2534
Digital Power Meter

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 2534-01E
2nd Edition

INTRODUCTION

Thank you for purchasing the YOKOGAWA Model 2534 Digital Power Meter.
This manual describes the functions and operating procedures of the Model 2534 Digital Power Meter, and the precautions to be observed when in its use. To ensure proper use of your instrument, please read this manual completely before beginning its use.
After reading this manual, take care to keep it available for later use; you will be sure to find useful when questions arise concerning the proper operating procedures.

Notes

- The contents of this manual are subject to change without prior notice.
- Every effort to ensure accuracy has been made in the preparation of this manual. However, if you should notice any errors or omissions, please contact your dealer or YOKOGAWA representative.
- Copying or reproduction by any means of all or any part of the contents of this manual without permission is strictly prohibited.
- MS-DOS is a registered trademark of Microsoft Corporation.
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2nd Edition : October 1992 (YG)

SAFETY PRECAUTIONS

This is a Safety class I instrument (provided with terminal for protective earthing). The following general safety precautions must be observed during all phases of opration, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. **The YOKOGAWA Elecric Corporation assumes no liability for the costomer's failure to comply with these requirements.**

- General difinitions of safety symbols used on equipment and in manuals.

Explanations: To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanations in the instruction manual.

High Voltage Terminal: Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked). Never touch!

Protective Grounding Terminal: To protect against electrical shock in cace of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment. (Where this symbol is not enclosed in a circle, it represents a Function Grounding connection terminal. Such terminals should not be used as a "Protective Grounding Terminal".)

Laser Radiation: This calls attention to a procedure, practice, condition or the like, which — if not correctly performed or adhered to — could result in loss of eyesight or injury to eyes of personnel.
(CLASS 3A)
Do not stare into this beam or VIEW directly with optical instruments.
(CLASS 3B)
Avoid exposure to this beam.

WARNING A WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which if not correctly performed or adhered to, could result in injury or death of personnel.

CAUTION A CAUTION sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part of the product.

WARNING

- **Power Supply**
  Ensure the source voltage matches the voltage of the power supply before turning ON the power.

- **Power Cord and Plug**
  To prevent an electric shock or a fire, be sure to use power supply cord and 3 to 2 pin adapter supplied by YOKOGAWA. Main power plug must be plugged in an outlet with protective grounding terminal only. Do not invalidate protection by using an extension cord without protective grounding.

- **Protective Grounding**
  Make sure to connect the protective grounding to prevent from an electric shock before turning on the power.

- **Necessity of Protective Grounding**
  Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective gorunding ternimal. Doing so poses a potential shock hazard.

- **Fuse**
  To prevent a fire, make sure to use the fuse with specified standard (current, voltage, type). Before replacing the fuse, turn off the power and unplug the power cord. Do not use a different fuse or short-curcuit the fuse holder.

- **Do not Operate in an Explosive Atmosphere**
  Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

- **Do Not Remove Any Covers**
  There are some areas with high voltage. Do not remove the cover if the power supply is connected. The cover should be removed by qualified personnel only.

- **External Connection**
  To ground securely, insert the main power plug before connecting to measurement or control units.

ORGANIZATION OF THIS MANUAL

This user manual consists of Chapters 1 through 13 and an Index, as indicated below.

When using the Model 2534 Digital Power Meter for the first time, you absolutely must read Chapter 1 before beginning operation. This chapter will acquaint you with most of the Model 2534 Digital Power Meter functions, and give you the background needed to understand the operations described in Chapters 4 and after. If you meet with any terminology that you do not understand, use the index to find the proper reference page.

Chapter	Title	Contents
1	**Capabilities of the 2534**	Describes the features, functions, and component names of the Model 2534 Digital Power Meter.
2	**Before Using this Instrument**	Describes items that must be observed before performing measurements, including checks of the package contents, general usage precautions, proper installation/placement, power cord connection, etc.
3	**Wiring**	Describes wiring for connection to the circuit under test.
4	**Measuring Voltage, Current, and Active Power**	Describes operations to measure voltage, current, and active power.
5	**Displaying Results of Apparent Power, Reactive Power, Power Factor, and Phase Angle Computations**	Describes operations to display the computation results for the apparent power, reactive power, power factor, and phase angle.
6	**Integrating Active Power**	Describes settings and operating procedures to integrate the active power.
7	**Measuring Frequency**	Describes operations to measure frequency.
8	**Using External Input/Output Functions**	Describes remote control operation, and operation for analog output of measured or computed data.
9	**Other Functions**	Describes functions to initialize setup information, and functions for backup of setup information when power fails.
10	**Using IC Memory Cards**	Describes operations to initialize an IC memory card, to save data to an IC memory card, and to load data from an IC memory card.

Chapter	Title	Contents
11	Using the Communications Function	Describes operations to use the GP-IB interface or RS-232-C interface for remote control and data output.
12	Troubleshooting and Maintenance	Describes how to find the causes of problems and corrective measures to be taken, and the meanings of error codes displayed, and means for dealing with them. Also describes power fuse replacement procedures and calibration.
13	Specifications	Describes functional and general specifications of the device.

Conventions Used in This Manuals

Symbols Used

The following symbols are used in this manual.

WARNING ... Describes precautions to be observed to prevent danger of injury or death to the user due to electrical shock that may be incurred if these precautions are not obeyed.

CAUTION ... Describes precautions to be observed where there is a risk of damage to the instrument.

Note ... States information that is important for proper operation of the 2534.

CONTENTS

CHAPTER 10. USING THE IC MEMORY CARD

CHAPTER 11. USING THE COMMUNICATIONS FUNCTIONS

CHAPTER 12. TROUBLESHOOTING AND MAINTENANCE

CHAPTER 13. SPECIFICATIONS

Chapter 1

Capabilities of The 2534

This chapter describes the features, functions, and component names of the 2534. All first-time users should read this chapter before beginning to use the instrument. This is important to ensure understanding of the operational descriptions in Chapters 4 and after.

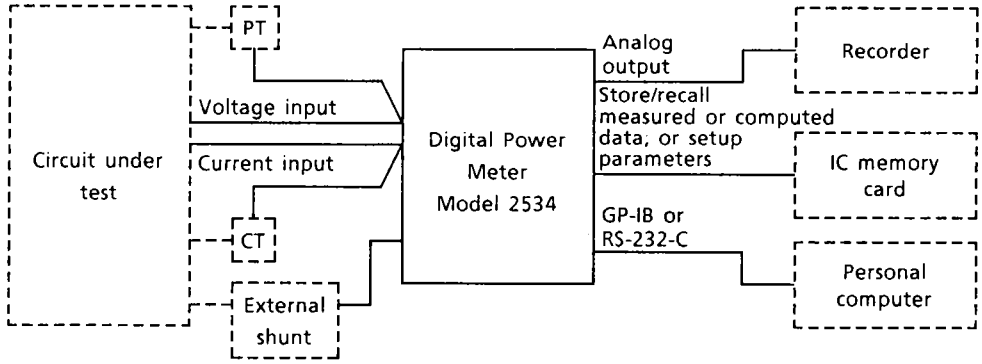
1.1 Features

The 2534 is a compact digital power meter capable of high-accuracy wide-band power measurement at DC and 10Hz to 20kHz.

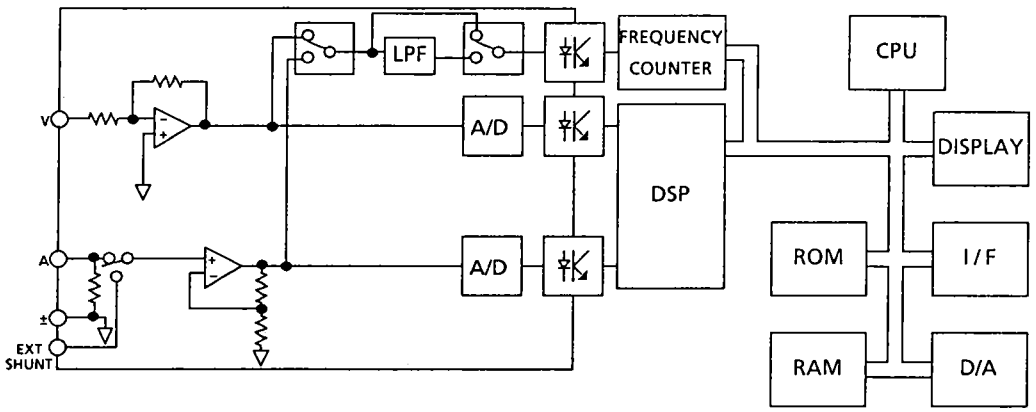
- Use of high-performance shunt resistors in the current input section enable the 2534 to make high-accuracy DC current and power measurements.
- High-speed sample-and-hold circuits and high-speed A/D converters make the 2534 capable of simultaneous sampling of voltage and current inputs for measurements free of timing skew effects.
- In addition to voltage, current, and active power measurement, the 2534 has functions for computing apparent power, reactive power, power factor, phase angle, frequency, and integrated power.
- The 2534 has functions to store measured and computed data to an IC memory card, and functions to recall such data for later display.
- The 2534 can be equipped with a GP-IB interface or RS-232-C interface (options).
- Any single voltage, current, active power, apparent power, reactive power, power factor, frequency, or phase angle data item can be selected for analog output.
- The 2534 includes scaling functions that are very useful when using externally connected potential and/or current transformers.
- A measurement range specifically for use with external shunt resistors is provided for convenience in the use of external shunts.

1.2 System Configuration and Functional Block Diagram

System Configuration



Functional Block Diagram



1.3 Functions

Input Functions

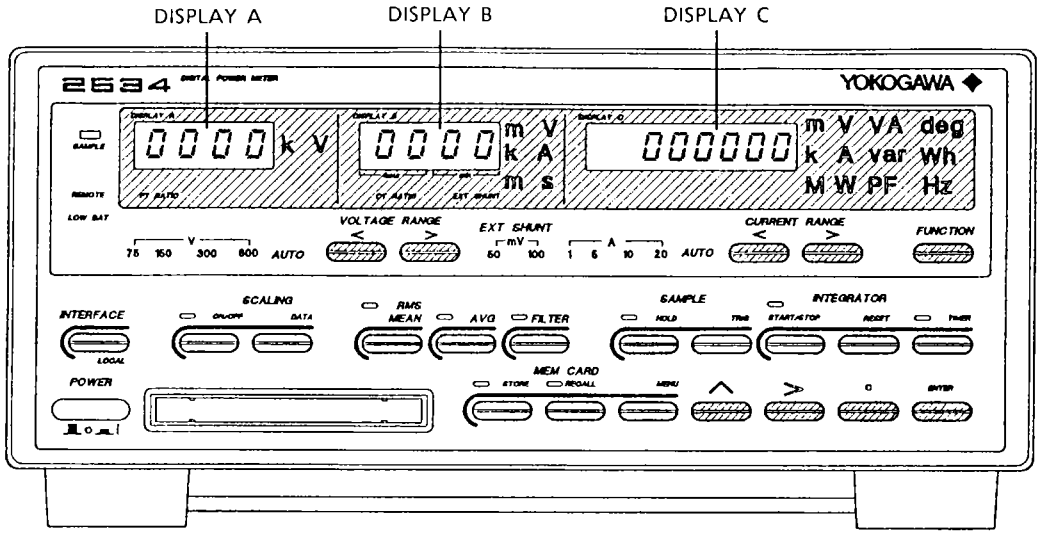
- **Voltage Input Sections and Current Input Sections**
  After level adjustment, the signals from the individual voltage or current inputs are applied to A/D converters which convert them to 12-bit digital signals. These digital signals are passed via photoisolators to the DSP (Digital Signal Processor) and CPU, where all of the measured values are computed.

- **Measurement Frequency Range**
  Power can be measured at DC and over the frequency band from 10Hz to 20kHz.

- **Filter**
  A filter is provided to eliminate higher harmonics when measuring the frequency of signals such as invertor waveforms.

Display Functions

Measured and computed values are indicated on high-brightness red 7-segment LED displays. There are two 4-digit displays to display voltage or current, and one 6-digit display which can be used to display either voltage, current, or active power values, any of the other computed data. Thus three values can be displayed at the same time.



Computing Functions

- The following data can be computed from input voltages and input currents.

Computed Item	Apparent Power VA	Reactive Power var	Power Factor PF	Phase Angle deg
Computational formula	V×A	$\sqrt{(V\times A)^2-W^2}$	W/(V×A)	$\cos^{-1}(W/(V\times A))$

- A scaling function is provided so that, when using a PT, CT, or external shunt, you can set up scaling parameters according to the primary-to-secondary ratio so as to display the measurements in terms of their values on the primary side. When this scaling function is in use, the active power, apparent power, reactive power, and integrated power are all scaled before display.
- An averaging function can be used to perform exponential averaging on the measured values before display in cases when the measured values are not stable.

Active Power Integration Function

Active power integration can be performed. While integration is in progress, the integrated value and elapsed integration time can be simultaneously displayed.

Frequency Measurement Function

The frequency of an input voltage or input current waveform can be measured.
The measurement range is 4Hz to 22kHz.

External Input/Output

The following functions can be performed using input/output signals (contact or logic-level signals) available at the external-control/analog-output connector.

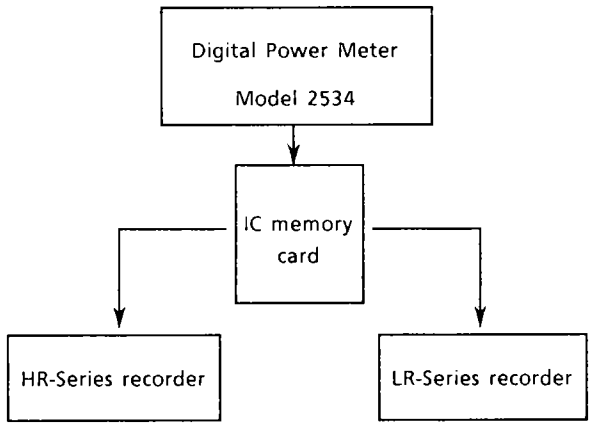
- **$\overline{\text{EXT TRIG}}$ (contact signal or logic-level signal)**
  Forces an update of the displayed values.
- **$\overline{\text{EXT HOLD}}$ (contact signal or logic-level signal)**
  Used to place updating of the displayed values into a hold status, or release the hold status.
- **$\overline{\text{INTEG START}}$ (contact signal or logic-level signal)**
  Starts active power integration.
- **$\overline{\text{INTEG STOP}}$ (contact signal or logic-level signal)**
  Stops active power integration.
- **$\overline{\text{INTEG RESET}}$ (contact signal or logic-level signal)**
  Resets active power integration.
- **$\overline{\text{INTEG BUSY}}$ (contact signal or logic-level signal)**
  Output when active power integration is in progress.
- **D/A (analog signal)**
  Outputs as an analog signal whatever variable is displayed on DISPLAY C (except for integrated power). A trend recording of the measured or computed data can be made by connecting this signal to a recorder (for example, YOKOGAWA's HR-Series or LR-Series recorders).

IC Memory Card

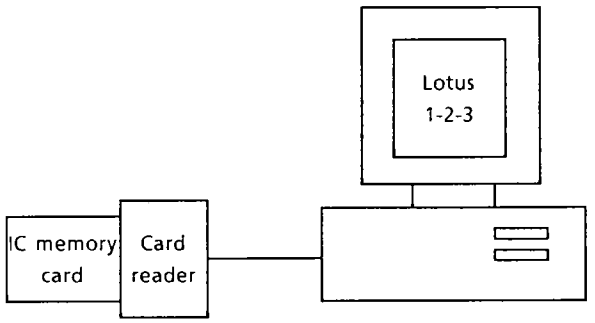
Measured and computed data can be stored to and recalled from IC memory cards.
The setup information entered from the front panel can also be saved and loaded using IC memory cards.

- **Auto Load Function**
  If an IC memory card to which setup information has been saved is present in the IC memory card slot when power to the instrument is turned on, the instrument will automatically load itself with that setup information.

- An IC memory card to which measured and/or computed data has been saved can be inserted into a YOKOGAWA HR-Series or LR-Series recorder to obtain an analog trend recording.



- Using the 1-2-3 MEMORIA* add-in package for Lotus 1-2-3, measured and computed data stored to an IC memory card can be loaded to a personal computer, and input into a Lotus 1-2-3 worksheet.
  * 1-2-3 MEMORIA is a product of YOKOGAWA Digital Computer Co.



Communications Function

A GP-IB interface or RS-232-C interface can be installed as an option. Either of these communications interfaces will enable measured data, computed data, and setup information to be output to a personal computer. They can also be used for remote control of the Model 2534 Digital Power Meter from a personal computer.

Other Convenient Functions

- **Setup Information Initialization Function**
  This function returns the setup information to the initial settings in effect when the device was shipped from the factory.

- **Setup Information Backup Function**
  This function provides temporary backup of setup information (including integrated active power values) when power is temporarily interrupted because of a power failure or other cause.

1.4 Component Names and Functions

This section describes the names and function of the components on the front and rear panels of the 2534.

The page number to the right of each key name indicates the page on which the operations associated with that key are described.
Keys and components whose descriptions are shaded gray will be referred to as being in the "gray zone." All others will be referred to as being in the "white zone."
The gray zone indicates those keys that control the basic operation of the 2534; the white zone indicates those keys that control various application features of the 2534.

Front Panel

selection keys

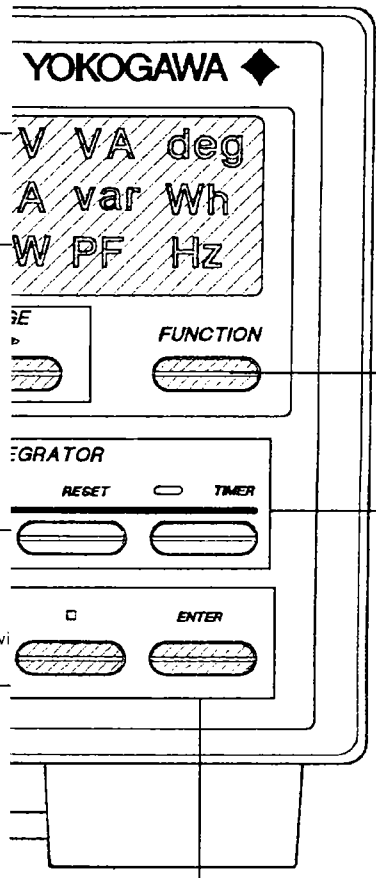
urrent range from
ɜr.
urrent range from
ɜr.

FUNCTION keys [See page 4-4]
Selects which measured or computed variable to display (function).
V : To display voltage
A : To display current
W : To display active power
VA : To display apparent power
var : To display reactive power
PF : To display power factor
deg : To display phase angle
Wh : To display integrated power
Hz : To display frequency

SAMPLE indicator LED
Flashes at the sample rate (0.25 seconds). When hold mode is selected using the sample mode key, this LED will be off. If the TRIG key is pressed when the instrument is in hold mode, this LED will flash once (see page 4-7).

REMOTE indicator LED
Lights when the instrument is in remote status, controlled via communications.

LOW BAT indicator LED
[See page 10-19]
Lights when an IC memory card is inserted if the IC memory card battery voltage is below the rated value.



INTERFACE/LOCAL key [See page 11-5]
Press to perform setup for the communications interface. If 2534 is operating in remote status under communication control, pressing this key wi enable local operation via the panel keys.

INTEGRATOR keys [See page 6-2]
START/STOP key: Starts or stops integration. LED is on while integration is in progress.
RESET key : Resets the integrated data. This key is enabled only when integration is stopped.
TIMER key : Sets the integration time.

POWER switch

IC memory card slot

Numeric value setting keys
Used to select parameters to be set, and to set their values.
Λ key : Changes the currently selected digit or the menu item selection on the display.
> key : Shifts the digit position being set.
. (decimal point) key : Shifts the decimal point position.
ENTER key: Enters a numeric value setting, or places a setup parameter menu selection into effect.

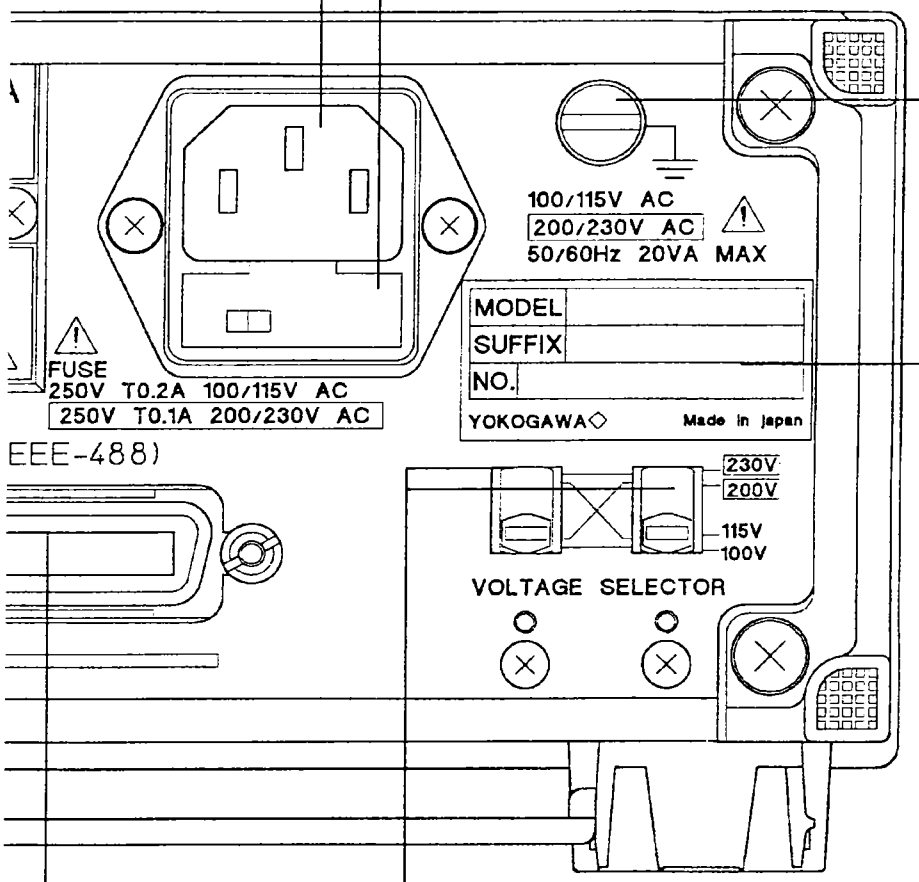
AMPLE mode keys [See page 4-7]
witches display update between free-run
nd hold modes.
OLD key: Press to hold the displayed values.
When power integration is in progress, pressing this key holds the display but integration continues.
RIG key : Press to update the measured values when in hold status.

SCALING keys [See page 4-9]
ON/OFF key: Turns the scaling function ON and OFF.
DATA key : Sets the scaling constant.
LED lights when the scaling function is ON.

inal
easurement
n source side of

Power connector
3-pin connector providing connection for protective ground.
Connect the supplied power cord here.
A proper connection to protective ground is absolutely necessary to prevent electrical shock.

Power fuse holder
Use fuse rated at 250V, 200mA for 100/115VAC operation; use fuse rated at 250V, 100mA for 200/230VAC operation.
A spare fuse is provided in the holder.

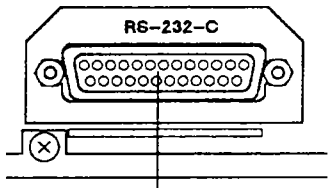


Function ground terminal
This ground terminal cannot be used as protective ground terminal.
Use this terminal for grounding for the functional purpose.

Name plate

EEE-488)

wer supply voltage selection
itches
e voltage can be changed using these two
tches. See page 2-8 for switch combinations
f cautionary notes.



RS-232-C connector
RS-232-C cable connection for communications via RS-232-C interface.

Chapter 2

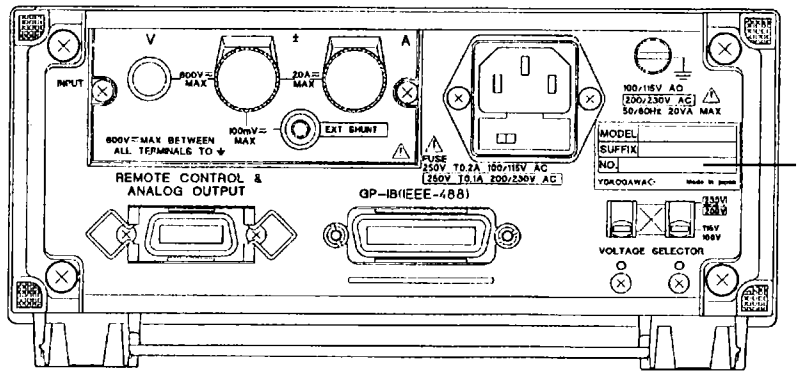
Before Using This Instrument

This chapter describes actions that must be done before performing any measurements, such as checking the package contents on delivery, reviewing general usage precautions, physical installation, and power cord and interface cable connections. Be sure to read this chapter thoroughly before using the instrument, since it includes a comprehensive summary of the safety precautions that must be observed when using the 2534.

2.1 Checking Package Contents

After opening the shipping carton and before beginning to install the instrument, check the contents of the shipping carton. If any item is missing or visibly damaged, inform your sales representative. Please indicate the model and the serial number in all correspondence.

- **Checking Model and Specifications of the 2534**
  The model code, suffix codes, and serial number of the instrument are inscribed on a rear panel name plate (see figure below). Check the model and suffix codes against the tables below to verify that the specifications exactly match those of your order.



- **Models**

Model	Basic Specifications
2534 10	Capable of single phase 2-wire measurement

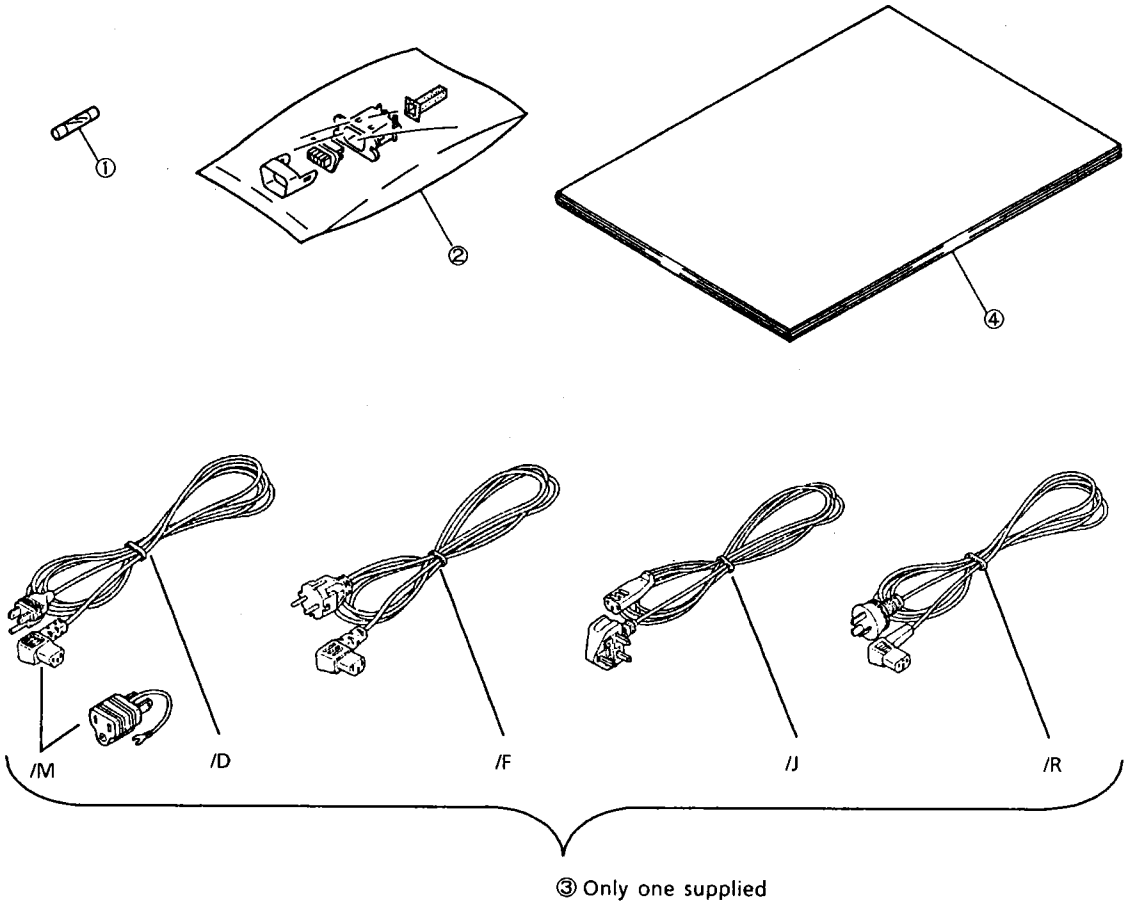
- **Suffix Codes**

Suffix Code	Specifications
-A	Version
-1	Rated supply voltage setting: 100VAC
-3	Rated supply voltage setting: 115VAC
-5	Rated supply voltage setting: 200VAC
-7	Rated supply voltage setting: 230VAC
/D	UL/CSA standard power cord (Rating: 125VAC, 7A) (Part number: A1006WD)
/F	VDE standard power cord (Rating: 250VAC, 10A) (Part number: A1009WD)
/R	SAA standard power cord (Rating: 240VAC, 10A) (Part number: A1024WD)
/J	BS standard power cord (Rating: 250VAC, 5A) (Part number: A1023WD)
/M	UL/CSA standard power cord +3-pin to 2-pin adapter (Part number: A1253JZ)
/C1	GP-IB interface
/C2	RS-232-C interface

• Check Accessories

The following accessories are supplied with the 2534.

Number	Name		Part Number	Quantity	Remarks
①	Power fuse	For 100V range systems	A1343EF	1	• Should match the rated supply voltage specified by the suffix code (250V, 200mA time-lag fuse, for 100V range systems; 250V, 100mA time-lag fuse, for 200V range systems). • The spare fuse is stored inside the power fuse holder on the rear panel.
		For 200V range systems	A1341EF		
②	Remote control connector		A1003JD	1	Connector for use on the cable to be connected to the remote-control/analog-output connector.
③	Power cord (+3-pin to 2-pin adapter if applicable)		Indicated on preceding page	1	Type of cord is specified by suffix code.
④	User's manual		IM 2534-01E	1	This manual

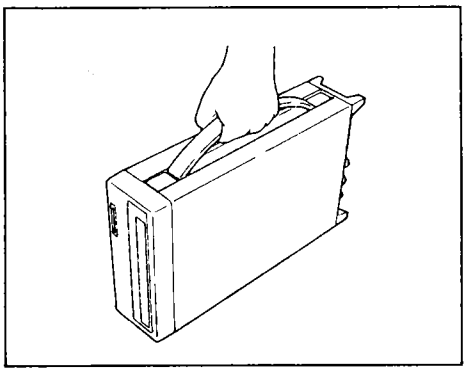


2.2 Safety and Operating Precautions

General Precautions

The following precautions must be taken to ensure safe and proper operation of the instrument.

- Never place anything on top of the 2534.
  - Never place any container holding water on top of the instrument. Entry of water into the 2534 case may result in damage to the instrument.
- Observe the following precautions when carrying or transporting the 2534.
  - Disconnect the power cord and all connecting cables before moving the instrument.
  - Always lift and carry the 2534 by its handles, as shown in the figure below.



- To prevent excessive internal temperature rise, be careful not to block the ventilation openings in the instrument case.
- Do not bring any object carrying an electrostatic charge near the input terminals. Damage to the input circuits may result.
- Never allow volatile or organic solvents to contact the case or operating panel. Also never allow rubber, vinyl, or other such materials to remain in contact with the case or operating panel for an extended time. Damage to the instrument may result.
- The operating panel is of thermoplastic resin. Take care not to allow soldering iron tips or other such hot objects to touch the panel.
- Whenever you do not intend to use the instrument for an extended period of time, unplug the power cord from the AC power receptacle.

Safety Precautions

- Never remove the case of the 2534.
  - The interior contains high voltage points which are very dangerous.
  - For internal inspection and adjustment, contact your sales representative or the nearest YOKOGAWA representative.
- If your 2534 ever shows any indirect sign of malfunction such as emitting smoke or a bad odor, immediately turn the power switch OFF, and unplug the power cord from the AC power receptacle. Also cut power to any circuit under test that is connected to the input terminals.
  - If such a problem occurs, contact your sales representative or the nearest YOKOGAWA representative.
- Unlike earlier YOKOGAWA power meters (2532, 2533, etc.), the 2534 uses a three-terminal system in which there is no isolation between the voltage input terminals and the current input terminals. Thus, it is important to read the precautions given in **Chapter 3, "WIRING" (See page 3-1 to 3-6)** with great care before making any wiring connections.
- Never place any object on top of the power cord. Never let the power cord come into contact with any hot object.
  - If the power cord is damaged, contact your sales representative or the nearest YOKOGAWA representative.
- When disconnecting the power cord from the AC power receptacle, always grip the plug; never pull on the cord itself.

Storage Locations

Never store the 2534 in a location where any of the following conditions is or may be present:

- High humidity of 75% or more relative humidity
- Exposed to direct sunlight
- High temperatures of 40°C or above
- Near any high-temperature heat source
- Subject to severe vibration
- Corrosive or combustible gasses
- Large amounts of dust, dirt, salt particles, or iron filings
- Airborne spray or mist of water, oil, or chemicals

2.3 Installation and Location Selection

Installation Conditions

Install the instrument in a location that meets the following requirements.

- **Ambient Temperature and Ambient Humidity within the Following Ranges**
  - Ambient temperature: 5 to 40°C
  - Ambient humidity : 20% to 80% R.H. (non-condensing)
- **Good Ventilation**
  - There are ventilation openings in the top and bottom of the 2534. To prevent excessive internal temperature rise, be careful not to block these ventilation openings.

Note

- For most accurate measurement, the instrument location should meet the following conditions:
  Ambient temperature : 23 ± 3°C
  Ambient humidity : 45% to 75% R.H. (non-condensing)
  When using the 2534 in a temperature range of 5 to 20°C or 26 to 40°C, apply the measured value temperature coefficient indicated in Chapter 13, "SPECIFICATIONS" (page 13-3).
- If installing the 2534 in a location with an ambient humidity of 30% or below, use an anti-static mat and other measures to prevent generation of static electric charges.
- If you move the instrument from a location where temperature or humidity is low to one where they are high, condensation may form internally due to the sudden change in ambient temperature. In such cases, let the instrument acclimate to the new ambient temperature for at least one hour before using.

Avoid Installing the Instrument in the Following Types of Locations

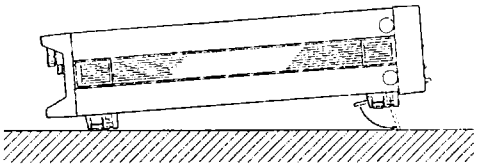
- **In Direct Sunlight or Near a Heat Source**
  - Installing the instrument in direct sunlight or near a heat source will have a deleterious effect on the internal circuits and case. Locate the instrument so as to minimize temperature variations.
- **Where Large Amounts of Soot, Steam, Dust, or Corrosive Gases are Present**
  - The presence of soot, steam, dust, or corrosive gases may cause damage or corrosion.
- **Near Magnetic Field Sources**
  - If the 2534 is used near any source of strong magnetic fields, the field may adversely affect the internal circuits of the instrument.
- **Near High Voltage Equipment or Power Lines**
  - To improve resistance to noise, do not locate the 2534 near noise sources such as high voltage equipment or power lines.
- **Where High Levels of Mechanical Vibration are Present**
  - Installing the 2534 in a location subject to high mechanical vibration levels will have a deleterious effect on the component parts, and may make accurate measurement impossible.
- **In an Unstable Location**
  - Using the 2534 in an location with unstable conditions may interfere with accurate measurement.

Installation Position

- **Bench Top**

  Place the instrument either horizontal or tilted at an angle using the stand as shown in the figure below.

  When using the stand, pull it out until it is perpendicular to the bottom of the instrument. When not using the stand, press it in and return it to its original position.



- **Rack Mount**

  To rack mount the 2534, use the rack mounting kit, sold separately.

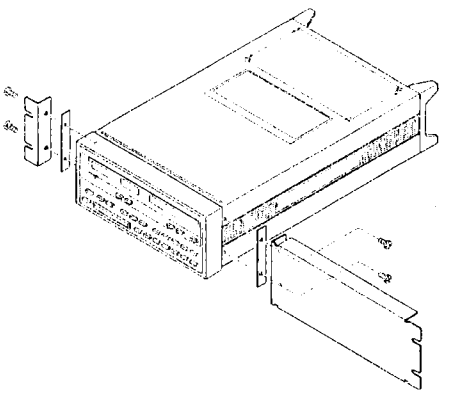
  · **Rack Mounting Kit Model Codes (Sold Separately)**

Name	Model	Standard	Specification
Rack mounting kit	7515 01	EIA	Single mounting type
Rack mounting kit	7515 02	EIA	Double mounting type
Rack mounting kit	7515 03	JIS	Single mounting type
Rack mounting kit	7515 04	JIS	Double mounting type

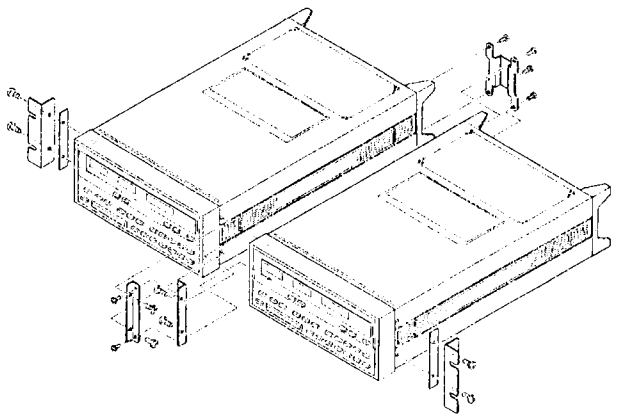
  · **Mounting Procedure**

  1. Remove the seals on the rack mounting holes on both sides of the instrument.
  2. Install the rack mounting kit hardware as shown in the figure below.
  3. Remove the four legs on the bottom of the instrument.
  4. Mount the instrument in the rack.
     - When mounting the instrument in the rack, be sure to provide support from below.
     - **See page 13-7** for rack mounting dimensions.

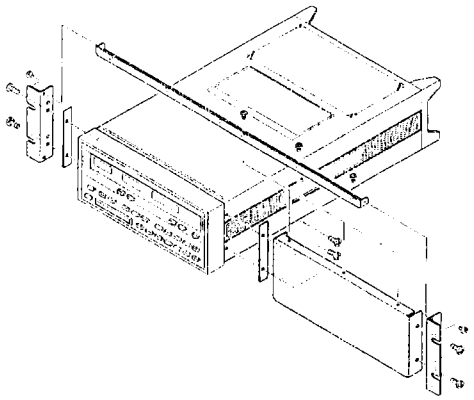
  • EIA Rack (Single mounting type)



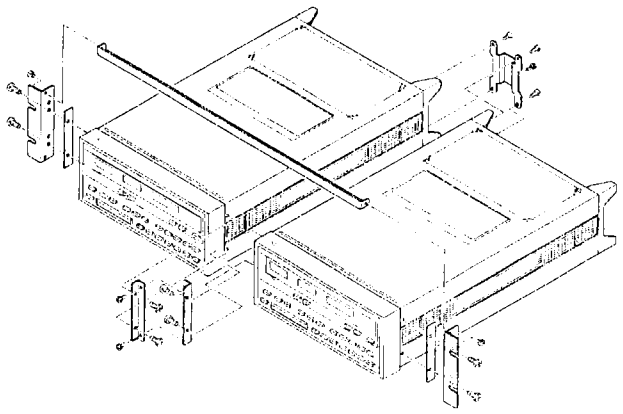
- EIA Rack (Double mounting type)



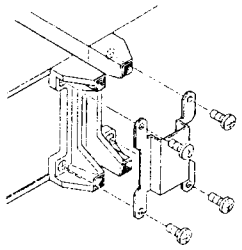
- JIS Rack (Single mounting type)



- JIS Rack (Double mounting type)



- Install the rack mounting kit hardware for double mounting as shown in the figure below.



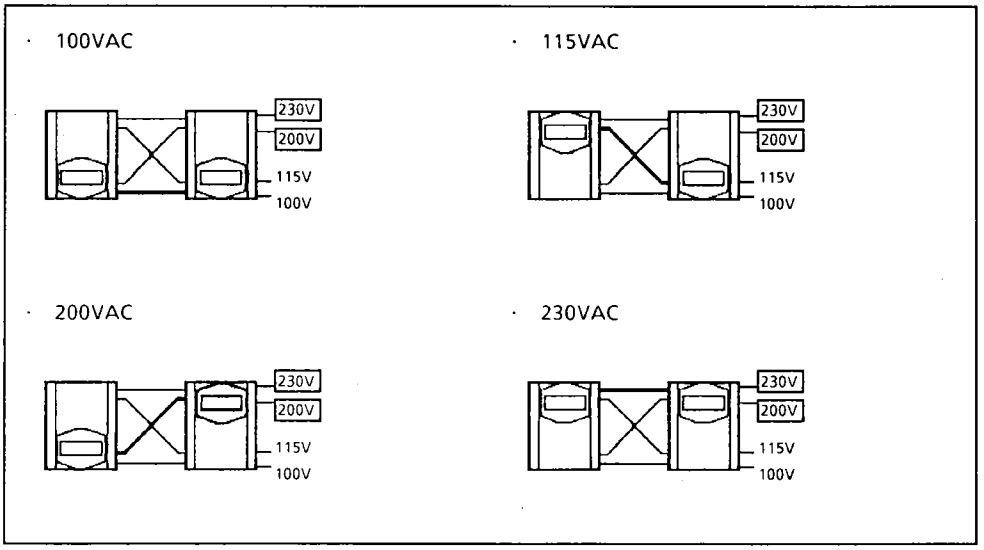
2.4 Power Supply Connections

Power Supply Requirements and Supply Voltage Selection Switch Position Check

- The 2534 can be used with the following four types of AC power supplies.

Rated Supply Voltage	100VAC	115VAC	200VAC	230VAC
Allowable Range of Supply Voltage Variation	±10% of rated supply voltage			
Rated Power Frequency	50/60Hz			
Power Frequency Variation Range	48 to 63Hz			

- **Checking the Supply Voltage Selection Switch Settings**
  Check that the power voltage selections switches on the rear panel are properly set for the cord specified when ordering (rated supply voltage setting). If this is different from the supply voltage being used, change to the correct setting.

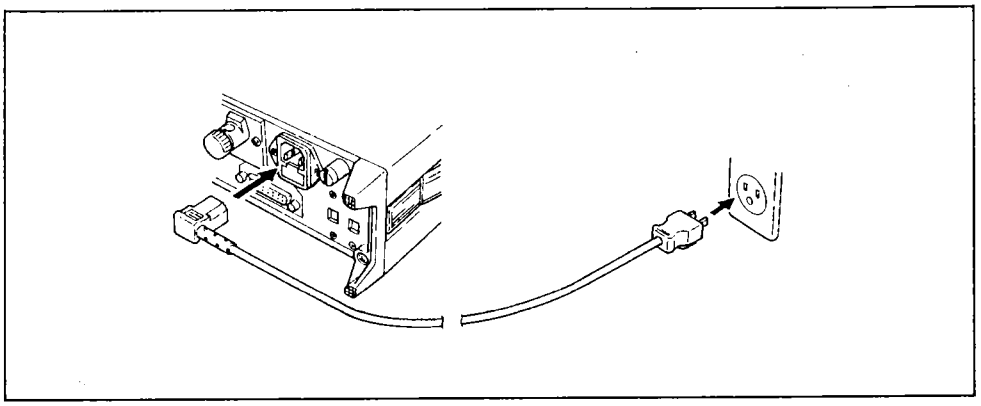


Caution

- If you change the setting with which the instrument was shipped, check that power fuse and power cord being used are appropriate for the newly selected voltage before using the 2534.
- Refer to Section 12.3, "Replacing the Fuse" (page 12-7), when checking the power fuse being used.
- Refer to the ratings given in the suffix code table in Section 2.1, "Checking Package Contents" (page 2-2), when checking the power cord being used.

Connecting the Power Cord

1. Check that the power switch at the lower left of the front panel of the 2534 is OFF.
2. Connect the power cord supplied with the unit to the power connector on the rear panel of the 2534.
3. Connect the power cord to a receptacle that meets the following requirements.



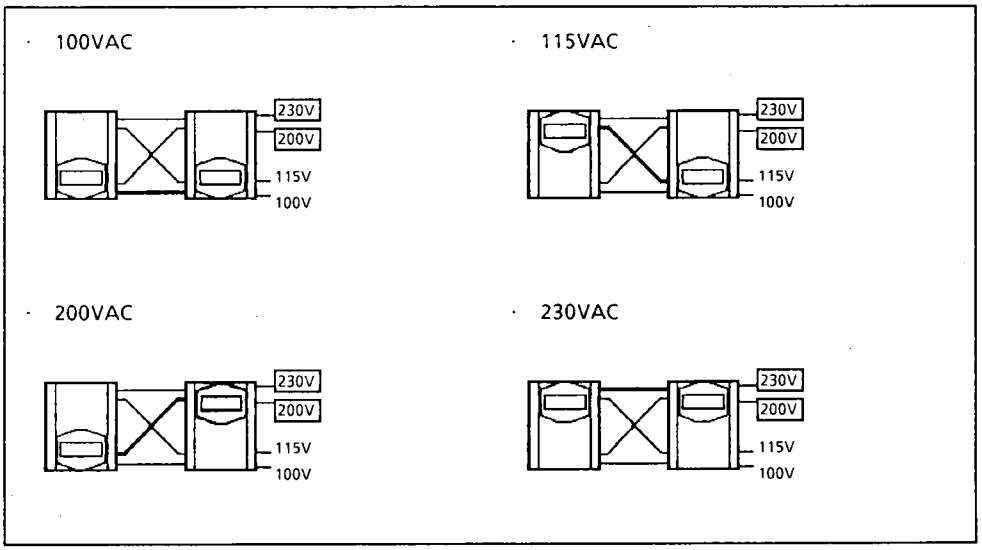
⚠ Warning

- If the outlet does not have a protective ground terminal, provide a separate connection to an earth ground having no more than 100Ω maximum resistance to ground.
- Before plugging in the power cord, check that the supply voltage is within the range indicated on the previous page.
- The protective function of the power cord will be nullified if a extension cord is used that does not have a third protective ground wire.

2.5 Turning Power ON or OFF

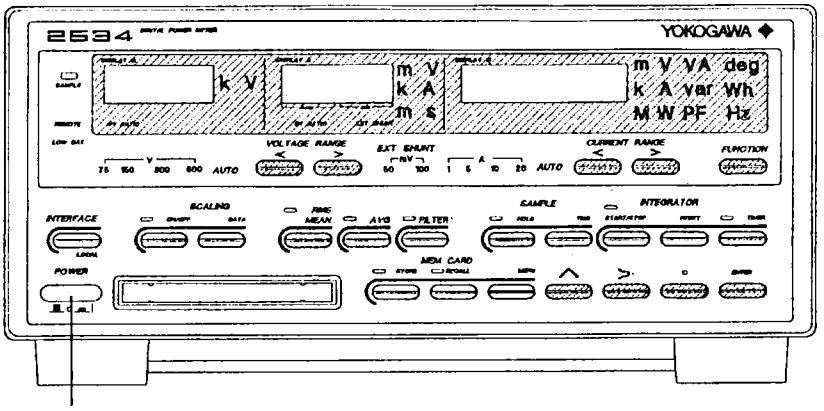
Checks to Perform Before Turning Power ON

- Refer to **Section 2.3, "Installation and Location Selection" (page 2-6)**, to verify that the 2534 is correctly installed.
- Verify that the voltage of the power supply being used matches the voltage set at the supply voltage selection switches.



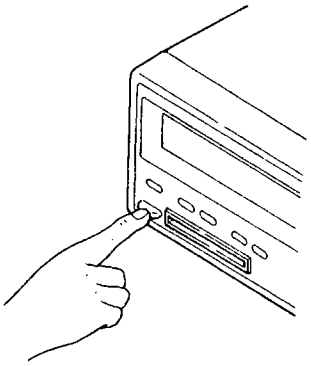
Power Switch Location

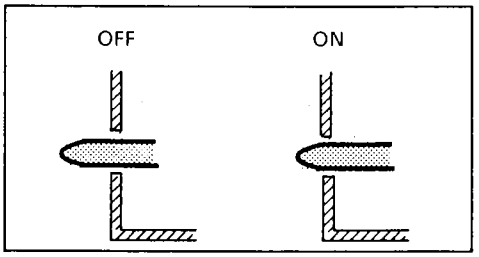
The power switch is located at the lower left of the front panel.



Power Switch ON/OFF Operation

The power switch is a pushbutton; press the switch once to turn power ON and a second time to turn power OFF.





Note

- Although the 2534 has a function that provides temporary backup during power outages for the setup information entered from the operating panel, this feature will not retain the setup information for an extended period. Thus, if you wish to later restore at power-on the operating panel setup in effect when power is turned off, you should first save that setup to an IC memory card, and then insert that IC memory card into the card slot before power is turned on. At power-on, the auto load function will automatically reload the setup information saved to the IC memory card.
- See Section 9.2, "Setup Information Backup Function" (page 9-3) concerning the function that backs up setup information during power outages.
- Warm-up time until all specifications are satisfied is approximately 30 minutes.

Power-On Operations and Display

Turning the power switch ON starts an internal test program. This test program performs various memory checks and other tests. If all checks are normal in the test program, the opening message shown in the following page is displayed, and the instrument goes to measurement mode.

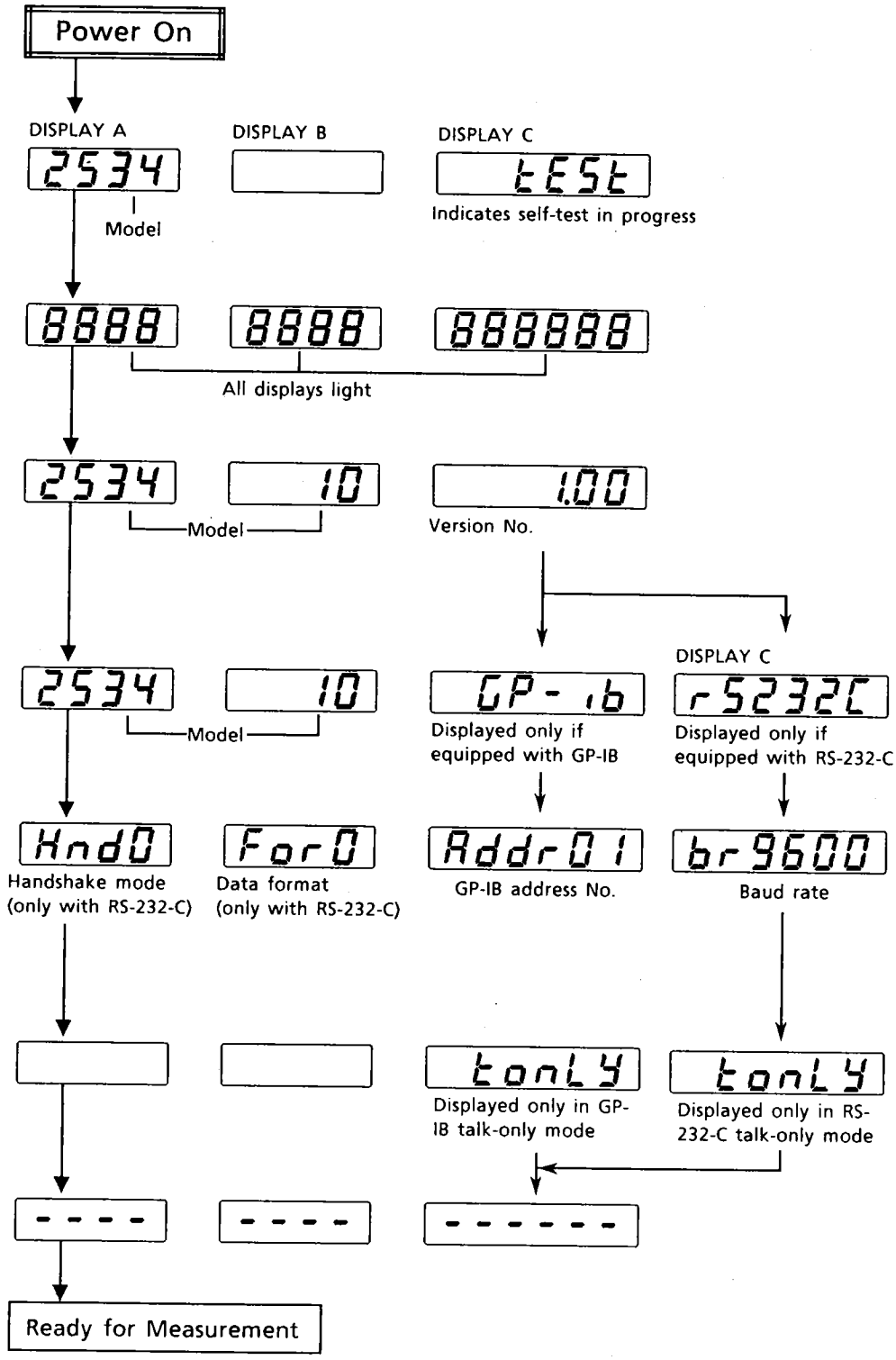
- If any of the following error codes remains on display after the test program is completed, the 2534 is not operating normally. In this case, immediately turn power off, and contact your YOKOGAWA representative listed on the back of this manual. Indicate the model and serial number inscribed on the name plate on the rear panel of the instrument, as well as the error code that was displayed.

Err61	Err62	Err70	Err71	Err80	Err85	Err87	Err88	Err89

Note

- If any error code other than those listed above is displayed, check the nature of the error in Section 12.2., "Error Codes and Corrective Actions" (page 12-3), and handle the error.
- The auto load function is activated whenever power is turned on with an IC memory card present in the slot. If setup information has been saved to the IC memory card, it is loaded automatically; if there is no setup information on the IC memory card, none can be loaded, and error code "Err32" is displayed. If this message is displayed, the setup returns either to the settings in effect before power went off, or to the standard initial setup, just as if no IC memory card were inserted. The initial setup is used only if the power-off duration was too long for the backup function to preserve the setup information, and in this case error code "Err60" is displayed. If an IC memory card that has not been initialized is inserted, error code "Err31" is displayed.

• **Opening Messages**



Chapter 3

Wiring

Chapter 3 describes the wiring connections to be used for each of the carious possible forms of circuit under test.

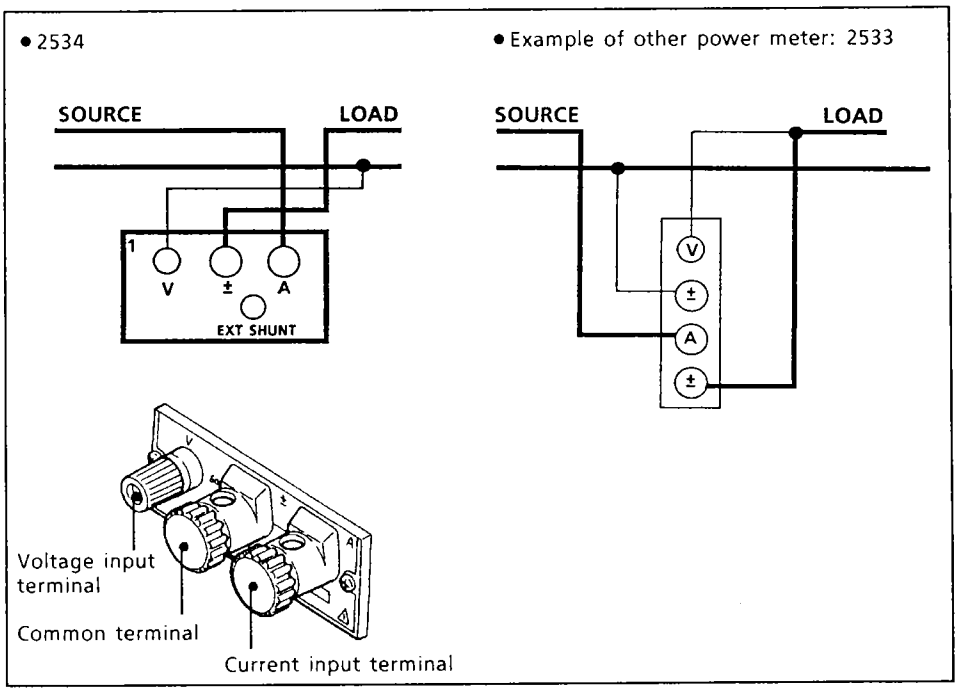
3.1 Precautions to Observe When Wiring

This section describes precautions which should be observed with particular care when wiring to the circuit under test.

⚠ Warning

- To prevent danger of electrical shock, a protective ground connection absolutely must be made by the following procedure before connecting any measurement leads.
  The 2534 is supplied with a 3-wire power cord in which the third conductor is a ground wire. Wherever possible, you should connect this power cord to a matching electrical outlet receptacle that will provide a protective ground connection for the grounding prong on the power cord plug. If the outlet does not have a protective ground terminal, provide a separate connection to an earth ground having no more than 100Ω maximum resistance to ground.
- Make absolutely sure that power is off to the circuit under test before connecting it. It is very dangerous to connect or disconnect a measurement leads with power applied to the circuit under test.
- Be very careful not to connect the current circuit to the voltage input terminal or the voltage circuit to the current input terminal. A mistake in making these connections will burn out the 2534, and also poses a danger of personal injury.

Unlike other YOKOGAWA power meters, the 2534 uses a three-terminal system as shown in the figure below. On the 2534, the common voltage input and current input terminal is shared, and there is no isolation between the voltage input and current input terminals. When wiring, be sure to follow the wiring diagrams in Section 3.2 (page 3-4) on the following pages (also inscribed on the top of the 2534).



- Never apply inputs exceeding the following values to the voltage input or current input terminals, no matter whether the power switch is ON or OFF.

	Voltage Input	Current Input
Maximum Instantaneous Input (for one second)	Peak value of three times range or 1,400V, whichever is lower	Peak value of seven times range or 70A, whichever is lower External shunt input range: Peak voltage 5V
Maximum Continuous Input (at 50/60Hz)	Peak value of 1,000V or rms value of two times range, whichever is lower	Peak value of 50A, rms value of 30A, or rms value of three times range, whichever is lowest

- If using an external current transformer (CT), use one with whose withstanding voltage is fully adequate for the measurement voltage (guideline: 2E + 1000, where E is measurement voltage). During use, be extremely careful never to allow the CT secondary to be in an open-circuit condition. An open-circuit on the CT secondary side will generate extremely dangerous high voltages.
- If using the 2534 as a rack mounted instrument, then for safety you should install a switch that will allow all power to the 2534 to be cut from the front of the rack.
- The measurement leads connected to the input terminal should be trimmed so that their ends do not protrude from the terminals. Securely tighten the terminal so that the leads cannot come loose from the terminals. Failure to take these precautions is extremely dangerous, since the likelihood will increase that isolation of the case from circuit under test may be lost, or that a person may accidentally touch a measurement lead conductor.

⚠ Caution

- For the leadwires to be used in wiring connections, use wires with adequate margin in withstanding voltage and current carrying capacity for the voltage and current to be measured, and with high-voltage insulation resistance appropriate to the applicable standards and ratings.
  Example: If measuring at 600V and 20A, use copper wires with a conductor cross-sectional area of 5.5mm^2 minimum.

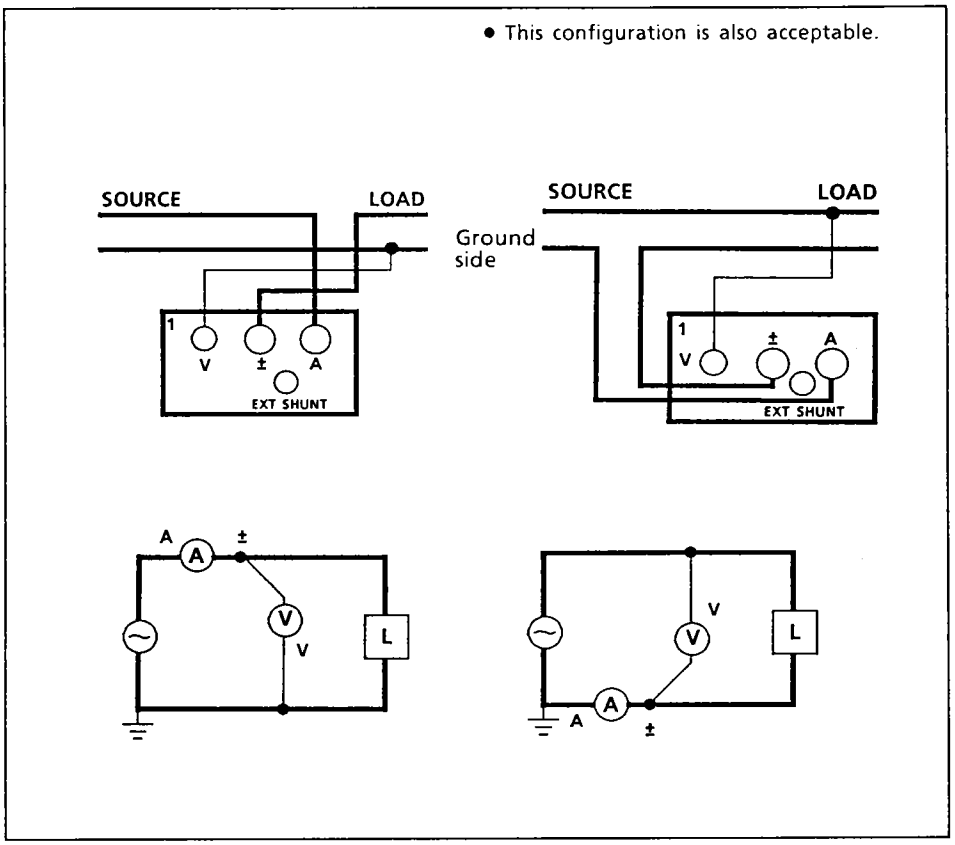
Note

- When measuring high currents, or currents or voltages that contain high-frequency components, pay adequate attention to countermeasures against mutual interference and noise when wiring.
- Keep the leadwires used as short as possible.
- In the wiring diagrams shown in Section 3.2 on the pages that follow, always use heavy leadwires for the current circuits indicated by the thick lines.
- The leadwire from the voltage input terminal should be connected to the circuit under test as near as possible to the load.
- In order to minimize stray capacitance to ground, route the leadwires so as to maintain the greatest possible separation from the ground wire and from the case of the 2534.

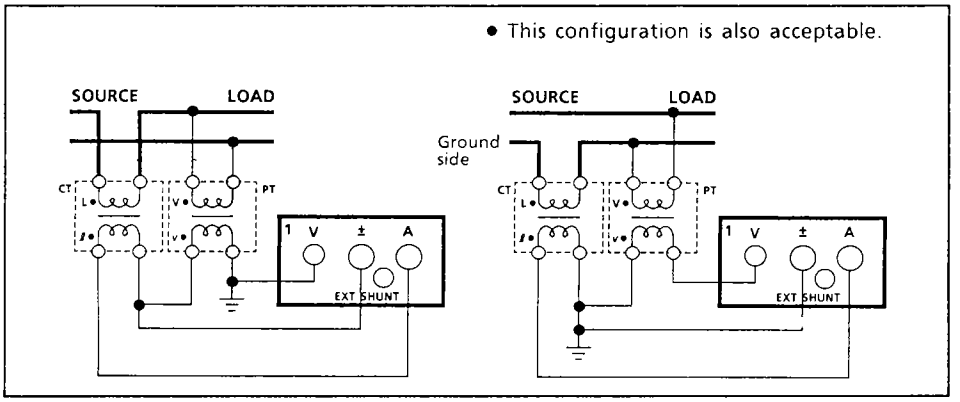
3.2 Wiring

This section describes wiring for measurements.

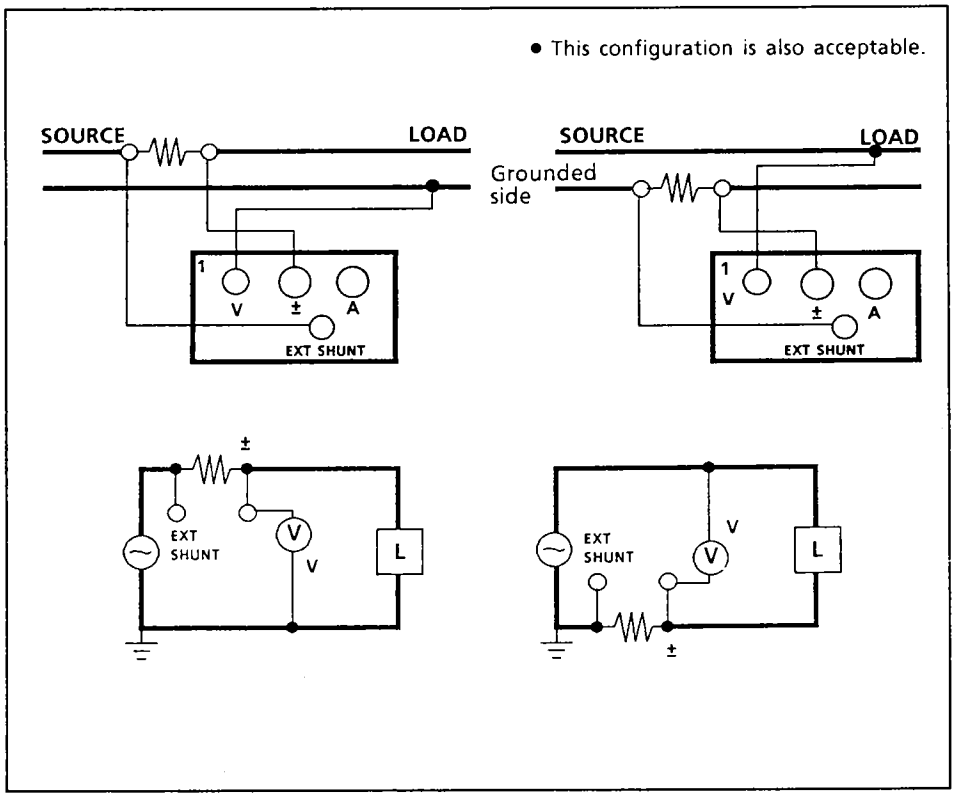
- **If Both the Maximum Voltage and the Maximum Current of the Circuit Under Test are Less than or Equal to the Maximum Measurement Ranges:**
  - The maximum voltage measurement range of the 2534 is 600V, and the maximum current measurement range is 20A. For measurements within these ranges, the measurement leadwires can be connected directly to the input terminals.
  - Connect the measurement leadwires to the current input and voltage input terminals on the rear panel as shown in the figure below. In the figure, the thick lines represent the current circuit, and the thin line represents the voltage circuit.



- **If Both the Maximum Voltage and the Maximum Current of the Circuit Under Test Exceed the Maximum Measurement Ranges:**
  - If the maximum voltage of the circuit under test exceeds 600V, connect an external potential transformer (PT) to the circuit under test, and connect the secondary side of the transformer to the voltage input terminals. If the maximum current value of the circuit under test exceeds 20A, connect an external current transformer (CT) to the circuit under test, and connect the secondary side of the transformer to the current input terminals. Wire the measurement leadwires to the voltage input and current input terminals as shown in the figure below. In the figure, the thick lines represent the current circuit, and the thin lines represent the voltage circuit.
  - Be careful when using a PT or CT, since the frequency and phase characteristics of the transformers will affect the measured values.



- **Using an External Shunt when the Maximum Current of the Circuit Under Test Exceeds 20A:**
  - Connect the external shunt input cord to the external shunt connection terminals as shown in the figure below, and connect the measurement leadwires to the voltage input terminals. In the figure, the thick lines represent the current circuit, and the thin lines represent the voltage circuit.
  - Select a shunt with frequency and phase characteristics adequate to the application. The frequency and phase characteristics of the shunt will affect the measured values.



Warning

- Do not use any shunt that is not housed safely within a case. Use of a naked shunt will present a serious danger of deadly electrical shock to anyone who might touch the shunt by mistake. If a case must be specially constructed, it must be fabricated so as to have a dielectric withstanding voltage adequate for the measurement voltage. Note that if the shunt is connected on the power supply ground side as shown in the wiring diagram at right above, the shunt does not necessarily have to meet these conditions.

Note

- For shunt input, use a standard Banana Plug.

Chapter 4

Measuring Voltage, Current, And Active Power

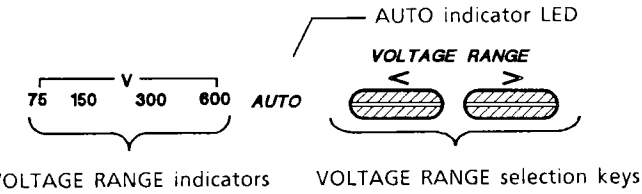
This chapter describes how to measure voltage, current, and active power.

4.1 Setting Measurement Ranges

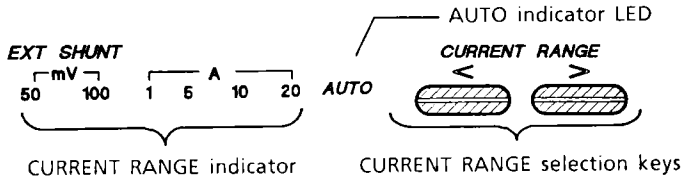
This section describes how to set the voltage, current, and active power measurement ranges.

Setting Voltage and Current Ranges

- **Voltage Range Selection Keys and Range Indicators**



- **Current Range Selection Keys and Range Indicators**



- **Manual Ranging Mode and Auto Ranging Mode**

Manual Ranging Mode

When the AUTO indicator LED is OFF, the 2534 is in manual ranging mode. In this mode you can use the < and > keys to switch among the following measurement ranges.

VOLTAGE RANGE Indicator (rated voltage value)	Range of Measurement Capability	Range for Warranted Accuracy *
75V	0 to 97.50V	7.50to 82.50V
150V	0 to 195.0 V	15.0 to 165.0 V
300V	0 to 390.0 V	30.0 to 330.0 V
600V	0 to 780.0 V	60.0 to 660.0 V

* Range for warranted accuracy is 10% to 110% of rated voltage

CURRENT RANGE Indicator (rated current value)	Range of Measurement Capability	Range for Warranted Accuracy *
1A	0 to 1.300A	0.100 to 1.100A
5A	0 to 6.50 A	0.500 to 5.500A
10A	0 to 13.0 A	1.0 to 11.0 A
20A	0 to 26.0 A	2.0 to 22.0 A
EXT SHUNT 50mV	0% to 130% of rated current for shunt being used	10% to 110% of rated current for shunt being used
EXT SHUNT 100mV		

* Range for warranted accuracy is 10% to 110% of rated current

- To switch from auto ranging mode (AUTO indicator LED ON) to manual ranging mode, you need only press the < key or > key. This will select the next lower (<) or higher (>) range relative to the range selected by auto ranging.

Auto Ranging Mode

When the AUTO indicator LED is ON, the 2534 is in auto ranging mode. In this mode, the measurement range is switched automatically as follows according to the input voltage or input current.

- **Range Upshift to Next Higher Range:**
  Voltage measurement: Range is upshifted if the instantaneous voltage during sampling is 250% or more of rated voltage for two samples, or if the measured voltage is 110% or more of the rated voltage.
  Current measurement: Range is upshifted if the instantaneous current during sampling is 300% or more of rated current for two samples, or if the measured current is 110% or more of the rated current.
- **Range Downshift:**
  Range is downshifted when measured voltage or current after completion of sampling is 50% or less of the rated value. The 5A range is an exception to this rule; on the 5A range the downshift to the 1A range is done only when the measured current is 1A (20% of the rated value) or less.
- **Range Switching Time:**
  The maximum time to switch to the appropriate range once the range switching conditions have been satisfied is 1 second.

Note

- For measurement accuracy, see Chapter 13, "SPECIFICATIONS" (page 13-3).

Power Range

- The rated active power values of the power ranges are based on the voltage and current ranges as follows.

		Current Range (A)			
		1.000A	5.000A	10.00A	20.00A
Voltage Range (V)	75.00V	75.00W	375.0W	750.0W	1.500kW
	150.0V	150.0W	750.0W	1.500kW	3.000kW
	300.0V	300.0W	1.500kW	3.000kW	6.000kW
	600.0V	600.0W	3.000kW	6.000kW	12.00kW

- The range of measurement capability for active power is related to the nominal power range (rated active power value) as shown below.
  Range of measurement capability:
  0% to 130% of power range (rated active power)
  Note that range of warranted accuracy is 10% to 110%.

Note

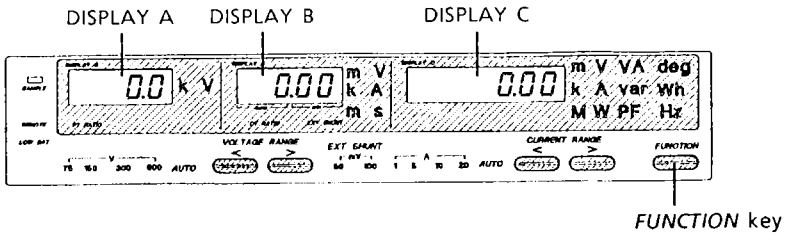
- Measurement accuracy is the same as for voltage and current measurement. See Chapter 13, "SPECIFICATIONS" (page 13-3). The power factor effect is as follows.
  At $\cos\phi = 0.5$: ±0.5% of reading max. (at 50/60Hz)
- In auto ranging mode, the range selected may differ for identical power measurement values, since the range is selected based on the individual voltage and current values according to the conditions previously described.

4.2 Selecting What to Display on the Digital Displays

This section describes how to select which voltage, current, power, or other measured or computed variable to present on each display.

Selecting What to Display

As the figure below shows, there are three digital displays, A, B, and C. The information to be presented on the DISPLAY C is selected using the *FUNCTION* and *ELEMENT* keys located below that display.



- *FUNCTION* key Operations

  Pressing the *FUNCTION* key selects the specific type of information to be displayed on the DISPLAY C as shown below.

Active power (W) → Apparent power (VA) → Reactive power (var)
↑ ↓
Current (A) Power factor (PF)
↑ ↓
Voltage (V) Phase angle (deg)
↑ ↓
Current frequency (AHz)
↑
Voltage frequency (VHz) ← Integrated power (Wh)

Voltage, Current and Power Measurement Displays

- **Display Ranges**

  · Measured Voltage

Range	Minimum/Maximum
75V	0.00 / 97.50V
150V	0.0 /195.0 V
300V	0.0 /390.0 V
600V	0.0 /780.0 V

  · Measured Current

Range	Minimum/Maximum
1A	0.000 / 1.300A
5A	0.00 / 6.50 A
10A	0.00 / 13.0 A
20A	0.00 / 26.0 A

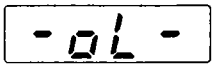
  · Measured Active Power

  0% to 130% of rated values described on page 4-3

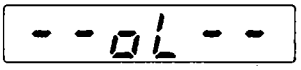
- **Measurement Error Displays**
  - Over-range Display

    If the measured voltage, measured current, or measured power exceeds 130% of the range indicator value (rated value) when in manual ranging mode, the 2534 is in an over-range condition, and one of the following codes is presented on the digital display.

    DISPLAY A or B

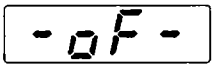
    DSIPLAY C

  - Computation Overflow Display

    If there is a computation overflow during a computation, one of the following codes will appear.

    DISPLAY A or B

    DISPLAY C

  - Peak Over-range Display

    If the instantaneous voltage is 2.5 times or more of the rated range value in two consecutive samples, or if the instantaneous current value is 3 times or more of the rated range value in two consecutive samples, one of the following codes will appear.

    DISPLAY A or B

    DISPLAY C

- **Interrupted Measurement Display**

  The following are displayed when a measurement is interrupted by switching of the measurement range or displayed information.

  DISPLAY A or B

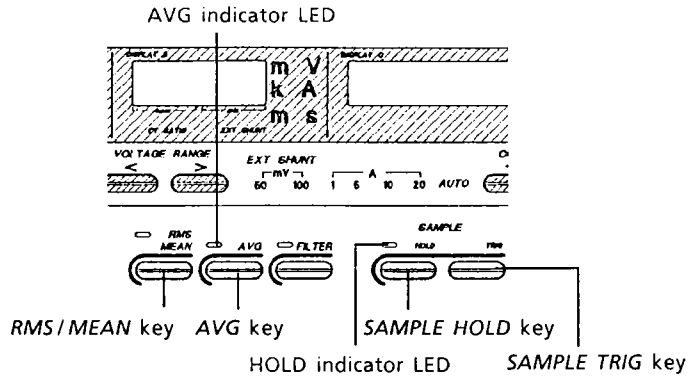
  DISPLAY C

4.3 Selecting the Measurement Mode

This section describes how to select the wiring and voltage measurement modes, and how to decide whether or not to use averaging. It also describes the operations for selection of measured value sampling action.

Operating Panel Keys



Selecting the Voltage Measurement Mode

When measuring voltage, the *RMS/MEAN* key is used to select one of the measurement modes below.

- **RMS Mode (LED On)**
  Measures the input voltage as an rms value, and displays it as an rms value.
  Select the RMS mode when measuring non-sinusoidal or distorted-sinewave waveforms.
- **MEAN Mode (LED Off)**
  Measures the input voltage using as the average of the rectified waveform, and displays the equivalent rms value assuming that the waveform is a perfect sine wave.
  Since the value displayed is the average measured value multiplied by 1.1107, the value displayed in this mode will be identical to that in RMS mode when measuring a perfect sine wave.

Averaging

The measured values for voltage, current, and active power can be smoothed using exponential averaging for display.
Pressing the *AVG* key turns on the AVG indicator LED and begins display of exponentially averaged values.

$$An = A_{n-1} + \frac{1}{K}(Mn - A_{n-1})$$

An : Exponentially averaged value
Mn : Measured value
A_{n-1} : Exponentially averaged value from previous cycle
K : Attenuation constant (for the 2534, "8")

Selecting Sampling Action

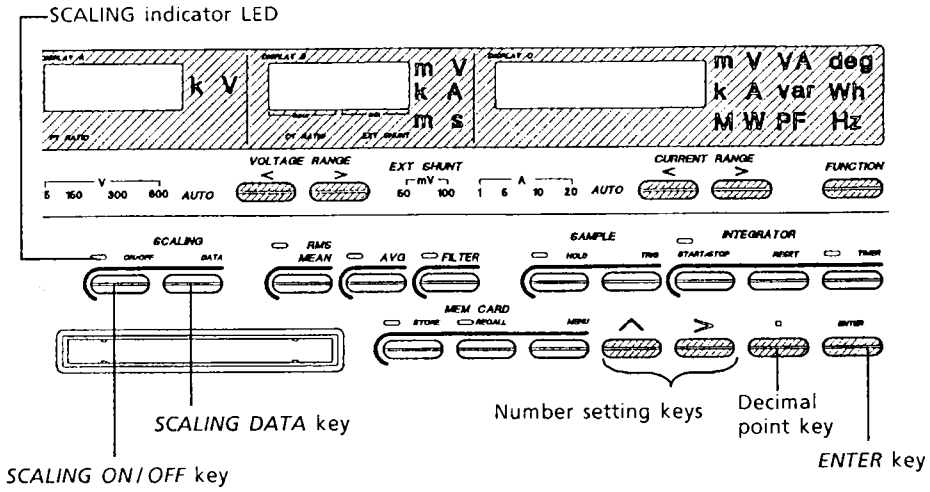
Two modes are available for measured value display, and are selected with the *SAMPLE HOLD* key.

- **Auto Sampling Mode (HOLD Indicator LED OFF)**
  The measured value is updated and displayed every 500ms.
  If measured values are being sent to external destinations (by D/A output, or via communications), the output values are updated at the same time.
- **Manual Sampling Mode (HOLD Indicator LED ON)**
  In this mode the measured value displayed is held until *SAMPLE TRIG* key is pressed to trigger a measured value update. Measured value update can also be triggered by an external trigger signal input.
  If measured values are being sent to external destinations (by D/A output or via communications), those output values, too, are updated each time the *SAMPLE TRIG* key is pressed.

4.4 Using the Scaling Function

This section describes how to use the scaling function. This function is convenient when measuring voltage, current and power using external shunt, potential transformer (PT), or current transformer (CT) devices.

Operating Keys



Scaling Function

When using PT, CT, or external shunt devices for voltage, current or power measurements, the scaling function can be used to enter scaling values for the PT ratio and/or CT ratio; the 2534 will then convert the measured values to the corresponding values for the transformer primary sides before display.

When using the external shunt range, the scaling function can be used to display the measured external shunt voltage values directly as measured current.

Displayed Variable	Measured/ Computed Value	Scaled Value
Voltage	V	Kv×V
Current	A	Ki×A (×Ks)
Active power	W	Kv×Ki×W (×Ks)
Reactive power	var	Kv×Ki×var (×Ks)
Apparent power	VA	Kv×Ki×VA (×Ks)

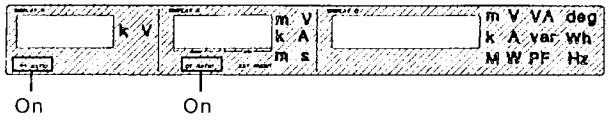
Kv: Voltage scaling value (PT ratio)
Ki: Current scaling value (CT ratio)
Ks: External shunt current value

Scaling Value Setting Ranges

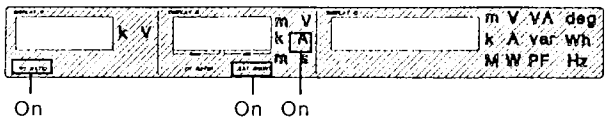
- PT ratio : 1.000 to 1000 (initial value, 1.000)
- CT ratio : 1.000 to 1000 (initial value, 1.000)
- External shunt current value : 1.000 to 1000A (initial value, 1.000A)

Procedure for Setting Scaling Value

1. Press the *SCALING DATA* key.
   The display appears as shown below.
   - When current range is set to 1A, 5A, 10A, or 20A



   - When current range is set to "EXT SHUNT 50mV" or "EXT SHUNT 100mV"



- **Setting a PT Ratio**

2. Use the **number setting** keys and **decimal point** key to input the PT ratio to **DISPLAY A**.
   - The digit which can be set is indicated by flashing. When you begin, the first (leftmost) of the four digits will be flashing.
   - Use the > (right shift) key to select the digit to be set. Pressing the > key when the last of the four digits is flashing moves the setting position back to the first digit.
   - Use the ∧ key to select the number for each digit. Pressing the ∧ key increases the number.
   - Use the **decimal point** key to select the decimal point position. Each time this key is pressed, the decimal point moves one position to the right. Pressing this key with the decimal point at the last digit moves the decimal point back to the first position.
3. Press the *ENTER* key.

- **Setting CT Ratio or External Shunt Rated Current**

4. Use the **number setting** keys and **decimal point** key to input the CT ratio or the external shunt rated current to **DISPLAY B**.
   - Use the operations described in step 2 above to input the numbers.
5. Press the *ENTER* key.

- **Turning Scaling Function ON**

6. Press the *SCALING ON/OFF* key; the SCALING indicator LED will turn ON.

	Voltage	Current	External Shunt
Scaling Off	PT secondary side	CT secondary side	Shunt current
Scaling On	PT primary side	CT primary side	Shunt current

Note

- If a scaling value is set that is outside of the setting range, error code "Err12" is displayed.
  If this code appears, re-enter a correct value.
- For most accurate measurement, select the nearest measurement range below the PT or CT secondary rating, or below the external shunt rated output.
- When using an external shunt range, the values will be multiplied by the external shunt current value before display regardless of whether the scaling function is ON or OFF. Turning the scaling function ON when using an external shunt range results in those values being further multiplied by the CT ratio before display, as shown below. If there is no need to multiply by an additional coefficient, set the CT ratio to "1.000."
  Scaling OFF: Current value = Ks × A
  Scaling ON: Current value = Ks × Ki × A

Measured Value Display Range With Scaling Function ON

- The range of displayable values for scaled measurements is:
  0.000 to 9999

- If the scaled measured value exceeds the maximum value that can be displayed, the following code appears to indicate overflow.

Chapter 5

Displaying Results of Apparent Power, Reactive Power, Power Factor, and Phase Angle

This chapter describes the functions for computing the apparent power, reactive power, power factor, and phase angle.

5.1 Displaying Apparent Power Computation Results

This section describes the apparent power computation functions.

- **Basic Computational Formula**
  Apparent power (VA) = V×A

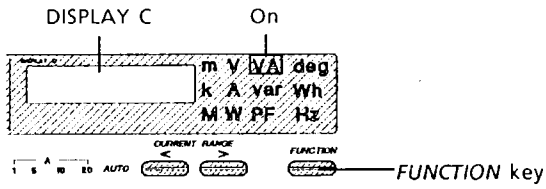
- **Computation Accuracy**
  ±0.05%×(apparent power at rated input)
  Note that this does not include error due to voltage or current measurement error.

- The rated apparent power is based on the combination of voltage range and the current range as follows.

		Current Range (A)			
		1.000A	5.000A	10.00A	20.00A
Voltage Range (V)	75.00V	75.00VA	375.0VA	750.0VA	1.500kVA
	150.0V	150.0VA	750.0VA	1.500kVA	3.000kVA
	300.0V	300.0VA	1.500kVA	3.000kVA	6.000kVA
	600.0V	600.0VA	3.000kVA	6.000kVA	12.00kVA

- The range over which apparent power can be computed is related to the apparent power range as shown below.
  Range of computability:
  0% to 130% of apparent power range (rated range)
  Note that range for warranted accuracy is 10% to 110%.

- **Displaying Computation Results**
  The result is displayed using the *FUNCTION* key under DISPLAY C, as shown below.



- ***FUNCTION* Key Operations**
  Press the *FUNCTION* key to select apparent power (VA) display. Successive *FUNCTION* key presses will change the variable presented on DISPLAY C as follows.

Active power (W)→Apparent power (VA)→Reactive power (var)
↑ ↓
Current (A) Power factor (PF)
↑ ↓
Voltage (V) Phase angle (deg)
↑
Current frequency (AHz) ↓
↑
Voltage frequency (VHz) ← Integrated power (Wh)

- **Display Range and Error Indications**
  The display range and error displays are the same as for active power measurement. See **Section 4.2, "Selecting What to Display on the Digital Displays" (page 4-4)**. The computation overflow message code is displayed if the measured voltage, measured current, or measured power is over-range.

5.2 Displaying Reactive Power Computation Results

This section describes the reactive power computation functions.

- **Basic Computational Formula**
  Reactive power (var) $= \sqrt{(V \times A)^2 - W^2}$

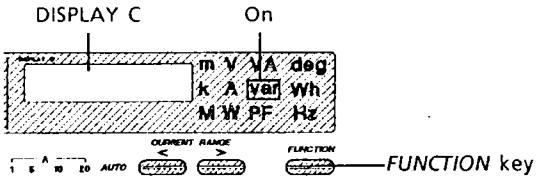
- **Computation Accuracy**
  $\pm 0.05\% \times$ (reactive power at rated input)
  Note that this does not include error due to voltage or current measurement error.

- The rated reactive power is based on the combination of voltage range and the current range as follows.

		Current Range (A)			
		1.000A	5.000A	10.00A	20.00A
Voltage Range (V)	75.00V	75.00var	375.0var	750.0var	1.500kvar
	150.0V	150.0var	750.0var	1.500kvar	3.000kvar
	300.0V	300.0var	1.500kvar	3.000kvar	6.000kvar
	600.0V	600.0var	3.000kvar	6.000kvar	12.00kvar

- The range of reactive power computability is related to the reactive power range as shown below.
  Range of computability:
  0% to 130% of reactive power range (rated range)
  Note that range for warranted accuracy is 10% to 110%.

- **Displaying Computation Results**
  The result is displayed using the *FUNCTION* key under DISPLAY C, as shown below.



- ***FUNCTION* Key Operations**
  Press the *FUNCTION* key to select reactive power (var) display. Successive *FUNCTION* key presses will change the variable presented on DISPLAY C as follows.

Active power (W) → Apparent power (VA) → Reactive power (var)
↑ ↓
Current (A) Power factor (PF)
↑ ↓
Voltage (V) Phase angle (deg)
↑ ↓
Current frequency (AHz)
↑
Voltage frequency (VHz) ← Integrated power (Wh)

- **Display Range and Error Indications**
  The display range and error displays are the same as for active power measurement. See **Section 4.2, "Selecting What to Display on the Digital Displays" (page 4-4)**. The computation overflow message code is displayed if the measured voltage, measured current, or measured power is over-range.

5.3 Displaying Power Factor Computation Results

This section describes the power factor computation functions.

- **Basic Computational Formula**

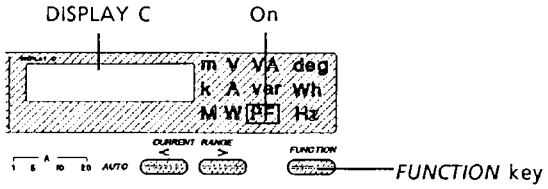
$$\text{Power factor (PF)} = \frac{W}{V \times A}$$

- **Computation Accuracy**
  ±0.002 (with power factor at 1.0)
  Note that this does not include error due to voltage or current measurement error.

- **Computation Range**
  −1.000 to +1.000

- **Effective Operating Input Range**
  10% or more of measurement range for both voltage input and current input.

- **Displaying Computation Results**
  The result is displayed using the *FUNCTION* key under DISPLAY C, as shown below.



- ***FUNCTION* Key Operations**
  Press the *FUNCTION* key to select power factor (PF) display. Successive *FUNCTION* key presses will change the variable presented on DISPLAY C as follows.

Active power (W)→Apparent power (VA)→Reactive power (var)
↑ ↓
Current (A) Power factor (PF)
↑ ↓
Voltage (V) Phase angle (deg)
↑ ↓
Current frequency (AHz)
↑
Voltage frequency (VHz) ← Integrated power (Wh)

- **Display Range and Error Indications**
  · Display range: −1.000 to +1.000
  · If the computation result exceeds "1" due to inputs being outside of the effective operating input range, the display is as follows.

Computation Result	Display
1.001 to 2.000	1.000
2.001 or more	PFErr

5.4 Displaying Phase Angle Computation Results

This section describes the phase angle computation functions.

- **Basic Computational Formula**

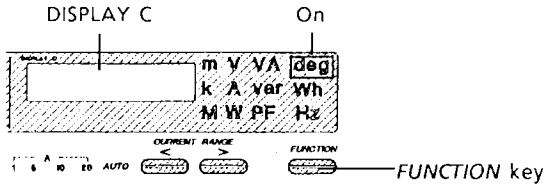
$$\text{Phase angle}(\phi) = \cos^{-1}\frac{W}{V \times A}$$

- **Computation Accuracy**
  ±0.2deg (with phase angle at 60 deg)
  Note that this does not include error due to voltage or current measurement error.

- **Computation Range**
  G90.0 to 0.0 to d90.0 deg (G: Lag, d: Lead)

- **Effective Operating Input Range**
  · 10% or more of measurement range for both voltage input and current input
  · Maximum measurement frequency not to exceed 1kHz

- **Displaying Computation Results**
  The result is displayed using the *FUNCTION* key under DISPLAY C, as shown below.

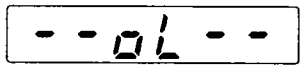


- ***FUNCTION* Key Operations**
  Press the DISPLAY C *FUNCTION* key to select phase angle (deg) display. Successive *FUNCTION* key presses will change the variable presented on DISPLAY C as follows.

Active power (W)→Apparent power (VA)→Reactive power (var)
↑ ↓
Current (A) Power factor (PF)
↑ ↓
Voltage (V) Phase angle (deg)
↑ ↓
Current frequency (AHz)
↑
Voltage frequency (VHz) ← Integrated power (Wh)

- **Display Range and Error Indications**
  - Display range: G90.0 to 0.0 to d90.0 deg (G: Lag, d: Lead)
  - If the result is outside the above range, the over-range display code appears as shown below.

    DISPLAY C

  - The distinction between lead and lag is indicated as shown below.

    · Lag

    · Lead

  - If the power factor exceeds "1" when an input is outside of the effective operating input range, "dEGErr" is displayed.
  - The lead or lag indication is displayed only if the frequency is between 10Hz and 1kHz, and both the measured voltage and current are between 10% and 110% of the rated measurement range. Since the distinction between lead and lag cannot be made at absolute values of 2 deg or less, the indication is not displayed.

Note

- Before obtaining the phase angle (deg), make sure that the voltage and current are within the effective measurement range.

Chapter 6

Integrating Active Power

This chapter describes the functions for active power integration.

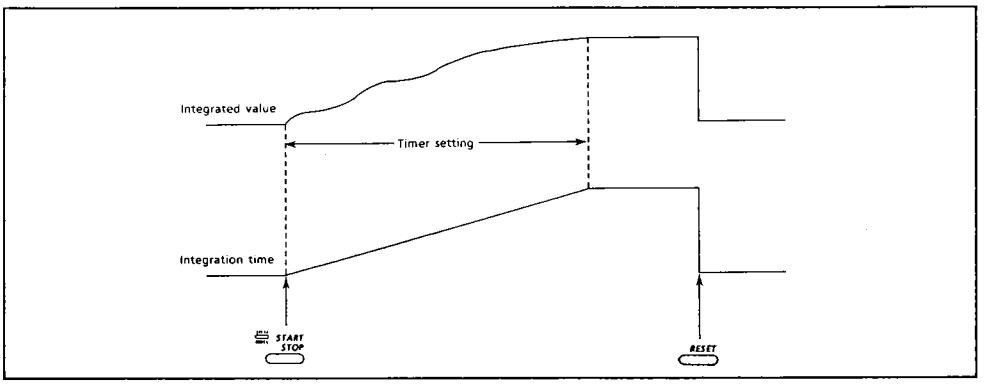
6.1 Overview of the Active Power Integration Function

This section presents an overview of the operating procedures used to integrate active power.

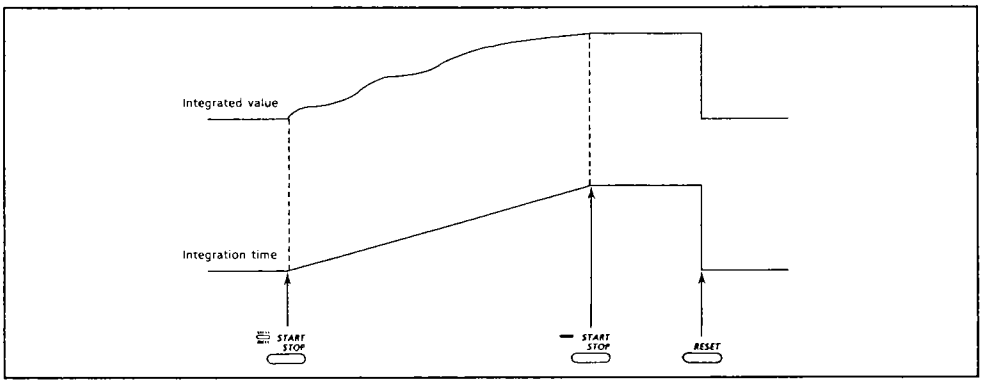
Integration Modes

The following two modes can be used to integrate the active power. Select the mode that is appropriate for the application.

- **Standard Integration Mode**
  In this mode, integration is started after using the *INTEGRATOR TIMER* key to set the timer. Pressing the *INTEGRATOR START/STOP* key starts the timer; when the preset time has elapsed, integration stops automatically, and the system holds the integrated value and the elapsed integration time.
  Note that if the integrated value reaches the maximum possible integrated value before the preset time has elapsed, integration stops at that point, and the system holds the integrated value and the elapsed integration time.



- **Manual Integration Mode**
  In this mode, integration is performed manually without using a timer. Pressing the *INTEGRATOR START/STOP* key starts integration; pressing the *INTEGRATOR START/STOP* again stops integration, and the system holds the integrated value and the elapsed integration time.
  Note that if the integration time reaches the maximum integration time while integration is in progress, or the integrated power reaches the maximum possible integrated value, integration stops, and the system holds the integrated value and the elapsed integration time at that point.



Starting, Stopping, and Resetting Integration

There are three ways to start, stop, and reset integration. Refer to the following pages concerning these operations.

- **Using the Power Integration Keys (*INTEGRATOR* keys)**
  - Integration using standard integration mode
    → **Section 6.2, "Integration Using Standard Integration Mode" (page 6-4)**
  - Integration using manual integration mode
    → **Section 6.3, "Integration Using Manual Integration Mode" (page 6-6)**
- Using GP-IB/RS-232-C commands
  → **Chapter 11, "Using the Communications Functions"**
- Using external signal inputs
  → **Chapter 8, "Using the External Input/Output Functions"**

Maximum Integration Time and Maximum Integrated Value

The table below shows the maximum integration time and the maximum integrated value at the various rated inputs.

			Current Input A1			
			1.000A	5.000A	10.00A	20.00A
Voltage Input V1	75.00V	cosφ="+"	99 hr 59 min 7500.00 Wh	99 hr 59 min 37500.0 Wh	99 hr 59 min 75000.0 Wh	99 hr 59 min 150.000 kWh
		cosφ="−"	13 hr 19 min −999.99 Wh	26 hr 39 min −9999.9 Wh	13 hr 19 min −9999.9 Wh	66 hr 39 min −99.999 kWh
	150.0V	cosφ="+"	99 hr 59 min 15000.0 Wh	99 hr 59 min 75000.0 Wh	99 hr 59 min 150.000 kWh	99 hr 59 min 300.000 kWh
		cosφ="−"	66 hr 39 min −9999.9 Wh	13 hr 19 min −9999.9 Wh	66 hr 39 min −99.999 kWh	33 hr 19 min −99.999 kWh
	300.0V	cosφ="+"	99 hr 59 min 30000.0 Wh	99 hr 59 min 150.000 kWh	99 hr 59 min 300.000 kWh	99 hr 59 min 600.000 kWh
		cosφ="−"	33 hr 19 min −9999.9 Wh	66 hr 39 min −99.999 kWh	33 hr 19 min −99.999 kWh	16 hr 39 min −99.999 kWh
	600.0V	cosφ="+"	99 hr 59 min 60000.0 Wh	99 hr 59 min 300.000 kWh	99 hr 59 min 600.000 kWh	99 hr 59 min 1200.00 kWh
		cosφ="−"	16 hr 39 min −9999.9 Wh	33 hr 19 min −99.999 kWh	16 hr 39 min −99.999 kWh	83 hr 19 min −999.99 kWh

6.2 Integration Using Standard Integration Mode

This section describes the operating procedures for using standard integration mode to integrate the active power.

Setting to Standard Integration Mode

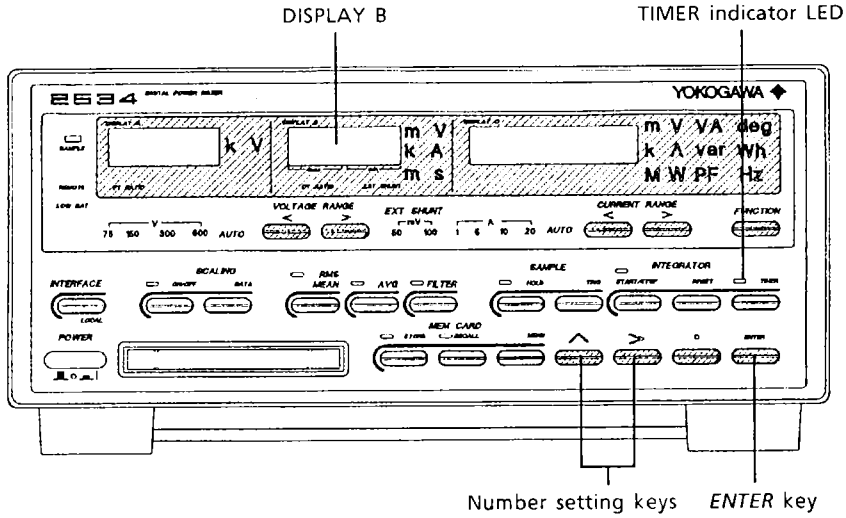
1. Press the *INTEGRATOR TIMER* key.
   - This sets the device to the integration timer setup mode; the timer setup display appears on DISPLAY B.
   - The first (leftmost) digit of the four-digit setting time flashes.

DISPLAY B

2. Use the ∧ and > keys (number setting keys) to move the flashing digit indication to the desired digit.
   - Pressing the ∧ key changes the number in the sequence 1, 2, 3 ... 9, 0 and back to 1, except for the third digit, which changes in the sequence 0, 1, 2, 3, 4, 5, 0.
   - Pressing the > key shifts the digit position being set. Pressing the > key moves the setting to the next lower digit. From the lowest digit, the setting position wraps around to the highest digit; from the highest digit, it wraps around to the lowest digit.

DISPLAY B

3. After setting the timer preset time, press the *ENTER* key.
   - This enters the timer preset time, and turns the TIMER indicator LED on.



Starting, Stopping, and Resetting Integration

- **Starting Integration**

  After you press the *ENTER* key to complete the timer setup, the display goes from the integration timer setup mode to the integration operating mode. Pressing the *INTEGRATOR START/STOP* with the display in this mode will start integration. Make sure that the INTEGRATOR START indicator LED lights after you start integration.

- **Stopping Integration**

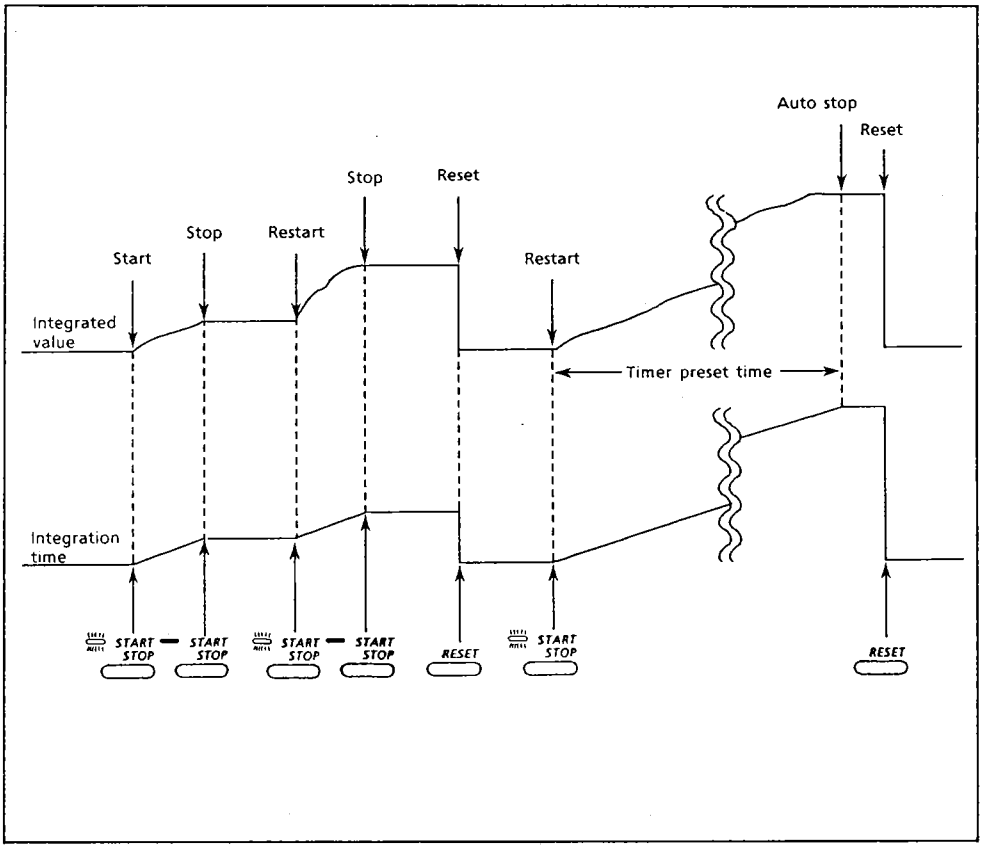
  When the timer preset time has elapsed, integration will stop automatically.

  If the *INTEGRATOR START/STOP* key is pressed while integration is in progress, integration stops. Until the *INTEGRATOR START/STOP* key is pressed again, the display will continue to hold the integrated value and the integration time as of the instant that integration was stopped.

  If the integrated value reaches the maximum integrated value before the integration time has elapsed, integration stops, and the system holds the integrated value and the integration time.

- **Resetting Integration**

  Pressing the *INTEGRATOR RESET* key after integration has been stopped automatically or manually will reset the integrated value and the integration time.



6.3 Integration Using Manual Integration Mode

This section describes the operating procedures for using manual integration mode to integrate the active power.

Setting to Manual Integration Mode

To use manual integration mode, the timer must be set to "00 hour 00 min." Pressing the *INTEGRATOR TIMER* key will display the present timer preset time on DISPLAY B.
If the timer preset time is not already "00 hour 00 min", set it by the procedure below.
Note that when the instrument is shipped, it is initially set for manual integration mode.

- **Setting Timer Preset Time to "00 hour 00 min"**

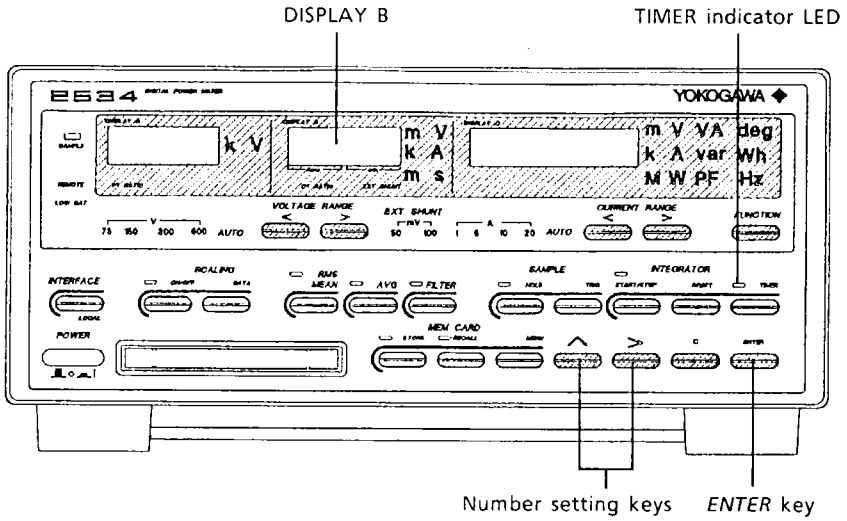
1. Press the *INTEGRATOR TIMER* key.
   - This sets the device to the integration timer setup mode; the timer setup display appears on DISPLAY B.
   - The first (leftmost) digit of the four-digit setting time flashes.

DISPLAY B

2. Use the ∧ and > keys (number setting keys) to change each flashing digit to "0."
   - Pressing the ∧ key changes the number in the sequence 1, 2, 3 ... 9, 0 and back to 1, except for the third digit, which changes in the sequence 0, 1, 2, 3, 4, 5, 0.
   - Pressing the > key shifts the digit position being set. Pressing the > key moves the setting to the next lower digit. From the lowest digit, the setting position wraps around to the highest digit.

DISPLAY B

3. Press the *ENTER* key.
   - This sets the timer preset time, and turns the TIMER indicator LED off.

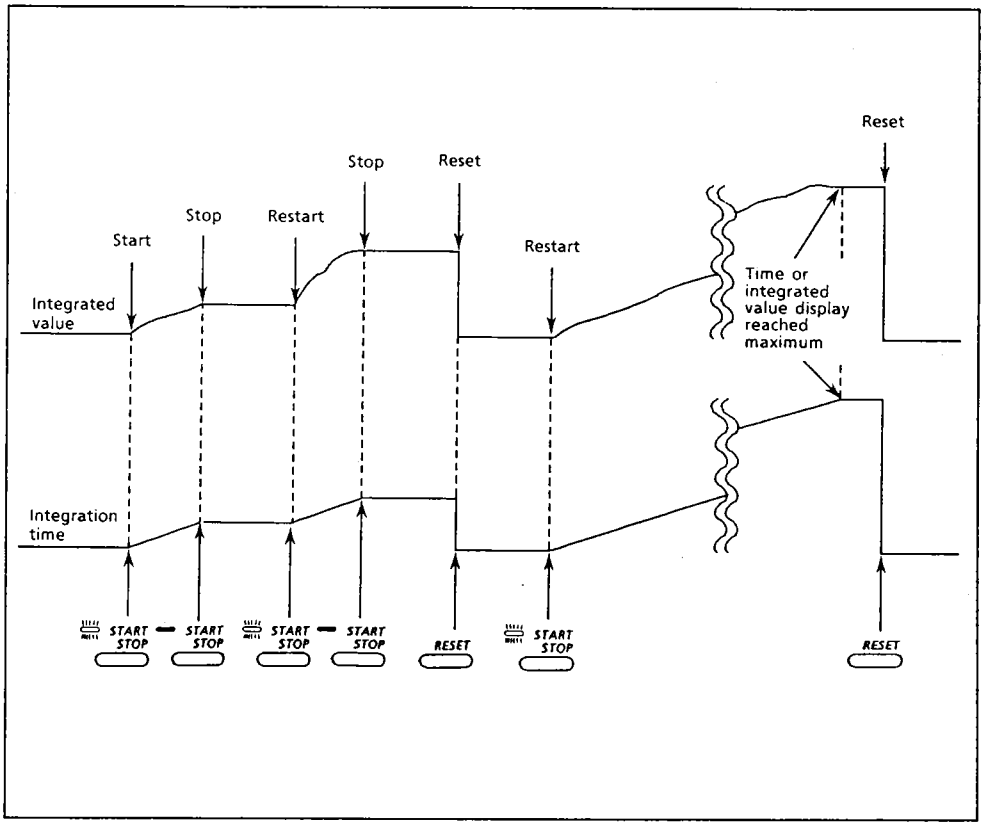


Starting, Stopping, and Resetting Integration

- **Starting Integration**
  Press the *INTEGRATOR START/STOP* key to start integration. Make sure that the INTEGRATOR START indicator LED lights.

- **Stopping Integration**
  Press the *INTEGRATOR START/STOP* key a second time to stop integration. Until the *INTEGRATOR START/STOP* key is pressed again, the display will continue to hold the integrated value and the integration time as of the instant that integration was stopped.
  If the integrated value reaches the maximum integrated value before the integration time has elapsed, integration stops, and the system holds the integrated value and the integration time.

- **Resetting Integration**
  Pressing the *INTEGRATOR RESET* key after integration has been stopped automatically or manually will reset the integrated value and the integration time.

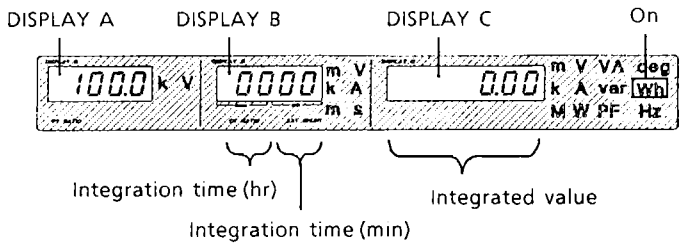


6.4 Displaying Active Power Integrated Value

This section describes the active power integration display.

- **Integration DISPLAY Contents and Display Range**

DISPLAY A	DISPLAY B	DISPLAY C
	Integration time	Integrated value
Voltage	00 hr 00 min to	0 to 999,999Wh or 0 to 999,999kWh
	99 hr 59 min	−99,999 to 0Wh or −99,999 to 0kWh



- **Integrated Value Display Update Interval**
  500ms

- **Effective Power Integration Accuracy**
  ±(measurement accuracy+0.2% of reading)

- **Integration Time Accuracy**
  ±0.02%

- **Integrated Value Polarity Indication**
  In measurement on a circuit containing a battery that is being discharged, the active power integrated value may decrease with time rather than increase. If the integrated power decreases to a negative value, a "−" (minus sign) will appear ahead of the integrated value.

- **Integration Overflow Indication**
  If the integrated value reaches the maximum possible value before integration stops, integration stops at that time, and the display holds the integrated value as of the time when integration stopped.

- **Integrated Value Display Update Hold**
  Pressing the *SAMPLE HOLD* key while integration is in progress causes the display to hold the integrated value as of the instant that the key was pressed.
  Pressing the *SAMPLE TRIG* key while the integrated value display is in hold (HOLD indicator LED is on) updates the display with the present integrated value that time.

6.5 Important Notes on Use of the Active Power Integration Function

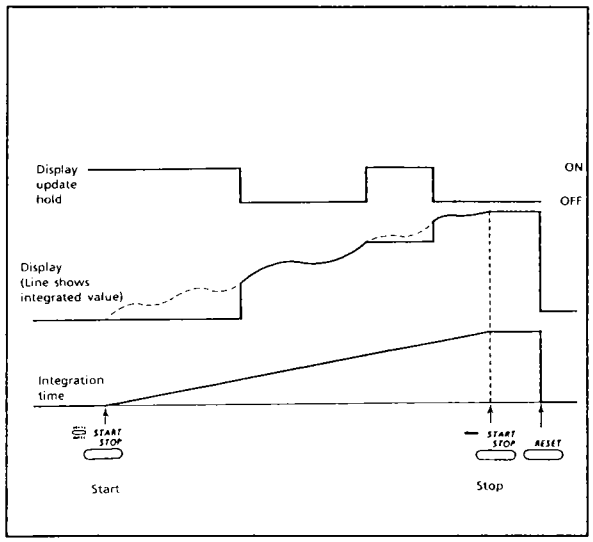
Certain points must be kept in mind when using the active power integration function.

Integration When Display Update is on Hold

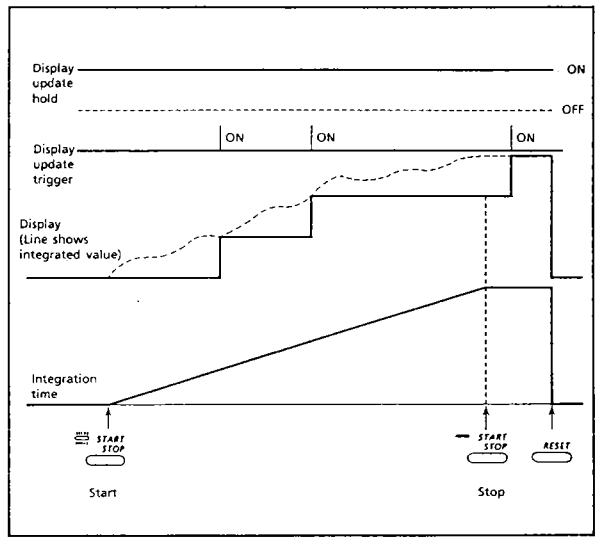
When the *SAMPLE HOLD* key is pressed to place display update on hold (HOLD indicator LED is on), the displayed integrated value and the integrated value for communication output are on hold, but integration continues regardless of whether display update hold is ON or OFF. The SAMPLE indicator LED continues to flash during this time.

- If integration is started when display update hold is ON, as shown in Figure (a), the displayed integrated value remains as it was when last held. However, as soon as hold is turned OFF or the *SAMPLE TRIG* key is pressed, the integrated value accumulated up to that time is displayed.
- If integration stops while display update hold is ON, as shown in Figure (b), the integrated value remains on hold. However, if the *SAMPLE TRIG* key is pressed or if hold is turned OFF, the final integrated value is displayed.

(a)



(b)



Backup During Power Outages

- If power fails while integration is in progress, the integrated value and integration time are retained by a backup feature.
  - When power is recovered, integration will remain stopped. Moreover, even if the *INTEGRATOR START/STOP* key is pressed, integration will not restart. To restart integration, you must press the *INTEGRATOR RESET* key to reset integration before pressing the *INTEGRATOR START/STOP* key.
  - If the timer reaches its preset value, the integrated value at that time is displayed.

Panel Key Operations in Integration Mode

In integration mode, certain key operations are placed in a "reserve" (restricted) condition so that the setup will not be accidentally changed even if the operating keys are touched. The table below gives the details of which operations are restricted by the reserve condition.

Table Legend

- NOT RESERVE : When integration is turned off
- RESERVE START : Integration in progress (INTEGRATOR START indicator LED on)
- RESERVE STOP : Integration interrupted (INTEGRATOR START indicator LED off)
- × : Key is operable
- ○ : Key is not operable

Key \ Operating Status		NOT RESERVE	RESERVE START	RESERVE STOP
MODE	*RMS / MEAN FILTER*	○	×	×
	AVG SCALING	○	○	○
SAMPLE	*HOLD TRIG*	○	○	○
RANGE	*VOLTAGE AUTO*	○	×	×
	<, >	○	×	×
	CURRENT AUTO	○	×	×
	<, >	○	×	×
DATA Setup	*SCALING DATA TIMER ∧, >, ENTER*	○	○ *TIMER* key only displays preset time	○ *TIMER* key only displays preset time
MEM CARD	*STORE MENU*	○	○	○
	RECALL	○	×	○
FUNCTION		○	○	○
INTEGRATOR	*START / STOP*	○	○	○
	RESET	○	×	○

- If a nonoperable key is pressed, error code "Err13" appears on DISPLAY C.
- The integrated value cannot be reset while integration is in progress. To reset, press the *INTEGRATOR START/STOP* key to stop integration, and then press the *INTEGRATOR RESET* key.
- To use keys whose operation is prohibited while integration is in progress, you must first press the *INTEGRATOR START/STOP* key to stop integration, and then to press the *INTEGRATOR RESET* key to reset the displayed integrator value.
- If integration is started while in auto range setup mode, the instrument switches to manual setup mode, retaining the measurement ranges selected at that time.
- Note that when integration operation is interrupted while in manual integration mode, the INTEGRATOR START indicator LED turns off, creating a condition which is difficult to distinguish from the "integration turned off" condition. Pressing a nonoperable key while integration is in this interrupted condition will cause error code "Err13" to be displayed.

Behavior of the Integrated Value When the Instantaneous Input Exceeds Measurement Limits

If the instantaneous input exceeds the measurement limits, the instrument will be unable to maintain the accuracy of the integrated value obtained. Be careful!

- If the instantaneous input voltage exceeds 2.5 times the rated measurement range, the integrated value is computed using a value of 2.5 times the rated measurement range as the nominal measured voltage.
- If the instantaneous input current exceeds 3 times the rated measurement range, the integrated value is computed using a value of 3 times the rated measurement range as the nominal measured current.
- If the active power is in an over-range, peak overflow, or computation overflow condition, the integrated value is computed using a value of approximately 1.3 times the rated measurement range as the nominal measured active power.

Chapter 7

Measuring Frequency

This chapter describes the background knowledge and operating procedures required to measure frequency.

7.1 Measuring Frequency

This section describes the operating procedures used to measure frequency. If the filter is to be used, refer to **Section 7.2, "Measuring Frequency with Filter ON" (page 7-4)**.

- **Measured Input**
  Voltage input signal or current input signal to input module 1 (frequencies of inputs connected to input modules 2 and 3 cannot be measured)

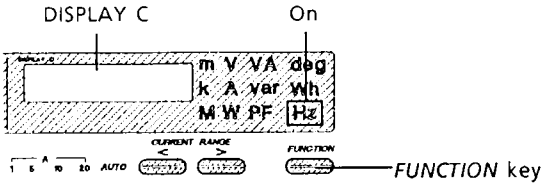
- **Measurement Method**
  Reciprocal counting method

- **Minimum Input Sensitivity**
  10% of rated input

- **Measurement Time**
  100ms to 250ms

- **Measurement Range**
  The measurement range is set automatically to one of the four ranges below according to the measured value.
  4.00Hz to 99.99Hz
  100.0Hz to 999.9Hz
  1.000kHz to 9.999kHz
  10.0kHz to 22.00kHz

- **Displaying the Measured Value**
  As shown in the figure below, the *FUNCTION* key under DISPLAY C is used to display the measured value.



- ***FUNCTION* Key Operations**

  Press the *FUNCTION* key to select VHz (voltage frequency measurement) or AHz (current frequency measurement). Successive *FUNCTION* key presses will change the variable presented on DISPLAY C as follows.

  Active power (W)→Apparent power (VA)→Reactive power (var)
  ↑ ↓
  Current (A) Power factor (PF)
  ↑ ↓
  Voltage (V) Phase angle (deg)
  ↑
  Current frequency (AHz) ↓
  ↑
  Voltage frequency (VHz) ← Integrated power (Wh)

- **Display Range and Error Indications**
  - Display range: Same as the measurement ranges on the preceding page
  - If the input signal level is low or the input frequency is lower than the measurement range, error code "ErrLo" is displayed. Error code "ErrLo" is also displayed if no measurement input signal is applied to input module 1.
  - If the input frequency is higher than the measurement range, error code "ErrHi" is displayed. Note, however, that a very high frequency signal may be so attenuated by the internal circuits that the presence of the input is not recognized, so that error code "ErrLo" is displayed.

Note

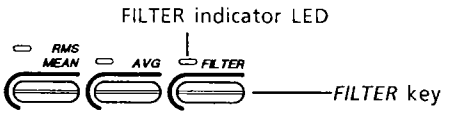
- Provided that "AHz" is not displayed on DISPLAY C, the voltage input frequency is measured. Note, however, that if there is no input voltage, the current frequency will be automatically measured.
- Upon switching the input whose frequency is to be measured (voltage or current), up to 750ms may elapse before the first frequency measurement is completed. If the display is updated during this time, the frequency display will show "-----", and communication output will be "999999.E+3." If a store operation is in progress, the value "999999.E+3" is stored.
  Note that when in this condition, measured values other than frequency may be inaccurate for a period of up to 1 second after the frequency measurement input (voltage or current) selection is changed.
- When switching the frequency measurement input (voltage or current) in manual sampling mode, the first trigger switches the frequency measurement input, and the second trigger updates the frequency display. You should wait at least 1 second after the first trigger before applying the second trigger.

7.2 Measuring Frequency with Filter ON

This section describes points to be kept in mind when measuring frequency with the filter ON.

- The filter can be used to eliminate high-frequency harmonics, such as appear in invertor waveforms, in order to measure the fundamental waveform. The filter can also be used to eliminate noise when measuring a low frequency signal.

- **Turning Filter ON and OFF**
  Press the *FILTER* key as shown in the figure below. When the filter is ON, the FILTER indicator LED at the left of the key is on.



- **Frequency Measurement Range**
  The frequency measurement range is as follows with the filter ON.

Filter ON	4Hz to 300Hz
Filter OFF	4Hz to 22kHz

Note

- Note that although the filter affects only frequency measurements and has no effect on the voltage or current input waveforms themselves, it does affect computations that include voltage, current, or active power. Measurement and computations cannot be performed on inputs at 300Hz or more with the filter ON.
- If the filter is ON and a waveform signal at 300Hz or more is input, the error code "ErrLo" may be displayed, depending on the frequency and level of the signal. This is because the signal is so attenuated by the filter that its presence is not recognized.

Chapter 8

Using The External Input/Output Functions

This chapter describes the operating procedures used in remote control and analog output of measured and computed values.

8.1 Input/Output Signals

This section describes signals that are input and output via the remote control/analog output connector.

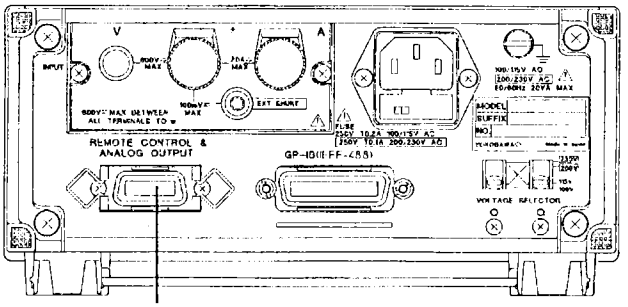
Signal Input/Output Functions

The remote control/analog output connector can be used for the following purposes.

- To start, stop, and reset active power integration (*INTEGRATOR START/STOP* key and *INTEGRATOR RESET* key functions)
  → See **Section 8.2, "Remote Control" (page 8-4).**
- To place display data on hold and apply update triggers (*SAMPLE HOLD* key and *SAMPLE TRIG* key functions)
  → See **Section 8.2, "Remote Control" (page 8-4).**
- To output measured/computed data as an analog signal
  → See **Section 8.3, "Analog Output of Measured/Computed Data" (page 8-6).**

Location of Remote Control/Analog Output Connector

The connector is located as shown in the figure below. The connector used is an AMPHENOL 57-30140 equivalent. Use the accessory "remote control connector" as the plug to terminate the interface cable.



Remote control/analog output connector

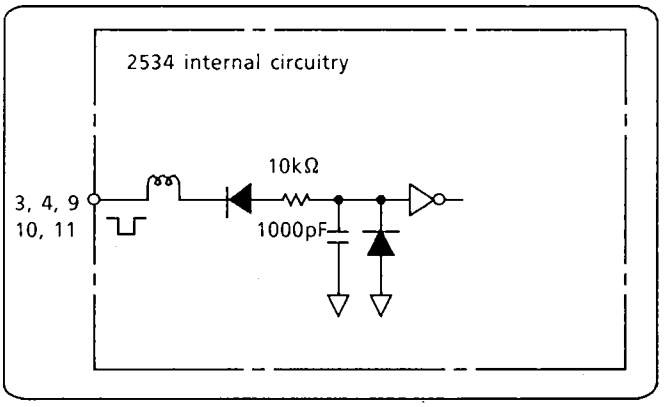
Remote Control/Analog Output Connector Signal Assignments

The table below shows the pin assignments for this connector.

Pin No.	Signal Name	Pin No.	Signal Name
1	D. COM	8	D. COM
2	D. COM	9	$\overline{\text{EXT. HOLD}}$
3	$\overline{\text{INTEG START}}$	10	$\overline{\text{INTEG STOP}}$
4	$\overline{\text{INTEG RESET}}$	11	$\overline{\text{EXT. TRIG}}$
5	$\overline{\text{INTEG BUSY}}$	12	—
6	A. COM	13	A. COM
7	D/A	14	—

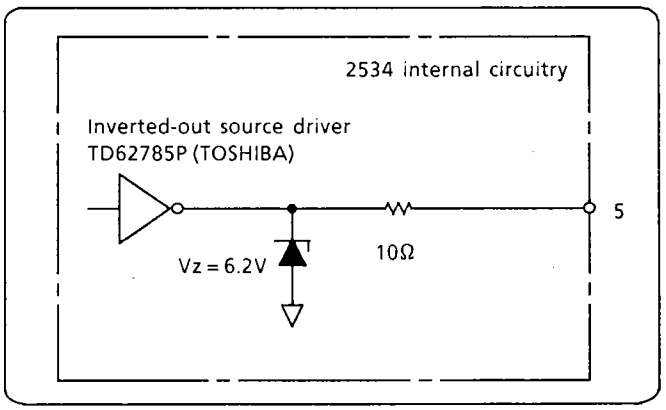
$\overline{\text{INTEG START}}$: Input signal that starts active power integration
$\overline{\text{INTEG RESET}}$: Input signal that resets active power integration
$\overline{\text{INTEG BUSY}}$: Output signal for active power integration status
D/A : Analog output signal
$\overline{\text{EXT. HOLD}}$: Input signal that holds display data
$\overline{\text{INTEG STOP}}$: Input signal that stops active power integration
$\overline{\text{EXT. TRIG}}$: Input signal that updates display data
D. COM : Signal common for digital input/output signals
A. COM : Signal common for analog output signal

• Input Circuit



◦ TTL level
L : 0 to 0.6V
H : 2.4 to 5V

• Output Circuit



◦ TTL level
L : 1mA
H : −400μA

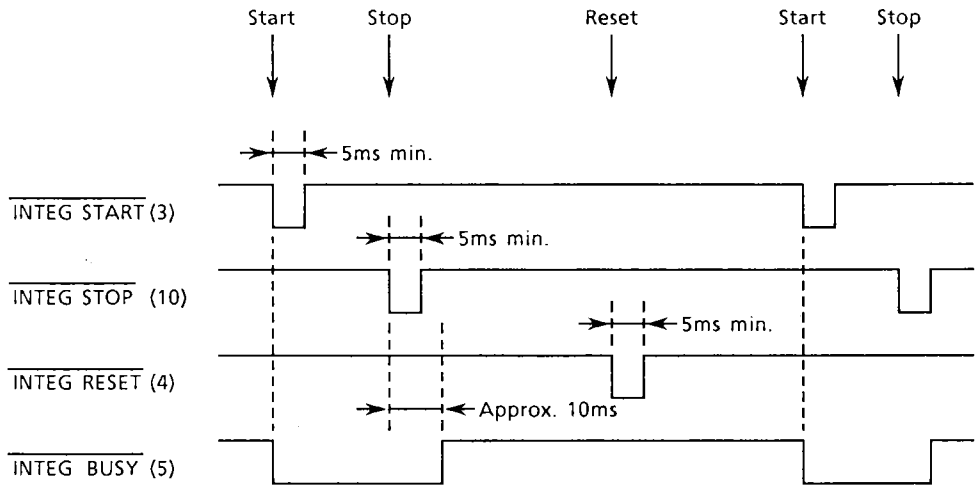
Note • Connnect a 1kΩ "pull-down" resistor if receiving TTL level signals.

8.2 Remote Control

This section describes the operating procedures that are used for external control of active power integration and display data update.

Controlling Active Power Integration

- To control integration, apply input signals according to the timing chart below.



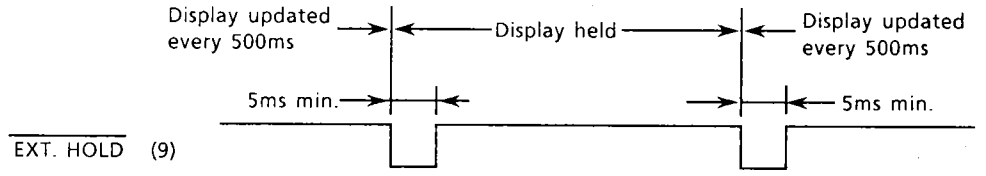
No. Numbers in ( ) are connector pin numbers

- As shown in the figure, the INTEG BUSY output signal goes low while integration is in progress. Use this to monitor integration, etc.

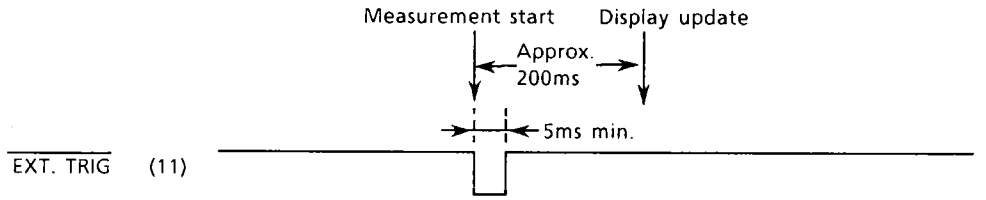
Holding Display Data Update, and Updating Display Data When on Hold

- **Holding Display Data Update (Same Function as *SAMPLE HOLD* Key)**
  To hold the display data update, apply the $\overline{\text{EXT. HOLD}}$ signal input per the timing chart below.

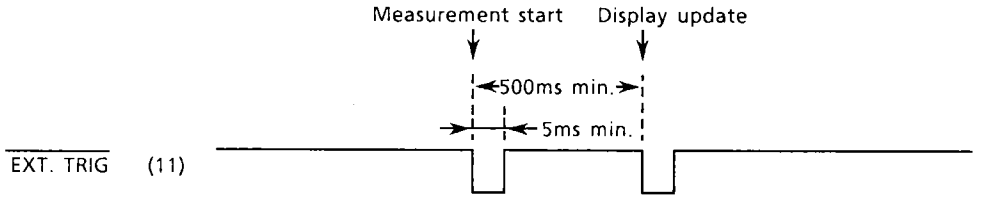
- **Updating Display Data on Hold (Same Function as *SAMPLE TRIG* key)**
  Applying an $\overline{\text{EXT. TRIG}}$ signal when display data is on hold forces display data update.



- **If Active Power Integration is not in Progress**



- **If Active Power Integration is in Progress**



Numbers in ( ) are connector pin numbers

- When measured or computed data is to be saved to the IC memory card, you can apply the starting trigger using the $\overline{\text{EXT. TRIG}}$ signal instead of by pressing the *SAMPLE TRIG* key.

8.3 Analog Output of Measured/Computed Data

This section describes the operating procedures for outputting measured or computed data as an analog signal using the remote control/analog output connector.

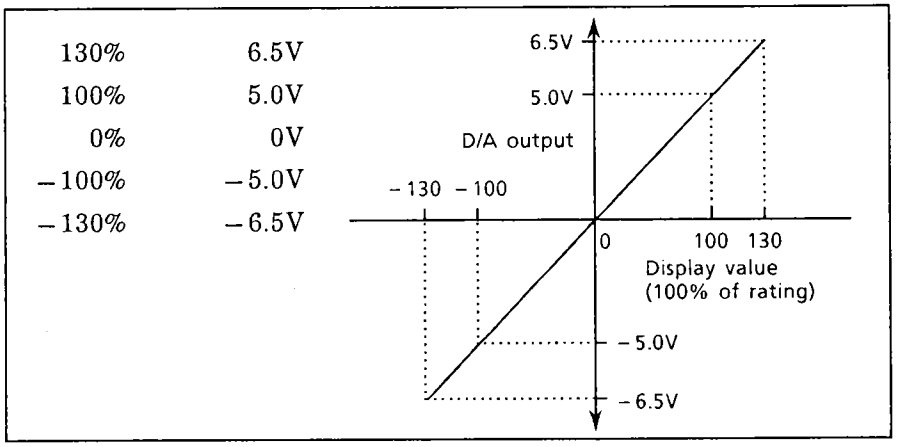
Data to Be Output

This function D/A converts the measured or computed data displayed on DISPLAY C and outputs results as an analog signal from the "D/A" terminal (pin No. 7) of the remote control/analog output connector.
Note that no signal is output when DISPLAY C is being used for active power integration (Wh) display.

Displayed Value and Output Voltage

The following shows the relationship between the output voltage and the measured or computed value displayed on DISPLAY C.

- In the case of voltage (V), current (A), active power (W), apparent power (VA), or reactive power (var), the output has a nominal range of ±5VDC proportional to the measurement range display value (rated value). The maximum output voltage is ±6.5VDC, at 130% of the rated value.

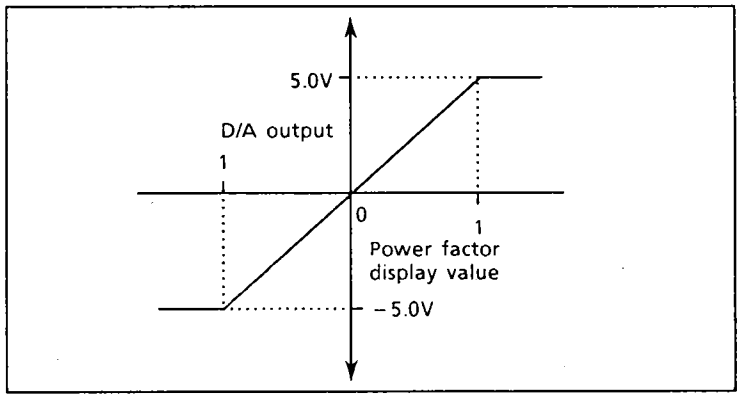


Even if the scaling function is on, the voltage is output without scaling.

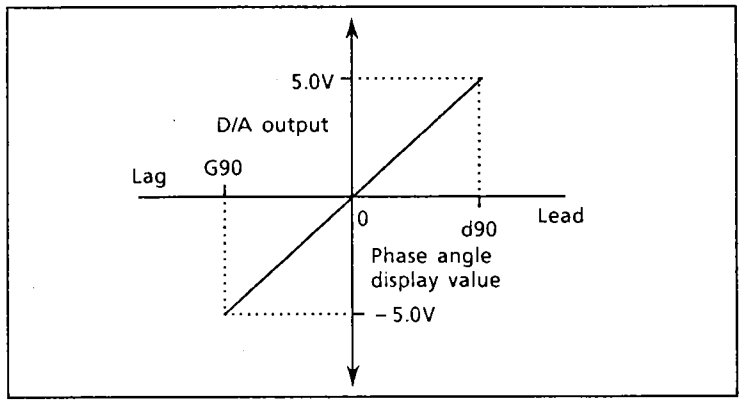
- The voltages below are output when a measurement error code is on display.

Error Code	Nature of Error	Output Voltage
--Po--	Peak overflow	+7.5V
--oL--	+over-range	+7.5V
	−over-range	−7.5V
PFErr	Computation error	+7.5V
dEGErr		
--oF--	Computation overflow	+7.5V
ErrHi	Frequency +over-range	+7.5V
ErrLo	Frequency −over-range	+7.5V

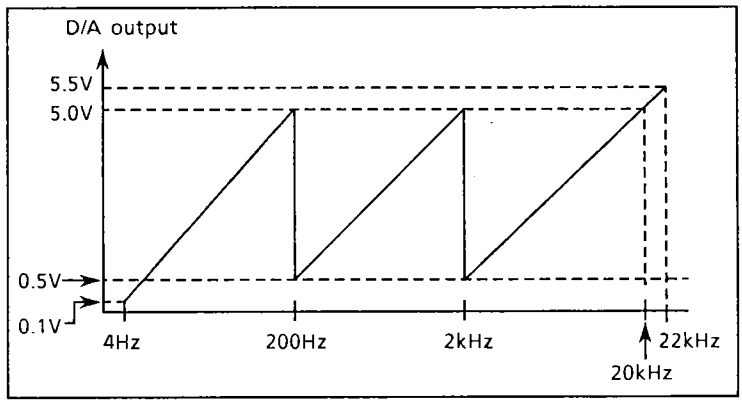
- **For Power Factor (PF)**



- **For Phase Angle (deg)**



- **For Frequency (Hz)**
  As shown in the figure below, the frequency range is divided into four parts to generate the voltage output.



Note

- The D/A output is zero when the lead or lag indication is not displayed.

Chapter 9

Other Functions

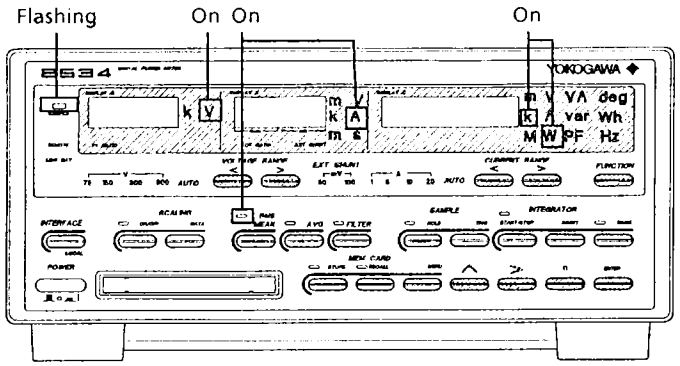
This chapter describes the function that initializes the setup information, and the function provided to back up setup information during power outages.

9.1 Returning Setup Information to Initial Settings

This section describes the operating procedures to return the setup information to the initial settings in effect when the instrument was shipped from the factory.

Initialized Items

- **Display**



- **Scaling Values**
  PT RATIO: 1.000 CT RATIO: 1.000 External shunt constant: 1.000A

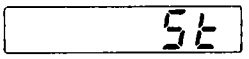
- **IC Memory Card Settings**

Storage rate	: 500ms	Storage mode	: Auto
Recall rate	: 1s	Recall mode	: Auto
NS value	: 1	RD value	: 0

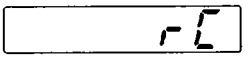
Procedure

1. Press the *MEM CARD MENU* key.
   - Pressing the *MENU* key and the ∧ key will cause the code last selected to reappear on DISPLAY C.
2. Press the ∧ key to select "rC."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.
3. Press the *ENTER* key.
   - Pressing the *ENTER* key starts initialization and causes "-----" to appear on the displays. When initialization is completed, the display returns to measured value display mode.

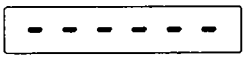
DISPLAY C

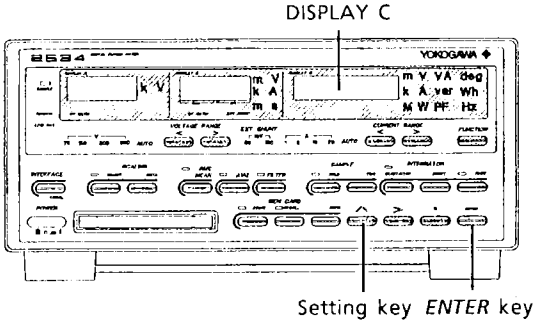


DISPLAY C



DISPLAY C





9.2 Setup Information Backup Function

This section describes the function that backs up the setup information (operating panel setup information).

The 2534 has a function that temporarily backs up the setup information listed below (including the active power integrated value) if power is cut off accidentally as a result of a power failure or other reason.
However, the following should be noted concerning the use of this function.

- Since the backup power source is a double-layer electrolytic capacitor, backup time is limited.
- The backup time depends on the charge in the capacitor.
  For example, if power is on to the 2534 for one hour, maximum backup time is approximately four hours.
  In case the necessary backup is expected to be long, we recommend to use the IC Memory Card for saving / loading (refer to 10.5)
- If power is turned on after the maximum backup time has elapsed, error code "Err60" is displayed, and the setup information returns to the initial settings.
- The double-layer electrolytic capacitor is maintenance-free and does not require periodic replacement.

Information That Is Back Up

- Measurement ranges
- Measurement functions
- Measurement mode
- Scaling values
- Timer preset value
- Parameter settings related to storage and recall of measured and computed data
- Communication interface parameter settings (if the device is equipped with a communications interface)
- Active power integrated value

Chapter 10

Using The IC Memory Card

This chapter describes the operating procedures used to initialize a IC memory card, to save data to an IC memory card, and to load data from an IC memory card.

10.1 General Handling of IC Memory Cards

This section describes the types of IC memory cards that can be used with the 2534, and general notes and precautions concerning their use.

IC Memory Cards That Can Be Used With the 2534

The following IC memory cards can be used with the 2534, and are offered for sale by YOKOGAWA.

Model	Storage Capacity
3789 01	8Kbytes
3789 02	16Kbytes
3789 03	64Kbytes

IC Memory Card Functions in the 2534

The following lists IC memory card operations and the sections that describe them:

- To initialize an IC memory card → See page 10-4.
- To store measured/computed data (storage) → See page 10-5.
- To recall measured/computed data (callup and display of stored measured/computed data) → See page 10-11.
- To save panel setup information (storage) → See page 10-17.
- To load panel setup information (callup of stored setup information and changing panel setup information) → See page 10-17.

Note

- Both measured/computed data and setup information can be stored on the same IC memory card.

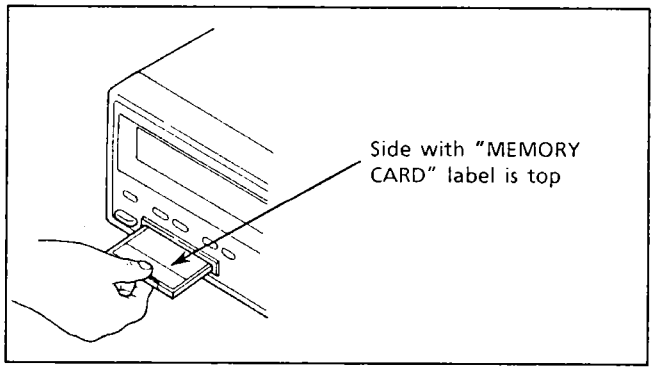
IC Memory Card Operating Modes

When an IC memory card is in use, pressing the *MEM CARD MENU* key will display the codes for the operating modes on DISPLAY C. Use the ∧ key to display the eight codes in sequence.
The codes represent the following operating modes.

- St (ST) Storage mode setup
- rE (RE) Recall mode setup
- nS (NS) NS value setup
- rd (RD) Stored data read start position setup
- SS (SS) Panel setup information save
- SL (SL) Panel setup information load
- Ci (CI) Memory card initialization
- rC (RC) Panel setup information initialization

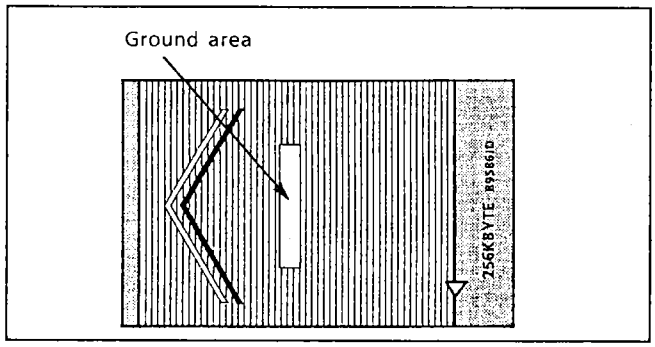
Inserting an IC Memory Card

As shown in the figure below, hold the card with the "MEMORY CARD" side (front) up, and gently insert the card into the card slot. Press the card until it stops. When the card is fully inserted, the end of the card will protrude from the panel by approximately 8mm.



Precautions When Using IC Memory Card

- Before using a card, install the battery supplied with it. Refer to **Section 10.6, "Installing and Replacing the IC Memory Card Battery" (page 10-19)**.
- Always initialize a new IC memory card before using it. Refer to **Section 10.2, "Initializing an IC Memory Card" (page 10-4)**.
- Never remove the IC memory card from the card slot when reading from it or writing to it. If the card is removed during a write or read operation, the data already saved may be lost, and or it may become impossible to load any data from it.
- Never drop or bend an IC memory card, or otherwise subject it to severe shock.
- Never let an IC memory card get wet.
- Be careful to keep dust and debris out of the connector. Keep a dummy card in the slot when not using an IC memory card.
  To order a dummy card, use part number "B9586NG."
- Never leave an IC memory card in direct sunlight. Always keep the card away from any device that generates high temperatures.
- Never store an IC memory card in a location with high temperature or high humidity.
- Never affix the label to the ground contact area in the middle of the card back. Placing a label over the ground area will negate the static electricity protection effect, and may lead to loss of the stored data.



10.2 Initializing an IC Memory Card

This chapter describes operating procedures to initialize the IC memory card to be used with the 2534.

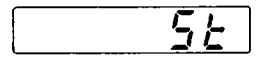
Notes on Initializing an IC Memory Card

- Always use the 2534 to initialize an IC memory card. Cards cannot be initialized with a personal computer or other instrument, since the formatting method will differ.
- Be careful, since all data is deleted when an IC memory card on which data is stored is initialized.

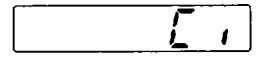
Procedures

1. Insert the IC memory card into the card slot.
2. Press the *MEM CARD MENU* key.
   - Pressing the *MENU* key and the ∧ key will cause the code last selected to reappear on DISPLAY C.
3. Press the ∧ key to select "Ci."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.
4. Press the *ENTER* key.
   - Pressing the *ENTER* key starts initialization and causes "-----" to appear on the displays. When initialization is completed the display returns to the measured value displayed before the step 2 above.
   - If the IC memory card is not inserted completely, error code "Err34" is displayed. If this occurs, insert the IC memory card correctly, and press the *ENTER* key again.

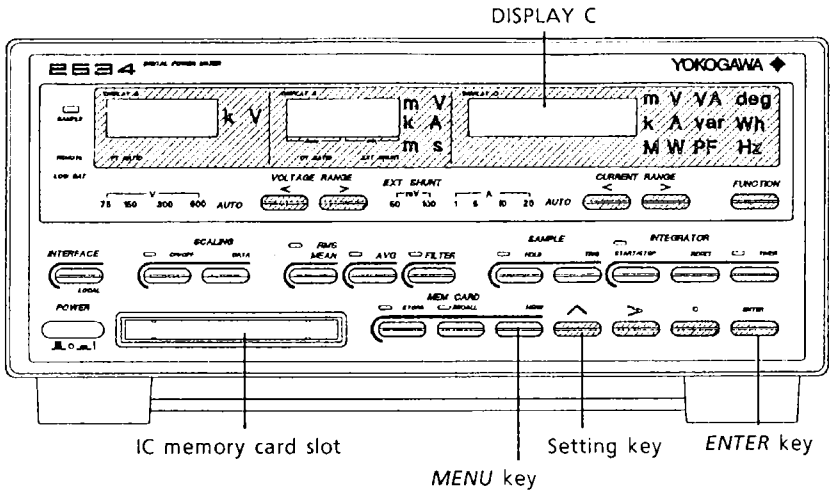
DISPLAY C



DISPLAY C



DISPLAY C



10.3 Storing Measured and Computed Data

This section describes the operating procedures to store measured or computed data to the IC memory card.

Measured/Computed Data Storage Function

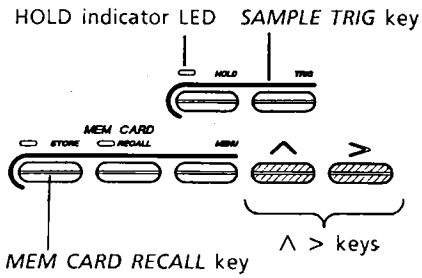
- **Types of Measured and Computed Data to be Stored**
  - The data stored with this function is the individual measured values for voltage (V) and current (A), plus active power (W) or the computed variable displayed on DISPLAY C (VA, var, PF, deg, Wh, and Hz). Note that if DISPLAY C is being used to present either the V or A measured values, then only those measured values can be stored.
  - If the power integrated value (Wh) is displayed on DISPLAY C, the integration time and integrated value will be stored.

- **Number of Data Samples that can be Stored to an IC Memory Card**

  The number of data samples that can be stored to an IC memory card differs as shown below according to the storage capacity of the IC memory card.

	Card Capacity		
	8k	16k	64k
Number of Data Samples	1 to 150	1 to 400	1 to 1500

- **Operating Keys**

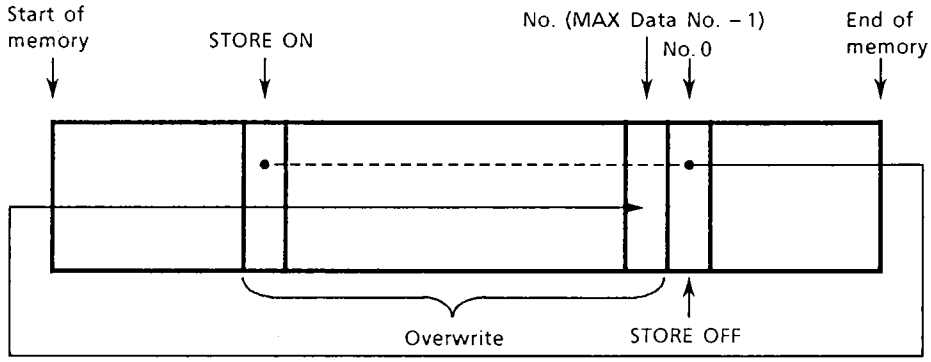


- **About the Three Store Modes**

The following three modes can be used to store measured and computed data.

A. Auto Store Mode

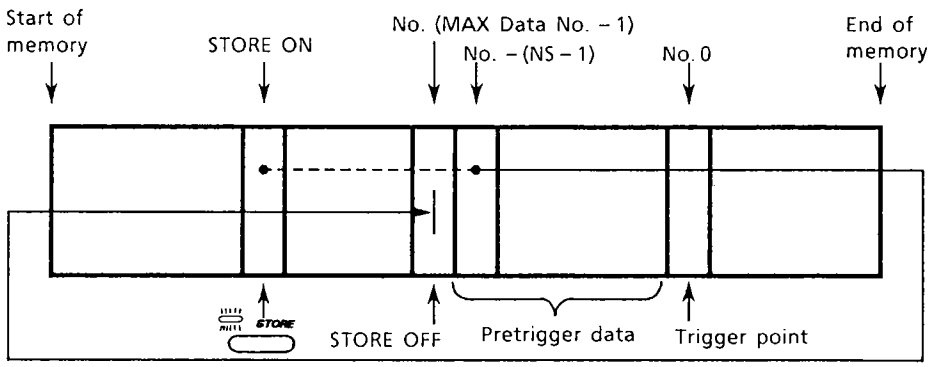
- This mode can be selected when the 2534 is set to auto sampling mode (HOLD indicator LED off) by using the operating mode setup procedures described later in this section to select "S Auto." When in auto store mode, pressing the *MEM CARD STORE* key causes the writing of measured/computed data to begin at the start of the file and to proceed in sequence at the preset store rate. Pressing the same key a second time causes storage to stop.
- If the maximum number of data samples that can be stored on the IC memory card is written before the *MEM CARD STORE* key is pressed the second time to halt storage, the 2534 will return to the head of the file and begin writing data again in sequence from the start of the file. Note that this means that the old data is automatically erased in sequence.



- In auto store mode, the trigger function can be used to start the writing of data. Applying a trigger by pressing the *SAMPLE TRIG* key or other means* after pressing the *MEM CARD STORE* key starts the writing of data; writing stops automatically when the number of data stored after the time of the trigger reaches the maximum number of data that can be stored. This function also allows pretrigger data to be stored, as shown in the figure below. When the trigger is applied, the 2534 will retain a number of data samples from prior to the trigger (equal to the preset pretrigger data count [NS value] – 1), continuing to write data and stop automatically upon reaching the maximum number of data that can be stored.

* External signal input (EXT. TRIG) or communications can also be used.

However, if the number of data stored during the time from when the *MEM CARD STORE* key is pressed until the trigger is applied has not reached the pretrigger count – 1, then all data stored up to that instant is retained, and additional data is stored until reaching the maximum number of data that can be stored.



B. Single Store Mode

- This mode is in effect when the 2534 is in manual sampling mode (HOLD indicator LED on). In single store mode, applying triggers by pressing the *SAMPLE TRIG* key or other means* after pressing the *MEM CARD STORE* key causes one set of measured/computed data to be written for each trigger; data writing begins at the start of the file and proceeds sequentially. When the number of data stored reaches the preset "NS value" (SAMPLE indicator LED off), then no more data will be stored, even if more triggers are applied.

  * External signal input (EXT. TRIG) or communications can also be used.

- Setting a preset count with "NS value" in advance results in the SAMPLE indicator LED turning off when exactly that number of data have been stored. After that, even if more triggers are applied, no more data will be stored to the card. If the preset number is larger than the maximum number of data that can be stored, the SAMPLE indicator LED will turn off when the maximum number of data that can be stored have been written to the card. After that, no more data will be stored to the card even if more triggers are applied.

C. N Reading Store Mode

- This mode can be selected when the 2534 is set to auto sampling mode (HOLD indicator LED off) by using the operating mode setup procedures described later in this section to select "S nrdG." In N reading store mode, pressing the *MEM CARD STORE* key stops measurement or computation, and sets the 2534 to wait for a trigger. Applying a trigger by pressing the *SAMPLE TRIG* key or by other means* will start the storing of measured/computed data sequentially from the start of the file at the preset store rate. Note that if active power integration is in progress, measurement continues, but the display and external output are not updated. When the trigger arrives, the display and external output are updated at the store rate. When the number of data stored reaches the preset "NS value", measurement and computation stop automatically, and the 2534 returns to the trigger wait state. If the *SAMPLE TRIG* key is later pressed again, data will again be stored until the number of data reaches the preset number. If the number of data stored reaches the maximum number of data that can be stored on the card, data storage stops automatically.

  * External signal input (EXT. TRIG) or communications can also be used.

- If the *SAMPLE TRIG* key is pressed while data storage is still taking place, data storage will begin again with previously stored data being overwritten.
- If the NS value is greater than the maximum number of data that can be stored on the card, writing stops when the number of data stored reaches the maximum.

- **Store Rate**

  In the above auto store mode and N reading store mode, data is stored periodically at a preset store rate. The selectable store rates are displayed in the sequence shown below.

  500ms → 1s → 5s → 10s → 30s → 60s → 300s → 600s → 1800s → 3600s

- **NS Value**
  The function of the NS value, which is set by the setup procedure indicated below, changes according to the store mode as follows:
  · Auto store mode : Pretrigger data count
  · Single store mode : Preset count
  · N reading mode : Number of data stored per trigger
  NS Value Setting Ranges
  · Pretrigger Count Setting Range

Card Capacity		
8k	16k	64k
1 to 150	1 to 400	1 to 1500

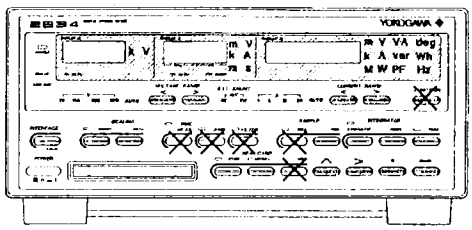
  · Setting Range for Preset Count and Number of Data Stored
  Same as **"Number of data samples that can be stored to an IC memory card"** on **page 10-5**.

Notes on Storing Measured/Computed Data

- Each IC memory card on which measured/computed data is stored must be initialized (formatted). See **Section 10.2, "Initializing an IC Memory Card" (page 10-4)**.
- Even if scaling is performed on the measured/computed data for display, the data stored is not scaled.
- When the *MEM CARD STORE* key is pressed, the 2534 first deletes all previously stored data before beginning data storage.
- The sampling rate changes in accordance with store rate.

Note

- While storage is in progress, the keys crossed out in the figure below cannot be used. Pressing any of these keys will cause error code "Err13" (when in power integration) or "Err14" to be displayed.



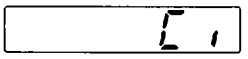
Setup Procedures

1. Insert the IC memory card into the card slot.
   - For instructions on how to insert the IC memory card, refer to **Section 10.1, "General Handling of IC Memory Cards" (page 10-2).**

• Set the Store Mode to Auto Store or N Reading Store

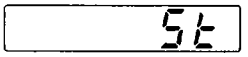
2. Press the *MEM CARD MENU* key.
   - Pressing the the Λ key will cause the code last selected to reappear on DISPLAY C.

DISPLAY C



3. Press the Λ key to select "St."
   - Pressing the Λ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.

DISPLAY C



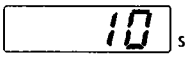
4. Press the *ENTER* key.
   - The store rate appears on DISPLAY B (with the rightmost digit flashing) and the store mode code appears on DISPLAY C ("S Auto" or "S nrdG").

DISPLAY B

DISPLAY C

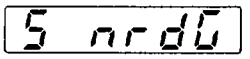
5. Press the Λ key to select the desired store rate.
   - For store rates that can be selected, refer to "• **Store Rates**", above.

DISPLAY B

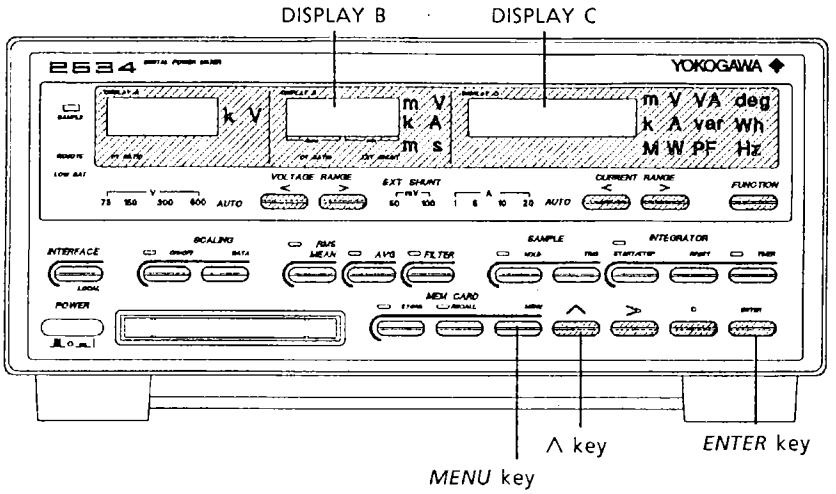


6. Press the *ENTER* key.
   - The rightmost digit in DISPLAY C flashes.
7. Press the Λ key to select "Auto" for auto store mode or to select "nrdG" for N reading store mode.
   - Pressing the Λ key toggles the display between "Auto" and "nrdG."

DISPLAY C



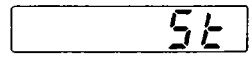
8. Press the *ENTER* key.
   - Pressing the *ENTER* key returns you to the display in effect prior to the operations in Step 2 above.



- **Setting the NS Value**

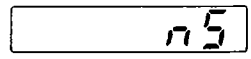
2. Press the *MEM CARD MENU* key.
   - The "St" code will appear on DISPLAY C as shown at right, unless some other code has been selected with the *MENU* and ∧ keys since power-on.

DISPLAY C



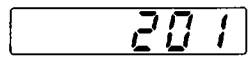
3. Press the ∧ key to select "nS."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St →rE →nS →rd →SS →SL →Ci →rC.

DISPLAY C

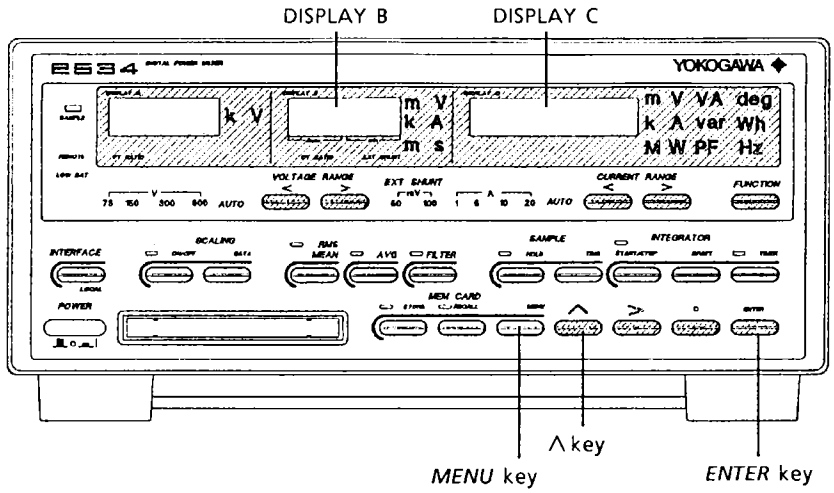


4. Press the *ENTER* key.
   - "nS" appears on DISPLAY B, and the currently specified NS value appears on DISPLAY C.
5. Press the ∧ key and the > key to input the NS value.
   - Press the ∧ key to change the number that is flashing.
   - Press the > key to move the number input position (flashing number).

DISPLAY C



6. Press the *ENTER* key.
   - Pressing the *ENTER* key returns you to the display in effect prior to the operations in Step 2 above.
   - If a value of 0 or greater than 1500 is input, error code "Err12" will appear. If this occurs, return to Step 4 above, and input a correct number.

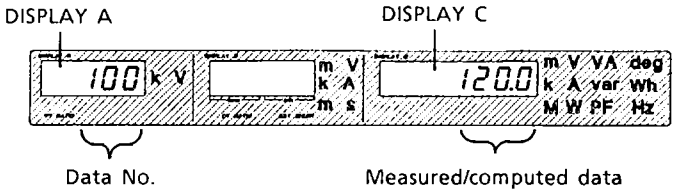


10.4 Recalling Stored Measured and Computed Data

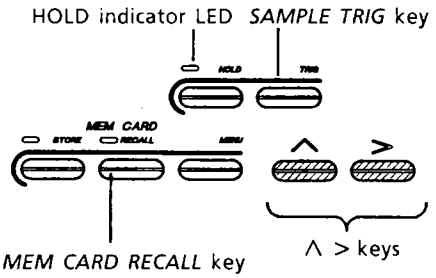
This section describes the operating procedures to recall (to the displays) measured and computed data previously stored to an IC memory card.

About the Measured Data Recall Function

This function is used to display measured data that has been previously stored on an IC memory card. As shown in the figure below, DISPLAY A shows the Data No., DISPLAY C shows one of the measured or computed data variables that was stored.
Whenever DISPLAY C is showing a power integration value (Wh), DISPLAY B will show the corresponding integration time.



- **Operating Keys**



- **About the Three Recall Modes**

The following three modes can be used to recall measure data.

A. Auto Recall Mode

· To select this mode, place the 2534 in auto sampling mode (HOLD indicator LED off) and use the recall mode setup procedure described later in this section to set select "r Auto." In auto recall mode, pressing the *MEM CARD RECALL* key causes data display to begin at once, at the previously specified recall rate; the data samples are presented in sequence beginning with the data sample having the specified Data No.

· After the last data sample is displayed, recall stops automatically.

B. Single Recall Mode

- To select this mode, place the 2534 in manual sampling mode (HOLD indicator LED on). In single recall mode, applying triggers by pressing the *SAMPLE TRIG* key or by other means* after pressing the *MEM CARD RECALL* key will display the stored data in sequence beginning at the data sample having the specified Data No.
- After the last data sample is displayed, recall stops automatically.

* External signal input (EXT. TRIG) or communications can also be used.

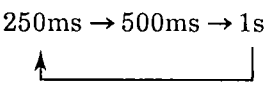
C. N Reading Recall Mode

- To select this mode, place the 2534 in auto sampling mode (HOLD indicator LED off) and use the recall mode setup procedure described later in this section to select "r nrdG." In N reading recall mode, pressing the *MEM CARD RECALL* key stops measurement and sets the device to wait for a trigger. Applying a trigger by pressing the *SAMPLE TRIG* key or by other means* starts display at the preset recall rate beginning at the data sample having the specified Data No. When the number of data samples specified by "NS value" has been displayed, recall goes into a hold state, and the 2534 waits for another trigger. If the *SAMPLE TRIG* key is then pressed again, the 2534 again recalls and displays the specified number of data samples. When the last data is displayed, recall stops automatically.

* External signal input (EXT. TRIG) or communications can also be used.

- **Recall Rate**

In the auto recall and N reading recall modes described above, data samples are recalled and displayed periodically at a preset recall rate. The recall rate is selected from among three values displayed in sequence as follows.



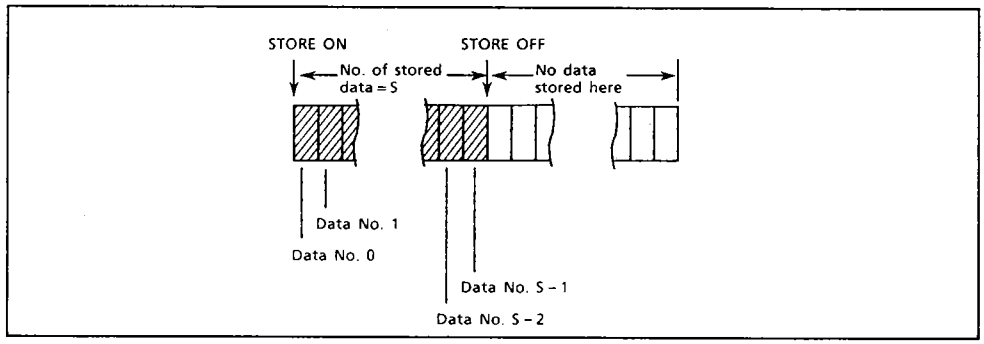
- **Ranges for the Data Read Start Position**

  For data that was stored in auto store mode

  · Range if the pretrigger function was not used:

  0 to (number of stored data − 1)

  The first data stored after the *MEM CARD STORE* key is pressed is given Data No. 0.

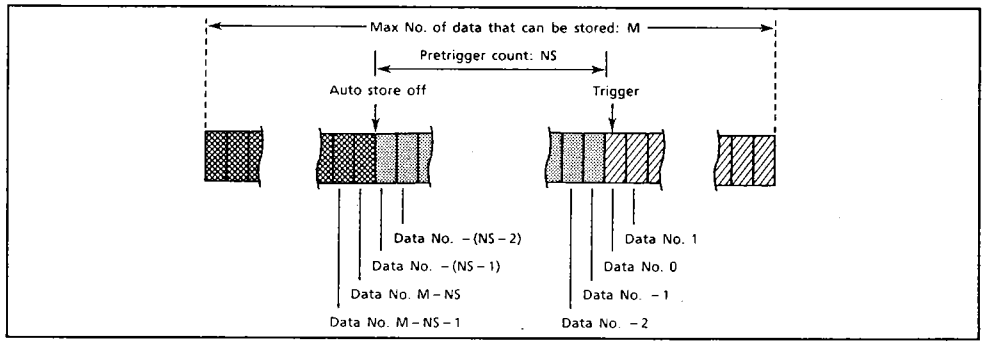


  · Range if the pretrigger function was used:

  −(NS value − 1) to (MAX Data No. − NS value)

  The first data stored after the trigger is given Data No. 0. Note that if the number of data samples "S" stored from when the *MEM CARD STORE* key was pressed until the trigger was applied is less than (NS value − 1), then the range is −S to (M − S − 1), where "M" is the maximum number of data that can be stored.

  In addition, if the *MEM CARD STORE* key is pressed to stop storage after the trigger is applied and before storage would have stopped automatically, then the range is −(NS − 1T) to (T − 1) or −S to (T − 1), where "T" is the number of data stored prior to triggering.



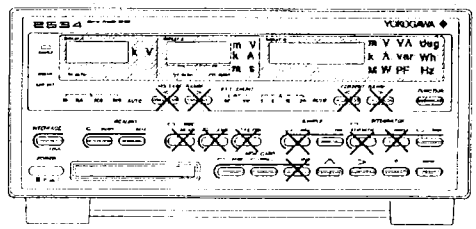
- **About the NS Value**

  · The NS value, which is set by the setup procedure described below, serves as the "number of recall data" in N reading recall mode.

  · The setting range for number of recall data is 1 to 1500

Note

- If you attempt to select measured data that was not stored, "-----" is displayed.
- If the scaling indicator LED is on, the measured data are displayed as scaled values.
- While recall is in progress, the key that are crossed out in the figure below are inoperable. Attempting to operate any of these keys will result in error code "Err13" (when in power integration) or "Err14" being displayed.



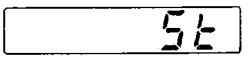
Setup Procedures

1. Insert the IC memory card into the card slot.
   - For instruction on how to insert the IC memory card, refer to **Section 10.1, "General Handling of IC Memory Cards" (page 10-2).**

• Setting the Recall Mode to Auto Recall or N Reading Recall

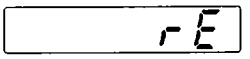
2. Press the *MEM CARD MENU* key.
   - Pressing the *MENU* key and the ∧ key will cause the code last selected to reappear on DISPLAY C.

DISPLAY C



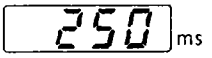
3. Press the ∧ key to select "rE."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.

DISPLAY C



4. Press the *ENTER* key.
   - The currently specified recall rate appears on Display B (with the rightmost digit flashing), and "r Auto" or "r nrdG" appears on DISPLAY C.
5. Press the ∧ key to select the desired recall rate.
   - For recall rates that can be selected, refer to "• **Recall Rates**", above.

DISPLAY B

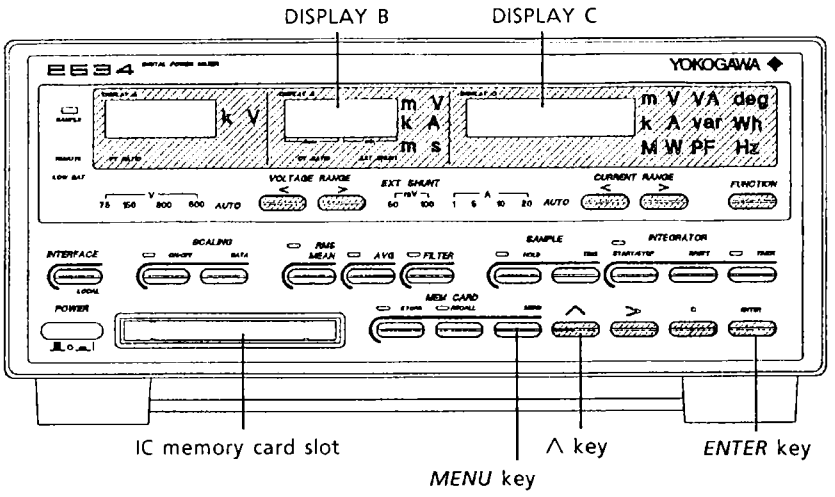


ms

6. Press the *ENTER* key.
7. Press the ∧ key to select "Auto" for auto recall mode or to select "nrdG" for N reading recall mode.
   - Pressing the ∧ key toggles the display between "Auto" and "nrdG."

DISPLAY C

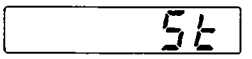
8. Press the *ENTER* key.
   - Pressing the *ENTER* key returns you to the display in effect prior to the operations in Step 2 above.



- **Setting the Data Read Starting Position**

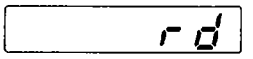
2. Press the *MEM CARD MENU* key.
   - The "St" code will appear on DISPLAY C as shown at right, unless some other code has been selected with the *MENU* and ∧ key since power-on.

DISPLAY C



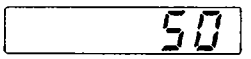
3. Press the ∧ key to select "rd."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.

DISPLAY C



4. Press the *ENTER* key.
   - "rd" appears on DISPLAY B, and data number of the currently specified data readout starting position appears on DISPLAY C. The cursor is flashing.
5. Press the ∧ key and the > key to input the Data No. of the data read starting position.
   - Press the ∧ key to change the number that is flashing.
   - Press the > key to move the number input position (flashing number).

DISPLAY C

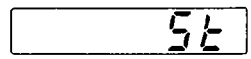


6. Press the *ENTER* key.
   - Pressing the *ENTER* key returns you to the display in effect prior to the operations in Step 2 above.
   - If "0" or a number outside of the range from "−1499" to "+1499" is input, error code "Err12" is displayed. If this occurs, return to Step 4 above, and input a correct number.

- **Setting the NS Value**

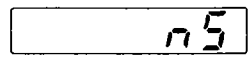
2. Press the *MEM CARD MENU* key.
   - As shown at right, the "St" code will appear on DISPLAY C, unless some other code has been selected with the *MENU* and ∧ keys since power-on, in which case that other code will appear.

DISPLAY C



3. Press the ∧ key to select "nS."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.

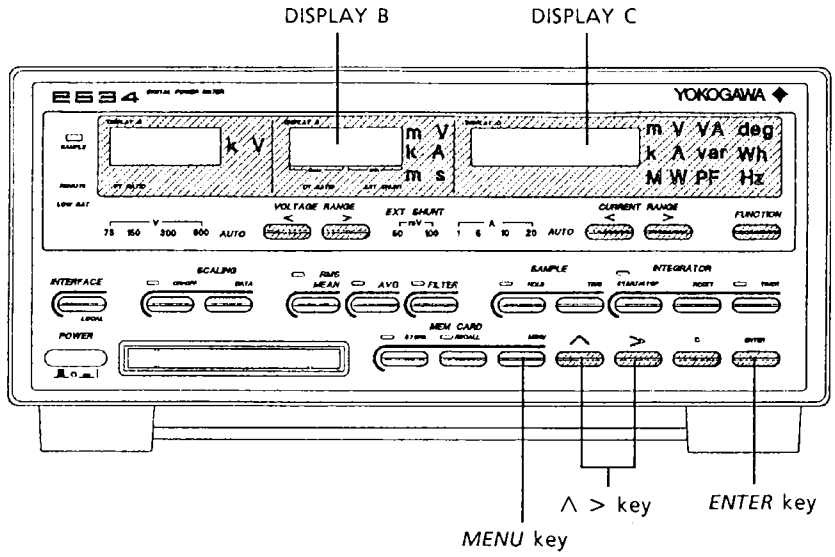
DISPLAY C



4. Press the *ENTER* key.
   - "nS" appears on DISPLAY B, and the currently specified NS value appears on DISPLAY C.
5. Press the ∧ key and the > key to input the NS value.
   - Press the ∧ key to change the number that is flashing.
   - Press the > key to move the number input position (flashing number).

DISPLAY C

6. Press the *ENTER* key.
   - Pressing the *ENTER* key returns you to the display in effect prior to the operations in Step 2 above.
   - If a value of 0 or greater than 1500 is input, error code "Err12" will appear. If this occurs, return to Step 4 above, and input a correct number.



10.5 Saving and Loading Setup Information

This section describes the operating procedures to save panel setup information to the IC memory card and to load setup information from the IC memory card.

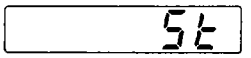
Notes on Storing Panel Setup Information

- The IC memory card on which setup information is to be stored must already have been initialized. See **Section 10.2, "Initializing an IC Memory Card" (page 10-4)**.
- If setup information has previously been saved to the IC memory card, the procedure below will update (replace) that setup information.

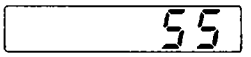
Procedures for Saving Panel Setup Information

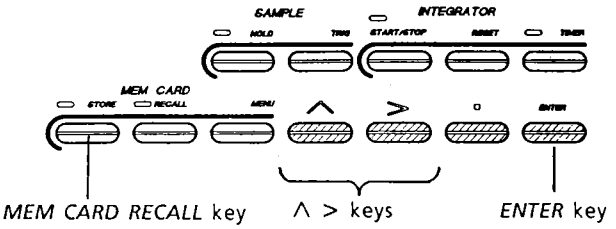
1. Insert an IC memory card into the card slot.
   - For instructions on how to insert the IC memory card, refer to **Section 10.1, "General Handling of IC Memory Cards" (page 10-2)**.
2. Press the *MEM CARD MENU* key.
   - Pressing the *MENU* key and the ∧ key will cause the code last selected to reappear on DISPLAY C.
3. Press the ∧ key to select "SS."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.
4. Press the *ENTER* key.
   - Pressing the *ENTER* key saves the panel setup information to the IC memory card and returns you to the display in effect prior to the operations in Step 2 above.

DISPLAY C



DISPLAY C

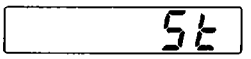




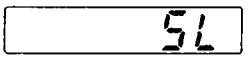
Procedures for Loading Setup Information

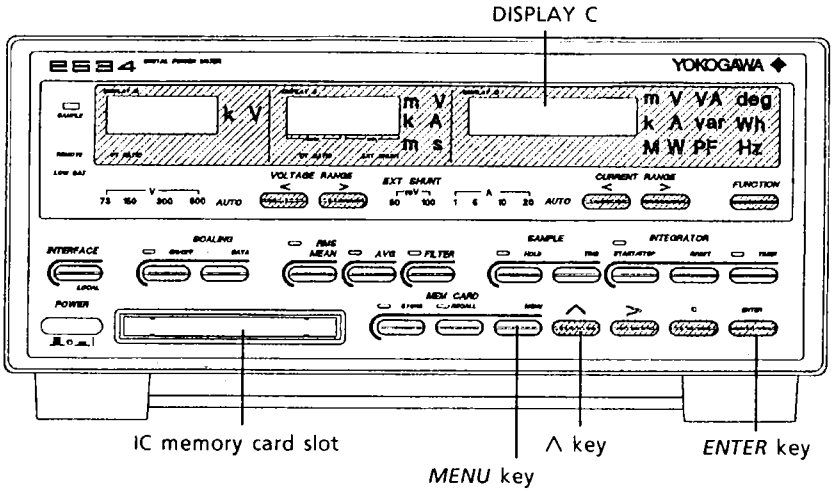
1. Insert the IC memory card into the card slot.
   - To insert the IC memory card, refer to **Section 10.1, "General Handling the IC Memory Card" (page 10-2).**
2. Press the *MEM CARD MENU* key.
   - Pressing the *MENU* key and the ∧ key will cause the code last selected to reappear on DISPLAY C.
3. Press the ∧ key to select "SL."
   - Pressing the ∧ key changes the code on DISPLAY C in the sequence:
     St → rE → nS → rd → SS → SL → Ci → rC.
4. Press the *ENTER* key.
   - Pressing the *ENTER* key loads the panel setup information and returns you to the display in effect prior to the operations in Step 2 above.
   - Pressing the *MENU* key before pressing the *ENTER* key will return you to the display in effect before the operations in Step 2 above, without loading the setup data.

DISPLAY C



DISPLAY C





Auto Load Function

The auto load function loads the setup information automatically if an IC memory card on which the setup information has been saved is present in the card slot when the power switch is turned ON.

Loading of Communication Interface Setting

Loading interface settings can be done for instruments which display a version number of 2.00 and over when the power is tuned ON (to verify the version number, refer to 2.5).

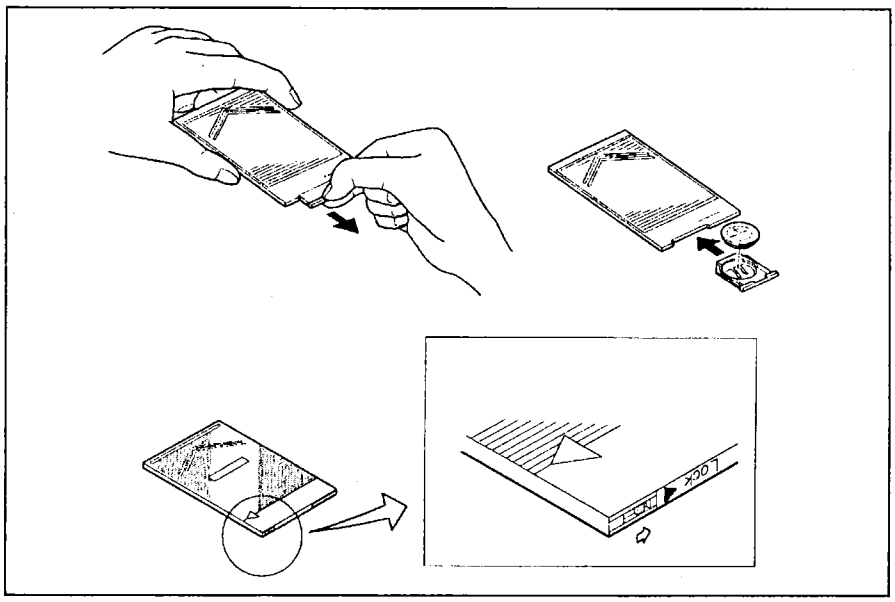
Only the auto load function can be used to load the interface settings. The settings will not be loaded when performing the loading procedure described on top of this page.

10.6 Installing and Replacing the IC Memory Card Battery

This section describes the operating procedures to install and replace the battery that is used to back up data on the IC memory card.

Installing the Battery in a New IC Memory Card

1. Hold the IC memory card with its back side (the side that shows the memory capacity) up.
2. Hook your a fingernail into the slot in the battery holder, and pull out the battery holder.
3. Insert the battery supplied with the card into the battery holder with the + (plus) side up.
4. Insert the battery holder into the IC memory card.
5. Use the tip of a ballpoint pen, etc. to move the battery holder lock on the front of the IC memory card in the direction of the arrow (▸).

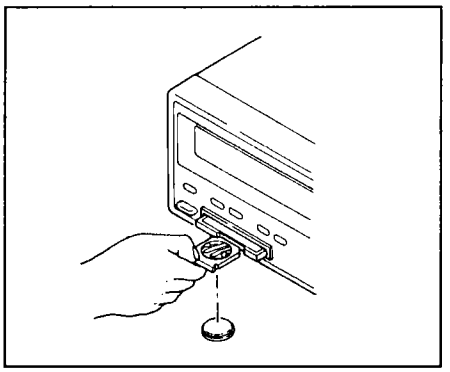


Replacing an IC Memory Card Battery

If an IC memory card's battery is low, the "LOW BAT" indicator at the left of DISPLAY A will light when the card is used. If this occurs, use the procedures below to replace the battery.

- **If you do not Mind Losing the Stored Data**
  1. Remove the IC memory card from the card slot.
  2. Use the tip of a pen, etc. to move the battery holder lock on the front of the IC memory card away from the arrow (▸).
  3. Hold the IC memory card with its back side (the side that shows the memory capacity) up.
  4. Hook your fingernail into the slot in the battery holder, and pull out the battery holder.
  5. Remove the old battery from the battery holder.
  6. Insert the new battery with the + (plus) side up in the battery holder.
  7. Insert the battery holder into the IC memory card.
  8. Use the tip of a pen, etc. to move the battery holder lock on the front of the IC memory card in the direction of the arrow (▸).

- **Replacing the Battery if the Saved Data Must not be Lost**
  The card must remain in the card slot with power on throughout the replacement procedure. Follow Steps 2, and 4 through 8 above with the IC card in the card slot.
  · Be careful since the battery will fall out when the battery holder is removed in Step 5.
  · In Step 6, insert the battery with the +side down.



Note

- The part number for battery ordering is "B9586JU."
- All data stored on the IC memory card will be lost if the card is removed from the card slot with the battery removed.
- The life of the IC memory card battery is approximately four years (64Kbytes).
- Replacing the battery with the IC memory card removed from the card slot causes the card to become unformatted. The card must be initialized again before attempting to save data.

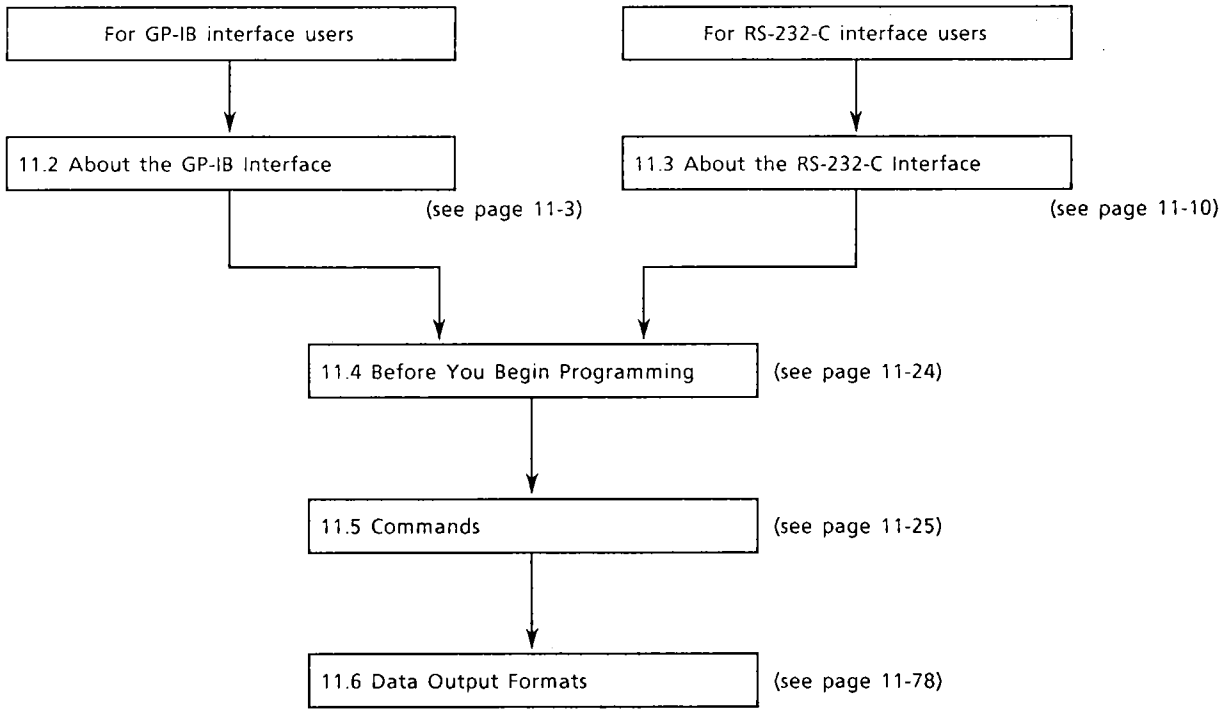
Chapter 11

Using The Communications Functions

This chapter describes the communications functions available via the GP-IB or RS-232-C interface.

11.1 Overview of Communications Functions

The optional communications functions of the 2534 can be used with either a GP-IB or an RS-232-C interface. They permit remote control from a personal computer, and output of a variety of data.



11.2 About the GP-IB Interface

GP-IB Interface Functions

The following two modes are provided for the GP-IB interface of the 2534.

- **Addressable Mode**
  Allows the 2534 can be controlled using commands from a controller (personal computer).
- **Talk-only Mode**
  Provides only output of measured/computed data.

The table below shows the functions that can be used in each of these modes.

Mode	Function	
Addressable mode	Listener	• Functions performed through front panel key operations (excluding *INTERFACE* key operations) Example: Voltage/current range setup Display data selection Measurement mode setup • Panel setup information output request • Error code output request
	Talker	• Measured/computed data output • IC memory card data output • Panel setup information output • Error code output • Status byte output
Talk-only mode	Talker	Measured/computed data output

11.2.1 GP-IB Interface Specifications and Data Transmission Rates

GP-IB Specifications

- **Electrical and Mechanical Specifications** :
  Conforms to IEEE St'd 488.1-1978
- **Functions Supported** : SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0
- **Code Set Used** : ISO (ASCII) code set
- **Address Settings** : Talker and listener addresses 0 to 30 can be selected by panel entry
- **Remote Mode Clear** : Can be cleared by pressing the *INTERFACE* key on the front panel. (disabled when LOCAL LOCKOUT has been set from the GP-IB controller).
- **Functions**

FUNCTION	Description
SH1	Full source handshake capability
AH1	Full acceptor handshake capability
T5	Basic talker capability, serial polling, untalk on MLA (My Listen Address), talk-only capability
L4	Basic listener capability, unlisten on MTA (My Talk Address)
SR1	Full service request capability
RL1	Full remote/local capability
PP0	No parallel polling capability
DC1	Full device clear capability
DT1	Full device trigger capability
C0	No controller function

GP-IB Data Transmission Rate

Estimates of effective throughput for measured/computed data output via the GP-IB interface should be based on the following guidelines.

- For the case of data acquisition using BASIC language "LINE INPUT @" commands to read 18-byte lines of data, throughput is approximately 2400bytes/second. (Using a personal computer comparable to a 10MHz clock rate IBM PC/AT computer).

11.2.2 Response to Interface Messages, and Transfer Between Remote and Local Statuses

Response to Interface Messages

Responses to interface messages are as follows:

- **SDC (Selected Device Clear), DCL (Device Clear)**
  Initializes the instrument to the same state as after power-on (except for the interface).

- **GET (Group Execute Trigger)**
  Equivalent to pressing the *SAMPLE TRIG* key (same as "E" command).

- **REN (Remote Enable)**
  Transfers the 2534 from local control to remote control (front panel keys are disabled). The REMOTE indicator LED turns ON.
  Pressing the *INTERFACE LOCAL* key will return the 2534 to local control.

- **IFC (Interface Clear)**
  Cancels (unaddresses) talker and listener.

Note

- Performing a device clear will clear all measured and computed data values.

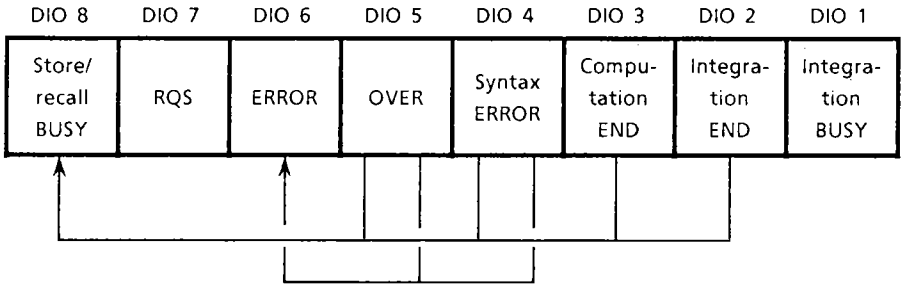
Transfers Between Remote and Local

- **Transferring from Local to Remote**
  Local panel setup parameters are maintained even if the system is transferred to remote status.

- **Transferring from Remote to Local**
  Remote panel setup parameters are maintained even if the system is transferred to local status.

11.2.3 GP-IB Status Byte Format

The following shows the format of the status byte sent in response to a serial poll.



- **Store/recall BUSY (DIO 8)**
  Set to "1" while measured/computed data is being stored to or recalled from the IC memory card. This bit cannot be disabled by the IM command.

- **RQS (DIO 7)**
  Service request. Set to "1" when any one or more of the status byte interrupt cause bits enabled by the IM command (OVER, Syntax ERROR, Integration END, and/or Computation END) is set to "1." When this bit is set to "1", the SRQ line is set to True, sending an interrupt to the controller. After a response is sent to the serial poll, this bit returns to "0." This bit cannot be disabled by the IM command.

- **ERROR (DIO 6)**
  Set to "1" when either of the status byte interrupt cause bits OVER or Syntax ERROR is set to "1" (they can be set only if enabled by the IM command). This bit cannot be disabled by the IM command.

- **OVER (DIO 5)**
  Set to "1" for measured data over-range, peak overflow, or computation overflow. The exact cause of the error can be identified with the OE command **(see page 11-65)**. Note that if OVER and Syntax ERROR occur at the same time, the Syntax ERROR has priority in output in response to the OE command.

- **Syntax ERROR (DIO 4)**
  Set to "1" if any of the following conditions exists when a GP-IB command is received:
  · Command is undefined
  · Parameter is outside of range
  · Command cannot be executed due to the current instrument status
  The exact nature of the error can be identified with the OE command **(see page 11-65)**.

- **Computation END (DIO 3)**
  Set to "1" each time computations are completed (every 500ms).
  Note that if the trigger mode is manual, this bit is set to "1" whenever the subsequent measurements and computations are completed after:
  · the front panel *SAMPLE TRIG* key is pressed, or
  · a external trigger signal is applied, or
  · the E command or the GET command is received.

- **Integration END (DIO 2)**
  Set to "1" when active power integration is completed.

- **Integration BUSY (DIO 1)**
  Set to "1" while active power integration is being executed. This bit cannot be disabled by the IM command.

Note

- When any one or more of the OVER, Syntax ERROR, Integration END, or Computation END bits goes to "1", the RQS (DIO 7) bit goes to "1" and an SRQ is generated. Note, however, that none of these interrupt cause bits will be allowed to go to "1" unless it is enabled by specifying it in an IM command.

11.2.4 Selecting Between Addressable Mode and Talk-Only Mode

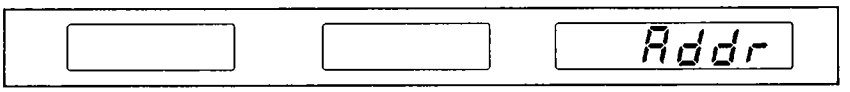
The GP-IB interface on the 2534 has two modes:

- **Addressable Mode**
  In addressable mode the 2534 is controlled by commands from a controller (usually a personal computer). The procedure for placing the 2534 in this mode requires that a bus address be entered, thereby enabling the 2534 to recognize commands sent to it from a controller over the bus.
- **Talk-only Mode**
  In talk-only mode the 2534 is able only to output measured and computed data. Addressing is irrelevant in this mode.

Procedures

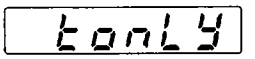
1. Place the 2534 in local status.
   To select the mode the 2534 must be in local status. If the 2534 is in remote status, press the *INTERFACE* key to go to local status.

2. Call up the mode selection display.
   Pressing the *INTERFACE* key changes the display to the mode selection screen, as shown below. DISPLAY C will be flashing.



3. Select addressable mode or talk-only mode.
   Pressing the ∧ key will toggle DISPLAY C between the selections shown. Select the desired mode, and use the *ENTER* key to enter it.
   Addr : Addressable mode
   tonLy: Talk-only mode

DISPLAY C



4. If talk-only mode is selected, the screen returns to the normal measurement display.
   If addressable mode is selected, proceed to follow the instructions in **Section 11.2.5, "Setting the Address"** (next page), to set the address.

11.2.5 Setting the Address

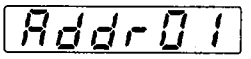
If addressable mode is selected in Section 11.2.4, use the procedures below to set the 2534 address. Any address from 0 to 30 can be set.

Procedure

1. Selecting addressable mode causes the display to change to the address setup display as shown below. One of the two digits on DISPLAY C will be flashing (at shipment from the factory, this address is set to "01").

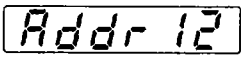
2. Use the > key to select the digit to be set.

DISPLAY C



3. Use the ∧ key to input the number.
   - The setting range is 0 to 30.

DISPLAY C



4. Set the other digit in the same way.

5. After both of the digits have been input, press the *ENTER* key to enter the address.
   - Pressing the *ENTER* key after completing the setting returns the instrument to the normal measurement display.

11.3 About the RS-232-C Interface

RS-232-C Interface Functions

The RS-232-C interface of the 2534 has two modes:

- **Normal Mode**
  In normal mode data the 2534 can both send and receive data.
- **Talk-only Mode**
  In talk-only mode the 2534 is able only to send data (to output measured/computed data).

The table below shows the functions that can be used in each of these modes.

Mode	Function	
Normal mode	Receive	• Functions performed through front panel key operations Example : Voltage/current range setup Display data selection Measurement mode setup • Panel setup information output request • Error code output request
	Transmit	• Measured/computed data output • IC memory card data output • Panel setup information output • Error code output • Status byte output
Talk-only mode	Receive	Measured/computed data output

11.3.1 RS-232-C Interface Specifications

General Specifications

- **Electrical Interface** : Conforms to EIA RS-232-C
- **Connection** : Point-to-point
- **Communication** : Full-duplex
- **Synchronization** : Asynchronous (start-stop)
- **Baud Rate** : 1200, 2400, 4800, 9600 (selectable)
- **Data Format**

  Start bit : Start bit is fixed at 1 bit
  Data length : Either 7 or 8 bits
  Parity : Even, odd or no parity
  Stop bit : Either 1 or 2 stop bits

The table below shows the four data format combinations that can be selected.

Format Setting	Start Bit	Data Length	Parity	Stop Bits
0	1	8	None	1
1	1	7	Even	1
2	1	7	Odd	1
3	1	7	None	2

- **Connector** : DBSP-JB25S (JAE or equivalent) (on rear panel).
  Use an interface cable with DB-25P or equivalent connector.
- **Handshaking**

  Hardware handshaking : User can select whether CA, CB, CC, and CD signals will be always TRUE, or be used for control.

  Software handshaking : User can select whether to control only transmission using X-on and X-off characters, or to control both transmission and reception using X-on and X-off characters.

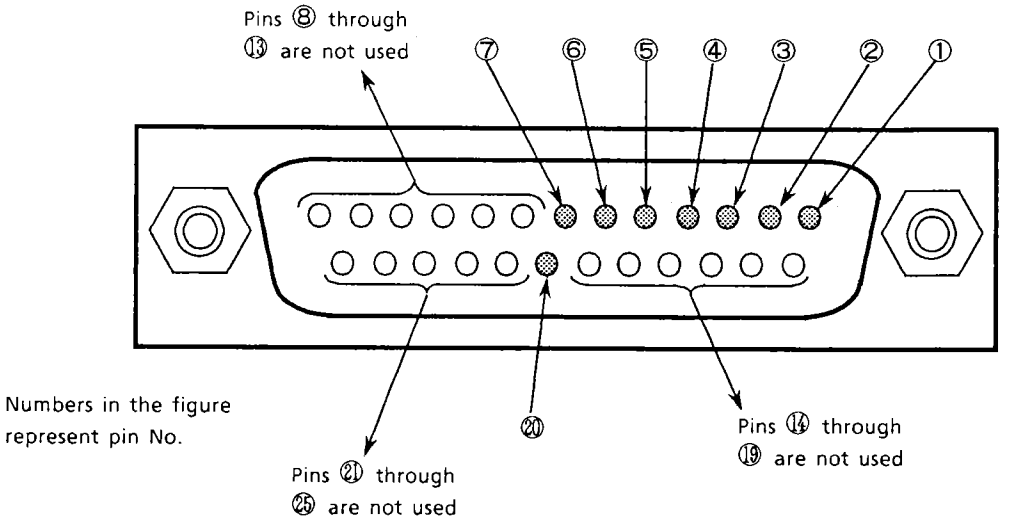
  X-on ····· ASCII 11H
  X-off ····· ASCII 13H

  * For available combinations of hardware and software handshaking, see **Section 11.3.2, "Handshaking" (page 11-14).**

- **Receive Buffer Size** : 64bytes

Connector and Signal Names

RS-232-C connector : DBSP-JB25S or equivalent



①AA (GND ; Protective Ground) : Grounded to the 2534 case.

②BA (TXD ; Transmitted Data) : Data transmitted to personal computer.
Signal direction: Output

③BB (RXD ; Received Data) : Data received from personal computer.
Signal direction: Input

④CA (RTS ; Request to Send) : Signal used to handshake when receiving data from personal computer.
Signal direction: Output

⑤CB (CTS ; Clear to Send) : Signal used to handshake when transmitting data to personal computer.
Signal direction: Input

⑥CC (DSR ; Data Set Ready) : Signal used to handshake when transmitting data to personal computer.
Signal direction: Input

⑦AB (GND ; Signal Ground) : Ground connection for signal common.

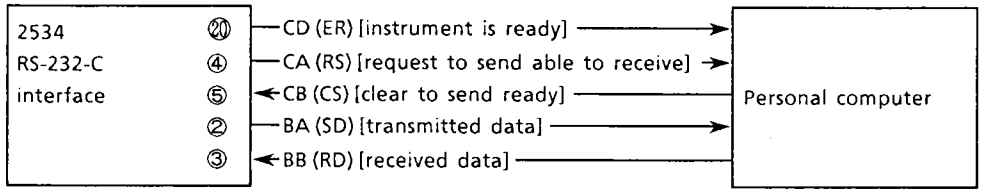
⑳CD (DTR ; Data Terminal Ready) : Signal used to handshake when receiving data from personal computer.
Signal direction: Output

Note

- Pins ⑧ through ⑲ and ㉑ through ㉕ are not used.

Signal Direction

The figure below shows the direction of the signals used by the RS-232-C interface of the 2534.



* Codes in ( ) are JIS abbreviations

Table of RS-232-C Standard Signals and Their JIS and CCITT Standard Abbreviations

Pin Number (25-pin connector)	Abbreviations			Name
	RS-232-C	CCITT	JIS	
①	AA (GND)	101	FG	Protective ground
⑦	AB (GND)	102	SG	Signal ground
②	BA (TXD)	103	SD	Transmitted data
③	BB (RXD)	104	RD	Received data
④	CA (RTS)	105	RS	Request to send
⑤	CB (CTS)	106	CS	Clear to send
⑥	CC (DSR)	107	DR	Data set ready
⑳	CD (DTR)	108/2	ER	Data terminal ready
22	CE (RI)	125	CI	Ring indicator
8	CF (DCD)	109	CD	Data channel received carrier detect
21	CG (—)	110	SQD	Data signal quality detect
23	CH / CI (—)	111	SRS	Data signal rate select
24/15	DA / DB (TXC)	113/114	ST_1 / ST_2	Transmitter signal element timing
17	DD (RXC)	115	RT	Receiver signal element timing
14	SBA (—)	118	BSD	Secondary transmitted data
16	SBB (—)	119	BRD	Secondary received data
19	SCA (—)	120	BRS	Secondary request to send
13	SCB (—)	121	BCS	Secondary clear to send
12	SCF (—)	122	BCD	Secondary received carrier detect

* Circles indicate numbers of pins used by the 2534 RS-232-C interface.

11.3.2 Handshaking

Handshaking System Combinations

When the 2534 is connected to a personal computer via the RS-232-C interface, one of several possible procedural protocols will be used by mutual agreement to ensure dependable transfers of data. These protocols use a technique known as "handshaking." A variety of different handshaking systems can be used. The choice must be made based on the computer hardware and software to be used, since the 2534 and the computer must be set up to use the same system.

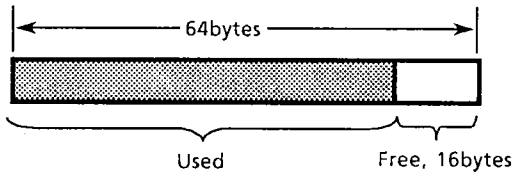
The 2534 allows you to set one parameter to select from among eight handshaking modes that implement the systems shown in the table below (see **Section 11.3.7, "Setting Handshake Mode, Data Format, Baud Rate" (page 11-22)**.

Handshaking System Combinations (○: Function used)

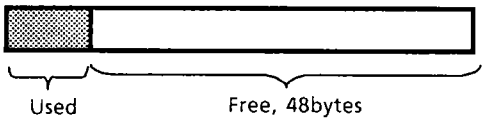
Mode selection No.	Transmit data control (System for control when sending data to personal computer)				Received data control (System for control when receiving data from personal computer)			
	Software handshake	Hardware handshake			Software handshake	Hardware handshake		
	Stop sending when X-off received, resume when X-on received	Stop sending when CB (CTS) is False, resume when True	Stop sending when CC (DSR) is False, resume when True	No hand-shake	Send X-off when receive buffer data reaches 3/4-full, send X-on when buffer reaches 1/4-full	Set CD (DTR) to False when receive buffer data reaches 3/4-full, set to True when buffer 1/4-full	Set CA (RTS) to False when receive buffer data reaches 3/4-full, set to True when buffer 1/4-full	No hand-shake
0				○				○
1	○				○			
2	○					○		
3	○						○	
4		○				○		
5		○					○	
6			○			○		
7			○				○	

Data Control

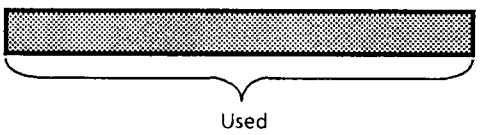
Even when a data reception control handshaking mechanism is in use, data may still be mistakenly sent from the computer in spite of the handshaking. If this occurs and the receive buffer becomes full, then the excess data will be lost, regardless of whether handshaking is or is not in use. Data storage to the buffer will begin again when there is free area in the buffer.



If handshaking is in use, and data cannot be passed to the main program fast enough to keep up with the transmission, then handshaking will attempt to stop the transmission when the buffer free area falls to 16 bytes.



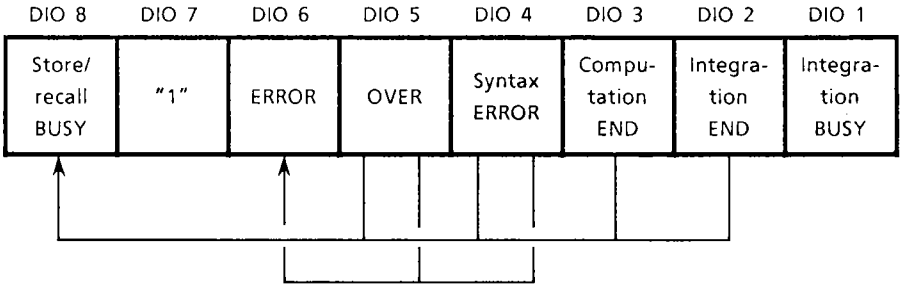
After the above, data continues to be passed to the internal program, and handshaking will allow transmission to resume when the buffer free area rises to 48 bytes.



Whether a handshake is performed or not, if the buffer becomes full, any additional data received is no longer stored, and is lost.

11.3.3 RS-232-C Status Byte Format

The format of the status byte is as follows.



- **Store/recall BUSY (DIO 8)**
  Set to "1" while measured/computed data is being stored to or recalled from the IC memory card. This bit cannot be disabled by the IM command.

- **DIO 7**
  Always "1."

- **ERROR (DIO 6)**
  Set to "1" when either of the status byte interrupt cause bits OVER or Syntax ERROR is set to "1" (they can be set only if enabled by the IM command). This bit cannot be disabled by the IM command.

- **OVER (DIO 5)**
  Set to "1" for measured data over-range, peak overflow, or computation overflow. The exact cause of the error can be identified with the OE command (**see page 11-65**). Note that if OVER and Syntax ERROR occur at the same time, the Syntax ERROR has priority in output in response to the OE command.

- **Syntax ERROR (DIO 4)**
  Set to "1" if any of the following conditions exists when an RS-232-C command is received:
  · Command is undefined
  · Parameter is outside of range
  · Command cannot be executed due to the current instrumen status
  The exact nature of the error can be identified with the OE command (**see page 11-65**).

- **Computation END (DIO 3)**
  Set to "1" each time computations are completed (every 500ms).
  Note that if the trigger mode is manual, this bit is set to "1" whenever the subsequent measurements and computations are completed after:
  · the front panel *SAMPLE TRIG* key is pressed, or
  · a external trigger signal is applied, or
  · the E command or the GET command is received.

- **Integration END (DIO 2)**
  Set to "1" when active power integration is completed.

- **Integration BUSY (DIO 1)**
  Set to "1" while active power integration is being executed. This bit cannot be disabled by the IM command.

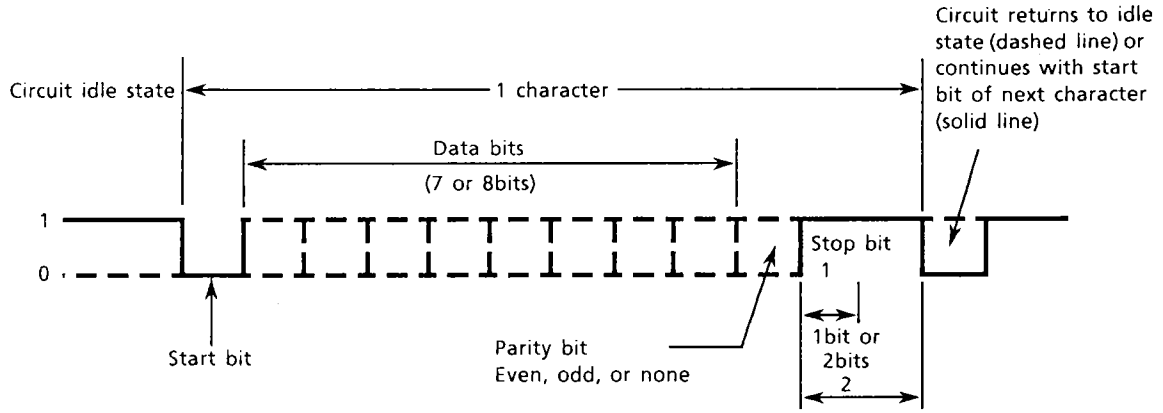
Note

- When either the OVER bit or the Syntax ERROR bit goes to "1", the ERROR (DIO 6) bit will also go to "1." However, neither of the former bits will be allowed to go to "1" unless specified with the IM command as an allowed interrupt cause.

11.3.4 Communication Data Format

Setting Data Format

The RS-232-C interface of the 2534 communicates using start-stop synchronization. In start-stop synchronization the devices transmit one character at a time, each character beginning with a start bit, which is followed in sequence by the data bits, a parity bit, and one or two stop bits (see figure below).

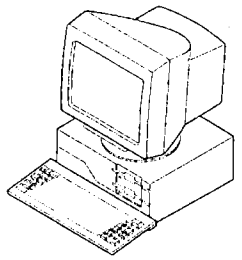


The table below shows the data format combinations supported. There are four different formats, selected using the *INTERFACE* key.

Format Setting	Start Bit	Data Length	Parity	Stop Bit
0	1	8	None	1
1	1	7	Odd	1
2	1	7	Even	1
3	1	7	None	2

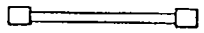
11.3.5 Cable Connections to the Personal Computer

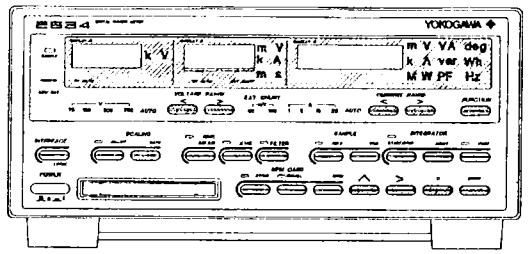
If connecting this instrument to a personal computer, use the panel key switches to set the handshake mode, data transmission rate, and data format to be consistent with those used by the computer.
For details, see **Section 11.3.7, "Setting Handshake Mode, Data Format, Baud Rate" (page 11-22)**. Use an interface cable that meets the specifications for this instrument.



Personal computer

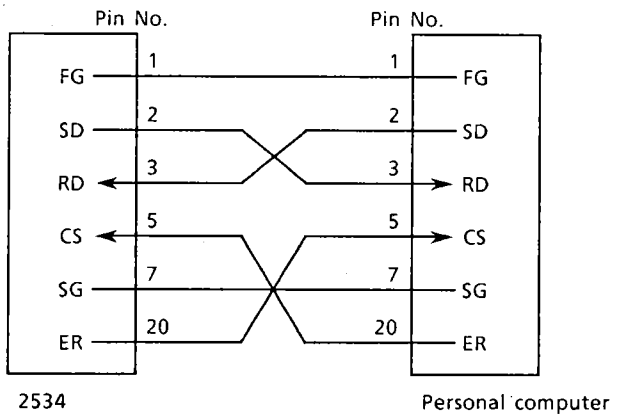
RS-232-C cable



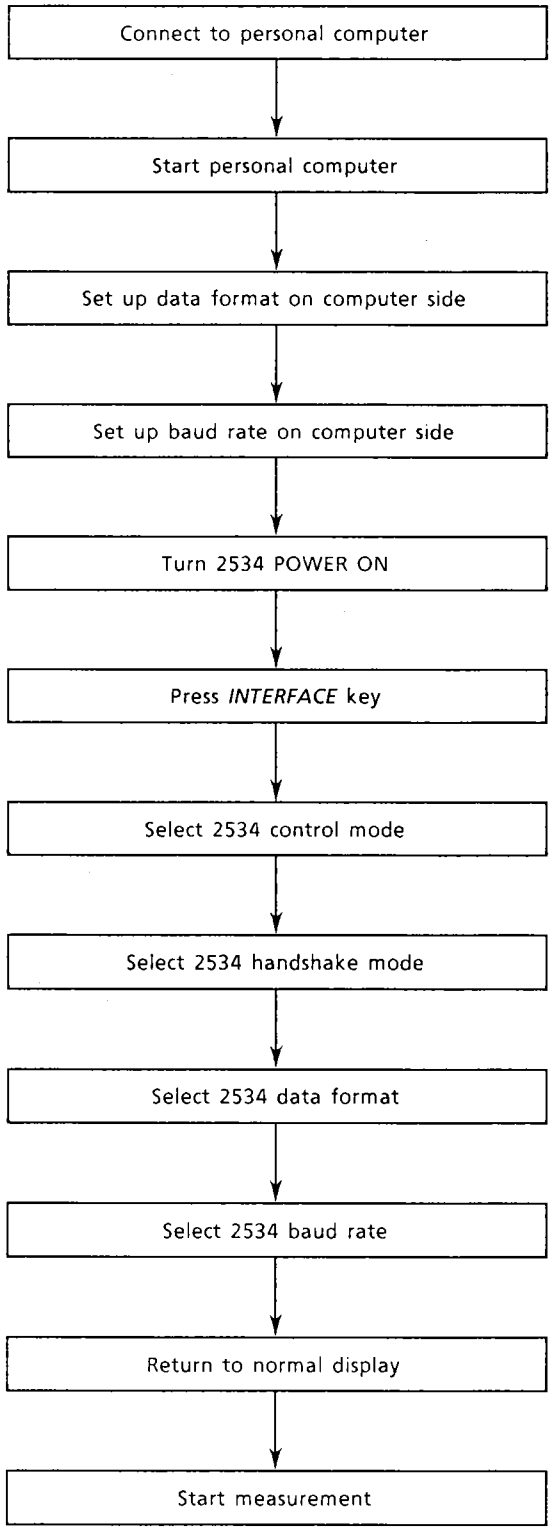


Model 2534

Cable Wiring Diagram (Personal Computer to 2534)



General Procedures



11.3.6 Selecting Between Normal Mode and Talk-Only Mode

The RS-232-C interface on the 2534 has two control modes:

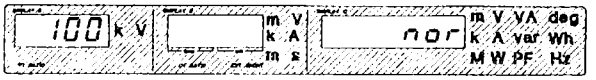
- **Normal Mode**
  Normal mode permits both transmission and reception.
- **Talk-only Mode**
  Talk-only mode permits only transmission (output of measured data or computed data).

Use the procedure below to select between these modes. Measurement stops while the mode is being set.

Procedures

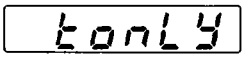
1. Place the 2534 in local status.
   To select the mode the 2534 must be in local status. If the 2534 is in remote status, press the *INTERFACE* key to go to local status.

2. Call up the mode selection display.
   Pressing the *INTERFACE* key changes the display to the mode selection screen, as shown below. DISPLAY C will be flashing.



3. Select normal mode or talk-only mode.
   Pressing the ∧ key will toggle DISPLAY C between the selections shown. Select the desired mode, and use the *ENTER* key to enter it.
   nor : Normal mode
   tonLy: Talk-only mode

DISPLAY C



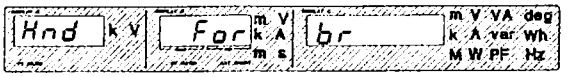
4. After selecting the mode, continue on to the instructions in **Section 11.3.7, "Setting Handshake Mode, Data Format, Baud Rate"** (next page), to set the remaining communications parameters.

11.3.7 Setting Handshake Mode, Data Format, Baud Rate

Before communications can be performed, the communications parameters such as handshake mode, data format, and baud rate must be set up. Measurement stops while these communications parameters are being set up.

Procedures

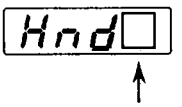
1. After the control mode has been selected as described above, the display changes to the communications parameter setup display shown below. The last digit of DISPLAY A will be flashing.



2. Selecting the handshake mode

Input the number of the desired mode in the table below on DISPLAY A.
Select the desired mode from 0 to 7 using the ∧ key, and use the *ENTER* key to enter the setting (this parameter is set to "0" when the 2534 is shipped from the factory).

DISPLAY A

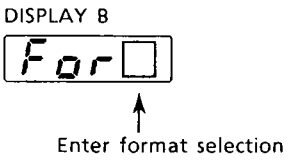


Handshaking System Combinations (○: Function used)

Mode selection No.	Transmit data control (System for control when sending data to personal computer)				Received data control (System for control when receiving data from personal computer)			
	Software handshake	Hardware handshake		No handshake	Software handshake	Hardware handshake		No handshake
	Stop sending when X-off received, resume when X-on received	Stop sending when CB (CTS) is False, resume when True	Stop sending when CC (DSR) is False, resume when True		Send X-off when receive buffer data reaches 3/4-full, send X-on when buffer reaches 1/4-full	Set CD (DTR) to False when receive buffer data reaches 3/4-full, set to True when buffer 1/4-full	Set CA (RTS) to False when receive buffer data reaches 3/4-full, set to True when buffer 1/4-full	
0				○				○
1	○				○			
2	○					○		
3	○						○	
4		○				○		
5		○					○	
6			○			○		
7			○				○	

3. Selecting the data format

After the handshake mode is entered, the last digit on DISPLAY B will begin flashing. Select the desired format setting from the table below.
Use the ∧ key to select a data format number from 0 to 3, and press the *ENTER* key to input the setting (this parameter is set to "0" when the 2534 is shipped from the factory).

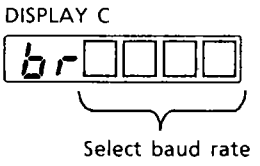


Data Format Combinations

Format Setting	Start Bit	Data Length	Parity	Stop Bit
0	1	8	None	1
1	1	7	Odd	1
2	1	7	Even	1
3	1	7	None	2

4. Selecting the baud rate

After the data format is entered, the last four digits on DISPLAY C will begin flashing. Select the baud rate here.
Use the ∧ key to select a baud rate from 1200 to 9600, and press the *ENTER* key to input the setting (this parameter is set to "0" when the 2534 is shipped).



Display order 9600 ⇆ 4800
↓↑ ↓↑
1200* ⇆ 2400

* When measured or computed data is being output via communications, it is not possible to output data every 500ms at 1200 baud rates. Setting the sample rate is to 1s or more will enable data to be output for each sample for the other combinations.
Use the following method to set the sample rate to 1s or more.

- Set the sample mode to "hold", and apply a trigger every 1s or more to execute the measurements.
- Set the store rate to 1s or more; then insert an IC memory card into the card slot, and press the *MEM CARD STORE* key (store indicator LED will turn ON).

5. When the above setup has been completed, the display returns to normal measurement display. Measurement stops while modes and communications parameters are being set.

11.4 Before You Begin Programming

Basic Programming Format

The following shows the structure of a programming command statement for the 2534.

[Command] + [Parameter] + [Terminator]

Command statement strings are encoded using the ASCII code set.

Example: R Am CR

Command Parameter Terminator

- **Command** : Predefined string of 1 to 3 capital letters.
- **Parameter** : Numeric values (ASCII encoded).
- **Terminator** : Any of the following three will be accepted...
  - CR+LF
  - LF
  - Semicolon (" ; ")

Note

- A single line can contain multiple command statements if they are separated with the semicolon (" ; ").
- Command statement lines must not exceed 50 characters. Anything beyond 50 characters will be ignored.
- If the personal computer used normally terminates output lines with the a CR only, end all lines with a semicolon (" ; ").
- [Terminator] + EOI may also be used.

11.5 Commands

11.5.1 Command Summary Table

GP-IB Command Summary Table

Program Statement				Action	Page Reference
Measurement display	Range	AVm	(Auto Voltage range)	Selects voltage auto/manual ranging	11-27
		AAm	(Auto current(A) range)	Selects current auto/manual ranging	11-27
		RVm	(set Range Voltage)	Selects voltage range	11-30
		RAm	(set Range current(A))	Selects current range	11-30
	Display	DCm	(set Display C function)	Selects DISPLAY C function	11-33
Functions	Filter	FLm	(FiLter mode)	Selects filter	11-35
	RMS value	MNm	(MeaN)	Selects computational formula for RMS values	11-35
	Averaging	AGm	(AveraGing)	Selects averaging	11-35
	Integration	IS	(Integrate Start)	Integration start command	11-39
		IP	(Integrate stoP)	Integration stop command	11-39
		IR	(Integrate Reset)	Integration reset command	11-39
		TMh, m	(TiMer)	Sets timer preset time	11-39
	Sampling	HDm	(sampling HolD)	Selects sampling mode	11-42
		E	(trigger <GET>)	Generates trigger	11-42
	IC memory card	SS	(panel Setting Save)	Saves setup information	11-45
		SL	(panel Setting Load)	Loads setup information	11-45
		CI	(Card Initialize)	Initializes IC memory card	11-45
		SOm	(Store On)	Stores measured/computed data	11-45
		SMm	(Store Mode)	Sets up store operating mode	11-50
		NSm	(Number of Data)	Sets pretrigger point/No. of data	11-50
		SRm	(Store Rate)	Sets store rate	11-53
		ROm	(Recall On)	Recalls measured/computed data	11-53
		RMm	(Recall Mode)	Sets up recall operating mode	11-53
		RDm	(Recall Data)	Sets first Data No. of recall data	11-57
		RRm	(Recall Rate)	Sets recall rate	11-57
	Scaling	SCm	(SCaling)	Selects scaling mode	11-60
		KVm	(K*Voltage)	Sets PT ratio	11-60
		KAm	(K*Ampare)	Sets CT ratio	11-60
		SAm	(set Shunt current(A))	Sets external shunt rated value	11-63
Other	Output	OS	(Output panel Setting)	Outputs panel setup information	11-65
		OE	(Output Error code)	Outputs error code	11-65
	Control	IMm	(Interrupt Mask)	Sets status byte interrupt cause mask	11-67
		RC	(Reset Command)	Initializes panel setup information	11-67
		DLm	(DeLimter)	Selects delimiter	11-67

RS-232-C Command Summary Table

Program Statement				Action	Page Reference
Measurement display	Range	AVm	(Auto Voltage range)	Selects voltage auto range/manual range	11-27
		AAm	(Auto current(A) range)	Selects current auto range/manual range	11-27
		RVm	(set Range Voltage)	Selects voltage range	11-30
		RAm	(set Range current(A))	Selects current range	11-30
	Display	DCm	(set Display C function)	Selects DISPLAY C function	11-33
Functions	Filter	FLm	(FiLter mode)	Selects filter	11-35
	RMS value	MNm	(MeaN)	Selects computational formula for RMS values	11-35
	Averaging	AGm	(AveraGing)	Selects averaging	11-35
	Integration	IS	(Integrate Start)	Integration start command	11-39
		IP	(Integrate stoP)	Integration stop command	11-39
		IR	(Integrate Reset)	Integration reset command	11-39
		TMh, m	(TiMer)	Sets timer preset time	11-39
	Sampling	HDm	(sampling HolD)	Selects sampling mode	11-42
		E	(Trigger)	Generates trigger	11-42
	IC memory card	SS	(panel Setting Save)	Saves setup information	11-45
		SL	(panel Setting Load)	Loads setup information	11-45
		CI	(Card Initialize)	Initializes IC memory card	11-45
		SOm	(Store On)	Stores measured/computed data	11-45
		SMm	(Store Mode)	Sets up store operating mode	11-50
		NSm	(Number of Data)	Sets pretrigger point/No. of data	11-50
		SRm	(Store Rate)	Sets store rate	11-53
		ROm	(Recall On)	Recalls measured/computed data	11-53
		RMm	(Recall Mode)	Sets up recall operating mode	11-53
		RDm	(Recall Data)	Sets first Data No. of recall data	11-57
		RRm	(Recall Rate)	Sets recall rate	11-57
	Scaling	SCm	(SCaling)	Selects scaling status	11-60
		KVm	(K*Voltage)	Sets PT ratio	11-60
		KAm	(K*Ampare)	Sets CT ratio	11-60
		SAm	(set Shunt current(A))	Sets external shunt rated value	11-63
Other	Output	OS	(Output panel Setting)	Outputs panel setup information	11-65
		OE	(Output Error code)	Outputs error code	11-65
		OD	(Output Data)	Outputs measured/computed data on IC memory card	11-65
		ESC S		Outputs status byte	11-71
	Control	IMm	(Interrupt Mask)	Sets status byte interrupt cause mask	11-72
		RC	(Reset Command)	Initializes panel setup information	11-67
		ESC R		Selects remote control	11-71
		ESC L		Selects local control	11-71
		ESC C		Clears device	11-71
		DLm	(DeLimter)	Selects delimiter	11-67

11.5.2 Range Selections

AVm (Auto Voltage range)
AAm (Auto current (A) range)

【 Function 】 Selects auto or manual ranging for the voltage ranges or current ranges.

【 Syntax 】 **AVm** <terminator> m=0, 1
AAm <terminator> m=0, 1

【 Description 】
- "m=0": Manual ranging mode
- "m=1": Auto ranging mode
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- This command cannot be executed during integration (error code 13) or measured data recall (error code 14).

<Sample Programs>

AV: Auto range (voltage) GP-IB

```
10 '*************************
20 '* AV:Auto Voltage range * GP-IB
30 '*************************
40 ' ---------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ---------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "AV1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

AV: Auto range (voltage) RS-232-C

```
10 '*************************
20 '* AV:Auto Voltage range * RS-232-C
30 '*************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"AV1"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

AA: Auto range (current) GP-IB

```
10 '*****************************
20 '* AA:Auto current(A) range * GP-IB
30 '*****************************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR , 50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.■", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "AA1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

AA: Auto range (current) RS-232-C

```
10  '*****************************
20  '* AA:Auto current(A) range * RS-232-C
30  '*****************************
110 OPEN "COM1:1200, N, 8, 1, DS0, CS0, LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1, "AA1"
150 PRINT #1, "OS"
160 LINE INPUT #1, D$
170 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
180 PRINT D$
190 IF LEFT$(D$, 2)<>"NS" THEN 150
200 END
```

RV (set Range Voltage)

[**Function**] Selects voltage range
[**Syntax**] **RVm** <terminator> m=6 to 9
[**Description**]
- "m" indicates the voltage range. The voltage range indicator lights for the specified range.
  m=6: 75V range
  m=7: 150V range
  m=8: 300V range
  m=9: 600V range
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the < > keys to select the voltage range in local status.

RA (set Range current (A))

[**Function**] Selects current range
[**Syntax**] **RAm** <terminator> m=3 to 5 and 7 to 9
[**Description**]
- "m" indicates the current range. The current range indicator lights for the specified range.
  m=3: External shunt, 50mV/FS
  m=4: External shunt, 100mV/FS
  m=5: 1A range
  m=7: 5A range
  m=8: 10A range
  m=9: 20A range
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the < > keys used to select the current range in local status.

<Sample Programs>

RV: Range (voltage) GP-IB

```
10  '************************
20  '* RV:set Range Voltage * GP-IB
30  '************************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RV7"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RV: Range (voltage) RS-232-C

```
10  '************************
20  '* RV:set Range Voltage * RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"RV6"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

RA: Range (current) GP-IB

```
10  '**********************
20  '* RA:Range current(A) * GP-IB
30  '**********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RA7"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RA: Range (current) RS-232-C

```
10  '************************
20  '* RA:Range current(A) * RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"RA5"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

11.5.3 Function Selection for DISPLAY C

DC (set Display C function)

[**Function**] Selects the function for DISPLAY C
[**Syntax**] DCm <terminator> m=0 to 9
[**Description**] • "m" indicates one of the following functions.

Parameter m	Statement DCm	
0	V	Voltage display
1	A	Current display
2	W	Active power display
3	VA	Apparent power display
4	var	Reactive power display
5	PF	Power factor display
6	DEG	Phase angle display
7	Wh	Active power integrated value display
8	HzV	Voltage frequency display
9	HzA	Current frequency display

- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the *FUNCTION* key in local status.

<Sample Programs>

DC: Display function selection GP-IB

```
10 '*********************************************
20 '* DA/DB/DC:Dispaly A, B, C Function Selection * GP-IB
30 '*********************************************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "DA0DB1DC2"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

DC: Display function selection RS-232-C

```
10 '*********************************************
20 '* DA/DB/DC:Dispaly A, B, C Function Selection * RS-232-C
30 '*********************************************
110 OPEN "COM1:1200, N, 8, 1, DS0, CS0, LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1, "DA0DB1DC2"
150 PRINT #1, "OS"
160 LINE INPUT #1, D$
170 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
180 PRINT D$
190 IF LEFT$(D$, 2)<>"NS" THEN 160
200 END
```

11.5.4 Measurement Mode Selection

FL (FiLter)

[Function] Turns filter ON or OFF (for frequency measurement)
[Syntax] FLm <terminator> m=0, 1
[Description]
- "m" indicates filter ON or filter OFF.
  m=0: FILTER OFF (FILTER indicator LED off)
  m=1: FILTER ON (FILTER indicator LED on)
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the *FILTER* key in local status.

MN (MeaN)

[Function] Selects whether to compute RMS value (RMS) directly or as mean value of rectified waveform (MEAN)
[Syntax] MNm <terminator> m=0, 1
[Description]
- "m" indicates either RMS value computation or mean rectified value computation.
  m=0: RMS (RMS/MEAN indicator LED on)
  m=1: MEAN (RMS/MEAN indicator LED off)
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the *RMS/MEAN* key in local status.

AG (AveraGing)

[Function] Selects whether or not to perform exponential averaging for voltage, current, and power measurements
[Syntax] AGm <terminator> m=0, 1
[Description]
- "m" indicates whether or not to perform exponential averaging.
  m=0: Do not perform exponential averaging
  m=1: Perform exponential averaging
- In local status the setting is the initialized value.
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operations performed with the *AVG* key in local status.

<Sample Programs>

FL: L. P. F ON/OFF GP-IB

```
10  '********************
20  '* FL:Filter ON/OFF * GP-IB
30  '********************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "FL1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

FL: L. P. F ON/OFF RS-232-C

```
10  '********************
20  '* FL:Filter on/off * RS-232-C
30  '********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"FL1"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

MN: RMS/MEAN GP-IB

```
10 '***************
20 '* MN:RMS/MEAN * GP-IB
30 '***************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "MN0"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

MN: RMS/MEAN RS-232-C

```
10 '***************
20 '* MN:RMS/MEAN * RS-232-C
30 '***************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"MN1"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

AG: Averaging ON/OFF GP-IB

```
10 '**********************************
20 '* AG:Averaging function slection * GP-IB
30 '**********************************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "AG1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)◇"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

AG: Averaging ON/OFF RS-232-C

```
10 '**********************************
20 '* AG:Averaging function slection * RS-232-C
30 '**********************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"AG1"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)◇"NS" THEN 160
200 END
```

11.5.5 Controlling Integration Functions

IS (Integrate Start)

[**Function**] Starts integration function
[**Syntax**] **IS** <terminator>
[**Description**] • Function is equivalent to operation of the *INTEGRATOR START* key in local status.

IP (Integrate stoP)

[**Function**] Stops integration function
[**Syntax**] **IP** <terminator>
[**Description**] • Function is equivalent to operation of the *INTEGRATOR STOP* key in local status.

IR (Integrate Reset)

[**Function**] Resets integration
[**Syntax**] **IR** <terminator>
[**Description**] • Function is equivalent to operation of the *INTEGRATOR RESET* key in local status.

TM (set integrate TiMer)

[**Function**] Selects manual mode or timer mode, and sets the integration time if timer mode
[**Syntax**] **TM h, m** <terminator> $0 \leqq h \leqq 99$ $0 \leqq m \leqq 59$
h, m : 0,0 to 99,59
h : hour, m : minute
[**Description**] • If the time set is outside of the allowed range of "h, m" values, or more than 100 hours, a syntax error results.
• This command is not accepted while in integration mode. Error code 13 will result.
• Initial value is "0,0."

<Sample Programs>

IS: Integration start GP-IB

```
10  '**********************
20  '* IS:Integrate Start * GP-IB
30  '**********************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V%=1:CALL IBEOT(M2535%, V%)
170 CMD$ = "DC7"
180 CALL IBWRT(M2535%, CMD$) : GOSUB 500
190 INPUT "INTEG START(ret)";Y$
200 CMD$ = "IS"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 INPUT "INTEG STOP(ret)";Y$
230 CMD$ = "IP"
240 CALL IBWRT(M2535%, CMD$) : GOSUB 500
250 INPUT "INTEG RESET(ret)";Y$
260 CMD$ = "IR"
270 CALL IBWRT(M2535%, CMD$) : GOSUB 500
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

IS: Integration start RS-232-C

```
10  '************************
20  '* IS:Integrate Start * RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 PRINT #1,"DC7"
140 INPUT "INTEG START(ret)";Y$
150 PRINT #1,"IS"
160 '
170 INPUT "INTEG STOP(ret)";Y$
180 PRINT #1,"IP"
190 '
200 INPUT "INTEG RESET(ret)";Y$
210 PRINT #1,"IR"
220 END
```

<Sample Programs>

TM: Timer setup GP-IB

```
10 '**************************
20 '*  TM:set integrate TiMer * GP-IB
30 '**************************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "TM90, 59"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

TM: Timer setup RS-232-C

```
10 '****************************
20 '*  TM:set integrate TiMer * RS-232-C
30 '****************************
110 OPEN "COM1:1200, N, 8, 1, DS0, CS0, LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1, "TM90, 59"
150 PRINT #1, "OS"
160 LINE INPUT #1, D$
170 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
180 PRINT D$
190 IF LEFT$(D$, 2)<>"NS" THEN 160
200 END
```

11.5.6 Controlling Sampling Mode

HD (sampling HolD)

[Function] Selects auto or hold sampling mode
[Syntax] HDm <terminator> m=0, 1
[Description]
- "m" indicates the sampling mode.
  "m=0": Auto mode (HOLD indicator LED off)
  "m=1": Hold mode (HOLD indicator LED on)
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operation of the *SAMPLE HOLD ON/OFF* key in local status.

E

[Function] Generates a trigger when in sample hold mode
[Syntax] E <terminator>
or Either can be used
GET <interface message>
[Description]
- This command has an effect only when the 2534 is in sample hold or in IC memory card auto store mode. Otherwise, it is ignored (no syntax error results).
- Function is equivalent to operation of the *SAMPLE TRIG* key in local status.

<Sample Programs>

HD: Hold ON/OFF test GP-IB

```
10  '********************
20  '* HD:sampling HolD * GP-IB
30  '********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 500
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 '
210 INPUT "HOLD ON (ret)?";Y$
220 CMD$ = "HD1"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 600
240 CMD$ = "OS"
250 CALL IBWRT(M2535%, CMD$) : GOSUB 600
260 BUF$ = SPACE$(255)
270 CALL IBRD(M2535%, BUF$) : GOSUB 600
280 PRINT LEFT$(BUF$, IBCNT%-2)
290 IF LEFT$(BUF$, 2)<>"NS" THEN 260
300 '
310 INPUT "HOLD OFF (ret)?";Y$
320 CMD$ = "HDO"
330 CALL IBWRT(M2535%, CMD$) : GOSUB 600
340 CMD$ = "OS"
350 CALL IBWRT(M2535%, CMD$) : GOSUB 600
360 BUF$ = SPACE$(255)
370 CALL IBRD(M2535%, BUF$) : GOSUB 600
380 PRINT LEFT$(BUF$, IBCNT%-2)
390 IF LEFT$(BUF$, 2)<>"NS" THEN 360
400 CALL IBLOC(M2535%)
410 END
500 ' *** When IBFIND call failed ***
510 PRINT " ===== No such board or device name ===== "
520 GOTO 400
600 ' *** GP-IB error check ***
610 IF IBSTA% >= 0 THEN RETURN
620 PRINT " ===== Error ===== "
630 GOTO 400
```

HD: Hold ON/OFF test RS-232-C

```
10  '********************
20  '* HD:sampling HolD * RS-232-C
30  '********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 INPUT "HOLD ON (ret)";Y$
150 PRINT #1,"HD1"
160 PRINT #1,"OS"
170 LINE INPUT #1,D$
180 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
190 PRINT D$
200 IF LEFT$(D$,2)<>"NS" THEN 170
210 '
220 INPUT "HOLD OFF (ret)";Y$
230 PRINT #1,"HDO"
240 PRINT #1,"OS"
250 LINE INPUT #1,D$
260 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
270 PRINT D$
280 IF LEFT$(D$,2)<>"NS" THEN 250
290 END
```

<Sample Program>

E: Trigger GP-IB

```
10  '*************
20  '* E:Trigger * GP-IB
30  '*************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 '
210 INPUT "HOLD ON (ret)";Y$
220 CMD$ = "HD1"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 '
250 INPUT "Trigger (ret)";Y$
260 CMD$ = "E"
270 CALL IBWRT(M2535%, CMD$) : GOSUB 500
280 '
290 BUF$ = SPACE$(255)
300 CALL IBRD(M2535%, BUF$) : GOSUB 500
310 PRINT LEFT$(BUF$, IBCNT%-2)
320 IF LEFT$(BUF$, 2)<>"HM" THEN 290
330 CALL IBLOC(M2535%)
340 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 330
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 330
```

E: Trigger RS-232-C

```
10  '**************
20  '* E:Trigger * RS-232-C
30  '**************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 '
150 INPUT "HOLD ON (ret)";Y$
160 PRINT #1,"HD1"
170 '
180 INPUT "Trigger (ret)";Y$
190 PRINT #1,"E"
200 '
210 PRINT #1,"OD"
220 LINE INPUT #1,D$
230 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
240 PRINT D$
250 LINE INPUT #1,D$
260 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
270 PRINT D$
280 LINE INPUT #1,D$
290 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
300 PRINT D$
310 LINE INPUT #1,D$
320 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
330 PRINT D$
340 END
```

11.5.7 Controlling IC Memory Card

SS (panel Setting Save)

[**Function**] Saves the current setup information to the IC memory card
[**Syntax**] SS <terminator>
[**Description**]
- The following items are saved.
  - Model code
  - Voltage range
  - Current range, external shunt current value
  - Measurement modes (RMS/MEAN, filter on/off, averaging on/off, sample auto/hold, scaling on/off)
  - Function selected for DISPLAY C
  - Scaling (PT ratio, CT ratio)
  - Timer preset time for active power integration
  - NS value, store/recall settings
- Function is equivalent to selecting "SS" with *MEM CARD* key in local status.

SL (panel Setting Load)

[**Function**] Loads the setup information from the IC memory card
[**Syntax**] SL <terminator>
[**Description**]
- The items that are read are the same as the items that are saved using the "SS" command.
- Function is equivalent to selecting "SL" with *MEM CARD* key in local status.

CI (Card Initiarize)

[**Function**] Initializes the IC memory card
[**Syntax**] CI <terminator>
[**Description**]
- Function is equivalent to selecting "CI" with *MEM CARD* key in local status.

SO (Store On)

[**Function**] Selects whether or not measured/computed data is stored to the IC memory card
[**Syntax**] SOm <terminator> m=0, 1
[**Description**]
- "m" indicates whether STORE is ON or OFF.
  - m=0: STORE OFF (STORE indicator LED off)
  - m=1: STORE ON (STORE indicator LED on)
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operation of the *MEM CARD STORE* key in local status.

<Sample Programs>

SS: Panel save GP-IB

```
10  '*************************
20  '* SS:panel Setting Save * GP-IB
30  '*************************
40  ' ------------------------------------------------------------------------
50  '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120  ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SS"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400  ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500  ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SS: Panel save RS-232-C

```
10  '*************************
20  '* SS:panel Setting Save * RS-232-C
30  '*************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"SS"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

SL: Panel load GP-IB

```
10  '*************************
20  '* SL:panel Setting Load * GP-IB
30  '*************************
40  ' ------------------------------------------------------------------------
50  '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SL"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SL: Panel load RS-232-C

```
10  '*************************
20  '* SL:panel Setting Load * RS-232-C
30  '*************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"SL"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

CI: Card initialize GP-IB

```
10  '**********************
20  '* CI:Card Initialize * GP-IB
30  '**********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V%=1:CALL IBEOT(M2535%, V%)
170 CMD$ = "CI"
180 CALL IBWRT(M2535%, CMD$) : GOSUB 500
190 CALL IBLOC(M2535%)
200 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 190
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 190
```

CI: Card initialize RS-232-C

```
10  '**********************
20  '* CI:Card Initialize * RS-232-C
30  '**********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
130 PRINT #1,"CI"
140 PRINT #1,"R01"
150 PRINT #1,"OE"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
170 IF LEFT$(D$,3)<>"ERR" THEN 150
180 PRINT D$
190 END
```

<Sample Programs>

SO: Store ON/OFF GP-IB

```
10  '************************
20  '* SO:set Store On/Off * GP-IB
30  '************************
40  ' ---------------------------------------------------------------------
50  '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ---------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 INPUT "STORE START(ret)";Y$
170 CMD$ = "SO1"
180 CALL IBWRT(M2535%, CMD$) : GOSUB 500
190 INPUT "STORE STOP(ret)";Y$
200 CMD$ = "SOO"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CALL IBLOC(M2535%)
230 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 220
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 220
```

SO: Store ON/OFF RS-232-C

```
10  '************************
20  '* SO:set Store On/Off * RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 INPUT "STORE START(ret)";Y$
140 PRINT #1,"SO1"
150 '
160 INPUT "STORE STOP(ret)";Y$
170 PRINT #1,"SOO"
180 END
```

SM (Store Mode)

[**Function**] Selects the operating mode for storing measured/computed data to the IC memory card

[**Syntax**] **SMm** <terminator> m=1, 2

[**Description**]
- "m" indicates the operating mode.
  m=1: Auto store mode
  m=2: N reading store mode
  If sampling hold mode has been selected with (HD 1), only "m=2" will have an effect.
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- "m" cannot be changed while data store is in progress. If an attempt is made to change "m", a syntax error results (error code 14).
- Function is equivalent to selecting "St" with the *MEM CARD* key in local status.

NS (Number of Data)

[**Function**] Sets the pretrigger point or and the number of data samples

[**Syntax**] **NSm** <terminator> m=0001 to 1500

[**Description**]
- In auto store mode, this sets the pretrigger point; in N reading store or recall mode, this sets the number of data.
- "m" cannot be changed while data is being stored or recalled. If an attempt is made to change "m", a syntax error results (error code 14).
- The maximum value that "m" can have is limited by the memory capacity of the IC memory card as shown in the table below. If "m" is set to any value higher than in the table below, this is interpreted as the maximum valid value for the setting.

Memory card capacity	8K	1 to 150
	16K	1 to 400
	64K	1 to 1500

- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to selecting "nS" with the *MEM CARD* key in local status.

<Sample Programs>

SM: Store mode GP-IB

```
10  '**********************
20  '* SM:set Store Mode * GP-IB
30  '**********************
40  '-------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' -------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SM2"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SM: Store mode RS-232-C

```
10  '**********************
20  '* SM:set Store Mode * RS-232-C
30  '**********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"SM2"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

NS: NS value setting GP-IB

```
10  '**************
20  '* NS:Sets NS * GP-IB
30  '**************
40  ' ------------------------------------------------------------------------
50  '                ** Basic Declarations **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "NS100"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

NS: NS value setting RS-232-C

```
10  '**************
20  '* NS:Sets NS * RS-232-C
30  '**************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"NS100"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

SR (Store Rate)

[Function] Sets the store rate
[Syntax] SRm <terminator> m=3 to 12
[Description] • "m" indicates the store rate.

Parameter m	Store Rate
3	500ms
4	1s
5	5s
6	10s
7	30s
8	60s
9	300s
10	600s
11	1800s
12	3600s

- This command is used in combination with the "SO1" command (**see page 11-45**). The store rate can be set only if store is off (no syntax error results).
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- "m" cannot be changed while data store is in progress. If an attempt is made to change "m", a syntax error results (error code 14).
- Function is equivalent to setting the store rate via item "St" with the *MEM CARD* key in local status.

RO (Recall On)

[Function] Selects whether or not to recall measured/computed data from the IC memory card
[Syntax] ROm <terminator> m=0, 1
[Description] • "m" indicates whether RECALL is ON or OFF.
m=0: RECALL OFF (RECALL indicator LED off)
m=1: RECALL ON (RECALL indicator LED on)

- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operation of the *MEM CARD RECALL* key in local status.

RM (Recall Mode)

[Function] Selects the operating mode for measured/computed data recall
[Syntax] RMm <terminator> m=1, 2
[Description] • "m" indicates the recall mode.
m=1: Auto recall mode
m=2: N reading recall mode
If sampling hold mode has been selected with (HD 1), only "m=2" will have an effect.

- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- "m" cannot be changed while data store is in progress. If an attempt is made to change "m", a syntax error results (error code 14).
- Function is equivalent to selecting the recall mode "rE" with the *MEM CARD* key in local status.

<Sample Programs>

SR: Store rate GP-IB

```
10  '**********************
20  '* SR:set Store Rate * GP-IB
30  '**********************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SR4"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SR: Store rate RS-232-C

```
10  '**********************
20  '* SR:set Store Rate * RS-232-C
30  '**********************
110 OPEN "COM1:1200, N, 8, 1, DS0, CS0, LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1, "SR9"
150 PRINT #1, "OS"
160 LINE INPUT #1, D$
170 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
180 PRINT D$
190 IF LEFT$(D$, 2)<>"NS" THEN 160
200 END
```

<Sample Programs>

RO: Recall ON/OFF GP-IB

```
10  '************************
20  '* RO:set Recall On/Off *  GP-IB
30  '************************
40  ' ---------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ---------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V%=1:CALL IBEOT(M2535%, V%)
170 INPUT "RECALL START(ret)";Y$
180 CMD$ = "RO1"
190 CALL IBWRT(M2535%, CMD$) : GOSUB 500
200 INPUT "RECALL STOP(ret)";Y$
210 CMD$ = "ROO"
220 CALL IBWRT(M2535%, CMD$) : GOSUB 500
230 CALL IBLOC(M2535%)
240 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 230
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 230
```

RO: Recall ON/OFF RS-232-C

```
10  '************************
20  '* RO:set Recall On/Off *  RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 INPUT "RECALL START(ret)";Y$
140 PRINT #1,"RO1"
150 '
160 INPUT "RECALL STOP(ret)";Y$
170 PRINT #1,"ROO"
180 END
```

<Sample Programs>

RM: Recall mode GP-IB

```
10 '**********************
20 '* RM:set Recall Mode *  GP-IB
30 '**********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RM2"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RM: Recall mode RS-232-C

```
10 '**********************
20 '* RM:set Recall Mode *  RS-232-C
30 '**********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"RM2"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

RD (Recall Data)

[Function] Sets the starting data number for recall of measured/computed data using the "RO1" command

[Syntax] RDm <terminator> m = −1499 to +1499

[Description]
- "m" indicates the number of the first data sample to be read (sign + up to 4 digits).
- If data was saved using SM1 (auto store mode), values higher than the pretrigger point are valid.
- If data was saved using SM2 (N reading store mode), values less than the specified number of data are valid.
- This command is used in combination with the "RO1" command (see page 11-53).
- "m" cannot be changed while data store is in progress. If an attempt is made to change "m", a syntax error results (error code 14).
- This serves to select the first data sample to be read, in the same way as item "rd" set with the *MEM CARD* key in local status.

RR (Recall Rate)

[Function] Selects the rate at which data is recalled when recall is on

[Syntax] RRm <terminator> m = 2 to 4

[Description]
- "m" indicates the recall rate.
  m = 2: Recall rate, 250ms
  m = 3: Recall rate, 500ms
  m = 4: Recall rate, 1s
- This command is used in combination with the "RO1" command (see page 11-53). If recall is off, the only immediate effect is to set the rate parameter (no syntax error results).
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- "m" cannot be changed while data store is in progress. If an attempt is made to change "m", a syntax error results (error code 14).
- This serves to select the recall rate in the same way as setting item "rE" with the *MEM CARD* key in local status.

<Sample Programs>

RD: Recall first GP-IB

```
10  '************************
20  '* RD:set Recall Data  * GP-IB
30  '************************
40  ' ------------------------------------------------------------------------
50  '                ** Basic Declarations **
60 CLEAR , 50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RD100"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RD: Recall first RS-232-C

```
10  '************************
20  '* RD:set Recall Data  * RS-232-C
30  '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"RD100"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

RR: Recall rate GP-IB

```
10  '**********************
20  '* RR:set Recall Rate *  GP-IB
30  '**********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RR3"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RR: Recall rate RS-232-C

```
10  '**********************
20  '* RR:set Recall Rate *  RS-232-C
30  '**********************
110 OPEN "COM1:1200, N, 8, 1, DS0, CS0, LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1, "RR4"
150 PRINT #1, "OS"
160 LINE INPUT #1, D$
170 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
180 PRINT D$
190 IF LEFT$(D$, 2)<>"NS" THEN 160
200 END
```

11.5.8 Controlling the Scaling Function

SC (SCaling)

[Function] Selects whether to display the raw measured values, or the measured values multiplied by the scaling constants

[Syntax] SCm <terminator> m=0, 1

[Description]
- "m" indicates whether scaling is ON or OFF.
  m=0: SCALING OFF (*SCALING ON/OFF* key lamp off)
  m=1: SCALING ON (*SCALING ON/OFF* key lamp on)
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
- Function is equivalent to operating the *SCALING* key in local status.

KV (K*Voltage)
KA (K*Ampare)

[Function] Sets the PT ratio or CT ratio scaling constant

[Syntax] KVm <terminator>
KAm <terminator> m=1.000 to 1000
(5-digit ASCII character string including decimal point)

[Description]
- Has an effect only if scaling is on. If scaling is off, this command is ignored (no syntax error results). This command is used in combination with the "SC1" command above.
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
  However, if "m" is a legal value, it will be set provided that its length does not exceed eight characters (example: KV3, KV10.00000).
- Function is equivalent to setting the PT RATIO or CT RATIO in local status.

<Sample Programs>

SC: Scaling ON/OFF GP-IB

```
10 '**************************
20 '* SC:set SCaling on/off  * GP-IB
30 '**************************
40 ' ------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SC1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SC: Scaling ON/OFF RS-232-C

```
10 '**************************
20 '* SC:set SCaling on/off  * RS-232-C
30 '**************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"SC1"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

KV/KA : Scaling constant GP-IB

```
10 '*********************************
20 '* KV/KA:Sets the scaling factor * GP-IB
30 '*********************************
40 ' ------------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "KA100.0KV10.00"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

KV/KA : Scaling constant RS-232-C

```
10 '*********************************
20 '* KV/KA:sets the scaling factor * RS-232-C
30 '*********************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"KA2.000KV5.000"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

SA (Set shunt Current (A))

[**Function**] Sets the external shunt current

[**Syntax**] **SAm** <terminator> m = 1.000 to 1000 (5-digit ASCII character string including decimal point)

[**Description**]
- If "m" is omitted or set to an illegal value, a syntax error results (error code 12).
  However, if "m" is a legal value, it will be set provided that its length does not exceed eight characters (example: SA3, SA10.00).
- This corresponds to the external shunt current setting in local status.

<Sample Programs>

SA: Shunt setting GP-IB

```
10  '****************************
20  '* SA:set Shunt current(A) * GP-IB
30  '****************************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "SA10.00"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

SA: Shunt setting RS-232-C

```
10  '****************************
20  '* SA:set Shunt current(A) * RS-232-C
30  '****************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"SA100.0"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

11.5.9 Output Request Commands

OS (Output panel Setting)

[Function] Setup information output
[Syntax] OS <terminator>
[Description]
- Reception of the OS command causes the 2534 to output its setup information. On completion, the 2534 returns to the measured/computed data output mode.
- For the output format, see **Section 11.6.4, "Panel Setup Information Output Format" (page 11-82)**.

OE (Output Error code)

[Function] Error code output
[Syntax] OE <terminator>
[Description]
- Reception of the OE command causes the 2534 to output its error code. On completion, the 2534 returns to the measured/computed data output mode.
- If no errors have been generated, error code 00 is output.
- For the output format, see **Section 11.6.4, "Panel Setup Information Output Format" (page 11-82)**.

OD (Output Data) (RS-232-C only)

[Function] Reception of the OD command causes the 2534 to output either its measured/computed data, or data from the IC memory card.
[Syntax] OD <terminator>
[Description]
- See **Section 11.6.2, "Measured/Computed Data Output Format" (page 11-80)**, and **Section 11.6.3, "Measured/Computed Data Recall Output Format" (page 11-81)**.

<Sample Programs>

OE: Output Error GP-IB

```
10 '************************
20 '* OE:Output Error no. * GP-IB
30 '************************
40 ' ---------------------------------------------------------------------
50 '                ** Basic Declarations **
60 CLEAR ,50000!
70      IBINIT1 = 50000!
80      IBINIT2 = IBINIT1 + 3
90      BLOAD "bib.m", IBINIT1
100      CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110      CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ---------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "AG1"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OE"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 CALL IBLOC(M2535%)
280 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 270
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 270
```

OE: Output Error RS-232-C

```
10 '************************
20 '* OE:Output Error no. * RS-232-C
30 '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"OE"
150 LINE INPUT #1,D$
160 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
170 PRINT D$
180 END
```

OD: Output Data RS-232-C

```
10 '********************
20 '* OD:Output Data * RS-232-C
30 '********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 FOR I=1 TO 10
150  PRINT #1,"OD"
160  LINE INPUT #1,A$
170  IF LEFT$(A$,1)=LF$ THEN A$=MID$(A$,2)
180  LINE INPUT #1,B$
190  IF LEFT$(B$,1)=LF$ THEN B$=MID$(B$,2)
200  LINE INPUT #1,C$
210  IF LEFT$(C$,1)=LF$ THEN C$=MID$(C$,2)
220  LINE INPUT #1,D$
230  IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
240  PRINT A$:PRINT B$:PRINT C$:PRINT D$
250 NEXT I
260 END
```

IM (Interrupt Mask) (For GP-IB)

[Function] Specifies which interrupt causes will be allowed to generate a status byte (RQS) interrupt

[Syntax] IMm <terminator> m=2 to 30

[Description]
- "m" values represent interrupt causes as follows:
  - m=2 : Enables interrupt at end of active power integration
  - m=4 : Enables interrupt at end of measurement and computation
  - m=8 : Enables interrupt on syntax error
  - m=16 : Enables interrupts due to measurement over-range or computation overflow
- If more than one of these causes is to be allowed to generate an interrupt, set "m" to the sum of their individual "m" values.
  - Example: m=12 ... Enable generation of interrupts at end of measurement and computation, or on syntax errors
- Initialized value is "m=30."
- If the "m" value for a particular bit is not included in the specified "m" value, then that interrupt cause is masked. That is, neither that bit nor the RQS bit (DIO 7) will be set to "1" by the event that would otherwise cause that interrupt.
- Reading the status byte by serial polling causes the status byte to be cleared.
- Integration BUSY and store/recall BUSY cannot be masked by this command.
- For the status byte format, see **Section 11.2.3, "GP-IB Status Byte Format" (page 11-6)**.

Status Byte

DIO 8	DIO 7	DIO 6	DIO 5	DIO 4	DIO 3	DIO 2	DIO 1
Store/ recall BUSY	RQS	ERROR	OVER	Syntax ERROR	Compu-tation END	Integra-tion END	Integra-tion BUSY
			16	8	4	2	

RC (Reset Command)

[Function] Forces initialization of the setup information (except the interface function setup)

[Syntax] RC <terminator>

[Description]
- Function is equivalent to executing the "rC" item with the *MEM CARD* key in local status.

DL (DeLimiter)

[Function] Sets the terminator for the output data

[Syntax] DLm <terminator> m=0, 1, 2

[Description]

m	GB-IB	RS-232-C
0	CR, LF+EOI	CR, LF
1	LF	LF
2	EOI	CR

<Sample Programs>

IM: Interrupt Mask GP-IB

```
10 '**********************
20 '* IM:Interrupt Mask * GP-IB
30 '**********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V%=1:CALL IBEOT(M2535%, V%)
170 CMD$ = "IM30"
180 CALL IBWRT(M2535%, CMD$) : GOSUB 500
190 CALL IBLOC(M2535%)
200 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 190
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 190
```

<Sample Programs>

RC: Reset GP-IB

```
10 '*********************
20 '* RC:Reset Command * GP-IB
30 '*********************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 CMD$ = "RC"
210 CALL IBWRT(M2535%, CMD$) : GOSUB 500
220 CMD$ = "OS"
230 CALL IBWRT(M2535%, CMD$) : GOSUB 500
240 BUF$ = SPACE$(255)
250 CALL IBRD(M2535%, BUF$) : GOSUB 500
260 PRINT LEFT$(BUF$, IBCNT%-2)
270 IF LEFT$(BUF$, 2)<>"NS" THEN 240
280 CALL IBLOC(M2535%)
290 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 280
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 280
```

RC: Reset RS-232-C

```
10 '*********************
20 '* RC:Reset Command * RS-232-C
30 '*********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 LF$=CHR$(&HA)
140 PRINT #1,"RC"
150 PRINT #1,"OS"
160 LINE INPUT #1,D$
170 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
180 PRINT D$
190 IF LEFT$(D$,2)<>"NS" THEN 160
200 END
```

<Sample Programs>

DL: Delimiter GP-IB

```
10 '****************
20 '* DL:DeLimiter * GP-IB
30 '****************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V%=1:CALL IBEOT(M2535%, V%)
170 CMD$ = "DL1"
180 CALL IBWRT(M2535%, CMD$) : GOSUB 500
190 CALL IBLOC(M2535%)
200 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 190
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 190
```

DL: Delimiter RS-232-C

```
10 '****************
20 '* DL:DeLimiter * RS-232-C
30 '****************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 PRINT #1,"DL1"
140 END
```

11.5.10 RS-232-C Specific Commands

The following are commands are specific to RS-232-C. The rest of the commands used by RS-232-C are the same as the GP-IB commands on pages 11-27 through 11-70.

<ESC>S

[**Function**] Reception of <ESC>S causes the 2534 to output its status byte
[**Syntax**] **<ESC>S** <terminator>
[**Description**] • See **Section 11.3.3, "RS-232-C Status Byte Format" (page 11-16)**.

<ESC>R

[**Function**] Reception of <ESC>R causes the 2534 to transfer from local status to remote status
[**Syntax**] **<ESC>R** <terminator>
[**Description**] • In remote status, no operations can be performed from the front panel keys.

<ESC>L

[**Function**] Reception of <ESC>L causes the 2534 to transfer from remote status to local status
[**Syntax**] **<ESC>L** <terminator>
[**Description**] • In local status, operations can be performed from the front panel keys.

<ESC>C

[**Function**] Clears the 2534
[**Syntax**] **<ESC>C** <terminator>
[**Description**] • This returns the 2534 to the same status as that to which it is initialize when power is turned on.

Note • <ESC> is represented as "1BH" in the ASCII code set.

IM (Interrupt Mask) (for RS-232-C)

[Function] Specifies which causes will be allowed to generate a status byte

[Syntax] **IMm** <terminator> m=2 to 30

[Description]

- "m" is assigned as follows:
  - m=2 : Set "DIO 2" to "1" when active power integration time-out occurs
  - m=4 : Set "DIO 3" to "1" when measurement or computation is completed
  - m=8 : Set "DIO 4" to "1" when syntax error occurs
  - m=16 : Set "DIO 16" to "1" when measurement over-range or computation overflow occurs
- If more than one of these causes is to generate, set "m" to the sum of their individual "m" values.
  - Example: m=12 ... Set "DIO 3" to "1" at end of measurement and computation, or set "DIO 4" to "1" on syntax errors
- Initialized value is "m=30."
- If the "m" value for a particular bit is not included in the specified "m" value, then that interrupt cause is masked, and that bit will not be set to "1" by the event that would otherwise cause that interrupt.
- Reading the status byte by serial polling causes the status byte to be cleared.
- Integration BUSY and store/recall BUSY cannot be masked by this command.
- For the status byte format, see **Section 11.3.3, "RS-232-C Status Byte Format" (page 11-16)**.

Status Byte

DIO 8	DIO 7	DIO 6	DIO 5	DIO 4	DIO 3	DIO 2	DIO 1
Store/ recall BUSY	"1"	ERROR	OVER	Syntax ERROR	Compu-tation END	Integra-tion END	Integra-tion BUSY
			16	8	4	2	

<Sample Programs>

ESC S: Status read RS-232-C

```
10 '***********************************************
20 '* ESC S:Requests output of the status byte * RS-232-C
30 '***********************************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 LF$=CHR$(&HA)
130 PRINT #1,CHR$(&H1B)+"S"
140 INPUT #1,S$
150 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
160 PRINT HEX$(ASC(S$))
170 END
```

ESC R: Remote RS-232-C

```
10 '*****************
20 '* ESC R:Remote * RS-232-C
30 '*****************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 PRINT #1,CHR$(&H1B)+"R"
130 END
```

ESC L: Local RS-232-C

```
10 '****************
20 '* ESC L:Local * RS-232-C
30 '****************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 PRINT #1,CHR$(&H1B)+"L"
130 END
```

ESC C: Device clear RS-232-C

```
10 '************************
20 '* ESC C:Device clear  * RS-232-C
30 '************************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 PRINT #1,CHR$(&H1B)+"C"
130 END
```

IM: Interrupt Mask RS-232-C

```
10 '***********************
20 '* IM:Interrupt Maske * RS-232-C
30 '***********************
110 OPEN "COM1:1200,N,8,1,DS0,CS0,LF" AS #1
120 '
130 PRINT #1,"IM30"
140 END
```

11.5.11 Sample Programs

A sample program for each command is given after the description of the command. This section presents sample programs that use several commands.

- **Outputting Measured Data in Auto Ranging Mode**
  - GP-IB

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * GP-IB
30  '*****************************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 '
210 CMD$ = "WR1"
220 CALL IBWRT(M2535%, CMD$) : GOSUB 500
230 CMD$ = "AV1AA1"
240 CALL IBWRT(M2535%, CMD$) : GOSUB 500
250 CMD$ = "DA0DB1DC2"
260 CALL IBWRT(M2535%, CMD$) : GOSUB 500
270 '
280 BUF$ = SPACE$(255)
290 CALL IBRD(M2535%, BUF$) : GOSUB 500
300 PRINT LEFT$(BUF$, IBCNT%-2)
310 IF LEFT$(BUF$, 2)<>"HM" THEN 280
320 GOTO 280
330 '
340 CALL IBLOC(M2535%)
350 END
360 '
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 340
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 340
```

  - RS-232-C

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * RS-232-C
30  '*****************************
110 OPEN "COM1:9600, N, 8, 1, DS0, CS0, LF" AS #1
120 LF$=CHR$(&HA)
130 '
140 PRINT #1, "WR1"
150 PRINT #1, "AV1AA1"
160 PRINT #1, "DA0DB1DC2"
170 '
180 PRINT #1, "OD"
190 LINE INPUT #1, D$
200 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
210 PRINT D$
220 IF LEFT$(D$, 2)<>"HM" THEN 190
230 END
```

• Outputting Measured Data in Trigger Mode

• GP-IB

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * GP-IB
30  '*****************************
40 ' ------------------------------------------------------------------------
50 '                  **  Basic Declarations  **
60 CLEAR , 50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 400
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 '
210 CMD$ = "WR1"
220 CALL IBWRT(M2535%, CMD$) : GOSUB 500
230 CMD$ = "AV1AA1"
240 CALL IBWRT(M2535%, CMD$) : GOSUB 500
250 CMD$ = "DA0DB1DC2"
260 CALL IBWRT(M2535%, CMD$) : GOSUB 500
270 CMD$ = "HD1"
280 CALL IBWRT(M2535%, CMD$) : GOSUB 500
290 '
300 FOR I = 1 TO 1000 : NEXT
310 CMD$ = "E"
320 CALL IBWRT(M2535%, CMD$) : GOSUB 500
330 BUF$ = SPACE$(255)
340 CALL IBRD(M2535%, BUF$) : GOSUB 500
350 PRINT LEFT$(BUF$, IBCNT%-2)
360 IF LEFT$(BUF$, 2)<>"HM" THEN 330
370 GOTO 300
380 CALL IBLOC(M2535%)
390 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 380
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 380
```

• RS-232-C

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * RS-232-C
30  '*****************************
110 OPEN "COM1:9600, N, 8, 1, DS0, CS0, LF" AS #1
120 LF$=CHR$(&HA)
130 '
140 PRINT #1, "WR1"
150 PRINT #1, "AV1AA1"
160 PRINT #1, "DA0DB1DC2"
170 '
180 PRINT #1, "IM4"
190 PRINT #1, CHR$(&H1B)+"S"
200 INPUT #1, S$
210 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
220 TNI = VAL("&H"+HEX$(ASC(S$)))
230 IF TNI AND &H4 THEN GOSUB 300
240 GOTO 190
250 END
260 '
300 PRINT #1, "OD"
310 LINE INPUT #1, D$
320 IF LEFT$(D$, 1)=LF$ THEN D$=MID$(D$, 2)
340 PRINT D$
350 IF LEFT$(D$, 2)<>"HM" THEN 310
360 RETURN
```

• Outputting Measured Data in SRQ Mode

• GP-IB

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * GP-IB
30  '*****************************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 BDNAME$="GPIB0"
140 CALL IBFIND(BDNAME$, BRD0%)
150 IF M2535%<0 THEN 400
160 DEVICE$="M2535"
170 CALL IBFIND(DEVICE$, M2535%)
180 IF M2535%<0 THEN 400
190 V% = &HA+&H400
200 CALL IBEOS(M2535%, V%)
210 V%=1
220 CALL IBEOT(M2535%, V%)
230 '
240 CMD$ = "WR1"
250 CALL IBWRT(M2535%, CMD$) : GOSUB 500
260 CMD$ = "AV1AA1"
270 CALL IBWRT(M2535%, CMD$) : GOSUB 500
280 CMD$ = "DA0DB1DC2"
290 CALL IBWRT(M2535%, CMD$) : GOSUB 500
300 '
310 CMD$ = "IM4"
320 CALL IBWRT(M2535%, CMD$) : GOSUB 500
330 MASK% = &H1000
340 CALL IBWAIT(BRD0%, MASK%) : GOSUB 500
350 CALL IBRSP(M2535%, SPR%)
360 IF SPR% AND &H4 THEN GOSUB 600
370 GOTO 340
380 CALL IBLOC(M2535%)
390 END
400 ' *** When IBFIND call failed ***
410 PRINT " ===== No such board or device name ===== "
420 GOTO 360
500 ' *** GP-IB error check ***
510 IF IBSTA% >= 0 THEN RETURN
520 PRINT " ===== Error ===== "
530 GOTO 360
600 ' *** Data output ***
610 BUF$ = SPACE$(255)
620 CALL IBRD(M2535%, BUF$) : GOSUB 500
630 PRINT LEFT$(BUF$, IBCNT%-2)
640 IF LEFT$(BUF$, 2)<>"HM" THEN 610
650 RETURN
```

• RS-232-C

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * RS-232-C
30  '*****************************
110 OPEN "COM1:9600,N,8,1,DS0,CS0,LF" AS #1
120 LF$=CHR$(&HA)
130 '
140 PRINT #1,"WR1"
150 PRINT #1,"AV1AA1"
160 PRINT #1,"DA0DB1DC2"
170 PRINT #1,"HD1"
180 '
190 FOR I = 1 TO 1000 : NEXT
200 PRINT #1,"E"
210 FOR I = 1 TO 100 : NEXT
220 PRINT #1,"OD"
230 LINE INPUT #1,D$
240 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
250 PRINT D$
260 IF LEFT$(D$,2)<>"HM" THEN 230
270 GOTO 190
280 END
```

• Storing and Recalling Measured Data in N Reading Mode

• GP-IB

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * GP-IB
30  '*****************************
40  ' ------------------------------------------------------------------------
50  '                  **  Basic Declarations  **
60 CLEAR ,50000!
70       IBINIT1 = 50000!
80       IBINIT2 = IBINIT1 + 3
90       BLOAD "bib.m", IBINIT1
100       CALL IBINIT1(IBFIND, IBTRG, IBCLR, IBPCT, IBSIC, IBLOC, IBPPC, IBBNA, IBONL, IBR
SC, IBSRE, IBRSV, IBPAD, IBSAD, IBIST, IBDMA, IBEOS, IBTMO, IBEOT, IBRDF, IBWRTF)
110       CALL IBINIT2(IBGTS, IBCAC, IBWAIT, IBPOKE, IBWRT, IBWRTA, IBCMD, IBCMDA, IBRD, I
BRDA, IBSTOP, IBRPP, IBRSP, IBDIAG, IBXTRC, IBRDI, IBWRTI, IBRDIA, IBWRTIA, IBSTA%, IBERR%,
IBCNT%)
120 ' ------------------------------------------------------------------------
130 DEVICE$="M2535"
140 CALL IBFIND(DEVICE$, M2535%)
150 IF M2535%<0 THEN 600
160 V% = &HA+&H400
170 CALL IBEOS(M2535%, V%)
180 V%=1
190 CALL IBEOT(M2535%, V%)
200 '
210 CMD$ = "WR1"
220 CALL IBWRT(M2535%, CMD$) : GOSUB 700
230 CMD$ = "AV1AA1"
240 CALL IBWRT(M2535%, CMD$) : GOSUB 700
250 CMD$ = "DA0DB1DC2"
260 CALL IBWRT(M2535%, CMD$) : GOSUB 700
270 CMD$ = "HD0"
280 CALL IBWRT(M2535%, CMD$) : GOSUB 700
290 '
300 CMD$ = "SM2"
310 CALL IBWRT(M2535%, CMD$) : GOSUB 700
320 CMD$ = "SR3"
330 CALL IBWRT(M2535%, CMD$) : GOSUB 700
340 CMD$ = "NS10S01"
350 CALL IBWRT(M2535%, CMD$) : GOSUB 700
360 INPUT "STORE START (ret)";Y$
370 CMD$ = "E"
380 CALL IBWRT(M2535%, CMD$) : GOSUB 700
390 INPUT "PLEASE (ret) AFTER STORE END";Y$
400 '
410 CMD$ = "S00"
420 CALL IBWRT(M2535%, CMD$) : GOSUB 700
430 CMD$ = "RM2RD0"
440 CALL IBWRT(M2535%, CMD$) : GOSUB 700
450 CMD$ = "RR4"
460 CALL IBWRT(M2535%, CMD$) : GOSUB 700
470 CMD$ = "NS10R01"
480 CALL IBWRT(M2535%, CMD$) : GOSUB 700
481 CMD$ = "E"
482 CALL IBWRT(M2535%, CMD$) : GOSUB 700
490 INPUT "PLEASE (ret) AFTER RECALL END";Y$
500 CMD$ = "R00"
510 CALL IBWRT(M2535%, CMD$) : GOSUB 700
520 CALL IBLOC(M2535%)
530 END
600 ' *** When IBFIND call failed ***
610 PRINT " ===== No such board or device name ===== "
620 GOTO 520
700 ' *** GP-IB error check ***
710 IF IBSTA% >= 0 THEN RETURN
720 PRINT " ===== Error ===== "
730 GOTO 520
```

• RS-232-C

```
10  '*****************************
20  '* READ OUTPUT DATA (NORMAL) * RS-232-C
30  '*****************************
110 OPEN "COM1:9600,N,8,1,DS0,CS0,LF" AS #1
120 '
130 PRINT #1,"WR1"
140 PRINT #1,"AV1AA1"
150 PRINT #1,"DA0DB1DC2"
160 PRINT #1,"HD0"
170 '
180 PRINT #1,"SM2"
190 PRINT #1,"SR3"
200 PRINT #1,"NS10S01"
210 INPUT "STORE START (ret)";Y$
220 PRINT #1,"E"
230 INPUT "PLEASE (ret) AFTER STORE END";Y$
240 PRINT #1,"S00"
250 '
260 PRINT #1,"RM2RD0"
270 PRINT #1,"RR4"
280 PRINT #1,"NS10R01"
290 PRINT #1,"E"
300 INPUT "PLEASE (ret) AFTER RECALL END";Y$
310 PRINT #1,"R00"
320 END
```

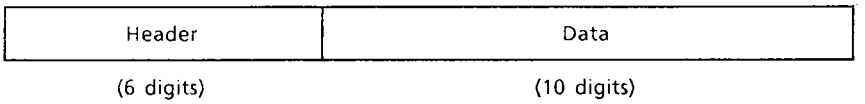
11.6 Data Output Formats

11.6.1 Data Structures

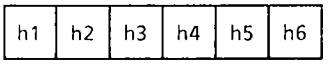
The data output formats shown below are same for both GP-IB and RS-232-C. However, the status byte formats are different.

Data Structure

Each data item consists of a header section and a data section.



Header Section



- **h1 to h3**: Type of data (␣ represents a space)
  - V␣␣ : Voltage
  - A␣␣ : Current
  - W␣␣ : Power
  - VA␣ : Apparent power
  - var : Reactive power
  - PF␣ : Power factor
  - DEG : Phase angle
  - HM␣ : Integration time
  - Wh␣ : Integrated power
  - HzV : Frequency (voltage measurement)
  - HzA : Frequency (current measurement)
  - MEM : Recall data number

- **h4**: Element
  Always "1".

- **h5**: Data status
  - N : Normal
  - I : Over-range
  - O : Computation overflow

- **h6**: Phase shift direction if data type is DEG
  - D : Lead
  - G : Lag
  - ␣ : If data type is not DEG, or shift is not detectable

Data Section

d1	d2	d3	d4	d5	d6	d7	d8	d9	d10

- d1 to d7 : −999.9 to 99999.9
- d8 to d10 : Exponent ... E−3: 10^{-3} [m]
  E+0: 1
  E+3: 10^{3} [k]
  E+6: 10^{6} [M]

- **Output Data Value for Measurement/Computation Error**
  - Output data for over-range condition
    (if display shows "--oL--" or "--Po--")

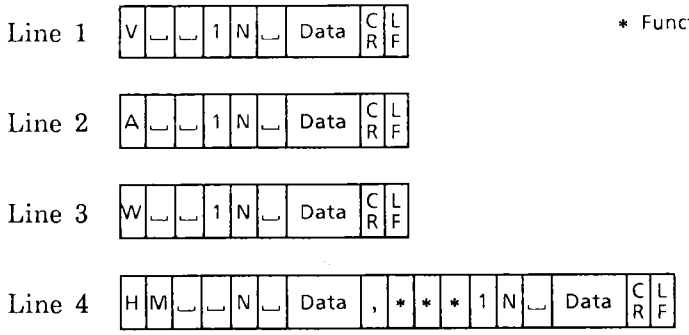
h1	h2	h3	h4	I	␣	9	9	9	9	9	9	.	E	+	3

  - Output data for computation overflow condition
    (if display shows "--oF--", "PF Err", "dEGErr", "ErrLo", or "ErrHi")

h1	h2	h3	h4	O	␣	8	8	8	8	8	8	.	E	+	0

11.6.2 Measured/Computed Data Output Format

Reception of the "OD" command (**see page 11-65**) causes the 2534 to output the measured and computed data.
The measured and computed data output normally consists of four lines for each update cycle.



* Function on DISPLAY C

Note

- Even if the function on DISPLAY C is not "Wh", the integration time ("0000") is output.

11.6.3 Measured/Computed Data Recall Output Format

Reception of the "ROm" command (**see page 11-53**), results in output of measured/computed data from the IC memory card.
The IC memory card output normally consists of five lines for each Data No.

Line 1 | M | E | M | ␣ | N | ␣ | Data No. | CR | LF |

Line 2 | V | ␣ | ␣ | 1 | N | ␣ | Data | CR | LF |

Line 3 | A | ␣ | ␣ | 1 | N | ␣ | Data | CR | LF |

Line 4 | W | ␣ | ␣ | 1 | N | ␣ | Data | CR | LF |

Line 5 | H | M | ␣ | ␣ | N | ␣ | Data | , | * | * | * | 1 | N | ␣ | Data | CR | LF |

* Function on DISPLAY C

Note

- Even if the function on DISPLAY C is not "Wh", the integration time ("0000") is output.

11.6.4 Panel Setup Information Output Format

Reception of the "OS" command (**see page 11-65**) causes the setup information to be output.

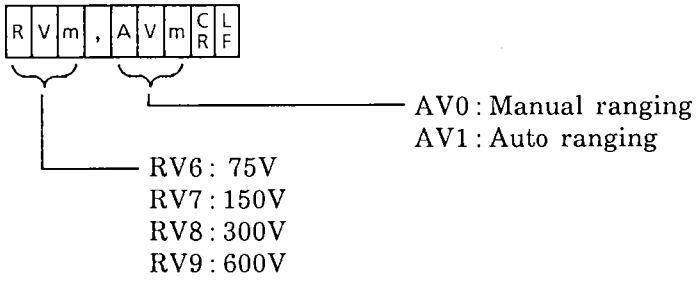
Output Order

Line 1	Model	CR LF
Line 2	Voltage range setup	CR LF
Line 3	Current range setup	CR LF
Line 4	Measurement mode setup	CR LF
Line 5	Display function setup	CR LF
Line 6	Display element setup	CR LF
Line 7	Scaling setup	CR LF
Line 8	Timer setup	CR LF
Line 9	NS value, store/recall setup	CR LF

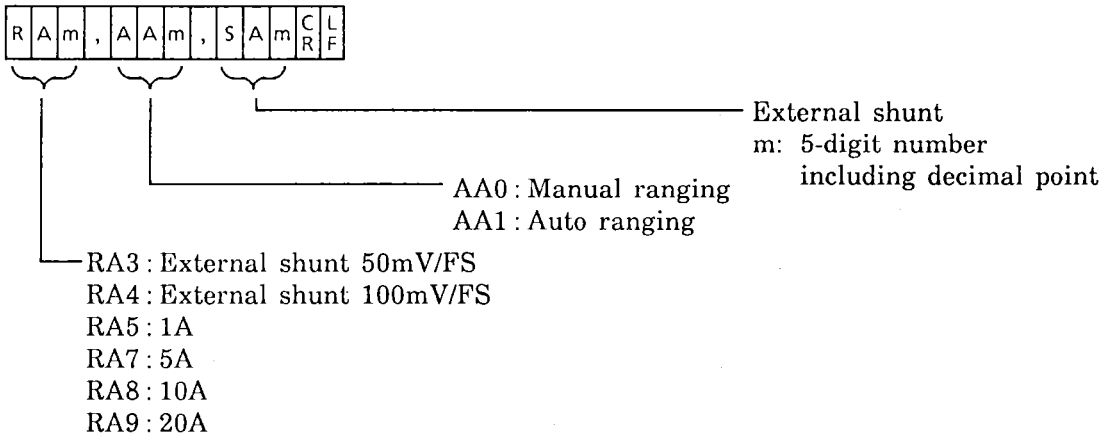
Data Structures of Individual Lines

- **Line 1: Model**

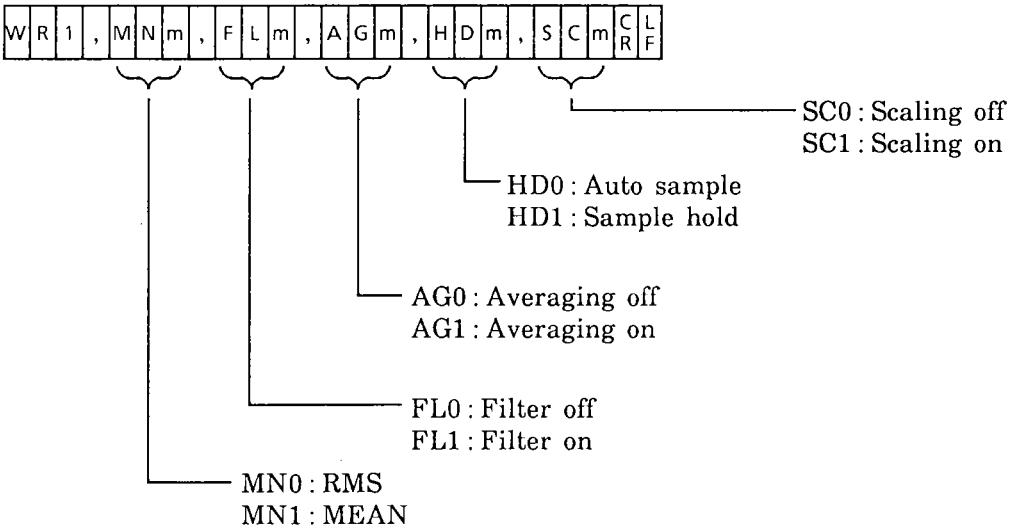
- **Line 2: Voltage Measurement Range Setup**



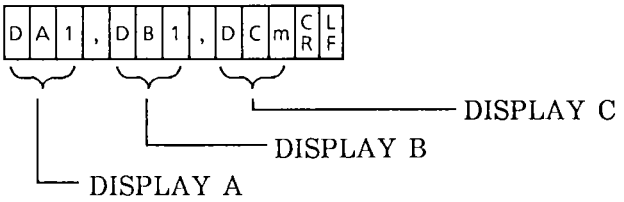
- **Line 3: Current Measurement Range Setup**



- **Line 4: Measurement Mode Setup**

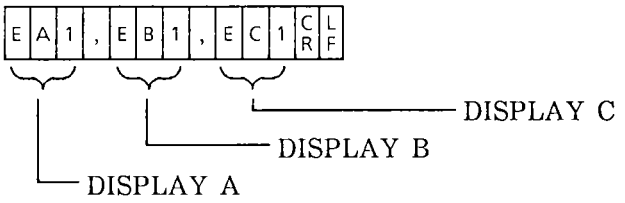


- **Line 5: Display Function Setup**

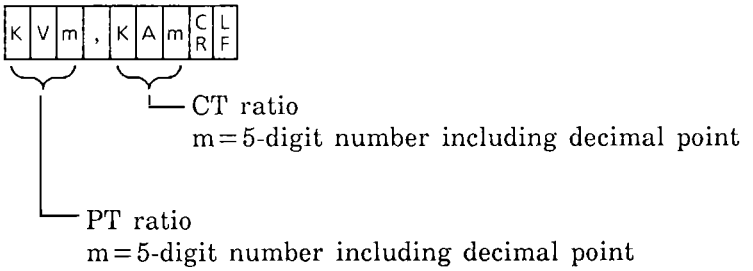


Parameter m	Statement DCm	
0	V	Voltage display
1	A	Current display
2	W	Active power display
3	VA	Apparent power display
4	var	Reactive power display
5	PF	Power factor display
6	DEG	Phase angle display
7	Wh	Active power integrated value display
8	Hz<V1>	Voltage frequency display
9	Hz<A1>	Current frequency display

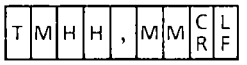
- **Line 6: Display Element Setup**



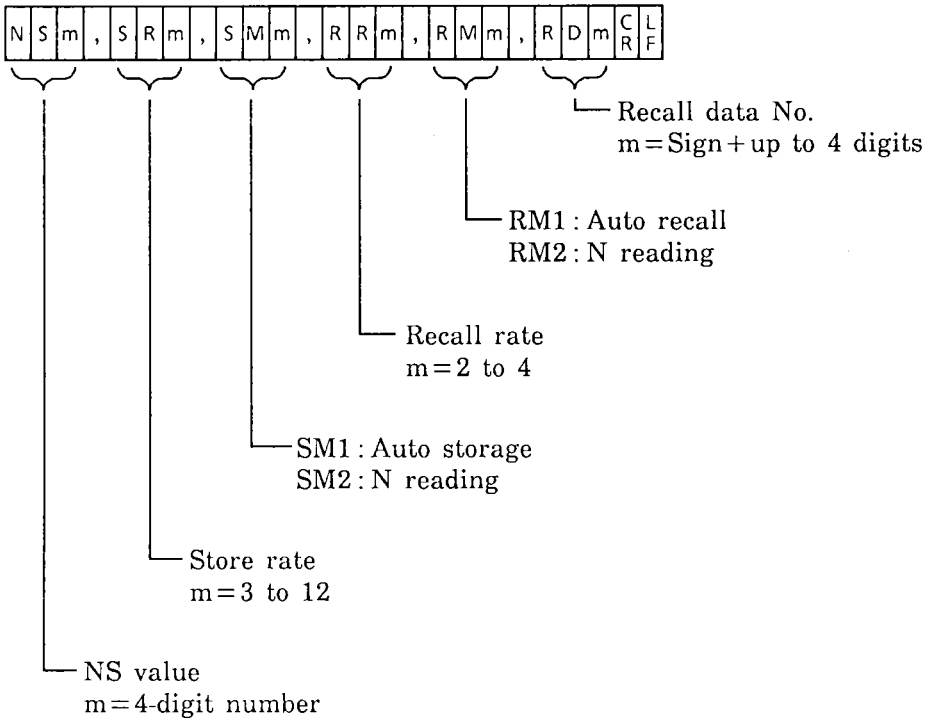
- **Line 7: Scaling Setup**



- **Line 8: Timer Setup**



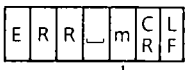
- **Line 9: NS Value (pretrigger point or No. of data), Store and Recall Setup**



11.6.5 Error Code Output Format

Reception of the "OE" command (**see page 11-65**) causes the error code to be output.

Data Structure



"m" is the 2-digit error code.

Error Code Lists

• Memory Card Errors

Error Code	Description
30	Memory card file data error (file error)
31	Memory card not initialized (at data save/load)
32	File not present on memory card (at data load/recall)
33	Insufficient file capacity. No free area
34	Memory card not inserted
35	Memory card failure
36	No recall data
37	Memory card battery error
38	NS value or recall start Data No. exceeds file area
39	Not a 2534 file

• Command Errors

Error Code	Description
11	Command error
12	Parameter error
13	Attempted to execute protected command during integration operation
14	Attempted to execute protected command during store or recall operation
15	Attempted to execute protected command during operation other than integration, store, or recall

• Active Power Integration Errors

Error Code	Description
41	• Attempted to start integration during active power integration value overflow condition • Attempted to start integration after active power integration time had reached timer preset value
42	Attempted to start integration while active power integration in progress
44	Attempted to stop integration, but integration was not in progress

- **Measurement/Computation Errors**

Error Code	Description	
50	A/D conversion time-out	
51	Measured data peak over-range	"--PO--" ±
52	+over-range	"--OL--" +
53	−over-range	"--OL--" −
54	Computation overflow	"--OF--"
55	Power factor 2.001 or more	"PFErr"
56	Phase outside of 0.0 to 90.0 range	"dEGErr"
57	Frequency below 4.00Hz	"ErrLo"
58	Frequency above 22.00kHz	"ErrHi"
59	No measured value for function selected	"------"

Chapter 12

Troubleshooting and Maintenance

This chapter explains how to deduce the probable causes of problems and decide what corrective actions to take, and advises on corrective actions to take in response to displayed error codes.
This chapter also explains how to replace the power fuse and calibration.

12.1 Apparent Hardware Failure? Check These Things First!

This chapter describes points that you should check before concluding that improper operation is due to a hardware failure, and suggests corrective actions. For instructions concerning corrective actions for error codes presented on DISPLAY C, see next page.

- If the 2534 does not operate properly even after performing the actions outlined below, note the ROM Version No. (for example, 1.00) displayed on DISPLAY C at power-on, and contact YOKOGAWA or your YOKOGAWA sales representative.

Symptom	What to Check	Reference Pages
Nothing displayed even though power switch is ON	• Is power cord securely connected to the 2534 power connector and power outlet receptacle? • Is power voltage within allowable limits? • Has fuse blown?	2-10 2-9 12-6
Display data is odd	• Is there noise on the signals? • Are measurement leadwires connected correctly? • Is filter off? • Are ambient temperature and humidity within allowable limits?	2-6 3-2 7-4 2-6
Display data flickers	• Is there noise on the signals.	2-6
Keys do not function	• Is "REMOTE" indicator at left of DISPLAY A on?	1-9 11-5
Unable to store or save to IC memory card	• Is "LOW BAT" indicator at left of DISPLAY A on? • Is IC memory card correctly inserted in slot? • Is an error code displayed on DISPLAY C?	1-9 10-19 10-3 12-4
Unable to recall or load from IC memory card	• Is "LOW BAT" display at left of DISPLAY A on? • Is IC memory card correctly inserted in slot? • Is an error code displayed on DISPLAY C?	1-9 10-19 10-3 12-4
Unable to set up or control via GP-IB interface	• Does the GP-IB address coded for the 2534 in the program match the address set up in the 2534? • Does the interface meet IEEE Standard 488.1-1978 electrical and mechanical specifications?	11-9 11-4 13-5
Unable to set up or control via RS-232-C interface	• Are the 2534 and controller set for the same communications specifications?	11-11 11-19

12.2 Error Codes and Corrective Actions

This section describes the error codes displayed on DISPLAY C for operating errors and instrument malfunctions, and the corrective action to be tried in response to each code.

Error Code	Description	Corrective Action	Reference Pages
--oF--	Computed value overflow	Select proper measurement range	4-7 11-27
--oL--	Input voltage/current exceeds measurement limits	• Select higher measurement range • If already at highest range, measurement is not possible • Use an external potential or current transformer to extend range	4-7 11-27
--Po--	• Instantaneous input voltage exceeded 2.5 times the range rated value • Instantaneous input current exceeded 3 times the range rated value	• Select higher measurement range • If already at highest range, measurement is not possible • Use an external potential or current transformer to extend range	4-5
ErrLo	• Input level too low for frequency measurement • Input voltage/current frequency is below measurement low limit • Input signal frequency is very far above the measurement high limit	Increase input level, if possible	7-2 13-4
ErrHi	Input voltage/current frequency is above measurement high limit	———	7-2 13-4
PFErr	Power factor computation overflow	———	5-4
dEGErr	• Phase angle computation overflow • Input signal frequency exceeds 1kHz	———	5-6
Err11	Received command not used in the 2534	Check for error in the command sent	11-25
Err12	Parameter value specified is outside allowed range	Correct to a value allowed for the specified parameter	Section 11.5

Error Code	Description	Corrective Action	Reference Pages
Err13	Attempted to execute a key operation or communications command, while active power integration was running or in an interrupted state, that cannot be executed in that state	Check whether integration is in progress or in an interrupted condition	10-13 Section 11.5
Err14	Pressed key that cannot be used during store/recall of measured and computed data to/from IC memory card	———	10-8 10-12
Err15	Attempted use of communication command to select auto ranging mode when external shunt range selected	———	—
Err16	Auto load has been executed while communication interface settings have not been saved	Save the panel setting conditions again	Section 10.5
Err30	IC memory card file data error (File error)	Must re-initialize IC memory card and store/save data again	10-4 10-5 10-17
Err31	IC memory card not initialized	Initialize IC memory card	10-4
Err32	File not present on IC memory card	Store/save data to IC memory card	10-5 10-17
Err33	Insufficient area to store/save data to IC memory card	Initialize IC memory card	10-4
Err34	IC memory card not properly inserted in slot	Insert IC memory card properly in slot	10-3
Err35	IC memory card failure	Replace IC memory card	10-2
Err36	Measured/computed data to be recalled is not present on IC memory card	———	10-5
Err37	IC memory card battery error	Replace IC memory card battery	10-19
Err38	IC memory card NS value or stored data read start position is outside allowed range	Set the NS value or stored data read start position to an appropriate value	10-13
Err39	IC memory card contents are not 2534 files	———	—

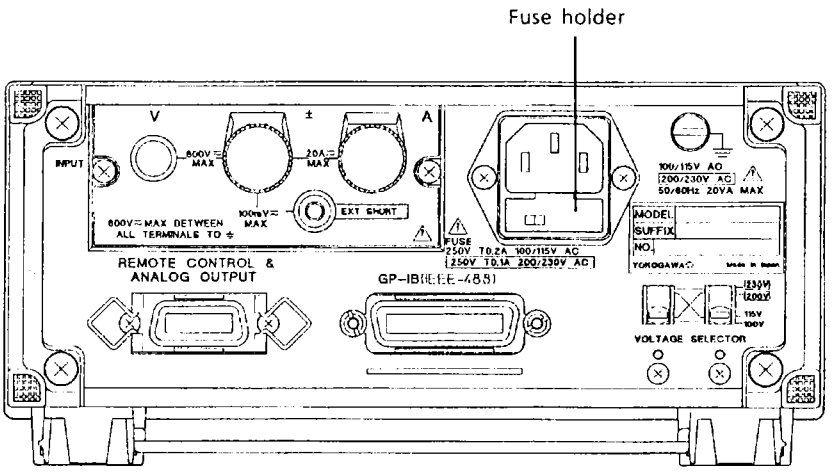
Error Code	Description	Corrective Action	Reference Pages
Err41	• Attempted to start integration during active power integration value overflow condition • Attempted to start integration after active power integration time had reached timer preset value	Reset integration	6-3
Err42	Attempted to start integration while active power integration in progress	Stop integration	6-3
Err44	Attempted to stop integration, but integration was not in progress	———	6-3
Err50	A/D conversion time-out	———	—
Err60	Setup data backup time exceeded (panel setup information returned to initial settings)	———	9-3
Err61	Verification error on write to EEPROM	Requires service	—
Err62	Sum check error on read from EEPROM	Requires service	—
Err70	GP-IB controller failure	Requires service	—
Err71	RS-232-C controller failure	Requires service	—
Err80	RAM read/write check error	Requires service	—
Err81	Integrated value backup data sum check error (starts with integrated value at zero)	———	—
Err82	Communication setup backup data sum check error (starts at initial settings)	———	—
Err83	Panel setup information backup sum check error (starts at initial settings)	———	—
Err85	ROM sum check error	Requires service	—
Err87	DSP1 failure	Requires service	—
Err88	DSP2 failure	Requires service	—
Err89	DSP3 failure	Requires service	—

12.3 Replacing the Fuse

This section explains AC power fuse selection and replacement.

Fuse Position

As shown in the figure below, the fuse holder is located below the power connector.



Fuse Selection

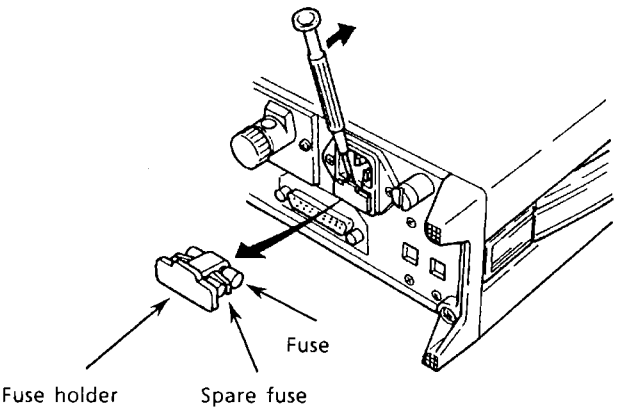
The fuse to be used in the 2534 will differ as shown below according to AC power voltage used. Take care not to select the wrong fuse for replacement.

- **100VAC or 115VAC Power Supply:**
  250V, 200mA rating time-lag fuse
  (To order, part number is A1343EF)

- **200VAC or 230VAC Power Supply:**
  250V, 100mA rating time-lag fuse
  (To order, part number is A1341EF)

Replacing the Fuse

1. Turn the power switch OFF.
2. Disconnect the power cord from the power connector on the 2534.
3. Insert the tip of a flat-blade screwdriver into the slot in the fuse holder in the power cord connector, and move the screwdriver in the direction of the arrow to remove the fuse holder.
4. Remove the blown fuse at the end of the fuse holder.
5. Insert the new fuse into the fuse holder, and replace the fuse holder under the power cord connector.
   - Use the spare fuse supplied in the fuse holder to replace the fuse the first time. Note, however, that the spare fuse in the fuse holder is rated for the power voltage specified when the 2534 was ordered. If the power supply voltage used has been changed, check whether the spare fuse is appropriate for the power voltage now selected.



⚠ Warning

- The fuse used must be of the specified rating to prevent a fire hazard. Never use a fuse of any other rating, and never short-circuit the fuse holder to bypass the fuse.
- Do not operate the 2534 if you have any reason to suspect any defect or problem in the fuse.

12.4 Calibration Considerations

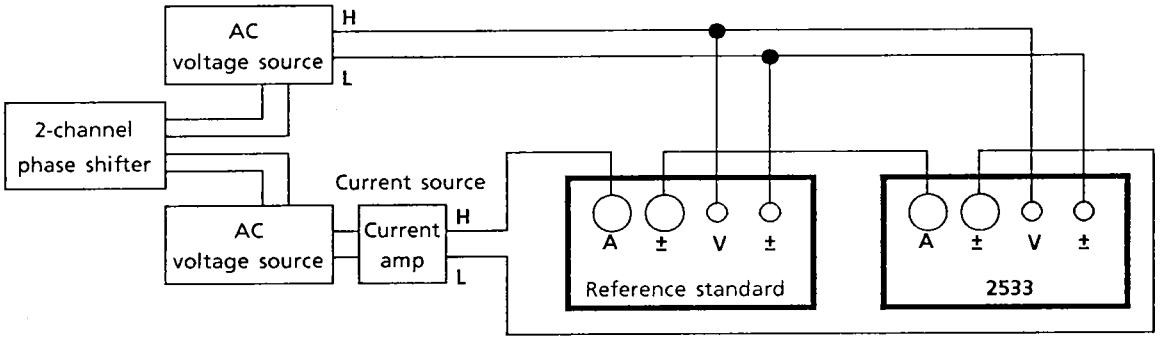
This section discusses issues to which attention must be paid when calibrating the 2534 using locally available powermeter calibration facilities.

To maintain high measurement accuracy, the 2534 should be calibrated every 90 days.
The YOKOGAWA offices listed on the back cover of this manual can advise you of YOKOGAWA representatives providing calibration services.

Calibration Using Locally Available Powermeter Calibration Facilities

Unlike earlier YOKOGAWA powermeter models (2532, 2533, etc.), the 2534 has input circuits in which one side of the voltage input is connected in common with one side of the current input (that is, one of the voltage input terminals and one of the current input terminals are internally connected). Therefore, the 2534 cannot be wired in the manner (shown in the figure below) that would be used for a 2533 powermeter. Carefully read the section below before wiring the 2534.

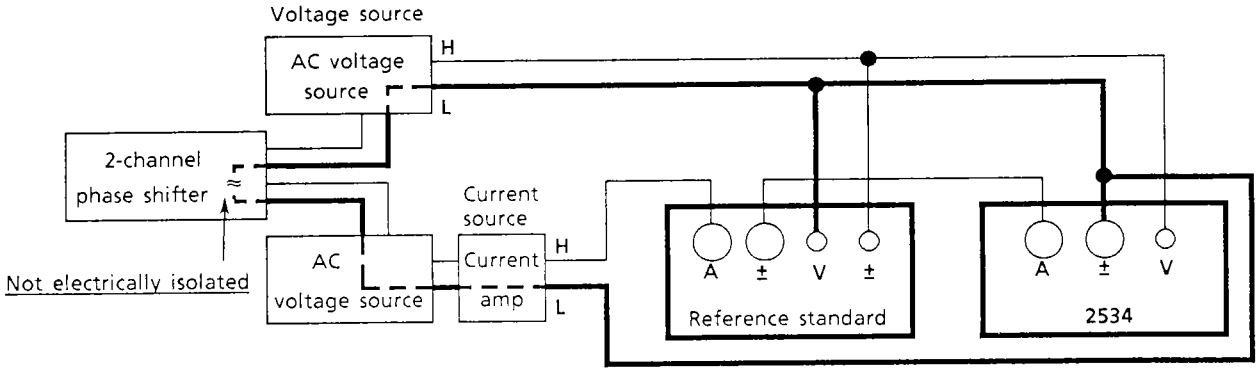
Voltage source **Calibration Wiring for Model 2533 (NOT usable for Model 2534)**



- As Figures (a) and (b) illustrate, when you are connecting the voltage source and the voltage input terminals, connect the "L" side of the voltage source outputs to the "V" side of the reference standard instrument voltage inputs, and the "H" side of the source outputs to the common terminal (±) of the inputs. This is done for greatest possible similarity to the way in which the 2534 is connected to an actual load.

- **If the Voltage and Current Sources are Electrically Isolated:**
  · Make the connections as shown in Figure (a) below. The voltage source "L" side and the current source "L" side are both connected to the common terminal (±) of the 2534.

(a) **Calibration Wiring for Model 2534, Using Electrically Isolated Sources**



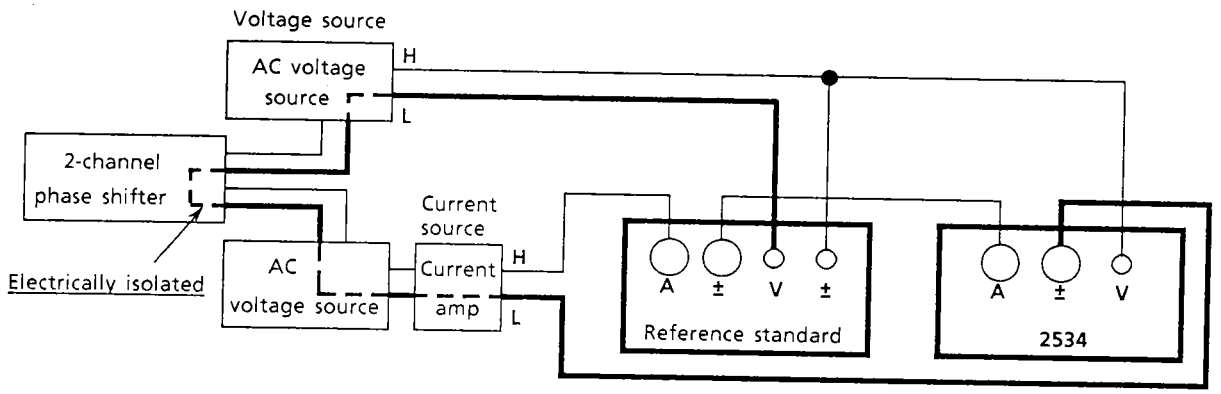
- **If Voltage and Current Sources are NOT Electrically Isolated:**
  - Make the connections as shown in Figure (b) below. Be sure to note that in this case, unlike in Figure (a) above, the voltage source "L" side and current source "L" side are NOT both connected to the common terminal (±) of the 2534.
  - In this method of connection, the longer the wiring on the common side (represented by the thick line in Figure (b)), the higher the impedance in that line. Since higher impedance increases voltage drop, affecting the measured voltage value, it also increases error. Thus this connection should be made with the shortest, thickest wire possible.
  - Depending on the calibration equipment, the measured current value may vary when the high-voltage/low-current range combination (voltage range 600V, current range 1A) is selected. This is due to the current drawn by the voltage input circuit (equal to the applied voltage divided by 2MΩ) through the common terminal (±).

    Example values measured at YOKOGAWA (for your reference):

    600V / 1A ... Error: Approx. ±0.3%

    300V / 1A ... Error: Approx. ±0.15%

(b) **Calibration Wiring for Model 2534, Using Electrically Non-Isolated Sources**



Chapter 13

Specifications

This chapter presents the functional specifications and the general specifications of the 2534.

13.1 Specifications

Input Section

Item \ Input	Voltage (V)	Current (A)
Input type	Floating inputs (but no isolation between V & A terminals)	
	Resistive voltage divider	Shunt input
Rated range values (Range display)	75/150/300/600V	Current inputs: 1, 2, 5A External shunt input: 50, 100, 200mV
Guaranteed accuracy range	10% to 110% of rated value	
Instrument loss	Input resistance, approx. 2Ω (all ranges) (approx. 60pF in parallel)	Approx. 15Ω External shunt input resistance: Approx. 2kΩ
	Approx. 200pF between input terminals (±) and case	
Usable frequency range	DC, and 10Hz to 20kHz	
Maximum allowable instantaneous input (for 1 sec)	Peak value of 1400V or 3 times range, whichever is lower	Peak value of 7 times range or 70A, whichever is lower External shunt input range: Peak voltage is 5V max.
Maximum allowable continuous input (at 50/60Hz)	Peak of 1000V, or rms value of 2 times range, whichever is lower	Peak of 50A, rms value of 30A, or rms value of 3 times range, whichever is lower External shunt input range: Peak voltage is 1V max.
Maximum continuous common mode voltage 50/60Hz	600Vrms	
Common mode voltage influence (at 50/60Hz)	±0.03% of range max. (with input terminals shorted, 600V applied between inputs and case)	±0.03% of range max. (with input terminals open, 600V applied between input (±) and case)
Input terminals	Binding posts	Large binding posts External shunt input: round 4-pin connector (accessory)
Input over-range detection	2.5 times rated range value	3 times rated range value
A-D conversion section	Simultaneous sampling of voltage & current inputs Resolution: 12bits Maximum conversion rate: 42kS/s	
Range selection	V and A can be independently selected using manual, automatic, or external control (GP-IB or RS-232-C interface)	
Auto range selection	Range upshift : If measured value exceeds 110% of rating Range downshift : If measured value falls below 50% of rating (or below 20% of rated value in 5A range)	

Measurement Functions

Item		Voltage (V)	Current (A)	Power (W)
Frequency range		DC, and 10Hz to 20kHz		
Crest factor		Max. 2.5 at rated input	Max. 3 at rated input	—
DISPLAY accuracy*	DC	± (0.4% of reading + 0.2% of range)		
	10≦f<25Hz	± (1.5% of range)		
	25≦f<45Hz	± (0.5% of reading + 0.4% of range)		
	45≦f≦66Hz	± (0.25% of reading + 0.1% of range) *1		
	66<f≦2kHz	± (0.5% of reading + 0.4% of range)		
	2k<f≦10kHz	± (1.5% of range)		
	10k<f≦20kHz	± (3.5% of range)		
Power factor influence (when cosφ=0.5, at 50/60Hz)		—		±0.5% of reading max.
Temperature coefficient (at 5 to 20°C or 26 to 40°C)		±0.05% of range/°C		

* Measurement conditions for display accuracy:

Ambient temperature	:	23±3°C	Calibration interval	:	90 days
Ambient humidity	:	45% to 75% R.H.	Scaling	:	Off
Power voltage	:	100VAC±1%	Input range	:	10% to 110% of range rated value
Input waveform	:	Sine wave			
Common mode voltage	:	0V	Filter	:	Off
			Power at cosφ=1		

*1 When External Shunt Input is used ±(0.4 of reading + 0.1% of range)

Display Functions

Display: LED (light-emitting diode)

Displayed information	Display	Displayed Information	Maximum Display Value
	A	V	V : 9999 A : 9999
	B	A Elapsed active power integration time	
	C	V, A, W, VA, var, PF, deg, Wh, Hz	Wh : 999999 to −99999 Hz : 9999

Units display: m, k, M, V, A, W, VA, var, Hz, Wh, deg, s

Display update interval: Approx. 500ms (Sample rate: Approx. 250ms)

Response time: Max. 1.5 sec.
(Time to settle to final value, within specified accuracy, after step change from 10% to 100% of range, or 100% to 10% of range)

- **Display Scaling Function**

Significant digits: Automatically selected according to significant digits in voltage/current range

Setting range: 1.000 to 10000 (External shunt current: 1.000 to 1000A)

Settings: DISPLAY A: PT ratio
DISPLAY B: CT ratio, external shunt current

- **Display Averaging Function**

Method: Exponential averaging

Attenuation factor: 8 (fixed)

Computation Functions

Computation Item	Apparent Power VA	Reactive Power var	Power Factor PF	Phase Angle deg
Computation formula	V×A	$\sqrt{(V\times A)^2-W^2}$	$\frac{W}{V\times A}$	$COS^{-1}\left(\frac{W}{V\times A}\right)$
Computation range	Rated value determined by V and A range	Rated value determined by V and A range (var≥0)	−1.000 to 1.000	G90.0 to 0.0 to d90.0
Computation accuracy	±0.05% of rated VA value	±0.05% of rated var value	±0.002 (When power factor is "1")	±0.2deg (When phase angle is 60 deg)

Note : The 2534 obtains the reactive power, (var), apparent power, (VA), power factor, (PF), and phase angle, (deg), from the voltage, current, and active power by digital computation. In the case of non-sinusoidal (distorted) input waveforms, these values may differ from those obtained with instruments employing different measurement principles.

Integrator Functions (Wh)

Maximum display	−99999 to 999999
Maximum integration time	99h, 59min
Measured frequency range	DC, 10Hz to 20kHz
Display	DISPLAY C shows Wh value
Timer	Integration can be stopped automatically based on timer preset Setting range: 00h 00min to 99h 59min ("00h 00min" selects manual mode)
Elapsed time	DISPLAY B shows time elapsed since integration start
Count overflow	If integration value overflows, elapsed time is saved and integration is stopped
Accuracy	±(measurement accuracy ±0.2% of reading)
Timer accuracy	±0.02%
Remote control	Start, stop, and remote control can be performed using an external contact signal

Frequency Measurement

Measurement method	Reciprocal counting method
Measured input	Voltage or current
Accuracy	± (0.1% of range + 1digit)
Minimum input sensitivity	10% of rated input
Display range	4.00Hz to 22.00kHz
Frequency measurement range	See table below

Filter	Frequency Measurement Range
ON	4Hz to 300Hz
OFF	4Hz to 22kHz

D/A Converter Output

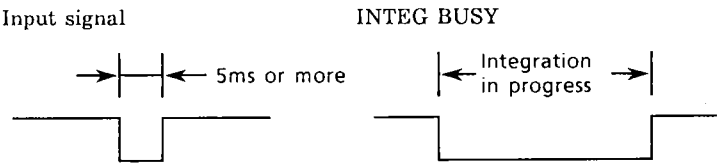
System	15-bit PWM
Output voltage	±5VDC for each rated value (max., approx. 7.5VDC)
Accuracy	± (measurement accuracy +0.2% of FS)
Temperature coefficient	±0.05% of FS/°C
Output data	Any data type that can be displayed in DISPLAY C (V, A, W, VA, var, PF, deg, Hz)
Output update interval	Approx. 500ms (same as display update interval)
Response time	Approx. 2 sec. (display response +approx. 500ms) (Time to settle to final value, within specified accuracy, after step change from 10% to 100% of range, or 100% to 10% of range, with filter OFF.)

External Control Input and Outputs

Signal level: TTL

Signal types:

Signal Name	Input/Output	Function
$\overline{\text{EXT HOLD}}$	Input	Display data update hold
$\overline{\text{EXT TRIG}}$		Update display during display hold
$\overline{\text{INTEG START}}$		Active power integration start
$\overline{\text{INTEG STOP}}$		Active power integration stop
$\overline{\text{INTEG RESET}}$		Active power integration reset
$\overline{\text{INTEG BUSY}}$	Output	Active power integration in progress



Communication Specifications

- **GP-IB**

Electrical and mechanical specifications	Conform to IEEE St'd 488.1-1978
Interface functions	SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0

- **RS-232-C**

Transmission mode	Asynchronous start-stop
Baud rate	1200, 2400, 4800, 9600

IC Memory Card

Card types	IC memory cards of up to 64Kbytes capacity
Functions	Store and recall measured data Save and reload panel setup information Initialize IC memory card

General Specifications

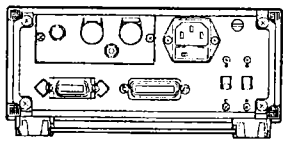
Operating temperature range	5 to 40°C
Operating humidity range	20% to 80% R.H. (non-condensing)
Warm-up time	Approx. 30 min. (to satisfy all specifications)
Insulation resistance	50MΩ min at 500VDC (between input terminals and case, between input terminals and output terminals, between input terminals/output terminals/case and power supply)
Withstanding voltage	2200VAC, 50/60Hz, for 1 minute (between input terminals and case, between input terminals and output terminals, between input terminals and power supply) 1500VAC, 50/60Hz, for 1 minute (between output terminals/case and power supply)
Power supply voltage	100VAC, 115VAC, 200VAC, 230VAC
Power voltage range	±10% of rating
Frequency	50Hz/60Hz
Frequency range	48 to 63Hz
Power consumption	Approx. 20VA
External dimensions	Approx. 88×213×350mm (excluding legs, terminals, etc.)
Weight	Approx. 4.5kg
Accessories	One power cord, one spare fuse, one remote control connector, one user's manual (this manual)

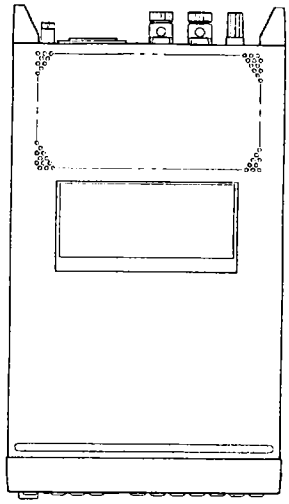
Outline Drawings

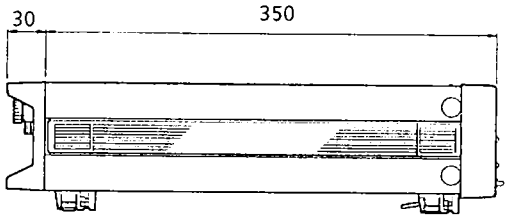
Model 2534 10

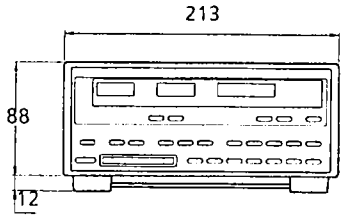
Units: mm

Rear View

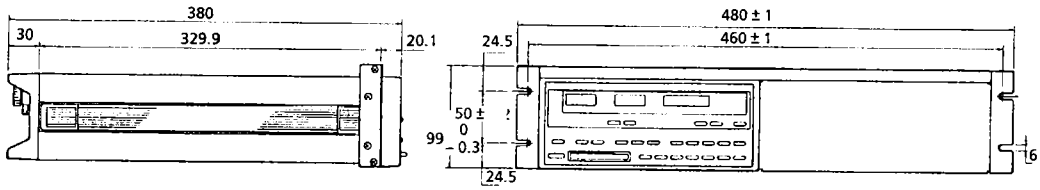


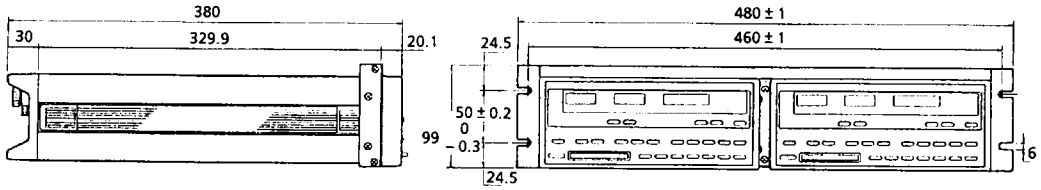




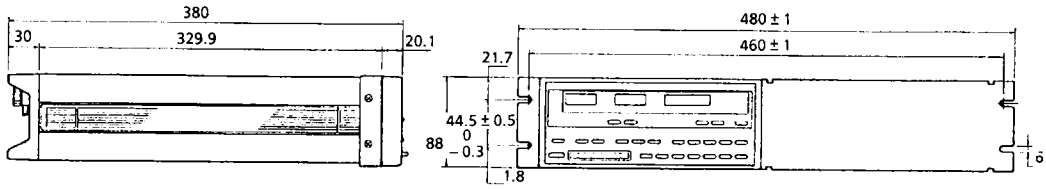


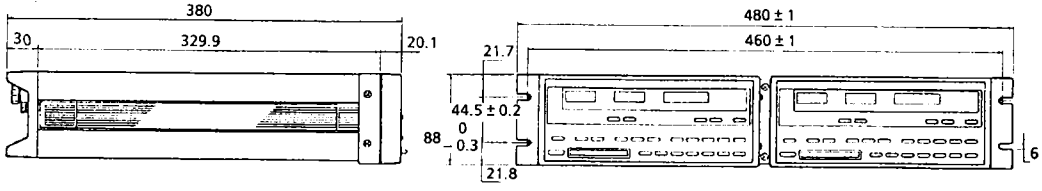
- Rack Mount (JIS)





- Rack Mount (EIA)





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User's Manual

Model 2534 Digital Power Meter

Notice of Alterations

Please note the following alternations to the 2534 Digital Power Meter USER'S MANUAL.

Alternation on page 11-74 "11.5.11 Sample Programs"

A sample program for each command is given after the description of the command. This section presents sample programs that use several commands.
In the sample programs described on the pages 11-74 to 77, the following commands are not necessary for the model 2534. However, when the program is to be used in common with the model 2535, these commands become necessary.

CMD$="WR1" : command to select the wiring setting
CMD$="DA0DB1DC2" : command to select the display function.

Alteration on Page 13-2"13.1 Specifications"

Input Section

Item \ Input	Voltage (V)	Current (A)
Input type	Floating inputs (but no isolation between V & A terminals)	
	Resistive voltage divider	Shunt input
Rated range values (Range display)	75/150/300/600V	Current inputs: 1, 5, 10, 20 A External shunt input: 50, 100 m V 200mV
Guaranteed accuracy range	10% to 110% of rated value	
Instrument loss	Input resistance, approx. 2MΩ (all ranges) (approx. 60pF in parallel)	Approx. 15mΩ External shunt input resistance: Approx. 2kΩ
	Approx. 200pF between input terminals (±) and case	
Usable frequency range	DC, and 10Hz to 20kHz	
Maximum allowable instantaneous input (for 1 sec)	Peak value of 1400V. or 3 times range, whichever is lower	Peak value of 7 times range or 70A, whichever is lower External shunt input range: Peak voltage is 5V max.
Maximum allowable continuous input (at 50/60Hz)	Peak of 1000V, or rms value of 2 times range, whichever is lower	Peak of 50A, rms value of 30A, or rms value of 3 times range, whichever is lower External shunt input voltage:

Alteration on Page 1-6 '13.1 Specifications'

Add to the following 'Measurement Functions'.

Item	Specification
Accuracy(Display) Within 1 year after calibration	Compared with the 90 days Accuracy, add (TOTAL ERROR)×0.5