HIOKI

INSTRUCTION MANUAL

2331-20

POWER METER MODULE

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing the HIOKI “Model 2331-20 POWER METER MODULE”. To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

Inspection

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

Accessories

Instruction manual 1

Options

9695-02	CLAMP ON SENSOR (50 Arms)
9695-03	CLAMP ON SENSOR (100 Arms)
9661-01	CLAMP ON SENSOR (500 Arms)
9765*	CLAMP ON SENSOR (5 Arms) (See "When using Model 9765 " (p.10))
9238	CLAMP SENSOR CABLE

* Not complied with the CE marking.

Safety Notes

⚠DANGER This instrument 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 instrument. 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 instrument defects.

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

Safety Symbols

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the instrument.
	The ⚠ symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates a grounding terminal.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).

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 instrument.
NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Other Symbols

	Indicates the prohibited action.
❖	Indicates the reference.

Accuracy

We define measurement tolerances in terms of f.s. (full scale), and rdg. (reading) values, with the following meanings:

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

Measurement categories (Overvoltage categories)

This instrument complies with CAT III safety requirements.
To ensure safe operation of measurement instruments, 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 instrument.

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.

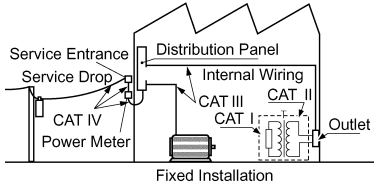
CAT IV The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection instrument (distribution panel).

Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement instrument designed for CAT III environments can endure greater momentary energy than a instrument designed for CAT II.

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.

Never use a CAT I measuring instrument in CAT II, III, or IV environments.

The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



Notes on Use

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

⚠ DANGER

- The maximum input voltage is as follows.
  U INPUT: 300 Vrms, 424.3 V peak
  ALARM : 30 VDC
  CLAMP SENSOR INPUT: 1.5 Vrms, 2.2 V peak
  Attempting to measure voltage in excess of the maximum input could destroy the instrument and result in personal injury or death.
- The maximum rated voltage between input terminals and ground is 300 Vrms. Attempting to measure voltages exceeding 300 Vrms with respect to ground could damage the instrument and result in personal injury.

⚠ WARNING

Do not allow the instrument to get wet.

Corrosive or combustible gases

Do not allow the instrument to get wet, and do not take measurements with wet hands.
This may cause an electric shock.

Do not use the instrument where it may be exposed to corrosive or combustible gases.
The instrument may be damaged or cause an explosion.

⚠CAUTION

Electromagnetic radiation or highly electrically charged object

Do not use the instrument near a source of strong electromagnetic radiation, or near a highly electrically charged object.

These may cause a malfunction.

Operation and Installation environment.

This instrument should be installed and operated indoors only, between 0 and 50°C (32 to 122°F) and 80% RH or less.

Temperature or humidity

Dust

This instrument is not designed to be entirely water- or dust-proof.

Do not use it in an especially dusty environment, nor where it might be splashed with liquid. This may cause damage.

When the module is used in a dusty environment, place it in a dustproof case and take measures to ensure heat dissipation.

Direct sunlight

Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation.

Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.

To avoid damage to the instrument, protect it from physical shock when transporting and handling.

Be especially careful to avoid physical shock from dropping.

Do not obstruct the ventilation holes.

Ventilation holes for heat radiation are provided on the top and rear panels of the instrument. Leave sufficient space around the ventilation holes and install the instrument with the holes unobstructed. Installation of the instrument with the ventilation holes obstructed may cause a malfunction or fire.

⚠CAUTION **When using the instrument in the case, drill ventilation holes.**

Drill ventilation holes or install a ventilation fan to prevent heat buildup.

Wiring

⚠DANGER

- 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.
- U INPUT terminals 1 to 3 share the N terminal and inputs to the terminals are not insulated from each other. Beware of electric shock and short-circuiting.
- The CLAMP SENSOR INPUT terminals are not insulated from the U INPUT terminals. Beware of electric shock and short- circuiting.

⚠WARNING

- A qualified electrician shall perform the wiring to prevent electric shock.
- Avoid live-line electrical work to prevent electric shock, module malfunction due to short-circuiting or opening of the CT secondary side, overheating, and fire.
- When tightening the screws, confirm that all screws are securely tightened. A loose screw may result in module errors or the generation of high voltage on the CT secondary side, which may cause fire or electric shock.

⚠WARNING

- Be sure to tighten the screws within the specified torque. Excessive torque may damage the terminals. Inadequate torque may result in module errors or the generation of high voltage on the CT secondary side, which may cause fire or electric shock.
- Ensure that the power supply module and input are OFF until all wiring work is finished. This will prevent module trouble and electric shock.
- Ensure that the power supply module and input are OFF when connecting or disconnecting the module to the system. This will prevent electric shock, errors, and malfunction.
- Avoid using an unused terminal for relaying or any other purpose to prevent electric shock, errors, and malfunction.

⚠CAUTION

- Connect the module to a power source that matches the rating in order to prevent fire.
- Ensure that the power supply, input, and output are correctly wired according to the wiring diagram. (See Chapter 3 "Preparations " (p.25)) This will prevent fire, malfunction, and errors.
- Use cables of the proper sizes for the rated current. This will prevent module errors due to broken wire, malfunction due to opening of the CT secondary side, overheating, and fire.
- Use crimp connectors of the proper sizes for the cables. This will prevent module errors due to broken wire, malfunction due to opening of the CT secondary side, overheating, and fire.

⚠CAUTION

- Do not connect a current sensor other than the specified clamp sensor directly to this module. Excessive input may result in module malfunction.
- Be careful to avoid dropping the clamps or otherwise subjecting them to mechanical shock, which could damage the mating surfaces of the core and adversely affect measurement.
- Measurements are degraded by dirt on the mating surfaces of the clamp-on sensor, so keep the surfaces clean by gently wiping with a soft cloth.
- If power supply noise poses a problem, use of a noise filter is recommended.
- Avoid stepping on or pinching cables, which could damage the cable insulation.
- Keep the cables well away from heat sources, as bare conductors could be exposed if the insulation melts.
- When the power and signal lines may be subject to a lightning-induced surge, install a lightning arrester between another instrument or module connected to this module and line to protect the system.

When using Model 9765

⚠DANGER

- To avoid short circuits and potentially life-threatening hazards, never attach the product to a circuit that operates at more than 30 VAC, or over bare conductors.
- This product 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.

Preliminary Checks

- Before using the instrument 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.
- Before using the instrument, 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.

Overview Chapter 1

1.1 Product Overview

- The 2331-20 is a measurement module of the Hioki "Smart Site" (remote measurement system).
- This module measures and records power at regular intervals.
- And the voltage, current, active power, power factor, active energy within an interval, and frequency are also can be measured.
- The 2331-20 is used with the power supply module, communications module, and module base.

Number of measurement circuits	(1P2W/1P3W/3P3W/3P4W) 1 circuit
Voltage input	100 V (70 to 130 VAC)/ 200 V (140 to 260 VAC) line
Current Input	Clamp sensor

(Conceptual image)

NOTE Do not use this module as a wattmeter or watt-hour meter for business transactions.

1.2 Major Features

- This is a clamp-type wattmeter is used for a 100/200 VAC single-phase line to a 3-phase, 4-wire line.
- The recording interval is selectable from 1 second to 60 minutes.
- The maximum, minimum, and average measurements during the recording interval can be recorded (with sampling once a second).
- The module has an alarm output terminal.

Rough Estimate of Storable Data Quantity and Time

Action at memory full: Continue recording (Endless)

1P2W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	13000	5900	4600
Recording interval			
1 sec.	3.5 hours	1.5 hours	1 hour
2 sec.	7 hours	3 hours	2.5 hours
5 sec.	18 hours	8 hours	6 hours
10 sec.	1.5 days	16 hours	12.5 hours
15 sec.	2 days	1 day	19 hours
20 sec.	3 days	1 day	1 day
30 sec.	4.5 days	2 days	1.5 days
1 min.	9 days	4 days	3 days
2 min.	18 days	8 days	6 days
5 min.	46 days	20 days	16 days
10 min.	92 days	41 days	32 days
15 min.	138 days	61 days	48 days
20 min.	184 days	82 days	64 days
30 min.	277 days	123 days	96 days
60 min.	554 days	246 days	192 days

NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

Action at memory full: Continue recording (Endless)

1P3W/3P3W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	10000	4400	3400
Recording interval			
1 sec.	2.5 hours	1 hour	0.5 hours
2 sec.	5.5 hours	2 hours	1.5 hours
5 sec.	14.5 hours	6 hours	4.5 hours
10 sec.	1 day	12 hours	9.5 hours
15 sec.	1.5 days	18 hours	14 hours
20 sec.	2 days	1 day	19 hours
30 sec.	3.5 days	1.5 days	1 day
1 min.	7 days	3 days	2 days
2 min.	14 days	6 days	4.5 days
5 min.	36 days	15 days	11 days
10 min.	73 days	30 days	23 days
15 min.	110 days	46 days	35 days
20 min.	147 days	61 days	47 days
30 min.	221 days	92 days	71 days
60 min.	443 days	184 days	143 days

NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

Action at memory full: Continue recording (Endless)

3P4W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	8800	3500	2700
Recording interval			
1 sec.	2 hours	0.5 hours	0.5 hours
2 sec.	4.5 hours	1.5 hours	1.5 hours
5 sec.	12 hours	4.5 hours	3.5 hours
10 sec.	1 day	9.5 hours	7.5 hours
15 sec.	1.5 days	14.5 hours	11 hours
20 sec.	2 days	19.5 hours	15 hours
30 sec.	3 days	1.5 days	22.5 hours
1 min.	6 days	2 days	1.5 days
2 min.	12 days	4 days	3.5 days
5 min.	30 days	12 days	9 days
10 min.	61 days	24 days	18 days
15 min.	92 days	36 days	28 days
20 min.	123 days	49 days	37 days
30 min.	184 days	73 days	56 days
60 min.	369 days	147 days	113 days

NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

Action at memory full: Stop recording (Memory full stop)

1P2W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	15000	6800	5300
Recording interval			
1 sec.	4 hours	1.5 hours	1 hour
2 sec.	8.5 hours	3.5 hours	1.5 hours
5 sec.	21 hours	9 hours	7 hours
10 sec.	1.5 days	18.5 hours	14.5 hours
15 sec.	2.5 days	1 day	22 hours
20 sec.	3.5 days	1.5 days	1 day
30 sec.	5 days	2 days	1.5 days
1 min.	10 days	4.5 days	3.5 days
2 min.	21 days	9 days	7 days
5 min.	53 days	23 days	18 days
10 min.	106 days	47 days	37 days
15 min.	159 days	71 days	55 days
20 min.	213 days	94 days	74 days
30 min.	319 days	142 days	111 days
60 min.	639 days	284 days	222 days

NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

Action at memory full: Stop recording (Memory full stop)

1P3W/3P3W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	12000	5100	3900
Recording interval			
1 sec.	3 hours	1 hour	1 hour
2 sec.	6.5 hours	2.5 hours	2 hours
5 sec.	17 hours	7 hours	5.5 hours
10 sec.	1 day	14 hours	11 hours
15 sec.	2 days	21 hours	16.5 hours
20 sec.	2.5 days	1 day	22 hours
30 sec.	4 days	1.5 days	1 day
1 min.	8 days	3.5 days	2.5 days
2 min.	17 days	7 days	5 days
5 min.	42 days	17 days	13 days
10 min.	85 days	35 days	27 days
15 min.	127 days	53 days	41 days
20 min.	170 days	71 days	55 days
30 min.	255 days	106 days	82 days
60 min.	511 days	213 days	165 days

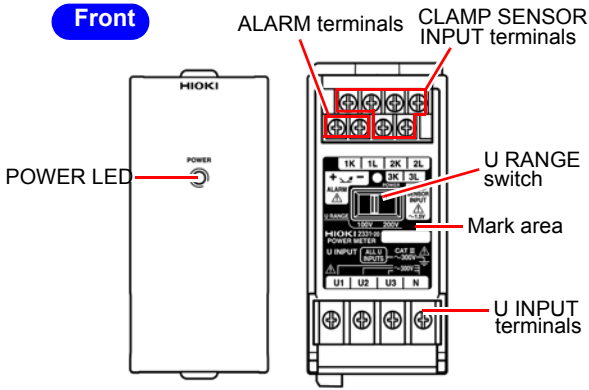
NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

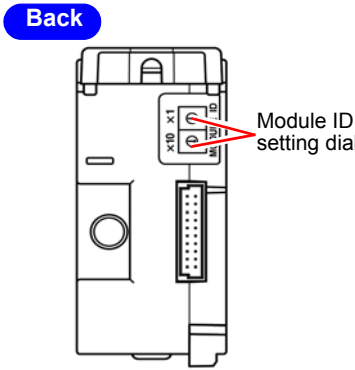
Action at memory full: Stop recording (Memory full stop)

3P4W			
	Recording Mode		
	Instantaneous Value	MAX/MIN/AVE	Instantaneous Value + MAX/MIN/AVE
Quantity of storable data	10000	4000	3100
Recording interval			
1 sec.	2.5 hours	1 hour	0.5 hours
2 sec.	5.5 hours	2 hours	1.5 hours
5 sec.	14 hours	5.5 hours	4 hours
10 sec.	1 day	11 hours	8.5 hours
15 sec.	1.5 days	17 hours	13 hours
20 sec.	2 days	22.5 hours	17.5 hours
30 sec.	3.5 days	1 day	1 day
1 min.	7 days	2.5 days	2 days
2 min.	14 days	5 days	4 days
5 min.	35 days	14 days	10 days
10 min.	71 days	28 days	21 days
15 min.	106 days	42 days	32 days
20 min.	142 days	56 days	43 days
30 min.	213 days	85 days	65 days
60 min.	426 days	170 days	131 days

NOTE When the alarm log is ON, the higher the number of alarms generated, the smaller the recording period. (Approx. 1/2 of the data per alarm)

1.3 Name and Function of the Parts

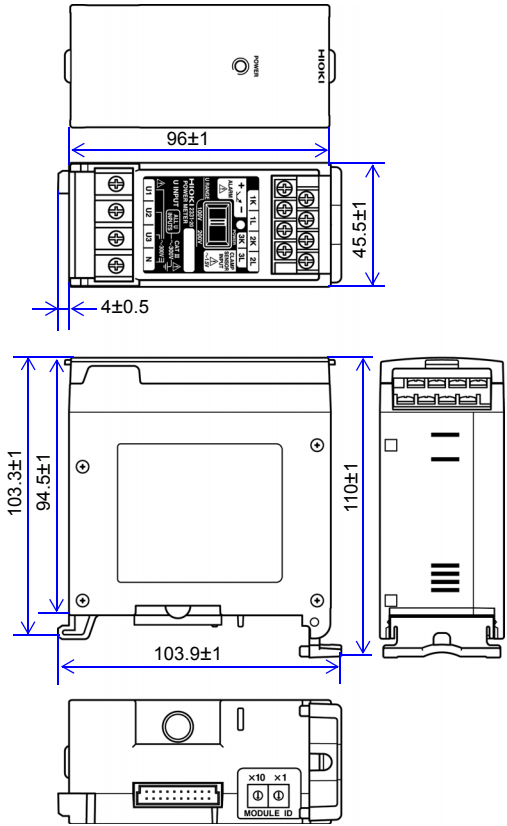




POWER LED	Goes on or flashes when power is supplied to the module. Remains on, flashes, or changes to another color according to the state of the module. **POWER LED indication** Lit in green : Data being recorded. Flashing in green : Standing by. Lit in yellow : Alarm output. Flashing in yellow : It indicates one of the following: • The voltage is outside the effective measurement range. • The current is out of range. • The active power is a negative value. Lit in red : Non-recoverable error occurred. *1 Flashing in red : Recoverable error occurred. *2
Mark area	Use this area to make a note of the object to measure or the module ID. Use an ink pen, since pencil lead may rub off.
CLAMP SENSOR INPUT terminals	Connect the output of clamp sensors to these terminals (for 3 channels).
U INPUT terminals	Connect voltages to be measured to these terminals.
ALARM terminals	Connect the alarm output cable to these terminals. These terminals are electrically insulated from the input terminals.
U RANGE switch	Select a voltage range of 100 V (70 to 130 VAC) or 200 V (140 to 260 VAC).
Module ID setting dial	Use the dial to set the module's identification No.

*1: The module needs repair. Contact your vendor (agent) or nearest Hioki office.
*2: The same module ID may be used by another module.

1.4 Dimension Diagrams



(Unit: mm)

Settings Chapter 2

2.1 Setting the Module ID

You can connect up to 63 measurement modules to one communications module.

Setting Procedure

Use the module ID setting dial to set the ID No. of the module to a number from 01 and to 63. (You cannot set a number other than the above.)

NOTE

- Ensure that the set ID is not used for any other module connected to the same communications module.
- The ID numbers of modules need not be consecutive.
- Setting the ID to 99, then turning on the power resets all internal settings to the defaults.
- The module ID and COM ID are not related and can be set independently.

Preparations ⚠ Chapter 3

3.1 Installing the Module

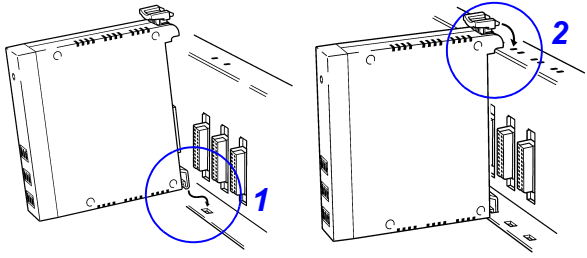
3.1.1 Installing the Module Base

⚠CAUTION Do not mount the module base on the ceiling where it may fall off.

Fasten the module base to a DIN rail or the wall according to the procedure described in the 2391 or 2392 series MODULE BASE instruction manual.

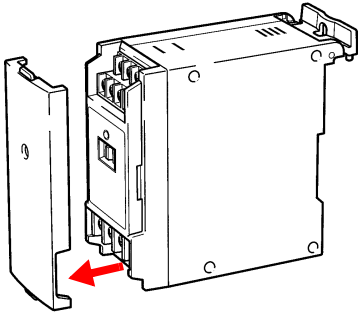
3.1.2 Mounting a Module on the Module Base

Mount a module on the module base as shown below. Ensure that the lever clicks.



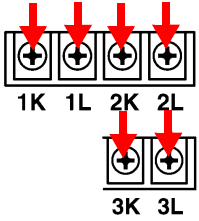
3.2 Connecting the Clamp Sensor to Module

1. Remove the cover from the module.



2. Connect the clamp sensor cables to the module's CLAMP SENSOR INPUT terminals (at a tightening torque of 0.5 N•m).

❖ "Connection diagram" (p.33)



CLAMP SENSOR INPUT

Clamp Sensors:
9695-02 (50 A), 9695-03 (100 A), 9661-01 (500 A), 9765 (5 A, For CT secondary side)

Terminals

M3.0 screws are used for the terminal blocks for this module and the clamp sensors. For connection, a round crimp connector (RAV 1.25-3) is recommended.

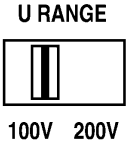
Cables

The 9695-02 and 9695-03 use terminal blocks. Therefore, various types of cables may be usable. Cables equivalent to or better than 600 V vinyl-insulated 0.9 mm^2 or 300 V vinyl-insulated 0.75 mm^2 are recommended.
The 9238 CLAMP SENSOR CABLE (3 m) is optionally available.

NOTE Note that measurement may be adversely affected by external noise or the electromagnetic environment when using cable longer than 3 meters.

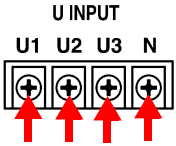
3.3 Connecting the Voltage Cable to the Module

1. Use the U RANGE switch to select 100 V (70 to 130 VAC) or 200 V (140 to 260 VAC).



2. Connect voltage cables to the U INPUT terminals (at a tightening torque of 0.8 N•m).

❖ "Connection diagram" (p.33)



The terminal blocks use M3.5 screws. For connection, a round crimp connector (RAV 1.25-3.5) is recommended.
For wiring, cables equivalent to or better than 600 V vinyl-insulated 0.9 mm^2 is recommened.

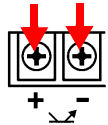
3.4 Connecting Alarm Output

⚠DANGER Design the wiring to prevent short-circuiting of the ALARM and CLAMP SENSOR INPUT terminals, thus avoiding electric shock and accidents due to short-circuiting.

The terminal blocks use M3.0 screws (at a tightening torque of 0.5 N•m).
We recommend that you use a round crimp connector (RAV 1.25-3) for connection.
Open collector output (Rating: 30 VDC, 20 mA max.)

NOTE

- The ALARM terminals are electrically insulated from the U INPUT terminals and CLAMP SENSOR INPUT terminals.
- To avoid the effects of external noise, design the wiring so that cables connected to the ALARM terminals are separated from those for measurement, as well as cables connected to the CLAMP SENSOR INPUT terminals and voltage cables.



3.5 Connecting to the Measured Line

⚠DANGER

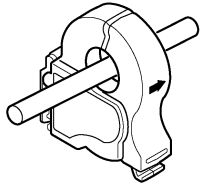
- U INPUT terminals 1 to 3 share the N terminal; inputs to these terminals are not insulated from each other. Be careful to avoid electric shock and short-circuiting.
- The CLAMP SENSOR INPUT terminals are not insulated from the U INPUT terminals. Be careful to avoid electric shock and short-circuiting when using the U INPUT terminals.
- To avoid short circuits and potentially life-threatening hazards, never attach the clamp sensor to a circuit that operates at more than the maximum rated voltage, or over bare conductors.
- 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.
- If the secondary circuit is opened while electricity is being sent through the CT, very high and dangerous voltage may be generated at the secondary side terminal.
- Be sure to cover the measured line when live to avoid electric shock and short-circuiting.

⚠WARNING In order to prevent electric shock and short-circuit accidents, shut off the power to the line to be measured before connecting the clamp sensors and voltage cords.

⚠CAUTION
- Avoid stepping on or pinching cables, which could damage the cable insulation.
- Do not input voltage or current to the U INPUT terminals and CLAMP SENSOR INPUT terminals when module power is OFF. This will avoid damaging the module.

Connect the sensors and cables to the measured line according to the connection diagram.

1. Connect the clamp sensors to the line.
2. Connect the voltage cables to the line.



❖ "Connection diagram" (p.33)
❖ Instruction manuals of the clamp sensors

NOTE

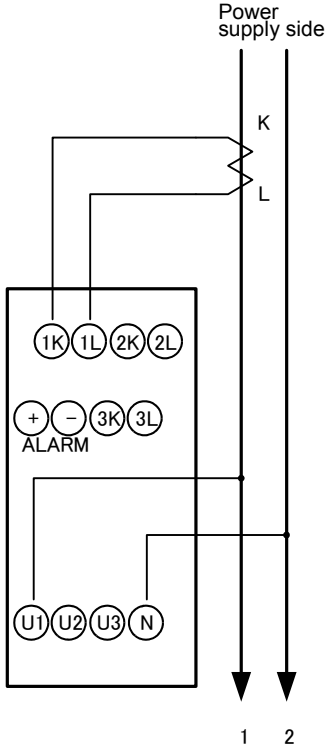
- Ensure that the measured line is correctly set and connection correctly made to ensure accurate measurement.
- Clamp the cladding of the wire by placing the clamp with the arrow on it facing the load side.
- This module can be used for a single-phase, 2-wire line to a 3-phase, 4-wire line. Each channel is not independent, however, and thus the module cannot be used as two single-phase wattmeters.
- When measuring a 3-phase line, be sure to align the phase sequence of the measured line with the order of measurement channels of the module.

Completing Measurement

1. Remove the voltage cables.
2. Remove the clamp sensors.

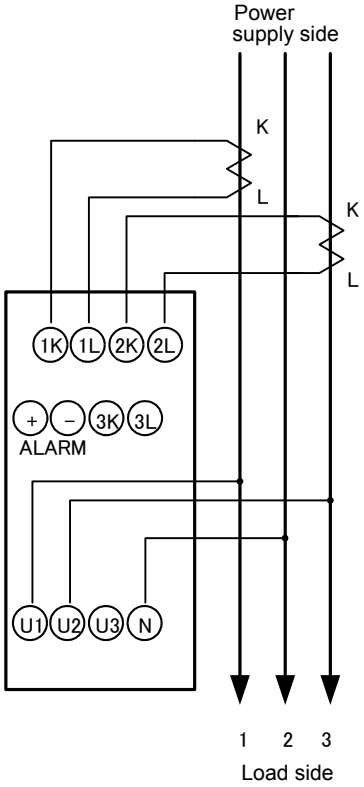
Connection diagram

Measurement of single-phase, 2-wire line



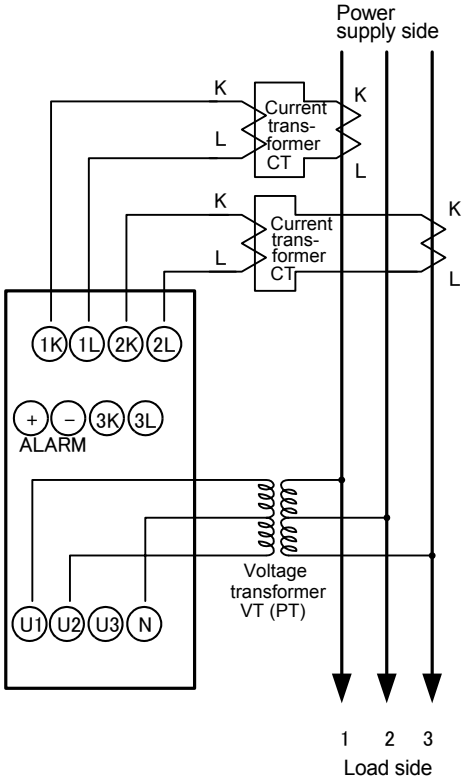
Connection diagram

Measurement of singe-phase, 3-wire line or 3-phase, 3-wire line



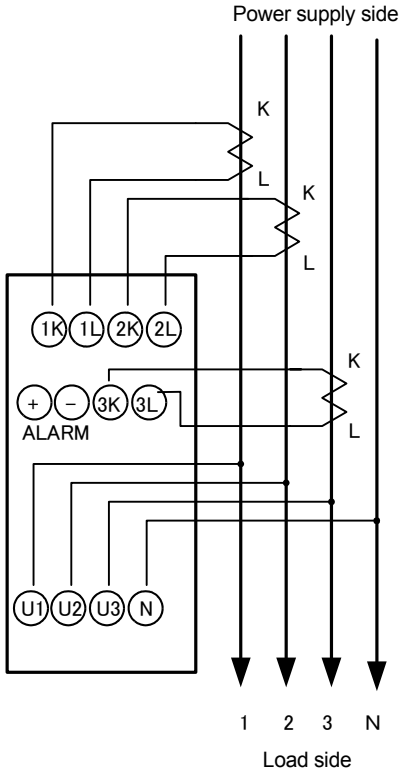
Connection diagram

Measurement of singe-phase, 3-wire line or 3-phase, 3-wire line using CT and VT (PT)



Connection diagram

Measurement of 3-phase, 4-wire line



INPUT: 3PHASE 4WIRE

Others Chapter 4

4.1 Alarm Output

4.1.1 Output Rating

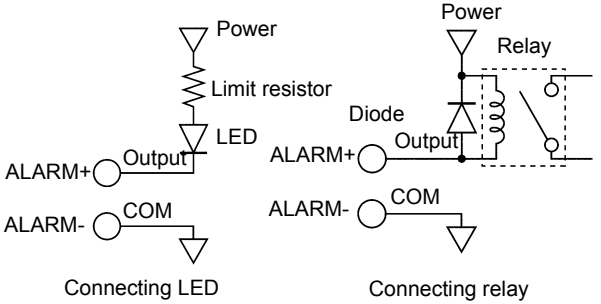
⚠WARNING Ensure that the input does not exceed the maximum input voltage or current to avoid module damage, short-circuiting and electric shock resulting from heat building.

Output method	Open collector
Maximum input voltage / current	30 V, 20 mA max. (Allowable loss: 75 mW)
Signal logic	Enabled: ON Disabled: OFF

NOTE

- Signal logic indicates the signal state in which a signal's function is enabled.
- The output transistor works as a switch between signal output and ground in the module. When output becomes enabled, the switch is turned on and current flows from the output signal to COM in the module. Therefore, a relay or LED lamp can be connected directly to the output terminal ❖ (p.38).

Circuit diagram

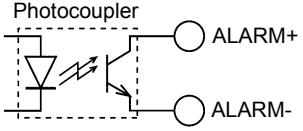


NOTE

- When connecting a relay or LED lamp, ensure that the relay or lamp operates at up to 30 V and 20 mA (with allowable loss of 75 mW or less). When connecting a relay, be sure to use a diode to absorb counterelectromotive force.

4.1.2 Target of Alarm Monitoring

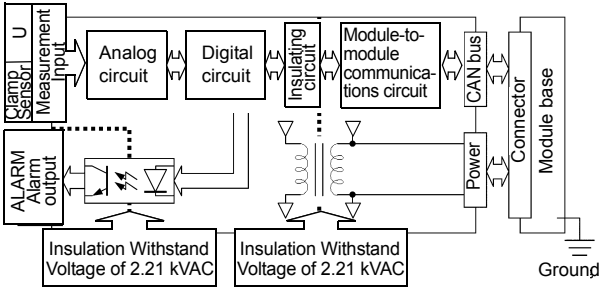
One measurement item is judged whether high or low.



4.2 Insulation of Internal Circuit

⚠DANGER Insulation is not provided between the measurement input terminals or between the CLAMP SENSOR INPUT terminals and U INPUT terminals. Beware of electric shock and short- circuiting. Moreover, be sure to cover the measured line when live.

In the 2331-20, the input circuit and alarm output are insulated from the CAN bus as shown in the block diagram below. (Withstand voltage: 2.21 kVAC, 50/60 Hz, Response current: 5 mA, 1 minute)



Specifications Chapter 5

5.1 Basic Specifications

Condition of guaranteed accuracy

Condition of Guaranteed accuracy	10-minute warming-up time, Sine wave input, Power factor =1, Maximum rated voltage to earth=0 V
Period of Guaranteed Accuracy	One year
Effective Measurement Range	Voltage : 70%f.s. to 130%f.s. Current : 2%f.s. to 130%f.s.
Effective power	2%f.s. to 130%f.s.
The Range of Operating Temperature and Humidity for Guaranteed Accuracy	23°C±5°C (73°F±8.5°F), 80%RH or less The ranges above apply unless otherwise specified in each specification.
Fundamental Frequency Range	45 to 66Hz

Measurement items and accuracy specifications

Measurement Lines	single-phase 2-wire line, single-phase 3-wire line, three-phase 3-wire line, three-phase 4-wire line
Measurement Items	Voltage, current, active power, power factor, active energy within an interval, and frequency

Voltage / Current measurement

Measurement Range	Voltage: U1,U2,U3 100 V,200 V (Switched using the SW.) Current: I1,I2,I3 1A,5A,50A,100A,200A,500A,1000A (Depends on the clamp sensor used.)
Measurement Accuracy	Voltage : ±1.0%f.s. Current : ±1.0%f.s. + Clamp sensor accuracy

Current range

Clamp Sensor and Its Current Range	2331-20 Current Range (Selectable using the PC application)
1 A (100 mV/A)	1 A
9765 5 A (20 mV/A)	5 A
9695-02 50 A (10 mV/A)	5 A
	50 A
9695-03 100 A (1 mV/A)	100 A
9661-01 500 A (1 mV/A)	100 A
	500 A
1000 A (0.5 mV/A)	200 A
	1000 A

Power range

Current / Voltage / Wiring		1.000 A	5.000 A	50.00 A	100.0 A	200.0 A	500.0 A	1.000 kA
100.0 V	1P2W	100.0 W	500.0 W	5.000 kW	10.00 kW	20.00 kW	50.00 kW	100.0 kW
	1P3W 3P3W	200.0 kW	1.000 kW	10.00 kW	20.00 kW	40.00 kW	100.0 kW	200.0 kW
	3P4W	300.0 W	1.500 kW	15.00 kW	30.00 kW	60.00 kW	150.0 kW	300.0 kW
200.0 V	1P2W	200.0 W	1.000 kW	10.00 kW	20.00 kW	40.00 kW	100.0 kW	200.0 kW
	1P3W 3P3W	400.0 W	2.000 kW	20.00 kW	40.00 kW	80.00 kW	200.0 kW	400.0 kW
	3P4W	600.0 W	3.000 kW	30.00 kW	60.00 kW	120.0 kW	300.0 kW	600.0 kW

- The range table lists the full scales of voltage and current measurement ranges.
- When the VT (PT) ratio and CT ratio are set, the ranges will be multiplied by (VT (PT) ratio × CT ratio).
- The number of digits of a measurement to display depends on the PC application used.

Active Power Measurement

Measurement Range	Effective Power P Voltage range × Current range
Measurement Accuracy	±1.5%f.s.+Clamp sensor accuracy
Polarity	Consumption: No sign Regeneration: "-"

Active Energy Measurement

Measurement Range	Active energy within interval Wh + consumed component only
Totalization Accuracy	±1.6% f.s. ± clamp sensor accuracy (Note that f.s. is voltage range × current range.)

Power Factor

Measurement Range	Power factor PF 0 to 1
Measurement Accuracy	±5%rdg. (At full-scale input with power factor of 1)

Frequency measurement

Measurement Range	Frequency FREQ 40Hz to 70Hz
Measurement Accuracy	±0.5%rdg. (When input is 70% to 130% f.s. of voltage range)
Object to be Measured	Voltage U1

Operation Method for Totalization

Start of Totalization	The PC application starts measurement.
End of Totaliztion	The PC application ends measurement (depending on recording end conditions). For details, refer to specifications of the PC application.

Other Characteristics

Temperature	Within ±0.05 f.s./°C
Effect of Maximum Rated Voltage to Earth	Within±0.5%f.s. (Maximum rated voltage to earth 50Hz/60Hz)
Actual Time Accuracy	±100 ppm (Reference value at temperature from 0 to 50°C (32 to 122°F) without using communications module)
Effect of Electromagnetic Field	Within ±2% f.s. (in field of 400 Vrms/m and 50/60Hz)

Zero Suppression	Voltage : Less than 0.5% f.s. of measurement Current : Less than 0.5% f.s. of measurement (less than 0.9% f.s. when using the 9695-02 with 5A range selected) Power : When voltage or current is 0

5.2 Function Specifications

Recorded Data	One data set contains time, voltage, current, effective power, power factor, Active energy within an interval, frequency • Instantaneous recording mode 1P2W U1, I1, P, PF, Wh+, FREQ 1P3W/3P3W U1, U2, I1, I2, P, PF, Wh+, FREQ 3P4W U1, U2, U3, I1, I2, I3, P, PF, Wh+, FREQ • MAX/MIN/AVE recording mode 1P2W Maximum/Minimum/Average of U1, I1, P, PF, FREQ, Wh+ 1P3W/3P3W Maximum/Minimum/Average of U1, U2, I1, I2, P, PF, FREQ, Wh+ 3P4W Maximum/Minimum/Average of U1, U2, U3, I1, I2, I3, P, PF, FREQ,Wh+ • Instantaneous value + MAX/MIN/AVE recording mode 1P2W Instantaneous value/ Maximum/Minimum/Average of U1, I1, P, PF, FREQ, Wh+ 1P3W/3P3W Instantaneous value/Maximum/Minimum/Average ofU1, U2, I1, I2, P, PF, FREQ, Wh+ 3P4W Instantaneous value/ Maximum/Minimum/Average ofU1, U2, U3, I1, I2, I3, P, PF, FREQ, Wh+
Recording Start/End	Recording is started and ended by a command. (Immediate start, timed start, or timed end)
Recording Method	Interval recording (Measurements are recorded at a set recording interval.)

Recording Mode	• Instantaneous value • MAX/MIN/AVE • Instantaneous value + MAX/MIN/AVE Total 3 modes ♦Set the mode before the start of recording.
Recording End Condition	Memory full stop or indefinite ♦Set the condition before the start of recording.
Data Acquisition Method	All logging data, data before, at, and after the specified time, or the current instantaneous value (monitored value)
Recording Interval	1/2/5/10/15/20/30 sec. 1/2/5/10/15/20/30/60 min.
Alarm	An alarm is activated when any measurement item is too high or too low.
Alarm Output	Alarm output × 1CH (Open collector: 30 VDC, 20 mA max.)
Data Deletion	All items of data are deleted by a command. ♦New data will be added to the previous data at the start of recording.
Power Outage Protection	After recovering from a power outage, the 2331-20 automatically returns to the state held before the outage.

5.3 General Specifications

Input Method	U INPUT: Insulated input (Not insulated from current measurement circuit) CLAMP SENSOR INPUT: Input insulated by a clamp sensor
Input Resistance (50/60 Hz)	U INPUT: 1.6 MΩ ± 10% (Difference input) CLAMP SENSOR INPUT: 200 kΩ ± 10%
Measurement Method	Digital sampling
Internal Memory	512 k bytes Flash memory
Backup	Recorded data (saved in flash memory) ♦Data loss for up to 2 minutes before and after a power outage may occur.
Clock Function	The real time clock (year, month, day, hour, minute, and second) of the communications module is used.
LED Display	Used for monitoring and warning
Communication Interface	CAN bus
Maximum Input Voltage	U INPUT: 300 Vrms, 424.3 V peak ALARM : 30 VDC CLAMP SENSOR INPUT: 1.5 Vrms, 2.2 V peak value
Maximum Rated Voltage to Earth	Voltage input (U INPUT) terminal 300 Vrms, 50/60 Hz
Rated Supply Voltage	+5V±0.3 VDC
Maximum Rated Power	2.5 W

Withstanding Voltage	3.536 kVAC Between U INPUT terminals and Case (excluding terminal section) 2.210 kVAC Between U INPUT terminals and ALARM terminals, interface terminals CLAMP SENSOR INPUT terminals and ALARM terminals, Interface terminals (50/60 Hz, Response current 5 mA, one minutes
Dimensions	Approx. 45.5W × 96H × 94.5D mm (1.79"W × 3.78"H × 3.72"D) (including cover, excluding projections)
Mass	Approx. 240 g (8.5 oz.) (including cover)
Accessories	Instruction manual 1
Option	9695-02 CLAMP ON SENSOR (50 Arms) 9695-03 CLAMP ON SENSOR (100 Arms) 9661-01 CLAMP ON SENSOR (500 Arms) 9765* CLAMP ON SENSOR (5 Arms) (See "When using Model 9765 " (p.10)) 9238 CLAMP SENSOR CABLE ♦All sensors are the voltage-output type. * Not complied with the CE marking.
Operational Ranges for Temperature and Humidity	0 to 50°C (32 to 122°F), 80%RH or less (with no condensation)
Temperature and Humidity Ranges for Storage	-10 to 50°C (14 to 122°F), 80%RH or less (with no condensation)
Location for Use	Max. 2000 m (6562-ft.) height, indoors
Standards Applying	Safety EN61010-1:200 Pollution Degree 2 Measurement Category III, (anticipated transient overvoltage 4000 V) EMC EN61326:1997+A1:1998+A2:2001 CLASS A

Maintenance and Service Chapter 6

6.1 Cleaning

To clean the instrument, 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.

6.2 Service

⚠WARNING Never modify the instrument. Only Hioki service engineers should disassemble or repair the instrument. Failure to observe these precautions may result in fire, electric shock, or injury.

- If the instrument seems to be malfunctioning, confirm that the cables are not open circuited before contacting your dealer or Hioki representative.
- When sending the instrument for repair, pack carefully to prevent damage in transit. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.
- When transporting the 2331-20 or a system containing this module, tape the front of the module or take similar measures to avoid losing internal components.

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name: HIOKI E.E. CORPORATION

Manufacturer's Address: 81 Koizumi, Ueda, Nagano 386-1192, Japan

Product Name: POWER METER MODULE

Model Number: 2331-20

Options:
9695-02 CLAMP ON SENSOR
9695-03 CLAMP ON SENSOR
9238 CLAMP SENSOR CABLE
9661-01 CLAMP ON SENSOR
9019-02 VOLTAGE CORD
9019-03 VOLTAGE CORD
9019-04 VOLTAGE CORD

The above mentioned products comform to the following product specifications:

Safety: EN61010-1:2001

EMC: EN61326:1997+A1:1998+A2:2001
Class A equipment
Equipment intended for use in industrial location

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

HIOKI E.E. CORPORATION

16 July 2004

Yuji Hioki

President

2331A999-00

HIOKI 2331-20 POWER METER MODULE
Instruction Manual

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Technical Support Section

All inquiries to International Sales and Marketing Department
81 Koizumi, Ueda, Nagano, 386-1192, Japan
TEL: +81-268-28-0562 / FAX: +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.co.jp/

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HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 / FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.co.jp/

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 / FAX +1-609-409-9108

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