HIOKI

INSTRUCTION MANUAL

3645-20

VOLTAGE LOGGER

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing this HIOKI "3645-20 VOLTAGE LOGGER." To get the maximum performance from the unit, please read this manual first, and keep this at hand.

Inspection

When the unit is delivered, check and make sure that it has not been damaged in transit. If the unit is damaged, or fails to operate according to the specifications, contact your dealer or HIOKI representative.

Accessories

9639 CONNECTION CABLE
9632 CONNECTION CABLE
Instruction Manual
LR03 alkaline battery X 4 (built into this unit, for monitor)

Before using the product the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.

NOTE

- Testing monitor batteries installed in the unit may possibly be weak. Replace batteries before extended measurement usage.
- Before using the product, make sure that the insulation on the cables is undamaged and that no bare conductors are improperly exposed. Using the product in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.

Safety Notes

This equipment is designed according to IEC 61010 Safety Standards, and has been tested for safety prior to shipment. Incorrect measurement procedures could result in injury or death, as well as damage to the equipment. Please read this manual carefully and be sure that you understand its contents before using the equipment. The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its product.

This Instruction Manual provides information and warnings essential for operating this equipment in a safe manner and for maintaining it in safe operating condition. Before using this equipment, be sure to carefully read the following safety notes.

Safety Symbols

- This symbol is affixed to locations on the equipment where the operator should consult corresponding topics in this manual (which are also marked with the ⚠ symbol) before using relevant functions of the equipment.
- In the manual, this mark indicates explanations which it is particularly important that the user read before using the equipment.

Indicates DC (Direct Current).

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

 DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
 WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
	Denotes items of advice related to performance of the equipment or to its correct operation.

Accuracy

The specifications in this manual include figures for "measurement accuracy" when referring to digital measuring instruments, and for "measurement tolerance" when referring to analog instruments.

f.s. (maximum display or scale value, or length of scale)
Signifies the maximum display (scale) value or the length of the scale (in cases where the scale consists of unequal increments or where the maximum value cannot be defined).
In general, this is the range value (the value written on the range selector or equivalent) currently in use.

rdg. (displayed or indicated value)
This signifies the value actually being measured, i.e., the value that is currently indicated or displayed by the measuring instrument.

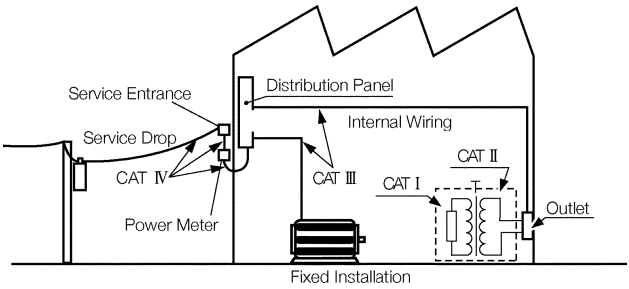
dgt. (resolution)
Signifies the smallest display unit on a digital measuring instrument, i.e., the value displayed when the last digit on the digital display is "1".

Measurement categories (Overvoltage categories)

This product complies with CAT I safety requirements.
To ensure safe operation of measurement product, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. These are defined as follows.

CAT I	Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.
CAT II	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
CAT III	Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.
CAT IV	The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement device designed for CAT III environments can endure greater momentary energy than a device designed for CAT II. Using a measurement product in an environment designated with a higher-numbered category than that for which the product is rated could result in a severe accident, and must be carefully avoided.
Never use a CAT I measuring product in CAT II, III, or IV environments. The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



Notes on Use

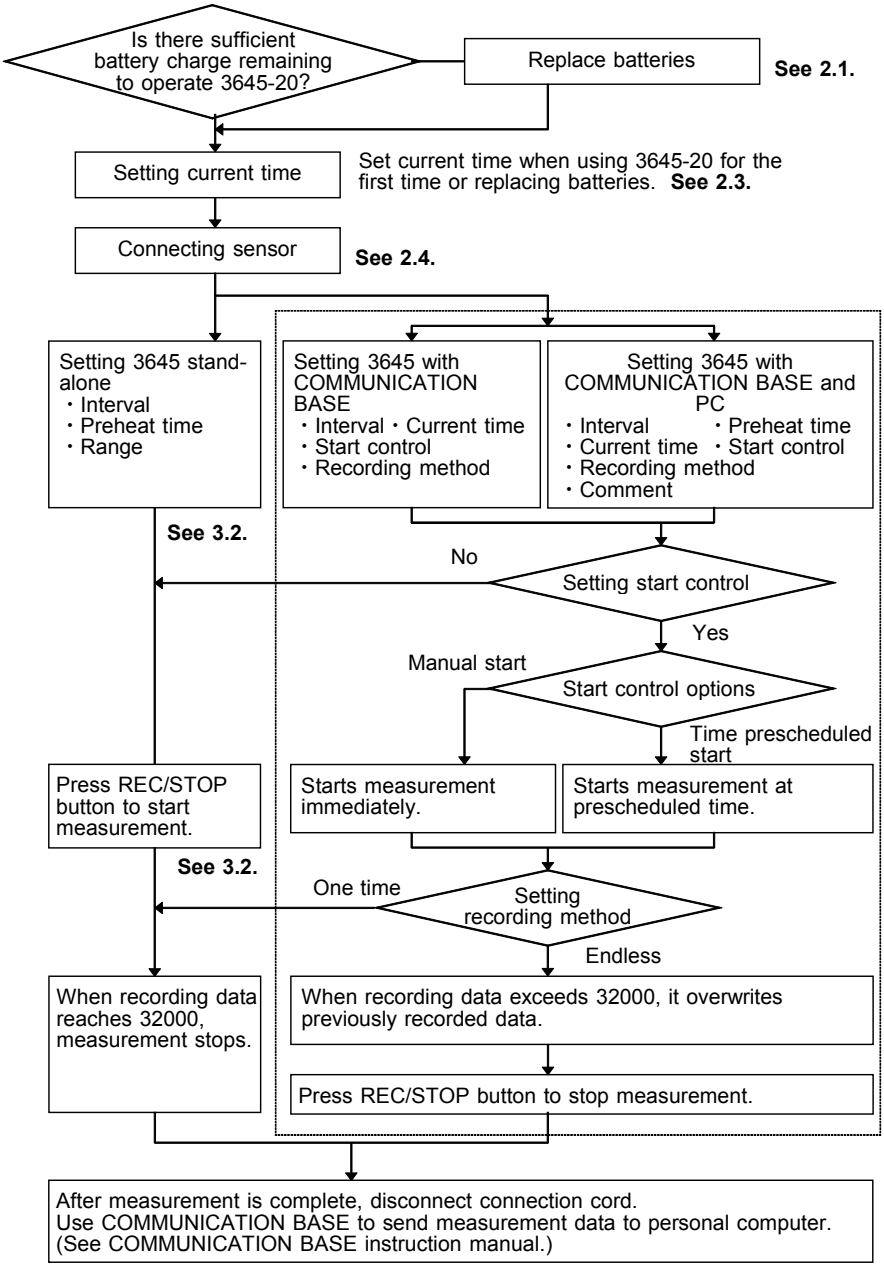
In order to ensure safe operation and to obtain maximum performance from the unit, observe the cautions listed below.

The maximum input voltage is ±60 V DC. Attempting to measure voltage in excess of the maximum input could destroy the product and result in personal injure or death.

- **To avoid electric shock, do not allow the product to get wet, and do not use it when your hands are wet.**
- **To avoid electric shock, shut off the line power supply before connecting the connection cable to the terminals.**

- To avoid electric shock, before replacing the connection cable, remove the all connection cable from the device to be measured.
- To avoid damaging connection cable (especially where the leads connect to the probes), do not kink or pull on the leads.
- This product is designed for indoor use, and operates reliably from 0℃ to 40℃.
- Do not store or use the product where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the product may be damaged and insulation may deteriorate so that it no longer meets specifications.
- This product is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.

Measurement Flow Chart and Reference Guide

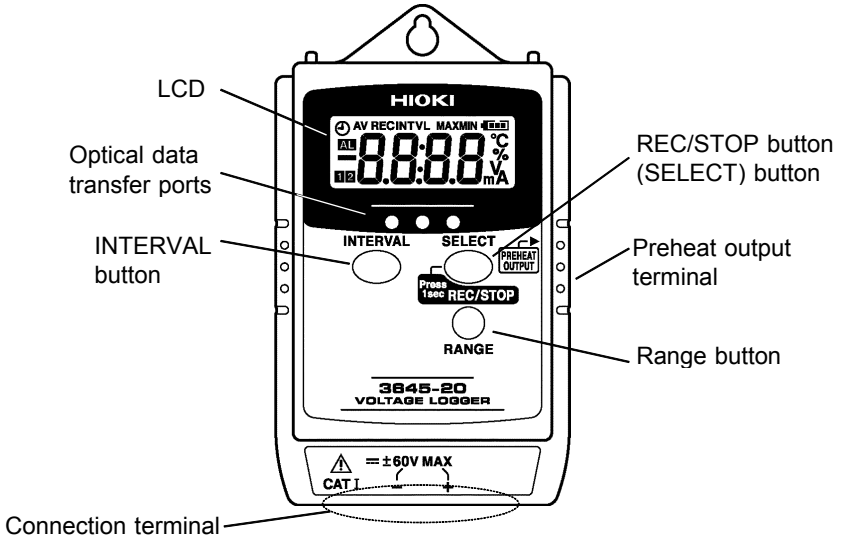


Chapter 1
Product Outline

3645-20 VOLTAGE LOGGER enables measurement with intervals and recording up to ±50 VDC.
This logger is designed with four measurement ranges covering ±50 mV to ±50 V, to enable measurement of the outputs of various types of sensors, and the voltages of diverse devices and power supplies. The 3645-20 comes equipped with a Preheat function. When a synchronized Preheat signal is used in the measurement, the logger allows control of the power supply to various types of sensors. Data is saved in nonvolatile memory when batteries are weak or removed for replacement.

NOTE 3645-20 cannot be set with 3910-20 COMMUNICATION BASE. Use 3911-20, 3912-20 COMMUNICATION BASE to set 3645-20.

1.1 Name and Functions of Parts



LCD	Displays measurement value and settings.
Optical data transfer ports	Enables optical data transfer to COMMUNICATION BASE.
INTERVAL button	Calls up interval setting display to set interval and preheat time.
Connection terminal	Connects 9639 CONNECTION CABLE.
REC/STOP button	Pressing more than 1 second initiates or stops recording.
(SELECT) button	Interval is selected in interval setting display.
Preheat output terminal	When the 9632 CONNECTION CABLE is plugged into this terminal, it outputs the Preheat signal (open-collector output).
RANGE button	Changes measurement range from 50 mV/500 mV/5 V/50 V.

1.2 Interval and Maximum Recording Time

Interval and maximum recording time (when power save function is valid) are as follows.
Maximum recording time is limited by battery charge condition. Maximum recordable data is 32000 per unit.

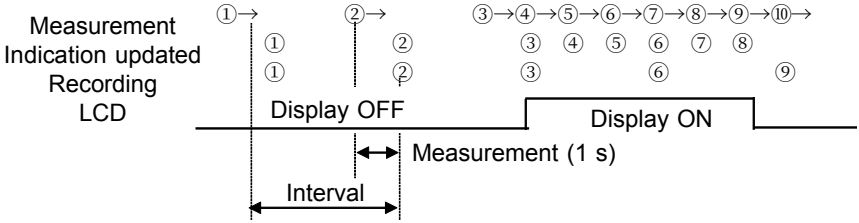
INTVL	Maximum Recording Time
1 s	8 h 53 min 20 s
2 s	17 h 46 min 40 s
5 s	1 day 20 h 26 min 40 s
10 s	3 day 16 h 26 min 40 s
15 s	5 day 13 h 20 min
20 s	7 day 9 h 46 min 40 s
30 s	11 day 2 h 40 min
1 min	22 day 5 h 20 min
2 min	44 day 10 h 40 min
5 min	111 day 2 h 20 min
10 min	222 day 5 h 20 min
15 min	333 day 8 h
20 min	444 day 10 h 40 min
30 min	666 day 6 h
60 min	1333 day 8 h

1.3 Timings of Measurement

When Preheat is OFF

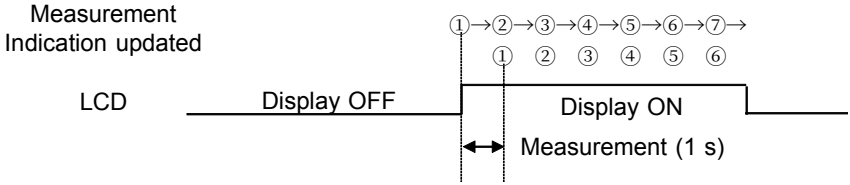
(1) Recording ("**REC**" on)

In the recording mode, the unit conducts measurement once the preset recording interval has elapsed. It then records the measurement value and updates the LCD indication. When the power-save function is disabled, or when the power-save function is active and any button is pressed to restart the LCD indicator, the unit conducts measurement every second and updates the LCD indication only, until the preset recording interval elapses.



(2) Monitoring ("**REC**" off)

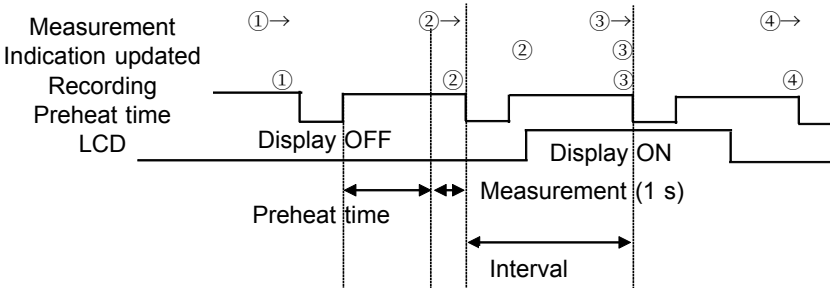
In the monitoring mode, the unit conducts measurement every second and updates the LCD indication.



When Preheat is ON

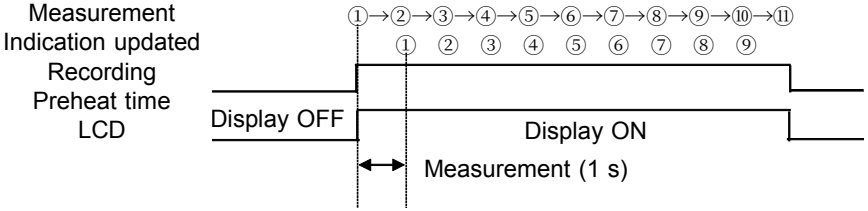
(1) Recording ("**REC**" on)

In the recording mode, the unit first outputs the Preheat signal once the preset recording interval has elapsed, and then conducts measurement. It records the measurement value and updates the LCD indication.



(2) Monitoring ("**REC**" off)

In the monitoring mode, the unit conducts measurement every second and updates the LCD indication. In this condition, the unit delivers the Preheat signal permanently.



NOTE If the Preheat function is active, the measurement value recorded in the immediately preceding measurement is displayed in Recording ("**REC**" on) until the recording interval elapses, allowing the following measurement to be conducted. When the power-save function is active and any button is pressed to conduct monitoring, quite some time may be required for stable measurement values to be obtained, depending on the response time of the connected sensor (time required for the output to stabilize after the sensor is powered up).

Chapter 2
Set Up

2.1 Replacing the Battery

WARNING

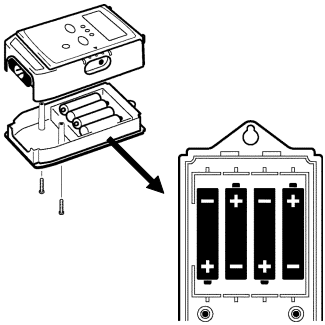
- **During battery replacement, use caution not to put any foreign materials such as a metal object into the unit to avoid damage to the unit.**
- **Before using the product after replacing the batteries, replace the cover and screw.**
- **Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.**
- **Handle and dispose of batteries in accordance with local regulations.**

⚠CAUTION When exchanging the batteries, the circuit may sometimes short circuit due to static electricity. As far as possible, do not touch the base board with bare hands.

Installing new batteries ensures about 1 year of recording. (reference value with interval setting set to 1 minute or more, preheat is OFF and power save setting set to valid and at 20℃) Remaining battery power indicator (▮▮▮) indicates remaining battery life reducing incrementally from right. Empty battery power indicator (▮) indicates time to replace batteries.

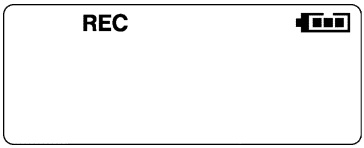
1. Remove back cover screw to remove cover. Verify polarity and install four new LR03 alkaline batteries.

2. Fit cover properly and tighten screw.



2.2 Power Save Function

Display window is automatically turned off in approximately 15 seconds after last key entry. (Sleep) However, while recording, **REC**/ ▮▮▮/ 🕘 mark shows each conditions.



Sleeping.....

Press any button to turn display on to display measurement value or to set settings.
Note when interval setting display is on, sleep does not engage with no button press.

Initially, power save function is on. To turn off power save function, follow the instructions below.
When power save function is off, maximum continuous duration is approximately 20 days.

1. Connect logger, COMMUNICATION BASE and personal computer.
2. Start up application software packaged with COMMUNICATION BASE.
3. Go to Communications on the menu bar and select Power Save Options. Choose Off to turn off power save function.

NOTE See COMMUNICATION BASE instruction manual to connect logger and to install application software. To use application software, see operation guide.

2.3 Setting Current Time

When replacing 3645-20 VOLTAGE LOGGER batteries or using 3645-20 stand-alone (with manual operation) for the first time, connect with COMMUNICATION BASE and set current time.

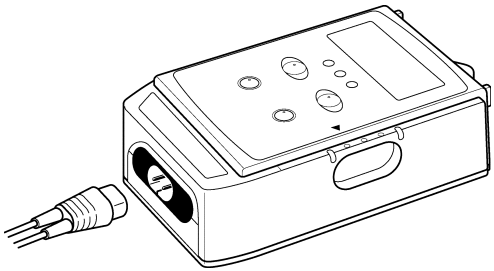
See how to set current time in COMMUNICATION BASE instruction manual.

2.4 Connecting 9639 CONNECTION CABLE

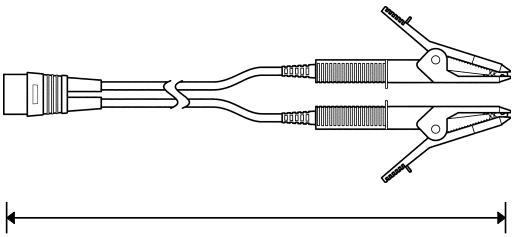
WARNING

- **If the end of the 9639 CONNECTION CABLE short-circuits lines with a voltage between them, this is very dangerous and can lead to a serious accident. Exercise great care when measuring voltages.**
- **The maximum input voltage is ±60 VDC. Do not measure voltage in excess of these limitations, as doing so may damage the unit or cause an accident that might result in injury or death.**

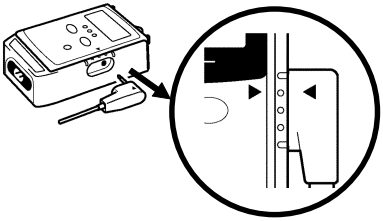
Connect 9639 CONNECTION CABLE to 3645-20.



9639 CONNECTION CABLE



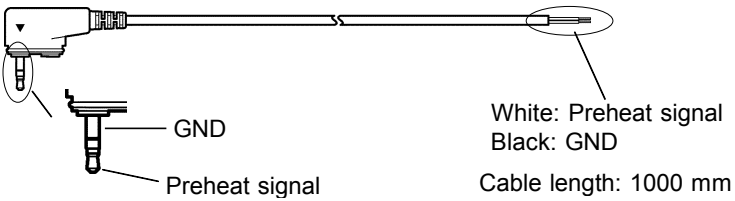
2.5 Preheat Signal



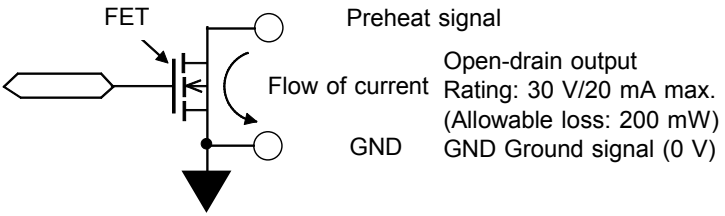
Plug in the 9632 CONNECTION CABLE.
To do so, insert the cable with the ▲ mark on the connection terminal that matches the ▲ mark on the connection cable.

Inappropriate insertion of the cable is likely to result in malfunction of the unit. Particularly following communication with the COMMUNICATION BASE connected to the unit, make sure the connection terminal is not mistakenly lifted.

(1) 9632 CONNECTION CABLE



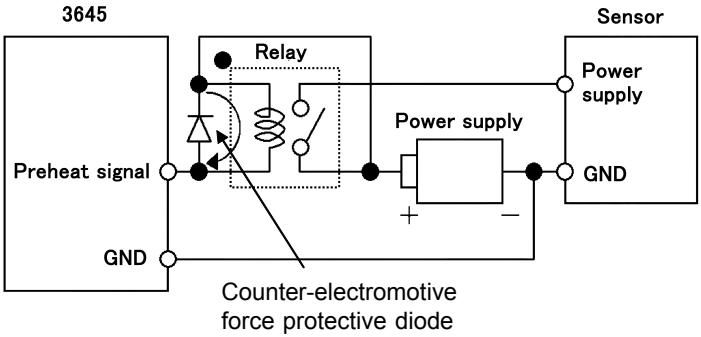
(2) Internal Circuit (Preheat Signal)



*Open-drain output
The switch (FET), which is inserted between the Preheat signal and the GND signal, turns on when this signal becomes active (in Preheat mode).
Make a connection such that the current will flow from the Preheat signal toward the GND.

(3) Example of a Preheat-Signal Connection Circuit

The Preheat signal controls the sensor power on/off. Connect the 3645-20 to a sensor, power supply, and relay in the manner illustrated below.



Confirm that the power supply to be used does not exceed the ratings (30 V, 20 mA max.) of the Preheat signal.
When selecting a relay, note its ratings (voltages and currents to be imposed on the coil and the relay contacts) and the polarity of the coil.
When connecting a relay, be aware that the circuit may be destroyed by a counter-electromotive force generated when the relay is turned on/off. To prevent such destruction of the circuit, always insert a protective diode in the manner illustrated above.

Chapter 3
Settings

3.1 Setting Items

Logger stand-alone manual settings and settings in combination with COMMUNICATION BASE with measurement conditions stored in memory loaded from personal computer.

	3645-20	3645-20＋ COMMUNICATION BASE	3645-20＋ COMMUNICATION BASE＋PC
1. Start recording	Vaild	Vaild	Vaild
2. Stop recording	Vaild	---	---
3. Interval setting	Vaild	Vaild	Vaild
4. Preheat time setting	Vaild	---	Vaild
5. Current time setting	---	Vaild	Vaild
6. Start control	---	Vaild	Vaild
7. Recording method setting	---	Vaild	Vaild
8. Range setting	Vaild	---	Vaild
9. Comments	---	---	Vaild

NOTE The Setup of Preheat Time and Comment is valid only where the PC, the COMMUNICATION BASE, and the 3645 are interconnected.

1. Start recording

Start manual recording by pressing logger REC/STOP button for 1 second or initiate by time prescheduled start set using COMMUNICATION BASE.
When time scheduled start is engaged, "🕘" icon appears in display.
When batteries are weak, recording does not start. During recording, weak battery interrupts recording.

Manual start

During recording

Time prescheduled start

Prescheduled

During recording

The "🕘" icon will dim after recoring begins.

2. Stop recording

Stop recording by pressing logger REC/STOP button for 1 second.Or recording stops automatically when data is full when set to recording method: one time.

3. Interval setting

Set interval with logger alone or using COMMUNICATION BASE.
(1/2/5/10/15/20/30 s, 1/2/5/10/15/20/30/60 min)

4. Setting of Preheat Time

The Preheat time can be set for the 3645 alone or when the 3645, the COMMUNICATION BASE, and a PC are interconnected. The Preheat time can be chosen from among eight settings (OFF/0.5 sec/1 sec/2 sec/5 sec/10 sec/30 sec/60 sec).

NOTE A Preheat time longer than the recording interval cannot be set.

5. Current time setting

To set current time, see COMMUNICATION BASE instruction manual.

6. Start control

Set specific recording date and time using COMMUNICATION BASE to engage time scheduled start. When time scheduled start is engaged, "🕘" icon appears in display. The "🕘" icon will dim after recoring begins.

7. Recording method setting

Set recording method using COMMUNICATION BASE.
Choose either one time or endless recording method.
Default setting is one time.
One time: Ends recording when data reaches 32000.
Endless : Overwrites previously recorded data when data exceeds 32000.

8. Range setting

The range can be set for the 3645 alone or when the 3645, the COMMUNICATION BASE, and a PC are interconnected. Four different measurement ranges, 50 mV/500 mV/5 V/50 V, are available. Select the one best suited to the voltage to be measured.

9. Comments

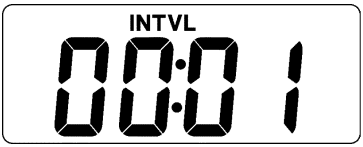
Set comments entered by personal computer to logger using COMMUNICATION BASE. When sorting collected recording data, comments are helpful.
Comment setting is available when personal computer is connected to both logger and COMMUNICATION BASE.

3.2 Manual Setting

3645-20 VOLTAGE LOGGER stand-alone manual operation settings are shown below.

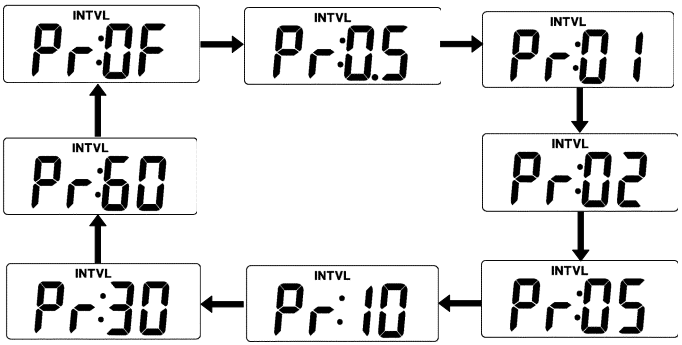
(1) Interval setting

Press INTERVAL button to switch measurement value display to interval setting display. ("**INTVL**" appears.)
Press SELECT button to designate interval.
Press INTERVAL button to complete setting.



(2) Setting of Preheat Time

Pressing the Range button on the Recording Interval Setup Screen ("**INTVL**" displayed) displays and changes the Preheat time (0.5 sec displayed in the illustration). Pressing the [SELECT] button again returns you to the Recording Interval Setup Screen.



The preheat time cannot be defined to be longer than the recording interval. Conversely, in the setup of the recording interval, you cannot select a shorter recording interval than the preheat time that is currently set.
If you choose a longer preheat time than the preset recording interval and press the [Recording Interval] button to complete the setup, the preset recording interval will automatically be rewritten with a longer time than the preheat time you have just chosen.
When you press the [Recording Interval] button to complete the setup after setting a preheat time, the system will briefly display the length of the recording interval that is currently set. At this time you should verify the settings you have made.

(3) Range setting

Pressing the Range button on the Monitor screen switches the measurement range among 50 mV, 500 mV, 5 V, and 50 V.
As the measurement range is changed, the decimal point will also change position.

50 mV range

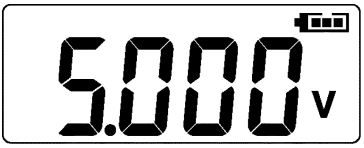
500 mV range

5 V range

50 V range

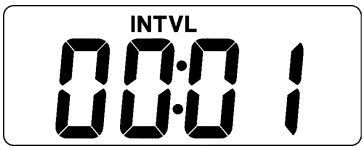
(4) Starting and ending recording

Press REC/STOP button for 1 second to clear last recorded data and start recording. ("**REC**" appears.)
Press REC/STOP button for 1 second to stop recording.
When memory is full, recording automatically stops when recording method: one time is selected.
When batteries are weak, recording does not start. During recording, weak batteries interrupt recording.

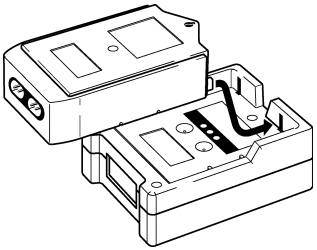


3.3 Setting by COMMUNICATION BASE

1. Press logger INTERVAL button lightly to display LCD.
2. When logger LCD shows "**REC**" mark or "⏲" icon, press REC/STOP button for more than 1 second to stop recording.
   During recording or waiting time before recording start time, data transfer cannot be established with COMMUNICATION BASE.
3. Press logger INTERVAL button to display interval setting display. ("**INTVL**" appears.)



4. Connect COMMUNICATION BASE with logger.
5. Press COMMUNICATION BASE SEND button for more than 1 second to send data settings to logger.

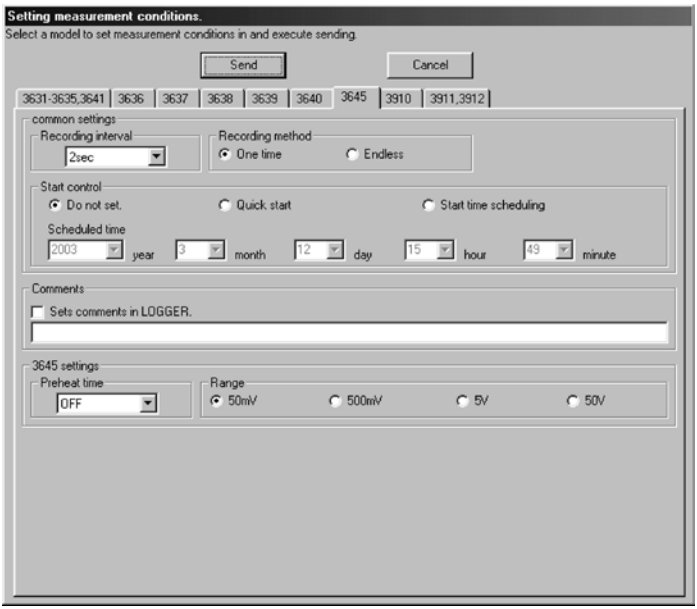


NOTE

- Previously recorded logger data is erased when recording is resumed. Be sure to load data to be saved to COMMUNICATION BASE or to personal computer before recording.
- At any other time even when interval setting display is not shown, except during recording and waiting for recording, communication with COMMUNICATION BASE is available. However communication is disabled when logger is set to sleep.

3645-20 settings in application software COMMUNICATION UTILITY packaged with COMMUNICATION BASE are as follows.

Go to 'Communication' on the menu bar in COMMUNICATION UTILITY and select 'Set measurement condition'. When measurement condition setting window is open, select '3645 setting items' to set settings.



NOTE

- Comment, range and preheat Time are only available in 3645 setting items. Personal computer, COMMUNICATION BASE and 3645-20 must be connected during setting.
- Common settings are available to be set in '3911, 3912 setting items'. This enables 3645-20 and COMMUNICATION BASE settings.

Chapter 4
Specifications

Input	DC voltage
Maximum input voltage	±60 VDC
Number of input	1 ch
Measurement range	DC±50 mV/±500 mV/±5 V/±50 V
Accracy	±0.5% rdg.±5 dgt. Accuracy warranty range: 23±5℃ (73±9°F) Temperature coefficient: (0.02%rdg.±1.5 dgt.)/℃
Guaranteed accuracy period	1 year
Effect of radiated radio-frequency electromagnetic field	±20 dgt. at 3 V/m
LCD display	Measurement value, Interval, Battery status (remaining battery power indicator: 4 phases) Unit (mV,V), recording (REC), prescheduled (🕘)
Interval	1/2/5/10/15/20/30 s, 1/2/5/10/15/20/30/60 min
Preheat time	OFF/0.5/1/2/5/10/30/60 s *: The preheat time cannot be defined to be longer than the recording interval.
Recording capacity	32000 data
Recording start	Manual start, Time prescheduled start
Recording stop	Manual stop, Memory full
Recording method	One time, Endless
Preheat output	Open collector output (30 V, 20 mA MAX.)
Data backup	Available (Data not erased by weak batteries or battery replacement)
Interface	Infrared optical data transfer
Power supply	LR03 alkaline battery X 4 (1.5 VDC X 4)
Maximum rated power	0.1 VA

Battery life	About 1 year (temperature at 20℃, power save function: valid, interval: 1 minute, preheat: OFF) About 140 days (temperature at 20℃, power save function: valid, interval: 1 minute, preheat: 5 s) About 20 days (temperature at 20℃, power save function: OFF)
Dimensions	Approx. 57W X 86H X 30D mm (excluding projections) 2.24"W X 3.39"H X 1.18"D
Mass	Approx. 130 g (4.6 oz) (including batteries)
Location for use	Indoors, altitude up to 2000 m
Operate temperature and humidity range	0 to 40℃, 80% RH or less (no condensation) (32 to 122˚F)
Storage temperature and humidity range	-10 to 50℃, 80% RH or less (no condensation) (14 to 140˚F)
Accessories	LR03 alkaline battery X 4 9639 CONNECTION CABLE 9632 CONNECTION CABLE Instruction Manual
Options	COMMUNICATION BASE
Standards Applying	EMC EN61326 Safety EN61010 Measurement category I (anticipated transient overvoltage 330 V) Pollution Degree 2

Chapter 5
Maintenance and Service

Cleaning

To clean the product, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
Wipe the LCD gently with a soft, dry cloth.

Service

If the product seems to be malfunctioning, confirm that the batteries are not discharged, and that the sensor is not open circuited before contacting your dealer or Hioki representative.
Pack the product carefully so that it will not be damaged during shipment, and include a detailed written description of the problem. Hioki cannot be responsible for damage that occurs during shipment.

Error Message

The following error may be displayed on the LCD of the main instrument as shown below.

Error message	Meaning
Err 1	ROM error
Err2	RAM error
Err9	Adjustment data error

When this occurs, repair or check the device. Contact your dealer or Hioki representative.

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	VOLTAGE LOGGER
Model Number:	3645-20
Accessories:	9639 CONNECTION CABLE 9632 CONNECTION CABLE

The above mentioned products conform to the following product specifications:

Safety:	EN61010-1:2001 EN61010-031:2002
EMC:	EN61326-1:2006 ClassB equipment Portable test and measurement equipment

Supplementary Information:

The products herewith comply with the requirements of the EMC Directive 2004/108/EC, but is not applicable to the Low Voltage Directive 2006/95/EC.

HIOKI E.E. CORPORATION

11 April 2008

M. Tanaka

Mitsuyoshi Tanaka

Director of Quality Assurance

3645A999-05

HIOKI 3645-20 VOLTAGE LOGGER

Instruction Manual

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