

# CT6865, CT6865-05

## AC/DC CURRENT SENSOR

### Instruction Manual

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CT6865A981-03 15-03H



# HIOKI

HIOKI E. E. CORPORATION

**Headquarters**  
81 Koizumi, Ueda, Nagano 386-1192, Japan  
TEL +81-268-28-0562 FAX +81-268-28-0568  
E-mail: os-com@hioki.co.jp <http://www.hioki.com/>  
(International Sales and Marketing Department)

1407

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• Regional contact information  
• The latest revisions of instruction manuals and manuals in other languages.  
• Declarations of Conformity for instruments that comply with CE mark requirements.

#### Warranty

Warranty malfunctions occurring under conditions of normal use in conformity with the Instruction Manual and Product Precautionary Markings will be repaired free of charge. This warranty is valid for a period of one (1) year from the date of purchase. Please contact the distributor from which you purchased the product for further information on warranty provisions.

#### Introduction

Thank you for purchasing the HIOKI Model CT6865, CT6865-05 AC/DC Current Sensor. To obtain maximum performance from the device, please read this manual first, and keep it handy for future reference.

#### Usage with Other Hioki Products

The CT6865 is used in connection with a dedicated instrument (Hioki). See "Specifications" for details.

#### Inspection

When you receive the device, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories and cables. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

## Overview

The CT6865 (-05) is a feed-through current sensor designed to measure AC/DC currents up to 1000 A with high precision. Featuring good frequency characteristics (amplitude & phase) and good temperature characteristics (sensitivity & offset), the sensor is also suitable for high-precision power measurements. The CT6865-05 are dedicated models for Model PW6001 Power Analyzer.

## Safety Information

This manual contains information and warnings essential for safe operation of the device and for maintaining it in safe operating condition. Before using it, be sure to carefully read the following safety precautions.

### **⚠ DANGER**

This device is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the device. Using the device in a way not described in this manual may negate the provided safety features. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from device defects.

#### Safety Symbols

|  |                                                                                                                                                                                                                                                                                                              |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the device.<br>The ⚠ symbol printed on the device indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function. |
|  | Indicates a double-insulated device.                                                                                                                                                                                                                                                                         |

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

|                  |                                                                                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>⚠ DANGER</b>  | Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.    |
| <b>⚠ WARNING</b> | Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user. |
| <b>⚠ CAUTION</b> | Indicates that incorrect operation presents a possibility of injury to the user or damage to the device.                   |
| <b>NOTE</b>      | Indicates advisory items related to performance or correct operation of the device.                                        |

#### Symbols for Various Standards

|  |                                                                                                         |
|--|---------------------------------------------------------------------------------------------------------|
|  | Indicates the Waste Electrical and Electronic Equipment Directive (WEEE Directive) in EU member states. |
|  | This symbol indicates that the product conforms to regulations set out by the EC Directive.             |

#### Other Symbol

|  |                                |
|--|--------------------------------|
|  | Indicates a prohibited action. |
|--|--------------------------------|

#### Measurement categories

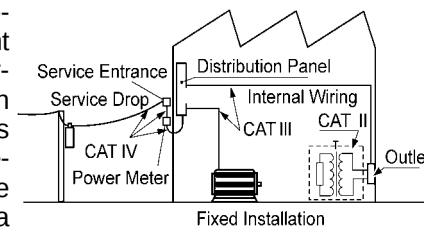
This device complies with CAT III safety requirements. To ensure safe operation of measurement devices, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

CAT II: Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)  
CAT II covers directly measuring electrical outlet receptacles.

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).

Using a measurement device in an environment designated with a higher-numbered category than that for which the device is rated could result in a severe accident, and must be carefully avoided. Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



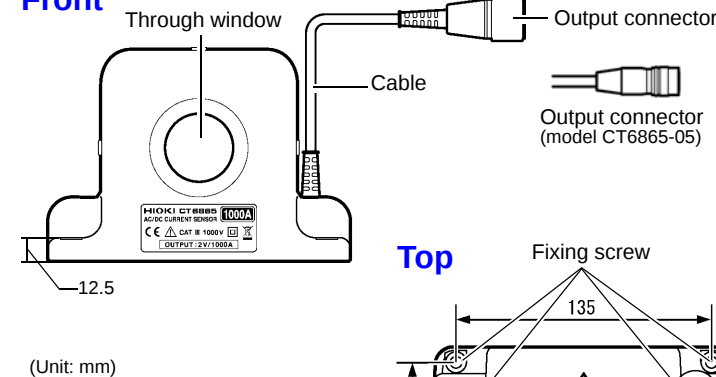
#### Instrument Installation

Operating temperature and humidity: -35 to 85°C, 80%RH or less (non-condensation)

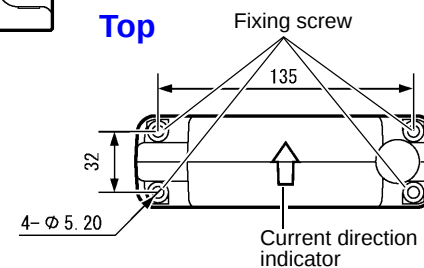
|                                                                                                 |                                                                                                         |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Avoid the following locations that could cause an accident or damage to the instrument.         |                                                                                                         |
| Exposed to direct sunlight<br>Exposed to high temperature                                       | In the presence of corrosive or explosive gases                                                         |
| Exposed to water, oil, other chemicals, or solvents<br>Exposed to high humidity or condensation | Exposed to strong electromagnetic fields<br>Near electromagnetic radiators                              |
| Exposed to high levels of particulate dust                                                      | Near induction heating systems (e.g., high-frequency induction heating systems and IH cooking utensils) |
| Subject to vibration                                                                            |                                                                                                         |

## Names of Parts

#### Front



#### Top



## Operating Precautions



Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

#### Preliminary Checks

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

### **⚠ DANGER**

- This device 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.
- The maximum rated voltage between input terminals and ground is 1000 V DC/AC. Attempting to measure voltages exceeding 1000 V with respect to ground could damage the device and result in personal injury.

### **⚠ WARNING**

- Before using the device, make sure that the insulation on the cable is undamaged and that no bare conductors are improperly exposed. Using the device in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.
- In order to prevent electric shock and short-circuit accidents, shut off the power to the line to be measured before connecting this device.
- Ensure that the input does not exceed the maximum input voltage or current to avoid device damage, short-circuiting and electric shock resulting from heat building.
- Avoid contact between the cable and the measured line in order to protect the cable from damage. Any contact can cause the device to malfunction and lead to short-circuits or electric shock.
- Do not use the device where it may be exposed to oil, chemicals, or solvents. Contact with these substances may cause cracking in the device, resulting in damage or electric shock.

### **⚠ CAUTION**

- This device is not drip-proof. Water droplets on the connector may result in malfunctions.
- Do not slant the device or place it on top of an uneven surface. Dropping or knocking down the device can cause injury or damage to the device.
- Avoid stepping on or pinching cables, which could damage the cable insulation.
- The cable is hardened under the 0 degree or colder environment. Do not bend or pull it to avoid tearing its shield or cutting cable.
- Keep the cables well away from heat sources, as bare conductors could be exposed if the insulation melts.
- To avoid damage to the device, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.
- When the power to lines to be measured is turned on or off, a current flowing through the lines can exceed considerably the maximum allowable current of the device. This could result in damage to the device. Make sure that there is not any over-current.
- Do not apply any current through the lines to be measured with the device turned off. This could result in damage to the device.

Specifications

Accuracy

f.s.: maximum display value or scale length (This is usually the maximum value of the currently selected range.)  
rdg.: reading value (The value currently being measured and indicated on the measuring instrument)  
asuring instrument)

About the CT6865-05

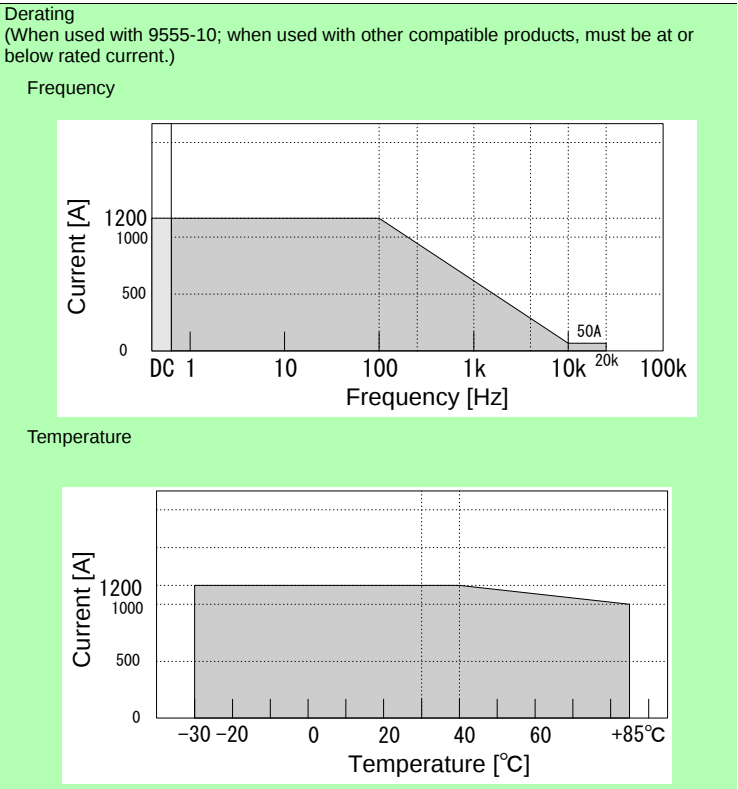
The specs are the same as those of the CT6865, respectively, except the output connector.

|                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Operating Environment                                                                                                                                                                                                                                                                                                                                                   | Indoors, Pollution degree 2, up to 2000 m (6562-ft.) ASL                                               |
| Operating temperature and humidity                                                                                                                                                                                                                                                                                                                                      | -30°C to 85°C (-22°F to 185°F), 80%RH or less (non-condensation)                                       |
| Storage temperature and humidity                                                                                                                                                                                                                                                                                                                                        | -30°C to 85°C (-22°F to 185°F), 80%RH or less (non-condensation)                                       |
| Maximum rated voltage to earth                                                                                                                                                                                                                                                                                                                                          | 1000 V AC/ DC (50 Hz/60 Hz), Measurement category III, anticipated transient overvoltage 8000 V        |
| Applicable standards                                                                                                                                                                                                                                                                                                                                                    | Safety : EN61010<br>EMC : EN61326                                                                      |
| Product warranty period                                                                                                                                                                                                                                                                                                                                                 | 1 year                                                                                                 |
| Dielectric strength                                                                                                                                                                                                                                                                                                                                                     | 7.4 kV AC (Sensitive current 1 mA), at 50 Hz/60 Hz, for 1minute, Through window-cable output connector |
| Rated primary current                                                                                                                                                                                                                                                                                                                                                   | 1000 A AC/DC                                                                                           |
| Output voltage                                                                                                                                                                                                                                                                                                                                                          | 2 V/1000 A                                                                                             |
| Maximum input current                                                                                                                                                                                                                                                                                                                                                   | 1200 A AC/DC (1800 A peak continuous, 100 Hz or less, 40°C or less, otherwise within derating range)   |
| Output resistance                                                                                                                                                                                                                                                                                                                                                       | 50 Ω (±5%)                                                                                             |
| Temperature and humidity range of guaranteed accuracy                                                                                                                                                                                                                                                                                                                   | 0°C to +40°C (32 to 104°F), 80%RH or less                                                              |
| Guaranteed accuracy period                                                                                                                                                                                                                                                                                                                                              | 1 year                                                                                                 |
| Guaranteed accuracy period from adjustment made by Hioki                                                                                                                                                                                                                                                                                                                | 1 year                                                                                                 |
| Accuracy<br>Sine wave input, conductor in center position, common-mode voltage=0, external electromagnetic field=0, using with Model 9555-10,Measuring instrument having 1 MΩ or higher input resistance,<br>Amplitude accuracy (Within a derating, DC < f < 5 Hz (design values))<br>Phase accuracy (At the maximum value of derating, DC < f < 10 Hz (design values)) |                                                                                                        |

| Frequency           | Amplitude            | Phase   |
|---------------------|----------------------|---------|
| DC                  | ±0.05%rdg.±0.01%f.s. | -       |
| DC < f < 16 Hz      | ±0.10%rdg.±0.02%f.s. | ±0.3deg |
| 16 Hz ≤ f ≤ 66 Hz   | ±0.05%rdg.±0.01%f.s. | ±0.2deg |
| 66 Hz < f ≤ 100 Hz  | ±0.5%rdg.±0.02%f.s.  | ±0.5deg |
| 100 Hz < f ≤ 500 Hz | ±1%rdg.±0.02%f.s.    | ±2.0deg |
| 500 Hz < f ≤ 1 kHz  | ±5%rdg.±0.05%f.s.    | ±3.0deg |
| 1 kHz < f ≤ 5 kHz   | ±5%rdg.±0.05%f.s.    | -       |
| 5 kHz < f ≤ 10 kHz  | ±15%rdg.±0.1%f.s.    | -       |
| 10 kHz < f ≤ 20 kHz | ±30%rdg.±0.1%f.s.    | -       |

|                                                           |                                                                                                                              |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Noise                                                     | 5 mVpp or less (100 kHz or less)                                                                                             |
| Temperature coefficient                                   | -30°C to 0°C and +40°C to +85°C<br>Amplitude sensitivity : ±0.01%rdg./°C or less<br>Offset voltage : ±0.01%f.s./°C or less   |
| Effect of conductor position                              | ±0.05%rdg. or less<br>(at 1000 A input, 50 Hz/60 Hz, using with the wire 20 mm diameter)                                     |
| Effect of external electromagnetic field                  | 200 mA or less<br>(Scaled value, In a DC or 60 Hz magnetic field of 400 A/m)                                                 |
| Effect of magnetic                                        | 50 mA or less (Scaled value, after 1000 ADC input)                                                                           |
| Effect of radiated radio-frequency electromagnetic field  | 1%f.s. at 10 V/m                                                                                                             |
| Effect of conducted radio-frequency electromagnetic field | 0.5%f.s. at 3 V                                                                                                              |
| Measurable conductor diameter                             | φ36 mm (1.42") or less                                                                                                       |
| Supply voltage                                            | ±11 V to ±15 V (Tracking)                                                                                                    |
| Power supply capacity                                     | ±300 mA or less<br>(1000 A/55 Hz measurement, with ±12 V power supply)                                                       |
| Rated power                                               | 7 VA or less<br>(1000 A/55 Hz measurement, with ±12 V power supply)                                                          |
| Dimensions                                                | Approx. 160W × 112H × 50D mm (excluding protrusions, cable)<br>(Approx. 6.30"W × 4.41"H × 1.97"D)                            |
| Mass                                                      | Approx. 980 g (34.6 oz.)                                                                                                     |
| Cable length                                              | Approx. 3 m                                                                                                                  |
| Output connector                                          | CT6865 RM51RM51EPA-10PC (made by HIROSE ELECTRIC CO.,LTD.)<br>CT6865-05 HR10A-10P-12P(74) (made by HIROSE ELECTRIC CO.,LTD.) |
| Accessories                                               | Instruction manual, Mark band 6 (3sets)                                                                                      |

| Options<br>(CT6865-05 has no options.)                     | Model 9705 Conversion Cable<br>Model 9706 Extension Cable<br>Model 9318 Conversion Cable<br>Model CT9900 Conversion Cable                                                                                                                                  |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Combined accuracy and conditions                           |                                                                                                                                                                                                                                                            |
| Model name                                                 | CT6865                                                                                                                                                                                                                                                     |
| 9555-10 Sensor Unit<br>9555 Sensor Unit                    | Accuracy of CT6865                                                                                                                                                                                                                                         |
| 3390 Power Analyzer                                        | Recognized as [AC/DC500 A]<br>You must set the CT ratio to "2."<br>Combined accuracy =<br>Accuracy of 3390 + Accuracy of CT6865 (Power factor: 1)                                                                                                          |
| 9602 AC/DC Clamp Input Unit                                | Recognized as [AC/DC500 A] when used together with the 3193, 3193-10 or 3194.<br>You must set the CT ratio to "2."<br>Combined accuracy =<br>Accuracy of 9602 + Accuracy of CT6865 + (±0.1%rdg.) (Power factor: 1)                                         |
| 3334-10 AC/DC Power HiTester                               | Recognized as [AC/DC500 A]<br>You must set the CT ratio to "50."<br>Combined accuracy =<br>Accuracy of 3334-10 + Accuracy of CT6865 (Power factor: 1)                                                                                                      |
| 8940 F/V Unit                                              | If the sensor is automatically recognized, it will be recognized as [AC/DC500 A] at connection. You must set the CT ratio to "2."<br>9705 Conversion Cable and 9318 Conversion Cable required<br>Combined accuracy = Accuracy of 8940 + Accuracy of CT6865 |
| 8951 Voltage/Current Unit                                  | If the sensor is automatically recognized, it will be recognized as [AC/DC500 A] at connection. You must set the CT ratio to "2."<br>9318 Conversion Cable required<br>Combined accuracy = Accuracy of 8951 + Accuracy of CT6865                           |
| 8971 Current Unit                                          | If the sensor is automatically recognized, it will be recognized as [AC/DC500 A] at connection. You must set the CT ratio to "2."<br>9318 Conversion Cable required<br>Combined accuracy = Accuracy of 8971 + Accuracy of CT6865                           |
| 9495 Input Unit<br>(No longer produced)                    | Recognized as 9278 (200 A rating) when used together with the 3192<br>You must set the CT ratio to "5."<br>Combined accuracy =<br>Accuracy of 9495 + Accuracy of CT6865 (Power factor: 1)                                                                  |
| 3167 AC/DC Clamp on Power HiTester<br>(No longer produced) | 9705 Conversion Cable required<br>Recognized as 9279 (500 A rating)<br>You must set the CT ratio to "2."<br>Combined accuracy =<br>Accuracy of 3167 + Accuracy of CT6865 (Power factor: 1)                                                                 |
| PW6001 Power Analyzer                                      | CT9900 Conversion Cable required<br>Recognized as [AC/DC500 A].<br>You must set the CT ratio to "2."<br>Accuracy of PW6001+ Accuracy of CT6841-05. (Power factor: 1)                                                                                       |
| Model name                                                 | CT6865-05                                                                                                                                                                                                                                                  |
| PW6001 Power Analyzer                                      | Recognized as [AC/DC1000 A].<br>Accuracy of PW6001+ Accuracy of CT6865-05. (Power factor: 1)                                                                                                                                                               |



Measurement Procedure

⚠WARNING

In order to prevent electric shock and short-circuit accidents, shut off the power to the line to be measured before connecting this device.

⚠CAUTION

- To prevent damage to the connected instrument and sensor, never connect or disconnect a sensor while the power is on.
- When the connected instrument's power is turned off, do not apply current to the sensor. Doing so may damage the device.
- When disconnecting the output connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.

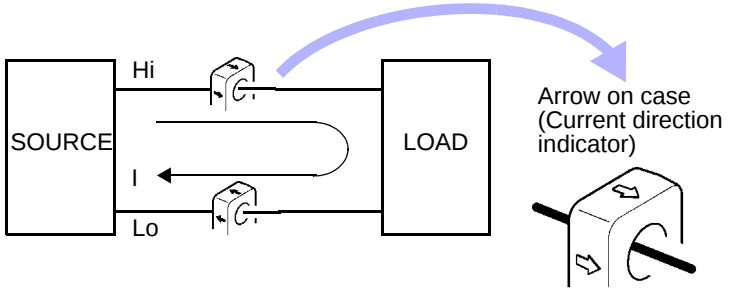
NOTE

The sensor's signal output circuit is protected by a resistor (output resistor). A digital multimeter used for monitoring should have high input resistance (recommended minimum: 1 MΩ).

Wiring

Make sure the direction of the arrow on the case matches the direction of the current flow, as shown in Figure 1. If they are oriented incorrectly, the output signal from the sensor will be reversed

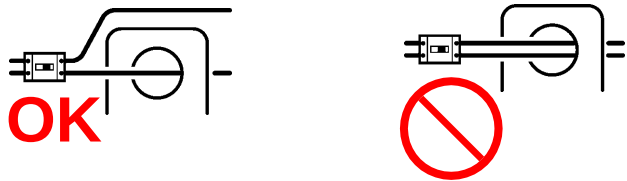
Figure 1. Wiring example



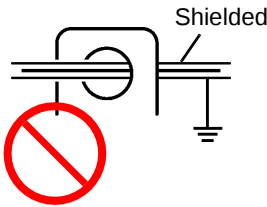
When the CT6865 is used with a wattmeter, follow the wiring instructions provided with the wattmeter.

NOTE

- Make sure to pass only one conductor through. Single-phase (2-wire) or three-phase (3-wire) cables conducted together will not produce any reading.



- Ground-shielded conductors cannot be accurately measured.



Maintenance and Service

⚠WARNING

- Do not attempt to modify, disassemble or repair the device; as fire, electric shock and injury could result.

- To clean the device, 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.
- If the device seems to be malfunctioning, contact your dealer or Hioki representative. When returning the device for repair, pack the device so that it will not sustain damage during shipping, and include a description of existing damage. We do not take any responsibility for damage incurred during shipping.

Options

9705 Conversion Cable

The CT6865, CT6865-05 differs from previous current sensors in that the output wire cannot be directly connected to some products. The 9705 Conversion Cable makes it possible to connect to and use with products which cannot be directly connected.

9706 Extension Cable

This is used to extend the CT6865, CT6865-05 cable. With the use of one 9706 Extension Cable the total length becomes 8 m. Up to 2 cables can be linked together. Three or more may be used, but the CT6865's performance is not guaranteed under such conditions.

Each cable adds ±0.1%rdg. to the sensor's accuracy.

9318 Conversion Cable

This is used to connect the CT6865, CT6865-05 to the 8940 F/V Unit or the 8951 Voltage/Current Unit.

CT9900 Conversion Cable

This is used to connect the CT6865, CT6865-05 to the PW6001 Power Analyzer.

NOTE

- Follow the "Connection example" when connecting the 9705, 9706, and 9318.
- Also refer to the Instruction manual for attached device.

Connection example

