WT1600FC

Impedance Meter Communication Interface

USER'S MANUAL

YOKOGAWA
Yokogawa Electric Corporation

IM 760151-17E
1st Edition

Thank you for purchasing the YOKOGAWA WT1600FC Impedance Meter.
This Communication Interface User's Manual describes the functions of the GP-IB, serial, and Ethernet interfaces and commands. To ensure correct use, please read this manual thoroughly before beginning operation.
After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.
The following two manuals, including this one, are provided as manuals for the WT1600FC. Read them along with this manual.

Manual Title	Manual No.	Description
WT1600FC Impedance Meter User's Manual	IM 760151-01E	Explains all functions and procedures of the WT1600FC excluding the communication functions.
WT1600FC Impedance Meter Communication Interface User's Manual	IM 760151-17E	This CD-R. Explains the communication functions of the GP-IB, serial, and Ethernet interfaces.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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Revisions

- 1st Edition: July, 2003

1st Edition: July 2003

How to Use This Manual

Structure of the Manual

This User's Manual consists of the following sections:

Chapter 1 GP-IB Interface
Describes the functions and specifications of the GP-IB interface.

Chapter 2 Serial Interface
Describes the functions and specifications of the serial interface.

Chapter 3 Ethernet Interface
Describes the functions and specifications of the Ethernet interface.

Chapter 4 Before Programming
Describes the syntax used to transmit commands.

Chapter 5 Using Communication Commands
Describes all the commands one by one.

Chapter 6 Status Reports
Describes the status byte, various registers, queues, and other information.

Chapter 7 Sample Program
Introduces a sample program written in Visual Basic using a Windows PC (the GP-IB board that is used is AT-GPIB/TNT IEEE-488.2 by National Instruments).

Appendix
Describes reference material such as an ASCII character code table.

Index
Index of contents.

Conventions Used in This Manual

Symbols Used for Notes and Keys

Type	Symbol	Description
Unit	k K	1000 Example: 100 kHz 1024 Example: 459 KB (file data size)
Note	***Note***	Calls attention to information that is important for proper operation of the instrument.
Key	**Communication**	Refers to a soft key displayed on the screen.

Symbols Used in the Syntax Descriptions

Symbols which are used in the syntax descriptions in Chapter 5 are shown below. These symbols are referred to as BNF (Backus-Naur Form) symbols. For details on the data, see pages 4-5 and 4-6.

Symbol	Description	Example	Example of Input
<>	Defined value	ELEMent<x> <x>=1 to 5	->ELEMENT2
{} |	One of the options in {} is selected. Exclusive OR	HCOPy:{TIFF|BMP}?	->HCOPy:TIFF?
[]	Can be omitted	CURSor[:TYPE]	->CURSor

Contents

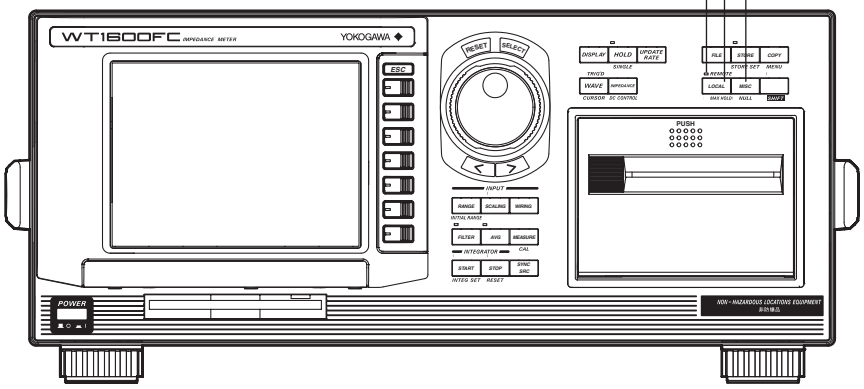
1.1 Names of the Parts and Their Functions

Front Panel

MISC key
Press this key to enter communication settings.

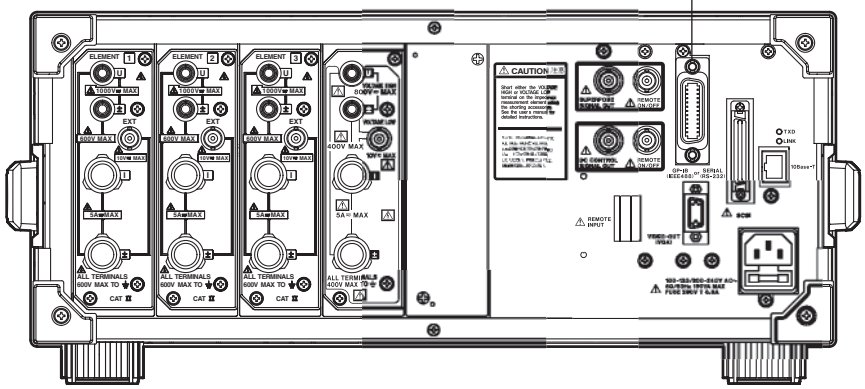
LOCAL key
Press this key to switch from remote mode to local mode so as to enable key operation.

REMOTE indicator
Lit while remote mode is active via communications.



Rear Panel

GP-IB connector
Used to connect a controller (personal computer etc.) using a GP-IB cable.
For information on how to connect the GP-IB cable, refer to the following page.
(selected at the time of purchase)



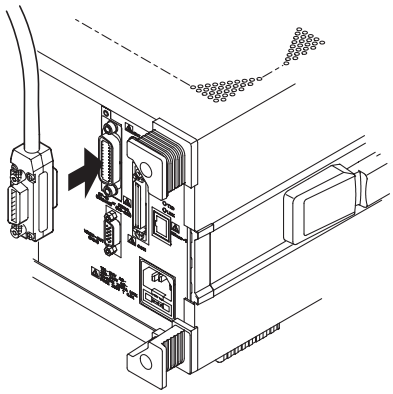
1.2 Connecting the GP-IB Cable

GP-IB Cable

The GP-IB connector on the side panel of the WT1600FC is a 24-pin connector that conforms to IEEE Standard 488-1978. Use a GP-IB cable that also conforms to IEEE Standard 488-1978.

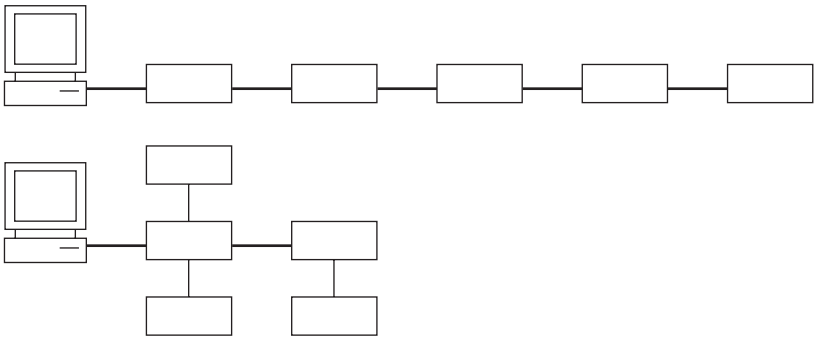
Connection Method

Connect the GP-IB cable as shown below.



Connection Precautions

- Be sure to tighten the screws on the GP-IB cable connector firmly.
- The instrument can be connected to more than one item of equipment (e.g. a personal computer) if more than one GP-IB cable is used. However, it is not possible to connect more than 15 items of equipment (including the controller) to a single bus.
- If you connect the instrument to more than one item of equipment, make sure that a different address is used for each item.
- Each connecting cable must be 2 m or less in length.
- The total length of all the cables must not exceed 20 m.
- While communications are in progress, more than two-thirds of the connected equipment items must be turned ON.
- When connecting more than one item of equipment, connect them so that the connection route forms a star or linear configuration. Loop or parallel wiring is not allowed.



CAUTION

Be sure to switch off power to both your PC and the oscilloscope before connecting or disconnecting cables. Failure to switch power off may cause internal circuit failure or improper operation.

1.3 GP-IB Interface Functions

GP-IB Interface Functions

Listener function

- Allows you to make the settings which you can make using the panel keys on the instrument, except for the power ON/OFF and GP-IB communications settings.
- Receives commands from a controller requesting output of set-up and waveform data.
  Also receives status report commands.

Talker function

- Outputs set-up and waveform data.

Note

The talk-only, listen-only and controller functions are not available on this instrument.

Switching between Remote and Local Modes

When switched from Local to Remote Mode

Remote mode is activated when a REN (Remote Enable) message is received from a controller while local mode is active.

- REMOTE is displayed on.
- All front panel keys except the LOCAL can no longer be operated any more.
- Settings entered in local mode are retained.

When switched from Remote to Local Mode

Pressing the LOCAL in remote mode puts the instrument in local mode. However, this is not possible if Local Lockout has been set by the controller (page 1-6).

- The REMOTE indicator is turned off.
- All front panel keys are operative.
- Settings entered in remote mode are retained.

1.4 GP-IB Interface Specifications

GP-IB Interface Specifications

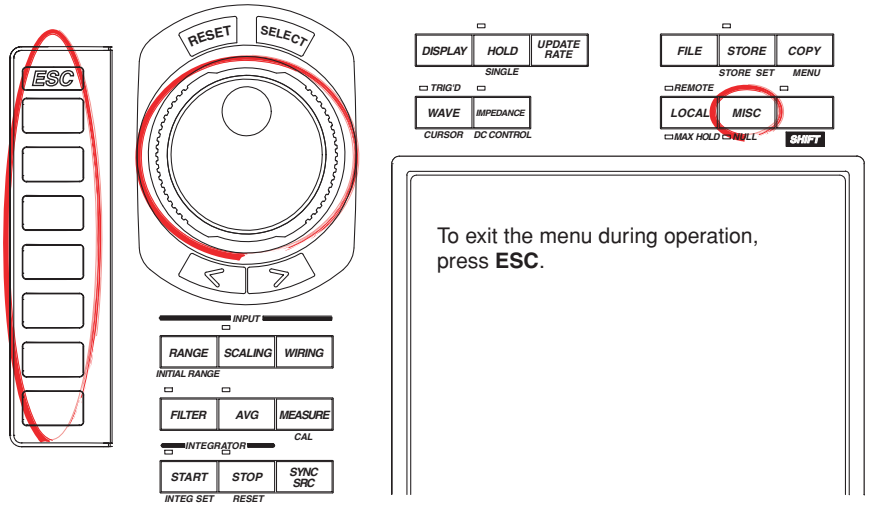
Electrical and mechanical specifications : Conforms to IEEE Standard 488-1978.
Interface functions : Refer to the table below.
Protocol : Conforms to IEEE Standard 488.2-1987.
Code : ISO (ASCII) code
Mode : Addressable mode
Address setting : Addresses 0 to 30 can be selected from the GP-IB setting screen, displayed when you press the MISC.
Remote mode clear : Remote mode can be cleared by pressing the LOCAL. However, this is not possible if Local Lockout has been set by the controller.

Interface functions

Function	Subset Name	Description
Source handshaking	SH1	Full source handshaking capability
Acceptor handshaking	AH1	Full acceptor handshaking capability
Talker	T6	Basic talker capability, serial polling, untalk on MLA (My Listen Address), no talk-only capability
Listener	L4	Basic listener capability, unlisten on MTA (My Talk Address), no listen-only capability
Service request	SR1	Full service request capability
Remote local	RL1	Full remote/local capability
Parallel poll	PP0	No parallel polling capability
Device clear	DC1	Full device clear capability
Device trigger	DT1	Device trigger capability
Controller	C0	No controller function
Electrical characteristic	E1	Open collector

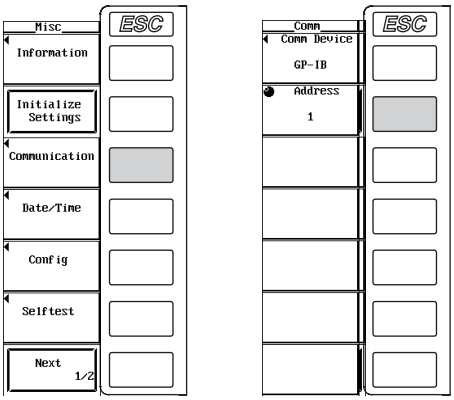
1.5 Setting the Address

Keys



Procedure

1. Press **MISC** to display the Misc menu.
2. Press the **Communication** soft key.
3. Press the **Comm Device** soft key to display the GP-IB menu.
4. Turn the **jog shuttle** to set the address.



Explanation

Carry out the following settings when using a controller to set information that can be specified through key operation on the WT1600FC or when outputting setting parameters or output waveform display data to the controller.

Setting the Address

Set the address of the WT1600FC within the following range for the addressable mode.
0 to 30

Each device that can be connected via GP-IB has a unique address within the GP-IB system. This address is used to distinguish the device from others. Therefore, when you connect the WT1600FC to a PC, for example, make sure to assign a unique address to the WT1600FC.

Note

Do not change the address while the controller or other devices are using the GP-IB system.

1.6 Response to Interface Messages

Response to Interface Messages

Response to a uni-line message

IFC (Interface Clear)

Clears the talker and listener. Stops output if data is being output.

REN (Remote Enable)

Switches between remote and local modes.

IDY (Identify) is not supported.

Response to a multi-line message (address command)

GTL (Go To Local)

Switches to local mode.

SDC (Selected Device Clear)

Clears the program message (command) which is currently being output. Also clears the output queue (page 6-5).
*OPC and *OPC? will be disabled if they are currently being executed.
*WAI and COMMunicate:WAIT will be stopped immediately.

GET (Group Execute Trigger)

Operates in the sameway as the TRG command.

PPC (Parallel Poll Configure) and TCT (Take Control) are not supported

Response to a multi-line message (universal command)

LLO (Local Lockout)

Invalidates the LOCAL on the front panel to disable switching to local mode.

DCL (Device Clear)

Same as SDC

SPE (Serial Poll Enable)

Sets the talker function to serial poll mode for all equipment connected to the communications bus. The controller performs polling on equipment sequentially.

SPD (Serial Poll Disable)

Clears serial poll mode as the talker function for all equipment connected to the communications bus.

PPU (Parallel Poll Unconfigure) is not supported.

What is an Interface Message?

An interface message is also called an interface command or bus command, and is issued by the controller. Interface messages are classified as follows.

Uni-line messages

Messages are transferred through a single control line. The following three types of uni-line message are available.
IFC (Interface Clear)
REN (Remote Enable)
IDY (Identify)

Multi-line message

Eight data lines are used to transmit a message. Multi-line messages are classified as follows.

Address commands

Valid when the equipment is designated as a listener or a talker. The following five address commands are available.

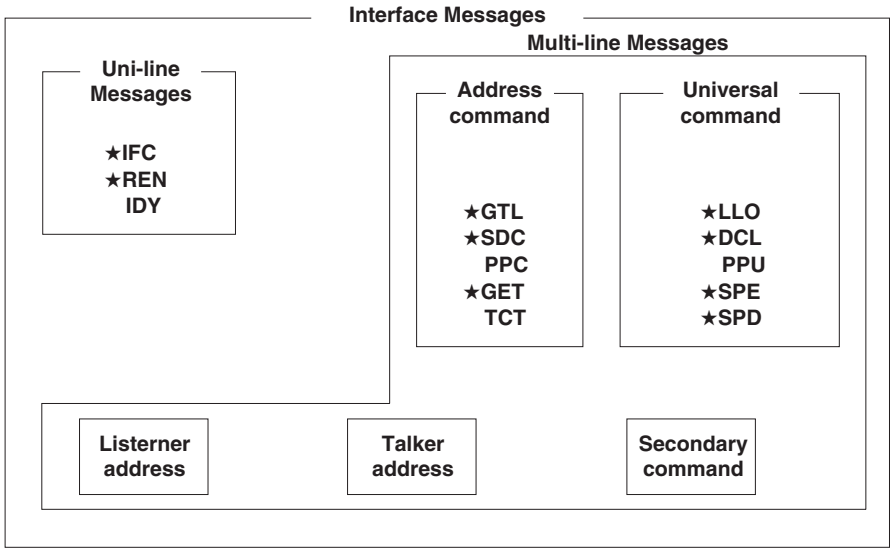
Commands valid for equipment designated as a listener
GTL (Go To Local)
SDC (Selected Device Clear)
PPC (Parallel Poll Configure)
GET (Group Execute Trigger)

Command valid for equipment designated as a talker
TCT (Take Control)

Universal commands

Valid for any item of equipment, irrespective of whether the item is designated as a listener or a talker. The following five universal commands are available.
LLO (Local Lockout)
DCL (Device Clear)
PPU(Parallel Poll Unconfigure)
SPE (Serial Poll Enable)
SPD (Serial Poll Disable)

In addition to the above commands, a listener address, talker address on secondary command can be sent in an interface message.



Messages marked with a "★" are interface messages supported by the WT1600FC

Note

Differences between SDC and DCL
The SDC command is an address command and requires that both the talker and listener be designated; however DCL is a universal command and does not require that the talker and listener be designated. Therefore, SDC is used for particular items of equipment, while DCL can be used for any equipment connected to the communications bus.

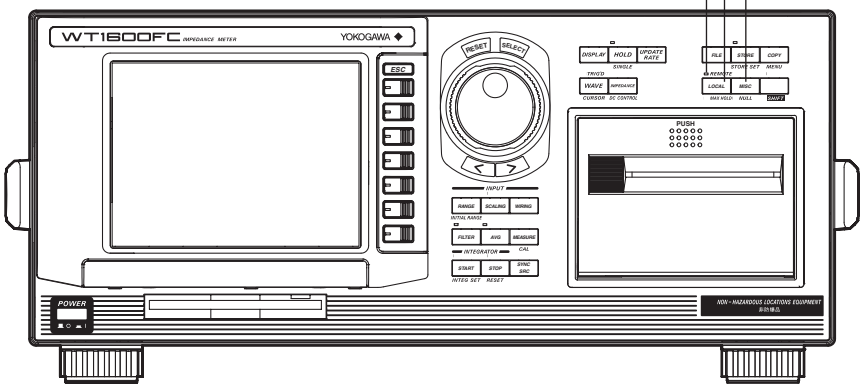
2.1 Names of the Parts and Their Functions

Front Panel

MISC key
Press this key to enter communication settings.

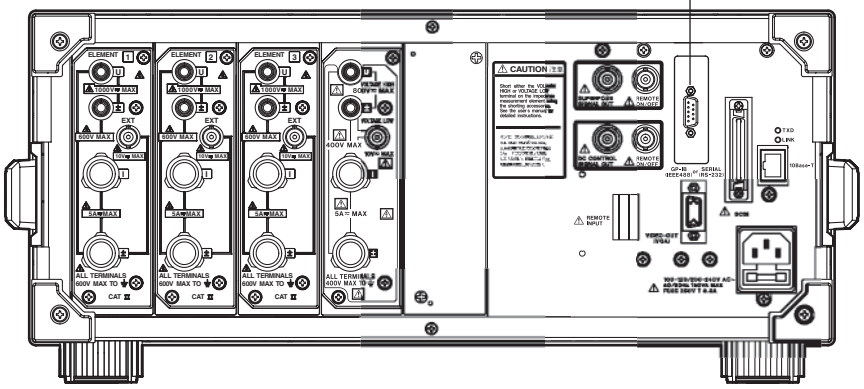
LOCAL key
Press this key to switch from remote mode to local mode so as to enable key operation.

REMOTE indicator
Lit while remote mode is active via communications.



Rear Panel

Serial (RS-232) connector
Complies with EIA-574 Standard (EIA-232 (RS-232) Standard for 9 pin)
Used to connect a controller (personal computer etc.) using a serial cable.
(selected at the time of purchase)



2.2 Serial Interface Functions and Specifications

Receiving Function

It is possible to make the same settings via the serial interface as can be made using the front panel keys.
Measured/computed data, panel set-up information and error codes can be received.

Sending Function

Measured/computed data can be output.
Panel set-up information and the status byte can be output.
Error codes which have occurred can be output.

Serial Interface Specifications

Electrical characteristics	: Complies with EIA-574 Standard (EIA-232 (RS-232) Standard for 9 pin)
Connection	: Point-to-point
Communications	: Full-duplex
Synchronization	: Start-stop system
Baud rate	: 1200, 2400, 4800, 9600, 19200
Start bit	: 1 bit (fixed)
Data Length	: 7 or 8 bits
Parity	: Even, odd or no parity
Stop Bit	: 1 or 2 bits
Connector	: DELC-J9PAF-13L6 (JAE or equivalent)
Hardware handshaking	: User can select whether CA or CB signals will always be True, or will be used for control.
Software Handshaking	: User can select whether to control only transmission or both transmission and reception using X-on and X-off signals. X-on (ASCII 11H) X-off (ASCII 13H)
Receive	: 256 bytes

Switching between Remote and Local Modes

When switched from Local to Remote Mode

Remote mode is activated when the "COMMunicate:REMote ON" command is received form a controller while local mode is active.

- REMOTE is displayed on.
- All front panel keys except the LOCAL can no longer be operated any more.
- Settings entered in local mode are retained.

When switched from Remote to Local Mode

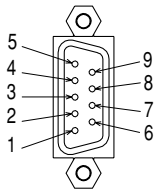
Pressing the LOCAL in remote mode puts the instrument in local mode. However, this is not possible of Local Lockout (when the "COMMunicate:LOCKout ON" command is received) has been set by the controller (page 1-6).
Local mode is activated when the "COMMunicate:REMote OFF" command regardless of Local Lockout.

- The REMOTE indicator is turned off.
- All front panel keys are operative.
- Settings entered in remote mode are retained.

2.3 Connecting the Serial Interface Cable

When connecting this instrument to a computer, make sure that the handshaking method, data transmission rate and data format selected for the instrument match those selected for the computer.
For details, refer to the following pages. Also make sure that the correct interface cable is used.

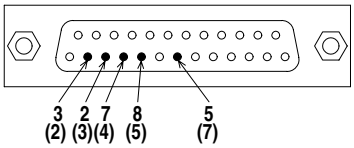
Connector and Signal Names



2. RD (Received Data) : Data received from personal computer
   Signal direction...Input
3. SD (Send Data) : Data transmitted to a personal computer
   Signal direction...Output
5. SG (Signal Ground) : Ground for signals
7. RS (Request to Send) : Signal used for handshaking when receiving data from a personal computer
   Signal direction...Output
8. CS (Clear to Send) : Signal used for handshaking when transmitting data to a personal computer
   Signal direction...Input

Pin Nos. 1, 4, 6 and 9 are not used.

9-25 Pin Connector



The number between brackets refer to the pin Nos. of the 25-pin connector.

Signal Direction

The figure below shows the direction of the signals used by the Serial interface.

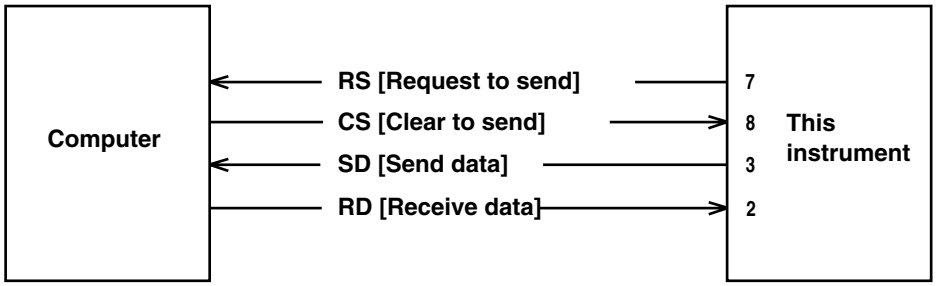


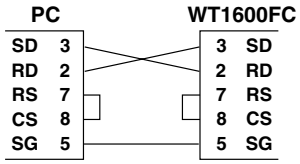
Table of Serial Standard Signals and their

Pin No. (9-pin connector)	Abbreviation			Description
	Serial (RS-232)	CCITT	JIS	
5	AB (GND)	102	SG	Signal ground
3	BA (TXD)	103	SD	Transmitted data
2	BB (RXD)	104	RD	Received data
7	CA (RTS)	105	RS	Request to send
8	CB (CTS)	106	CS	Clear to send

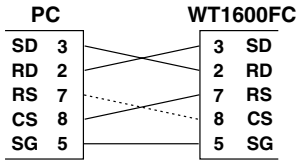
Signal line connection example

The pin numbers shown are that of 9-pin connectors.
In general, use a cross cable.

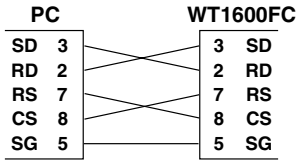
• OFF-OFF / XON-XON



• XON-RTS(XON-RS)



• CTS-RTS(CS-RS)



2.4 Handshaking

To use an serial interface for transferring data between this instrument and a computer, it is necessary to use certain procedures by mutual agreement to ensure the proper transfer of data. These procedures are called “handshaking.” Various handshaking systems are available depending on the computer to be used; the same handshaking system must be used for both the computer and this instrument.
This instrument allows you to choose any handshaking mode from the following four modes.

Handshake format Descriptions→○

Handshake Method		Data Sending Control (control method when sending data to a computer)			Data Receiving Control (control method when receiving data from a computer)		
		Software Handshake	Hardware Handshake		Software Handshake	Hardware Handshake	
	The menu of this instrument	Sending stops when X-off is received, and sending is resumed when X-on is received.	Sending stops when CB(CTS) is False, and sending is resumed when CB is True.	No handshake	X-off is sent when received data buffer becomes 3/4-full, and X-on is sent when the received data buffer is only 1/4-full.	CA (RTS) is set to False when received data buffer is only 3/4-full, and is set to True when received data buffer is only 1/4-full.	No handshake
OFF-OFF	NO-NO			○			○
XON-XON	XON-XON	○			○		
XON-RS	XON-RTS	○				○	
CS-RS	CTS-RTS		○			○	

1 OFF-OFF

Transmission data control

There is no handshake status between the instrument and host computer. The X-OFF and X-ON signal from the host computer is processed as data, and the CS signal is ignored.

Reception data control

There is no handshake status between the recorder and host computer. When the recorder reception buffer becomes full, the excess data is discarded. RS = True (fixed)

2 XON-XON

Transmission data control

A software handshake status is established between the instrument and host computer. The instrument will stop a data transmission when an X-OFF signal is received from the host computer, and will resume transmission when the next X-ON signal is received. A CS signal from the host computer is ignored.

Reception data control

A software handshake status is established between the instrument and host computer. When the instruments reception buffer vacancy reaches 64bytes, the X-OFF signal will be sent to the host computer. When the reception buffer vacancy reaches 192 bytes, the X-ON signal will be sent. RS = True (fixed)

3 XON-RS

Transmission data control

A software handshake status is established between the instrument and host computer. The instrument will stop a data transmission when an X-OFF signal is received from the host computer, and will resume transmission when the next X-ON signal is received. A CS signal from the host computer is ignored.

Reception data control

A hardware handshake status is established between the instrument and host computer. When the instruments reception buffer vacancy reaches 64bytes, an “RS = False” status will be established. When the reception buffer vacancy reaches 192 bytes, an “RS = True” status will be established.

4 CS-RS

Transmission data control

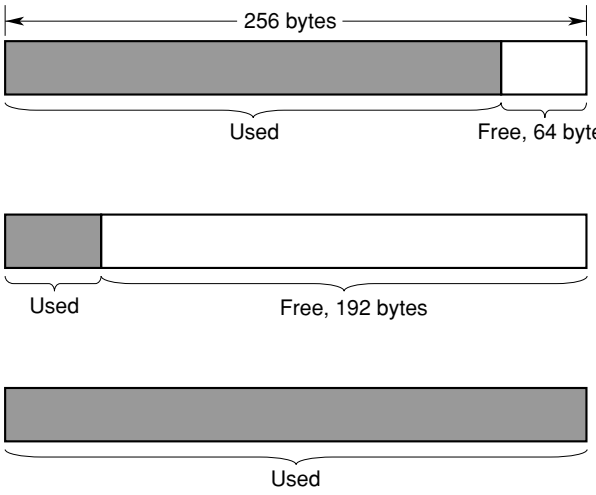
A software handshake status is established between the instrument and host computer. The instrument will stop a data transmission if a “CS = False” status is established, and will resume the transmission when a “CS = True” status is established. The X-OFF and X-ON signals from the host computer are processed as data.

Reception data control

A hardware handshake status is established between the instrument and host computer. When the instruments reception buffer vacancy reaches 64bytes, an “RS = False” status will be established. When the reception buffer vacancy reaches 192 bytes, an “RS = True” status will be established.

Precautions Regarding Data Receiving Control

When handshaking is used to control the reception of data, data may still be sent from the computer even if the free space in the receive buffer drops below 64 bytes. In this case, after the receive buffer becomes full, the excess data will be lost, whether handshaking is in effect or not. Data storage to the buffer will begin again when there is free space in the buffer.



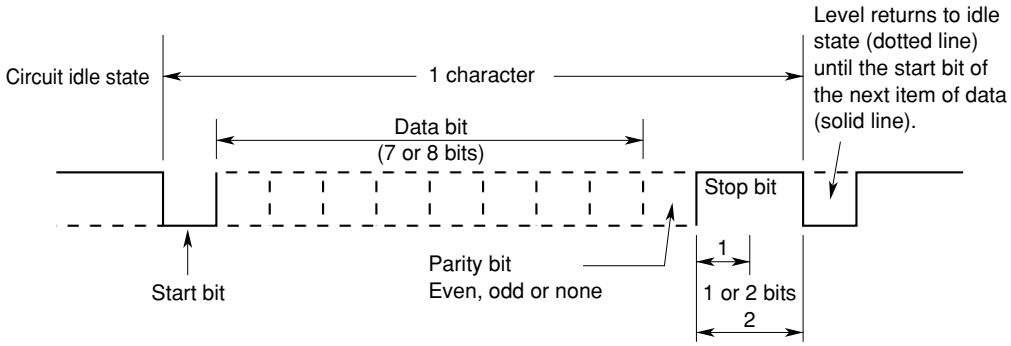
Data Receiving Control using Handshaking

Note

It is necessary to create a host computer program which prevents the buffers of both the instrument and the computer from becoming full.

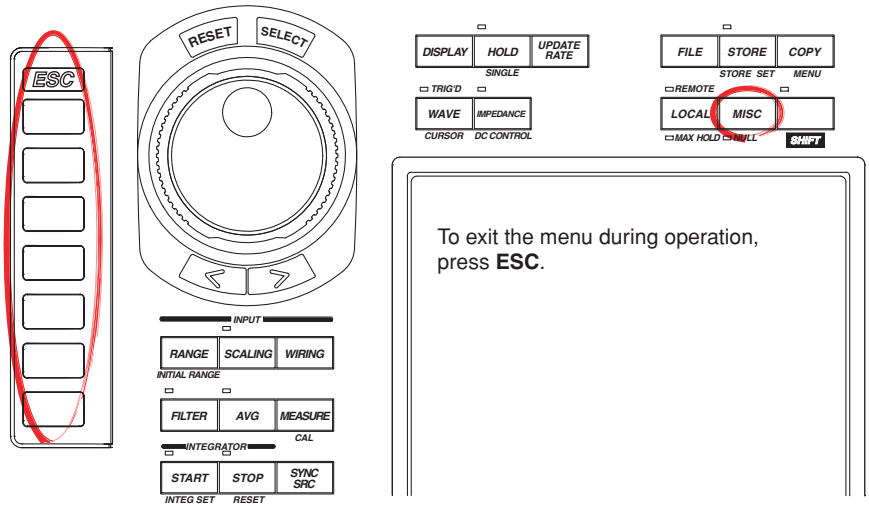
2.5 Matching the Data Format

The serial interface of this instrument performs communications using start-stop synchronization. In start-stop synchronization, one character is transmitted at a time. Each character consists of a start bit, data bits, a parity bit and a stop bit. Refer to the figure below.



2.6 Setting Serial Communications

Keys



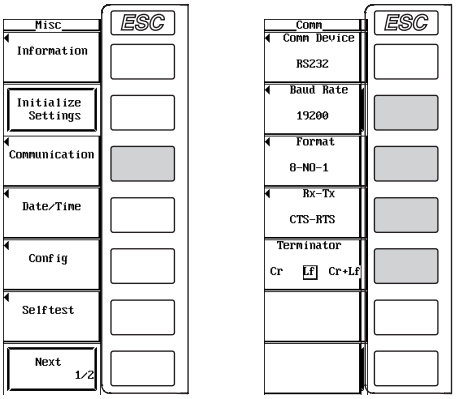
Procedure

Displaying the Serial Communication (RS-232) Menu

1. Press **MISC** to display the Misc menu.
2. Press the **Communication** soft key.
3. Press the **Comm Device** soft key to display the RS-232 menu.

Selecting the Baud Rate, Data Format, and Other Parameters

4. Press the **Baud Rate**, **Format**, **Rx-Tx** (handshaking method), and **Terminator** soft keys and select each item.



Explanation

Carry out the following settings when using a controller to set information that can be specified through key operation on the WT1600FC or when outputting setting parameters or output waveform data to the controller.

Selecting the Baud Rate

Select the baud rate from the following.
1200, 2400, 4800, 9600, and 19200

Selecting the Data Format

Select the combination of data length, parity, and stop bit from the following.
8-NO-1, 7-EVEN-1, 7-ODD-1, and 7-NO-2

Selecting the Handshaking Method

Select the transmit data control and receive data control from the following.
NO-NO, XON-XON, XON-RTS, and CTS-RTS

Selecting the Terminator

Select the terminator from the following. The menu of the WT1600FC selects the terminator that is used when transmitting data from the WT1600FC. Use “Lf” or “Cr+Lf” for the terminator when receiving the data on the WT1600FC.
Cr, Lf, and Cr+Lf

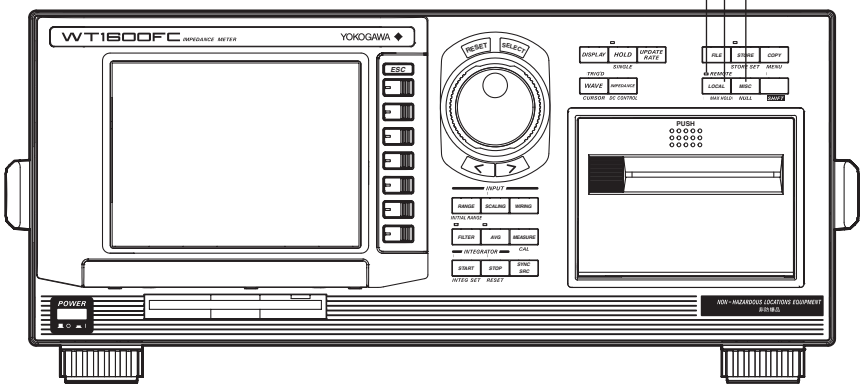
3.1 Names of the Parts and Their Functions

Front Panel

MISC key
Press this key to enter communication settings.

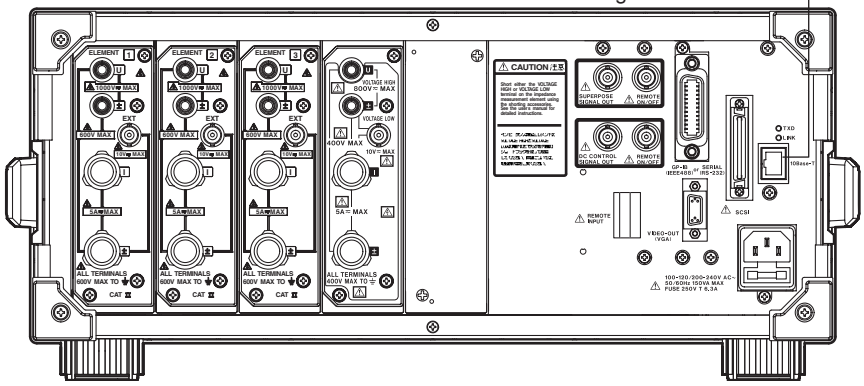
LOCAL key
Press this key to switch from remote mode to local mode so as to enable key operation.

REMOTE indicator
Lit while remote mode is active via communications.



Rear Panel

Ethernet Interface connector (10Base-T port)
For connecting the controller (PC) to the network, or for making a one-to-one connection (specify when ordering).
See section 11.1 in user's manual IM760151-01E for instructions on making connections.



3.2 Ethernet Interface Functions and Specifications

You can use a PC to control the WT1600FC using Ethernet communications. Details about specific functions and how to enter settings are provided below.

Receiving Function

You can specify the same settings as those specified by front panel key operations.
Receives output requests for measured and computed data, setting parameters of the panel, and error codes.

Sending Function

Outputs measured and computed data.
Outputs panel setup parameters and the status byte.
Outputs error codes that have occurred.

Ethernet Interface Specifications

Electrical and mechanical specifications: Conforms to IEEE 802.3.
Number of simultaneous connections: 1
Port number: 10001/tcp
For other specifications, see section 15.13, “Ethernet Interface (Option)” in the WT1600FC Digital Power Meter User’s Manual (IM760151-01E).

Switching between Remote and Local Mode

When Switched from Local to Remote Mode

Remote mode is activated when the `:COMMunicate:REMote ON` command is received from a controller while local mode is active.

- The REMOTE indicator is turned ON.
- All keys except the LOCAL key are disabled.
- Settings entered in local mode are retained even when switching to remote mode.

When Switched from Remote to Local Mode

Pressing LOCAL in remote mode puts the instrument in local mode. However, this is not possible when the `:COMMunicate:REMote ON` command is received from the PC while Local Lockout mode is active. Local mode is activated when the `:COMMunicate:REMote OFF` command is received regardless of Local Lockout.

- The REMOTE indicator is turned OFF.
- Key operations are enabled.
- Settings entered in remote mode are retained even when switching to local mode.

Note

The Ethernet interface cannot be used simultaneously with other communication interfaces (GP-IB, or serial (RS-232)).

User Verification Function

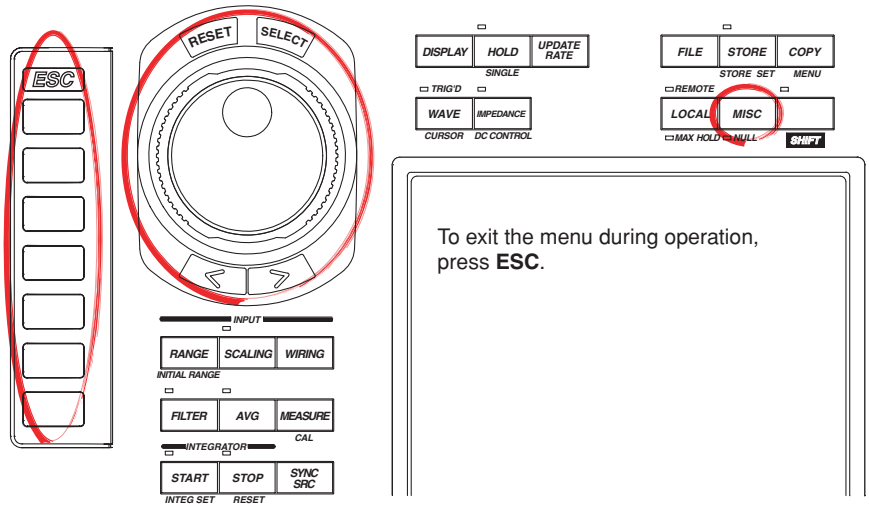
You must enter the user name and password to access the WT1600FC from a PC using the Ethernet interface. The user name and password for accessing the WT1600FC can be specified in the User Account screen under the MISC menu. For details, see “Setting the Ethernet Control” below.

Connecting the WT1600FC and the PC

For the procedure for connecting the WT1600FC to a PC, see section 11.1 in the user’s manual IM760151-01E.

3.3 Setting the Ethernet Control

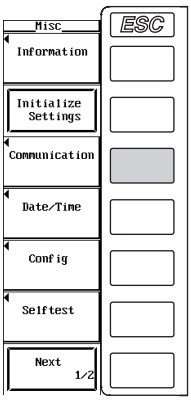
Keys



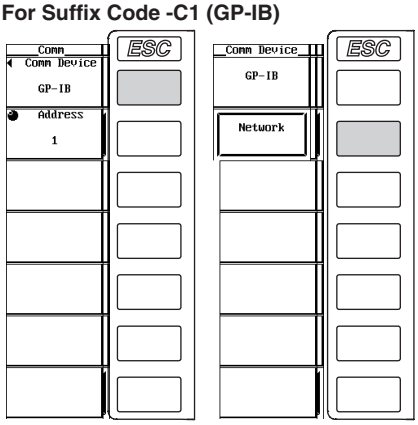
Procedure

Selecting the Communications Interface to Be Used for Controlling the WT

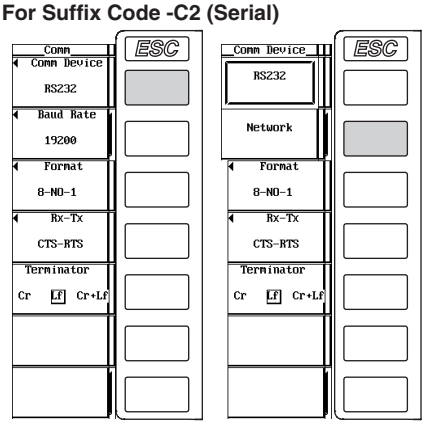
1. Press **MISC** to display the Misc menu.
2. Press the **Communication** soft key to display the Comm menu.
3. Press the **Comm Device** soft key to display the Comm Device menu.
4. Press the **Network** soft key. The Ethernet interface is selected as the interface for controlling the WT1600FC.



For Suffix Code -C1 (GP-IB)



For Suffix Code -C2 (Serial)



Note

Only the communication interface selected under Device can be used. The WT1600FC will not accept commands that are sent to other unselected communication interfaces.

Setting the User Name and Password

5. Press the **User Account** soft key to display the **User Account** dialog box.

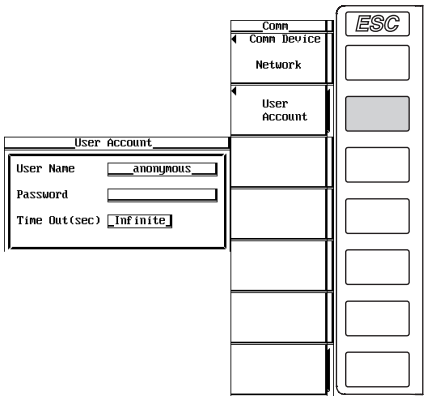
Note

When the FTP server function is specified (see section 11.6 of user's manual IM760151-01E), the user account and password are entered separately. It is recommended that you use the same settings as for the FTP server.

6. Turn the **jog shuttle** to select User Name.
7. Press **SELECT** to display the keyboard.
8. Use the keyboard to enter the user name.
   For instructions on keyboard operations, see section 3.8 in the user's manual IM760151-01E.
9. Turn the **jog shuttle** to select Password. The password setting is entered twice.
10. Press **SELECT** to display the keyboard.
11. Use the keyboard to enter the password. Password is not required if the login name is anonymous.
    For instructions on keyboard operations, see section 3.8 in the user's manual IM760151-01E.

Setting the Timeout Time

12. Turn the **jog shuttle** to select Time Out.
13. Press **SELECT** to display the timeout time selection box.
14. Turn the **jog shuttle** to set the timeout time.
    For instructions on jog shuttle operations, see section 3.8 in the user's manual IM760151-01E.
15. Press **SELECT** or **ESC** to close the box.



Entering TCP/IP Settings

You must enter TCP/IP settings to control the WT1600FC from a PC using the Ethernet interface. For instructions on entering settings, see section 11.2 in the user's manual IM760151-01E.

Explanation

You can control the WT1600FC from a PC using the Ethernet interface. To enable this function, YOKOGAWA's dedicated software must have been installed on the PC in addition to entering the settings described above.

Free Software

FcEvaluation version 1.01 or later.

The program can be downloaded from the following URL.

http://www.yokogawa.co.jp/Measurement/F-SOFT/

Setting the User Name

- Enter the user name to allow access to the WT1600FC.
- Enter up to 15 characters.
- The characters that can be used are 0-9, A-Z, %, _, ( ) (parenthesis), - (minus sign).
- If you specify anonymous, the WT1600FC can be accessed from the outside (PC) without a password.

Setting the Password

- Enter the password for the user name to allow access to the WT1600FC.
- Enter up to 15 characters.
- The characters that can be used are 0-9, A-Z, %, _, ( ) (parenthesis), - (minus sign).
- If the user name is set to anonymous, the WT1600FC can be accessed from the outside (PC) without a password.
- The password setting is entered twice.

Setting the Timeout Time

The WT1600FC closes the connection to the network if there is no access for a certain period of time (timeout time).

The available settings are 0 to 3600 s, or Infinite. The default value is Infinite.

Note

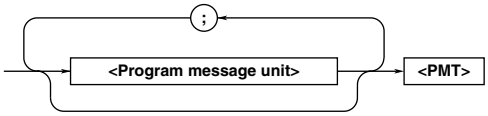
To apply new settings, the WT1600FC must be power cycled.

4.1 Messages

Blocks of message data are transferred between the controller and this instrument during communications. Messages sent from the controller to this instrument are called program messages, and messages sent back from this instrument to the controller are called response messages.
If a program message contains a message unit, i.e. a command which requests a response, this instrument returns a response message. A single response message is always returned in reply to a program message.

Program Messages

The format of a program message is shown below.



<Program message unit>

A program message consists of one or more program message units; each unit corresponds to one command. This instrument executes commands one by one according to the order in which they are received.
Program message units are delimited by a "**;**".
For a description of the format of the program message unit, refer to the explanation given further below.

Example

```
:IMPedance:STATe ON;MEASure:TYPE STABle<PMT>
```

Unit Unit

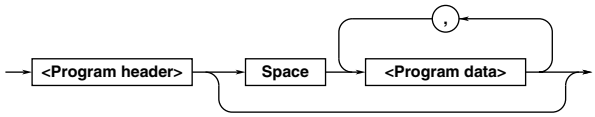
<PMT>

PMT is a terminator used to terminate each program message. The following three types of terminator are available.

`NL` (New Line) : Same as LF (Line Feed). ASCII code "0AH" is used.
`^END` : END message defined in IEEE488.1. (EOI signal)
(The data byte sent with an END message will be the final item of the program message unit.)
`NL^END` : NL with an END message attached
(NL is not included in the program message unit.)

Program message unit format

The format of a program message unit is shown below.



<Program header>

A program header is used to indicate the command type. For details, refer to page 4-3.

<Program data>

If certain conditions are required for the execution of a command, program data must be added. Program data must be separated from the header by a space (ASCII code "20H"). If multiple items of program data are included, they must be separated by a "**,**" (comma). For details, refer to page 4-5.

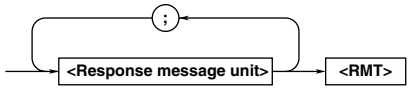
Example

```
:IMPedance:STATe ON<PMT>
```

Header Data

Response Messages

The format of a response message is shown below.



<Response message units>

A response message consists of one or more response message units: each response message unit corresponds to one response.
Response message units are delimited by a "**;**".
For the response message format, refer to the next page.

Example

```
:IMPEDANCE:STATE 1;MEASURE:TYPE STABLE<RMT>
```

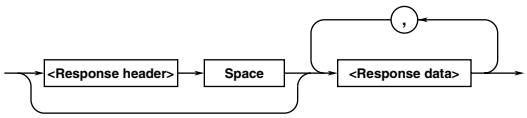
Unit Unit

<RMT>

RMT is the terminator used for every response message. Only one type of response message is available; `NL^END`.

Response message unit format

The format of a program message unit is shown below.



<Response header>

A response header sometimes precedes the response data. Response data must be separated from the header by a space. For details, refer to page 4-4.

<Response data>

Response data is used to define a response. If multiple items of response data are used, they must be separated by a "," (comma). For details, refer to page 4-5.

Example `100.00E-03<RMT>` `:DISPLAY:FORMAT` `WAVE<RMT>`

Data Header Data

If a program message contains more than one query, responses are made in the same order as the queries. Normally, each query returns only one response message unit, but there are some queries which return more than one response message unit. The first response message unit always responds to the first query, but it is not always true that the 'n' th unit always responds to the 'n' th query. Therefore, if you want to make sure that a response is made to each query, the program message must be divided up into individual messages.

Points to Note concerning Message Transmission

- It is always possible to send a program message if the previous message which was sent did not contain any queries.
- If the previous message contained a query, it is not possible to send another program message until a response message has been received. An error will occur if a program message is sent before a response message has been received in its entirety. A response message which has not been received will be discarded.
- If an attempt is made by the controller to receive a response message, even if there it no response message, an error will occur. An error will also occur if the controller makes an attempt to receive a response message before transmission of a program message has been completed.
- If a program message of more than one unit is sent and some of the units are incomplete, this instrument receives program message units which the instrument thinks complete and attempts to execute them. However, these attempts may not always be successful and a response may not always be returned, even if the program message contains queries.

Deadlock

This instrument has a buffer memory in which both program and response messages of 1024 bytes or more can be stored. (The number of bytes available will vary depending on the operating state of the instrument.) If the transmission and reception buffer memories become full at the same time, the instrument will not be able to continue the communication operation. This state is called deadlock. In this case, operation can be resumed by discarding the response message.

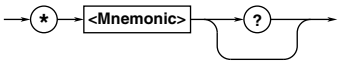
No dead lock will occur, if the size of the program message including the PMT is kept below 1024 bytes. Furthermore, no deadlock will occur if the program message does not contain a query.

4.2 Commands

There are three types of command (program header) which can be sent from the controller to this instrument. They differ in the format of their program headers.

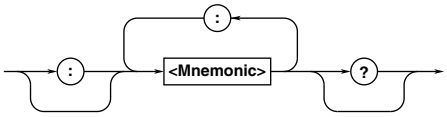
They are
- Common command header
- Compound header
- Simple header

Common Command Header
Commands defined in IEEE 488.2-1987 are called common commands. The header format of a common command is shown below. An asterisk (*) must always be attached to the beginning of a command.



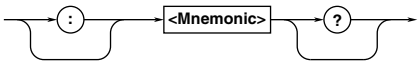
An example of a common command
```
*CLS
```

Compound Header
Commands designed to be used only with this instrument are classified and arranged in a hierarchy according to their function. The format of a compound header is illustrated below. A colon (:) must be used when specifying a lower-level header.



An example of a compound header
```
:DIAPlay:FORMat
```

Simple Header
These commands (headers) are functionally independent of each other and are not arranged hierarchically. The format of a simple header is shown below.



An example of a simple header
```
:HOLD
```

Note
A mnemonic is a character string made up of alphanumeric characters.

When Concatenating Commands
Command Group
A command group is a group of commands which have the same compound header. A command group may contain sub-groups.

Example Commands relating to the display of impedance measurement
```
:DISPlay:IMPedance?
:DISPlay:IMPedance:TYPE
:DISPlay:IMPedance:OBJect
:DISPlay:IMPedance:ICURsor
```

When Concatenating Commands of the Same Group
This instrument stores the hierarchical level of the command which is currently being executed, and performs analysis on the assumption that the next command to be sent will also belong to the same level. Therefore, it is possible to omit the header if the commands belong to the same group.

Example
```
:DISPlay:IMPedance:TYPE ZR_ZI;
OBJect 5<PMT>
```

When Concatenating Commands of Different Groups
A colon (:) must be included before the header of a command, if the command does not belong to the same group as the preceding command.

Example
```
:DISPlay:IMPedance:TYPE ZR_ZI;:
DISPlay:FORMat NUMeric<PMT>
```

When Concatenating Simple Headers
When you type in a simple header after another command, you must include a colon (:) before the simple header.

Example
```
:DISPlay:IMPedance:TYPE ZR_ZI;:
HOLD ON<PMT>
```

When Concatenating Common Commands
Common commands defined in IEEE 488.2-1987 are independent of hierarchical level. Thus, it is not necessary to add a colon (:) before a common command.

Example
```
:DISPlay:IMPedance:
TYPE ZR_ZI;*CLS;OBJect 5<PMT>
```

When Separating Commands with <PMT>

If a terminator is used to separate two commands, each command is a separate message. Therefore, the common header must be typed in for each command even when commands of the same command group are being concatenated.

Example
```
:DISPlay:IMPedance:
TYPE ZR_ZI<PMT>:DISPlay:
IMPedance:OBJect 5<PMT>
```

Upper-level Query

An upper-level query is a compound header to which a question mark is appended. Execution of an upper-level query allows all a group's settings to be output at once. Some query groups comprising more than three hierarchical levels can output all their lower level settings.

Example
```
:DISPlay[:NUMeric]:
IMPedance?<PMT> ->
:DISPLAY:NUMERIC:IMPEDANCE:
TYPE ZR_ZI;OBJECT 5;
ICURSOR 1<RMT>
```

In reply to a query, a response can be returned as a program message to this instrument. Transmitting a response can restore the settings made when the query was executed. However, some upper-level queries will not return set-up data which is not currently in use. Note that not all a group's information will necessarily be sent out as a response.

Header Interpretation Rules

This instrument interprets the header received according to the following rules.

- Mnemonics are not case sensitive.
  Example
  "`CURSor`" can also be written as "`cursor`" or "`CUrsor`".
- The lower-case part of a header can be omitted.
  Example
  "`CURSor`" can also be written as "`CURSO`" or "`CURS`".
- If the header ends with a question mark, the command is a query. It is not possible to omit the question mark.
  Example
  "`CURSor?`" cannot be abbreviated to anything shorter than "`CURS?`".
- If the "`x`" at the end of a mnemonic is omitted, it is assumed to be "`1`".
  Example
  If "`ELEMent<x>`" is written as "`ELEM`", this represents "`ELEMent1`".
- Any part of a command enclosed by `[ ]` can be omitted.
  Example
  "`[:INPut]:SCALing[:STATe] ON`" can be written as
  "`SCALing ON`".
- However, a part enclosed by `[ ]` cannot be omitted if is located at the end of an upper-level query.
  Example
  "`SCALing?`" and "`SCALing:STATe?`" belong to different upper-level query levels.

4.3 Response

On receiving a query from the controller, this instrument returns a response message to the controller. A response message is sent in one of the following two forms.

- Response consisting of a header and data
  If the query can be used as a program message without any change, a command header is attached to the query, which is then returned.
  Example `:DISPlay:FORMat?<PMT> ->`
  `:DISPLAY:FORMAT WAVE<RMT>`
- Response consisting of data only
  If the query cannot be used as a program message unless changes are made to it (i.e. it is a query-only command), no header is attached and only the data is returned. Some query-only cmands can be returned after a header is attached to them.
  Example `[:INPut]:POVer?<PMT> -> 0<RMT>`

When returning a response without a header

It is possible to remove the header from a response consisting of a header and data. The "`COMMunicate:HEADer`" command is used to do this.

Abbreviated form

Normally, the lower-case part is removed from a response header before the response is returned to the controller. Naturally, the full form of the header can also be used. For this, the "`COMMunicate:VERBose`" command is used. The part enclosed by `[]` is also omitted in the abbreviated form.

4.4 Data

Data

A data section comes after the header. A space must be included between the header and the data. The data contains conditions and values. Data is classified as below.

Data	Description
<Decimal>	Value expressed as a decimal number (Example: Set the PT ratio. `-> [:INPUt]:SCALing:PT:ELEMent1 100`)
<Voltage><Current> <Time><Frequency>	Physical value (Example: Set the voltage range. `-> [:INPUt]:VOLTage:RANGE:ELEMent1 100V`)
<Register>	Register value expressed as either binary, octal, decimal or hexadecimal (Example: Extended event register value `-> STATUS:EESE #HFE`)
<Character data>	Specified character string (mnemonic). Can be selected from { } (Example: Select the trigger mode. `-> WSETup:TRIGger:MODE {AUTO|NORMal}`)
<Boolean>	Indicates ON/OFF. Set to ON, OFF or value (Example: Turn ON data hold. `-> :HOLD ON`)
<Character string data>	Arbitrary character string (Example: User-defined function `-> MEASure:FUNCtion1:EXPRession "URMS(E1)"`)
<Filename>	Gives the name of a file. (Example: Name of file to be saved `-> FILE:SAVE:WAVE[:EXECute] "CASE1"`)
<Block data>	Arbitrary 8-bit data (Example: Response to acquired waveform data `-> #40012ABCDEFGHIJKL`)

<Decimal>

<Decimal> indicates a value expressed as a decimal number, as shown in the table below. Decimal values are given in the NR form specified in ANSI X3. 42-1975.

Symbol	Description	Example
<NR1>	Integer	`125 -1 +1000`
<NR2>	Fixed point number	`125.0 -.90 +001.`
<NR3>	Floating point number	`125.0E+0 -9E-1 +.1E4`
<NRf>	Any of the forms <NR1> to <NR3> is allowed.	

Decimal values which are sent from the controller to this instrument can be sent in any of the forms to <NR3>. In this case, <NRf> appears.
For response messages which are returned from this instrument to the controller, the form (<NR1> to <NR3> to be used) is determined by the query. The same form is used, irrespective of whether the value is large or small.
In the case of <NR3>, the "+" after the "`E`" can be omitted, but the "–" cannot.
If a value outside the setting range is entered, the value will be normalized so that it is just inside the range.
If the value has more than the significant number of digits, the value will be rounded.

<Voltage>, <Current>, <Time>, <Frequency>

<Voltage>, <Current>, <Time> and <Frequency> indicate decimal values which have physical significance. <Multiplier> or <Unit> can be attached to <NRf>. They can be entered in any of the following forms.

Form	Example
<NRf><Multiplier><Unit>	5MV
<NRf><Unit>	5E-3V
<NRf><Multiplier>	5M
<NRf>	5E-3

<Multiplier>

Multipliers which can be used are shown below.

Symbol	Word	Description
EX	Exa	10^{18}
PE	Peta	10^{15}
T	Tera	10^{12}
G	Giga	10^{9}
MA	Mega	10^{6}
K	Kilo	10^{3}
M	Mili	10^{-3}
U	Micro	10^{-6}
N	Nano	10^{-9}
P	Pico	10^{-12}
F	Femto	10^{-15}

<Unit>

Units which can be used are shown below.

Symbol	Word	Description
V	Volt	Voltage
A	Ampere	Current
S	Second	Time
HZ	Hertz	Frequency
MHZ	Megahertz	Frequency

<Multiplier> and <Unit> are not case sensitive.

"U" is used to indicate "μ".

"MA" is used for Mega (M) to distinguish it from Mili, except for in the case of Megahertz, which is expressed as "MHZ". Hence, it is not permissible to use "M" (Mili) for Hertz.

If both <Multiplier> and <Unit> are omitted, the default unit will be used.

Response messages are always expressed in <NR3> form. Neither <Multiplier> nor <Unit> is used, therefore the default unit is used.

<Register>

<Register> indicates an integer, and can be expressed in hexadecimal, octal or binary as well as a decimal number. <Register> is used when each bit of a value has a particular meaning. <Register> is expressed in one of the following forms.

Form	Example
<NRf>	1
#H<Hexadecimal value made up of the digits 0 to 9, and A to F>	#H0F
#Q<Octal value made up of the digits 0 to 7>	#Q777
#B<Binary value made up of the digits 0 and 1>	#B001100

<Register> is not case sensitive.
Response messages are always expressed as <NR1>.

<Character Data>

<Character data> is a specified string of character data (a mnemonic). It is mainly used to indicate options, and is chosen from the character strings given in { }. For interpretation rules, refer to "Header Interpretation Rules" on page 4-4.

Form	Example
{AUTO|NORMal}	AUTO

As with a header, the "COMMunicate:VERBose" command can be used to return a response message in its full form. Alternatively, the abbreviated form can be used.
The "COMMunicate:HEADer" command does not affect <character data>.

<Boolean>

<Boolean> is data which indicates ON or OFF, and is expressed in one of the following forms.

Form	Example
{ON|OFF|<NRf>}	ON OFF 1 0

When <Boolean> is expressed in <NRf> form, OFF is selected if the rounded integer value is "0" and ON is selected if the rounded integer is "Not 0".
A response message is always "1" if the value is ON and "0" if it is OFF.

<Character String Data>

<Character string data> is not a specified character string like <Character data>. It is an arbitrary character string. A character string must be enclosed in single quotation marks (') or double quotation marks (").

Form	Example
<Character string data>	"ABC" "IEEE488.2-1987"

Response messages are always enclosed in double quotation marks.

If a character string contains a double quotation mark ("), the double quotation mark will be replaced by two concatenated double quotation marks (""). This rule also applies to a single quotation mark within a character string.

<Character string data> is an arbitrary character string, therefore this instrument assumes that the remaining program message units are part of the character string if no single (') or double quotation mark (") is encountered. As a result, no error will be detected if a quotation mark is omitted.

<Filename>

Gives the name of a file. The format is as follows.

Form	Example
{<NRf>|<Character data>|<Character string>}	1 CASE "CASE"

If you input an <NRf> value, the system converts the value (after rounding to the nearest integer) to the corresponding 8-character ASCII string. (If you set the value to 1, the name becomes "00000001".) Note that negative values are not allowed.
If you enter a <character data> or <character string> argument that is longer than eight characters, only the first eight characters are used.
Response messages always return filenames as <character string> arguments.

<Block data>

<Block data> is arbitrary 8-bit data. <Block data> is only used for response messages. Response messages are expressed in the following form.

Form	Example
#N<N-digit decimal value><Data byte string>	#40012ABCDEFGHIJKL

#N

Indicates that the data is <Block data>. "N" is an ASCII character string number (digits) which indicates the number of data bytes that follow.

<N-digits decimal value>

Indicates the number of bytes of data. (Example: 0012 = 12 bytes)

<Data byte string>

The actual data. (Example: ABCDEFGHIJKL)

Data is comprised of 8-bit values (0 to 255). This means that the ASCII code "0AH", which stands for "NL", can also be a code used for data. Hence, care must be taken when programming the controller.

4.5 Synchronization with the Controller

Overlap Commands and Sequential Commands

There are two kinds of command; overlap commands and sequential commands. Execution of an overlap command may start before execution of the previously sent command is completed.
The INPut:VOLTage:RANge:ELEMent1 command, for example, is a sequential command. Assume that you set a new voltage range value and immediately request return of the new value, as follows:

```
:INPut:VOLTage:RANGe;ELEMent1 100V;
ELEMent?<PMT>
```

In this case, the response always returns the newest setting ("100V"). This is because it always completes processing of the current sequential command before moving on to the next command.
In contrast, assume that you begin a file load and then immediately query the voltage range value:

```
:FILE:LOAD:SETup "FILE1";:INPut:VOLTage:
RANGe:ELEMent1?
```

Because "FILE:LOAD:SETup" is an overlapped command, the WT1600FC will advance to the ":INPut:VOLTage:RANGe:ELEMent1?" command before it finishes the load. The returned voltage range value will not show the newest setting, but will rather show the setting in use before the setup was changed. Obviously, use of overlapped commands may in some cases produce inappropriate results. Where necessary, you can avoid such problems as described below.

Synchronization with an Overlap Command

Using the *WAI command

The *WAI command causes the commands which follow it to wait until an overlap command has been executed.
Example

```
:COMMunicate:OPSE #H0040;:FILE:LOAD:
SETup "FILE1";*WAI;:INPut:VOLTage:RANGe:
ELEMent1?<PMT>
```

The "COMMunicate:OPSE" command is used to designate which commands are to be subject to the *WAI command. In the above example, only auto set-up is designated.
Since a *WAI command is executed just before ":INPut:VOLTage:RANGe:ELEMent?", ":INPut:VOLTage:RANGE:ELEMent1?" will not be executed until auto set-up has been completed.

Using the COMMunicate:OVERlap command

The "COMMunicate:OVERlap" command is used to enable or disable overlap operation.

Example

```
:COMMunicate:OVERlap #HFFBF;:FILE:LOAD:
SETup "FILE1";:INPut:VOLTage:RANGe:
ELEMent1?<PMT>
```

The "COMMunicate:OVERlap #HFFBF" command disables overlapped operation of the medium access command, while enabling all other overlap-type operations. The oscilloscope will therefore handle "FILE:LOAD:SETup" s a sequential command, ensuring that the ":INPut:VOLTage:RANGe:ELEMent1?" command (in the above example) will not execute until file loading is completed.

Using the *OPC command

The *OPC command causes the OPC bit (bit 0) of the standard event register (page 6-3) to be set to "1" when an overlap operation has been completed.

Example

```
:COMMunicate:OPSE #H0040;*ESE 1;
*ESR?;*SRE 32;:FILE:LOAD:SETup "FILE1";
*OPC<PMT>
```

(Response to *ESR? is decoded.)

(Service request is awaited.)

```
:INPut:VOLTage:RANGe:ELEMent1?<PMT>
```

The "COMMunicate:OPSE" command is used to designate which commands are to be subject to the *OPC command. In the above example, only medium access commands are designated.

*ESE 1 and *SRE 32 stipulate that a service request is generated only when the OPC bit is set to "1".

*ESR? is used to clear the standard event register.

In the above example,

":INPut:VOLTage:RANGe:ELEMent1?" will not be executed until a service request is generated.

Using the *OPC? query

The *OPC? query generates a response when an overlap operation has been completed.

Example

```
:COMMunicate:OPSE #H0040;:FILE:LOAD:
SETup "FILE1";*OPC?<PMT>
```

(Response to *OPC? is decoded.)

```
:INPut:VOLTage:RANGe:ELEMent?<PMT>
```

The "COMMunicate:OPSE" command is used to designate which commands are to be subject to the *OPC? command. In the above example, only medium access commands are designated.

Since *OPC? does not generate a response until an overlap operation is completed, file loading will have been completed when a response to *OPC? is read.

Note

Most commands are sequential commands. Commands used in Chapter 5 are sequential commands unless otherwise specified.

Synchronization with Non-Overlap Commands

Even for sequential commands, synchronization is sometimes required to correctly query the measured data.

If you wish to query the newest numeric data on every time measured data is updated, for example, sending the ":NUMeric[:NORMal]:VALue?" command at an arbitrary timing can cause data that is the same as the previous data to be received. This is because the WT1600FC returns the current measured data regardless of whether the measured data has been updated since the previous query.

In this case, the following method must be used to synchronize with the end of the updating of the measured data.

Using STATus:CONDition? query

The "STATus:CONDition?" query is used to query the contents of the condition register (page 6-4). You can determine whether the measured data is being updated by reading bit 0 of the condition register. If bit 0 of the condition register is "1," the measured data is being updated. If it is "0," the measured data can be queried.

Using the extended event register

Changes in the condition register are reflected in the extended event register (page 6-4).

Example

```
:STATus:FILTer1 FALL;:STATus:EESE 1;
EESR?;*SRE 8<PMT>
(Read the response to :STATus:EESR?)
LOOP
(Wait for a service request)
:NUMeric[:NORMal]:VALue?<PMT>
(Read the response to :NUMeric[:NORMal]:
VALue?)
:STATus:EESR?<PMT>
(Read the response to :STATus:EESR?)
(Return to LOOP)
```

The "STATus:FILTer1 FALL" command sets the transition filter such that Bit 0 (FILTer1) of the Extended Event Register sets to 1 when Bit 0 of the Condition Register changes from 1 to 0.
"STATus:EESE 1" is a command used only to reflect the status of bit 0 of the extended event register in the status byte.
"STATus:EESR?" is used to clear the extended event register.
The "*SRE 8" command is used to generate a service request caused solely by the extended event register.
":NUMeric[:NORMal]:VALue?" will not be executed until a service request is generated.

Using the COMMunicate:WAIT command

The "COMMunicate:WAIT" command halts communications until a specific event is generated.

Example

```
:STATus:FILTer1 FALL;:STATus:
EESR?<PMT>
(Read the response to :STATus:EESR?)
LOOP
COMMunicate:WAIT 1<PMT>
:NUMeric[:NORMal]:VALue?<PMT>
(Read the response to :NUMeric[:NORMal]:
VALue?)
:STATus:EESR?<PMT>
(Read the response to :STATus:EESR?)
(Return to LOOP)
```

For a description of "STATus:FILTer1 FALL" and "STATus:EESR?", refer to "Using the extended event register" on this page.
"COMMunicate:WAIT 1" means that communications is halted until bit 0 of the extended event register is set to "1".
The ":NUMeric[:NORMal]:VALue?" command will not be executed until bit 0 of the extended event register is set to "1".

5.1 Command List

Command	Function	Page
COMMunicate Group		
:COMMunicate?	Queries all settings related to communications.	5-12
:COMMunicate:HEADer	Sets whether or not to be added a header to the response to a query or queries the current setting.	5-12
:COMMunicate:LOCKout	Sets or clears local lockout.	5-12
:COMMunicate:OPSE	Sets the overlap command that is to be used by the *OPC, *OPC?, and *WAI commands or queries the current setting.	5-13
:COMMunicate:OPSR?	Queries the operation pending status register.	5-13
:COMMunicate:OVERlap	Sets the commands that will operate as overlap commands or queries the current setting.	5-13
:COMMunicate:REMote	Sets remote or local.	5-13
:COMMunicate:STATus?	Queries line-specific status.	5-13
:COMMunicate:VERBose	Sets the response messages to full form or abbreviated form or queries the current setting.	5-13
:COMMunicate:WAIT	Waits for a specified extended event.	5-13
:COMMunicate:WAIT?	Creates the response that is returned when the specified event occurs.	5-14
CURSor Group		
:CURSor?	Queries all settings related to the cursor measurement.	5-16
:CURSor:TRENd?	Queries all settings related to the cursor measurement on the trend.	5-16
:CURSor:TRENd:POSition<x>	Sets the cursor position on the trend or queries the current setting.	5-16
:CURSor:TRENd[:STATe]	Turns ON/OFF the cursor display on the trend or queries the current setting.	5-16
:CURSor:TRENd:TRACe<x>	Sets the cursor target on the trend or queries the current setting.	5-16
:CURSor:TRENd:{X<x>|Y<x>|DY}?	Queries the cursor measurement value on the trend.	5-16
:CURSor:WAVE?	Queries all settings related to the cursor measurement on the waveform display.	5-16
:CURSor:WAVE:PATH	Sets the cursor path on the waveform display or queries the current setting.	5-16
:CURSor:WAVE:POSition<x>	Sets the cursor position on the waveform display or queries the current setting.	5-16
:CURSor:WAVE[:STATe]	Turns ON/OFF the cursor display on the waveform display or queries the current setting.	5-17
:CURSor:WAVE:TRACe<x>	Sets the cursor target on the waveform display or queries the current setting.	5-17
:CURSor:WAVE:{X<x>|DX|PERDt|Y<x>|DY}?	Queries the cursor measurement value on the waveform display.	5-17
DISPlay Group		
:DISPlay?	Queries all settings related to the screen display.	5-21
:DISPlay:FORMat	Sets the display format or queries the current setting.	5-21
:DISPlay:NUMeric?	Queries all settings related to the numeric display.	5-21
:DISPlay[:NUMeric]:IMPedance?	Queries all settings related to the numeric display for impedance measurement.	5-21
:DISPlay[:NUMeric]:IMPedance:ICURsor	Sets the cursor position on the numeric display for impedance measurement or queries the current setting.	5-21
:DISPlay[:NUMeric]:IMPedance:OBJect	Sets the numeric display element for impedance measurement or queries the current setting.	5-21
:DISPlay[:NUMeric]:IMPedance:TYPE	Sets the numeric display item for impedance measurement or queries the current setting.	5-22
:DISPlay[:NUMeric]:NORMal?	Queries all settings related to the numeric display for power measurement.	5-22
:DISPlay[:NUMeric]:NORMal:FCURsor	Sets the cursor position on the numeric display (all display) for power measurement or queries the current setting.	5-22

Command	Function	Page
:DISPlay[:NUMeric]:NORMal:IAMount		
	Sets the numeric display format for power measurement or queries the current setting.	5-22
:DISPlay[:NUMeric]:NORMal:ICURsor		
	Sets the cursor position on the numeric display (split display) for power measurement or queries the current setting.	5-22
:DISPlay[:NUMeric]:NORMal:ITEM<x>		
	Sets the numeric display item for power measurement or queries the current setting.	5-23
:DISPlay[:NUMeric]:NORMal:PRESet	Presets the display order pattern of numeric display items for power measurement.	5-23
:DISPlay:TRENd?	Queries all settings related to the trend.	5-23
:DISPlay:TRENd:ALL	Collectively turns ON/OFF all trends.	5-23
:DISPlay:TRENd:FORMat	Sets the display format of the trend or queries the current setting.	5-23
:DISPlay:TRENd:NORMal?	Queries all settings related to all the trends for power measurement.	5-24
:DISPlay:TRENd:NORMal:ITEM<x>?	Queries all settings related to the trend for power measurement.	5-24
:DISPlay:TRENd:NORMal:ITEM<x>[:FUNCtion]		
	Sets the trend item for power measurement or queries the current setting.	5-24
:DISPlay:TRENd:NORMal:ITEM<x>:SCALing?		
	Queries all settings related to the scaling of the trend for power measurement.	5-24
:DISPlay:TRENd:NORMal:ITEM<x>:SCALing:MODE		
	Sets the scaling of the trend for power measurement or queries the current setting.	5-24
:DISPlay:TRENd:NORMal:ITEM<x>:SCALing:VALue		
	Sets the upper and lower limits of manual scaling of the trend for power measurement or queries the current setting.	5-24
:DISPlay:TRENd:PDIV	Sets the horizontal axis (Point/div) of the trend or queries the current setting.	5-25
:DISPlay:TRENd:RESTart	Restarts the trend.	5-25
:DISPlay:TRENd[:SAMPling]	Turns ON/OFF the trend waveform sampling or queries the current setting.	5-25
:DISPlay:TRENd:TDIV	Sets the horizontal axis (T/div) of the trend for power measurement or queries the current setting.	5-25
:DISPlay:TRENd:T<x>	Turns ON/OFF the trend or queries the current setting.	5-25
:DISPlay:WAVE?	Queries all settings related to the waveform display.	5-25
:DISPlay:WAVE:ALL	Collectively turns ON/OFF all waveform displays.	5-26
:DISPlay:WAVE:FORMat	Sets the display format of the waveform or queries the current setting.	5-26
:DISPlay:WAVE:GRATicule	Sets the graticule (grid) type or queries the current setting.	5-26
:DISPlay:WAVE:INTerpolate	Sets the interpolation method of the waveform or queries the current setting.	5-26
:DISPlay:WAVE:MAPPing?	Queries all settings related to the waveform mapping to the split screen.	5-26
:DISPlay:WAVE:MAPPing[:MODE]	Sets the waveform mapping method for the split screen or queries the current setting.	5-26
:DISPlay:WAVE:MAPPing:{U<x>|I<x>}		
	Sets the waveform mapping to the split screen or queries the current setting.	5-26
:DISPlay:WAVE:SVALue	Turns ON/OFF the scale value display or queries the current setting.	5-27
:DISPlay:WAVE:TLABel	Turns ON/OFF the waveform labels or queries the current setting.	5-27
:DISPlay:WAVE:{U<x>|I<x>}	Turns ON/OFF the waveform display or queries the current setting.	5-27
FILE Group		
:FILE?	Queries all settings related to the file operation.	5-26
:FILE:CDIRectory	Changes the current directory.	5-26
:FILE:DELete:IMAGe:{TIFF|BMP|PSCRipt}		
	Deletes the screen image data file.	5-26
:FILE:DELete:NUMeric:{ASCii|FLOat}		
	Deletes the numeric data file.	5-26
:FILE:DELete:SETup	Deletes the setup parameter file.	5-29
:FILE:DELete:WAVE:{BINary|ASCii|FLOat}		
	Deletes the waveform display data file.	5-29
:FILE:DRIVe	Sets the target drive.	5-29

Command	Function	Page
:FILE:FORMat	Executes the floppy disk format.	5-29
:FILE:FREE?	Queries the free space on the target drive.	5-29
:FILE:LOAD:ABORt	Aborts file loading.	5-29
:FILE:LOAD:FGWave	Loads the pattern waveform file of the load current for impedance measurement.	5-30
:FILE:LOAD:SETup	Loads the setup parameter file.	5-30
:FILE:MDIRectory	Creates the directory.	5-30
:FILE:PATH?	Queries the absolute path of the current directory.	5-30
:FILE:SAVE?	Queries all settings related to the saving of files.	5-30
:FILE:SAVE:ABORt	Aborts file saving.	5-30
:FILE:SAVE:ANAMing	Sets whether to automatically name the files to be saved or queries the current setting.	5-30
:FILE:SAVE:COMMent	Sets the comment to be added to the file to be saved or queries the current setting.	5-30
:FILE:SAVE:NUMeric?	Queries all settings related to the saving of numeric data files.	5-30
:FILE:SAVE:NUMeric[:EXECute]	Saves the numeric data file.	5-30
:FILE:SAVE:NUMeric:NORMal?	Queries all settings related to the saving of numeric data files for power measurement.	5-31
:FILE:SAVE:NUMeric:NORMal:ALL	Collectively turns ON/OFF the output of all elements and functions when saving the numeric data file during power measurement.	5-31
:FILE:SAVE:NUMeric:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}	Turns ON/OFF the output of the {element|ΣA|ΣB|ΣC} when saving the numeric data list to a file during power measurement or queries the current setting.	5-31
:FILE:SAVE:NUMeric:NORMal:PRESet<x>	Presets the output ON/OFF pattern of the element and function when saving the numeric data to a file during power measurement.	5-31
:FILE:SAVE:NUMeric:NORMal:<power measurement function>	Turns ON/OFF the output of the function when saving the numeric data file during power measurement or queries the current setting.	5-31
:FILE:SAVE:NUMeric:TYPE	Sets the format of the numeric data to be saved or queries the current setting.	5-32
:FILE:SAVE:SETup[:EXECute]	Executes the saving of the setup parameter file.	5-32
:FILE:SAVE:WAVE?	Queries all settings related to the saving of waveform display data files.	5-32
:FILE:SAVE:WAVE[:EXECute]	Executes the saving of the waveform display data file.	5-32
:FILE:SAVE:WAVE:TRACe	Sets the waveform to be saved to a file or queries the current setting.	5-32
:FILE:SAVE:WAVE:TYPE	Sets the format of the waveform display data to be saved or queries the current setting.	5-32
HCOPy Group		
:HCOPy?	Queries all settings related to the output of screen image data.	5-34
:HCOPy:ABORt	Aborts screen image data output and paper feeding.	5-34
:HCOPy:BMP?	Queries all settings related to the BMP format.	5-34
:HCOPy:BMP:COLor	Sets the color tone for the BMP format or queries the current setting.	5-34
:HCOPy:BMP:COMPression	Sets the data compression for the BMP format or queries the current setting.	5-34
:HCOPy:COMMent	Sets the comment displayed at the bottom of the screen or queries the current setting.	5-35
:HCOPy:DIRection	Sets the output destination of the screen image data or queries the current setting.	5-35
:HCOPy:EXECute	Executes the screen image data output.	5-35
:HCOPy:FORMat	Sets the file format of the screen image data to be saved or queries the current setting.	5-35
:HCOPy:PRINter?	Queries all settings related to the built-in printer output.	5-35
:HCOPy:PRINter:DLISt?	Queries all settings related to the printing of the numeric data list using the built-in printer.	5-35
:HCOPy:PRINter:DLISt[:EXECute]	Executes the printing of the numeric data list using the built-in printer.	5-35
:HCOPy:PRINter:DLISt:INFOrmation	Sets whether or not to add setup parameters when printing the numeric data list using the built-in printer or queries the current setting.	5-35

Command	Function	Page
:HCOPy:PRINter:DLISt:NORMal?	Queries all settings related to the printing of the numeric data list for power measurement.	5-35
:HCOPy:PRINter:DLISt:NORMal:ALL	Collectively turns ON/OFF the output of all elements and functions when printing the numeric data list using the built-in printer during power measurement.	5-36
:HCOPy:PRINter:DLISt:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}	Turns ON/OFF the output of the {element|ΣA|ΣB|ΣC} when printing the numeric data list on using the built-in printer during power measurement or queries the current setting.	5-36
:HCOPy:PRINter:DLISt:NORMal:PRESet<x>	Presets the output ON/OFF pattern of the element and function when printing the numeric data list using the built-in printer during power measurement.	5-36
:HCOPy:PRINter:DLISt:NORMal:<power measurement function>	Turns ON/OFF the output of the function when printing the numeric data list using the built-in printer during power measurement or queries the current setting.	5-36
:HCOPy:PRINter:FEED	Executes paper feeding of the built-in printer.	5-36
:HCOPy:SAVE?	Queries all settings related to saving the file.	5-36
:HCOPy:SAVE:ANAMing	Sets whether to automatically name the files to be saved or queries the current setting.	5-36
:HCOPy:SAVE:COMMent	Sets the comment to be added to the file to be saved or queries the current setting.	5-36
:HCOPy:SAVE:NAME	Sets the name of the file to be saved or queries the current setting.	5-37
:HCOPy:TIFF?	Queries all settings related to the TIFF format.	5-37
:HCOPy:TIFF:COLor	Sets the color tone for the TIFF format or queries the current setting.	5-37
HOLD Group		
:HOLD	Sets the output data (display, communications, etc.) hold or queries the current setting.	5-37
IMAGe Group		
:IMAGe?	Queries all settings related to the output of screen image data.	5-38
:IMAGe:COLor	Sets the color tone of the screen image data to be output or queries the current setting.	5-38
:IMAGe:FORMat	Sets the output format of the screen image data or queries the current setting.	5-38
:IMAGe:SEND?	Queries the screen image data.	5-38
IMPedance Group		
:IMPedance?	Queries all settings related to impedance measurements.	5-41
:IMPedance:CURRent:MRANge?	Queries the present current range.	5-41
:IMPedance:DCControl?	Queries all settings related to the DC load current.	5-41
:IMPedance:DCControl:DETaile?	Queries all settings related to the detailed settings of the DC load current.	5-41
:IMPedance:DCControl:DETaile:HOLD	Sets the action taken by the WT1600FC (handling of the control signal to the DC electronic load device) when hold is activated or queries the current setting.	5-42
:IMPedance:DCControl:DETaile:LIMit	Sets the range of the DC load current or queries the current setting.	5-42
:IMPedance:DCControl:DETaile:RATio	Sets the current value per volt of the control signal to the DC electronic load device or queries the current setting.	5-42
:IMPedance:DCControl:OFFSet	Sets the current value of the DC load current or queries the current setting.	5-42
:IMPedance:DCControl:OUTPut	Turns ON/OFF the DC load current or queries the current setting.	5-42
:IMPedance:MEASure?	Queries all settings related to impedance measurements.	5-42
:IMPedance:MEASure:ANALysis?	Sets the type of impedance measurement mode or queries the current setting.	5-42
:IMPedance:MEASure:ARRay?	Queries the array information of the loaded pattern file.	5-42
:IMPedance:MEASure:TYPE	Sets the FFT window width of impedance measurements or queries the current setting.	5-42

Command	Function	Page
:IMPedance[:STATe]	Turns ON/OFF the impedance measurement mode or queries the current setting.	5-43
:IMPedance:SUPerpose?	Queries all settings related to the load current for impedance measurements.	5-43
:IMPedance:SUPerpose:AMPLitude	Sets the amplitude of the load current for impedance measurements or queries the current setting.	5-43
:IMPedance:SUPerpose:DETaile?	Queries all settings related to the detailed settings of the load current for impedance measurements.	5-43
:IMPedance:SUPerpose:DETaile:HOLD	Sets the action taken by the WT1600FC (handling of the control signal to the impedance measurement electronic load device) when hold is activated or queries the current setting.	5-43
:IMPedance:SUPerpose:DETaile:LIMit	Sets the range of the load current for impedance measurements or queries the current setting.	5-43
:IMPedance:SUPerpose:DETaile:RATio	Sets the current value per volt of the control signal to the impedance measurement electronic load device or queries the current setting.	5-43
:IMPedance:SUPerpose:DETaile:WAVeform	Sets the waveform of the load current for impedance measurements or queries the current setting.	5-43
:IMPedance:SUPerpose:FREQuency?	Queries all settings related to the frequency of the load current for impedance measurements.	5-43
:IMPedance:SUPerpose:FREQuency:RANGe	Sets the frequency range of the load current for impedance measurements or queries the current setting.	5-44
:IMPedance:SUPerpose:FREQuency:VALue	Sets the frequency of the load current for impedance measurements or queries the current setting.	5-44
:IMPedance:SUPerpose:OFFSet	Sets the magnitude of the DC component of the load current for impedance measurements or queries the current setting.	5-44
:IMPedance:SUPerpose:OUTPut?	Queries all settings related to the output of the load current for impedance measurements.	5-44
:IMPedance:SUPerpose:OUTPut[:STATe]	Turns ON/OFF the load current for impedance measurements or queries the current setting.	5-44
:IMPedance:SUPerpose:OUTPut:TYPE	Sets the output type of the load current for impedance measurements or queries the current setting.	5-44
:IMPedance:VOLTage?	Queries all settings related to the voltage sensing input of impedance measurements.	5-44
:IMPedance:VOLTage:ESTimate?	Queries the impedance estimates of all impedance measurement elements.	5-44
:IMPedance:VOLTage:ESTimate[:ALL]	Sets the impedance estimates of all impedance measurement elements collectively.	5-44
:IMPedance:VOLTage:ESTimate:ELEMent<x>	Sets the impedance estimate of the impedance measurement element or queries the current setting.	5-45
:IMPedance:VOLTage:INITialize	Sets the voltage range to the initial range.	5-45
:IMPedance:VOLTage:MRANge?	Queries the present voltage measurement range.	5-45
:IMPedance:VOLTage:RANGe?	Queries the voltage range mode of all impedance measurement elements.	5-45
:IMPedance:VOLTage:RANGe[:ALL]	Sets the voltage range mode of all impedance measurement elements collectively.	5-45
:IMPedance:VOLTage:RANGe:ELEMent<x>	Sets the voltage range mode of the impedance measurement element or queries the current setting.	5-45

Command	Function	Page
:IMPedance:VOLTage:TERMinal?	Queries the voltage input terminal of all impedance measurement elements.	5-45
:IMPedance:VOLTage:TERMinal[:ALL]	Sets the voltage input terminals of all impedance measurement elements collectively.	5-45
:IMPedance:VOLTage:TERMinal:ELEMent<x>	Sets the voltage input terminal of the impedance measurement element or queries the current setting.	5-45
INPut Group		
:INPut?	Queries all settings related to the input element.	5-48
[:INPut]:CURRent?	Queries all settings related to the current measurement.	5-48
[:INPut]:CURRent:AUTO[:ALL]	Collectively turns ON/OFF the current auto range of all power measurement elements.	5-48
[:INPut]:CURRent:AUTO:ELEMent<x>	Turns ON/OFF the current auto range of the power measurement element or queries the current setting.	5-49
[:INPut]:CURRent:MRANge?	Queries the present current measurement range.	5-49
[:INPut]:CURRent:RANGe?	Queries the current ranges of all power measurement elements.	5-49
[:INPut]:CURRent:RANGe[:ALL]	Collectively sets the current ranges of all power measurement elements.	5-49
[:INPut]:CURRent:RANGe:ELEMent<x>	Sets the current range of the power measurement element or queries the current setting.	5-50
[:INPut]:CURRent:SRATio?	Queries the current sensor scaling constants of all power measurement elements.	5-50
[:INPut]:CURRent:SRATio[:ALL]	Collectively sets the current sensor scaling constants of all power measurement elements.	5-50
[:INPut]:CURRent:SRATio:ELEMent<x>	Sets the current sensor scaling constant of the power measurement element or queries the current setting.	5-50
[:INPut]:CURRent:TERMinal?	Queries the current measurement terminal of all power measurement elements.	5-50
[:INPut]:CURRent:TERMinal[:ALL]	Collectively sets the current measurement terminals of all power measurement elements.	5-50
[:INPut]:CURRent:TERMinal:ELEMent<x>	Sets the current measurement terminal of the power measurement element or queries the current setting.	5-51
[:INPut]:FILTer?	Queries all settings related to the filter.	5-51
[:INPut]:FILTer:LINE?	Queries the line filter settings of all elements.	5-51
[:INPut]:FILTer[:LINE][:ALL]	Collectively sets the line filters of all elements.	5-51
[:INPut]:FILTer[:LINE]:ELEMent<x>	Sets the line filter of the element or queries the current setting.	5-51
[:INPut]:FILTer:ZCRoss?	Queries the zero-crossing filter settings of all power measurement elements.	5-51
[:INPut]:FILTer:ZCRoss[:ALL]	Collectively sets the zero-crossing filters of all power measurement elements.	5-51
[:INPut]:FILTer:ZCRoss:ELEMent<x>	Sets the zero-crossing filter of the power measurement element or queries the current setting.	5-51
[:INPut]:MODUle?	Queries the input element type.	5-52
[:INPut]:NULL	Turns ON/OFF the NULL function or queries the current setting.	5-52
[:INPut]:POVer?	Queries the peak over information.	5-52
[:INPut]:SCALing?	Queries all settings related to scaling.	5-52
[:INPut]:SCALing:{PT|CT|SFACtor}?	Queries the scaling constant of all elements.	5-52
[:INPut]:SCALing:{PT|CT|SFACtor}[:ALL]	Collectively sets the scaling constants of all elements.	5-52
[:INPut]:SCALing:{PT|CT|SFACtor}:ELEMent<x>	Sets the scaling constant of the element or queries the current setting.	5-52

Command	Function	Page
[:INPut]:SCALing:STATe?	Queries the scaling ON/OFF states of all elements.	5-53
[:INPut]:SCALing[:STATe][:ALL]	Collectively turns ON/OFF the scaling of all elements.	5-53
[:INPut]:SCALing[:STATe]:ELEMent<x>	Turns ON/OFF the scaling of the element or queries the current setting.	5-53
[:INPut]:SYNChronize?	Queries the synchronization source of all power measurement elements.	5-53
[:INPut]:SYNChronize[:ALL]	Collectively sets the synchronization source of all power measurement elements.	5-53
[:INPut]:SYNChronize:ELEMent<x>	Sets the synchronization source of the power measurement element or queries the current setting.	5-53
[:INPut]:VOLTage?	Queries all settings related to the voltage measurement.	5-53
[:INPut]:VOLTage:AUTO[:ALL]	Collectively turns ON/OFF the voltage auto range of all power measurement elements.	5-53
[:INPut]:VOLTage:AUTO:ELEMent<x>	Turns ON/OFF the voltage auto range of the power measurement element or queries the current setting.	5-54
[:INPut]:VOLTage:MRANge?	Queries the present voltage measurement range.	5-54
[:INPut]:VOLTage:RANGe?	Queries the voltage ranges of all power measurement elements.	5-54
[:INPut]:VOLTage:RANGe[:ALL]	Collectively sets the voltage ranges of all power measurement elements.	5-54
[:INPut]:VOLTage:RANGe:ELEMent<x>	Sets the voltage range of the power measurement element or queries the current setting.	5-54
[:INPut]:WIRing	Sets the wiring system or queries the current setting.	5-55
INTEGrate Group		
:INTEGrate?	Queries all settings related to the integration.	5-57
:INTEGrate:ACAL	Turns ON/OFF the auto calibration or queries the current setting.	5-57
:INTEGrate:CURRent?	Queries the current mode of the current integration of all power measurement elements.	5-57
:INTEGrate:CURRent[:ALL]	Collectively sets the current mode of the current integration of all power measurement elements.	5-57
:INTEGrate:CURRent:ELEMent<x>	Sets the current mode of the current integration of the power measurement element or queries the current setting.	5-57
:INTEGrate:INDependent	Turns ON/OFF the individual element integration or queries the current setting.	5-57
:INTEGrate:MODE	Sets the integration mode or queries the current setting.	5-57
:INTEGrate:RESet	Resets the integrated value.	5-58
:INTEGrate:RTIMe<x>?	Queries the integration start and stop times for real-time integration mode.	5-58
:INTEGrate:RTIMe<x>:{STARt|END}	Sets the integration {start|stop} time for real-time integration mode or queries the current setting.	5-58
:INTEGrate:STARt	Starts the integration.	5-59
:INTEGrate:STATe?	Queries the integration condition.	5-59
:INTEGrate:STOP	Stops the integration.	5-59
:INTEGrate:TIMer<x>	Sets the integration timer time or queries the current setting.	5-59
MEASure Group		
:MEASure?	Queries all settings related to the measurement.	5-61
:MEASure:AVERaging?	Queries all settings related to averaging.	5-61
:MEASure:AVERaging:COUNt	Sets the averaging coefficient for power measurement or queries the current setting.	5-61
:MEASure:AVERaging[:STATe]	Turns ON/OFF averaging or queries the current setting.	5-61
:MEASure:AVERaging:TYPE	Sets the averaging type for power measurement or queries the current setting.	5-62
:MEASure:DMeasure?	Queries all settings related to the delta computation.	5-62
:MEASure:DMeasure:OBJect	Sets the delta computation target or queries the current setting.	5-62
:MEASure:DMeasure:TYPE	Sets the delta computation mode or queries the current setting.	5-62
:MEASure:FREQuency?	Queries all settings related to frequency measurement.	5-62
:MEASure:FREQuency:ITEM	Sets the frequency measurement item or queries the current setting.	5-63

Command	Function	Page
:MEASure:FUNCtion<x>?	Queries all settings related to user-defined functions.	5-63
:MEASure:FUNCtion<x>:EXPRession	Sets the equation of the user-defined function or queries the current setting.	5-63
:MEASure:FUNCtion<x>[:STATe]	Enables (ON) or Disables (OFF) the user-defined function or queries the current setting.	5-63
:MEASure:FUNCtion<x>:UNIT	Sets the unit to be added to the computation result of the user-defined function or queries the current setting.	5-63
:MEASure:MHOLd	Turns ON/OFF the MAX HOLD function or queries the current setting.	5-63
:MEASure:PC?	Queries all settings related to the calculation of Pc (Corrected Power).	5-64
:MEASure:PC:IEC	Sets the equation used to calculate Pc (Corrected Power) or queries the current setting.	5-64
:MEASure:PC:P<x>	Sets the parameter used to calculate Pc (Corrected Power) or queries the current setting.	5-64
:MEASure:PHASe	Sets the display format of the phase difference or queries the current setting.	5-64
:MEASure:SFORmula	Sets the equation used to calculate S (reactive power) or queries the current setting.	5-64
NUMeric Group		
:NUMeric?	Queries all settings related to the numeric data output.	5-66
:NUMeric:FORMat	Sets the format of the numeric data that is transmitted by ":NUMeric:{NORMal|HARMonics|LIST:VALue?" or queries the current setting.	5-66
:NUMeric:IMPedance?	Queries all settings related to the numeric data output for impedance measurement.	5-66
:NUMeric:IMPedance:ARRay	Sets the number of data points (the number of arrays) when outputting an array-type function or queries the current setting.	5-66
:NUMeric:IMPedance:CLEar	Clears the numeric data output items for impedance measurement.	5-66
:NUMeric:IMPedance:ITEM<x>	Sets the numeric data output items for impedance measurement or queries the current setting.	5-67
:NUMeric:IMPedance:NUMber	Sets the number of items of the numeric data that is transmitted by ":NUMeric:IMPedance:VALue?" or queries the current setting.	5-67
:NUMeric:IMPedance:PRESet	Presets the pattern of the numeric data output items for impedance measurement.	5-67
:NUMeric:IMPedance:VALue?	Queries the numeric data for impedance measurement.	5-67
:NUMeric:NORMal?	Queries all settings related to the numeric data output for power measurement.	5-67
:NUMeric[:NORMal]:CLEar	Clears the numeric data output item for power measurement.	5-68
:NUMeric[:NORMal]:ITEM<x>	Sets the numeric data output items for power measurement or queries the current setting.	5-68
:NUMeric[:NORMal]:NUMber	Sets the number of the numeric data that is transmitted by ":NUMeric:NORMal:VALue?" or queries the current setting.	5-68
:NUMeric[:NORMal]:PRESet	Presets the output item pattern of numeric data for power measurement.	5-68
:NUMeric[:NORMal]:VALue?	Queries the numeric data for power measurement.	5-68
RATE Group		
:RATE	Sets the data update rate for power measurement or queries the current setting.	5-71
STATus Group		
:STATus?	Queries all settings related to the communication status function.	5-72
:STATus:CONDition?	Queries the contents of the condition register.	5-72
:STATus:EESE	Sets the extended event enable register or queries the current setting.	5-72
:STATus:EESR?	Queries the content of the extended event register and clears the register.	5-72
:STATus:ERRor?	Queries the error code and message information (top of the error queue).	5-73
:STATus:FILTer<x>	Sets the transition filter or queries the current setting.	5-73
:STATus:QENable	Sets whether or not to store messages other than errors to the error queue (ON/OFF) or queries the current setting.	5-73

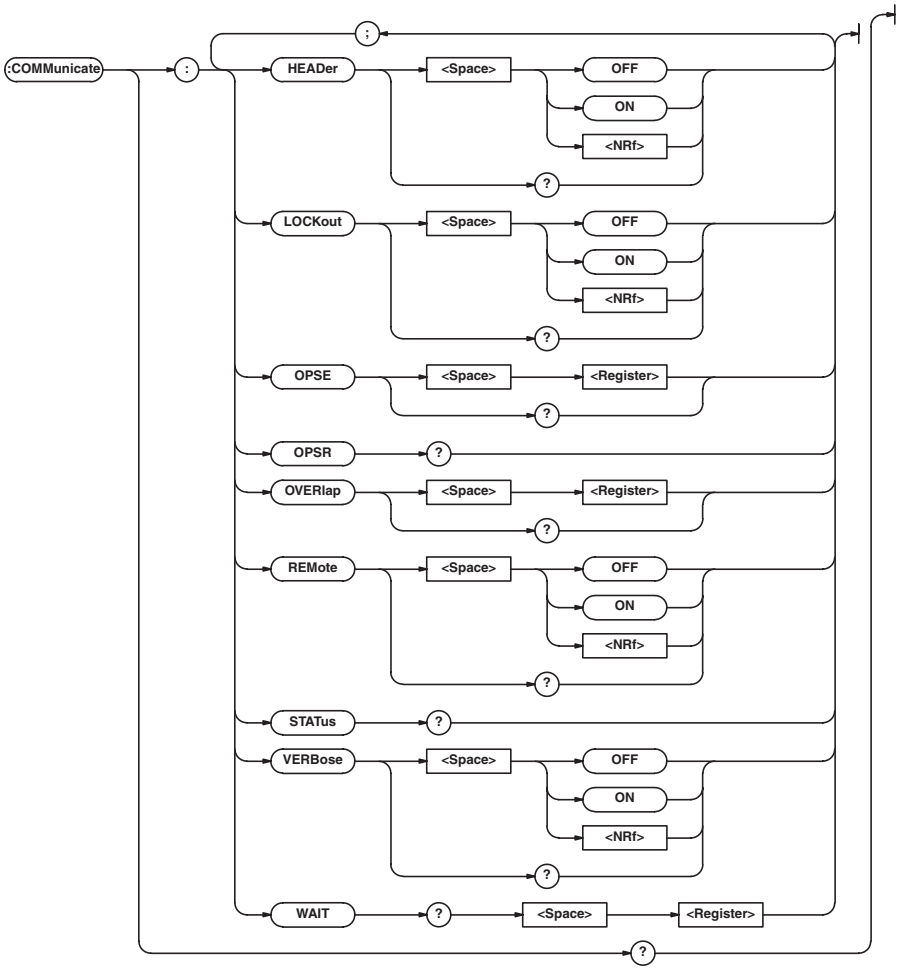
Command	Function	Page
:STATus:QMESsage	Sets whether or not to attach message information to the response to the "STATus:ERRor?" query (ON/OFF) or queries the current setting.	5-73
:STATus:SPOLI?	Executes the serial polling.	5-73
STORe Group		
:STORe?	Queries all settings related to store and recall.	5-75
:STORe:COUNt	Sets the store count or queries the current setting.	5-75
:STORe:DIRection	Sets the store destination or queries the current setting.	5-75
:STORe:FILE?	Queries all settings related to the saving of the stored data to a file.	5-75
:STORe:FILE:ANAMing	Sets whether to automatically name the files when saving the stored data or queries the current setting.	5-75
:STORe:FILE:COMMent	Sets the comment to be added to the file when saving the stored data or queries the current setting.	5-75
:STORe:FILE:NAME	Sets the name of the file when saving the stored data or queries the current setting.	5-76
:STORe:INTerval	Sets the store interval or queries the current setting.	5-76
:STORe:ITEM	Sets the items to be stored or queries the current setting.	5-76
:STORe:MEMory:CONVert:ABORt	Abort converting the stored data from the memory to the file.	5-76
:STORe:MEMory:CONVert:EXECute	Executes the converting of the stored data from the memory to the file.	5-76
:STORe:MEMory:INITialize	Executes the initialization of the storage memory.	5-76
:STORe:MODE	Sets the data storage/recall or queries the current setting.	5-76
:STORe:NUMeric?	Queries all settings related to the storage of numeric data.	5-77
:STORe:NUMeric:NORMal?	Queries all settings related to the storage of the numeric data for power measurement.	5-77
:STORe:NUMeric:NORMal:ALL	Collectively turns ON/OFF the output of all elements and functions when storing the numeric data during power measurement.	5-77
:STORe:NUMeric:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}	Turns ON/OFF the output of the {element|ΣA|ΣB|ΣC} when storing the numeric data list during power measurement or queries the current setting.	5-77
:STORe:NUMeric:NORMal:PRESet<x>	Presets the output ON/OFF pattern of the element and function when storing the numeric data during power measurement.	5-77
:STORe:NUMeric:NORMal:<power measurement function>	Turns ON/OFF the output of the function when storing the numeric data during power measurement or queries the current setting.	5-77
:STORe:RECall	Sets the data number to be recalled or queries the current setting.	5-78
:STORe:RTIMe?	Queries the store start and stop date/time for real-time store mode.	5-78
:STORe:RTIMe:{STARt|END}	Sets the store {start|stop} date/time for real-time store mode or queries the current setting.	5-78
:STORe:SMODe	Sets the store mode or queries the current setting.	5-78
:STORe:STARt	Starts the data store operation.	5-78
:STORe:STOP	Stops the data store operation.	5-78
:STORe:WAVE?	Queries all settings related to the storage of waveform display data.	5-78
:STORe:WAVE:ALL	Collectively turns ON/OFF the output of all waveforms when storing waveform display data.	5-78
:STORe:WAVE:{U<x>|I<x>}	Turns ON/OFF the output of the waveform when storing the waveform display data or queries the current setting.	5-78
SYSTem Group		
:SYSTem?	Queries all settings related to the system.	5-79
:SYSTem:DATE	Sets the date or queries the current setting.	5-79
:SYSTem:LANGuage	Sets the message language or queries the current setting.	5-80
:SYSTem:LCD?	Queries all settings related to the LCD monitor.	5-80
:SYSTem:LCD:BRIGhtness	Sets the brightness of the LCD monitor or queries the current setting.	5-80
:SYSTem:LCD:COLor?	Queries all settings related to the display colors of the LCD monitor.	5-80
:SYSTem:LCD:COLor:GRAPh?	Queries all settings related to the display colors of the graphic items.	5-80

Command	Function	Page
:SYSTem:LCD:COLor:GRAPh:{BACKground|GRATicule|CURSor|U<x>|I<x>}		
	Sets the display color of the {background|graticule|cursor| voltage waveform|current waveform} or queries the current setting.	5-80
:SYSTem:LCD:COLor:GRAPh:MODE	Sets the display color mode of the graphic items or queries the current setting.	5-80
:SYSTem:LCD:COLor:TEXT?	Queries all settings related to the display colors of the text items.	5-80
:SYSTem:LCD:COLor:TEXT:{LETTer|BACKground|BOX|SUB|SELected}		
	Sets the display color of the {text(Menu Fore)|menu background (Menu Back)|selected menu (Select Box)|pop-up menu (Sub Menu)| selected key (Selected Key)} or queries the current setting.	5-81
:SYSTem:LCD:COLor:TEXT:MODE	Sets the display color mode of the text items or queries the current setting.	5-81
:SYSTem:SCSI?	Queries all settings related to the SCSI-ID.	5-81
:SYSTem:SCSI:HDMotor	Turns ON/OFF the motor of the internal hard disk or queries the current setting.	5-81
:SYSTem:SCSI:INITialize	Executes the initialization of SCSI related parameters.	5-81
:SYSTem:SCSI:INTernalid	Set the SCSI-ID of the internal hard disk or queries the current settings.	5-81
:SYSTem:SCSI:OWNid	Set the SCSI-ID of the WT1600FC or queries the current settings.	5-81
:SYSTem:TIME	Sets the time or queries the current setting.	5-81
WAVeform Group		
:WAVeform?	Queries all information about the waveform display data.	5-82
:WAVeform:BYTeorder	Sets the output byte order of the waveform display data (FLOAT format) that is transmitted by ":WAVeform:SEND?" or queries the current setting.	5-82
:WAVeform:END	Sets the output end point of the waveform display data that is transmitted by ":WAVeform:SEND?" or queries the current setting.	5-82
:WAVeform:FORMat	Sets the format of the waveform display data that is transmitted by ":WAVeform:SEND?" or queries the current setting.	5-83
:WAVeform:LENGth?	Queries the total number of points of the waveform specified by ":WAVeform:TRACe".	5-83
:WAVeform:SEND?	Queries the waveform display data specified by ":WAVeform:TRACe".	5-83
:WAVeform:SRATe?	Queries the sample rate of the retrieved waveform.	5-83
:WAVeform:STARt	Sets the output start point of the waveform display data that is transmitted by ":WAVeform:SEND?" or queries the current setting.	5-83
:WAVeform:TRACe	Sets the target waveform for the commands in the WAVeform group or queries the current setting.	5-83
:WAVeform:TRIGger?	Queries the trigger position of the retrieved waveform.	5-83
WSETup (Wave SETup) Group		
:WSETup?	Queries all settings related to the waveform observation.	5-85
:WSETup:POSition?	Queries all settings related to the vertical position (GND position) of the waveform.	5-85
:WSETup:POSition:{UALL|IALL}	Collectively sets the vertical position (level of the center position) of the waveform {voltage|current} of all power measurement elements.	5-85
:WSETup:POSition:{U<x>|I<x>}	Sets the vertical position (level of the center position) of the waveform {voltage|current} of the element or queries the current setting.	5-85
:WSETup[:SAMPling]	Turns ON/OFF the waveform sampling or queries the current setting.	5-85
:WSETup:TDIV	Sets the Time/div value of the waveform or queries the current setting.	5-85
:WSETup:TRIGger?	Queries all settings related to the trigger.	5-85
:WSETup:TRIGger:LEVel	Sets the trigger level or queries the current setting.	5-85
:WSETup:TRIGger:MODE	Sets the trigger mode or queries the current setting.	5-85
:WSETup:TRIGger:SLOPe	Sets the trigger slope or queries the current setting.	5-85
:WSETup:TRIGger:SOURce	Sets the trigger source or queries the current setting.	5-86
:WSETup:VZoom?	Queries all settings related to the vertical zoom factor of the waveform.	5-86
:WSETup:VZoom:{UALL|IALL}	Collectively sets the vertical zoom factor of the waveform {voltage|current} of all power measurement elements.	5-86
:WSETup:VZoom:{U<x>|I<x>}	Sets the vertical zoom factor of the waveform {voltage|current} of the power measurement element or queries the current setting.	5-86

Command	Function	Page
Common Command Group		
*CAL?	Executes zero calibration (zero level compensation, same operation as pressing CAL (SHIFT+MEASURE)) and queries the result.	5-87
*CLS	Clears the standard event register, extended event register, and error queue.	5-87
*ESE	Sets the standard event enable register or queries the current setting.	5-87
*ESR?	Queries the standard event register.	5-88
*IDN?	Queries the instrument model.	5-88
*OPC	Sets a “1” to bit 0 (OPC bit) of the standard event register upon the completion of the specified overlap command.	5-88
	The register is cleared when the value rounded to an integer is a non-zero value.	5-88
*OPC?	ASCII code “1” is returned when the specified overlap command is completed when OPC? is transmitted.	5-88
*OPT?	Queries the installed options.	5-88
*PSC	Sets whether or not to clear the registers at power on or queries the current setting.	5-88
*RST	Executes the initialization of settings.	5-88
*SRE	Sets the service request enable register or queries the current setting.	5-89
*STB?	Queries the status byte register.	5-89
*TRG	Executes the same operation as when SINGLE (SHIFT+HOLD) is pressed.	5-89
*TST?	Performs a self-test and queries the result.	5-89
*WAI	Holds the subsequent command until the completion of the specified overlap operation.	5-89

5.2 COMMunicate Group

The commands in this group deal with communications.
There are no front panel keys that correspond to the commands in this group.



:COMMunicate?

Function	Queries all settings related to communications.
Syntax	`:COMMunicate?`
Example	`:COMMUNICATE? -> :COMMUNICATE:HEADER 1;OPSE 96;OVERLAP 96;VERBOSE 1`

:COMMunicate:HEADer

Function	Sets whether to add a header to the response to a query (example `DISPLAY:FORMAT NUMERIC`) or not add the header (example `NUMERIC`).
Syntax	`:COMMunicate:HEADer {<Boolean>}` `:COMMunicate:HEADer?`

Example	`:COMMUNICATE:HEADER ON`
	`:COMMUNICATE:HEADER? ->`
	`:COMMUNICATE:HEADER 1`

:COMMunicate:LOCKout

Function	Sets or clears local lockout.
Syntax	`:COMMunicate:LOCKout {<Boolean>}` `:COMMunicate:LOCKout?`

Example	`:COMMUNICATE:LOCKOUT ON`
	`:COMMUNICATE:LOCKOUT? ->`
	`:COMMUNICATE:LOCKOUT 1`

Description	This is a command specific to the serial (RS-232) interface. An interface message is available for the GP-IB interface.

:COMMunicate:OPSE (Operation Pending Status Enable register)

Function Sets the overlap command that is to used by the *OPC, *OPC?, and *WAI commands or queries the current setting.

Syntax
```
:COMMunicate:OPSE <Register>
:COMMunicate:OPSE?
```
<Register> = 0 to 65535, See the figure for the :COMMunicate:WAIT? command.

Example
```
:COMMUNICATE:OPSE 65535
:COMMUNICATE:OPSE? -> :COMMUNICATE:OPSE 96
```

Description In the above example, all bits are set to 1 to make all overlap commands applicable. However, bits fixed to 0 are not set to 1. Thus, the response to the query indicates 1 for bits 5 and 6 only.

:COMMunicate:OPSR? (Operation Pending Status Register)

Function Queries the value of the operation pending status register.

Syntax
```
:COMMunicate:OPSR?
```

Example
```
:COMMUNICATE:OPSR? -> 0
```

Description For details on the operation pending status register, see the figure for the :COMMunicate:WAIT? command.

:COMMunicate:OVERlap

Function Sets the commands that will operate as overlap commands or queries the current setting.

Syntax
```
:COMMunicate:OVERlap <Register>
:COMMunicate:OVERlap?
```
<Register> = 0 to 65535, See the figure for the :COMMunicate:WAIT? command.

Example
```
:COMMUNICATE:OVERLAP 65535
:COMMUNICATE:OVERLAP? ->
:COMMUNICATE:OVERLAP 96
```

Description
- In the above example, all bits are set to 1 to make all overlap commands applicable. However, bits fixed to 0 are not set to 1. Thus, the response to the query indicates 1 for bits 5 and 6 only.
- For the description regarding how to synchronize the program using COMMunicate:OVERlap, see page 4-8.
- In the above example, bits 5 and 6 are set to 1 to make all overlap commands applicable (see the figure for the :COMMunicate:WAIT? command).

:COMMunicate:REMote

Function Sets remote or local. ON is remote mode.

Syntax
```
:COMMunicate:REMote {<Boolean>}
:COMMunicate:REMote?
```

Example
```
:COMMUNICATE:REMOTE ON
:COMMUNICATE:REMOTE? ->
:COMMUNICATE:REMOTE 1
```

Description This is a command specific to the serial (RS-232) interface. An interface message is available for the GP-IB interface.

:COMMunicate:STATus?

Function Queries line-specific status.

Syntax
```
:COMMunicate:STATus?
```

Example
```
:COMMUNICATE:STATUS? ->
:COMMUNICATE:STATUS 0
```

Description The meaning of each status bit is as follows:

Bit	GP-IB	RS-232
0	Unrecoverable transmission error	Parity error
1	Always 0	Framing error
2	Always 0	Break character detected
3 to	Always 0	Always 0

The status bit is set when the corresponding cause occurs and cleared when it is read.

:COMMunicate:VERBose

Function Sets whether to return the response to a query using full spelling (example DISPLAY:FORMAT NUMERIC) or using abbreviation (example DISP:FORM NUM).

Syntax
```
:COMMunicate:VERBose {<Boolean>}
:COMMunicate:VERBose?
```

Example
```
:COMMUNICATE:VERBOSE ON
:COMMUNICATE:VERBOSE? ->
:COMMUNICATE:VERBOSE 1
```

:COMMunicate:WAIT

Function Waits for one of the specified extended events to occur.

Syntax
```
:COMMunicate:WAIT <Register>
```
<Register> = 0 to 65535 (extended event register, see page 6-4.)

Example
```
:COMMUNICATE:WAIT 1
```

Description For the description regarding how to synchronize the program using COMMunicate:WAIT, see page 4-9.

:COMMunicate:WAIT?

Function Creates the response that is returned when the specified event occurs.

Syntax `:COMMunicate:WAIT? <Register>`
`<Register>`= 0 to 65535 (extended event register, see page 6-4.)

Example `:COMMUNICATE:WAIT? 65535 -> 1`

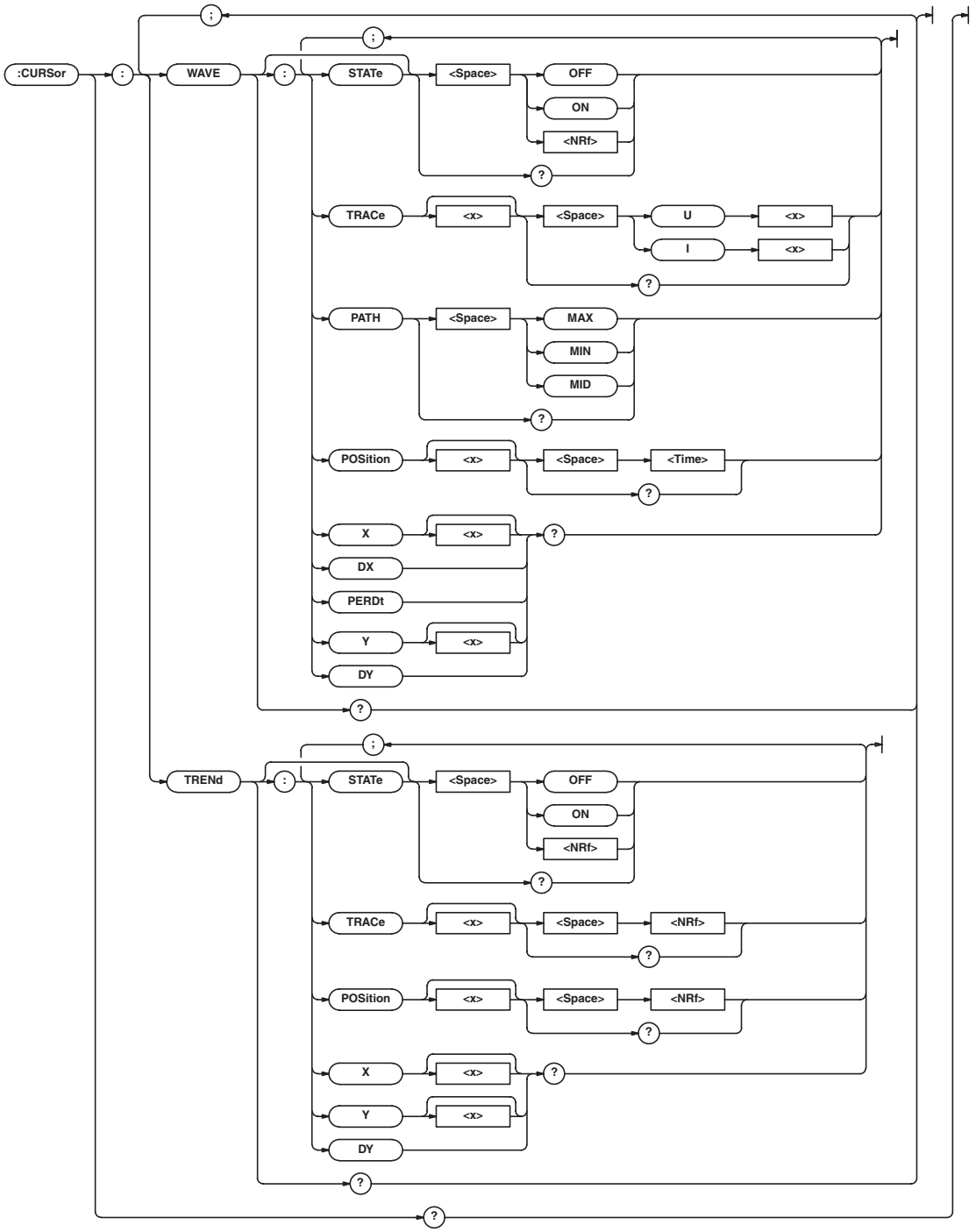
Operation pending status register/overlap enable register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	ACS	PRN	0	0	0	0	0

When bit 5 (PRN) = 1:
Built-in printer operation and network printer operation not complete
When bit 6 (ACS) = 1:
Access to the medium not complete.

5.3 CURSor Group

The commands in this group deal with cursor measurements. You can make the same settings and inquiries as when CURSOR (SHIFT+WAVE) on the front panel is used.
However, the commands in this group are invalid on models that are only equipped with impedance measurement elements.



:CURSor?

Function Queries all settings related to cursor measurements.

Syntax `:CURSor?`

Example
```
:CURSOR? -> :CURSOR:WAVE:STATE 0;
TRACE1 U1;TRACE2 I1;PATH MAX;
POSITION1 2.0E-03;
POSITION2 8.0E-03;:CURSOR:TREND:
STATE 0;TRACE1 1;TRACE2 2;
POSITION1 6;POSITION2 54
```

:CURSor:TRENd?

Function Queries all settings related to the cursor measurement on the trend.

Syntax `:CURSor:TRENd?`

Example
```
:CURSOR:TREND? ->
:CURSOR:TREND:STATE 1;TRACE1 1;
TRACE2 2;POSITION1 6;POSITION2 54
```

:CURSor:TRENd:POSition<x>

Function Sets the cursor position on the trend or queries the current setting.

Syntax
```
:CURSor:TRENd:POSition<x> {<NRf>}
:CURSor:TRENd:POSition<x>?
```
<x> = 1, 2
<NRf> = 0 to 500

Example
```
:CURSOR:TREND:POSITION1 10
:CURSOR:TREND:POSITION1? ->
:CURSOR:TREND:POSITION1 10
```

:CURSor:TRENd[:STATe]

Function Turns ON/OFF the cursor display on the trend or queries the current setting.

Syntax
```
:CURSor:TRENd[:STATe] {<Boolean>}
:CURSor:TRENd:STATe?
```

Example
```
:CURSOR:TREND:STATE ON
:CURSOR:TREND:STATE? -> :CURSOR:
TREND:STATE 1
```

:CURSor:TRENd:TRACe<x>

Function Sets the cursor target on the trend or queries the current setting.

Syntax
```
:CURSor:TRENd:TRACe<x> {<NRf>}
:CURSor:TRENd:TRACe<x>?
```
<x> = 1, 2
<NRf> = 1 to 16

Example
```
:CURSOR:TREND:TRACE1 1
:CURSOR:TREND:TRACE1? -> :CURSOR:
TREND:TRACE1 1
```

:CURSor:TRENd:{X<x>|Y<x>|DY}?

Function Queries the cursor measurement value on the trend.

Syntax
```
:CURSor:TRENd:{X<x>|Y<x>|DY}?
```
X<x> = Trend time string of the cursor position (X1=D+, X2=Dx)
Y<x> = Y-axis value of the cursor position (Y1=Y+, Y2=Yx)
DY = Y-axis value between cursors (ΔY)
<x> = 1, 2

Example
```
:CURSOR:TREND:X1? -> "2003/04/01
12:34:56"
:CURSOR:TREND:Y1? -> 78.628E+00
```

Description If the cursor display is not turned ON on the trend, the following results.
For X<x>: "****/**/** **:**:**" is returned.
For Y<x> and DY: "NAN (Not A Number)" is returned.

:CURSor:WAVE?

Function Queries all settings related to the cursor measurement on the waveform display.

Syntax `:CURSor:WAVE?`

Example
```
:CURSOR:WAVE? -> :CURSOR:WAVE:
STATE 1;TRACE1 U1;TRACE2 I1;
PATH MAX;POSITION1 2.0E-03;
POSITION2 8.0E-03
```

:CURSor:WAVE:PATH

Function Sets the cursor path on the waveform display or queries the current setting.

Syntax
```
:CURSor:WAVE:PATH {MAX|MIN|MID}
:CURSor:WAVE:PATH?
```

Example
```
:CURSOR:WAVE:PATH MAX
:CURSOR:WAVE:PATH? -> :CURSOR:WAVE:
PATH MAX
```

:CURSor:WAVE:POSition<x>

Function Sets the cursor position on the waveform display or queries the current setting.

Syntax
```
:CURSor:WAVE:POSition<x> {<Time>}
:CURSor:WAVE:POSition<x>?
```
<x> = 1, 2
<Time> = 0 to 5.00 s

Example
```
:CURSOR:WAVE:POSITION1 2MS
:CURSOR:WAVE:POSITION1? -> :CURSOR:
WAVE:POSITION1 2.0E-03
```

Description The selectable range and resolution of <Time> is determined by the Time/div value of the waveform (`:WSETup:TDIV`).

:CURSor:WAVE[:STATe]

Function Turns ON/OFF the cursor display on the waveform display or queries the current setting.

Syntax
```
:CURSor:WAVE[:STATe] {<Boolean>}
:CURSor:WAVE:STATe?
```

Example
```
:CURSOR:WAVE:STATE ON
:CURSOR:WAVE:STATE? -> :CURSOR:
WAVE:STATE 1
```

:CURSor:WAVE:TRACe<x>

Function Sets the cursor target on the waveform display or queries the current setting.

Syntax
```
:CURSor:WAVE:TRACe<x> {U<x>|I<x>}
:CURSor:WAVE:TRACe<x>?
```
<x> of TRACe<x> = 1 and 2
<x> of U<x>, I<x> = 1 to 4 (power measurement element)

Example
```
:CURSOR:WAVE:TRACE1 U1
:CURSOR:WAVE:TRACE1? ->
:CURSOR:WAVE:TRACE1 U1
```

:CURSor:WAVE:{X<x>|DX|PERDt|Y<x>|DY}?

Function Queries the cursor measurement value on the waveform display.

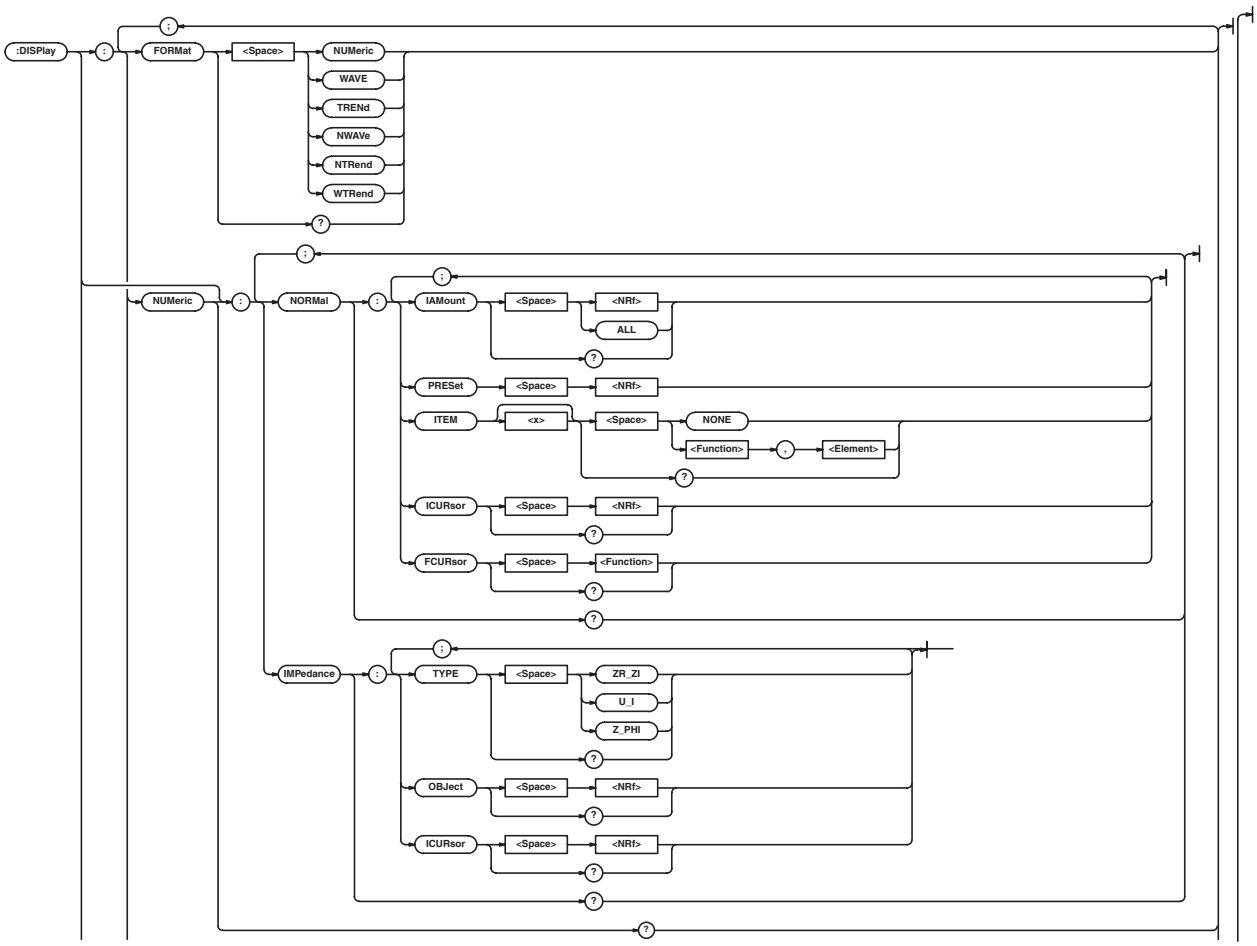
Syntax
```
:CURSor:WAVE:{X<x>|DX|PERDt|Y<x>|
DY}?
```
X<x> = X-axis value of the cursor position (X1=X+, X2=Xx)
DX = X-axis value between cursors (ΔX)
PERDt = 1/ΔT (1/ΔX) value between cursors
Y<x> = Y-axis value of the cursor position (Y1=Y+, Y2=Yx)
DY = Y-axis value between cursors (ΔY)
<x> = 1, 2

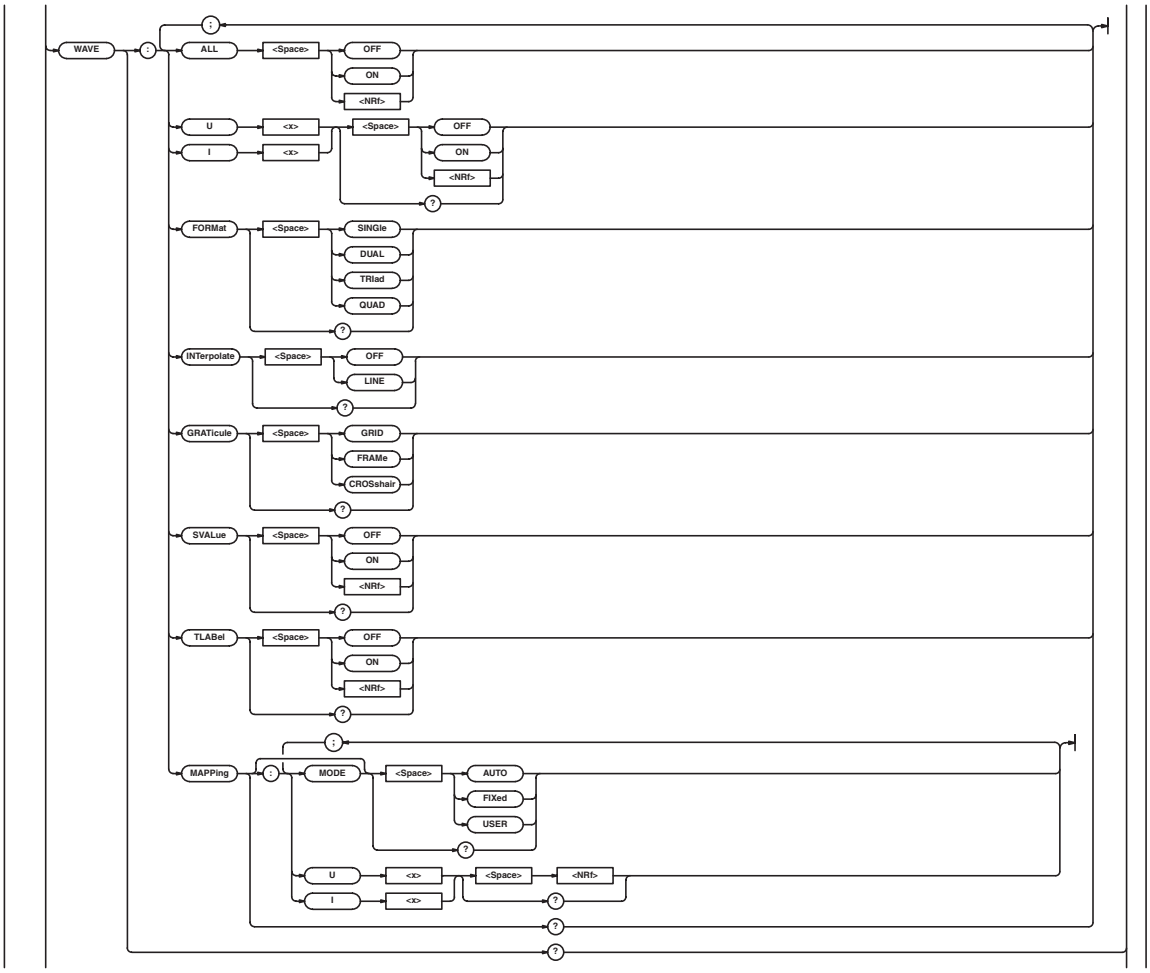
Example
```
:CURSOR:WAVE:Y1? -> 78.628E+00
```

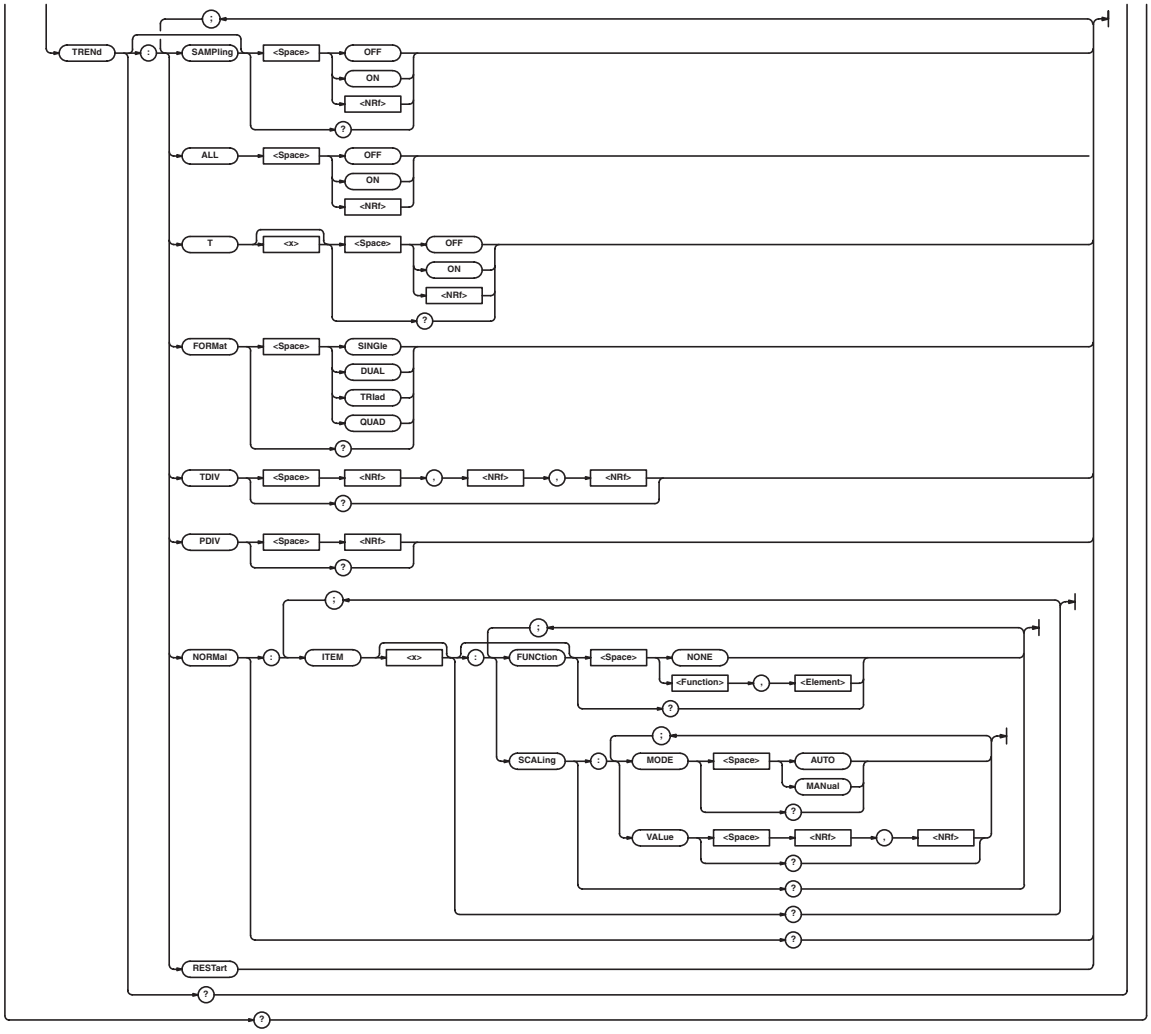
Description If the cursor display is not turned ON in the waveform display, “NAN (Not A Number)” is returned.

5.4 DISPlay Group

The commands in this group deal with the screen display.
You can make the same settings and inquiries as when DISPLAY on the front panel is used.




WAVE
:
ALL
<Space>
OFF
ON
<NRf>
U
I
<x>
<Space>
OFF
ON
<NRf>
?
FORMat
<Space>
SINGle
DUAL
TRIad
QUAD
?
INTerpolate
<Space>
OFF
LINE
?
GRATicule
<Space>
GRID
FRAMe
CROSshair
?
SVALue
<Space>
OFF
ON
<NRf>
?
TLABel
<Space>
OFF
ON
<NRf>
?
MAPPing
:
MODE
<Space>
AUTO
FIXed
USER
?
U
I
<x>
<Space>
<NRf>
?
?
?


TRENd
SAMPling
<Space>
OFF
ON
<NRf>
ALL
<Space>
OFF
ON
<NRf>
T
<x>
<Space>
OFF
ON
<NRf>
FORMat
<Space>
SINGle
DUAL
TRIad
QUAD
TDIV
<Space>
<NRf>
<NRf>
<NRf>
PDIV
<Space>
<NRf>
NORMal
ITEM
<x>
FUNCtion
<Space>
NONE
<Function>
<Element>
SCALing
MODE
<Space>
AUTO
MANual
VALue
<Space>
<NRf>
<NRf>
RESTart

:DISPlay?

Function Queries all settings related to the screen display.

Syntax `:DISPlay?`

Example
- Example in which the display format (`:DISPlay:FORMat`) is set to "NWAVe"
  `:DISPLAY? -> :DISPLAY:FORMAT NWAVE;`(Response to "`:DISPlay:NUMeric?`" with the first "`:DISPLAY:`" section removed)`;`(the response to "`:DISPlay:WAVE?`")

:DISPlay:FORMat

Function Sets the display format or queries the current setting.

Syntax
`:DISPlay:FORMat {NUMeric|WAVE|TRENd|NWAVe|NTRend|WTRend}`
`:DISPlay:FORMat?`
NUMeric = Displays only the numeric values.
WAVE = Displays only the waveforms.
TRENd = Trend
NWAVe = Displays both the numeric values and the waveforms.
NTrend = Displays both the numeric values and the trends.
WTRend = Displays both the waveforms and the trends.

Example
`:DISPLAY:FORMAT NUMERIC`
`:DISPLAY:FORMAT? -> :DISPLAY:FORMAT NUMERIC`

Description
- This command is valid only during power measurement. A dedicated impedance measurement display is shown during impedance measurement, regardless of this setting.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:NUMeric?

Function Queries all settings related to the numeric display.

Syntax `:DISPlay:NUMeric?`

Example
- During power measurement (`:IMPedance[:STATe]` is set to "OFF(0)")
  `:DISPLAY:NUMERIC? ->` (same as the response to "`:DISPlay[:NUMeric]:NORMal?`")
- During impedance measurement (`:IMPedance[:STATe]` is set to "ON(1)")
  `:DISPLAY:NUMERIC? ->` (same as the response to "`:DISPlay[:NUMeric]:IMPedance?`")

Description
- This command is valid only during power measurement. A dedicated impedance measurement display is shown during impedance measurement, regardless of this setting.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:IMPedance?

Function Queries all settings related to the numeric display for impedance measurement.

Syntax `:DISPlay[:NUMeric]:IMPedance?`

Example
`:DISPLAY:NUMERIC:IMPEDANCE? ->`
`:DISPLAY:NUMERIC:IMPEDANCE:TYPE ZR_ZI;OBJECT 5;ICURSOR 1`

:DISPlay[:NUMeric]:IMPedance:ICURsor

Function Sets the cursor position on the numeric display for impedance measurement or queries the current setting.

Syntax
`:DISPlay[:NUMeric]:IMPedance:ICURsor {<NRf>}`
`:DISPlay[:NUMeric]:IMPedance:ICURsor?`
<NRf> = 1 to 100

Example
`:DISPLAY:NUMERIC:IMPEDANCE:ICURSOR 1`
`:DISPLAY:NUMERIC:IMPEDANCE:ICURSOR? -> :DISPLAY:NUMERIC:IMPEDANCE:ICURSOR 1`

Description Specify the cursor position in terms of the item number.

:DISPlay[:NUMeric]:IMPedance:OBJect

Function Sets the numeric display element for impedance measurement or queries the current setting.

Syntax
`:DISPlay[:NUMeric]:IMPedance:OBJect {<NRf>}`
`:DISPlay[:NUMeric]:IMPedance:OBJect?`
<NRf> = 1 to 5 (impedance measurement element)

Example
`:DISPLAY:NUMERIC:IMPEDANCE:OBJECT 5`
`:DISPLAY:NUMERIC:IMPEDANCE:OBJECT? -> :DISPLAY:NUMERIC:IMPEDANCE:OBJECT 5`

:DISPlay[:NUMeric]:IMPedance:TYPE

Function Sets the numeric display format for impedance measurement or queries the current setting.

Syntax
```
:DISPlay[:NUMeric]:IMPedance:
TYPE {ZR_ZI|U_I|Z_PHI}
:DISPlay[:NUMeric]:IMPedance:TYPE?
```

Example
```
:DISPLAY:NUMERIC:IMPEDANCE:
TYPE ZR_ZI
:DISPLAY:NUMERIC:IMPEDANCE:TYPE? ->
:DISPLAY:NUMERIC:IMPEDANCE:
TYPE ZR_ZI
```

:DISPlay[:NUMeric]:NORMal?

Function Queries all settings related to the numeric display for power measurement.

Syntax
```
:DISPlay[:NUMeric]:NORMal?
```

Example
- Example in which the display format of numeric values (`:DISPlay[:NUMeric]:NORMal:IAMount`) is set to "<NRf>(split display)"

```
:DISPLAY:NUMERIC:NORMAL? ->
:DISPLAY:NUMERIC:NORMAL:
IAMOUNT 4;ITEM1 URMS,1;
ITEM2 UMN,1;ITEM3
UDC,1;...(omitted)
...;ITEM100 NONE;ICURSOR 1
```

- Example in which the display format of numeric values (`:DISPlay[:NUMeric]:NORMal:IAMount`) is set to "ALL (all display)"

```
:DISPLAY:NUMERIC:NORMAL? ->
:DISPLAY:NUMERIC:NORMAL:
IAMOUNT ALL;FCURSOR URMS
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:NORMal:FCURsor

Function Sets the cursor position on the numeric display (all display) for power measurement or queries the current setting.

Syntax
```
:DISPlay[:NUMeric]:NORMal:
FCURsor {<Function>}
:DISPlay[:NUMeric]:NORMal:FCURsor?
```
<Function> = {URMS|UMN|UDC|UAC|IRMS|...} (See the function selection list (1).")

Example
```
:DISPLAY:NUMERIC:NORMAL:
FCURSOR URMS
:DISPLAY:NUMERIC:NORMAL:FCURSOR? ->
:DISPLAY:NUMERIC:NORMAL:
FCURSOR URMS
```

Description
- Specify the cursor position in terms of the function.
- This command is valid when the display format of numeric values (`:DISPlay[:NUMeric]:NORMal:IAMount`) is set to "ALL (all display)."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:NORMal:IAMount

Function Sets the numeric display format for power measurement or queries the current setting.

Syntax
```
:DISPlay[:NUMeric]:NORMal:
IAMount {<NRf>|ALL}
:DISPlay[:NUMeric]:NORMal:IAMount?
```
<NRf> = 4, 8, 16, 42, or 78

Example
```
:DISPLAY:NUMERIC:NORMAL:IAMOUNT 4
:DISPLAY:NUMERIC:NORMAL:IAMOUNT? ->
:DISPLAY:NUMERIC:NORMAL:IAMOUNT 4
```

Description
- The contents of the measured data that are displayed are as follows depending on the setting of the numeric display format.
  <NRf>: Numeric display items are displayed in order by the item number.(<NRf> expresses the number of items that is displayed on a single screen.)
  ALL: All power measurement functions are displayed in order by element.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:NORMal:ICURsor

Function Sets the cursor position on the numeric display (split display) for power measurement or queries the current setting.

Syntax
```
:DISPlay[:NUMeric]:NORMal:
ICURsor {<NRf>}
:DISPlay[:NUMeric]:NORMal:ICURsor?
```
<NRf> = 1 to 100

Example
```
:DISPLAY:NUMERIC:NORMAL:ICURSOR 1
:DISPLAY:NUMERIC:NORMAL:ICURSOR? ->
:DISPLAY:NUMERIC:NORMAL:ICURSOR 1
```

Description
- Specify the cursor position in terms of the item number.
- This command is valid when the display format of numeric values (`:DISPlay[:NUMeric]:NORMal:IAMount`) is set to "<NRf> (split display)."

- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:NORMal:ITEM<x>

Function Sets the numeric display item for power measurement or queries the current setting.

Syntax
```
:DISPlay[:NUMeric]:NORMal:ITEM<x>
{NONE|<Function>,<Element>}
:DISPlay[:NUMeric]:NORMal:ITEM<x>?
```
<x> = 1 to 100 (item number)
NONE = No display item
<Function> = {URMS|UMN|UDC|UAC|IRMS|...} (See the function selection list (1).")
<Element> = {<NRf>|SIGMA|SIGMB|SIGMC}(<NRf> = 1 to 4 (power measurement element))

Example
```
:DISPLAY:NUMERIC:NORMAL:
ITEM1 URMS,1
:DISPLAY:NUMERIC:NORMAL:ITEM1? ->
:DISPLAY:NUMERIC:NORMAL:
ITEM1 URMS,1
```

Description
- This command is valid when the display format of numeric values (:DISPlay[:NUMeric]:NORMal:IAMount) is set to "<NRf> (split display)."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay[:NUMeric]:NORMal:PRESet

Function Presets the display order pattern of numeric display items for power measurement.

Syntax
```
:DISPlay[:NUMeric]:NORMal:
PRESet {<NRf>}
```
<NRf> = 1 to 4 (pattern number)

Example
```
:DISPLAY:NUMERIC:NORMAL:PRESET 1
```

Description
- Regardless of what value (1 to 4) is specified for <NRf>, the display pattern (order) of the numeric display items will be the same as the display order when Reset List Exec of the Display setting menu, which is displayed on the WT1600FC screen, is executed. For details on the order of displayed items when reset is executed, see the WT1600FC User's Manual (IM760151-01E).
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd?

Function Queries all settings related to the trend.

Syntax
```
:DISPlay:TRENd?
```

Example
```
:DISPLAY:TREND? -> :DISPLAY:TREND:
SAMPLING 1;T1 1;T2 1;T3 1;T4 1;
T5 1;T6 1;T7 1;T8 1;T9 0;T10 0;
T11 0;T12 0;T13 0;T14 0;T15 0;
T16 0;FORMAT SINGLE;TDIV 0,0,3;
NORMAL:ITEM1:FUNCTION URMS,1;
SCALING:MODE AUTO;VALUE 100.00E+00,
-100.00E+00;:DISPLAY:TREND:NORMAL:
ITEM2:FUNCTION IRMS,1;SCALING:
MODE AUTO;VALUE 100.00E+00,
-100.00E+00;...(omitted)...;
:DISPLAY:TREND:NORMAL:ITEM16:
FUNCTION FU,2;SCALING:
MODE AUTO;VALUE 100.00E+00,
-100.00E+00
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:ALL

Function Collectively turns ON/OFF all trends.

Syntax
```
:DISPlay:TRENd:ALL {<Boolean>}
```

Example
```
:DISPLAY:TREND:ALL ON
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:FORMat

Function Sets the display format of the trend or queries the current setting.

Syntax
```
:DISPlay:TRENd:FORMat {SINGle|DUAL|
TRIad|QUAD}
:DISPlay:TRENd:FORMat?
```

Example
```
:DISPLAY:TREND:FORMAT SINGLE
:DISPLAY:TREND:FORMAT? ->
:DISPLAY:TREND:FORMAT SINGLE
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal?

Function Queries all settings related to all the trends for power measurement.

Syntax `:DISPlay:TRENd:NORMal?`

Example
```
:DISPLAY:TREND:NORMAL? ->
:DISPLAY:TREND:NORMAL:ITEM1:
FUNCTION URMS,1;SCALING:MODE AUTO;
VALUE 100.00E+00,-100.00E+00;:
DISPLAY:TREND:NORMAL:ITEM2:
FUNCTION IRMS,1;SCALING:MODE AUTO;
VALUE 100.00E+00,-100.00E+00;...
(omitted)...;:DISPLAY:TREND:NORMAL:
ITEM16:FUNCTION FU,2;SCALING:
MODE AUTO;VALUE 100.00E+00,
-100.00E+00
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal:ITEM<x>?

Function Queries all settings related to the trend for power measurement.

Syntax `:DISPlay:TRENd:NORMal:ITEM<x>?`
<x> = 1 to 16 (item number)

Example
```
:DISPLAY:TREND:NORMAL:ITEM1? ->
:DISPLAY:TREND:NORMAL:ITEM1:
FUNCTION URMS,1;SCALING:MODE AUTO;
VALUE 100.00E+00,-100.00E+00
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal:ITEM<x>[:FUNCtion]

Function Sets the trend item for power measurement or queries the current setting.

Syntax
```
:DISPlay:TRENd:NORMal:ITEM<x>
[:FUNCtion] {NONE|<Function>,
<Element>}
:DISPlay:TRENd:NORMal:ITEM<x>:
FUNCtion?
```
<x> = 1 to 16 (item number)
NONE = No display item
<Function> = {URMS|UMN|UDC|UAC|IRMS|...} (See the function selection list (1).")
<Element> = {<NRf>|SIGMA|SIGMB|SIGMC}(<NRf> = 1 to 4) (power measurement element)

Example
```
:DISPLAY:TREND:NORMAL:ITEM1:
FUNCTION URMS,1
:DISPLAY:TREND:NORMAL:ITEM1:
FUNCTION? -> :DISPLAY:TREND:NORMAL:
ITEM1:FUNCTION URMS,1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal:ITEM<x>:SCALing?

Function Queries all settings related to the scaling of the trend for power measurement.

Syntax
```
:DISPlay:TRENd:NORMal:ITEM<x>:
SCALing?
```
<x> = 1 to 16 (item number)

Example
```
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING? -> :DISPLAY:TREND:NORMAL:
ITEM1:SCALING:MODE AUTO;
VALUE 100.00E+00,-100.00E+00
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal:ITEM<x>:SCALing:MODE

Function Sets the scaling mode of the trend for power measurement or queries the current setting.

Syntax
```
:DISPlay:TRENd:NORMal:ITEM<x>:
SCALing:MODE {AUTO|MANual}
:DISPlay:TRENd:NORMal:ITEM<x>:
SCALing:MODE?
```
<x> = 1 to 16 (item number)

Example
```
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING:MODE AUTO
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING:MODE? -> :DISPLAY:TREND:
NORMAL:ITEM1:SCALING:MODE AUTO
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:TRENd:NORMal:ITEM<x>:SCALing:VALue

Function Sets the upper and lower limits of manual scaling of the trend for power measurement or queries the current setting.

Syntax
```
:DISPlay:TRENd:NORMal:ITEM<x>:
SCALing:VALue {<NRf>,<NRf>}
:DISPlay:TRENd:NORMal:ITEM<x>:
SCALing:VALue?
```
<x> = 1 to 16 (item number)
<NRf> = –9.9999E+30 to 9.9999E+30

Example
```
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING:VALUE 100,-100
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING:VALUE? ->
:DISPLAY:TREND:NORMAL:ITEM1:
SCALING:VALUE 100.00E+00,
-100.00E+00
```

Description
- Set the upper limit and then the lower limit.
- This command is valid when the scaling mode of the trend (`:DISPlay:TRENd:NORMal:ITEM<x>:SCALing:MODE`) is set to "MANual."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:TRENd:PDIV`

Function Sets the horizontal axis (Point/div) of the trend or queries the current setting.

Syntax
```
:DISPlay:TRENd:PDIV {<NRf>}
:DISPlay:TRENd:PDIV?
```
<NRf> = 1, 2, 5, 10, 20, 50, 100, 200, or 500

Example
```
:DISPLAY:TREND:PDIV 50
:DISPLAY:TREND:PDIV? -> :DISPLAY:
TREND:PDIV 50
```

Description
- This command is valid when waveform sampling (`:WSETup[:SAMPling]`) is set to ON during power measurement.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:TRENd:RESTart`

Function Restarts the trend.

Syntax
```
:DISPlay:TRENd:RESTart
```

Example
```
:DISPLAY:TREND:RESTART
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:TRENd[:SAMPling]`

Function Turns ON/OFF the trend waveform sampling or queries the current setting.

Syntax
```
:DISPlay:TRENd:
[:SAMPling] {<Boolean>}
:DISPlay:TRENd:[:SAMPling]?
```

Example
```
:DISPLAY:TREND:SAMPLING ON
:DISPLAY:TREND:SAMPLING? ->
:DISPLAY:TREND:SAMPLING 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:TRENd:TDIV`

Function Sets the horizontal axis (T/div) of the trend for power measurement or queries the current setting.

Syntax
```
:DISPlay:TRENd:TDIV {<NRf>,<NRf>,
<NRf>}
:DISPlay:TRENd:TDIV?
```
{<NRf>, <NRf>, <NRf>} = 0, 0, 3 to 24, 0, 0
1st <NRf> = 1, 3, 6, 12, or 24 (hour)
2nd <NRf> = 2, 3, 6, 10, or 30 (minute)
3rd <NRf> = 3, 6, 10, or 30 (second)

Example
```
:DISPLAY:TREND:TDIV 0,0,3
:DISPLAY:TREND:TDIV? -> :DISPLAY:
TREND:TDIV 0,0,3
```

Description
- Set the three <NRf>'s so that one <NRf> is a non-zero value and the other two are zeroes.
- This command is valid when waveform sampling (`:WSETup[:SAMPling]`) is set to OFF.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:TRENd:T<x>`

Function Turns ON/OFF the trend or queries the current setting.

Syntax
```
:DISPlay:TRENd:T<x> {<Boolean>}
:DISPlay:TRENd:T<x>?
```
<x> = 1 to 16 (item number)

Example
```
:DISPLAY:TREND:T1 ON
:DISPLAY:TREND:T1? ->
:DISPLAY:TREND:T1 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

`:DISPlay:WAVE?`

Function Queries all settings related to the waveform display.

Syntax
```
:DISPlay:WAVE?
```

Example
```
:DISPLAY:WAVE? -> :DISPLAY:WAVE:
U1 1;U2 1;U3 1;U4 1;I1 1;I2 1;I3 1;
I4 1;FORMAT SINGLE;
INTERPOLATE LINE;GRATICULE GRID;
SVALUE 1;TLABEL 0;MAPPING:MODE AUTO
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:ALL

Function Collectively turns ON/OFF all waveform displays.
Syntax `:DISPlay:WAVE:ALL {<Boolean>}`
Example `:DISPLAY:WAVE:ALL ON`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:FORMat

Function Sets the display format of the waveform or queries the current setting.
Syntax `:DISPlay:WAVE:FORMat {SINGle|DUAL|TRIad|QUAD}`
`:DISPlay:WAVE:FORMat?`
Example `:DISPLAY:WAVE:FORMAT SINGLE`
`:DISPLAY:WAVE:FORMAT? -> :DISPLAY:WAVE:FORMAT SINGLE`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:GRATicule

Function Sets the graticule (grid) type or queries the current setting.
Syntax `:DISPlay:WAVE:GRATicule {GRID|FRAMe|CROSshair}`
`:DISPlay:WAVE:GRATicule?`
Example `:DISPLAY:WAVE:GRATICULE GRID`
`:DISPLAY:WAVE:GRATICULE? -> :DISPLAY:WAVE:GRATICULE GRID`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:INTerpolate

Function Sets the interpolation method of the waveform or queries the current setting.
Syntax `:DISPlay:WAVE:INTerpolate {OFF|LINE}`
`:DISPlay:WAVE:INTerpolate?`
Example `:DISPLAY:WAVE:INTERPOLATE LINE`
`:DISPLAY:WAVE:INTERPOLATE? -> :DISPLAY:WAVE:INTERPOLATE LINE`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:MAPPing?

Function Queries all settings related to the waveform mapping to the split screen.
Syntax `:DISPlay:WAVE:MAPPing?`
Example `:DISPLAY:WAVE:MAPPING? -> :DISPLAY:WAVE:MAPPING:MODE USER;U1 0;U2 1;U3 2;U4 3;I1 0;I2 1;I3 2;I4 3`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:MAPPing[:MODE]

Function Sets the waveform mapping method for the split screen or queries the current setting.
Syntax `:DISPlay:WAVE:MAPPing[:MODE] {AUTO|FIXed|USER}`
`:DISPlay:WAVE:MAPPing:MODE?`
Example `:DISPLAY:WAVE:MAPPING:MODE AUTO`
`:DISPLAY:WAVE:MAPPING:MODE? -> :DISPLAY:WAVE:MAPPING:MODE AUTO`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:MAPPing:{U<x>|I<x>}

Function Sets the mapping of the {voltage|current} waveform to the split screen or queries the current setting.
Syntax `:DISPlay:WAVE:MAPPing:{U<x>|I<x>} {<NRf>}`
`:DISPlay:WAVE:MAPPing:{U<x>|I<x>}?`
<x> = 1 to 4 (power measurement element)
<NRf> = 0 to 3
Example `:DISPLAY:WAVE:MAPPING:U1 0`
`:DISPLAY:WAVE:MAPPING:U1? -> :DISPLAY:WAVE:MAPPING:U1 0`
Description
- This command is valid when the waveform mapping method (`:DISPlay:WAVE:MAPPing[:MODE]`) is set to "USER."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:SVALue (Scale VALue)

Function Turns ON/OFF the scale value display or queries the current setting.

Syntax
```
:DISPlay:WAVE:SVALue {<Boolean>}
:DISPlay:WAVE:SVALue?
```

Example
```
:DISPLAY:WAVE:SVALUE ON
:DISPLAY:WAVE:SVALUE? -> :DISPLAY:
WAVE:SVALUE 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:TLABel (Trace LABel)

Function Turns ON/OFF the waveform label display or queries the current setting.

Syntax
```
:DISPlay:WAVE:TLABel {<Boolean>}
:DISPlay:WAVE:TLABel?
```

Example
```
:DISPLAY:WAVE:TLABEL OFF
:DISPLAY:WAVE:TLABEL? -> :DISPLAY:
WAVE:TLABEL 0
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:DISPlay:WAVE:{U<x>|I<x>}

Function Turns ON/OFF the {voltage|current} waveform or queries the current setting.

Syntax
```
:DISPlay:WAVE:{U<x>|I<x>}
{<Boolean>}
:DISPlay:WAVE:{U<x>|I<x>}?
```
<x> = 1 to 4 (power measurement element)

Example
```
:DISPLAY:WAVE:U1 ON
:DISPLAY:WAVE:U1? -> :DISPLAY:WAVE:
U1 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

*Function Selection (<Function>) List

(1) Functions in the Power Measurement Mode

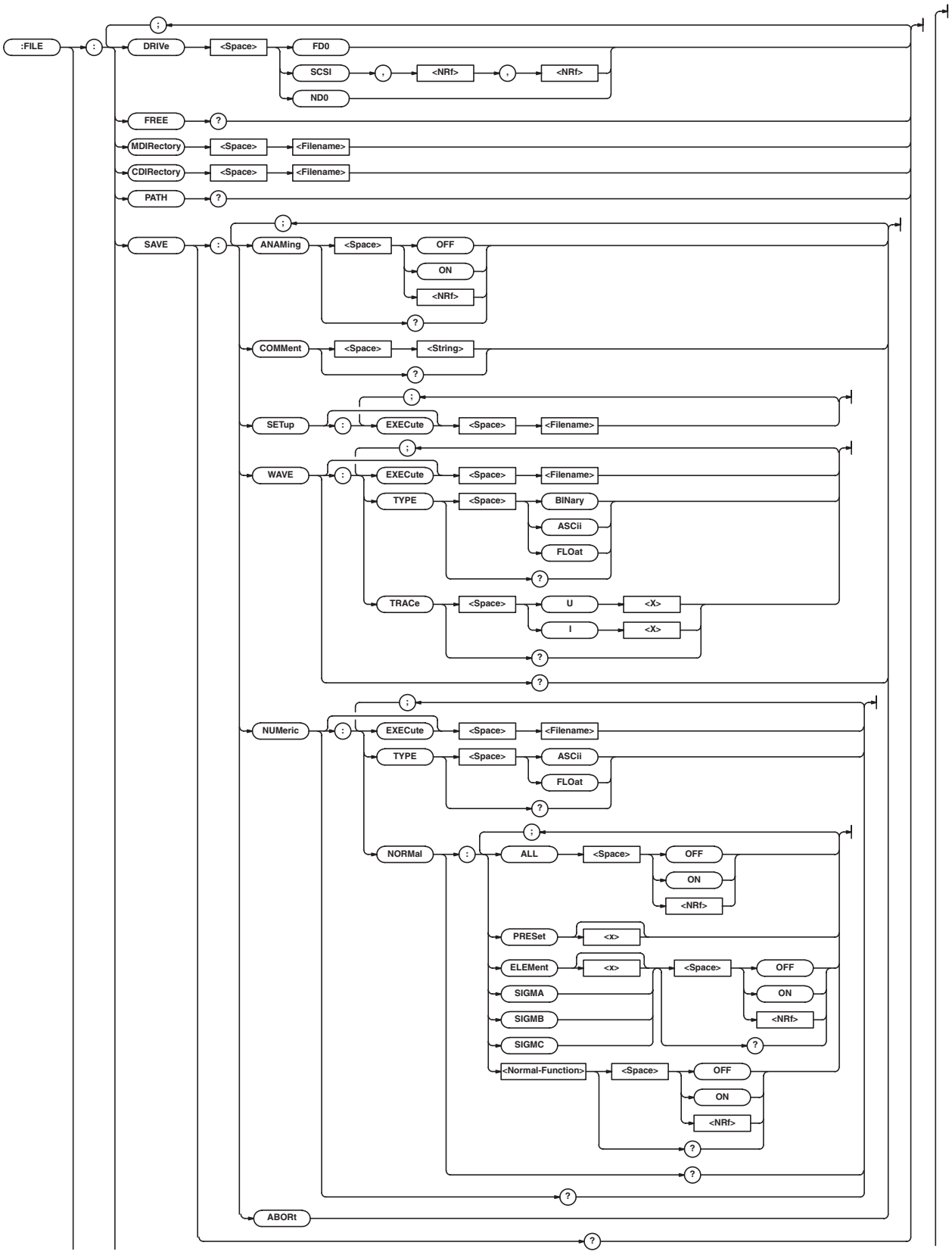
Applicable commands

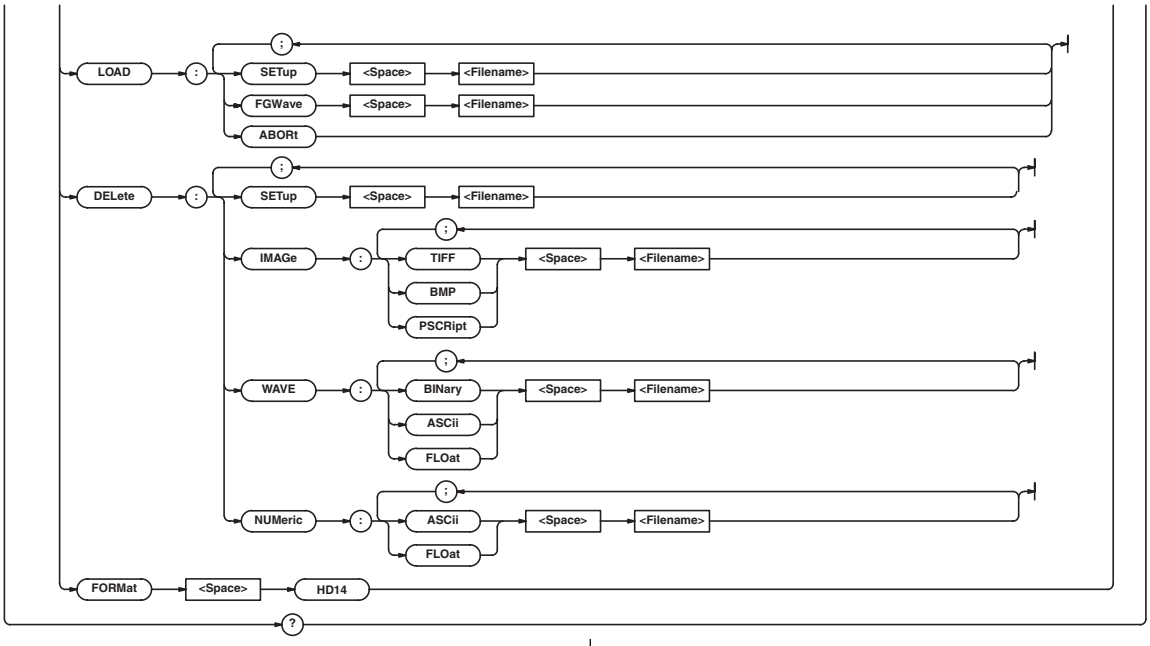
```
:DISPlay[:NUMeric]:NORMal:FCURsor
:DISPlay[:NUMeric]:NORMal:ITEM<x>
:DISPlay:TRENd:NORMal:ITEM<x>[:FUNCtion]
:FILE:SAVE:NUMeric:NORMal:...
:HCOPy:PRINter:DLISt:NORMal:...
:NUMeric[:NORMal]:ITEM<x>
:STORe:NUMeric:NORMal:...
```

Function name used in commands	:	Function name used on the menu (Numeric display header name)	
URMS	:	Urms	
UMN	:	Umean	
UDC	:	Udc	
UAC	:	Uac	
IRMS	:	Irms	
IMN	:	Imean	
IDC	:	Idc	
IAC	:	Iac	
P	:	P	
S	:	S	
Q	:	Q	
LAMBda	:	λ	
PHI	:	ϕ	
FU	:	FreqU	(fU)
FI	:	FreqI	(fI)
UPPeak	:	U+peak	(U+pk)
UMPeak	:	U-peak	(U-pk)
IPPeak	:	I+peak	(I+pk)
IMPeak	:	I-peak	(I-pk)
CFU	:	CfU	
CFI	:	CfI	
FFU	:	FfU	
FFI	:	FfI	
Z	:	Z	
RS	:	Rs	
XS	:	Xs	
RP	:	Rp	
XP	:	Xp	
PC	:	Pc	
TIME	:	I-Time	
WH	:	Wp	
WHP	:	Wp+	
WHM	:	Wp-	
AH	:	q	
AHP	:	q+	
AHM	:	q-	
ETA	:	η	
SETA	:	1/η	
F1	:	F1	
F2	:	F2	
F3	:	F3	
F4	:	F4	
DURMS	:	ΔUrms	
DUMN	:	ΔUmean	
DUDC	:	ΔUdc	
DUAC	:	ΔUac	
DIRMS	:	ΔIrms	
DIMN	:	ΔImean	
DIDC	:	ΔIdc	
DIAC	:	ΔIac	

5.5 FILE Group

The commands in this group deal with file operations.
You can make the same settings and inquiries as when FILE on the front panel is used.





:FILE?

Function Queries all settings related to the file operation.
Syntax :FILE?
Example :FILE? -> (Same as the response to ":FILE:SAVE?")

:FILE:CDIRectory

Function Changes the current directory.
Syntax :FILE:CDIRectory {<Filename>}
<Filename> = Directory name
Example :FILE:CDIRECTORY "IMAGE"
Description Specify ".." to move up to the parent directory.

:FILE:DELete:IMAGe:{TIFF|BMP|PSCRipt}

Function Deletes the screen image data file.
Syntax :FILE:DELete:IMAGe:{TIFF|BMP|PSCRipt} {<Filename>}
Example :FILE:DELETE:IMAGE:TIFF "IMAGE1"
Description Specify the file name without the extension.

:FILE:DELete:NUMeric:{ASCii|FLOat}

Function Deletes the numeric data file.
Syntax :FILE:DELete:NUMeric:{ASCii|FLOat} {<Filename>}
Example :FILE:DELETE:NUMERIC:ASCII "NUM1"
Description Specify the file name without the extension.

:FILE:DELete:SETup

Function Deletes the setup parameter file.
Syntax :FILE:DELete:SETup {<Filename>}
Example :FILE:DELETE:SETUP "SETUP1"
Description Specify the file name without the extension.

:FILE:DELete:WAVE:{BINary|ASCii|FLOat}

Function Deletes the waveform display data file.
Syntax :FILE:DELete:WAVE:{BINary|ASCii|FLOat} {<Filename>}
Example :FILE:DELETE:WAVE:BINARY "WAVE1"
Description Specify the file name without the extension.

:FILE:DRIVe

Function Sets the target drive.
Syntax :FILE:DRIVe {FD0|SCSI,<NRf>[,<NRf>]|ND0}
FD0 = Floppy disk
SCSI = SCSI device
1st <NRf> = SCSI address (0 to 7)
2nd <NRf> = Partition (0 to 9)
ND0 = Network drive
Example :FILE:DRIVE FD0
Description If the drive does not contain partitions, omit the 2nd <NRf>.

:FILE:FORMat

Function Executes the floppy disk format.
Syntax :FILE:FORMat {HD14}
Example :FILE:FORMAT HD14

:FILE:FREE?

Function Queries the free disk space (bytes) on the drive.
Syntax :FILE:FREE?
Example :FILE:FREE? -> 163840

:FILE:LOAD:ABORt

Function Aborts file loading.
Syntax :FILE:LOAD:ABORt
Example :FILE:LOAD:ABORT

:FILE:LOAD:FGWave

Function Loads the pattern waveform file of the load current for impedance measurement.
Syntax :FILE:LOAD:FGWave {<Filename>}
Example :FILE:LOAD:FGWAVE "FGWAVE1"
Description Specify the file name without the extension.

:FILE:LOAD:SETup

Function Loads the setup parameter file.
Syntax :FILE:LOAD:SETup {<Filename>}
Example :FILE:LOAD:SETUP "SETUP1"
Description
- Specify the file name without the extension.
- This command is an overlap command.

:FILE:MDIRectory

Function Creates the directory.
Syntax :FILE:MDIRectory {<Filename>}
<Filename> = Directory name
Example :FILE:MDIRECTORY "TEST"

:FILE:PATH?

Function Queries the absolute path of the current directory.
Syntax :FILE:PATH?
Example :FILE:PATH? -> "FD0<X>IMAGE"

:FILE:SAVE?

Function Queries all settings related to the saving of files.
Syntax :FILE:SAVE?
Example :FILE:SAVE? -> :FILE:SAVE:
ANAMING 1;COMMENT "";WAVE:
TYPE BINARY;:FILE:SAVE:NUMERIC:
TYPE ASCII;NORMAL:ELEMENT1 1;
ELEMENT2 0;ELEMENT3 0;ELEMENT4 0;
SIGMA 0;SIGMB 0;SIGMC 0;URMS 1;
UMN 1;UDC 1;UAC 1;IRMS 1;IMN 1;
IDC 1;IAC 1;P 1;S 1;Q 1;LAMBDA 1;
PHI 1;FU 1;FI 1;UPPEAK 1;UMPEAK 1;
IPPEAK 1;IMPEAK 1;CFU 1;CFI 1;
FFU 1;FFI 1;Z 1;RS 1;XS 1;RP 1;
XP 1;PC 1;TIME 0;WH 0;WHP 0;WHM 0;
AH 0;AHP 0;AHM 0;ETA 0;SETA 0;F1 0;
F2 0;F3 0;F4 0;DURMS 0;DUMN 0;
DUDC 0;DUAC 0;DIRMS 0;DIMN 0;
DIDC 0;DIAC 0

:FILE:SAVE:ABORt

Function Aborts file saving.
Syntax :FILE:SAVE:ABORt
Example :FILE:SAVE:ABORT

:FILE:SAVE:ANAMing

Function Sets whether to automatically name the files to be saved or queries the current setting.
Syntax :FILE:SAVE:ANAMing {<Boolean>}
:FILE:SAVE:ANAMing?
Example :FILE:SAVE:ANAMING ON
:FILE:SAVE:ANAMING? -> :FILE:SAVE:
ANAMING 1

:FILE:SAVE:COMMent

Function Sets the comment to be added to the file to be saved or queries the current setting.
Syntax :FILE:SAVE:COMMent {<String>}
:FILE:SAVE:COMMent?
<String> = Up to 30 characters
Example :FILE:SAVE:COMMENT "CASE1"
:FILE:SAVE:COMMENT? -> :FILE:SAVE:
COMMENT "CASE1"

:FILE:SAVE:NUMeric?

Function Queries all settings related to the saving of numeric data files.
Syntax :FILE:SAVE:NUMeric?
Example :FILE:SAVE:NUMERIC? ->
:FILE:SAVE:NUMERIC:TYPE ASCII;
NORMAL:ELEMENT1 1;2ELEMENT2 0;
ELEMENT3 0;ELEMENT4 0;SIGMA 0;
SIGMB 0;SIGMC 0;URMS 1;UMN 1;UDC 1;
UAC 1;IRMS 1;IMN 1;IDC 1;IAC 1;P 1;
S 1;Q 1;LAMBDA 1;PHI 1;FU 1;FI 1;
UPPEAK 1;UMPEAK 1;IPPEAK 1;
IMPEAK 1;CFU 1;CFI 1;FFU 1;FFI 1;
Z 1;RS 1;XS 1;RP 1;XP 1;PC 1;
TIME 0;WH 0;WHP 0;WHM 0;AH 0;AHP 0;
AHM 0;ETA 0;SETA 0;F1 0;F2 0;F3 0;
F4 0;DURMS 0;DUMN 0;DUDC 0;DUAC 0;
DIRMS 0;DIMN 0;DIDC 0;DIAC 0
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric[:EXECute]

Function Saves the numeric data to a file.
Syntax :FILE:SAVE:NUMeric
[:EXECute] {<Filename>}
Example :FILE:SAVE:NUMERIC:EXECUTE "NUM1"
Description
- Specify the file name without the extension.
- This command is an overlap command.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:NORMal?

Function Queries all settings related to the saving of numeric data files for power measurement.

Syntax `:FILE:SAVE:NUMeric:NORMal?`

Example
```
:FILE:SAVE:NUMERIC:NORMAL? ->
:FILE:SAVE:NUMERIC:NORMAL:
ELEMENT1 1;ELEMENT2 0;ELEMENT3 0;
ELEMENT4 0;SIGMA 0;SIGMB 0;SIGMC 0;
URMS 1;UMN 1;UDC 1;UAC 1;IRMS 1;
IMN 1;IDC 1;IAC 1;P 1;S 1;Q 1;
LAMBDA 1;PHI 1;FU 1;FI 1;UPPEAK 1;
UMPEAK 1;IPPEAK 1;IMPEAK 1;CFU 1;
CFI 1;FFU 1;FFI 1;Z 1;RS 1;XS 1;
RP 1;XP 1;PC 1;TIME 0;WH 0;WHP 0;
WHM 0;AH 0;AHP 0;AHM 0;ETA 0;
SETA 0;F1 0;F2 0;F3 0;F4 0;DURMS 0;
DUMN 0;DUDC 0;DUAC 0;DIRMS 0;
DIMN 0;DIDC 0;DIAC 0
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:NORMal:ALL

Function Collectively turns ON/OFF the output of all power measurement elements and functions when saving the numeric data file during power measurement.

Syntax
```
:FILE:SAVE:NUMeric:NORMal:
ALL {<Boolean>}
```

Example `:FILE:SAVE:NUMERIC:NORMAL:ALL ON`

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}

Function Turns ON/OFF the output of the {power measurement element|ΣA|ΣB|ΣC} when saving the numeric data to a file during power measurement or queries the current setting.

Syntax
```
:FILE:SAVE:NUMeric:NORMal:
{ELEMent<x>|SIGMA|SIGMB|
SIGMC} {<Boolean>}
:FILE:SAVE:NUMeric:NORMal:
{ELEMent<x>|SIGMA|SIGMB|SIGMC}?
```
<x> = 1 to 4 (power measurement element)

Example
```
:FILE:SAVE:NUMERIC:NORMAL:
ELEMENT1 ON
:FILE:SAVE:NUMERIC:NORMAL:
ELEMENT1? -> :FILE:SAVE:NUMERIC:
NORMAL:ELEMENT1 1
```

Description
- The command and query using ":FILE:SAVE:NUMeric:NORMal:SIGMB" is valid on models with two or more power measurement elements.
- The command and query using ":FILE:SAVE:NUMeric:NORMal:SIGMC" is valid on models with three or more power measurement elements.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:NORMal:PRESet<x>

Function Presets the output ON/OFF pattern of the power measurement element and function when saving the numeric data to a file during power measurement.

Syntax `:FILE:SAVE:NUMeric:NORMal:PRESet<x>`
<x> = 1 to 2 (preset pattern number)

Example `:FILE:SAVE:NUMERIC:NORMAL:PRESET1`

Description
- For details on the output pattern when preset is executed, see the WT1600FC User's Manual (IM760151-01E).
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:NORMal:<power measurement function>

Function Turns ON/OFF the output of the function when saving the numeric data file during power measurement or queries the current setting.

Syntax
```
:FILE:SAVE:NUMeric:NORMal:<power
measurement function> {<Boolean>}
:FILE:SAVE:NUMeric:NORMal:<power
measurement function>?
```
<Power measurement function> = {URMS|UMN|UDC|UAC|IRMS|...} (See the function selection list (1) of "DISPlay group.")

Example
```
:FILE:SAVE:NUMERIC:NORMAL:URMS ON
:FILE:SAVE:NUMERIC:NORMAL:URMS? ->
:FILE:SAVE:NUMERIC:NORMAL:URMS 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:NUMeric:TYPE

Function Sets the format of the numeric data to be saved or queries the current setting.

Syntax `:FILE:SAVE:NUMeric:TYPE {ASCii|FLOat}`
`:FILE:SAVE:NUMeric:TYPE?`

Example `:FILE:SAVE:NUMERIC:TYPE ASCII`
`:FILE:SAVE:NUMERIC:TYPE? ->`
`:FILE:SAVE:NUMERIC:TYPE ASCII`

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:SETup[:EXECute]

Function Saves of the setup parameter file.

Syntax `:FILE:SAVE:SETup [:EXECute] {<Filename>}`

Example `:FILE:SAVE:SETUP:EXECUTE "SETUP1"`

Description
- Specify the file name without the extension.
- This command is an overlap command.

:FILE:SAVE:WAVE?

Function Queries all settings related to the saving of waveform display data files.

Syntax `:FILE:SAVE:WAVE?`

Example `:FILE:SAVE:WAVE? -> :FILE:SAVE:WAVE:TYPE BINARY`

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:WAVE[:EXECute]

Function Executes the saving of the waveform display data file.

Syntax `:FILE:SAVE:WAVE [:EXECute] {<Filename>}`

Example `:FILE:SAVE:WAVE:EXECUTE "WAVE1"`

Description
- Specify the file name without the extension.
- This command is an overlap command.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:WAVE:TRACe

Function Sets the waveform to be saved to a file or queries the current setting.

Syntax `:FILE:SAVE:WAVE:TRACe {U<x>|I<x>}`
`:FILE:SAVE:WAVE:TRACe?`
<x> = 1 to 4 (power measurement element)

Example `:FILE:SAVE:WAVE:TRACE U1`
`:FILE:SAVE:WAVE:TRACE? ->`
`:FILE:SAVE:WAVE:TRACE U1`

Description
- This command is valid when the format of the waveform display data to be saved (`:FILE:SAVE:WAVE:TYPE`) is “FLOat.” When it is {BINary|ASCii}, all waveforms of which the display is turned ON are saved.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:FILE:SAVE:WAVE:TYPE

Function Sets the format of the waveform display data to be saved or queries the current setting.

Syntax `:FILE:SAVE:WAVE:TYPE {BINary|ASCii|FLOat}`
`:FILE:SAVE:WAVE:TYPE?`

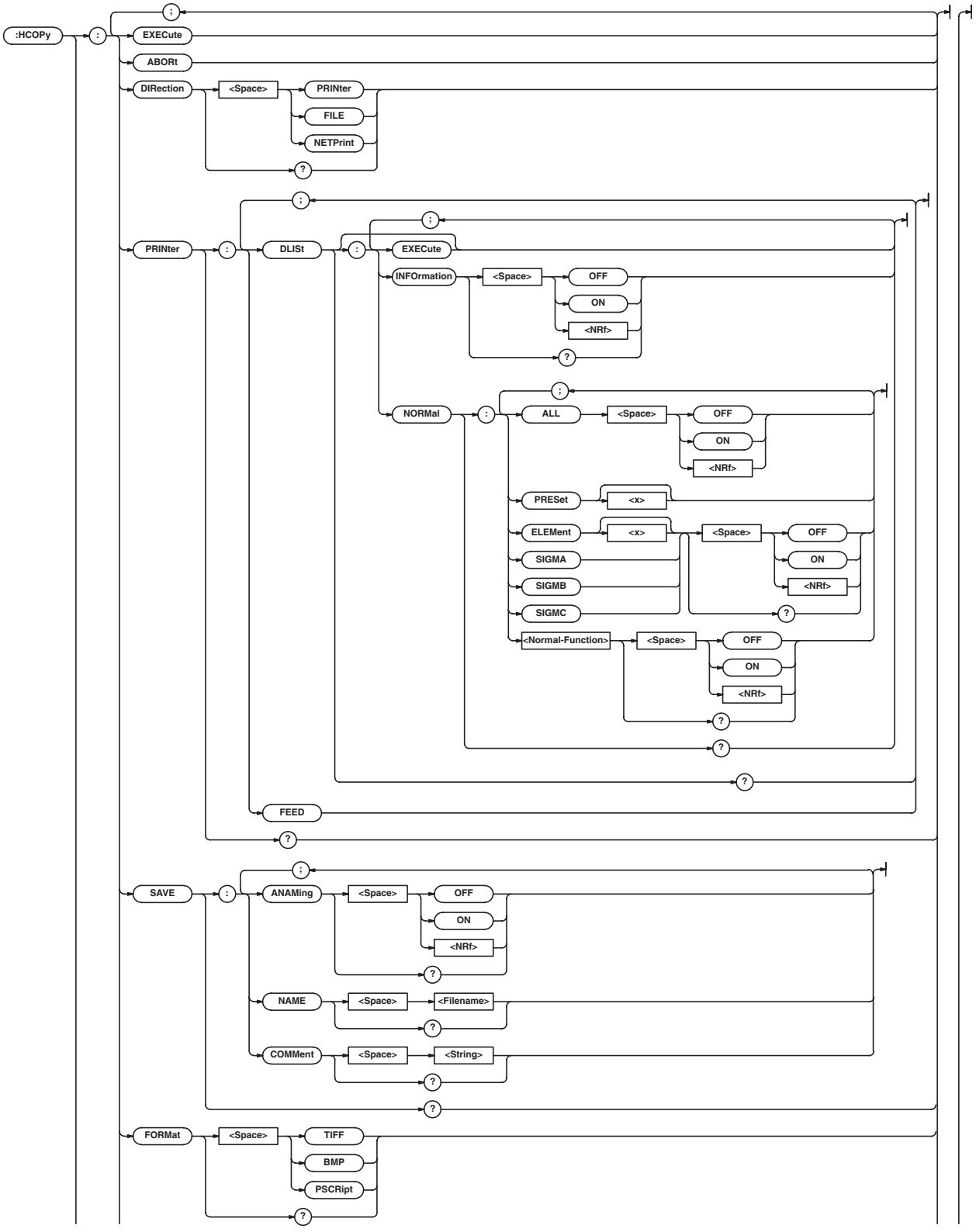
Example `:FILE:SAVE:WAVE:TYPE BINARY`
`:FILE:SAVE:WAVE:TYPE? ->`
`:FILE:SAVE:WAVE:TYPE BINARY`

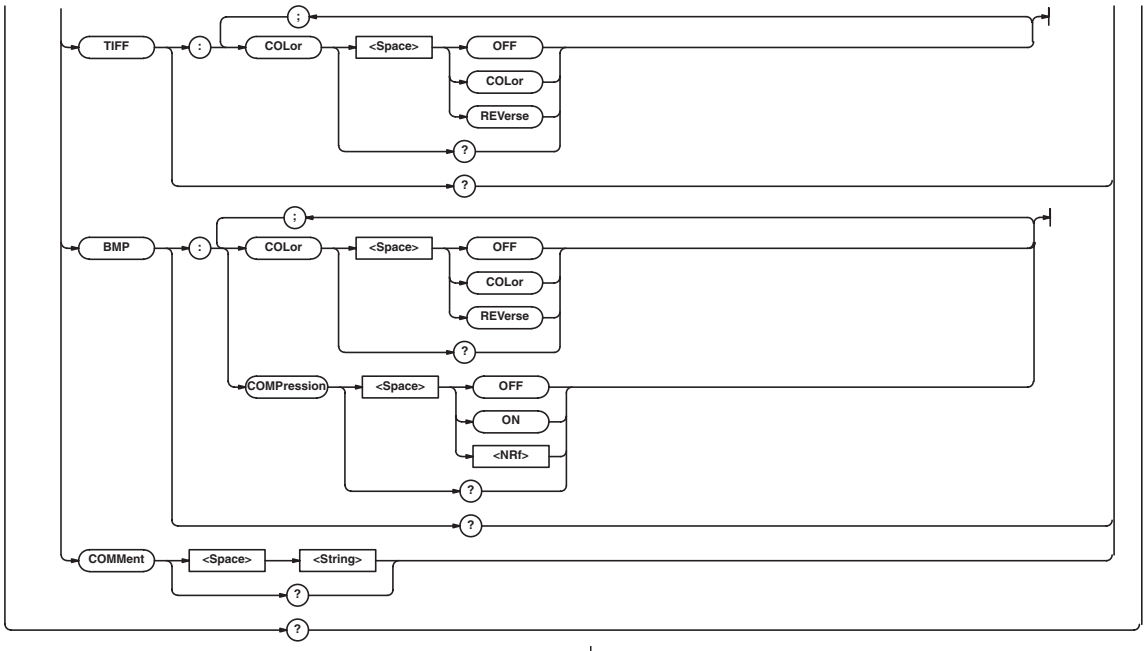
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

5.6 HCOPy Group

The commands in this group deal with the output of screen image data to the built-in printer (option) and other destinations.

You can make the same settings and inquiries as when COPY and MENU (SHIFT+COPY) on the front panel is used.





:HCOPy?

Function Queries all settings related to the output of screen image data.

Syntax :HCOPy?

Example :HCOPY? -> :HCOPY:
DIRECTION PRINTER;PRINTER:DLIST:
INFORMATION 1;NORMAL:ELEMENT1 1;
ELEMENT2 0;ELEMENT3 0;ELEMENT4 0;
SIGMA 0;SIGMB 0;SIGMC 0;URMS 1;
UMN 1;UDC 1;UAC 1;IRMS 1;IMN 1;
IDC 1;IAC 1;P 1;S 1;Q 1;LAMBDA 1;
PHI 1;FU 1;FI 1;UPPEAK 1;UMPEAK 1;
IPPEAK 1;IMPEAK 1;CFU 1;CFI 1;
FFU 1;FFI 1;Z 1;RS 1;XS 1;RP 1;
XP 1;PC 1;TIME 0;WH 0;WHP 0;WHM 0;
AH 0;AHP 0;AHM 0;ETA 0;SETA 0;F1 0;
F2 0;F3 0;F4 0;DURMS 0;DUMN 0;
DUDC 0;DUAC 0;DIRMS 0;DIMN 0;
DIDC 0;DIAC 0;:HCOPY:
COMMENT "THIS IS TEST."

:HCOPy:ABORt

Function Aborts screen image data output and paper feeding.

Syntax :HCOPy:ABORt

Example :HCOPY:ABORT

:HCOPy:BMP?

Function Queries all settings related to the BMP format.

Syntax :HCOPy:BMP?

Example :HCOPY:BMP? -> :HCOPY:BMP:
COLOR COLOR;COMPRESSION 0

:HCOPy:BMP:COLor

Function Sets the color tone for the BMP format or queries the current setting.

Syntax :HCOPy:BMP:COLor {OFF|COLor|
REVerse}
:HCOPy:BMP:COLor?

Example :HCOPY:BMP:COLOR COLOR
:HCOPY:BMP:COLOR? ->
:HCOPY:BMP:COLOR COLOR

:HCOPy:BMP:COMPression

Function Sets whether to compress the data in BMP format or queries the current setting.

Syntax :HCOPy:BMP:COMPression {<Boolean>}
:HCOPy:BMP:COMPression?

Example :HCOPY:BMP:COMPRESSION OFF
:HCOPY:BMP:COMPRESSION? -> :HCOPY:
BMP:COMPRESSION 0

Description This command is valid when the color tone (:HCOPy:BMP:COLor) is set to {COLor|REVerse}.

:HCOPy:COMMent

Function Sets the comment displayed at the bottom of the screen or queries the current setting.

Syntax :HCOPy:COMMent {<String>}
:HCOPy:COMMent?
<String > = 25 characters or less (However, only the first 20 characters are displayed.)

Example :HCOPY:COMMENT "THIS IS TEST."
:HCOPY:COMMENT? -> :HCOPY:
COMMENT "THIS IS TEST."

Description Only the characters and symbols displayed on the keyboard on the screen can be used.

:HCOPy:DIRection

Function Sets the output destination of the screen image data or queries the current setting.

Syntax
```
:HCOPy:DIRection {PRINter|FILE|
NETPrint}
:HCOPy:DIRection?
```

Example
```
:HCOPY:DIRECTION PRINTER
:HCOPY:DIRECTION? -> :HCOPY:
DIRECTION PRINTER
```

Description
- `{PRINTer}` is valid only when the built-in printer (/B5 option) is installed.
- `{NETPrint}` is valid only when the Ethernet interface (/C10 option) is installed.

:HCOPy:EXECute

Function Executes the screen image data output.

Syntax
```
:HCOPy:EXECute
```

Example
```
:HCOPY:EXECUTE
```

Description This command is an overlap command.

:HCOPy:FORMat

Function Sets the file format of the screen image data to be saved or queries the current setting.

Syntax
```
:HCOPy:FORMat {TIFF|BMP|PSCRipt}
:HCOPy:FORMat?
```

Example
```
:HCOPY:FORMAT TIFF
:HCOPY:FORMAT? -> :HCOPY:
FORMAT TIFF
```

Description This command is meaningless if the data output destination (`:HCOPy:DIRection`) is set to "PRINter."

:HCOPy:PRINter?

Function Queries all settings related to the built-in printer output.

Syntax
```
:HCOPy:PRINter?
```

Example :HCOPY:PRINTER? -> (Same as the response to "`:HCOPy:PRINter:DLISt?`")

:HCOPy:PRINter:DLISt?

Function Queries all settings related to the printing of the numeric data list using the built-in printer.

Syntax
```
:HCOPy:PRINter:DLISt?
```

Example
```
:HCOPY:PRINTER:DLIST? ->
:HCOPY:PRINTER:DLIST:INFORMATION 1;
NORMAL:ELEMENT1 1;ELEMENT2 0;
ELEMENT3 0;ELEMENT4 0;SIGMA 0;
SIGMB 0;SIGMC 0;URMS 1;UMN 1;UDC 1;
UAC 1;IRMS 1;IMN 1;IDC 1;IAC 1;P 1;
S 1;Q 1;LAMBDA 1;PHI 1;FU 1;FI 1;
UPPEAK 1;UMPEAK 1;IPPEAK 1;
IMPEAK 1;CFU 1;CFI 1;FFU 1;FFI 1;
Z 1;RS 1;XS 1;RP 1;XP 1;PC 1;
TIME 0;WH 0;WHP 0;WHM 0;AH 0;AHP 0;
AHM 0;ETA 0;SETA 0;F1 0;F2 0;F3 0;
F4 0;DURMS 0;DUMN 0;DUDC 0;DUAC 0;
DIRMS 0;DIMN 0;DIDC 0;DIAC 0
```

:HCOPy:PRINter:DLISt[:EXECute]

Function Prints of the numeric data list using the built-in printer.

Syntax
```
:HCOPy:PRINter:DLISt[:EXECute]
```

Example
```
:HCOPY:PRINTER:DLIST:EXECUTE
```

Description This command is an overlap command.

:HCOPy:PRINter:DLISt:INFOrmation

Function Sets whether or not to add setup parameters when printing the numeric data list using the built-in printer or queries the current setting.

Syntax
```
:HCOPy:PRINter:DLISt:
INFOrmation {<Boolean>}
:HCOPy:PRINter:DLISt:INFOrmation?
```

Example
```
:HCOPY:PRINTER:DLIST:INFORMATION ON
:HCOPY:PRINTER:DLIST:INFORMATION?
-> :HCOPY:PRINTER:DLIST:
INFORMATION 1
```

:HCOPy:PRINter:DLISt:NORMal?

Function Queries all settings related to the printing of the numeric data list for power measurement.

Syntax
```
:HCOPy:PRINter:DLISt:NORMal?
```

Example
```
:HCOPY:PRINTER:DLIST:NORMAL? ->
:HCOPY:PRINTER:DLIST:NORMAL:
ELEMENT1 1;ELEMENT2 0;ELEMENT3 0;
ELEMENT4 0;SIGMA 0;SIGMB 0;SIGMC 0;
URMS 1;UMN 1;UDC 1;UAC 1;IRMS 1;
IMN 1;IDC 1;IAC 1;P 1;S 1;Q 1;
LAMBDA 1;PHI 1;FU 1;FI 1;UPPEAK 1;
UMPEAK 1;IPPEAK 1;IMPEAK 1;CFU 1;
CFI 1;FFU 1;FFI 1;Z 1;RS 1;XS 1;
RP 1;XP 1;PC 1;TIME 0;WH 0;WHP 0;
WHM 0;AH 0;AHP 0;AHM 0;ETA 0;
SETA 0;F1 0;F2 0;F3 0;F4 0;DURMS 0;
DUMN 0;DUDC 0;DUAC 0;DIRMS 0;
DIMN 0;DIDC 0;DIAC 0
```

:HCOPy:PRINter:DLISt:NORMal:ALL

Function Collectively turns ON/OFF the output of all power measurement elements and functions when printing the numeric data list using the built-in printer during power measurement.

Syntax
```
:HCOPy:PRINter:DLISt:NORMal:
ALL {<Boolean>}
```

Example
```
:HCOPY:PRINTER:DLIST:NORMAL:ALL ON
```

:HCOPy:PRINter:DLISt:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}

Function Turns ON/OFF the output of the {power measurement element|ΣA|ΣB|ΣC} when printing the numeric data list using the built-in printer during power measurement or queries the current setting.

Syntax
```
:HCOPy:PRINter:DLISt:NORMal:
{ELEMent<x>|SIGMA|SIGMB|SIGMC}
{<Boolean>}
:HCOPy:PRINter:DLISt:NORMal:
{ELEMent<x>|SIGMA|SIGMB|SIGMC}?
```
<x> = 1 to 4 (power measurement element)

Example
```
:HCOPY:PRINTER:DLIST:NORMAL:
ELEMENT1 ON
:HCOPY:PRINTER:DLIST:NORMAL:
ELEMENT1? -> :HCOPY:PRINTER:DLIST:
NORMAL:ELEMENT1 1
```

Description
- The command and query using ":HCOPy:PRINter:DLISt:NORMal:SIGMB" is valid on models with two or more power measurement elements.
- The command and query using ":HCOPy:PRINter:DLISt:NORMal:SIGMC" is valid on models with three or more power measurement elements.

:HCOPy:PRINter:DLISt:NORMal:PRESet<x>

Function Presets the output ON/OFF pattern of the power measurement element and function when printing the numeric data list using the built-in printer during power measurement.

Syntax
```
:HCOPy:PRINter:DLISt:NORMal:
PRESet<x>
```
<x> = 1 to 2 (preset pattern number)

Example
```
:HCOPY:PRINTER:DLIST:NORMAL:PRESET1
```

Description For details on the print pattern when preset is executed, see the WT1600FC User's Manual (IM760151-01E).

:HCOPy:PRINter:DLISt:NORMal:<power measurement function>

Function Turns ON/OFF the output of the function when printing the numeric data list using the built-in printer during power measurement or queries the current setting.

Syntax
```
:HCOPy:PRINter:DLISt:NORMal:<power
measurement function> {<Boolean>}
:HCOPy:PRINter:DLISt:NORMal:<power
measurement function>?
<Power measurement function> =
{URMS|UMN|
UDC|UAC|IRMS|...}
```
(See the function selection list (1) of "DISPlay group.")

Example
```
:HCOPY:PRINTER:DLIST:NORMAL:URMS ON
:HCOPY:PRINTER:DLIST:NORMAL:URMS?
-> :HCOPY:PRINTER:DLIST:NORMAL:
URMS 1
```

:HCOPy:PRINter:FEED

Function Executes paper feeding of the built-in printer.

Syntax
```
:HCOPy:PRINter:FEED
```

Example
```
:HCOPY:PRINTER FEED
```

Description This command is an overlap command.

:HCOPy:SAVE?

Function Queries all settings related to saving the file.

Syntax
```
:HCOPy:SAVE?
```

Example
```
:HCOPY:SAVE? -> :HCOPY:SAVE:
ANAMING 1;NAME "DATA1";
COMMENT "CASE1"
```

:HCOPy:SAVE:ANAMing

Function Sets whether to automatically name the files to be saved or queries the current setting.

Syntax
```
:HCOPy:SAVE:ANAMing {<Boolean>}
:HCOPy:SAVE:ANAMing?
```

Example
```
:HCOPY:SAVE:ANAMING ON
:HCOPY:SAVE:ANAMING? -> :HCOPY:
SAVE:ANAMING 1
```

:HCOPy:SAVE:COMMent

Function Sets the comment to be added to the file to be saved or queries the current setting.

Syntax
```
:HCOPy:SAVE:COMMent {<String>}
:HCOPy:SAVE:COMMent?
```
<String> = Up to 25 characters

Example
```
:HCOPY:SAVE:COMMENT "CASE1"
:HCOPY:SAVE:COMMENT? ->
:HCOPY:SAVE:COMMENT "CASE1"
```

Description
- Only the characters and symbols displayed on the keyboard on the screen can be used.
- This command is valid when the data output destination (:HCOPy:DIRection) is set to "FILE."

:HCOPy:SAVE:NAME

Function Sets the name of the file to be saved or queries the current setting.

Syntax
```
:HCOPy:SAVE:NAME {<Filename>}
:HCOPy:SAVE:NAME?
```

Example
```
:HCOPY:SAVE:NAME "DATA1"
:HCOPY:SAVE:NAME? ->
:HCOPY:SAVE:NAME "DATA1"
```

Description
- The save destination of the screen data is specified using:
  - the "`:FILE:DRIVe`" command for the drive.
  - the "`:FILE:CDIRectory`" command for the directory. The save destination path can be queried using the "`:FILE:PATH?`" command.
- Specify the file name without the extension.

:HCOPy:TIFF?

Function Queries all settings related to the TIFF format.

Syntax
```
:HCOPy:TIFF?
```

Example
```
:HCOPY:TIFF? -> :HCOPY:TIFF:
COLOR COLOR
```

:HCOPy:TIFF:COLor

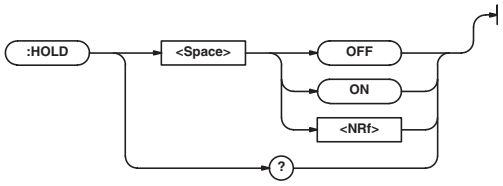
Function Sets the color tone for the TIFF format or queries the current setting.

Syntax
```
:HCOPy:TIFF:COLor {OFF|COLor|
REVerse}
:HCOPy:TIFF:COLor?
```

Example
```
:HCOPY:TIFF:COLOR COLOR
:HCOPY:TIFF:COLOR? -> :HCOPY:TIFF:
COLOR COLOR
```

5.7 HOLD Group

The commands in this group deal with the hold function of output data.
You can make the same settings and inquiries as when HOLD on the front panel is used.



:HOLD

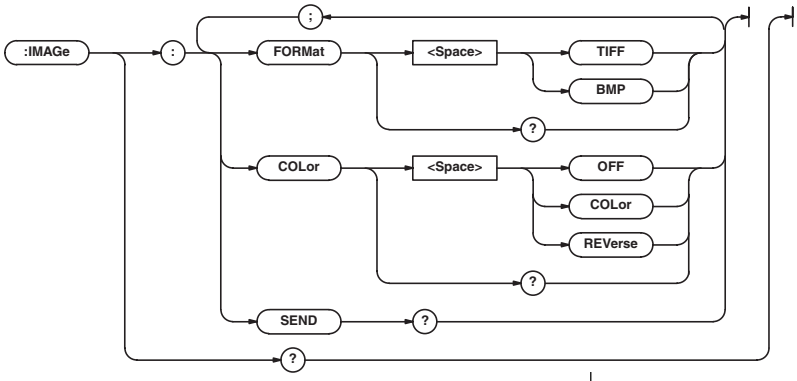
Function Sets the output data (display, communications, etc.) hold or queries the current setting.

Syntax
```
:HOLD {<Boolean>}
:HOLD?
```

Example
```
:HOLD OFF
:HOLD? -> :HOLD 0
```

5.8 IMAGe Group

The commands in this group deal with the output of screen image data.
There are no front panel keys that correspond to the commands in this group.



:IMAGe?

Function Queries all settings related to the output of screen image data.
Syntax `:IMAGe?`
Example `:IMAGE? -> :IMAGE:FORMAT TIFF;COLOR OFF`

:IMAGe:COLor

Function Sets the color tone of the screen image data to be output or queries the current setting.
Syntax `:IMAGe:COLor {OFF|COLor|REVerse}`
`:IMAGe:COLor?`
Example `:IMAGE:COLOR OFF`
`:IMAGE:COLOR? -> :IMAGE:COLOR OFF`

:IMAGe:FORMat

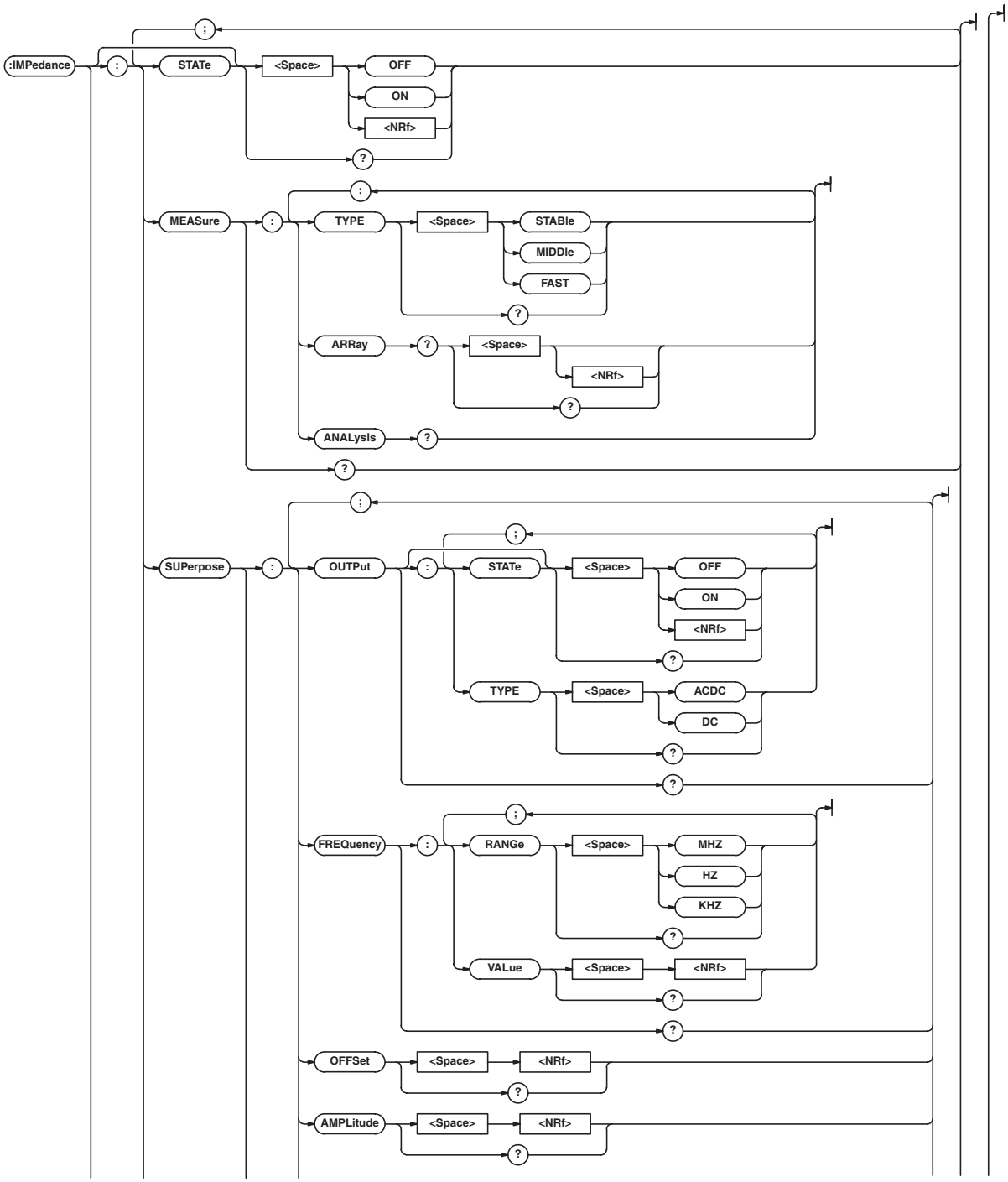
Function Sets the output format of the screen image data or queries the current setting.
Syntax `:IMAGe:FORMat {TIFF|BMP}`
`:IMAGe:FORMat?`
Example `:IMAGE:FORMAT TIFF`
`:IMAGE:FORMAT? -> :IMAGE:FORMAT TIFF`

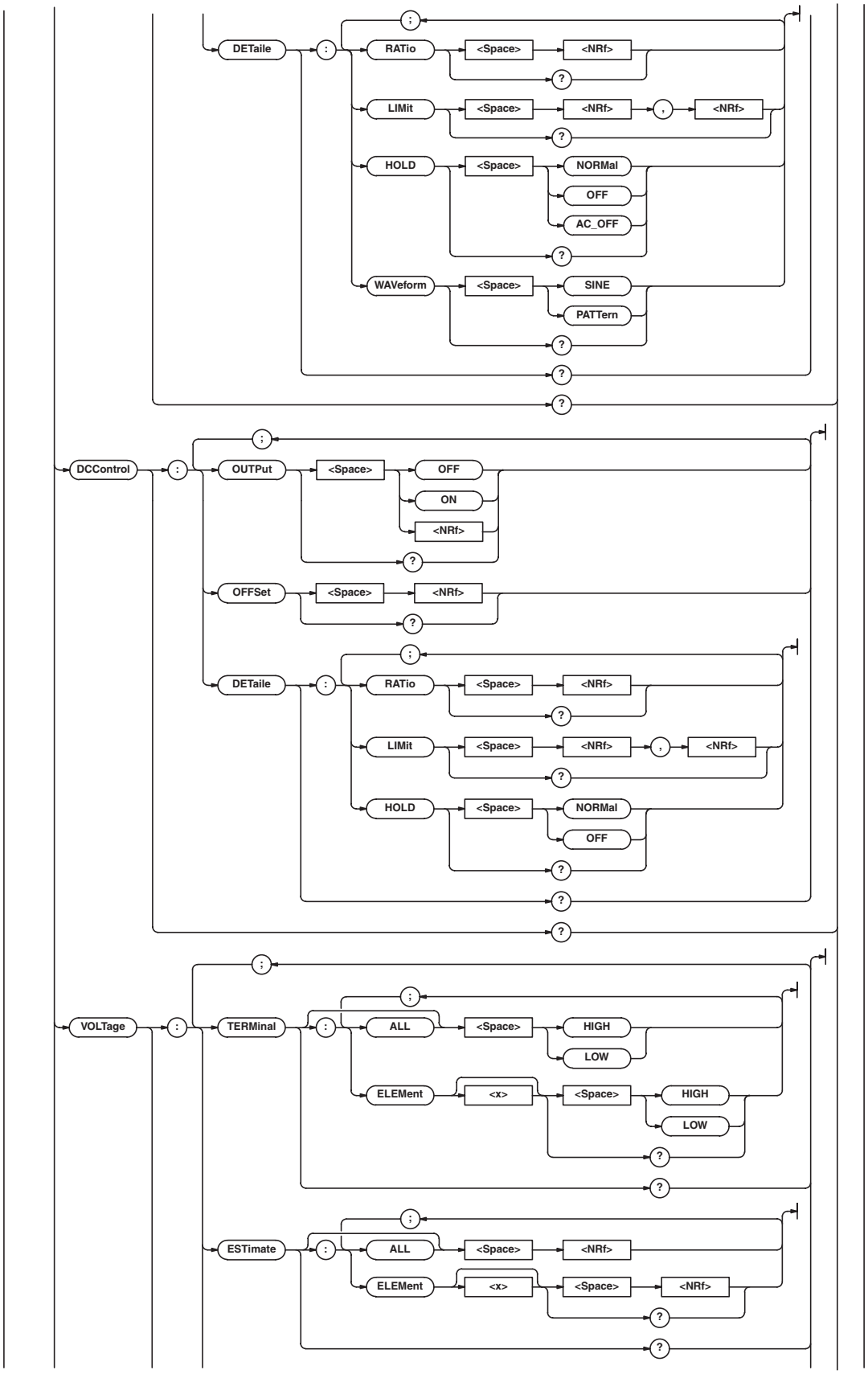
:IMAGe:SEND?

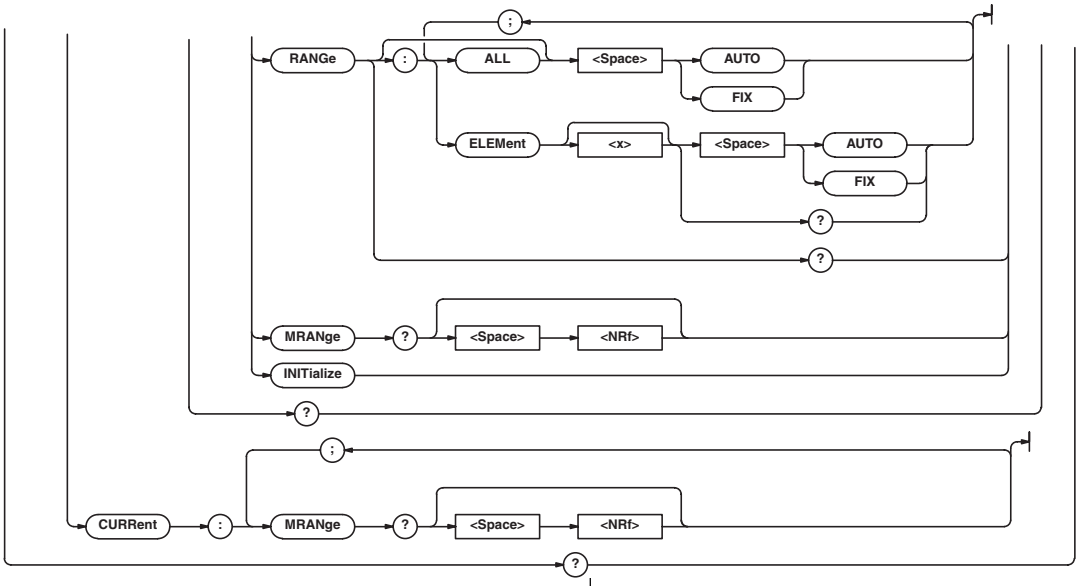
Function Queries the screen image data.
Syntax `:IMAGe:SEND?`
Example `:IMAGE:SEND? -> #6`(number of bytes, 6 digits)(series of data bytes)
Description
- The number of bytes of <Block data> is {2 + 6 + number of data points + 1 (delimiter)}.
- For details on <Block data>, see page 4-7.

5.9 IMPedance Group

The commands in this group deal with impedance measurements.
You can make the same settings and inquiries as when IMPEDANCE and DC CONTROL (SHIFT+IMPEDANCE) on the front panel is used.




DETaile
:
;
RATio
<Space>
<NRf>
?
LIMit
<Space>
<NRf>
,
<NRf>
?
HOLD
<Space>
NORMal
OFF
AC_OFF
?
WAVeform
<Space>
SINE
PATTern
?
?
?
DCControl
:
;
OUTPut
<Space>
OFF
ON
<NRf>
?
OFFSet
<Space>
<NRf>
?
DETaile
:
;
RATio
<Space>
<NRf>
?
LIMit
<Space>
<NRf>
,
<NRf>
?
HOLD
<Space>
NORMal
OFF
?
?
?
VOLTage
:
;
TERMinal
:
;
ALL
<Space>
HIGH
LOW
ELEMent
<x>
<Space>
HIGH
LOW
?
?
ESTimate
:
;
ALL
<Space>
<NRf>
ELEMent
<x>
<Space>
<NRf>
?
?



:IMPedance?

Function Queries all settings related to impedance measurements.

Syntax `:IMPedance?`

Example
```
:IMPEDANCE? -> :IMPEDANCE:STATE:1;
MEASURE:TYPE STABLE;:IMPEDANCE:
SUPERPOSE:OUTPUT:STATE 0;TYPE DC;:
IMPEDANCE:SUPERPOSE:FREQUENCY:
RANGE HZ;VALUE 1.0002;:IMPEDANCE:
SUPERPOSE:OFFSET 0.000;
AMPLITUDE 0.000;DETAILE:
RATIO 1.000;LIMIT 1000.000,
-1000.000;HOLD NORMAL;
WAVEFORM SINE;:IMPEDANCE:DCCONTROL:
OUTPUT 0;OFFSET 0.000;DETAILE:
RATIO 1.000;LIMIT 1000.000,
-1000.000;HOLD NORMAL;:IMPEDANCE:
VOLTAGE:TERMINAL:ELEMENT5 HIGH;:
IMPEDANCE:VOLTAGE:ESTIMATE:
ELEMENT5 0.0010;:IMPEDANCE:VOLTAGE:
RANGE:ELEMENT5 AUTO
```

:IMPedance:CURRent:MRANge? (Measured RANge)

Function Queries the current range with respect to the current measured value.

Syntax `:IMPedance:CURRent:MRANge? {<NRf>}`
`<NRf>` = 1 to 5 (impedance measurement element)

Example (Example when impedance measurement elements (Z5) are available in 2 and 3)
```
:IMPEDANCE:CURRENT:MRANGE? 2
-> 5.000E+00
:IMPEDANCE:CURRENT:MRANGE?
-> 5.000E+00,5.000E+00
```

Description
- Returns the measurement range displayed on the right side of the screen.
- If the parameter is omitted, the measurement ranges of all built-in impedance measurement elements are output in order from the smallest element number.

:IMPedance:DCControl?

Function Queries all settings related to the DC load current.

Syntax `:IMPedance:DCControl?`

Example
```
:IMPEDANCE:DCCONTROL? ->
:IMPEDANCE:DCCONTROL:OUTPUT 0;
OFFSET 0.000;DETAILE:RATIO 1.000;
LIMIT 1000.000,-1000.000;
HOLD NORMAL
```

:IMPedance:DCControl:DETaile?

Function Queries all settings related to the detailed settings of the DC load current.

Syntax `:IMPedance:DCControl:DETaile?`

Example
```
:IMPEDANCE:DCCONTROL:DETAILE? ->
:IMPEDANCE:DCCONTROL:DETAILE:
RATIO 1.000;LIMIT 1000.000,
-1000.000;HOLD NORMAL
```

:IMPedance:DCControl:DETaile:HOLD

Function Sets the action taken by the WT1600FC (handling of the control signal to the DC electronic load device) when hold is activated or queries the current setting.

Syntax
```
:IMPedance:DCControl:DETaile:
HOLD {NORMal|OFF}
:IMPedance:DCControl:DETaile:HOLD?
```

Example
```
:IMPEDANCE:DCCONTROL:DETAILE:
HOLD NORMAL
:IMPEDANCE:DCCONTROL:DETAILE:HOLD?
-> :IMPEDANCE:DCCONTROL:DETAILE:
HOLD NORMAL
```

:IMPedance:DCControl:DETaile:LIMit

Function Sets the range of the DC load current or queries the current setting.

Syntax
```
:IMPedance:DCControl:DETaile:
LIMit {<NRf>,<NRf>}
:IMPedance:DCControl:DETaile:LIMit?
```
<NRf> = –1000.000 to 1000.000(A)

Example
```
:IMPEDANCE:DCCONTROL:DETAILE:
LIMIT 1000,-1000
:IMPEDANCE:DCCONTROL:DETAILE:LIMIT?
-> :IMPEDANCE:DCCONTROL:DETAILE:
LIMIT 1000.000,-1000.000
```

Description Set the upper limit and then the lower limit.

:IMPedance:DCControl:DETaile:RATio

Function Sets the current value per volt of the control signal to the DC electronic load device or queries the current setting.

Syntax
```
:IMPedance:DCControl:DETaile:
RATio {<NRf>}
:IMPedance:DCControl:DETaile:RATio?
```
<NRf> = 0.001 to 1000.000

Example
```
:IMPEDANCE:DCCONTROL:DETAILE:
RATIO 1
:IMPEDANCE:DCCONTROL:DETAILE:RATIO?
-> :IMPEDANCE:DCCONTROL:DETAILE:
RATIO 1.000
```

:IMPedance:DCControl:OFFSet

Function Sets the current value of the DC load current or queries the current setting.

Syntax
```
:IMPedance:DCControl:OFFSet {<NRf>}
:IMPedance:DCControl:OFFSet?
```
<NRf> = –1000.000 to 1000.000(A)

Example
```
:IMPEDANCE:DCCONTROL:OFFSET 0
:IMPEDANCE:DCCONTROL:OFFSET? ->
:IMPEDANCE:DCCONTROL:OFFSET 0.000
```

:IMPedance:DCControl:OUTPut

Function Turns ON/OFF the DC load current or queries the current setting.

Syntax
```
:IMPedance:DCControl:
OUTPut {<Boolean>}
:IMPedance:DCControl:OUTPut?
```

Example
```
:IMPEDANCE:DCCONTROL:OUTPUT ON
:IMPEDANCE:DCCONTROL:OUTPUT? ->
:IMPEDANCE:DCCONTROL:OUTPUT 1
```

:IMPedance:MEASure?

Function Queries all settings related to impedance measurements.

Syntax
```
:IMPedance:MEASure?
```

Example
```
:IMPEDANCE:MEASURE? ->
:IMPEDANCE:MEASURE:TYPE STABLE
```

:IMPedance:MEASure:ANALysis?

Function Sets the type of impedance measurement mode or queries the current setting.

Syntax
```
:IMPedance:MEASure:ANALysis?
```

Example
```
:IMPEDANCE:MEASURE:ANALYSIS? ->
NORMAL
```

Description
- The details of the response are as follows:
  NORMal: Normal mode
  WIDE: Wideband mode
- For the details on the mode, see the WT1600FC User's Manual (IM760151-01E).

:IMPedance:MEASure:ARRay?

Function Queries the array information of the loaded pattern file.

Syntax
```
:IMPedance:MEASure:ARRay? {<NRf>}
```
<NRf> = 1 to 100 (array number)

Example
```
:IMPEDANCE:MEASURE:ARRAY? 1 -> 1
:IMPEDANCE:MEASURE:ARRAY? ->
1,2,5,10,-1,-1,...
```

Description
- Outputs the order of the specified array number.
- If the parameter is omitted, the orders of array numbers 1 to 100 are output sequentially (comma separated).

:IMPedance:MEASure:TYPE

Function Sets the FFT window width of impedance measurements or queries the current setting.

Syntax
```
:IMPedance:MEASure:TYPE {STABle|
MIDDle|FAST}
:IMPedance:MEASure:TYPE?
```

Example
```
:IMPEDANCE:MEASURE:TYPE STABLE
:IMPEDANCE:MEASURE:TYPE? ->
:IMPEDANCE:MEASURE:TYPE STABLE
```

:IMPedance[:STATe]

Function Turns ON/OFF the impedance measurement mode or queries the current setting.

Syntax
```
:IMPedance[:STATe] {<Boolean>}
:IMPedance:STATe?
```

Example
```
:IMPEDANCE:STATE ON
:IMPEDANCE:STATE? ->
:IMPEDANCE:STATE 1
```

:IMPedance:SUPerpose?

Function Queries all settings related to the load current for impedance measurements.

Syntax
```
:IMPedance:SUPerpose?
```

Example
```
:IMPEDANCE:SUPERPOSE? ->
:IMPEDANCE:SUPERPOSE:OUTPUT:
STATE 0;TYPE DC;:IMPEDANCE:
SUPERPOSE:FREQUENCY:RANGE HZ;
VALUE 1.0002;:IMPEDANCE:SUPERPOSE:
OFFSET 0.000;AMPLITUDE 0.000;
DETAILE:RATIO 1.000;LIMIT 1000.000,
-1000.000;HOLD NORMAL;WAVEFORM SINE
```

:IMPedance:SUPerpose:AMPLitude

Function Sets the amplitude of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:
AMPLitude {<NRf>}
:IMPedance:SUPerpose:AMPLitude?
```
<NRf> = 0.000 to 2000.000(App)

Example
```
:IMPEDANCE:SUPERPOSE:AMPLITUDE 0
:IMPEDANCE:SUPERPOSE:AMPLITUDE? ->
:IMPEDANCE:SUPERPOSE:
AMPLITUDE 0.000
```

:IMPedance:SUPerpose:DETaile?

Function Queries all settings related to the detailed settings of the load current for impedance measurements.

Syntax
```
:IMPedance:SUPerpose:DETaile?
```

Example
```
:IMPEDANCE:SUPERPOSE:DETAILE? ->
:IMPEDANCE:SUPERPOSE:DETAILE:
RATIO 1.000;LIMIT 1000.000,
-1000.000;HOLD NORMAL;WAVEFORM SINE
```

:IMPedance:SUPerpose:DETaile:HOLD

Function Sets the action taken by the WT1600FC (handling of the control signal to the impedance measurement electronic load device) when hold is activated or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:DETaile:
HOLD {NORMal|OFF|AC_OFF}
:IMPedance:SUPerpose:DETaile:HOLD?
```

Example
```
:IMPEDANCE:SUPERPOSE:DETAILE:
HOLD NORMAL
:IMPEDANCE:SUPERPOSE:DETAILE:HOLD?
-> :IMPEDANCE:SUPERPOSE:DETAILE:
HOLD NORMAL
```

:IMPedance:SUPerpose:DETaile:LIMit

Function Sets the range of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:DETaile:
LIMit {<NRf>,<NRf>}
:IMPedance:SUPerpose:DETaile:LIMit?
```
<NRf> = –1000.000 to 1000.000(A)

Example
```
:IMPEDANCE:SUPERPOSE:DETAILE:
LIMIT 1000,-1000
:IMPEDANCE:SUPERPOSE:DETAILE:LIMIT?
-> :IMPEDANCE:SUPERPOSE:DETAILE:
LIMIT 1000.000,-1000.000
```

Description Set the upper limit and then the lower limit.

:IMPedance:SUPerpose:DETaile:RATio

Function Sets the current value per volt of the control signal to the impedance measurement electronic load device or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:DETaile:
RATio {<NRf>}
:IMPedance:SUPerpose:DETaile:RATio?
```
<NRf> = 0.001 to 1000.000

Example
```
:IMPEDANCE:SUPERPOSE:DETAILE:
RATIO 1
:IMPEDANCE:SUPERPOSE:DETAILE:RATIO?
-> :IMPEDANCE:SUPERPOSE:DETAILE:
RATIO 1.000
```

:IMPedance:SUPerpose:DETaile:WAVeform

Function Sets the waveform of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:DETaile:
WAVeform {SINE|PATTern}
:IMPedance:SUPerpose:DETaile:
WAVeform?
```

Example
```
:IMPEDANCE:SUPERPOSE:DETAILE:
WAVEFORM SINE
:IMPEDANCE:SUPERPOSE:DETAILE:
WAVEFORM? -> :IMPEDANCE:SUPERPOSE:
DETAILE: WAVEFORM SINE
```

:IMPedance:SUPerpose:FREQuency?

Function Queries all settings related to the frequency of the load current for impedance measurements.

Syntax
```
:IMPedance:SUPerpose:FREQuency?
```

Example
```
:IMPEDANCE:SUPERPOSE:FREQUENCY? ->
:IMPEDANCE:SUPERPOSE:FREQUENCY:
RANGE HZ;VALUE 100.00
```

:IMPedance:SUPerpose:FREQuency:RANGe

Function Sets the frequency range of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:FREQuency:
RANGe {MHZ|HZ|KHZ}
:IMPedance:SUPerpose:FREQuency:
RANGe?
```

Example
```
:IMPEDANCE:SUPERPOSE:FREQUENCY:
RANGE HZ
:IMPEDANCE:SUPERPOSE:FREQUENCY:
RANGE? -> :IMPEDANCE:SUPERPOSE:
FREQUENCY:RANGE HZ
```

:IMPedance:SUPerpose:FREQuency:VALue

Function Sets the frequency of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:FREQuency:
VALue {<NRf>}
:IMPedance:SUPerpose:FREQuency:
VALue?
```
<NRf> = 0.9313 to 891.28 (mHz) (when frequency range = mHz)
<NRf> = 1.0002 to 992.06 (Hz) (when frequency range = Hz)
<NRf> = 1.1161 to 50.000 (kHz) (when frequency range = kHz)

Example
```
:IMPEDANCE:SUPERPOSE:FREQUENCY:
VALUE 1.0002
:IMPEDANCE:SUPERPOSE:FREQUENCY:
VALUE? -> :IMPEDANCE:SUPERPOSE:
FREQUENCY:VALUE 1.0002
```

:IMPedance:SUPerpose:OFFSet

Function Sets the magnitude of the DC component of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:OFFSet {<NRf>}
:IMPedance:SUPerpose:OFFSet?
```
<NRf> = –1000.000 to 1000.000(A)

Example
```
:IMPEDANCE:SUPERPOSE:OFFSET 0
:IMPEDANCE:SUPERPOSE:OFFSET? ->
:IMPEDANCE:SUPERPOSE:OFFSET 0.000
```

:IMPedance:SUPerpose:OUTPut?

Function Queries all settings related to the output of the load current for impedance measurements.

Syntax
```
:IMPedance:SUPerpose:OUTPut?
```

Example
```
:IMPEDANCE:SUPERPOSE:OUTPUT? ->
:IMPEDANCE:SUPERPOSE:OUTPUT:
STATE 0;TYPE DC
```

:IMPedance:SUPerpose:OUTPut[:STATe]

Function Turns ON/OFF the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:OUTPut[:
STATe] {<Boolean>}
:IMPedance:SUPerpose:OUTPut:STATe?
```

Example
```
:IMPEDANCE:SUPERPOSE:OUTPUT:
STATE ON
:IMPEDANCE:SUPERPOSE:OUTPUT:STATE?
-> :IMPEDANCE:SUPERPOSE:OUTPUT:
STATE 1
```

:IMPedance:SUPerpose:OUTPut:TYPE

Function Sets the output type of the load current for impedance measurements or queries the current setting.

Syntax
```
:IMPedance:SUPerpose:OUTPut:
TYPE {ACDC|DC}
:IMPedance:SUPerpose:OUTPut:TYPE?
```

Example
```
:IMPEDANCE:SUPERPOSE:OUTPUT:TYPE DC
:IMPEDANCE:SUPERPOSE:OUTPUT:TYPE?
-> :IMPEDANCE:SUPERPOSE:OUTPUT:
TYPE DC
```

:IMPedance:VOLTage?

Function Queries all settings related to the voltage sensing input of impedance measurements.

Syntax
```
:IMPedance:VOLTage?
```

Example
```
:IMPEDANCE:VOLTAGE? -> :IMPEDANCE:
VOLTAGE:TERMINAL:ELEMENT5 HIGH;:
IMPEDANCE:VOLTAGE:ESTIMATE:
ELEMENT5 0.0010;:IMPEDANCE:VOLTAGE:
RANGE:ELEMENT5 AUTO
```

:IMPedance:VOLTage:ESTimate?

Function Queries the impedance estimates of all impedance measurement elements.

Syntax
```
:IMPedance:VOLTage:ESTimate?
```

Example
```
:IMPEDANCE:VOLTAGE:ESTIMATE? ->
:IMPEDANCE:VOLTAGE:ESTIMATE:
ELEMENT5 0.0010
```

:IMPedance:VOLTage:ESTimate[:ALL]

Function Sets the impedance estimates of all impedance measurement elements collectively.

Syntax
```
:IMPedance:VOLTage:ESTimate[:
ALL] {<NRf>}
```
<NRf> = 0.0001 to 10000.0000 (Ω)

Example
```
:IMPEDANCE:VOLTAGE:ESTIMATE:
ALL 0.001
```

:IMPedance:VOLTage:ESTimate:ELEMent<x>

Function Sets the impedance estimate of the impedance measurement element or queries the current setting.

Syntax
```
:IMPedance:VOLTage:ESTimate:
ELEMent<x> {<NRf>}
:IMPedance:VOLTage:ESTimate:
ELEMent<x>?
```
<NRf> = 1 to 5 (impedance measurement element)
<NRf> = 0.0001 to 10000.0000 (Ω)

Example
```
:IMPEDANCE:VOLTAGE:ESTIMATE:
ELEMENT5 0.001
:IMPEDANCE:VOLTAGE:ESTIMATE:
ELEMENT5? -> :IMPEDANCE:VOLTAGE:
ESTIMATE:ELEMENT5 0.0010
```

:IMPedance:VOLTage:INITialize

Function Sets the voltage range to the initial range.

Syntax
```
:IMPedance:VOLTage:INITialize
```

Example
```
:IMPEDANCE:VOLTAGE:INITIALIZE
```

:IMPedance:VOLTage:MRANge? (Measured RANge)

Function Queries the voltage range with respect to the present measured value.

Syntax
```
:IMPedance:VOLTage:MRANge? {<NRf>}
```
<NRf> = 1 to 5 (impedance measurement element)

Example (Example when impedance measurement elements (Terminal=High) are available in 2 and 3)
```
:IMPEDANCE:VOLTAGE:MRANGE? 2 ->
150.0E-03
:IMPEDANCE:VOLTAGE:MRANGE? ->
150.0E-03,150.0E-03
```

Description
- Returns the measurement range displayed on the right side of the screen.
- If the parameter is omitted, the measurement ranges of all built-in impedance measurement elements are output in order from the smallest element number.

:IMPedance:VOLTage:RANGe?

Function Queries the voltage range mode of all impedance measurement elements.

Syntax
```
:IMPedance:VOLTage:RANGe?
```

Example
```
:IMPEDANCE:VOLTAGE:RANGE? ->
:IMPEDANCE:VOLTAGE:RANGE:
ELEMENT5 AUTO
```

:IMPedance:VOLTage:RANGe[:ALL]

Function Sets the voltage range mode of all impedance measurement elements collectively.

Syntax
```
:IMPedance:VOLTage:RANGe[:
ALL] {AUTO|FIX}
```

Example
```
:IMPEDANCE:VOLTAGE:RANGE:ALL AUTO
```

:IMPedance:VOLTage:RANGe:ELEMent<x>

Function Sets the voltage range mode of the impedance measurement element or queries the current setting.

Syntax
```
:IMPedance:VOLTage:RANGe:
ELEMent<x> {AUTO|FIX}
:IMPedance:VOLTage:RANGe:
ELEMent<x>?
```
<NRf> = 1 to 5 (impedance measurement element)

Example
```
:IMPEDANCE:VOLTAGE:RANGE:
ELEMENT5 AUTO
:IMPEDANCE:VOLTAGE:RANGE:
ELEMENT5? -> :IMPEDANCE:VOLTAGE:
RANGE:ELEMENT5 AUTO
```

:IMPedance:VOLTage:TERMinal?

Function Queries the voltage input terminal of all impedance measurement elements.

Syntax
```
:IMPedance:VOLTage:TERMinal?
```

Example
```
:IMPEDANCE:VOLTAGE:TERMINAL? ->
:IMPEDANCE:VOLTAGE:TERMINAL:
ELEMENT5 HIGH
```

:IMPedance:VOLTage:TERMinal[:ALL]

Function Sets the voltage input terminals of all impedance measurement elements collectively.

Syntax
```
:IMPedance:VOLTage:TERMinal[:
ALL] {HIGH|LOW}
```

Example
```
:IMPEDANCE:VOLTAGE:TERMINAL:ALL
HIGH
```

:IMPedance:VOLTage:TERMinal:ELEMent<x>

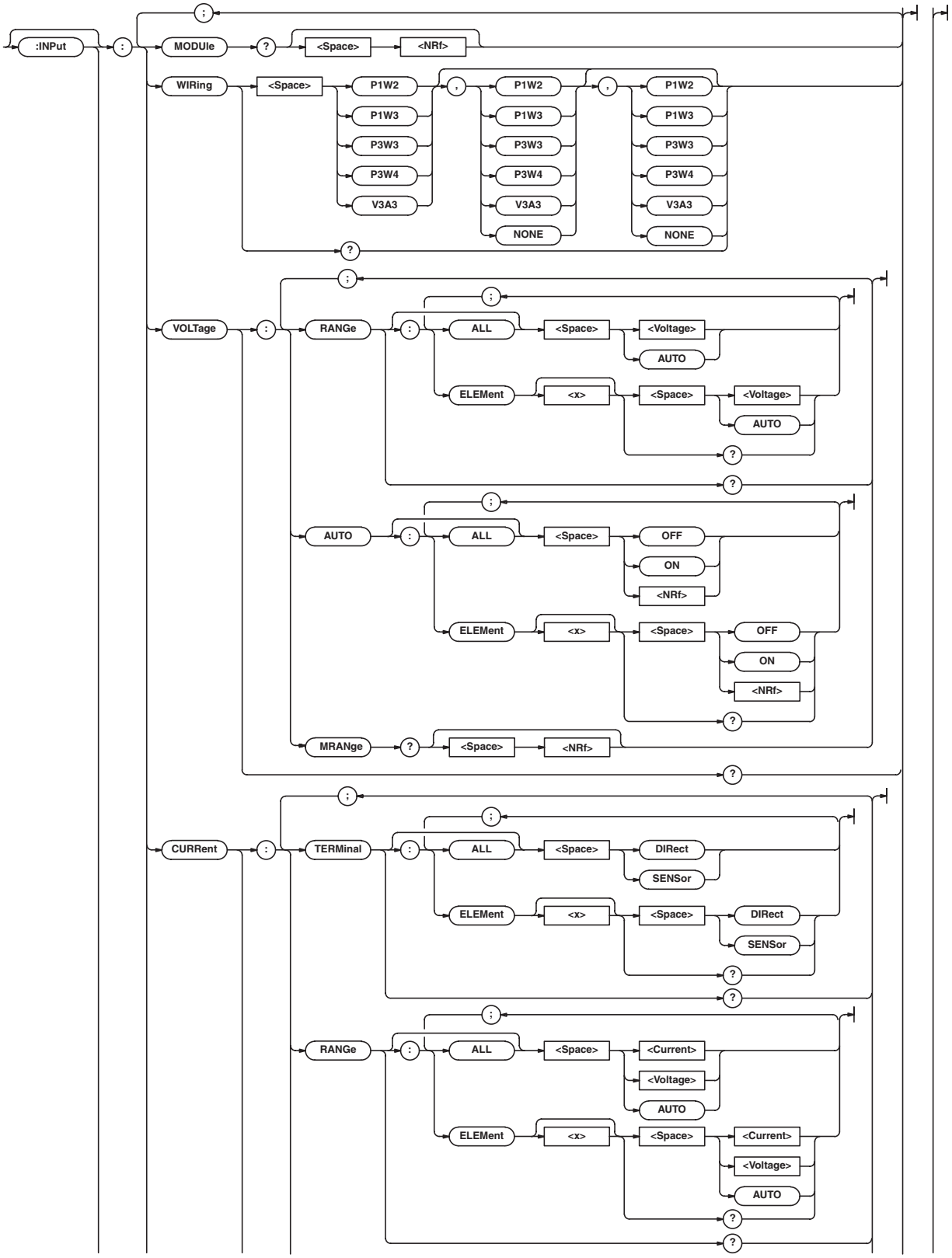
Function Sets the voltage input terminal of the impedance measurement element or queries the current setting.

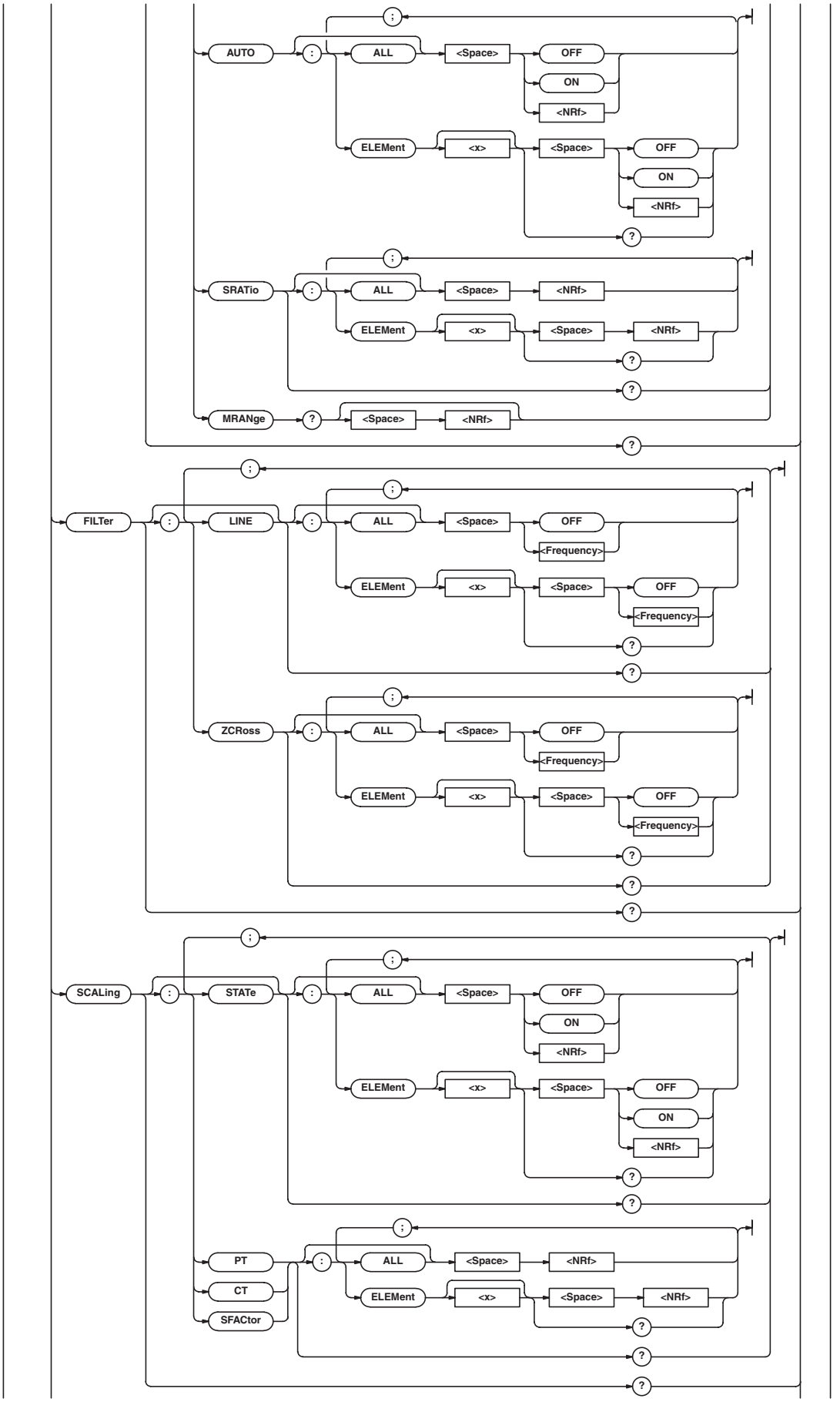
Syntax
```
:IMPedance:VOLTage:TERMinal:
ELEMent<x> {HIGH|LOW}
:IMPedance:VOLTage:TERMinal:
ELEMent<x>?
```
<NRf> = 1 to 5 (impedance measurement element)

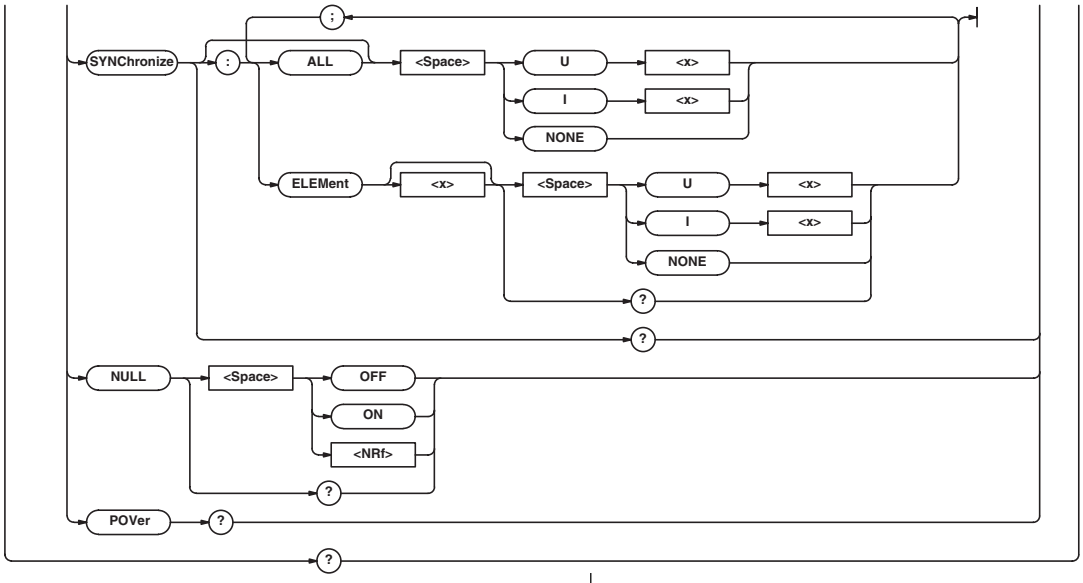
Example
```
:IMPEDANCE:VOLTAGE:TERMINAL:
ELEMENT5 HIGH
:IMPEDANCE:VOLTAGE:TERMINAL:
ELEMENT5? -> :IMPEDANCE:VOLTAGE:
TERMINAL:ELEMENT5 HIGH
```

5.10 INPut Group

The commands in this group deal with the measurement condition of the input element.
You can make the same settings and inquiries as when RANGE, SCALING, WIRING, FILTER, SYNC SRC, and NULL(SHIFT+MISC) of the INPUT group on the front panel are used.




AUTO
ALL
<Space>
OFF
ON
<NRf>
ELEMent
<x>
SRATio
MRANge
FILTer
LINE
<Frequency>
ZCRoss
SCALing
STATe
PT
CT
SFACtor



:INPut?

Function Queries all settings related to the input element.

Syntax :INPut?

Example
```
:INPUT? -> :INPUT:
WIRING P1W2,P1W2,P1W2;VOLTAGE:
RANGE:ELEMENT1 1.0000E+03;
ELEMENT2 1.0000E+03;
ELEMENT3 1.0000E+03;
ELEMENT4 1.0000E+03;:INPUT:CURRENT:
TERMINAL:ELEMENT1 DIRECT;
ELEMENT2 DIRECT;ELEMENT3 DIRECT;
ELEMENT4 DIRECT;:INPUT:CURRENT:
RANGE:ELEMENT1 5.00E+00;
ELEMENT2 5.00E+00;
ELEMENT3 5.00E+00;
ELEMENT4 5.00E+00;:INPUT:CURRENT:
SRATIO:ELEMENT1 10.0000;
ELEMENT2 10.0000;ELEMENT3 10.0000;
ELEMENT4 10.0000;:INPUT:FILTER:
LINE:ELEMENT1 OFF;ELEMENT2 OFF;
ELEMENT3 OFF;ELEMENT4 OFF;
ELEMENT5 OFF;:INPUT:FILTER:ZCROSS:
ELEMENT1 OFF;ELEMENT2 OFF;
ELEMENT3 OFF;ELEMENT4 OFF;:INPUT:
SCALING:STATE:ELEMENT1 0;
ELEMENT2 0;ELEMENT3 0;ELEMENT4 0;
ELEMENT5 0;:INPUT:SCALING:PT:
ELEMENT1 1.0000;ELEMENT2 1.0000;
ELEMENT3 1.0000;ELEMENT4 1.0000;
ELEMENT5 1.0000;:INPUT:SCALING:CT:
ELEMENT1 1.0000;ELEMENT2 1.0000;
ELEMENT3 1.0000;ELEMENT4 1.0000;
ELEMENT5 1.0000;:INPUT:SCALING:
SFACTOR:ELEMENT1 1.0000;
ELEMENT2 1.0000;ELEMENT3 1.0000;
ELEMENT4 1.0000;:INPUT:SYNCHRONIZE:
ELEMENT1 I1;ELEMENT2 I2;
ELEMENT3 I3;ELEMENT4 I4:INPUT:
NULL 0
```

[:INPut]:CURRent?

Function Queries all settings related to the current measurement.

Syntax [:INPut]:CURRent?

Example
```
:INPUT:CURRENT? -> :INPUT:CURRENT:
TERMINAL:ELEMENT1 DIRECT;
ELEMENT2 DIRECT;ELEMENT3 DIRECT;
ELEMENT4 DIRECT;:INPUT:CURRENT:
RANGE:ELEMENT1 5.00E+00;
ELEMENT2 5.00E+00;
ELEMENT3 5.00E+00;
ELEMENT4 5.00E+00;:INPUT:CURRENT:
SRATIO:ELEMENT1 10.0000;
ELEMENT2 10.0000;ELEMENT3 10.0000;
ELEMENT4 10.0000;
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:AUTO[:ALL]

Function Collectively turns ON/OFF the current auto range of all power measurement elements.

Syntax [:INPut]:CURRent:AUTO
[:ALL] {<Boolean>}

Example :INPUT:CURRENT:AUTO:ALL ON

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:AUTO:ELEMent<x>

Function Turns ON/OFF the current auto range of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:CURRent:AUTO:
ELEMent<x> {<Boolean>}
[:INPut]:CURRent:AUTO:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)

Example
```
:INPUT:CURRENT:AUTO:ELEMENT1 ON
:INPUT:CURRENT:AUTO:ELEMENT1? ->
:INPUT:CURRENT:AUTO:ELEMENT1 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:MRANge? (Measured RANge)

Function Queries the current range with respect to the present measured value.

Syntax
```
[:INPut]:CURRent:MRANge? {<NRf>}
```
<NRf> = 1 to 4 (power measurement element)

Example
```
:INPUT:CURRENT:MRANGE? 1 ->
5.00E+00
:INPUT:CURRENT:MRANGE? ->
5.00E+00,5.00E+00,5.00E+00,5.00E+00
```

Description
- Returns the measurement range displayed on the right side of the screen. The present measurement range can be retrieved even when set to auto range.
- If the parameter is omitted, the measurement ranges of all built-in power measurement elements are output in order starting with element 1.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:RANGe?

Function Queries the current ranges of all power measurement elements.

Syntax
```
[:INPut]:CURRent:RANGe?
```

Example
```
:INPUT:CURRENT:RANGE? -> :INPUT:
CURRENT:RANGE:ELEMENT1 5.00E+00;
ELEMENT2 5.00E+00;
ELEMENT3 5.00E+00;
ELEMENT4 5.00E+00
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:RANGe[:ALL]

Function Collectively sets the current ranges of all power measurement elements.

Syntax
```
[:INPut]:CURRent:RANGe
[:ALL] {<Voltage>|<Current>|AUTO}
```
- For a 5-A input element
  <Current> = 10, 20, 50, 100, 200, 500 (mA), 1, 2, or 5 (A) (when TERMinal = DIRect)
  <Voltage> = 50, 100, 250, 500 (mV), 1, 2.5, 5, or 10 (V) (when TERMinal = SENSor)
  AUTO = Auto range
- For a 50-A input element
  <Current> = 1, 2, 5, 10, 20, or 50 (A) (when TERMinal = DIRect)
  <Voltage> = 50, 100, 250, 500 (mV), 1, 2.5, 5, or 10 (V) (when TERMinal = SENSor)
  AUTO = Auto range

Example
```
:INPUT:CURRENT:RANGE:ALL 5A
```

Description
- The selectable range is determined by the input element type (5A/50A) of element 1 and the current measurement terminal setting ([:INPut]:CURRent:TERMinal:ELEMent1). Therefore, only the elements that are set to the same input element type and current measurement terminal setting as element 1 are set.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:RANGe:ELEMent<x>

Function Sets the current range of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:CURRent:RANGe:
ELEMent<x>
{<Current>|<Voltage>|AUTO}
[:INPut]:CURRent:RANGe:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)
- For a 5-A input element
  <Current > = 10, 20, 50, 100, 200, 500 (mA), 1, 2, or 5 (A) (when TERMinal = DIRect)
  <Voltage > = 50, 100, 250, 500 (mV), 1, 2.5, 5, or 10 (V) (when TERMinal = SENSor)
  AUTO = Auto range
- For a 50-A input element
  <Current> = 1, 2, 5, 10, 20, or 50 (A) (when TERMinal = DIRect)
  <Voltage> = 50, 100, 250, 500 (mV), 1, 2.5, 5, or 10 (V) (when TERMinal = SENSor)
  AUTO = Auto range

Example
```
:INPUT:CURRENT:RANGE:ELEMENT1 5A
:INPUT:CURRENT:RANGE:ELEMENT1? ->
:INPUT:CURRENT:RANGE:
ELEMENT1 5.00E+00
```

Description
- The selectable range is determined by the input element type (5A/50A) of the target element and the current measurement terminal setting ([:INPut]:CURRent:TERMinal:ELEMent<x>).
- Specifying “Auto” with this command is equivalent to setting “[:INPut]:CURRent:AUTO:ELEMent<x>” to “ON.”
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:SRATio?

Function Queries the current sensor scaling constants of all power measurement elements.

Syntax
```
[:INPut]:CURRent:SRATio?
```

Example
```
:INPUT:CURRENT:SRATIO? -> :INPUT:
CURRENT:SRATIO:ELEMENT1 10.0000;
ELEMENT2 10.0000;ELEMENT3 10.0000;
ELEMENT4 10.0000
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:SRATio[:ALL]

Function Collectively sets the current sensor scaling constants of all power measurement elements.

Syntax
```
[:INPut]:CURRent:SRATio
[:ALL] {<NRf>}
```
<NRf> = 0.0001 to 99999.9999

Example
```
:INPUT:CURRENT:SRATIO:ALL 10
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:SRATio:ELEMent<x>

Function Sets the current sensor scaling constant of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:CURRent:SRATio:
ELEMent<x> {<NRf>}
[:INPut]:CURRent:SRATio:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)
<NRf> = 0.0001 to 99999.9999

Example
```
:INPUT:CURRENT:SRATIO:ELEMENT1 10
:INPUT:CURRENT:SRATIO:ELEMENT1? ->
:INPUT:CURRENT:SRATIO:
ELEMENT1 10.0000
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:TERMinal?

Function Queries the current measurement terminal of all power measurement elements.

Syntax
```
[:INPut]:CURRent:TERMinal?
```

Example
```
:INPUT:CURRENT:TERMINAL? -> :INPUT:
CURRENT:TERMINAL:ELEMENT1 DIRECT;
ELEMENT2 DIRECT;ELEMENT3 DIRECT;
ELEMENT4 DIRECT
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:TERMinal[:ALL]

Function Collectively sets the current measurement terminals of all power measurement elements.

Syntax
```
[:INPut]:CURRent:TERMinal
[:ALL] {DIRect|SENSor}
```
DIRect = Direct input
SENSor = Current sensor input

Example
```
:INPUT:CURRENT:TERMINAL:ALL DIRECT
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:CURRent:TERMinal:ELEMent<x>

Function Sets the current measurement terminal of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:CURRent:TERMinal:
ELEMent<x> {DIRect|SENSor}
[:INPut]:CURRent:TERMinal:
ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)
DIRect = Direct input
SENSor = Current sensor input

Example
```
:INPUT:CURRENT:TERMINAL:
ELEMENT1 DIRECT
:INPUT:CURRENT:TERMINAL:ELEMENT1?
-> :INPUT:CURRENT:TERMINAL:
ELEMENT1 DIRECT
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:FILTer?

Function Queries all settings related to the filter.

Syntax
```
[:INPut]:FILTer?
```

Example
```
:INPUT:FILTER? -> :INPUT:FILTER:
LINE:ELEMENT1 OFF;ELEMENT2 OFF;
ELEMENT3 OFF;ELEMENT4 OFF;
ELEMENT5 OFF;:INPUT:FILTER:
ZCROSS:ELEMENT1 OFF;ELEMENT2 OFF;
ELEMENT3 OFF;ELEMENT4 OFF
```

[:INPut]:FILTer:LINE?

Function Queries the line filter settings of all elements.

Syntax
```
[:INPut]:FILTer:LINE?
```

Example
```
:INPUT:FILTER:LINE? -> :INPUT:
FILTER:LINE:ELEMENT1 OFF;
ELEMENT2 OFF;ELEMENT3 OFF;
ELEMENT4 OFF;ELEMENT5 OFF
```

[:INPut]:FILTer[:LINE][:ALL]

Function Collectively sets the line filters of all elements.

Syntax
```
[:INPut]:FILTer[:LINE][:ALL]
{OFF|<Frequency>}
```
OFF = Line filter OFF
<Frequency> = 500 Hz, 5.5 kHz (line filter ON, cutoff frequency)

Example
```
:INPUT:FILTER:LINE:ALL OFF
```

Description Line filters of all power measurement elements are collectively set. To set the line filter on impedance measurement elements, use the "[:INPut]:FILTer[:LINE]:ELEMent<x>" command. This command can be used only on models that are equipped with power measurement elements.

[:INPut]:FILTer[:LINE]:ELEMent<x>

Function Sets the line filter of the element or queries the current setting.

Syntax
```
[:INPut]:FILTer[:LINE]:
ELEMent<x> {OFF|<Frequency>}
[:INPut]:FILTer[:LINE]:ELEMent<x>?
```
<x> = 1 to 5 (element)
OFF = Line filter OFF
<Frequency> = 500 Hz, 5.5 kHz (line filter ON, cutoff frequency)

Example
```
:INPUT:FILTER:LINE:ELEMENT1 OFF
:INPUT:FILTER:LINE:ELEMENT1? ->
:INPUT:FILTER:LINE:ELEMENT1 OFF
```

[:INPut]:FILTer:ZCRoss?

Function Queries the zero-crossing filter settings of all power measurement elements.

Syntax
```
[:INPut]:FILTer:ZCRoss?
```

Example
```
:INPUT:FILTER:ZCROSS? ->
:INPUT:FILTER:ZCROSS:ELEMENT1 OFF;
ELEMENT2 OFF;ELEMENT3 OFF;
ELEMENT4 OFF
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:FILTer:ZCRoss[:ALL]

Function Collectively sets the zero-crossing filters of all power measurement elements.

Syntax
```
[:INPut]:FILTer:ZCRoss[:ALL]
{OFF|<Frequency>}
```
OFF = zero-crossing filter OFF
<Frequency> = 500 Hz (zero-crossing filter ON, cutoff frequency)

Example
```
:INPUT:FILTER:ZCROSS:ALL OFF
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:FILTer:ZCRoss:ELEMent<x>

Function Sets the zero-crossing filter of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:FILTer:ZCRoss:
ELEMent<x> {OFF|<Frequency>}
[:INPut]:FILTer:ZCRoss:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)
OFF = zero-crossing filter OFF
<Frequency> = 500 Hz (zero-crossing filter ON, cutoff frequency)

Example
```
:INPUT:FILTER:ZCROSS:ELEMENT1 OFF
:INPUT:FILTER:ZCROSS:ELEMENT1? ->
:INPUT:FILTER:ZCROSS:ELEMENT1 OFF
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:MODUle?

Function Queries the input element type.

Syntax
```
[:INPut]:MODUle? {<NRf>}
[:INPut]:MODUle?
```
<NRf> = 1 to 6 (element)

Example
```
:INPUT:MODULE? 1 -> 5
:INPUT:MODULE? -> 5,5,5,5,Z5,0
```

Description
- The response information is as follows:
  5 = 5-A input element for power measurement
  50 = 50-A input element for power measurement
  Z5 = 5-A input element for impedance measurement
  Z20 = 20-A input element for impedance measurement
  0 = No input element
- If the parameter is omitted, the input element types of all elements are output in order starting with element 1.

[:INPut]:NULL

Function Turns ON/OFF the NULL function or queries the current setting.

Syntax
```
[:INPut]:NULL {<Boolean>}
[:INPut]:NULL?
```

Example
```
:INPUT:NULL ON
:INPUT:NULL? -> :INPUT:NULL 1
```

[:INPut]:POVer?

Function Queries the peak over information.

Syntax
```
[:INPut]:POVer?
```

Example
```
:INPUT:POVER? -> 0
```

Description
- The peak over information of each element is mapped as shown below. For the response, a sum of decimal values of each bit is returned.
- If the response is "16," for example, peak over is occurring at U3.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	I5	U5	I4	U4	I3	U3	I2	U2	I1	U1

[:INPut]:SCALing?

Function Queries all settings related to scaling.

Syntax
```
[:INPut]:SCALing?
```

Example
```
:INPUT:SCALING? -> :INPUT:SCALING:
STATE:ELEMENT1 0;ELEMENT2 0;
ELEMENT3 0;ELEMENT4 0;ELEMENT5 0;:
INPUT:SCALING:PT:ELEMENT1 1.0000;
ELEMENT2 1.0000;ELEMENT3 1.0000;
ELEMENT4 1.0000;ELEMENT5 1.0000;:
INPUT:SCALING:CT:ELEMENT1 1.0000;
ELEMENT2 1.0000;ELEMENT3 1.0000;
ELEMENT4 1.0000;ELEMENT5 1.0000;:
INPUT:SCALING:SFACTOR:
ELEMENT1 1.0000;ELEMENT2 1.0000;
ELEMENT3 1.0000;ELEMENT4 1.0000
```

[:INPut]:SCALing:{PT|CT|SFACtor}?

Function Queries the {Voltage | Current | Power} scaling constants of all elements.

Syntax
```
[:INPut]:SCALing:{PT|CT|SFACtor}?
```

Example
```
:INPUT:SCALING:PT? -> :INPUT:
SCALING:PT:ELEMENT1 1.0000;
ELEMENT2 1.0000;ELEMENT3 1.0000;
ELEMENT4 1.0000;ELEMENT5 1.0000
```

Description The `[:INPut]:SCALing:SFACtor..` commands are invalid on models that are only equipped with impedance measurement elements.

[:INPut]:SCALing:{PT|CT|SFACtor}[:ALL]

Function Collectively sets the {Voltage | Current | Power} scaling constants of all elements.

Syntax
```
[:INPut]:SCALing:{PT|CT|SFACtor}
[:ALL] {<NRf>}
```
<NRf> = 0.0001 to 99999.9999

Example
```
:INPUT:SCALING:PT:ALL 1
```

Description
- The "`[:INPut]:SCALing:{PT|CT}[:ALL]`" command collectively sets the scaling constants on all power measurement elements. To set the scaling constants on impedance measurement elements, use the "`[:INPut]:SCALing:{PT|CT}:ELEMent<x>`" command. This command can be used only on models that are equipped with power measurement elements.
- The `[:INPut]:SCALing:SFACtor..` commands are invalid on models that are only equipped with impedance measurement elements.

[:INPut]:SCALing:{PT|CT|SFACtor}:ELEMent<x>

Function Sets the {Voltage | Current | Power} scaling constants of the element or queries the current setting.

Syntax
```
[:INPut]:SCALing:{PT|CT|SFACtor}:
ELEMent<x> {<NRf>}
[:INPut]:SCALing:{PT|CT|SFACtor}:
ELEMent<x>?
```
- For `[:INPut]:SCALing:{PT|CT}:ELEMent<x>`
  <x> = 1 to 5 (element)
- For `[:INPut]:SCALing:{SFACtor}:ELEMent<x>`
  <x> = 1 to 4 (power measurement element)

<NRf> = 0.0001 to 99999.9999

Example
```
:INPUT:SCALING:PT:ELEMENT1 1
:INPUT:SCALING:PT:ELEMENT1? ->
:INPUT:SCALING:PT:ELEMENT1 1.0000
```

Description The `[:INPut]:SCALing:SFACtor..` commands are invalid on models that are only equipped with impedance measurement elements.

[:INPut]:SCALing:STATe?

Function Queries the scaling ON/OFF states of all elements.
Syntax `[:INPut]:SCALing:STATe?`
Example `:INPUT:SCALING:STATE? -> :INPUT:SCALING:STATE:ELEMENT1 0;ELEMENT2 0;ELEMENT3 0;ELEMENT4 0;ELEMENT5 0`

[:INPut]:SCALing[:STATe][:ALL]

Function Collectively turns ON/OFF the scaling of all elements.
Syntax `[:INPut]:SCALing[:STATe][:ALL] {<Boolean>}`
Example `:INPUT:SCALING:STATE:ALL OFF`
Description Scaling of all power measurement elements are collectively set. To set the scaling on impedance measurement elements, use the "`[:INPut]:SCALing[:STATe]:ELEMent<x>`" command. This command can be used only on models that are equipped with power measurement elements.

[:INPut]:SCALing[:STATe]:ELEMent<x>

Function Turns ON/OFF the scaling of the element or queries the current setting.
Syntax `[:INPut]:SCALing[:STATe]:ELEMent<x> {<Boolean>}`
`[:INPut]:SCALing[:STATe]:ELEMent<x>?`
<x> = 1 to 5 (element)
Example `:INPUT:SCALING:STATE:ELEMENT1 OFF`
`:INPUT:SCALING:STATE:ELEMENT1? -> :INPUT:SCALING:STATE:ELEMENT1 0`

[:INPut]:SYNChronize?

Function Queries the synchronization source of all power measurement elements.
Syntax `[:INPut]:SYNChronize?`
Example `INPUT:SYNCHRONIZE? -> :INPUT:SYNCHRONIZE:ELEMENT1 I1;ELEMENT2 I2;ELEMENT3 I3;ELEMENT4 I4`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:SYNChronize[:ALL]

Function Collectively sets the synchronization source of all power measurement elements.
Syntax `[:INPut]:SYNChronize[:ALL] {U<x>|I<x>|NONE}`
<x> = 1 to 4 (power measurement element)
NONE = No synchronization source
Example `:INPUT:SYNCHRONIZE:ALL I1`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:SYNChronize:ELEMent<x>

Function Sets the synchronization source of the power measurement element or queries the current setting.
Syntax `[:INPut]:SYNChronize:ELEMent<x> {U<x>|I<x>|NONE}`
`[:INPut]:SYNChronize:ELEMent<x>?`
<x> = 1 to 4 (power measurement element)
NONE = No synchronization source
Example `:INPUT:SYNCHRONIZE:ELEMENT1 I1`
`:INPUT:SYNCHRONIZE:ELEMENT1? -> :INPUT:SYNCHRONIZE:ELEMENT1 I1`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage?

Function Queries all settings related to the voltage measurement.
Syntax `[:INPut]:VOLTage?`
Example `:INPUT:VOLTAGE? -> :INPUT:VOLTAGE:RANGE:ELEMENT1 1.0000E+03;ELEMENT2 1.0000E+03;ELEMENT3 1.0000E+03;ELEMENT4 1.0000E+03;`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:AUTO[:ALL]

Function Collectively turns ON/OFF the voltage auto range of all power measurement elements.
Syntax `[:INPut]:VOLTage:AUTO[:ALL] {<Boolean>}`
Example `:INPUT:VOLTAGE:AUTO:ALL ON`
Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:AUTO:ELEMent<x>

Function Turns ON/OFF the voltage auto range of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:VOLTage:AUTO:
ELEMent<x> {<Boolean>}
[:INPut]:VOLTage:AUTO:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)

Example
```
:INPUT:VOLTAGE:AUTO:ELEMENT1 ON
:INPUT:VOLTAGE:AUTO:ELEMENT1? ->
:INPUT:VOLTAGE:AUTO:ELEMENT1 1
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:MRANge? (Measured RANge)

Function Queries the voltage range with respect to the present measured value.

Syntax
```
[:INPut]:VOLTage:MRANge? {<NRf>}
```
<NRf> = 1 to 4 (power measurement element)

Example
```
:INPUT:VOLTAGE:MRANGE? 1 ->
1.0000E+03
:INPUT:VOLTAGE:MRANGE? ->
1.0000E+03,1.0000E+03,
1.0000E+03,1.0000E+03
```

Description
- Returns the measurement range displayed on the right side of the screen. The present measurement range can be retrieved even when auto range is ON.
- If the parameter is omitted, the measurement ranges of all built-in power measurement elements are output in order starting with element 1.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:RANGe?

Function Queries the voltage ranges of all power measurement elements.

Syntax
```
[:INPut]:VOLTage:RANGe?
```

Example
```
:INPUT:VOLTAGE:RANGE? -> :INPUT:
VOLTAGE:RANGE:ELEMENT1 1.0000E+03;
ELEMENT2 1.0000E+03;
ELEMENT3 1.0000E+03;
ELEMENT4 1.0000E+03
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:RANGe[:ALL]

Function Collectively sets the voltage range of all power measurement elements.

Syntax
```
[:INPut]:VOLTage:RANGe[:ALL]
{<Voltage>|AUTO}
```
<Voltage> = 1.5, 3, 6, 10, 15, 30, 60, 100, 150, 300, 600, or 1000 (V)
AUTO = Auto range

Example
```
:INPUT:VOLTAGE:RANGE:ALL 1000V
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:VOLTage:RANGe:ELEMent<x>

Function Sets the voltage range of the power measurement element or queries the current setting.

Syntax
```
[:INPut]:VOLTage:RANGe:
ELEMent<x> {<Voltage>|AUTO}
[:INPut]:VOLTage:RANGe:ELEMent<x>?
```
<x> = 1 to 4 (power measurement element)
<Voltage> = 1.5, 3, 6, 10, 15, 30, 60, 100, 150, 300, 600, or 1000 (V)
AUTO = Auto range

Example
```
:INPUT:VOLTAGE:RANGE:ELEMENT1 1000V
:INPUT:VOLTAGE:RANGE:ELEMENT1? ->
:INPUT:VOLTAGE:RANGE:
ELEMENT1 1.0000E+03
```

Description
- Specifying “Auto” with this command is equivalent to setting “`[:INPut]:VOLTage:AUTO:ELEMent<x>`” to “ON.”
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

[:INPut]:WIRing

Function Sets the wiring system or queries the current setting.

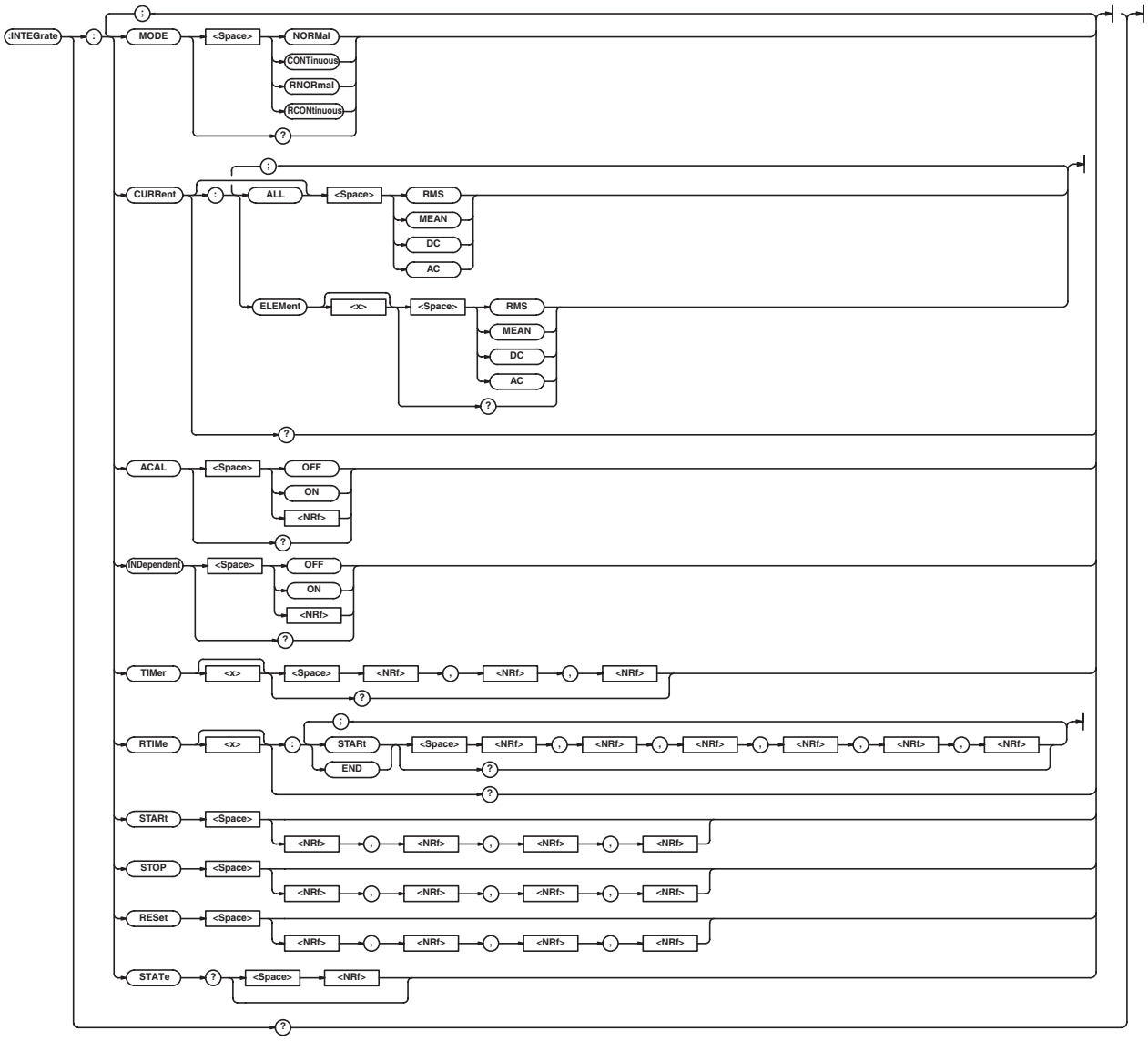
Syntax
```
[:INPut]:WIRing {(P1W2|P1W3|P3W3|
P3W4|V3A3)[,(P1W2|P1W3|P3W3|P3W4|
V3A3|NONE)][,(P1W2|P1W3|P3W3|P3W4|
V3A3|NONE)]}
[:INPut]:WIRing?
```
P1W2 = Single-phase, two-wire system
P1W3 = Single-phase, three-wire system
P3W3 = Three-phase, three-wire system
P3W4 = Three-phase, four-wire system
V3A3 = Three voltage, three current system
NONE = No wiring

Example
```
:INPUT:WIRING P1W2,P1W2,P1W2
:INPUT:WIRING? -> :INPUT:
WIRING P1W2,P1W2,P1W2
```

Description
- Set the wiring systems in the order ΣA, ΣB, and ΣC.
- If the combination does not allow setting of ΣB or ΣC, it can be omitted.
- Certain combinations of wiring systems are not selectable depending on the model type. For the combinations of wiring systems, see the WT1600FC User's Manual (IM760151-01E).
- On models with a single power measurement element, ΣA is fixed to P1W2. ΣB and ΣC cannot be specified.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

5.11 INTEGrate Group

The commands in this group deal with integration.
Excluding a section of the commands, you can make the same settings and inquiries as when START, STOP, RESET (SHIFT+STOP), and INTEG SET(SHIFT+START) of the INTEGRATOR group on the front panel are used.
The commands in this group are invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.



:INTEGrate?

Function Queries all settings related to the integration.

Syntax `:INTEGrate?`

Example
- Example during normal integration mode with individual element integration set to OFF
```
:INTEGRATE? -> :INTEGRATE:
MODE NORMAL;CURRENT:ELEMENT1 RMS;
ELEMENT2 RMS;ELEMENT3 RMS;
ELEMENT4 RMS;:INTEGRATE:ACAL 0;
INDEPENDENT 0;TIMER1 1,0,0
```
- Example during real-time normal integration mode with individual element integration set to OFF
```
:INTEGRATE? -> :INTEGRATE:
MODE RNORMAL;CURRENT:
ELEMENT1 RMS;ELEMENT2 RMS;
ELEMENT3 RMS;ELEMENT4 RMS;:
INTEGRATE:ACAL 0;INDEPENDENT 0;
TIMER1 1,0,0;RTIME1:
START 2001,1,1,0,0,0;
END 2001,1,1,1,0,0
```
- Example during normal integration mode with individual power measurement element integration set to ON
```
:INTEGRATE? -> :INTEGRATE:
MODE NORMAL;CURRENT:ELEMENT1 RMS;
ELEMENT2 RMS;ELEMENT3 RMS;
ELEMENT4 RMS;:INTEGRATE:ACAL 0;
INDEPENDENT 1;TIMER1 1,0,0;
TIMER2 1,0,0;TIMER3 1,0,0;
TIMER4 1,0,0
```
- Example during real-time normal integration mode with individual power measurement element integration set to ON
```
:INTEGRATE? -> :INTEGRATE:
MODE RNORMAL;CURRENT:
ELEMENT1 RMS;ELEMENT2 RMS;
ELEMENT3 RMS;ELEMENT4 RMS;:
INTEGRATE:ACAL 0;INDEPENDENT 1;
TIMER1 1,0,0;TIMER2 1,0,0;
TIMER3 1,0,0;TIMER4 1,0,0;
RTIME1:START 2001,1,1,0,0,0;
END 2001,1,1,1,0,0;:INTEGRATE:
RTIME2:START 2001,1,1,0,0,0;
END 2001,1,1,1,0,0;:INTEGRATE:
RTIME3:START 2001,1,1,0,0,0;
END 2001,1,1,1,0,0;:INTEGRATE:
RTIME4:START 2001,1,1,0,0,0;
END 2001,1,1,1,0,0
```

:INTEGrate:ACAL

Function Turns ON/OFF the auto calibration or queries the current setting.

Syntax `:INTEGrate:ACAL {<Boolean>}`
`:INTEGrate:ACAL?`

Example
```
:INTEGRATE:ACAL OFF
:INTEGRATE:ACAL? -> :INTEGRATE:
ACAL 0
```

:INTEGrate:CURRent?

Function Queries the current mode of the current integration of all power measurement elements.

Syntax `:INTEGrate:CURRent?`

Example
```
:INTEGRATE:CURRENT? -> :INTEGRATE:
CURRENT:ELEMENT1 RMS;ELEMENT2 RMS;
ELEMENT3 RMS;ELEMENT4 RMS
```

:INTEGrate:CURRent[:ALL]

Function Collectively sets the current mode of the current integration of all power measurement elements.

Syntax `:INTEGrate:CURRent[:ALL] {RMS|MEAN|DC|AC}`

Example `:INTEGRATE:CURRENT:ALL RMS`

:INTEGrate:CURRent:ELEMent<x>

Function Sets the current mode of the current integration of the power measurement element or queries the current setting.

Syntax `:INTEGrate:CURRent:ELEMent<x> {RMS|MEAN|DC|AC}`
`:INTEGrate:CURRent:ELEMent<x>?`
<x> = 1 to 4 (power measurement element)

Example
```
:INTEGRATE:CURRENT:ELEMENT1 RMS
:INTEGRATE:CURRENT:ELEMENT1? ->
:INTEGRATE:CURRENT:ELEMENT1 RMS
```

Description The WT1600FC operates according to the current mode of the current integration of each element regardless of whether the individual power measurement element integration (`:INTEGrate:INDependent`) is ON.

:INTEGrate:INDependent

Function Turns ON/OFF the individual power measurement element integration or queries the current setting.

Syntax `:INTEGrate:INDependent {<Boolean>}`
`:INTEGrate:INDependent?`

Example
```
:INTEGRATE:INDEPENDENT OFF
:INTEGRATE:INDEPENDENT? ->
:INTEGRATE:INDEPENDENT 0
```

:INTEGrate:MODE

Function Sets the integration mode or queries the current setting.

Syntax `:INTEGrate:MODE {NORMal|CONTinuous|RNORmal|RCONtinuous}`
`:INTEGrate:MODE?`
NORMal = Normal integration mode
CONTinuous = Continuous integration mode
RNORmal = Real-time normal integration mode
RCONtinuous = Real-time continuous integration mode

Example
```
:INTEGRATE:MODE NORMAL
:INTEGRATE:MODE? -> :INTEGRATE:
MODE NORMAL
```

:INTEGrate:RESet

Function Resets the integrated value.

Syntax `:INTEGrate:RESet {<NRf>,<NRf>,<NRf>,<NRf>}`
<NRf> = 1 to 4 (power measurement element that is stopped)

Example
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)"
  `:INTEGRATE:RESET`
  (Stop all power measurement elements)
  `:INTEGRATE:RESET 1,2,3`
  (Specify power measurement elements and stop)
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)"
  `:INTEGRATE:RESET`
  (Stop all power measurement elements)

Description
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)," you can specify up to 4 power measurement elements to be started as parameters. However, this method is possible only through communications. There are no front panel keys that correspond to this method. Omitting parameters is equivalent to specifying all power measurement elements.
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," you cannot specify parameters. If you do, an error occurs.

:INTEGrate:RTIMe<x>?

Function Queries the integration start and stop times for real-time integration mode.

Syntax `:INTEGrate:RTIMe<x>?`
<x> = 1 to 4 (power measurement element)

Example `:INTEGRATE:RTIME1? -> :INTEGRATE:RTIME1:START 2001,1,1,0,0,0;END 2001,1,1,1,0,0`

Description When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," the integration operates according to the integration start/stop time of power measurement element 1. Queries to other elements results in error.

:INTEGrate:RTIMe<x>:{STARt|END}

Function Sets the integration {start|stop} time for real-time integration mode or queries the current setting.

Syntax `:INTEGrate:RTIMe<x>:{STARt|END} {<NRf>,<NRf>,<NRf>,<NRf>,<NRf>,<NRf>}`
`:INTEGrate:RTIMe<x>:{STARt|END}?`
<x> = 1 to 4 (power measurement element)
{<NRf>, <NRf>, <NRf>, <NRf>, <NRf>, <NRf>} = 2001, 1, 1, 0, 0, 0 to 2099, 12, 31, 23, 59, 59

1st <NRf> = 2001 to 2099	(year)
2nd <NRf> = 1 to 12	(month)
3rd <NRf> = 1 to 31	(day)
4th <NRf> = 0 to 23	(hour)
5th <NRf> = 0 to 59	(minute)
6th <NRf> = 0 to 59	(second)

Example `:INTEGRATE:RTIME1:START 2001,1,1,0,0,0`
`:INTEGRATE:RTIME1:START? ->`
`:INTEGRATE:RTIME1:START 2001,1,1,0,0,0`

Description When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," the integration operates according to the integration start/stop time of power measurement element 1. Commands and queries to other elements result in error.

:INTEGrate:STARt

Function Starts integration.

Syntax `:INTEGrate:STARt {<NRf>,<NRf>,<NRf>,<NRf>}`
`<NRf>` = 1 to 4 (power measurement element that is stopped)

Example
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)"
  `:INTEGRATE:START`
  (Stop all power measurement elements)
  `:INTEGRATE:START 1,2,3`
  (Specify power measurement elements and stop)
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)"
  `:INTEGRATE:START`
  (Stop all power measurement elements)

Description
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)," you can specify up to 4 power measurement elements to be started as parameters. However, this method is possible only through communications. There are no front panel keys that correspond to this method. Omitting parameters is equivalent to specifying all power measurement elements.
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," you cannot specify parameters. If you do, an error occurs.

:INTEGrate:STATe?

Function Queries the integration condition.

Syntax `:INTEGrate:STATe? {<NRf>}`
`<NRf>` = 1 to 4 (power measurement element to be queried)

Example `:INTEGRATE:STATE? 1 -> RESET` (Query the specified power measurement element)
`:INTEGRATE:STATE? -> RESET,RESET,RESET,RESET`
(Query all power measurement elements)

Description
- The response information is as follows:
  RESet = Integration reset
  READy = Waiting (real-time integration mode)
  STARt = Integration in progress
  STOP = Integration stop
  ERRor = Abnormal integration termination (integration overflow, power failure)
  TIMeup = Integration stop due to integration timer time
- If the parameter is omitted, the query is made on the condition of all built-in power measurement elements. If a power measurement element that is not built in is specified as a parameter, an error occurs.

:INTEGrate:STOP

Function Stops integration.

Syntax `:INTEGrate:STOP {<NRf>,<NRf>,<NRf>,<NRf>}`
`<NRf>` = 1 to 4 (power measurement element that is stopped)

Example
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)"
  `:INTEGRATE:STOP`
  (Stop all power measurement elements)
  `:INTEGRATE:STOP 1,2,3`
  (Specify power measurement elements and stop)
- Example in which the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)"
  `:INTEGRATE:STOP`
  (Stop all power measurement elements)

Description
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "ON (1)," you can specify up to 4 power measurement elements to be started as parameters. However, this method is possible only through communications. There are no front panel keys that correspond to this method. Omitting parameters is equivalent to specifying all power measurement elements.
- When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," you cannot specify parameters. If you do, an error occurs.

:INTEGrate:TIMer<x>

Function Sets the integration timer time or queries the current setting.

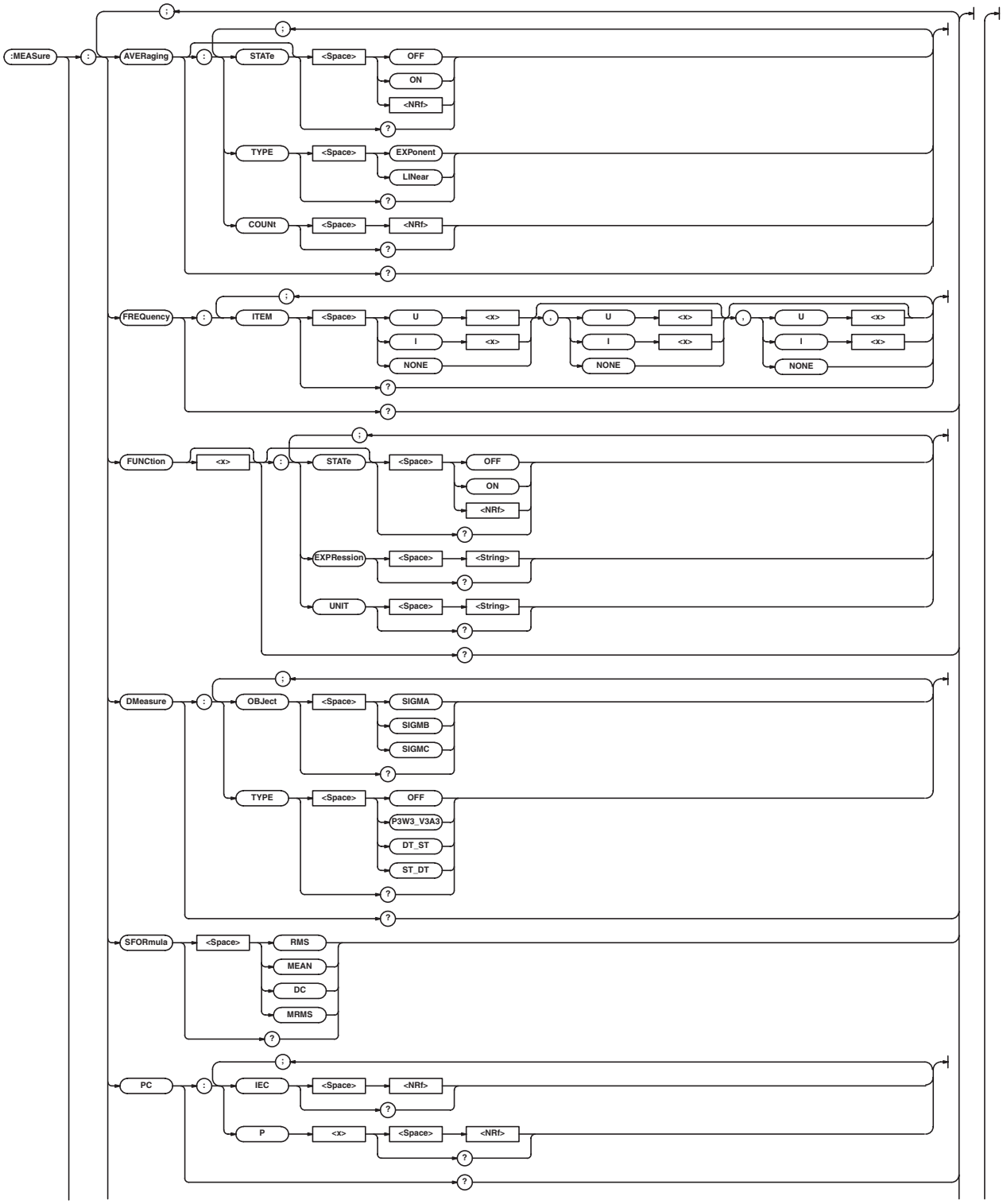
Syntax `:INTEGrate:TIMer<x> {<NRf>,<NRf>,<NRf>}`
`:INTEGrate:TIMer<x>?`
`<x>` = 1 to 4 (power measurement element)
{`<NRf>`, `<NRf>`, `<NRf>`} = 0, 0, 0 to 10000, 0, 0
1st `<NRf>` = 0 to 10000 (hour)
2nd `<NRf>` = 0 to 59 (minute)
3rd `<NRf>` = 0 to 59 (second)

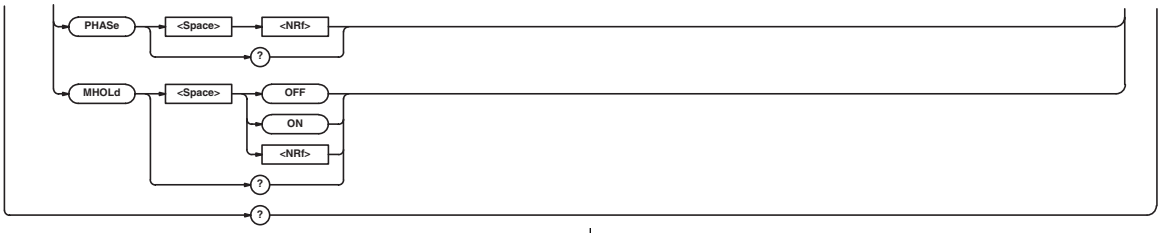
Example `:INTEGRATE:TIMER1 1,0,0`
`:INTEGRATE:TIMER1? -> :INTEGRATE:TIMER1 1,0,0`

Description When the individual power measurement element integration (`:INTEGrate:INDependent`) is "OFF (0)," the integration operates according to the integration start time of power measurement element 1. Commands and queries to other elements result in error.

5.12 MEASure Group

The commands in this group deal with measurements.
You can make the same settings and inquiries as when MEASURE, AVG, and MAX HOLD (SHIFT+LOCAL) on the front panel is used.





:MEASure?

Function Queries all settings related to the measurement.

Syntax `:MEASure?`

Example
- Example for power measurement

```
:MEASURE? -> :MEASURE:AVERAGING:
STATE 0;TYPE EXPONENT;COUNT 2;:
MEASURE:FREQUENCY:ITEM U1,I1,U2;:
MEASURE:FUNCTION1:STATE 0;
EXPRESSION "URMS(E1)";UNIT "V";:
MEASURE:FUNCTION2:STATE 0;
EXPRESSION "IRMS(E1)";UNIT "A";:
MEASURE:FUNCTION3:STATE 0;
EXPRESSION "UPPK(E1)";UNIT "V";:
MEASURE:FUNCTION4:STATE 0;
EXPRESSION "IPPK(E1)";UNIT "A";:
MEASURE:DMEASURE:OBJECT SIGMA;
TYPE OFF;:MEASURE:SFORMULA RMS;
PC:IEC 1976;P1 0.5000;P2 0.5000;:
MEASURE:PHASE 180;MHOLD 0
```

- For impedance measurement

```
:MEASURE? -> :MEASURE:AVERAGING:
STATE 0
```

:MEASure:AVERaging?

Function Queries all settings related to averaging.

Syntax `:MEASure:AVERaging?`

Example
- Example for power measurement

```
:MEASURE:AVERAGING? -> :MEASURE:
AVERAGING:STATE 1;TYPE EXPONENT;
COUNT 2
```

- For impedance measurement

```
:MEASURE:AVERAGING? -> :MEASURE:
AVERAGING:STATE 1
```

:MEASure:AVERaging:COUNt

Function Sets the averaging coefficient for power measurement or queries the current setting.

Syntax
```
:MEASure:AVERaging:COUNt {<NRf>}
:MEASure:AVERaging:COUNt?
```
<NRf> = 2, 4, 8, 16, 32, or 64 (when TYPE = EXPonent)
<NRf> = 8, 16, 32, 64, 128, or 256 (when TYPE = LINear)

Example
```
:MEASURE:AVERAGING:COUNT 2
:MEASURE:AVERAGING:COUNT? ->
:MEASURE:AVERAGING:COUNT 2
```

Description
- This command is valid only during power measurement. (It cannot be used during impedance measurement.)
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.
- For details on the averaging coefficient (attenuation constant) during impedance measurement, see the WT1600FC User's Manual (IM760151-01E).

:MEASure:AVERaging[:STATe]

Function Turns ON/OFF averaging or queries the current setting.

Syntax
```
:MEASure:AVERaging
[:STATe] {<Boolean>}
:MEASure:AVERaging:STATe?
```

Example
```
:MEASURE:AVERAGING:STATE ON
:MEASURE:AVERAGING:STATE? ->
:MEASURE:AVERAGING:STATE 1
```

Description The averaging for impedance measurement can only be turned ON/OFF. For details on the averaging during impedance measurement, see the WT1600FC User's Manual (IM760151-01E).

:MEASure:AVERaging:TYPE

Function Sets the averaging type for power measurement or queries the current setting.

Syntax
```
:MEASure:AVERaging:TYPE {EXPonent|LINear}
:MEASure:AVERaging:TYPE?
```

Example
```
:MEASURE:AVERAGING:TYPE EXPONENT
:MEASURE:AVERAGING:TYPE? ->
:MEASURE:AVERAGING:TYPE EXPONENT
```

Description
- This command is valid only during power measurement. (It cannot be used during impedance measurement.)
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.
- For details on the averaging type during impedance measurement, see the WT1600FC User's Manual (IM760151-01E).

:MEASure:DMeasure?

Function Queries all settings related to the delta computation.

Syntax
```
:MEASure:DMeasure?
```

Example
```
:MEASURE:DMEASURE? -> :MEASURE:
DMEASURE:OBJECT SIGMA;TYPE OFF
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:DMeasure:OBJect

Function Sets the delta computation target or queries the current setting.

Syntax
```
:MEASure:DMeasure:OBJect {SIGMA|SIGMB|SIGMC}
:MEASure:DMeasure:OBJect?
```
SIGMA = ΣA
SIGMB = ΣB (selectable with two or more power measurement elements)
SIGMC = ΣC (selectable with three or more power measurement elements)

Example
```
:MEASURE:DMEASURE:OBJECT SIGMA
:MEASURE:DMEASURE:OBJECT? ->
:MEASURE:DMEASURE:OBJECT SIGMA
```

Description
- This command is valid only during power measurement.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:DMeasure:TYPE

Function Sets the delta computation mode or queries the current setting.

Syntax
```
:MEASure:DMeasure:TYPE {OFF|P3W3_V3A3|DT_ST|ST_DT}
:MEASure:DMeasure:TYPE?
```

Example
```
:MEASURE:DMEASURE:TYPE OFF
:MEASURE:DMEASURE:TYPE? ->
:MEASURE:DMEASURE:TYPE OFF
```

Description
- This command is valid only during power measurement.
- The selections are as follows:
  OFF = Not perform delta computation
  P3W3_V3A3 = 3P3W -> 3V3A conversion
  DT_ST = Delta -> Star conversion
  ST_DT = Star -> Delta conversion
- Some of the selections may not be possible depending on the wiring system of the specified delta computation target (`:MEASure:DMeasure:OBJect`).
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FREQuency?

Function Queries all settings related to frequency measurement.

Syntax
```
:MEASure:FREQuency?
```

Example
```
:MEASURE:FREQUENCY? -> :MEASURE:
FREQUENCY:ITEM U1,I1,U2
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FREQuency:ITEM

Function Sets the frequency measurement item or queries the current setting.

Syntax
```
:MEASure:FREQuency:ITEM {(U<x>|I<x>|NONE)[,(U<x>|I<x>|NONE)]
[,(U<x>|I<x>|NONE)]}
:MEASure:FREQuency:ITEM?
```
<x> = 1 to 4 (power measurement element)

Example
```
:MEASURE:FREQUENCY:ITEM U1,I1,U2
:MEASURE:FREQUENCY:ITEM? ->
:MEASURE:FREQUENCY:ITEM U1,I1,U2
```

Description
- This command is valid only during power measurement.
- You can specify up to three frequency measurement items.
- If you are not specifying the frequency measurement item, select "NONE." The 2nd and 3rd parameters can be omitted.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FUNCtion<x>?

Function Queries all settings related to user-defined functions.

Syntax
```
:MEASure:FUNCtion<x>?
```
<x> = 1 to 4

Example
```
:MEASURE:FUNCTION1? ->
:MEASURE:FUNCTION1:STATE 1;
EXPRESSION "URMS(E1)";UNIT "V"
```

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FUNCtion<x>:EXPRession

Function Sets the equation of the user-defined function or queries the current setting.

Syntax
```
:MEASure:FUNCtion<x>:EXPRession
{<String>}
:MEASure:FUNCtion<x>:EXPRession?
```
<x> = 1 to 4
<String> = Up to 50 characters

Example
```
:MEASURE:FUNCTION1:
EXPRESSION "URMS(E1)"
:MEASURE:FUNCTION1:EXPRESSION? ->
:MEASURE:FUNCTION1:
EXPRESSION "URMS(E1)"
```

Description
- This command is valid only during power measurement.
- Only the characters and symbols displayed on the keyboard on the screen can be used.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FUNCtion<x>[:STATe]

Function Enables (ON) or Disables (OFF) the user-defined function or queries the current setting.

Syntax
```
:MEASure:FUNCtion<x>
[:STATe] {<Boolean>}
:MEASure:FUNCtion<x>:STATe?
```
<x> = 1 to 4

Example
```
:MEASURE:FUNCTION1:STATE ON
:MEASURE:FUNCTION1:STATE? ->
:MEASURE:FUNCTION1:STATE 1
```

Description
- This command is valid only during power measurement.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:FUNCtion<x>:UNIT

Function Sets the unit to be added to the computation result of the user-defined function or queries the current setting.

Syntax
```
:MEASure:FUNCtion<x>:UNIT
{<String>}
:MEASure:FUNCtion<x>:UNIT?
```
<x> = 1 to 4
<String> = Up to 8 characters

Example
```
:MEASURE:FUNCTION1:UNIT "V"
:MEASURE:FUNCTION1:UNIT? ->
:MEASURE:FUNCTION1:UNIT "V"
```

Description
- This command is valid only during power measurement.
- Only the characters and symbols displayed on the keyboard on the screen can be used.
- This command does not affect the computation result.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:MHOLd

Function Turns ON/OFF the MAX HOLD function or queries the current setting.

Syntax
```
:MEASure:MHOLd {<Boolean>}
:MEASure:MHOLd?
```

Example
```
:MEASURE:MHOLD ON
:MEASURE:MHOLD? -> :MEASURE:MHOLD 1
```

Description
- This command is valid only during power measurement.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:PC?

Function Queries all settings related to the calculation of Pc (Corrected Power).

Syntax `:MEASure:PC?`

Example `:MEASURE:PC? -> :MEASURE:PC:IEC 1976;P1 0.5000;P2 0.5000`

Description This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:PC:IEC

Function Sets the equation used to calculate Pc (Corrected Power) or queries the current setting.

Syntax `:MEASure:PC:IEC {<NRf>}`
`:MEASure:PC:IEC?`
<NRf> = 1976, 1993

Example `:MEASURE:PC:IEC 1976`
`:MEASURE:PC:IEC? -> :MEASURE:PC:IEC 1976`

Description
- This command is valid only during power measurement.
- Specify the year when the equation used to calculate the Pc was issued by IEC76-1.
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:PC:P<x>

Function Sets the parameter used to calculate Pc (Corrected Power) or queries the current setting.

Syntax `:MEASure:PC:P<x> {<NRf>}`
`:MEASure:PC:P<x>?`
<x> = 1, 2
<NRf> = 0.0000 to 9.9999

Example `:MEASURE:PC:P1 0.5`
`:MEASURE:PC:P1? -> :MEASURE:PC:P1 0.5000`

Description
- This command is valid only during power measurement.
- This parameter is used when the "`:MEASure:PC:IEC`" setting is set to "1976(IEC76-1(1976))."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:PHASe

Function Sets the display format of the phase difference or queries the current setting.

Syntax `:MEASure:PHASe {<NRf>}`
`:MEASure:PHASe?`
<NRf> = 180, 360

Example `:MEASURE:PHASE 180`
`:MEASURE:PHASE? -> :MEASURE:PHASE 180`

Description
- This command is valid only during power measurement.
- Displays the phase using ±0 to 180° (Lead/Lag) for "180" and 0 to 360° for "360."
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

:MEASure:SFORmula

Function Sets the equation used to calculate S (reactive power) or queries the current setting.

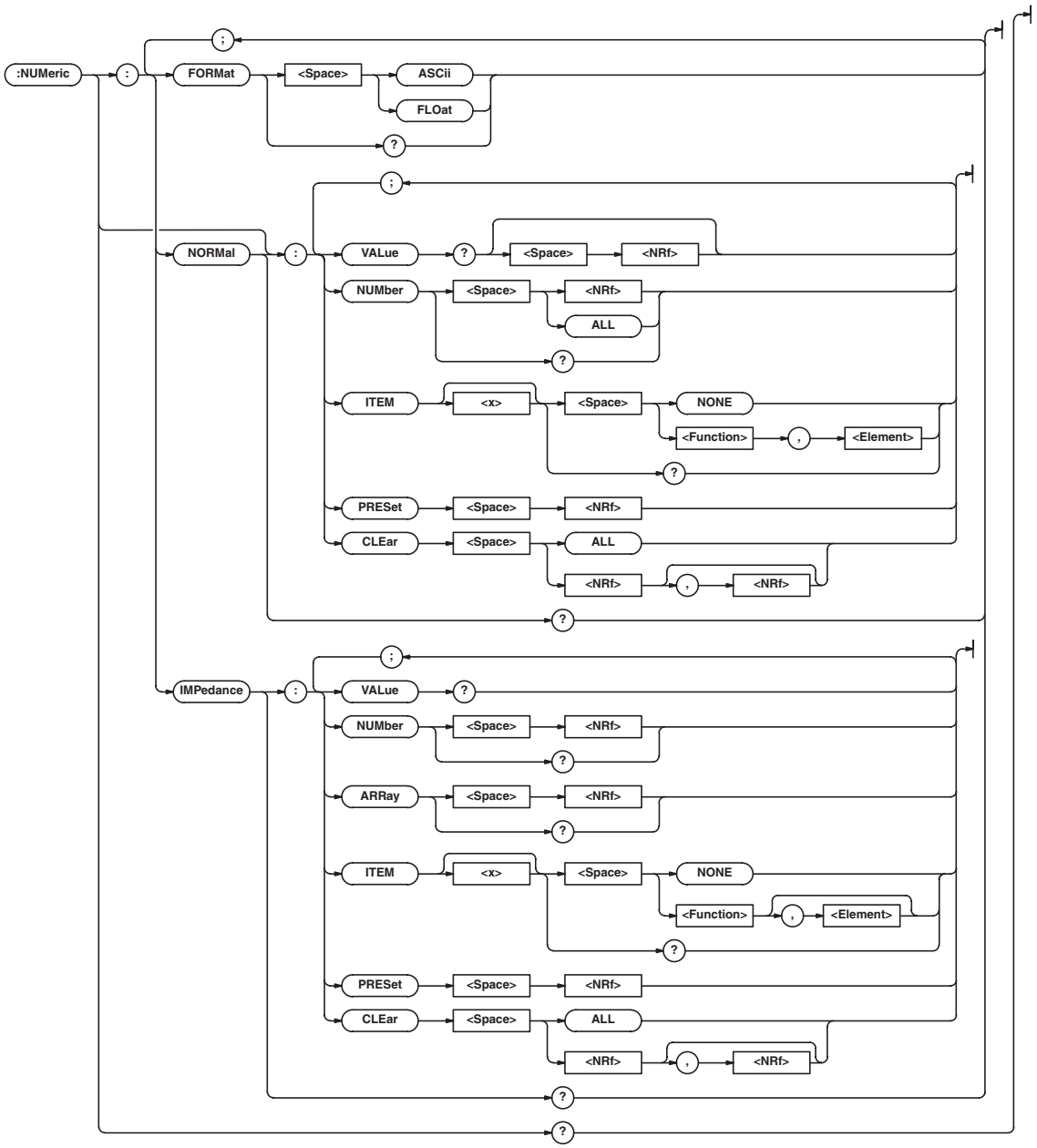
Syntax `:MEASure:SFORmula {RMS|MEAN|DC|MRMS}`
`:MEASure:SFORmula?`

Example `:MEASURE:SFORMULA RMS`
`:MEASURE:SFORMULA? -> :MEASURE:SFORMULA RMS`

Description
- This command is valid only during power measurement.
- The correspondence between the selections and equations is as follows.
  RMS : S = Urms * Irms
  MEAN : S = Umean * Imean
  DC : S = Udc * Idc
  MRMS : S = Umean * Irms
- This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

5.13 NUMeric group

The commands in this group deal with numeric data.
There are no front panel keys that correspond to the commands in this group.



:NUMeric?

Function Queries all settings related to the numeric data output.

Syntax `:NUMeric?`

Example
- Example for power measurement

```
:NUMERIC? -> :NUMERIC:
FORMAT ASCII;NORMAL:NUMBER 15;
ITEM1 URMS,1;ITEM2 UMN,1;
ITEM3 UDC,1;ITEM4 UAC,1;
ITEM5 IRMS,1;ITEM6 IMN,1;
ITEM7 IDC,1;ITEM8 IAC,1;
ITEM9 P,1;ITEM10 S,1;ITEM11 Q,1;
ITEM12 LAMBDA,1;ITEM13 PHI,1;
ITEM14 FU,1;ITEM15 FI,1
```

- For impedance measurement

```
:NUMERIC? -> :NUMERIC:
FORMAT ASCII;IMPEDANCE:NUMBER 6;
ARRAY 1;ITEM1 BU,4;ITEM2 BI,4;
ITEM3 BP,4;ITEM4 FREQ;ITEM5 ZR,5;
ITEM6 ZI,5
```

:NUMeric:FORMat

Function Sets the format of the numeric data that is transmitted by "`:NUMeric:{NORMal|IMPedance}:VALue?`" or queries the current setting.

Syntax
```
:NUMeric:FORMat {ASCii|FLOat}
:NUMeric:FORMat?
```

Example
```
:NUMERIC:FORMAT ASCII
:NUMERIC:FORMAT? -> :NUMERIC:
FORMAT ASCII
```

Description
- The format of the numeric data that is output varies depending on the "`:NUMeric:FORMat`" setting as follows.
  (1) When "ASCii" is specified
  The physical value is output in the <NR3> format. (<NR1> format only for the elapsed time of integration (TIME))
  The data of each item is delimited by a comma.
  (2) When "FLOat" is specified
  A 6-byte header (example "#40060") is added in front of the numeric data block.
  The physical value in IEEE single-precision floating point (4-byte) format follows the header.
  The byte order of the data of each item is MSB First.
- For the format of the individual numeric data, see "Numeric Data Format" at the end of this group (section).

:NUMeric:IMPedance?

Function Queries all settings related to the numeric data output for impedance measurement.

Syntax `:NUMeric:IMPedance?`

Example
```
:NUMERIC:IMPEDANCE? ->
:NUMERIC:IMPEDANCE:NUMBER 6;
ARRAY 1;ITEM1 BU,4;ITEM2 BI,4;
ITEM3 BP,4;ITEM4 FREQ;ITEM5 ZR,5;
ITEM6 ZI,5
```

Description For the values of "`:NUMeric:IMPedance:ITEM<x>`," the numeric data output items for the amount specified by "`:NUMeric:IMPedance:NUMber`" are output.

:NUMeric:IMPedance:ARRay

Function Of the numeric data output using "`:NUMeric:IMPedance:VALue?`," sets the number of data points (the number of arrays) when outputting an array-type function* or queries the current setting.
(* Array-type function = {`ZR|ZI|Z|PHI|U|I|FREQ`})

Syntax
```
:NUMeric:IMPedance:ARRay {<NRf>}
:NUMeric:IMPedance:ARRay?
```
<NRf> = 1 to 100

Example
```
:NUMERIC:IMPEDANCE:ARRAY 1
:NUMERIC:IMPEDANCE:ARRAY? ->
:NUMERIC: IMPEDANCE:ARRAY 1
```

Description
- "`:NUMeric:IMPedance:VALue?`" outputs the numeric data from 1 to the specified value in order for a single array-type function according to this setting.
- By default, the number of output data (the number of arrays) is set to "1."

:NUMeric:IMPedance:CLEar

Function Clears the numeric data output item (sets "NONE") for impedance measurement.

Syntax
```
:NUMeric:IMPedance:CLEar
{ALL|<NRf>[,<NRf>]}
```
ALL = Clear all items
1st <NRf> = 1 to 16 (Item number to start clearing)
2nd <NRf> = 1 to 16 (Item number to end clearing)

Example `:NUMERIC:IMPEDANCE:CLEAR ALL`

Description If the 2nd <NRf> is omitted, the output items from the start clear number to the last item (16) are cleared.

:NUMeric:IMPedance:ITEM<x>

Function Sets the numeric data output items for power measurement or queries the current setting.

Syntax
```
:NUMeric:IMPedance:ITEM<x>
{NONE|<Function>[,<Element>]}
:NUMeric:IMPedance:ITEM<x>?
```
<x> = 1 to 16 (item number)
NONE = No output item
<Function> =
{BU|BI|BP|ZR|ZI|Z|PHI|U|
I|FREQ}
<Element> = {<NRf>}(<NRf> = 1 to 5)

Example
```
:NUMERIC:IMPEDANCE:ITEM1 BU,4
:NUMERIC:IMPEDANCE:ITEM1? ->
:NUMERIC:IMPEDANCE:ITEM1 BU,4
```

Description
- The details of the item specified by <Function> are indicated below.
  BU = Voltage U (dc) of the battery power measurement element (display: Battery Voltage)
  BI = Current I (dc) of the battery power measurement element (display: Battery Current)
  BP = Power P (dc) of the battery power measurement element (display: Battery Power)
  ZR = Real part of the circuit impedance (display: Z')
  ZI = Imaginary part of the circuit impedance (display: Z'')
  Z = Absolute value of the circuit impedance (display: |Z|)
  PHI = Phase difference (display: Φ)
  U = Voltage of the impedance measurement element (display: U)
  I = Current of the impedance measurement element (display: I)
  FREQ = Frequency (display: Freq)
- If <Function> is set to FREQ, <Element> can be omitted.

:NUMeric:IMPedance:NUMber

Function Sets the number of items of the numeric data that is output by ":NUMeric:IMPedance:VALue?" or queries the current setting.

Syntax
```
:NUMeric:IMPedance:NUMber {<NRf>}
:NUMeric:IMPedance:NUMber?
```
<NRf> = 1 to 16

Example
```
:NUMERIC:IMPEDANCE:NUMBER 6
:NUMERIC:IMPEDANCE:NUMBER? ->
:NUMERIC:IMPEDANCE:NUMBER 6
```

Description
- ":NUMeric:IMPedance:VALue?" outputs the numeric data from 1 to the specified value in order according to this setting.
- By default, the number of items of numeric data is set to "6."

:NUMeric:IMPedance:PRESet

Function Presets the output item pattern of numeric data for impedance measurement.

Syntax
```
:NUMeric:IMPedance:PRESet {<NRf>}
```
<NRf> = 1 to 4 (preset pattern number)

Example
```
:NUMERIC:IMPEDANCE:PRESET 1
```

Description
- For details on the output items that are preset, see "(2) Preset Pattern of Output Items of Impedance Measurement Numeric Data."
- By default, output items of "Pattern 2" is selected.

:NUMeric:IMPedance:VALue?

Function Queries the numeric data for impedance measurement.

Syntax
```
:NUMeric:IMPedance:VALue?
```

Example
- Example in which ":NUMeric:FORMat" is set to "ASCii"
  ```
  :NUMERIC:IMPEDANCE:VALUE? ->
  104.75E+00,105.02E+00,-
  0.38E+00,..(omitted)..,49.868E+00
  ```
- Example in which ":NUMeric:FORMat" is set to "FLOat"
  ```
  :NUMERIC:IMPEDANCE:VALUE? ->
  #4(Number of bytes, 4 digits)(Series of data bytes)
  ```

Description
- Outputs the numeric data of items numbers in order from 1 to :NUMeric:IMPedance:NUMber.
- For an array-type function ({ZR|ZI|Z|PHI|U|I|FREQ}), numeric data of the number of arrays are output in order from 1 to :NUMeric:IMPedance:ARRay for a single item.
- For the format of the individual numeric data that is output, see "Numeric Data Format" at the end of this group (section).

:NUMeric:NORMal?

Function Queries all settings related to the numeric data output for power measurement.

Syntax
```
:NUMeric:NORMal?
```

Example
```
:NUMERIC:NORMAL? -> :NUMERIC:
NORMAL:NUMBER 15;ITEM1 URMS,1;
ITEM2 UMN,1;ITEM3 UDC,1;
ITEM4 UAC,1;ITEM5 IRMS,1;
ITEM6 IMN,1;ITEM7 IDC,1;
ITEM8 IAC,1;ITEM9 P,1;ITEM10 S,1;
ITEM11 Q,1;ITEM12 LAMBDA,1;
ITEM13 PHI,1;ITEM14 FU,1;
ITEM15 FI,1
```

Description For the values of ":NUMeric[:NORMal]:ITEM<x>," the numeric data output items for the amount specified by ":NUMeric[:NORMal]:NUMber" are output.

:NUMeric[:NORMal]:CLEar

Function Clears the numeric data output item (sets "NONE") for power measurement.

Syntax `:NUMeric[:NORMal]:CLEar {ALL|<NRf>[,<NRf>]}`
ALL = Clear all items
1st <NRf> = 1 to 255 (Item number to start clearing)
2nd <NRf> = 1 to 255 (Item number to end clearing)

Example `:NUMERIC:NORMAL:CLEAR ALL`

Description If the 2nd <NRf> is omitted, the output items from the start clear number to the last item (255) are cleared.

:NUMeric[:NORMal]:ITEM<x>

Function Sets the numeric data output items for power measurement or queries the current setting.

Syntax `:NUMeric[:NORMal]:ITEM<x> {NONE|<Function>,<Element>}`
`:NUMeric[:NORMal]:ITEM<x>?`
<x> = 1 to 255 (item number)
NONE = No output item
<Function> = {URMS|UMN|UDC|UAC|IRMS|...}(See the function selection list (1) of "DISPlay group.")
<Element> = {<NRf>|SIGMA|SIGMB|SIGMC}(<NRf> = 1 to 4) (power measurement element)

Example `:NUMERIC:NORMAL:ITEM1 URMS,1`
`:NUMERIC:NORMAL:ITEM1? -> :NUMERIC:NORMAL:ITEM1 URMS,1`

:NUMeric[:NORMal]:NUMber

Function Sets the number of the numeric data that is transmitted by "`:NUMeric:NORMal:VALue?`" or queries the current setting.

Syntax `:NUMeric[:NORMal]:NUMber {<NRf>|ALL}`
`:NUMeric[:NORMal]:NUMber?`
<NRf> = 1 to 255 (ALL)

Example `:NUMERIC:NORMAL:NUMBER 15`
`:NUMERIC:NORMAL:NUMBER ->`
`:NUMERIC:NORMAL:NUMBER 15`

Description
- If the parameter is omitted for the "`:NUMeric:NORMal:VALue?`" command, the numeric data from 1 to (the specified value) is output in order.
- By default, the number of numeric data is set to "15."

:NUMeric[:NORMal]:PRESet

Function Presets the output item pattern of numeric data for power measurement.

Syntax `:NUMeric[:NORMal]:PRESet {<NRf>}`
<NRf> = 1 to 4 (preset pattern number)

Example `:NUMERIC:NORMAL:PRESET 1`

Description
- For details on the output items that are preset, see "(1) Preset Pattern of Output Items of Power Measurement Numeric Data."
- By default, output items of "Pattern 2" is selected.

:NUMeric[:NORMal]:VALue?

Function Queries the numeric data for power measurement.

Syntax `:NUMeric[:NORMal]:VALue? {<NRf>}`
<NRf> = 1 to 255 (item number)

Example
- Example when <NRf> is specified
  `:NUMERIC:NORMAL:VALUE? 1 -> 104.75E+00`
- Example when <NRf> is omitted
  `:NUMERIC:NORMAL:VALUE? -> 104.75E+00,105.02E+00,-0.38E+00, ..(omitted)..,49.868E+00`
- Example in which "`:NUMeric:FORMat`" is set to "Float"
  `:NUMERIC:NORMAL:VALUE? ->`
  `#4`(Number of bytes, 4 digits)(Series of data bytes)

Description
- If <NRf> is specified, only the numeric data of the item number is output.
- If <NRf> is omitted, the numeric data of item numbers from 1 to "`:NUMeric[:NORMal]:NUMber`" is output in order.
- For the format of the individual numeric data that is output, see "Numeric Data Format" at the end of this group (section).

*** Numeric Data Format**

(1) Normal Data

- Phase difference ϕ (PHI) of a power measurement element in 180° (Lead/Lag) display
  ASCII: "D/G" + <NR3> format (mantissa: maximum significant digits = 5, exponent: 2 digits, example: G90.00E+00)
  FLOAT: IEEE single-precision floating point (4-byte) format
- Σ of the power value (P, S, Q, PC)
- Integrated value (WH, WHP, WHM, AH, AHP, AHM)
  ASCII: <NR3> format (mantissa: maximum significant digits = 6, exponent: 2 digits, example: [-]123.456E+00)
  FLOAT: IEEE single-precision floating point (4-byte) format
- Elapsed time of integration (TIME)
  ASCII: <NR1> format in units of seconds (example: for 1 hour (1:00:00), 3600)
  FLOAT: IEEE single-precision floating point (4-byte) format in units of seconds (example: for 1 hour (1:00:00), 0x45610000)
- No items (NONE)
  ASCII: "NAN" (Not A Number)
  FLOAT: 0x7E951BEE(9.91E+37)
- Other than above
  ASCII: <NR3> format (mantissa: maximum significant digits = 5, exponent: 2 digits, example: [-]123.45E+00)
  FLOAT: IEEE single-precision floating point (4-byte) format

(2) Error Data

- Data does not exist (display: "---------")
  ASCII: "NAN" (Not A Number)
  FLOAT: 0x7E951BEE(9.91E+37)
- Over the range (display: "---O L---")
- Overflow (display: "---O F---")
- Data over (display: " Error ")
  ASCII: "INF" (INFinity)
  FLOAT: 0x7E94F56A(9.9E+37)

*** List of Numeric Data Output Items That Are Preset**

The list of function names used in the commands and the corresponding function names used on the screen menu of the WT1600FC is given in the Function Selection List in the DISPlay group.

Note

The List of Numeric Data Output Items That Are Preset indicates the measurement function and element that are assigned to each item number (ITEM<x>). Items that are not set to be measured are displayed or output in the same fashion as when the data does not exist. For example, if frequency FI of the current of element 2 is not set to be measured, the output of item number ITEM19 is the same as the output when the data does not exist (NAN for ASCII).

(1) Preset Pattern of Output Items of Power Measurement Numeric Data

Applicable command

"`:NUMeric[:NORMal]:PRESet`"

- Pattern 1

ITEM<x>	<Function>,	<Element>
1	URMS,	1
2	IRMS,	1
3	P,	1
4	S,	1
5	Q,	1
6	LAMBda,	1
7	PHI,	1
8	FU,	1
9	FI,	1
10	NONE	
11-19	URMS to FI,	2
20	NONE	
21-29	URMS to FI,	3
30	NONE	
31-39	URMS to FI,	4
40	NONE	
41-49	URMS to FI,	5
50	NONE	
51-59	URMS to FI,	6
60	NONE	
61-69	URMS to FI,	SIGMA
70	NONE	
71-79	URMS to FI,	SIGMB
80	NONE	
81-89	URMS to FI,	SIGMC
90	NONE	
91-255	NONE	

- Pattern 2

ITEM<x>	<Function>,	<Element>
1	URMS,	1
2	UMN,	1
3	UDC,	1
4	UAC,	1
5	IRMS,	1
6	IMN,	1
7	IDC,	1
8	IAC,	1
9	P,	1
10	S,	1
11	Q,	1
12	LAMBda,	1
13	PHI,	1
14	FU,	1
15	FI,	1
16-30	URMS to FI,	2
31-45	URMS to FI,	3
46-60	URMS to FI,	4
61-75	URMS to FI,	5
76-90	URMS to FI,	6
91-105	URMS to FI,	SIGMA
106-120	URMS to FI,	SIGMB
121-135	URMS to FI,	SIGMC
136-255	NONE	

- Pattern 3

ITEM<x>	<Function>,	<Element>
1	URMS,	1
2	UMN,	1
3	UDC,	1
4	UAC,	1
5	IRMS,	1
6	IMN,	1
7	IDC,	1
8	IAC,	1
9	P,	1
10	S,	1
11	Q,	1
12	LAMBda,	1
13	PHI,	1
14	FU,	1
15	FI,	1
16	UPPeak,	1
17	UMPeak,	1
18	IPPeak,	1
19	IMPeak,	1
20	NONE	
21-39	URMS to IMPeak,	2
40	NONE	
41-59	URMS to IMPeak,	3
60	NONE	
61-79	URMS to IMPeak,	4
80	NONE	
81-99	URMS to IMPeak,	5
100	NONE	
101-119	URMS to IMPeak,	6
120	NONE	
121-139	URMS to IMPeak,	SIGMA
140	NONE	
141-159	URMS to IMPeak,	SIGMB
160	NONE	
161-179	URMS to IMPeak,	SIGMB
180	NONE	
181-255	NONE	

- Pattern 4

ITEM<x>	<Function>,	<Element>
1	URMS,	1
2	UMN,	1
3	UDC,	1
4	UAC,	1
5	IRMS,	1
6	IMN,	1
7	IDC,	1
8	IAC,	1
9	P,	1
10	S,	1
11	Q,	1
12	FU,	1
13	FI,	1
14	TIME,	1
15	WH,	1
16	WHP,	1
17	WHM,	1
18	AH,	1
19	AHP,	1
20	AHM,	1
21-40	URMS to AHM,	2
41-60	URMS to AHM,	3
61-80	URMS to AHM,	4
81-100	URMS to AHM,	5
101-120	URMS to AHM,	6
121-140	URMS to AHM,	SIGMA
141-160	URMS to AHM,	SIGMB
161-180	URMS to AHM,	SIGMC
181-255	NONE	

(2) Preset Pattern of Output Items of Impedance Measurement Numeric Data

Applicable command

“:NUMeric:IMPedance:PRESet”

- Pattern 1

ITEM<x>	<Function>,	<Element>
1	FREQ,	
2	ZR,	Impedance
3	ZI,	Impedance
4-16	NONE	

- Pattern 2

ITEM<x>	<Function>,	<Element>
1	BU,	Battery
2	BI,	Battery
3	BP,	Battery
4	FREQ,	
5	ZR,	Impedance
6	ZI,	Impedance
7-16	NONE	

- Pattern 3

ITEM<x>	<Function>,	<Element>
1	BU,	Battery
2	BI,	Battery
3	BP,	Battery
4	FREQ,	
5	U,	Impedance
6	I,	Impedance
7-16	NONE	

- Pattern 4

ITEM<x>	<Function>,	<Element>
1	BU,	Battery
2	BI,	Battery
3	BP,	Battery
4	FREQ,	
5	Z,	Impedance
6	PHI,	Impedance
7-16	NONE	

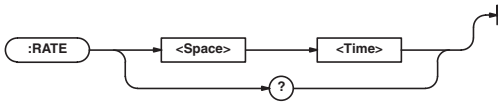
*** Description of <Element>**

Impedance = Impedance measurement element
(smallest number if multiple elements exist)
Battery = Battery power measurement element
(Only the single power measurement element adjacent to the impedance measurement element)

5.14 RATE Group

The commands in this group deal with the data update rate.

You can make the same settings and inquiries as when UPDATE RATE on the front panel is used.



:RATE

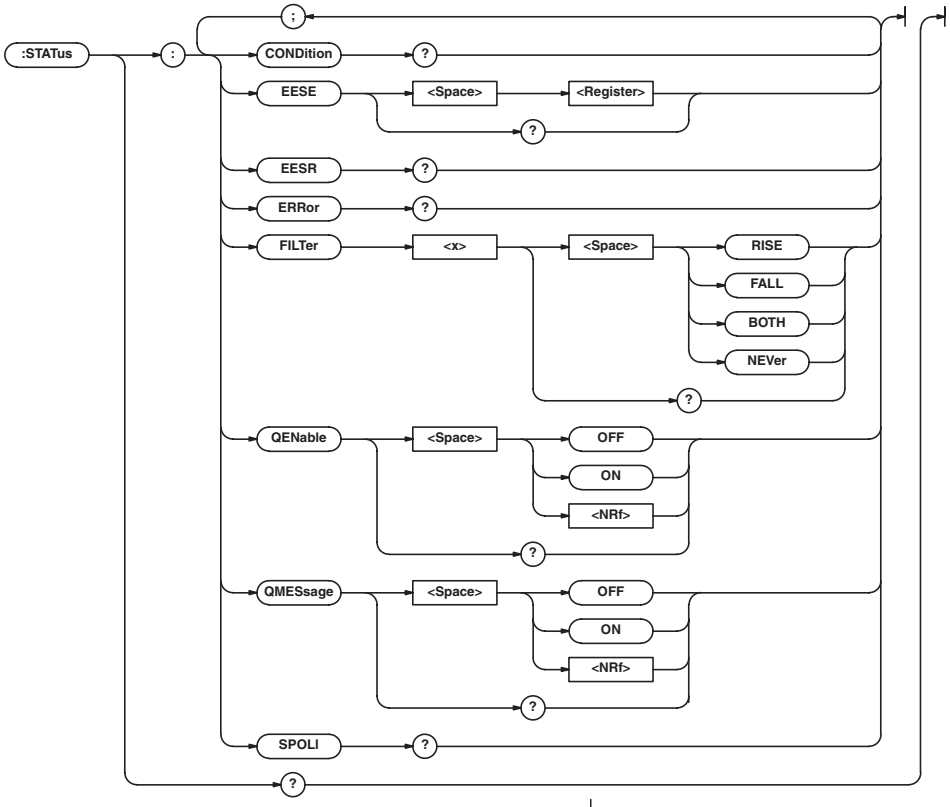
Function	Sets the data update rate for power measurement or queries the current setting.

Syntax	`:RATE {<Time>}`
	`:RATE?`
	`<Time>` = 50, 100, 200, 500 (ms), 1, 2, 5 (s)

Example	`:RATE 200MS` `:RATE? -> :RATE 200.0E-03`
Description	• This command is valid only during power measurement. It cannot be used during impedance measurement. • This command is invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.

5.15 STATus Group

The commands in the STATus group are used to make settings and inquiries related to the status report.
There are no front panel keys that correspond to the commands in this group.
For details on the status report, see chapter 6.



:STATus?

Function	Queries all settings related to the communication status function.
Syntax	:STATus?
Example	:STATUS? -> :STATUS:EESE 0;FILTER1 NEVER;FILTER2 NEVER;FILTER3 NEVER; FILTER4 NEVER;FILTER5 NEVER; FILTER6 NEVER;FILTER7 NEVER; FILTER8 NEVER;FILTER9 NEVER; FILTER10 NEVER;FILTER11 NEVER; FILTER12 NEVER;FILTER13 NEVER; FILTER14 NEVER;FILTER15 NEVER; FILTER16 NEVER;QENABLE 0;QMESSAGE 1

:STATus:CONDition?

Function	Queries the contents of the condition register.
Syntax	:STATus:CONDition?
Example	:STATUS:CONDITION? -> 16
Description	For the description regarding how to synchronize the program using :STATus:CONDition, see page 4-8.

:STATus:EESE
(Extended Event Status Enable register)

Function	Sets the extended event enable register or queries the current setting.
Syntax	:STATus:EESE <Register> :STATus:EESE? <Register> = 0 to 65535
Example	:STATUS:EESE #B0000000000000000 :STATUS:EESE? -> :STATUS:EESE 0

:STATus:EESR?
(Extended Event Status Register)

Function	Queries the content of the extended event register and clears the register.
Syntax	:STATus:EESR?
Example	:STATUS:EESR? -> 0

:STATus:ERRor?

Function Queries the error code and message information (top of the error queue).

Syntax `:STATus:ERRor?`

Example
```
:STATUS:ERROR? ->
113,"Underfined Header"
```

Description
- When there is no error, “0, “No error”” is returned.
- The message cannot be returned in Japanese.
- You can specify whether or not to add the message using the “`STATus:QMESsage`” command.

:STATus:FILTer<x>

Function Sets the transition filter or queries the current setting.

Syntax
```
:STATus:FILTer<x> {RISE|FALL|BOTH|
NEVer}
:STATus:FILTer<x>?
```
<x> = 1 to 16

Example
```
:STATUS:FILTER2 RISE
:STATUS:FILTER2? -> :STATUS:
FILTER2 RISE
```

Description Specify how each bit of the condition register is to change to set the event. If “RISE” is specified, the event is set when the bit changes from “0” to “1.”

:STATus:QENable

Function Sets whether or not to store messages other than errors to the error queue (ON/OFF) or queries the current setting.

Syntax
```
:STATus:QENable {<Boolean>}
:STATus:QENable?
```

Example
```
:STATUS:QENABLE ON
:STATUS:QENABLE? -> :STATUS:
QENABLE 1
```

:STATus:QMESsage

Function Sets whether or not to attach message information to the response to the “`STATus:ERRor?`” query (ON/OFF) or queries the current setting.

Syntax
```
:STATus:QMESsage {<Boolean>}
:STATus:QMESsage?
```

Example
```
:STATUS:QMESSAGE ON
:STATUS:QMESSAGE? -> :STATUS:
QMESSAGE 1
```

:STATus:SPOLI? (Serial Poll)

Function Executes serial polling.

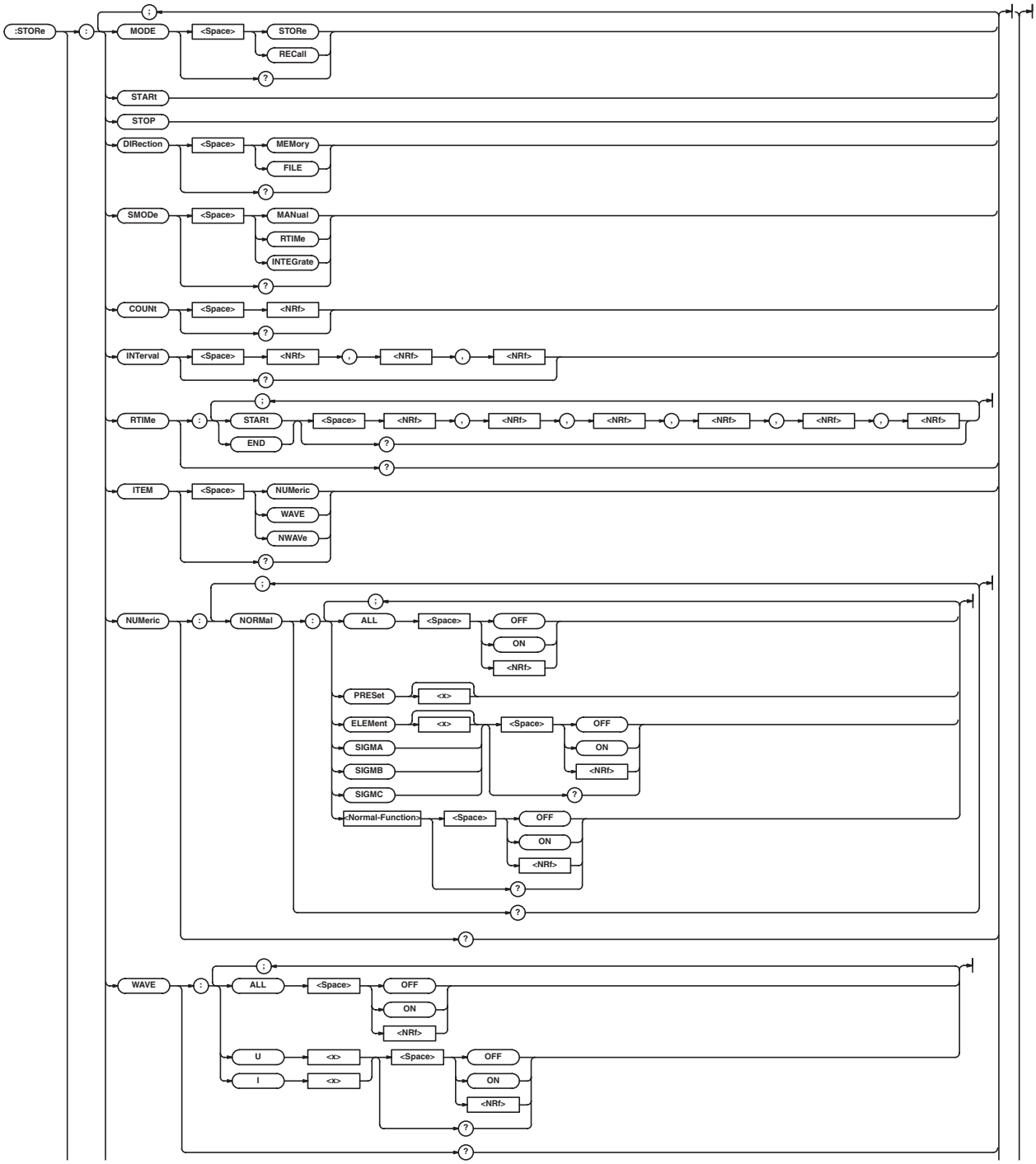
Syntax `:STATus:SPOLl?`

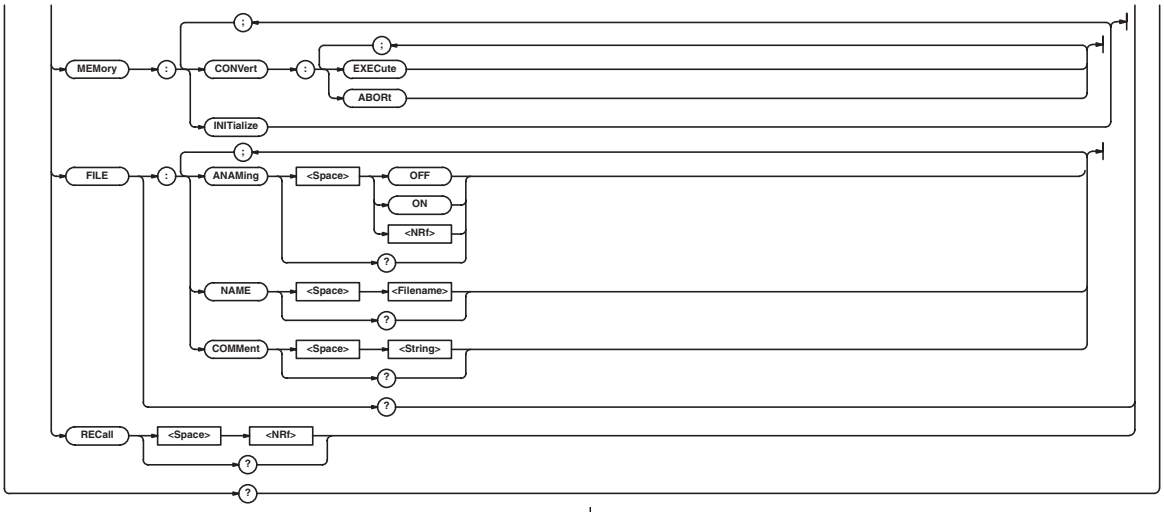
Example `:STATUS:SPOLL? -> :STATUS:SPOLL 0`

Description This is a command specific to the serial (RS-232) interface. An interface message is available for the GP-IB interface.

5.16 STORe Group

The commands in this group deal with store and recall.
You can make the same settings and inquiries as when STORE and STORE SET (SHIFT+STORE) on the front panel is used.
The commands in this group are invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.





:STORe?

Function Queries all settings related to store and recall.

Syntax :STORe?

Example :STORE? -> STORE:MODE STORE;
DIRECTION MEMORY;SMODE MANUAL;
COUNT 100;INTERVAL 0,0,0;
ITEM NUMERIC;NUMERIC:NORMAL:
ELEMENT1 1;ELEMENT2 0;ELEMENT3 0;
ELEMENT4 0;SIGMA 0;SIGMB 0;SIGMC 0;
URMS 1;UMN 1;UDC 1;UAC 1;IRMS 1;
IMN 1;IDC 1;IAC 1;P 1;S 1;Q 1;
LAMBDA 1;PHI 1;FU 1;FI 1;UPPEAK 1;
UMPEAK 1;IPPEAK 1;IMPEAK 1;CFU 1;
CFI 1;FFU 1;FFI 1;Z 1;RS 1;XS 1;
RP 1;XP 1;PC 1;TIME 0;WH 0;WHP 0;
WHM 0;AH 0;AHP 0;AHM 0;ETA 0;
SETA 0;F1 0;F2 0;F3 0;F4 0;DURMS 0;
DUMN 0;DUDC 0;DUAC 0;DIRMS 0;
DIMN 0;DIDC 0;DIAC 0

:STORe:COUNt

Function Sets the store count or queries the current setting.

Syntax :STORe:COUNt {<NRf>}
:STORe:COUNt?
<NRf> = 1 to 999999

Example :STORE:COUNT 100
:STORE:COUNT? -> :STORE:COUNT 100

:STORe:DIRection

Function Sets the store destination or queries the current setting.

Syntax :STORe:DIRection {MEMory|FILE}
:STORe:DIRection?

Example :STORE:DIRECTION MEMORY
:STORE:DIRECTION? -> :STORE:
IRECTION MEMORY

:STORe:FILE?

Function Queries all settings related to the saving of the stored data.

Syntax :STORe:FILE?

Example :STORE:FILE? -> :STORE:FILE:
ANAMING 1;NAME "DATA1";
COMMENT "CASE1"

:STORe:FILE:ANAMing

Function Sets whether to automatically name the files when saving stored data to files or queries the current setting.

Syntax :STORe:FILE:ANAMing {<Boolean>}
:STORe:FILE:ANAMing?

Example :STORE:FILE:ANAMING ON
:STORE:FILE:ANAMING? -> :STORE:
FILE:ANAMING 1

:STORe:FILE:COMMent

Function Sets the comment to be added to the file when saving the stored data or queries the current setting.

Syntax :STORe:FILE:COMMent {<String>}
:STORe:FILE:COMMent?
<String> = Up to 25 characters

Example :STORE:FILE:COMMENT "CASE1"
:STORE:FILE:COMMENT? ->
:STORE:FILE:COMMENT "CASE1"

:STORe:FILE:NAME

Function Sets the name of the file when saving the stored data or queries the current setting.

Syntax
```
:STORe:FILE:NAME {<Filename>}
:STORe:FILE:NAME?
```

Example
```
:STORE:FILE:NAME "DATA1"
:STORE:FILE:NAME? -> :STORE:FILE:
NAME "DATA1"
```

Description The save destination of the stored data is specified using:
- the ":FILE:DRIVe" command for the drive.
- the ":FILE:CDIRectory" command for the directory.

The save destination path can be queried using the ":FILE:PATH?" command.

:STORe:INTerval

Function Sets the store interval or queries the current setting.

Syntax
```
:STORe:INTerval {<NRf>,<NRf>,<NRf>}
:STORe:INTerval?
```
1st <NRf> = 0 to 99 (hour)
2nd <NRf> = 0 to 59 (minute)
3rd <NRf> = 1 to 59 (second)

Example
```
:STORE:INTERVAL 0,0,0
:STORE:INTERVAL? -> :STORE:
INTERVAL 0,0,0
```

:STORe:ITEM

Function Sets the items to be stored or queries the current setting.

Syntax
```
:STORe:ITEM {NUMeric|WAVE|NWAVe}
:STORe:ITEM?
```
NUMeric = Store only the numeric values.
WAVE = Store only the waveforms.
NWAVe = Store both the numeric values and the waveforms.

Example
```
:STORE:ITEM NUMERIC
:STORE:ITEM? -> :STORE:ITEM NUMERIC
```

:STORe:MEMory:CONVert:ABORt

Function Abort converting the stored data from the memory to the file.

Syntax
```
:STORe:MEMory:CONVert:ABORt
```

Example
```
:STORE:MEMORY:CONVERT:ABORT
```

:STORe:MEMory:CONVert:EXECute

Function Executes the converting of the stored data from the memory to the file.

Syntax
```
:STORe:MEMory:CONVert:EXECute
```

Example
```
:STORE:MEMORY:CONVERT:EXECUTE
```

Description
- The convert destination file is set using the ":STORe:FILE: ..." command.
- When file conversion is executed, the WT1600FC accesses the file twice. To confirm the completion of the file conversion, use the "COMMUNICATE:WAIT 64" command (checks the change in bit 6 (ACS) of the condition register) and check the completion of the file access of the WT1600FC twice. An example is indicated below.

```
"STATUS:EESR?"
```
(Clear the extended event register)
```
"STORE:MEMORY:CONVERT:EXECUTE"
```
(Start the file conversion)
```
"COMMUNICATE:WAIT 64"
```
(Wait for the conversion to finish, the first time)
```
"STATUS:EESR?"
```
(Clear the extended event register)
```
"COMMUNICATE:WAIT 64"
```
(Wait for the conversion to finish, the second time)
```
"STATUS:EESR?"
```
(Clear the extended event register)

:STORe:MEMory:INITialize

Function Executes the initialization of the storage memory.

Syntax
```
:STORe:MEMory:INITialize
```

Example
```
:STORE:MEMORY:INITIALIZE
```

:STORe:MODE

Function Sets the data storage/recall or queries the current setting.

Syntax
```
:STORe:MODE {STORe|RECall}
:STORe:MODE?
```

Example
```
:STORE:MODE STORE
:STORE:MODE? -> :STORE:MODE STORE
```

:STORe:NUMeric?

Function Queries all settings related to the storage of numeric data.

Syntax `:STORe:NUMeric?`

Example
```
:STORE:NUMERIC? -> :STORE:NUMERIC:
NORMAL:ELEMENT1 1;ELEMENT2 0;
ELEMENT3 0;ELEMENT4 0;SIGMA 0;
SIGMB 0;SIGMC 0;URMS 1;UMN 1;UDC 1;
UAC 1;IRMS 1;IMN 1;IDC 1;IAC 1;P 1;
S 1;Q 1;LAMBDA 1;PHI 1;FU 1;FI 1;
UPPEAK 1;UMPEAK 1;IPPEAK 1;
IMPEAK 1;CFU 1;CFI 1;FFU 1;FFI 1;
Z 1;RS 1;XS 1;RP 1;XP 1;PC 1;
TIME 0;WH 0;WHP 0;WHM 0;AH 0;AHP 0;
AHM 0;ETA 0;SETA 0;F1 0;F2 0;F3 0;
F4 0;DURMS 0;DUMN 0;DUDC 0;DUAC 0;
DIRMS 0;DIMN 0;DIDC 0;DIAC 0
```

:STORe:NUMeric:NORMal?

Function Queries all settings related to the storage of the numeric data for power measurement.

Syntax `:STORe:NUMeric:NORMal?`

Example
```
:STORE:NUMERIC:NORMAL? -> :STORE:
NUMERIC:NORMAL:ELEMENT1 1;
ELEMENT2 0;ELEMENT3 0;ELEMENT4 0;
SIGMA 0;SIGMB 0;SIGMC 0;URMS 1;
UMN 1;UDC 1;UAC 1;IRMS 1;IMN 1;
IDC 1;IAC 1;P 1;S 1;Q 1;LAMBDA 1;
PHI 1;FU 1;FI 1;UPPEAK 1;UMPEAK 1;
IPPEAK 1;IMPEAK 1;CFU 1;CFI 1;
FFU 1;FFI 1;Z 1;RS 1;XS 1;RP 1;
XP 1;PC 1;TIME 0;WH 0;WHP 0;WHM 0;
AH 0;AHP 0;AHM 0;ETA 0;SETA 0;F1 0;
F2 0;F3 0;F4 0;DURMS 0;DUMN 0;
DUDC 0;DUAC 0;DIRMS 0;DIMN 0;
DIDC 0;DIAC 0
```

:STORe:NUMeric:NORMal:ALL

Function Collectively turns ON/OFF the output of all power measurement elements and functions when storing the numeric data during power measurement.

Syntax
```
:STORe:NUMeric:NORMal:
ALL {<Boolean>}
```

Example `:STORE:NUMERIC:NORMAL:ALL ON`

:STORe:NUMeric:NORMal:{ELEMent<x>|SIGMA|SIGMB|SIGMC}

Function Turns ON/OFF the output of the {power measurement element|ΣA|ΣB|ΣC} when storing the numeric data during power measurement or queries the current setting.

Syntax
```
:STORe:NUMeric:NORMal:{ELEMent<x>|
SIGMA|SIGMB|SIGMC} {<Boolean>}
:STORe:NUMeric:NORMal:{ELEMent<x>|
SIGMA|SIGMB|SIGMC}?
```
<x> = 1 to 4 (power measurement element)

Example
```
:STORE:NUMERIC:NORMAL:ELEMENT1 ON
:STORE:NUMERIC:NORMAL:ELEMENT1? ->
:STORE:NUMERIC:NORMAL:ELEMENT1 1
```

Description
- The command and query using ":STORE:NUMeric:NORMal:SIGMB" is valid on models with two or more power measurement elements.
- The command and query using ":STORE:NUMeric:NORMal:SIGMC" is valid on models with three or more power measurement elements.

:STORe:NUMeric:NORMal:PRESet<x>

Function Presets the output ON/OFF pattern of the power measurement element and function when storing the numeric data during power measurement.

Syntax
```
:STORe:NUMeric:NORMal:PRESet<x>
```
<x> = 1 to 2 (preset pattern number)

Example `:STORE:NUMERIC:NORMAL:PRESET1`

Description For details on the storage pattern when preset is executed, see the WT1600FC User's Manual (IM760151-01E).

:STORe:NUMeric:NORMal:<power measurement function>

Function Turns ON/OFF the output of the function when storing the numeric data during power measurement or queries the current setting.

Syntax
```
:STORe:NUMeric:NORMal:<power
measurement function> {<Boolean>}
:STORe:NUMeric:NORMal:<power
measurement function>?
<Power measurement function> =
{URMS|UMN|
UDC|UAC|IRMS|...} (See the function
selection list (1) of "DISPlay group.")
```

Example
```
:STORE:NUMERIC:NORMAL:URMS ON
:STORE:NUMERIC:NORMAL:URMS? ->
:STORE:NUMERIC:NORMAL:URMS 1
```

:STORe:RECall

Function Sets the data number to be recalled or queries the current setting.
Syntax `:STORe:RECall {<NRf>}`
`:STORe:RECall?`
<NRf> = 1 to 999999
Example `:STORE:RECALL 1`
`:STORE:RECALL? -> :STORE:RECALL 1`

:STORe:RTIMe?

Function Queries the store start and stop date/time for real-time store mode.
Syntax `:STORe:RTIMe?`
Example `:STORE:RTIME? -> :STORE:RTIME:START 2001,1,1,0,0,0;END 2001,1,1,1,0,0`

:STORe:RTIMe:{STARt|END}

Function Sets the store {start|stop} date/time for real-time store mode or queries the current setting.
Syntax `:STORe:RTIMe:{STARt|END} {<NRf>,<NRf>,<NRf>,<NRf>,<NRf>,<NRf>}`
`:STORe:RTIMe:{STARt|END}?`
{<NRf>, <NRf>, <NRf>, <NRf>, <NRf>, <NRf>} = 2001, 1, 1, 0, 0, 0 to 2099, 12, 31, 23, 59, 59
1st <NRf> = 2001 to 2099 (year)
2nd <NRf> = 1 to 12 (month)
3rd <NRf> = 1 to 31 (day)
4th <NRf> = 0 to 23 (hour)
5th <NRf> = 0 to 59 (minute)
6th <NRf> = 0 to 59 (second)
Example `:STORE:RTIME:START 2001,1,1,0,0,0`
`:STORE:RTIME:START? -> :STORE:RTIME:START 2001,1,1,0,0,0`

:STORe:SMODe

Function Sets the store mode or queries the current setting.
Syntax `:STORe:SMODe {MANual|RTIMe|INTEGrate}`
`:STORe:SMODe?`
MANual = Manual store mode
RTIMe = Real-time store mode
INTEGrate = Integration synchronization store mode
Example `:STORE:SMODE MANUAL`
`:STORE:SMODE? -> :STORE:SMODE MANUAL`

:STORe:STARt

Function Starts the data store operation.
Syntax `:STORe:STARt`
Example `:STORE:START`
Description When "`:STORe:SMODe`" is set to MANual, the store operation is executed. When set to {RTIMe|INTEGrate} the WT1600FC enters the store wait state.

:STORe:STOP

Function Stops the data store operation.
Syntax `:STORe:STOP`
Example `:STORE:STOP`

:STORe:WAVE?

Function Queries all settings related to the storage of waveform display data.
Syntax `:STORe:WAVE?`
Example `:STORE:WAVE? -> :STORE:WAVE:U1 1;U2 0;U3 0;U4 0;I1 1;I2 0;I3 0;I4 0`

:STORe:WAVE:ALL

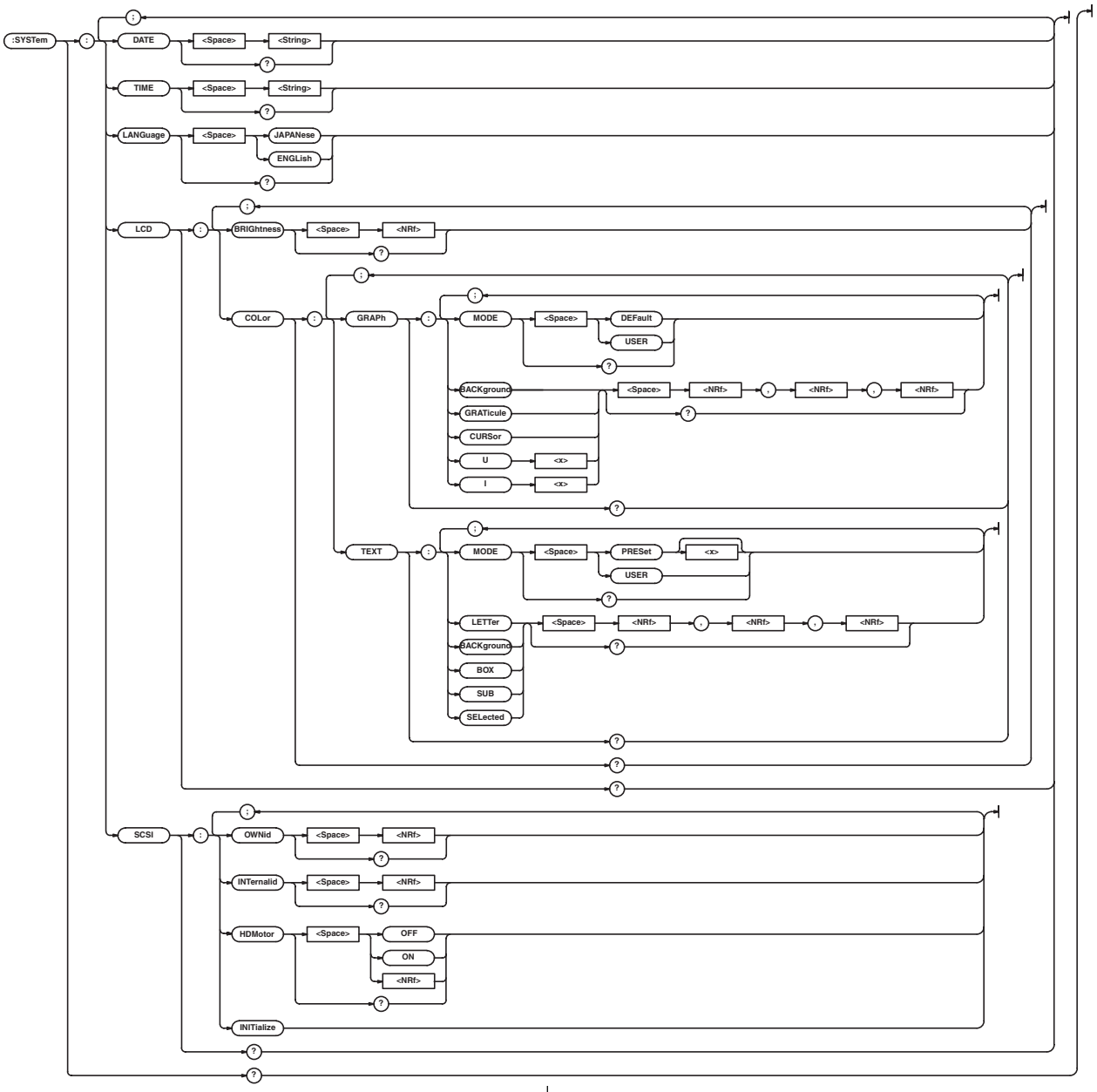
Function Collectively turns ON/OFF the output of all waveforms when storing waveform display data.
Syntax `:STORe:WAVE:ALL {<Boolean>}`
Example `:STORE:WAVE:ALL ON`

:STORe:WAVE:{U<x>|I<x>}

Function Turns ON/OFF the output of the waveform when storing the waveform display data or queries the current setting.
Syntax `:STORe:WAVE:{U<x>|I<x>} {<Boolean>}`
`:STORe:WAVE:{U<x>|I<x>}?`
<x> = 1 to 4 (power measurement element)
Example `:STORE:WAVE:U1 ON`
`:STORE:WAVE:U1? -> :STORE:WAVE:U1 1`

5.17 SYSTem Group

The commands in this group deal with the system.
You can make the same settings and inquiries as when MISC on the front panel is used.



:SYSTem?

Function	Queries all settings related to the system.
Syntax	:SYSTem?
Example	:SYSTEM? -> :SYSTEM: LANGUAGE ENGLISH;LCD:BRIGHTNESS 2; COLOR:GRAPH:MODE DEFAULT;:SYSTEM: LCD:COLOR:TEXT:MODE PRESET1;: SYSTEM:SCSI:OWNID 6;INTERNALID 4; HDMOTOR 1

:SYSTem:DATE

Function	Sets the date or queries the current setting.
Syntax	:SYSTem:DATE {<String>} :SYSTem:DATE? <String> = "YY/MM/DD" (YY = year, MM = month, DD = day)
Example	:SYSTEM:DATE "00/01/01" :SYSTEM:DATE? -> "00/01/01"
Description	"Year" is the lowest two digits of the year.

:SYSTem:LANGuage

Function Sets the message language or queries the current setting.

Syntax
```
:SYSTem:LANGuage {JAPANese|ENGLish}
:SYSTem:LANGuage?
```

Example
```
:SYSTEM:LANGUAGE ENGLISH
:SYSTEM:LANGUAGE? -> :SYSTEM:
LANGUAGE ENGLISH
```

:SYSTem:LCD?

Function Queries all settings related to the LCD monitor.

Syntax
```
:SYSTem:LCD?
```

Example
```
:SYSTEM:LCD? -> :SYSTEM:LCD:
BRIGHTNESS 2;COLOR:GRAPH:
MODE DEFAULT;:SYSTEM:LCD:COLOR:
TEXT:MODE PRESET1
```

:SYSTem:LCD:BRIGhtness

Function Sets the brightness of the LCD monitor or queries the current setting.

Syntax
```
:SYSTem:LCD:BRIGhtness {<NRf>}
:SYSTem:LCD:BRIGhtness?
```
<NRf> = –1 to 3

Example
```
:SYSTEM:LCD:BRIGHTNESS 2
:SYSTEM:LCD:BRIGHTNESS? -> :SYSTEM:
LCD:BRIGHTNESS 2
```

:SYSTem:LCD:COLor?

Function Queries all settings related to the display colors of the LCD monitor.

Syntax
```
:SYSTem:LCD:COLor?
```

Example
```
:SYSTEM:LCD:COLOR? -> :SYSTEM:LCD:
COLOR:GRAPH:MODE DEFAULT;:SYSTEM:
LCD:COLOR:TEXT:MODE PRESET1
```

:SYSTem:LCD:COLor:GRAPh?

Function Queries all settings related to the display colors of the graphic items.

Syntax
```
:SYSTem:LCD:COLor:GRAPh?
```

Example
```
:SYSTEM:LCD:COLOR:GRAPH? ->
:SYSTEM:LCD:COLOR:GRAPH:MODE USER;
BACKGROUND 0,0,0;GRATICULE 6,6,6;
CURSOR 7,7,7;U1 7,7,0;U2 7,0,7;
U3 7,0,0;U4 0,4,7;I1 0,7,0;
I2 0,7,7;I3 7,4,0;I4 5,5,5
```

:SYSTem:LCD:COLor:GRAPh:{BACKground|GRATicule|CURSor|U<x>|I<x>}

Function Sets the display color of the {background|graticule|cursor|voltage waveform|current waveform} or queries the current setting.

Syntax
```
:SYSTem:LCD:COLor:GRAPh:
{BACKground|GRATicule|CURSor|U<x>|
I<x>} {<NRf>,<NRf>,<NRf>}
:SYSTem:LCD:COLor:GRAPh:
{BACKground|GRATicule|CURSor|U<x>|
I<x>}?
```
<x> = 1 to 4 (power measurement element)
<NRf> = 0 to 7

Example
```
:SYSTEM:LCD:COLOR:GRAPH:
BACKGROUND 0,0,0
:SYSTEM:LCD:COLOR:GRAPH:
BACKGROUND? -> :SYSTEM:LCD:COLOR:
GRAPH:BACKGROUND 0,0,0
```

Description Set the color in the order R, G, and B.
This command is valid when the display color mode of graphic items (`:SYSTem:LCD:COLor:GRAPh:MODE`) is set to “USER.”

:SYSTem:LCD:COLor:GRAPh:MODE

Function Sets the display color mode of the graphic items or queries the current setting.

Syntax
```
:SYSTem:LCD:COLor:GRAPh:
MODE {DEFault|USER}
:SYSTem:LCD:COLor:GRAPh:MODE?
```

Example
```
:SYSTEM:LCD:COLOR:GRAPH:
MODE DEFAULT
:SYSTEM:LCD:COLOR:GRAPH:MODE? ->
:SYSTEM:LCD:COLOR:GRAPH:
MODE DEFAULT
```

:SYSTem:LCD:COLor:TEXT?

Function Queries all settings related to the display colors of the text items.

Syntax
```
:SYSTem:LCD:COLor:TEXT?
```

Example
```
:SYSTEM:LCD:COLOR:TEXT? -> :SYSTEM:
LCD:COLOR:TEXT:MODE USER;
LETTER 7,7,7;BACKGROUND 2,2,6;
BOX 0,0,7;SUB 3,3,3;SELECTED 0,4,7
```

:SYSTem:LCD:COLor:TEXT:{LETTer|BACKground|BOX|SUB|SELected}

Function Sets the display color of the {text(Menu Fore)|menu background (Menu Back)|selected menu (Select Box)|pop-up menu (Sub Menu)|selected key (Selected Key)} or queries the current setting.

Syntax
```
:SYSTem:LCD:COLor:TEXT:{LETTer|BACKground|BOX|SUB|SELected} {<NRf>,<NRf>,<NRf>}
:SYSTem:LCD:COLor:TEXT:{LETTer|BACKground|BOX|SUB|SELected}?
```
<NRf> = 0 to 7

Example
```
:SYSTEM:LCD:COLOR:TEXT:LETTER 7,7,7
:SYSTEM:LCD:COLOR:TEXT:LETTER? ->
:SYSTEM:LCD:COLOR:TEXT:LETTER 7,7,7
```

Description Set the color in the order R, G, and B.
This command is valid when the display color mode of text items (:SYSTem:LCD:COLor:TEXT:MODE) is set to "USER."

:SYSTem:LCD:COLor:TEXT:MODE

Function Sets the display color mode of the text items or queries the current setting.

Syntax
```
:SYSTem:LCD:COLor:TEXT:MODE {PRESet<x>|USER}
:SYSTem:LCD:COLor:TEXT:MODE?
```
<x> = 1 to 3

Example
```
:SYSTEM:LCD:COLOR:TEXT:MODE PRESET1
:SYSTEM:LCD:COLOR:TEXT:MODE? ->
:SYSTEM:LCD:COLOR:TEXT:MODE PRESET1
```

:SYSTem:SCSI?

Function Queries all settings related to the SCSI-ID.

Syntax
```
:SYSTem:SCSI?
```

Example
```
:SYSTEM:SCSI? -> :SYSTEM:SCSI:OWNID 6;INTERNALID 4;HDMOTOR 1
```

Description An error occurs if the SCSI interface (option) is not installed.

:SYSTem:SCSI:HDMotor

Function Turns ON/OFF the motor of the internal hard disk or queries the current setting.

Syntax
```
:SYSTem:SCSI:HDMotor {<Boolean>}
:SYSTem:SCSI:HDMotor?
```

Example
```
:SYSTEM:SCSI:HDMOTOR ON
:SYSTEM:SCSI:HDMOTOR? -> :SYSTEM:SCSI:HDMOTOR 1
```

Description An error occurs if the SCSI interface (option) is not installed.

:SYSTem:SCSI:INITialize

Function Executes the initialization of SCSI related parameters.

Syntax
```
:SYSTem:SCSI:INITialize
```

Example
```
:SYSTEM:SCSI:INITIALIZE
```

Description
- An error occurs if the SCSI interface (option) is not installed.
- If you changed the SCSI-ID of the WT1600FC using the ":SYSTem:SCSI:OWNid" command, make sure to issue this command.

:SYSTem:SCSI:INTernalid

Function Set the SCSI-ID of the internal hard disk or queries the current settings.

Syntax
```
:SYSTem:SCSI:INTernalid {<NRf>}
:SYSTem:SCSI:INTernalid?
```
<NRf> = 4 (fixed)

Example
```
:SYSTEM:SCSI:INTERNALID 4
:SYSTEM:SCSI:INTERNALID? ->
:SYSTEM:SCSI:INTERNALID 4
```

Description An error occurs if the SCSI interface (option) is not installed.

:SYSTem:SCSI:OWNid

Function Set the SCSI-ID of the WT1600FC or queries the current settings.

Syntax
```
:SYSTem:SCSI:OWNid {<NRf>}
:SYSTem:SCSI:OWNid?
```
<NRf> = 0 to 7

Example
```
:SYSTEM:SCSI:OWNID 6
:SYSTEM:SCSI:OWNID? -> :SYSTEM:SCSI:OWNID 6
```

Description An error occurs if the SCSI interface (option) is not installed.

:SYSTem:TIME

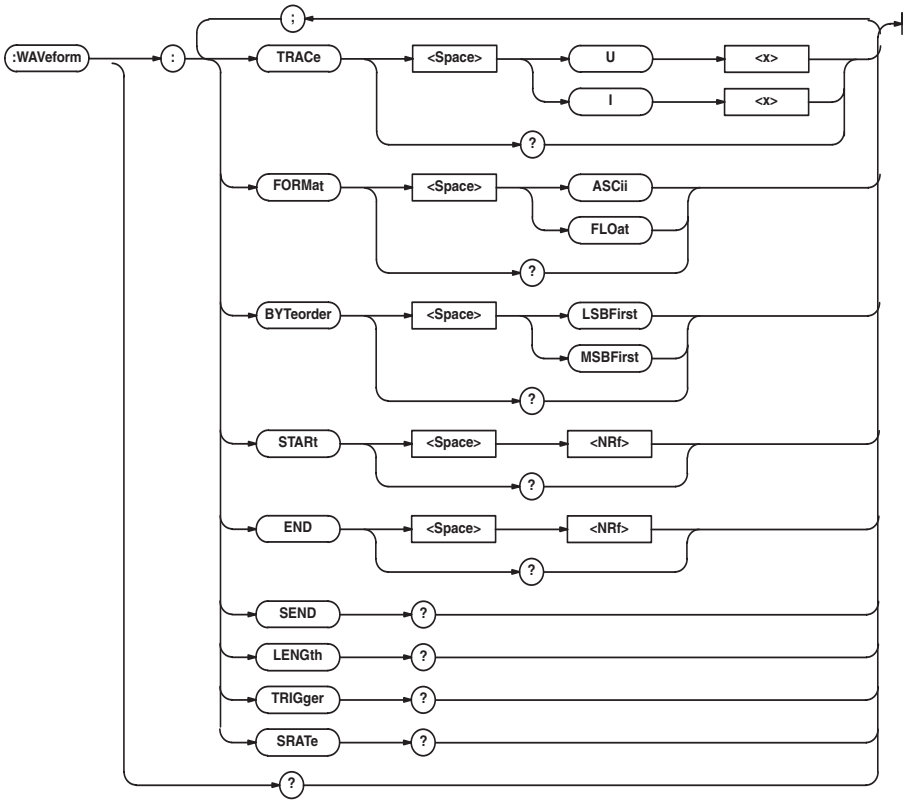
Function Sets the time or queries the current setting.

Syntax
```
:SYSTem:TIME {<String>}
:SYSTem:TIME?
```
<String> = "HH:MM:SS" (HH = hour, MM = minute, SS = second)

Example
```
:SYSTEM:TIME "14:30:00"
:SYSTEM:TIME? -> "14:30:00"
```

5.18 WAVeform Group

The commands in this group deal with the output of the retrieved waveform display data.
There are no front panel keys that correspond to the commands in this group.



:WAVeform?

Function Queries all information about the waveform display data.
Syntax `:WAVeform?`
Example `:WAVEFORM? -> :WAVEFORM:TRACE U1;FORMAT ASCII;START 0;END 1001`

:WAVeform:BYTeorder

Function Sets the output byte order of the waveform display data (FLOAT format) that is transmitted by "`:WAVeform:SEND?`" or queries the current setting.
Syntax `:WAVeform:BYTeorder {LSBFirst|MSBFirst}`
`:WAVeform:BYTeorder?`
Example `:WAVEFORM:BYTEORDER LSBFIRST`
`:WAVEFORM:BYTEORDER? -> :WAVEFORM:BYTEORDER LSBFIRST`
Description This value is valid when "`:WAVeform:FORMat`" is set to "`{FLOat}`."

:WAVeform:END

Function Sets the output end point of the waveform display data that is transmitted by "`:WAVeform:SEND?`" or queries the current setting.
Syntax `:WAVeform:END {<NRf>}`
`:WAVeform:END?`
`<NRf>` to 0 to (total number of data points - 1)
Example `:WAVEFORM:END 1001`
`:WAVEFORM:END? -> :WAVEFORM:END 1001`
Description The "`:WAVeform:LENGth?`" command can be used to query the (total number of data points).

:WAVeform:FORMat

Function Sets the format of the waveform display data that is transmitted by ":WAVeform:SEND?" or queries the current setting.

Syntax
```
:WAVeform:FORMat {ASCii|FLOat}
:WAVeform:FORMat?
```

Example
```
:WAVEFORM:FORMAT FLOAT
:WAVEFORM:FORMAT? -> :WAVEFORM:
FORMAT FLOAT
```

Description For the differences in the waveform display data output due to the format setting, see the description for ":WAVeform:SEND?."

:WAVeform:LENGth?

Function Queries the total number of points of the waveform specified by ":WAVeform:TRACe".

Syntax
```
:WAVeform:LENGth?
```

Example
```
:WAVEFORM:LENGTH? -> 1002
```

Description The number of data points is fixed. "1002" is always returned.

:WAVeform:SEND?

Function Queries the waveform display data specified by ":WAVeform:TRACe".

Syntax
```
:WAVeform:SEND?
```

Example
- When ":WAVeform:FORMat" is set to {ASCii}
  ```
  :WAVEFORM:SEND? -> <NR3>,<NR3>,
  ...
  ```
- When ":WAVeform:FORMat" is set to {FLOat}
  ```
  :WAVEFORM:SEND? -> #4
  ```
  (number of bytes, 4 digits) (series of data bytes)

Description The format of the waveform display data that is output varies depending on the ":WAVeform:FORMat" setting as follows.

(1)When "ASCii" is specified
The physical value is output in the <NR3> format.The data of each point is delimited by a comma.

(2)When "FLOat" is specified
The physical value is output in IEEE single-precision floating point (4-bytes) format. The output byte order of the data of each point follows the order that is set using the ":WAVeform:BYTeorder" command.

:WAVeform:SRATe?

Function Queries the sample rate of the retrieved waveform.

Syntax
```
:WAVeform:SRATe?
```

Example
```
:WAVEFORM:SRATE? -> 200.000E+03
```

:WAVeform:STARt

Function Sets the output start point of the waveform display data that is transmitted by ":WAVeform:SEND?" or queries the current setting.

Syntax
```
:WAVeform:STARt {<NRf>}
:WAVeform:STARt?
```
<NRf> to 0 to (total number of data points - 1)

Example
```
:WAVEFORM:START 0
:WAVEFORM:START? -> :WAVEFORM:
START 0
```

Description The ":WAVeform:LENGth?" command can be used to query the (total number of data points).

:WAVeform:TRACe

Function Sets the target waveform for the WAVeform:SEND and WAVeform:LENGth commands or queries the current setting.

Syntax
```
:WAVeform:TRACe {U<x>|I<x>}
:WAVeform:TRACe?
```
<x> = 1 to 4 (power measurement element)

Example
```
:WAVEFORM:TRACE U1
:WAVEFORM:TRACE? -> :WAVEFORM:
TRACE U1
```

:WAVeform:TRIGger?

Function Queries the trigger position of the retrieved waveform.

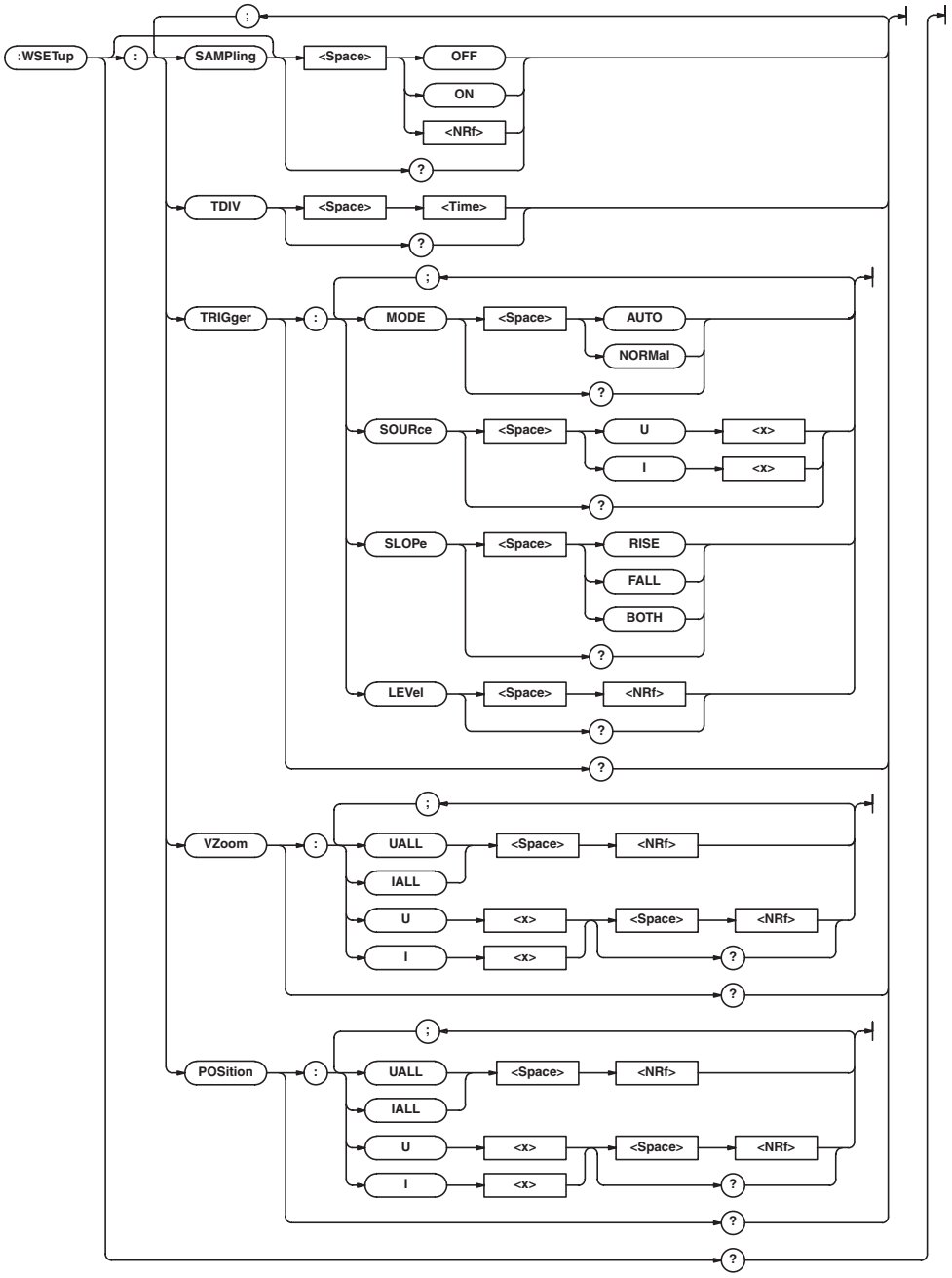
Syntax
```
:WAVeform:TRIGger?
```

Example
```
:WAVEFORM:TRIGGER? -> 0
```

Description Since the trigger position is always at the beginning of the waveform display data, "0" is returned.

5.19 WSETup (Wave SETup) Group

The commands in this group deal with waveform observation.
You can make the same settings and inquiries as when WAVE on the front panel is used.
The commands in this group are invalid on models that are only equipped with impedance measurement elements, since the mode is fixed to impedance measurement.



:WSETup?

Function Queries all settings related to the waveform observation.

Syntax :WSETup?

Example :WSETUP? -> :WSETUP:SAMPLING 0;
TDIV 500.0E-06;TRIGGER:MODE AUTO;
SOURCE U1;SLOPE RISE;LEVEL 0.0;:
WSETUP:VZOOM:U1 1.00;U2 1.00;
U3 1.00;U4 1.00;I1 1.00;I2 1.00;
I3 1.00;I4 1.00;:WSETUP:POSITION:
U1 0.000;U2 0.000;U3 0.000;
U4 0.000;I1 0.000;I2 0.000;
I3 0.000;I4 0.000;

:WSETup:POSition?

Function Queries all settings related to the vertical position (GND position) of the waveform.

Syntax :WSETup:POSition?

Example :WSETUP:POSITION? -> :WSETUP:
POSITION:U1 0.000;U2 0.000;
U3 0.000;U4 0.000;I1 0.000;
I2 0.000;I3 0.000;I4 0.000;

:WSETup:POSition:{UALL|IALL}

Function Collectively sets the vertical position (level of the center position) of the waveform {voltage|current} of all elements.

Syntax :WSETup:POSition:{UALL|
IALL} {<NRf>}
<NRf> = –130.000 to 130.000(%)

Example :WSETUP:POSITION:UALL 0

:WSETup:POSition:{U<x>|I<x>}

Function Sets the vertical position (level of the center position) of the waveform {voltage|current} of the power measurement element or queries the current setting.

Syntax :WSETup:POSition:{U<x>|
I<x>} {<NRf>}
:WSETup:POSition:{U<x>|I<x>}?
<x> = 1 to 4 (power measurement element)
<NRf> = –130.000 to 130.000(%)

Example :WSETUP:POSITION:U1 0
:WSETUP:POSITION:U1? -> :WSETUP:
POSITION:U1 0.000

:WSETup[:SAMPling]

Function Turns ON/OFF the waveform sampling or queries the current setting.

Syntax :WSETup[:SAMPling] {<Boolean>}
:WSETup:SAMPling?

Example :WSETUP:SAMPLING ON
:WSETUP:SAMPLING? -> :WSETUP:
SAMPLING 1

:WSETup:TDIV

Function Sets the Time/div value of the waveform or queries the current setting.

Syntax :WSETup:TDIV {<Time>}
:WSETup:TDIV?
<Time> = 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 (ms)

Example :WSETUP:TDIV 0.5MS
:WSETUP:TDIV? -> :WSETUP:
TDIV 500.0E-06

Description The specifiable Time/div value is up to 1/10 of the data update rate (:RATE).

:WSETup:TRIGger?

Function Queries all settings related to the trigger.

Syntax :WSETup:TRIGger?

Example :WSETUP:TRIGGER? ->
:WSETUP:TRIGGER:MODE AUTO;
SOURCE U1;SLOPE RISE;LEVEL 0.0

:WSETup:TRIGger:LEVel

Function Sets the trigger level or queries the current setting.

Syntax :WSETup:TRIGger:LEVel {<NRf>}
:WSETup:TRIGger:LEVel?
<NRf> = –100.0 to 100.0 (%) (The resolution is 0.1(%))

Example :WSETUP:TRIGGER:LEVEL 0
:WSETUP:TRIGGER:LEVEL? -> :WSETUP:
TRIGGER:LEVEL 0.0

Description Set the value in terms of a percentage of the full scale value displayed on the screen.

:WSETup:TRIGger:MODE

Function Sets the trigger mode or queries the current setting.

Syntax :WSETup:TRIGger:MODE {AUTO|NORMal}
:WSETup:TRIGger:MODE?

Example :WSETUP:TRIGGER:MODE AUTO
:WSETUP:TRIGGER:MODE? -> :WSETUP:
TRIGGER:MODE AUTO

:WSETup:TRIGger:SLOPe

Function Sets the trigger slope or queries the current setting.

Syntax :WSETup:TRIGger:SLOPe {RISE|FALL|
BOTH}
:WSETup:TRIGger:SLOPe?

Example :WSETUP:TRIGGER:SLOPE RISE
:WSETUP:TRIGGER:SLOPE? -> :WSETUP:
TRIGGER:SLOPE RISE

:WSETup:TRIGger:SOURce

Function Sets the trigger source or queries the current setting.

Syntax
```
:WSETup:TRIGger:SOURce {U<x>|I<x>}
:WSETup:TRIGger:SOURce?
```
<x> = 1 to 4 (power measurement element)

Example
```
:WSETUP:TRIGGER:SOURCE U1
:WSETUP:TRIGGER:SOURCE? -> :WSETUP:
TRIGGER:SOURCE U1
```

:WSETup:VZoom?

Function Queries all settings related to the vertical zoom factor of the waveform.

Syntax
```
:WSETup:VZoom?
```

Example
```
:WSETUP:VZOOM? -> :WSETUP:VZOOM:
U1 1.00;U2 1.00;U3 1.00;U4 1.00;
I1 1.00;I2 1.00;I3 1.00;I4 1.00;
```

:WSETup:VZoom:{UALL|IALL}

Function Collectively sets the vertical zoom factor of the waveform {voltage|current} of all power measurement elements.

Syntax
```
:WSETup:VZoom:{UALL|IALL} {<NRf>}
```
<NRf> = 0.1 to 100 (see the WT1600FC User's Manual (IM760151-01E)

Example
```
:WSETUP:VZOOM:UALL 1
```

:WSETup:VZoom:{U<x>|I<x>}

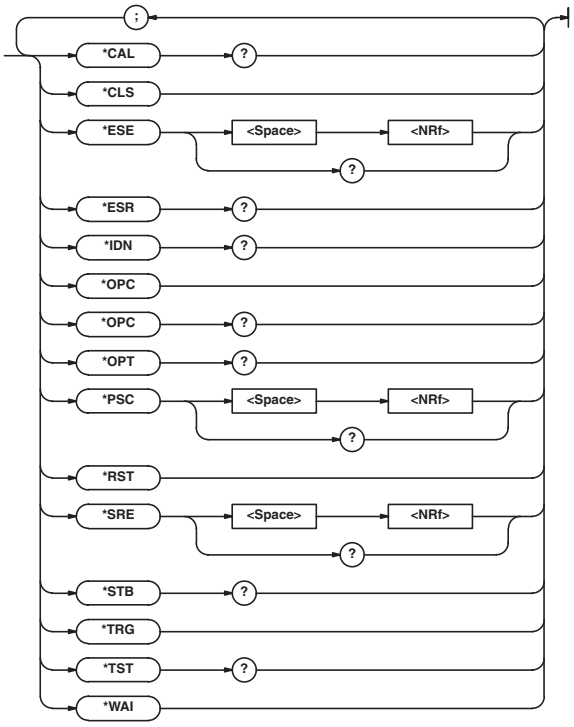
Function Sets the vertical zoom factor of the waveform {voltage|current} of the power measurement element or queries the current setting.

Syntax
```
:WSETup:VZoom:{U<x>|I<x>} {<NRf>}
:WSETup:VZoom:{U<x>|I<x>}?
```
<x> = 1 to 6
<NRf> = 0.1 to 100 (see the WT1600FC User's Manual (IM760151-01E)

Example
```
:WSETUP:VZOOM:U1 1
:WSETUP:VZOOM:U1? -> :WSETUP:VZOOM:
U1 1.00
```

5.20 Common Command Group

The commands in the common group are defined in the IEEE488.2-1987 and are independent of the instrument's functions.There are no front panel keys that correspond to the commands in this group.



***CAL? (CALibrate)**

Function Executes zero calibration (zero level compensation, same operation as pressing CAL (SHIFT+MEASURE)) and queries the result.

Syntax `*CAL?`

Example `*CAL? -> 0`

Description If the calibration terminates normally, "0" is returned. If abnormality is detected, "1" is returned.

***CLS (CLear Status)**

Function Clears the standard event register, extended event register, and error queue.

Syntax `*CLS`

Example `*CLS`

Description
- If the *CLS command is located immediately after the program message terminator, the output queue is also cleared.
- For details on the register and queue, see chapter 6.

***ESE**
(standard Event Status Enable register)

Function Sets the standard event enable register or queries the current setting.

Syntax `*ESE {<NRf>}`
`*ESE?`
<NRf> = 0 to 255

Example `*ESE 251`
`*ESE? -> 251`

Description
- Specify the value as a sum of decimal values of each bit.
- For example, specifying "*ESE 251" will cause the standard enable register to be set to "11111011." In this case, bit 2 of the standard event register is disabled which means that bit 5 (ESB) of the status byte register is not set to "1," even if a "query error" occurs.
- The default value is "*ESE 0" (all bits disabled).
- A query using *ESE? will not clear the contents of the standard event enable register.
- For details on the standard event enable register, see page 6-3.

*ESR? (standard Event Status Register)

Function Queries the standard event register and clears the register.

Syntax `*ESR?`

Example `*ESR? -> 32`

Description
- A sum of decimal values of each bit is returned.
- You can check what type of events occurred when an SRQ is generated.
- For example, if a value of “32” is returned, this indicates that the standard event register is set to “00100000.” In this case, you can see that the SRQ occurred due to a “command syntax error.”
- A query using *ESR? will clear the contents of the standard event register.
- For details on the standard event register, see page 6-3.

*IDN? (IDeNtify)

Function Queries the instrument model.

Syntax `*IDN?`

Example `*IDN? ->`
`YOKOGAWA,760151-0401,0,F1.01`

Description The information is returned in the following form: <Manufacturer>,<Model>,<Serial No.>,<Firmware version>In actuality, <Serial No.> is not returned (always 0).

*OPC (OPeration Complete)

Function Sets a “1” to bit 0 (OPC bit) of the standard event register bit upon the completion of the specified overlap command.

Syntax `*OPC`

Example `*OPC`

Description
- For the description regarding how to synchronize the program using *OPC, see page 4-8.
- The “COMMunicate:OPSE” command is used to specify the overlap command.
- If *OPC is not the last command of the message, the operation is not guaranteed.

*OPC? (OPeration Complete)

Function If the specified overlap command is completed, ASCII code “1” is returned.

Syntax `*OPC?`

Example `*OPC? -> 1`

Description
- For the description regarding how to synchronize the program using *OPC, see page 4-8.
- The “COMMunicate:OPSE” command is used to specify the overlap command.
- If *OPC? is not the last command of the message, the operation is not guaranteed.

*OPT? (OPTion)

Function Queries the installed options.

Syntax `*OPT?`

Example `*OPT? -> B5,DA,MTR,C10`

Description
- The presence or absence of the built-in printer (/B5), DA output (/DA), motor evaluation function (/MTR), SCSI interface (/C7), or Ethernet+SCSI+built-in HDD (/C10) is returned.
- If none of the options is installed, an ASCII code “0” is returned.
- The “*OPT?” query must be the last query of the program message. An error occurs if there is a query after this query.

*PSC (Power-on Status Clear)

Function Sets whether or not to clear the registers below at power up or queries the current setting. The register is cleared when the value rounded to an integer is a non-zero value.
- Standard event enable register
- Extended event enable register
- Transition filter

Syntax `*PSC {<NRf>}`
`*PSC?`
`<NRf>` = 0(not clear), non-zero (clear)

Example `*PSC 1`
`*PSC? -> 1`

Description For details on the registers, see chapter 6.

*RST (ReSeT)

Function Initializes the settings.

Syntax `*RST`

Example `*RST`

Description
- Also clears *OPC and *OPC? commands that have been sent earlier.
- All settings except communication settings are reset to factory default values.

***SRE (Service Request Enable register)**

Function Sets the service request enable register or queries the current setting.

Syntax
```
*SRE <NRf>
*SRE?
```
<NRf> = 0 to 255

Example
```
*SRE 239
```
*SRE? -> 175 (since the bit 6 (MSS) setting is ignored)

Description
- Specify the value as a sum of decimal values of each bit.
- For example, specifying "*SRE 239" will cause the service request enable register to be set to "11101111." In this case, bit 4 of the service request enable register is disabled which means that bit 4 (MAV) of the status byte register is not set to "1," even if "the output queue is not empty."
- Bit 6 (MSS) of the status byte register is the MSS bit itself, and therefore, it is ignored.
- The default value is "*SRE 0" (all bits disabled).
- A query using *SRE? will not clear the contents of the service request enable register.
- For details on the service request enable register, see page 6-2.

***STB? (STatus Byte)**

Function Queries the status byte register.

Syntax
```
*STB?
```

Example
```
*STB? -> 4
```

Description
- The sum of the bits is returned as a decimal value.
- Since the register is read without executing serial polling, bit 6 is a MSS bit not RQS.
- For example, if a value of "4" is returned, this indicates that the status byte register is set to "00000100." In this case, you can see that "the error queue is not empty" (an error occurred).
- A query using *STB? will not clear the contents of the status byte register.
- For details on the status byte register, see page 6-2.

***TRG (TRiGger)**

Function Executes the same operation as when SINGLE (SHIFT+HOLD) is pressed.

Syntax
```
*TRG
```

Example
```
*TRG
```

Description The multi-line message GET (Group Execute Trigger) also performs the same operation as this command.

***TST? (TeST)**

Function Performs a self-test and queries the result.

Syntax
```
*TST?
```

Example
```
*TST? -> 0
```

Description
- The self-test involves internal memory tests.
- "0" is returned if the self-test is successful, "1" if it is not.

***WAI (WAIt)**

Function Holds the subsequent command until the completion of the specified overlap operation.

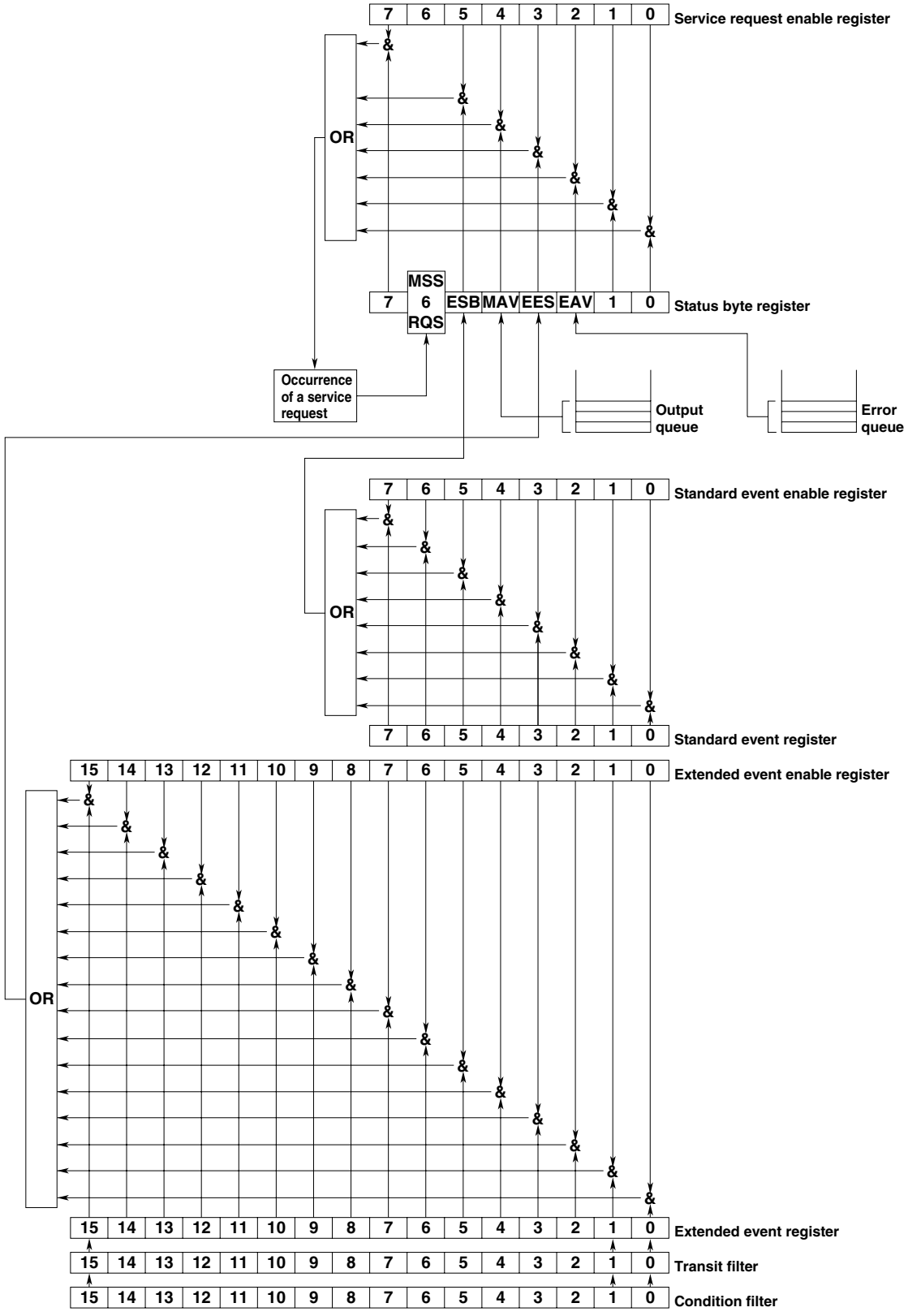
Syntax
```
*WAI
```

Example
```
*WAI
```

Description
- For the description regarding how to synchronize the program using *WAI, see page 4-7.
- The "COMMunicate:OPSE" command is used to specify the overlap command.

6.1 Overview of the Status Report

The figure below shows the status report which is read by a serial poll. This is an extended version of the one specified in IEEE 488.2-1987.



Overview of Registers and Queues

Name	Function	Writing	Reading
Status byte		—	Serial poll (RQS), *STB?(MSS)
Service request enable register	Masks status byte.	*SRE	*SRE?
Standard event register	Change in device status	—	*ESR?
Standard event enable register	Masks standard event register	*ESE	*ESE?
Extended event register	Change in device status	—	STATus:EESR?
Extended event enable register	Masks standard event register	STATus:EESE	STATus:EESE?
Condition register	Current instrument status	—	STATus:CONDition?
Transit filter	Extended event occurrence conditions	STATus:FILTer<x>	STATus:FILTer<x>?
Output queue	Stores response message to a query.	All executable queues	
Error queue	Stores error Nos. and messages.	—	STATus:ERRor?

Registers and Queues which Affect the Status Byte

Registers which affect each bit of the status byte are shown below.

Standard event register : Sets bit 5 (ESB) of status byte to "1" or "0".
Output queue : Sets bit 4 (MAV) of status byte to "1" or "0".
Extended event register : Sets bit 3 (EES) of status byte to "1" or "0".
Error queue : Sets bit 2 (EAV) of status byte to "1" or "0".

Enable Registers

Registers which mask a bit so that the bit does not affect the status byte, even if the bit is set to "1", are shown below.

Status byte : Masks bits using the service request enable register.
Standard event register : Masks bits using the standard event enable register.
Extended event register : Masks bits using the extended event enable register.

Writing/Reading from Registers

The *ESE command is used to set bits in the standard event enable register to "1" or "0", and the *ESR? query is used to check whether bits in that register are set to "1" or "0". For details of these commands, refer to Chapter 5.

6.2 Status Byte

Overview of Status Byte

7	RQS 6 MSS	ESB	MAV	EES	EAV	1	0

Bits 0, 1 and 7

Not used (always "0")

Bit 2 EAV (Error Available)

Set to "1" when the error queue is not empty, i.e. when an error occurs. For details, refer to page 6-5.

Bit 3 EES (Extended Event Summary Bit)

Sets to "1" when the logical AND of an Extended Event Register bit and the corresponding Enable Register bit is equal to "1."—that is, when an event takes place in the instrument. Refer to page 6-4.

Bit 4 MAV (Message Available)

Set to "1" when the output queue is not empty, i.e. when there is data which is to be output when an query is made. Refer to page 6-5.

Bit 5 ESB (Event Summary Bit)

Set to "1" when the logical AND of the standard event register and the corresponding enable register is "1", i.e. when an event takes place in the instrument. Refer to page 6-3.

Bit 6 RQS (Request Status)/MSS (Master Summary Status)

Sets to "1" when the logical AND of any one of the Status Byte bits (other than bit 6) and the corresponding Service Request Enable Register bit becomes "1"—that is, when the instrument is requesting service from the controller.
RQS is set to "1" when MSS changes from "0" to "1", and is cleared when a serial poll is performed or when MSS changes to "0".

Bit Masking

To mask a bit in the status byte so that it does not cause an SRQ, set the corresponding bit of the service request enable register to "0".
For example, to mask bit 2 (EAV) so that no service will be requested, even if an error occurs, set bit 2 of the service request enable register to "0". This can be done using the *SRE command. To query whether each bit of the service request enable register is "1" or "0", use *SRE?. For details of the *SRE command, refer to Chapter 5.

Operation of the Status Byte

A service request is issued when bit 6 of the status byte becomes "1". Bit 6 becomes "1" when any of the other bits becomes "1" (or when the corresponding bit in the service request enable register becomes "1"). For example, if an event occurs causing the logical AND of any one bit in the standard event register and the corresponding bit of the enable register to become "1," bit 5 (ESB) is set to "1." In this case, if bit 5 of the service request enable register is "1", bit 6 (MSS) will be set to "1", thus requesting service from the controller.
It is also possible to check what type of event has occurred by reading the contents of the status byte.

Reading from the Status Byte

The following two methods are provided for reading the status byte.

- **Inquiry using the *STB? query**
  Making an query using the *STB? query sets bit 6 to MSS. This causes the MSS to be read. After completion of the read-out, none of the bits in the status byte will be cleared.
- **Serial poll**
  Execution of a serial poll changes bit 6 to RQS. This causes RQS to be read. After completion of the read-out, only RQS is cleared. Using a serial poll, it is not possible to read MSS.

Clearing the Status Byte

No method is provided for forcibly clearing all the bits in the status byte. Bits which are cleared are shown below.

- **When an query is made using the *STB? query**
  No bit is cleared.
- **When a serial poll is performed**
  Only the RQS bit is cleared.
- **When the *CLS command is received**
  When the *CLS command is received, the status byte itself is not cleared, but the contents of the standard event register (which affects the bits in the status byte) are cleared. As a result, the corresponding bits in the status byte are cleared, except bit 4 (MAV), since the output queue cannot be emptied by the *CLS command. However, the output queue will also be cleared if the *CLS command is received just after a program message terminator.

6.3 Standard Event Register

Overview of the Standard Event Register

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Bit 7 PON (Power ON)
Bit 7 PON (Power ON) Set to "1" when power is turned ON
Bit 6 URQ (User Request)
Not used (always "0")
Bit 5 CME (Command Error)
Set to "1" when the command syntax is incorrect.
Examples: Incorrectly spelled command name; received string data that have spelling errors or that are not in the selection.
Bit 4 EXE (Execution Error)
Set to "1" when the command syntax is correct but the command cannot be executed in the current state.
Examples: Parameters are outside the setting range: received a command that has a parameter that is outside the range or a command that deals with an option that is not installed.
Bit 3 DDE (Device Dependent Error)
Set to "1" when execution of the command is not possible due to an internal problem in the instrument that is not a command error or an execution error.
Example: The circuit breaker is reset.
Bit 2 QYE (Query Error)
Set to "1" if the output queue is empty or if the data is missing even after a query has been sent.
Examples: No response data; data is lost due to an overflow in the output queue.
Bit 1 RQC (Request Control)
Not used (always "0")
Bit 0 OPC (Operation Complete)
Set to "1" when the operation designated by the *OPC command has been completed. Refer to Chapter 5.

Bit Masking

To mask a bit in the standard event register so that it does not cause bit 5 (ESB) of the status byte to change, set the corresponding bit in the standard event enable register to "0".
For example, to mask bit 2 (QYE) so that ESB will not be set to "1", even if a query error occurs, set bit 2 of the standard event enable register to "0". This can be done using the *ESE command. To inquire whether each bit of the standard event enable register is "1" or "0", use the *ESE?. For details of the *ESE command, refer to Chapter 5.

Operation of the Standard Event Register

The standard event register is provided for eight different kinds of event which can occur inside the instrument. Bit 5 (ESB) of the status byte is set to "1" when any of the bits in this register becomes "1" (or when the corresponding bit of the standard event enable register becomes "1").

Examples

1. A query error occurs.
2. Bit 2 (QYE) is set to "1".
3. Bit 5 (ESB) of the status byte is set to "1" if bit 2 of the standard event enable register is "1".

It is also possible to check what type of event has occurred inside the instrument by reading the contents of the standard event register.

Reading from the Standard Event Register

The contents of the standard event register can be read by the `*ESR` command. After completion of the read-out, the register will be cleared.

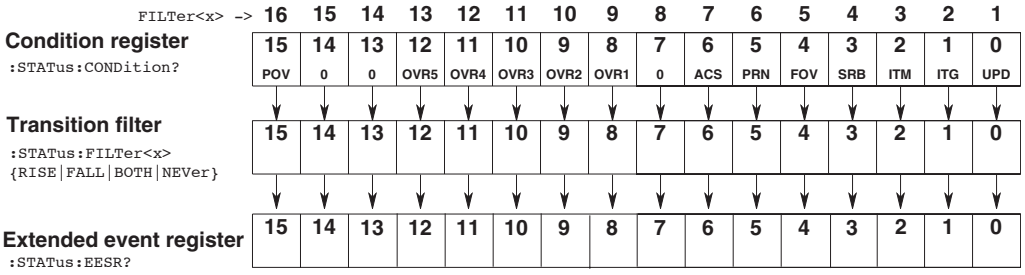
Clearing the Standard Event Register

The standard event register is cleared in the following three cases.

- When the contents of the standard event register are read using `*ESR?`
- When the `*CLS` command is received
- When power is turned ON again

6.4 Extended Event Register

Reading the extended event register tells you whether changes in the condition register (reflecting internal conditions) have occurred. A filter can be applied which allows you to decide which events are reported to the extended event register.



The meaning of each bit of the condition register is as follows.

Bit 0	UPD (Updating)	Set to "1" when the measured data is being updated. The falling edge of UPD (1 -> 0) signifies the end of the updating.
Bit 1	ITG (Integrate Busy)	Set to "1" while integration is in progress.
Bit 2	ITM (Integrate Timer Busy)	Set to "1" while the integration timer is running.
Bit 3	SRB (Store/Recall Busy)	Set to "1" while storing or recalling data.
Bit 4	FOV (Frequency Over)	Set to "1" when the frequency is in error.
Bit 5	PRN (Printing)	Set to "1" while the internal printer is in operation or data is being output to the external printer (Centronics or network printer).
Bit 6	ACS (Accessing)	Set to "1" while the floppy disk, internal hard disk, or external disk drive (SCSI or network device) is being accessed.
Bit 8	OVR1 (Element1 Measured Data Over)	Set to "1" when the voltage or current of element 1 is over the range.
Bit 9	OVR2 (Element2 Measured Data Over)	Set to "1" when the voltage or current of element 2 is over the range.
Bit 10	OVR3 (Element3 Measured Data Over)	Set to "1" when the voltage or current of element 3 is over the range.
Bit 11	OVR4 (Element4 Measured Data Over)	Set to "1" when the voltage or current of element 4 is over the range.
Bit 12	OVR5 (Element5 Measured Data Over)	Set to "1" when the voltage or current of element 5 is over the range.
Bit 15	POV (ElementX Input Peak Over)	Set to "1" when peak over is detected in any of the elements.

The filter is applied to each bit of the condition register separately, and can be selected from the following. Note that the numbering of the bits used in the filter setting differs from the actual bit number (1 to 16 vs. 0 to 15).

Rise	The bit of the extended event register becomes "1" when the bit of the condition register changes from "0" to "1".
Fall	The bit of the extended event register becomes "1" when the bit of the condition register changes from "1" to "0".
Both	The bit of the extended event register becomes "1" when the bit of the condition register changes from "0" to "1", or from "1" to "0".
Never	The bit of the extended event register is disabled and always "0".

6.5 Output Queue and Error Queue

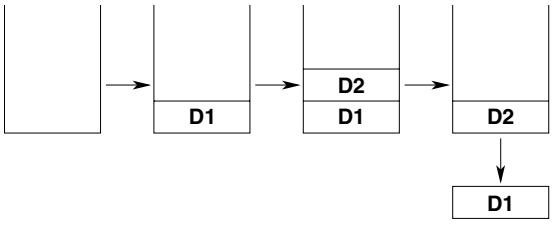
Overview of the Output Queue

The output queue is provided to store response messages to queries. For example, when the `WAVeform:SEND?` query is sent to request output of the acquired waveform, the response data will be stored in the output queue until it is read out.

The example below shows that data is stored record by record in the output queue, and is read out oldest item first, newest item last. The output queue is emptied in the following cases (in addition to when read-out is performed).

- When a new message is received from the controller
- When dead lock occurs (page 4-2)
- When a device clear command (DCL or SDC) is received
- When power is turned ON again

The output queue cannot be emptied using the `*CLS` command. To see whether the output queue is empty or not, check bit 4 (MAV) of the status byte.



Overview of the Error Queue

The error queue stores the error No. and message when an error occurs. For example, if the controller sends an incorrect program message, the number, "`113, "Undefined header"`", and the error message are stored in the error queue, when the error is displayed.

The contents of the error queue can be read using the `STATus:ERRor?` query. As with the output queue, messages are read oldest first, newest last (refer to the previous page).

If the error queue becomes full, the final message will be replaced by message "`350, "Queue overflow"`".

The error queue is emptied in the following cases (in addition to when read-out is performed).

- When the `*CLS` command is received
- When power is turned ON again

To see whether the error queue is empty or not, check bit 2 (EAV) of the status byte.

7.1 Before Programming

System Requirements

Computer:	Windows PC
Programming language:	Visual Basic Ver 5.0 Professional Edition or later.
GP-IB board:	AT-GP-IB/TNT IEEE-488.2 by National Instruments.

Settings on Visual Basic

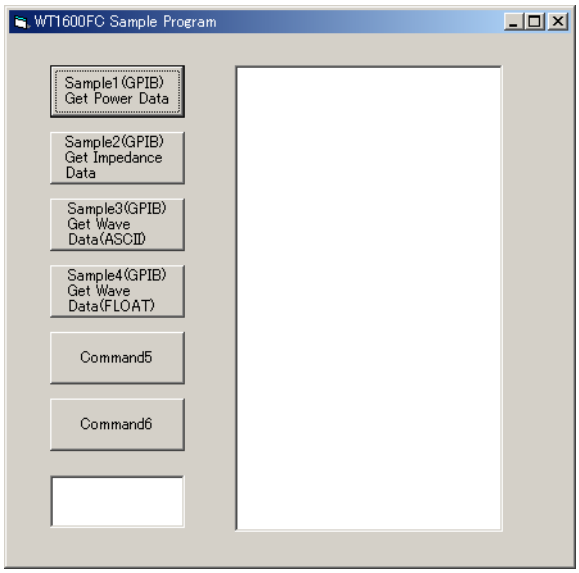
Standard modules used:	Niglobal.bas
	Vbib-32.bas

Setting the WT1600FC

GP-IB

The sample programs given in this chapter use a GP-IB address of 1 for the WT1600FC. Set the GP-IB address to 1 according to the procedures on page 1-5.

7.2 Sample Program Image



7.3 Initialization, Error, and Functions for Execution

```
_____________________________________________
Option Explicit
Dim StartFlag As Integer                        'Start Flag
Dim addr As Integer                             'GPIB Address
Dim Timeout As Integer                          'Timeout
Dim Dev As Integer                              'Device ID(GPIB)
Dim term As String                              'Terminator
Dim Query(1100) As String                       'Query String
Dim Dummy As Integer
_____________________________________________
Private Function InitGpib() As Integer
    Dim eos As Integer                          'EOS
    Dim eot As Integer                          'EOI
    Dim brd As Integer                          'GPIB Board ID
    Dim sts As Integer
    eos = &HC0A                                 'Terminator = LF
    eot = 1                                     'EOI = Enable
    term = Chr(10)
    Timeout = T10s                              'Timeout = 10s
    brd = ilfind("GPIB0")
    If (brd < 0) Then
        Call DisplayGPIBError(brd, "ilfind")
        InitGpib = 1
        Exit Function
    End If
    Dev = ildev(0, addr, 0, Timeout, eot, eos)
    If (Dev < 0) Then
        Call DisplayGPIBError(Dev, "ildev")
        InitGpib = 1
        Exit Function
    End If
    sts = ilsic(brd)                            'Set IFC
    If (sts < 0) Then
        Call DisplayGPIBError(sts, "ilsic")
        InitGpib = 1
        Exit Function
    End If
    InitGpib = 0
End Function
_____________________________________________
Private Sub DisplayGPIBError(ByVal sts As Integer, ByVal msg As String)
    Dim wrn As String
    Dim ers As String
    Dim ern As Integer

    If (sts And TIMO) Then
        wrn = "Time out" + Chr(13)
    Else
        wrn = ""
    End If
    If (sts And EERR) Then
        ern = iberr
        If (ern = EDVR) Then
            ers = "EDVR:System error"
        ElseIf (ern = ECIC) Then
            ers = "ECIC:Function requires GPIB board to be CIC"
        ElseIf (ern = ENOL) Then
            ers = "ENOL:No Listeners on the GPIB"
        ElseIf (ern = EADR) Then
            ers = "EADR:GPIB board not addressed correctly"
        ElseIf (ern = EARG) Then
            ers = "EARG:Invalid argument to function call"
        ElseIf (ern = ESAC) Then
            ers = "ESAC:GPIB board not System Controller as required"
        ElseIf (ern = EABO) Then
            ers = "EABO:I/O operation aborted(timeout)"
        ElseIf (ern = ENEB) Then
            ers = "ENEB:Nonexistent GPIB board"
        ElseIf (ern = EDMA) Then
            ers = "EDMA:DMA error"
        ElseIf (ern = EOIP) Then
            ers = "EOIP:I/O operation started before previous operation completed"
        ElseIf (ern = ECAP) Then
            ers = "ECAP:No capability for intended operation"
        ElseIf (ern = EFSO) Then
            ers = "EFSO:File system operation error"
        ElseIf (ern = EBUS) Then
            ers = "EBUS:GPIB bus error"
        ElseIf (ern = ESTB) Then
            ers = "ESTB:Serial poll status byte queue overflow"
        ElseIf (ern = ESRQ) Then
            ers = "ESRQ:SRQ remains asserted"
```

```
        ElseIf (ern = ETAB) Then
            ers = "ETAB:The return buffer is full"
        ElseIf (ern = ELCK) Then
            ers = "ELCK:Address or board is locked"
        Else
            ers = ""
        End If
    Else
        ers = ""
    End If
    MsgBox ("Status No. " + Str(sts) + Chr(13) + wrn + "Error No. " + Str(ern) + Chr(13)
+ ers + Chr(13) + msg), vbExclamation, "Error!"
    Call ibonl(Dev, 0)
    Dev = -1
End Sub
-------------------------------------------------
Private Sub Command1_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
    Dummy = DoEvents()
    sts = GpibPower                          'Run Sample1(GPIB) Get Numeric Data
(Power)
    If (sts = 0) Then
        Text1.Text = "END"
    Else
        Text1.Text = "ERROR"
    End If
    StartFlag = 0
End Sub
-------------------------------------------------
Private Sub Command2_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
    Dummy = DoEvents()
    sts = GpibImpedance                       'Run Sample2(GPIB) Get Numeric Data
(Impedance)
    If (sts = 0) Then
        Text1.Text = "END"
    Else
        Text1.Text = "ERROR"
    End If
    StartFlag = 0
End Sub
-------------------------------------------------
Private Sub Command3_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
    Dummy = DoEvents()
    sts = GpibWaveAscii                       'Run Sample3(GPIB) Get Waveform data
(ASCII)
    If (sts = 0) Then
        Text1.Text = "END"
    Else
        Text1.Text = "ERROR"
    End If
    StartFlag = 0
End Sub
-------------------------------------------------
Private Sub Command4_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
```

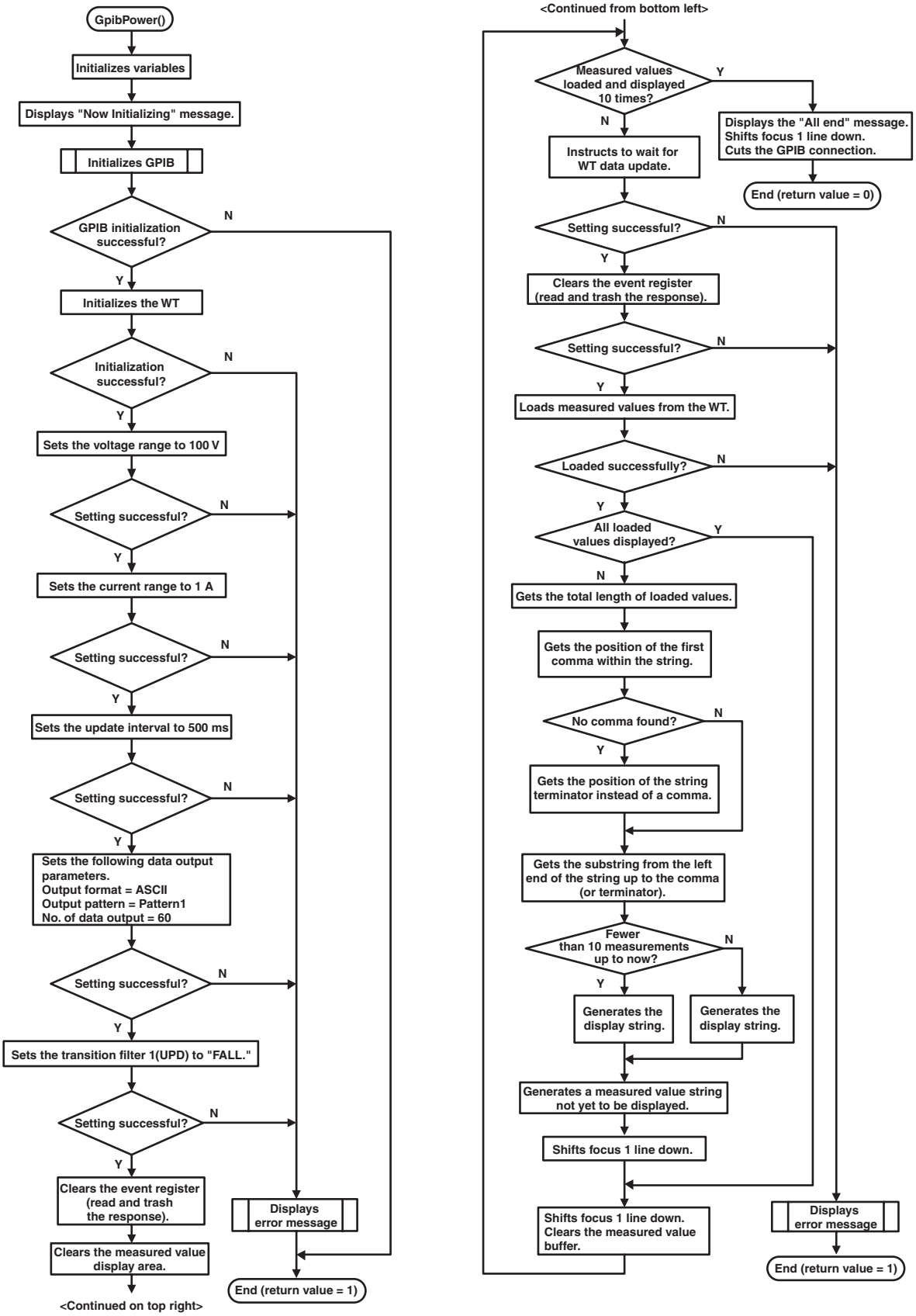
```
    Dummy = DoEvents()
    sts = GpibWaveFloat                          'Run Sample4(GPIB) Get Waveform data
(FLOAT)
    If (sts = 0) Then
        Text1.Text = "END"
    Else
        Text1.Text = "ERROR"
    End If
    StartFlag = 0
End Sub
```

```
Private Sub Command5_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
    List1.AddItem "NOT MAKE"
    Text1.Text = "END"
    StartFlag = 0
End Sub
```

```
Private Sub Command6_Click()
    Dim sts As Integer
    If (StartFlag = 1) Then
        Exit Sub
    End If
    StartFlag = 1
    Text1.Text = "START"
    List1.Clear
    List1.AddItem "NOT MAKE"
    Text1.Text = "END"
    StartFlag = 0
End Sub
```

```
Private Sub Form_Load()
    StartFlag = 0                                  'Clear Start Flag
    Dev = -1                                       'Clear device id
    addr = 1                                       'GPIB Address = 1
    Command1.Caption = "Sample1(GPIB)" + Chr(13) + "Get Power Data"
    Command2.Caption = "Sample2(GPIB)" + Chr(13) + "Get Impedance Data"
    Command3.Caption = "Sample3(GPIB)" + Chr(13) + "Get Wave Data(ASCII)"
    Command4.Caption = "Sample4(GPIB)" + Chr(13) + "Get Wave Data(FLOAT)"
    Text1.Text = ""
End Sub
```

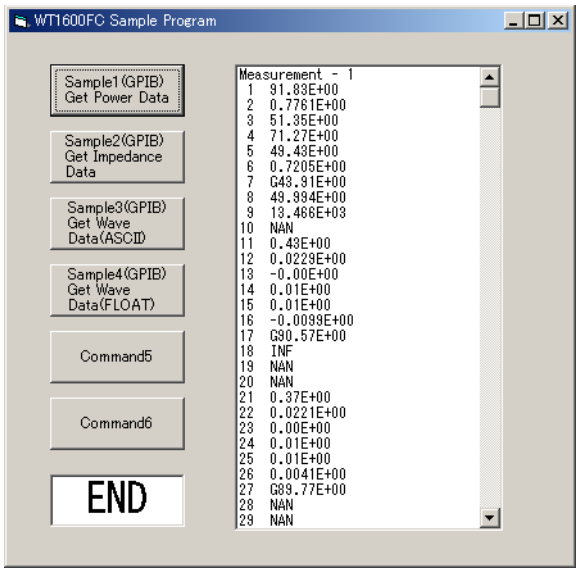
7.4 Output of Power Measurement Data



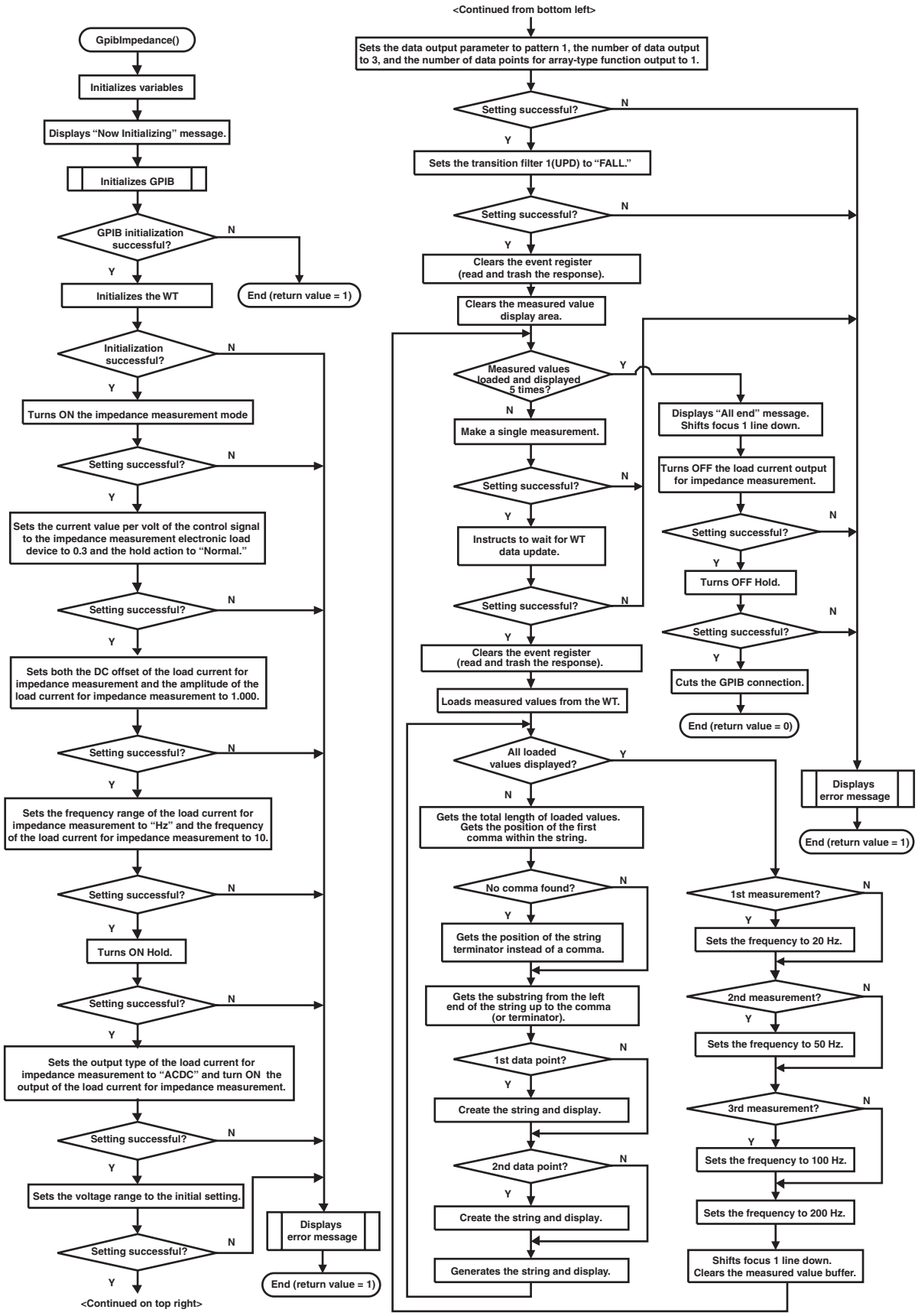
Sample1(GPIB) Get Power Data

```
Private Function GpibPower() As Integer
    Dim msg As String                               'Command buffer
    Dim qry As String                               'Query buffer
    Dim sts As Integer
    Dim item As Integer
    Dim comma As Integer
    Dim length As Integer
    Dim cnt As Integer
    term = Chr$(10)                                 'terminator
    msg = Space$(100)
    qry = Space$(900)
    List1.AddItem "Now Initializing. Wait a moment."
    Dummy = DoEvents()
    sts = InitGpib                                  'Initialize GPIB
    If (sts <> 0) Then
        GpibPower = 1
        Exit Function
    End If
    'Initialize the settings
    msg = "*RST" + term                             'Initialize the settings
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
   'Set the measurement condition
    msg = "VOLTAGE:RANGE 100V" + term               'Voltage range = 100V
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    msg = "CURRENT:RANGE 1A" + term                 'Current range = 1A
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    msg = "RATE 500MS" + term                       'Update Rate = 500ms
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    'Set the numeric data output items
    'ASCII format, Preset pattern1, Number of data = 60
    msg = "NUMERIC:FORMAT ASCII;NORMAL:PRESET 1;NUMBER 60" + term
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    'Set the transition filter used to detect the completion of the data updating
    msg = "STATUS:FILTER1 FALL" + term              'Falling edge of bit0(UPD)
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    'Clear the extended event register (Read and trash the response)
    msg = "STATUS:EESR?" + term
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    sts = ilrd(Dev, qry, Len(qry))                  'Receive Query
    If (sts < 0) Then
```

```
        Call DisplayGPIBError(sts, msg)
        GpibPower = 1
        Exit Function
    End If
    List1.Clear
    'Read and display the numeric data  (It is repeated 10 times in this program)
    For cnt = 1 To 10
        'Wait for the completion of the data updating
        msg = "COMMUNICATE:WAIT 1" + term
        sts = ilwrt(Dev, msg, Len(msg))            'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibPower = 1
            Exit Function
        End If
        'Clear the extended event register (Read and trash the response)
        msg = "STATUS:EESR?" + term
        sts = ilwrt(Dev, msg, Len(msg))            'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibPower = 1
            Exit Function
        End If
        sts = ilrd(Dev, qry, Len(qry))             'Receive Query
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibPower = 1
            Exit Function
        End If
        'Read out numeric data
        msg = "NUMERIC:NORMAL:VALUE?" + term
        sts = ilwrt(Dev, msg, Len(msg))            'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibPower = 1
            Exit Function
        End If
        sts = ilrd(Dev, qry, Len(qry))             'Receive Query
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibPower = 1
            Exit Function
        End If
        'Extract items that are separated by commas(,) from the received data
        List1.AddItem "Measurement - " + CStr(cnt)
        List1.ListIndex = List1.ListIndex + 1
        For item = 1 To 60
            length = Len(qry)
            comma = InStr(qry, ",")
            If (comma = 0) Then comma = InStr(qry, term)
            Query(item) = Left(qry, comma - 1)
            If item < 10 Then
                List1.AddItem " " + CStr(item) + "  " + Query(item)
            Else
                List1.AddItem CStr(item) + "  " + Query(item)
            End If
            qry = Mid(qry, comma + 1)
            List1.ListIndex = List1.ListIndex + 1
        Next item
        List1.AddItem ""
        List1.ListIndex = List1.ListIndex + 1
        qry = Space$(900)
        Dummy = DoEvents()
    Next cnt
    List1.AddItem "  All end"
    List1.ListIndex = List1.ListIndex + 1
    Call ibonl(Dev, 0)
    GpibPower = 0
End Function
```


WT1600FC Sample Program
Sample1(GPIB) Get Power Data
Sample2(GPIB) Get Impedance Data
Sample3(GPIB) Get Wave Data(ASCII)
Sample4(GPIB) Get Wave Data(FLOAT)
Command5
Command6
END
Measurement - 1
1 91.83E+00
2 0.7761E+00
3 51.35E+00
4 71.27E+00
5 49.43E+00
6 0.7205E+00
7 G43.91E+00
8 49.994E+00
9 13.466E+03
10 NAN
11 0.43E+00
12 0.0229E+00
13 -0.00E+00
14 0.01E+00
15 0.01E+00
16 -0.0099E+00
17 G30.57E+00
18 INF
19 NAN
20 NAN
21 0.37E+00
22 0.0221E+00
23 0.00E+00
24 0.01E+00
25 0.01E+00
26 0.0041E+00
27 G89.77E+00
28 NAN
29 NAN

7.5 Output of Impedance Measurement Data

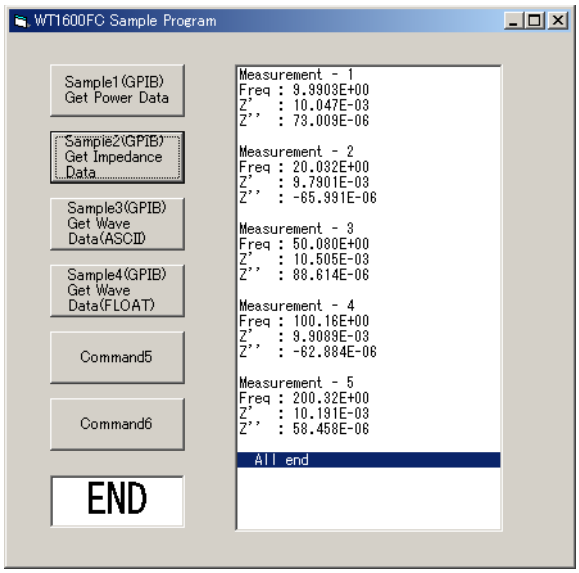


Sample2(GPIB) Get Impedance Data

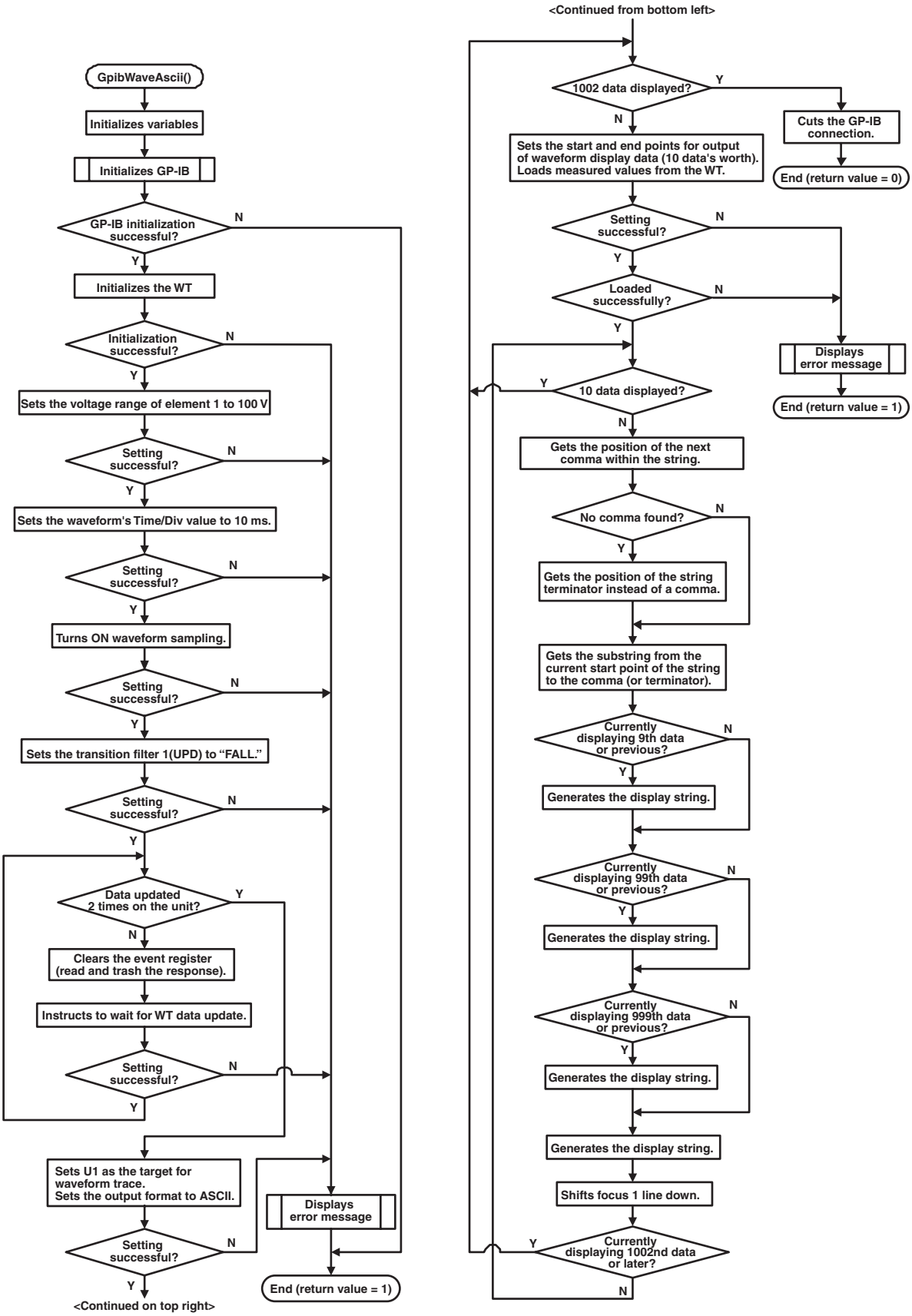
```
Private Function GpibImpedance() As Integer
    Dim msg As String                                   'Command buffer
    Dim qry As String                                   'Query buffer
    Dim sts As Integer
    Dim wait As Integer
    Dim item As Integer
    Dim comma As Integer
    Dim length As Integer
    Dim cnt As Integer
    term = Chr$(10)                                     'terminator
    msg = Space$(100)
    qry = Space$(1200)
    List1.AddItem "Now Initializing. Wait a moment."
    Dummy = DoEvents()
    sts = InitGpib                                      'Initialize GPIB
    If (sts <> 0) Then
        GpibImpedance = 1
        Exit Function
    End If
    'Initialize the settings
    msg = "*RST" + term                                 'Initialize the settings
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If

    'Set the measurment condition
    'Mode = impedance mode
    msg = "IMPEDANCE:STATE ON" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Superpose Output Ratio = 0.3, Hold Action = Normal
    msg = "IMPEDANCE:SUPERPOSE:DETAILE:RATIO 0.3;HOLD NORMAL" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Superpose DC Offset = 1.000, Superpose AC Amp = 1.000
    msg = "IMPEDANCE:SUPERPOSE:OFFSET 1;AMPLITUDE 1" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Frequency Range = Hz, Frequency Value = 10
    msg = "IMPEDANCE:SUPERPOSE:FREQUENCY:RANGE HZ;VALUE 10" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Hold On
    msg = "HOLD ON" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Superpose Output Type = AC/DC, Superpose Output = ON
    msg = "IMPEDANCE:SUPERPOSE:OUTPUT:TYPE ACDC;STATE ON" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Initialize voltage range
    msg = "IMPEDANCE:VOLTAGE:INITIALIZE" + term
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
```

```
'Preset pattern1, Number of data = 3, Number of data of array function = 1
msg = "NUMERIC:IMPEDANCE:PRESET 1;NUMBER 3;ARRAY 1" + term
sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibImpedance = 1
    Exit Function
End If
'Set the transition filter used to detect the completion of the data updating
msg = "STATUS:FILTER1 FALL" + term              'Falling edge of bit0(UPD)
sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibImpedance = 1
    Exit Function
End If
'Clear the extended event register (Read and trash the response)
msg = "STATUS:EESR?" + term
sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibImpedance = 1
    Exit Function
End If
sts = ilrd(Dev, qry, Len(qry))                  'Receive Query
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibImpedance = 1
    Exit Function
End If
List1.Clear
'Read and display the numeric data  (It is repeated 5 times in this program)
For cnt = 1 To 5
    msg = "*TRG" + term                         'Single trigger
    sts = ilwrt(Dev, msg, Len(msg))             'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Wait for the completion of the data updating
    msg = "COMMUNICATE:WAIT 1" + term
    sts = ilwrt(Dev, msg, Len(msg))             'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Clear the extended event register (Read and trash the response)
    msg = "STATUS:EESR?" + term
    sts = ilwrt(Dev, msg, Len(msg))             'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    sts = ilrd(Dev, qry, Len(qry))              'Receive Query
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Read out numeric data
    msg = "NUMERIC:IMPEDANCE:VALUE?" + term
    sts = ilwrt(Dev, msg, Len(msg))             'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    sts = ilrd(Dev, qry, Len(qry))              'Receive Query
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    'Extract items that are separated by commas(,) from the received data
    List1.AddItem "Measurement - " + CStr(cnt)
    List1.ListIndex = List1.ListIndex + 1
    For item = 1 To 3
        length = Len(qry)
        comma = InStr(qry, ",")
        If (comma = 0) Then comma = InStr(qry, term)
        Query(item) = Left(qry, comma - 1)
        If (item = 1) Then
            List1.AddItem "Freq : " + Query(item)
```

```
            ElseIf (item = 2) Then
                List1.AddItem "Z'   : " + Query(item)
            Else
                List1.AddItem "Z''  : " + Query(item)
            End If

            qry = Mid(qry, comma + 1)
            List1.ListIndex = List1.ListIndex + 1
        Next item

        'Change Frequency
        If cnt = 1 Then
            msg = "IMPEDANCE:SUPERPOSE:FREQUENCY:VALUE 20" + term       'Frequency Value
= 20
        ElseIf cnt = 2 Then
            msg = "IMPEDANCE:SUPERPOSE:FREQUENCY:VALUE 50" + term       'Frequency Value
= 50
        ElseIf cnt = 3 Then
            msg = "IMPEDANCE:SUPERPOSE:FREQUENCY:VALUE 100" + term      'Frequency Value
= 100
        Else
            msg = "IMPEDANCE:SUPERPOSE:FREQUENCY:VALUE 200" + term      'Frequency Value
= 200
        End If
        sts = ilwrt(Dev, msg, Len(msg))             'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibImpedance = 1
            Exit Function
        End If

        List1.AddItem ""
        List1.ListIndex = List1.ListIndex + 1
        qry = Space$(900)
        Dummy = DoEvents()
    Next cnt
    List1.AddItem "  All end"
    List1.ListIndex = List1.ListIndex + 1

    msg = "IMPEDANCE:SUPERPOSE:OUTPUT:STATE OFF" + term                 'Superpose
Output = OFF
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    msg = "HOLD OFF" + term                         'Hold Off
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibImpedance = 1
        Exit Function
    End If
    Call ibonl(Dev, 0)
    GpibImpedance = 0
End Function
```



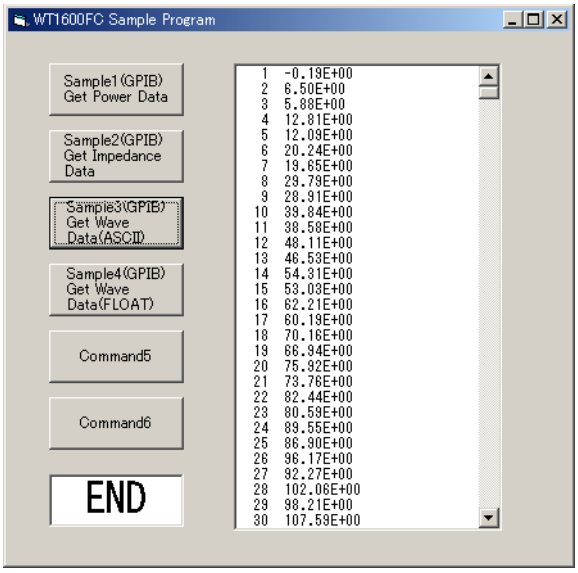
7.6 Output of Waveform Data (ASCII Format)



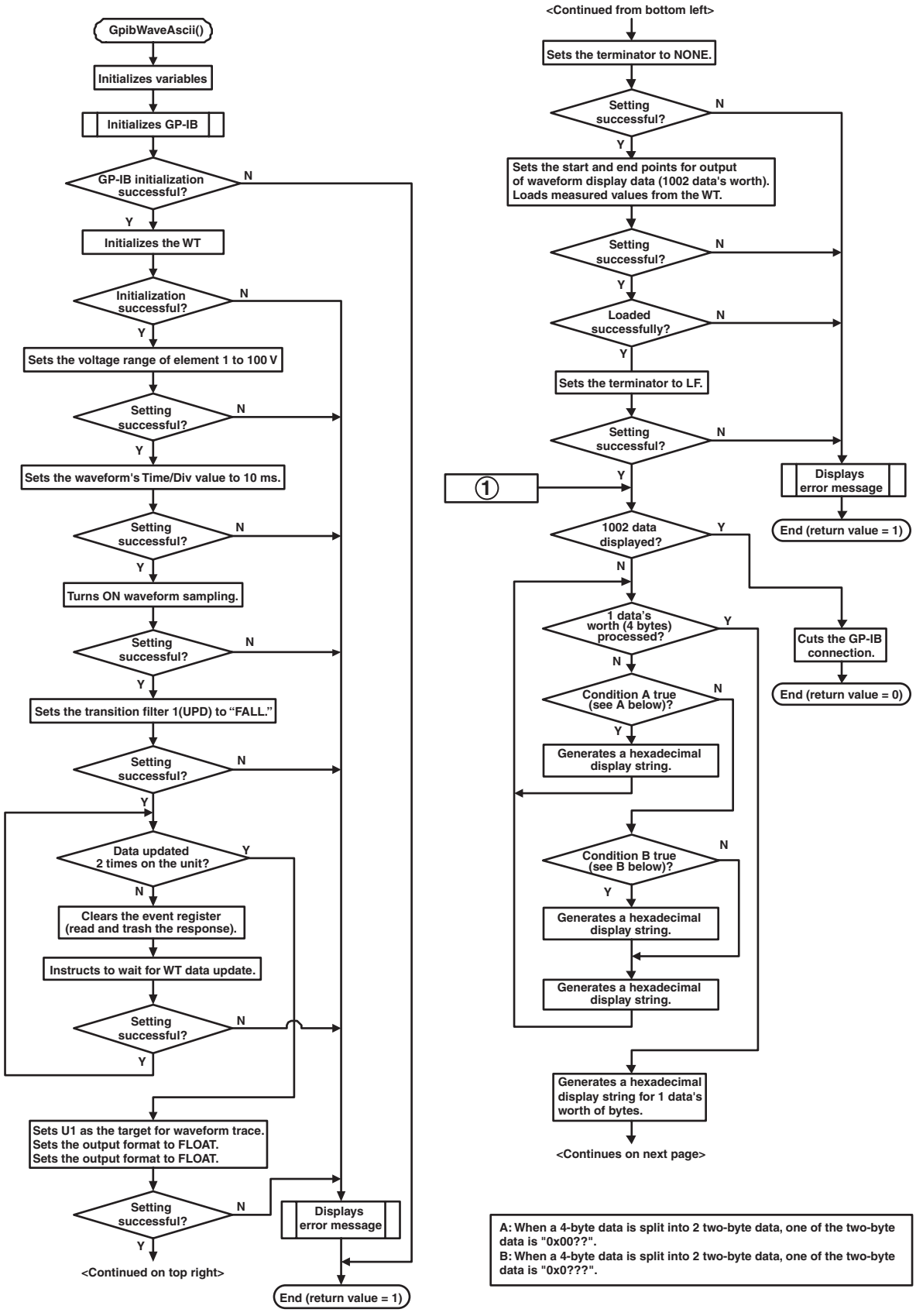
Sample3(GPIB) Get Wave Data (ASCII)

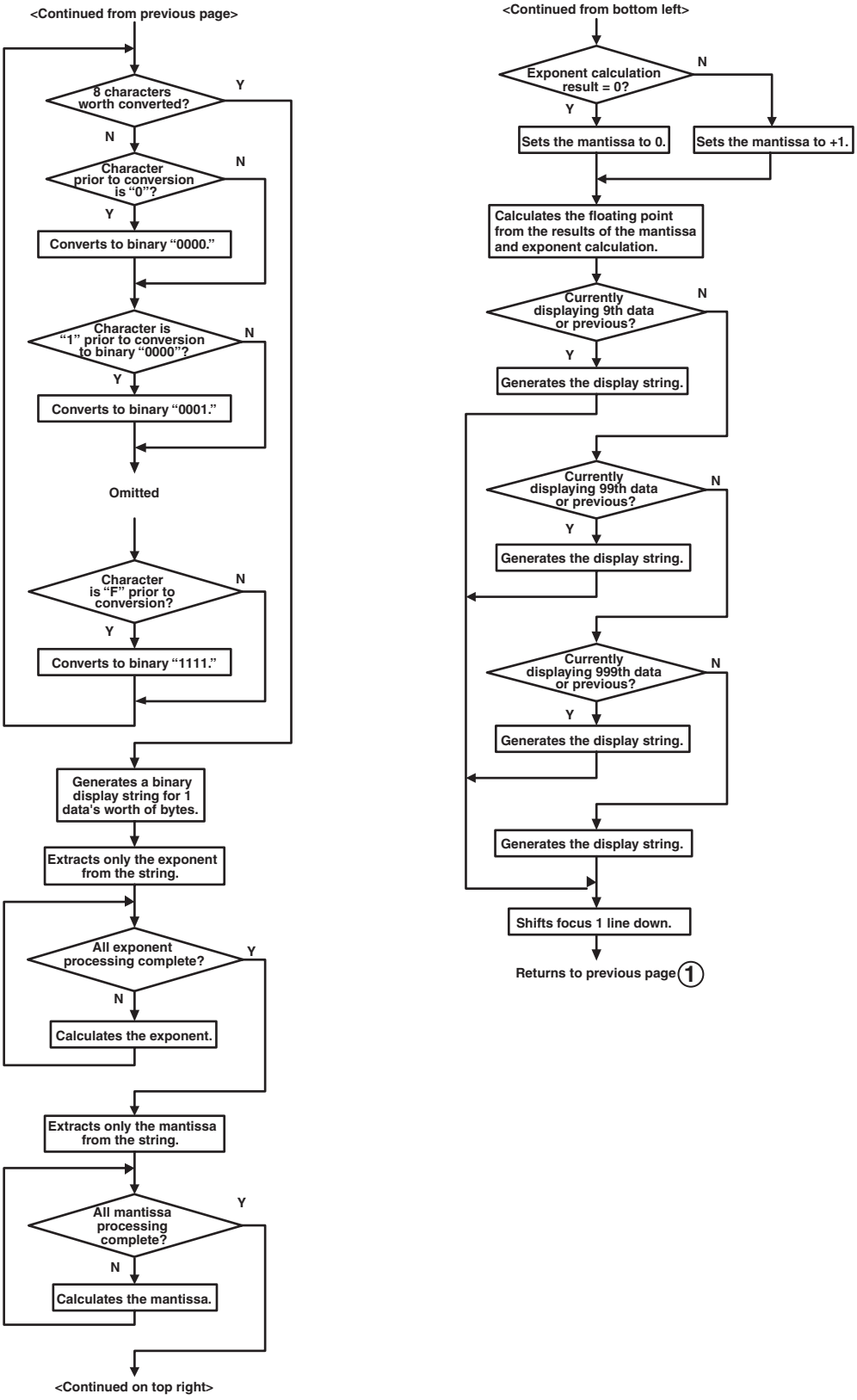
```
Private Function GpibWaveAscii() As Integer
    Dim msg As String                                   'Command buffer
    Dim qry As String                                   'Query buffer
    Dim sts As Integer
    Dim wait As Integer
    Dim pntl As Integer
    Dim num As Integer
    Dim i As Integer
    Dim j As Integer
    Dim k As Integer
    Dim comma As Integer
    term = Chr$(10)                                     'terminator
    msg = Space$(100)
    qry = Space$(200)

    sts = InitGpib                                      'Initialize GPIB
    If (sts <> 0) Then
        GpibWaveAscii = 1
        Exit Function
    End If
    'Initialize the settings
    msg = "*RST" + term                                 'Initialize the settings
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    'Set the measurment condition
    msg = "VOLTAGE:RANGE:ELEMENT1 100V" + term          'Voltage range = 100V
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    msg = "WSETUP:TDIV 10MS" + term                     'Time/div = 10ms
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    msg = "WSETUP:SAMPLING ON" + term                   'Wave sampling start
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    'Set the transition filter used to detect the completion of the data updating
    msg = "STATUS:FILTER1 FALL" + term                  'Falling edge of bit0(UPD)
    sts = ilwrt(Dev, msg, Len(msg))                     'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    'Wait until waveform measure is stable (2 samples in this program)
    For wait = 1 To 2
        'Clear the extended event register (Read and trash the response)
        msg = "STATUS:EESR?" + term
        sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibWaveAscii = 1
            Exit Function
        End If
        sts = ilrd(Dev, qry, Len(qry))                  'Receive Query
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibWaveAscii = 1
            Exit Function
        End If
        'Wait for the completion of the data updating
        msg = "COMMUNICATE:WAIT 1" + term
        sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
        If (sts < 0) Then
```

```
            Call DisplayGPIBError(sts, msg)
            GpibWaveAscii = 1
            Exit Function
        End If
    Next wait
    'Set conditions for reading the waveform
    'ASCII format, Trace = U1
    msg = "WAVEFORM:TRACE U1;FORMAT ASCII" + term
    sts = ilwrt(Dev, msg, Len(msg))                'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveAscii = 1
        Exit Function
    End If
    'Read and display the waveform data
    pntl = 1002
    num = 0
    For i = 0 To pntl Step 10
        'Read in the waveform data 10 data points at a time
        msg = "WAVEFORM:START" + Str(i) + ";END" + Str(i + 9) + ";SEND?" + term
        sts = ilwrt(Dev, msg, Len(msg))            'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibWaveAscii = 1
            Exit Function
        End If
        sts = ilrd(Dev, qry, Len(qry))             'Receive Query
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
            GpibWaveAscii = 1
            Exit Function
        End If
        k = 1
        'Extract items that are separated by commas(,) from the received data
        For j = 0 To 9
            comma = InStr(k, qry, ",")
            If (comma = 0) Then comma = InStr(k, qry, term)
            num = num + 1
            Query(num) = Mid(qry, k, (comma - k))
            If (num < 10) Then
                List1.AddItem "   " + CStr(num) + "  " + Query(num)
            ElseIf (num < 100) Then
                List1.AddItem "  " + CStr(num) + "  " + Query(num)
            ElseIf (num < 1000) Then
                List1.AddItem " " + CStr(num) + "  " + Query(num)
            Else
                List1.AddItem CStr(num) + "  " + Query(num)
            End If
            k = comma + 1
            List1.ListIndex = List1.ListIndex + 1
            If (num >= pntl) Then Exit For
        Next j
        qry = Space$(200)
        Dummy = DoEvents()
    Next i
    Call ibonl(Dev, 0)
    GpibWaveAscii = 0
End Function
```



7.7 Output of Waveform Data (FLOAT Format)



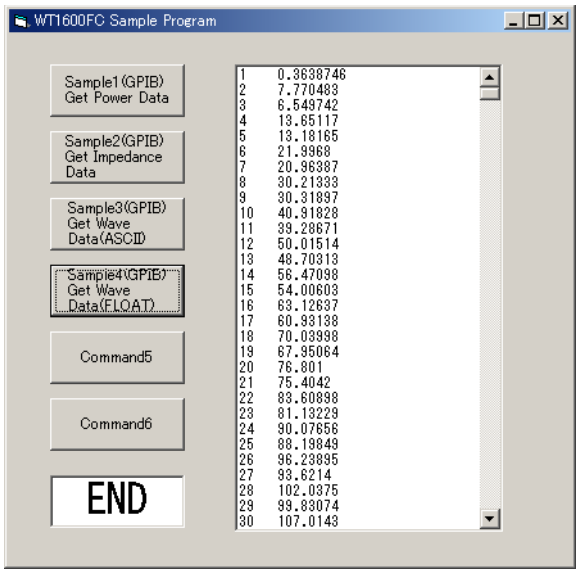

<Continued from previous page>
8 characters worth converted?
Y
N
Character prior to conversion is "0"?
N
Y
Converts to binary "0000."
Character is "1" prior to conversion to binary "0000"?
N
Y
Converts to binary "0001."
Omitted
Character is "F" prior to conversion?
N
Y
Converts to binary "1111."
Generates a binary display string for 1 data's worth of bytes.
Extracts only the exponent from the string.
All exponent processing complete?
Y
N
Calculates the exponent.
Extracts only the mantissa from the string.
All mantissa processing complete?
Y
N
Calculates the mantissa.
<Continued on top right>
<Continued from bottom left>
Exponent calculation result = 0?
N
Y
Sets the mantissa to 0.
Sets the mantissa to +1.
Calculates the floating point from the results of the mantissa and exponent calculation.
Currently displaying 9th data or previous?
N
Y
Generates the display string.
Currently displaying 99th data or previous?
N
Y
Generates the display string.
Currently displaying 999th data or previous?
N
Y
Generates the display string.
Generates the display string.
Shifts focus 1 line down.
Returns to previous page 1

Sample4(GPIB) Get Wave Data (FLOAT)

```
Private Function GpibWaveFloat() As Integer
    Dim msg As String
    Dim qry As String
    Dim wait As Integer
    Dim eos As Integer
    Dim w As String
    Dim a(8) As String
    Dim b(8) As String
    Dim buf As String
    Dim all As String
    Dim allb As String
    Dim stre As String
    Dim sts As Integer
    Dim pntl As Integer
    Dim i As Integer
    Dim j As Integer
    Dim k As Integer
    Dim l As Integer
    Dim m As Integer
    Dim valu As Integer
    Dim vale As Integer
    Dim bufv(2007) As Integer
    Dim valf As Single
    Dim flo As Single
    term = Chr$(10)                                 'terminator
    msg = Space$(100)
    qry = Space$(200)
    sts = InitGpib                                  'Initialize GPIB
    If (sts <> 0) Then
        GpibWaveFloat = 1
        Exit Function
    End If
    'Initialize the settings
    msg = "*RST" + term                             'Initialize the settings
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    'Set the measurment condition
    msg = "VOLTAGE:RANGE:ELEMENT1 100V" + term      'Voltage range = 100V
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    msg = "WSETUP:TDIV 10MS" + term                 'Time/div = 10ms
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    msg = "WSETUP:SAMPLING ON" + term               'Wave sampling start
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    'Set the transition filter used to detect the completion of the data updating
    msg = "STATUS:FILTER1 FALL" + term              'Falling edge of bit0(UPD)
    sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    'Wait until waveform measure is stable (2 samples in this program)
    For wait = 1 To 2
        'Clear the extended event register (Read and trash the response)
        msg = "STATUS:EESR?" + term
        sts = ilwrt(Dev, msg, Len(msg))             'Send Command
        If (sts < 0) Then
            Call DisplayGPIBError(sts, msg)
```

```
        GpibWaveFloat = 1
        Exit Function
    End If
    sts = ilrd(Dev, qry, Len(qry))              'Receive Query
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
    'Wait for the completion of the data updating
    msg = "COMMUNICATE:WAIT 1" + term
    sts = ilwrt(Dev, msg, Len(msg))             'Send Command
    If (sts < 0) Then
        Call DisplayGPIBError(sts, msg)
        GpibWaveFloat = 1
        Exit Function
    End If
Next wait
'Set conditions for reading the waveform
'FLOAT(MSB first) format, Trace = U1
msg = "WAVEFORM:TRACE U1;FORMAT FLOAT;BYTEORDER MSBFIRST" + term
sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibWaveFloat = 1
    Exit Function
End If
'Read and display the waveform data
eos = 0
sts = ileos(Dev, eos)                           'Terminator = None(for Binary Data)
If (sts < 0) Then
    Call DisplayGPIBError(sts, "ileos")
    GpibWaveFloat = 1
    Exit Function
End If
'Read in the waveform data
pntl = 1002
msg = "WAVEFORM:START 0;END 1001;SEND?" + term
sts = ilwrt(Dev, msg, Len(msg))                 'Send Command
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibWaveFloat = 1
    Exit Function
End If
sts = ilrdi(Dev, bufv(), 6 + 1002 * 4 + 1)      'Receive Query(Integer data)
If (sts < 0) Then
    Call DisplayGPIBError(sts, msg)
    GpibWaveFloat = 1
    Exit Function
End If
eos = &HC0A
sts = ileos(Dev, eos)                           'Terminator = LF
If (sts < 0) Then
    Call DisplayGPIBError(sts, "ileos")
    GpibWaveFloat = 1
    Exit Function
End If
For i = 1 To pntl
    buf = ""
    For j = 1 To 2
        If Left(Right("00" + Hex$(bufv((i * 2) + j)), 4), 2) = "00" Then
            buf = buf + Right("00" + Hex$(bufv((i * 2) + j)), 4)
        ElseIf Left(Right("0" + Hex$(bufv((i * 2) + j)), 4), 1) = "0" Then
            buf = buf + Right("0" + Hex$(bufv((i * 2) + j)), 4)
        Else
            buf = buf + Hex$(bufv(2 + ((i - 1) * 2) + j))
        End If
    Next j
    all = Mid(buf, 3, 2) + Mid(buf, 1, 2) + Mid(buf, 7, 2) + Mid(buf, 5, 2)
    For k = 1 To 8
        a(k) = Mid$(all, k, 1)
        If a(k) = "0" Then b(k) = "0000"
        If a(k) = "1" Then b(k) = "0001"
        If a(k) = "2" Then b(k) = "0010"
        If a(k) = "3" Then b(k) = "0011"
        If a(k) = "4" Then b(k) = "0100"
        If a(k) = "5" Then b(k) = "0101"
        If a(k) = "6" Then b(k) = "0110"
        If a(k) = "7" Then b(k) = "0111"
        If a(k) = "8" Then b(k) = "1000"
        If a(k) = "9" Then b(k) = "1001"
        If a(k) = "A" Then b(k) = "1010"
        If a(k) = "B" Then b(k) = "1011"
        If a(k) = "C" Then b(k) = "1100"
        If a(k) = "D" Then b(k) = "1101"
```

```
            If a(k) = "E" Then b(k) = "1110"
            If a(k) = "F" Then b(k) = "1111"
        Next k
        allb = b(1) + b(2) + b(3) + b(4) + b(5) + b(6) + b(7) + b(8)
        vale = 0
        valf = 0
        valu = Val(Left$(allb, 1))
        stre = Mid$(allb, 2, 8)
        For l = 0 To 7
            vale = vale + (2 ^ l) * Val(Mid$(stre, (8 - l), 1))
        Next l
        w = Mid$(allb, 10, 23)
        For m = 1 To 23
            valf = valf + (2 ^ (-m)) * Val(Mid$(w, m, 1))
        Next m
        If (vale = 0) Then valf = 0 Else: valf = valf + 1
        flo = ((-1) ^ valu) * (2 ^ (vale - 127)) * valf
        If i < 10 Then
            List1.AddItem CStr(i) + "     " + CStr(flo)
        ElseIf i < 100 Then
            List1.AddItem CStr(i) + "    " + CStr(flo)
        ElseIf i < 1000 Then
            List1.AddItem CStr(i) + "   " + CStr(flo)
        Else
            List1.AddItem CStr(i) + "  " + CStr(flo)
        End If
        List1.ListIndex = List1.ListIndex + 1
        qry = Space$(200)
        Dummy = DoEvents()
    Next i
    Call ibonl(Dev, 0)
    GpibWaveFloat = 0
End Function
```

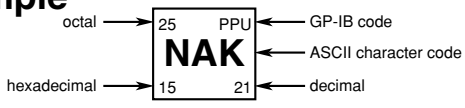


Appendix 1 ASCII Character Code

ASCII character codes are given

	0	1	2	3	4	5	6	7
0	0 NUL 0 0	20 DEL 10 16	40 0 SP 20 32	60 16 0 30 48	100 0 @ 40 64	120 16 P 50 80	140 0 ‘ 60 96	160 16 p 70 112
1	1 GTL SOH 1 1	21 LLO DC1 11 17	41 1 ! 21 33	61 17 1 31 49	101 1 A 41 65	121 17 Q 51 81	141 1 a 61 97	161 17 q 71 113
2	2 STX 2 2	22 DC2 12 18	42 2 ” 22 34	62 18 2 32 50	102 2 B 42 66	122 18 R 52 82	142 2 b 62 98	162 18 r 72 114
3	3 ETX 3 3	23 DC3 13 19	43 3 # 23 35	63 19 3 33 51	103 3 C 43 67	123 19 S 53 83	143 3 c 63 99	163 19 s 73 115
4	4 SDC EOT 4 4	24 DCL DC4 14 20	44 4 $ 24 36	64 20 4 34 52	104 4 D 44 68	124 20 T 54 84	144 4 d 64 100	164 20 t 74 116
5	5 PPC ENQ 5 5	25 PPU NAK 15 21	45 5 % 25 37	65 21 5 35 53	105 5 E 45 69	125 21 U 55 85	145 5 e 65 101	165 21 u 75 117
6	6 ACK 6 6	26 SYN 16 22	46 6 & 26 38	66 22 6 36 54	106 6 F 46 70	126 22 V 56 86	146 6 f 66 102	166 22 v 76 118
7	7 BEL 7 7	27 ETB 17 23	47 7 ’ 27 39	67 23 7 37 55	107 7 G 47 71	127 23 W 57 87	147 7 g 67 103	167 23 w 77 119
8	10 GET BS 8 8	30 SPE CAN 18 24	50 8 (28 40	70 24 8 38 56	110 8 H 48 72	130 24 X 58 88	150 8 h 68 104	170 24 x 78 120
9	11 TCT HT 9 9	31 SPD EM 19 25	51 9) 29 41	71 25 9 39 57	111 9 I 49 73	131 25 Y 59 89	151 9 i 69 105	171 25 y 79 121
A	12 LF A 10	32 SUB 1A 26	52 10 * 2A 42	72 26 : 3A 58	112 10 J 4A 74	132 26 Z 5A 90	152 10 j 6A 106	172 26 z 7A 122
B	13 VT B 11	33 ESC 1B 27	53 11 + 2B 43	73 27 ; 3B 59	113 11 K 4B 75	133 27 [5B 91	153 11 k 6B 107	173 27 { 7B 123
C	14 FF C 12	34 FS 1C 28	54 12 , 2C 44	74 28 < 3C 60	114 12 L 4C 76	134 28 \ 5C 92	154 12 l 6C 108	174 28 | 7C 124
D	15 CR D 13	35 GS 1D 29	55 13 - 2D 45	75 29 = 3D 61	115 13 M 4D 77	135 29] 5D 93	155 13 m 6D 109	175 29 } 7D 125
E	16 SO E 14	36 RS 1E 30	56 14 . 2E 46	76 30 > 3E 62	116 14 N 4E 78	136 30 ^ 5E 94	156 14 n 6E 110	176 30 ~ 7E 126
F	17 SI F 15	37 US 1F 31	57 15 / 2F 47	77 UNL ? 3F 63	117 15 O 4F 79	137 UNT _ 5F 95	157 15 o 6F 111	177 DEL (RUBOUT) 7F 127
	Address Command	**Universal Command**	**Listener Address**		**Talker Address**		**Secondary Command**	

Example



Appendix 2 Error Messages

Error messages related to communications are given below.

- The instrument allows error messages to be displayed in either Japanese or English, however, they are shown only in English when they are displayed on a personal computer.
- When servicing is required, contact your nearest YOKOGAWA dealer.
- Only error messages relating to communications are given. For other error messages, refer to the User's Manual IM 760151-01E.

Errors in communication command (100 to 199)

Code	Message	Action	Reference Page
102	Syntax error	Incorrect syntax.	Chapter 4, 5
103	Invalid separator	Insert a comma between data items to separate them.	4-1
104	Data type error	Refer to pages 4-5 to 4-6 and enter using the correct data format.	4-5 to 4-6
108	Parameter not allowed	Check the number of parameters.	4-5, Chapter 5
109	Missing parameter	Enter required parameters.	4-5, Chapter 5
111	Header separator error	Insert a space between header and data to separate them.	4-1
112	Program mnemonic too long	Check the mnemonic (a character string consisting of letters and numbers).	Chapter 5
113	Undefined header	Check the header.	Chapter 5
114	Header suffix out of range	Check the header.	Chapter 5
120	Numeric data error	Numeric value must be entered for <NRf> format.	4-5
123	Exponent too large	Use a smaller exponent for <NR3> format.	4-5, Chapter 5
124	Too many digits	Limit the number of digits to 255 or less.	4-5, Chapter 5
128	Numeric data not allowed	Enter in a format other than <NRf> format.	4-5, Chapter 5
131	Invalid suffix	Check the unit for <Voltage>, <Time> and <Frequency>.	4-5
134	Suffix too long	Check the units for <Voltage>, <Time> and <Frequency>.	4-5
138	Suffix not allowed	No units are allowed other than <Voltage>, <Time>	4-5
		and <Frequency>.	
141	Invalid character data	Enter one of the character strings in {...|...|...}.	Chapter 5
144	Character data too long	Check the character strings in {...|...|...}.	Chapter 5
148	Character data not allowed	Enter in a format other than in {...|...|...}.	Chapter 5
150	String data error	<Character string> must be enclosed by double quotation	4-6
		marks or single quotation marks.	
151	Invalid string data	<Character string> is too long or contains characters	Chapter 5
		which cannot be used.	
158	String data not allowed	Enter in a data format other than <Character string>.	Chapter 5
161	Invalid block data	<Block data> is not allowed.	4-6, Chapter 5
168	Block data not allowed	<Block data> is not allowed.	4-6, Chapter 5
171	Invalid expression	Equation is not allowed.	Chapter 5
178	Expression data not allowed	Equation is not allowed.	Chapter 5
181	Invalid outside macro definition	Does not conform to the macro function specified in IEEE488.2.	—

Error in communications execution (200 to 299)

Code	Message	Action	Reference Page
221	Setting conflict	Check the relevant setting.	Chapter 5
222	Data out of range	Check the setting range.	Chapter 5
223	Too much data	Check the data byte length.	Chapter 5
224	Illegal parameter value	Check the setting range.	Chapter 5
241	Hardware missing	Check availability of options.	—
260	Expression error	Equation is not allowed.	—
270	Macro error	Does not conform to the macro function specified in IEEE488.2.	—
272	Macro execution error	Does not conform to the macro function specified in IEEE488.2.	—
273	Illegal macro label	Does not conform to the macro function specified in IEEE488.2.	—
275	Macro definition too long	Does not conform to the macro function specified in IEEE488.2.	—
276	Macro recursion error	Does not conform to the macro function specified in IEEE488.2.	—
277	Macro redefinition not allowed	Does not conform to the macro function specified in IEEE488.2.	—
278	Macro header not found	Does not conform to the macro function specified in IEEE488.2.	—

Error in communications Query (400 to 499)

Code	Message	Action	Reference Page
410	Query INTERRUPTED	Check transmission/reception order.	4-2
420	Query UNTERMINATED	Check transmission/reception order.	4-2
430	Query DEADLOCKED	Limit the length of the program message including <PMT> to 1024 bytes or less.	4-2
440	Query UNTERMINATED after indefinite response	Do not enter any query after `*IDN?` and `*OPT?`.	—

Error in System Operation (912 to 914)

Code	Message	Action	Reference Page
912	Fatal error in Communications-driver	Servicing is required.	—

Warning

Code	Message	Action	Reference Page
5	`*OPC/?` exists in message	Place the `*OPC` or `*OPC?` at the end of the program message.	—

Other errors (350 and 390)

Code	Message	Action	Reference Page
350	Queue overflow	Read the error queue. Code 350 occurs when the error queue is full up. This message is output only for the `STATus:ERRor?` query and is not displayed on the screen.	6-5
390	Overrun error (only Serial(RS-232))	Execute with a lower baud rate.	—

Note

Code 350 indicates overflow of error queue. This code is returned as a response to the "`STATus:ERRor?`" query; it does not appear on the screen.

App

Appendix

Appendix 3 Overview of IEEE 488.2-1987

The GP-IB interface provided with WT1600FC conforms to IEEE 488.2-1987. This standard requires the following 23 points be stated in this document. This Appendix describes these points.

1 Subsets supported by IEEE 488.1 interface functions
Refer to Section 1.4 “GP-IB Interface Specifications”.

2 Operation of device when the device is assigned to an address other than addresses 0 to 30.
The WT1600FC does not allow assignment to an address other than 0 to 30.

3 Reaction when the user changes the address
The current address is changed when a new address is set using the MISC key. The newly set address is valid until another new address is set.

4 Device set-up at power ON. Commands which can be used at power ON
Basically, the previous settings (i.e. the settings which were valid when power was turned OFF) are valid. All commands are available at power ON.

5 Message transmission options

a Input buffer size
1024 bytes

b Queries which return multiple response messages
Refer to Chapter 5, “Command List”.

c Queries which generate response data during analysis of the syntax
Every query generates a response data when analysis of the syntax is completed.

d Queries which generate response data during reception
No query generates response data when the query is received by the controller.

e Commands consisting of parameters which restrict one other
Refer to Chapter 5, “Command List”.

6 Options included in command function elements and composite header elements
Refer to Chapters 4 and 5.

7 Buffer size which affects transmission of block data
During transmission of block data, the output queue is extended according to the size of the data blocks.

8 List of program data elements which can be used in equations, and nesting limit
No equations can be used.

9 Syntax of response to queries
Refer to the description of the commands given in Chapter 5.

10 Communications between devices which do not follow the response syntax
No communications between devices.

11 Size of data block of response data
1 to 308922 bytes

12 List of supported common commands
Refer to Section 5.20 “Common Command Group”.

13 Condition of device when calibration is successfully completed
Same as the one under which measurements are performed

14 Maximum length of block data which can be used for definition of `*DDT` trigger macro
Not supported

15 Maximum length of macro label used in definition of macro, maximum length of block data which can be used for definition of macro, processing when recursion is used in definition of macro
Macro functions are not supported.

16 Response to `*IDN?`
Refer to Section 5.20 “Common Command Group”.

17 Size of storage area for protected user data for `PUD` and `*PUD?`
`*PUD` and `*PUD?` are not supported.

18 Length of `*RDT` and `*RDT?` resource name
`*RDT` and `*RDT?` are not supported.

19 Change in status due to `*RST`, `*LRN?`, `*RCL` and `*SAV`
`*RST`
Refer to Section 5.20 “Common Command Group”.
`*LRN?`, `*RCL`, `*SAV`
These commands are not supported.

20 Execution range of self-test using the `*TST?`
All the memory tests (for each internal memory) given in the Self Test menu displayed using the MISC can be executed.

21 Structure of extended return status
Refer to Chapter 6.

22 To find out whether each command is performed in parallel or sequentially
Refer to Section 4.5 “Synchronization with the Controller” and to Chapter 5.

23 Description of execution of each command
Refer to Chapter 5 of this manual and to the User’s Manual IM 760151-01E.

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Command List