KYOWA

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DATA LOGGER

UCAM-65C

INSTRUCTION MANUAL

Thank you for purchasing KYOWA's product UCAM-65C Data Logger.
Read this Instruction Manual carefully in order to make full use
of the high performance capabilities of the product.
Do not use the product in methods other than described in this Manual.

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TYPE

The following types of UCAM-65C are available depending on the specifications of the power supply.

UCAM-65C-AC	For AC power supply	AC 100 ~ 240 V
UCAM-65C-DC	For DC power supply	DC 10 ~ 16 V

STANDARD ACCESSORIES

The following accessories are enclosed with the UCAM-60C. Check that there are no missing accessories after opening the package.

• Instruction Manual (CD-R)		1 set
• UCS-60B Control Software (CD-R)		1 set
• Simplified Instruction Manual		1 booklet
• AC power supply cable P-18	(for devices running on AC power)	1 unit
• 3P-2P conversion adaptor CM-52	(for devices running on AC power)	1 piece
• AC power supply fuse	(for devices running on AC power)	1 piece
• DC power supply cable P-76	(for devices running on DC power)	1 unit
• DC power fuse	(for devices running on DC power)	1 piece
• Magnet screwdriver		1 unit
• Ground wire		1 unit
• Terms and Conditions of New Product Warranty		1 copy

OPTIONAL PRODUCTS

The following options are available for the UCAM-60C. Select the right options for your measurement.

• Dedicated built-in scanner, TEDS-compatible	USS-61B
• Dedicated built-in scanner with NDIS connectors, TEDS-compatible	USS-62B
• Dedicated built-in scanner with lightning arrester, TEDS-compatible	USS-63B
• Short Bar (1-gage 2-wire used for short between terminal B and C)	ML-1000-3H1
• Scanner interface for USB-70 series	USI-67A
• External input/output unit	UIO-60A
• AC adaptor for UCAM-65C-DC	H-12439

The following scanner can be used in other UCAM series as well.
Follow the instructions in the instruction manual enclosed with the scanner and the instruction manual (CD-R) enclosed with the main unit.

●Scanner USB-70 series

SAFETY PRECAUTIONS (Be sure to read this before use)

BEFORE USE

Be sure to comply with the following safety precautions during use.
Kyowa Electronic Instruments Co., Ltd. shall not be liable for any damage suffered as a result of using the product not in compliance with these safety instructions.

SAFETY SYMBOLS

●The following symbol markings are used in this device to ensure that it is used safely.

 GND	Indicates the grounding terminal. Ground all terminals showing this symbol in this device where possible. However, this shall exclude cases in which a 3-pin AC power supply cable is used for grounding.

●The following warning and caution symbols are used in these Safety Precautions and this device to ensure that it is used safely.

⚠WARNING	Possibility of death or serious injuries being inflicted on the user when handled wrongly.
⚠ CAUTION	Risk of damage being suffered by the user or possibility of physical damage when handled wrongly.

⚠ WARNING

●Grounding
To prevent electric shock, ground this device where possible before connecting the AC power supply cable.
If grounding is not carried out, there is a risk of electric shock when a failure or current leakage occurs.
Either use a 3-pin AC power supply cable to ground the unit, or connect the "GND" terminal to the earth.

●Necessity of grounding terminal
To prevent electric shock, do not disconnect the external ground wire of this device, and do not remove the wiring of the ground terminal.

●Checking the grounding function
To prevent electric shock, check that there is no fault in the grounding function before operating this device.
If you think there is a fault in the protective grounding and grounding function of the fuse holder etc., do not operate this device.

●Power supply
To prevent fire, check that the voltage of the power supply that you are using matches the power supply voltage specifications of this

●Power supply cable and power supply outlet
To prevent electric shock and fire, use the enclosed power supply cable and 3P-2P conversion adapter, and where possible,
use a power supply outlet equipped with a ground terminal.
When using a 3-pole power supply cable, use a 3-pole power supply outlet equipped with a ground terminal.
If a power supply extension cable without a ground wire is used, the protection function will be disabled.
When connecting the power supply cable, connect the ground terminal to the earth first before doing so.
When disconnecting the power supply cable, do so first before disconnecting the ground wire.
Make sure this device is grounded first before taking any measurements.
In the case of a device that only uses a DC power supply, be especially careful regarding the polarity of the DC power cable. A reverse connection can cause a failure or fire.

⚠ WARNING

●**Fuse**

To prevent fire, use only fuses with the specified ratings (current, voltage, type) in this device.
Do not use fuses that are not specified, and do not short-circuit the fuse holder.
Pull out the power supply cable first before replacing the fuse.

●**External connections**

To prevent electric shock, ground this device properly first before connecting any external devices such as PCs and the measured object.

●**Flammable gas atmosphere**

To prevent fire and explosions, do not use this device in a location where there are flammable gases, flammable vapors, or flammable dust.

To prevent failure and accidents due to wrong handling and installation, understand the operating environmental conditions and operating method indicated below first so that this device can be used correctly and safely to exploit its performance satisfactorily.

To prevent malfunction and accidents due to erroneous handling and installation, and to allow the UCAM-65C for a safe and well performance, understand the handling method and condition by reading the following instructions

⚠ CAUTION

1) Do not turn off the power supply when reading/writing a data file and do not take out the USB memory.
- ●The data file may be damaged or lost.
- ●This may result in a failure.

2) After turning off the power supply, wait for 5 sec or longer before turning on the power supply again.
- ●If the power supply is turned on within 5 sec or turned on/off repeatedly, the fuse may be broken or this device may malfunction by the rush current generated when the power supply is turned on.

3) Use this device within a temperature range of 0 - 50℃.
- ●When used outside the operating temperature range, this will result in a failure or a drop in the performance.
- ●When you have no choice but to use this device in a cold place or location exposed to direct sunlight, use a blind or insulate the device.

4) Do not block the ventilation outlets.
- ●When there is no space for heat release, the temperature inside this device will rise, resulting in a failure or a drop in the performance.

5) Use this device in a relative humidity range of 20 - 85%.
- ●When used outside the operating humidity range or in an environment exposed to water droplets, this will result in a failure or a drop in the performance.

6) Do not use this device straightaway if the environment changes suddenly.
- ●Leave the device in the operating environment for a while to let it get used to the environment first before use.
- ●When the ambient temperature changes suddenly due to movement etc., condensation may occur, resulting in a failure or a drop in the performance.

7) Do not use this device in a dusty environment.
- ●Use the device in an environment in which PCs can be used.
- ●When the printer or USB port is left open, dust will get inside the device, resulting in a failure or a drop in the performance.

8) Do not use this device in an environment exposed to vibration and shock.
- ●Do not use the device in a location exposed to vibration and shock.
- ●When exposed continuously to vibration or a large shock, this will result in a failure or a drop in the performance.

9) Do not use this device in a strong magnetic field.
- ●Use the device in an environment in which PCs can be used.
- ●When used near devices that generate a strong magnetic field such as radios, microwave ovens, electric furnaces, this will result in a failure, malfunction, or a drop in the performance.

10) Do not use this device in a location where the power supply environment is bad.
- ●For AC power specifications, use a 100 V - 240 V, noise-less power supply which does not stop momentarily.
- ●For DC power specifications, use a 10 V - 16 V, noise-less power supply which does not stop momentarily.

11) Do not pull the connection cable.
- ●Connect the cable with some spare allowance so that excessive forces do not act on the connection.
- ●If the cable is pulled or subject to excessive forces, this will result in a failure or interrupt the measurement.

12) Warm up this device before use.
- ●After turning on the power supply, wait for about 30 - 60 minutes to warm up the device.

NOTATIONS USED IN THE INSTRUCTION MANUAL

For convenience, the following notations are used in this Instruction Manual for convenience.

- **Operating switches and LEDs on the display panel, menu and selected items are expressed as follows:**

  Operating switches and LEDs on the display panel are expressed in double quotation marks " ."

  Ex.) "POWER" LED, etc.

  Menu items are expressed in brackets [ ].

  Ex.) [IP Address], etc.

  Selected items are expressed in single quotation marks ' .'

  Ex.) '192.168.71.65,' etc.

- **Precautions**

  Precautions for safe operation and reference information for correct handling are expressed as follows.

  Example :

Note

Describes essential instructions for handling the UCAM-65C.

MEMO

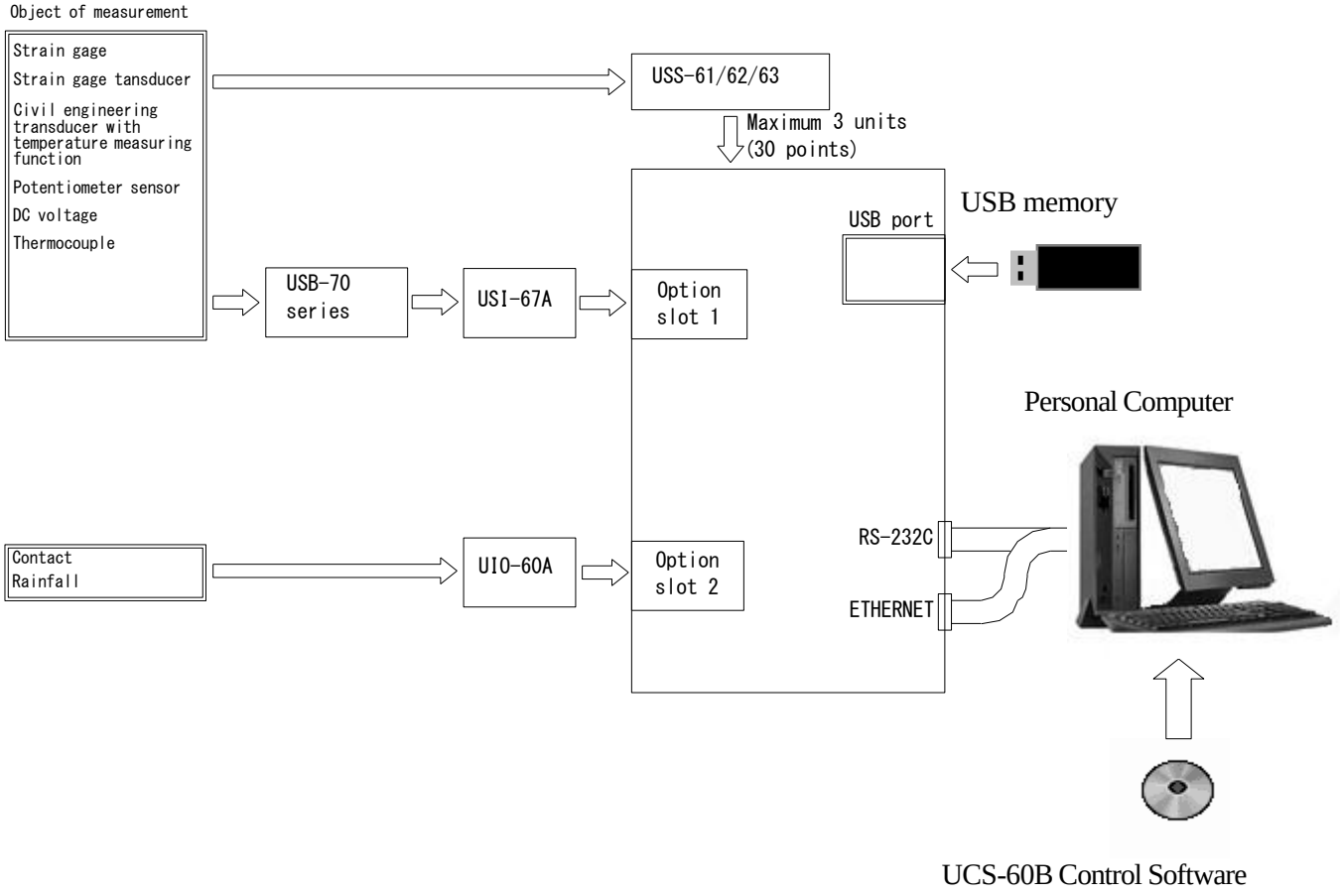
Describes reference information for handling the UCAM-65C.

1. PRODUCT OUTLINE

1-1 SETTING MEASURING FUNCTION

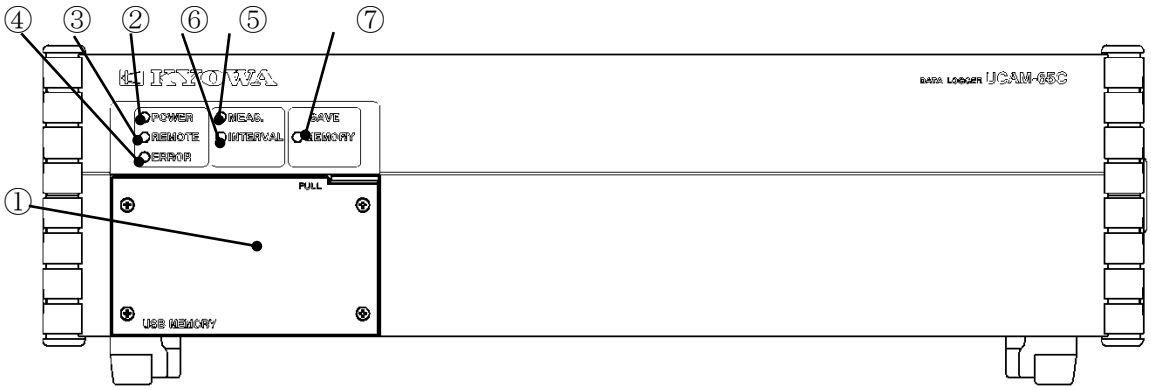
UCAM-65C Data Logger is a measuring instrument that is designed for precise measurement using the attached Control Software (UCS-60B) by connecting to the PC.
Ethernet and RS-232C are provided in the standard UCAM-65C as interface to the PC.
As applicable sensors, various sensors are connected to the UCAM-65C such as strain gage, strain gage transducer, civil engineering transducer with temperature measuring function, potentiometer sensor, DC voltage, thermocouple and platinum resistance thermometer sensor.
The UCAM-65C is capable of measurement of up to 30 channels solely by itself by installing scanning units. For large-scale multipoint measurement, the UCAM-65C can measure up to 1000 channels by connecting USB-70 series scanners.
In addition, since the Control Command Software has been opened to the public, customers can create your own software to control the UCAM-65C.

1-2 SYSTEM CONFIGURATION



2. CONTROLS AND INDICATORS

2-1 FRONT PANEL



①USB port cover

②"POWER" LED .....Lights up with power ON.

③"REMOTE" LED .....Lights up in remote measurement.

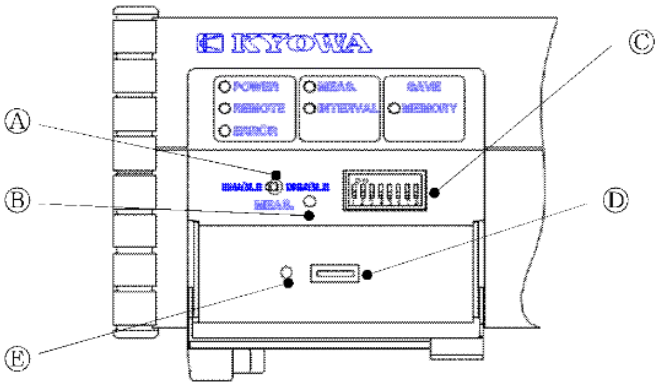
④"ERROR" LED .....Lights up when error occurred.

Refer to Chapter 4 Error Number in the Control Command Volume of the UCAM-60/65C Instruction Manual for details of the error.

⑤"MEAS" LED .....Lights up during the measurement.

⑥"INTERVAL" LED .....Lights up in interval measurement.

⑦"MEMORY" LED .....Lights up when saving measured data into internal memory.



A) "ENABLE/DISABLE" Switch .....Enables/disables the interval measurement.

B) "DISABLE" LED .....Lights up when the "ENABLE/DISABLE" is in "Disable" state.

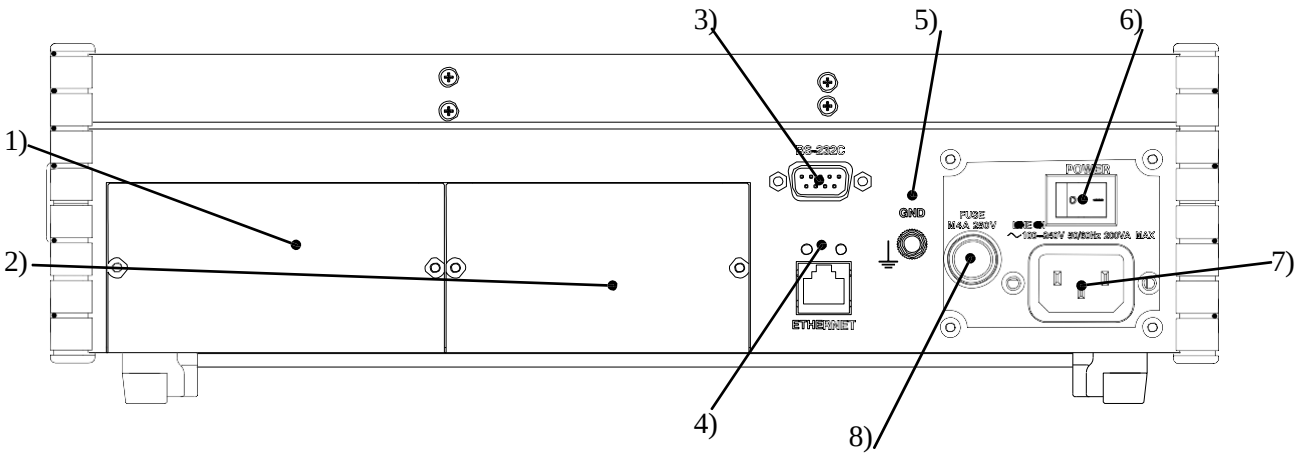
C) DIP Switch .....Switchovers various functions. (For details, see section "4-3.")

D) USB Port ….....When moving data into the USB memory, insert the USB memory into this USB port .

E) USB Memory Access LED .....Lights up when writing data into the USB Memory. Do not eject the USB Memory while this LED is ON.

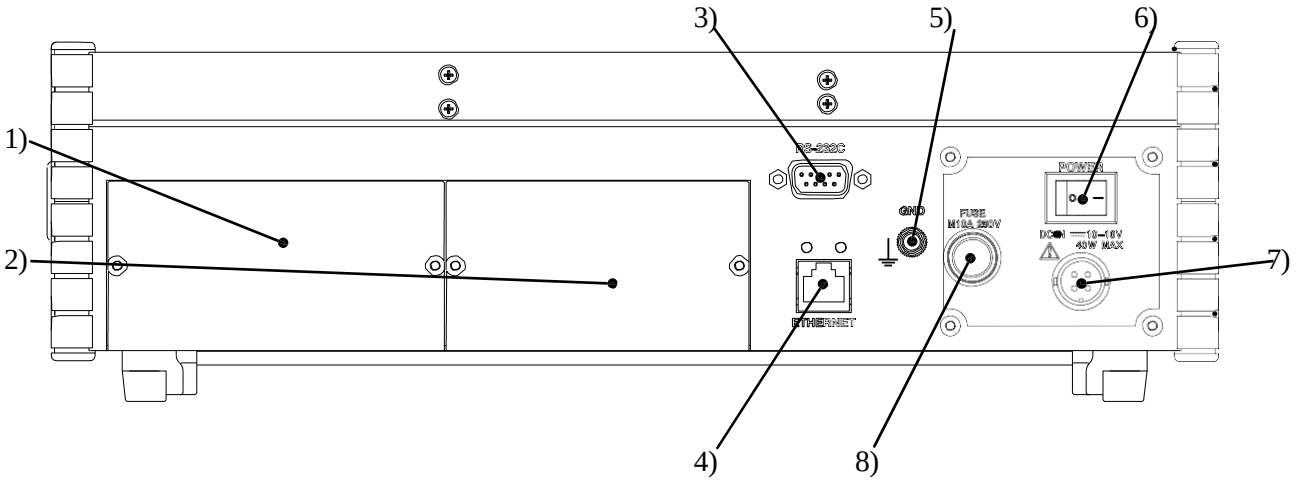
2-2 REAR PANEL

(1) AC Power Supply Dedicated Unit



1) Option slot 1 .....Scanner interface USI-67A is inserted into this slot.
2) Option slot 2 .....External input/output unit UIO-60A is inserted into this slot.
3) "RS-232C" connector .....RS-232C interface connector
4) "ETHERNET" connector .....Ethernet interface connector
5) "GND" terminal .....UCAM-65C ground terminal
6) "POWER" switch .....Power switch
7) "LINE IN" connector .....Power inlet to connect the power cable
8) "FUSE" holder .....Fuse holder
For fuse blowout, use fuses of normal fusing type, rated current 4 A.

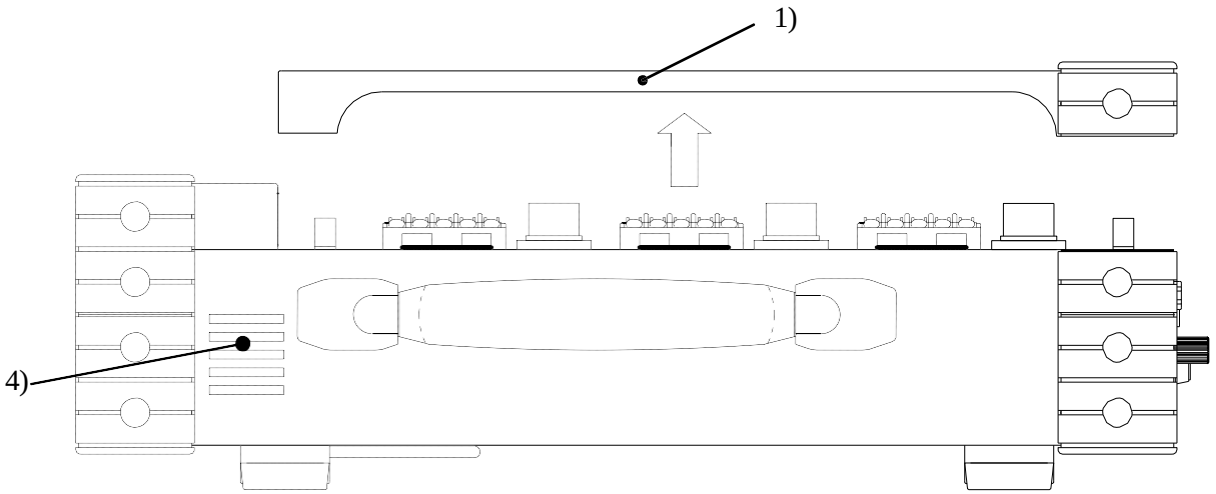
(2) DC Power Supply Dedicated Unit



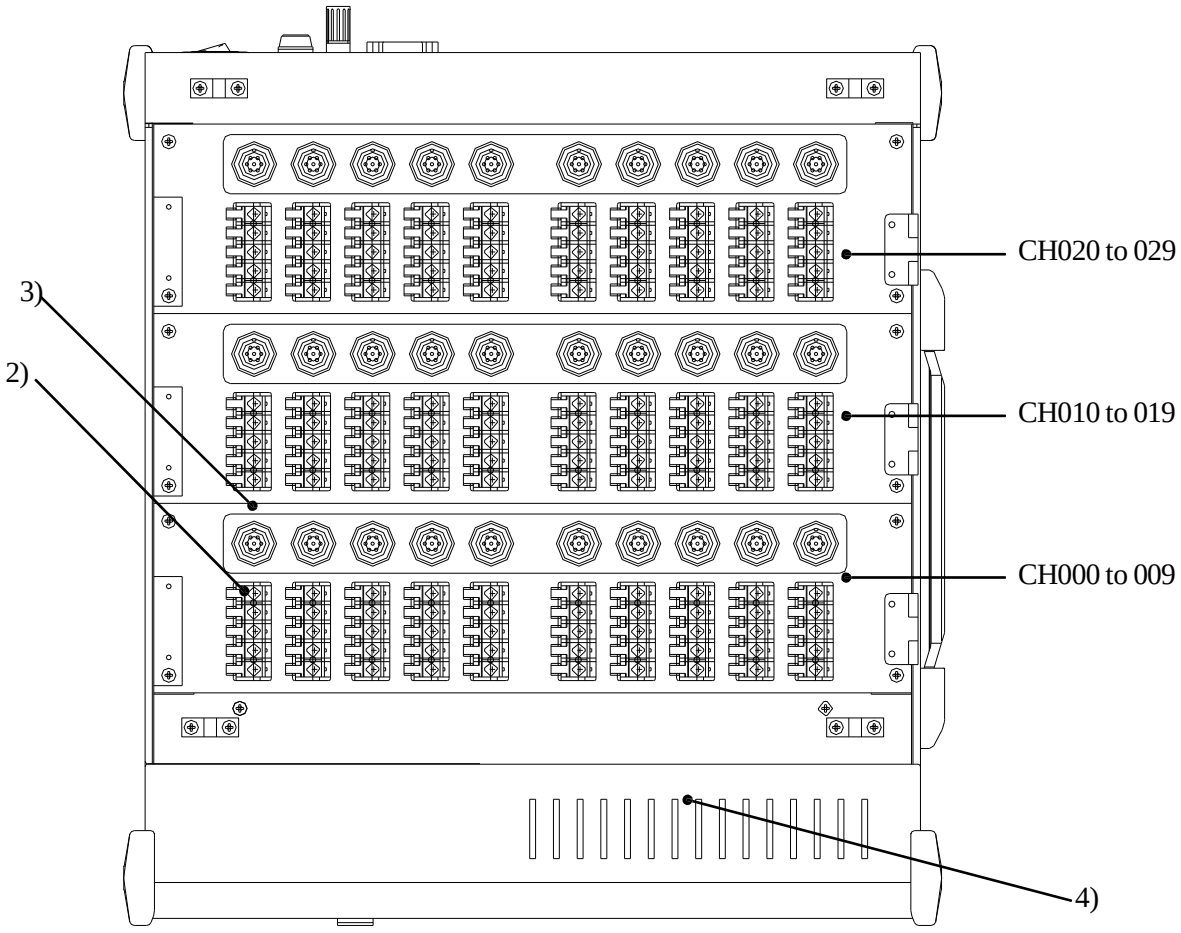
1) Option slot 1 .....Scanner interface USI-67A is inserted into this slot.
2) Option slot 2 .....External input/output unit UIO-60A is inserted into this slot.
3) "RS-232C" connector .....RS-232C interface connector
4) "ETHERNET" connector .....Ethernet interface connector
5) "GND" terminal .....UCAM-65C ground terminal
6) "POWER" switch .....Power switch
7) "DC IN" connector .....DC cable connecting connector
8) "FUSE" holder .....Fuse holder

For fuse blowout, use fuses of normal fusing type, rated current 10 A.

2-3 TOP FACE



* Remove the top cover to the upward direction.



1) Top cover
2) Input terminal board
3) NDIS connector (Provided only for USS-62B scanning unit)
4) Ventilating hole (Do not seal while operating the UCAM-65C)

* The above figure is an example mounted with three USS-62Bs.

3. CONNECTING DEVICES & PREPARING FOR MEASUREMENT

3-1 SYSTEM INSTALLATION

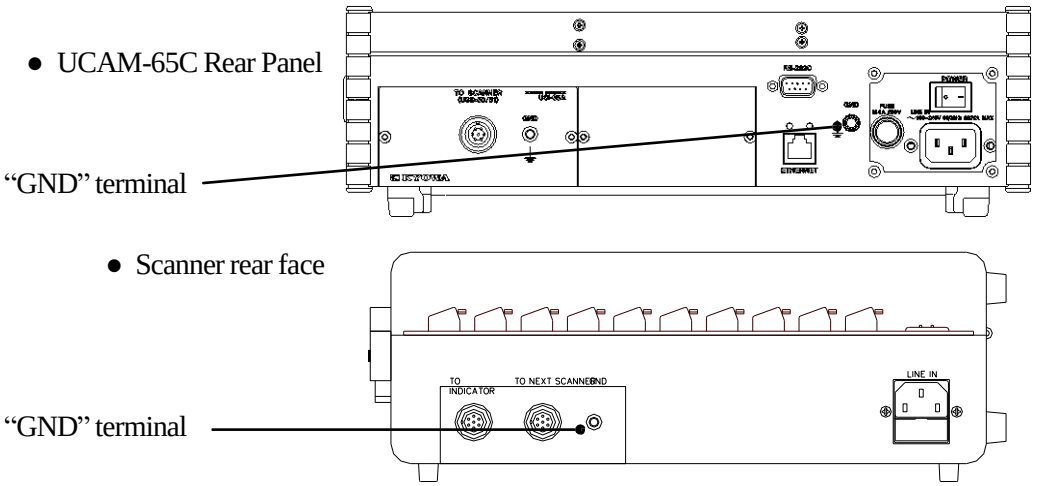
3-1-1 Grounding

Always ground the GND terminal to prevent the UCAM-65C from being affected by noise as well as receiving electric shock due to leaks in the electric current. For wire rods, it is recommended to use green color vinyl coated wire having a diameter of more than 0.75 mm^2.

Grounding standard is not in the same way according to the operating environment. See the following grounding examples and consider the appropriate grounding method so as to reduce adverse effect from noise and to enable a stable measurement.

Basis of the grounding is one-point grounding. If the grounding is made at more than 2 points, it should be noted that a loop may be formed resulting to cause the UCAM-65C easily affected by noise.

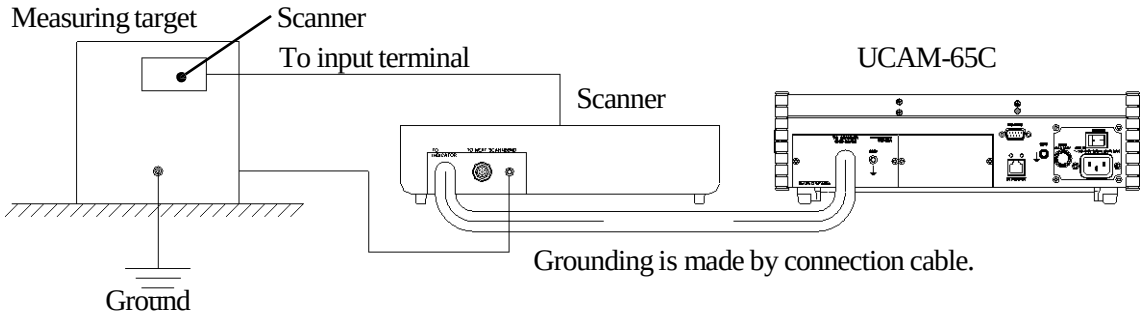
In addition, grounding should be independently made from the power system.

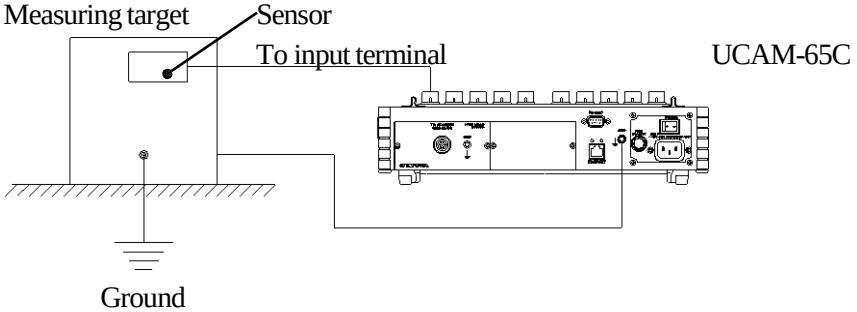


3-1-1-1 When Measuring Target is Grounded

(1) Connect the measuring target to a "GND" terminal of a scanner in USB-70 series, etc.

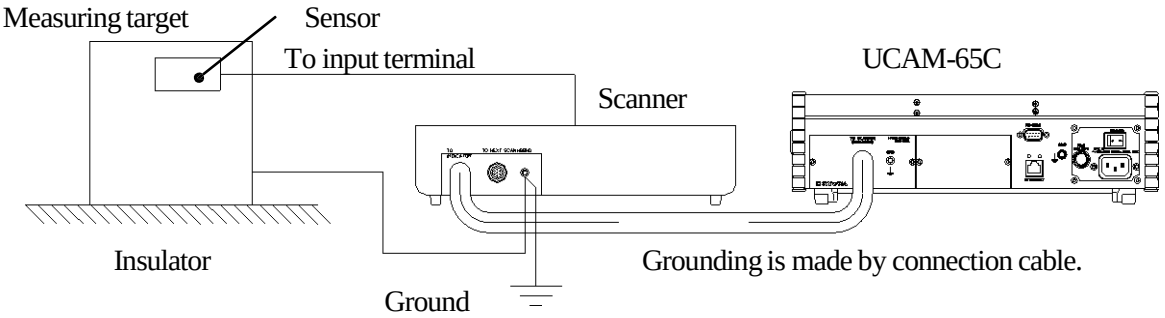
(2) If no scanner is used, connect the measuring target to the UCAM-65C "GND" terminal.

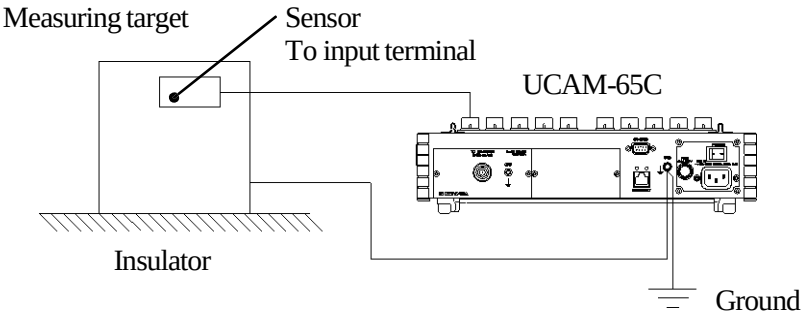




3-1-1-2 When Measuring Target is Insulated From Ground

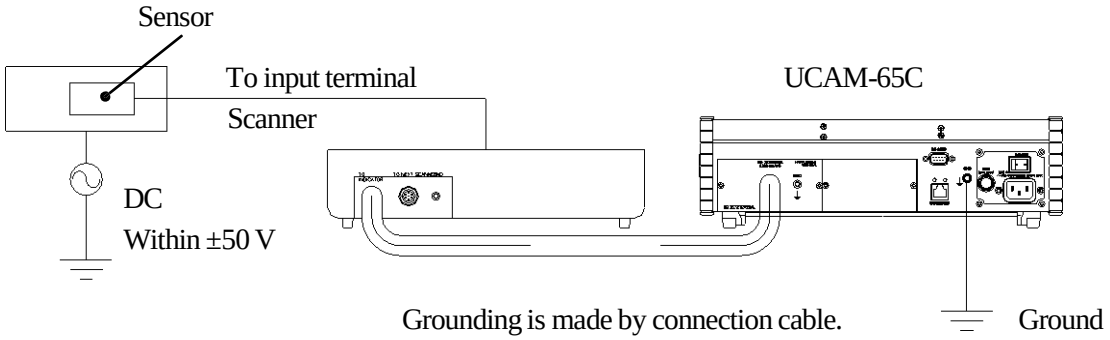
(1) Connect the measuring target to the scanner "GND" terminal of USB-70 series, etc.
(2) If no scanner is used, connect the measuring target to the "GND" terminal of the UCAM-65C.
(3) Connect to ground either the scanner "GND" terminal of USB-70 series or "GND" terminal of the UCAM-65C.





3-1-1-3 When Measuring Target is has Potential to the Ground

(1) Connect to ground either of the scanner "GND" terminal of USB-70 series or a "GND" terminal of the UCAM-65C.

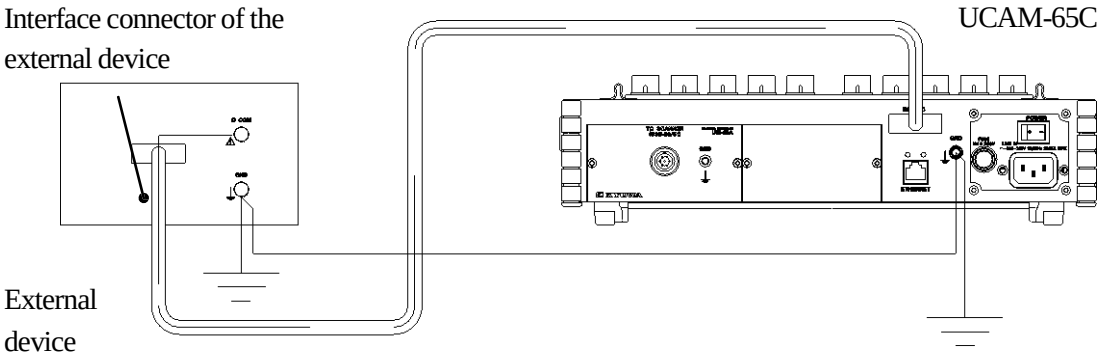


(2) Do not ground the "GND" terminal. Or, it may lower the performance and cause trouble.

3-1-1-4 When Connecting to External Device with Digital Common Not Connected to GND Terminal

(1) Connect a UCAM-65C "GND" terminal to "GND" terminal of the external device.

(2) Connect to ground either the UCAM-65C "GND" terminal or "GND" terminal of the external device.

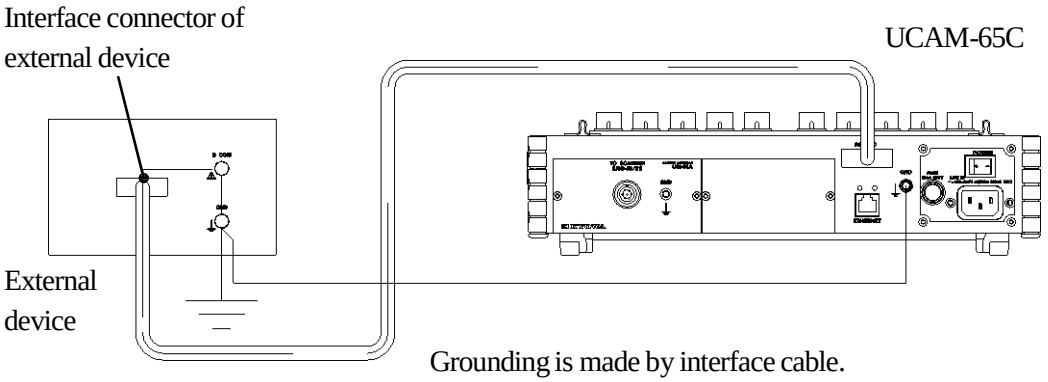


Grounding is made by interface cable.

3-1-1 5 When Connecting to External Device with Digital Common Connected to GND Terminal (or Chassis)

(1) Connect the "GND" terminal of the UCAM-65C to the "GND" terminal of the external device.

(2) Connect to ground the "GND" terminal of the external device.

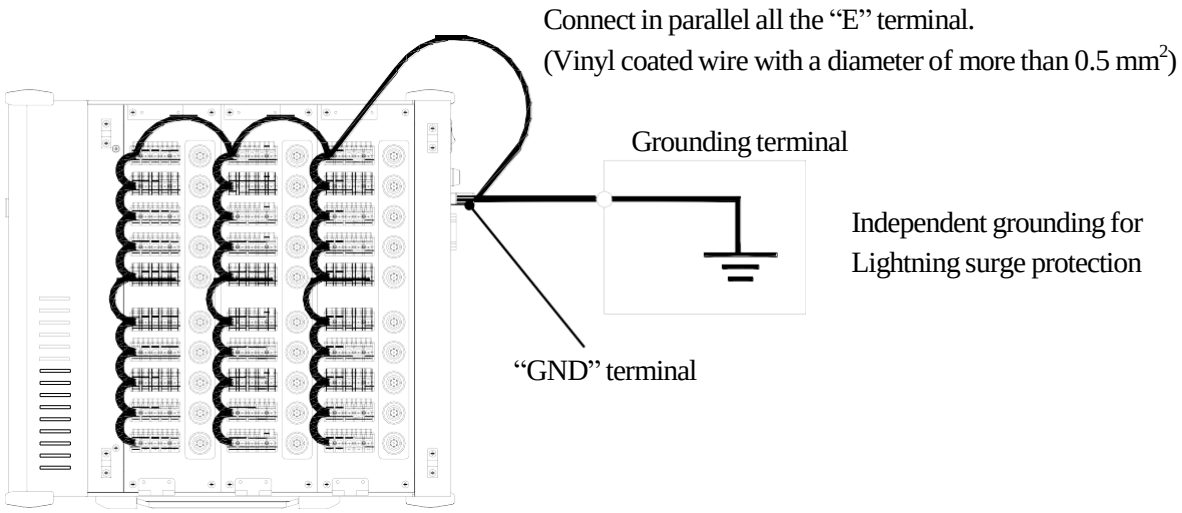


Grounding is made by interface cable.

3-1-2 Connecting Grounding Conductor for Lightning Surge Protection

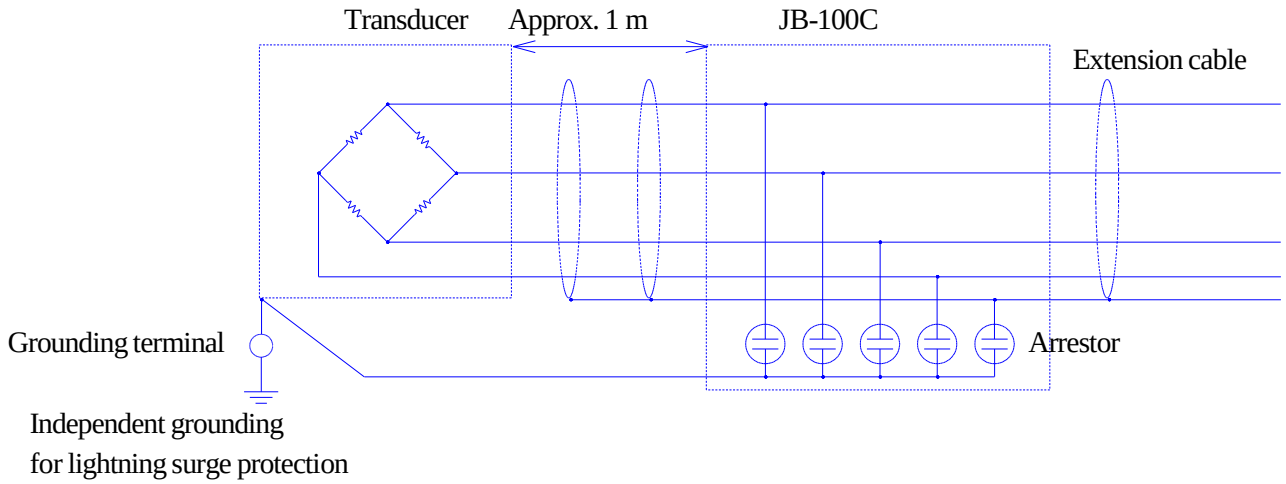
To protect the UCAM-65C or scanners from lightning surge, do not forget to connect the grounding conductor for lightning surge protection to "E" terminals of each of the input terminals and to the "GND" terminal.
For lightning surge protection, grounding should be independently made.
The effect of the lightning surge protection depends on whether grounding and wiring are sufficiently made.
Connect between the "GND" terminal and lightning surge protecting ground with as short as possible green color vinyl coated wire with 1.25 mm^2 in diameter.

3-1-2-1 Connecting Grounding Conductor for Protecting Data Logger & Scanners from Lightning Surge



3-1-2-2 Connecting Grounding Conductor for Protecting Sensors from Lighting Surge

(1) When KYOWA's strain gage transducer is used
Connect KYOWA's Cable Splicing Kit with Arrester JB-100C close to (about 1m) transducers and connect a grounding conductor that is independently arranged for lightning surge protection.
(For details, refer to JB-100C instruction manual.)

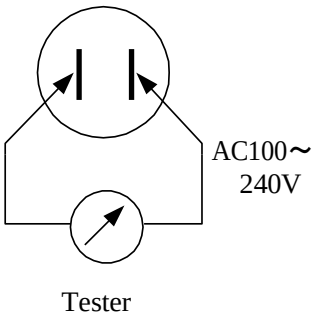


(2) When other sensors are used
Take appropriate measures for protecting sensors from lightning surge according to instruction manual of sensors as well as manufacturer's instructions.

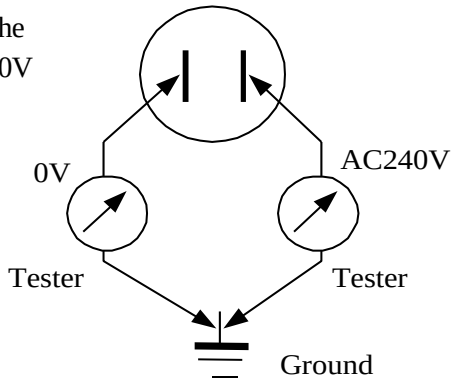
3-1-3 Connecting Power Cable

AC power supply specs of the UCAM-65C requires 100 to 240 V. (For AC power supply dedicated unit)
Before connecting the power cable, do not forget to confirm the following.

(1) Measure voltage between 2-prong wall outlet with a tester and confirm it is provided with power voltage from 100 to 240 V.



(2) Measure voltage between each end of the 2-prong wall outlet and the ground with a tester and confirm one side has 0V and the other, 240V or less.



(3) If the UCAM-65C is operated in environment where interfering devices are used such as induction motor, welding machine, etc. power supply state may be deteriorated due to noise.
It is recommended to use KYOWA's Insulation Transformer UPT-300B.

MEMO

Insulation Transformer UPT-300B (KYOWA made)
Input: 100/120/220/240 V
Output: 100 V, Capacity 300 VA

(4) If the power voltage excessively varies, it is recommended to use a stabilized power supply unit.
(5) Do not operate the UCAM-65C with power supply having unstable frequency or square-wave output.
Or, it may invite errors in the operation.

3-1-4 Connecting DC Power Supply

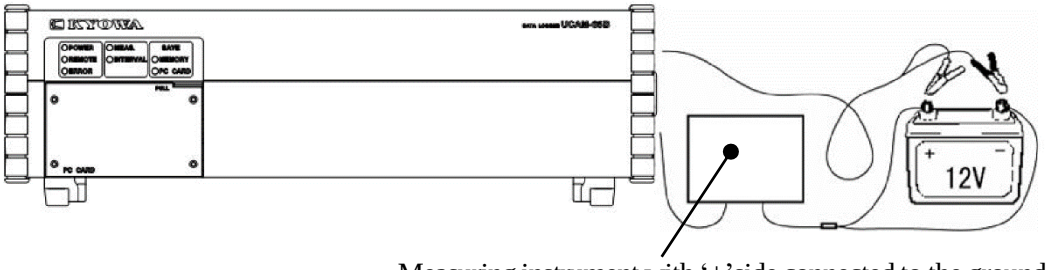
DC power supply specs of the UCAM-65C requires 10 to 16 V.
Before connecting the power cable, do not forget to confirm the following.

(1) Confirm that the DC power supply voltage has 10 to 16 V.
If the UCAM-65C is used with power voltage other than the above, it may lower the performance and cause trouble.
(2) Ground the "GND" terminal on the UCAM-65C rear panel.
(3) Ensure a correct connection between DC power cable (P-76) and DC power connector with a correct polarity in correspond to each other.

A reverse connection can cause a failure or fire.
Connect the connector side of the included DC power cable to the back of this device.
Connect the cable end to the following voltage:
Cable end: red, white → DC10V to 30V
Cable end: black, green → DC0V

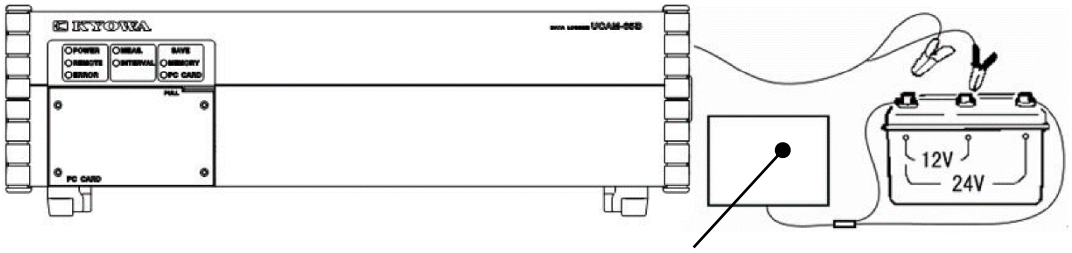
MEMO

• The minus ('-') side of the UCAM-65C DC power connector is connected to the ground. Therefore, do not connect the UCAM-65C to measuring instruments with plus ('+') sides connected to the ground or do not let the UCAM-65C contact or connect the plus ('+') side of the power supply connector.
Or, performance of the UCAM-65C is lowered and cause trouble.



Measuring instrument with '+'side connected to the ground

• Do not connect to the minus ('-') side of the UCAM-65C DC power connector (=GND) from halfway potential of power voltage.

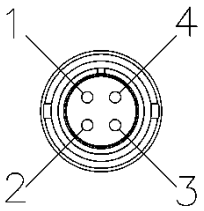


Other measuring instruments, etc.

MEMO

The power connector model and pin assignment are shown below.

Pin No	Assign
1	+SIDE
2	
3	-SIDE
4	



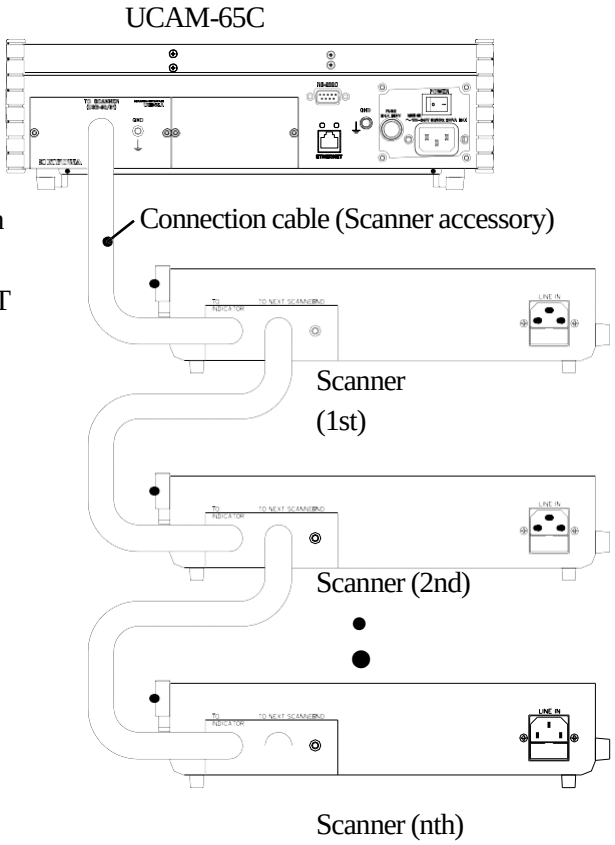
Part No. : RM12BRD-4PH(receptacle)
manufacturer : Hirose electronic
Compatible plug : RM12BPE-4S
(Hirose electronic)

3-2 CONNECTING EXTERNAL DEVICES

3-2-1 Connecting USB-70 Series Scanners

For connecting USB-70 series scanners to the UCAM-65C, it is required to use a scanner interface USI-67A (Optional).

(1) Install the scanner interface USI-67A to the option slot 1 on the rear panel.
(2) Connect the "TO SCANNER (USB-70)" connector of the USI-67A and "TO INDICATOR" connector of USB-70 series with the scanner accessory connection cable.
(3) For connecting the 2nd scanner, connect the "TO NEXT SCANNER" connector of the 1st scanner and "TO INDICATOR" connector of the 2nd scanner with the accessory connection cable.
(4) For connecting on and after the 2nd scanners, connect as mentioned in item (3).



MEMO

For using USB-70 series scanners with the following connection, it is required to install an AC power supply unit UPS-70A/70B (Optional) to all scanners.

- When '1' USB-70 scanner is used and the cable is extended to 240 m or more.
- When '2' USB-70 scanners are used and the total extension of the cable exceeds 120 m or more.
- When '3' USB-70 scanners are used and the total extension of the cable exceeds 60 m or more.
- When more than '4' USB-70 scanners are used.

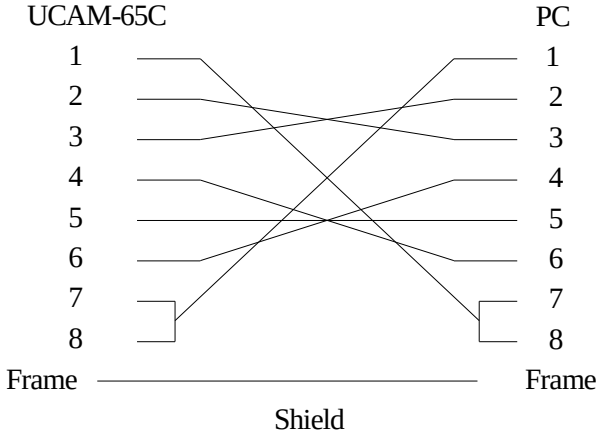
MEMO

When using USB-70 series scanner equipped with AC power supply unit (UPS-70A/70B), the maximum number of scanners that can be connected to the UCAM-65C and the maximum extension length of the connection cable are as follows.

- Connection cable can be extended up to 1 km with maximum 20 scanners connected.
- Maximum 20 internal scanners are used.

3-2-2 Connecting RS-232C Interface

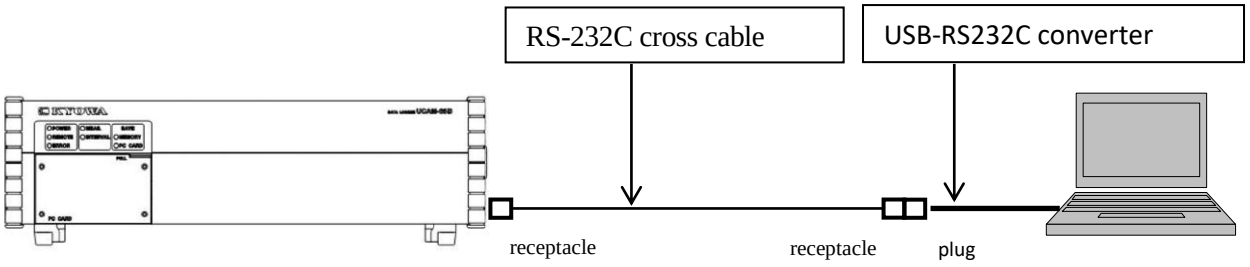
RS-232C interface connector is provided on the rear face of the UCAM-65C.
See the following figure when connecting the PC to the UCAM-65C.



MEMO

Applicable cable
SANWA SUPPLY CORP. made RS-232C cable (cross cable), KRS-403XF3K2 (3m),

If your computer does not have an RS-232C (serial) communication port, a USB-RS-232C converter can be used to make a connection.



NOTE

USB-RS232C converter
Example of product：USB-RSAQ6R made by I-O data
(Instrument side：D-sub 9pin plug PC side：USB typeB)

* It is necessary to install a separate USB driver.
For details on compatible operating systems, USB driver installation, and RS communications protocol settings, see the USB-RS232C-converter manufacturer's website.

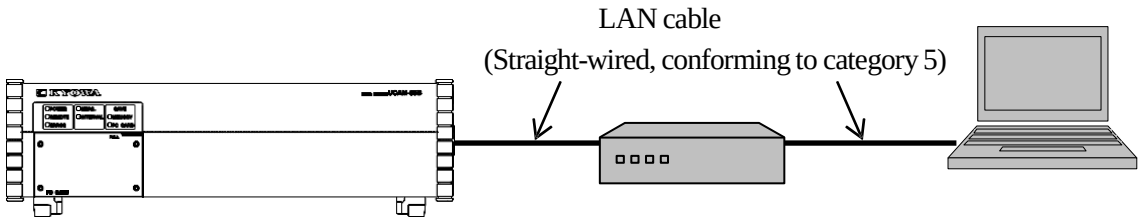
It is necessary to unify the RS communications protocol (the baud rate, termination code, etc.) for the UCAM itself, USB-RS232C converter, and UCS-60B (control software).

For detail of RS communications protocol settings, Refer to UCAM-60C/65C_Control Commands Instruction Manual and UCS-60B Instruction Manual

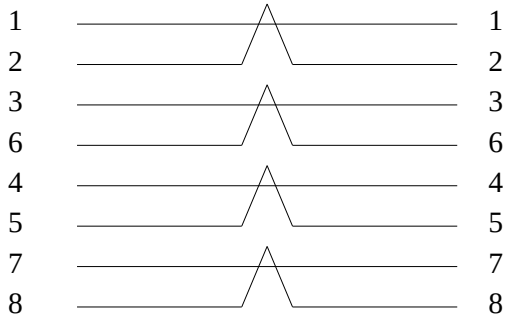
The USB-RS232C-converter communications protocol can be set from the computer's Device Manager under Control Panel.

3-2-3 Connecting LAN

When connecting to network via hub



Use a straight-wired LAN cable of category 5 or higher.
Schematic drawing is described in the following.

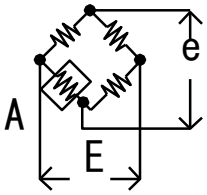
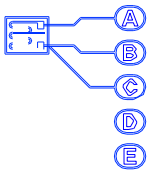
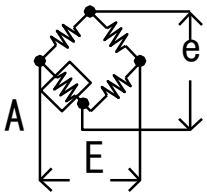
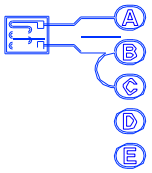
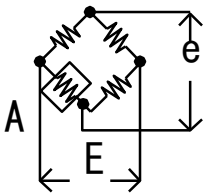
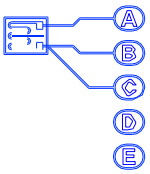


Note

- Do not use those of the cross cable connection of the LAN cable because OS makers are not eligible
- When connecting to the network, set the IP address in advance. See "5. SETTING ETHERNET" for interface setting operation.
- For details of setting the IP address, etc., confirm to the 'Network Administrator' of the connected network
- Note that the UCAM-65C is not provided with such functions as 'Fire Wall' function. Take special care for the security of the system when connecting to the network. .

3-3 CONNECTING SENSORS

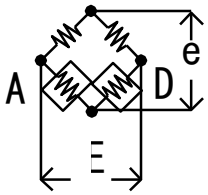
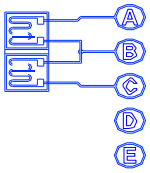
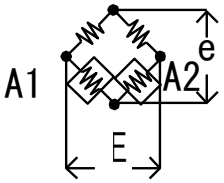
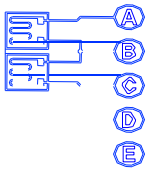
3-3-1 Connecting Strain Gage and Strain Gage Transducer

Measuring Method	Bridge Circuit : Strain gage : Built-in fixed resistor A : Active gage D : Dummy gage E : Bridge exciter e : Bridge output	Connection Method A : Active gage D : Dummy gage	CH Mode
1-gage method (3-wire system connection) Gage resistance 120 Ω 240 Ω 350 Ω		A 	1G120 (BV 2V) 1G240 (BV 2V) 1G350 (BV 2V) 1G120_5 V (*1) 1G240_5 V (*1) 1G350_5 V (*1)
1-gage method (2-wire system connection) Gage resistance 120 Ω 240 Ω 350 Ω		A 	1G120 (BV 2V) 1G240 (BV 2V) 1G350 (BV 2V) 1G120_5 V (*1) 1G240_5 V (*1) 1G350_5 V (*1)
1-gage method (True-dummy method) Gage resistance 120 Ω 350 Ω		A or D 	1G120/D (BV 2V) 1G350/D (BV 2V) 1G120/A (BV 2V) 1G350/A (BV 2 V) 1G120D_5 V (*1) 1G350D_5 V (*1) 1G120A_5 V (*1) 1G350A_5 V (*1)

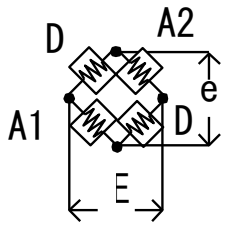
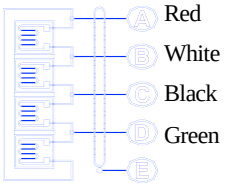
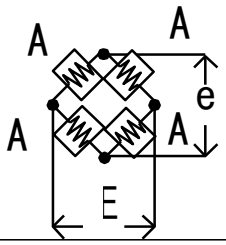
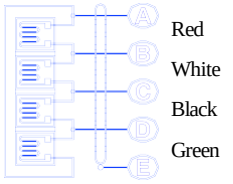
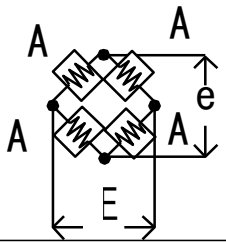
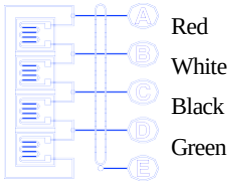
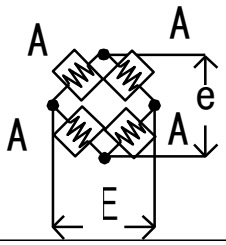
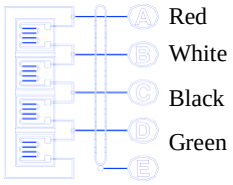
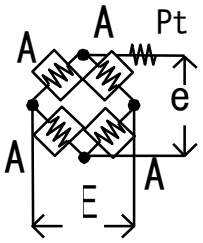
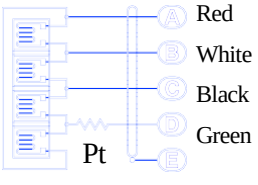
- (*1) Not available for the external scanner.
- (*1) BV 5 V

Note

- For 1-gage connection, it is recommended to adopt a “3-wire system” connection method that has less error factors such as temperature influence due to gage lead wire, dislocation of the initial value, etc.
- When measured in environment with exceeding noise, we recommend you to use KYOWA’s low-noise lead wire (L-13/14/15/16).

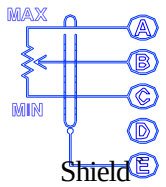
Measuring Method	Bridge Circuit : Strain gage : Build-in fixed resistance A : Active gage D : Dummy gage E : Bridge exciter e : Bridge output	Connection Method A : Active gage D : Dummy gage	CH Mode
2-gage method (Active-dummy method) Gage resistance 60 Ω to 1 kΩ		A D 	2G/A-D (BV 2 V) (*1) 2G/A-D_5 V
2-gage method (Active-active method) Gage resistance 60 Ω to 1 kΩ		A A 	2G/A-A (BV 2 V) (*1) 2G/A-A_5 V

- (*1) Not available for the external scanner.
- (*1) BV 5 V

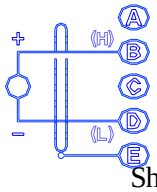
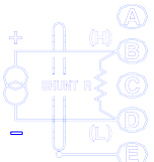
Measuring Method	Bridge Circuit : Strain gage : Built-in fixed resistance A : Active gage D : Dummy gage E : Bridge exciter e :Bridge output	Connection Method A : Active gage D : Dummy gage	CH Mode
4-gage method (Opposite side active method) Gage resistance 60 Ω to 1 kΩ (＊2)		A1 D A2 D 	4G/A_A
4-gage method Full-bridge method Strain gage transducer Bridge resistance 60 Ω to 1 kΩ High resolution 120 Ω to 1 kΩ		A A A A 	4G 4G_HR
4-gage method (Constant current excitation) Full-bridge method Strain gage transducer Bridge resistance 120 Ω		A A A A 	4G/I (120)
4-gage method (Constant current excitation) Full-bridge method Strain gage transducer Bridge resistance 350 Ω		A A A A 	4G/I (350) 4G/I_HR
4-gage method Full-bridge method Civil engineering transducer with temperature measuring function Bridge resistance 350 Ω		A A A A 	4G/T

■ (*2) Bridge nonlinearity compensation is carried out.

3-3-2 Connecting Potentiometer

Measuring Method	Connection Method	CH Mode
Potentiometer sensor Potentiometer resistance 1to 10 kΩ	 Shield	POT.

3-3-3 Connecting Voltage and Current Output Type Transducer

Measuring Method	Connection Method	CH Mode
Voltage measurement	Voltage source  Shield	V/500 mV V/50 V
Current measurement R-250 Ω Highly accurate resistor	Voltage source  shield	I／50mA

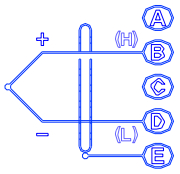
MEMO

Recommendation of high accuracy resistor for measuring electric current

- When it is used within range from 0 to ±30 mA: Y0875250R000T9L (VISHAY Foil Resistor made)
- When it is used within range from 0 to ±50 mA: Y0785500R000T9L (VISHAY Foil Resistor made)

*When it is used within range from 0 to ±50 mA, Two Y0785500R000T9L have to connect parallel

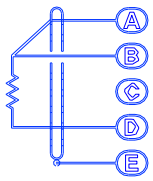
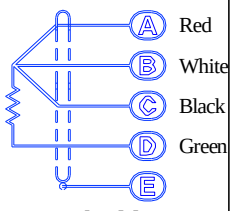
3-3-4 Connecting Thermocouple

Measuring Method	Connection Method	CH Mode
• Thermocouple temperature measurement	 Shield	TC/K TC/T TC/E TC/J TC/R

MEMO

- When measuring temperature, do not forget to put a terminal cover to have the terminal portion adaptable to and equivalent to room temperature.
  Do not expose the terminal portion to air-conditioner wind or direct light.
  Thermal gradient may invite error in the measurement.
- Locate the scanner on a flat surface. If it is set against the wall or arranged one behind the other, thermal gradient may generate to cause error in the measurement.
- Use a twisted pair shield type cable for thermocouple measurement.
  If a parallel or non-shield type cable is used, it may be affected by external noise to cause error in the measurement.
- Do not directly connect the thermocouple to a measuring target having potential larger than the ground, which may lower the performance and cause error in the measurement.

3-3-5 Connecting Resistance Thermometer Sensor

Measuring Method	Connection Method	Measuring Channel Mode
Platinum resistance thermometer sensor 3-wire system	 Shield	Pt100 JPt100
Small size thermometer BTS-100AT	 Shield	Pt100

3-4 ABOUT CHECK FUNCTION

The UCAM-65C is provided with the following check functions.

(1) BV2V

Measures bridge excitation voltage (2V) supplied to strain gages and strain gage transducers at the terminal board to which these sensors are connected, outputs the measured results on the display or printer, and checks any abnormality on the bridge power supply.

(This function can be used for dedicated scanners and USB-70 series scanners.)

(2) BV5V

Measures the bridge excitation voltage (5V) supplied to strain gages and strain gage transducers at a terminal board where sensors are actually connected, outputs the measured results on the display or printer, and checks any abnormality on the bridge power supply.

(This function can be used for dedicated scanners.)

(3) Input Resistance

Measures input resistance of strain gages and strain gage transducers, outputs the measured results on the display or printer, and checks any abnormality on sensors and the measuring circuit.

NOTE

Regarding the input resistance, the resistance value between terminal block A and C is measured as the input resistance.

(4) Output Resistance

Measures output resistance of strain gages and strain gage transducers, outputs the measured results on the display or printer, and checks any abnormality on sensors and the measuring circuit.

NOTE

Regarding the output resistance, the resistance value between terminal block B and D is measured as the output resistance.
In the case of 1 gauge, because B to D is open, the value is 999999.

(5) Mode Detection

Detects bridge configuration for strain measurement to judge the proper channel mode to be set and outputs the results on the display or printer.

MEMO

Measuring modes detected by "Detect Mode" function are indicated in the following 6 types.

- 1-gage method connection: 1G 120 Ω, 1G 240 Ω, 1G 350 Ω
- 2-gage method connection: 2G/A-A
- 4-gage method connection: 4G
- Civil-engineering transducers with temperature measuring function: 4G/T

(6) Terminal Temperature

Outputs the temperature of the input terminal board which is the reference junction for temperature measurement from 0°C with thermocouple. The reference temperature is measured by the built-in thermometer of scanning unit. This function is useful for checking any abnormality on the temperature measuring circuit.

(7) Disconnection

Checks any possible disconnection of the sensor's input cable in strain measurement and output the checked results (OK/NG) on the display or printer.

(8) Burnout

Checks any possible disconnection of the thermocouple which may be deteriorated due to oxidation through high-temperature measurement and outputs the result (OK/NG) on the display or printer.

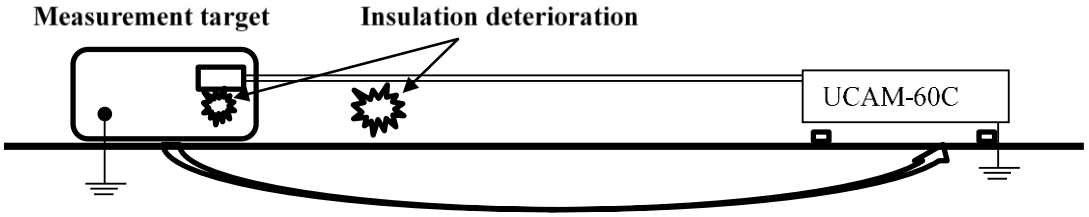
(9) Insulation

Simply measures insulation resistance of transducer and outputs the result. This function is provided since strain gage transducers such as civil engineering transducers which are used in the field for a long period of time, may have

MEMO

Insulation check function is measured by applied 15V between E-B terminal.
Therefore,when use this function,Both of measurement target and UCAM must connect to earth,
as shown below.

Regarding the gauge insulation resistance, use the separately provided ohmmeter (Megger)
*Incidentally, ohmmeter applies a high voltage to measurement target.
If measurement is performed while connected, high voltage is applied to the UCAM input, which can cause it to break.
Accordingly, disconnect from the UCAM terminal block before performing measurement.
For details on how to measure the accurate insulation resistance of the sensor,
please contact each manufacturer



MEMO

Insulation resistance is displayed with measured value from 1 to 100 MΩ.
1 MΩ or less: Displayed as "LOW" MΩ
Exceeding 100 MΩ: Displayed as "HIGH" MΩ
Even when Insulation resistance between Cable and Earth is declining, as shown above,
Displayed as "LOW" MΩ

	Built-in Scanning Unit		External Scanner	
	For general purpose	For civil engineering	For general purpose	For Civil engineering
Check Function	USS-61A USS-62A USS-61B USS-62B	USS-63A USS-63B	USB-70-10 USB-70-20	USB-70-30
BV2V	○	○	○	○
BV5V	○	○	×	×
Input/Output Resistance	○	○	×	×
Detect Mode	○	○	×	×
Terminal Temp	○	○	○	○
Disconnection	○	○	○	○
Burnout	○	○	○	○
Insulation	○	○	○	○

3-5 ABOUT INTERNAL BACKUP BATTERY

When power of the UCAM-65C is off, internal backup battery is used for maintaining the contents for the clock function

NOTE

The expiration data of the internal backup battery is 7 years.
For battery replacement, it will be changed to collect and exchange

4. OPERATING INSTRUCTIONS

4-1 OPERATION FLOW

This section describes basic operation procedures for measurement.

(1) Installing and connecting devices.
Connect scanners, etc. to the UCAM-65C and connect the ground to GND terminal.
For details, see "3. CONNECTING DEVICES AND PREPARING FOR MEASUREMENT."

(2) Connecting sensors
Connect sensors. For wiring, see "3-3 CONNECTING SENSORS."

(3) Setting required measuring conditions
Set required conditions for the measurement. Contents of basic settings are described in the following section.
For details, see separate volume of "UCS-60B Instruction Manual" or "Control Command Version of the UCAM-65C."

4-2 SETTING VARIOUS CONDITIONS FOR MEASUREMENT

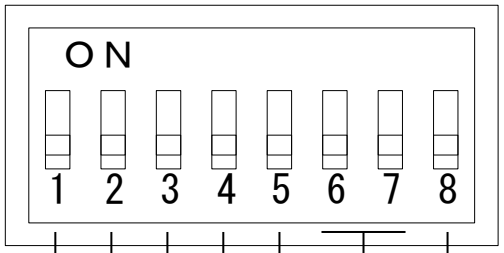
Outline and basic setting conditions required the measurement are described in the following table, which are entirely set by the UCS-60B Control Software attached to the standard product.

Setting Items		Details
Main Items	Sub Items	
System	Internal scanner	Set whether or not internal scanner is used.
	Scan speed	Set scanning speed in bulk for all channels.
	Cold junction compensation	When thermocouple is used, set a method for cold junction compensation.
	Power frequency	● Basically, it is not necessary to set the power frequency for the AC power supply dedicated unit. The required power frequency is automatically detected. ● For the DC power supply dedicated unit, set the power frequency of the operating environment.
MEAS Conditions	MEAS CH	Set start and end channels of the measurement.
	Repeat times	Set the number of repeat times to be conducted with 1 measurement start operation.
CH Conditions	CH Mode	Set a channel mode corresponding to the connected sensors for every CH.
	Scan speed	Set scanning speed for every CH.
	CAL coefficient	Set coefficient for converting measured value into physical value.
	Number of digits below decimal point	Set a decimal point position for indicating physical value converted value.
	Unit	Set unit for indicating physical value converted value.
	Offset	Set offset value for converting measured value into physical value.
	Reference resistance value	Set resistance value when temperature of a platinum resistance thermometer sensor or KYOWA's transducer with temperature measuring function is set to 0 ℃.

4-3 HOW TO SET VARIOUS FUNCTIONS

4-3-1 Setting DIP Switch

The UCAM-65C is equipped with a dip switch. Select the desired function by setting dip switch bits.



External I/F
- OFF (0): ETHERNET
- ON (1): RS-232C

Baud rate

6	7	
OFF (0)	OFF (0):	9600 Baud
OFF (0)	ON (1):	19200 Baud
ON (1)	OFF (0):	38400 Baud
ON (1)	ON (1):	2400 Baud

Power frequency
- OFF (0): 50 Hz
- ON (1): 60 Hz

Reserved for maker's service : Always OFF

MEMO

All the dip switch bits are set to OFF (0) prior to shipment.

4-3-2 Boot up Sequence

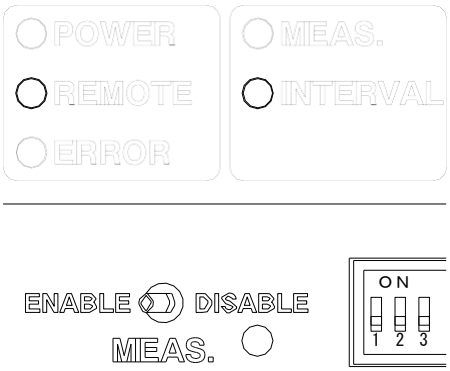
Boot up sequence of the UCAM-65C is described in the following.
LEDs light up with the power ON.

- While starting up: All LEDs light up.

- Self check: LEDs light up in due order from
  "POWER" → "REMOTE" → "ERROR" →"MEAS." → "INTERVAL" →
  "MEMORY" → "MEAS.DISABLE"

- Ready state: "POWER" LED is always turned ON.
  SAVE destination LED lights up by setting the dip switch.
  "MEAS.DISABLE" LED lights up by setting the "MEAS.ENABLE/DISABLE" switch.
  "INTERVAL" LED lights up when the interval measurement is conducted.

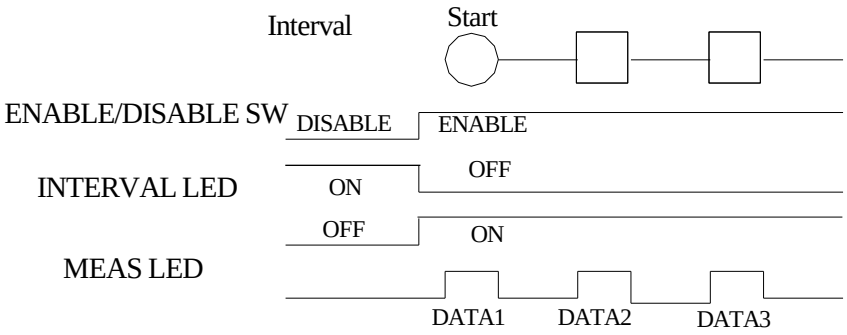
4-3-3 Operation of "ENABLE/DISABLE" Switch



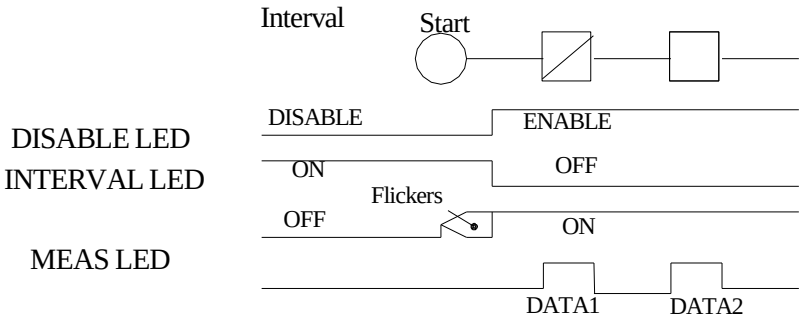
When conducting the interval measurement independently by the UCAM-65C, set the required interval conditions in advance. Then, set the "ENABLE/DISABLE" switch to the "ENABLE" side to start the interval measurement.

■ Example

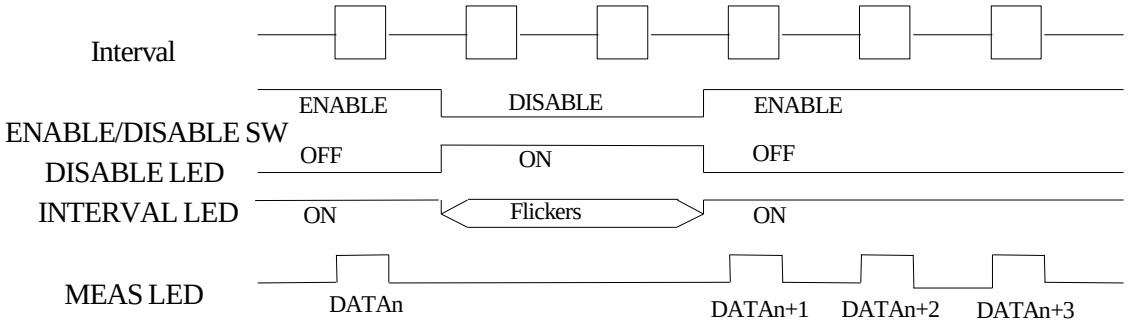
(1) Set the "ENABLE/DISABLE" switch to the "ENABLE" side before the start time.



(2) Set the "ENABLE/DISABLE" switch to the "ENABLE" side after the start time.



(3) Switchover the "ENABLE/DISABLE" switch on halfway of the interval measurement.

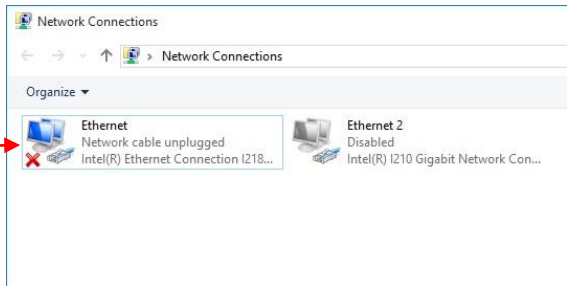


5. SETTING ETHERNET

* This Chapter describes Ethermet setting by taking an example with Windows 10 and “Microsoft edge.” The same procedures can be applied to other Web browsers.

* Following description is based on the default settings of the UCAM-65C prior to shipment.
  The UCAM-65C is set to the following factory default prior to shipment.
  - IP address 192.168.0.65
  - Subnet mask 255.255.255.0
  - Default gateway None

* Do not forget to connect the PC to the UCAM-65C before setting the Ethernet.
* Menu items are expressed in brackets [ ].

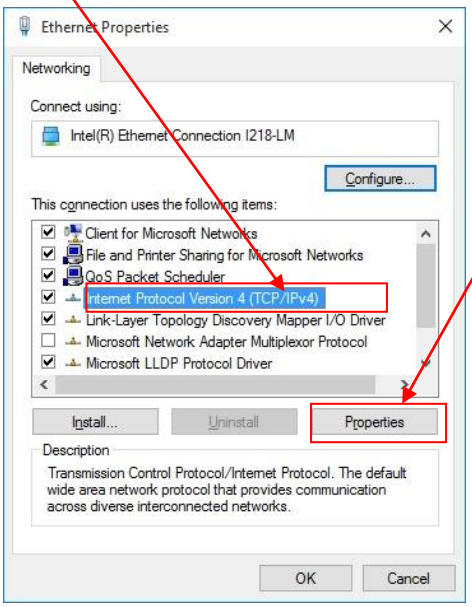


(1)First, confirm the IP address setting on the PC side.

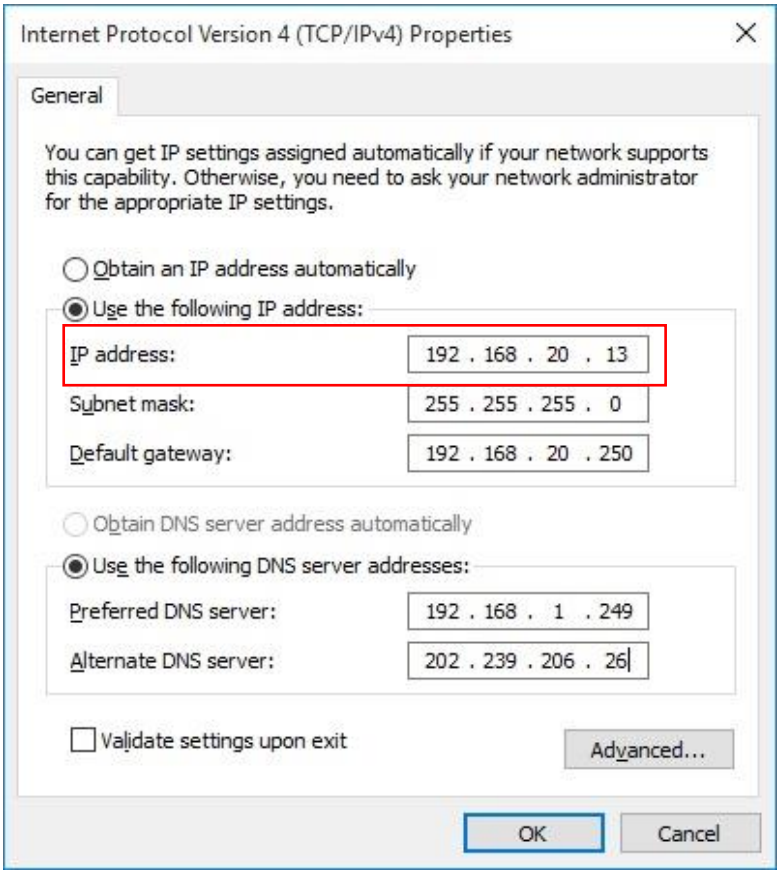
1) Select "Control Panel".
→"Network and Sharing Center"
→"Change adapter setting"
→ "Network Connection".
Network connections opens.

2) "Ethernet" right click and Select ”Property”.

3) Select "Internet Protocol Version 4 (TCP/IP)" from "Ethernet Property" and click "Property".



4) Confirm the IP address of the "Internet Protocol Version 4 (TCP/IP)" property.
(Example)



In the above-mentioned (example), the IP address is 192. 168. 20. 13.

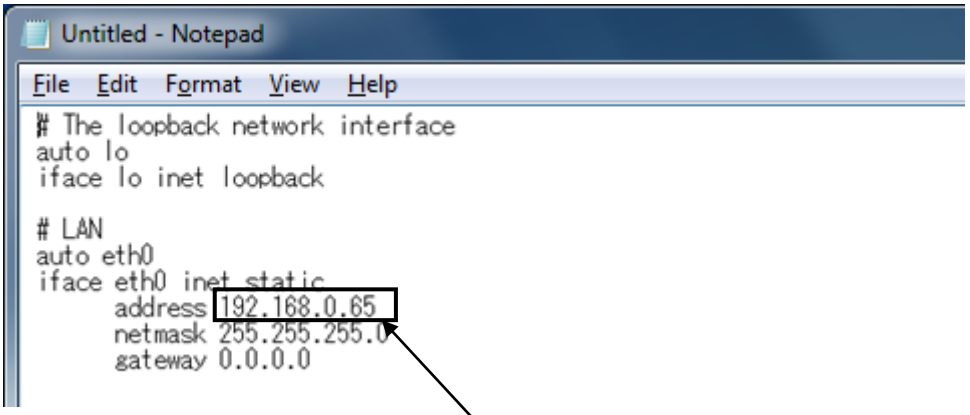
(2) Setting on the UCAM-65C side

1) Create a folder named“_ucam_get_config” in the USB memory.

2) Insert the USB memory into the UCAM-65C. Then turn the “ENABLE / DISABLE”switch to the DISABLE position.

3) Turn ON the power supply of the UCAM-65C. The REMOTE LED will flash during the startup process so turn the “ENABLE / DISABLE” switch to the ENABLE position during this time. The communication condition file of the UCAM-65C will be written into the “_ucam_get_config” folder of the USB memory.

4) Insert the USB memory into your PC and open the “interfaces” file in the “_ucam_get_config” folder in a memo pad.



The IP address on the UCAM side is 192.168.0.65.
Change this number to the IP address you wish to set for the UCAM-65C

The first 3 groups of the IP address need to be the same as the IP address on the PC side.
Enter any number that is different from that on the PC side for the 4th group.
However, if other PCs or devices are connected in the LAN environment, check all the IP addresses and set a number that is not a duplicate of any of these devices.
In this example, the IP address on the PC side is 192.168.20.13.
Therefore the IP address of the UCAM-65C needs to be set to 192.168.20.XXX.
(where XXX may be any number other than 13)

5) Create a folder named “_ucam_set_config” in the USB memory and move the “interfaces” file changed earlier to this folder.

6) Turn OFF the power supply of the UCAM-65C first before inserting the USB memory. Then turn the “ENABLE / DISABLE” switch to the DISABLE position.

7) Turn ON the power supply of the UCAM-65C. The REMOTE LED will flash during the startup process so turn the “ENABLE / DISABLE” switch to the ENABLE position during this time.

8) The communication conditions described in the “interface” file in in the USB memory will be written into the UCAM-65C.

(3) When connecting the UCAM-65C to PC with LAN, Ethernet cable, check the connection by the following.

1. Confirmation by Hardware

   The Ethernet port of the UCAM-65C provides 2 LED lamps, which enable confirmation of correct connection by hardware. Turn ON the UCAM-65C. If Ethernet connection is correct, one LED lights up and the other flickers (irregularly).

   If not, check the LAN cable and hub.

2. Confirmation by Software

   Check by Ping command.

   Send a Ping command from PC's command prompt. If the UCAM-65C corresponds to the command, the Ethernet connection is correct.

1) Startup the command prompt

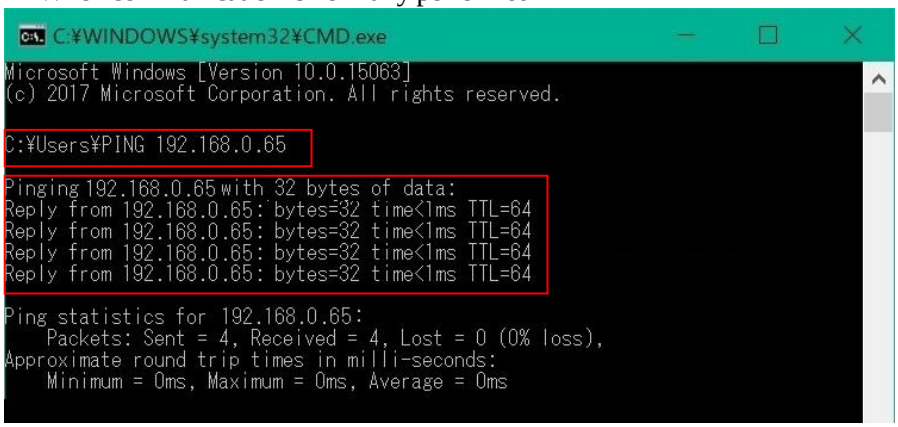
   Point to "Start" and select "All Programs" → "Accessories" → "Command Prompt."

2) Input Ping Command

Input ping _IP address of the UCAM-65C and press the Enter key.

3) Communication is carried out 4 times and results are displayed on the window.

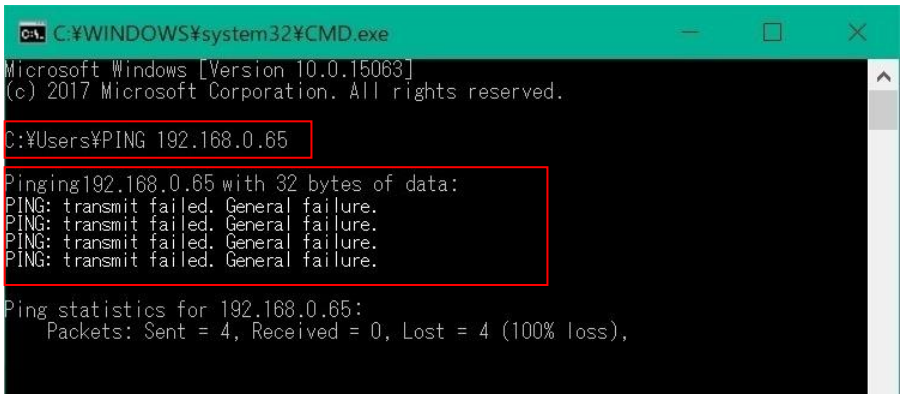
* When communication is normally performed



IP address of UCAM-65C

Results (Normal)

* When communication error occurs



IP address of UCAM-65C

Results (Error)

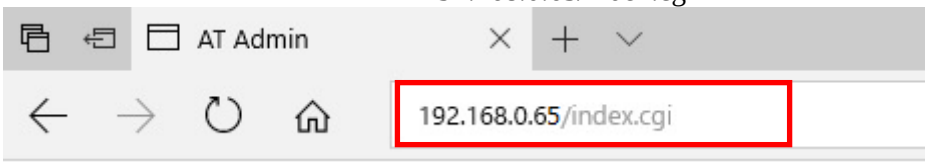
4) If correct connection for Ethernet communication is confirmed by both hardware and software but control on a practical application is not available,

- Check the setting condition of the current application.
- Check with security software Firewall removed.
- Ethernet communication is not available if the communication port (9001) is set to a state where it is always closed.

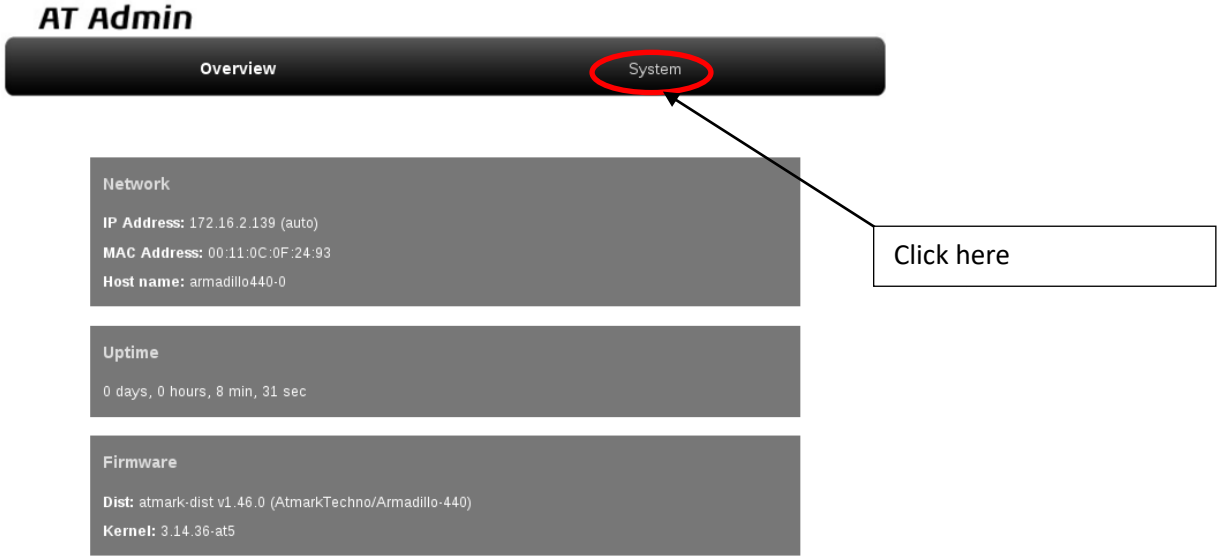
***Supplements (procedure to change the IP address etc. of this device via the Ethernet)**

1) Start the Web browser

2) The Web browser window will appear. Click the address field, then enter “UCAM’s IP address/index.cgi”and press the [Enter] key.
Enter the IP address here as “192.168.0.65/index.cgi” since it is assumed to be the initial setting state.



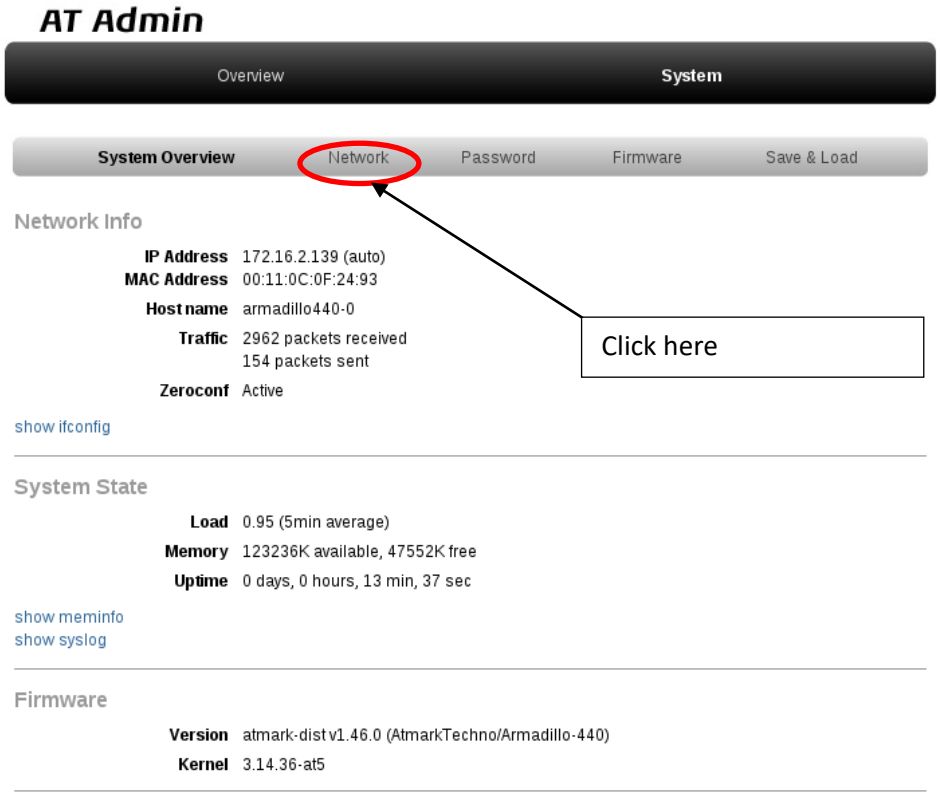
3) The configuration window for the Ethernet settings will appear. Click “system”.



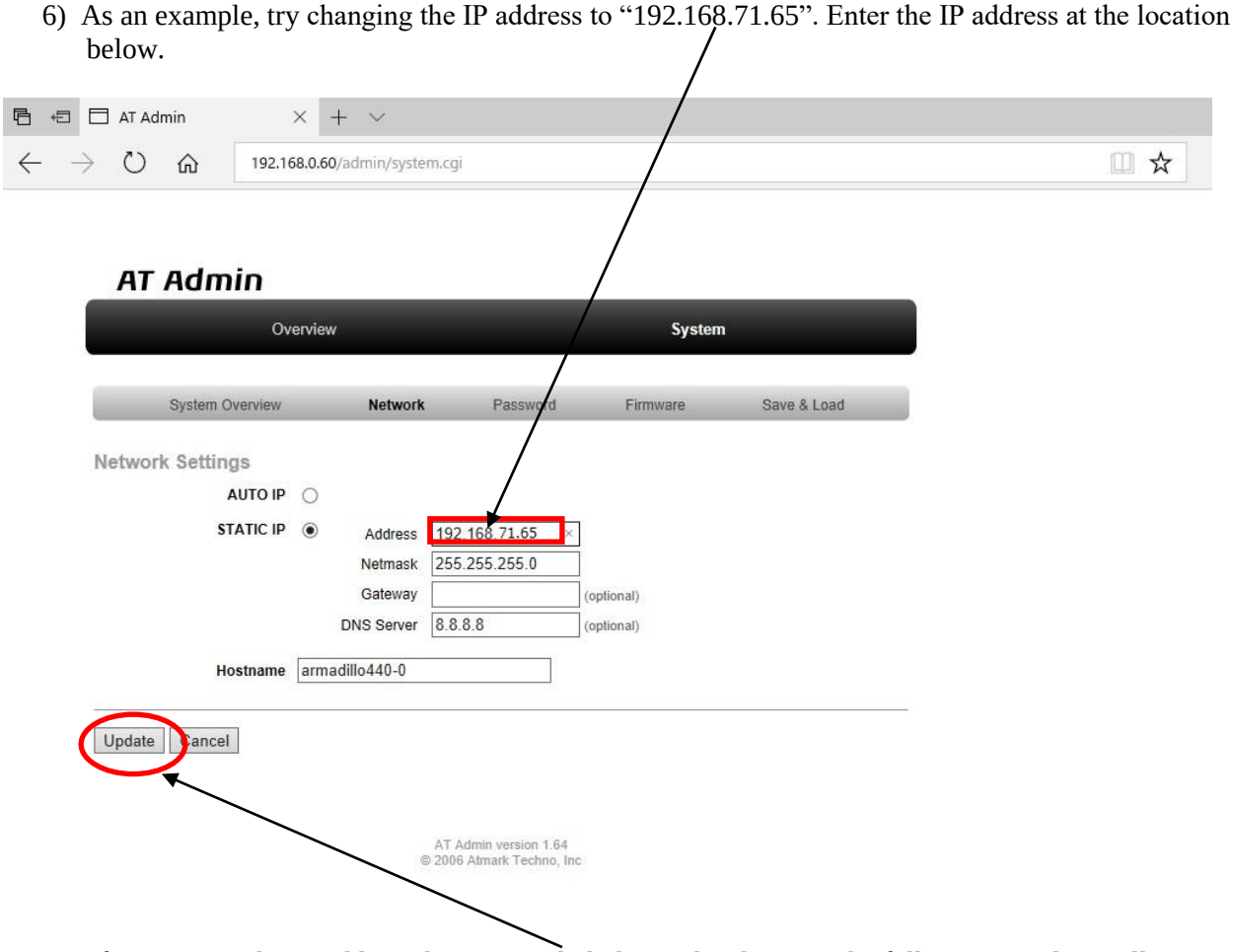
4) A login window will appear so enter the user name and password to log in.
The user name and password in the default status are as follows.
Enter the user name and password and press the OK button.

User name	password
admin	admin

5) If authentication is carried out correctly, the following window will appear. To change the IP address etc., click Network



6) As an example, try changing the IP address to “192.168.71.65”. Enter the IP address at the location shown below.



After entering the IP address, be sure to click the Update button. The following window will appear.

NOTE

Japanese language is displayed on the configuration windows.
So, if other browser is used, garbled characters may be occured.

7) Carry out the process below to save the details set.
First, click SAVE & LOAD. The window below will appear.

8) Click the SAVE button. After clicking, restart the UCAM to apply the changes to the IP address.

(5)Changing the IP address on the computer side

As the IP address of the UCAM-65C has been changed to “192.168. 71. 65”, the IP address on the computer side needs to be changed to “192.168. 71.***”.
“***” can be any number that has not been in other addresses.

The IP address value above is an example of a setting.

6. APPENDIX

6-1 SETTING SCANNER

When Using One USB-70/65A

CH.070~079	:	USB-70/65A	:	CH switch	[07]
CH.060~069	:	↓	:	↓	[06]
CH.050~059	:	↓	:	↓	[05]
CH.040~049	:	↓	:	↓	[04]
CH.030~039	:	↓	:	↓	[04]
CH.020~029	:	USS-6*B	:	Assign CHs even if with no USS	
CH.010~019	:	USS-6*B	:	Assign CHs even if with no USS	
CH.000~009	:	USS-6*B	:	Assign CHs even if with no USS	

When Using One USB-70/65A

CH.040~049	:	USB-70/65A	:	CH switch	[04]
CH.030~039	:	↓	:	↓	[03]
CH.020~029	:	↓	:	↓	[02]
CH.010~019	:	↓	:	↓	[01]
CH.000~009	:	↓	:	↓	[00]

- USS-2 *A: Internal scanning unit USS-21A, 22A, 23A
- USS-6 *A: Internal scanning unit USS-61A, 62A, 63A
- USS-6 *B: Internal scanning unit USS-61B, 62B, 63B

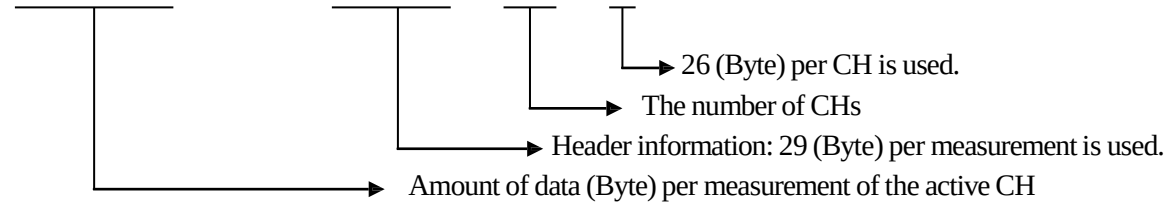
Maximum 3 units of any of the above scanning units are installed. (CHs 000 to 029)

6-2 AMOUNT OF DATA IN INTERNAL MEMORY

Amount of data of 1 measurement can be obtained by the following simplified format.

(Simplified format)

One measurement (Byte)/[CHs] = 29 (Byte) + [CHs] ＋26 (Byte)



MEMO

(1) The above example is applicable only when 1 file is stored in the internal memory.
When multiple files are stored, extra sector on the memory may be used to reduce the measuring times.

(2) When CH mode "4G/T" is used, the amount of data is doubled as 2 data of strain + temperature per CH.

6-3 CONSUMPTION CURRENT OF DC POWER SUPPLY DEVICE

- Consumption current

Scanner	UCAM-65C (DC Power Supply Dedicated Unit)
Internal 30 CHs only or more than four USB-70s (UPS-70 is required)	Approx. 12 W When 12 V: Approx. 1.0 A
Internal 30 CHs + USB-70 (1 unit)	Approx. 18 W When 12 V: Approx. 1.5 A
Internal 30 CHs + USB-70 (3 units)	Approx. 25 W When 12 V: Approx. 2.1 A

- Power Control Function of UCAM-65C-DC

MEMO

(1) The current power supply may be applied with 10 A of rush current when starting up the UCAM-65C. It is preferable to use the power supply device with enough current.
(2) When more than four USB-70s are used, it is required to load power supply to the USB. See instruction in the catalog.

(1) For DC power supply dedicated unit, a power control function (that automatically turns ON/OFF at interval measurement) is enabled. (See "12-6 Power Control.")
Set the Power Control to "Use" to have the power control function enabled at more than 1 hour intervals.

(1) When the UCAM-65C is not under measurement, power is turned OFF, turned ON 5 minutes before the measurement, and turned OFF after the measurement.
However, even if it is not under measurement, approximately maximum 10 mA current is consumed.
(Since minimum power is used for time control, power ON/OFF operation, etc., take care that it is different from completely turned OFF state with the power switch turned OFF.)

(3) Operation of the interval measurement during power control shall be as follows.
When the interval measurement is finished, the UCAM-65C becomes turned OFF state (Not under measurement state).
Then, the power control function turns ON 5 minutes before the next interval measurement.
When the number of preset interval measurement times is completed, the UCAM-65C shall be in power OFF state (Not under measurement state).

(4) After finishing the interval measurement, the UCAM-65C shall be in not under measurement state.
Turn OFF and then turn ON. Then, the UCAM-65C starts up as usual.

(5) To normally return from not under measuring state, turn OFF and ON. Then, the UCAM-65C starts up as usual.
When the interval measurement is left ON as it is, after finishing the next interval measurement, the UCAM-65C becomes turn OFF (Not under measuring state) state once again.

- Reference Material for Selecting Battery

The following is a reference example.
In practice, since battery capacity varies with capacity change and electric current in battery self-discharge and ambient temperature, it is essential up to how much extent we should consider the battery characteristic data and safety factor.

Example (1) Battery capacity calculation when using battery in interval measurement

Measuring Period: 1 month
Interval Condition: Once/30 minutes (Power control is disabled. Always set to power ON state)
Battery: 12 V 72 Ah specification
UCAM-65C-DC (Built-in printer not used, only internal 30 CHs)
1.7 (A) × 24 (Hour) × 31 (Day) = 1265 (Ah)
1265 (Ah) ÷ 72 (Ah/Battery) = 17.6
Calculate by setting battery capacity safety factor in 70%. Then, the battery capacity is obtained by the following expression.
17.6 × 6 (1 ÷ 0.7) = Approx. 25
* Use 25 batteries in parallel connection.

Example (2) Battery capacity calculation when using battery in interval measurement

Measuring Period: 1 month
Interval Condition: Once/1 Hour (Power control is enabled. Power ON times is hour/15 minutes)
Battery: 12 V 72 Ah specification
UCAM-65C-DC (Built-in printer not used, only internal 30 CHs)
1.7 (A) × 24 (Hour) × 31 (Day) × 15 (Minute)/60 (Minute) = 316 (Ah) * Power ON
0.01 (A) × 24 (Hour) × 31 (Day) × 45(Minute)/60 (Minute) = 5.6 (Ah) * Not measuring state
Sum: Approx. 322 (Ah)
322 (Ah) ÷ 72 (Ah/Battery) = 4.47
Calculate by setting battery capacity safety factor to 70%. Then, the battery capacity is obtained by the following expression.
4.47 × 6 (1 ÷ 0.7) = Approx. 6.4
* Use 7 batteries in parallel connection.

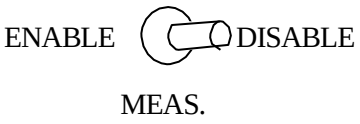
6-4 HOW TO RESET TO FACTORY DEFAULT

NOTE

Only items currently set in [MEAS Condition], [CH Condition], [Auto-MEAS] and [System Control] menus can be reset to factory default setting.

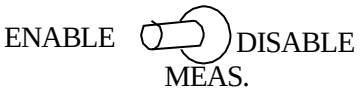
(1) Open the USB port cover on the front panel and turn ON only bit '3' of the DIP

(2) Set the "MEAS. ENABLE/DISABLE" switch to "DISABLE" side.

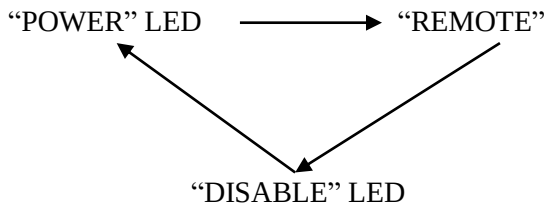


(3) Turn ON the UCAM-65C.

(4) On starting up the UCAM-65C, when the "REMOTE" LED flickers, set the "MEAS.ENABLE/DISABLE" switch to "ENABLE" side.



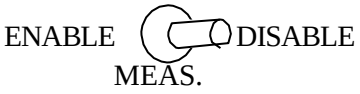
(5) Check the LEDs on the front panel lights up in the following order.



(6) Turn OFF the UCAM-65C.

(7) Open the USB port cover on the front panel, turn OFF the bit '3' of the DIP switch, and set the necessary

(8) Set the "MEAS.ENABLE/DISABLE" switch to "DISABLE" side.



(9) Turn ON the UCAM-65C once again. Then, the UCAM-65C starts up in factory default state.

6-5 INDEPENDENT INTERVAL MEASUREMENT BY THE UCAM-65C

This section describes a method for conducting independent interval measurement solely by the UCAM-65C. Create a condition file for UCAM-65C independent interval measurement with a Control Software UCS-60B (hereinafter referred to as the UCS-60B). The UCAM-65C automatically reads the file to conduct the interval measurement according to the preset conditions.

Setting Procedures

(1) Set measuring conditions with the UCS-60B.
(2) Create a MEAS condition file 'ucam65a.kyw' in the USB Memory.
(3) Set a Dip switch (Data saving destination) on the UCAM-65C front panel.
(4) Load the USB Memory into the UCAM-65C USB port and turn ON.
(5) Interval measurement starts up.

1. Set MEAS Condition with the Control Software UCS-60B

1) Set the following items set by the UCS-60B (See UCS-60B Instruction Manual.)
- Setting MEAS condition (Setting system control is included)
- MEAS mode (*: See remarks.)
- Interval measurement of automatic MEAS condition setting.
- File name of MEAS data file setting (*: See remarks.)

2) Set measurement environment and conduct initial measurement with the UCS-60B. (*: See remarks.)

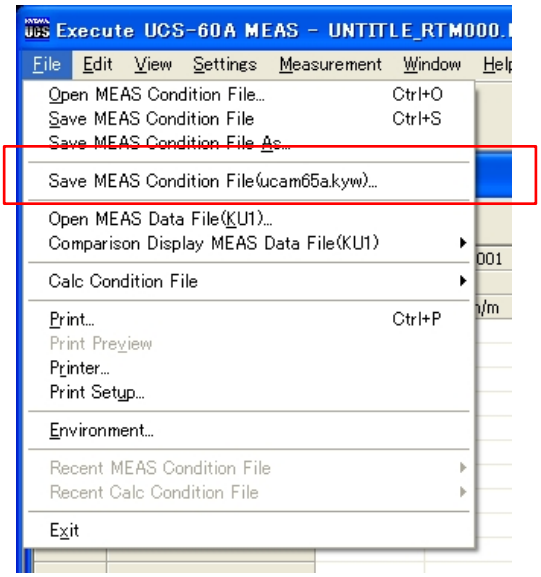
2. Create a MEAS Condition File 'ucam65a.kyw' in the USB memory

1) Point to [File] and select [Save MEAS Condition File 'ucam65a.kyw'] to create a ''ucam65a.kyw.'

2) Create a folder 'update' on the USB Memory route and save the above file 'ucam65a.kyw' on the folder.

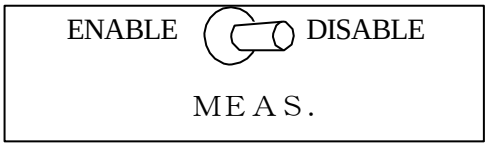
NOTE

The UCAM-65C loads the 'ucam65a.kyw' file in the 'update' folder on the USB Memory route.
See item (4).



3. Load the PC Card in the UCAM-65C and Turn ON

1) Set the "MEAS. ENABLE/DISABLE" switch to the "DISABLE" side.



2) Load the USB Memory created in

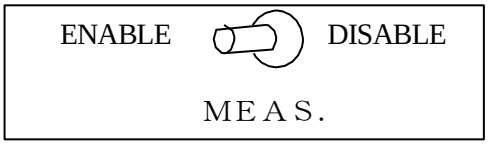
3) Turn ON the UCAM-65C.

MEMO

Automatically load the 'ucam65a.kyw' file in the 'update' folder in the USB memory.

4. Starting Interval Measurement

1) Set the "MEAS. ENABLE/DISABLE" switch to the "ENABLE" side.



2) Interval measurement starts up according to the 'ucam65a.kyw' file loaded in item 4.

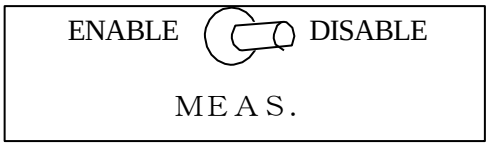
MEMO

For LED display during the interval measurement, see "4-3-3."

5. Exit

1) After the interval measurement is finished, the INTERVAL LED on the UCAM-65C front panel lights out.

2) Set the "MEAS. ENABLE/DISABLE" switch to the "DISABLE" side.



3) Eject the USB Memory.

Remarks

1.MEAS Condition File 'ucam65a.kyw'

(1) Contents of the file

The following conditions are set by the UCS-60B

- Setting MEAS condition (Setting system control is included)
- MEAS mode
- Interval measurement of automatic MEAS condition setting
- File name of MEAS data file setting

With the above conditions, the file converted into Control Command format shall be 'ucam65a.kyw.'

```
CHR00000901X,ORG
MOD12X12X12X12X12X12X12X12X12X12X
CST01.0000+0000X01.0000+0000X01.0000+000
OFS00.0000X00.0000X00.0000X00.0000X00.00
ROC0100.00X0100.00X0100.00X0100.00X0100.
INI+998.0000X+998.0000X+998.0000X+998.00
SPD0X0X0X0X0X0X0X0X0X0X
POF,COF,SOF
DSW11000100000X
FNMtest012
INV-------------X
INV00000000005001001X
INV01000100100001002X
INV02000100150001003X
INV03000100200001004X
INV04000100250010EX
INV05000100000010EX
INV06000100000010EX
INV07000100000010EX
INV08000100000010EX
INV09000100000010EX
INV10000100000010EX
INV11000100000010EX
INV12000100000010EX
INV13000100000010EX
INV14000100000010EX
```

(2) Initial value

'Initial value' in the [MEAS Condition] setting of the UCS-60B is reflected.

(3) After the interval measurement is finished, MEAS condition file in the USB Memory is renamed from 'ucam65a.kyw' to 'ucam65a.ky-.'

To use the above file once again, it is required to rename the file.

(4) Note that the MEAS condition file 'ucam65a.kyw' cannot be loaded by the UCS-60B.

2. MEAS Mode

(1) Set and select the MEAS mode by FUNC. key on the UCS-60B measurement operation panel.
The selected MEAS mode is reflected on the MEAS condition file 'ucam65a.kyw.'

(2) When the MEAS mode is set by the initial measurement, firstly conduct the initial measurement and create a data file '(Specified file name).ini'. Then, it automatically turns to MEAS measurement.

(3) When the MEAS mode is set by the MEAS measurement, initial value in the MEAS condition file 'ucam65a.kyw' is registered in the UCAM-65C in advance. Based on the initial value, MEAS value is calculated. Therefore, before starting the measurement, it is recommended to conduct the initial measurement with the UCS-60B and create a MEAS condition file 'ucam65a.kyw.'

3. MEAS Data

(1) MEAS data is filed in UCAM-65C specified file format (Interval file with extension 'itl').
It can be reproduced by the UCS-60B.

(2) The MEAS data file is in 7 characters (excluding the extension).
Therefore, "MEAS data file set file name" created by the UCS-60B is reflected up to 7 characters.

(3) If the MEAS data is saved in the internal memory, it is required to connect the Ethernet to obtain the MEAS data from the PC.

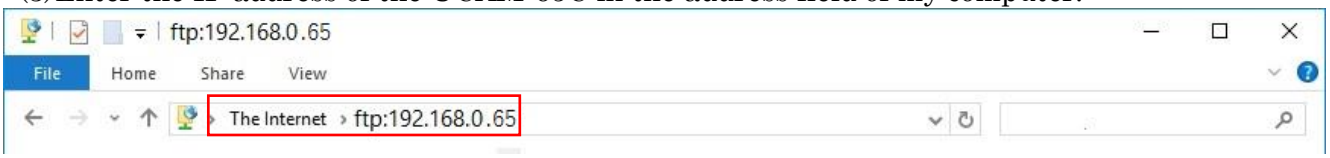
6-6 HOW TO VIEW THE INSIDE OF INTERNAL MEMORY FROM THE PC

By connecting through Ethernet, you can access to internal memory and PC card of the UCAM-65C.
(Description shall be made when loading internal memory data by [Reproduce Data] of the UCS-60B.)

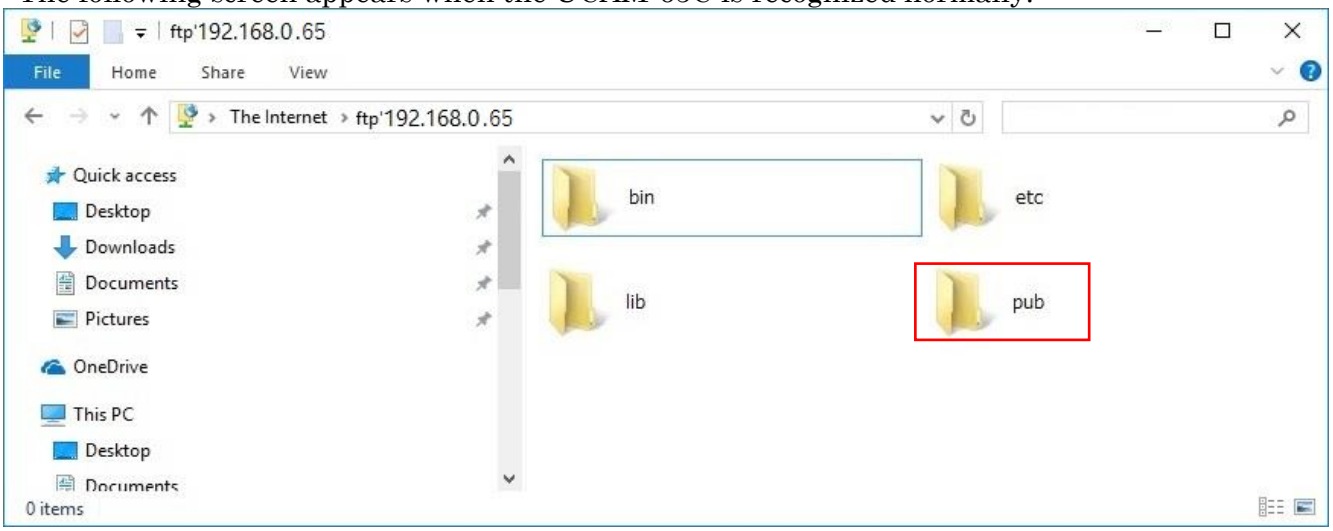
(1) Set various Ethernet settings and turn ON the UCAM-65C.

(2)Press the "windows" key and "E" key at the same time to start up Explorer.

(3)Enter the IP address of the UCAM-65C in the address field of my computer.



*The following screen appears when the UCAM-65C is recognized normally.

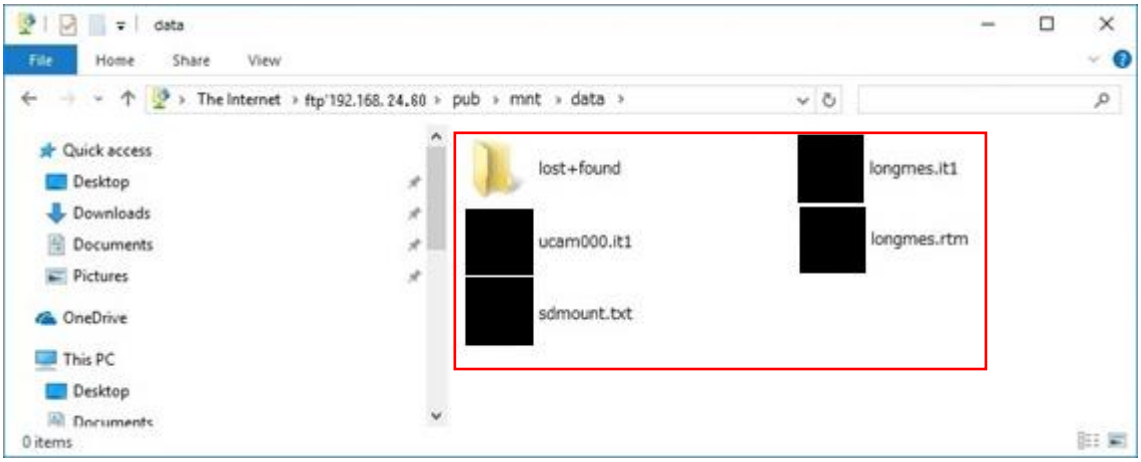


Data of the built-in memory of the UCAM-65C exists in the "pub" folder.

NOTE

Do not operate any folders other than the "pub" folder.
Otherwise, it may cause malfunction.

Move "pub" folder⇒”mnt" folder⇒"data" folder to display the MEMORY contents of the UCAM-60C.



NOTE

(1) Even when the separately sold "UCS-60B" is in use, you can access the built-in memory if you specify the above-mentioned folder.
(2) Files can be copied to the PC from the built-in memory and so on.
Files can also be deleted or moved in the built-in memory.
In addition, files cannot be copied or moved to the built-in memory from your PC.
(3) The description above is for Windows 10. Operations may differ depending on the environmental settings and OS.
(4) The time stamp of the file in the built-in memory is created from Greenwich mean time.

6-7 UPDATE

"Main CPU", "Sub CPU" and "FPGA" exist as update targets in UCAM-65C.
An explanation for the update of each target is given here.

6-7-1 Update of the main CPU

(1) Create a folder named _ucam65c_update" in the USB memory.

(2) Save the 2 files below in the "_ucam65c_update" folder of the USB memory.

- FIRMWARE update file (kernel) : linux65Cv****.bin.gz
- FIRMWARE update file (user land) : romfs65Cv****.img.gz

[**** contains the version.]

(3) Activate UCAM - 65C, turn ENABLE / DISABLE SW to DISABLE at the point when it is ready, and turn bit 1 of DIP SW ON.

(4) When the USB memory is inserted, the buzzer sounds, the MEMORY LED lights up, the DISABLE LED flashes for about 4 seconds, so ENABLE / DISABLE SW is set to ENABLE at that time.

(5) The update will be executed.

・・・・・ The update time is about 3 minutes. Please never turn off the power during this time.

(6) When the update is completed, the buzzer beeps again and the LEDs other than the POWER LED go out.

(7) Set ENABLE / DISABLE SW to DISABLE and set bit 1 of the DIP SW to OFF.

(8) Removing the USB memory will restart the UCAM.

* If the buzzer sounds off during the operation in (4), remove the USB memory and perform the operation from (4).

6-7-2 Update of FPGA

(1) Create a folder named "_ucam_fpga_update" in the USB memory.

(2) Save the file below in the "_ucam_fpga_update" folder of the USB memory.

● FPGA update file : UMBF60Cv****.rpd

[**** contains the version.]

The update file of FPGA is common to UCAM - 60C and UCAM - 65C.

(3) Activate UCAM - 65C, turn ENABLE / DISABLE SW to DISABLE at the point when it is ready, and turn bit 4 of DIP SW ON.

(4) When the USB memory is inserted, the buzzer sounds, the MEMORY LED lights up, the DISABLE LED flashes for about 4 seconds, so ENABLE / DISABLE SW is set to ENABLE at that time.

(5) The update will be executed.

・・・・・ The update time is about 2 minutes. Please never turn off the power during this time.

(6) When the update is completed, the buzzer beeps again and the LEDs other than the POWER LED go out.

(7) Set ENABLE / DISABLE SW to DISABLE and set bit 4 of the DIP SW to OFF.

(8) Please unplug the USB memory and turn the power off and then on again.

* If the buzzer sounds off during the operation in (4), remove the USB memory and perform the operation from (4).

6-7-3 Update of the Sub CPU

(1) Create a folder named "_ucam_subcpu_update" in the USB memory.

(2) Save the 2 files below in the "_ucam_ subcpu_update" folder of the USB memory.

● FIRMWARE update file : sh7044fw..bin

u60_sub.bin

The update file of FPGA is common to UCAM - 60C and UCAM - 65C.

(3) Activate UCAM - 65C, turn ENABLE / DISABLE SW to DISABLE at the point when it is ready, and turn bit 2 of DIP SW ON.

(4) When the USB memory is inserted, the buzzer sounds, the MEMORY LED lights up, the DISABLE LED flashes for about 4 seconds, so ENABLE / DISABLE SW is set to ENABLE at that time.

(5) The update will be executed.

・・・・・ The update time is about 2 minutes 30 seconds.. Please never turn off the power during this time.

(6) When the update is completed, the buzzer beeps again and the LEDs other than the POWER LED go out.

(7) Set ENABLE / DISABLE SW to DISABLE and set bit 2 of the DIP SW to OFF.

(8) Please unplug the USB memory and turn the power off and then on again.

* If the buzzer sounds off during the operation in (4), remove the USB memory and perform the operation from (4).

.

7. TROUBLE SHOOTING

In the event that the product does not operate as expected or in a stable manner, you should trace the factor(s) that may be causing such a condition before concluding that the system has failed. Items to be checked and countermeasure against various phenomena are described in the following table. If troubles are not solved despite countermeasures, contact Kyowa or our representatives.
Repairs may be rejected if the product is damaged as a result of not following the instructions given in this instruction manual, or if the product is disassembled or modified by the customer.

Phenomenon	Checked Items and Countermeasures
Power to the main body does not turn on when using AC power. POWER LED does not light up.	・Make sure the AC power outlet has the specified voltage. ⇒Confirm with a tester etc. ・Make sure the power cable is connected correctly. ・Make sure the fuse blows out. A spare fuse is enclosed as an accessory. If the fuse blows out, replace it after eliminating the cause.
Power to the main body does not turn on when using DC power. POWER LED does not light up.	・Make sure the DC power supply has the specified voltage. Confirm with a tester etc. ・Make sure the power cable is connected correctly. ・Make sure the fuse blows out. A spare fuse is enclosed as an accessory. If the fuse blows out, replace it after eliminating the cause.
Operation stops and accepts no instruction at all.	・Make sure the operation failed due to noise. ⇒Turn off the power and turn on again. Take appropriate countermeasures for removing the noise from the environment, power source, etc. if the phenomenon caused by the noise recur.
The measured value varies.	・Make sure the measuring target (Specimen) and "GND" terminal of the product are grounded correctly. ⇒Ground them correctly. ・Make sure the noise resulted in abnormalities in the operation of the product. ⇒Take appropriate countermeasures for removing the noise from the environment, power source, etc. ・Make sure the input lead wire and cable are connected correctly to the input terminal. ⇒When the connections to the input terminal (soldering or screw stop) are unstable, the measured value fluctuates. Check the connection and securely connect it.
Strain measurement value is incorrect.	・See "UCS-60B INSTRUCTION MANUAL 7-1-2 BV 2V Check and 7-1-3 BV 5VCheck" to conduct the same bridge excitation voltage check as the measurement mode to see whether the prescribed bridge excitation voltage is being output. ⇒If the bridge excitation voltage is incorrect, it means that the bridge excitation circuit is faulty. Contact Kyowa or our representatives.

Strain measurement value is incorrect.	・See " UCS-60B INSTRUCTION MANUAL 7-1-4 Input Resistances Check and 7-1-5 Output Resistances Check " to conduct an input & output resistance check to see if it is equal to the resistance of the connected sensor and gauge. ⇒If the input & output resistance differs from the resistance of the connected sensor and gauge, the sensor and gauge may be faulty. Contact Kyowa or our representatives.
The measured value of thermocouple is incorrect.	・See " UCS-60B INSTRUCTION MANUAL 7-1-6 Terminal Temperature Check" to conduct a terminal temperature check to see whether the result is almost the same as the surrounding temperature. ⇒If the result is incorrect, it means that the terminal temperature measurement element is faulty. Contact Kyowa or our representatives. ・See " UCS-60B INSTRUCTION MANUAL 7-1-8 Burnout Check" to conduct a burnout check. ⇒If the result is NG, it means that the thermocouple is disconnected.
The measured value of a sensor used for a long time in the field is unstable e.g. strain gauge civil engineering transducer, etc.	・See " UCS-60B INSTRUCTION MANUAL 7-1-1 Insulation Check" to conduct an insulation check. ⇒If the result is LOW, or if the measured insulation resistance is lower than the value prescribed for the sensor, it means that the insulation of the sensor has dropped and the measured value has become unstable due to the penetration of moisture.

8. TECHNICAL INFORMATION REQUIRED FOR MEASMENT

8-1 COMPENSATING NONLINEARITY IN STRAIN GAGE

An ideal bridge output in strain measurement can be obtained by the following equation.

Output voltage $e = \frac{1}{4} Ks \cdot \varepsilon \cdot E$

where, Ks: Gage factor
ε: Strain value
E: Bridge applied voltage

Assume that only one side of the wheatstone bridge is regarded as the strain gage and when only the said side changes, nonlinearity generates between the strain value and output voltage.
Nonlinearity generates in relation between strain value and output voltage. The output voltage at that time is obtained by the following equation resulting to cause error as shown in the following table.

Output voltage $e = \frac{\varepsilon}{1+\varepsilon}$

True Strain Value	Error
1,000 μm/m	-0.1%
10,000 μm/m	-1.0%
100,000μm/m	-9.1%

The UCAM-65C automatically conducts compensation calculation for the output voltage to obtain the true strain value.

Output voltage $e = \frac{\varepsilon}{1-\varepsilon}$

The above nonlinearity also generates when opposite side active measuring method is adopted.

MEMO

1.When measuring the internal scanner of the UCAM-60/65 series, nonlinearity compensation is not required for 1-gage method.
2. When measuring the internal scanner, nonlinearity compensation is required for 2-gage method (Active-dummy method) and 4-gage method (Opposite side active method) and compensating process is internally conducted in the UCAM-65C.
3. When measuring the external scanner, nonlinearity compensation is required for 1-gage method, 2-gage method (active-dummy method), and 4-gage method (Opposite side active method) and compensating process is internally conducted in the UCAM-65C.
A list of compensation equations is described in the next page.

Compensation equation regarding MEAS CH mode in strain measurement is described in the following table.

Measuring Method	MEAS CH Mode	Compensation Equation	Internal Scanner	External Scanner
1-gage method (3-wire system connection) (2-wire system connection)	1G 120 1G 240 1G 350	$\varepsilon = \frac{e}{1-e}$	Not compensated (Note 1)	Compensated
1-gage method (True-dummy method)	1G 120/D 1G 120/A 1G 350/D 1G 350/A	$\varepsilon = \frac{e}{1-e}$	Not compensated (Note 1)	Compensated
2-gage method (Active-dummy method)	2G/A-D 2G/COM-D	$\varepsilon = \frac{e}{1-e}$	Compensated	Compensated
2-gage method (Active-active method)	2G/A-A	$\varepsilon = e$	Not compensated	Not compensated
4-gage method (Opposite side active method)	4G/A-A	$\varepsilon = \frac{2e}{2-e}$	Compensated	Compensated
4-gage method (Full-bridge method)	4G 4G_HR 4G/I (120) 4G/I (350) 4g/I_HR 4G/T	$\varepsilon = e$	Not compensated	Not compensated

(Note 1) Provided only for the UCAM-60/65 series

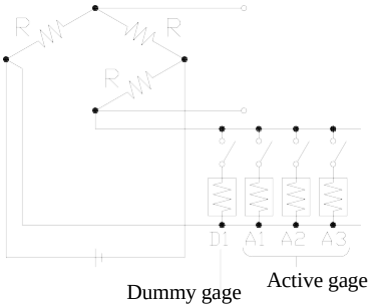
8-2 HOW TO USE DUMMY GAGE METHOD

A true-dummy method is adopted in KYOWA's Data Logger UCAM series that is designed to exclude in effective manner by the Software, an apparent strain resulted from linear expansion coefficient of measuring target (test piece) caused by change in ambient temperature.
When compensating temperature of multiple active gages with one dummy gage, if temperature between both gages are identical, correct temperature compensation is available. Therefore, if the dummy gage is used for strain measurement of materials with poor thermal conductivity such as plastic, composite materials, concrete, etc., a true gage can be realized and it is largely effective for improving measurement accuracy.
Normally, if the SELCOM gage is used, dummy gage is not necessary but when the SELCOM gage applicable for the linear expansion coefficient of measuring target (test piece) is not available, the true dummy gage method is a very effective method.

(1) True-Dummy Method

One dummy gage is arranged in a group having the same temperature condition and measured with the same condition as the active gage. The respective data is recorded in the memory and then, subjected to subtraction process by the software for temperature compensation.

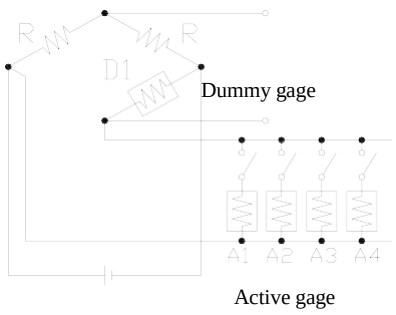
Thus the temperature compensation of multiple active gages is available without affected by self-heating and all the more capable of correctly measuring strain with one dummy gage.



(2) Common Dummy Method

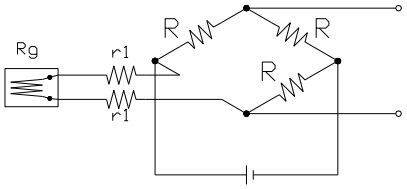
In this common dummy method, active gages are changed in series and bridge excitation voltage is applied only when it is in measurement. On the other hand, bridge excitation voltage is applied to dummy gage every time the active gage is measured.

Therefore, since difference in self-heating influence may generate between the active and dummy gages, it is difficult to conduct a complete temperature compensation with this common dummy method.



8-3 HOW TO COMPENSATE TEMPERATURE INFLUENCE ON LEAD WIRE (3-WIRE SYSTEM CONNECTION)

When a lead wire is extended from the gage to a bridge circuit using a SELCOM gage as shown in the following, resistance change of the lead wire caused by temperature is viewed as an apparent strain.
With this state, it is not available to fully exert effective features of the SELCOM gage in strain measurement.
An apparent strain caused by temperature effect on the lead wire can be obtained by the following equation.



$$\varepsilon = \frac{\Delta R}{R} \cdot \frac{1}{Ks} = \frac{r1 \cdot 2l \cdot \alpha \cdot \Delta t}{Rg + r1 \cdot 2l} \cdot \frac{1}{Ks}$$

Rg: Gage resistance value (Ω)
α: Resistance temperature coefficient of lead wire (/°C)
Δt :Temperature change (°C)
l: Lead wire length (m)
rl: Resistance value of 1-m long lead wire (Ω/m)
Ks: Gage factor = 2.00

For example, when one way of parallel vinyl coated wire having cross-section 0.3 mm^2 in 10 meter (Resistance value: 0.062 Ω/m, Resistance temperature coefficient: 3.93×10^{-3}/°C) is 10 m, an apparent strain per degree temperature change shall be obtained by the following expression.

$$\varepsilon = \frac{0.062 \times 2 \times 10 \times 3.93 \times 10^{-3} \times 1}{120 \times 0.062 \times 2 \times 10} \times \frac{1}{2} \cong 20\mu m/m/℃$$

In the same manner, the apparent strains for 20 meter and 50 meter lead wires are obtained as follows resulting to have large difference. .

20 m: 40 μm/m/°C
50 m: 100 μm/m/°C

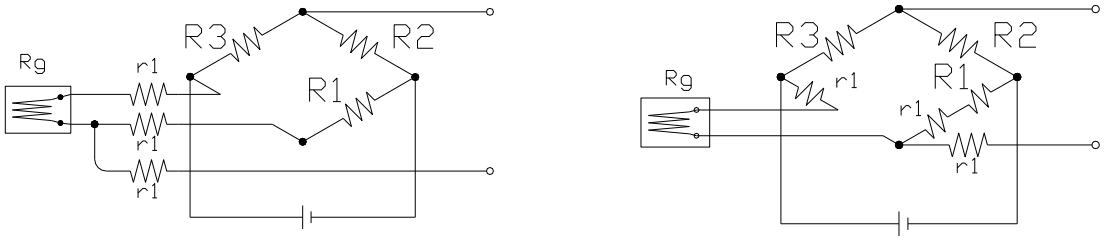
In addition, when a parallel vinyl coated wire having cross-section 0.08 mm^2 in diameter (Resistance value: 0.239 Ω/m, Resistance temperature coefficient: 3.93×10^{-3}/°C) is used and calculated in the same manner, the apparent strain shall be obtained by the following expression.

10 m: 145 μm/m/°C
20 m: 290 μm/m/°C
50 m: 725 μm/m/°C

As a result, an apparent strain generates that is larger than the parallel vinyl coated wire with cross section 0.03 mm^2. Thus, the smaller the cross section of the lead wire and longer the length of the lead wire, the larger it becomes the temperature influence.
As a method for removing the temperature effect on the lead wire, 3-wire system connection is currently widely adopted in strain meter measuring instrument.

Principle of the 3-wire system connection is described in the following.

In the following figures, Rg represents a strain gage, R1, R2, and R3 represent internal fixed resistance, and r1 represents lead wire resistance. Figure (b) is a simplified figure of a basic circuit of figure (a).
In the above figures, the 3-wire system connection is configured by using 3 lead wires for strain gage lead wire to have one lead wire resistor provided to the adjacent side.
With this connection method, temperature effect on lead wire is cancelled and ignored.
As essential precautions when using the 3-wire system connection method, in order to have the same temperature effect on the lead wire, the 3 lead wires should be of same type, should have the same length, cross section, and coating color.
To satisfy the above requirements, a 3-wire parallel vinyl coated wire is applicable.



(a) (b)

8-4 COMPENSATING GAGE FACTOR

The UCAM-60B is designed to conduct measurement with gage factor 2.00. When the gage factor of the current gage is not 2.00, it is required to compensate the strain gage. Compensation can be conducted by the following expression.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{2.00}{\text{Gage factor of the current strain gage}}$$

The above calculation can be carried out by using the coefficient calculation function.

8-5 COMPENSATIION FOR LONG LEAD WIRE AND CABLE

If the length of the lead wire is extended in 1-gage method and 2-gage method connections, bridge circuit of the strain gage may be structured with unnecessary lead wire resistance in series and gage factor of the apparent strain lowers.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{\text{Gage resistance} + \text{Lead wire resistance}}{\text{Gage resistance}}$$

The above resistance of the lead wire is resistance of the whole lead wire (Round-trip resistance).
However, for the 3-wire system connection method, substitute one-way resistance.

If the length of the cable is extended 4-gage connection method (Full-bridge method, transducers), bridge circuit may be structured with unnecessary cable resistance in series and sensitivity is deteriorated due to decrease in excitation voltage.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{\text{Bridge resistance} + \text{Cable resistance}}{\text{Gage resistance}}$$

The above cable resistance is resistance of the whole cable (Round-trip resistance).
The above expression can be obtained by coefficient calculation function.

Example of round-trip resistance per meter for lead wire and cable is described in the following table.
The resistance may slightly vary with the wire rod actually used. If you can check the resistance of the actually used wire rod, use the correct value.

Cross-section (mm2)	Number of wires/ Wire diameter	Round-trip resistance per 10 meter (Ω)	Remarks
0.08	7/0.12	4.4	L-6, 17
0.11	10/0.12	3.2	L-9, 10
0.3	12/0.18	1.17	L-2
0.5	20/0.18	0.7	L-5
0.5	----------	0.8	4-conductor shield cabtire cable

9. SPECIFICATIONS

(1) Model UCAM-65C

(2) Type Data Logger

(3) Description Static Strain measuring Instrument(Fully controlled from the PC)

Type	Power supply	Control software UCS-60B	Features
UCAM-65C-AC	AC	Standard	Fully controlled from the pc Oprerate key,display,printer none
UCAM-65C-AC-0	AC	Optional	
UCAM-65C-DC	DC	standard	
UCAM-65C-DC-0	DC	Optional	

(4) Measuring Targets and Connectable Scanners

・Measuing Targets Strain gages, strain gage transducers, civil engineering transducers with a thermal sensor, DC voltage-output or DC current-output instruments, potentiometer sensors, thermal sensors(Thermocouples and platinum resistance thermometer bulbs)

・Connectable Scanners USS-61B,62B,63B
(Dedicated Scanners,mounted on top of the UCAM-65C)
The main unit can connect to the following scanners via the optional scanner interface
USB-70B series (via USI-67A)

・Measuring Targets and Connectable Scanners

Measuring Targets \ Scanners			Dedicated Scanners	External Scanners	
				General purpose	Civil engineering
				USB-70B-10/20	USB-70B-30
Strain gages and Strain-gage transducers *3	Quarter bridge system	120 Ω	●	●	●
		240 Ω	●	●	●
		350 Ω	●	●	●
	Quarter bridge (true-dummy system)	120 Ω	●	●	●
		350 Ω	●	●	●
	Half bridge 60 to 1000 Ω	Active dummy system	●	●	●
		Active Active system	●	●	●
		Common Dummy system		●	●
	Full bridge 60 to 1000 Ω(*2)	Opposite-leg active system	●	●	●
		Full bridge system	●	●	●
Civil engineering transducers	Full bridge 120 Ω	Constant-current excitation	●		
	Full bridge 350 Ω	Constant-current excitation	●	●	●
		Transducers with a thermal sensor	●		●

Measuring Targets \ Scanners			Dedicated Scanners	External Scanners	
				General purpose	Civil engineering
				USB-70B-10/20	USB-70B-30
Voltage	DC voltage-output instruments		●	●	●
Current	DC current-output instruments		●	●	●
temperature	thermocouples	K(CA)	●	●	●
		T(CC)	●	●	●
		E(CRC)	●	●	●
		J(IC)	●	●	●
		R	●	●	●
	Platinum Resistance Thermometer bulbs	Pt100(new JIS)	●		●
		JPt100(old JIS)	●		●
Potentiometer sensors			●	●	●
Built-in lighting arresters			●(*1)		●

*1. With USS-63B mounted.
*2. 120 to 1000 Ω in high-resolution mode.
*3. Can not use remote sensing sensor directly.

(5) Channels — Max 30 with dedicated scanners
Max 1000 with external scanners connected
Max 1000 with dedicated scanners and external scanners connected

(6) Input Terminals — Can connect to lead wires through either soldering or screwing.
(screw:M3 with metal plate)
NDIS connectors(USS-62B)

(7) Switching Terminal — Semiconductor relays

(8) Scanning speed

50 ms/channel(Standard mode)
0.28 s/channel(High-resolution mode)
Note: individually switchable for desired channels.
20 ms/channel(High-speed mode)
Note: Only collective switching for all channels of dedicated scanners.

Scanners \ Line Frequencies	50 Hz Zone	60 Hz Zone
Dedicated scanner(standard mode)	50 ms/channel	
Dedicated scanner(High-resolution mode)	0.28 s/channel	
Dedicated scanner(High-speed mode)	20 ms/channel	
USB-70 series(standard mode only)	60 ms/channel	58.4 ms/channel

Note: Scanning speeds stated above are standard maximum speeds in respective modes. Besides these, the following speeds are set for each individual channel:0.28 s, 0.5 s, 1s ,2 s , 5 s, and 10 s

Note2: Repeat measurement interval time = (Number of Measuring channels * scanning speed)
+ data processing time (2～20s)
data processing time is indeterminate,changed by measurement setting and environment.

Measuring Targets \ Scanning speed	Standard Mode (50 ms/CH)	High-resolution Mode (0.28 s/CH)	High-speed Mode (20 ms/CH)
Strain(Gage & transducer)	●	●	●
Voltage/current-output sensor	●	×	●
Civil engineering transducer	●	×	×
Temperature sensor（TC, Pt）	●	×	×
Potentiometer sensor	●	×	●

Notes: 1.High-resolution mode and high-speed mode are selectable for dedicated scanners only.
2.High-resolution mode is available only with Full bridge system.
3.High-speed mode is available Full bridge system, Voltage, Current, and Potentiometer sensor.

(9) Operating Modes — Real-time, monitor, and automatic

(10) Measurement Functions

・Initial
Initial values are measured and stored in internal memory.
・Original
Raw values are measured without subtraction of initial values.
・Measure
Initial values are subtracted from original values.
・Easy Measure
Auto zero balancing function is activated.

Note: The selected function is applied to all channels.

(11) Coefficient Calculation Function — Multiplication by calibration coefficient, calibration by TEDS, conversion of measured values to physical quantities, scaling and correction.

(12) Unit — 59 units

(13) Automatic Measurement Function・Interval Measurement
Measurement is automatically performed at preset time intervals.

(14) Storage — Internal memory, approx. 1.8 GB

(15) Strain Measurement(Standard Mode)

- ・constant voltage excitation — Approx. 2 or 5 VDC
- ・constant current excitation — Approx. 5.7mA(Bridge resistance 350 Ω)
  Approx. 16.7mA(Bridge resistance 120 Ω)
- ・Scanning speed — 50 ms/channel
- ・gage factor — 2.00 fixed
  (Coefficient calculation function enables correction with 2.00/Ks)
- ・Initial value memory range — Same as measuring range
- ・Measuring range, Resolution and Accuracy

Measuring Range	Resolution	Accuracy
0 to ±50k μm/m	1 μm/m	±(0.05% of reading + 1) μm/m
±50k to ±500k μm/m	10 μm/m	±(0.05% of reading + 10) μm/m

Note: Resolution and accuracy be automatically change by Autorange function

(16) Strain Measurement(High-Resolution Mode)

- constant voltage excitation Approx. 5 VDC
- constant current excitation Approx. 16.7 mA(Bridge resistance 350 Ω)
- Scanning speed 0.28 s/channel
- gage factor 2.00 fixed
  (Coefficient calculation function enables correction with 2.00/Ks)
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Measuring Range	Resolution	Accuracy
0 to ±20k μm/m	0.1 μm/m	±(0.05% of reading + 0.3) μm/m
±20k to ±200k μm/m	1 μm/m	±(0.05% of reading + 3) μm/m

Notes: 1.Available only with full bridges system(120 to 1000 Ω)
2.Bridge resistance should be 120 to 1000 Ω for bridge excitation with constant voltage.
3.Bridge resistance should be 350 Ω for bridge excitation with constant current.
Measuring range 0 to 15k μm/m
0 to 150k μm/m
4.Available only with dedicated scanners.
5.Resolution and accuracy be automatically change by Autorange function

(17) Strain Measurement(High-speed Mode)

- constant voltage excitation Approx. 2 VDC
- constant current excitation Approx. 5.7 mA(Bridge resistance 350 Ω)
  Approx. 16.7 mA(Bridge resistance 120 Ω)
- Scanning speed 20 ms/channel
- gage factor 2.00 fixed
  (Coefficient calculation function enables correction with 2.00/Ks)
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Measuring Range	Resolution	Accuracy
0 to ±50k μm/m	1 μm/m	±(0.08% of reading + 3) μm/m
±50k to ±500k μm/m	10 μm/m	±(0.08% of reading + 30) μm/m

Notes: 1.Available only with full bridges system(120 to 1000 Ω)
2.Available only with dedicated scanners.
3.Resolution and accuracy be automatically change by Autorange function

(18) Voltage Measurement(Standard Mode)

- Scanning speed 50 ms/channel
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Range Mode	Measuring Range	Resolution	Accuracy	Input Resistance
V/500mV	0 to ±50.000 mV	1 μV	±(0.05% of reading + 0.003) mV	10 MΩ or more
	±50.00 to ±500.00 mV	10 μV	±(0.05% of reading + 0.03) mV	
V/50V	0 to ±5.0000 V	100 μV	±(0.05% of reading + 0.0002) V	1 MΩ or more
	±5.000 to ±50.000 V	1 mV	±(0.05% of reading + 0.002) V	

Note: Resolution and accuracy be automatically change by Autorange function

(19) Voltage Measurement(High-speed Mode)

- Scanning speed 20 ms/channel
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Range Mode	Measuring Range	Resolution	Accuracy	Input Resistance
V/500mV	0 to ±50.000 mV	1 μV	±(0.08% of reading + 0.006) mV	10 MΩ or more
	±50.00 to ±500.00 mV	10 μV	±(0.08% of reading + 0.06) mV	
V/50V	0 to ±5.0000 V	100 μV	±(0.08% of reading + 0.0006) V	1 MΩ or more
	±5.000 to ±50.000 V	1 mV	±(0.08% of reading + 0.006) V	

Note: 1.Resolution and accuracy be automatically change by Autorange function.
2.Available only with dedicated scanners.

(20) Current Measurement(Standard Mode)

- Scanning speed 50 ms/channel
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Channel Mode	Measuring Range	Resolution	Accuracy
I/50 mA	0 to ±50.00 mA	10 μA	±(0.05% of reading + 0.01) mA

Notes: 1. External shunt resistor (High-accuracy 250 Ω) is required.
2. Stated accuracy does not include the external shunt resistor.

(21) Current Measurement(High-speed Mode)

- Scanning speed 20 ms/channel
- Initial value memory range Same as measuring range
- Measuring range, Resolution and Accuracy

Channel Mode	Measuring Range	Resolution	Accuracy
I/50 mA	0 to ±50.00 mA	10 μA	±(0.08% of reading + 0.01) mA

Notes: 1. Available only with dedicated scanners.
2. External shunt resistor (High-accuracy 250 Ω) is required.
3. Stated accuracy does not include the external shunt resistor.

(22) Temperature Measurement with Thermocouple (Standard Mode)

・Scanning speed 50 ms/channel

・Measuring range, Resolution and Accuracy

Type	Measuring range	Resolution	Accuracy	Internal Reference Junction Compensator Accuracy
K	-200.0 to 1230.0 ℃	0.1 ℃	±0.7 ℃	±0.5 ℃ (With input terminal temperature balanced in an ambient) (Temp. range of 0 to 50 ℃)
T	-200.0 to 400.0 ℃		±0.7 ℃	
E	-200.0 to 660.0 ℃		±0.5 ℃	
J	-200.0 to 870.0 ℃		±0.6 ℃	
R	0 to 1760.0 ℃		±2.2 ℃	

Notes: 1. Accuracies do not include the internal reference junction compensator accuracy.
2. The reference junction compensator is switchable between internal and external.
3. Thermocouple resistance should be 1 kΩ or less.

(23) Temperature Measurement with Civil Engineering Transducers with a thermal sensor (Standard Mode)

・Scanning speed 50 ms/channel

・Measuring range, Resolution and Accuracy

Measuring range	Resolution	Accuracy
-50.0 to 200.0 ℃	0.1 ℃	±0.5 ℃

Notes: 1. Target physical quantity and temperature are measured in a single channel.
2. Strain measuring range are the same as in strain measurement in standard mode.

(24) Temperature Measurement with Platinum Resistance Thermometer Bulb (Standard Mode)

・Scanning speed 50 ms/channel

・Measuring range, Resolution and Accuracy

Type	Measuring range	Resolution	Accuracy
Pt100	-200.0 to 660.0 ℃	0.1 ℃	±0.3 ℃
JPt100	-200.0 to 510.0 ℃		

Notes: Connection is 3-wire system

(25) Measurement with Potentiometer sensor(Standard Mode)

- Scanning speed 50 ms/channel
- Initial value memory range same as measuring range
- sensor power supply approx. 2 VDC
- Potentiometer resistance 1 kΩ to 10 kΩ
- Measuring range, Resolution and Accuracy

Channel Mode	Measuring range	Resolution	Accuracy
POT	0 to ±50.00 %	0.01 %	±0.1 %FS

(26) Measurement with Potentiometer sensor(High-speed Mode)

- Scanning speed 20 ms/channel
- Initial value memory range same as measuring range
- sensor power supply approx. 2 VDC
- Potentiometer resistance 1 kΩ to 10 kΩ
- Measuring range, Resolution and Accuracy

Channel Mode	Measuring range	Resolution	Accuracy
POT	0 to ±50.00 %	0.01 %	±0.1 %FS

Note: Available only with dedicated scanners.

(27) Internal timer Real time clock is Built-in（Battery backup）

(28) Interface RS-232C
LAN (10BASE-T/100BASE-TX)
USB2.0 (collect measurement data by USB Flash Drive)
Notes: 1 Measurement data cannot be saved directly to USB memory.
Notes: 2 USB Flash Drives Capacity:32GB or less
FileFormat:FAT32
Notes: 3 Recommend USB Flash Drives: GH-UFI-XSC2G

(29) Self –diagnosis Function	Checks bridge excitation, leadwire-off, input/output resistance, insulation resistance, mode, etc.
(30) TEDS	・Interface IEEE1451.4 Mixed mode Transducer Interface Class2 ・applicable sensor Should have information written in accordance with IEEE template No.33 Cable length should be 30m or less (with dedicated scanner USS-61B/62B/63B)
(31) Operating Temperature amd Humidity	0 to 50 ℃, 20 to 85 %RH（Non-condensation）
(32) Strage Temperature	-20 to 60 ℃
(33) Setting Maintenance Function	ACOM at measurement circuit is switchable between floating and GND connect.
(34) Power supply	AC 100 to 240 V (AC-operated version) DC 10 to 16 V (DC-operated version)
(35) Current consumption	0.5 A or less: 100 VAC (With 3 dedicated scanners mounted) 4.0 A or less: 12 VDC (With 3 dedicated scanners mounted)
(36) Dimensions	327(W)×88(H)×365(D) mm (Excluding protrusions)
(37) Weight	Approx. 5.0 kg (Excluding scanner) Approx. 8.3 kg (With 3 dedicated scanners uss-62B mounted)

KYOWA

Kyowa Electronic Instruments Co., Ltd.
3-5-1, Chofugaoka, Chofu, Tokyo 182-8520 Japan
http://www.kyowa-ei.com/