# HIOKI

# 3169-20/21

# CLAMP ON POWER HiTESTER

HIOKI E. E. CORPORATION

# Contents

# Introduction

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- The 3169-20/21 CLAMP ON POWER HiTESTER is supplied with a instruction manual in addition to this manual. Please be sure to read both manuals.
- This manual is a quick reference source with examples and information regarding the setting-up of and key operation for the 3169-20/21 CLAMP ON POWER HiTESTER for measurement purposes.
- For current input with this device, a clamp-on sensor (optional) is required. For details, refer to the instruction manual for the clamp-on sensor you are using.

# Safety Notes

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The following symbols in this manual indicate the relative importance of cautions and warnings.

| ⚠ **DANGER** | Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user. |
|---|---|
| ⚠ **WARNING** | Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user. |
| ⚠ **CAUTION** | Indicates that incorrect operation presents a possibility of injury to the user or damage to the product. |
| **NOTE** | Advisory items related to performance or correct operation of the product. |

## Other Symbols

| 🚫 | Indicates the prohibited action. |
|---|---|
| ❖ | Indicates the reference. |
| ❓➡ | Indicates quick references for operation and remedies for troubleshooting. |
| * | Indicates terminology explained at the bottom of the page. |

# Parts Names

*1*

❖4 "Connecting to Lines to be Measured" (page 35)

❖11 "Using D/A Output (3169-21 only)" (page 157)

Recorder, logger

D/A output (3169-21)

EXT I/O

❖10 "Using the External Input/ Output Terminal" (page 151)

❖9 "Using the Instrument with a Computer" (page 145)

RS-232C

PC

PC card

Printer

❖7.2 "Using a PC Card" (page 117)

❖8 "Using a Printer" (page 137)

❖3 "Measurement Preparations" (page 25)
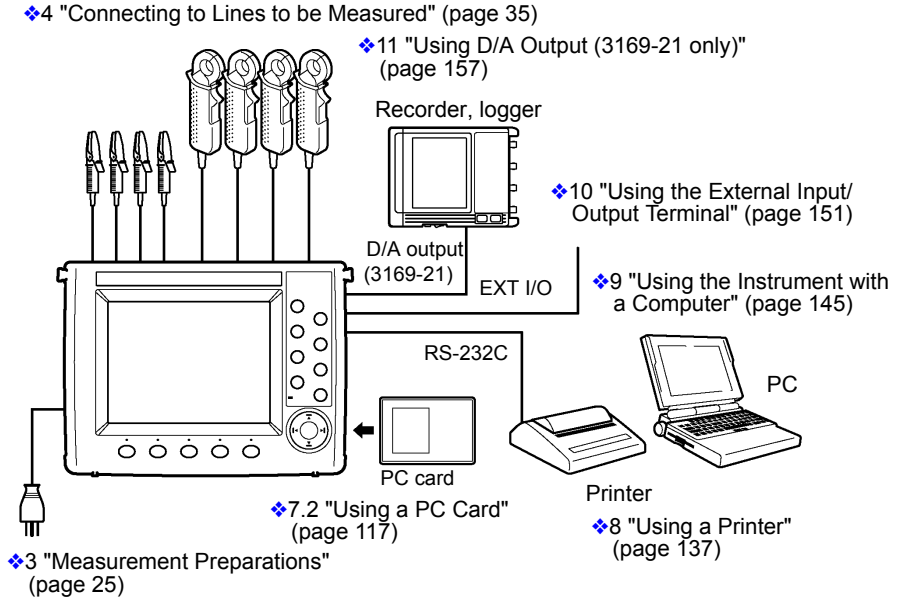
*: The RS-232C is connected to a printer or PC.

**NOTE** The reference pages referred to above are those in the instruction manual.

# 1.1 Instrument Labels and Functions

## Front Panel

**Display**
5.7-inch STN LCD



**Function (F1-F5) keys**
Selects or switches the screens and setting items.

**Cursor key**
These keys move the cursor on the screen.

## Front Panel Enhanced View



**MEASURE key**
Switches to a screen that displays measurements.

**SET UP key**
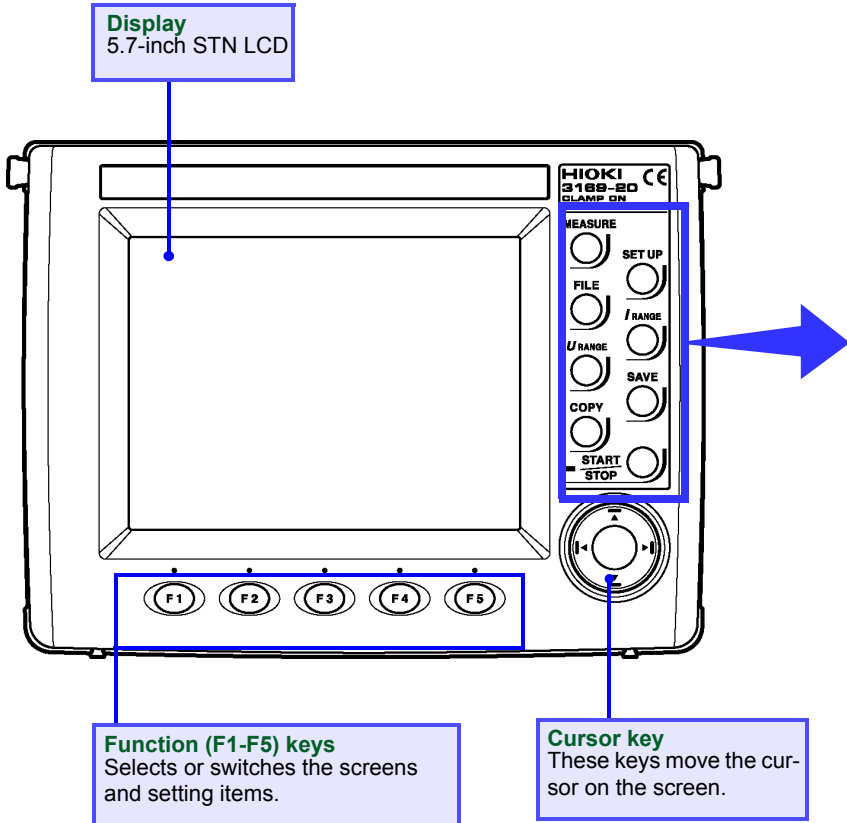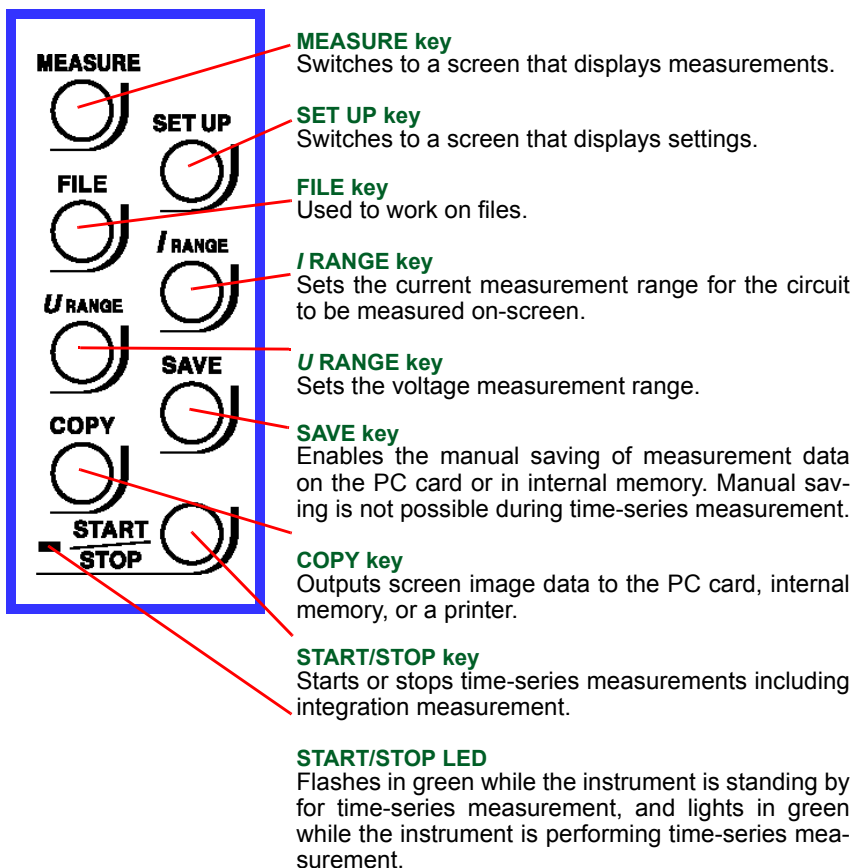Switches to a screen that displays settings.

**FILE key**
Used to work on files.

**I RANGE key**
Sets the current measurement range for the circuit to be measured on-screen.

**U RANGE key**
Sets the voltage measurement range.

**SAVE key**
Enables the manual saving of measurement data on the PC card or in internal memory. Manual saving is not possible during time-series measurement.

**COPY key**
Outputs screen image data to the PC card, internal memory, or a printer.

**START/STOP key**
Starts or stops time-series measurements including integration measurement.

**START/STOP LED**
Flashes in green while the instrument is standing by for time-series measurement, and lights in green while the instrument is performing time-series measurement.

## Top Panel

**Voltage Input terminals**
Connect the supplied 9438-03 VOLTAGE CORD.

Black Red Yellow Blue
$N$ $U_1$ $U_2$ $U_3$



CH1 CH2 CH3 CH4
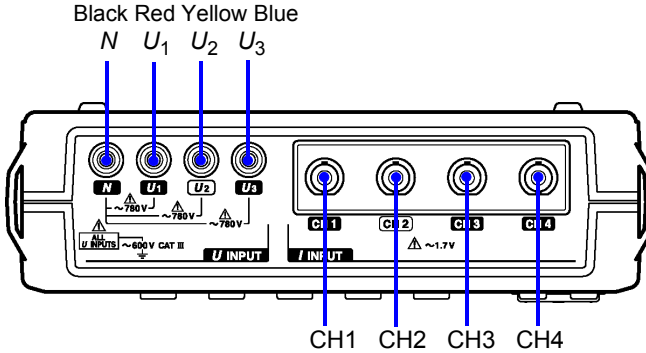
**Current Input terminals**
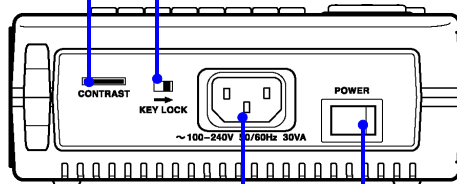Connect an optional clamp-on sensor.

## Left Panel

**Contrast Control Knob (CONTRAST)**
Adjusts the contrast of the screen.

**KEY LOCK switch**
Sliding this switch in the direction of the arrow disables all key operation except the POWER switch.



**AC Power Inlet**
Connects the power cord. The supply voltage ranges from 100 V to 240 V.

**POWER switch**
Turns the instrument on and off.
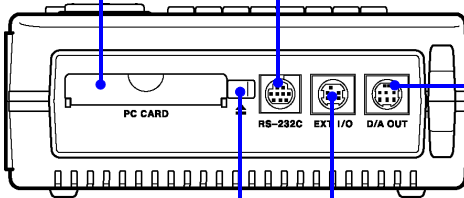○: Power OFF
|: Power ON

## Right Panel

**PC Card slot**
A PC Card can be inserted here.

**RS-232C Interface connector**
Connects to a PC or printer using an RS-232C cable.

**D/A Output Terminal (D/A OUT)**
Installed in the 3169-21 only. Connects the supplied 9441 connection cable. Used for analog output.

PC CARD     RS–232C   EXT I/O   D/A OUT

**Eject button**
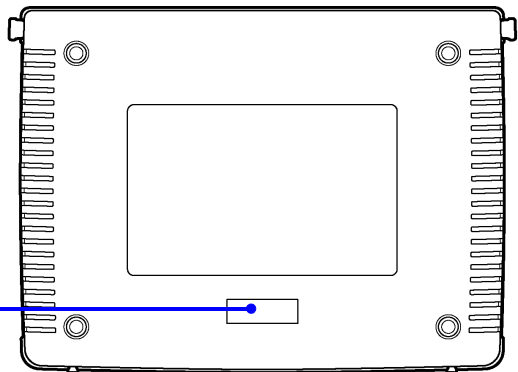Press this button to eject a PC Card from the slot.

**External Input/Output Terminal (EXT I/O)**
Connects the optional 9440 connection cable. Used to start and stop time-series measurement, and control data storage on the PC card.

## Rear Panel

**Number plate**
Contains manufacturer's ID numbers. Please do not remove, as this information is reguired for product management.

# 1.2 Screen Names and Display Elements

## 1.2.1 Screen Configuration

The screens are divided into three basic types: measurement screens, setting screens, and file screens. Each screen is selected using three panel keys: **MEASURE**, **SET UP**, and **FILE**.

Measurement screen



MAIN
POWER
INTEGRATE
DEMAND
ZOOM
HARMONIC LIST
HARMONIC GRAPH
WAVEFORM
WIRING CHECK
WIRING DIAGRAM

File screen
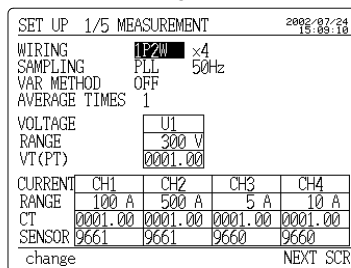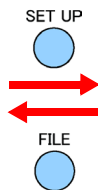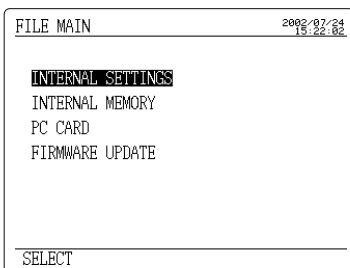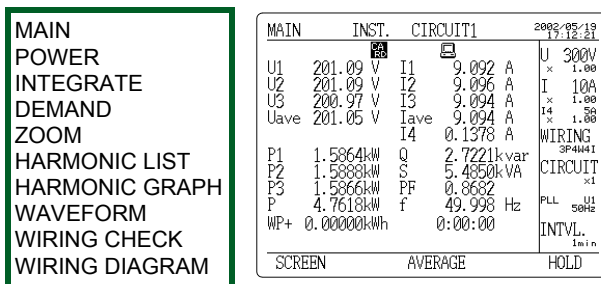


Setting screen



INTERNAL SETTINGS
INTERNAL MEMORY
PC CARD
FIRMWARE UPDATE

MEASUREMENT
DATA OUTPUT
SAVE, PRINT ITEMS
SYSTEM
D/A OUTPUT (3169-21 only)

## 1.2.2   Common Display

This section of the screen shows information common to all measurement screens (except the zoom screen and the wiring diagram screen).

**Common Display**



| Time | Displays the current time. |
|---|---|
| Range | Displays the voltage range and current range of the on-screen circuit. The VT(PT) ratio and CT ratio are shown under these ranges. The current range and CT ratio of I4 are shown only when 3P4W4I is set as the wiring method. |
| Wiring | Displays the wiring method set on the setting screen. |
| No. of circuits | Displays the number of circuits to be measured as set on the setting screen. |
| Synchronization method | Displays the synchronization method and frequency of the line to be measured as set on the setting screen. |
| Interval | Displays the interval set on the setting screen. |

## 1.2.3 On-Screen Indicators

```
MAIN      INST.   CIRCUIT1 VAR  🔑 2002/06/25
                                       14:05:59
          ᴹᴱᴹ CA   ᶠᵁ ⌨🖶H PL UovIov  U  150V
              RD   LL                  ×   1.00
U1    over  V    I1    over  A
U2    over  V    I2    over  A         I   5A
U3*   over  V    I3*   over  A         ×   1.00
Uave  over  V    Iave  over  A
                                       WIRING
                                         3P3W2M
P     over kW   Q      over kvar       CIRCUIT
                S      over kVA           ×2
                PF     over
                f    50.000 Hz         PLL   U1
                                             50Hz
WP+   0.000 Wh        0:00:00          INTVL.
                                          1min
 SCREEN  CIRCUIT AVERAGE          HOLD
```

| | |
|---|---|
| VAR | Goes on when the reactive-power-meter method is ON. |
| H | Goes on when the displayed measurement is held. |
| CA RD | Goes on when the medium for saving data is set to PC card. Flashes when the PC card is accessed. |
| MEM | Goes on when the medium for saving data is set to internal memory. Flashes when the internal memory is accessed. |
| FU LL | Goes on when the PC card or internal memory is full. |
| ⌨ | Goes on when the device to be connected to the RS-232C is set to PC. |
| 🖶 | Goes on when the device to be connected to the RS-232C is set to printer. |
| PLL | Goes on when the PLL is unlocked; the synchronization method is automatically switched over to the fixed clock. |
| 🔑 | Goes on when the keys are locked. |
| Uov Iov | Goes on when the voltage or current dynamic range is exceeded. |
| over | Displayed when the range is exceeded. |

**NOTE** U3* and I3* indicate that the data is obtained by calculating the 2-voltage, 2-current measurement results when 3P3W2M (three-phase, 3-wire, 2-power-meter method) is selected.
❖Instruction manual "Appendix" (page 195)

# Power Measurement

# 2.1   Outline

This chapter explains setting and measurement procedures using the following conditions.

**Measure the power of a Three-phase 3-wire line for 7 days.**
Measurement location:
A Tree-phase 3-wire 200 V line of a switchboard (50 Hz, 50 A load)
Setting:
Time-series measurement start time: 2002/06/20 08:00
Time-series measurement stop time: 2002/06/27 08:00
Data is automatically output to the PC card at 5-minute intervals.
Average value (voltage, current, and power) and integrated power are stored on the PC card. The reactive power-meter method is not used.



9438-03 VOLTAGE CORD

9661 CLAMP ON SENSOR

Upper side of the 3169-20/21

Face the arrow toward the Load
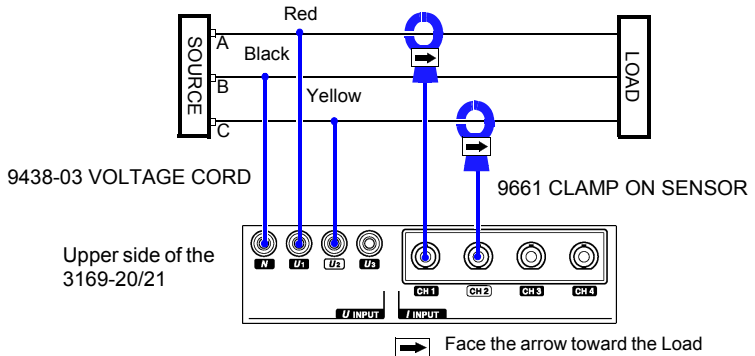
◆ **Instrument and Accessories Required for Measurement**
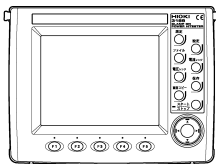


3169-20/21
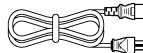
Power cord

PC card
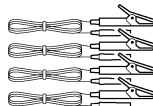
9438-03 VOLTAGE CORD
1 set (4 cords)(One each red, yellow, blue, and black cords.)
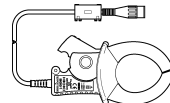
9661 CLAMP ON SENSOR
x 2

◆ **Setting Screens under the Example Conditions**

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                 15:37:32
WIRING          3P3W2M  ×1
SAMPLING        PLL     50Hz
VAR METHOD      OFF
AVERAGE TIMES   1

VOLTAGE          U12
RANGE           300 V
VT(PT)          0001.00

CURRENT  CH12
RANGE    50 A
CT      0001.00
SENSOR  9661

 change                        NEXT SCR
```

**\<MEASUREMENT\>**
**WIRING              : 3P3W2M**
                            **(Three-phase 3-wire,**
                       **2-power-meter method)**
**Number of circuits : X 1 (1 circuit)**
**SAMPLING          : PLL**
**Measured frequency: 50 Hz**
**VAR METHOD       : OFF**
**AVERAGE TIMES  : 1**
**VOLTAGE RANGE : 300 V**
**VT (PT)             : 0001.00**
**CURRENT RANGE : 50 A**
**CT                   : 0001.00**
**SENSOR            : 9661**

```
SET UP  2/5 DATA OUTPUT        2002/06/19
                                 15:45:00
MEAS. START      TIME
                2002/06/20 08:00

MEAS. STOP       TIME
                2002/06/27 08:00

INTERVAL TIME      5 min

SAVE IN...       PC CARD

DATA FILE NAME   INTEG

RS CONNECTION    PC

DISPLAY COPY     PC CARD
 MANUAL   TIME    JUST          NEXT SCR
```

**\<DATA OUTPUT\>**
**MEAS. START          : TIME**
                        **(2002/06/20 08:00)**
**MEAS. STOP           : TIME**
                        **(2002/06/27 08:00)**
**INTERVAL TIME       : 5 min**
**SAVE IN...            : PC CARD**
**DATA FILE NAME    : INTEG**

```
SET UP  3/5 SAVE,PRINT ITEMS   2002/06/19
                                 15:46:06
                   NO. OF ITEMS   39

┌─────────────┬────────────┐
│NORM.MEAS.   ON│INST.  OFF │
│               │AVE.   ON  │
├─────────────┤MAX.   OFF │
│HARMONIC    OFF│MIN.   OFF │
└─────────────┴────────────┘

┌──────────────────────┐
│INTEG.& DEM.    ON     │
└──────────────────────┘


SAVE TIME AVAIL.   73d  18h 40m  0s
 OFF    ON                     NEXT SCR
```

**\<SAVE, PRINT ITEMS\>**
**NORM. MEAS.: ON**   **INST.  : OFF**
**HARMONIC    : OFF**  **AVE.  : ON**
                          **MAX.  : OFF**
                          **MIN.   : OFF**

**INTEG. & DEM.: ON**

# 2.2 Measurement Procedure

**Measurement Preparations**
(page 14)

1. Connecting the Power Cord
2. Connecting the Voltage Cords
3. Connecting the Clamp-On Sensor
4. Inserting a PC Card
5. Turning the Power On

**Connect to the Line to be Measured**
(page 18)

1. Setting the wiring details
2. Displaying the Wiring Diagram
3. Connectting the voltage cords and clamp-on sensor to the line to be measured
4. Checking the Wiring

**Perform Measurement**
(page 26)

1. Setting the measurement conditions
2. Confirm range
3. Start measurement
4. Stop measurement

**Shutdown Procedure**
1. Disconnect the voltage cords and clamp-on sensor from the measured line.
2. Turn off the power to the 3169-20/21.
3. Disconnect the power cord from the AC outlet.
4. Remove the PC card from the 3169-20/21 and analyze the saved data on PC.

# 2.3 Measurement Preparations

## 1. Connecting the Power Cord

⚠ **WARNING**

• **Before turning the product on, make sure the source voltage matches that indicated on the product's power connector. Connection to an improper supply voltage may damage the product and present an electrical hazard.**

• **To avoid electric shock and ensure safe operation, connect the power cable to a grounded (3-contact) outlet.**
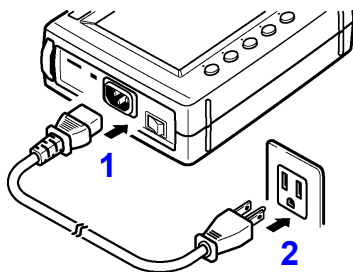


*1.* Connect the power cord to the AC power inlet.

*2.* Plug the power cord into the AC mains outlet.

# 2. Connecting the Voltage Cords

**⚠DANGER**

**Connect the voltage cords to the product first, and then to the active lines to be measured. Observe the following to avoid electric shock and short circuits.**

• **Voltage cord should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**

• **Do not allow Do not allow the voltage cable clips to touch two wires at the same time. Never touch the edge of the metal clips. Never touch the edge of the metal clips.**

• **Voltage input terminals $U_1$, $U_2$, and $U_3$ are common to the N terminal and are not insulated. To avoid the risk of electric shock, do not touch the terminals.**

**⚠CAUTION**

• For safety reasons, when taking measurements, only use the 9438-03 VOLTAGE CORD provided with the product.

• The supplied voltage cords consist of one each red, yellow, blue and black cords.  Connect only the cords actually needed for measurement.  Cords not being used for measurement should be disconnected.

Black  Red  Yellow    Voltage input terminals

**N**   **U₁**  **U₂**  **U₃**

**U INPUT**

Connect the 9438-03 VOLTAGE CORD to the voltage input terminals of the 3169-20/21.

Insert plugs all the way in.

## 3. Connecting the Clamp-On Sensor
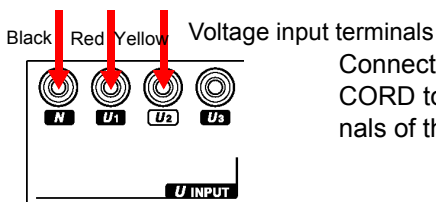
**⚠ DANGER**

**Connect the clamp-on sensors to the product first, and then to the active lines to be measured. Observe the following to avoid electric shock and short circuits.**

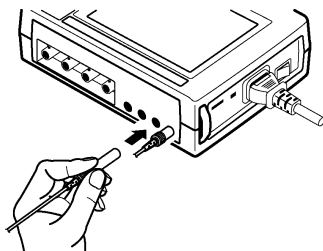• **Clamp sensor should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**

• **When the clamp sensor is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between two lines, and do not use over bare conductors.**

• **To prevent damage to the product and sensor, never connect or disconnect a sensor while the power is on.**

• **The current input terminals of the 3169-20/21 are not insulated. To avoid the risk of electric shock, only use the specified optional clamp-on sensor.**

Red Yellow
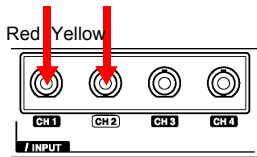
Current input terminas

Connect the 9661 CLAMP ON SENSOR to the current input terminals of the 3169-20/21.

3169-20/21 Current input terminal connector guide pins
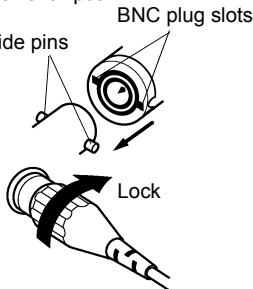
BNC plug slots

Lock

Align the slots in the BNC plug with the guide pins on the connector at the instrument side, then push and turn the plug clockwise. (to unplug the connector, push the plug and turn it counterclockwise before pulling it apart.)

**NOTE**

When disconnecting the BNC connector, be sure to release the lock before pulling the connectors apart. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.

## 4. Inserting a PC Card

⚠️**WARNING**
**Use only PC Cards sold by HIOKI. Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards.**

⚠️**CAUTION**
• The PC card or the instrument can be damaged if the card is inserted forcefully in the wrong direction.
• Never eject a PC card while it is being accessed by the instrument.  Data on the PC card may be lost.
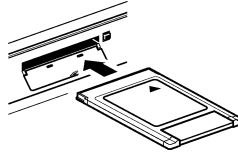
Open the cover and insert the PC card with the arrow facing up and in the direction of the PC card slot, as far as it will go.

❖ Instruction manual 7.2 "Using a PC Card" (page 117)

## 5. Turning the Power On

⚠️**WARNING**
**Before turning the product on, make sure the source voltage matches that indicated on the product's power connector. Connection to an improper supply voltage may damage the product and present an electrical hazard.**
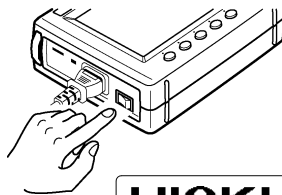
Turn the POWER switch ON ( | ).

As soon as the power is turned on, the self-test screen appears. Upon completion of the self test, display switches to the measurement screen.

Screen after the power is turned on (Self-test screen)

**HIOKI 3169**
CLAMP ON POWER HiTESTER

Version  1.00

BACKUP TEST  OK
FLASH TEST  OK
DRAM  TEST  OK
SRAM  TEST  OK
VRAM  TEST  OK
ADJUST TEST  OK

Model No. of the product

Version No.

Internal memory test result
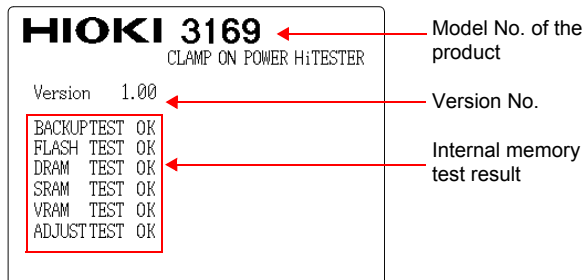
# 2.4 Connect to the Line to be Measured

## 1. Setting the wiring details

Set the 3169-20/21 to measure a three-phase 3-wire 200 V line (50 Hz, 50 A load) using the 9661 CLAMP ON SENSOR (500 A rated).

**(1) Set the wiring to "3P3W2M."**

SET UP

Press the **SET UP** key to display the setting screen.

**NEXT SCR** F5

Press the **F5** (NEXT SCR) key to display the measurement setting screen.

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:34:41
WIRING          1P2W    ×1
SAMPLING        PLL     50Hz
VAR METHOD      OFF
AVERAGE TIMES   1

VOLTAGE           U1
RANGE            300 V
VT(PT)          0001.00

CURRENT  CH1
RANGE    100 A
CT      0001.00
SENSOR  9661
 change                        NEXT SCR
```

Move the cursor to "**WIRING**."

**change** F1  Press the **F1** (change) key to display the selection window.

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:34:49
WIRING          1P2W    ×1
SAMPLING        PLL     50Hz
VAR METHOD      OFF
AVERAGE TIMES   1

VO 1P2W           U1
RA 1P3W          300 V
VT 3P3W2M       0001.00
CU 3P3W3M   H1
RA 3P4W     00 A
CT 3P4W4I   .00
SENSOR  9661
 select   cancel
```

Select "**3P3W2M**"(Three-phase 3-wire, 2-power-meter method) by using the cursor key.

**select** F1  Press the **F1** (select) key.

**(2) Make sure the number of circuits to be measured is set to "X1 (1 circuit)."**

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:35:11
WIRING       3P3W2M  X1
SAMPLING     PLL     50Hz
VAR METHOD   OFF
AVERAGE TIMES  1
```

When multiple circuits of the same voltage system (the same transformer) are to be measured, use a preset between X2 (2 circuits) and X4 (4 circuits).

| 1P2W | X1 (1 circuit), X2 (2 circuits), X3 (3 circuits), X4 (4 circuits) |
|---|---|
| 1P3W | X1 (1 circuit), X2 (2 circuits) |
| 3P3W2M | X1 (1 circuit), X2 (2 circuits) |
| 3P3W3M,3P4W, 3P4W4I | X1 (1 circuit) only |

**(3) Make sure the synchronization method (sampling) is set to "PLL."**

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:35:19
WIRING       3P3W2M  x1
SAMPLING     PLL     50Hz
VAR METHOD   OFF
AVERAGE TIMES  1
```

**(4) Make sure the frequency of the line to be measured is set to "50 Hz."**

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:35:24
WIRING       3P3W2M  x1
SAMPLING     PLL     50Hz
VAR METHOD   OFF
AVERAGE TIMES  1
```

**(5) Make sure the reactive power-meter method is "OFF."**

```
SET UP  1/5 MEASUREMENT        2002/06/19
                                  15:35:28
WIRING       3P3W2M  x1
SAMPLING     PLL     50Hz
VAR METHOD   OFF
AVERAGE TIMES  1
```

## (5) Make sure the displayed data averaging times is set to "1."

```
SET UP  1/5 MEASUREMENT          2002/06/19
                                   15:35:35
WIRING          3P3W2M ×1
SAMPLING        PLL    50Hz
VAR METHOD      OFF
AVERAGE TIMES   1
```

## (6) Set the voltage range to "300 V."

```
SET UP  1/5 MEASUREMENT          2002/06/19
                                   15:36:04
WIRING          3P3W2M ×1
SAMPLING        PLL    50Hz
VAR METHOD      OFF
AVERAGE TIMES   1

VOLTAGE          U12
RANGE           300 V
VT(PT)          0001.00
```

Move the cursor to "**VOLTAGE RANGE**."

F1  **-**      Select "**300 V**" using the function keys.

F2  **+**

## (7) Make sure the VT (PT) ratio is set to "1."

```
SET UP  1/5 MEASUREMENT          2002/06/19
                                   15:36:12
WIRING          3P3W2M ×1
SAMPLING        PLL    50Hz
VAR METHOD      OFF
AVERAGE TIMES   1

VOLTAGE          U12
RANGE           300 V
VT(PT)          0001.00
```

Set the VT (PT) ratio, if necessary.
(Example)
When the primary voltage is 6.6 kV and the secondary voltage is
110 V, the VT ratio is 60 (6600 V/110 V). In this case, as the rated
measurement voltage is 110 V, set the voltage range to 150 V.

**(8) Make sure "9661" is selected as the clamp-on sensor to be used.**

```
RANGE    100 A
CT       0001.00
SENSOR   9661
  change                    NEXT SCR
```

**(9) Set the current range to "50 A."**

```
CURRENT  CH12
RANGE    50 A
CT       0001.00
SENSOR   9661
   −      +                 NEXT SCR
```

Move the cursor to "**CURRENT RANGE**."

F 1   **-**

Select "**50A**" using the function keys.

F 2   **+**

NOTE   Selectable current ranges vary according to the clamp-on sensor used.
Clamp-On Sensor and Current Range:

| 9660, 9695-03 | 5 A, 10 A, 50 A, 100 A |
|---|---|
| 9661 | 5 A, 10 A, 50 A, 100 A, 500 A |
| 9667-5 kA (5000 A range) | 5 kA |
| 9667-500 A (500 A range) | 500 A |
| 9669 | 100 A, 200 A, 1 kA |
| 9694 | 0.5 A, 1 A, 5 A |
| 9695-02 | 0.5 A, 1 A, 5 A, 10 A, 50 A |

**(10) Make sure the CT ratio is set to "1."**

```
CURRENT  CH12
RANGE    50 A
CT       0001.00
SENSOR   9661
   −      +                 NEXT SCR
```

Set the CT ratio, if necessary.
(Example)
When the primary current is 100 A and the secondary current is 5 A, the CT ratio is 20 (100 A/5 A). In this case, as the rated measurement current is 5 A, set the current range to 5 A.

# 2. Displaying the Wiring Diagram

MEASURE

Press the **MEASURE** key to display the measurement screen.

**F1** **SCREEN** Press the **F1** (SCREEN) key to display the selection window.



Move the cursor to "**WIRING DIAGRAM**."

**F1** **select** Press the **F1** (select) key; the wiring diagram will appear.
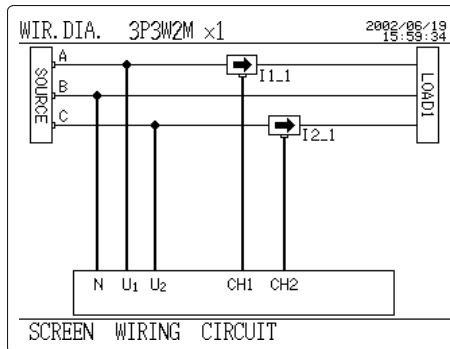
# 3. Connectting the voltage cords and clamp-on sensor to the line to be measured

Connect the 9438-03 voltage cords and the 9661 clamp-on sensor to the line to be measured, while referring to the wiring diagram. We recommend that the color of a voltage cord be matched to that of the attached input-cord label used for the same channel.

9438-03 VOLTAGE CORD   9661 CLAMP ON SENSOR

➡ Face the arrow toward the Load

SOURCE

A

Red

Black

B

Yellow

C

LOAD

Input cord label (Red)

Input cord label (Yellow)

N   U₁   U₂   U₃

CH 1   CH 2   CH 3   CH 4

*U* INPUT   *I* INPUT
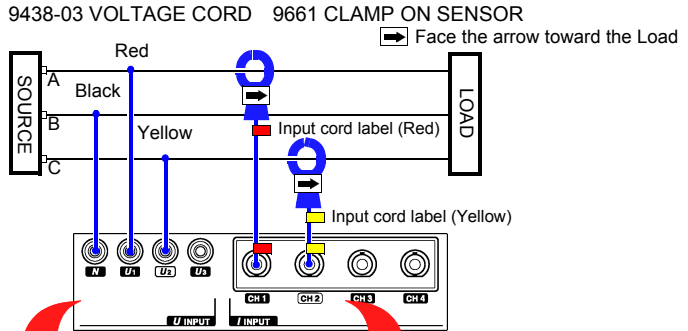
(Example)
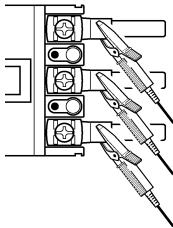
Clip securely to metal parts such as connection screws or bus bars at the power side.

LOAD   Load

Conductor

SOURCE

Source

Current flow direction arrow
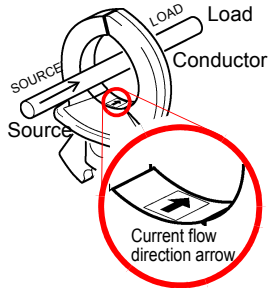
The arrows on the clamp indicating the direction of current flow should point toward the load side.

**OK**
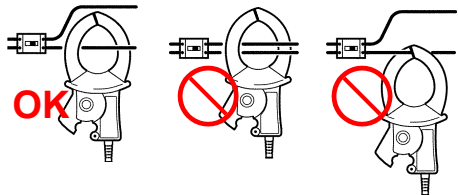
Clamp around only one conductor.  Measurement is not possible if the clamp is placed around two lines in a single-phase circuit, or three lines in a three-phase circuit.
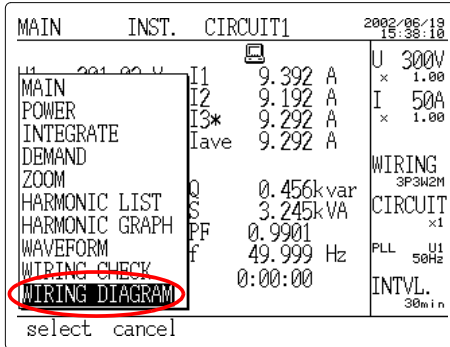
## 4. Checking the Wiring

MEASURE

Press the **MEASURE** key to display the measurement screen.

**F1** **SCREEN** Press the **F1** (SCREEN) key to display the selection window.

```
WIR.DIA.   3P3W2M ×1                    2002/06/19
                                        16:00:26
     A
  P                        →I1_1                    L
MAIN                                               O
POWER                                              A
INTEGRATE                  →I2_1                    D
DEMAND                                             1
ZOOM
HARMONIC LIST
HARMONIC GRAPH
WAVEFORM
WIRING CHECK          CH1  CH2
WIRING DIAGRAM
 select  cancel
```
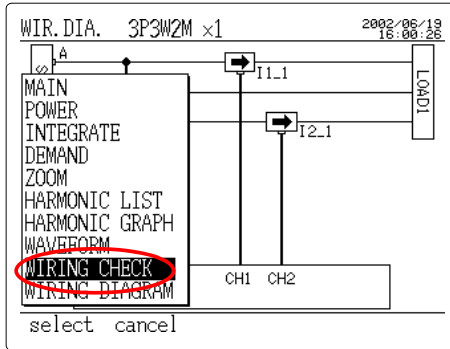
Move the cursor to "**WIRING CHECK**."

**F1** **select** Press the **F1** (select) key.
The connection status is shown by the voltage, current vectors,
and the connection check result.
If the wiring check result is not "**OK**," check the wiring.

```
WIR.CHK.          CIRCUIT1              2002/06/19
                                        15:39:18
                    🖳
              U1 201.0 V      0deg   U  300V
         U2   U2 202.4 V     59deg   × 1.00
   I2                                I  50A
                  U1I1  9.39 A - 37deg   × 1.00
         I1   I2  9.19 A    82deg   WIRING
                                     3P3W2M
VOLT INPUT   OK  PHASE I1-U1  OK   CIRCUIT
CURR INPUT   OK  PHASE I2-U2  OK     ×1
VOLT PHASE   OK                    PLL  U1
CURR PHASE   OK  VOLT BALANCE OK        50Hz
                                   INTVL.
                                     30min
 SCREEN                          HOLD
```
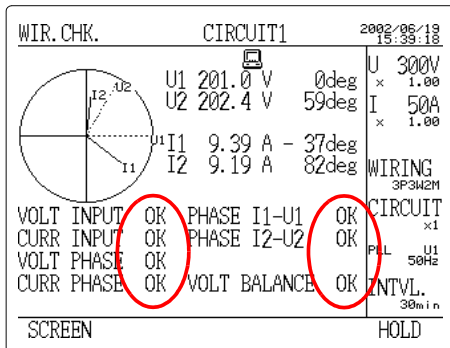
**NOTE**   The wiring check function may indicate improper connection
("NG") even when the actual wiring is correct, or vice versa.
Check the vectors and measurement data as well.

# The wiring check result is NG.

| The voltage input is NG. | • Do the voltage clips grip the wires properly?<br>• Is the voltage cord properly inserted into the voltage input terminal of the 3169-20/21? |
|---|---|
| The current input is NG. | • Is the clamp-on sensor securely inserted into the current input terminals?<br>• Is the set current range too large for the input level? |
| The voltage phase is NG. | • Are the voltage cords connected to the correct terminals? |
| The current phase is NG. | • Does the arrow of the clamp-on sensor point to the load side?<br>• Is the clamp-on sensor connected to the correct terminals? |
| The phase difference (I-U) is NG. | • Are the voltage cords and clamp-on sensor properly connected?<br>• Does the arrow of the clamp-on sensor point to the load side?<br>• Is the power factor of the line to be measured too low, such as 0.5 or less? |
| The voltage balance is NG. | • Does the connection method of the line to be measured differ from that set?<br>• Do the voltage clips grip the wires properly?<br>• Is the voltage cord properly inserted into the voltage input terminal? |

# 2.5 Perform Measurement

## 1. Setting the measurement conditions

```
SET UP  2/5 DATA OUTPUT        2002/06/19
                                  15:45:00
MEAS. START        TIME
                   2002/06/20 08:00
MEAS. STOP         TIME
                   2002/06/27 08:00
INTERVAL TIME      5 min
SAVE IN...         PC CARD
DATA FILE NAME     INTEG
RS CONNECTION      PC
DISPLAY COPY       PC CARD
  MANUAL    TIME    JUST       NEXT SCR
```

**DATA OUTPUT**
- Measurement start: 2002/06/20 08:00
- Measurement stop: 2002/06/27 08:00
- Data is automatically output to the PC card at 5-minute intervals.
- Data file name: INTEG

```
SET UP  3/5 SAVE,PRINT ITEMS   2002/06/19
                                  15:46:08
                   NO. OF ITEMS    39

 NORM.MEAS.     ON  INST.    OFF
                    AVE.     ON
                    MAX.     OFF
 HARMONIC      OFF  MIN.     OFF

 INTEG.& DEM.     ON

SAVE TIME AVAIL.   73d  18h 40m  0s
  OFF      ON                 NEXT SCR
```

**SAVE, PRINT ITEMS**
Saves the average value (voltage, Current, and Power) and integrated power on a PC card

### (1) Set the measurement start time to "2002/06/20 08:00."

Before setting the measurement start time, make sure the current date and time displayed on the screen are correct.
❖ Instruction manual 5.5.7 "Setting the Clock" (page 92)

SET UP

Press the **SET UP** key to display the setting screen.

F 5   **NEXT SCR**

Press the **F5** (NEXT SCR) key to display the data-output setting screen.

```
SET UP  2/5 DATA OUTPUT        2002/06/19
                                  15:40:00
MEAS. START        MANUAL
```

Move the cursor to "**MEAS. START.**"

```
SET UP  2/5 DATA OUTPUT          2002/06/19
                                   15:40:33
MEAS. START      TIME
                 2002/06/20 08:00
```

**F 2** TIME — Press the **F2** (TIME) key.

| MANUAL | Measurement starts when the **START/STOP** key is pressed (default setting). |
| TIME | Measurement starts at the time set by users. |
| JUST | Measurement will begin as soon as the internal clock reaches a time that is evenly divisible by the set interval. |

❖Instruction manual 5.3.1 "Setting the Time-Series Measurement Start Method" (page 69)

Move the cursor to the measurement start time.

**F 1** -
**F 2** +

Set the measurement start time to "**2002/06/20 08:00**" using the function keys. (Cursor ◀: Moves left to next digit; Cursor ▶: Moves right to next digit)

| - | Decrements the number. |
| + | Increments the number. |

**NOTE**

If **F3** (AUTO) key is pressed when the cursor is at the measurement start time, the start time will be set to a date and time close to the current time.

---

**(2) Set the measurement stop time to "2002/06/27 08:00."**

```
SET UP  2/5 DATA OUTPUT          2002/06/19
                                   15:40:48
MEAS. START      TIME
                 2002/06/20 08:00
MEAS. STOP       MANUAL
```

Move the cursor to "**MEAS. STOP**."

**F 2** TIME — Press the **F2** (TIME) key.

| MANUAL | Measurement stops when the **START/STOP** key is pressed (default setting). |
| TIME | Measurement stops at the time set by users. |
| TIMER | Measurement stops when the duration set by the users has elapsed. 1 second to 8784 hours |

**F 1** -
**F 2** +

Move the cursor to the measurement stop time and set it to "**2002/06/27 08:00**."

## (3) Set the interval time to "5 minutes."

Move the cursor to "**INTERVAL TIME**."

**F1** **change** Press the **F1** (change) key to display the selection window.

```
SET UP  2/5 DATA OUTPUT        2002/06/19
                               15:41:34
MEAS. START        TIME
                   2002/06/20 08:00

MEAS. STOP         TIME
                   2002/06/27 08:00
    ┌ 1 min  ▲
IN │ 2 min        30 min
SA │ 5 min        PC CARD
DA │ 10 min   ME
RS │ 15 min   N
   └ 30 min  ▼     PC
DISPLAY COPY       PC CARD

 select  cancel
```

Select "**5 min**" using the cursor key.

**F1** **select** Press the **F1** (select) key.

**Storable Data According to Interval Setting**

| Interval setting | Normal measurement data | integrated power/demand measurement data | Harmonic measurement data |
|---|---|---|---|
| 1/2/5/10/15/30/60 minutes | Yes | Yes | Yes |
| 1/2/5/10/15/30 seconds | Yes | Yes | No |
| All wave/100/200/500 ms | Yes (Instantaneous values only) Binary data | No | No |

## (4) Make sure the medium for saving data to is set to "PC card."

```
INTERVAL TIME      5 min
SAVE IN...         PC CARD
DATA FILE NAME
RS CONNECTION      PC
DISPLAY COPY       PC CARD
  CARD   MEMORY              NEXT SCR
```

## (5) Set the data output file name to "INTEG."

Move the cursor to "**DATA FILE NAME**."

**F1** change  Press the **F1** (change) key to display the selection window.

```
SET UP  2/5 DATA OUTPUT        2002/06/19
                                   15:43:57
MEAS. START      TIME
                 2002/06/20 08:00
MEAS. STOP  FILE NAME
            [INTEG   ]  /27 08:00
INTERVAL TIME 01234 56789
            ABCDE FGHIJ
SAVE IN...  K MNO PQRST
DATA FILE NAM UVWXY Z!#$%
RS CONNECTION &' ()~ @-_{}
DISPLAY COPY     PC CARD
   input   BS    enter   cancel
```

Enter "**INTEG**" using the cursor and **F1** (input) key. To make a correction, press the **F2** (BS) key. Pressing the **F2** key once will delete one letter.

**F1** input

**F2** BS

**F3** enter  Press the **F3** (enter) key.

**NOTE**
- The file is saved as "INTEG.csv" on the PC card.
- If a filename is not specified or a file with the same name exists on the PC card, the file will automatically be named "69MEASXX" (XX: 00 to 99).

## (6) Set the data output items

**F5** **NEXT SCR**  Press the **F5** (NEXT SCR) key to display the save/print items setting screen.

```
SET UP  3/5 SAVE,PRINT ITEMS    2002/06/19
                                   15:46:06
                    NO. OF ITEMS    39          256 or less

  NORM.MEAS.      ON  INST.   OFF
                      AVE.    ON
  HARMONIC       OFF  MAX.    OFF
                      MIN.    OFF

  INTEG.& DEM.        ON


SAVE TIME AVAIL.    73d  18h 40m  0s          7 days or more
    OFF      ON                   NEXT SCR
```

Move the cursor to "**NORM. MEAS.**."

**F1** **ON**  Press the **F1** (ON) key.
Turn ON "**AVE.**" and "**INTEG. & DEM.**" in a similar way.
All other items shall be turned OFF.

**NOTE**
- Check the storable time. This indicates the length of time for which the currently installed PC card stores data. If the storable time is shorter than the measurement time (7 days), delete unnecessary files from the PC card or replace it with a larger-capacity PC card.
- If the number of output is greater of equal to 256, all of the data may not be read into common spreadsheet software.
- For details on settings for harmonics measurement-data output, see 5.4.4 "Setting Harmonic Measurement-data Output Items" (page 82) of the instruction manual.
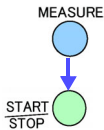
# 2. Confirm range

MEASURE
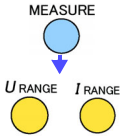
Press the **MEASURE** key to display the measurement screen.

U RANGE    I RANGE

Press the **U RANGE** key or **I RANGE** key to select an appropriate range.

NOTE

If you press the **I RANGE** Key, it selects a current range with a sufficient margin, in consideration of fluctuations in the load current of the line to be measured.

# 3. Start measurement

MEASURE

Press the **MEASURE** key to display the measurement screen.

START
STOP

Press the **START/STOP** key to place the 3169-20/21 in standby mode (LED blinking).

```
MAIN      INST.  CIRCUIT1      2002/06/20
                                 07:59:43
WAITING            🖳          U  300V
U1   201.04 V  I1     9.392 A  × 1.00
```

The 3169-20/21 will automatically start measurement (LED remaining ON) at the measurement start time.

```
MAIN      INST.  CIRCUIT1      2002/06/20
                                 08:00:06
RUNNING    ▨       🖳          U  300V
U1   201.03 V  I1     9.393 A  × 1.00
```

## Switch Over to Another Screen.

F1 **SCREEN**  Press the **F1** (SCREEN) key to display the selection window.

```
MAIN      INST.  CIRCUIT1      2002/06/20
                                 08:00:22
RUNNING            🖳          U  300V
U1   201 02 V  I1     9.392 A  × 1.00
┌───────────┐ I2     9.192 A  I  50A
│MAIN       │ I3*    9.292 A  × 1.00
│POWER      │ Iave   9.292 A
│INTEGRATE  │
│DEMAND     │                 WIRING
│ZOOM       │                  3P3W2M
│HARMONIC LIST │ Q  0.456kvar  CIRCUIT
│HARMONIC GRAPH│ S  3.245kVA     ×1
│WAVEFORM   │ PF 0.9901
│WIRING CHECK│ f  50.002 Hz   PLL  U1
│WIRING DIAGRAM│    0:00:22         50Hz
└───────────┘                 INTVL.
                                  5min
 select  cancel
```

Select a screen to be viewed using the cursor key.

F1 **select**  Press the **F1** (select) key.

# 4. Stop measurement

The 3169-20/21 will automatically stop measurement at the stop time. The measurement data "INTEG.csv" has been saved on the PC card.

## Interrupt Measurement.

START
STOP

Press the **START/STOP** key. The message "**Do you want to stop the time-series measurement?**" is displayed for you to confirm.

```
MAIN    INST.  CIRCUIT1      2002/06/20
                                08:00:34
RUNNING              🖳        U  300V
U1   ┌─────────────────────┐  x  1.00
U2   │Do you want to stop   │
U3*  │the time-series measurement?│  50A
Uave 201.66 V   Iave  9.292 A  x  1.00

                               WIRING
P      3.213kW   Q   0.457kvar   3P3W2M
                 S   3.246kVA  CIRCUIT
                 PF  0.9901        x1
                 f   49.998 Hz  PLL   U1
WP+  0.0306kWh      0:00:34         50Hz
                               INTVL.
                                  5min
   yes       no
```

F1  **yes**   Press the **F1** (yes) key.

**NOTE**   All measurement data before the interruption is saved on the PC card if the measurement is interrupted.

### Shutdown Procedure
1. Disconnect the voltage cords and clamp-on sensor from the measured line.
2. Turn off the power to the 3169-20/21.
3. Disconnect the power cord from the AC outlet.
4. Remove the PC card from the 3169-20/21 and analyze the saved data on PC.

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