Electronic Test Instruments & Power Supplies

8CH Charge/Discharge Tester

PFX40W-08

OPERATION MANUAL

KIKUSUI

Use of Operation Manual

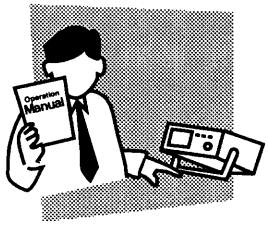
- Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.
- If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual it gets lost or soiled, a new Operation Manual can be purchased. In either case, please contact your Kikusui agent, and provide the "Kikusui Part No." given on this page.
- This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact your Kikusui agent.

KIKUSUI PART No. Z1-000-712 IB000921

Printed in Japan.

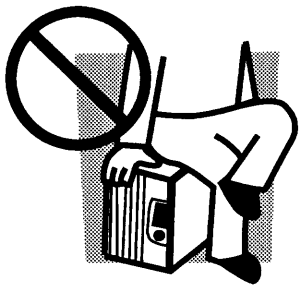
⚠ Safety Precautions

The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly. Kikusui assumes no liability against any damages or problems resulting from negligence of the precautions.



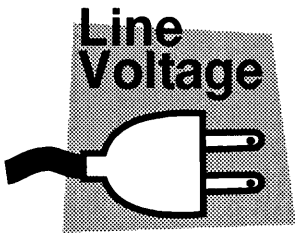
Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)



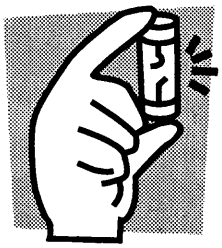
Purposes of use

- If the product is to be used for purposes not described in this manual, contact your Kikusui agent in advance.



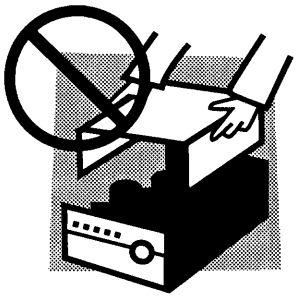
Input power

- Use the product with the specified input power voltage.
- For applying power, use the AC power cable provided. The shape of the plug differs according to the power voltage and areas. Use the cable which is suitable for the line voltage used.



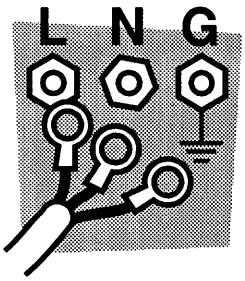
Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.



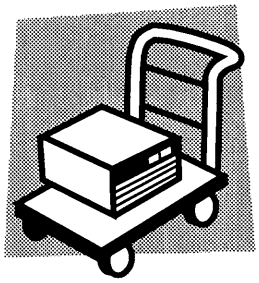
Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover. If the cover must be removed, contact your Kikusui agent in advance.



Installation

- When installing products be sure to observe "Conditions at the Installation Location" described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When applying power to the products from a switchboard, be sure work is performed by a qualified and licensed electrician or is conducted under the direction of such a person.
- Be sure to use the AC power cable provided. Consult your Kikusui agent if other cable than included is to be used for some reason.
- When installing products with casters, be sure to lock the casters.



Relocation

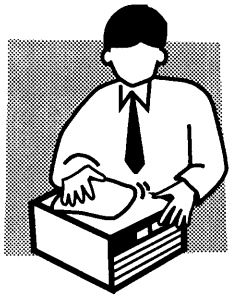
- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 20 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.

Operations

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the AC power cable. Be sure to unplug the AC power cable or stop applying power before checking.
- If any abnormality or failure is detected in the products, stop using it

immediately. Unplug the AC power cable or disconnect the AC power cable from the switchboard. Be careful not to allow the product to be used before it is completely repaired.

- For output wiring or load cables, use connection cables with larger current capacity.
- Do not disassemble or modify the product. If it must be modified, contact your Kikusui agent.



Maintenance and checking

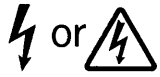
- To avoid electrical shock, be absolutely sure to unplug the AC power cable or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking. If the cover must be removed, contact your Kikusui agent in advance.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact your Kikusui agent.

Safety Symbols

This operation manual and this product use the following safety symbols. Note the meaning of each of the symbols to ensure safe use of the product. (As using symbols depend on the product, all of symbols may not be used.)

	Indicates the presence of 1000V or higher. Never attempt to touch this part when the power switch of the product is turned on.
WARNING	Indicates the possibility of personal injury or death. Never fail to follow the operating procedure. Do not proceed beyond a WARNING sign until the noted conditions are fully understood and met.
CAUTION	Indicates the existence of damage to the product or connected equipment. Always follow the operating procedure. Do not proceed beyond a CAUTION sign until the indicted conditions are fully understood and met.
NOTE	Indicates additional information such as operating procedure.
Description	Describes technical terms used in this manual.
	Indicates action prohibited.
	Indicates general warning, caution, risk of danger. When this mark is indicated on the product, refer the relevant section of the Operation Manual.
	Indicates a grounding (earth) terminal.
	Indicates a chassis grounding terminal.

CONTENTS

Introduction

This operation manual pertains to PFX40W-08 (8CH Charge/Discharge Testers) incorporating ROM Version 1.0*. When contacting Kikusui with questions about the tester, please inform us of the ROM version of your tester and the manufacturing number shown on the rear panel. (Only the manufacturing number is necessary when inquiring about problems with your tester.)

How to check your ROM number

Turn on the 【POWER】 switch and the system will display the ROM number on its initial screen.

When the tester is used for the first time or after it is reinstalled, be sure to read about its basic operation, beginning with the following:

" ⚠ Safety Precautions," page I
"Safety Symbols," page IV
Chapter 1, "Setting Up the Tester," page 1-1

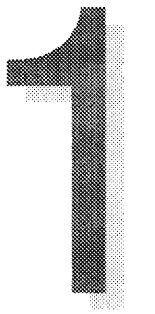
General

The PFX40W-08 Charge/Discharge Tester is designed for testing the secondary batteries used in portable equipment. The tester includes eight charging/discharging power supplies with a maximum output power of 10V 4A or 20V 2A. It also incorporates various controllers and measuring instruments, and can output measurement results to a printer.

Features

- The charging/discharging power supply section of the tester consists of switching-mode power supplies, constant-current power supplies using Power MOSFET, and load equipment. Using a high-accuracy current detector, it can measure current to a precision of less than 1 mA.
- The tester uses MOSFET devices to switch between charging, discharging, and pause operations. It therefore provides high reliability over many hours of continuous operation.
- The tester uses a 16-bit microcomputer for general control and an 8-bit microcomputer to control each channel. As a result of its dual microcomputer control, the tester provides highly accurate control of your testing operations.
- The tester's measurement section uses 16-bit and 12-bit A/D converters, providing high resolution of up to 1 mV or 1 mA (for 20V full-scale or 4A full-scale).
- The tester comes standard with a GPIB interface and can accommodate an optional RS232C or MCB (Multi Channel Bus) interface.
  In addition, application software called "SD01-PFX" is available for the tester. This software is for testing battery characteristics using a personal computer via GPIB interface

X



Chapter 1
Setting Up the Tester

This chapter describes basic unpacking, installation, and operational procedures for the tester.

1.1 Checking at Unpacking

The instrument should be checked upon receipt for damage that might have occurred during transportation. Also check that all accessories have been provided.

Should the instrument be damaged or any accessory missing, notify your Kikusui agent.

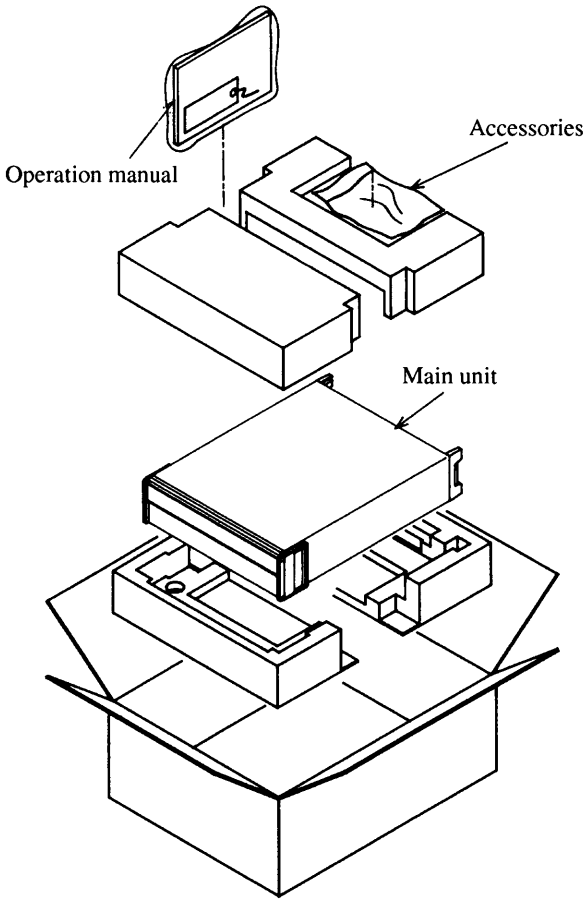


Figure 1-1 Packing/Unpacking

Caution

- When the product need to be transported, always use the dedicated packing materials.

  If additional packing materials are, contact your Kikusui agent.

- Disconnect the input power cable and other cables for packing.

	List of accessories	Quantity	Check
1	Input power cable	1	
2	3-pin to 2-pin conversion plug for the input power cable	1	
3	Output connector	8	
4	Signal connector	16	
5	Trip signal connector	1	
6	Memory card	2	
7	Filter seal	2	
8	WEIGHT seal	1	
9	Operation manual	1	

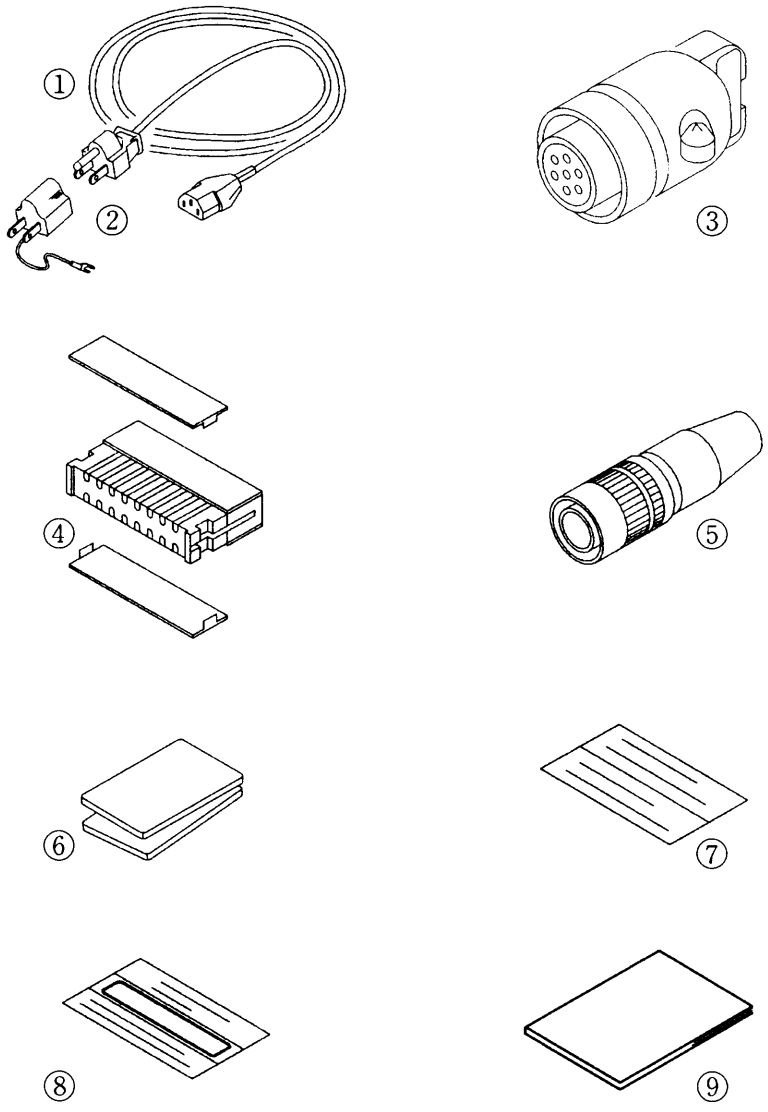


Figure 1-2 Accessories

Put the filter seal ⑦
and the weight seal ⑧
on appropriate locations.

1.2 Conditions at the Installation Location

Be sure to observe the following precautions when installing the unit.

■ Do not use the unit in a flammable atmosphere.

To prevent explosion or fire, do not use the unit near alcohol or thinner, or in an atmosphere containing such vapors.

■ Avoid locations where the unit is exposed to high temperature or direct sunshine.

Do not locate the unit near a heater or in areas subject to drastic temperature changes.

Temperature range: 0 ℃ to 40 ℃

■ Avoid locations of high humidity.

Do not locate the unit in high-humidity locations, i.e., near a boiler, humidifier, water supply, etc.

Humidity range: 30% to 80% RH (without dew condensation)

■ Do not place the unit in a corrosive atmosphere.

Do not install the unit in a corrosive atmosphere or one containing sulfuric acid mist, etc. This may cause corrosion of various conductors and imperfect contact with connectors, malfunction and failure, or in the worst case, a fire.

■ Do not locate the unit in a dusty location.

■ Do not use the unit where ventilation is poor.

Leave sufficient space around the tester to allow air to flow through its front and rear ports.

■ Do not install the unit along a tilted section of floor or in a location subject to vibrations.

■ Do not use the unit in locations affected by strong magnetic and/or electric fields.

1.3 Connecting the Input Power cable

For power input to the tester, always be sure to use the power cable included with it.

① Make sure the power cable is not plugged into any outlet.
② Make sure the 【POWER】 switch on the front panel of the tester is turned off.
③ Plug the power cable into the INPUT connector on the rear panel of the tester.
④ Connect the power cable to the grounded AC power line.
⑤ When using the 2P-3P conversion plug included with the tester, always be sure to connect a grounding lead that is properly grounded.

Caution

- The rated input power ranges from 90 VAC to 110 VAC. Application of a greater voltage may damage the tester.

1.4 Connecting the Connectors

(1) Connecting the output connector

This connector connects the battery to each channel output on the rear panel of the tester.

Caution

- Improper pin connections may cause the battery to short-circuit, resulting in tester breakdown. Always check the wiring before turning on the [POWER] switch.

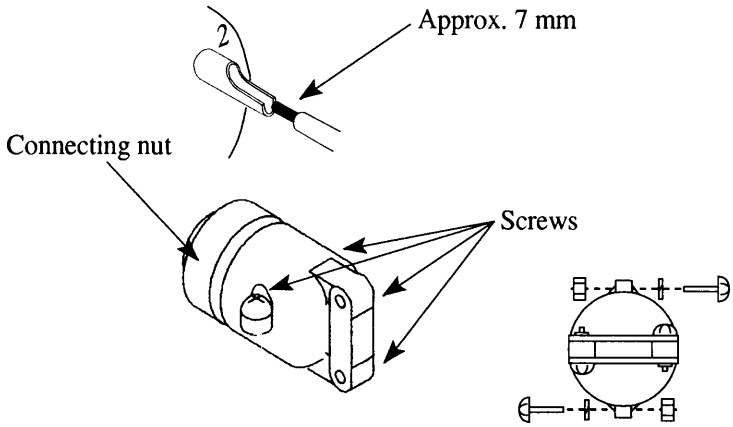
The connector pin assignments are as follows:

Pin No.	Name	Function
1	+	Positive current pin. Connect this to the + terminal of the battery.
2	-	Negative current pin. Connect this the - terminal of the battery.
3	+S	Positive voltage measurement pin. Connect this to the + terminal of the battery.
4	-S	Negative voltage measurement pin. Connect this to the - terminal of the battery.
5	GND	Grounding pin. This is Connected to the tester chassis.
6	NC	Unused.
7	NC	Unused.

Table 1-1 Output Connector Pin Assignments

■ Wiring and hooking up the output connector

① Prepare suitable wire in consideration of the current used.
② Remove approximately 7 mm of sheathing from the end of the wire.
③ Solder wire in accordance with the output connector pin assignments in Table 1-1.
④ Make sure the wire is securely soldered.
⑤ Attach a connecting nut.
⑥ Attach a cover and secure it using screws in four locations.



⑦ Twist the positive and negative wires of the current cable and then the positive and negative wires of the voltage measurement cable.
⑧ Connect the battery to the tester in accordance with the output connector pin assignments shown in Table 1-1.

Note

- Connect the voltage measurement cable to the point most suitable for measuring the terminal voltage.

⑨ Make sure the [POWER] switch is turned off.
⑩ Insert the output connector into the socket on the rear panel of the tester.
⑪ Tighten the connecting nut.
⑫ Check the wiring and pin connections again.

■ Concerning parallel connections

When you want to connect channels CH1 to CH8 in parallel to increase the current capacity, connect the wires in accordance with the channel combinations shown in Table 1-2.

CH No. / Number of parallel channels	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
2 Unit	①		②		③		④	
4 Unit	①				②			
8 Unit	❶							

Table 1-2 Channel Combination for Parallel Connection

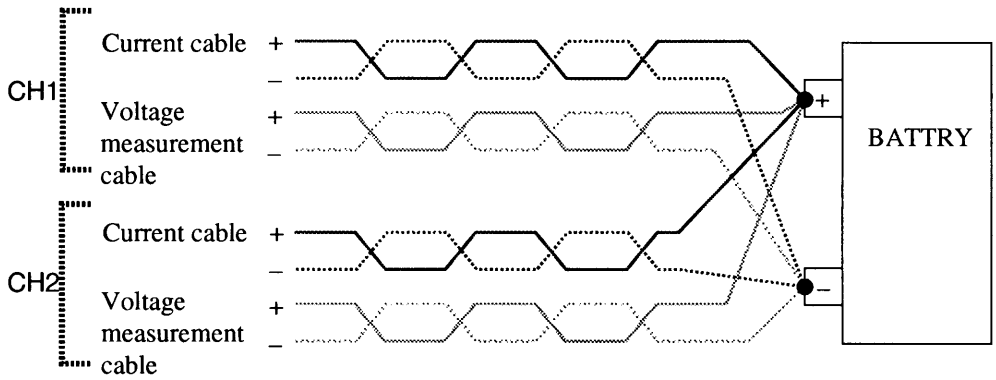
Example: If you choose "2 Unit" as the number of parallel channels, channels are allocated so that CH1 and CH2 constitute (1) (CH1); CH3 and CH4 constitute (2) (CH2); CH5 and CH6 constitute (3) (CH3); and CH7 and CH8 constitute (4) (CH4). Thus, the tester operates in four channels.

Before the tester can actually be operated in this channel configuration, CONFIG must be set. Refer to Section 3.1, "Test Condition," (2) Number of units operated in parallel, on page 3-3.

Note

- Make sure the wires are connected in parallel at the battery's terminal positions for accurate identification.

Example: The following shows how to twist wires and where they should be connected (for parallel connection of CH1 and CH2).



(2) Connecting signal connectors P1 and P2

P1

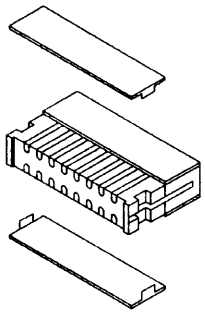
This connector is used with various signal input/output for connection to a temperature sensor or a voltage/current monitoring analog output.

P2

This connector is used to output operating status signals and input a synchronization signal.

Wiring and connection of the signal connector

① Prepare AWG24 (maximum outer diameter of wire = 1.3 mm; number of twisted cores = 7).
② Connect wires in accordance with the signal connector pin assignments.
Use a pressure-welding tool to connect the wires. Refer to "pressure-welding tools" (below) for connection of the wires.
③ Attach the connector covers.
④ Connect the end of the connector to each signal source in accordance with the signal connector pin assignments.



Note

- Connect signal wires to the point most suitable for identification.

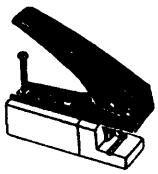
⑤ Make sure the wires are securely connected.
⑥ Make sure the 【POWER】 switch is turned off.
⑦ Plug the connector into the socket on the rear panel of the tester.

Pressure-welding tools

Read the instruction manual for details on how to use the tool.

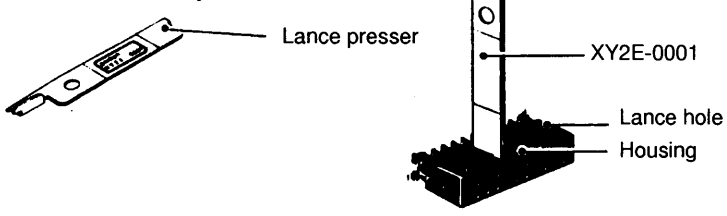
① Simple pressure-welding tool

XY2B-7006 (manufactured by Omron)



② Contact pull-out tool

XY2E-0001 (manufactured by Omron)



Pin No.	Name	Function
1	-S OUT	This pin outputs the -S signal of the connector via a 47Ω resistor.
2	+S OUT	This pin outputs the +S signal of the connector via a 47Ω resistor.
3	A GND	This pin is an analog ground.
4	V MON	This pin outputs the voltage across +S and -S (0V to 20V) with a 47Ω output impedance useing the analog ground as a common ground (0V to 10V).
5	A GND	This pin is an analog ground.
6	I MON 1	This pin outputs a voltage (0 to 4V) converting a current (0 to 4A). It has a 47Ω output impedance and uses the analog ground as a common ground.
7	A GND	This pin is an analog ground.
8	I MON 2	This pin outputs a voltage (0 to 4V) converting a current (0 to 4A). It has a 100Ω output impedance and uses the analog ground as a common ground. It outputs in negative voltages when discharging.
9	NC	Unused.
10	NC	Unused.
11	Th+	This pin connects a thermistor. Connect "103AT" here.
12	Th-	This pin connects a thermistor. Connect "103AT" here.
13	Th out-	This pin outputs a thermistor pin voltage (-) .
14	Th out+	This pin outputs a thermistor pin voltage (+) .
15	D GND	This pin is a digital ground (common with TRIG OUT).
16	TRIG OUT	This pin outputs an open-collector's ON signal for approximately 10 ms when the battery begins charging or discharging. This output is active low. Vce: 30 V max; Ic: 30 mA max.

Table 1-3 P1 Signal Connector Pin Assignment

Pin No.	Name	Function
1		Uses prohibited
2		
3		
4		
5		
6		
7		
8		
9	D GND	This is a common ground for P2 signals.
10	RESTSTS	This pin outputs a +5V CMOS signal indicating rest status. This output is active high.
11	DISCSTS	This pin outputs a +5V CMOS signal indicating discharging status. This output is active high.
12	CHGSTS	This pin outputs a +5V CMOS signal indicating charging status. This output is active high.
13	FINISH	This is an external sync signal input. This pin is pulled up to CMOS level +5V via a 10kΩ resistor. This input is active low (edge triggered).
14		Uses prohibited
15		
16		

Table 1-4 P2 Signal Connector Pin Assignment

(3) Connecting the trip connector

This connector is used to input the 【POWER】 switch's shut-off signal and connect an external temperature measurement thermistor.

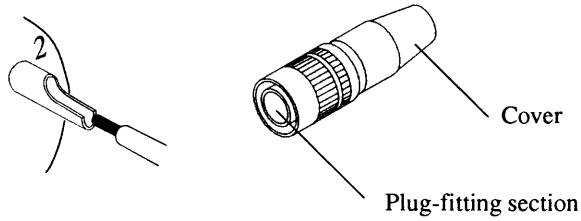
The recommended type of thermistor is "103AT" manufactured by Ishizuka Electronics.

Pin No.	Name	Function
1	EX Th+	This pin connects a thermistor. Use "103AT" (manufactured by Ishizuka Electronics).
2	EX Th-	This pin connects a thermistor. Use "103AT" (manufactured by Ishizuka Electronics).
3	D GND	This pin is a common ground for Th ON.
4	Th ON	Connect this pin to D GND when measuring external temperature.
5	Trip 1	When Trip 1 and Trip 2 are connected, the 【POWER】 switch shuts off.
6	Trip 2	

Table 1-5 Trip Connector Pin Assignment

Wiring and connecting the trip connector

① Remove approximately 2 mm of sheathing from the end of the wire.
② Solder wire in accordance with the trip connector pin assignments shown in Table 1-4.
③ Make sure the wire is securely soldered.



④ Attach a plug-fitting section to the connector.
⑤ Attach a cover.
⑥ Twist wires as required for use.
⑦ Connect the end of the connector to each signal source in accordance with the trip connector pin assignments shown in Table 1-5.

Note

- Connect signal wires to the point most suitable for identification.
- For the shut-off signal contact, use a floating type with a in contact capacity of 24 VDC, 0.2A or more.

⑧ Make sure the 【POWER】 switch is turned off.
⑨ Insert the connector into the TRIP socket on the rear panel of the tester.

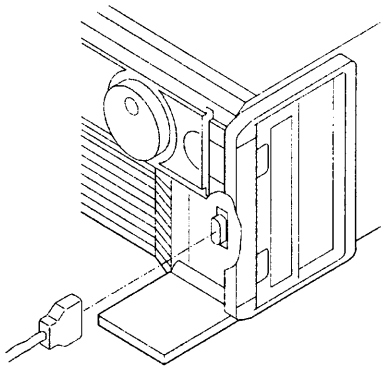
(4) Connecting the printer connector

This connector is used to connect a printer to output hard copies of data, graphs, settings, and test conditions.

These hardcopies can be output by a printer that supports ESC/P24J-J84.

For more information, read Section 2.2.5, "PRINT", on page 2-10.

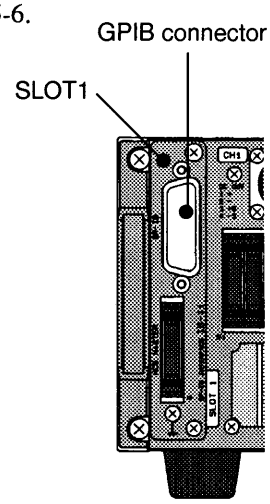
① Make sure the 【POWER】 switches of both the tester and printer are turned off.
② Plug a printer cable with a length of 1.5 m or less into the 【PRINTER】 connector on the front panel of the tester.



(5) Connecting GPIB connector

This connector is used to connect a GPIB interface for computerized testing of automatic charging and discharging.

For more information, read Section 5.3, "GPIB Control", on page 5-6.



① Make sure the 【POWER】 switches of both the tester and computer are turned off.
② Make sure a GPIB interface board called "IB11" is inserted into SLOT1 on the rear panel of the tester.
③ Plug a cable into the 【GPIB】 connector.

Note

- No GPIB cable is provided for the tester.

Chapter 2
Operating the Tester

This chapter explains the basic method of operating the tester. For CONFIG, see Chapter 3, for "Worksheet", see Chapter 4. For the advanced method of use, see Chapter 5.

2.1 Outline of the Method of Operation

2.1.1 Basic Operating Modes

Broadly classified, the tester features two operating modes: MANUAL and CYCLE.

MANUAL operation

In this mode, operating the desired voltage/current can be set and used as a constant-current power supply or electronic load.

Time management is not exercised because charging/discharging is performed manually, but the set current can be modified at all times.

CYCLE operation

This mode executes a series of operations for charging/discharging testing under the worksheet conditions when CONFIG and EDIT is set.

2.1.2 Operation Concept

The tester includes seven functions, including the MANUAL and CYCLE operations described above.

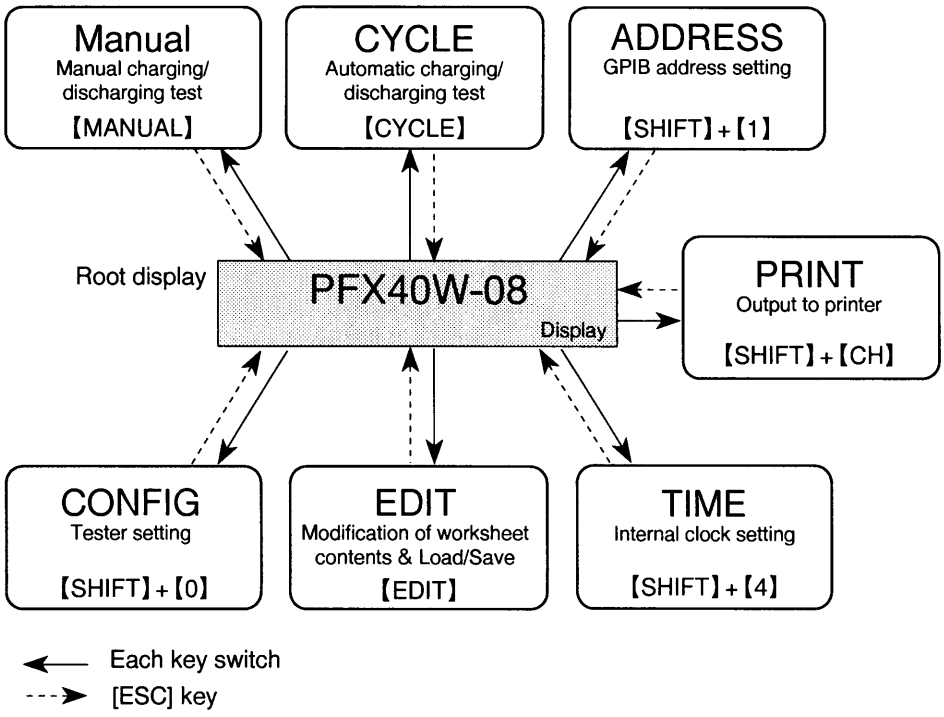


Figure 2-1 Conceptual diagram of operation

The following sections explain each function.

A menu structure for each functional block is shown for reference in the Appendix of this manual.

2.2 Operation Method

2.2.1 MANUAL

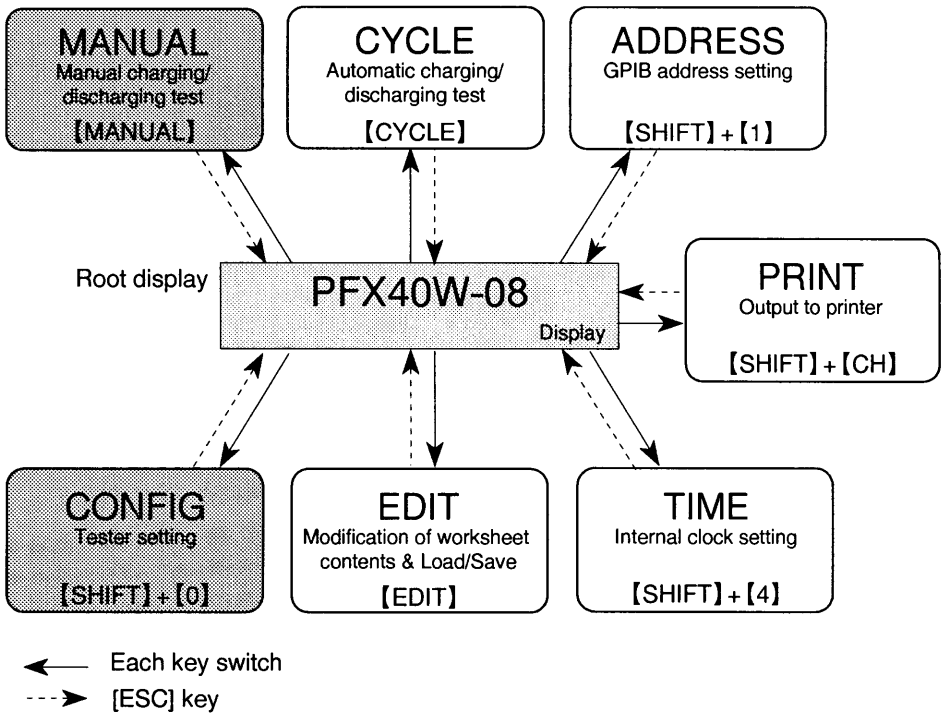
(1) Operation procedure

Caution

- Prior to manual operation, to protect the load, be sure to set the overvoltage protection level from 0.001 to 20.000V.

Before any charging/discharging operations can be performed, CONFIG must first be set.

For details, see Section 3.1, "TEST CONDITION" , on page 3-2; and Section 3.4 "VOLTAGE PROTECT" , on page 3-8.

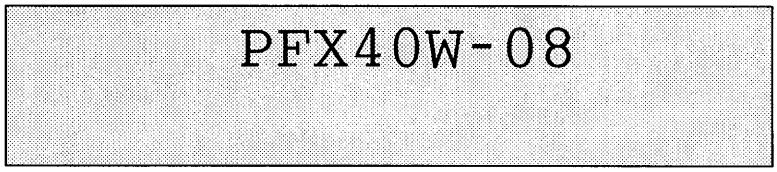


Charging operation

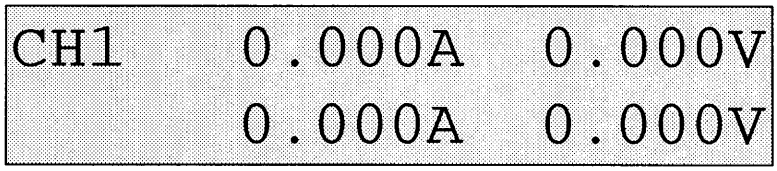
① Make sure the 【OUTPUT】 key is turned off.

② Press the 【MANUAL】 key in accordance with the root display to enter the manual mode.

Root display



③ Press the 【CH】 key followed by a number key to choose the desired channel.



The measured value is shown in the upper row; the set value is shown in the lower row.

④ Press the 【CHG】 key to place the tester in charging mode.

⑤ Use the 【◀】 or 【▶】 key to move the cursor to the charging current or CV voltage position, then use a number key or jog shuttle for setting.

⑥ Make sure the channel you chose for use is connected to the load.

Caution

- Always be sure to connect a battery before performing a charging test. If testing is conducted under non-load conditions, the output will rise to such a high level that overvoltage protection will be actuated. When overvoltage protection is actuated, the tester displays as shown below. In this case, press RESET (【SHIFT】 + 【ESC】 keys) in accordance with the instructions.

⑦ Press the 【OUTPUT】 key and the battery will start charging. (The OUTPUT lamp will light.)

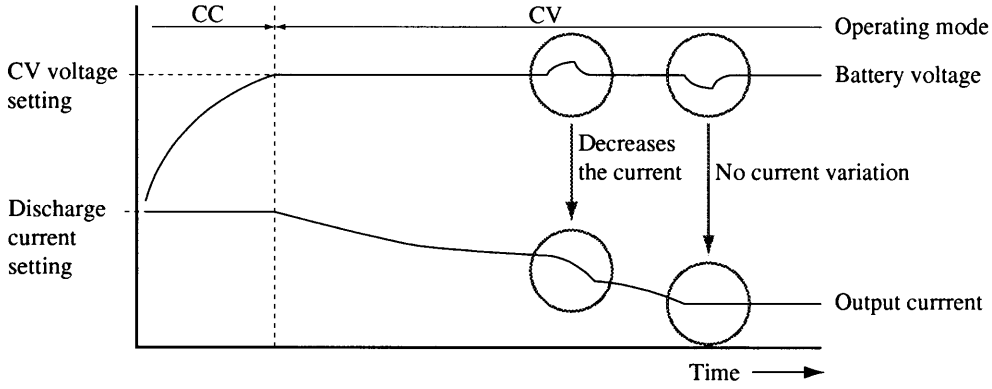
Press the 【OUTPUT】 key again to stop charging. (The OUTPUT lamp will go out.)

Description

- Constant voltage (CV) operation of the tester

  This tester decreases the output current if the battery voltage exceeds the CV voltage in order to make the battery voltage constant.

Operation in the CV operation mode

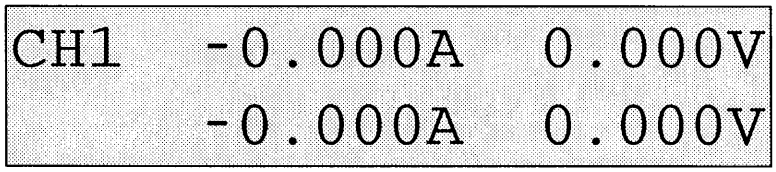


Note

- This function allows the output current to be controlled (reduced) by means of software as shown above. Therefore, the output current may not catch up with a rapid voltage increase or instantaneous voltage variation.
- Constant voltage operation of the tester works normally only when the battery is connected. It does not work with a resistive load.

Discharging operation

① Make sure the 【OUTPUT】 key is in the OFF position.
② Press the 【CH】 key followed by a number key to choose the desired channel.



The measured value is shown in the upper row; the set value is shown in the lower row.

③ Press the 【DISCH】 key to place the tester in discharge mode.
④ Use the 【◀】 or 【▶】 key to move the cursor to the discharging current or cut-off voltage position, and then use a number key or jog shuttle for setting.
⑤ Make sure the channel you chose for use is connected to the channel load.

Note

- Always be sure to connect a battery before performing a discharging test. The measured voltage will indicate 0V and undervoltage protection will be actuated. If undervoltage protection is actuated, the tester will display as shown below. In this case, press RESET (【SHIFT】 + 【ESC】 keys) in accordance with the instructions.

⑥ Press the 【OUTPUT】 key and the battery will start discharging. Press the 【OUTPUT】 key again to stop charging. If the measured voltage drops below the cut-off voltage, the output is automatically turned off.

Description

- Overvoltage protection (OVP)

  Protects the load from excessive output voltage.

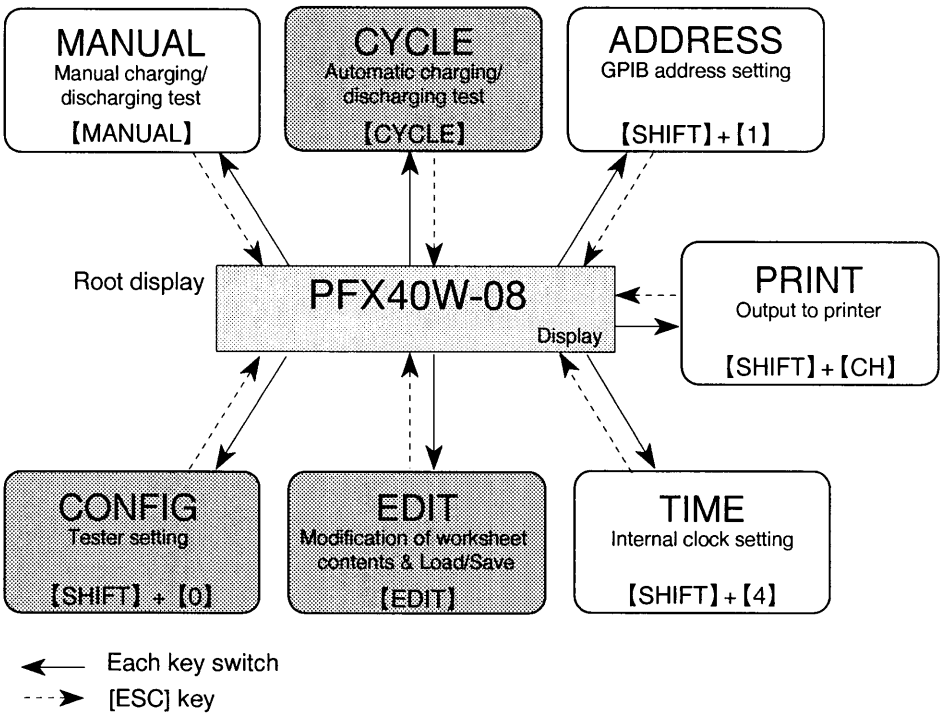
- Undervoltage protection (UVP)

  Protects the load from low output voltage.

2.2.2 CYCLE

This section explains CYCLE operation under the assumption that test conditions in CONFIG and worksheets A through H have been set.

If you have not set the test conditions in CONFIG and the worksheets, refer to Chapter 3, "CONFIG" on page 3-1 and Chapter 4, "Worksheet", on page 4-1.



Description

- The test conditions in worksheets A through H can be output to a printer.

During CYCLE operation, the keys specified in fig 2-2 below can be used to enter HOLD or IDLE status.

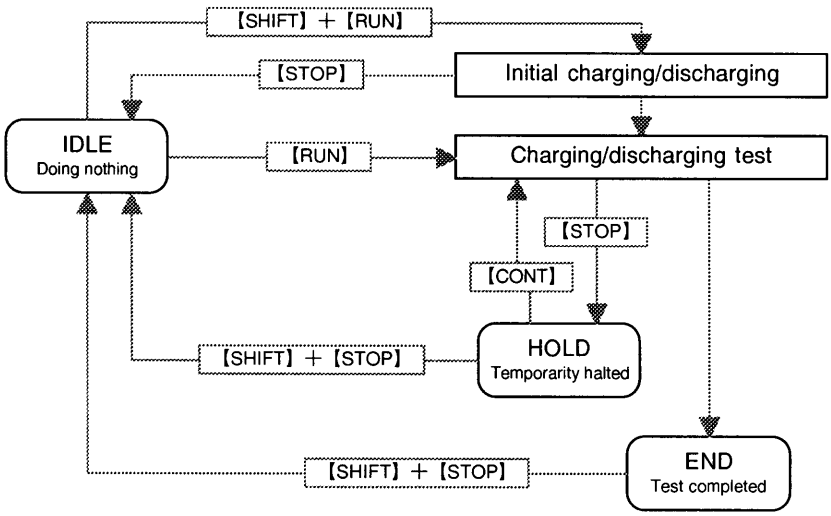


Figure 2-2 CYCLE operation

(1) Operation procedure

① Make sure the 【OUTPUT】 key is in the OFF position.
② Make sure the channel you want to use is connected to the channel load.
③ Press the 【CYCLE】 key in accordance with the root display to enter the cycle mode.
④ Press the 【CH】 key and followed by a number key to choose the channel you want to use.

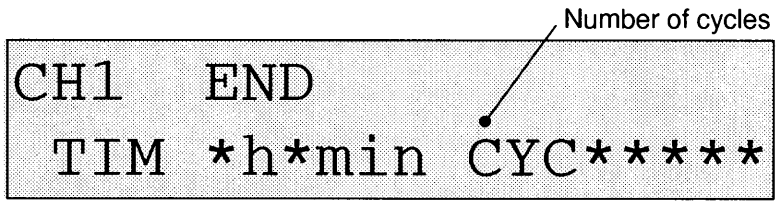
```
CH1   IDLE
```

⑤ If you are starting the test beginning with the initial charging, press the 【SHIFT】 + 【RUN】 keys; if you want to perform the charging/discharging test only, press only the 【RUN】 key. The display will change as shown below. Choose the desired test condition from the eight worksheets A through H.

```
        RUN
[A] B C D E F G H
```

That enclosed with an [ ] is the selected worksheet.

⑥ Press the 【ENTER】 key to start a cycle test.
When the test is completed, the following is shown on the display:



⑦ To enter IDLE status, press QUIT (【SHIFT】 + 【STOP】 keys).

Description

- To stop the test, press the 【STOP】 key. The tester will be placed in IDLE status during initial charging, or in HOLD status during the charging/discharging test.
- To return to the charging/discharging test from HOLD status, press the 【CONT】 key; to enter IDLE status, press QUIT (【SHIFT】 + 【STOP】 keys).

```
CH1   HOLD
TIM *h*min CYC*****
```

2.2.3 ADDRESS

This mode is used to set the GPIB address or optional MCB (Multiple-Channel Bus) address for the tester.

Setup procedure

① Press the 【SHIFT】 + 【1】 keys when they are in the root display to enter the address setup mode.

② Use the 【▲】 or 【▼】 key to choose GPIB or MCB.

③ Input the address using the number keys and press the 【ENTER】 key.
GPIB: 0 to 30 MCB: 0 to 15

Note

- If the address has been modified, temporarily turn off the 【POWER】 switch and then turn it on as the address is not updated by pressing the 【ENTER】 key.

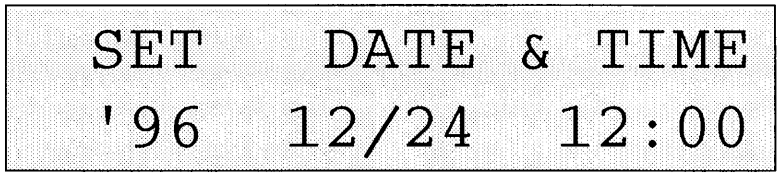
2.2.4 TIME

This mode is used to set the internal date and time for the tester.

Setup procedure

① Press the 【SHIFT】 + 【4】 keys in the root display to enter the time setup mode.

② Input the date (year/month/day) and time (hour/minute) using the number keys. When this procedure is completed, press the 【ENTER】 key to confirm what has been input.



2.2.5 PRINT

The tester can output data, graphs, settings, and test conditions to a printer that supports ESC/P24J-J84. Before you can actually output to a printer, CONFIG must first be set. See Section 3.3, "PRINTER ITEM", on page 3-7.

① Always check the wiring before using the printer.

Caution

- Unless the printer's cable is firmly plugged in, a printing error may result or valuable data may become invalid.

② Set the mode of the printer to ESC/P.
③ Make sure the printer is on-line.

If the printer is off-line

① If the printer goes off-line when the setup contents of CONFIG or the worksheet are being output, the tester generates a "PRINTER BUSY" message on the display after suspending printer output. (Printing is resumed when the printer comes on-line.)

② If the printer goes off-line when test results are being output in cycle mode, the tester display indicates "HOLD" after suspending printer output.
To execute the next cycle test, set the printer on-line to output the rest of the test results and then press the 【CONT】 key.

Description

- The ESC/P24J-J84 is the abbreviated name of the 24-dot matrix Kanji printer with function level 84 for Epson Standard Code for Printer. It is a standardized control code system for terminal printers from Epson.

(1) How to output to the printer

■ Charging characteristic graph, discharging characteristic graph

When operating in cycle mode, charging and discharging characteristic graphs are automatically output to the printer by the CONFIG settings.

Charging characteristic graph: Output when the full-charging test is completed.

Discharging characteristic graph: Output when the full-discharging test is completed.

For more information, refer to Appendix 3, "Printer Output Samples", on pages A-6 and A-7.

■ Life graph and characteristic data

The life graph and characteristic data are automatically output once every 10 cycles of the capacity test (full-charging or discharging) and when the test is completed. The 【SHIFT】 + 【CH】 keys can also be used to output the life graph or characteristic data during cycle operation.

For more information, refer to Appendix 3, "Printer Output Samples", on pages A-8 and A-9.

■ Outputting CONFIG

This refers to outputting the tester's operating conditions.

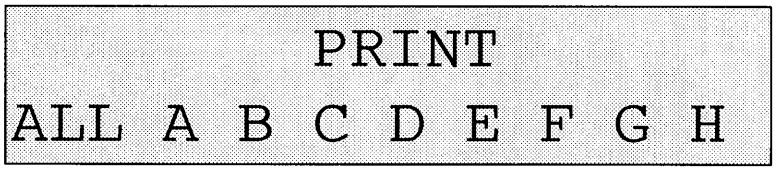
① Press 【SHIFT】 + 【0】 in the root display to enter the CONFIG mode.
② Press 【SHIFT】 + 【CH】 when CONFIG is at the top of the display to output CONFIG settings.

For more information, refer to Appendix 2, "Printer Output Examples of Factory Default Settings ", on page A-4.

■ Outputting worksheets

This refers to outputting the settings of worksheets A through H.

① Press 【SHIFT】 + 【CH】 in the root display. The display shown below will appear.
② Use the 【◀】 or 【▶】 key or jog shuttle to choose the desired worksheet.
To output the settings of all worksheets, choose ALL.



③ Press the 【ENTER】 key to output worksheet settings.

For more information, refer to Appendix 2, "Printer Output Examples of Factory Default Settings", on page A-4.

2.2.6 EDIT

This mode is used to set worksheets or load/save them onto a memory card.
To set or modify worksheets, recall them from the internal memory to the edit area. To use the worksheets into a memory card loading them into the internal memory.

Recall : From the internal memory to the edit area

Store : From the edit area to the internal memory

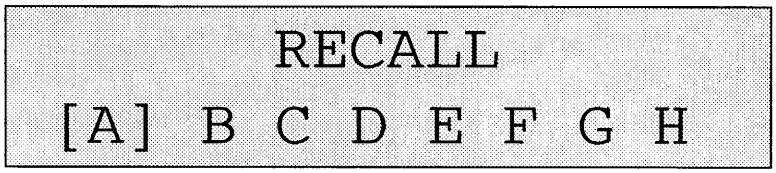
Load : From the memory card to the internal memory

Save : From the internal memory to the memory card

The operation depends on presence or absence of memory card.

(1) If your tester does not include a memory card

① Press 【EDIT】 in accordance with the root display to enter the edit mode.



② Choose a worksheet for which conditions are to be set and press the 【ENTER】 key.

③ Set conditions by referring to Chapter 4, "Worksheet", on page 4-1.

④ When you have finished performing the setting operation, press the 【ESC】 key until the next display appears.

Description

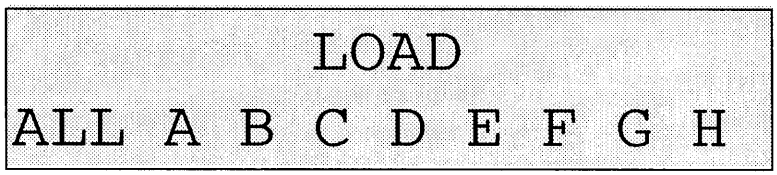
- If a memory card is inserted before the 【ESC】 key is pressed, the tester shows the display described in item ⑧ in the next section, "(2) If your tester includes a memory card."

⑤ Choose the worksheet you want to be stored into the internal memory and press the 【ENTER】 key. After storing, the tester will return to a root display to complete the setting.

(2) If your tester includes a memory card

① Make sure the memory card is firmly inserted.

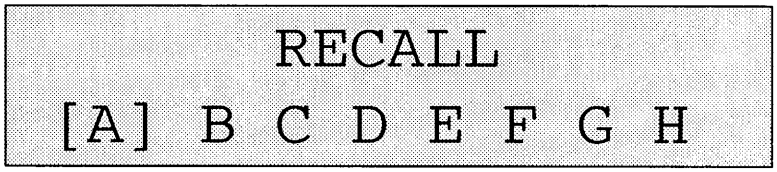
② Press the 【EDIT】 key in the root display to enter the Load mode.



③ Choose the worksheet to be load into the internal memory and press the 【ENTER】 key. If ALL is chosen, all worksheets including CONFIG are load in.

④ When you are prompted for confirmation, respond with Yes or No.

⑤ When the display shown below appears, choose the desired worksheet and press the 【ENTER】 key if it is necessary to modify.



Press the 【ESC】 key if you do not want to modify. Omit steps ⑥ and ⑦ and go to step ⑧.

⑥ If it is necessary to modify, refer to Chapter 4, "Worksheet", on page 4-1.

⑦ When you have finished performing the setting operation, press the 【ESC】 key until the next display appears.

⑧ Choose the worksheet to be stored to the internal memory and press the 【ENTER】 key. The worksheet is stored to the internal memory. If no memory card is then inserted, the session is completed upon return to the root display. If a memory card is inserted, the following display appears:

⑨ Choose the worksheet to be saved to the memory card and press the 【ENTER】 key. If ALL is chosen, all worksheets including CONFIG are saved to the memory card.

⑩ When you are prompted for confirmation, respond with Yes or No.
After saving to the memory card, the tester returns to the root display to complete the setting procedure.

Note

- When using a card for other Kikusui equipment or a new card, the following message appears upon completion of steps ② (LOAD) and ⑧ (SAVE).

When step ② (LOAD) is performed

The LOAD processing cannot be performed because of different memory card format. Unload the memory card to proceed with the next step.

When step ⑧ (SAVE) is performed

The memory card format is different. Press the ENTER key to proceed with the format processing and SAVE processing for memory cards.

Chapter 3 CONFIG

This chapter describes how to set the operating conditions and CYCLE-operation conditions for the tester.

CONFIG sets the operating condition of the tester and the cycle operating condition.

The following five items can be set.

- TEST CONDITION

  Sets the voltage range, parallel operating conditions, temperature measurement, and synchronous operation with a thermostatic tank.

- CYCLE FORM

  Sets the number of charging and discharging cycles, capacitance test interval (between full charge and full discharge), life determination condition, and test end condition.

- PRINTER ITEM

  Sets the conditions for printer.

- VOLTAGE PROTECT

  Sets overvoltage protection (OVP) and undervoltage protection (UVP).

- FACTORY DEFAULT

  Restores the CONFIG or worksheet setting to the initial condition (factory-set condition).

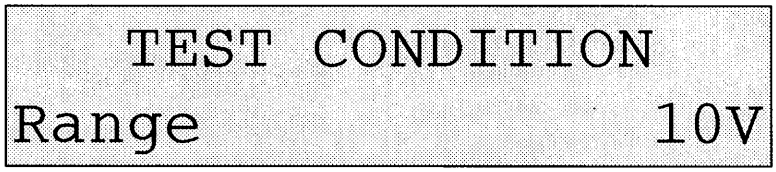
3.1 TEST CONDITION

Here the voltage range, the number of units operating in parallel, temperature control (measurement), and synchronous operation is set.

(1) Range

Set the range used, 10 V or 20 V.

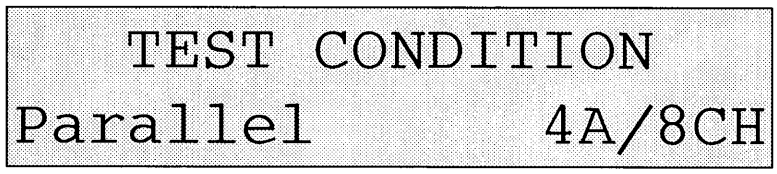
10 V range: 0 V to 10 V, 0 A to 4 A
20 V range: 0 V to 20 V, 0 A to 2 A



(2) Number of units operating in parallel

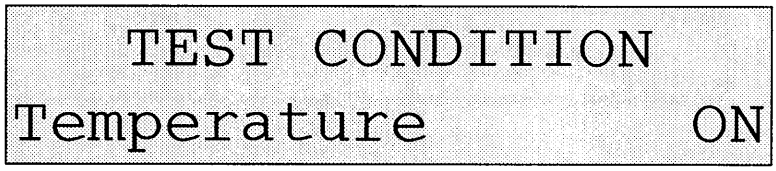
Set the number of channels.

8CH: When all channels are used independently.
4CH: When operating 1CH and 2CH, 3CH and 4CH, 5CH and 6CH, and 7CH and 8CH in parallel.
2CH: When operating 1CH through 4CH and 5CH through 8CH in parallel.
1CH: When operating 1CH through 8CH in parallel.



(3) Temperature control

Turn the temperature control on to measure the temperature, or use Max Temp or ⊿T/dt in cut-off conditions.



(4) Synchronous operation

The tester can be operated synchronously with a thermostatic tank, etc. by setting the time to start charging or discharging.

Estimate the time at which the thermostatic tank reaches a specified temperature, and then set the time to start charging or discharging.

Setup procedure (synchronization with thermostatic tank)

① Turn on the synchronization switch.

Note

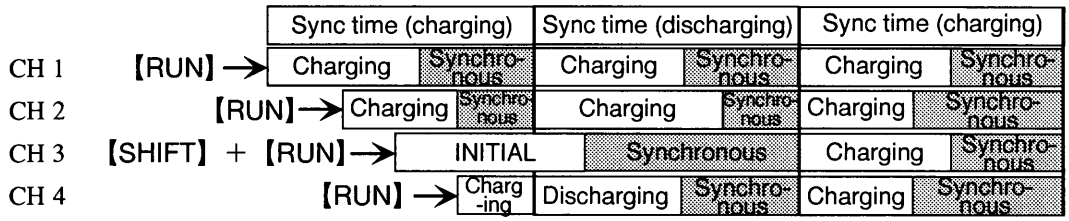
- For the sync time, set the operating time in each charging/discharging mode + pause time + alpha.

  Operating time: Actual charging or discharging time

  Pause time: Each battery's pause time

  Alpha: thermostatic tank temperature change time

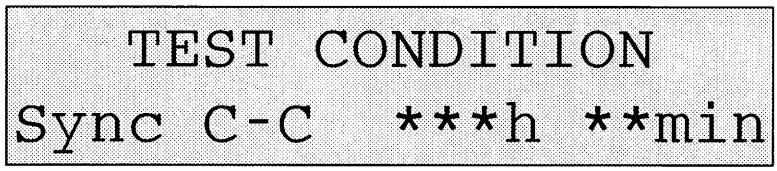
  When the sync time is reached during charging/discharging, the tester executes the next cycle after stopping charging/discharging.



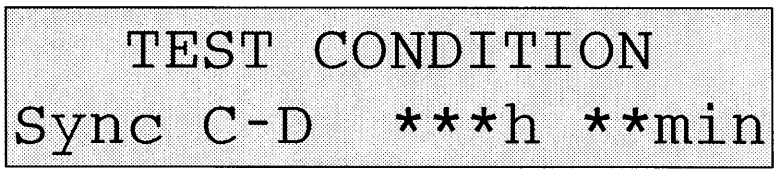
- Initial charging/discharging is not synchronized.
- Full-charging time includes discharging before the capacity test.
- Full-discharging time includes charging after the capacity test.

② Set the sync time of the following four modes:

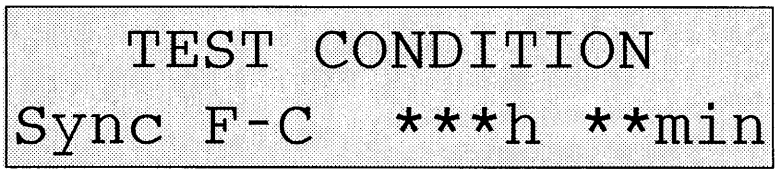
Cycle-charging time



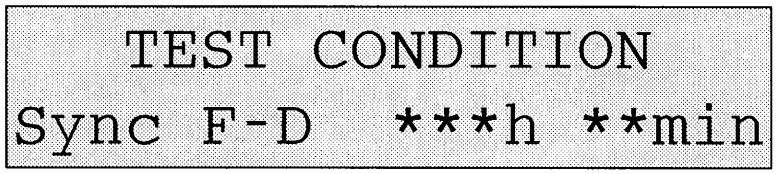
Cycle-discharging time



Full-charging time



Full-discharging time



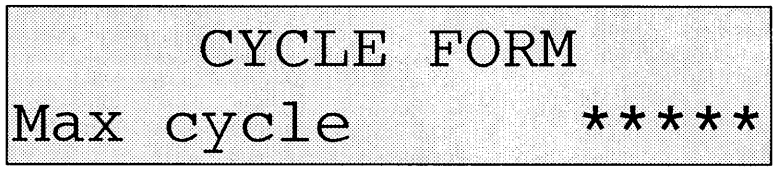
3.2 CYCLE FORM

Here the maximum number of cycles, capacity test intervals, life judgment criteria, life judgment count, and terminated state are set.

(1) Maximum number of cycles

Set the maximum number of cycles for the test, with each cycle consisting of one charging and one discharging operation.

Up to 99,999 operations can be set.

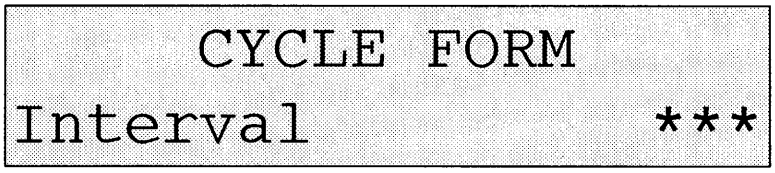


(2) Capacity test intervals

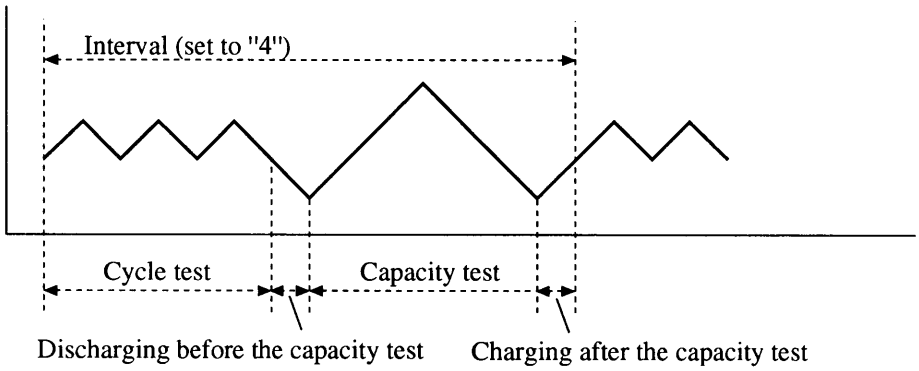
For the purposes of the tester, a series of cycles each consisting of Full Charge and Full Discharge is known as a capacity test.

Here intervals at which a capacity test is performed during a cycle test consisting of Cycle Charge and Cycle Discharge are set. If a capacity test is to be performed once every two cycles, set the Interval as "2". If "1" is set, a capacity test is performed in each cycle.

Up to 999 operations can be set.



Example: If "4" is set as the Interval (the capacity test is performed once every four cycles)



(3) Life judgment

A battery's capacity generally decreases as it is repeatedly discharged and recharged.

Here a battery's life is specified in percentage terms with respect to the reference capacity (100%) when the test is terminated. Use "Judge Percent" to make this setting.

Up to 100% operations can be set.

```
CYCLE FORM
Judge Percent      **%
```

"Judge Life" can also be used to determine when the test is terminated by counting the number of times the battery is used after "Judge Life".

Up to 9 operations can be set.

```
CYCLE FORM
Judge Life         *
```

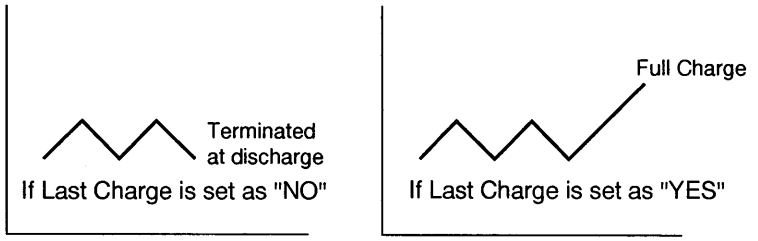
Description

- For details concerning reference capacity, refer to the Capacity Rate in Section 4.1, "SAMPLE BATTERY", on page 4-3.

(4) Choosing the test status at termination

A test is basically terminated at discharge because each cycle consists of one charging and one discharging operation.

However, if the battery is to be charged upon completion of a test, specify "YES" for Last Charge. The battery will then be charged in Full Charge.




```
    CYCLE FORM
Last Charge      YES
```

3.3 PRINTER ITEM

Here the printer output is set.

(1) When using a printer

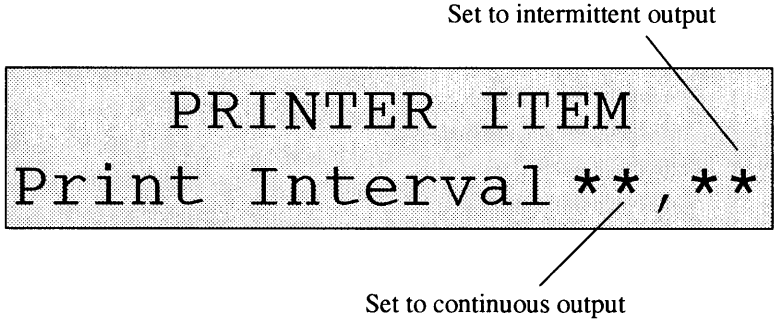
When a printer is used to output test results, set "USE" for the Printer.

Note

- When the printer is not to be used, select NOT USE. If no printer is connected with the USE setting, you cannot proceed with the next cycle.

(2) Printer output intervals

Set the intervals at which the charging characteristic and discharging characteristic graphs are to be output after the capacity test. Either continuous output or intermittent output can be specified. Up to 99 operations can be set.

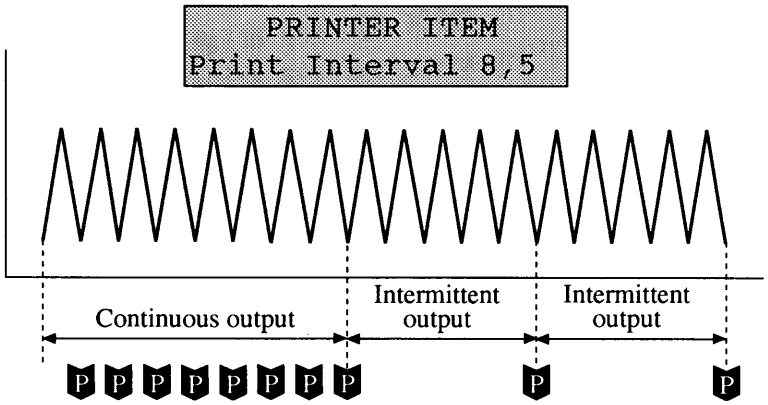


Continuous output

Test results are output each time a test is performed during the period from the start of the test to the n'th test specified.

Intermittent output

Test results are output at specified intervals after continuous output.



3.4 VOLTAGE PROTECT

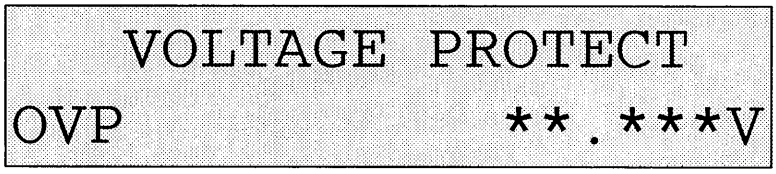
Here Overvoltage Protection and Undervoltage Protection are set.

When any of these protective functions is actuated, the tester generates the display shown below. In such a case, eliminate the cause of the activation of the protective function and press RESET (【SHIFT】 + 【ESC】 keys).

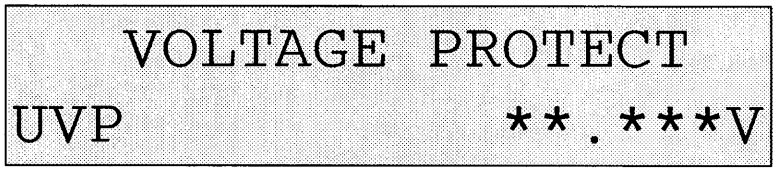
Caution

- For Overvoltage Protection, always be sure to set a suitable value in terms of safety.
- If the overvoltage protection level is set to 20.001V, the tester does not work. The overvoltage protection level is set when canceling overvoltage protection in the abnormal load test.
- If the undervoltage protection level is set to 0.000V, the tester does not work.

Overvoltage protection (1 to 20.001V)



Undervoltage protection (0 to 20.000V)

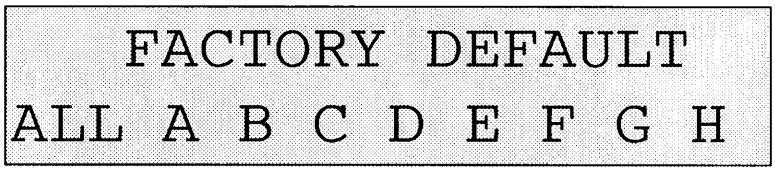


3.5 FACTORY DEFAULT

This function resets the tester's settings to its factory default settings.

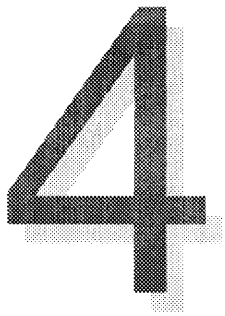
ALL: The contents of all worksheets including CONFIG are reset to the factory default settings.

A to H: The contents of the selected worksheet are reset to the factory default setting.



Description

- For details concerning factory default settings, refer to Appendix 2, "Printer Output Examples of Factory Default Settings", on page A-4.



Chapter 4 Worksheet

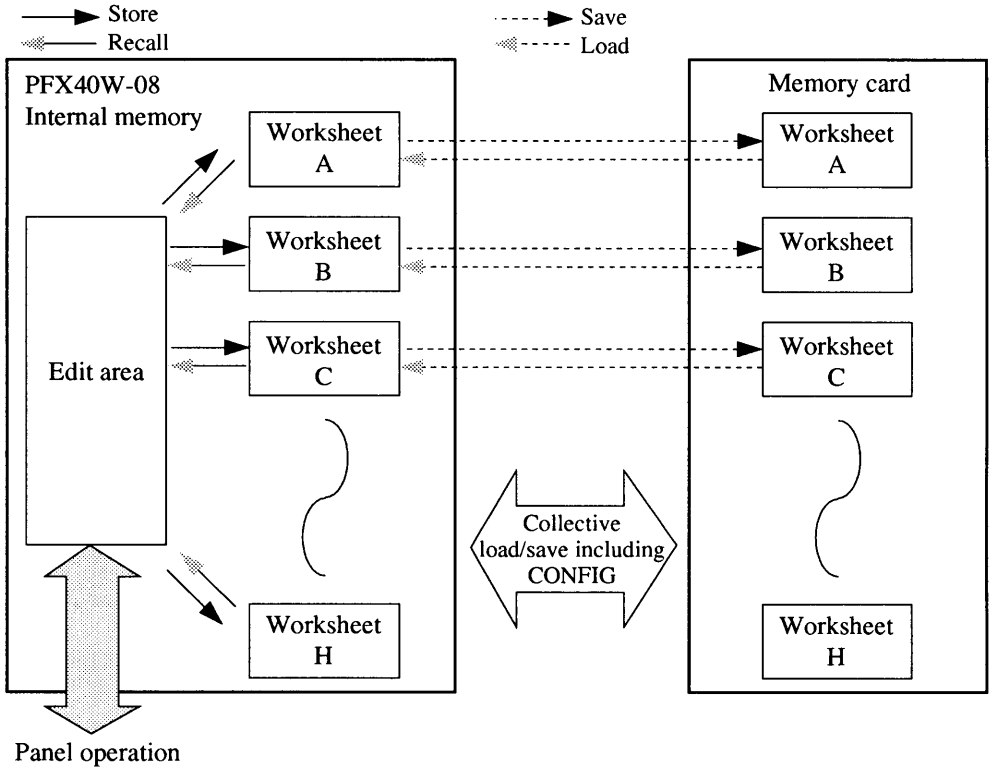
This chapter explains how to set the following seven test condition items:

4.1 SAMPLE BATTERY
4.2 INITIAL PATTERN
4.3 OPTION
4.4 CYCLE CHARGE
4.5 CYCLE DISCHARGE
4.6 FULL CHARGE
4.7 FULL DISCHARGE

If the contents of worksheets are to be modified, recall (or call up) each worksheet into the edit area and place it back in the internal memory to store it.

When setting worksheets for a memory card or modifying worksheet settings, such worksheets must be loaded into the internal memory before they can actually be set or modified.

With respect to loading and saving worksheets to and from the internal memory or a memory card, internal memory A corresponds to worksheet A and so on. If ALL is chosen, all worksheets including CONFIG are loaded or saved.



Broadly classified, the following seven items of a worksheet must be set:

- SAMPLE BATTERY (battery information and charging/discharging methods)
- INITIAL PATTERN (initial charging/discharging)
- OPTION (discharging before and charging after the capacity test)
- CYCLE CHARGE (cycle-charging setup)
- CYCLE DISCHARGE (cycle-discharging setup)
- FULL CHARGE (full-charging setup)
- FULL DISCHARGE (full-discharging setup)

4.1 SAMPLE BATTERY

Specify the battery to be tested and the charging/discharging methods.

Use the jog to choose a battery or the number keys to input a value for selection.

Setup item	Display
Product name	Product Name
	* (Input from GPIB)
Battery type	Battery Type
	* (Input from GPIB)
	NI - Cd
	NI - MH
	Pb
	Li
Nominal voltage	Nominal Voltage
	□□.□□□V
Capacity rate	Capacity Rate
	□□.□□□Ah
Charging method (shallow charging)	Cycle Charge Mode
	CC
	CC - CV
	CC PATTERN
	CC - CV PATTERN
Discharging method (shallow discharging)	Cycle Discharge Mode
	CC
	CP
	CC PATTERN
	CP PATTERN
Charging method (deep charging)	Full Charge Mode
	CC
	CC - CV
Discharging method (deep discharging)	Full Discharge Mode
	CC
	CP

4.2 INITIAL PATTERN

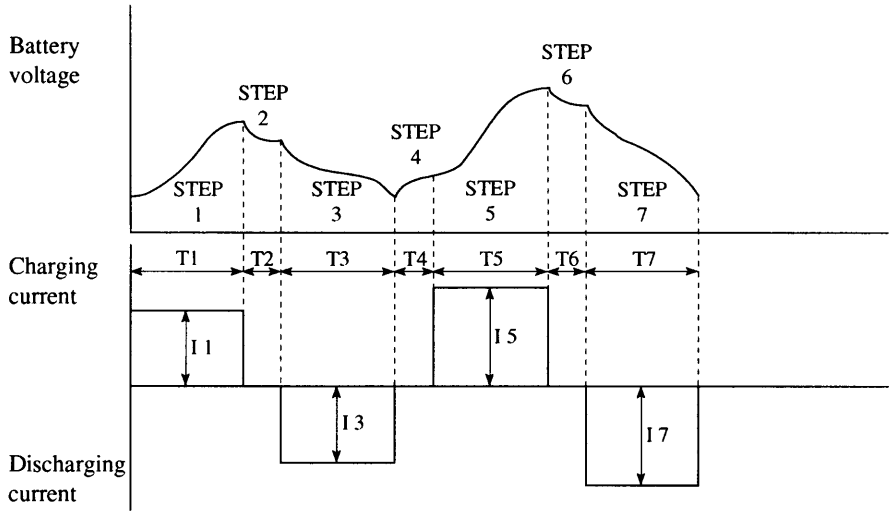
Initial charging/discharging can be set in up to 30 steps.

Use positive (+) and negative (-) current values to specify charging and discharging.

Setting 0A causes the tester to rest. To prevent any step from being executed, set 0 hours 0 minutes.

(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.)

INITIAL PATTERN			
STEP 1	±□.□□□A □□□h □□min	STEP 16	±□.□□□A □□□h □□min
STEP 2	±□.□□□A □□□h □□min	STEP 17	±□.□□□A □□□h □□min
STEP 3	±□.□□□A □□□h □□min	STEP 18	±□.□□□A □□□h □□min
STEP 4	±□.□□□A □□□h □□min	STEP 19	±□.□□□A □□□h □□min
STEP 5	±□.□□□A □□□h □□min	STEP 20	±□.□□□A □□□h □□min
STEP 6	±□.□□□A □□□h □□min	STEP 21	±□.□□□A □□□h □□min
STEP 7	±□.□□□A □□□h □□min	STEP 22	±□.□□□A □□□h □□min
STEP 8	±□.□□□A □□□h □□min	STEP 23	±□.□□□A □□□h □□min
STEP 9	±□.□□□A □□□h □□min	STEP 24	±□.□□□A □□□h □□min
STEP 10	±□.□□□A □□□h □□min	STEP 25	±□.□□□A □□□h □□min
STEP 11	±□.□□□A □□□h □□min	STEP 26	±□.□□□A □□□h □□min
STEP 12	±□.□□□A □□□h □□min	STEP 27	±□.□□□A □□□h □□min
STEP 13	±□.□□□A □□□h □□min	STEP 28	±□.□□□A □□□h □□min
STEP 14	±□.□□□A □□□h □□min	STEP 29	±□.□□□A □□□h □□min
STEP 15	±□.□□□A □□□h □□min	STEP 30	±□.□□□A □□□h □□min



4.3 OPTION

Use OPTION to set special charging/discharging before and after a capacity test.

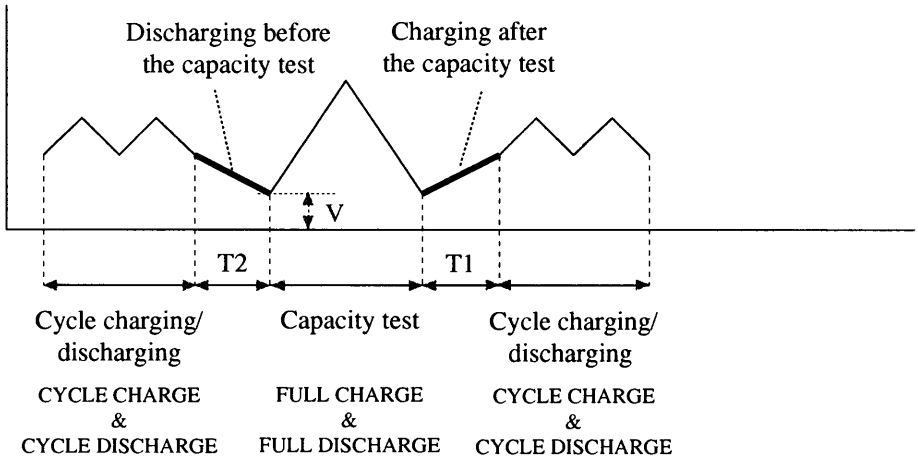
Discharging before a capacity test: This operation is performed to cancel memory effects, thus enabling measurement of the exact charging capacity.

Charging after the capacity test: This operation is performed to return to normal cycles.

(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.)

(0.001 to 20.00V in the 20V range)

Setup item	Display	
Charging current	CHG Cur	□.□□□A
Charging time (T1)	CHG Time	□□□h □□min
Discharging current	DISCH Cur	□.□□□A
Discharging voltage (V)	DISCH Volt	□□.□□□V
Discharging time (T2)	Time	□□□h □□min



Note

- If the capacity test interval (Interval) is set at "1", discharging before the capacity test and charging after the capacity test are not executed because all tests to be executed are set to the capacity test.

4.4 CYCLE CHARGE

Here the cycle-charging operations are set: CC/CC-CV/CC PATTERN/CC-CV PATTERN.

(1) CC constant-current charging

Set the CC (constant-current charging) mode of the cycle-charging operation.

(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.) (1 to 999mV) (1 to 99℃/min) (1 to 100℃) (0.001 to 20.00V in the 20V range)

Setup item	Display	
Charging current (I1)	Current	□.□□□A
Maximum charging time (T1)	Time	□□□h □□min
-⊿V voltage	−dV	□□□mV
⊿T/⊿t value	dT/dt	□□℃/min
Maximum temperature	Max Temp	□□□℃
Maximum voltage (V)	Max Voltage	□□.□□□V
Auxiliary charging current (I2)	Aux Cur	□.□□□A
Auxiliary charging time (T2)	Aux Time	□□□h □□min
Rest time (T3)	Rest Time	□□□h □□min

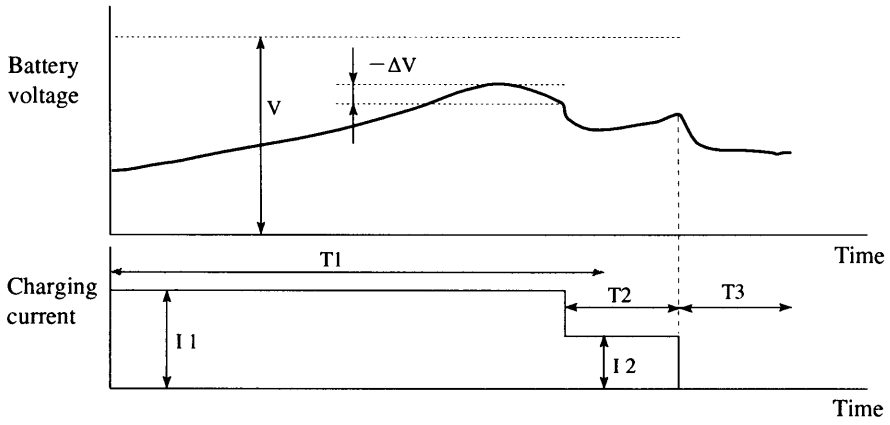
Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① -⊿V voltage detection : Disabled for about 10 minutes after starting the test.

  ② ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.

  ③ Maximum voltage detection : Disabled for about 5 minutes after starting the test.



(2) CC-CV constant-voltage charging

Set the CC-CV (constant-voltage charging) mode of the cycle charging operation.

(0.001 to 32.00A in 8-unit parallel operation) (0.001 to 20.00V in the 20V range) (0 to 999h) (0 to 59min.) (1 to 99℃/min) (1 to 100℃)

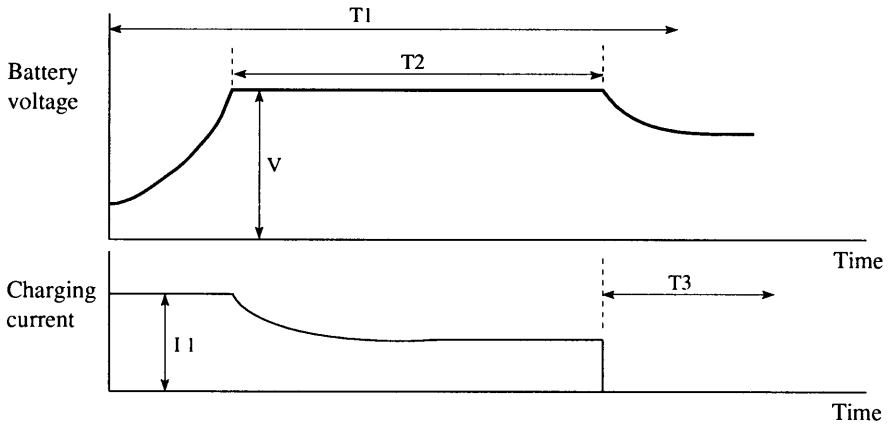
Setup item	Display	
Charging current (I1)	Current	□.□□□A
Charging voltage (V)	Voltage	□□.□□□V
Maximum charging time (T1)	Time	□□□h □□min
⊿T/⊿t value	dT/dt	□□℃/min
Maximum temperature	Max Temp	□□□℃
Rest time (T3)	Rest Time	□□□h □□min

Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.

- For notes on constant-voltage operation, see the description on page 2-5.



(3) CC-PATTERN constant-current charging pattern

Set the CC-PATTERN (constant-current charging pattern) mode of the cycle-charging operation.

This pattern can be set in up to 15 steps.

(1 to 999mV) (1 to 99℃/min) (1 to 100℃) (0.001 to 20.00V in the 20V range)

(0 to 999h) (0 to 59min)

Setup item	Display	
-⊿V voltage	−dV	□□□mV
⊿T/⊿t value	dT/dt	□□℃/min
Maximum temperature	Max Temp	□□□℃
Maximum voltage (V)	Max Voltage	□□.□□□V
Rest time (T)	Rest Time	□□□h □□min

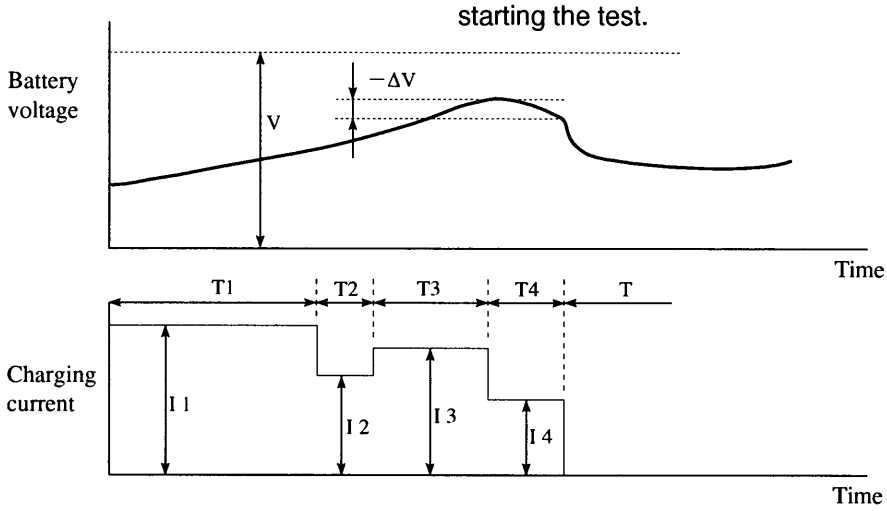
Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① -⊿V voltage detection : Disabled for about 10 minutes after starting the test.

  ② ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.

  ③ Maximum voltage detection : Disabled for about 5 minutes after starting the test.



(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.)

Setup item		Display	
Charging current	(I1)	STEP 1	±□.□□□A
Charging time	(T1)		□□□h □□min
Charging current	(I2)	STEP 2	±□.□□□A
Charging time	(T2)		□□□h □□min
Charging current	(I3)	STEP 3	±□.□□□A
Charging time	(T3)		□□□h □□min
Charging current	(I4)	STEP 4	±□.□□□A
Charging time	(T4)		□□□h □□min
Charging current	(I5)	STEP 5	±□.□□□A
Charging time	(T5)		□□□h □□min
Charging current	(I6)	STEP 6	±□.□□□A
Charging time	(T6)		□□□h □□min
Charging current	(I7)	STEP 7	±□.□□□A
Charging time	(T7)		□□□h □□min
Charging current	(I8)	STEP 8	±□
Charging time	(T8)		
Charging current	(I9)	STEP 9	
Charging time	(T9)		
Charging current	(I10)	ST	
Charging time	(T10)		
Charging current	(I11)		
Charging time	(T11)		
Charging current	(I12)		
Charging time	(T12)		
Charging current	(I13)		
Charging time	(T13)		

(4) CC-CV PATTERN constant-voltage charging pattern

Set the CC-CV PATTERN (constant-voltage charging pattern) mode of the cycle-charging operation.

This pattern can be set in up to 15 steps.

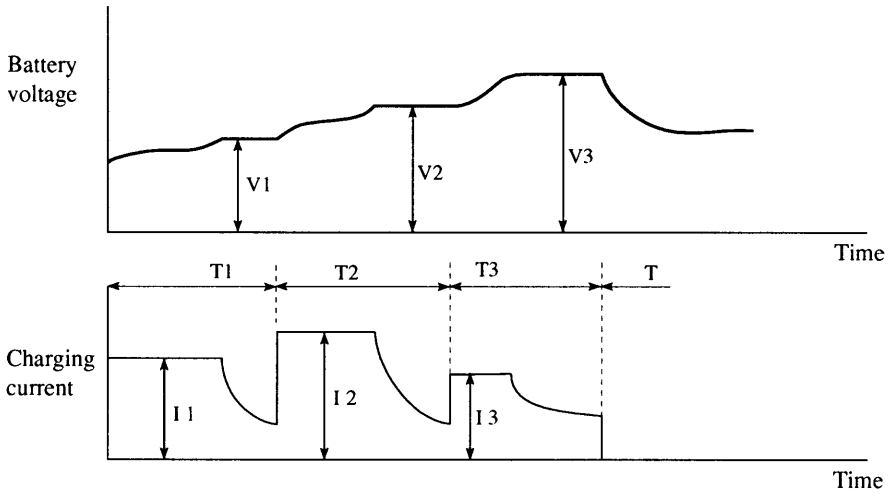
(1 to 99℃/min) (1 to 100℃) (0 to 999h) (0 to 59min.)

Setup item	Display	
⊿T/⊿t value	dT/dt	□□℃／min
Maximum voltage	Max Temp	□□□℃
Rest time (T)	Rest Time	□□□h □□min

Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.



(0.001 to 32.00A in 8-unit parallel operation) (0.001 to 20.00V in the 20V range) (0 to 999h) (0 to 59min)

Setup item		Display	
Charging current	(I1)	STEP 1	±□.□□□A
Charging voltage	(V1)		□□.□□□V
Charging time	(T1)		□□□h □□min
Charging current	(I2)	STEP 2	±□.□□□A
Charging voltage	(V2)		□□.□□□V
Charging time	(T2)		□□□h □□min
Charging current	(I3)	STEP 3	±□.□□□A
Charging voltage	(V3)		□□.□□□V
Charging time	(T3)		□□□h □□min
Charging current	(I4)	STEP 4	±□.□□□A
Charging voltage	(V4)		□□.□□□V
Charging time	(T4)		□□□h □□min
Charging current	(I5)	STEP 5	±□.□□□A
Charging voltage	(V5)		□□.□□□V
Charging time	(T5)		□□
Charging current	(I6)	STEP 6	
Charging voltage	(V6)		
Charging time	(T6)		
Charging current	(I7)		
Charging voltage	(V7)		
Charging time	(T7)		
Charging current	(I8)		
Charging voltage	(V8)		
Charging time	(T8)		
Charging current	(I		

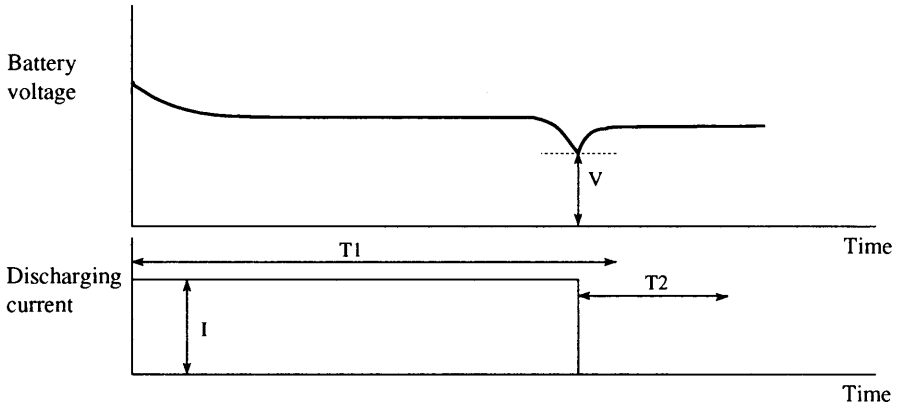
4.5 CYCLE DISCHARGE

Here the cycle-discharging operations are set: CC/CP/CC PATTERN/CP PATTERN.

(1) CC constant-current discharging

Set the CC (constant-current discharging) mode of the cycle-discharging operation.
(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.) (0.001 to 20.00V in the 20V range)

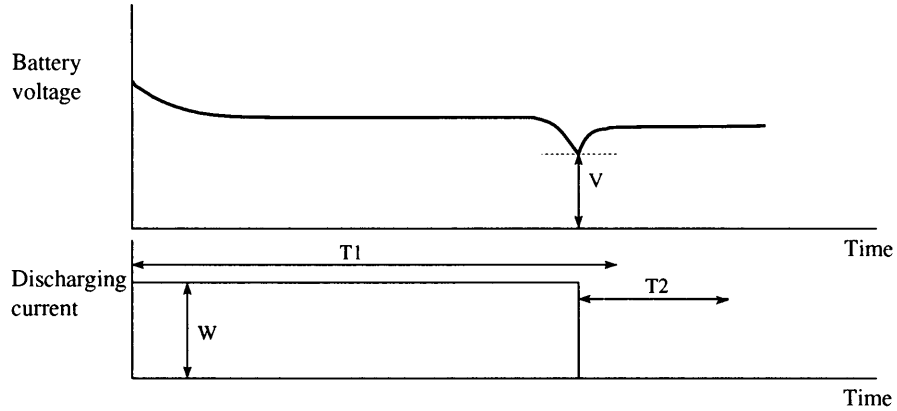
Setup item	Display	
Discharging current (I)	Current	□.□□□A
Maximum discharging time (T1)	Max Time	□□□h □□min
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T2)	Rest Time	□□□h □□min



(2) CP constant-power discharging

Set the CP (constant-power discharging) mode of the cycle-discharging operation.
(0.001 to 320.0W in 8-unit parallel operation) (0 to 999h) (0 to 59min.)
(0.001 to 20.00V in 20V range)

Setup item	Display	
Discharging power (W)	Power	□□.□□□W
Maximum discharging time (T1)	Max Time	□□□h □□min
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T2)	Rest Time	□□□h □□min



(3) CC-PATTERN constant-current discharging pattern

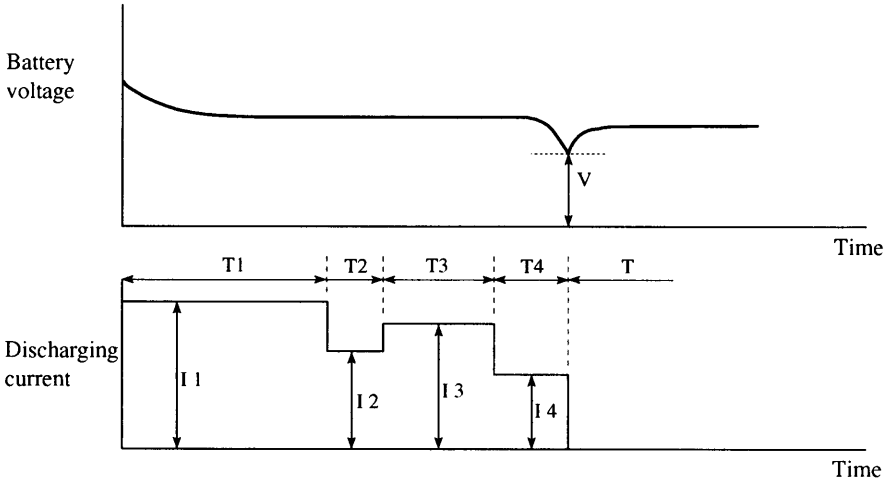
Set the CC-PATTERN (constant-current discharging pattern) mode of the cycle-discharging operation.

This pattern can be set in up to 15 steps.

If Repeat is turned on, steps 1 through 15 are repeated until the terminal voltage is reached.

(0. 001 to 20.00V in the 20V range) (0 to 999h) (0 to 59min.)

Setup item	Display	
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T)	Rest Time	□□□h □□min
Repeat	Repeat	ON／OFF



(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.)

Setup item		Display	
Discharging current	(I1)	STEP 1	±□.□□□A
Discharging time	(T1)		□□□h □□min
Discharging current	(I2)	STEP 2	±□.□□□A
Discharging time	(T2)		□□□h □□min
Discharging current	(I3)	STEP 3	±□.□□□A
Discharging time	(T3)		□□□h □□min
Discharging current	(I4)	STEP 4	±□.□□□A
Discharging time	(T4)		□□□h □□min
Discharging current	(I5)	STEP 5	±□.□□□A
Discharging time	(T5)		□□□h □□min
Discharging current	(I6)	STEP 6	±□.□□□A
Discharging time	(T6)		□□□h □□min
Discharging current	(I7)	STEP 7	±□.□□□A
Discharging time	(T7)		
Discharging current	(I8)	STEP 8	
Discharging time	(T8)		
Discharging current	(I9)	STE	
Discharging time	(T9)		
Discharging current	(I10)		
Discharging time	(T10)		
Discharging current	(I11)		
Discharging time	(T11)		
Discharging current	(I12)		
Discharging time	(T		

(4) CP-PATTERN constant-power discharging pattern

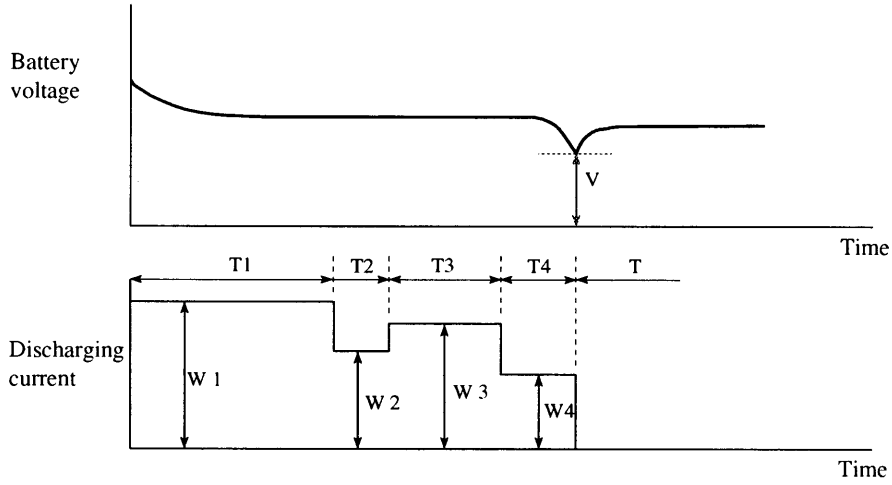
Set the CP-PATTERN (constant-power discharging pattern) mode of the cycle-discharging operation.

This pattern can be set in up to 15 steps.

If Repeat is turned on, steps 1 through 15 are repeated until the terminal voltage is reached.

(0. 001 to 20.00V in the 20V range) (0 to 999h) (0 to 59min.)

Setup item	Display	
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T)	Rest Time	□□□h □□min
Repeat	Repeat	ON/OFF



(0.001 to 32.00W in 8-unit parallel operation) (0 to 999h) (0 to 59min.)

Setup item		Display	
Discharging power	(W1)	STEP 1	□.□□□W
Discharging time	(T1)		□□□h □□min
Discharging power	(W2)	STEP 2	□.□□□W
Discharging time	(T2)		□□□h □□min
Discharging power	(W3)	STEP 3	□.□□□W
Discharging time	(T3)		□□□h □□min
Discharging power	(W4)	STEP 4	□.□□□W
Discharging time	(T4)		□□□h □□min
Discharging power	(W5)	STEP 5	□.□□□W
Discharging time	(T5)		□□□h □□min
Discharging power	(W6)	STEP 6	□.□□□W
Discharging time	(T6)		□□□h □□min
Discharging power	(W7)	STEP 7	□.□□□W
Discharging time	(T7)		
Discharging power	(W8)	STEP 8	
Discharging time	(T8)		
Discharging power	(W9)	STE	
Discharging time	(T9)		
Discharging power	(W10)		
Discharging time	(T10)		
Discharging power	(W11)		
Discharging time	(T11)		
Discharging power	(W12)		
Discharging time	(T1		

4.6 FULL CHARGE

Here CC/CC-CV of the full-charging operation is set.

(1) CC constant-current full charging

Set the CC (constant-current charging) mode of the full-charging operation.

(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.) (1 to 999mV) (1 to 99℃/min.) (1 to 100℃) (0.001 to 20.00V in the 20V range)

Setup item	Display	
Charging current (I1)	Current	□.□□□A
Maximum charging time (T1)	Time	□□□h □□min
−⊿V voltage	−dV	□□□mV
⊿T/⊿t value	dT/dt	□□℃/min
Maximum temperature	Max Temp	□□□℃
Maximum voltage (V)	Max Voltage	□□.□□□V
Auxiliary charging current (I2)	Aux Cur	□.□□□A
Auxiliary charging time (T2)	Aux Time	□□□h □□min
Rest time (T3)	Rest Time	□□□h □□min

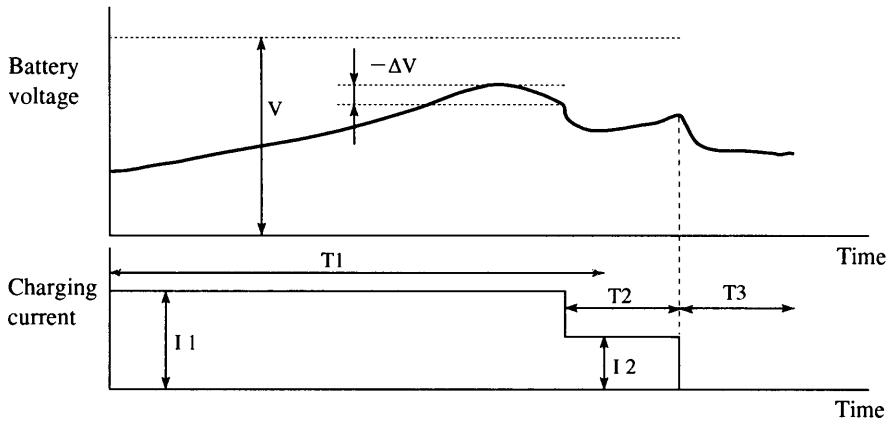
Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① -⊿V voltage detection : Disabled for about 10 minutes after starting the test.

  ② ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.

  ③ Maximum voltage detection : Disabled for about 5 minutes after starting the test.



(2) CC-CV constant-voltage full charging

Set the CC-CV (constant-voltage charging) mode of the full-charging operation.

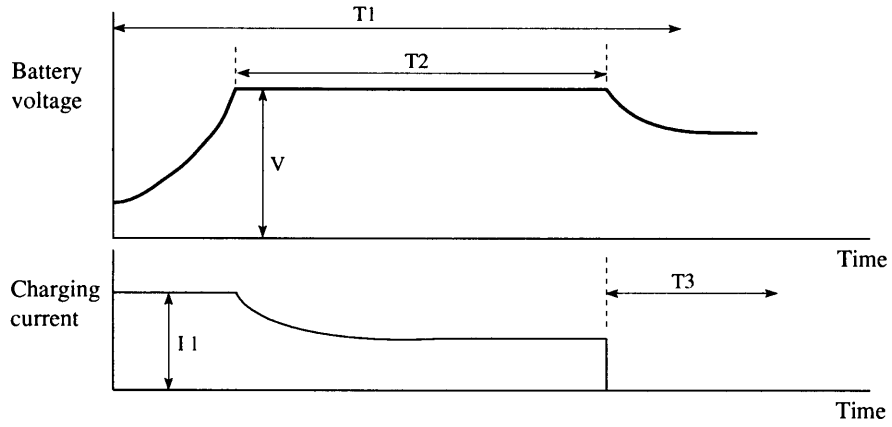
(0.001 to 32.00A in 8-unit parallel operation) (0.001 to 20.00V in the 20V range)
(0 to 999h) (0 to 59min.) (1 to 99℃/min.) (1 to 100℃)

Setup item	Display	
Charging current (I1)	Current	□.□□□A
Charging voltage (V)	Voltage	□□.□□□V
Maximum charging time (T1)	Time	□□□h □□min
CV charging time (T2)	CVTime	□□□h □□min
⊿T/⊿t value	dT/dt	□□℃／min
Maximum temperature	Max Temp	□□□℃
Rest time (T3)	Rest Time	□□□h □□min

Note

- To prevent malfunction, the following detection functions are disabled immediately after starting the test.

  ① ⊿T/⊿t value detection : Disabled for about 30 minutes after starting the test.



4.7 FULL DISCHARGE

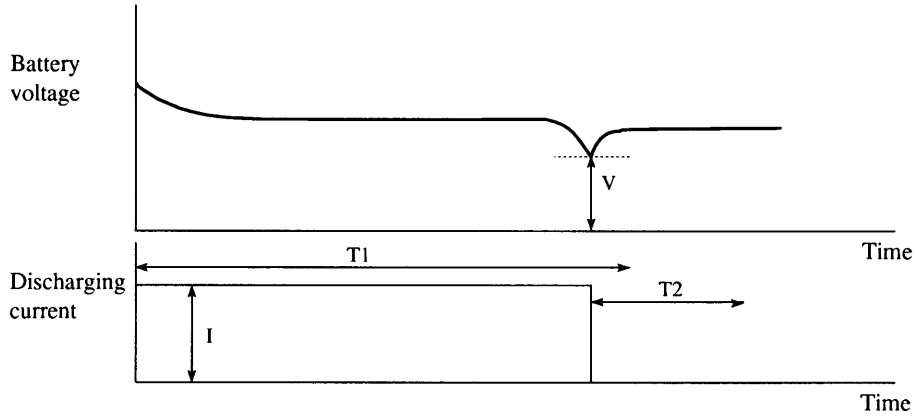
Here CC/CP of the full-discharging operation is set.

(1) CC constant-current full discharging

Set the CC (constant-current discharging) mode of the full-discharging operation.

(0.001 to 32.00A in 8-unit parallel operation) (0 to 999h) (0 to 59min.) (0.001 to 20.00V in the 20V range)

Setup item	Display	
Discharging current (I)	Current	□.□□□A
Maximum discharging time (T1)	Max Time	□□□h □□min
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T2)	Rest Time	□□□h □□min

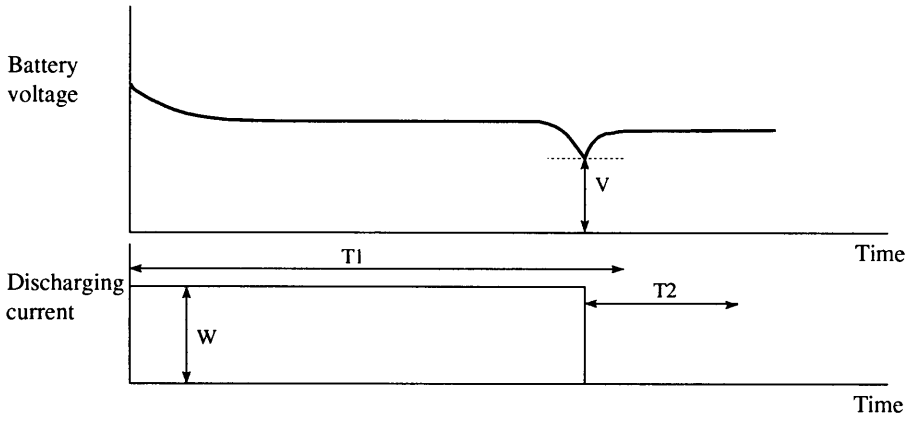


(2) CP constant-power full discharging

Set the CP (constant-power discharging) mode of the full-discharging operation.

(0.001 to 320.0W in 8-unit parallel operation) (0 to 999h) (0 to 59min.) (0.001 to 20.00V in the 20V range)

Setup item	Display	
Discharging power (W)	Power	□□.□□□W
Maximum discharging time (T1)	Max Time	□□□h □□min
Terminal voltage (V)	Cut Voltage	□□.□□□V
Rest time (T2)	Rest Time	□□□h □□min



Chapter 5
Advanced Operation

This chapter describes an example of advanced operation and how to operate the tester through GPIB remote control.

5.1 Operation in Parallel Connection

By connecting output units CH1 through CH8 in parallel, the tester can be used with increased current and power. For details concerning the usage range, refer to the list of current, voltage, and power ranges shown in Table 5-1 below.
For details concerning connections, refer to ■, "Concerning parallel connections", on page 1-6.
CONFIG must be set before the tester can actually be used. For details, refer to Section 3.1, "TEST CONDITION", on page 3-2.
The channel numbers for the list of current, voltage, and power ranges shown in Table 5-1 represent the channel numbers when the output units are connected in parallel.

	10V range		20V range	
Voltage	0.001 to10.000V		0.001 to 20.000V	
Current	8CH	0.001 to 4.000A	8CH	0.00 to 2.000A
	4CH	0.001 to 8.000A	4CH	0.001 to 4.000A
	2CH	0.001 to 16.000A	2CH	0.001 to 8.000A
	1CH	0.001 to 32.000A	1CH	0.001 to 16.000A
Power	8CH	0.001 to 40.000W		
	4CH	0.001 to 80.000W		
	2CH	0.001 to 160.000W		
	1CH	0.001 to 320.000W		
Initial charging current	8CH	-4.000 to 4.000A	8CH	-2.000 to 2.000A
	4CH	-8.000 to 8.000A	4CH	-4.000 to 4.000A
	2CH	-16.000 to 16.000A	2CH	-8.000 to 8.000A
	1CH	-32.000 to 32.000A	1CH	16.000 to 16.000A
Pattern charging/ discharging voltage	0.000 to 10.001V		0.000 to 20.001V	
Pattern current	8CH	0.000 to 4.000A	8CH	0.000 to 2.000A
	4CH	0.000 to 8.000A	4CH	0.000 to 4.000A
	2CH	0.000 to 16.000A	2CH	0.000 to 8.000A
	1CH	0.000 to 32.000A	1CH	0.000 to 16.000A
Pattern power	8CH	0.000 to 40.000W		
	4CH	0.000 to 80.000W		
	2CH	0.000 to 160.000W		
	1CH	0.000 to 320.000W		

Table 5-1 List of Current, Voltage, and Power Ranges

☆ Method for calculating the current and power ranges in Full Discharge

Discharging current — Upper limit: Maximum current

Lower limit: Capacity rate / 1000 (minimum value = 0.001 A)

Discharging power — Upper limit: (Nominal value x maximum current) x 2 (maximum value = maximum power value)

Lower limit: (Capacity rate / 1000) x nominal voltage (minimum value = 0.001 W)

5.2 Synchronous Operation with an External Charger

This is an applied operation method in which an external charger is used to charge the battery and the test of capacity and life is performed using the tester. All tester functions can be employed in this test in the same way as in the regular test, except that the charging current and capacity cannot be calculated during charging.

Note

- If the external charger does not include a function for automatically disconnecting the battery when charging is completed a relay, etc. must be added.
- During charging, the tester also generates a charging current of approximately 1 mA that flows into the battery.

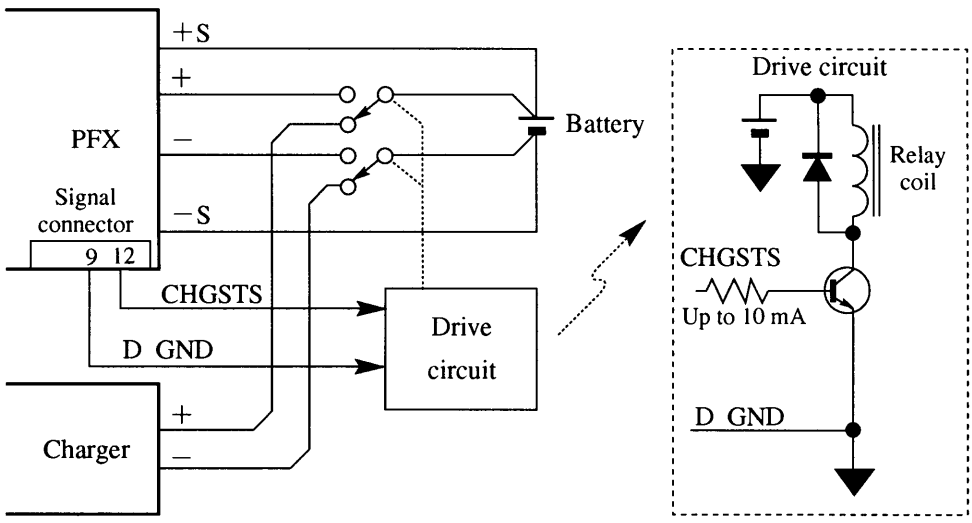
Setting up the tester for charging

- Set the charging current at 1 mA.
- Set the charging time as (charging time for the external charger) + (rest time).

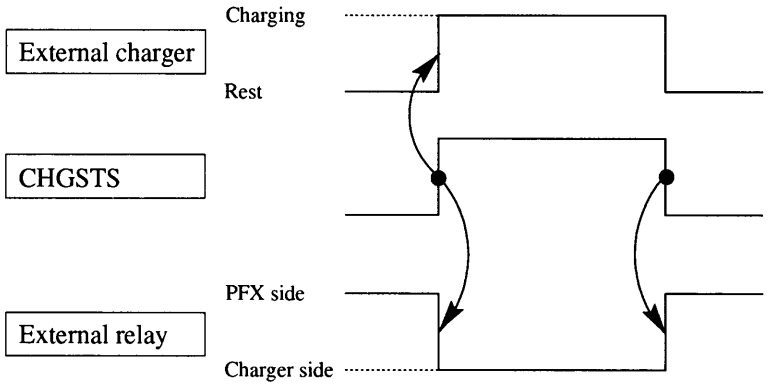
(1) Usage example 1

When using the No. 12 CHGSTS (charging operation signal) of signal connector P2.

Connection diagram



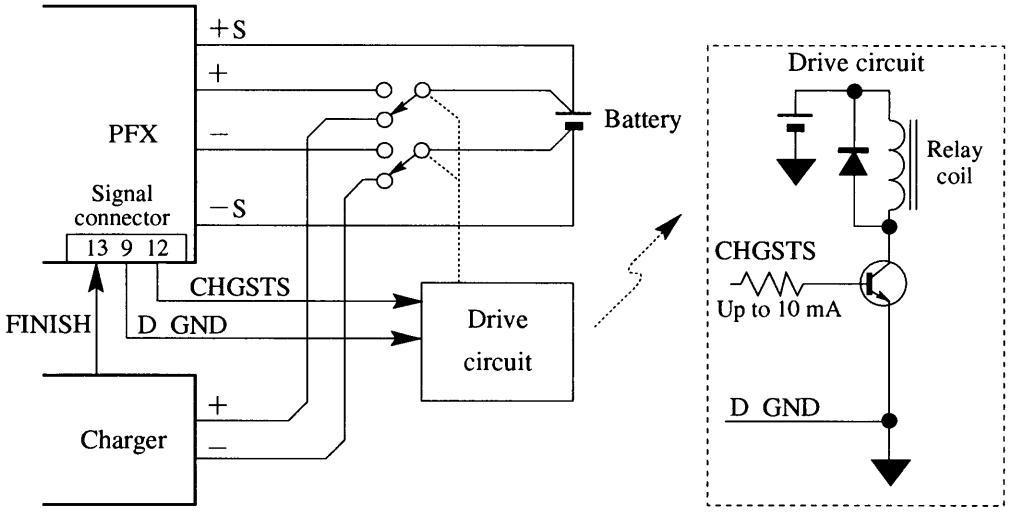
Timing chart



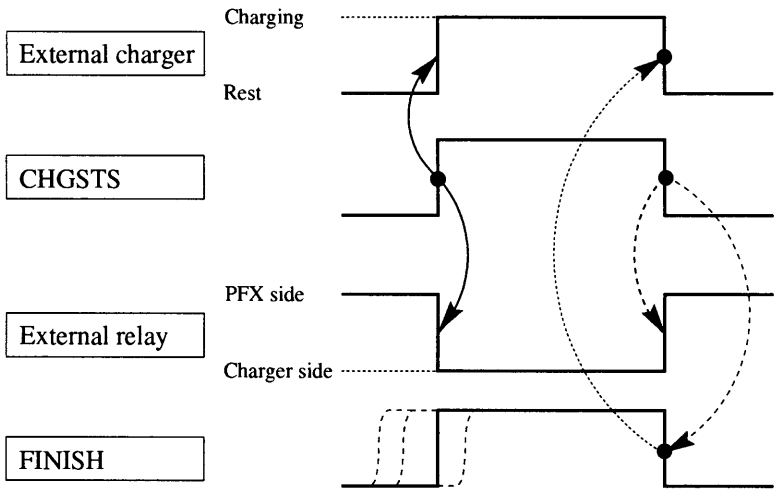
(2) Usage example 2

When using No. 12 CHGSTS and No. 13 FINISH of signal connector P2.

Connection diagram



Timing chart



(3) Signal connector functions required for synchronous operation

Terminal	Pin No.	I/O	Circuit	Operation	Function
CHGSTS	P2-12	Out	CMOS level+5V	Active-high	Indicates that the tester is in the charging state.
DISCSTS	P2-11	Out	CMOS level+5V	Active-high	Indicates that the tester is in the discharging state.
RESTSTS	P2-10	Out	CMOS level+5V	Active-high	Indicates that the tester is in the rest state. Note) This signal dose not occur during OUT OFF in manual mode.
TRG	P1-16	Out	Open collector 30V 30mA SINK	Active-low pulse for approximately 10ms	This signal is output at the beginning of both charging and discharging. Note) This signal is also output when the current is set in manual mode.
FINISH	P2-13	In	Pulled up with 10kΩ to CMOS level+5V	Active-low edge	1. During charging ①CV charging The CV lamp lights, with no chnge in operation. ②CC charging The tester switches to auxiliary charging. ③CC pattern charging The tester switches to rest. ④CV charging The CV lamp lights, with no chnge in operation. 2. During discharging The tester switches to rest regardless of the discharging mode. 3. During rest and auxiliary charging No change.
DGND	P1-15 P2-9				Connected to the internal potential.

Caution

- When connecting P1-15 and P2-9 of D GND to an external equipment, be sure to make insulation using a relay or photo coupler as shown in usage examples 1 and 2.

5.3 GPIB Control

The tester allows you to perform computerized automatic charging/discharging tests through a GPIB interface.

GPIB functions

- SH1 : All source handshake functions
- AH1: All acceptor handshake functions
- T5 : Talker functions (basic output, talker canceling through listener functions)
- L4 : Listener functions (basic input, listener canceling through talker functions)
- SR0 : No service request function
- RL1 : All remote local functions
- PP0 : No parallel pall function
- DC0: No device clear function
- DT0: No device trigger function
- C0 : No controller function
- E1 : Open-collector driver

5.3.1 Confirmation before Using

Caution

- When using the GPIB interface without connecting a printer, set PRINTER ITEM of CONFG to NOT USE by panel operation. Using the GPIB interface with the USE setting may cause a communication error.

(1) Checking an address

- Check the tester's address. For details, refer to Section 2.3.3, "ADDRESS", on page 2-7.
- If you have modified the tester's address, turn the 【POWER】 switch off and then turn on.

(2) Response message terminator (delimiter)

The tester's response message terminator (delimiter) is set at 'CRLF' + EOI.

5.3.2 How to Read a Command Table

① Command

This is an ASCII-code character string.

The command name can be either uppercase or lowercase.

② Argument

Each command must be accompanied by an argument as necessary.

Units of measure in argument

Current: A -⊿: mV Time: Minute

Voltage: V ⊿T/⊿t: ℃/min Temperature: ℃

Power: W

A unit of measure cannot be added to the argument.

③ Range

This indicates a setup range.

④ Default

This indicates a factory default value.

⑤ NR

NR1: Binary data

NR2: Integer data in decimal form

NR3: Hexadecimal form

NR4: Decimal-point or integer data

⑥ Mode

This is the operation number indicating the mode in which a command can be used.

0: Setup mode 1: Cycle mode 2: Manual mode

⑦ BUP

The settings for this command are backed up even when the 【POWER】 switch is turned off.

⑧ Separator

Use "," ("2C"Hex) to separate command arguments from read-back parameters.

⑨ **Ch**

This indicates a channel number (1 to 8).

⑩ **Step**

This indicates a step number (1 to 15 and 30)

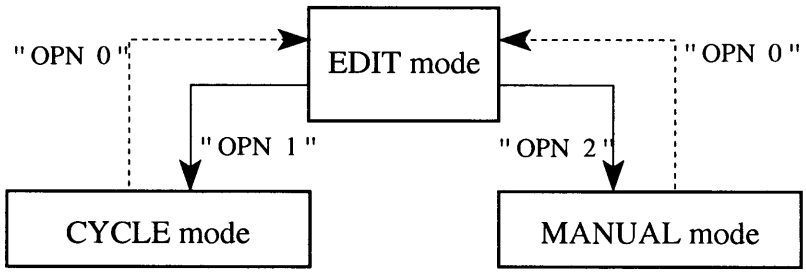
⑪ **String**

This indicates an alphanumeric character.

5.3.3 Command Description

(1) Switchover command

The tester features three separate operation modes: 【EDIT】, 【CYCLE】, and 【MANUAL】. An operation mode can normally be entered by key operation. When operating via a GPIB interface, however, use the "OPN" command to switch between operation modes.



EDIT mode : This setting mode for the tester is used to set test conditions.

CYCLE mode : This mode is used to perform CYCLE tests.

MANUAL mode : This mode is used to perform MANUAL tests.

Note

- When switching from CYCLE mode to EDIT mode, place all channels in the IDLE position before switching modes.
- If you switch to the EDIT mode from MANUAL mode, the tester stops the test in whichever channel it is currently being executed before switching to the EDIT mode.

Command	Argument	Range	Default	NR	Mode	BUP
OPN (OPeratioN)	Operation number	0 to 2 0 : EDIT mode 1 : CYCLE 2 : MANUAL	0	NR2	0,1,2	—
OPN ?					0,1,2	
CH (CHannel)	Channel number	1 to 8	1	NR2	1,2	—
CH ?					1,2	

(2) Command for switching worksheets

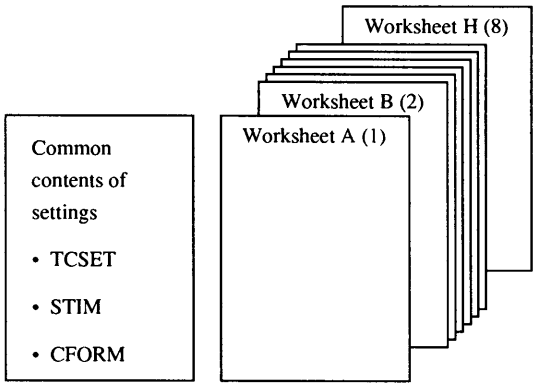
The tester allows test conditions to be set in up to eight patterns.

These test conditions can also be stored separately in worksheets [A], [B], [C], [D], [E], [F], [G], and [H].

Use the switchover command "WSSET" to choose a worksheet with contents you want to modify.

Command	Argument	Range	Default	NR	Mode	BUP
WSSET (Work Sheet SET)	Worksheet number	1 to 8 1 : A 2 : B ⋮ 8 : H	1	NR2	0,1	—
WSSET ?					0,1	

The ranges set by the CONFIG commands "TCSET, "STIM," and "CFORM" affect all worksheets.



Representation of worksheets in which conditions are stored

If worksheet A is selected, each setup command modifies the contents of worksheet A. When the command "WSSET 3" is sent, the contents of worksheet C are modified from then on.

When actually performing a test, the worksheet to be used for each particular channel can be chosen.

When the tester is executing a test, only test conditions for worksheets not in use can be modified.

For example, if the command "WSSET 4" is sent when a test is being performed using worksheets,

CH1 - Worksheet A

CH2 - Worksheet B

CH3 - Worksheet C,

the contents of worksheet D can be modified.

(3) Commands related to CONFIG

These commands enable the tester's operating conditions to be set.

Command	Argument	Range	Default	NR	Mode	BUP
TCSET	Range	0 : 10V range	1 (20V)	NR1	0	○
(Test Condition		1 : 20V range				
SET)	Parallel	10V range	0 (2A/8CH)	NR2		
		0 : 4A/8CH				
		1 : 8A/4CH				
		2 : 16A/2CH				
		3 : 32A/1CH				
		20V range		NR2		
		0 : 2A/8CH				
		1 : 4A/4CH				
		2 : 8A/2CH				
		3 : 16A/1CH				
	Temperature measurement	0 : OFF	1 (ON)	NR1		
		1 : ON				
	Synchronous test	0 : OFF	0 (OFF)	NR1		
		1 : ON				
TCSET ?					0,1,2	
STIM	Cycle-charging test time	0 to 59999	1 min		0	○
(Synchronous	Cycle-discharging test time	0 to 59999	1 min			
TIMe)	Full-charging test time	0 to 59999	1 min			
	Full-discharging test time	0 to 59999	1 min			
STIM ?					0,1,2	
CFORM	Maximum number of cycle	1 to 99999	1	NR2	0	○
(Cycle FORM)	Number of interval	1 to 999	1	NR2		
	Criteria setting	1 to 100	80 %	NR2		
	Life judgment count	1 to 9	1	NR2		
	Battery status after the end	0 : Discharge	0	NR1		
	of the test	1 : Charge		NR2		
CFORM ?					0,1,2	

(4) Commands for tested batteries

These commands allow the contents of SAMPLE BATTERY to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
BATT	Comment	Character string of	" * "	CHAR	0,1	○
(BATTery)		up to 20 characters				
	Battery type	Character string of	" * "	CHAR		
		up to 20 characters or		or		
		1 : Ni-Cd		NR2		
		2 : Ni-MH				
		3 : Pb				
		4 : Li				
	Nominal voltage	0.001 to 20.0	0.001 V	NR4		
	Capacity rate	0.001 to 9999	1.000 Ah	NR4		
	Cycle-charging mode	0 : CC	0 (CC)	NR2		
		1 : CC-CV				
		2 : CC Pattern				
		3 : CC-CV Pattern				
	Cycle-discharging mode	0 : CC	0 (CC)	NR2		
		1 : CP				
		2 : CC Pattern				
		3 : CP Pattern				
	Full-charging mode	0 : CC	0 (CC)	NR2		
		1 : CC-CV				
	Full-discharging mode	0 : CC	0 (CC)	NR2		
		1 : CP				
BATT ?					0,1	

(5) Commands for initial charging

These commands allow the contents of INITIAL PATTERN to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
ICHG	Step number	1 to 30	Step 1 :	NR2	0,1	○
(Initial CHarGe)			0.001A			
	Charging current	- 32.0 to 32.0	1 min	NR4		
			Step 2 to 30 :			
	Charging time	0 to 59999	0A	NR2		
			0min			
ICHG step, ?	Step number	1 to 30		NR2	0,1	

(6) Cycle-charging commands

These commands allow the contents of CYCLE CHARGE to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
CCCC	Charging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Cycle Charge CC)	Charging time	0 to 59999	1 min	NR2		
	−⊿V	1 to 999	999 mV	NR2		
	⊿T/⊿t	1 to 99	99℃/min	NR2		
	Maximum temperature	1 to 100	100℃	NR2		
	Charging voltage	0.001 to 20.0	0.001 V	NR4		
	Auxiliary Charging current	0.001 to 32.0	0.001 A	NR4		
	Auxiliary Charging time	0 to 59999	1 min	NR2		
	Rest time	0 to 59999	1 min	NR2		
CCCC ?					0,1	
CCCV	Charging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Cycle Charge	Charging voltage	0.001 to 20.0	0.001 V	NR4		
CC-CV)	Charging time	0 to 59999	1 min	NR2		
	⊿T/⊿t	1 to 99	99℃/min	NR2		
	Maximum temperature	1 to 100	100℃	NR2		
	Rest time	0 to 59999	1 min	NR2		
CCCV ?					0,1	
CCCCP	−⊿V	1 to 999	999 mV	NR2	0,1	○
(Cycle Charge	⊿T/⊿t	1 to 99	99℃/min	NR2		
CC Pattern)	Maximum temperature	1 to 100	100℃	NR2		
	Charging voltage	0.001 to 20.0	0.001 V	NR4		
	Rest time	0 to 59999	1 min	NR2		
CCCCP ?					0,1	
CCCCPS	Step number	1 to 15		NR2	0,1	○
(Cycle Charge	Charging current	0.000 to 32.0		NR4		
CC Pattern Step)	Charging time	0 to 59999		NR2		
CCCCPS step ?	Step number	1 to 15		NR2	0,1	○
CCCVP	⊿T/⊿t	1 to 99	99℃/min	NR2	0,1	○
(Cycle Charge	Maximum temperature	1 to 100	100℃	NR2		
CC- CV Pattern)	Rest time	0 to 59999	1 min	NR2		
CCCVP ?					0,1	
CCCVPS	Step number	1 to 15		NR2	0,1	○
(Cycle Charge	Charging current	0.000 to 32.0		NR4		
CC-CV Pattern	Charging voltage	0.000 to 20.0		NR4		
Step)	Charging time	0 to 59999		NR2		
CCCVPS step, ?	Step number	1 to 15		NR2	0,1	○

(7) Cycle-discharging commands

These commands allow the contents of CYCLE DISCHARGE to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
CDCC	Discharging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Cycle Disharge CC)	Discharging time	0 to 59999	1 min	NR2		
	Discharging terminal voltage	0.001 to 20.0	0.001V	NR4		
	Rest time	0 to 59999	1 min	NR2		
CDCC ?					0,1	
CDCP	Discharging power	0.001 to 320.0	0.001 W	NR4	0,1	○
(Cycle Disharge CP)	Discharging time	0 to 59999	1 min	NR2		
	Discharging terminal voltage	0.001 to 20.0	0.001V	NR4		
	Rest time	0 to 59999	1 min	NR2		
CDCP ?					0,1	
CDCCP	Discharging terminal voltage	0.001 to 20.0	0.001V	NR4	0,1	○
(Cycle Disharge	Rest time	0 to 59999	1 min	NR2		
CC Pattern)	Repeat	0:OFF 1:ON	0(OFF)	NR1		
CDCCP ?					0,1	
CDCCPS	Step number	1 to 15		NR2	0,1	○
(Cycle Disharge	Discharging current	0.000 to 32.0		NR4		
CC Pattern Step)	Discharging time	0 to 59999		NR2		
CDCCPS step ?	Step number	1 to 15		NR2	0,1	○
CDCPP	Discharging terminal voltage	0.001 to 20.0	0.001V	NR4	0,1	○
(Cycle Disharge	Rest time	0 to 59999	1 min	NR2		
CP Pattern)	Repeat	0:OFF 1:ON	0(OFF)	NR1		
CDCPP ?					0,1	
CDCPPS	Step number	1 to 15		NR2	0,1	○
(Cycle Disharge	Discharging power	0.000 to 320.0	0.001 A	NR4		
CP Pattern Step)	Discharging time	0 to 59999		NR2		
CDCPPS step, ?	Step number	1 to 15		NR2	0,1	○

(8) Commands for full charging

These commands allow the contents of FULL CHARGE to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
FCCC	Charging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Full Charge CC)	Charging time	0 to 59999	1 min	NR2		
	$-\Delta V$	1 to 999	999 mV	NR2		
	$\Delta T/\Delta t$	1 to 99	99℃/min	NR2		
	Maximum temperature	1 to 100	100℃	NR2		
	Charging voltage	0.001 to 20.0	0.001 V	NR4		
	Auxiliary Charging current	0.001 to 32.0	0.001 A	NR4		
	Auxiliary Charging time	0 to 59999	1 min	NR2		
	Rest time	0 to 59999	1 min	NR2		
FCCC ?					0,1	
FCCV	Charging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Full Charge	Charging voltage	0.001 to 20.0	0.001 V	NR4		
CC-CV)	Charging time	0 to 59999	1 min	NR2		
	CV Charging time	0 to 59999	1 min	NR2		
	$\Delta T/\Delta t$	1 to 99	99℃/min	NR2		
	Maximum temperature	1 to 100	100℃	NR2		
	Rest time	0 to 59999	1 min	NR2		
FCCV ?					0,1	

(9) Commands for full discharging

These commands allow the contents of FULL DISCHARGE to be set in the worksheet.

Command	Argument	Range	Default	NR	Mode	BUP
FDCC	Discharging current	0.001 to 32.0	0.001 A	NR4	0,1	○
(Full Discharge	Discharging time	0 to 59999	1 min	NR2		
CC)	Discharging terminal voltage	0.001 to 20.0	0.001 V	NR4		
	Rest time	0 to 59999	1 min	NR2		
FDCC ?					0,1	
FDCP	Discharging power	0.001 to 320.0	0.001 W	NR4	0,1	○
(Full Discharge	Discharging time	0 to 59999	1 min	NR2		
CP)	Discharging terminal voltage	0.001 to 20.0	0.001 V	NR4		
	Rest time	0 to 59999	1 min	NR2		
FDCP ?					0,1	

(10) Commands for charging/discharging before and after full charge/discharge

These commands enable the contents of worksheet OPTION to be set.

Command	Argument	Range	Default	NR	Mode	BUP
CAFD	Charging current after	0.001 to 32.0	0.001 A	NR4	0,1	○
(Charge After	full discharge					
Full Discharge)	Charging time after	0 to 59999	0 min	NR2		
	full discharge					
CAFD ?					0,1	
DBFC	Disharging current before	0.001 to 32.0	0.001 A	NR4	0,1	○
(Discharge Before	full charge					
Full Charge)	Disharging voltage before	0.001 to 20.0	0.001 V	NR4		
	full charge					
	Disharging time before	0 to 59999	0 min	NR2		
	full charge					
DBFC ?					0,1	

(11) Commands for test execution

These commands allow a test to be started, stopped, and restarted.

Command	Argument	Range	NR	Mode	BUP
IRUN (Initial RUN)	Channel number Worksheet number	1 to 8 1 to 8	NR2 NR2	1	—
RUN	Channel number Worksheet number	1 to 8 1 to 8	NR2 NR2	1	—
STOP	Channel number	1 to 8	NR2	1	—
MSTOP (Mode STOP)	Channel number	1 to 8	NR2	1	—
CSTOP (Cycle STOP)	Channel number	1 to 8	NR2	1	—
MSKIP (Mode SKIP)	Channel number	1 to 8	NR2	1	—
CONTINUE	Channel number	1 to 8	NR2	1	—
COUNTRST (COUNTer ReSeT) or QUIT	Channel number	1 to 8	NR2	1	—
RESET	(Channel number)	(1 to 8)	(NR2)	1,2	—

Stop and restart commands

The following are the five stop commands:

STOP: When this command is received, the tester is placed in IDLE status during initial charging or HOLD status when the tester is performing a cycle test.

MSTOP: When this command is received during charging, the tester is placed in HOLD status after completion of charging; when the command is issued during discharging, the tester is placed in HOLD status after completion of discharging.

CSTOP: When this command is received, the tester is placed in HOLD status after completion of the cycle test currently being executed.

MSKIP: When this command is received, the tester is switched from the charge or discharge test condition to rest status (Rest Time).

COUNTRST: When this command is received, the tester completes a cycle test if the specified channel is in HOLD status.

Use the following command to restart:

CONTINUE: When this command is received, the tester returns from the HOLD status resulting from a STOP, MSTOP, or CSTOP command to cycle status, and restarts the test.

(12) Read-back commands

These commands are used to obtain the status of each item.

Command	Returned value	Range	Contents	Mode
MON ch , ? (MONiter)			Shows the current status of a specified channel	1
	NR2	0 to 13, 20	Current status of the specified channel 0 : Idle 1 : Initial charging 2 : Cycle charging 3 : Cycle charging in rest status 4 : Cycle discharging 5 : Cycle discharging in rest status 6 : Discharging before full charging 7 : Full charging 8 : Full charging in rest status 9 : Full discharging 10 : Full discharging in rest status 11 : Charging after full discharging 12 : Hold 13 : End 14 : Last charge 20 : Alarm	
	NR2	1 to 99999	Number of current cycles	
	NR2	0 to 3599940	Elapsed time (s)	
	NR4	0.000 to 32.0	Measured current value (A)	
	NR4	0.000 to 20.0	Measured voltage value (V)	
	NR4	0.0 to 100.0	Measured temperature value (℃)	
RCCT ch , ? (Result of Charge Capacity Test)			Results of the charge test	1
	NR2	0 to 99	Year in which charging for the capacity test was begun	
	NR2	1 to 12	Month in which charging for the capacity test was begun	
	NR2	1 to 31	Day on which charging for the capacity test was begun	
	NR2	0 to 23	Time in hours when charging for the capacity test was begun	
	NR2	0 to 59	Time in minutes when charging for the capacity test was begun	
	NR2	0	Time in seconds when charging for the capacity test was begun	
	NR2	1 to 99999	Number of cycles of the capacity test	
	NR2	0.000 to 9999	capacity value (Ah)	
	NR2	0 : $-\Delta V$ 1 : $\Delta T/\Delta t$ 2 : Maximum voltage 3 : Charging time	Cause of termination of charging for the capacity test	
	NR4	0.000 to 20.0	Open voltage (V)	
	NR4	0.000 to 20.0	Charging start voltage (V)	
	NR4	0.000 to 20.0	Mean voltage (V)	
	NR2	0 to 3599940	Elapsed time until the maximum voltage was reached (s)	
	NR4	0.000 to 20.0	Maximum voltage (V)	
	NR4	0.000 to 20.0	Terminal voltage (V)	

Command	Returned value	Range	Contents	Mode
RDCT ch , ?			Results of the discharging test	1
(Result of Discharge	NR2	0 to 99	Year in which discharging for the capacity test was begun	
Capacity Test)	NR2	1 to 12	Month in which charging for the capacity test was begun	
	NR2	1 to 31	Day on which discharging for the capacity test was begun	
	NR2	0 to 23	Time in hours when discharging for the capacity test was begun	
	NR2	0 to 59	Time in minutes when discharging for the capacity test was begun	
	NR2	0	Time in seconds when discharging for the capacity test was begun	
	NR4	1 to 99999	Number of cycles of the capacity test	
	NR1	0 : OK 1 : NG	Judgment of the capacity test	
	NR4	0.000 to 9999	capacity value (Ah)	
	NR2	0 : Discharging time 1 : Terminal voltage	Cause of termination of full discharge	
	NR4	0.000 to 20.0	Open voltage (V)	
	NR4	0.000 to 20.0	Discharging start voltage (V)	
	NR4	0.000 to 20.0	c /2 voltage (V)	
	NR4	0.000 to 20.0	c voltage (V)	
	NR4	0.000 to 20.0	Mean voltage (V)	
LIFRSPS ch , ?			Results of life characteristics	1
(LIFe ReSPonSe)	NR2	0 to 99999	Number of cycles when the test is terminated	
or				
RLIFE ch , ?	NR2	0 to 99	NG counts of life judgment	
(Result of LIFE)				

(13) Waveform data read-back commands

These commands allow waveform data to be obtained for each item.

Command	NR	Range	Contents	Mode
GDV ch , ? (Graph Discharge Voltage)	NR2	1 to 8	Waveform data for the discharging voltage	1
GDC ch , ? (Graph Discharge Current)	NR2	1 to 8	Waveform data for the discharging current	1
GDT ch , ? (Graph Discharge Temperature)	NR2	1 to 8	Waveform data for the discharging temperature	1
GCV ch , ? (Graph Charge Voltage)	NR2	1 to 8	Waveform data for the charging voltage	1
GCC ch , ? (Graph Charge Current)	NR2	1 to 8	Waveform data for the charging current	1
GCT ch , ? (Graph Charge Temperature)	NR2	1 to 8	Waveform data for the charging temperature	1
POINTRESET ch or GRESET ch (Graph RESET)	NR2	1 to 8	All points of waveform data are reset	1

(14) Acquisition of waveform data

The tester continues charging/discharging waveform data (current, voltage, and temperature) in a capacity test until the next capacity test is begun or the tester is placed in IDLE status.

The amount of waveform data thus stored is limited to 1,024 points.

The point-sampling time is determined according to the set time.

Calculating sampling time

To charge waveform data, the point-to-point sampling time is determined according to the charging time; to discharge waveform data, the point-to-point sampling time is determined according to the discharging time. This sampling time can be calculated using the following equation:

Sampling time (s) = Charging time (s) ÷ 1024 + 1
(or discharging time)

Because the sampling time is controlled integer units numbers after the decimal point in division operations are discarded. The last "+1" is inserted to increase the discarded fractions to the nearest integer.

Example: If the charging time is 30 minutes

(30 x 60) ÷ 1024 = 1...because fractions below the decimal point are discarded

1 + 1 = 2 ... discarded fractions are increased to an integer

Thus, a sampling time of 2 [s] is obtained.

Data format for voltage and current

Current and voltage are expressed in hexadecimal form.

This hexadecimal data takes on different meanings depending on the condition of parallel operation as listed below.

Voltage VMax = FFFF(h) VMin = 0(h)

Current IMax = FFFF(h) IMin = 0(h)

	VMax (V)	VMin (V)	IMax (A)	IMin (A)
8CH	20	0	4	0
4CH	20	0	8	0
2CH	20	0	16	0
1CH	20	0	32	0

☆ The value "0" in VMin and IMin denotes the termination of a test.

☆ The VMax value does not change according to the voltage range.

Therefore, data can be converted into measured values using the following equations:

Voltage value = (VMax x obtained voltage data) ÷ 65535

Current value = (IMax x obtained current data) ÷ 65535

Temperature data format

Temperature data is expressed with an integral value after multiplying the measured value by 10. Therefore, to convert data back to a measured value, the following calculation must be performed:

Temperature value = Obtained temperature data ÷ 10

☆ The value "0" in temperature data denotes the termination of a test, as with the current and voltage data.

I/F commands

The following six commands are available for use to obtain waveform data:

- GCV
- GCC
- GCT
- GDV
- GDC
- GDT

These commands allow waveform data to be obtained 8 points at a time.

To obtain data for all 1024 points, the command must be executed 128 times.

In addition to the above six commands, there are the commands "POINTRESET" and "GRESET". These two commands serve the same purpose; they collectively reset the acquisition start pointer of each of the six commands for obtaining waveform data.

"POINTRESET" or "GRESET" must always be sent before waveform data can be obtained. When you begin to receive waveform data without sending either of these two commands, correct waveform data cannot be obtained if the acquisition start pointer is not in the correct position.

Once you have issued these commands, they do not need to be issued again until you receive more waveform data.

(15) Manual mode commands

These commands allow the tester to be set up for operation in manual mode and the settings to be read out.

Cmmand	Argument	NR	Contents	Mode
MCHG (Manual CHarGe)	Channel number Charging current Charging voltage	NR2 NR4 NR4	Sets charge in manual mode. * The charging voltage is invalid if OUTPUT is turned ON.	2
MDCHG (Manual DisCHarGe)	Channel number Disharging current Disharging rest voltage	NR2 NR4 NR4	Sets discharge in manual mode. * The discharging rest voltage is invalid if OUTPUT is turned ON.	2
OUT	Channel number Output	NR2 NR1	 0 : OFF 1 : ON	2
OUT ch , ?	Channel number	NR2		2
VOUT ch , ?	Channel number	NR2	Obtains a measured voltage value	2
IOUT ch , ?	Channel number	NR2	Obtains a measured current value	2
TEMP ch , ?	Channel number	NR2	Obtains a measured temperature value	2

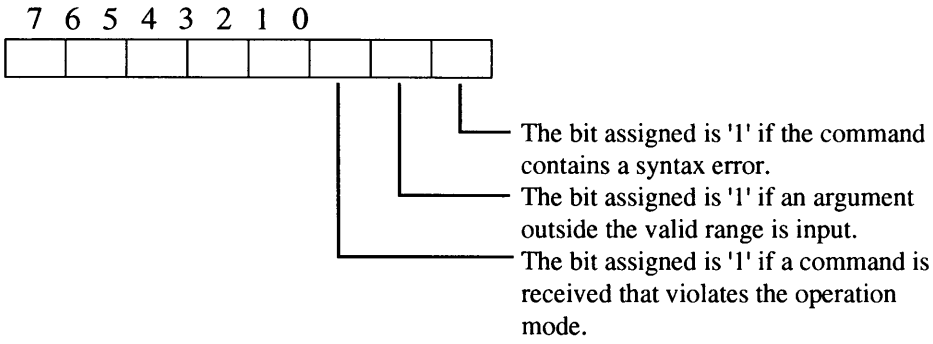
(16) System commands

These commands allow the system to be set up and the settings to be read out.

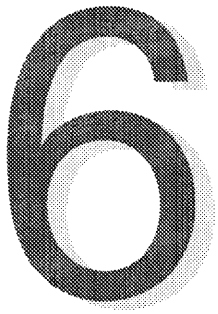
If your command input results in an error, the contents of the error are written into the error register.

The error register can be reset using an "ERR?" command.

The following shows the bit assignments in the error register:



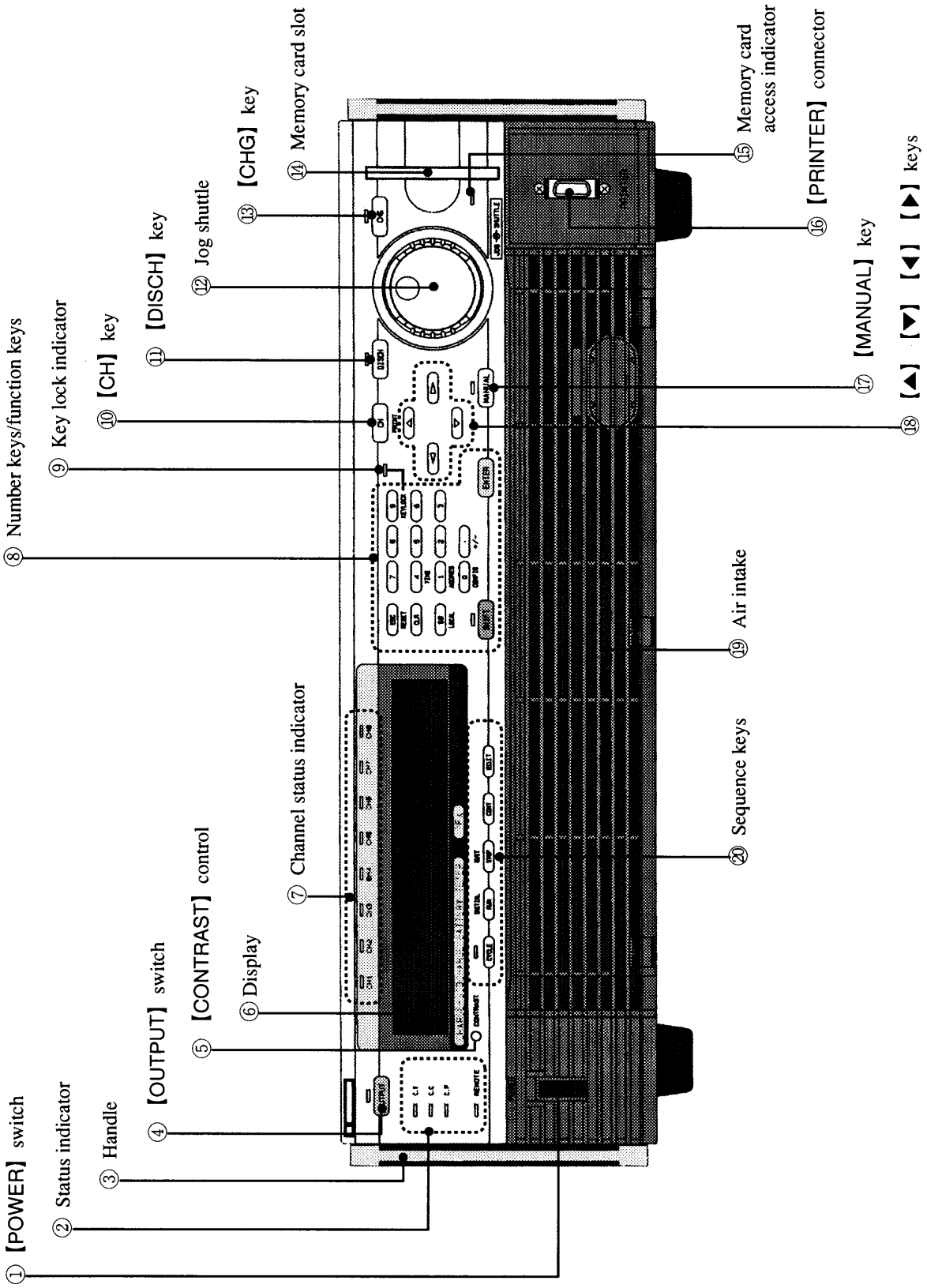
Command	NR	Contents	Mode
HEAD	NR1	0 : Does not add a header to the query messege. 1 : Add a header to the query messege.	0,1,2
HEAD ?		Returns [0 , 1]	0,1,2
IDN ?	string string string	Obtains the tester's model name. Obtains the tester's ROM version. Obtains the subCPU's ROM version.	0,1,2
ERR ?	NR2	Obtains the error code.	0,1,2



Chapter 6
Name and Function of Each Part

This chapter explains the switches, indicators, and connectors of the tester.

6.1 Front Panel



① 【POWER】 switch

This switch turns the power to the tester on and off.

The power switch can be shut off by an external signal.

② Status indicator

CV lamp: Lights when the channel shown on the display is operating at a constant voltage.

CC lamp: Lights when the channel shown on the display is operating at a constant current.

CP lamp: Lights when the channel shown on the display is operating at a constant power.

REMOTE lamp: Lights when the tester is controlled via GPIB.

③ Handle

Pull this handle out for use when carrying the tester or to protect the front panel during transport.

To pull out the handle for use, simultaneously slide the lock switches located on each side of the tester into the UNLOCK position.

④ 【OUTPUT】 switch

This switch turns the output on and off during operation in manual mode.

This switch does not function during a cycle test.

⑤ 【CONTRAST】 control

Use this control to adjust the contrast of the display.

⑥ Display

This display shows the voltage/current values in addition to various parameters, menus, and messages.

⑦ Channel status indicator

This indicates the operating status of each channel.

Red: Charging status

Green: Discharging status

Orange: Rest status

Off: Idle status

⑧ Number keys/function keys

Use these keys to input numeric values and choose menus and functions.

【ESC】 : Cancels operation or returns to the previous menu.

【CLR】 : Clears the currently input value.

【BS】 : Deletes the immediately preceding value.

【0】 - 【9】 : Use these keys to input a numeric value.

【SHIFT】 : Press this key to execute the function written in blue characters below the key. This key is valid when the SHIFT indicator is lit.

【ENTER】 : Press this key to confirm an input value. Pressing this key from the menu enables the parameter mode to be entered.

• RESET : 【SHIFT】 + 【ESC】

Resets an error and the alarm.

• LOCAL : 【SHIFT】 + 【BS】

Cancels remote control via GPIB.

• ADDRESS: 【SHIFT】 + 【1】

Enters the GPIB address setup mode.

• TIME : 【SHIFT】 + 【4】

Allows the time to be set.

• CONFIG : 【SHIFT】 + 【0】

Specifies the tester's operating environment.

• +/- : 【SHIFT】 + 【 · 】

Modifies the polarity of a numeric value.

• KEYLOCK: 【SHIFT】 + 【9】

Locks the front-panel keys. To unlock, press 【SHIFT】 + 【9】 again.

⑨ Key lock indicator

This indicator lights when the front-panel keys are locked using [SHIFT] + [9].

⑩ 【CH】 key

This key is used to choose a channel.

Channels can be changed by pressing a number key after the [CH] key.

⑪ 【DISCH】 key

This key is used to choose the discharging function in manual mode.

⑫ Jog shuttle

Turn this jog shuttle to incrementally increase or decrease a numeric value or scroll a menu.

⑬ 【CHG】 key

This key is used to choose the charging function in manual mode.

⑭ Memory card slot

This slot is used for inserting a memory card (included with your tester).

⑮ Memory card access indicator

This indicator lights when the memory card is accessed for reading or writing.

⑯ 【PRINTER】 connector

This is a 20P half-pitch connector used to connect printer cable.

⑰ 【MANUAL】 key

This key is used to manually operate the tester after setting the voltage and current without running a sequence.

⑱ 【▲】 【▼】 【◀】 【▶】 keys

These keys are used to scroll a menu in the vertical or horizontal directions.

⑲ Air intake

Cooling air is taken in through this opening.

⑳ Sequence keys

【CYCLE】 : This key is used to automatically perform charging/discharging. The indicator on the key lights when a CYCLE is selected.

【RUN】 : Press this key to execute a cycle test for the channel shown on the display.

【STOP】 : Press this key to temporarily stop a cycle test.

【CONT】 : Press this key to restart a cycle test after temporarily stopping it.

【EDIT】 : Press this key to set or modify test conditions and parameters.

· INITIAL : 【SHIFT】 + 【RUN】

Press these keys to perform a normal cycle test after executing an initial charge.

· QUIT : 【SHIFT】 + 【STOP】

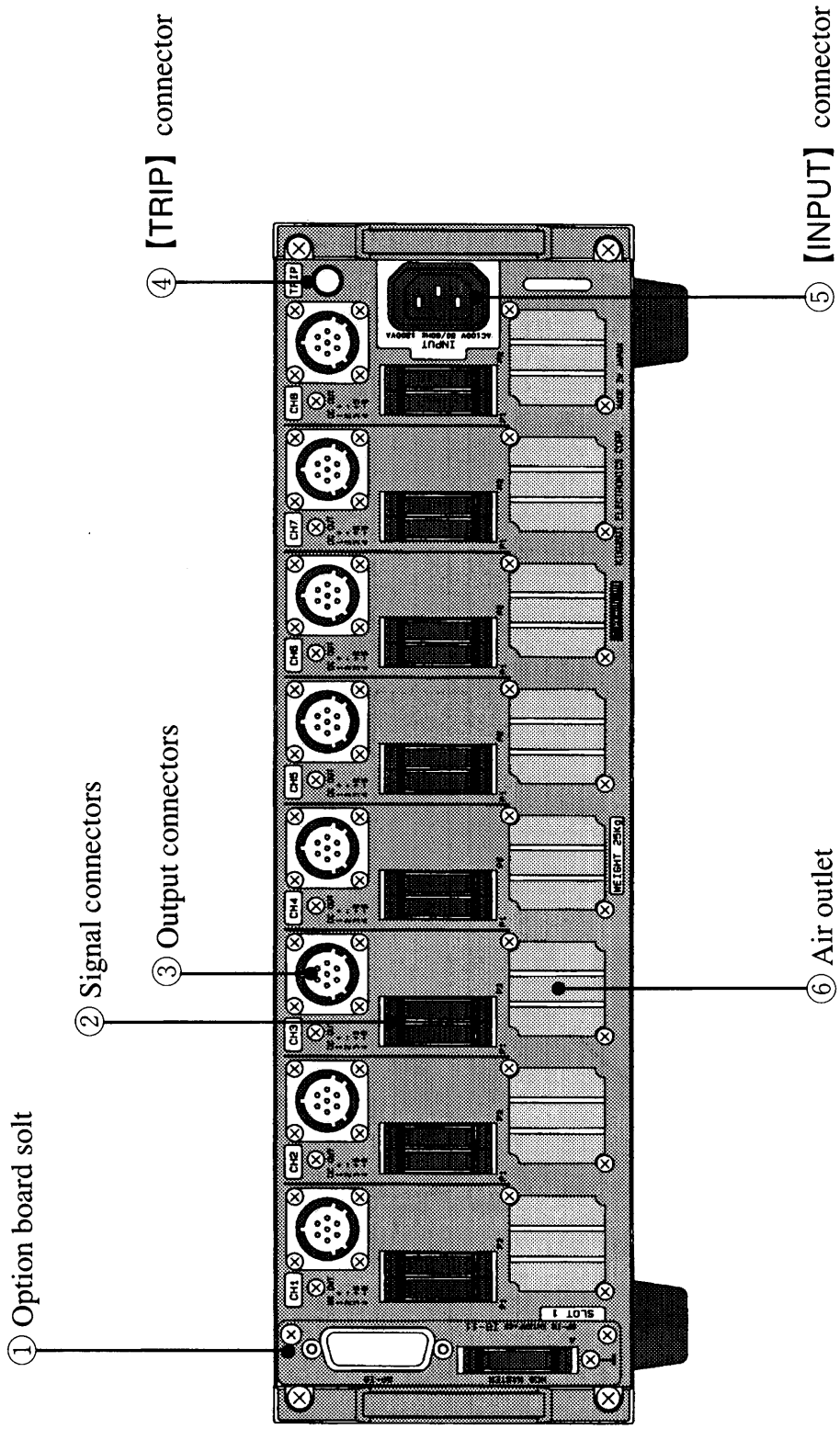
Press these keys to terminate a test.

A test is terminated by pressing the 【SHIFT】 + 【STOP】 keys after it is temporarily stopped using the 【STOP】 key.

Caution

- Using QUIT causes all test data in the current session to be lost.

6.2 Rear Panel



① Option board slot

This slot is used for inserting an interface board.

The tester comes standard with IB11 (GPIB interface board).

Two optional boards are available for the tester: RS11 (RS-232C interface board) and MC11S (MCB interface board).

② Signal connectors

These connectors are used to input/output various signals.

- Connect the thermistor to sense the temperature
- Connect the analog output to monitor the voltage/current

③ Output connectors

These connectors are used for connecting a battery.

④ 【TRIP】 connector

This connector is used for 【POWER】 switch shutoff and to measure external temperature.

- 【POWER】 switch shutoff

  The 【POWER】 switch is shut off when terminals are short-circuited.

  Use floating contacts with a contact capacity of 24 VDC, 0.2 A or more.

- External temperature measurement

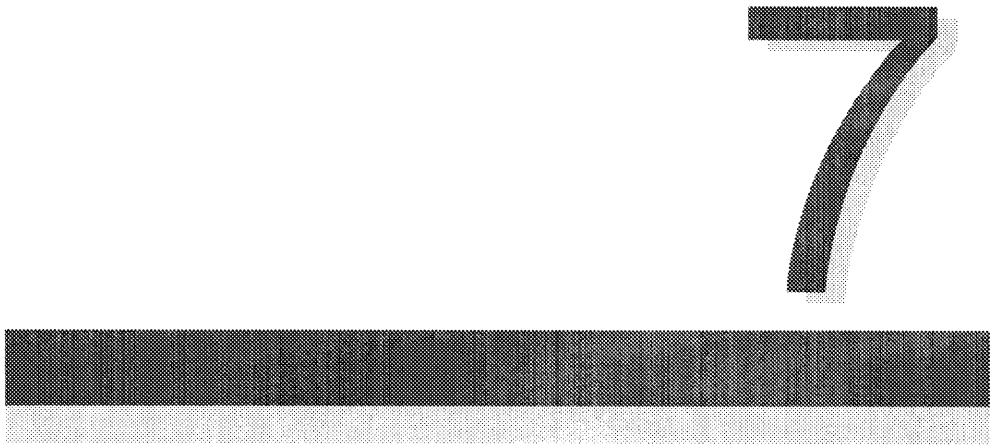
  Connect a thermistor between terminals.

⑤ 【INPUT】 connector

This connector is used to connect the input power cable.

⑥ Air outlet

Air is blown through this opening for cooling purposes.



Chapter 7
Maintenance and Calibration

This chapter describes how to maintain and calibrate the tester.

7.1 Cleaning the Tester

Caution

- Always be sure to turn off the [POWER] switch before cleaning the tester.

(1) Cleaning front panel

If the panel surface is dirty, clean the panel by gently wiping it with a soft cloth soaked in neutral detergent diluted with water.

Caution

- Do not use volatile solvents such as thinner or benzine. These solvents may discolor the panel surface, erase printed labels, or cloud the display.

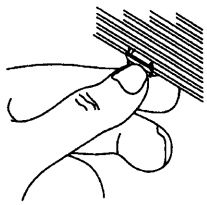
(2) Cleaning the dust filter

If the dust filter is clogged, various problems may occur, including deterioration of the tester's internal cooling effect, shortening of the useful life, and malfunctioning of the tester.

Periodically clean the filter before to prevent it from becoming clogged.

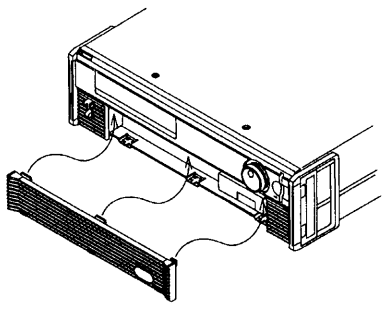
Removing the louver

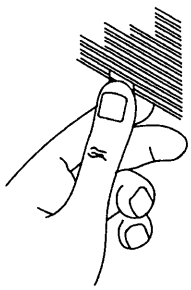
Push down the hooks at three locations.



Attaching the louver

Align the protrusions at the top of the louver with the indentations in the tester, then fit the louver into position and push in the hooks at three locations.





7.2 Inspecting the Tester

Power cable and auxiliary cable

Check for breakage in the sheathing and backlash or cracking in the plug or connector.

Caution

- A cable with broken sheathing is dangerous because it can cause an electric shock. Immediately discontinue use such a cable.

  To purchase a new accessory, contact your Kikusui agent.

7.3 Overhauling the Tester

The electrolytic capacitors and fan motor used in the tester are consumables.

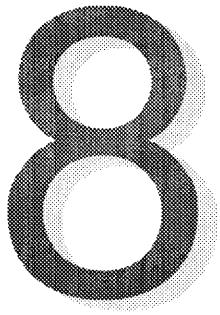
It is recommended that the tester be overhauled after every 10,000 hours of use with the power on as a means of inspecting and cleaning the tester's internal parts.

For overhauling of your tester, contact your Kikusui agent.

7.4 Calibrating the Tester

The tester is properly calibrated before being shipped from the factory. However, the tester's functional accuracy deteriorates over time, so the tester will require occasional calibration.

To calibrate your tester, contact your Kikusui agent.



Chapter 8 Specifications

In this chapter the tester's electrical and mechanical specifications are given.

8.1 Specifications

Item		Contents
Rated output	Charging/discharging voltage/current range	0 V to 10 V/ 0 A to 4 A (10 V range) 0 V to 20 V/ 0 A to 2 A (20 V range)
	Number of outputs	8 channels, with each output electrically isolated; channels can be connected in parallel. (Isolation voltage between each channel: 50 VDC)
Output stability	Constant-current stability	± (0.1%+1mA)
	Constant-voltage stability	± (0.05%+1mV)
Ripple	Constant-current ripple	Within 3 mA rms (DC to 500 kHz)
Analog monitor	Current monitor	0 V to 4 V output at 0 A to 4 A [accuracy : ± (1.0% + 10 mV)]
	Voltage monitor	0 V to 10 V output at 0 A to 20 V [accuracy : ± (1.0% + 10 mV)]
Protective function	Overvoltage protection (OVP)	Set voltage range: 1 mV to 20.001 V (OUTPUT turned off during operation)
	Undervoltage protection (UVP)	Set voltage range: 0 V to 20 V (OUTPUT turned off during operation)
	Overcurrent protection	Charging/discharging current (battery): Protected by an internal fuse Charging/discharging current (power supply): Protected by an internal fuse
	Overheat protection	Actuated when the internal heatsink temperature rises above 100℃.
	Input overcurrent protection	Protected by an internal fuse.
	Interlock	The [POWER] switch is shut off by an external signal (make contact).
Display	Display	20-column x 2-line LCD (liquid crystal display)
	Voltage	20.000 V display (FS) Error + (0.07% + 5 digits)
	Current	4.000 A display (FS) Error + (0.3% + 5 digits)
	Time	999H59M display
	Power	40.000 W display (displayed only when setting parameters)
	Cycle	9999 display
Temperature range	Operating temperature range	0 to +40°C
	Storage temperature range	–10 to +70°C
Humidity range	Operating humidity range	30% RH to 80% RH (without dew condensation)
	Storage humidity range	20% RH to 80% RH (without dew condensation)
Insulation resistance	Between the input and chassis	30MΩ or more at 500 VDC
	Between each output and the chassis	20MΩ or more at 50 VDC
Withstand voltage characteristics	Between the input and chassis	No problem shall occur when 1500 VAC is applied for one minute.
	Between the input and each output	No problem shall occur when 1500 VAC is applied for one minute.
Input characteristics	Input range	100 VAC ± 10%, single-phase, 50/60 Hz
	Power consumption	Approx. 1200 VA (when charging all channels with rated output) Approx. 100 VA (with no channel loads)

Item	Contents
External dimensions	Approx. 430 W x 132 H x 550 D mm (Max dimensions: approx. 450 W x 155 H x 613 D mm)
Weight	Approx. 20 kg
Accessories	Input power cable x 1 3P-2P conversion plug for the input power cable x 1 Output connector x 8 Signal connector x 16 Trip signal connector x 1 Memory card x 2 Memory card seal x 2 Filter seal x 2 WEIGHT seal x 1 Operation manual x 1
Options	RS-232C Interface MCB (Multi Channel Bus) interface SD01-PFX (Battery Performance Checker)

*1 At 23 ℃±5 ℃

*2 The constant voltage stability is measured with battery load. For details, see the description on constant voltage operation (page 2-5).

*3 At 23 ℃±5 ℃

8.2 Connector Pin Assignment

(1) Output connector

Pin No.	Name	Function
1	+	Positive current pin. Connect this to the + terminal of the battery.
2	-	Negative current pin. Connect this the - terminal of the battery.
3	+S	Positive voltage measurement pin. Connect this to the + terminal of the battery.
4	-S	Negative voltage measurement pin. Connect this to the - terminal of the battery.
5	GND	Grounding pin. This is Connected to the tester chassis.
6	NC	Unused.
7	NC	Unused.

(2) Signal connector P1

Pin No.	Name	Function
1	-S OUT	This pin outputs the -S signal of the connector via a 47Ω resistor.
2	+S OUT	This pin outputs the +S signal of the connector via a 47Ω resistor.
3	A GND	This pin is an analog ground.
4	V MON	This pin outputs the voltage across +S and -S (0V to 20V) with a 47Ω output impedance useing the analog ground as a common ground (0V to 10V).
5	A GND	This pin is an analog ground.
6	I MON 1	This pin outputs a voltage (0 to 4V) converting a current (0 to 4A). It has a 47Ω output impedance and uses the analog ground as a common ground.
7	A GND	This pin is an analog ground.
8	I MON 2	This pin outputs a voltage (0 to 4V) converting a current (0 to 4A). It has a 100Ω output impedance and uses the analog ground as a common ground. It outputs in negative voltages when discharging.
9	NC	Unused.
10	NC	Unused.
11	Th+	This pin connects a thermistor. Connect "103AT" here.
12	Th-	This pin connects a thermistor. Connect "103AT" here.
13	Th out-	This pin outputs a thermistor pin voltage (-) .
14	Th out+	This pin outputs a thermistor pin voltage (+) .
15	D GND	This pin is a digital ground (common with TRIG OUT).
16	TRIG OUT	This pin outputs an open-collector's ON signal for approximately 10 ms when the battery begins charging or discharging. This output is active low. Vce: 30 V max; Ic: 30 mA max.

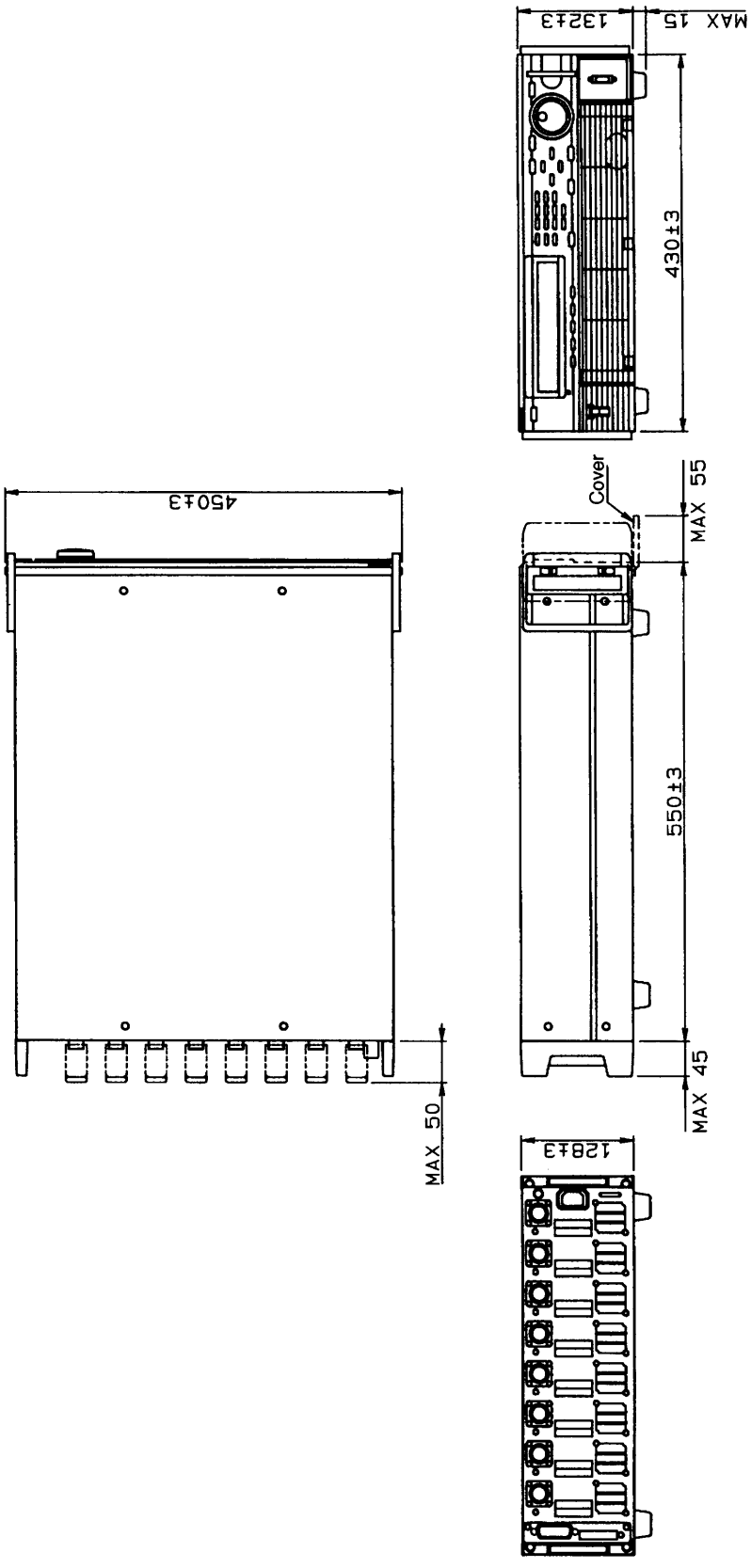
(3) Signal connector P2

Pin No.	Name	Function
1		Uses prohibited
2		
3		
4		
5		
6		
7		
8		
9	D GND	This is a common ground for P2 signals.
10	RESTSTS	This pin outputs a +5V CMOS signal indicating rest status. This output is active high.
11	DISCSTS	This pin outputs a +5V CMOS signal indicating discharging status. This output is active high.
12	CHGSTS	This pin outputs a +5V CMOS signal indicating charging status. This output is active high.
13	FINISH	This is an external sync signal input. This pin is pulled up to CMOS level +5V via a 10kΩ resistor. This input is active low (edge triggered).
14		Uses prohibited
15		
16		

(4) Trip signal connector

Pin No.	Name	Function
1	EX Th+	This pin connects a thermistor. Use "103AT" (manufactured by Ishizuka Electronics).
2	EX Th-	This pin connects a thermistor. Use "103AT" (manufactured by Ishizuka Electronics).
3	D GND	This pin is a common ground for Th ON.
4	Th ON	Connect this pin to D GND when measuring external temperature.
5	Trip 1	Connected to Trip 2 when the 【POWER】 switch is turned off.
6	Trip 2	Connected to Trip 1 when the 【POWER】 switch is turned off.

8.3 Dimensional Outline Drawing



Unit : mm

8.4 Optional Software SD01-PFX

The tester enables testing of a battery's characteristics and the recording of results through an external personal computer. This software designed specifically for this purpose is called Battery Performance Checker SD01-PFX (hereinafter referred to as the BP Checker).

(1) Outline

The BP Checker enables collective control of a maximum of six PFX40W-08 testers, i.e., up to 48 battery-testing channels, through a single personal computer. A record of test results can also be generated using this system.

The BP Checker features two operating modes: a life-cycle mode and a sequence mode. Either one of them can be chosen for use. In the life-cycle mode a battery's life characteristics can be tested under channel-to-channel test conditions (worksheets). Record test conditions in a folder (an information-storage system that can hold up to 99 worksheet files) and on worksheets (scenarios necessary for executing a test) so that tests can be conducted according to your specifications. In this way, the BP Checker automatically saves life test data for extended periods. The sequence mode is provided for the initial characteristics of a battery that cannot be set using the PFX40W-08 tester alone. In this mode a battery can be tested by sequentially changing test conditions (i.e., worksheets). A folder can be created for a combination of worksheets suited to the scenarios of your test. This enables the BP Checker to automatically manage a test under sequentially varied conditions, and to automatically save all measured data.

The BP Checker consists of the following five execution files:

1. PFX Config

This file sets the environment of the entire system and sets common items in the PFX unit.

2. Folder Editor

This editor allows the contents of a test to be written on worksheets and generates a folder to manage up to 99 of such worksheets. One folder can store multiple worksheets. In life cycle mode, one worksheet is chosen from the folder to conduct a test. In sequence mode, a test is conducted while test conditions are changed according to the worksheet sequence.

3. Test Executive

This file controls tests in each channel by executing and stopping a test and monitoring test status. It also automatically generates a test result file consisting of graphs and reports.

4. BPC Graph

This file processes result files by transforming them into graphs, changing the graph's range, superimposing graphs on top of each other, and generating a list of data in each file. It also outputs the results of processing to the display screen or a printer. This file can also be used to convert the result files to a text format.

5. BPC Spy

Because Test Executive features a DDE server function, it can be used to communicate with other programs. BPC Spy is an application based on this function, designed to intercept the data being monitored by the Test Executive. It allows data to be obtained that cannot be obtained as graph data.

In addition, by creating user applications featuring a DDE client function using Visual Basic, for example, BPC Spy can be used to issue commands to other GPIB equipment according to changes in the BP Checker's status.

Thus, the BP Checker allows sophisticated test system to be implemented to check battery performance. This could not be accomplished using the PFX40W-08 tester alone.

(2) Environmental requirements

The following environment is required for the BP Checker to operate efficiently:

■ Personal computer

- IBM PC/AT (or IBM compatible) or NEC PC-9801/9821 series supporting Windows 3.1
- The recommended CPU is i486DX/33 MHz or above
- The recommended memory size is 8 MB or more
- Available disk capacity of 20 MB or more
- A high-resolution (SVGA 1024 x 768 or above) video subsystem is recommended. The greater the number of open windows, the wider the required display screen.
- A 17-inch or 20-inch large-sized display is recommended.

■ Communication environment

- GPIB board

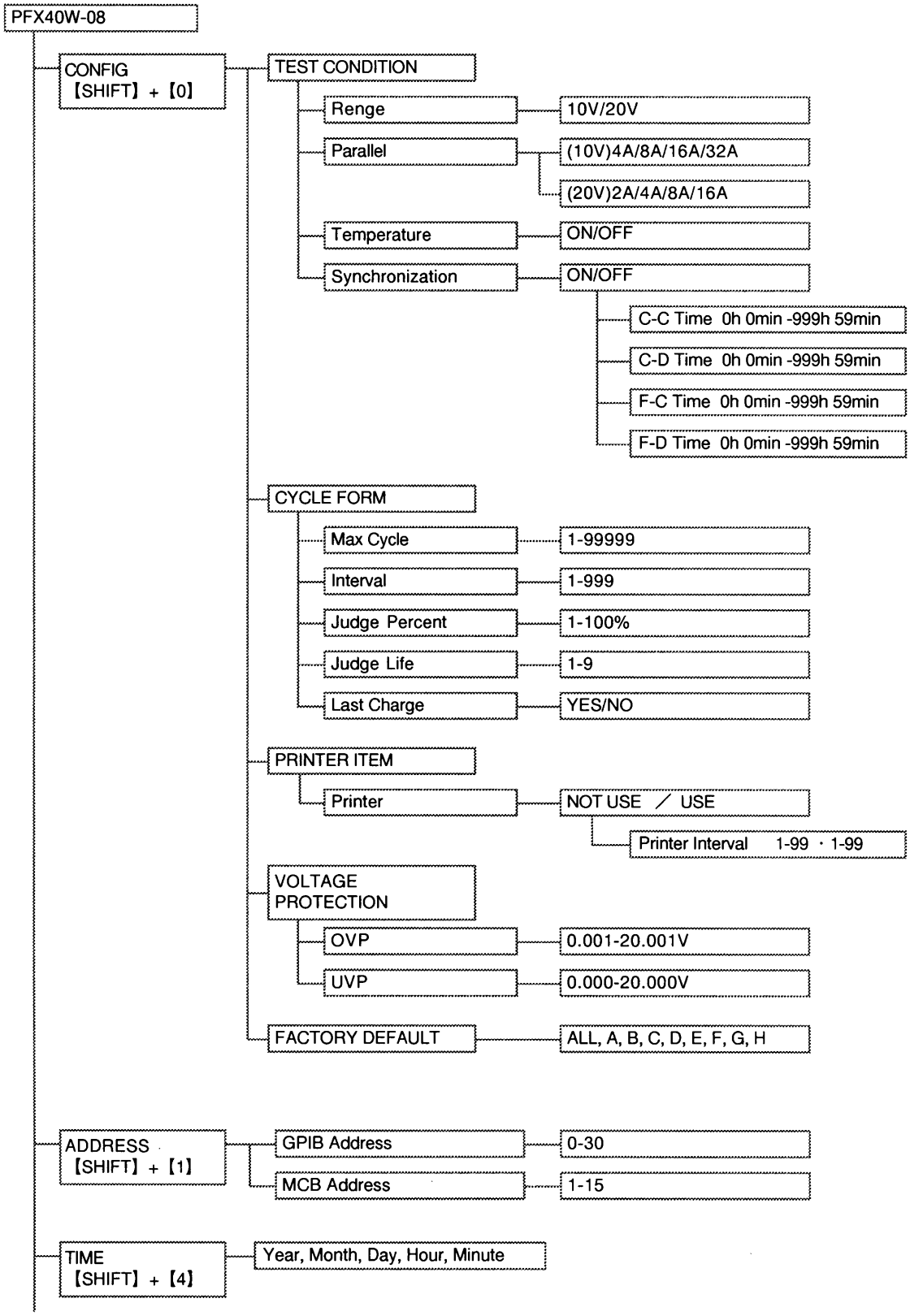
  Use one of the following three boards:

  NI-488.2 specification GPIB board from National Instruments
  GPIB board for Driver 488/WIN from IOtech
  PC-9801-29N board from NEC Corporation
- GPIB cable

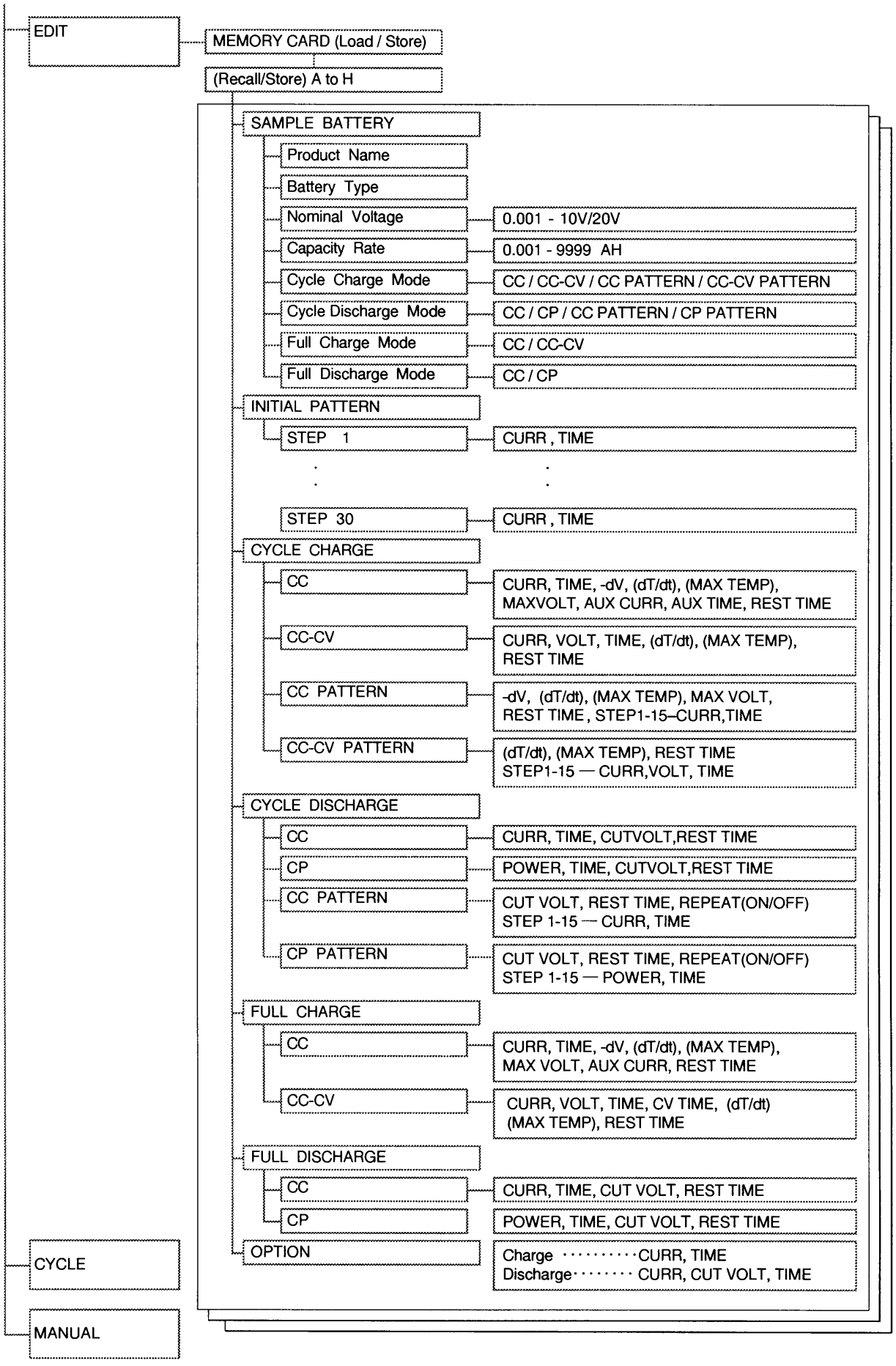
  One cable with a 24-pin connector in accordance with IEEE-488 GPIB standards is required each PFXtester used.

Appendix

Appendix 1 Menu Structure



Continued on the next page


EDIT
MEMORY CARD (Load / Store)
(Recall/Store) A to H
SAMPLE BATTERY
Product Name
Battery Type
Nominal Voltage
0.001 - 10V/20V
Capacity Rate
0.001 - 9999 AH
Cycle Charge Mode
CC / CC-CV / CC PATTERN / CC-CV PATTERN
Cycle Discharge Mode
CC / CP / CC PATTERN / CP PATTERN
Full Charge Mode
CC / CC-CV
Full Discharge Mode
CC / CP
INITIAL PATTERN
STEP 1
CURR , TIME
STEP 30
CURR , TIME
CYCLE CHARGE
CC
CURR, TIME, -dV, (dT/dt), (MAX TEMP), MAXVOLT, AUX CURR, AUX TIME, REST TIME
CC-CV
CURR, VOLT, TIME, (dT/dt), (MAX TEMP), REST TIME
CC PATTERN
-dV, (dT/dt), (MAX TEMP), MAX VOLT, REST TIME , STEP1-15–CURR,TIME
CC-CV PATTERN
(dT/dt), (MAX TEMP), REST TIME STEP1-15 — CURR,VOLT, TIME
CYCLE DISCHARGE
CC
CURR, TIME, CUTVOLT,REST TIME
CP
POWER, TIME, CUTVOLT,REST TIME
CC PATTERN
CUT VOLT, REST TIME, REPEAT(ON/OFF) STEP 1-15 — CURR, TIME
CP PATTERN
CUT VOLT, REST TIME, REPEAT(ON/OFF) STEP 1-15 — POWER, TIME
FULL CHARGE
CC
CURR, TIME, -dV, (dT/dt), (MAX TEMP), MAX VOLT, AUX CURR, REST TIME
CC-CV
CURR, VOLT, TIME, CV TIME, (dT/dt) (MAX TEMP), REST TIME
FULL DISCHARGE
CC
CURR, TIME, CUT VOLT, REST TIME
CP
POWER, TIME, CUT VOLT, REST TIME
OPTION
Charge ·····CURR, TIME
Discharge····· CURR, CUT VOLT, TIME
CYCLE
MANUAL

Appendix 2 Printer Output Examples of Factory Default Settings

```
UNIT  #1      Work Sheet  A                                  KIKUSUI  PFX
                                                               (Ver 1.05)

    ---- SAMPLE BATTERY ITEM ----
    Product Name          : *
    Battery Type          : *
    Nominal Voltage       : 0.001 V
    Capacity Rate         : 1.000 Ah
    Cycle Charge Mode     : CC
    Cycle Discharge Mode  : CC
    Full Charge Mode      : CC
    Full Discharge Mode   : CC

     ---- INITIAL PATTERN ----
    STEP     :     CURR     :     TIME
      1           0.001 A       0 h  1 min
      2           0.000 A       0 h  0 min
      3           0.000 A       0 h  0 min
      4           0.000 A       0 h  0 min
      5           0.000 A       0 h  0 min
      6           0.000 A       0 h  0 min
      7           0.000 A       0 h  0 min
      8           0.000 A       0 h  0 min
      9           0.000 A       0 h  0 min
     10           0.000 A       0 h  0 min
     11           0.000 A       0 h  0 min
     12           0.000 A       0 h  0 min
     13           0.000 A       0 h  0 min
     14           0.000 A       0 h  0 min
     15           0.000 A       0 h  0 min
     16           0.000 A       0 h  0 min
     17           0.000 A       0 h  0 min
     18           0.000 A       0 h  0 min
     19           0.000 A       0 h  0 min
     20           0.000 A       0 h  0 min
     21           0.000 A       0 h  0 min
     22           0.000 A       0 h  0 min
     23           0.000 A       0 h  0 min
     24           0.000 A       0 h  0 min
     25           0.000 A       0 h  0 min
     26           0.000 A       0 h  0 min
     27           0.000 A       0 h  0 min
     28           0.000 A       0 h  0 min
     29           0.000 A       0 h  0 min
     30           0.000 A       0 h  0 min

       ---- CYCLE CHARGE ----
    Current               :     0.001 A
    Time                  :   0 h  1 min
    -dV                   :       999 mV
    dT/dt                 :        99 °C/min
    Max Temp              :       100 °C
    Max Voltage           :     0.001 V
    Auxiliary Charge      :     0.001 A
    Auxiliary Time        :   0 h  1 min
    Rest Time             :   0 h  1 min

     ---- CYCLE DISCHARGE ----
    Current               :     0.001 A
    Max Time              :   0 h  1 min
    Cut Voltage           :     0.001 V
    Rest Time             :   0 h  1 min

       ---- FULL CHARGE ----
    Current               :     0.001 A
```

Worksheet

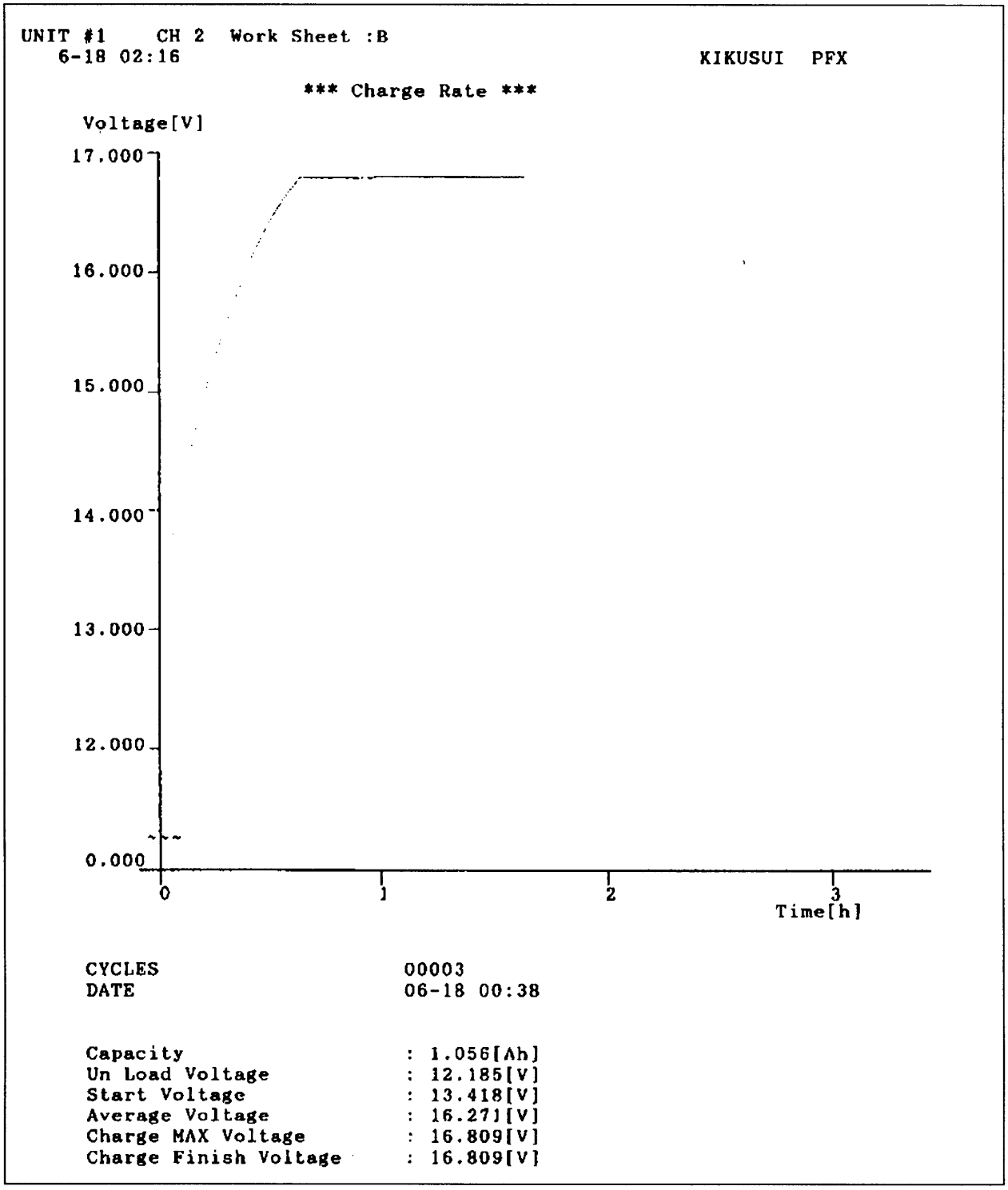
```
      Max Time            :   0 h  1 min
      -dV                 :      999 mV
      dT/dt               :       99 °C/min
      Max Temp            :      100 °C
      Max Voltage         :    0.001 V
      Auxiliary Charge    :    0.001 A
      Auxiliary Time      :   0 h  1 min
      Rest Time           :   0 h  1 min

       ---- FULL DISCHARGE ----
      Current             :    0.001 A
      Max Time            :   0 h  1 min
      Cut Voltage         :    0.001 V
      Rest Time           :   0 h  1 min

          ---- OPTIONALY ----
      Charge Current      :    0.001 A
      Charge Time         :   0 h  0 min
      Discharge Current   :    0.001 A
      Discharge Voltage   :    0.001 V
      Discharge Time      :   0 h  0 min
```

```
UNIT  #1                                          KIKUSUI  PFX
                                                     (Ver 1.05)

    ---- TEST CONDITION ----
   Range               : 20V
   Parallel            : 2A/8CH
   Temperature         : ON
   Synchronization     : OFF
   Sync Time C-C       :   0 h  1 min
   Sync Time C-D       :   0 h  1 min
   Sync Time F-C       :   0 h  1 min
   Sync Time F-D       :   0 h  1 min

      ----  TEST FORM ----
   Max Cycle           :     1
   Interval            :     1
   Judge Percent       :  80 %
   Judge Life          :     1
   Last Charge         :    NO

        ---- ADDRESS ----
   GPIB Address        :  1
   MCB Address         :  2

       ------- ETC -------
   Print Interval      :    1,  1
   OVP                 : 20.001 V
   UVP                 :  0.000 V
```

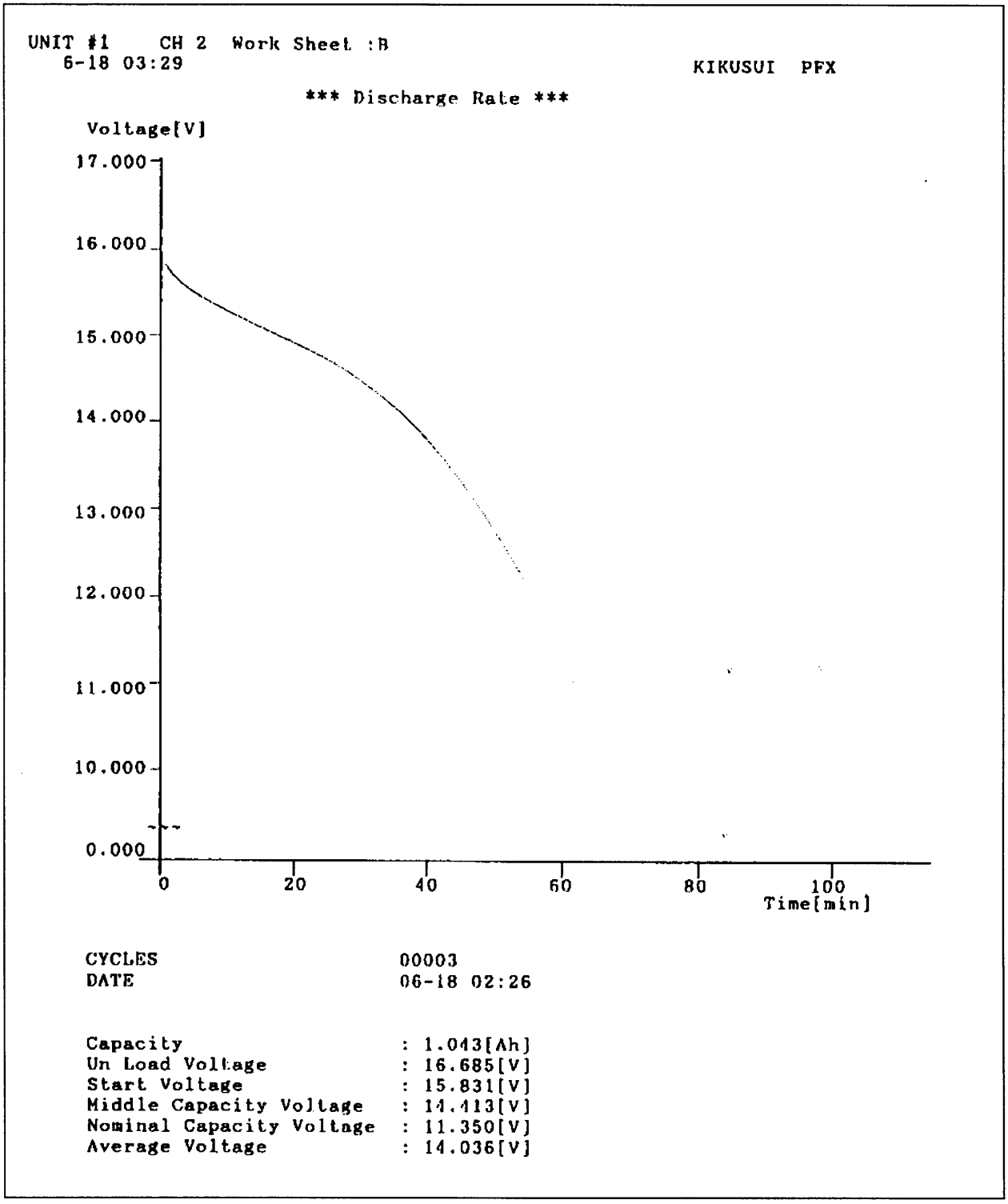
CONFIG

Appendix 3 Printer Output Samples

(1) Charging characteristic graph



(2) Discharging characteristic graph



(3) Charging/discharging data

UNIT #1 CH 2 KIKUSUI PFX

Start Time : 6-17 18:47

---- SAMPLE BATTERY ITEM ----
Product Name :
Battery Type : Li
Nominal Voltage : 14.400 V
Capacity Rate : 1.000 Ah
Cycle Charge Mode : CC
Cycle Discharge Mode : CC
Full Charge Mode : CC-CV
Full Discharge Mode : CC

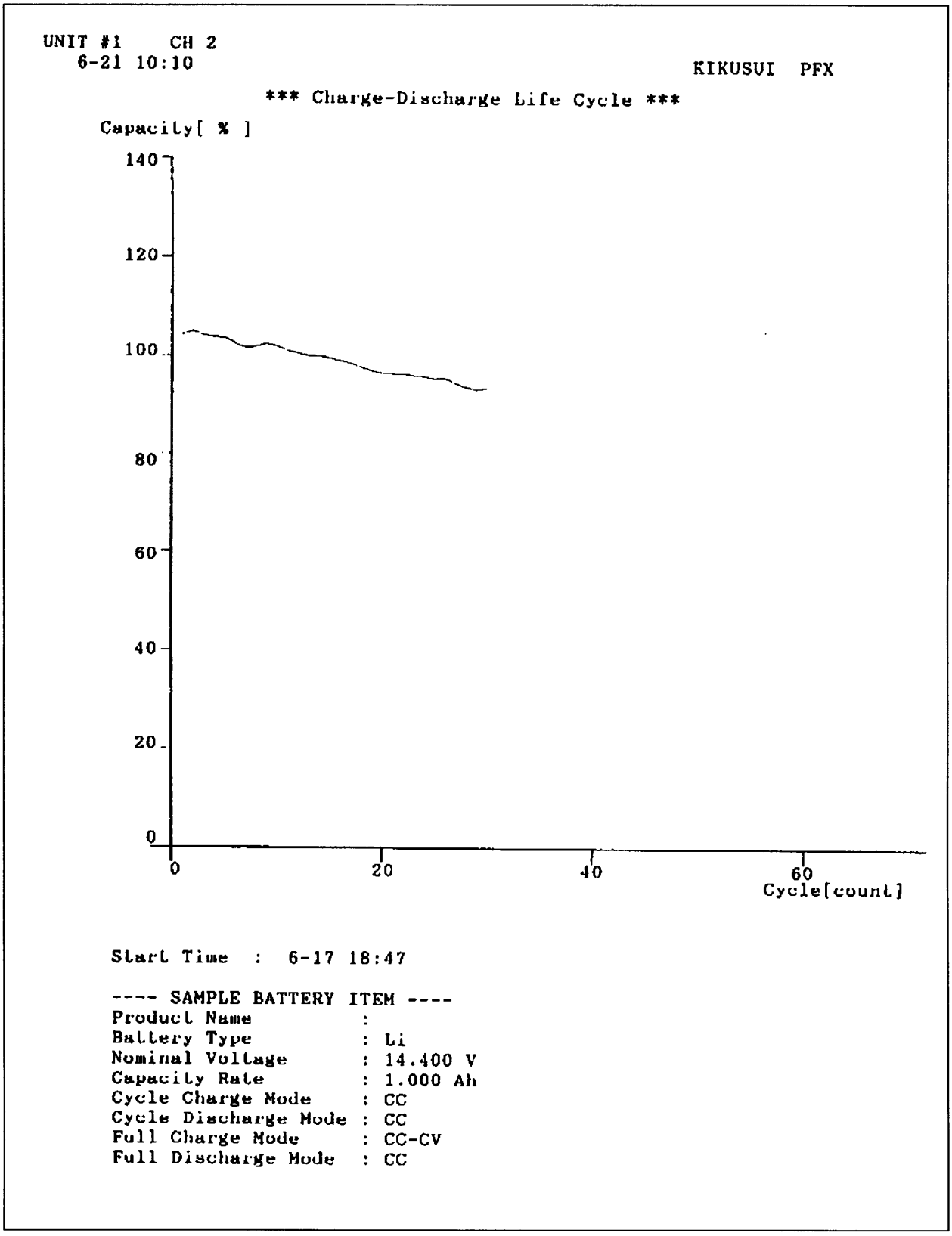
<< CHARGE >>

CYCLE	DATE	TIME	Ta	Capa [Ah]	Un Load Volt [V]	Start Volt [V]	Average Volt [V]	Charge MaxVol [V]	Charge FinVol [V]
00001	06-17	18:47		0.878	14.082	15.173	16.584	16.818	16.808
00002	06-17	21:35		1.067	12.161	13.388	16.264	16.823	16.809
00003	06-18	00:38		1.056	12.185	13.418	16.271	16.809	16.809
00004	06-18	03:39		1.050	12.201	13.439	16.276	16.809	16.809
00005	06-18	06:40		1.047	12.216	13.453	16.279	16.826	16.804
00006	06-18	09:40		1.041	12.219	13.454	16.280	16.809	16.809
00007	06-18	12:39		1.030	12.264	13.515	16.292	16.823	16.809
00008	06-18	15:37		1.023	12.294	13.556	16.301	16.809	16.809
00009	06-18	18:35		1.034	12.274	13.523	16.293	16.824	16.784
00010	06-18	21:33		1.033	12.273	13.511	16.291	16.814	16.808

<< DISCHARGE >>

CYCLE	DATE	TIME	Ta	Capa [Ah]	Un Load Volt [V]	Start Volt [V]	Middle Volt [V]	NomiCap Volt [V]	Average Volt [V]
00001	06-17	20:23		1.044	16.662	15.807	14.401	11.332	14.013
00002	06-17	23:25		1.051	16.690	15.842	14.422	11.409	14.036
00003	06-18	02:26		1.043	16.685	15.831	14.413	11.350	14.036
00004	06-18	05:27		1.039	16.685	15.828	14.409	11.317	14.033
00005	06-18	08:28		1.038	16.685	15.832	14.419	11.318	14.043
00006	06-18	11:28		1.026	16.679	15.809	14.392	11.203	14.027
00007	06-18	14:26		1.017	16.674	15.796	14.386	11.120	14.023
00008	06-18	17:23		1.019	16.668	15.789	14.377	11.123	14.014
00009	06-18	20:22		1.026	16.682	15.822	14.409	11.231	14.048
00010	06-18	23:21		1.021	16.683	15.817	14.404	11.178	14.045

(4) Life characteristic graph



GLOSSARY

END status

This is charging/discharging test completed, IDLE status can be entered from this status.
(Channel number, [END], time and number of cycle at the test completed are shown on the display.)

HOLD status

This is charging/discharging test is temporarily stopped, the test can be continued or IDLE status can be entered from this status.
(Channel number, [HOLD], time and number of cycle at the test is stopped are shown on the display.)

IDLE status

This is no relation to any test such as the 【POWER】 switch is just turned on.
(Channel number and [IDLE] are shown on the display.)

OVP

This means Over Voltage Protection. This function protects load from excessive output voltage. Set it on the VOLTAGE PROTECTION display of the CONFIG menu.
(Channel number and [ALARM] are shown on the display, and the output voltage is turned off.)

UVP

This means Under Voltage Protection. This function protects load when output voltage goes too down. Set it on the VOLTAGE PROTECTION display of the CONFIG menu.
(Channel number and [ALARM] are shown on the display, and the output voltage is turned off.)

Initial charging/discharging

This is preparatory charging/discharging before starting a test. Set it on the INITIAL PATTERN display of the CONFIG menu.

Memory effect

For alkali battery, this is discharging voltage temporarily goes down at full discharging test during cycle charging/discharging.

Capacity test

This is a series of cycles each consisting of full charge and full discharge. Interval of capacity test, and charging/discharging before and after capacity test can be set.

Charging after capacity test

This is charging function to return to normal cycles after capacity test.
Set it on the OPTION display of worksheet.

Discharging before capacity test

This is discharging function to measure the exact charging capacity before capacity test.
Set it on the OPTION display of worksheet.

Root display

This is the highest rank display. The model name is displayed.
CONFIG, ADDRESS, TIME, EDIT, CYCLE or MANUAL menu can be entered from this display.

INDEX

Commands