)

【Note】 In the specification, 1m measurement cable length is assumed. If the length exceeds 1m, it should be adjusted again. If the length exceeds 2m, this function must not be used.

10.2.4 Self-calibration and self-diagnosis functions

The self-calibration and self-diagnosis functions are executed by depressing the Exec key or sending the Exec command from the interface.

For self-calibration, which auto-execution is allowed, set an interval while self-diagnosis automatically executes at power ON.

Executed function

Self-calibration : A/D converter calibration, current range calibration
(Auto-execution allowed)

Self-diagnosis : A/D converter calibration, current range calibration, memory check

10.2.5 Comparative measurement, deviation/percentage/measuring function

Comparative measurement indication : When DUT is NG, its associated side mark blinks.
BEEP sound (GO or NO-GO determination) gives an alarm.

Deviation/percentage/measurement indication: Displays the values in % or the unit for the measurement mode.
The reference setting range is all the measurement range.

	Description
Comparison method	Upper limit HI GO: measured valueupper limit intermediate limit IN GO: upper limit ≧ measured value ≧ lower limit lower limit LO GO: upper limit>measured value
Percentage mode	(measured value − reference value) × 100 /reference value
deviation mode	measured value − reference value

10.2.6 Measurement (instrument setting, data processing) function

Measures surface resistivity and volume resistivity.

The use of instrument constants allows you to directly measure surface resistivity and volume resistivity.

Required data

Surface resistivity : Inner and outer diameters of electrodes

Volume resistivity : Inner and outer diameters of electrodes, and sample

thickness

Any electrode coefficients may be directly set.

10.2.7 Measurement sequence program

10 types of sequence patterns, discharge-charge-measurement-discgarge, may be programmed.

	Description
Program sequence	① discharge 1 ② charge ③ measurement ④ discharge 2
Allowable program count	10 types
Set time range	0.0 ～ 999.9 s

10.2.8. Measured Data Storage and Display functions

(1) Measured data buffer

Can store up to 1000 data sequentially.

Displays the latest 1000 data on the Storage/Measurement screen.

(2) Histogram counter

Divides measured values into 10 groups and counts the number of each group data in its counter. Sets the thresholds in each measurement mode, and displays them in terms of bar charts on the screen. The setting range of thresholds should be within the measurement range.

10.2.9 Operability and display

(1) Keyboard

Rubber key switches are used.

May turn key click sound ON/OFF.

May turn key lock (for preventing any malfunction from occurring in the Remote mode).

(2) Indicator part

① LCD 240×64 dots Graphic LCD (30 digits, 8 lines)

Backlight (yellow and green LEDs)

Font size

Measured values 4-fold full size

Conditions Full size

Bar chart

② High-voltage warning Red LED Blinks at about 30V or higher

10.2.10 Resume function

At a power failure, stores the parameter settings and restores them at power ON except while voltage being applied.

10. 2. 11 I/O function (external control interface)

(1) GP-IB interface

May control all the items, which can be operated from the panel, through the GP-IB interface.

The measurement result is sent in the form of one-line data string containing the 5-digit index of measured value, comparison result, result of measurement state check.

A 4-digit fixed point number or 5-digit integer is returned in response to the Query command.

(2) RS-232C interface functional specification

May control all the items, which can be operated from the panel, through the RS-232C interface.

The measurement result is sent in the form of one-line data string containing the 5-digit index of measured value, comparison result, result of measurement state check.

A 4-digit fixed point number or 5-digit integer is returned in response to the Query command.

(3) Handler interface functional specification

The interface used for measurement by directly operating the instrument from the measurement handler.

Transferred data and electrical specification are shown below.

Open/close of instrument cover, front panel key key lock mechanism, contact start, measurement start, contact check start, contact check result, measurement voltage ON/OFF, determination result, analog measurement completed, failure if any

Electric specification Contact I/O through photo-coupler

The connector type is 57LE-40360-7700

10.3 General Specification

10.3.1	I/O terminal	Toa's specification compliant insulation I/O connector	(INPUT)
		Black binding post	(GND)
		Blue binding post	(GUARD)
		Red binding post	(OUTPUT)
		Blue binding post	(CHARGE)
10.3.2	Operating environment	Temperature 0~40 ℃ relative humidity 85% or less	
10.3.3	Source voltage	AC 100V, 115V, 220V, 240V ±10%	

10.3.4	Source frequency	50/60Hz
10.3.5	Power consumption	55VA
10.3.6	Dimensions	332(W) × 89(H) × 450(D) mm
10.3.7	Weight	8kg

HIOKI DSM-8103
DIGITAL ULTRA SUPER MEGOHMMETER
Instruction Manual

Publication date: November 2006 Edition 1

Edited and published by HIOKI E.E. CORPORATION
Technical Support Section

All inquiries to International Sales and Marketing Department
81 Koizumi, Ueda, Nagano, 386-1192, Japan
TEL: +81-268-28-0562 / FAX: +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.co.jp/

Printed in Japan DS8103A981-00

HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 / FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp / URL http://www.hioki.co.jp/

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 / FAX +1-609-409-9108

DS8103A981-00 06-11H

Printed on recycled paper