Universal Counter
SC-7207H
SC-7206H
SC-7205H

Instruction Manual

Introduction

◇ Thank you for purchasing this Iwatsu's instrument.

◇ Please read this manual before using the instrument, then keep the manual handy for future reference.

◇ To ensure safe operation of this instrument and to prevent injury to the user or damage to property, read and carefully observe the warnings and cautions in the following section.

◇ This manual mainly describes notes on use, operation method, examples of use and performance, RS-232 and GP-IB remote control.

◇ This manual targets the product of SC-7207H/SC-7206H/SC-7205H. Please refer to the manual of the product for SC-7207/SC-7206/SC-7205.

Safety Precautions

To ensure safe operation of this instrument and to prevent injury to the user or damage to property, read and carefully observe the ⚠ warnings and ⚠ cautions in the following section and associated symbols marked on the panel diagrams.

Definitions of ⚠ warnings and ⚠ cautions used in this manual

⚠ **WARNING**	Incorrect operation or failure to observe the warning may result in death or serious injury.
⚠ **CAUTION**	Incorrect operation or failure to observe the caution may result in injury or damage to instrument.

Precautions

◇ Parts of the contents of this manual may be modified without notice for improvements in performance and functions.

◇ Reproduction or reprinting of the contents of this manual without prior permission from Iwatsu is prohibited.

◇ For questions about this instrument, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.

Revision History

◇ February 2010 : 1st edition

◇ March 2010 : 2nd edition

◇ January 2011 : 3rd edition

◇ September 2011 : 4th edition

◇ September 2013 : 5th edition

⚠ Warnings

● **Do not use in an environment with explosive gases.**
This may result in explosion.

● **If you notice smoke, abnormal smell or abnormal sound, immediately turn off the power and unplug the power plug from the receptacle.**
Continued use under these circumstances may result in electric shock or fire. Turn off the power, disconnect the power plug from the receptacle and contact our Homepage listed at the end of this manual or our sales distributors for repair. Repairing the product yourself is very dangerous. Do not attempt to repair the product under any circumstances.

● **Make sure no water gets on or inside the product.**
Do not use the product if this happens. Failure to observe this precaution may result in electric shock or fire. If water gets on or inside the unit, immediately turn off the power, unplug the power plug from the receptacle and have the unit repaired. Contact our Homepage listed at the end of this manual or our sales distributors for repair.

● **Do not touch the plug of the power cable if your hands are wet.**
This may result in electric shock.

● **Do not put any foreign objects, such as metallic or flammable objects through the ventilation port.**
If any foreign object is put through the ventilation port, this may result in electric shock, fire, and/or malfunction.
If any foreign object enters the instrument, immediately turn OFF the power switch, unplug the plug from the receptacle, and contact our Homepage listed at the end of this manual or our sales distributors for repair.

● **Do not place this instrument on an unstable place such as a shaky stand or inclined place.**
Letting the instrument fall or topple down may result in electric shock, fire or injury. If this instrument falls or its cover is damaged, turn off the power switch, unplug the power plug from the receptacle and contact our Homepage listed at the end of this manual or our sales distributors for repair.

● **Do not remove the cover and panel.**
If any part inside the instrument is touched, this may result in electric shock. Contact our Homepage listed at the end of this manual or our sales distributors for inspections, calibrations.

● **Do not attempt to modify the instrument.**
This may result in electric shock, fire or malfunction.
Requests to repair the unit may be refused if unauthorized modifications have been made.

⚠ **Warnings** (Continued)

● **Always connect the grounding line of the input connector of this instrument to the ground potential level (ground) of an object to be measured.**

If the grounding line of the input connector of this instrument is connected to a level other than the ground level of an object to be measured, this may result in electric shock (damage to object to be measured, this instrument, or other connected devices).

● **Do not measure the primary power supply.**

The input circuit of this instrument is a type of unbalanced method.   If electrically floating two points, such as primary electric power supply, are connected, this may result in electric shock, fire, and/or malfunction.   Start the measurement after checking that the grounding potential levels of an object to be measured are obtained correctly.

● **Use the instrument at a specified supply voltage.**

Table 1   Power voltage range

Mid-voltage	LINE VOLTAGE
100V	90V - 110V
110 - 120V	99V - 132V
220 - 240V	198V - 264V

Using the instrument at a voltage other than that specified may result in electric shock, fire or malfunction.   The mid-voltage is shown on the rear panel.   Before connecting the power cord, always check the power voltage.   The instrument can be operated in a voltage range shown in Table 1.

● **When handling power code:**

DO NOT ATTEMPT TO REPAIR CODES YOURSELF.   This may result in fire or electric shock.   If the power cord is damaged, have repairs conducted.   Contact our Homepage listed at the end of this manual or our sales distributors for repair.

- Do not attempt to fabricate the power cord.
- Do not forcibly bend the power cord.
- Do not twist the power cord.
- Do not bind the power cords together.
- Do not pull power cord by the cord.
- Do not heat the power cord.
- Avoid getting the power cord wet.
- Do not place heavy objects on top of the power cord.

● **Confirm that any dust does not adhere to the power plug before inserting it into the receptacle. In addition, remove the power plug and the power adapter from the receptacle and check/clean them once a half year or a year.**

Dust may result in electrical shock, fire, or malfunction.

⚠ **Cautions**

● **Always use a 3-core power cord applicable to the power voltage.**
When using a power cord not applicable to the power voltage, fire may result.
Unless otherwise specified at purchase, the power cord for the 100V system[*1] is supplied with the instrument.   If the instrument is operated with the power voltage changed to the 200V system[*2], always use the 3-core power cord for the 200V system (rating : 250V) specified by our company.
Mid-voltages of 110 - 120V and 220 - 240V are factory options.
　　　∗1　The mid-voltage is 100V, 110V, or 120V.
　　　∗2　The mid-voltage is 220V or 240V.

● **Turn off the power switch before connecting or disconnecting the power cord.**
Connecting or disconnecting the power cord while the power switch is ON may result in electric shock or malfunction.

● **When disconnect the power cord from the receptacle, hold the plug to pull it out.**
Pulling the power cord may result in electric shock or fire.

● **When any cables are connected to the instrument, do not pull such cables so that the instrument does not fall down.   Always strictly observe this caution.**
If the instrument is fallen down, this may result in electric shock, personal injury and/or fire.

● **Do not use any damaged cable or adaptor.**
If any damaged cable or adaptor is used, this may result in electric shock and/or fire.

● **If the instrument will not be used for an extended period of time, unplug the power plug from the power receptacle for safety.**

● **If the counter is fallen down, the impact may result in personal injury or damage to other devices.**
When transporting this instrument, always disconnect the cables and hold the center of the grip firmly so that the instrument does not fall down.

● **When transporting this instrument, use the packing material provided at the time of purchase or packing material equivalent at least.**
Excessive vibration or shock applied to this instrument during transportation may cause it to malfunction, resulting in fire.   If you do not have the proper packing materials needed to ship the unit, contact our Homepage listed at the end of this manual or our sales distributors for repair. When having the unit transported by a shipping company, write "Precision Instrument - Handle With Care" on each side of the packing box.

● **Do not attempt to use this product if is has become damaged.**
This may result in electric shock or fire.
If the unit fails to operate properly, have it repaired.   Contact our Homepage listed at the end of this manual or our sales distributors for repair.

⚠ **Cautions** (Continued)

● **Do not apply a voltage beyond the specified level to the input terminal.**
If a voltage exceeding the specified level is applied, this may result in malfunction.   The maximum input voltage is 200V peak for input A and B, and +30dBm for input C.

● **Do not connect any deformed or damaged cable with the BNC connector to the input plug when inputting the signal.**
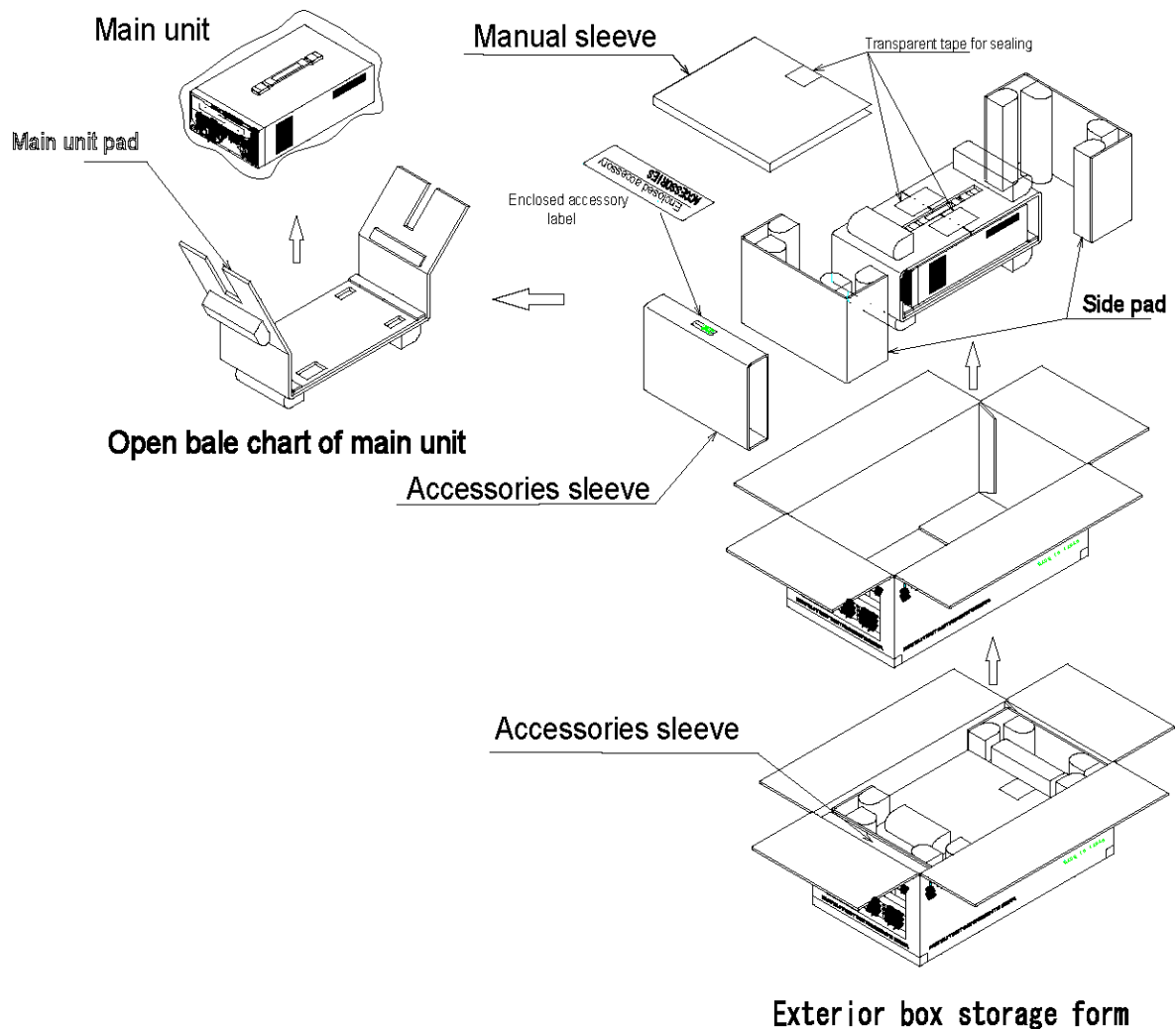Doing so may result in damage to the CH-A, CH-B, and CH-C connectors.

Confirmation of the packaging contents

Once you receive the product, check the contents of the package. If any components are missing or there is damage following transportation, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual, our sales distributors or your local sales representative immediately.

Composition products and goods

・Main unit ・・・・・・・・・1
・Accessories
  Power code ・・・・・・・・・1
  Instruction manual（CD） ・・・・・・・・・1
  User's・Guide ・・・・・・・・・1
  Clear file ・・・・・・・・・1

Open bale chart（Main unit ＆ Accessories）

Main unit

Main unit pad

Open bale chart of main unit

Manual sleeve

Transparent tape for sealing

Enclosed accessory label

Side pad

Accessories sleeve

Accessories sleeve

Exterior box storage form

Management of products

When this product is abandoned, it is necessary to recycle or to abandon it appropriately according to the law in the region and the rule.

Repair and return of repair goods

Please send it back to our service handling place when the breakdown occurs by any chance. Sorry to trouble you, but please describe the name, belonging, and the telephone number etc. of the product name, the serial number (The label is pasted to the back of this product), and a defective content and the person in charge clearly before sending back the repair goods.

Views and symbols used in this manual

- [   ] shows the operation key to the front panel

  [FREQ A] shows FREQ A .

- [2nd＋   ] shows the operation in the state that the two lamps light when [2nd]key and the other key are pushed. The pushing order is not asked.

  Example   2 nd ＋ STAT

- S C A L E = o f f   shows that the 〔off〕 character of LED has blinked.

- ⬡ ⬟ ⬠ ⬡   are written by [↑]、 [↓]、 [←]、 [→] .

  On the fluorescent display, they show +,－, of the blinking digit, the setting of the numerical value, and the right and left movement.

- <<   >>   are written by [<<]、 [>>].

  They select the items of the utility menu on the fluorescent display.

Memo

Instruction Manual

Contents

Memo

Chapter 1 Overview

1.1   Features

This universal counter SC-7207H/7206H/7205H provide various measurements, the frequency, period, time interval, pulse width, phase, frequency ratio, duty factor, and accumulation count measurements.

These measurements can be performed with simple operation.

This model is a basic measuring instrument suitable for R&D, QA, and production/inspection lines.

The features of this product are shown below.

■Frequency comparison among three models

SC-7207H   3.0GHz $\times$ 1CH and 230MHz $\times$ 2CH (CH-A, CH-B).

SC-7206H   2GHz and 230MHz $\times$ 1CH (CH-A).

SC-7205H   230MHz $\times$ 2CH (CH-A, CH-B).

■ Versatile measuring functions are provided.

■ One key is assigned to one action. This ensures simple operation.

■ Detailed information is displayed on the clear fluorescent display.

■ Auto-trigger function (manual settings are also available) does not require complicated trigger level settings.

■ Calculation functions (comparator and statistic) ensure highly efficient inspection work.

■ Calculation functions (scaling) ensure easy unit conversion (RPM and speed, etc.).

■ Voltage amplitude of the input signal can be measured.

■ Panel setup data is saved and recalled.

■ RS-232 interface is provided as a standard accessory.

■ GP-IB full-remote and high-speed data transmission are provided.

■ Factory options
  ・GP-IB
    For SC-7207H/7206H, it is standard equipment, and only for SC-7205H,it is factory option.

  ・Highly stable reference oscillator

  ・Comparator output

  ・AC power voltage change

1.2 Measurement items (SC7207H/7206H/7205H)

A, B, and C are inputs from the front panel, and LINE is a power input to the counter.

○: possible   ×: impossible

Key marks	Measuring items	SC-7207H	SC-7206H	SC-7205H
FREQ-A	Frequency	○	○	○
FREQ-B	Frequency	○	×	○
FREQ-LINE	Frequency	○	×	○
FREQ-C	Frequency	○	○	×
PERI-A	Period	○	○	○
DUTY-A	Duty ratio	○	○	○
P.W-A	Pulse width	○	○	○
T.INT A-B	Interval	○	×	○
FREQ A/B	Frequency ratio	○	×	○
PHAS A-B	Phase	○	×	○
TOT-A	Accumulation count	○	○	○
MODE Note)	Peak voltage（A）	○	○	○
MODE Note)	Peak voltage（B）	○	×	○

Note) Only when the setting of the peak voltage is effective, this measurement is possible.

1.3 Measurement method

Direct counting method

The input signal is converted into a pulse signal after it has been amplified and shaped, and then this signal is input to the gate circuit.

In the time base section, the reference pulse is made by dividing the stable frequency of the quartz oscillator. The gate control circuit is driven by this reference pulse to send the converted pulse input signal to the count circuit only for a certain period of time.

At this time, the measurement error is a quantization error of ± 1 count due to accuracy of the reference oscillator and gating of the converted pulse input signal. Therefore, the measurement with an extremely high accuracy can be performed.
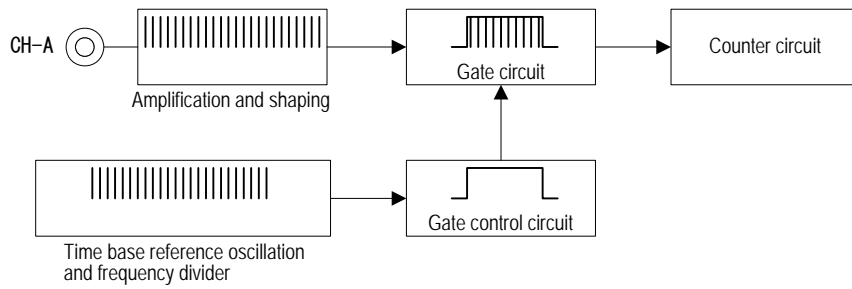
Reciprocal calculation method

This reciprocal calculation frequency measurement method means that the result of the average period measurement is converted into the frequency by utilizing a relationship of f=1/p. At this time, the resolution of the result does not depend on the input frequency, but depends on the frequency of the reference oscillator.

For example, when a 50Hz signal is measured with the 1 sec. gate if the frequency of the reference oscillator is 10 MHz, the direct counting method shows only 50, but the reciprocal calculation method obtains a 7-digit display of "50.00000".

To obtain the same resolution using the direct counting method, a measurement time of 10^5 sec. is needed.
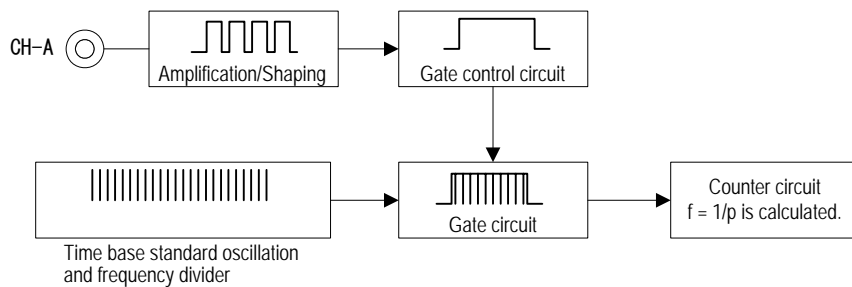
Memo

Chapter 2 Basic Operation

2.1   Before starting operation

2.1.1   Cautions for installation

● **Always operate this measuring instrument within its specified operating range.**

If the instrument is operated in a range other than that specified, this may cause the instrument to malfunction.
The following shows the operating temperature and humidity ranges.

Indoor use only
Temperature: 0°C - +40°C
Humidity: 85% RH (0°C - +40°C) or less (No condensation is allowed)

● **Do not install this instrument in a place where a large amount of moisture or dust exists.**

If the instrument is operated in a place where a large amount of moisture or dust exists, this may cause electric shock and/or fire.

● **Do not put any object on this instrument.**

If any object is put on this instrument, the cover may be in contact with the internal circuit, causing electric shock, fire, and/or malfunction.

● **Do not put any object close to the ventilation port.**

If any object is put close to the ventilation port, the temperature inside the instrument becomes hot, causing fire and/or malfunction.

● **Keep a sufficient space on the rear and both sides of the instrument.**

If this instrument is installed inside the rack or on other measuring unit, pay special attention so that the temperature does not rise.

Failure to do so may cause the operability or performance to lower. For further information, contact the service network of the last page.

┌───┐
│ ● **If the counter falls down, the impact**
│ **may cause personal injury or damage**
│ **to other units.**
│
│ When transporting this instrument, always
│ disconnect the cables and hold the center of
│ the grip firmly so that it does not fall down.
└───┘
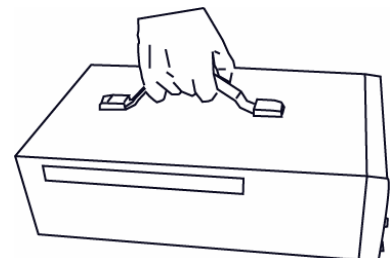
● **Installation of this instrument**

Always install the instrument horizontally or using the stand as shown in the Fig. below. When using the stand, pull the feet toward the front panel and lock them as shown in the Fig. below.

Do not face the rear panel downward.

Stand
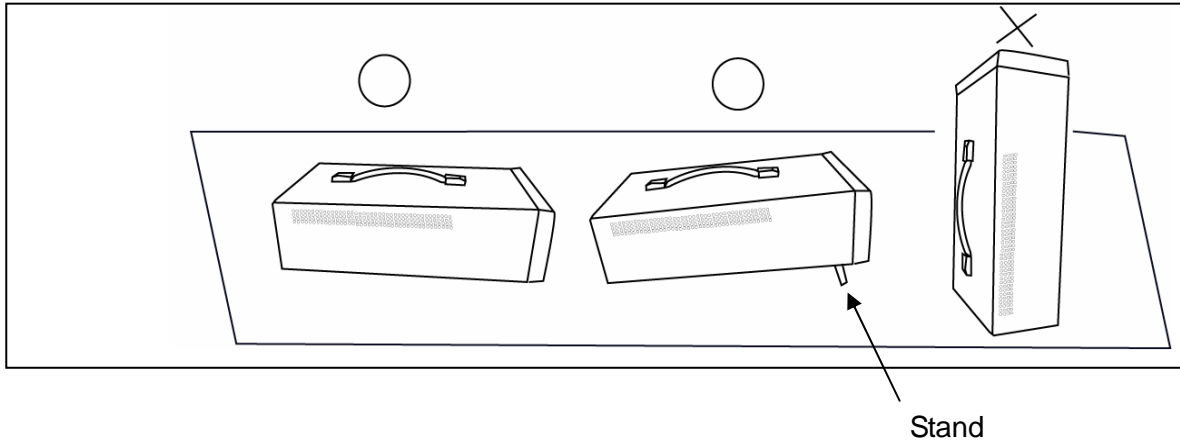
2.2 Starting of operation

Connection of power supply

1 Turn OFF (the state of "**O**") the power switch. After checking the specified power voltage shown on the rear panel, connect the power cord to a power outlet. At this time, always use the 3-prong power cord supplied with the measuring instrument.
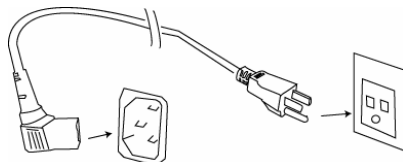
2 Turn ON(the state of " **I** ") the POWER switch.

3 After the internal functions have been checked, the measurement is then started with the panel settings made immediately before turning OFF(the state of "**O**") the POWER switch. If no input signals are connected, the message, ! No-Signal , is shown.

Measurement of power frequency

4 Press FREQ LINE . The frequency of the power supplied to this instrument is then measured.

```
          5 0 . 0 0 7 3 3   H z
```
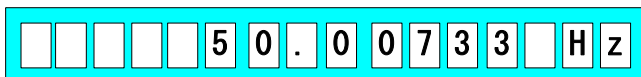
It is possible to check whether or not the basic functions are operated correctly.

Measurement of internal reference frequency

5 Press FREQ A of **FUNCTION** .

6 Press TRIG LVL of **UTILITY** to select "AUTO". (For details, see page 2-16.)

7 Press 0.1 s of **GATE** .

8 Press RES of **MES** .

9   Connect the 10MHz STD OUT and CH-A BNC terminals on the rear panel with the BNC cable. Measure the internal reference frequency. (For details, see section 3.3.5.)
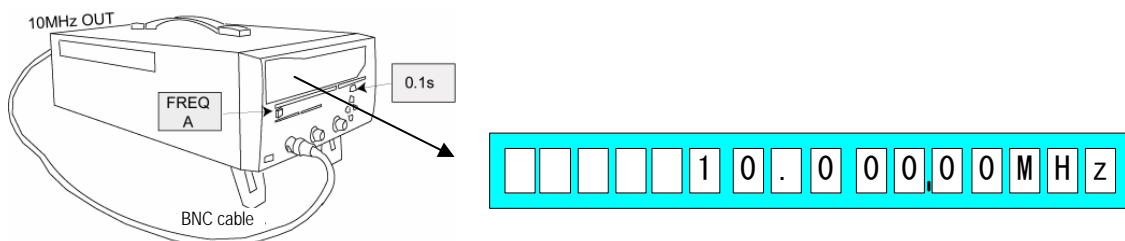
Measurement of other signal frequency

10   Set $\boxed{\begin{smallmatrix}\text{CPL}\\\text{DC}\end{smallmatrix}}$, $\boxed{\begin{smallmatrix}\text{LPF}\\\text{10kHz}\end{smallmatrix}}$, $\boxed{\begin{smallmatrix}\text{ATT}\\\text{26dB}\end{smallmatrix}}$, or $\boxed{\begin{smallmatrix}\text{SLP}\\\end{smallmatrix}}$ of CH-A appropriately corresponding to the input signal. (For details, see section 3.4.2.)

Turning OFF of calculation function

1   Press SCLE. Press >> several times to display "SCALE = XXXXX". Press ⬡ to select "SCALE = OFF". (For details, see section 2.6.3 and 3.5.1.)

2   Press STAT. Press >> to select "STATISTICS = OFF". (For details, see section 2.6.4 and 3.5.2.)

3   Press COMP. Press >> to select "COMPARE = OFF". (For details, see section 2.6.5 and 3.5.3.)

2.3   Front panel
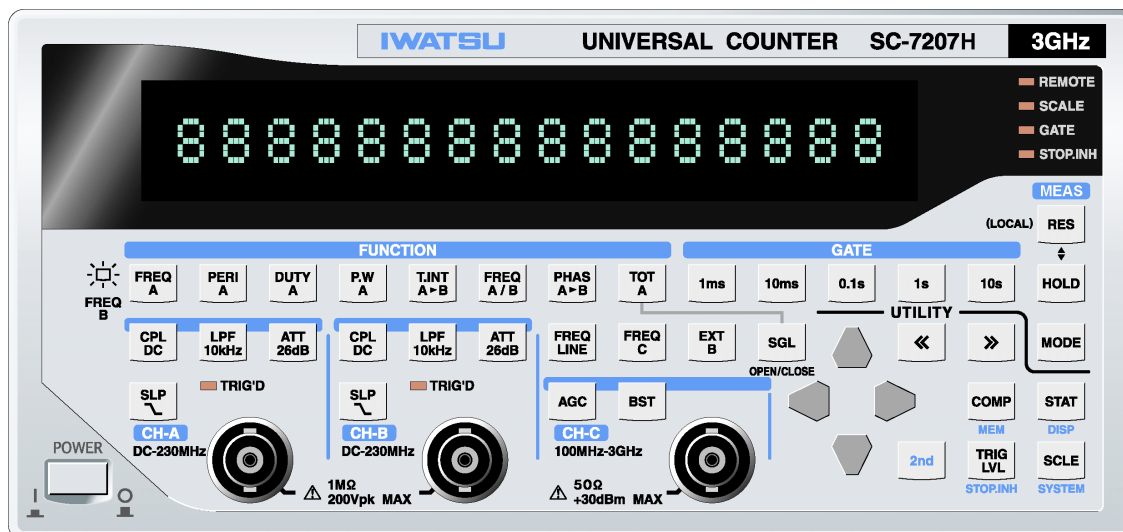
 FUNCTION

Select a desired measuring function. When the selected function is turned ON, the selected function key is lit.

FREQ A

Measures the frequency of the signal input to CH-A.

FREQ B (7205H and 7207H only)

Measures the frequency of the signal input to CH-B.

PERI A

Measures the period of the signal input to CH-A.

DUTY A

Measures the duty ratio of the signal input to CH-A.

P. W A

Measures the pulse width of the signal input to CH-A.

T.INT A-B (7205H and 7207H only)

Measures the time interval between the signal input to CH-A and that input to CH-B.

FREQ A/B (7205H and 7207H only)

Measures the frequency ratio of the signal input to CH-A and that input to CH-B.

PHAS A/B (7205H and 7207H only)

Measures the phase difference between the signal input to CH-A and that input to CH-B.

TOT A

Totalizes the counts of the signals input to CH-A.

FREQ LINE (7205H and 7207H only)

Measures the frequency of the AC power supply voltage.

FREQ C (7206H and 7207H only)

Measures the frequency of the signal input to CH-C.

CH-A

CPLDC

Selects an input signal coupling method. This key is lit when DC is selected.
If the key is off, this shows that AC is selected.

LPF10kHz

Turns ON or OFF the 10kHz low-pass filter.
The key is lit when it is turned ON.

ATT26dB

Turns ON or OFF the 1/20-attenuator. The key is lit when it is turned ON.

SLP (Slope)

Selects the positive or negative trigger slope. The key is lit when the negative slope is selected.

TRIG'D LED

This LED shows that the signal input to CH A is detected (triggered). (The LED is lit when the signal is detected.) This LED functions as an input signal indicator.

BNC connector (CH-A)

Signals are input to this connector when performing the following measurements.

The input impedance of this connector is 1MΩ.

Input for frequency measurement (FREQ A)

Input for period measurement (PERI A)

Input for duty measurement (DUTY A)

Input for pulse width measurement (P.W.A)

A input for frequency ratio measurement (FREQ A/B)

A input for phase difference measurement (PHAS A►B)

Input for starting of time interval measurement (T. INT A►B)
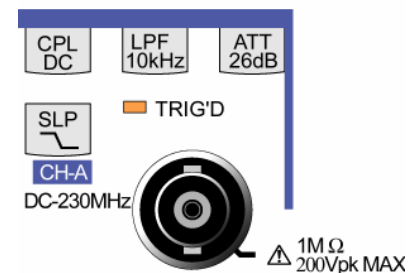
Input for accumulation count measurement (TOT A)

CH-B (SC-7207H and SC-7205H only)

All of CPLDC, LPF10kHz, ATT26dB, and SLP are the same as those described for CH-A.

BNC connector (CH-B)

Signals are input to this connector when performing the following measurements.

EXT-B gate input for frequency measurement (FREQ A)

EXT-B gate input for period measurement (PERI A)

B input for frequency ratio measurement (FREQ A/B)

B input for phase difference measurement (PHAS A▶B)

B input for interval measurement (T. INT A▶B)

EXT-B gate input for totalize measurement (TOT A)
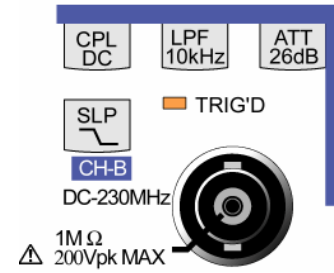
CH-C (SC-7207H and SC-7206H only)

BNC connector (CH-C)

Signals are input to this connector when performing the frequency measurement (FREQ C).
The input impedance of this connector is 50Ω.
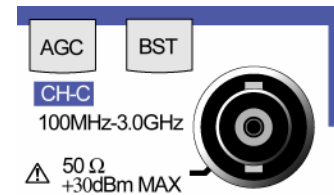
AGC

Selects to turn ON or OFF the AGC circuit. The key is lit when this function is turned ON. The auto gain control of the signal input to CH-C is then set. (For details of AGC function, see section 3.4.5.3.)

BST

Selects the burst wave measurement mode or continuous wave measurement mode. The key is lit when this function is turned ON. This shows that the burst measurement mode is selected. (For details of burst measurement mode, see section 3.4.5.3.)

GATE

Selects a gate time. The key is lit, which is set valid.

The gate is opened for a period of gate time, 1ms, 10ms, 0.1s, 1s, or 10s according to the selected key.
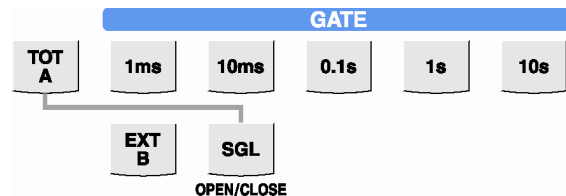
EXT B (SC-7207H and SC-7205H only)

To use the input to CH-B as EXT-B gate, select this key.
This key is used to reset the count only when the function is set at TOT-A.

SGL

This key is used to perform the measurement with the SGL gate. For details, see the section, Gate, in Chapter 3.
The [SGL] key is used as manual gate open/close key only when the function is set at the accumulation count measurement (TOT-A). This switch functions as an OPEN/CLOSE toggle switch.

UTILITY

[↑] [↓] [←] [→] [<<] [>>]

These keys are used to set the items necessary for each utility function.

The [<<] and [>>] keys are normally used to change the setting item. Press the [<<] or [>>] key several times to display a desired setting item, and then set a desired value.
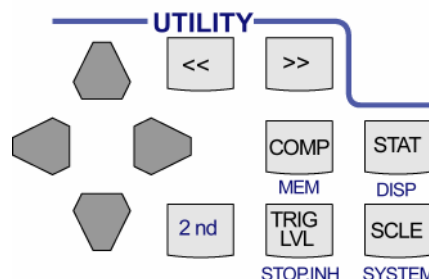
The [←] and [→] keys are used to select what part (digit) of the set value is changed.
The value at the flashing digit (one digit or all digits) can be changed.
When pressing the [←] or [→] key, the flashing part is moved.

The [↑] and [↓] keys are used to change the set value. Make a desired part (digit) flashing using the [←] or [→] key and change the value using the [↑] or [↓] key.
The value at the flashing part is then changed.

2nd

When this key and [TRIG LVL][SCLE][COMP][STAT] are pressed, STOP INH, SYSTEM, MEM, DISP are valid. From the following explanations, pressing the [2nd] (2nd key is lit) and other key is shown as [2nd + ***].

[2nd + COMP] shows the operation that [COMP] is pressed with the 2nd key made lit.

The pressing order is not required.

COMP

Sets the comparison calculation (Hi limit value and Lo limit value).

MEM [2nd+COMP]

Saves or recalls the setup data (including initialization).

STAT `STAT`

Sets the continuous mode (maximum/minimum), N-sample mode (maximum, minimum, average, deviation), and CH-A and B peak voltage measurement of the statistic calculation.

DISP [2nd+STAT] `2nd` `STAT`

Sets the number of no-display digits, display update interval, and display power saving time.

TRIG LVL `TRIG LVL`

Sets the trigger conditions (auto/manual) for CH-A and B.

STOP-INH [2nd+TRIG-LVL] (SC-7207H and 7205H only) `2nd` `TRIG LVL`

This key is valid in the T.INT A-B and PHAS A-B measurements when CH-A is used as measurement start signal and CH-B as measurement end signal. This key is used to set the time to make the end of the measurement signal invalid (stop inhibit time).

SCLE `SCLE`

Sets the scaling calculation, "(X-a)/b", "X-Xref", and "c/X".

SYSTEM [2nd+SCLE] `2nd` `SCLE`

Sets the interface, input and output on the rear panel, and buzzer.

MEAS
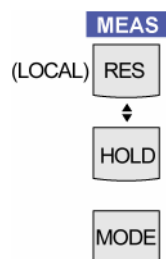
RES/HOLD

Sets [RES] for measurement and [HOLD] for hold.

MODE

Changes the display among the measurement result, statistic calculation result, and peak voltage.
Every time the [MODE] key is pressed, the items set at "on" are changed in the following order.
For details, see "section 3.2.2 MODE key".

| | | | | | 1 | . | 0 | 0 | 4 | 3 | 8 | 0 | M | H | z | Latest measured value |

| Mx | | | | | 1 | . | 0 | 0 | 4 | 3 | 8 | 2 | M | H | z | Maximum value |

| Mn | | | | | 1 | . | 0 | 0 | 4 | 3 | 7 | 8 | M | H | z | Minimum value |

| x̄ | | | | | 1 | . | 0 | 0 | 4 | 3 | 8 | 0 | M | H | z | Average value |

| σ | | | | | 3 | . | 2 | 6 | 4 | 4 | 0 | 8 | | H | z | Deviation value |

| A | | + | 0 | . | 9 | 9 | V | | | − | 1 | . | 0 | 0 | V | Peak voltage value A |

| B | | + | 0 | . | 5 | 3 | V | | | − | 0 | . | 4 | 8 | V | Peak voltage value B |

2.4   Rear panel
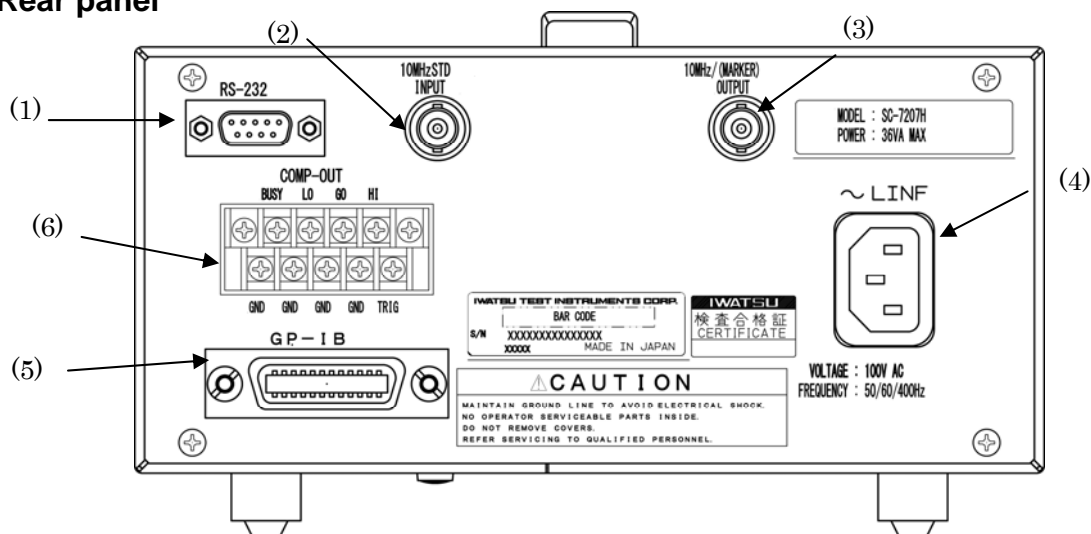
(1) RS-232 interface

This is an RS-232 interface connection terminal. It is possible to connect with PC etc. , and remotely to control from the outside. Please refer to the remote control manual for the rule, the command, and use, etc. Please refer to section 17 of Chapter4 for the specification.

(2) 10MHz STD INPUT

The highly stable 10MHz reference frequency is externally input to this terminal. When SYSTEM-REF-Clock is set at EXT, the internal reference oscillator is separated, and then the measurement is performed at a frequency of 10MHz of the external reference oscillator. As for the setting method, please refer to "3.5.5 system setting mode: SYSTEM (2nd+SCLE)" and, please refer to section 17 of Chapter4 for the specification.

(3) 10MHz / (MARKER) OUTPUT

The 10MHz internal reference frequency signal and marker signal are output from this terminal. The 10MHz internal reference signal is output. As for the setting method, please refer to "3.5.5 system setting mode: SYSTEM (2nd+SCLE)" and, please refer to section 16 of Chapter4 for the specification.

(4) ～ LINE（AC INPUT）
This is an inlet for power cord connection. Always connect the 3-prong power cord supplied with this instrument.

(5) GPIB interface (standard; for SC-7206H and SC-7207H , optional; only for SC-7205H)
This is a connected terminal in the GP-IB interface. It is possible to connect with PC etc. , and remotely to control from the outside. Please refer to the remote control manual for the rule, the command, and use, etc. Please refer to section 18 of Chapter4 for the specification.

(6) COMP-OUT (factory option)
 This is a comparator output terminal. The SC-702 DIO board is necessary for this. Please refer to secion 3.5.3 for the use. Please refer to section 26.2 of Chapter4 for the specification.

2.5   Display

This is a 16-digit fluorescent display that shows the measurement results of the input signals.

2.5.1   Display example in measurement mode

16-digit fluorescent display

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Header	Polarity sign	Mantissa part	Multiplier and unit display
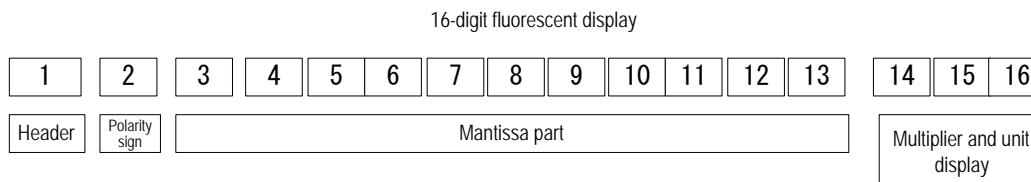
1) Header

This part shows "Hi, _, Lo" calculated with comparator or statistic calculation result "Mx, Mn, X, σ", and "!" if an error occurs.

2) Polarity sign

This part shows "_" (blank) for the positive value and "−" for the negative value.

3) 11-digit mantissa part

This part shows the numerical value of ten digits or less and the decimal point.
（『,』 (comma) of each treble do not enter the number of digits, and are displayed automatically.）

4) Multiplier

This part shows any of "p, n, μ, m, _, k, M, G, T". The maximum display is "±999.999,999,9T".

5) Unit display

This part shows any of "Hz, s_, %_, ° _, __" according to the function settings.

This part shows "__" during scaling c/X calculation.

2.5.2   Hysteresis display

This function prevents a flicker if the measurement results and the decimal point is changed frequently.

Even if the measured value decreases and the decimal point changes, the decimal point and multiplier are not changed with leading zeros are added to display zero at the significant digits. This time is to be able to change by the display menu (2.6.7 references).

When the latest measurement value is display, this function is valid, but the statistic calculation or peak voltage value is display this function is invalid.

2.5.3　Status monitor

The state of the equipment is displayed in the upper right of the display with the LED lamp as shown in the figure below (orange color).
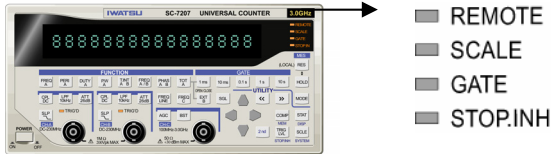
REMOTE

This LED shows that the instrument is in the remote mode through the GPIB or RS-232 interface.

・Lit : remote mode
・Off : local mode

In the remote mode, all keys except for the [RES] key become invalid.

When the [RES] key is pressed, the REMOTE LED goes off and the mode is returned to the local mode.

For details of remote control, see the section 3.5.5 system setting mode SYSTEM.

SCALE

This LED shows whether the scaling calculation is valid (on) or invalid (off).

・Lit: effective（on）
・Off: invalid（off）

For details about how to set the scaling calculation, see the section 3.5.1 Scaling calculation setup : [SCLE].

GATE

This LED shows that all of the internal gate, external gate (EXTB), and manual gate are opened.

・Lit : Gates are opened.
・Off : Gates are closed.

For details about how to set the gates, see the section 3.4.4 Gate（GATE）.

STOP.INH (only for SC-7207H/SC-7205H)

This LED is lit when a value other than "0 ms" is set in the STOP.INH (stop inhibit) setup.

The stop inhibit function is valid only for the T.INT A-B and PHAS A-B functions.

For details about how to set the STOP.INH function, see the section, 3.5.4 Setting of STOP.INH time.

2.6 Utility menus and display examples

2.6.1 List of menus

The figure below shows an example of displaying each item in the utility menu, a reference paragraph, a setting range, and an initial value, etc.

```
                                                      2nd
TRIG LVL(Trigger Level、2.6.2、3.4.3)         STOP,INH(Stop inhibit time setup、3.5.4)
     *****M [A] + [AUTO]                            ******B  [0.0]ms
     *****M [B] +0.00V  ┌───┐ ─2.5V～+2.5V                        ┌───┐ ─ 0.0 ms ～ 25.5ms
                        └───┘ ─50.0V～+50.0V                      └───┘        (off)
  (Five high rank digit display of the latest measurements)  (Five high rank digit display of the latest measurements)

                                                      2nd
SCLE(Scaling calculation setup,3.5.1)         SYSTEM(System setup mode,3.5.5)
      a= [+0,000,000,000]                         GATE_CLOSE ────── = [WAIT]/ FIRST
 [≪]  b= [+1,000,000,000]      setting           TOT_CLR   ────── = [BY RES]/ BY GATE
 [≫]  c= [+1,000,000,000]      value             GP-IB     ──────  : Address = 0 ～ 30
      Xf= [+0,000,000,000]                                           : DELIM = [CR+LF]/ LF
      SCALE= [off]                                 RS      ──────  : RATE = 300bps ～ [38,400bps]
                   ┌───┐ ── SCALE=c/X                                : DELIM = [CR+LF]/ LF
                   └───┘ ── SCALE=X ─ Xref [≪]                      : Stop-Bit = [1]/ 2
                        ── SCALE=(X ─ a)/b [≫]                      : Parity = [None]/ Even / Odd
                                                   DIO     ──────  : CompIni = [off]/ on
                                                                    : StatIni = [off]/ on
STAT(Statistic calculation setup,3.5.2)           RefClk   ──────  : CHECK = [off]/ on
 [≪]  Vpp A= [off] B= [off] ── A=off,on B=off,on                    : SOUR = [INT]/ EXT
 [≫]                                                                : RECOV = [AUT]/ MAN
      STATISTICS= [off]                           Output   ────── = [REF-CLOCK]
                         ── CONTINUE=ᴹ & ᴹ                         = MARKER
                         ── XXX SMPL-REP=ᴹ & ᴹ & X̄ & σ  BEEP ────── : KeyPush = [on]/ off
                         ── XXX SMPL-SGL=ᴹ & ᴹ & X̄ & σ              : Caution = [off]/ on
                                                                    : Comp = [off]/ on

                                                      2nd
COMP(Comparator calculation setup,3.5.3)      DISP(Display setup,3.5.6)
 [≪]  [COMPARE= off]    ── COMPARE= on             DISP : MASK  ────── = [0] ～ 9 dgts
 [≫]  L<+999,999,999,9T     setting               DISP : LoPow ────── = [off],10 min～60 min
      H>+999,999,999,9T     value      [≪]         DISP : RATE  ────── = [0.0 s] ～ 200 s
                                       [≫]         DISP : H-Time ───── = [3 s]/ 10 s / 30 s
                                                   DISP : LoPow ────── = [off]/ on

                                                      2nd
MEM(Saving and Recalling of panel setting,3.5.7)
      [Recall<=#Initial]  [≪] ── Recall-ok?[Y≫,N≪]  [≫] Recall-Complete
      Save =>#0 (#0～9)    [≫] ── Save-ok?[Y≫,N≪]    [≫] Save-Complete
      Recall<=#0 (#0～9)       ── Recall-ok?[Y≫,N≪]  [≫] Recall-Complete
```

・ shows the key that can operate the menu.

・Blinking the menu character shows the fixation of the setting.

・ of a set parameter indicates an initial value.

2.6.2   Trigger menu

TRIG LVL and STOP INH can be set while referring to the measured values.

For details of STOP INH menu, see section 3.5.4.

TRIG LVL

The display contents may vary depending on the settings at power OFF.

1.   Press ⌈TRIG LVL⌋. The measured value (example, 1.0007 MHz) and setting menu are displayed.

O shows the flashing digit.

┌──────── Display ────────┐

| 1 | . | 0 | 0 | 0 | 7 | M | A | + | 0 | . | 0 | 0 | V |
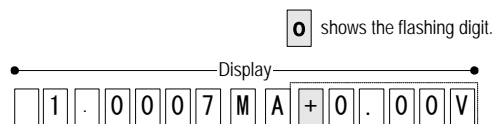
Selection of channel CH-A or CH-B

2.   Press ⬅ or ➡ to make A or B flashing.

| 1 | . | 0 | 0 | 0 | 7 | M | A | | A | U | T | 0 | |

3.   Press ⬆ or ⬇ to select CH-A or CH-B.

B
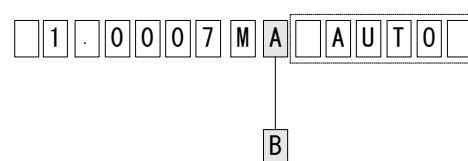
Setting of level to AUTO

4.   Press ⬅ or ➡ to move the digit so that "+" or "−" flashes.

| 1 | . | 0 | 0 | 0 | 7 | M | A | + | 1 | . | 3 | 0 | V |

5.   Press ⬆ to select AUTO.

| 1 | . | 0 | 0 | 0 | 7 | M | A | | A | U | T | 0 | |
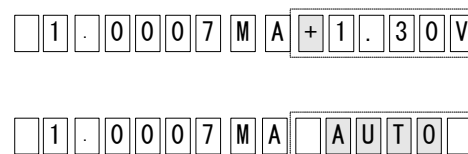
Setting of level to MANUAL

6.   When AUTO is flashing, press ⬆.

| 1 | . | 0 | 0 | 0 | 7 | M | A | + | 1 | . | 0 | 0 | V |

7.   Press ⬅ or ➡ to move the digit so that a desired setting digit flashes.

| 1 | . | 0 | 0 | 0 | 7 | M | A | + | 1 | . | 0 | 0 | V |
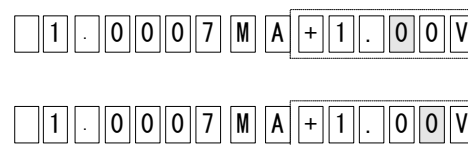
8.   Press ⬆ or ⬇ to set a trigger level value.

| 1 | . | 0 | 0 | 0 | 7 | M | A | + | 1 | . | 0 | 5 | V |

ATT 26 dB (1/20 magnification)   :OFF (Off) setting range   ⌈ATT 26dB⌋   ┌ + 2 . 5 0 V
                                                                                └ − 2 . 5 0 V
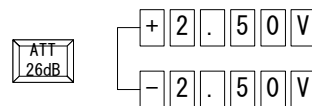
                                       :ON (Lit) setting range   ⌈ATT 26dB⌋   ┌ + 5 0 . 0 V
                                                                                └ − 5 0 . 0 V
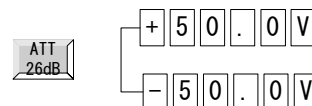
2.6.3   Scaling calculation menu

SCLE

The display contents may vary depending on the settings at power OFF.

| `O` | shows the flashing digit. |

●──────── Display ────────●

`b = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

1. Press `SCLE`.

2. Press `>>` or `<<` to display the scaling calculation mode message "SCALE = XXXXX".

`a = + 0 . 5 0 0 , 0 0 0 , 0 0 0`

`c = + 1 . 0 0 0 , 0 0 0 , 0 0 0`

`X f = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

3. Press ⬆ or ⬇ to select a desired calculation item.

Example: To measure the RPM of the motor:

When SCALE is set to "(X-a)/b", "a" to "0", and "b" to "1/60", the RPM becomes 60X (X is the measured value). (In case of 100kHz signal)

`S C A L E = o f f`

`S C A L E = c / X`

`S C A L E = X − X r e f`

`S C A L E = ( X − a ) / b`

Setting of constant "a" to 0

4. Press `>>`.

`a = + 0 . 5 0 0 , 0 0 0 , 0 0 0`

5. Press ➡ to make the `5` digit flashing. Set `0` using the ⬆ or ⬇ key.

`a = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

   [Note]The flashing state shows that the value is set.

Setting of constant "b" to 1/60 nearly equivalent to 0.016666666

6. Press `>>`.

`b = + 1 . 0 0 0 , 0 0 0 , 0 0 0`

7. Press ➡ to move the flashing digit right.

`b = + 1 . 0 0 0 , 0 0 0 , 0 0 0`

`b = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

8. Press ⬇ to set `0`.

`b = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

9. Press ➡ to make `0` flashing.

`b = + 0 . 0 1 0 0 , 0 0 0 , 0 0`

10. Press ⬆ to set `1`.

`b = + 0 . 0 1 6 6 , 6 6 6 6`

In the same manner as described above, set "b" to "0.016666666".

`6 . 0 0 0 , 0 0 0 M H z`

11. Press `RES`.

The SCALE status indicator is lit.
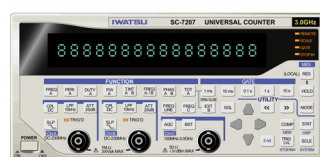
- REMOTE
- SCALE
- GATE
- STOP.INH

2.6.4 Statistic calculation menu

STAT

The display contents may vary depending on the settings at power OFF.

|o| shows the flashing digit.

●────────Display────────●

`V p p □ A = o f f □ B = o f f □`

1. Press `STAT`.

`□ S T A T I S T I C S = o f f`

2. Press `>>` or `<<` to display the contents shown to the right.

Setting of calculation

`1 0 0 S M P L - S G L : Mx Mn x̄ σ`
`1 0 0 S M P L - R E P : Mx Mn x̄ σ`
`C O N T I N U E □ □ □ : Mx & Mn`

3. In above setting step 2, press ⬆ or ⬇ to select a mode.

Number of samples

4. Press ⬅ to move the flashing digit left.

`1 0 0 S M P L - R E P : Mx Mn x̄ σ`

5. Press ⬆ or ⬇ to select the number of samples.

`□ 1 0`
`□ 5 0`

Measurement of voltage
In above setting step 2, select "Vpp A = off, b = off", and press ⬆ to select "ON".

`V p p □ A = o f f □ B = o f f □`
`□ □ □ □ □ o n`

6. Press `RES`.

The SCALE status indicator is lit.

`□ □ □ □ □ 1 . 0 0 4 3 8 0 M H z`

7. Every time `MODE` is pressed, no measurement (measurement = OFF) is performed, and the maximum value Mx, minimum value Mn, average value x̄, and deviation value σ are measured in order.

If any items are set at "off", such items are skipped.

`□ □ □ □ □ □ 1 . 0 0 4 3 8 0 M H z`
`Mx □ □ □ □ □ 1 . 0 0 4 3 8 2 M H z`
`Mn □ □ □ □ □ 1 . 0 0 4 3 7 8 M H z`
`x̄ □ □ □ □ □ 1 . 0 0 4 3 8 0 M H z`
`σ □ □ □ □ □ 3 . 2 6 4 4 0 8 □ H z`
`A □ + 0 . 9 9 V □ □ - 1 . 0 0 V`
`B □ + 0 . 5 3 V □ □ - 0 . 4 8 V`
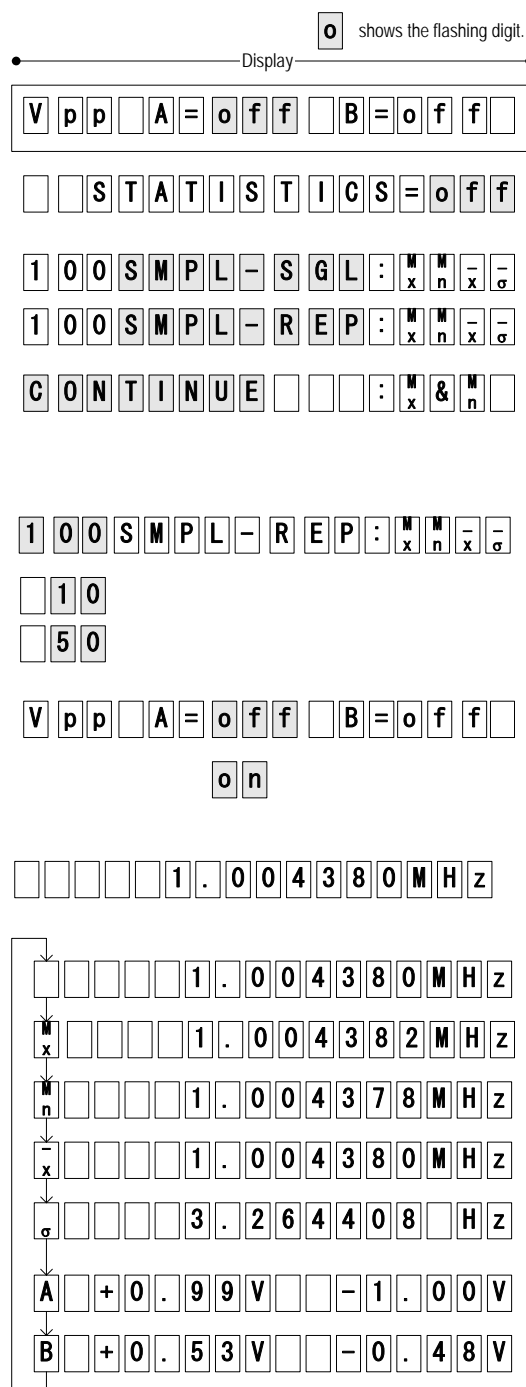
2.6.5 Comparator menu

COMP
The display contents may vary depending on the settings at power OFF.

O shows the flashing digit.

— Display —

`[ ][▲H][>][+][9][9][9][.][9][9][9][9][9][9][9][T]`

1. Press COMP.

2. Press `>>` or `<<` to display the contents shown to the right.

`[ ][L▼][<][–][9][9][9][.][9][9][9][9][9][9][9][T]`

`[C][O][M][P][A][R][E][=][o][f][f][ ][ ][ ][ ]`

3. In above setting step 2, select "COMPARE = off" and press ⬆ to select "comparator ON".

`[C][O][M][P][A][R][E][=][o][n][ ][ ][ ][ ][ ]`

Example: To judge whether or not the measured frequency is within 1 MHz ±10 Hz.

`[ ][▲H][>][+][9][.][9][9][9][,][9][9][9][,][9][9][9][ ]`
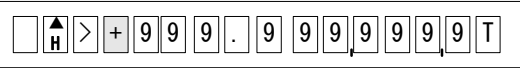
4. Press `>>` and set an upper limit value.

`[ ][▲H][>][+][9][.][9][9][9][,][9][9][9][,][9][9][9][ ]`

5. Press ➡ to move the flashing digit to `9`.

`[ ][▲H][>][+][1][.][9][9][9][,][9][9][9][,][9][9][9][ ]`

6. Press ⬇ to set `1`.

`[ ][▲H][>][+][1][.][9][9][9][,][9][9][9][,][9][9][9][ ]`

7. Press ➡ to move the flashing digit to `9`.

`[ ][▲H][>][+][1][.][0][9][9][,][9][9][9][,][9][9][9][ ]`

8. Press ⬇ to set `0`.

`[ ][▲H][>][+][1][.][0][0][0][,][0][1][0][,][0][0][0][ ]`

9. Repeat the above operation steps to set "1,000,010".

`[ ][▲H][>][+][1][.][0][0][0][,][0][1][0][,][0][0][0][_]`

10. Press ➡ to move the flashing digit to the right end.

`[ ][▲H][>][+][1][.][0][0][0][,][0][1][0][,][0][0][0][M]`

11. Press ⬆ to set the unit to `M`.

`[ ][L▼][<][+][0][.][9][9][9][,][9][9][1][,][0][0][0][M]`
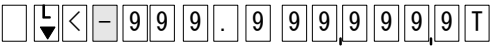
12. Repeat the above operation steps to set the lower limit value to "0. 999, 991, 0".

± 10Hz or less

`[ ][ ][ ][ ][ ][1][.][0][0][0][,][0][0][5][,][0][M][H][z]`

13. Press RES.

`[▲H][ ][ ][ ][ ][1][.][0][0][0][,][0][1][3][,][0][M][H][z]`

If the measured frequency becomes beyond the set range, ▲H or L▼ is displayed.

`[L▼][ ][ ][ ][ ][0][.][9][9][9][,][9][9][0][,][3][M][H][z]`

2.6.6 System menu

SYSTEM

The display contents may vary depending on the settings at power OFF.

For details of RS-232, GPIB, DIO and GATE_CLOSE, see section 3.5.5.

1. Press `2nd` and `SCLE`.

2. Press `⟩⟩` or `⟨⟨` to display the contents shown to the right.
   "GPIB" is displayed only when this option is installed.

Setting of reference clock

In above setting step 2, select "Ref-Clock".

(1) Press ⬆ or ⬇ to select "INT" (internal) or "EXT" (external).

Setting of output signal

In above setting step 2, select "OUTPUT".

(1) Press ⬆ or ⬇ to select "REF-CLOCK" (reference clock) or "MARKER" (marker).

Setting of beep sound

In above setting step 2, select "BEEP".

(1) Press ⬆ or ⬇ to select a desired beep sound type.

(2) Press ➡ to move the flashing digit right.

(3) Press ⬆ or ⬇ to select the beep sound ON or OFF.

Clear setting of addition calculation

In above setting step 2, select "TOT_CLR"

(1) Press ⬆ or ⬇.

It multiplies until the RES key is pushed when BY RES is selected.
When BY GATE is selected, each GATE OPEN is multiplied from 0.

O shows the flashing digit.

— Display —

```
GATE_CLOSE=WAIT
TOT_CLR=BY RES
RS:Rate=38400bps
GPIB:Addrss= 7
DIO:CompIni=off
RefClk:SOUR=INT
OutPut=REF-CLOCK
BEEP:Keypush=off
```

```
RefClk:SOUR=INT
           EXT
```

```
OUTPUT=REF-CLOCK
       MARKER
```

```
BEEP:Comp=off
BEEP:Caution=off
BEEP:Keypush=off
```

```
BEEP:Keypush=on
BEEP:Keypush=off
```

```
TOT_CLR=BY RES
```

2-19
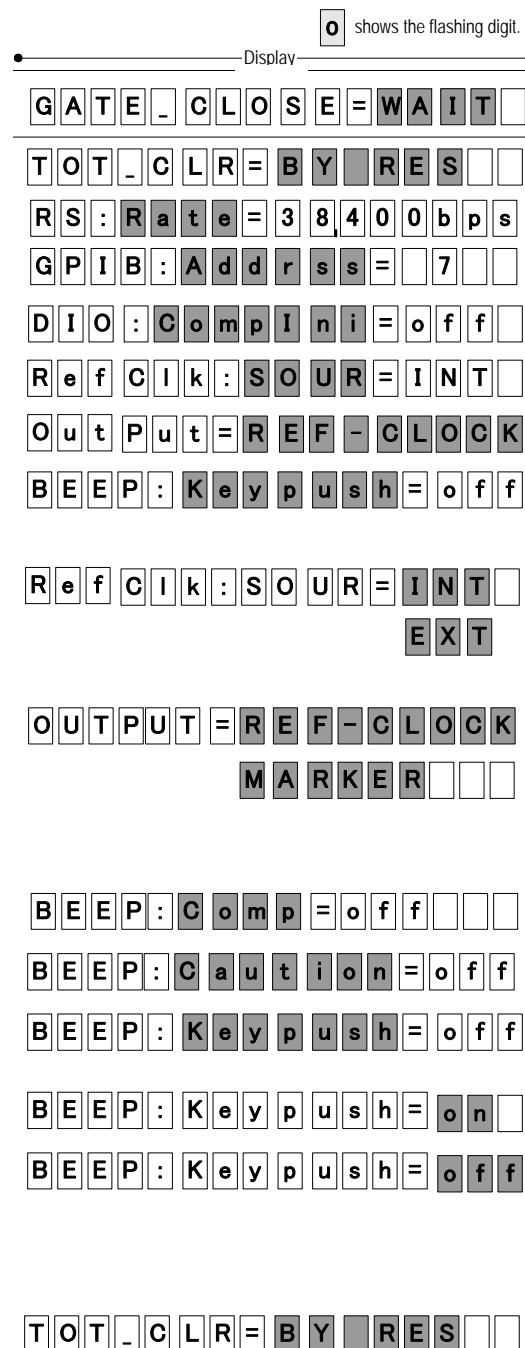
2.6.7 Display menu

DISP

The display contents may vary depending on the settings at power OFF.

1. Press `2nd` and `STAT`.

2. Press `>>` or `<<` to display the contents shown to the right.

Setting of the number of masking digits
(This function displays only necessary digits.)

In above setting step 2, select "DISP: MASK".

3. Press ⬆ or ⬇ to set the number of masking digits (0-9).

The display on the right shows an example when 3 masking digits are set.

Setting of power saving mode
In above setting step 2, select "DISP: LoPow".

4. Press ⬆ or ⬇.
   If no key operation is made for a set period of time, all digits of the display will disappear.

Setting of display update interval
In above setting step 2, select "DISP: Rate".

5. Press ▷ to move the flashing digit right.

6. Press ⬆ or ⬇ to set a period of display update interval time.
   With the setting shown to the right, the display data is updated at intervals of 3 sec.
   The setting range is 0.0 - 200.0 sec. (in steps of 0.1 sec.).

Setting of hysteresis display time
Choose DISP:Rate by setting procedure 2.

7. Press ⬆ or ⬇ set the hysteresis display time.

o shows the flashing digit.

Display

DISP:MASK=0　dgts

DISP:LoPow=off

DISP:Rate=- 0.0s
DISP:H-Time= 3s

DISP:MASK=0 dgts

3

Before setting
1000184MHz

After setting
1000___MHz

DISP:LoPow=off

10min

60min

DISP:Rate=_ 0.0s

DISP:Rate= 0.0s

DISP:Rate= 3.0s

DISP:H-Time= 3s

10s

30s
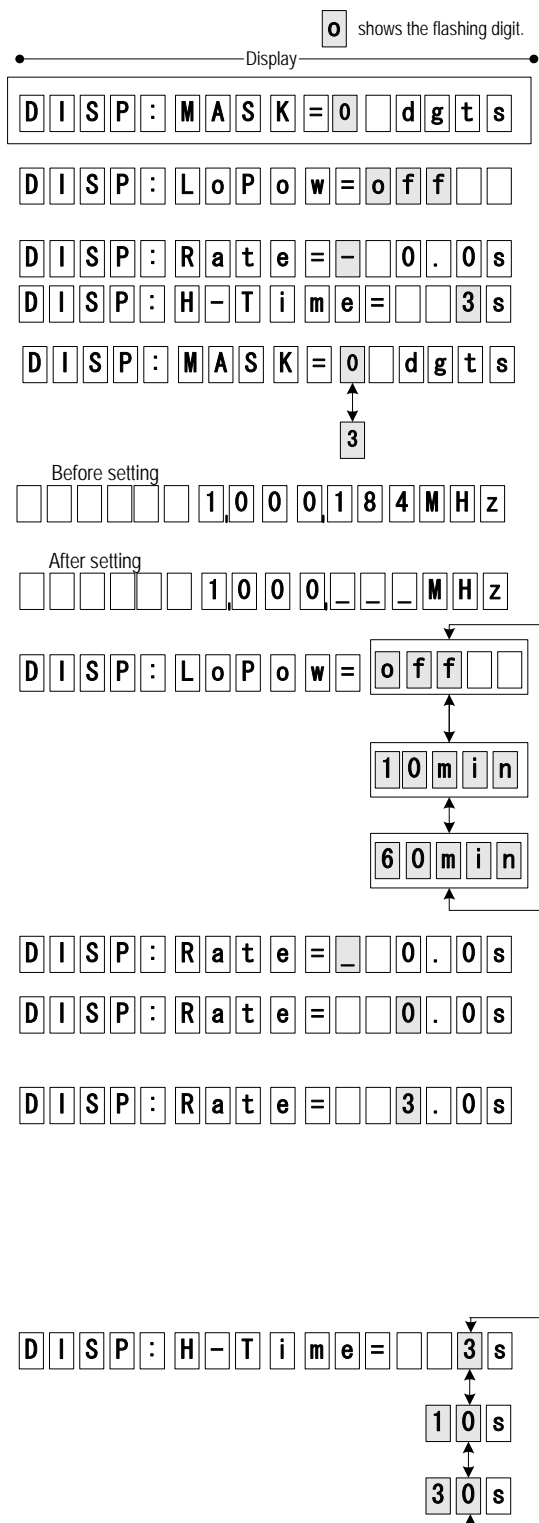
Chapter 3   Operating Procedures

3.1   About measurement mode

This instrument has the measurement mode (all of four [COMP], [STAT], [TRIG-LVL], and [SCLE] keys are off) and utility function setup mode.

3.1.1   Measurement mode

In this mode, when a desired key of **FUNCTION** is pressed, relevant operation, such as counting of the input signal, calculation, result display, or optional data output is performed.

MODE Every time the [MODE] key is pressed in the measurement mode, the display is changed in the following order. At this time, however, items not set at "on" are skipped.

① Measured value is displayed.	Latest measured value is displayed.
② Statistic calculation value is displayed.	Maximum, minimum, average, and deviation calculation values are displayed while the measurement is being performed.
③ Peak voltage is displayed.	Voltage level of the input signal is measured and displayed. At this time, the time axis is not measured.
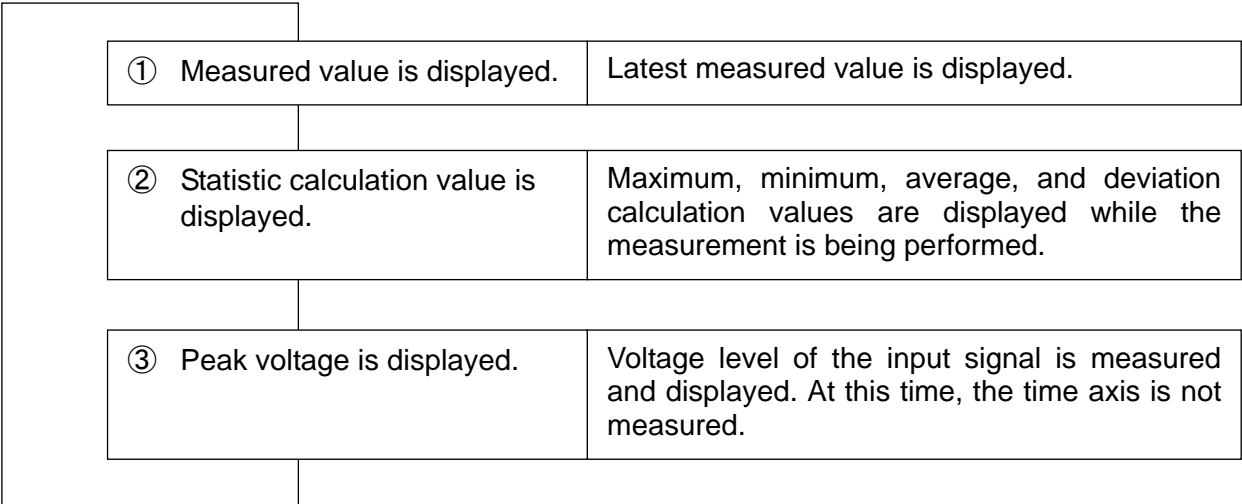
3.2   Measurement（MEAS）

Three keys, [RES], [HOLD], and [MODE], are provided in MEAS.

3.2.1   RES (LOCAL)/HOLD key

[RES] key is used to start the measurement and [HOLD] key is used to hold the measurement.

In the measurement mode, both [RES] and [HOLD] keys are off.

In the hold mode, only the [HOLD] key is lit.
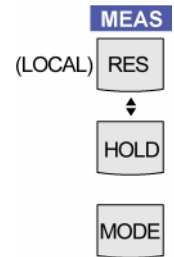
A)   When the [HOLD] key is pressed in the measurement mode, the [HOLD] key is lit and the measurement is stopped.
The value measured last is shown on the display.

However, if the [HOLD] key is pressed while the measurement is being performed in the [HOLD] mode (the message, "___MEASURING • • • • ", is displayed), the message, "!__No-Data_____", is shown.

B)   When [RES] is pressed in the measurement mode, the current measurement is stopped forcibly and the measurement is restarted with the same conditions.
Additionally, if the statistic calculation is set at "on" and scaling difference calculation is set at "on", the re-measurement result values are displayed.

C)   When the [HOLD] key is pressed in the hold mode, the measurement is performed only once.
The [HOLD] key is off during measurement and will be lit after the measurement result has been displayed.

D)   When the [RES] key is pressed in the hold mode, the [HOLD] key goes off and the measurement is then started.
Notes) * The statistic calculation and scaling difference calculation are not initialized.

   * The [RES] key functions as [LOCAL] key in the remote mode.

   * When the [RES] key is pressed while the settings are being made in the utility mode, the mode enters the measurement mode.

3.2.2　MODE key

This key is used to change the measurement result, statistic calculation result, and peak voltage displays in the measurement mode.

Every time the [MODE] key is pressed, items set at "on" are changed in the following order.

Measured value ⇒ Maximum value (Mx) ⇒ Minimum value (Mn) ⇒ Average value ($\bar{x}$) ⇒ Deviation value (σ) ⇒ Peak voltage value (A) ⇒ Peak voltage value (B) ⇒ Returned to the measured value.

* Items, which are set at "off", are skipped.

* The measurement of the time axis is stopped in the peak voltage display mode.

					1	.	0	0	4	3	8	0	M	H	z		
Mx					1	.	0	0	4	3	8	2	M	H	z		
Mn					1	.	0	0	4	3	7	8	M	H	z		
$\bar{x}$					1	.	0	0	4	3	8	0	M	H	z		
σ					3	.	2	6	4	4	0	8		H	z		
A		+	0	.	9	9	V			−	1	.	0	0	V		
B		+	0	.	5	3	V			−	0	.	4	8	V		
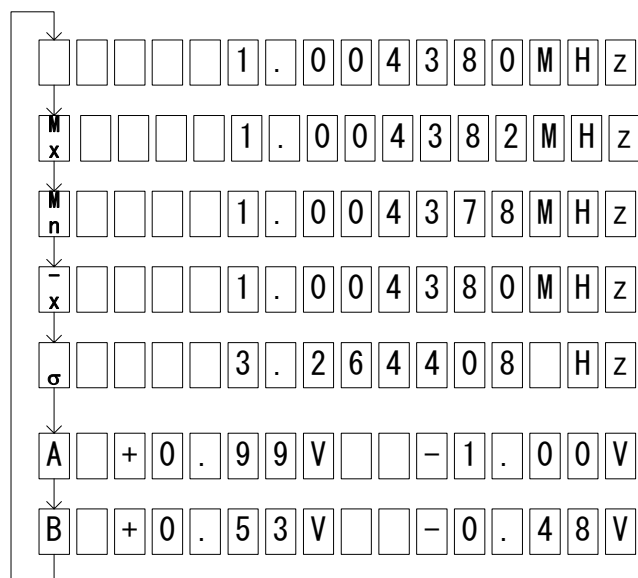
3.3 Backup of setup data

When the power is turned ON, the measurement is started with the settings (setup) immediately before turning OFF the power.

Up to 10 kinds of panel settings are stored in the setup memory.

3.3.1 Contents of backup data

Backup item	Backup ○ (possible), × (impossible)
1. Setup	---
FUNCTION	○
GATE	○
MEAS (RES/HOLD)	× (Fixed at RES when the power is turned ON.)
MEAS (MODE)	○
CPL (Coupling) of CH-A and B	○
FLT 10kHz (Filter) of CH-A and B	○
ATT26dB (Attenuator) of CH-A and B	○
SLP (Slope) of CH-A and B	○
AGC of CH-C	○
BST of CH-C	○
Measurement/Utility mode	× (Fixed in the measurement mode when the power is turned ON.)
Various settings of utility	○
2. Setup memory #0 - #9	○
3. Measurement and statistic calculation results	×

1) The GPIB/RS232 set values can be recalled through panel operation. The set values cannot be recalled through remote operation.

2) If the input frequency is beyond the specification or the signal is not input with the reference oscillator set at "EXT", the measurement may be started with the reference oscillator set at INT. (For details, see the processing setting etc. of 3.5.5 system set mode SYSTEM when the external standard clock error is detected.)

3) For details about how to save and recall the panel settings, see section 3.5.7, Backup memory.

3.3.2　Initialization of setup

The settings are initialized to those made before shipment from the factory through the key operation in the utility mode. (For details of key operation, see section 3.5.7 saving/recalling of the panel setting.)

The following list shows the contents of the settings made before shipment from the factory.

Backup item	Initialization status (Settings before shipment)
1. Setup	---
FUNCTION	FREQ-A
GATE	0.1s
MEAS (RES/HOLD)	HOLD
MEAS (MODE)	Measured value display mode
CPL (Coupling) of CH-A and B	AC
LPF 10kHz (Filter) of CH-A and B	off
ATT26dB (Attenuator) of CH-A and B	off
SLP (Slope) of CH-A and B	Positive "+"
AGC of CH-C	off
BST of CH-C	off
Measurement/Utility mode	Utility mode
Various settings of utility	Utility setup screen (See section 2.6.1.)
2. Setup memory #0 - #9	All are the same as above.
3. Measurement and statistic calculation results	(No data)

1) Remote control and key operation

It is possible to set by * RST command at a remote control.

For details, see "4.3.2 * RST command" of a remote section. Moreover, the following contents are different from the key operation.

・ Measurement/Utility mode　　　： Measurement mode
・ The values of GP-IB/RS-232　　： Not changed

3.4 Measurement functions

3.4.1 Operation flowchart

The following shows operating procedures for each measurement function.
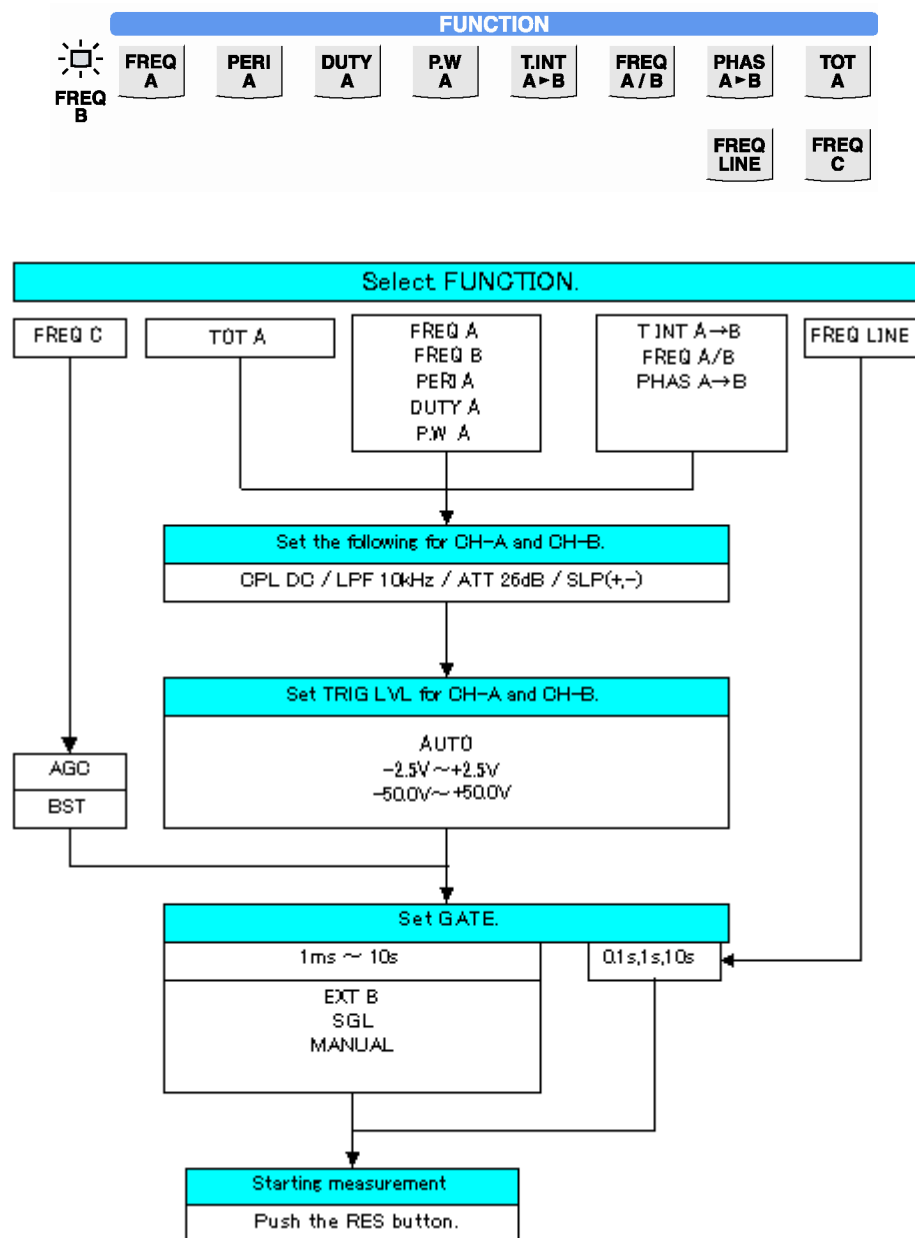
3.4.2 Setting of CH-A/B

Procedures

Setting of CH-A/B

a) According to the frequency of the input signal and whether or not the DC voltage is included it, select a coupling of CH-A/B using the [CPL DC] key.

> AC coupling (LED off):The signal with 10 Hz or less is attenuated to remove DC components.

> The AC coupling is used to measure the AC signals.

> The following shows an example that the DC coupling is switched to the AC coupling.

Ground line ➝

DC coupling   AC coupling
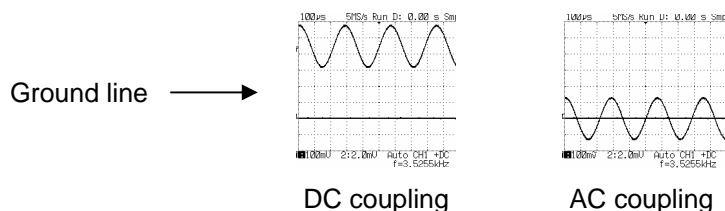
> DC coupling (LED on):All signal frequency contents including DC components are passed.

b) According to the amplitude of the input signal, select [26dB] (26dB attenuator; reduced to 1/20) of CH-A/B.

> If a input signal is included noise exceeding the hysteresis voltage of the waveform shaping circuit, the correct measurement cannot be performed.

> In this case, if [26dB] is turned ON (LED is lit), the noise also becomes its 1/20 level. This eliminates the error.

c) According to the period of the input signal and whether or not noise exists, select a filter of CH-A using the [LPF10kHz] key.

> When this function is turned ON (LED is lit), the frequency contents with 10 kHz or more are attenuated. Therefore, when measuring a low frequency with 10 kHz or less, the error due to high frequency noise included on the input signal can be eliminated.

d) A polarity ($+$, $-$) to trigger the input signal is selected using the [SLP] key.

Positive slope ➝   ← Negative slope
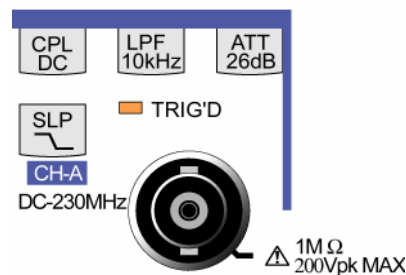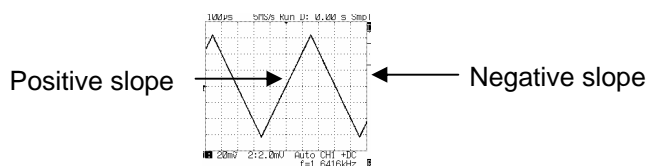
Cautions for input cables and probe connections

Maximum input voltage	Do not input a voltage exceeding the maximum input voltage. CH-A, CH-B: 200V, CH-C: +30dBm (Approximately 7Vrms based on "1mW/50 Ω = 0dBm")
Cable	If the impedance of the signal source or cable is not matched with the input impedance of the counter when measuring the high frequency signal, the waveform is distorted, causing the correct measurement not to be started. Always make the impedance of the signal source and cable matched with that of the counter. A difference in cable length may cause a measurement error in the high-speed time interval measurement. Always use the cables with the same length and type, or make the correction.

Note) If a deformed or damaged BNC connector is used or a connector not meeting the BNC specifications is used when connecting the signals, this may cause damage to the input plug or the performance to lower.

3.4.3 Setting of TRIG level

Pushing [TRIGLVL] key

↓

Selection of CH-A or CH-B

↓

Selection of AUTO or manual trigger

↓

Selection of trigger level value

↓

Press [TRIGLVL] to enter the measurement mode.
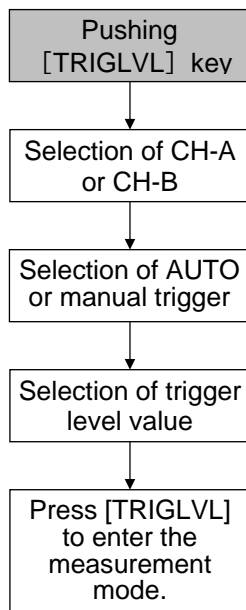
Trigger level setting procedures

The trigger level is set by flow as shown in the figure left. It explains with this page and next page in order of flow.

Selection of CH-A or CH-B

(1) Press the [TRIG LVL] key to enter the trigger setup mode. ([TRIG LVL] key is lit.)

"A" is flashing on the display. "A" shows the channel (A or B) and "AUTO" shows the auto trigger. When setting the trigger level manually, the voltage value of the trigger level is shown.
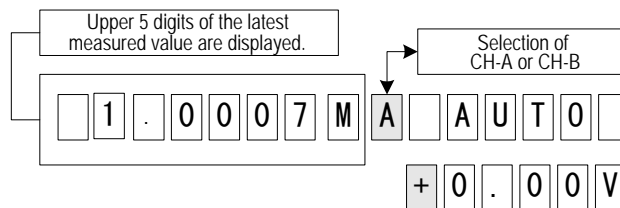
Selection of AUTO or Manual Trigger

From Manual Trigger level to AUTO:

When the trigger level is displayed, press the [←] key to move the flashing part to the polarity ("+" or "−").

In this state, press the [↑] or [↓] key to change the display "+" ⇔ "− " ⇔ "AUTO" in that order.

Display "AUTO". However, when "+" is flashing at +0.00V, the display is changed "+" ⇔ "AUTO".

Note1）Set the single-engined signal　and low frequency signal with the Manual Trigger.

Note2)　Refer to paragraph 1.1.3 of Chapter 4 Specifications for the trigger level and the range of the frequency of the AUTO trigger.

From AUTO to Manual Trigger

When the [↑] or [↓] key is pressed with "AUTO" flashing, $\boxed{+}\boxed{0}\boxed{.}\boxed{0}\boxed{0}\boxed{V}$ is displayed and the trigger level can be set.

Setting of CH-A/CH-B trigger level

Use the [←] or [→] key to make a desired setting digit flashing.

Use the [↑] or [↓] key to set a numeric value.

The setting range is −2.50V - +2.50V. (When [26dB] is set "on", the setting range becomes −50.0V - +50.0V.)

It is preferable to set this trigger level to the mid-level of the input signal waveform in the frequency, period, frequency ratio, and totalize measurements.

For example, to set the trigger level of CH-A to 2.5V, appear the display shown below.

$\boxed{ }\boxed{1}\boxed{.}\boxed{0}\boxed{0}\boxed{0}\boxed{7}\boxed{M}\boxed{A}\boxed{+}\boxed{2}\boxed{.}\boxed{5}\boxed{0}\boxed{V}$

AUTO trigger

If the offset contents are changed when the input signal waveform is a sine waveform, positive pulse, or negative pulse with DC included, the trigger level is automatically corrected to a proper level.

AUTO:　Automatically set to a proper level. Set the trigger level to the center level of the waveform.

Input signal
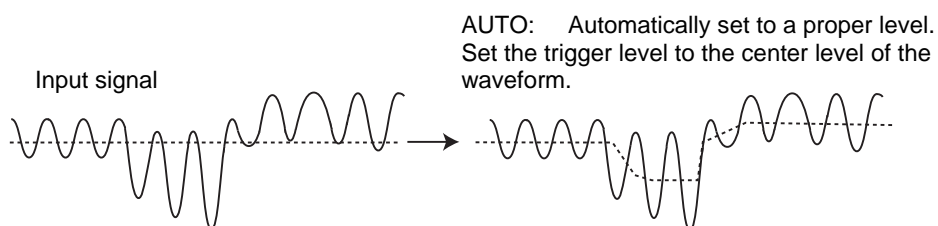
3.4.4　Gate (GATE)

There are internal gate, external gate, and manual gate about OPEN/CLOSE of the gate.

Seven keys [1ms], [10ms], [0.1s], [1s], [10s], [EXT-B], and [SGL] are provided to operate the gate, and they becomes the following.

・Internal gate　　　　　　　　　　: [1ms]、[10ms]、[0.1s]、[1s]、[10s]

・External gate　　　　　　　　　　: [EXT-B]

・Manual gate　　　　　　　　　　: [SGL] (only for totalize measurement)

The [SGL] key works as OPEN/CLOSE key to the manual gate at totalize measurement TOT-A. When the key is operated, the [SGL] gate is measured excluding totalize measurement TOT-A.

Measurement with gate time specified

Select any of the [1ms], [10ms], [0.1s], [1s], and [10s] keys.

The default setting after the function has been changed is [0.1s] ([SGL] only for TOT-A).

The average measurement is performed repeatedly within the gate time.

The actual gate time is extended with the integer cycle when the input signal period is long than the selected gate time.
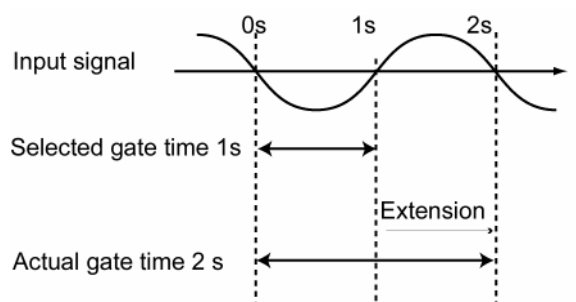
The longest time of the gate is 100sec. (10mHz) for SC-7207H, and 1000sec. (1mHz) for 7205H and 7206H. If the longest time of the gate exceeds this specified level, relevant error　（『!__No-Signal_____』）　occurs.

For details, see "Specifying how to respond if there is no signal during measurement" in "3.5.5 System setup mode [SYSTEM]

SGL gate measurement [SGL]

The SGL gate measurement measures one wave form of the input signal.
The single mode measurement is performed using the [SGL] key. When [SGL] is made valid ([SGL] is lit), the single mode measurement is valid for slow signals. The error occurs if the single mode measurement is performed for fast signals.

One-shot trigger measurement is repeated.

Note1) The standard of an early signal and a slow signal relates to sampling speed and the display resolution of this product. The standard of the signal that doesn't do the error display, is about -10MHz in SC-7207H/7206H and about -1MHz in SC-7205H.

Note2) The error message displayed by the SGL gate measurement is 『!＿No-Signal ＿＿＿＿』 for a slow signal and is 『!＿Too Fast Signal＿＿』 for an early signal. See the table of " 3.6 Error messages and data handling.

Measurement with EXT-B gate (EXT-B)

For the frequency measurement (CH-A, CH-C), period measurement (PERI-A), and totalize measurement (TOT-A), the counting time can be controlled with the channel B used as EXT-B gate signal.

Set the gate to "EXT-B" and connect the EXT-B gate signal to "CH-B".

Trigger level, filter, attenuator, and coupling method are set at CH-B.

In the slope and trigger level settings of CH-B, it is specified that the gate is opened at high or low.

Slope [SLP] (off) of channel B "+" :   The gate is opened while the B input is "high".

Slope [SLP] (lit) of channel B "-" :   The gate is opened while the B input is "low".

To take the synchronization of this product and an external gating signal, the measurement is begun by an effective trigger signal (edge) to the EXT-B input (CH-B input terminal) after this product shifts in the state of the measurement beginning (EXT gate waiting).
(See the figure below)

EXT-B   example of selecting ＋slope

Operating state	:Stop	Starting measurement (waiting EXT gate)	Measuring	Finishing measurement (Stop)

EXT-B input
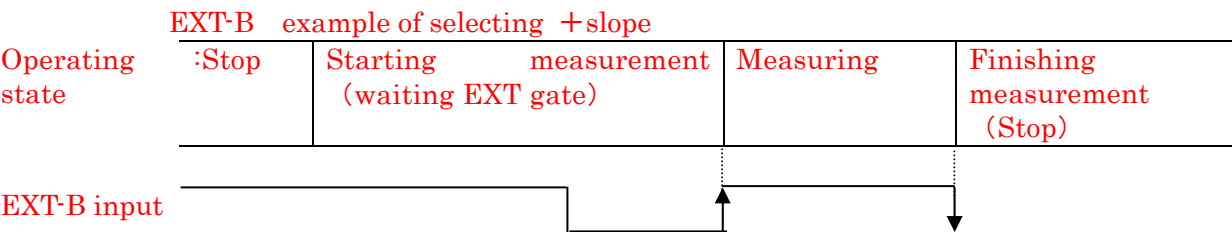
Measurement with manual gate ([SGL])

The manual gate can be opened or closed only when the totalize measurement function ([TOT A]) is specified. Every time [SGL] is pressed, the manual gate is switched between CLOSE (initial value) and OPEN.

To reset the totalize to zero, press the [RES] key.

The following Table shows combinations between the models functions and gates.

Function		Gate				Model		
Panel name	Function	1m - 10s	EXT-B	MANUAL	SGL	SC-7207H	SC-7206H	SC-7205H
FREQ-A	Frequency	○	○	×	○	○	○	○
FREQ-B	Frequency	○	×	×	○	○	×	○
FREQ-LINE	Frequency	△	×	×	×	○	×	○
FREQ-C	Frequency	○	○	×	×	○	○	×
PERI-A	Period	○	○	×	○	○	○	○
DUTY-A	Duty	○	×	×	○	○	○	○
P.W-A	Pulse width	○	×	×	○	○	○	○
TOT A	Totalize	○	○	○	×	○	○	○
T.INT A-B	Interval	○	×	×	○	○	×	○
FREQ A/B	Frequency ratio	○	×	×	×	○	×	○
PHAS A-B	Phase	○	×	×	○	○	×	○

○ Selectable   × Invalid   △ Invalid when the gate is 1ms or 10ms.

CAUTION

If 1m - 10s gate is selected in the duty, pulse width, interval, and phase measurements, the actual measurement operation is started by the second CH-A trigger signal.

3.4.5　Measuring procedures

3.4.5.1　Inputting to channel A

The same procedures apply to operations except for gate operation of the totalize measurement.

Frequency measurement	FREQ A	Period measurement	PERI A	Duty measurement	DUTY A	Pulse width measurement	P.W A	Totalize measurement	TOT A

Procedures

(1) Press a desired key of ▉▉▉ FUNCTION ▉▉▉ to set relevant function (LED is lit).

(2) Setting of CH-A: According to the input signal, select [CPL DC], [ATT 26dB], [LPF 10kHz], or [SLP]. For details, see section 3.4.2.

CPL DC　　ATT 26dB　　LPF 10kHz　　SLP

(3) Connect the input signal to CH-A.

CH-A
DC-230MHz
⚠ 1MΩ
200Vpk MAX

(4) According to the type of input signal, operate the trigger level of CH-A to make the trigger. For details, see section 3.4.3.
After above operation steps have been completed, the instrument becomes ready for operation.

(5) Select a proper gate for measurement.

GATE
TOT A　　1ms　　10ms　　0.1s　　1s　　10s
EXT B　　SGL
OPEN/CLOSE
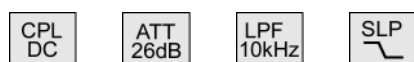
Note) If a signal is detected while the gate is opened, at least one period is measured.
Therefore, it is possible to measure a maximum period of 100s or 1,000s regardless of the gate time.
The SGL gate is valid for such slow signals because this gate is opened only for one period. This ensures the stable measurement.

Totalize (TOT) measurement

A selectable gate is internal gate, EXT-B and manual gate [SGL]. [1ms]-[10s] key is selected for an internal gate and the time of the gate is set. A input signal to CH-B is used as a external gate (EXT-B), or as when using the manual gate, toggle operation between CLOSE (initial value) and OPEN is performed every time [SGL] is pressed.
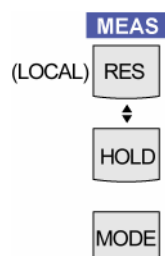
MEAS

(LOCAL) RES

HOLD

MODE

(6) Press [RES], if the operation is in the HOLD mode (HOLD is lit), the measurement is started after it has been cancelled.

When the [HOLD] key is pressed in the HOLD mode, the [HOLD] key goes off and the measurement is performed only once.

The [HOLD] key is lit after the measurement results have been displayed.

When the [RES] key is pressed in the HOLD mode (HOLD is lit), the measurement is started. (HOLD is off during measurement.)

AC line frequency measurement FREQ LINE

(1) Press the [FREQ LINE] key to set the frequency measurement function (LED is lit).

GATE

(2) 0.1 s   1 s   10 s   Only three kinds of of the figure below time of the gate can be selected. Select a proper gate for measurement.

(3) The measured AC line frequency is displayed.

3.4.5.2 Inputting to channel B（only for SC-7207H/SC-7205H）

frequency measurement

FREQ A

FREQ B

Procedures

(1) Pushing the [FREQ A] key sets to the frequency measurement function (LED blinking of FREQ A).
    Moreover, the LED blinking FREQ A means the selection of FREQ B.

(2) Setting of CH-A: According to the input signal, select [CPL DC], [ATT 26dB], [LPF 10kHz], or [SLP]. For details, see section 3.4.2.

CPL DC   ATT 26dB   LPF 10kHz   SLP

(3) Connect the input signal to CH-B.

CH-B
DC-230MHz

⚠ 1MΩ
200Vpk MAX

(4) According to the type of input signal, operate the trigger level of CH-A to make the trigger. For details, see section 3.4.3.
After above operation steps have been completed, the instrument becomes ready for operation.

(5) Select a proper gate for measurement.
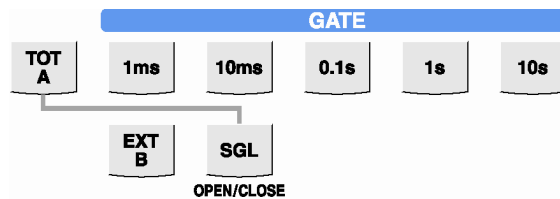
Note1) If a signal is detected while the gate is opened, at least one period is measured.
Therefore, it is possible to measure a maximum period of 100s or 1,000s regardless of the gate time.
The SGL gate is valid for such slow signals because this gate is opened only for one period. This ensures the stable measurement.

Note2) The EXT B gate cannot use the CH-B input.

3.4.5.3 Inputting to channel C (only for SC-7206H/7207H)

| Frequency measurement | FREQ C |
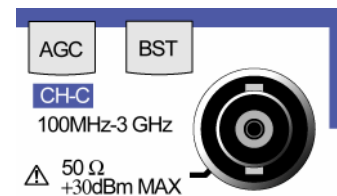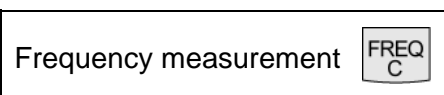
(1) Press the [FREQ C] key to set the frequency measurement function (LED is lit).

(2) According to the input signal, select AGC ON or OFF using the [AGC] key. AGC is lit when turned ON while AGC is off when turned OFF.

(3) According to the type of input signal, select the burst measurement ON or OFF using the [BST] key. BST is lit when the burst measurement is turned ON.

(4) Connect the input signal to CH-C.

(5) Select a proper gate for the measurement.
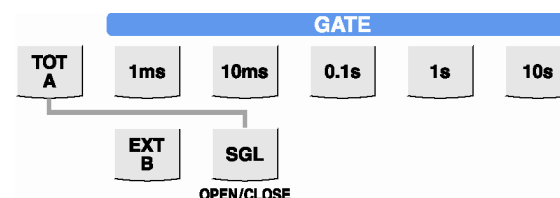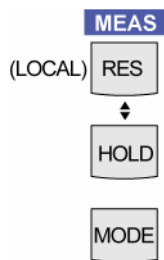
(6) Press [RES], if the operation is in the HOLD mode (HOLD is lit), the measurement is started after it has been cancelled.

When the [HOLD] key is pressed in the HOLD mode, the [HOLD] key goes off and the measurement is performed only once.

The [HOLD] key is lit after the measurement results have been displayed.

When the [RES] key is pressed in the HOLD mode (HOLD is lit), the measurement is started. (HOLD is off during measurement.)

MEAS
(LOCAL) RES
HOLD
MODE

AGC function

This function is used to remove the distortion produced by the amplifier when an excessive signal is input, and converts the input voltage to a level close to the hysteresys voltage of the waveform shaping circuit.

BST function

The burst signal can be measured.

The count of the gate begins after detecting the edge of the burst when WAIT is set to BST function ON and GATE_CLOSE. Therefore, it waits infinitely until the edge of the burst comes. See section 3.5.5 for GATE_CLOSE.

CAUTION

If the gain is changed automatically, the stable measurement cannot be performed due to characteristics of the burst waveform. To avoid this trouble, always turn OFF AGC.

3.4.5.4 Inputting to channels A and B(only for SC-7207H/7205H)

Time interval measurement	T.INT A▶B	Frequency ratio measurement	FREQ A / B	Phase difference measurement	PHAS A▶B

Procedures

(1) Press a desired key of **FUNCTION** to set relevant function (LED is lit).
(2) Setting of CH-A and CH-B: According to the input signal, select [CPL DC], [ATT 26dB], [LPF 10kHz], or [SLP]. For details, see section 3.4.2.

CPL DC ATT 26dB LPF 10kHz SLP
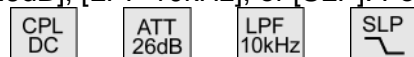
(3) Connect the input signal to CH-A and CH-B.

CH-A DC-230MHz   CH-B DC-230MHz   1MΩ 200Vpk MAX

(4) According to a input signal, operate the trigger level of CH-A and CH-B. For details, see section 3.4.3.

TRIG LVL

After above operation steps have been completed, the instrument becomes ready for measurement.

(5) Select a gate depend on a input signal.
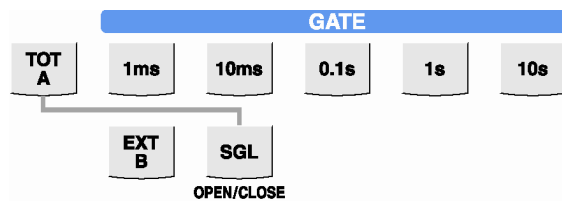
Panel name	Function	EXT-B	SGL
T.INT A-B	Interval	×	○
FREQ A/B	Frequency ratio	×	×
PHAS A-B	Phase	×	○
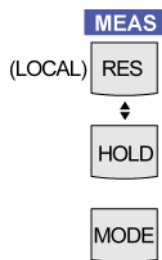
(6) Press [RES], if the operation is in the HOLD mode (HOLD is lit), the measurement is started after it has been cancelled.
When the [HOLD] key is pressed in the HOLD mode, the [HOLD] key goes off and the measurement is performed only once.

The [HOLD] key is lit after the measurement results have been displayed.

When the [RES] key is pressed in the HOLD mode (HOLD is lit), the measurement is started. (HOLD is off during measurement.)

Time interval measurement (T.INT A-B)

Connect the start signal to CH-A and the stop signal to CH-B.

According to the time interval to be measured, select a slope of the start signal using [SLP] of CH-A.

Operate the trigger level of CH-A to make the trigger. For details, see section 3.4.3.

Select a slope of the stop signal using [SLP] of CH-B.

Operate the trigger level of CH-B to make the trigger. For details, see section 3.4.3.

For high-speed signals, use the cables with the same length.
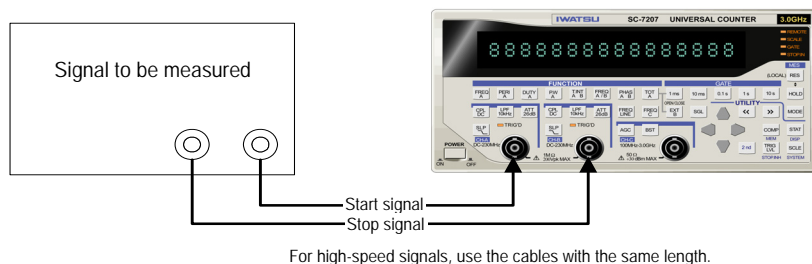
SLOPE A= + and B = -
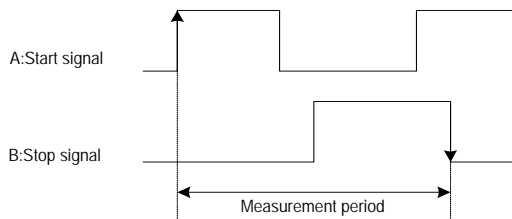
Frequency ratio measurement (FREQ A/B)

• Connect the reference signal to CH-B.

Phase difference measurement (PHAS A-B)

• Normally, a signal to be input to A and to B must have the same frequency.

3.4.6   Input frequency and resolution

Relationship between input frequency and resolution in reciprocal calculation method

Gate time	SC-7207H	SC-7206H /7205H
1ms	5 digits	4 digits
10ms	6 digits	5 digits
0.1s	7 digits	6 digits
1s	8 digits	7 digits
10s	9 digits	8 digits

Resolution [Hz] vs Input frequency [Hz]

SC-7206H/05H 1 m
SC-7206H/05H 10 m
SC-7207H 1 m
SC-7206H/05H 0.1 s
SC-7207H 10 m
SC-7206H/05H 1 s
SC-7207H 0.1 s
SC-7206H/05H 10 s
SC-7207H 1 s
SC-7207H 10 s

SC-7206H, 7205H →

SC-7207H →

3.5 Utility (UTILITY)

Various settings, such as calculation, trigger, and remote control can be made using the [COMP], [TRIG LVL], [STAT], [SCLE], and [2nd] keys in the utility area and the [<<], [>>], [↑], [↓], [←], and [→] keys.
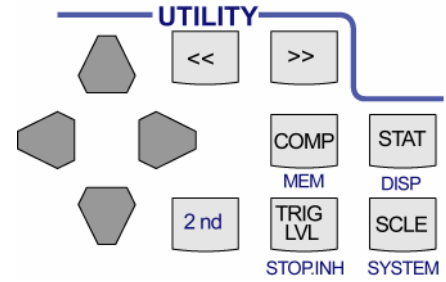
In the measurement mode, press any of [TRIG LVL], [COMP], [STAT], and [SCLE] to enter a selected utility mode. (One of four keys will be lit.)

At this time, the function key and gate key become invalid. To return to the measurement mode, press the valid utility key (lit key) to make it turned off.

For details of trigger setup [TRIG LVL], see section 3.4.3.

The measurement continues (the hold state also continues) while the trigger is being set ([TRIG LVL] is selected). If [COMP], [STAT], or [SCLE] is selected, the operation enters the HOLD mode ([HOLD] is lit) and the measurement is stopped.

3.5.1 Scaling calculation setup: [SCLE]

Scaling off	`S C A L E = o f f`
Scaling = c/X	`S C A L E = c / X`
Scaling = X - Xref	`S C A L E = X − X r e f`
Scaling = (X - a)/b	`S C A L E = ( X − a ) / b`
Setting of constant "a"	`a = + 0 . 0 0 0 , 0 0 0 , 0 0 0`
Setting of constant "b"	`b = + 1 . 0 0 0 , 0 0 0 , 0 0 0`
Setting of constant "c"	`c = + 1 . 0 0 0 , 0 0 0 , 0 0 0`
Setting of reference value	`X f = + 0 . 0 0 0 , 0 0 0 , 0 0 0`

Procedures

(1) Selection of calculation type

i) Press the [SCLE] key to make it lit.

ii) Press the [>>] or [<<] key several times to display "SCALE=xxxxx".

iii) Press the [↓] or [↑] key to select the calculation type (SCALE = (X-a)/b, SCALE = X-Xref, SCALE = c/X).

If the [↓] or [↑] key is pressed continuously four times, the display is returned to the previous display.

(2) Setting of "a", "b", "c", "Xref" constants

Setting of "a"

i) Press the [>>] or [<<] key several times to display "a = ***********" when [SCLE] lights.
(At this time, the polarity sign "+" or "−" is flashing.)

ii) Press the [↓] or [↑] key to select "+" or "−".

iii) Set the decimal point position.

Press the [←] or [→] key to make the decimal point flashing. Then, press the [↓] or [↑] key to set the position. Every time the [↑] key is pressed, the decimal point is moved left (the value becomes "1/10"). On the contrary, every time the [↓] key is pressed, the decimal point is moved right (the value becomes "x10").

 * The decimal point can be set only in the upper 3 digits area.
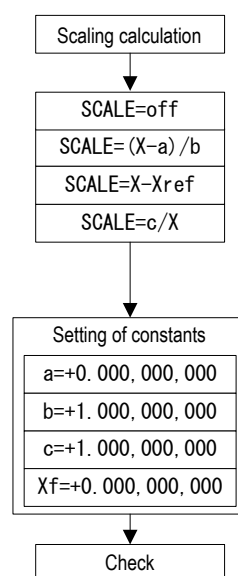
Scaling calculation
↓
SCALE=off
SCALE=(X−a)/b
SCALE=X−Xref
SCALE=c/X
↓
Setting of constants
a=+0. 000, 000, 000
b=+1. 000, 000, 000
c=+1. 000, 000, 000
Xf=+0. 000, 000, 000
↓
Check

iv) Set each value.

Press the [←] or [→] key to make the numeric value at a desired digit flashing. Press the [↓] or [↑] key to set a numeric value.

Repeat the above operations to set numeric values at all other digits.

v) Set a multiplier.

Press the [↑] key to move the unit forward and press the [↓] key to move it backward. Any of p, n, μ, m, _, k, M, G, and T can be set for the multiplier.

Setting of "b"

i) Press the [>>] or [<<] key several times to display "b = ***********".
(At this time, the polarity sign "+" or "−" is flashing.)

ii) The subsequent setting operations are the same as those described in the previous section, Setting of "a".

Setting of "Xref"

i) Press the [>>] or [<<] key several times to display "Xf = ***********".
(At this time, the polarity sign "+" or "−" is flashing.)

ii) The subsequent setting operations are the same as those described in the previous section, Setting of "a".

Measurement mode

Press the [RES] key to start the measurement. The calculation results are shown on the panel.

If the "a" or "b" set value is incorrect, the error message (see "3.6 Error messages and data handling" .) is shown, and then the X measured value is displayed directly.

When the scaling calculation is "on", the status monitor [SCALE] LED is lit. Even though the measurement function is changed, the calculation is valid.

"a" and "b" do not have the unit.

That is, when "a = 0.5m" is specified, the calculation is performed with "a = 0.5m[Hz]" in the frequency measurement and it is performed with "a = 0.5ms" in the period measurement.

The calculation is performed with 10 digits. The value at the 11th digit is cut off.

Example: Scaling calculation (X-a)/b

The constant "a" is subtracted from the measured value "X", and then divided by the constant "b". When "b = −1" is set in the totalize measurement, the equation becomes "(X−a)/b = a − X". This equation is used as a decrement counter from the preset value "a". Additionally, when the frequency of one pulse electrical signal is measured by one rotation, it is possible to measure the number of rotations (minute, 60 sec.) if the settings are made so that a = 0 and b = 1/60 = 0.016,666,667.

Example: Scaling calculation X-Xref

If the reference value is set in Xref, the measurement is performed as variation (stability) in frequency or time used as difference.

Example: Scaling calculation c/X

When "c" and "X" are set to distance and time in the time interval measurement, respectively, the speed (km/sec) can be measured.

How to make the scaling calculation "off"

Press the [SCALE] key to make it lit. Press the [>>] or [<<] key several times to display any of "c/X", "(X-a)/b", and "X-Xref", and then press the [↑] or [↓] key to display "_SCALE=off". The scaling calculation is then set to "off".

Press the [SCALE] key again to make the key turned off and return to the measurement mode.

3.5.2   Statistic calculation setup: [STAT]

Press the [STAT] key to make it lit. Press the [<<] or [>>] key to select a statistic calculation. (A desired item of the statistic calculation items is displayed.)

```
Setting of statistic
    calculation
```
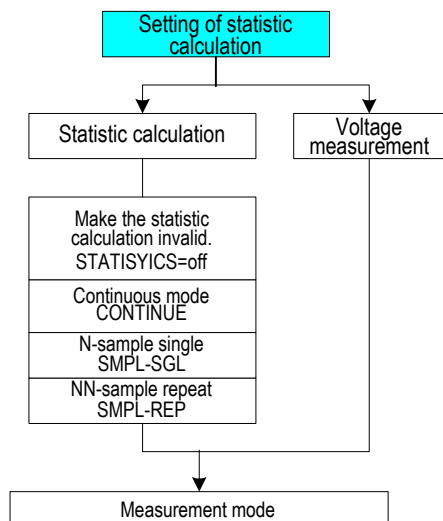
```
Statistic calculation          Voltage
                              measurement
```

```
Make the statistic
calculation invalid.
  STATISYICS=off
```
```
Continuous mode
   CONTINUE
```
```
N-sample single
   SMPL-SGL
```
```
NN-sample repeat
   SMPL-REP
```

```
Measurement mode
```

Voltage:

| V | p | p | | A | = | o | f | f | | B | = | o | f | f | |

Statistic calculation:

		S	T	A	T	I	S	T	I	C	S	=	o	f	f
1	0	0	S	M	P	L	–	S	G	L	:	Mx	Mn	x̄	σ
1	0	0	S	M	P	L	–	R	E	P	:	Mx	Mn	x̄	σ
C	O	N	T	I	N	U	E				:	Mx	&	Mn	

How to make the statistic calculation invalid

Press the [STAT] key to make it lit. Press the [<<] or [>>] key to select a statistic calculation item.

Press the [↑] or [↓] key several times to display "STATISTICS = off". The statistic calculation then becomes "off". (Press the [↑] or [↓] key continuously four times to return to the previous display.)

Press the [STAT] key to make it turned off. The mode is then returned to the measurement mode.

Displaying of statistic calculation

Press the [STAT] key to make it lit.

Press the [<<] or [>>] key to select a statistic calculation item.

Press the [↑] or [↓] key several times to select any of
"xxxSMPLE_SGL:Mx&Mn_",
"xxxSMPLE_REP:Mx&Mn_", and
"CONTINUE___:Mx&Mn_".

Press the [STAT] key again to return to the measurement mode. Every time the [MODE] key is pressed, the items set at "on" are changed in the following order.

				1	.	0	0		3		0	M	H	z
Mx				1	.	0	0		3			M	H	z
Mn				1	.	0	0		3			M	H	z
x̄				1	.	0	0		3		0	M	H	z
σ				3	.						0		H	z
A		+	0	.	9	9	V			–	1	.	0	0	V
B		+	0	.	5	3	V			–	0	.			V

Measured value   Maximum value Mx   Minimum value Mn   Average value $\bar{x}$
Deviation value σ Voltage value A   Voltage value B   Returned to the measured value.

     * Items set at "off" are skipped.

The measurement of the time axis is stopped in the peak voltage display mode.

The message, "!__No Signal___", is shown for a period of time when no data exists in the RES mode.

Continuous mode	`C O N T I N U E     :` M_x `&` M_n
N-sample repeat mode	`1 0 0 S M P L – R E P :` M_x M_n $\bar{x}$ σ
N-sample single mode	`1 0 0 S M P L – S G L :` M_x M_n $\bar{x}$ σ
Voltage measurement	`V p p   A = o f f   B = o f f`

Continuous mode (maximum or minimum calculation)

In this mode, the maximum or minimum value calculation is made continuously with the same function and the calculation results are shown on the display. The calculation results are updated every time the measurement is performed.

Press the [STAT] key to make it lit.

Press the [↑] or [↓] key several times to display "CONTINUE___:Mx&Mn_". Press the [STAT] key again to return to the measurement mode. Press the [MODE] key to change the display.

N-sample repeat mode (maximum, minimum, average, and deviation calculations)

The maximum, minimum, average, and deviation calculations are repeated certain times equivalent to the number of set samples (N). The previous calculation results are shown until the number of measurements reaches the set cycles (N).

If the calculation results do not still exist, the message, "!__No Signal___", is shown.

Every time the measurement is performed N times, the calculation results are updated.

Setting of the number of samples

Press the [←] key on the "XXXSMPL-YYY___" menu to make "XXX" flashing. Press the [↑] or [↓] key to set the number of samples.

Five kinds of the numbers of samples, 5, 10, 20, 50, and 100 can be set.

For example, when the number of samples is set to 100, the message, "_100SMPL-REP:MxMn $\bar{x}$ σ" is shown.

N-sample single mode

The maximum, minimum, average, and deviation calculations are performed only once with the same function. The previous calculation results are shown until the number of measurements reaches the set cycles (N).

If the calculation results do not still exist, the message, "!__No Signal___", is shown.

Every time the measurement is performed N times, the calculation results are updated.

Voltage measurement

The peak voltage value of the target signal is measured, and then displayed.

If the calculation results still do not exist, the message, "!__No Signal___", is shown on the display.

Press the [STAT] key to make it lit.

Press the [<<] or [>>] key to select a voltage measurement item. At this time, press the [←] or [→] key to change the flashing between "A = off/on" and "B = off/on".

For example, when the voltage display auto of CH-A and CH-B is set at "on", "Vpp_A=on_B=on" is shown.

Press the [STAT] key again to return to the measurement mode. Press the [MODE] key to change the display.

When the [MODE] key is pressed while the voltage is being displayed, the display is returned to the latest measured value display.

After the data has been obtained in RES, the maximum and minimum peak voltage values are displayed like "X ・・・ XVp_X ・・・ XVp".

3.5.3　Comparator calculation setup: [COMP]

| C | O | M | P | A | R | E | = | o | f | f | | | | | |

| C | O | M | P | A | R | E | = | o | n | | | | | | |

Upper limit value

| | ▲ H | > | + | 9 | 9 | 9 | . | 9 | 9 | 9 | 9 | 9 | 9 | 9 | T |

Lower limit value

| | L ▼ | < | − | 9 | 9 | 9 | . | 9 | 9 | 9 | 9 | 9 | 9 | 9 | T |

The preset upper and lower limit values are compared to the measured results, and then the comparison results are displayed.

If (measured value) > (upper limit value), "▲" is shown at the leftmost position of the display.

If (measured value) < (lower limit value), "▼" is shown at the leftmost position of the display.

If (lower limit value) $\leq$ (measured value) $\leq$ (upper limit value), nothing is displayed at the leftmost position of the display.

(1)　Setting of comparator calculation

Press the [COMP] key to make it lit. Press the [<<] or [>>] key several times to display "COMPARE=XXX___".

Press the [↑] or [↓] key to set the comparator calculation to "on".

The message, "COMPARE=on___", is shown on the display.

(2)　Setting of upper limit value

i)　Press the [>>] or [<<] key several times to display "_Hi<X • • • X". (At this time, the polarity sign "+" or "−" is flashing.)
(If the [<<] or [>>] key is pressed continuously four times, the display is returned to the previous display.)

ii)　Press the [↓] or [↑] key to select "+".

iii)　Set the decimal point position.

Press the [←] or [→] key to make the decimal point flashing. Then, press the [↓] or [↑] key to set the decimal point position.

The decimal point is moved like +9.99999, +99.9999, and +999.999.

　*　The decimal point can be set only in the upper 3 digits area.

iv)　Set each value.

Press the [←] or [→] key to make the numeric value at a desired digit flashing. Press the [↓] or [↑] key to set a numeric value.

Repeat the above operations to set numeric values at all other digits.

v) Set the multiplier.

Press the [↑] key to increase the unit and press the [↓] key to decrease it. Any of the following units can be set for the multiplier.
(pico=p=10^{-12}, nano=n=10^{-9}, micro=μ=10^{-6}, milli=m=10^{-3}, _, kilo=k=10^3, mega=M=10^6, giga=G=10^9, tera=T=10^{12})

(3) Setting of lower limit value

Press the [>>] key to display "_Lo>X • • • X".

How to set the numeric value is the same as that described for setting of the upper limit.

If the effective digit of the measurement result is smaller than the COMP calculation set value, the calculation is performed assuming that values at the lower digits of the measured value are "0".

3.5.4 Stop inhibit time setup : [STOP INH] (2nd TRIGLVL)

This setup is possible for only SC-7207H and SC-7205H
Press the [2nd] and [TRIG-LVL] keys to enter the STOP.INH setup mode.

(Both the [2nd] and [TRIG-LVL] keys are lit.)

This stop inhibit function is valid when measuring T.INT A→B and PHAS A→B for an SGL gate with CH-A used as the measurement start signal and CH-B as the measurement end signal.

It is possible to set the time that makes the measurement end signal invalid.

The setting range is 0.0 (off) - 25.5ms. Excluding 0.0(off), the status monitor STOP.INH LED is lit.

When 0.0 sec. is set, the stop inhibit function is then set to "off".

However, a delay of 10ns or more is needed from the start of CH-A to the end of CH-B.

Example

When using the relay contact output, as the end signal, the chattering of the contact point becomes a problem, causing correct data not to be obtained.

In such case, the stop inhibit function is used to cancel the chattering signal for a certain period of time after the start signal has been input.
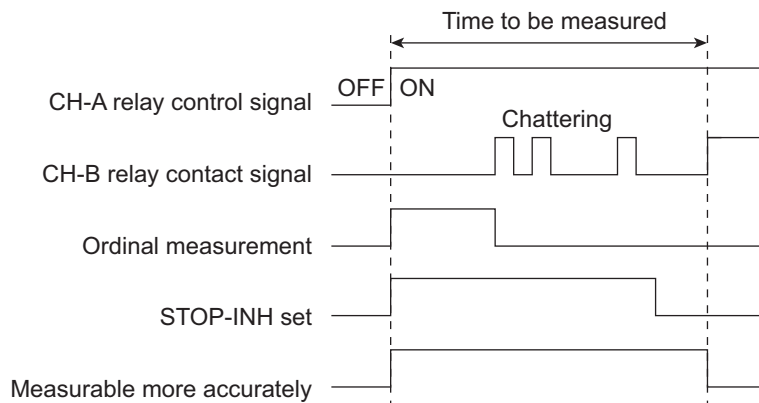
3.5.5　System setup mode : [SYSTEM] (　2nd+SCLE　)

GPIB	`G` `P` `I` `B` `:` `A` ⬚ ⬚ `r` `s` `s` `=` ⬚ ⬚ ⬚ ⬚
RS-232	`R` `S` `:` `R` `a` `t` `e` `=` `3` `,` `0` `0` `b` `p` `s`
Reference clock	`R` `e` `f` `−` `C` `l` `o` `c` ⬚ `=` `I` `N` `T` ⬚ ⬚
Internal clock/marker output	`O` `u` `t` `P` `u` `t` `=` `R` `E` ⬚ `−` `C` `L` `O` `C` ⬚
Beep sound	`B` `E` `E` `P` `:` ⬚ `e` ⬚ `p` `u` `s` ⬚ `=` `o` `f` `f`

In the system setup mode, the settings about the remote control, reference clock, maker output, and beep sound are set.

If both GPIB and RS-232 interfaces are installed, the interface, which receives the remote command first, takes precedence.

Setting of GPIB

If the GPIB board is not installed, this setting is not displayed and cannot be made.

Press the [2nd] and [SCLE] keys to enter the system setup mode.

Press the [<<] or [>>] key to display "GPIB : X ・・・・ X".

("DELIM, Address" is flashing.)

(1)　Setting of address

Press the [→] key once. Press the [↑] or [↓] key several times to display "GPIB : Address = XX". ("Address" is flashing.)

Press the [←] or [→] key to make the address value "XX" flashing.

Press the [↑] or [↓] key to change the address.

The numeric value at the flashing digit can be changed. To change the flashing position, press the [←] or [→] key. The setting range is 0 - 30.

For example, when the GPIB address is set to "2", the message, "GPIB : Address = _2", is shown on the display.

(2)　Setting of delimiter

Press the [↑] key once when the message, "Address", is flashing.

The message, "GPIB:DELIM=XXXXX", is displayed. ("DELIM" is flashing.)

Press the [←] or [→] key once to make the "X　　　X" part flashing.

Press the [↑] or [↓] key to set the delimiter to "LF___" or "CR+LF".

For example, when the delimiter is set to "CR+LF", the message, "GPIB:DELIM=CR+LF", is shown on the display.

(3) How to cancel the remote

In the remote mode, the status monitor Remote LED is lit.

In this mode, press the [RES] key (functions as the [LOCAL] key) to put this instrument in the local mode.

Setting of RS-232

Press the [2nd] and [SCLE] keys to enter the system setup mode.

Press the [<<] or [>>] key several times to display "RS : YYY = XXX" ("RS" is flashing).

(1) Setting of communication rate

When "YYY" of "RS : YYY = XXX" is flashing, press the [↑] or [↓] key several times to display "RS : RATE = XXXXXbps". ("Rate" is flashing.)

Press the [←] or [→] key to make "XXX" flashing. Press the [↑] or [↓] key to set the communication rate. The selection range is 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400 bps.

For example, when the communication rate is set to 9600 bps, the message, "RS : RATE = _9,600bps", is shown on the display.

(2) Setting of parity

When "Rate" is flashing, press the [↑] key once.

The message, "RS : Parity = X_", is shown. ("Parity" is flashing.)

Press the [→] key to make "X" flashing. Press the [↑] or [↓] key or the [←] or [→] key to make "Parity" flashing.

Select any of None (no parity), Odd (odd number), and Even (even number) for the setting contents of X.

For example, when the parity is set to "no parity", the message, "RS:Parity=None", is shown.

(3) Setting of stop bit

When "Parity" is flashing, press the [↑] key once.

The message, "RS : Stop-Bit = X_", is shown. ("Stop-Bit" is flashing.)

Press the [←] or [→] key to make "X" flashing. Press the [↑] or [↓] key to set the stop bit to "1" or "2".

For example, when the stop bit is set to "1", the message, "RS:Stop-Bit=1", is shown on the display.

(4) Setting of delimiter

When "Stop-Bit" is flashing, press the [↑] key once.

The message, "RS : DELIM = X_", is shown. ("DELIM" is flashing.)

Press the [←] or [→] key to make "X" flashing. Press the [↑] or [↓] key to set the delimiter to LF or CR+LF for the setting contents of X. For example, when the delimiter is set to LF, the message, "RS : DELIM = LF", is shown on the display.

(5)   How to cancel the remote

In the remote mode, the status monitor Remote LED is lit.

In this mode, press the [RES] key (functions as the [LOCAL] key) to put this instrument in the local mode.

Setting of reference clock

It is possible to select whether the internal 10MHz oscillator or external reference oscillator is used for the reference clock.

Press the [2nd] and [SCLE] keys to enter the system setup mode.

Press the [<<] or [>>] key to display "RefClk:SOUR=XXX___". ("XXX" is flashing.) Press the [↑] or [↓] key to select "INT" (internal) or "EXT" (external).

For example, when the external clock is set, the message, "RefClk:SOUR =EXT___", is shown on the display.

When the reference clock is set to "EXT", it is necessary to connect the signals from the external reference oscillator to "10MHz STD IN" on the rear panel.

If the connected external reference clock is beyond the specified accuracy, the error message is displayed and the clock is forcibly changed to the internal clock.

External reference clock check function ON/OFF

Whether or not the accuracy of the external reference clock is within 10 MHz± approx. 1 kHz is checked.

RefClk:CHECK=on.........The external reference clock is checked every time the measurement is completed.

RefClk:CHECK=off.........The external reference clock is not checked decimal times (When beginning to measure).

10MHz ± about 1kHz is judged as a normal clock about the input external standard clock. An external standard clock is not checked even if "RefClk:CHECK=on "is set at totalization measurement TOT-A.

[Remarks]   When this function is set at on, the number of measurement cycles per unit time is decreased when compared to that with this function set at off.

Process setup if external reference clock error is detected

The process, which is used if the external reference clock error is detected, can be set up.

RefClk:RECOV=AUT .....If the external reference clock error is detected, the clock is automatically changed to the internal reference clock to continue the measurement.

RefClk:RECOV=MAN ....If the external reference clock error is detected, the error is kept displayed until the external reference clock is recovered.

Cautions for connections of external reference input signals

The maximum input voltage is 5Vrms. If an excessive voltage is input, this may cause dasmage to the instrument.

Setting of internal clock and marker output

It is possible to output the clock signal of the internal 10MHz reference oscillator or marker signal from 10MHz STD/(MAKER OUT) on the rear panel.

Press the [2nd] and [SCLE] keys to enter the system setup mode.

Press the [<<] or [>>] key to display "Output=X ・・・ X".

Press the [↑] or [↓] key to set the "X ・・・ X" part.

When the "X ・・・ X" part is set to "REF-Clock", the clock signal of the internal 10MHz reference oscillator is output.

When the "X ・・・ X" part is set to "Marker___", the marker signal is output.

Marker out

When measuring T.INT A→B and PHAS A→B, the time interval and trigger level point can be observed by using the marker out put and input signal with oscilloscope, also the modulated time interval with brightness can be observed by connecting the marker output to Z input of the oscilloscope.
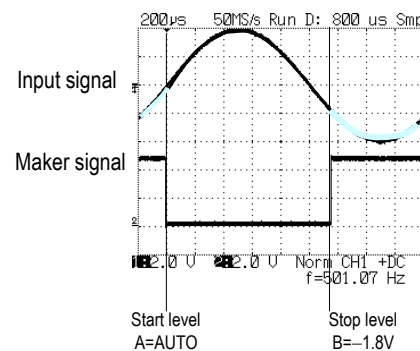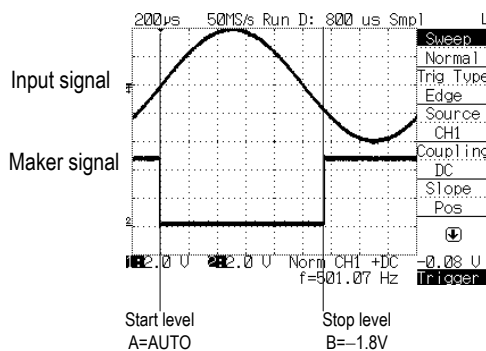
Setting of beep sound

The beep sound is set to "on" or "off".

Press the [2nd] and [SCLE] keys to enter the system setup mode.

Press the [<<] or [>>] key to display "BEEP : X ・・ X=on/off".

("BEEP" is flashing.)

(1) Setting of key push sound to "on" or "off"

Press the [→] key once while "X ・・・ X" is flashing. The flashing digit is then moved.

Press the [↑] key several times to display "BEEP : KeyPush = xx".

("KeyPush" is flashing.)

Press the [→] key to make the "xx" part flashing.

Press the [↑] or [↓] key to set "on" or "off".

Tone 1 sounds when the valid key is pressed while tone 2 sounds when the invalid key is pressed.

(2) Setting of Comp sound to "on" or "off"

Press the [↑] key while "KeyPush" at "BEEP : KeyPush=on/off" is flashing to display "BEEP : Comp = x • • • x". ("Comp" is flashing.)   Press the [→] key to make "x • • • x" flashing.

Press the [↑] or [↓] key to set "on" or "off".

Press the [↑] or [↓] key to select "off___", "GO.on__" (beep sound when the measured value is the set value or less) or "NOGO.on" (beep sound when the measured value is beyond the set value).

Two kinds of tones, tone 1 and 2, are provided. When "GO.on" is set, tone 1 (same tone as that when the valid key is pressed) applies. When "NOGO.on" is selected, tone 2 (same tone as that when the invalid key is pressed) applies.

(3) Setting of Caution sound to "on" or "off"

Press the [↑] key once while "Comp" at "BEEP : Comp=on/off" is flashing.

The message, "BEEP:Caution=xxx_ _", is shown. ("Caution" is flashing.)

Press the [→] key once to make the "XXX" part flashing.

Press the [↑] or [↓] key to set the Caution sound to "on" or "off".

When the Caution sound is set to "on", tone 2 (same tone as that when the invalid key is pressed) sounds if an error occurs.

Initialization setup of DIO comparator output

When the DIO board is not installed, this part is not displayed, and cannot be set.
Whether or not the previous comparator output is initialized is set when starting the measurement.

[2nd] and [SCLE] key are pushed into the system setting mode.

[<<] or [>>] key is pushed and 'DioCompIni= XXX_ _ _' is displayed. (The character of 'CompIni' blinks.)
[   ] key is pushed once, and the part of XXX is blinked.

On/off in the state of the judgment output is set pushing [   ] or [   ] key.

DIO:CompIni=on ....When the measurement is started, each judgement output of HI/LO/GO is set to "High-Z".

DIO:CompIni=off ....Even though the measurement is started, the previous judgement outputs are kept.

As this specification was changed, the specifications of the comparator output were also changed as described below.

Initialization setup of statistical calculation data

If the effective trigger input is detected at the TRIG-IN terminal on the DIO board, the initialization of the data for the statistical calculation, which has already been obtained until then, is selected.

DIO:StatIni=on ....When the trigger input is detected, the data for the statistical calculation (including the number of measurement cycles), which has already been obtained until then, is initialized.

Additionally, "Xref" of the SCALE calculation initializes the value measured immediately after receiving of the trigger input.

DIO:StatIni=off .... When the trigger input is detected, the statistical calculation data and Xref value are not initialized.

Specifying how to respond if there is no signal during measurement

It is possible to select how to respond if there is no signal when the gate status is OPEN.

Press the [2nd] and [SCLE] keys to enter the system setting mode.

Press the [<<] or [>>] key to display "GATE_CLOSE=XXX_ _ _" (where "XXX" is flashing). Press the [↑] or [↓] key to select "WAIT" or "FAST". If "FAST" is specified, for example, "GATE_CLOSE=FAST_ _ _" is displayed.

GATE_CLOSE=WAIT   If there is no signal while the gate is open, there is no response until this instrument overflows.

"!_No-Signal___" is displayed when the overflow occurs.

GATE_CLOSE=FAST   If measurement has not finished approximately one second after the specified gate time, the operation forcibly terminates and "!_No-Signal_ _ _" is displayed.

Specifying when to clear the accumulation count

It is possible to select when to clear the accumulation count. The two settings below can be specified.

Press the [2nd] and [SCLE] keys to enter the system setting mode.

Press the [<<] or [>>] key to display "TOT_CLR=X   X" (where "X

X" is flashing). Press the [↑] or [↓] key to select "BY GATE" or "BY RES". If "BY GATE" is specified, for example, "TOT_CLR= BY GATE_ _ _" is displayed.

TOT_CLR=BY GATE   Each time the gate is opened, accumulation starts over from 0 and the value is instantly displayed.

During measurement, the last measurement result that was displayed is retained.

If the [RES] key is pressed during measurement, accumulation starts over from 0.

TOT_CLR=BY RES   When the gate is opened, at first, accumulation starts over from 0 and the value is instantly displayed.

When the gate is closed, the last measurement result that was displayed is retained.

If the gate is opened when the gate status is CLOSE and the measurement result is not 0, the previous measurement result is added to.

If the [RES] key is pressed when the gate status is CLOSE, accumulation resets to 0.

If the [RES] key is pressed during measurement, accumulation starts over from 0.

3.5.6 Display setup : [DISP] ([2nd+STAT])

Setting of masking `D I S P : M A S K = 0 _ d g t s`

Setting of power saving `D I S P : L o P o w = o f f _ _`

Setting of display update interval `D I S P : R a t e = − _ 0 . 0 s`

Setting of hysteresis display time `D I S P : H − T i m e = _ _ 3 s`

Display initialization setup `D I S P : D i s p l n i = o f f`

Setting of masking

Press the [2nd] and [STAT] keys to enter the display setup mode.

Press the [<<] or [>>] key several times to display "DISP:Mask=X_dgts". (A numeric value, 0 - 9, is flashing in "X".)   (Press the [<<] or [>>] key continuously three times to return to the previous display.)

Press the [↑] or [↓] key to set the number of subordinate position digits for masking. (For example, to mask 3 digits, display "DISP:Mask=3_dgts".)

When the [RES] key is pressed, the under bar "_" is displayed at the masking digits.

Setting of power saving mode

Press the [2nd] and [STAT] keys to enter the display setup mode.

Press the [<<] or [>>] key several times to display "DISP:Lopow=XXXXX". ("X" is flashing.)

Every time the [↑] or [↓] key is pressed, the "X" part of the display is changed to "off__" and "10min" - "60min" (in steps of 10 min.) in order. If "off" is set, the power saving mode becomes invalid.

If no keys are pressed for a specified period, "10 min." - "60 min", the display will disappear.

When any key is pressed, the display will appear again, the key relevant operation is started.

In the remote mode, when a key other than the "LOCAL" key (that is [RES] key) is pressed, the display will appear but the pressed key operation is not started.

When the "LOCAL" key (that is [RES] key) is pressed, the display will appear and set the local mode.

Setting of display update interval

Press the [2nd] and [STAT] keys to enter the display setup mode.

Press the [<<] or [>>] key several times to display "DISP:Rate=XXX.X". (A numeric value, 0 - 9, is flashing in "X".)

Press the [→] key once to make "XXX" flashing.

In this state, press the [↑] or [↓] key to set a value.

Press the [←] or [→] key to make a desired setting digit flashing.

Press the [↑] or [↓] key to set a value.

The setting range is _0.0 - 200.0s (in steps of 0.1s).

If set value < actually measured time, the actually measured time becomes the sample rate.

Display initialization setup

It is set whether or not the previously measured results are initialized when starting the measurement newly.

DIO:CompIni=on .... When the measurement is started, the screen display is initialized to "MEASURING…".

DIO:CompIni=off .... Even though the measurement is started, the previous measurement results are kept displayed.

[Remarks]   If this function is set at ON when measuring the free-run using the internal gate, the measurement results are initialized immediately.   Therefore, it becomes difficult to see the display.
At this time, change "Setting of display update interval" described on page 3-34 to make the adjustment so that the display can be seen easily.

Setting of hysteresis display time

The [2nd] and the [STAT] key are pushed to enter the display setting mode.

Display "DISP:H-Time=XXs" (x is in the state of blinking) pushing the [>>] key several times.

The "x" changes in order of "3", "10", "30" whenever [   ] or [   ] is pushed.

3.5.7 Saving and Recalling of panel settings : [MEM] ([2nd+COMP])

Initialization of panel settings

| R | e | c | a | l | l | | | ⇐ | I | n | i | t | i | a | l | |

Saving of panel settings

| S | a | | e | | | | | ⇒ | | 0 | | | | | | |

Recalling of panel settings

| R | e | c | a | l | l | | | ⇐ | | 0 | | | | | | |

Up to ten kinds of current panel settings (various settings of measurement function and utility) can be saved into the memory.

Additionally, it is possible to initialize the panel settings to those made before shipment from the factory (see section 3.3.2). The following setting items can be saved into the memory.

Table 3.5.7

Backup item	Initialization status (Settings before shipment)
1. Setup	---
FUNCTION	FREQ-A
GATE	0.1s
MEAS (RES/HOLD)	HOLD
MEAS (MODE)	Measured value display mode
CPL (Coupling) of CH-A and B	AC
LPF 10kHz (Filter) of CH-A and B	OFF
ATT26dB (Attenuator) of CH-A and B	OFF
SLP (Slope) of CH-A and B	Positive "+"
AGC of CH-C	OFF
BST of CH-C	OFF
Measurement/Utility mode	Utility mode
Various settings of utility	Utility setup screen (See section 2.6.1.)
2. Setup memory #0 - #9	All are the same as above.
3. Measurement and statistic calculation results	(No data)

    * The GPIB/RS232 set values can be recalled through panel operation. These values cannot be recalled through remote operation.

Saving of panel settings

Items stated in Table 3.5.7 are set to your interest values.

(1) Press the [2nd] and [COMP] keys to make two LEDs lit.
Press the [↑] or [↓] key several times to display "Save___ =>#X_____". ("Save" is flashing.)

(2) Press the [→] key to make "X" flashing.

Press the [↑] or [↓] key to select a save memory from ten memories.

(The setting range is 0 - 9.)

For example, to save the settings to the memory at address 3, display "Save___ =>#3_____".

(3) Press the [>>] key once to display "__Save-OK? [Y >>, N <<]".
In this state, press the [>>] key again to save the panel settings.

To cancel saving of the panel setting, press the [<<] key.

The message, "_____Save-Complete___", is shown, and then the display is returned to "Save___ =>#3_____".

Recalling of panel settings

The settings saved in the memory are recalled and the counter is then set to these settings.

(1) Press the [2nd] and [COMP] keys.

Press the [↑] or [↓] key several times to display "Recall___ <= #X_____". ("Recall" is flashing.)

(2) Press the [→] or [←] key to make "X" flashing.
Press the [↑] or [↓] key to specify a memory of ten memories, from which the settings are recalled.

(The setting range is 0 - 9.)

For example, to recall the settings from the memory at address 3, display "Recall___ <= #3_____".

(3) Press the [>>] key once to display "Recall-ok?[Y >>, N <<]".
In this state, press the [>>] key once to recall the panel settings.

To cancel recalling of the settings, press the [<<] key.

The message, "Recall-Complete__", is shown, and then the display is returned to "Recall___ <= #3_____".

Initialization of panel settings

The panel setting and internal memories are cleared and the factory setting restored.

(1) Press the [2nd] and then press the [COMP] key.
Press the [↑] or [↓] key several times to display "Recall___ <= Initial__".

(2) Press the [>>] key once to display "Recall-ok?Y [>>, N <<]".
In this state, press the [>>] key to initialize the panel settings.

To cancel the initialization of the settings, press the [<<] key.

The message, "Recall-Complete__", is shown on the display, and then the display is returned to "Recall___ <= Initial__".

3.6 Error messages and data handling

3.6.1 Error messages

If an error occurs in the measurement and various calculations, the relevant message listed below is displayed.

Message	Cause
『!_Error-ExtClock』	The external reference clock does not have the specified accuracy or there is no signal input to the 10 MHz STD INPUT pin. ・If RefClk:RECOV=MAN is specified This error is displayed until a signal that has the specified accuracy is input to the 10 MHz STD INPUT pin. ・If RefClk:RECOV=AUTO is specified "!__Error-ExtClock" is displayed for one second, the clock is forcibly changed to the internal reference clock, and measurement continues.
『!_Over-Flow__』	The counter value overflows the effective digits.
『!_No-Signal___』	This error is displayed due to the following causes: ・Signals that should be input for various functions are not input. ・The counter value is zero even though the scaling calculation is set.
『!_SCALE:b=ZERO__』	"b" is 0 when "scaling calculation = (X-a)/b" is selected.
『!_SCALE:c=ZERO__』	"c" is 0 when "scaling calculation = c/X" is selected.
『!_±Over-Scale__』	The calculation result is beyond ±1000T when the scaling calculation is set at "on".
『!X・・X』	The setting is "Lo > Hi" when the comparator calculation is set at "on". (Normally, "X・・X" shows the measurement result.)
『!X・・X』	The burst time is less than the specified level when the function is set at "FREQ-C + burst". Normally, "!X・・X" shows the measurement result and the accuracy is beyond the guarantee.
『!_Too Fast Signal__』	This error is displayed due to the following causes: ・A signal that is 25 MHz or more is input to CH-A when using the FREQ-A or DUTY-A measurement function and the SGL gate. ・A signal that is 25 MHz or more is input to CH-B when using the FREQ-B measurement function and the SGL gate. ・A signal that is 25 MHz or more is input to CH-B when EXT-B is specified for the gate.
『!_STSTEM ERROR__』	This error occurs if the internal hardware has a problem. For details about this instrument, please Contact our Homepage listed at the end of this manual or our sales distributors.

3.6.2 Error data handling

The following Table shows how to handle the error data for various calculations.

○: Valid   ×: Not counted as invalid measurement results or samples.

Cause	Scaling calculation	Comparator calculation	Statistic calculation
The counter is zero. ∗	×	×	×
The counter overflows.	×	×	×
The measured value is beyond the guarantee of the accuracy.	○	×	×
The calculation result is over-scale.	―――	×	×
"(X-a)/0" (division by 0) is set in the calculation setting.	―――	×	×
"0/X" (result is always 0) is set in the calculation setting.	―――	×	×
"Lo > Hi" is performed in the limit setting. (The lower limit is larger than the upper limit.)	○	―――	○
SGL gate	×	×	×

*) Except for the functions, T.INT A▶B, PHAS A▶B, and TOT A

Memo

Chapter 4   Specifications

1.   Channel input

1.1   CH-A/CH-B input terminal (CH-B is only for SC-7205H, 7207H)

Maximum input voltage	200V (DC + AC peak)	
Input RC	Approximately 1 MΩ// 20pF or less	
Input coupling	DC and AC	
Low-pass filter	None, 10kHz	
Slope	+,−	
Attenuator	None, 26 dB (1/20)	

1.1.1   Trigger level

Setting range	ATT: OFF	−2.50V - +2.50V (Resolution: 10mV)
	ATT: ON	−50.0V - +50.0V (Resolution: 100mV)
Accuracy (0 - +40°C)	ATT: OFF	10% of set value ± 30 mV (±3% in a range of +2 - −2V)
	ATT: ON	10% of set value ± 300mV (±3% in a range of +40 - −40V)

1.1.2   Operating input voltage range

ATT off	±2.5V Peak
ATT on	±50V Peak

1.1.3   Trigger sensitivity

Manual	ATT: off	30mVrms (DC - 230MHz)
	ATT: on	0.6Vrms (DC - 230MHz)
Auto	ATT: off	200mVrms (10kHz - 230MHz sine wave)
	ATT: on	4Vrms (10kHz - 230MHz sine wave)

1.1.4   Trigger error

Trigger error = $\dfrac{\sqrt{X^2 + En^2}}{Y[V/s]}$

X = Internal noise (mVrms)

En = Noise within input signal band (mVrms)

Y [V/s] = Input signal slew rate at trigger level

Internal noise = 1mVrms

1.1.5　EXT-B input (only for SC-7205H/7207H)

An operation of using combinedly doing in the CH-B input terminal and an electric specification are the same as the CH-B input specification.

It is possible to use the gate in FREQ-A, FREQ-C, PERI-A, and TOT-A measurement as a measurement gate input from the outside.

1.2 CH-C input terminal (Only for SC-7207H,7206H)

Maximum input voltage	+30dBm (Approximately 7Vrms based on "1 mW/50Ω = 0dBm".)
Input RC	50Ω
Input coupling	AC
VSWR	2.0 or less (SC-7207H: 100MHz - 3GHz, SC-7206H: 100MHz - 2GHz)

1.2.1 Trigger sensitivity (Sine waveform: Up to 2GHz for SC-7206H)

AGC off/on
-20dBm: 100MHz $\leq$ Input frequency $\leq$ 300MHz

-25dBm: 300MHz $<$ Input frequency $\leq$1.5GHz

-20dBm: 1.5GHz $<$ Input frequency $\leq$ 3GHz

1.2.2 Burst detection

Caution: AGC must be turned OFF.

Detection frequency range:	SC-7207H	100MHz - 3GHz
	SC-7206H	100MHz - 2GHz

Detection sensitivity (sine waveform)

AGC off
-20dBm: 100MHz $\leq$ Input frequency $\leq$ 1.2GHz

-10dBm: 1.2GHz $<$ Input frequency $\leq$ 3GHz

Detection delay time 500μs

Note) If the equation "Burst period $\geq$ Set gate + Detection delay time" is satisfied, the burst error occurs. The measured value, which is beyond the guarantee, is shown on the display with the error mark "!" put.

1.2.3 Trigger error

Trigger error = $\dfrac{\sqrt{X^2 + En^2}}{Y[V/s]}$ X = Internal noise   En = Noise within input signal band

Y [V/s] = Input signal slew rate at trigger level

Internal noise = 1mVrms

2. Measurement operation

There are three kinds of state ;the repetition measurement ([RES] key), the SGL gate measurement ([SGL] key), and the state of holding ([HOLD] key).

3. Frequency measurement (FREQ-A/ FREQ-B)

3.1 Measurement range

Input coupling	SC-7207H	SC-7206H/7205H
DC	6mHz - 230MHz	0.6mHz - 230MHz
AC	10Hz - 230MHz	

3.2 Resolution

Reference frequency	SC-7207H 100MHz (10ns)		SC-7206H/7205H 10MHz (100ns)	
Frequency Counting method	Less than 100 MHz Reciprocal calculation	100MHz or more Direct counting	Less than 10 MHz Reciprocal calculation	10MHz or more Direct counting
1ms gate	5 digits or more	1kHz	4 digits or more	1kHz
10ms gate	6 digits or more	100Hz	5 digits or more	100Hz
0.1s gate	7 digits or more	10Hz	6 digits or more	10Hz
1s gate	8 digits or more	1Hz	7 digits or more	1Hz
10s gate	9 digits or more	0.1Hz	8 digits or more	0.1Hz
EXT-B gate	The reciprocal calculation method is used and the number of display digits depends on the EXT-B gate time.			
SGL gate	The reciprocal calculation method is used and the number of display digits depends on the measured signal.			

*The EXT-B gate cannot be installed in SC-7206H.

*When FREQ-B is measured, EXT-B cannot be selected.

① If the measured signal exceeds the reference frequency, the direct counting method is used. In this case, the measurement resolution depends on the gate time and the number of display digits depends on the measured signal.

Example) If the signal is 230MHz with the 10 sec. gate used, the number of display digits becomes 10 and "230.000,000,0MHz" is shown.

② If the measured signal is less than the reference frequency, the reciprocal calculation is used and the number of display digits depends on the gate time and reference frequency. If the period of the measured signal is longer than the gate time, the number of display digits depends on this period in order to measure at least one period.

3.3   Measurement error

1)   Direct counting

$$\left[\text{Accuracy of reference oscillator} + \left[\frac{\pm \sqrt{2} \times \text{trigger error [s]}}{\text{Gate time [s]}}\right]\right] \times \text{measured frequency [Hz]} \pm 1 \text{ [count]}$$

2)   Reciprocal calculation

$$\left[\text{Accuracy of reference oscillator} + \left[\frac{\pm \sqrt{2} \times \text{trigger error [s]} \pm 1 \text{ reference time [s]}}{\text{Gate time [s]}}\right]\right] \times \text{Measured frequency [Hz]}$$

When using the SGL gate, the gate time used in the above error calculation equation becomes "1/ measured frequency".

4. AC line Frequency measurement (FREQ-LINE) (only for SC-7207H and SC-7205H)

4.1 Measurement range

Model Reference frequency	SC-7207H 100MHz (10ns)	SC-7205H 10MHz (100ns)
Measurement range	45Hz - 440Hz	

4.2 Measurement resolution

Gate time	SC-7207H	SC-7205H
0.1s	7 digits or more	6 digits or more
1s	8 digits or more	7 digits or more
10s	9 digits or more	8 digits or more

4.3 Measurement error

$$\left(\text{Accuracy of reference oscillator} + \left[\frac{\pm \sqrt{2} \times \text{trigger error [s]} \pm 1 \text{ reference time [s]}}{\text{Gate time [s]}} \right] \right) \times \text{Measured frequency [Hz]}$$

5. Frequency measurement (FREQ-C)

The content of this section contains the burst measurement.

5.1 Measurement range

Reference frequency	SC-7207H 100MHz (10ns)	SC-7206H Reference frequency 10MHz (100ns)
AC coupling only	100MHz - 3GHz 1/16 pre-scaler	100MHz - 2GHz 1/16 pre-scaler

5.2 Resolution

Item	SC-7207H		SC-7206H	
Frequency of signal to be measured	Less than 1.6GHz	1.6GHz or more	Less than 160MHz	160MHz or more
Measurement method	Reciprocal calculation	Direct counting	Reciprocal calculation	Direct counting
1ms gate	5 digits or more	10kHz	4 digits or more	10kHz
10ms gate	6 digits or more	1kHz	5 digits or more	1kHz
0.1s gate	7 digits or more	100Hz	6 digits or more	100Hz
1s gate	8 digits or more	10Hz	7 digits or more	10Hz
10s gate	9 digits or more	1Hz	8 digits or more	1Hz
EXT-B gate	Reciprocal calculation counting method is used and the number of digits depends on the EXT-B gate time.			

*The EXT-B gate cannot be installed in SC-7206H.

① If the frequency of measured signal is "reference frequency × 16" or more, the direct counting method is used. The measurement resolution depends on the gate time and the number of display digits depends on the measured signal.

Example) If the signal is 2GHz with the 10 sec. gate used, the number of display digits becomes 10 and "2.000,000,000GHz" is shown.

② If the frequency of measured signal is less than "reference frequency × 16", the reciprocal calculation counting method is used. The number of display digits depends on the gate time and reference oscillation frequency. If the period of the measured signal is longer than the gate time, the number of display digits depends on this period in order to measure at least one period.

5.3 Measurement error

1) Direct counting

$$\left[\text{Accuracy of reference oscillator} + \left[\frac{\pm\sqrt{2} \times \text{trigger error [s]}}{\text{Gate time [s]}}\right]\right] \times \text{measured frequency [Hz]} \pm 1 \text{ [count]}$$

2) Reciprocal calculation

$$\left[\text{Accuracy of reference oscillator} + \left[\frac{\pm\sqrt{2} \times \text{trigger error [s]} \pm 1 \text{ reference time [s]}}{\text{Gate time [s]}}\right]\right] \times \text{Measured frequency [Hz]}$$

6.   Period measurement (PERI-A)

6.1   Measurement range

	SC-7207H	SC-7206H, 7205H
Reference time	10ns	100ns
Input coupling: DC	5ns – 171s	5ns - 1,717s
Input coupling: AC	5ns - 0.1s	

6.2   Resolution   SC-7206H is not available EXT-B

Gate time	SC-7207H	SC-7206H, 7205H
1ms	5 digits or more	4 digits or more
10ms	6 digits or more	5 digits or more
0.1s	7 digits or more	6 digits or more
1s	8 digits or more	7 digits or more
10s	9 digits or more	8 digits or more
EXT-B	The number of display digits depends on the EXT-B gate time.	
SGL	The number of display digits depends on the measured signal.	

*The EXT-B gate cannot be installed in SC-7206H.

① The number of display digits depends on the gate time and reference oscillation frequency.
   Example) When SC-7207H is used to measure 200 MHz with 1 sec. gate, the number of display digits becomes 8 and "5.000,000,0ns" is shown.

② If the period of the measured signal is longer than the gate time, the number of display digits depends on this period in order to measure at least one period.

CAUTION

If the period of the measured signal exceeds 100s (SC-7207H) or 1,000s (SC-7206H or 7205H), the measurement resolution becomes "reference time × 10".

6.3   Measurement error

$$\left[\text{Accuracy of reference oscillator} + \left[\frac{\pm\sqrt{2} \times \text{trigger error [s]} \pm 1 \text{ reference time [s]}}{\text{Gate time [s]}} \right] \right] \times \text{Measured period value [S]}$$

When using the SGL gate, the gate time used in the above error calculation equation becomes the measured period.

7. Duty ratio measurement (DUTY-A)

7.1 Input signal frequency range Same as FREQ-A.

Input coupling	SC-7207H	SC-7206H/7205H
DC	6mHz - 230MHz	0.6mHz - 230MHz
AC	10Hz - 230MHz	

7.2 Measurement range

Gate time	SC-7207H	SC-7206H, 7205H
SGL gate	0.01μ - 99.999,999,99 **[%]**	
Internal gate	0.2μ - 99.999,999,8 **[%]**	2μ - 99.999,998 **[%]**

7.3 Resolution

Measurement mode	SC-7207H	SC-7206H, 7205H
SGL gate	10ns / Input period × 100　　　　**[%]**	100ns / Input period × 100　　　　**[%]**
1m - 10s Internal gate Number of average cycles		
1 - 24	10ns / Average input period × 100 **[%]**	100ns / Average input period × 100 **[%]**
25 - 2,499	1ns / Average input period × 100　**[%]**	10ns / Average input period × 100 **[%]**
2,500 - 249,999	100ps / Average input period × 100 **[%]**	1ns / Average input period × 100　**[%]**
250,000 - 24,999,999	10ps / Average input period × 100 **[%]**	100ps / Average input period × 100 **[%]**
25,000,000 or more	1ps / Average input period × 100　**[%]**	10ps / Average input period × 100 **[%]**

7.4 Measurement error

$$\pm \frac{\text{Input pulse width} + |\text{Pulse width measurement error}|}{\text{Input period} - |\text{Period measurement error}|} \times 100 - \text{Measured duty value } \textbf{[\%]}$$

8. Pulse width measurement (P.W-A)

8.1 Minimum pulse width   6ns

8.2 Maximum repetition frequency   80MHz

8.3 Measurement range

Gate time	SC-7207H	SC-7206H, 7205H
Reference time	10ns	100ns
SGL gate	10ns - 171s	100ns - 1,717s
*1) 1ms - 10s gate	10ns - Approximately 1/2 gate time	100ns - Approximately 1/2 gate time

*1) To perform the average measurement, the period of the signal to be measured must be 1/2 or less of 1m - 10s gate.

8.4 Resolution

Item	SC-7207H	SC-7206H, 7205H
SGL gate	10ns - 100ns	100ns - 1 μ s
1ms - 10s gate Number of average cycles		
1 - 24	10ns	100ns
25 - 2,499	1ns	10ns
2,500 - 249,999	100ps	1ns
250,000 - 24,999,999	10ps	100ps
25,000,000 or more	1ps	10ps

*When using the SGL gate, the number of resolution digits may be missing due to limitations on maximum 10 display digits.

8.5   Measurement error

Accuracy of reference oscillator $\times$ measured pulse width value [s]

$\pm$ Trigger error [s] at start slope $\pm$ Trigger error [s] at stop slope

$\pm$ Trigger level timing error $*^1$ ± 2 [ns] $*^2$ ± 1 reference time [s] $*^3$

*1 Trigger level timing error

$$\left[\frac{20mV}{\text{Slew rate at start trigger point}} - \frac{20mV}{\text{Slew rate at stop trigger point}} \right] \pm$$

$$\frac{\text{Trigger level setting accuracy}}{\text{Slew rate at start trigger point}} \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate at stop trigger point}}$$

*2 Internal skew

*3 If the relationship between the signal to be measured and reference period is not synchronized, this value is reduced to $\dfrac{1}{\text{the number of average cycles}}$.

9. Time interval measurement (T.INT A→B)

9.1 Minimum time interval   *6ns*

9.2 Maximum repetition frequency   *80MHz*

9.3 Input signal frequency range *Both CH-A and CH-B are the same as FREQ-A.*

9.4 Measurement range

Measurement mode	SC-7207H	SC-7205H
SGL gate	10ns – 10,995s	100ns - 109,951s
∗1) 1ms - 10s gate	10ns - Approximately 1/2 gate time	100ns - Approximately 1/2 gate time

∗1) To perform the average measurement, the period of the signal to be measured must be 1/2 or less of 1ms - 10s gate.

9.5 Resolution

Measurement mode	SC-7207H	SC-7205H
SGL gate	10ns - 10 μ s	100ns - 100 μ s
1ms - 10s gate Number of average cycles		
1 - 24	10ns	100ns
25 - 2,499	1ns	10ns
2,500 - 249,999	100ps	1ns
250,000 - 24,999,999	10ps	100ps
25,000,000 or more	1ps	10ps

*When using the SGL gate, the number of resolution digits may be missing due to limitations on maximum 10 display digits.

9.6   Measurement error

Accuracy of reference oscillator $\times$ measured time width value [s]

$\pm$ Trigger error [s] at start slope $\pm$ Trigger error [s] at stop slope

$\pm$ Trigger level timing error $*^1$ $\pm$ 1 [ns] $*^2$ $\pm$ 1 reference time [s] $*^3$

    $*1$ Trigger level timing error

$$\left[\frac{20mV}{\text{Slew rate at start trigger point}} - \frac{20mV}{\text{Slew rate at stop trigger point}} \right] \pm$$

$$\frac{\text{Trigger level setting accuracy}}{\text{Slew rate at start trigger point}} \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate at stop trigger point}}$$

    $*2$ Internal skew

    $*3$ If the relationship between the signal to be measured and reference period is not synchronized, this value is reduced to $\dfrac{1}{\text{the number of average cycles}}$.

9.7   Stop inhibit

It is possible to set 0-25.5 Even ms by 0.1ms carving in the utility menu.

10. Frequency ratio measurement (FREQ A/B)

10.1 Input signal frequency range

Both CH-A and CH-B are the same as FREQ-A.

Input coupling	SC-7207H	SC-7205H
DC	6mHz - 230MHz	0.6mHz - 230MHz
AC	10Hz - 230MHz	

For stable measurement, the period of the signal to be measured must be a gate time of 1ms - 10s or less.

10.2 Measurement range

Internal gate (1ms - 10s) $1E-9 - 1E+9$

10.3 Resolution

Internal gate (1ms - 10s) $1 + LOG$ (CH-A input frequency $\times$ gate time) digits

10.4 Measurement error

$$\frac{\sqrt{2} \times \text{CH-B trigger error [s]}}{\text{Number of CH-B measurement periods [unlabeled number]} \times \text{gate time [s]}} \pm 1 \text{ [count]}$$

11. Phase measurement (PHAS A→B)

11.1 Minimum time interval   6ns

Note) It is impossible to measure for 0 the phase difference, and less than 6ns.

11.2 Maximum repetition frequency   80MHz

11.3 Input signal frequency range *Both CH-A and CH-B are the same as FREQ-A.*

11.4 Measurement range

Measurement mode	SC-7207H	SC-7205H
*1) SGL gate	0.1μ - 359.999,999,9 [°]	
*2) 1m - 10s gate	1μ - 359.999,999 [°]	10μ - 359.999,99 [°]

*1) Since the SGL gate is used to measure only one period of the signal to be measured, it becomes valid at a slow frequency.

*2) To perform the average measurement, the period of the signal to be measured must be 1/2 or less of 1m - 10s gate

11.5 Resolution

Measurement mode	SC-7207H	SC-7205H
SGL gate	10ns/Input period × 100 [%]	100ns/Input period × 100 [%]
1m - 10s gate Number of average cycles		
1 - 24	10ns/Average input period × 360[°]	100ns/Average input period × 360[°]
25 - 2,499	1ns/Average input period × 360[°]	10ns/Average input period × 360[°]
2,500 - 249,999	100ps/Average input period × 360[°]	1ns/Average input period × 360[°]
250,000 - 24,999,999	10ps/Average input period × 360[°]	100ps/Average input period × 360[°]
25,000,000 or more	1ps/Average input period × 360[°]	10ps/Average input period × 360[°]

*3) It is necessary to match the result calculated from the above table to the expression because the resolution becomes the numerical value of 0.01, 0.1, 0.01···etc. 10n (n: integer).

When the expression is matched, the most significant digit of the digit that 0 of the calculated values is rounded up.

Example: 10ns / 50ms × 360=0.000072

This calculated value is converted into the shape of $0.y \times 10^n$.

(y is a most significant digit of the calculated values except for 0.)

0.7×10^{-4}

Next, 0.7 is rounded up and the resolution is requested.

At the result, Resolution=1×10^{-4}＝0.1m°

11.6 Measurement error

$$\pm \frac{\text{Input time interval} + |\text{time interval measurement error}|}{\text{Input period} - |\text{Period measurement error}|} \times 360 - \text{Measured phase value [°]}$$

12. Totalize measurement (TOT-A)

12.1 Minimum pulse width   2. 5ns

12.2 Input signal frequency range Same as FREQ-A.

Input coupling	SC-7207H/SC-7206H/SC-7205H
DC	DC - 230MHz
AC	10Hz - 230MHz

12.3 Measurement range
0 - 4,294,967,295 counts when the scaling calculation is set at "off".

12.4 Measurement gate

It is possible to select the gate from 1ms-10s, EXT-B, and MANUAL.
*The EXT-B gate cannot be installed in SC-7206H.

12.5 Clear of the values

It is possible to select it from TOT_CLR=BY RESET or TOT_CLR=BY GATE according to the SYSTEM menu.

12.6 Measurement error   ±1 count (only when the gate is opened and closed.)

13. Other Functions

13.1 Gate closure

This setting is valid only when the internal gate (1 ms to 10 s) is selected for an operation other than TOT-A measurement.
If the measurement signal is interrupted, it is possible to select whether to forcibly terminate operation.

・WAIT:　　　　The system waits until another signal is input.
・FIRST:　　　　The operation is forcibly terminated after the specified internal gate time + 1 second.

13.2 BEEP sound

This can be individually set to ON or OFF when there is a KeyPush, Caution, or Comp event.

13.3 Calculations

13.3.1 Scaling calculations

$(X - a)/b$, $X-Xref$, c/X

13.3.2 Statistical calculations

Continuous mode 　　　　: maximum value and minimum value
N-sample repeat mode 　: maximum value, minimum value, average value, and deviation (N = 5, 20, 50, 100)
N-sample single mode 　: maximum value, minimum value, average value, and deviation (N = 5, 20, 50, 100)
(In this mode, measurement stops after sampling is performed the specified number of times.)

13.3.3 Comparator calculations

Any 10-digit high limit and low limit values can be specified.

13.3.4 Saving / recalling

Up to 10 sets of panel setup data can be saved.

13.3.5 Power saving mode (turning off the fluorescent display)

A time from 10 to 60 minutes can be specified (in steps of 10 minutes).
It is possible to instantly turn off the display by using a command in the remote mode.

13.3.6 Display update interval

A time from 0 to 200 seconds can be specified in steps of 0.1 seconds.

13.3.7 Display mask

0 to 9 digits can be masked, starting with the lower digits in steps of 1 digit.

13.3.8 Hysteresis display time

3 s, 10 s, or 30 s can be specified.

14. Indicator

5×7 dot　16digits　VFD

15. 10MHz STD IN (External reference clock input)

This BNC terminal is for to input more stable reference frequency from an external device.

Input frequency　　10MHz $\pm$ 50Hz ($\pm$5ppm)

Input amplitude　　1Vrms - 5Vrms　Threshold value = 0V

Input resistance　　Approximately 6.4 kΩ

Input coupling　　AC

1) It is impossible to switch from internal reference clock in the utility menu.

2) It is possible to check by the internal reference clock whether or not the external reference clock is normal.
The setting of the clock can be automatically switched to an internal reference clock when the external reference clock is non-standard.
However, when the totalization measurement (TOT-A) is operated, it is invalid.

16. 10MHz STD OUT / (MARKER OUT)

This BNC terminal is for to output the internal reference frequency or marker signal.

Output	CMOS level
Reference frequency output	10MHz, The stability is the same as the internal reference oscillator.
Market output	Band: 5MHz, "L" is output during actual measurement.

The marker signal output is "L" between starting of the CH-A measurement and starting of the CH-B measurement when the function is set at the time interval (T.INT A→B) or phase (PHAS A → B).　This signal is used to modulate the luminance of the oscilloscope (Z-axis).　The output is fixed at "H" in other functions.
(This function is provided only on SC-7207H and SC-7205H.　The marker cannot be selected in SC-7206H.)

17. RS-232 interface

A full-remote function is provided. For details, see the remote function.

Baud rate	300,600,1200,2400, 4800, 9600, 19200, 38400
Data bits	7 bits or 8 bits
Parity	None, Odd, Even
Delimiter	LF or CR/LF

18. GP-IB interface

A full-remote function in conformity with IEEE488-1 is provided. For details, see the remote function.

(This function is a factory option and need SC-701 for SC-7205H.)

Address	0～30
Delimiter	LF or CR+LF

19. Voltage measurement

Frequency range	150Hz - 50MHz
Response time	2 sec. or less
Measurement voltage range	$\pm$ 2.50V (ATT off, 10mV resolution)
	$\pm$50.0V (ATT on, 100mV resolution)
Measurement error	ATT off: 10% of display value $\pm$ 50mV

20. Reference oscillator

This reference oscillator is built into SC-7207H, SC-7206H, and SC-7205H as a standard accessory.

The signal can be output to the 10MHz OUT BNC terminal on the rear panel of the instrument.

Oscillation frequency	10MHz
Temperature characteristics	$\pm$2.5 ppm/0°C - +40°C
Aging rate	$\pm$1.0 ppm/year

21. Power supply

Power supply other than 100V is a factory option.

Power voltage   Rating: AC100/110 - 120/220 - 240

Power frequency   Rating: 50 / 60 / 400 Hz

Power consumption   When the power supply is AC 100V and optional units SC-701, 702, 703A, or 704A is installed (703A and 704A are equipped with only either of them.):

Maximum SC-7205H 31VA

Maximum SC-7206H 33VA

Maximum SC-7207H 36VA

Over Voltage Category Ⅱ

22. Mechanical specifications

Dimensions   （210±2）W×（99±2）H×（353±2）L (unit:mm)
See the separate outside view drawing.at the last section.

Weight   4.0kg or less (optional units, SC-701, 702, 703A or 704A is installed.)

23. Environmental conditions (indoor use only)

Warm up time   60 min. or longer

Operating temperature and humidity   0°C - +40°C /85%R.H or less
(No condensation is allowed.)

Storage temperature and humidity   −20°C - +60°C /90%R.H or less
(No condensation is allowed.)

Pollution Degree 2

24. Forecast deterioration

Brightness of the display tube will be reduced by half in 30,000 hours.

25. Factory options

25.1 GP-IB interface SC-701 (This function is built-into SC-7207H/7206H as a standard accessory.)

A full-remote function in conformity with IEEE488-1 is provided. For details, see the remote function.

25.2 Comparator output SC-702 (DIO board)

The measurement start timing is controlled and the comparator calculation results are output.

However, both the input and output become invalid in the Vp measurement mode.
(The output is a high-impedance.)

Terminal pin assignments (when viewed from the front of the terminal)

Top side

2	4	6	8	
1	3	5	7	9

Numeric values show the terminal numbers.

Bottom side

Terminal No.	Signal name	Type	Terminal No.	Signal name	Type
1	GND	Power supply ground (To be grounded inside the counter.)	2	/BUSY	Open collector output
3	GND		4	/ LO	Open collector output
5	GND		6	/ GO	Open collector output
7	GND		8	/ HI	Open collector output
9	/TRIG	C-MOS input See below for input level. H : 3.5 V or more L : 1.2 V or less			

Maximum ratings of output terminal

Withstanding voltage	DC 50V
Withstanding current	DC 150mA
Frequency response	DC - 1kHz

Maximum ratings of input terminal

Withstanding voltage	DC 5V
Frequency response	DC - 1kHz

Data output   Open collector output (L: Output transistor ON, Z: Output transistor OFF)

Conditions		Output specifications			
Calculation = Comparator calculation		/HI	/GO	/LO	/BUSY
After measurement	Calculation **on** and data presence				
	Calculation **on**, data presence, and **HI** limit out	L	Z	Z	Z
	Calculation **on**, data presence, and **GO**	Z	L	Z	Z
	Calculation **on**, data presence, and **LO** limit out	Z	Z	L	Z
	Regardless of calculation **on/off**, the mode is the **Vp** mode	Z	Z	Z	Z
	Regardless of calculation **on/off**, error occurs.	Z	Z	Z	Z
	Regardless of calculation **on/off**, no data is present.	Z	Z	Z	Z
	Calculation **off** and data presence	Z	Z	Z	Z
During measurement		∗			L
During utility mode		Z	Z	Z	Z

∗ With the **SYSTEM** menu of the main unit, it is possible to select whether the previous status of the output immediately before the measurement is kept or the status is initialized using "**Z**".

● **Timing chart with** DIO:COMPARE = off
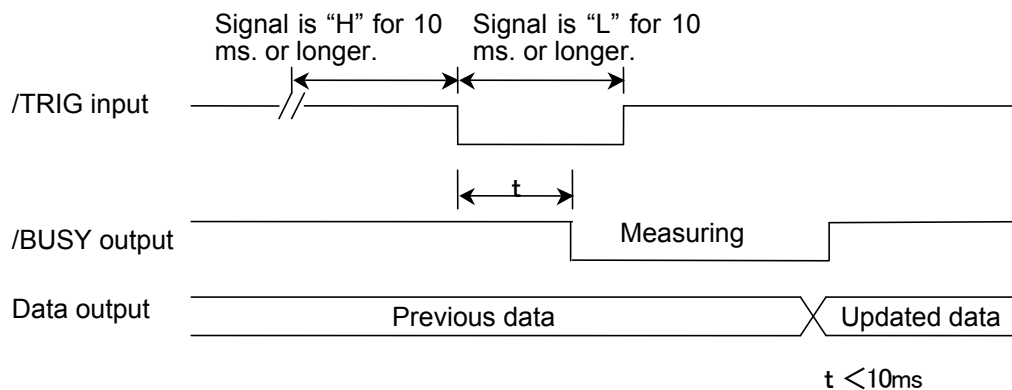
● **Timing chart with** DIO:COMPARE = on

Control signal

/TRIG C-MOS input	The measurement is started by the "L" pulse continuing for 10 ms. or longer after the "H" pulse has continued for 10 ms. or longer. (Level detection) Additionally, if the trigger signal satisfying the above measurement conditions is input during measurement, the current measurement is cancelled, and then the re-measurement is started (retriggerable operation). Put the main unit into the state of HOLD when you want to begin measuring only with the TRIG input signal. It can be selected whether to initialize the statistical operation result by the TRIG input according to the utility menu. This input becomes invalid when the main unit is in the remote state or utility mode.

25.3   Power voltage change

Power voltage   Rating: AC110 - 120/220 - 240

Power frequency   Rating: 50 / 60 / 400Hz

25.4   Medium/high stability reference oscillator (SC-703A: Product manufactured on order)

This optional product can be mounted on the SC-7207H/7206H/7205H and outputs the frequency signal from the BNC terminal of "10MHz OUT" on the rear of the main unit.

Unless otherwise specified particularly, the characteristics stated in the following Table are specification values at an ambient temperature of $+25°C \pm 3°C$.

	Medium stability reference oscillator SC-703A
Oscillation frequency	10MHz
Temperature characteristics	±0.05 ppm Range of 0 to +40°C based on a reference temperature of +25°C
Startup characteristics	±0.05 ppm [*1]
Secular change (/day)	±0.02 ppm [*2]
Secular change (/year)	±0.1 ppm [*3]

*1   10 min. after power ON based on the frequency, which is obtained 1 hr. after power ON.

*2   72 hrs. after power ON based on the frequency, which is obtained 48 hrs. after power ON.

*3   1 year. after power ON based on the frequency, which is obtained 10 days. after power ON.

*1～*3   If the product is stored with the power turned OFF for an extended period of time, it may be required to separately perform the aging for 48 hrs. or longer even though this aging time may vary depending on the storage environment.

[Adjustment of SC-703A]

CAUTION ⚠

When adjusting this optional product, always strictly observe the following cautions.

- **Since electric shock hazard exists, always use a non-conductive slotted screwdriver for the adjustment work.**

- **Adjust this optional product in an environment at an ambient temperature of normal temperature (+25°C)±3°C and humidity of 85%RH or less.**

- **Start the adjustment when 48 hrs. have elapsed after power ON.**

- **Since the gravity may affect the adjustment, place this optional product horizontally, and then make the adjustment and inspection.**

- **Since the adjustment potentiometer is vulnerable to breakage, do not turn it forcibly.**

Adjusting procedures

① When adjusting the product, set the counter and signal source as shown below.

- Function: FREQ-A
- Coupling: CH-A = DC
- Trigger level: CH-A = 0.00V
- ATT: CH-A = OFF
- FILT: CH-A = OFF
- Gate: SC-703A:1 s
- SCALE: OFF
- STAT: OFF
- Input signal: CH-A = 200MHz
                     200 mVrms or more
                     Frequency accuracy
                          SC-703A : 0.01 ppm or less

② Adjust the potentiometer at the innermost position in the ventilation hole so that the measured value of the counter is within the following range.

$\pm$0.01 ppm or less

(Example: When the measurement signal is 10 MHz, 10E6 $\times$ ($\pm$0.01E-6) =$\pm$0.1 Hz or less)

The hole position is the 6th hole from the top of the rightmost line indicated by an arrow mark on the left side panel of the main unit as shown in the Fig. below.

*   Use a non-conductive flatblade screwdriver.

Hole position

Front panel
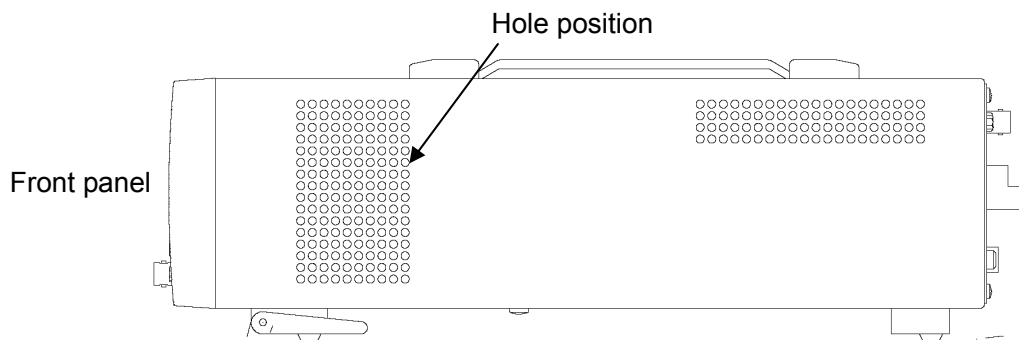
[Serial number]

When the SC-703A is mounted, "M" or "H" is put at the last of the serial No. on the rear.

IWATSU TEST INSTRUMENTS CORP.

2 1 4 0 1 0 4 5 1 0 6 0 0 0 5

S/N   AE067060005   MADE IN JAPAN

SC-703A:M

Outside view drawing (HWD dimensions)

210 ±2

(15)   99 ±2   (8)   (6.5)   353 ±2   17.5

(6.5°)
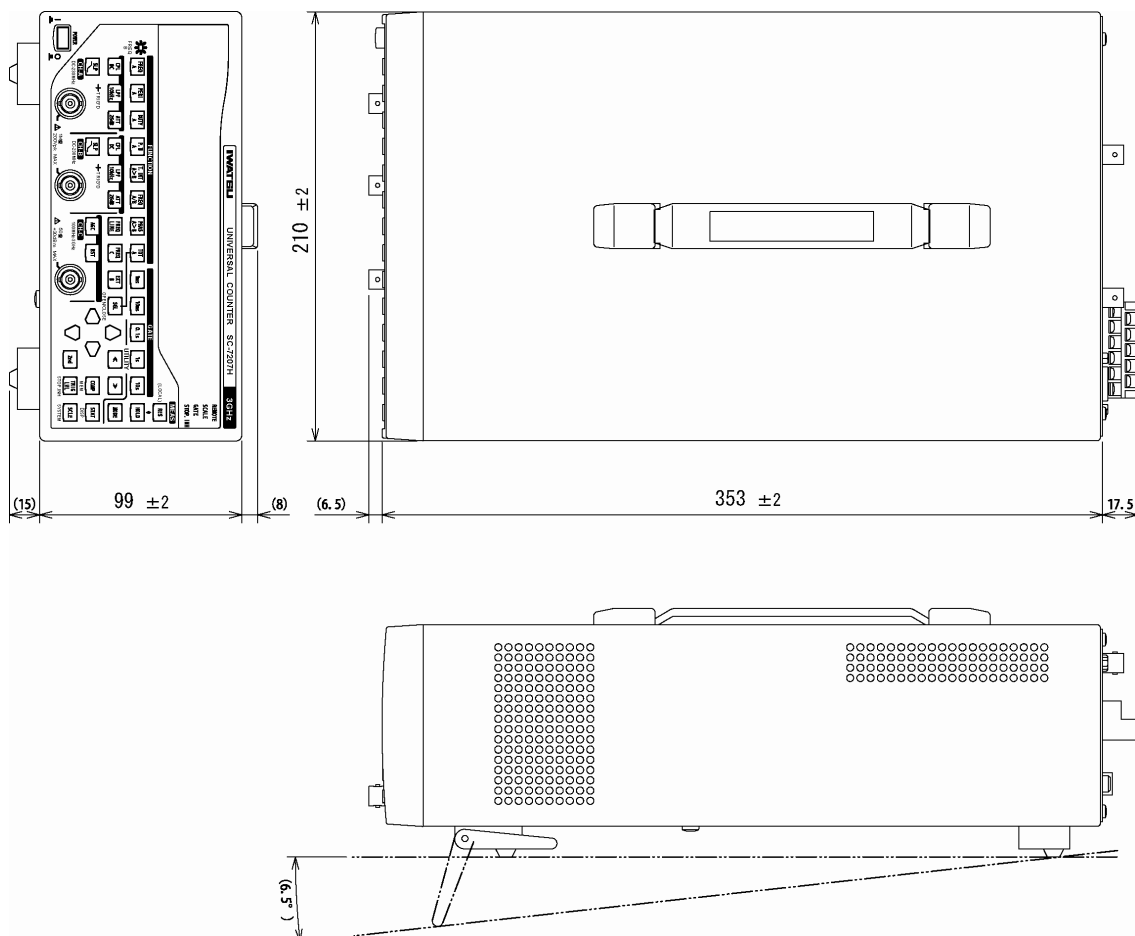
Unit:mm

Remote Manual

Contents

1. Remote Control

1.1 General

This instrument can be operated by remote control through an external controller (usually a personal computer) in almost the same way as when you operate it manually using buttons.

Data on measurement results and panel setup can also be transferred by remote control. So you can collect data using a personal computer and configure the automatic measurement system.

There are two ways to operate this instrument by remote control, as described below.

① Through the standard RS-232 interface

② Through the GP-IB interface (SC-701)
(SC-701 is a standard accessory for SC-7207H/7206H and optional for SC-7205H.)

To connect this instrument and a remote personal computer through the GP-IB interface, insert a GP-IB board or card into the expansion slot of the personal computer.
Because up to 15 devices can be connected to one system through the GP-IB interface, it is useful to control this instrument from multiple remote devices.

An RS-232 interface is installed on most personal computers as standard equipment, so you can easily connect this instrument to a remote computer. However, there is a limitation that the RS-232 can control only one unit.

1.2 Restrictions of remote control

It is possible to remotely control almost all of the functions provided on this instrument. However, the power switch ON/OFF and various settings about remote control in the SYSTEM menu cannot be controlled remotely.

For details about functions operated through the remote control and control commands, see Chapter 4, Remote control commands.

When operating this instrument through the remote control, the RS-232 interface and GP-IB interface must not be used at the same time. (When using one interface, it is recommended to disconnect other interface cable for safe operation.)

1.3 Remote/Local control

A state, in which each function of this instrument is remotely controlled by messages sent through the interface, is called "remote mode". On the contrary, a state, in which the instrument is operated by panel key entries, is called "local mode".

In the remote mode, operation of the instrument is controlled by messages sent through the interface. At this time, all panel keys except for the LOCAL ([RES]) key become invalid.

The remote/local mode change procedures of the RS-232 interface may vary from those of the GP-IB interface. For details of RS-232 interface, see section 2.4. For details of GP-IB interface, see section 3.1.5.1.

2. Remote Control Through RS-232 Interface

RS-232 is a serial interface standard for the data exchange process between the computer and connected peripheral device.

This interface standard is defined by the EIA in the U.S.A. and built-into almost all personal computers as a standard input/output interface.

This instrument also has the RS-232 port on its rear panel as a standard accessory.

2.1 Connection with external devices

The RS-232 port of this instrument uses a 9-pin D-SUB connector and inch screws (4-40 UNC).

The following Table shows the signal lines and functions of the RS-232 interface.

Pin No.	Abbreviation of signal	Function	Remarks
1	DCD	Receive carrier detection	Not used in this instrument.
2	RXD	Receive data	
3	TXD	Send data	
4	DTR	Data terminal ready	Not used in this instrument.
5	GND	Signal ground	
6	DSR	Data set ready	Not used in this instrument.
7	RTS	Transmission request	
8	CTS	Transmission enable	
9	RI	Called signal	Not used in this instrument.

To connect this instrument to an external device, use the connection cable having the following wiring.

When connecting the instrument to a personal computer, use of cable generally called "cross cable" makes it possible to perform the remote control. However, to ensure safe operation, check the connector shape and pin assignments of both the instrument and computer before connecting to the personal computer, and then prepare a proper cable.

This instrument   External device

Pin No.	Abbreviation of signal		Abbreviation of signal
1	DCD		DCD
2	RXD		RXD
3	TXD		TXD
4	DTR		DTR
5	GND		GND
6	DSR		DSR
7	RTS		RTS
8	CTS		CTS
9	RI		RI
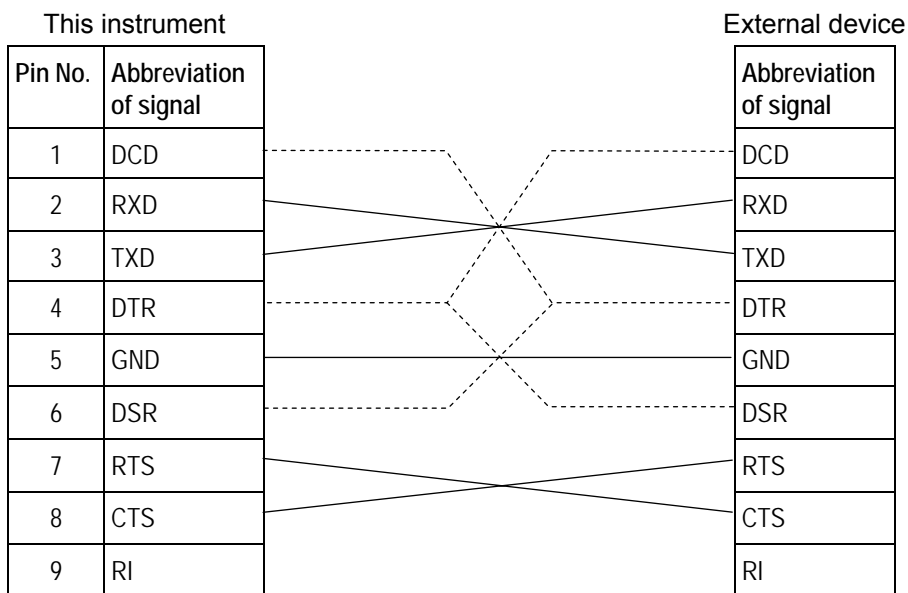
2.2　Communication mode

This instrument uses the full-duplex communication method. Therefore, the instrument may start sending the response message even while it is receiving the message. Normally, this is not a problem since the data receive buffer is provided. However, if any problem is foreseen, the flow control must be taken into consideration.

This instrument performs the hardware flow control. The instrument does not have other flow controls and the hardware flow control cannot be made invalid.

In this instrument, if the input buffer becomes full, the RTS signal is held off when the messages to the delimiter are received. After the received messages are interpreted and processed, the RTS signal hold off is cancelled.

The size of the input buffer provided in this instrument is 80 bytes. Therefore, care should be taken so that one send message does not exceed 80 bytes.

The size of the output buffer (hereafter referred to as "output queue") provided in this instrument is 80 bytes. This instrument uses the full-duplex communication method and starts sending the data as soon as the output data is prepared. Therefore, it is not necessary to take care about the size of the output queue. However, the size of the output queue must be considered when performing the flow control. (Do not send the command to this instrument that requests the response exceeding 80 bytes.)

To communicate with an external device, it is absolutely necessary to make the settings of this instrument matched with those of the external device.

Various settings listed below can be made by selecting the RS menu from the SYSTEM menu of UTILITY. (These settings can be made through the remote control.)

(1) Baud rate (RS: Rate)
    Any of 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400 (bps) is selected.

(2) Parity bit (RS: Parity)
    Any of NONE, EVEN, and ODD is selected.

(3) Stop bit (RS: Stop)
    "1" or "2" is selected.

(4) Delimiter (RS: DELIM)
    "CR+LF" or "LF" is selected.

The data bit is fixed at "8-bit" and the start bit at "1-bit".

For details about how to set the external device, see the instruction manual supplied with the external device to perform the setup necessary to communicate with the instrument.

If the baud rate is set at a high speed, the overrun error may occur. If this error occurs frequently, the instrument needs to be operated with the baud rate decreased.

2.3   Synchronization

This instrument can use only hardware flow control for the synchronization in the serial communication with the external device.

To perform the synchronization with the software, it is recommended to create a remote program that the last message unit of the message to be sent to this instrument is used as a query (command that requests the response message from this instrument) and the next message is sent after the response has been received from this instrument.

∗OPC? query (see section 4.3.), etc. can be used.

2.4   Remote/Local control

a.   Local mode

In the local mode, operation of the instrument is controlled through panel key operation. The REMOTE LED is off.

This instrument enters the local mode when the power is turned on.

The following two kinds of methods are provided to return the mode from the remote mode to the local mode.

- Turn off the power, and turn it on again.
- Press the LOCAL ([RES]) key.

When the remote mode is returned to the local mode, various settings made in the remote mode, such as measurement condition settings can be used continually.

b.   Remote mode

In the remote mode, operation of the instrument is controlled by messages sent through the interface.

All panel key entries except for the LOCAL ([RES]) key become invalid.

The REMOTE LED is lit during remote control. If the instrument receives the message from the external device, it then enters the remote mode.

At this time, as soon as the instrument receives the start byte of the message correctly, it then enters the remote mode.

When the instrument enters the remote mode, various settings made in the local mode, such as measurement condition settings can be used continually. However, the measurements enter the HOLD mode and the remote measurement must be performed by the remote control command (such as the :MEAS? query, etc.) that instructs the measurement start.

As for exceptions, the HOLD lamp is lit only when the manual gate measurement is specified in the TOT A function. Pay special attention to this caution.

Additionally, when the reference clock (Ref-Clock) for counting is set at EXT (external), the clock, which is input externally, is tested only at a timing when the ∗TST? query is received.

When necessary, the externally input clock is checked using the ∗TST? query.

c.   Local lock out mode

This instrument does not support the local lock out mode under the control through the serial interface. If lock out operation is needed, the GP-IB interface must be used.

3. Remote Control Through GP-IB Interface

This chapter describes how to control this instrument through the GP-IB interface. To use the GP-IB interface with SC-7205H, it is absolutely necessary to install SC-701, an optional GP-IB interface.

3.1 Performance

Electrical, mechanical, and functional specifications shall conform to the IEEE Std. 488.1-1987 and JIS C 1901-1987.

The specifications for the commands, formats, and protocols shall conform to the IEEE Std. 488.2-1987.

3.2 Interface functions

This instrument has the IEEE488.1 subsets about GP-IB as shown in Table 3.1.1.

Table 3.1.1   GP-IB interface functions

SH1	Supports all source handshake functions.
AH1	Supports all acceptor handshake functions.
T5	Specifies and cancels the talker by means of basic talker, serial poll, and MLA.
TE0	Does not support the extended talker function.
L4	Specifies and cancels the listener by means of basic listener and MTA.
LE0	Does not support the extended listener function.
SR1	Supports all the service request functions.
RL1	Supports all the remote local functions.
PP0	Does not support the parallel poll function.
DC1	Supports all device clear functions.
DT1	Supports all device trigger functions.
C0	Does not support the controller function.
E2	Uses the 3-state driver.

3.3 Connections

CAUTION

- Before connecting or disconnecting the cables, always turn off the power to all the devices connected to the GP-IB cable.

- To operate the GP-IB system, turn on all the devices connected to the system bus.

a. Up to 15 GP-IB devices can be connected to one system.

b. The total length of the cables used to connect devices in the system is 20m or less and 2m $\times$ (the number of devices making up the system) or less.

c. The length of each cable used in the system is freely decided by the person in charge of system configuration.
However, if the length of the cable connecting two devices is 4m or more, noise margin shall be taken into consideration.

d. A desired cable connection method (star or daisy chain, etc.) can be selected by the user.
However, use of the connection that creates the ground loop is not allowed.

e. The number of cable stacks on the connector located on the rear panel of the instrument shall be 3 or less due to mechanical strength.

f. The connection cable applicable to the IEEE 488.1 or JIS C 1901 standard shall be used.
To improve the reliability of the system, it is recommended to use the cable, on which the EMS measures are taken (connector with metallic housing).

g. The GP-IB system needs to be operated in an electrically and mechanically good environment.

h. Before configuring the system, see clause 6 and appendix J of JIS C 1901-1987.

3.4   Hardware addressing

Any address ranging from "0" to "30" can be selected for the listener and talker addresses.

The listener and talker (lower five bits of the code set) of the instrument use a common address.

Effective code set for listener address: Column 0 - 3 and Column 14 of code table 2

Effective code set for talker address: Column 0 - 5 and Column 14 of code table 4

The default address set before shipment from the factory is 7.

MLA: Column 7 of code table 2

MTA: Column 7 of code table 4

To set an address, select the GP-IB menu from the SYSTEM menu of UTILITY. A desired address ranging from "0" to "30" is set.

3.5   Response to interface message

3.5.1   Remote/Local control

Each function of the instrument can be controlled remotely by messages sent through the interface.

A state, in which the instrument is controlled by messages sent through the interface, is called "remote mode".

On the contrary, a state, in which the instrument is operated by panel key entries, is called "local mode".

This instrument has all the remote and local functions defined in the IEEE Std. 488.1-1987 and JIS C 1901-1987.

For details about transition of the remote and local modes, see the section, RL function, in the specification.

a.   Local mode

In the local mode, operation of the instrument is controlled through panel key operation. The REMOTE LED is off.

This instrument enters the local mode when the power is turned on.

The following four kinds of methods are provided to return the mode from the remote mode to the local mode (if the GP-IB interface is used).

• Turn off the power, and turn it on again.

• Set the REN line to "false" (electrically high level).

• Press the LOCAL ([RES]) key.

• Set this instrument to listener and send the address command GTL.

When the remote mode is returned to the local mode, various settings made in the remote mode, such as FUNCTION and GATE settings can be used continually.

b.   Remote mode

In the remote mode, operation of the instrument is controlled by messages sent through the GP-IB interface.

All panel key entries except for the LOCAL ([RES]) key become invalid.

The REMOTE LED is lit during remote control.

To change the operation mode of the instrument from the local mode to the remote mode, it is necessary to set this instrument to listener (MLA is received) with the REN line set at "true" (electrically low level).

Various settings made in the local mode, such as FUNCTION and GATE settings can be used continually.

However, the measurements enter the HOLD mode and the remote measurement must be performed by the remote control command (such as the :MEAS? query, etc.) that instructs the measurement start.

As for exceptions, the HOLD lamp is not lit only when the manual gate measurement is specified in the TOT A function. Pay special attention to this caution.

Additionally, when the reference clock (Ref-Clock) for counting is set at EXT (external), the clock, which is input externally, is tested only at a timing when the *TST? query is received.

When necessary, the externally input clock is checked using the *TST? query.

c. Local lock out mode

This instrument enters the local lock out mode in any of the following cases.

- The universal command LLO is received in the remote mode.
- The instrument enters the remote mode after the universal command LLO has been received.

In the local lockout mode, it is prevented that the mode is returned to the local mode even though the operator presses the LOCAL ([RES]) key.

The operation and response except for that the LOCAL ([RES]) key input is ignored are the same as those in the remote mode.

To return the instrument from the local lock out mode to the local mode, set the instrument to listener and send the GTL message. However, when the mode is changed to the remote mode again, the instrument enters the local lock out mode even though the LLO command is not received newly.

To cancel the local lock out mode completely (to return to the remote mode), it is necessary to temporarily change the mode to the local mode in any of the following manner.

- Turn off the power, and turn it on again.
- Set the REN line to "false" (electrically high level).

3.5.2   GET (Group Execute Trigger)

When the address command GET is received with the instrument specified as listener, the measurement is started.

When the address command GET is received in the TOT measurement, the counter is reset.

When the instrument receives the GET command, the NDAC signal is held to hold the handshake off until the internal process (starting of measurement) is completed.

3.5.3 DCL · SDC

Upon receiving the universal command DCL (Device Clear), this instrument initializes the device function. The same initialization occurs when this instrument is being set to "listener" and receives the address command SDC (Selected Device Clear).

The DCL or SDC message shows that the following initialization is being executed.

- Data input/output is terminated, and the input buffers and the output queue are cleared. The MAV bit of status byte register are also cleared. (As a result, the MSS bit may be affected by these operations.) See section 4.2.

- If the instrument is performing the measurement, the measurement is stopped and the instrument is put in the HOLD mode.

When this instrument receives the DCL or SDC interface message, the NDAC signal is held to hold the handshake off until the internal microprocessor recognizes the signal receive.

3.6 Delimiter

If this instrument sends <Response Message>, the user can select LF or CR LF as a delimiter (<Response Message Terminator>).

EOI is always sent.

The delimiter is set by the GP-IB I/F sub-menu of the system menu. (The setting cannot be made through the remote interface.)

When this instrument receives the program message, it recognizes any of LF, CR LF, or EOI as the delimiter (<Response Message Terminator>). Note that this recognition is independent of the delimiter setting.

3.7 Input and Output Buffers

This instrument supports a 80-byte input buffer.

When this instrument receives a delimiter, it begins to interpret the commands in the buffer even if the input buffer is not full. This instrument does not receive next messages when interpreting or executing received commands. The handshake is held off by the start byte of the new message. Once the interpretation and execution of commands is completed, this instrument resumes its handshake.

When the input buffer becomes full, the handshake is held off. After the command of the message unit in the buffer has been interpreted and executed, the handshake is restarted.

This instrument supports a 80-byte output buffer (output queue).

If multiple query messages are gathered as one message, care should be taken so that the total byte of the response messages does not exceed 80 bytes.

4.   Remote control commands

4.1   Message protocol

This section describes the configuration of the program message that this instrument communicates with the controller, as well as the send and receive operations of the instrument.

For details about data format of each command, see the description of relevant command.

Remarks

The elements defined in IEEE 488.2 are given as follows.

<Program Message>

<Character Program Data>

<Numeric Program Data>

<Suffix Program Data>

<String Program Data>

<Response Message>

<Character Response Data>

<NR1 Numeric Response Data>

<NR2 Numeric Response Data>

<NR3 Numeric Response Data>

<String Response Data>

<Arbitrary ASCII Response Data>

4.1.1   Message Format

One message unit consists of a header, the data, and a header separator that divides these two major parts.

(Example)

:INPA:ATT   ON

Data

Header separator
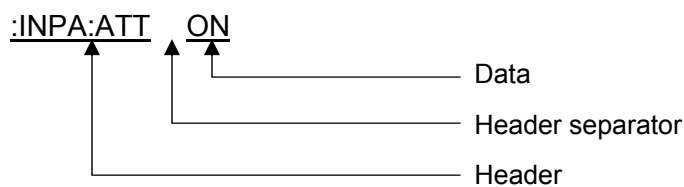
Header

a. Header

The header consists of ASCII characters. The header is composed of one to three mnemonic parts separated by a colon (:) and expresses the function or operation of this instrument.

The string in the example above is a command used when setting up this instrument.

When the string is a query that looks for a setting (in which cases, this instrument creates response data), the header ends with a question mark "?".

b. Header separator

This code separates the header and the data. The header separator is a space code (ASCII characters) of at least one character. The white space character defined in IEEE 488.2 may be used.

The command without the data part does not need the header separator. Additionally, it is not allowed to omit the data part except for commands without the data part in this instrument.

c. Data

The data is a parameter describing the concrete setting of the function specified in the header. This part may consist of mnemonics (strings) or numerical values.

When multiple parameters are needed, a comma "," is used to separate respective parameters.

The number of parameters and the configuration depend on the command. For details on the data format, see the description of relevant command.

4.1.2 Multi-commands

Multiple message units can be assembled to configure one message.

Respective message units are separated and connected with a semicolon ";".

(Example)

:INPA:ATT   ON ; :INPB:ATT   ON

———————————— Message unit

———————————— Message unit separator

———————————— Message unit
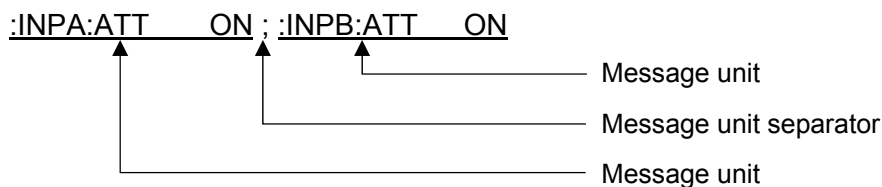
The device-specific commands for this instrument are a hierarchical command called "compound command program header". For example, the parent command INPA can be combined with subcommands such as ATT, COUP, and LPF to build a header (e.g., :INPA:LPF or :INPA:COUP). When the message units, each of which has a header composed of a common parent command, are combined to build one message, the parent command may be omitted on the second and following message units.

(Example)

:INPA:LPF ON;:INPA:ATT ON;:INPA:COUP DC

The above message can be written in the following format.

:INPA:LPF ON;ATT ON;COUP DC

(If the parent command is omitted, care should be taken so that the colon (:) is not put in the header part.)

This function specifies the parent command INPA as the header path.

The header path designation is valid only within the message (until the delimiter). In the next message, the parent command of the start message unit is specified as a header path. Therefore, if the colon (:) for the first character of the header part is omitted at the top of the message, the message is determined as parent command.

(Example)

"INPA:LPF ON" is interrupted as it equals ":INPA:LPF ON".

If ":INPA:LPF ON; ATT OFF" is sent as one message, it is interrupted correctly.

However, ":INPA:LPF ON; ATT OFF" is sent with it separated into ":INPA:LPF ON" and "ATT OFF", it is determined as an error.

(This instrument does not have the ATT parent command.)

If the message is started with a colon (:), this command is determined as a parent command.

The header path is also updated and this command becomes a new header path.

(Example)

:INPA:LPF ON;<u>ATT ON</u>;:INPB:LPF ON;<u>ATT ON</u>

         ↑   ↑

  The header path is INPA.   The header path is INPB.

This instrument does not search for the command along with the command tree. Therefore, if the message units with different parent commands are determined as one message, a colon (:) is put at the top of the message unit that needs to change the header path.

(Example)

:INPA:LPF ON;<u>ATT ON</u>;:INPB:LPF ON;<u>ATT ON</u>

               ↑

     This part cannot be omitted.

The above header path rules do not apply to the common commands (∗WAI, ∗OPC, etc.) defined in IEEE488.2.

The common commands are executed with the header path omitted. However, the header path destination is not broken and the previous header path is valid when interpreting the next message unit after the common command.

(Example)

:INPA:LPF ON;∗WAI;<u>ATT ON</u>;COUP DC

The header path is INPA.

The common command ∗WAI is executed correctly.
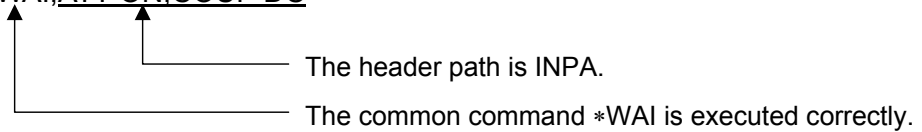
4.1.3 Query

A message whose header ends with a question mark "?" is called a query. The query is a command used to inquire settings and measurement results. Upon reception of a query, this instrument creates a response message and stores it in the output queue.

When (a part of) the response message remains in the output queue and a new message is received, the current contents of the output queue are cleared, causing a query error (service request event).

Depending on the type of query, the created response message, in which multiple message units are connected by a semicolon (;).

For details of response message format, see the description of relevant query.

4.1.4 Mnemonic

The header mnemonic is formed from ASCII codes for A to Z, 0 to 9, and an underscore (_).

ASCII's A - Z characters are not case-sensitive. In other words, there is no distinction between uppercase and lowercase letters, as they are interpreted in the same way.

Almost all mnemonics are composed of three or four characters, and express the abbreviation of the function name.

In this instrument, the response message unit created corresponding to the query is composed of only data part without header.

The mnemonic of the data part of the response message that the instrument sends is always upper-case.

4.1.5 Data format

a. <Character Program Data> / <Character Response Data>

As with header mnemonics, <Character Program Data> and <Character Response Data> are data are formed from a combination of ASCII codes for A to Z, 0 to 9, and an underscore (_).

    :INPA:LPF ON;:INPA:COUP DC

In this example, ON and DC, which are the parameters for the :INPA:LPF command and the :INPA:COUP command respectively, serve as the <Character Program Data>.

As with the header mnemonic, the ASCII codes used in <Character Program Data> are not case-sensitive and abbreviation is available.

This instrument always creates uppercase character response data for the <Response Message>.

b.   <Numeric Program Data> / <Numeric Response Data>

Numerical data can be formatted as an integer (NR1), real number (NR2), or exponent (NR3). If the message is described in the form of ":INPA:TLEV:VAL 50E-3", "50E-3" corresponds to the numeric program data. The following numerical values are all interpreted as identical values.

        0.05 = 50E-3=5e-2=5E-2=50e-3

In addition, the suffix showing physical unit "V" or "m" is divided into two parts: one is the unit itself (e.g., V (volts) or Hz (hertz)); and the other is the multiplier for the unit, i.e., m (milli) or k (kilo).

This instrument does not support the suffix.

Note: NR3 range

NR3 is a numeric value in the range of $\pm$(12-digit numeric value + decimal point)E$\pm$99.

If NR3 is outside this range, an execution error occurs and the value is discarded.

NR3-format errors are command errors.

Because the numeric value ranges differ for each command, see the command descriptions.

The <Numeric Program Data> received by this instrument can have any of the formats listed below.
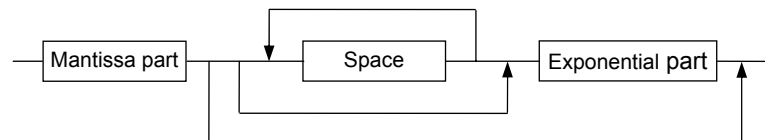
The format of the mantissa part is shown below.
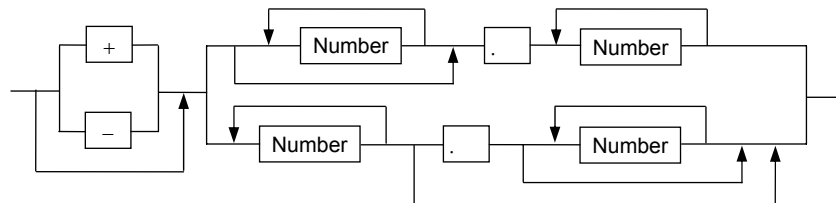
The format of the exponential part is shown below.

```
 ┌───┐              ┌─────┐     ┌───┐          ┌────────┐
─┤ E ├──────────┬──┤Blank├──┬──┤ + ├──┬────────┤ Number ├──
 ├───┤          └──────────┘  ├───┤  │        └────────┘
 │ e │                        │ − │
 └───┘                        └───┘
```
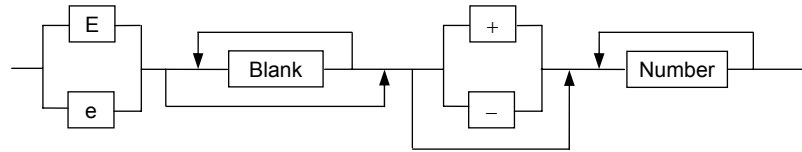
Remarks: Space or blank in the above format includes <white space> defined in IEEE488.2.

<Numeric Response Data> sent by this instrument can have any of the formats listed below.

NR1 (Integer) type

```
 ┌───┐   ┌────────┐    ┌────────┐
─┤ + ├───┤ Number ├─┬──┤ Number ├──┬──
 ├───┤   └────────┘ │  └────────┘  │
 │ − │              └──────────────┘
 └───┘
```

NR2 (Real number) type

```
 ┌───┐   ┌────────┐  ┌─┐  ┌────────┐   ┌────────┐
─┤ + ├─┬─┤ Number ├──┤.├──┤ Number ├─┬─┤ Number ├─┬──
 ├───┤ │ └────────┘  └─┘  └────────┘ │ └────────┘ │
 │ − │ │                             └────────────┘
 └───┘
```

NR3 (Exponent) type

```
 ┌───┐   ┌────────┐  ┌─┐  ┌────────┐   ┌────────┐      ┌───┐   ┌────────┐
─┤ + ├─┬─┤ Number ├──┤.├──┤ Number ├─┬─┤ Number ├─┬─ E ┤ + ├─┬─┤ Number ├──
 ├───┤ │ └────────┘  └─┘  └────────┘ │ └────────┘ │   ├───┤ │ └────────┘
 │ − │ │                             └────────────┘   │ − │ │
 └───┘ └───────────────────────────────────────────┘  └───┘
```
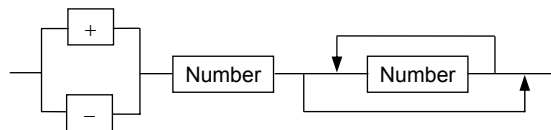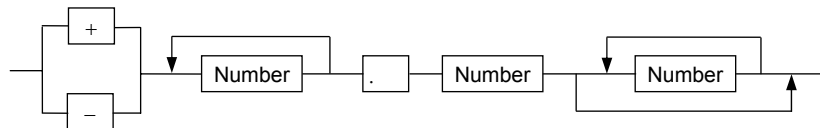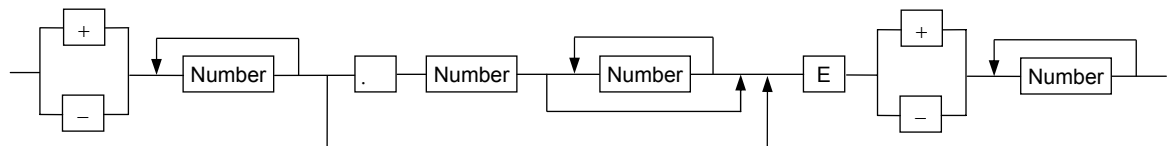
c. <Desired ASCII response data>

This data is response data created by this instrument composed of text characters including ASCII characters not allowed in <Character response data> and Numeric value response data.

If a new query message unit exits between the query returning <Desired ASCII response data> and delimiter, the response is not created for such query and this state is determined as a query error.

4.2   Status report structure

4.2.1   Service Requests (SRQ)

If an operation is completed or an error occurs, this instrument outputs a service request using a GP-IB interface (i.e., it sets the SRQ line to "L").

While only one SRQ line, which is wired-OR connection, is used on the bus line for the service request, this instrument has multiple service request events. To identify the cause of the service request, the controller must execute a serial poll or read the internal status register of this instrument.

When using a serial interface, the service request or serial polling cannot be used. Therefore, it is necessary to make a program that the controller reads the status register inside the instrument when necessary.

4.2.2   Status Byte Register

This register allows serial polling via the GP-IB system bus or a readout using a ∗STB? query.

This register is the last stage of the hierarchical status information on this instrument.

This register consists of 8 bits; these bits have the following contents.

(Bit 7)	This instrument does not use bit 7 of the status byte register. Bit 7 is always set to 0.
RQS (bit 6)	When serial polling is executed, a message is returned as bit 6 of the status byte of serial poll response. A message is generated when other bits in the status byte register (ESB, MAV,..., MEV) are masked by the service request enable register, and consequently, the logical sum of all bits is changed from 0 to 1. RQS is cleared when the logical sum described above is changed from 0 to 1, the power is turned on, or serial polling is executed.
MSS (bit 6)	A message is returned as bit 6 of the ˌSTB? query response. MSS connects the logical sum of all bits when other bits in the status byte register (ESB, MAV,..., MEV) are masked by the service request enable register.
ESB (bit 5)	A message is returned as bit 5 of the serial poll or ˌSTB? query response. This is a summary message connected to the logical sum when the standard event status register is masked by standard event status register.
MAV (bit 4)	A message is returned as bit 4 of the serial poll or ˌSTB? query response. This is a summary message connected to the output queue.
(Bit 3)	This instrument does not use bit 3 of the status byte register. Bit 3 is always set to 0.
(Bit 2)	This instrument does not use bit 2 of the status byte register. Bit 2 is always set to 0.

| (Bit 1) | This instrument does not use bit 1 of the status byte register. Bit 1 is always set to 0. |
| MEV (bit 0) | A message is returned as bit 0 of the serial poll or STB? query response. This is a summary message connected to the measurement event status register. |

4.2.3   Service Request Enable Register (SRE)

The service request enable register masks the status byte register. A message is returned to the RQS or MSS bit, depending on the result of masking. (Consequently, this register masks the SRQ output of GP-IB.)

The mask pattern is can be set using the ∗SRE command and read using the ∗SRE? query.

Whether or not the contents of this register are cleared (to 0) as the power is turned on is set using the ∗PSC command.

This does not directly affect the GP-IB device clear message and the ∗CLS command.

4.2.4   Standard Event Status Register

This register can be read using the ∗ESR? query. After the contents of this register are masked by the standard event status enable register, the logical sum of all bits is connected to the ESB bit of the status byte register.

The contents of this register are cleared (that is, set to 0) when the register is read using the ∗CLS command or ∗ESR? query.

This register consists of 8 bits, and each bit has the following contents.

PON (bit 7)	After the power is turned on, this bit is set to 1.
(Bit 6)	This instrument does not use bit 6. Bit 6 is always set to 0.
CME (bit 5)	If a command error occurs, this bit is set to 1. This indication shows that some error exists in the command syntax.
EXE (bit 4)	If an execution error occurs, this bit is set to 1. This indication shows that the command cannot be executed or could not be completely normally.
DDE (bit 3)	If a device-specific error occurs, this bit is set to 1. This is a summary message of the DDER register.
QYE (bit 2)	If a query error occurs, this bit is set to 1. This indication shows that an error occurs when the controller attempts to read the message from this instrument without sending the query command, or the next message is sent before the response message has not been completely read.
(Bit 1)	This instrument does not use bit 1. Bit 1 is always set to 0.
OPC (bit 0)	When the operation is completed, this bit is set to 1. This bit supports the ∗OPC-command-based controller-device synchronization.

4.2.5   Standard Event Status Enable Register

The standard event status enable register masks the standard event status register. A message is returned to the ESB bit of the status byte register, depending on the results of masking.

The mask pattern can be set using the ∗ESE command and read using an ∗ESE? query.

Whether or not the contents of this register are cleared (to 0) as the power is turned on is set using the ∗PSC command.

This does not directly affect the GP-IB device clear message and the ∗CLS command.

4.2.6   Output Queue

The output queue is an output buffer in which the response message to the controller is stored.

Appropriate response messages are stored in the output queue, depending on the type of query.

The MAV bit of the status byte register is set to 1 so long as data of one byte or greater exists in the output queue.

The contents of this output queue are cleared (that is, set to 0) when the power is turned on or the device clear command is executed. When the output queue is not empty and a new program message is sent before the controller reads all the data bytes, a query error occurs and the contents of the output queue are also cleared.

When using a serial interface, the serial polling cannot be used. As a result, the MAV bit cannot be utilized efficiently. (As the MAV bit status is read using the ∗STB? query, the contents of the previous queue are already sent.)

Additionally, this instrument uses the full-duplex communication. Therefore, the instrument receives the program message even though the output queue is not empty (data sending). As a result, the query error is not given.

4.2.7   Device specific error occurrence event register (DDER)

This register is an event register used to report the detailed information on DDE.

(Bit 15-12)	This instrument does not use bit 15 – 12 (upper 4-bit) of the DDER register. These bits are normally set at "0"
SFE (Bit 11)	Shows that the framing error occurs in the serial interface.
SOE (Bit 10)	Shows that the overrun error occurs in the serial interface.
(Bit 9)	This instrument does not use bit 9 of the DDER register. This bit is normally set at "0".
CKE (Bit 8)	Shows that an error occurs when the reference clock is set at EXT (reserved).
BCZ (Bit 7)	Shows that the calculation constant B = 0 or C = 0 error occurs.

HLE (Bit 6)   Shows that the comparator upper or lower limit value setup error (H < L) occurs.

(Bit 5 - 4)   This instrument does not use bit 5 - 4 of the DDER register. These bits are normally set at "0".

OVM (Bit 3)   Shows that the scaling calculation result overscaling occurs.

FCE (Bit 2)   Shows that the Freq C measurement burst error occurs.

NOS (Bit 1)   Shows that the "No Signal" or "Too Fast" error occurs.

OVS (Bit 0)   Shows that the measurement result counter value overflow occurs.

It is possible to obtain the current contents of the device specific error occurrence event status register using the DDER? query.

When the contents of the event status register are read, they are then cleared.

Query syntax

DDER?

Response message   <status>

<status> is a numeric value ranging from "0" to "3535" in the <NR1 numeric value response data> format that the value of each bit in the device specific error occurrence event status register is weighted by exponentiation of "2".

4.2.8   Device specific error occurrence event enable register (DDEE)

This register is used to mask the device specific error occurrence event status register.

According to the masked results, the DDE bit of the standard event status register is set.

It is possible to set the mask pattern using the :DDEE command and to read it using the :DDEE? query.

Whether or not the contents of this register are cleared (set to 0) as the power is turned on is set using the *PSC command.

This setting is not affected by the device clear nor *CLS command.

The :DDEE command is used to set each bit of the device specific error occurrence event status enable register.

It is possible to obtain the current contents of the device specific error occurrence event status enable register using the :DDEE? query.

Command syntax

:DDEE <mask_arg>

<mask_arg> is a parameter necessary to set the device specific error occurrence event status enable register and is a numeric value ranging from "0" to "65535" in the <numeric value program data> format. If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

One meaning is assigned to each bit of the device specific error occurrence event status enable register. When a bit corresponding to the enable register is set to "1", relevant event becomes enabled (this affects the DDE bit of the standard event status register). On the contrary, when a bit is set to "0", relevant event becomes disabled (this does not affect the DDE bit).

Query syntax

:DDEE?

Response message   <mask>

<mask> is a numeric value ranging from "0" to "3535" in the <NR1 numeric value response data> format that the setting of each bit in the device specific error occurrence event status enable register is weighted by exponentiation of "2".

4.2.9　Measurement event status register

This register is an event register used to report the measurement end and comparator result.

Logical OR of all bits of the result that the contents of this register are masked by the measurement event status enable register may affect the MEV bits of the status byte register.

This register uses only upper 3 bits and lower 2 bits. Other bits are always determined as "0".

The query corresponding to this register is ":MESR?".

The contents of this register are cleared (set to 0) when the power is turned on.

Lout (Bit 7)　　This bit is set to "1" if the measurement result is smaller than the lower limit value when the comparator calculation is specified.

Hout (Bit 6)　　This bit is set to "1" if the measurement result is larger than the upper limit value when the comparator calculation is specified.

GO (Bit 5)　　This bit is set to "1" if the measurement result is in a range between the upper and lower limit values when the comparator calculation is specified.

(Bit 4)　　This bit is not used in this instrument and is normally "0".

(Bit 3)　　This bit is not used in this instrument and is normally "0".

(Bit 2)　　This bit is not used in this instrument and is normally "0".

SNE (Bit 1)　　This bit is set to "1" if the number of measurement cycles reaches the set value when the statistic calculation is specified.

SDR (Bit 0)　　This bit is set to "1" if the measurement is completed.

It is possible to obtain the current contents of the measurement event status register using the :MESR? query.

When the contents of the event status register are read, they are then cleared.

Query syntax

:MESR?

Response message　　<status>

<status> is a numeric value ranging from "0" to "227" in the <NR1 numeric value response data> format that the value of each bit in the measurement event status register is weighted by exponentiation of "2".

4.2.10 Measurement event status enable register

This register is used to mask the measurement event status register.

According to the masked results, the MEV bit of the status byte register is set.

It is possible to set the mask pattern using the :MESE command and to read it using the :MESE? query.

Whether or not the contents of this register are cleared (set to 0) as the power is turned on is set using the ∗PSC command.

This setting is not affected by the device clear nor ∗CLS command.

Command syntax

:MESE <mask_arg>

<mask_arg> is a parameter necessary to set the measurement event status enable register and is a numeric value ranging from "0" to "255" in the <numeric value program data> format.
If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

One meaning is assigned to each bit of the measurement event status register. When a bit corresponding to the enable register is set to "1", relevant event becomes enabled (this affects the status byte register). On the contrary, when a bit is set to "0", relevant event becomes disabled (this does not affect the status byte).

Query syntax

:MESE?

Response message   <mask>

<mask> is a numeric value ranging from "0" to "227" in the <NR1 numeric value response data> format that the setting of each bit in the measurement event status enable register is weighted by exponentiation of "2".

Status byte

Not used

Standard event status

This reflects the output queue

This reflects the measurement event register

Not used

Not used

Not used

This is read by the serial pole

0	RQS / MSS	ESB	MAV	0	0	0	MEV

Status byte register

This is read by *STB? query

X	X			X	X	X	

Service request enable register
This is set by *SRE command and read by *SRE? query

OR

Standard event status

Power ON

Command error

Execution error

Unit specific error

Query error

Not used

Operation completion

Not used

PON	0	CME	EXE	DDE	QYE	0	OPC

Standard event status register
This is read by *ESR? query.

	X					X	

Standard event status enable register
This is set by *ESE command and read by *ESE? query.

OR

To ESB bit of the status byte register

Measurement event status

Comparator result = L-OUT
Comparator result = H-OUT
Comparator result = GO
The number of statistic calculations reaches the specified value
Not used
Not used   Not used
Measurement completion

Lout	Hout	GO	0	0	0	SNE	SDR

Measurement event status register
This is read by MESR? query

			X	X	X		

Measurement event status enable register
This is set by MESE command
This is read by MESE? query

OR

The MEV bit of the status byte register

DDE event register

RS framing error
RS overrun error
Reference clock EXT error
B or C setting zero
Comparator H < L setting
Scaling calculation over
FreqC burst measurement error
No signal/Too fast
Measurement result over-scale

Not used
Not used
Not used

0	0	0	0	SFE	SOE	0	CKE	BCZ	HLE	0	0	OVM	FCE	NOS	OVS

This is read by DDER?

X	X	X	X			X				X	X				

This is set by DDEE
This is read by DDEE?

OR

To DDE bit of the standard event status register

4.3   Common commands

This section describes the commands defined in the IEEE Std. 488.2 standard, which are built-into this instrument.

4.3.1   *IDN? query (Identification Number)

The instrument can be recognized through the system interface using the ∗IDN? query.

Query syntax

∗IDN?

Response message   IWATSU,\<model_number\>,0,\<software_revision\>\<NL\>

The response is composed of four fields separated by a comma. Each field has the following meaning.

Field 1	Manufacturer name	IWATSU
Field 2	Model name	SC-7207H, SC-7206H, or SC-7205H
Field 3	Serial number	Always set at 0. This instrument does not support this field.
Field 4	Firmware level	ASCII numeric value (unsigned \<NR2\>)

Remarks

The response data uses four fields to form the \<Desired ASCII response data\> format. Therefore, the ∗IDN? query must be the last query in \<program message\>.

If this rule is violated, the query error is given and the response message corresponding to the queries after the ∗IDN? query are not created and sent.

4.3.2 *RST command (Reset)

When this instrument receives the ∗RST command, it initializes the internal setup to its default values made before shipment from the factory.

At this time, however, the settings about the RS-232 and GP-IB interfaces are not changed.

Command syntax

∗RST

Remarks

If this command is performed during TOT measurement, the instrument enters the HOLD mode.

4.3.3 ∗TST? query (Test)

When this instrument receives the ∗TST? query, it starts the internal test and stores the response in the output queue showing whether or not the test is completed without error.

Query syntax

∗TST?

Response message   <result>

<result> shows the test results in the <NR1 numeric value response data> format.

If the test is passed, the response message becomes "0".

If the test error occurs, the response message becomes "−330".

Remarks

The simple ROM test is performed.

If the reference clock for counting (Ref-Clock) is set at EXT (external), it is checked whether or not the clock, which is input externally, is within the specified range.

If the external clock is outside the specified range, a test error occurs. At the same time, if the setting for automatically changing the internal reference clock is AUT, the setting for the reference clock for counting is changed to internal (INT). If the setting for automatically changing the internal reference clock is MAN, the error is displayed until the external clock enters the specified range.

If the reference clock for counting is set to INT, only a ROM SUM check is performed.

4.3.4 ∗OPC/OPC? command/query (Operation Complete)

When this instrument receives the ∗OPC command, it sets the operation completion message (OPC bit) of the standard event status register to "1" after the operation of the devices, which are specified by commands and queries sent before this command, has been completed.

When this instrument receives the ∗OPC? query, it stores the ASCII character "1" into the output queue instead of setting of the OPC bit (the ASCII character "1" is not set in the standard event status register).

Command syntax

∗OPC

Query syntax

∗OPC?

Response message   1

The response message is "1" in the <NR1 numeric value response data> format.

4.3.5 *WAI command (Wait)

When this instrument receives the *WAI command, it holds the execution of subsequent commands and queries until the operation of the devices, which are specified by commands and queries sent before this command, has been completed.

Command syntax

*WAI

4.3.6   ∗CLS command (Clear Status)

The ∗CLS command clears both the standard event status register and device specific event register of this instrument. Additionally, this command clears the summery bit in the status byte register influenced by the contents of these registers and queues.

Command syntax

∗CLS

4.3.7 *ESE/ESE? command/query (Event Status Enable)

The *ESE command is used to set each bit of the standard event status enable register.

It is possible to obtain the current contents of the standard event status enable register using the *ESE? query.

Command syntax

*ESE <mask_arg>

<mask_arg> is a parameter to set the standard event status enable register and is a numeric value ranging from "0" to "255" in the <numeric value program data> format. If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

One meaning is assigned to each bit of the standard event status register. When a bit corresponding to the enable register is set to "1", relevant event becomes enabled (this affects the status byte register). On the contrary, when a bit is set to "0", relevant event becomes disabled (this does not affect the status byte).
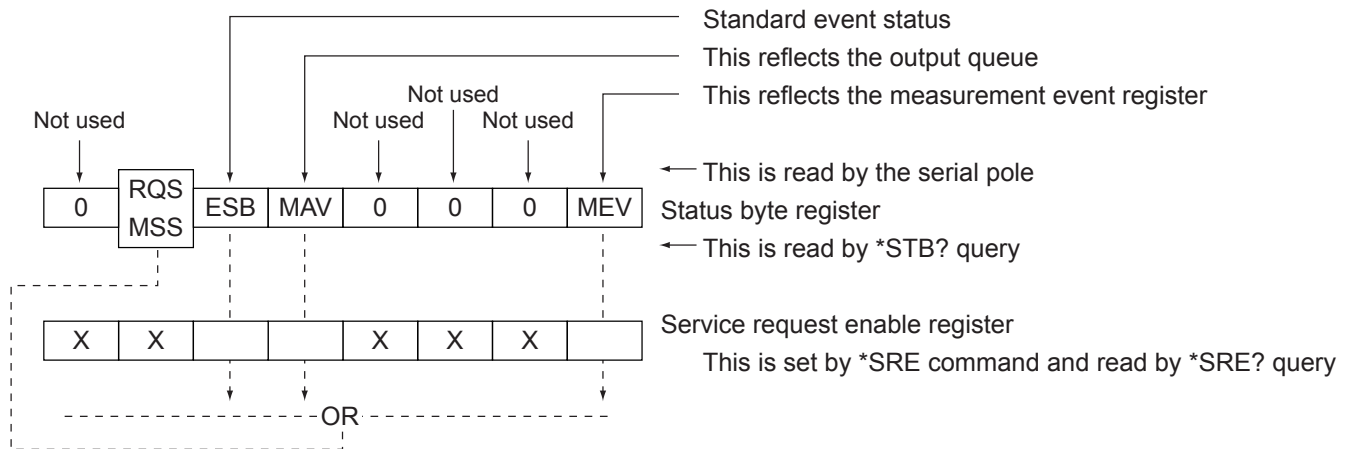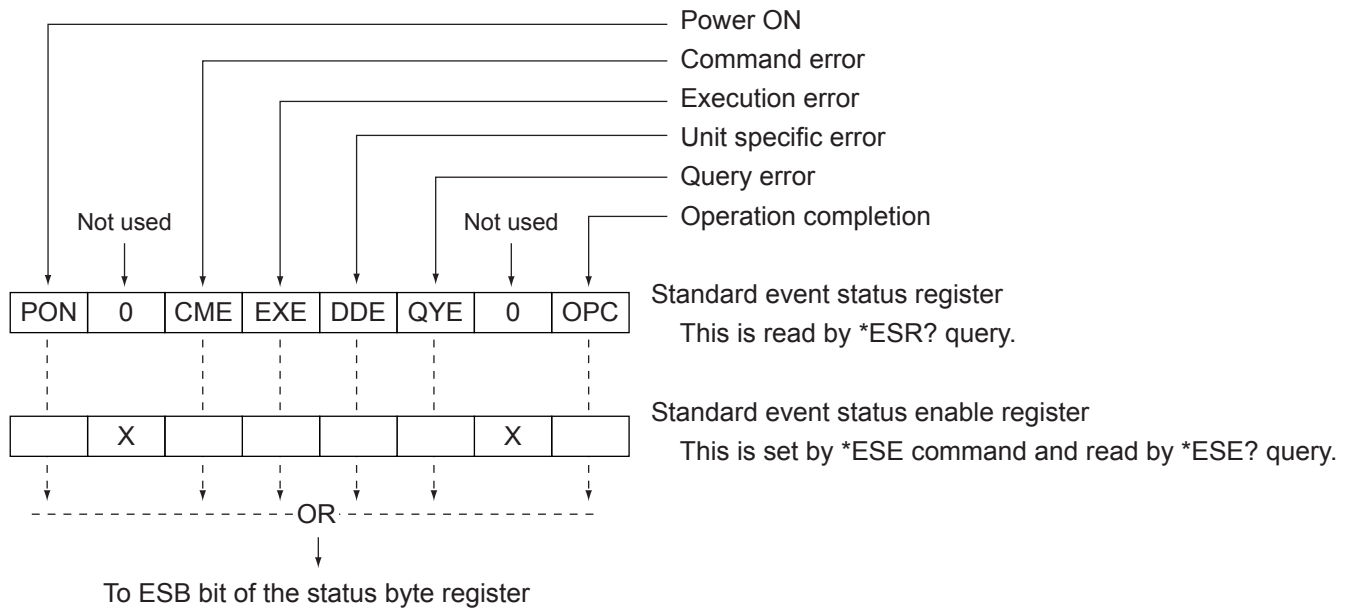
Query syntax

*ESE?

Response message   <mask>

<mask> is a numeric value ranging from "0" to "189" in the <NR1 numeric value response data> format that the setting of each bit in the standard event status enable register is weighted by exponentiation of "2".
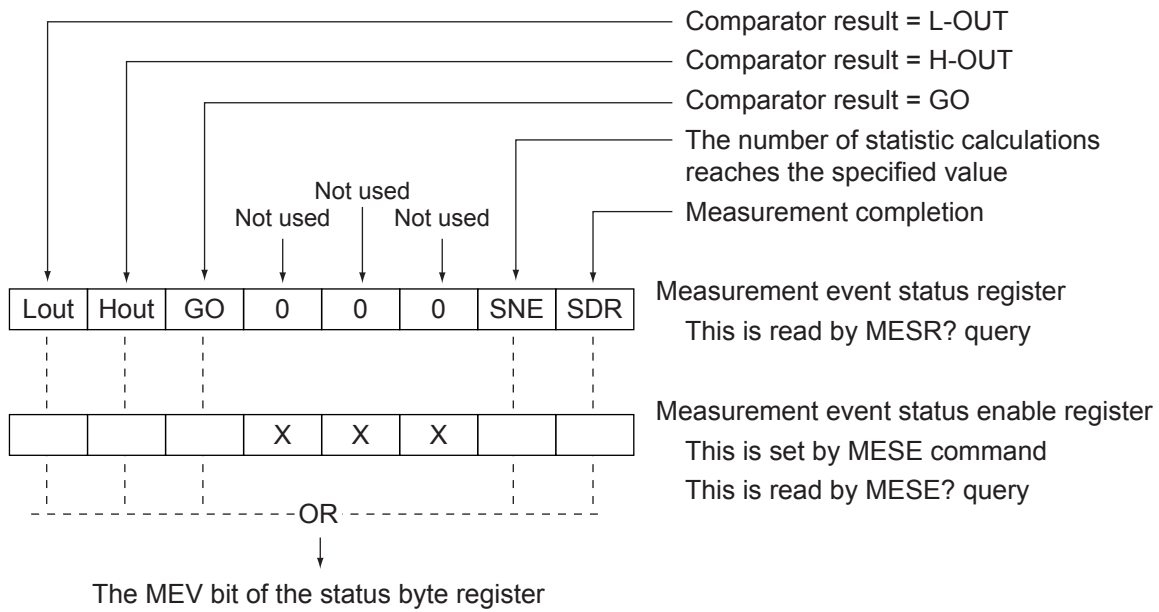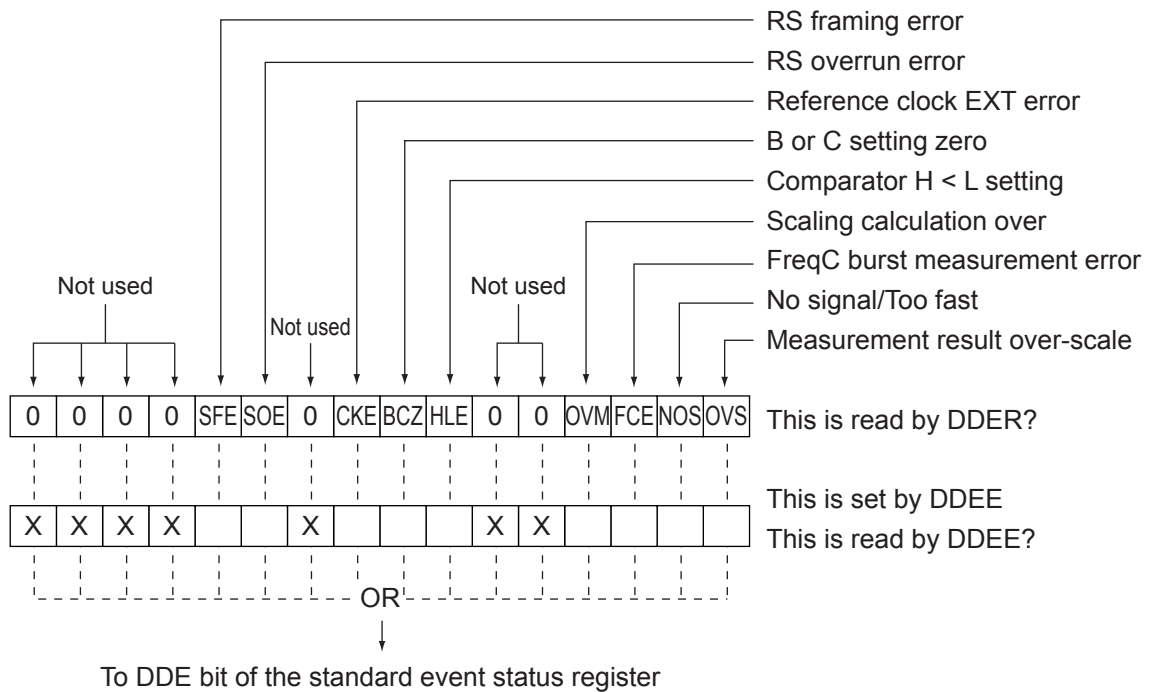
Remarks   Structure of standard event status enable register

Bit	Weighting	Meaning
7	128	PON-Power ON
6	64	(URQ)-Not used in this instrument.
5	32	CME-Command error
4	16	EXE-Execution error
3	8	DDE-Device specific error
2	4	QYE-Query error
1	2	(RQC)-Not used in this instrument.
0	1	OPC-Operation complete

This instrument does not use bit 2 and 6. Therefore, even though all bits of this register are set at "1", the maximum value of the response message becomes 189 (=255 − 64 − 2).

4.3.8 ∗ESR? Query (Event Status Register)

It is possible to obtain the current contents of the standard event status register using the ∗ESR? query.

When the contents of the event status register are read, they are then cleared.

Query syntax

∗ESR?

Response message   <status>

<status> is a numeric value ranging from "0" to "189" in the <NR1 numeric value response data> format that the value of each bit in the standard event status register is weighted by exponentiation of "2".

Remarks   Structure of standard event status register

Bit	Weighting	Meaning
7	128	PON-Power ON
6	64	(URQ)-Not used in this instrument.
5	32	CME-Command error
4	16	EXE-Execution error
3	8	DDE-Device specific error
2	4	QYE-Query error
1	2	(RQC)-Not used in this instrument.
0	1	OPC-Operation complete

This instrument does not use bit 2 and 6. Therefore, even though all bits of this register are set at "1", the maximum value of the response message becomes 189 (=255 − 64 − 2).

4.3.9 ∗PSC/∗PSC? command/query (Power on Status Code)

The ∗PSC command controls the automatic clear of the service request enable register, standard event status enable register, and hardware-specific event enable register groups at power on.

The values set by the ∗PSC command can be obtained using the ∗PSC? query. If the value of the response data is "0", the status of each enable register is retained even while the power is off. If the value of the response data is "1", this shows that each of above enable registers is cleared when the power is turned on again.

Command syntax

∗PSC <psc_flag_arg>

<psc_flag_arg> is a parameter for setting of the power on status clear flag and is a numeric value ranging "−32767" to "+32767" in the <numeric value program data> format.

When <psc_flag_arg> is set at "0", the status of each enable register is retained even while the power is turned off.

When <psc_flag_arg> is set at "1" (value other than "0"), each enable register is cleared when the power is turned on again.

Query syntax

∗PSC?

Response message   <psc_flag>

<psc_flag> is a numeric value showing the contents of the power on status clear flag and is normally "0" or "1" in the <NR1 numeric value response data> format.

4.3.10 *SRE/SRE? command/query (Service Request Enable)

The *SRE command is used to set each bit of the service request enable register.

It is possible to obtain the current contents of the service request enable register using the *SRE? query.

Command syntax

*SRE <mask_arg>

<mask_arg> is a parameter to set the service request enable register and is a numeric value ranging from "0" to "255" in the <numeric value program data> format.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

One meaning is assigned to each bit of the service request enable register. When a bit corresponding to the enable register is set to "1", relevant event becomes enabled (this causes the service request to occur). On the contrary, when a bit is set to "0", relevant event becomes disabled (this does not cause the service request to occur).

Query syntax

*SRE?

Response message   <mask>

<mask> is a numeric value ranging from "0" to "49" in the <NR1 numeric value response data> format that the setting of each bit in the service request enable register is weighted by exponentiation of "2".

Remarks   Structure of service request enable register

Bit	Weighting	Meaning
7	128	XXX-Since this instrument does not use this bit, the bit is always set at "0".
6	64	RQS/MSS-Request service/message summery status
5	32	ESB-Event status
4	16	MAV-Message available
3	8	XXX-Since this instrument does not use this bit, the bit is always set at "0".
2	4	XXX-Since this instrument does not use this bit, the bit is always set at "0".
1	2	XXX-Since this instrument does not use this bit, the bit is always set at "0".
0	1	MEV-Measurement event status

The response data is created assuming that bit 6 is always "0" regardless of the designation of the *SRE command parameter. However, note that this bit is always determined as enable during actual operation.

Since the instrument does not use bits 2-4 and 7, and the response of bit 6 is "0", the maximum value of the response message becomes 49 (=32 + 16 + 1) even though all bits of this register are set at "1".

4.3.11 STB? Query (Status Byte)

The status byte and master summery status bit (MSS message) can be read using the ∗STB? query.

Query syntax

∗STB?

Response message   <status>

<status> is a numeric value ranging from "0" to "113" in the <NR1 numeric value response data> format that the value of each bit in the status byte register is weighted by exponentiation of "2".

Remarks   Structure of status byte register

Bit	Weighting	Meaning
7	128	XXX-Since this instrument does not use this bit, the bit is always set at "0".
6	64	RQS/MSS-Request service/message summery status
5	32	ESB-Event status
4	16	MAV-Message available
3	8	XXX-Since this instrument does not use this bit, the bit is always set at "0".
2	4	XXX-Since this instrument does not use this bit, the bit is always set at "0".
1	2	XXX-Since this instrument does not use this bit, the bit is always set at "0".
0	1	MEV-Measurement event status

This instrument does not use bit 2 to 4 and 7. Therefore, even though all bits of this register are set at "1", the maximum value of the response message becomes 113 (= 64 + 32 + 16 + 1).

When the contents of the status byte register are read using the ∗STB? query, the MSS message is used for bit 6 instead of RQS in conformity with the IEEE488.2 standard. Other bits become the same values read by the serial polling.

The MSS message is obtained by logical OR of all bits except for bit 6 after the contents of the status byte register are masked (logical AND) according to the contents of the service request enable register.

The RQS message is basically retained in the status byte register until the serial polling is performed. On the contrary, the MSS message affects the internal status of the device at real-time.

4.3.12 ∗TRG command (Trigger)

When this instrument receives the ∗TRG command, it starts the measurement.

Command syntax

∗TRG

Remarks

If the measurement function is set at TOT A, this command functions as counter reset command.

4.3.13 ∗RCL command (Recall)

The setup file saved in the internal memory of this instrument can be recalled using the ∗RCL <register_number_arg> command.

Command syntax

∗RCL <register_number_arg>

<register_number_arg> is used to specify a parameter for setting of the file No. to be recalled and is a numeric value ranging from "0" to "9" in the <numeric value program data> format.

If the numeric value is outside the range, it is discarded and an execution error occurs.

A numeric value corresponding to the register No. to be selected for the save/recall operation of the local operation is specified.

Remarks

If <register_number_arg> is omitted, the command error is given.

If an integer value that <register_number_arg> is rounded is 10 or more, the execution error is given and the recall operation is not performed.

4.3.14 SAV command (SAV)

The setup information is saved into the internal memory of this instrument using the ∗SAV <register_number_arg> command.

Command syntax

∗SAV <register_number_arg>

<register_number_arg> is used to specify a parameter for setting of the file No. to be saved and is a numeric value ranging from "0" to "9" in the <numeric value program data> format.

If the numeric value is outside the range, it is discarded and an execution error occurs.

A numeric value corresponding to the register No. to be selected for the save/recall operation of the local operation is specified.

Remarks

If <register_number_arg> is omitted, the command error is given and the save operation is not executed.

If an integer value that <register_number_arg> is rounded is 10 or more, the execution error is given and the save operation is not performed.

4.4 Hardware-specific commands

This chapter describes the hardware specific commands built-into this instrument. The hardware-specific commands about the status report are described in section 4.2 and common commands built-into this instrument is described in section 4.3.

4.4.1 INPA/INPB/INPC related commands/queries

When ":INPA:<item>……" is specified, it is possible to make various settings for CH-A. The actual setting items are set by the header of the <item> part.

Accordingly, when ":INPB:<item>……" or ":INPC:<item>……" is specified, it is possible to make various settings for CH-B or CH-C.

Command syntax

:INPA:<item>……

:INPB:<item>……

:INPC:<item>……

Remarks

If the header specifying CH not installed in this instrument is received, the command error is given.

The INPA header is valid for all models, SC-7205H, SC-7206H, and SC-7207H.

The INPB header is valid only for SC-7205H and SC-7207H.

The INPC header is valid only for SC-7206H and SC-7207H.

4.4.1.1 COUP/COUP? command/query

The input coupling (AC/DC) of CH-A or CH-B can be switched using the :INPA:COUP <mode_arg> or :INPB:COUP <mode_arg> command.

The current input coupling set status of CH-A or CH-B can be read using the :INPA:COUP? or :INPB:COUP? query.

Command syntax

:INPA:COUP <mode_arg>

:INPB:COUP <mode_arg>

<mode_arg> is a parameter for setting of the input coupling (AC/DC) and is a mnemonic in the <character program data> format.

Either AC or DC is set.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:COUP?

:INPB:COUP?

Response message   <mode>

<mode> is a mnemonic in the <character response data> format and shows the current input coupling.

The response message is either AC or DC.

Remarks

CH-C does not support the input coupling switching function. If the preceding header part or header path is INPC, the command error is given.

4.4.1.2 LPF/LPF? command/query

The low-pass filter ON/OFF setting of CH-A or CH-B can be switched using the :INPA:LPF <mode_arg> or :INPB:LPF <mode_arg> command.

The current low-pass filter ON/OFF setting of CH-A or CH-B can be read using the :INPA:LPF? or :INPB:LPF? query.

Command syntax

:INPA:LPF <mode_arg>

:INPB:LPF <mode_arg>

<mode_arg> is a parameter for setting of the filter ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:LPF?

:INPB:LPF?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

CH-C is not equipped with a low-pass filter. If the preceding header part or header path is INPC, the command error is given.

4.4.1.3 ATT/ATT? command/query

The attenuator ON/OFF setting of CH-A or CH-B can be switched using the :INPA:ATT <mode_arg> or :INPB:ATT <mode_arg> command.

The current attenuator ON/OFF setting of CH-A or CH-B can be read using the :INPA:ATT? or :INPB:ATT? query.

Command syntax

:INPA:ATT <mode_arg>

:INPB:ATT <mode_arg>

<mode_arg> is a parameter for setting of the attenuator ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

If ATT ON/OFF is switched, this may affect the trigger level setting.

If ATT is switched from ON to OFF, the voltage value of the trigger level is 20 times larger than the original level (x20).

If ATT is switched from OFF to ON, the voltage value of the trigger level is 20 times smaller than the original level (1/20).

(The operation is the same as the local operation.)

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:ATT?

:INPB:ATT?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

CH-C is not equipped with an attenuator. If the preceding header part or header path is INPC, the command error is given.

4.4.1.4 SLOP/SLOP? command/query

The setting of the trigger slope (POS/NEG) of CH-A or CH-B can be switched using the :INPA:SLOP <slope_arg> or :INPB:SLOP <slope_arg> command.

The current trigger slope set status of CH-A or CH-B can be read using the :INPA:SLOP? or :INPB:SLOP? query.

Command syntax

:INPA:SLOP <slope_arg>

:INPB:SLOP <slope_arg>

<mode_arg> is a parameter for setting of the slope (POS/NEG) and is a mnemonic in the <character program data> format.

Either POS or NEG is set.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:SLOP?

:INPB:SLOP?

Response message   <slope>

<slope> is a mnemonic in the <character response data> format and shows the current setting of the trigger slope.

The response message is either POS or NEG.

Remarks

CH-C does not support the trigger slope setting function. If the preceding header part or header path is INPC, the command error is given.

4.4.1.5 TLEV sub-system

When ":INPA:TLEV: <tlev_item>……" is specified, it is possible to set the trigger level for CH-A. The actual setting items are set by the header of the <tlev_item> part.

Accordingly, when ":INPB:TLEV: <tlev_item>……" is specified, it is possible to set the trigger level for CH-B.

Command syntax

:INPA:TLEV <tlev_item>……

:INPB:TLEV <tlev_item>……

Remarks

CH-C does not support the trigger level related setting functions. If the preceding header part or header path is INPC, the command error is given.

4.4.1.5.1   AUTO/AUTO? command/query

ON/OFF setting of the trigger level setting auto mode of CH-A or CH-B can be switched using the :INPA:TLEV:AUTO <mode_arg> or :INPB:TLEV:AUTO <mode_arg> command.

The current trigger level setting auto mode ON/OFF setting of CH-A or CH-B can be read using the :INPA:TLEV:AUTO? or :INPB:TLEV:AUTO? query.

Command syntax

:INPA:TLEV:AUTO <mode_arg>

:INPB:TLEV:AUTO <mode_arg>

<mode_arg> is a parameter for setting of the trigger level setting auto mode ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:TLEV:AUTO?

:INPB:TLEV:AUTO?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

If the preceding header part or header path is INPC:TLEV, the command error is given.

4.4.1.5.2 VAL/VAL? command/query

It is possible to set the trigger level for CH-A or CH-B using the :INPA:TLEV:VAL <trig_level_arg> or :INPB:TLEV:VAL<trig_level_arg> command.

It is also possible to read the current trigger level using the :INPA:TLEV:VAL? or :INPB:TLEV:VAL? query.

Command syntax

:INPA:TLEV:VAL <trig_level_arg>

:INPB:TLEV:VAL <trig_level_arg>

<trig_level_arg> is a parameter for setting of the trigger level in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 3-digit mantissa part rounded to that in the NR3 format (value at 4th digit is cut off).

The numeric value is evaluated assuming that the unit is V. However, the suffix character is not accepted.

The following shows the effective setting range.

ATT = OFF: -2.50 - $+2.50$ (V)
ATT = ON: -50.0 - $+50.0$ (V)

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

When the trigger level setting is in the AUTO mode, the trigger level values are set internally and the execution error is given with AUTO = ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPA:TLEV:VAL?

:INPB:TLEV:VAL?

Response message   <trig_level>

<trig_level> is a numeric value in the <NR2 numeric value response data> format and shows the current trigger level set value.

The numeric value is sent assuming that the unit is "V". However, the suffix is not sent.

If the trigger level setting is in the AUTO mode, "9.91E+37" is returned as a response and the execution error is given.

If the preceding header part or header path is INPC:TLEV, the command error is given.

4.4.1.6 SINH/SINH? command/query

The stop inhibit time of CH-B can be set using the :INPB:SINH <stop_inhibit_arg> command.

The current stop inhibit set time of CH-B can be read using the :INPB:SINH? query.

Command syntax

:INPB:SINH <stop_inhibit_arg>

<stop_inhibit_arg> is a parameter for setting of the stop inhibit time in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 3-digit mantissa part rounded to that in the NR3 format (value at 4th digit is cut off).

The numeric value is evaluated assuming that the unit is s (sec.). However, the unit character is not accepted.

The effective setting range is "0" - "+25.5E-3" (sec.).

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPB:SINH?

Response message   <stop_inh_time>

<stop_inh_time> is a numeric value in the <NR3 numeric value response data> format and shows the current stop inhibit time set value.

The numeric value is sent assuming that the unit is "s". However, the suffix is not sent.

Remarks

If the preceding header part or header path is INPA or INPC, the command error is given.

4.4.1.7 AGC/AGC? command/query

The AGC function ON/OFF setting of CH-C can be switched using the :INPC:AGC <mode_arg> command.

The current AGC function ON/OFF setting can be read using the :INPC:AGC? query.

Command syntax

:INPC:AGC <mode_arg>

<mode_arg> is a parameter for setting of the AGC function ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPC:AGC?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

If the preceding header part or header path is INPA or INPB, the command error is given.

4.4.1.8 BURS/BURS? command/query

The burst ON/OFF setting of CH-C can be switched using the :INPC:BURS <mode_arg> command.

The current burst ON/OFF setting can be read using the :INPC:BURS? query.

Command syntax

:INPC:BURS <mode_arg>

<mode_arg> is a parameter for setting of the burst ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:INPC:BURS?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

If the preceding header part or header path is INPA or INPB, the command error is given.

When the burst mode is set at ON, the DDE error is given if the burst error occurs during execution of the FREQ C measurement.

4.4.2　FUNCTION/GATE setting commands

4.4.2.1　FUNC/FUNC? command/query

A desired measurement function is specified using the :FUNC <function_arg> command. The current measurement function can be read using the :FUNC? query.

Command syntax

:FUNC <function_arg>

<function_arg> is a parameter for setting of the measurement function and is a mnemonic in the <character program data> format.

Any of the following functions can be specified.

FINA	FREQ A measurement	
FINB	FREQ B measurement	SC-7205H and SC-7207H only
FINC	FREQ C measurement	SC-7206H and SC-7207H only
FLIN	FREQ LINE measurement	SC-7205H and SC-7207H only
PER	PERI A measurement	
DUTY	DUTY A measurement	
PWID	P. W A measurement	
TINT	T. INT A-B measurement	SC-7205H and SC-7207H only
FRAT	FREQ A/B measurement	SC-7205H and SC-7207H only
PHAS	PHAS A-B measurement	SC-7205H and SC-7207H only
TOT	TOTALIZE A measurement	
VPPA	CH-A input +pk/−pk measurement	
VPPB	CH-B input +pk/−pk measurement	SC-7205H and SC-7207H only

When the measurement function setting is changed, this may affect the measurement gate setting. In this case, the measurement gate is set after the measurement function has been specified.

If a mnemonic specifying a measurement function not installed in this instrument is received, the command error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:FUNC?

Response message   \<function\>

\<function\> is a mnemonic in the \<character response data\> format and shows the current measurement function.

The response message is any of the followings.

FINA	FREQ A measurement	
FINB	FREQ B measurement	SC-7205H and SC-7207H only
FINC	FREQ C measurement	SC-7206H and SC-7207H only
FLIN	FREQ LINE measurement	SC-7205H and SC-7207H only
PER	PERI A measurement	
DUTY	DUTY A measurement	
PWID	P. W A measurement	
TINT	T. INT A-B measurement	SC-7205H and SC-7207H only
FRAT	FREQ A/B measurement	SC-7205H and SC-7207H only
PHAS	PHAS A-B measurement	SC-7205H and SC-7207H only
TOT	TOTALIZE A measurement	
VPPA	CH-A input +pk/−pk measurement	
VPPB	CH-B input +pk/−pk measurement	SC-7205H and SC-7207H only

4.4.2.2 GATE setting sub-system

When ":GATE:<item>……" is specified, it is possible to make various settings related to the measurement gate. The actual setting items are set by the header of the <item> part.

The measurement function setting may affect (limit) the settings related to the measurement gate. When performing the settings related to the measurement gate, it is necessary to set the measurement function first.

Command syntax

:GATE:<item>……

4.4.2.2.1 TYPE/TYPE? command/query

The type of the measurement gate is specified using the :GATE:TYPE <gate_type_arg> command.

The current type of the measurement gate can be read using the :GATE:TYPE? query.

Command syntax

:GATE:TYPE <gate_type_arg>

<gate_type_arg> is a parameter for setting of the type of the measurement gate and is a mnemonic in the <character program data> format.

Any of the following functions can be specified.

INT   Internal gate

The actual gate time is specified using the TIME command.

EXT   EXT B gate is specified.

SING   SGL gate is specified.

MAN   Manual OPEN/CLOSE gate is specified.

The gate is opened or closed using the :GATE:MGAT command.

Some types may not be used depending on the measurement function.

If an unusable type is selected, the execution error is given.

If the function setting is changed, the TYPE setting becomes the initial value. The function setting has the higher priority.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

SC-7206H does not have the CH-B input. If EXT is specified in SC-7206H, the command error is given.

If EXT is specified in the measurement function (FREQ B, DUTY A, P.W A, T.INT A-B, FREQ A/B, PHAS A-B, FREQ LINE) that does not allow the EXT gate, the execution error is given.

If SING is specified in the measurement function (FREQ A/B, FREQ LINE, FREQ C, TOT A) that does not allow the SGL gate, the execution error is given.

The MAN gate is valid only in the TOA measurement function. If MAN is specified in a measurement function other than the TOA measurement function, the execution error is given.

CAUTION

If the measurement gate type is set at MAN (manual OPEN/CLOSE gate is specified) in the TOT A function measurement of the remote mode, the LED on the HOLD key on the front panel of the instrument goes off. The measurement HOLD function is invalid in the TOT A function measurement of the local mode. The HOLD key LED never lights up with the current specifications of this instrument.

Always take care of the above caution.

Query syntax

:GATE:TYPE?

Response message   <gate_type>

<gate_type> is a mnemonic in the <character response data> format and shows the current type of the measurement gate.

The response message is any of the followings.

INT   Internal gate
       The actual gate time is inquired using the :GATE:TIME? query.

EXT   EXT B gate is specified.

SING   SGL gate is specified.

MAN   Manual OPEN/CLOSE gate is specified.
       Whether the gate is OPEN or CLOSE is inquired using the :GATE:MGAT? query.

4.4.2.2.2   TIME/TIME? command/query

The gate time for the internal gate is specified using the :GATE:TIME <int_time_arg> command.

The current gate time for the internal measurement gate can be read using the :GATE:TIME? query.

Command syntax

:GATE:TIME <int_time_arg>

<int_time_arg> is a parameter for setting of the internal gate time in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 1-digit mantissa part rounded to that in the NR3 format (value at 2nd digit is cut off).

The numeric value is evaluated assuming that the unit is s (sec.). However, the unit character is not accepted.

The effective set value is any of 1ms, 10ms, 0.1s, 1s, and 10s.

If the numeric value is negative, it is discarded and an execution error occurs. Other numeric values are rounded to a specifiable value from 1 ms to 10 s.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

The TIME command can be executed only when :GATE:TYPE=INT. The execution error is given in other cases.

The internal gate time settings are lost when the type of the measurement gate is changed to that other than INT.

When changing the type of the internal gate to INT, it is necessary to set the internal gate time again.

Query syntax

:GATE:TIME?

Response message   <int_time>

<int_time> is a numeric value in the <NR3 numeric value response data> format and shows the current internal gate time set value.

The numeric value is sent assuming that the unit is "s". However, the suffix is not sent.

If :GATE:TYPE is not "INT", "9.91E+37" is sent to give the execution error.

4.4.2.2.3 MGAT/MGAT? command/query

The status of the manual gate can be specified using the :GATE:MGAT <manual_gate_arg> command.

The current status of the manual gate can be read using the :GATE:MGAT? query.

Command syntax

:GATE:MGAT <manual_gate_arg>

<manual_gate_arg> is a parameter for setting of the status of the manual gate and is a mnemonic in the <character program data> format.

Either OPEN or CLOS can be set.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

The MGAT setting is valid only when :GATE:TYPE is MAN. The execution error is given in other cases.

Query syntax

:GATE:MGAT?

Response message   <manual_gate>

<manual_gate> is a mnemonic in the <character response data> format and shows the current status of the manual gate.

The response message is either OPEN or CLOS.

Remarks

The MGAT? query is valid only when :GATE:TYPE is MAN. In other cases, CLOS is returned to give the execution error.

4.4.2.2.4   TEXT/TEXT? command/query

Whether the EXT B gate is valid or invalid can be specified using the :GATE:TEXT <total_ext_arg> command while the TOT A function has been selected.

The current status of the EXT B gate can be read using the :GATE:TEXT? query.

Command syntax

:GATE:TEXT <total_ext_arg>

<total_ext_arg> is a parameter for setting of the status of the EXT B gate while the TOT A function has been selected, and is a mnemonic in the <character program data> format.

Either ENAB or DIS can be set.

When ENAB is specified, the counting is performed while the gate signal is being input to the CH-B input.

When DIS is specified, the counting is not performed even though the gate signal is input to the CH-B input.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

The TEXT setting is valid only when :GATE:TYPE is EXT and :FUNC is TOT. The execution error is given in other cases.

Query syntax

:GATE:TEXT?

Response message   <total_ext>

<total_ext> is a mnemonic in the <character response data> format and shows the status of the EXT B gate while the TOT A function has been selected.

The response message is either ENAB or DIS.

Remarks

The TEXT? query is valid only when :GATE:TYPE is EXT and :FUNC is TOT. In other cases, DIS is returned to give the execution error.

4.4.2.2.5 CLOS/CLOS? command/query

The :GATE:CLOS <gate_close_arg> command can be used to specify how to respond if there is no signal while the gate is open.

The :GATE:CLOS? query can be used to read the current response status if there is no signal while the gate is open.

Command syntax

:GATE:CLOS <gate_close_arg>

The <gate_close_arg> parameter is used to specify the manual gate status and is a <character program data> format mnemonic.

FAST or WAIT can be specified.

The parameter is required. If the parameter is omitted, a command error occurs.

- WAIT: The system does not respond until there is an overflow.
- FAST: If measurement has not finished approximately one second after the gate time, the operation forcibly terminates.

Remarks

The :GATE:CLOS command is only valid for the SC-7205H, SC-7206H, and SC-7207H models. This command causes an error for other SC-7205, SC-7206, and SC-7207 models.

Query syntax

:GATE:CLOS?

Response message   <gate_close>

<gate_close> is a <Character Response Data> format mnemonic that indicates the current response status.

The status is FAST or WAIT.

Remarks

The :GATE:CLOS? query is only valid for the SC-7205H, SC-7206H, and SC-7207H models. This query causes an error for other SC-7205, SC-7206, and SC-7207 models.

4.4.2.2.6 TCLR/TCLR? command/query

The :GATE:TCLR <total_clr_arg> command can be used to specify whether to clear addition calculations when using the TOT A function while the gate is open.

The :GATE:TCLR? query can be used to read whether to clear addition calculations when using the TOT A function while the gate is open.

Command syntax

:GATE:TCLR <total_clr_arg>

The <total_clr_arg> parameter is used to specify whether to clear addition calculations when using the TOT A function while the gate is open and is a <Character Program Data> format mnemonic.
Specify ON in the <Character Program Data> format, OFF in the same format, or a numeric value in the <Numeric Program Data> format. If the value is 0 after rounding and conversion to an integer, it is regarded as OFF, and, if the value is not 0, it is regarded as ON.

Remarks

The :GATE:TCLR command is only valid for the SC-7205H, SC-7206H, and SC-7207H models. This command causes an error for other SC-7205, SC-7206, and SC-7207 models.

Query syntax

:GATE:TCLR?

Response message   <total_clr>

<total_clr> has the <NR1 numeric value response data> format and is the one-digit number 0 or 1. 0 means OFF (BY RES) and 1 means ON (BY GATE).

Remarks

The :GATE:TCLR? query is only valid for the SC-7205H, SC-7206H, and SC-7207H models. This query causes an error for other SC-7205, SC-7206, and SC-7207 models.

The value returned by this query corresponds to the TOT_CLR setting in the SYSTEM menu during local operations.

Note that OFF means BY RES and ON means BY GATE.

4.4.3 Calculation related setting commands

4.4.3.1 COMP setting sub-system

When ":COMP:<item>……" is specified, it is possible to make various settings related to the comparator function. The actual setting items are set by the header of the <item> part.

Command syntax

:COMP:<item>……

4.4.3.1.1 STAT/STAT? command/query

Whether the comparator function is ON or OFF is specified using the :COMP:STAT <mode_arg> command.

The current comparator ON/OFF setting can be read using the :COMP:STAT? query.

Command syntax

:COMP:STAT <mode_arg>

<mode_arg> is a parameter for setting of the comparator function ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:COMP:STAT?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

4.4.3.1.2 UPP command/query

The upper limit value for the comparator function is specified using the :COMP:UPP <upper_arg> command.

It is also possible to read the current upper limit value using the :COMP:UPP? query.

Command syntax

:COMP:UPP <upper_arg>

<upper_arg> is a parameter for setting of the upper limit value in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from −12 to +12

The valid setting range is from ±1.000000000E-12 to ±999.9999999E+12.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

Even though a value with upper limit value < lower limit value is specified, this value is set as it is.

The execution error is not reported when making the setting.

If upper limit value < lower limit value during measurement (in the COMP operation), the device specific error is reported.

Query syntax

:COMP:UPP?

Response message   <upper>

<upper> is a numeric value in the <NR3 numeric value response data> format and shows the current upper limit set value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example)   Product setting: +000.123,450,0M

Query result: +000.1234500E+6

4.4.3.1.3 LOW command/query

The lower limit value for the comparator function is specified using the :COMP:LOW <lower_arg> command.

It is also possible to read the current lower limit value using the :COMP:LOW? query.

Command syntax

:COMP:LOW <lower_arg>

<lower_arg> is a parameter for setting of the lower limit value in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from -12 to $+12$

The valid setting range is from ±1.000000000E-12 to ±999.9999999E+12.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

Even though a value with upper limit value < lower limit value is specified, this value is set as it is.

The execution error is not reported when making the setting.

If upper limit value < lower limit value during measurement (in the COMP operation), the device specific error is reported.

Query syntax

:COMP:LOW?

Response message   <lower>

<lower> is a numeric value in the <NR3 numeric value response data> format and shows the current lower limit set value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example) Product setting: +000.123,450,0M

　　　　　Query result:　　+000.1234500E+6

4.4.3.2 SCAL setting sub-system

When ":SCAL:<item>……" is specified, it is possible to make various settings related to the scaling calculation. The actual setting items are set by the header of the <item> part.

Command syntax

:SCAL:<item>……

4.4.3.2.1 TYPE command/query

The type of the scaling calculation is specified using the :SCAL:TYPE <scale_type_arg> command.

The current type of the scaling calculation can be read using the :SCAL:TYPE? query.

Command syntax

:SCAL:TYPE <scale_type_arg>

<scale_type_arg> is a parameter for setting of the type of the scaling calculation and is a mnemonic in the <character program data> format.

Any of the following functions can be specified.

SCAL   Specifies the (X-A)/B calculation.

DIFF   Specifies the X-Xref calculation.

REC   Specifies the C/X calculation.

OFF   Sets the calculation to OFF.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:SCAL:TYPE?

Response message   **<scale_type>**

<scale_type> is a mnemonic in the <character response data> format and shows the current type of the scaling calculation.

The response message is any of the followings.

SCAL   (X-A)/B calculation.

DIFF   X-Xref calculation.

REC   C/X calculation.

OFF   Calculation OFF.

4.4.3.2.2 VALA/VALA? command/query

The calculation constant A can be set using the :SCAL:VALA <value_a_arg> command.

It is also possible to read the current calculation constant A set value using the :SCAL:VALA? query.

Command syntax

:SCAL:VALA <value_a_arg>

<value_a_arg> is a parameter for setting of the calculation constant A in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from -12 to $+12$

The valid setting range is from $\pm1.000000000E\text{-}12$ to $\pm999.9999999E\text{+}12$.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

If TYPE is not SCAL, the internal setting of the constant A is performed using the specified parameters. At this time, the calculation TYPE is not changed and the execution error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:SCAL:VALA?

Response message   <value_a>

<value_a> is a numeric value in the <NR3 numeric value response data> format and shows the current calculation constant A set value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

If TYPE is not SCAL, the response message is set to "9.91E+37" and the execution error is given.

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example) Product setting: +000.123,450,0M

Query result: +000.1234500E+6

4.4.3.2.3 VALB/VALB? command/query

The calculation constant B can be set using the :SCAL:VALB <value_b_arg> command.

It is also possible to read the current calculation constant B set value using the :SCAL:VALB? query.

Command syntax

:SCAL:VALB <value_b_arg>

<value_b_arg> is a parameter for setting of the calculation constant B in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from −12 to +12

The valid setting range is from ±1.000000000E-12 to ±999.9999999E+12.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

However, if the numeric value is 0, an execution error occurs and the value is discarded.

If TYPE is not SCAL, the internal setting of the constant B is performed using the specified parameters. At this time, the calculation TYPE is not changed and the execution error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

If B is "0", the execution error is given and the set value is not changed.

Query syntax

:SCAL:VALB?

Response message   <value_b>

<value_b> is a numeric value in the <NR3 numeric value response data> format and shows the current calculation constant B set value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

If TYPE is not SCAL, the response message is set to "9.91E+37" and the execution error is given.

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example) Product setting: +000.123,450,0M

           Query result: +000.1234500E+6

4.4.3.2.4 VALC/VALC? command/query

The calculation constant C can be set using the :SCAL:VALC <value_c_arg> command.

It is also possible to read the current calculation constant C set value using the :SCAL:VALC? query.

Command syntax

:SCAL:VALC <value_c_arg>

<value_c_arg> is a parameter for setting of the calculation constant C in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from -12 to $+12$

The valid setting range is from ±1.000000000E-12 to ±999.9999999E+12.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

However, if the numeric value is 0, an execution error occurs and the value is discarded.

If TYPE is not REC, the internal setting of the constant C is performed using the specified parameters. At this time, the calculation TYPE is not changed and the execution error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

If C is "0", the execution error is given and the set value is not changed.

Query syntax

:SCAL:VALC?

Response message   <value_c>

<value_c> is a numeric value in the <NR3 numeric value response data> format and shows the current calculation constant C set value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

If TYPE is not REC, the response message is set to "9.91E+37" and the execution error is given.

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example) Product setting: +000.123,450,0M

Query result: +000.1234500E+6

4.4.3.2.5 XREF/XREF? command/query

The Xref initial value can be set using the :SCAL:XREF <xref_arg> command.

It is also possible to read the current Xref value using the :SCAL:XREF? query.

Command syntax

:SCAL:XREF <xref_arg>

<xref_arg> is a parameter for setting of the calculation Xref initial value in the <numeric value program data> format and does not support the suffix.

The mantissa and exponent of the parameter have the following NR3 format.

- Mantissa: The mantissa has 10 digits, without counting the sign and decimal point. The 11th and subsequent digits are discarded. The mantissa is rounded to an NR2 format value within 10 digits. The range for the integer is from 0 to the three-digit value 999.

- Exponent: an integer from -12 to $+12$

The valid setting range is from ±1.000000000E-12 to ±999.9999999E+12.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

If TYPE is not DIFF, the internal setting of the Xref is performed using the specified parameters. At this time, the calculation TYPE is not changed and the execution error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:SCAL:XREF?

Response message   <xref>

<xref> is a numeric value in the <NR3 numeric value response data> format.

This shows the current Xref registered value.

The suffix is not sent. The suffix multiplier (expressed by symbol, such as μ, m, k, or M) is converted into the exponential numeric value.

The suffix unit (character expressing the unit) is not sent.

Remarks

If TYPE is not DIFF, the response message is set to "9.91E+37" and the execution error is given.

Numeric values in the NR3 format that are read using calculation-related queries for this product are read without normalization as they are specified for the product, as shown below.

Example) Product setting: +000.123,450,0M
          Query result: +000.1234500E+6

4.4.3.3 STAT setting sub-system

When ":STAT:<item>……" is specified, it is possible to make various settings related to the statistic calculation. The actual setting items are set by the header of the <item> part.

Command syntax

:STAT:<item>……

4.4.3.3.1 TYPE command/query

The type of the statistic calculation is specified using the :STAT:TYPE <stat_type_arg> command.

The current type of the statistic calculation can be read using the :STAT:TYPE? query.

Command syntax

:STAT:TYPE <scat_type_arg>

<stat_type_arg> is a parameter for setting of the type of the statistic calculation and is a mnemonic in the <character program data> format.

Any of the following functions can be specified.

CONT   Specifies the continuous mode.

REP   Specifies the repeat mode.

SING   Specifies the single mode.

OFF   Sets the statistic calculation to OFF.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:STAT:TYPE?

Response message   <stat_type>

<stat_type> is a mnemonic in the <character response data> format and shows the current type of the statistic calculation.

The response message is any of the followings.

CONT   Shows the continuous mode.

REP   Shows the repeat mode.

SING   Shows the single mode.

OFF   Shows the statistic calculation OFF.

4.4.3.3.2 NUMB/NUMB? command/query

The number of statistic calculation cycles (n) can be set using the :STAT:NUMB <number_arg> command.

The current set value of the number of calculation cycles (n) can be read using the :STAT:NUMB? query.

Command syntax

:STAT:NUMB <number_arg>

<number_arg> is a parameter for setting of the number of calculation cycles in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 3-digit mantissa part rounded to that in the NR3 format (value at 4th digit is cut off).

The effective set value is any of 5, 10, 20, 50, and 100. The value is set to that most close to any of the above values.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

If the statistic calculation type is not REP or SING, the internal setting "n" is performed according to the specified parameter. However, the statistic calculation type is not changed and the execution error is given.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:STAT:NUMB?

Response message   <number>

<number> is a numeric value in the <NR1 numeric value response data> format and shows the set value of the current number of calculation cycles (n).

Remarks

If the statistic calculation type is not REP or SING, the response message is set to "0" and the execution error is given.

4.4.3.3.3 INIT command

The statistic calculation can be initialized using the :STAT:INIT command.

Command syntax

:STAT:INIT

Remarks

If the statistic calculation type is OFF, the execution error is given.

4.4.3.3.4 DISP/DISP? command/query

The type of the statistic calculation result display is specified using the :STAT:DISP <stat_disp_arg> command.

The current type of the statistic calculation result display can be read using the :STAT:DISP? query.

Command syntax

:STAT:DISP <stat_disp_arg>

<stat_disp_arg> is a parameter for setting of the type of the statistic calculation display and is a mnemonic in the <character program data> format.

Any of the following functions can be specified.

> MAX   Specifies the MAX display mode.
>
> MIN   Specifies the MIN display mode.
>
> AVER   Specifies the average value display mode.
>
> SIG   Specifies the standard deviation value display mode.
>
> OFF   Sets the statistic calculation display to OFF.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

If a value other than "OFF" is set with the statistic calculation set at OFF or if AVER or SIG is specified with the statistic calculation type set at continuous, the execution error is given.

Query syntax

:STAT:DISP?

Response message   <stat_disp>

<stat_disp> is a mnemonic in the <character response data> format and shows the current type of the statistic calculation display.

The response message is any of the followings.

> MAX   MAX display mode.
>
> MIN   MIN display mode.
>
> AVER   Average value display mode.
>
> SIG   Standard deviation value display mode.
>
> OFF   Statistic calculation display OFF.

4.4.4　System related setting commands

4.4.4.1　DISP setting sub-system

When ":DISP:<item>……" is specified, it is possible to make various settings related to the display function. The actual setting items are set by the header of the <item> part.

Command syntax

:DISP:<item>……

4.4.4.1.1 INIT/INIT? command/query

Display initialization setup.

Command syntax

DISP:INIT <mode_arg>

<mode_arg> is a parameter used to initialize the screen display when starting the measurement.

"ON" (or a numeric value other than "0") or "OFF" (or "0") is specified.

Query syntax

:DISP:INIT?

Response message   <mode>

<mode> uses <NR1 numeric value response data> format. 1-digit numeric value "0"

or "1" is specified.

"0" means OFF while "1" means ON.

4.4.4.1.2 MASK/MASK? command/query

The number of mask digits on the display can be set using the :DISP:MASK <digits_arg> command.

The current set value of the number of mask digits on the display can be read using the :DISP:MASK? query.

Command syntax

:DISP:MASK <digits_arg>

<digits_arg> is a parameter for setting of the number of mask digits in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 1-digit mantissa part rounded to that in the NR3 format (value at 2nd digit is cut off).

The effective set value is any of 0 to 9. The value is set to that most close to any of the above values.

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:DISP:MASK?

Response message   <digits>

<digits> is a numeric value in the <NR1 numeric value response data> format and shows the set value of the current number of mask digits on the display.

Remarks

The setting with the :DISP:MASK command controls only the number of mask digits on the display. This setting does not affect the number of digits of the measurement result read by the MEAS? query or the :DATA? query.

4.4.4.1.3 LOWP/LOWP? command/query

A period of time necessary to enter the low-power mode can be set using the :DISP:LOWP <time_arg> command.

The current low power mode transition time can be read using the :STAT:NUMB? query.

Command syntax

:DISP:LOWP <time_arg>

<time_arg> is a parameter for setting of the low power mode transition time in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 2-digit mantissa part rounded to that in the NR3 format (value at 3rd digit is cut off).

The effective setting range is any of the following values.

0 (OFF), 10, 20, 30, 40, 50, or 60 (minutes)

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

The suffix is not accepted. The internal setting is performed assuming that the unit is "min.".

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:DISP:LOWP?

Response message   <time>

<time> is a numeric value in the <NR1 numeric value response data> format.

This shows the current low power mode transition time.

Remarks

Once the instrument has entered the low power mode, there are no remote control methods to cancel the low power mode.

To exit the low power mode, it is necessary to press relevant key on the front panel of the instrument.

4.4.4.1.4 LOWP:IMM command

The mode is immediately changed to the low power mode using the :DISP:LOWP:IMM command.

Command syntax

:DISP:LOWP:IMM

Remarks

The execution of this command does not affect the low power mode transition time setting.

When this instrument is set in the low power mode, the time necessary to create the measurement result display data and to update the display is reduced.

The instrument is put in the low power mode if it is necessary to read out the measurement results as soon as possible.

4.4.4.1.5 SRAT/SRAT? command/query

The sample rate time can be set using the :DISP:SRAT <sample_rate_time_arg> command.

The current sample rate time setting can be read using the :DISP:SRAT? query.

Command syntax

:DISP:SRAT <sample_rate_time_arg>

<sample_rate_time_arg> is a parameter for setting of the sample rate time in the <numeric value program data> format and does not support the suffix.

The parameter is evaluated with 4-digit mantissa part rounded to that in the NR2 format (value at 5th digit is cut off).

The effective setting range is "0.0" - "200.0" (sec.).

If the numeric value is outside the range, it is rounded to the maximum or minimum value as appropriate and specified, and an execution error occurs.

The numeric value is evaluated assuming that the unit is s (sec.). However, the unit character is not accepted.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:DISP:SRAT?

Response message   <sample_rate_time>

<sample_rate_time> is a numeric value in the <NR2 numeric value response data> format and shows the current sample rate time set value.

Remarks

The sample rate time setting/inquiry can be performed using this command/query.

However, the set sample rate time has no meanings during remote operation.

This instrument basically enters the HOLD mode during remote operation and starts the measurement only when the measurement start message (∗TRG command, etc.) is received through the remote interface.

4.4.4.2 BEEP setting sub-system

When ":BEEP:<item>……" is specified, it is possible to make various settings related to the buzzer sound. The actual setting items are set by the header of the <item> part.

Command syntax

:BEEP:<item>……

4.4.4.2.1 ERR/ERR? command/query

The buzzer sound ON/OFF at the time of error occurrence can be set using the :BEEP:ERR <mode_arg> command.

The error buzzer sound ON/OFF setting can be read using the :BEEP:ERR? query.

Command syntax

:BEEP:ERR <mode_arg>

<mode_arg> is a parameter for setting of the error buzzer sound ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:BEEP:ERR?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

Remarks

This command/query is applicable to the BEEP:Caution setting of the SYSTEM menu in the local operation.

4.4.4.2.2 KEY/KEY? command/query

The key push sound ON/OFF can be set using the :BEEP:KEY <mode_arg> command.

The key push sound ON/OFF setting can be read using the :BEEP:KEY? query.

Command syntax

:BEEP:KEY <mode_arg>

<mode_arg> is a parameter for setting of the key push sound ON/OFF, and is ON or OFF in the <character program data> format or a numeric value in the <numeric value program data> format.

If an integer value that the numeric value is rounded is "0", this shows OFF. If this integer value is a value other than "0", it is determined as ON.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:BEEP:KEY?

Response message   <mode>

<mode> is a 1-digit numeric value, 0 or 1, in the <NR1 numeric value response data> format. "0" shows OFF while "1" shows ON.

4.4.4.2.3 COMP/COMP? command/query

The buzzer sound ON/OFF based on the comparator calculation result can be set using the :BEEP:COMP <mode_arg> command.

The buzzer sound of the comparator calculation result setting can be read using the :BEEP:COMP? query.

Command syntax

:BEEP:COMP <mode_arg>

<mode_arg> is a parameter for setting of the buzzer sound conditions and is GO, NOGO, or OFF in the <character program data> format.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:BEEP:COMP?

Response message   <mode>

<mode> is a parameter for setting of the buzzer sound conditions and is GO, NOGO, or OFF in the <character response data> format.

4.4.4.3 :ROSC/:ROSC? root level command/query

Whether the reference clock for counting is set to the internal clock or external clock can be specified using the ROSC <ref_osc_arg> command.

The internal/external setting of the current reference clock for counting can be read using the ROSC? query.

Command syntax

:ROSC <ref_osc_arg>

<ref_osc_arg> is a parameter to specify the reference clock to internal or external, and is INT or EXT in the <character program data> format.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Remarks

When EXT is specified, whether or not the external clock input is correct is tested using the *TST? query. If the test result is incorrect, the *TST? response becomes "-330" and the ROSC setting is changed to INT.

Additionally, the hardware-specific error is given.

Query syntax

:ROSC?

Response message   <ref_osc>

<ref_osc> is a parameter showing that the reference clock is set at internal or external, and is INT or EXT in the <character response data> format.

4.4.4.3.1 :CHEC/:CHEC? root level command/query

External reference clock function ON/OFF.

Command syntax

ROSC:CHEC <mode_arg>

<mode_arg> is a parameter used to select whether or not the external reference clock

is checked.

ON (or a numeric value other than "0") or OFF (or "0") is specified.

Remarks

If INT is specified for the reference clock, internal settings are changed when the command
is received, and an execution error occurs.

Query syntax

:ROSC:CHEC?

Response message   <mode>

<mode> uses <NR1 numeric value response data> format. 1-digit numeric value "0"

or "1" is specified.

"0" means OFF while "1" means ON.

4.4.4.3.2 :RECV/:RECV? root level command/query

Process setup if external reference clock error is detected.

Command syntax

ROSC:RECV <mode_arg>

<mode_arg> is a parameter used to select whether or not the external clock is automatically changed to the internal reference clock if the clock error is detected when selecting the external reference clock.
"AUT" or "MAN" is specified.

Remarks

If INT is specified for the reference clock, internal settings are changed when the command is received, and an execution error occurs.

Query syntax

:ROSC:RECV?

Response message   <mode>

If <mode> is AUT, the external reference clock is automatically switched to the internal reference clock, and, if <mode> is MAN, it is not.

4.4.4.4 :ROUT/:ROUT? root level command/query

Whether the output signal from the connector on the rear panel is internal reference clock or marker signal can be specified using the :ROUT <rear_out_arg> command.

The current setting of the output signal from the connector on the rear panel can be read using the :ROUT? query.

Command syntax

:ROUT <rear_out_arg>

<rear_out_arg> is a parameter for specifying of the output signal from the connector on the rear panel and is IOSC or MARK in the <character program data> format.

It is not allowed to omit the parameter. If the parameter is omitted, the command error is given.

Query syntax

:ROUT?

Response message   <rear_out>

<rear_out> is a parameter for setting of the output signal from the connector on the rear panel and is set at IOSC or MARK in the <character response data> format.

4.4.5　Measurement read related queries

4.4.5.1　:MEAS? query

Using the :MEAS? query, the measurement is started and the measurement results are read.

However, only results (results during measurement) can be read in the TOT measurement.

Query syntax

:MEAS? <meas_type>

<meas_type> is a parameter to specify the type of the measurement to be started and the measurement result to be read, and is any of the followings in the <character program data> format.

XNOW	Measurement result (calculation result if the SCALE calculation is specified.)
XREF	Measurement result (registered as Xref.)
VMXA	+pk voltage measurement result of CHA
VMNA	−pk voltage measurement result of CHA
VMXB	+pk voltage measurement result of CHB
VMNB	−pk voltage measurement result of CHB
MAX	Maximum value (statistic calculation result)
MIN	Minimum value (statistic calculation result)
AVER	Average value (statistic calculation result)
SIG	Sigma value (statistic calculation result)

Response message　<result>

<result> is a numeric value in the <NR3 numeric value response data> format and is results of the measurement (calculation) specified by the parameter.

If the overflow occurs or if <result> does not exist due to incorrect calculation related setting, the response data becomes "9.91E+37".

Remarks

If XREF is specified with the DIFF calculation set at OFF, the response message is set to "9.91E+37" and the execution error is given.

If VMXB or VMNB is specified in SC-7206H, the command error is given.

If the statistic calculation result is specified when the statistic calculation is set at OFF or if no statistic calculation results exist, the response message is set to "9.91E+37" and the execution error is given.

For the MEAS? query, the number of measurements is one. To obtain statistic calculation results if the repeat mode or single mode is specified for the type of statistic calculation, the MEAS? query must be sent once for each calculation specified to be performed.

4.4.5.2 :DATA? query

The latest measurement result can be read using the :DATA? query.

Query syntax

:DATA? <data_type>

<data_type> is a parameter to specify the measurement result to be read, and is any of the followings in the <character program data> format.

XNOW	Measurement result (calculation result if the SCALE calculation is specified.)
XREF	Measurement result (registered as Xref.)
VMXA	+pk voltage measurement result of CHA
VMNA	−pk voltage measurement result of CHA
VMXB	+pk voltage measurement result of CHB
VMNB	−pk voltage measurement result of CHB
MAX	Maximum value (statistic calculation result)
MIN	Minimum value (statistic calculation result)
AVER	Average value (statistic calculation result)
SIG	Sigma value (statistic calculation result)

Response message   <result>

<result> is a numeric value in the <NR3 numeric value response data> format and is results of the measurement (calculation) specified by the parameter.

If the overflow occurs or if <result> does not exist due to incorrect calculation related setting, the response data becomes "9.91E+37".

Remarks

The :DATA?XREF query is used to read the latest measurement result and register it as the Xref value.

The :SCAL:XREF? query is used to inquire the current Xref value.

If XREF is specified with the DIFF calculation set at OFF, the response message is set to "9.91E+37" and the execution error is given.

If VMXB or VMNB is specified in SC-7206H, the command error is given.

If the statistic calculation result is specified when the statistic calculation is set at OFF or if no statistic calculation results exist, the response message is set to "9.91E+37" and the execution error is given.

If VMXA, VMXB, VMNA, or VMNB is specified at a time other than when displaying voltage measurement results on the screen for the corresponding channel, the response message is 9.91E+37, and an execution error is reported.

4.4.6　Free-run mode setup command

4.4.6.1　FRUN/FRUN? command/query

The :FRUN <free_run_arg> command can be used to enable or disable the free-run mode.
The :FRUN? query can be used to read whether the free-run mode is enabled or disabled.
Note that free-run means repeatedly performing measurement.

Command syntax

:FRUN <free_run_arg>

The <free_run_arg> parameter is used to specify whether to set the free-run mode to ON
or OFF and is a <Character Program Data> format mnemonic.
Specify ON in the <Character Program Data> format, OFF in the same format, or a
numeric value in the <Numeric Program Data> format.
If the value is 0 after rounding and conversion to an integer, it is regarded as OFF, and, if
the value is not 0, it is regarded as ON.
Setting the free-run mode to ON or OFF performs the following operations.

OFF:　Immediately after this setting is specified, the system enters the HOLD status and
the HOLD key LED turns on.
When a measurement command (*TRG or :MEAS?) is executed, measurement is
performed once, the result is returned, and then the system returns to the HOLD
status.

ON:　Immediately after this setting is specified, the system enters the repeated
measurement status and the HOLD key LED turns off.
When a measurement command (*TRG or :MEAS?) is executed, measurement is
performed once, the result is returned, and then the system returns to the repeated
measurement status.

The parameter is required. If the parameter is omitted, a command error occurs.

Remarks

The :FRUN command is only valid for the SC-7205H, SC-7206H, and SC-7207H models.
This command causes an error for other SC-7205, SC-7206, and SC-7207 models.

Query syntax

:FRUN?

Response message　　<free_run>

<free_run> has the <NR1 numeric value response data> format and is the one-digit
number 0 or 1.

0 is OFF and 1 is ON.

Remarks

The :FRUN? query is only valid for the SC-7205H, SC-7206H, and SC-7207H models. This
query causes an error for other SC-7205, SC-7206, and SC-7207 models.

SC-7207H/ SC-7206H/ SC-7207H

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