

KOGANEI

Stroke Sensors

Owner's Manual Ver.1.0

- Sensor Head ZMA1□
- Counter ZMC1
- Humidity Correction Unit ZMH1

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Thank you very much for purchasing these Koganei products.
 Before use, please read this Owner's Manual carefully, then use the
 products in an appropriate manner.
 Be sure to store this Owner's Manual in a safe place.



DANGER

Do not use these products for the purpose of
 safety assurance such as accident prevention.
 This could result in injury.

1 Safety Precautions (Stroke Sensors)

Always read these precautions carefully before use.

Before selecting and using products, please read all the Safety Precautions carefully to ensure proper product use. The Safety Precautions shown below are to help you use the product safely and correctly, and to prevent injury or damage to you, other people, and assets.

Follow the Safety Precautions for: ISO4414 (Pneumatic fluid power—Recommendations for the application of equipment to transmission and control systems), JIS B 8370 (Pneumatic system regulations)

The directions are ranked according to degree of potential danger or damage: “DANGER!”“WARNING!”“CAUTION!”and “ATTENTION!”

 DANGER	Expresses situations that can be clearly predicted as dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 WARNING	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in death or serious injury. It could also result in damage or destruction of assets.
 CAUTION	Expresses situations that, while not immediately dangerous, could become dangerous. If the noted danger is not avoided, it could result in light or semi-serious injury. It could also result in damage or destruction of assets.
 ATTENTION	While there is little chance of injury, this content refers to points that should be observed for appropriate use of the product.

■ This product was designed and manufactured as parts for use in General Industrial Machinery.

- In the selection and handling of equipment, the system designer or other person with fully adequate knowledge and experience should always read the Safety Precautions, Catalog, Owner’s Manual and other literature before commencing operation. Making mistakes in handling is dangerous.
- After reading the Owner’s Manual, always place it where it can be easily available for reference to users of this product.
- If transferring or lending the product to another person, always attach the Owner’s Manual, to the product where it is easily visible, to ensure that the new user can use the product safely and properly.
- The danger, warning, and caution items listed under these “Safety Precautions” do not cover all possible cases. Read the catalog and Owner’s manual carefully, and always keep safety first.

DANGER

- Do not use for the purposes listed below:
 1. Medical equipment related to maintenance or management of human lives or bodies.
 2. Mechanical devices or equipment designed for the purpose of moving or transporting people.
 3. Critical safety components in mechanical devices.
 This product has not been planned or designed for purposes that require advanced stages of safety. It could cause injury to human life.
- When attaching the product, always firmly support and secure them (including workpieces) in place. Dropping or falling of the product or improper operation could result in injury.
- Never attempt to modify the product. This could result in abnormal operation leading to injury, electric shock, fire, etc.
- Never attempt inappropriate disassembly, assembly or repair of the product’s basic construction, or of its performance or functions. This could result in injury, electric shock, fire, etc.
- Do not splash water on the product. Spraying it with water, washing it, or using it underwater could result in malfunction of the product leading to injury, electric shock, fire, etc.
- Do not use the stroke sensor counter and sensor head in locations where explosives, inflammables, and other dangerous substances are present. The counter and sensor head are not explosion-proof. There is a chance that they will explode or ignite.
- Do not make any adjustments to the attached mechanisms (attachment or removal of connectors for wiring, mounting or positioning of the sensor head, etc.) while in operation. Abnormal operation could result in injury.

WARNING

- Do not use the product in excess of its specification range. Such use could result in product breakdowns, function stop, damage or drastically reduce the operating life.
- Before supplying air or electricity to the device and before starting operation, always conduct a safety check of the area of machine operation. Unintentional supply of air or electricity could possibly result in electric shock, or in injury caused by contact with moving parts.
- Do not touch exposed electrical parts of terminals, etc., while the power is switched on. This could result in electric shock or abnormal operation.
- Do not throw the product into fire. The product could explode and/or release toxic gases.
- Do not sit on the product, place your foot on it, or place other objects on it. Accidents such as falling or tripping over the product could result in injury. Dropping the product could result in injury, or also damage or break it resulting in abnormal or erratic operation, or runaway, etc.
- Do not damage cords of lead wires for the counter and sensor head. Damage, excessive bending, or pulling of the cord, or wrapping the cord tightly, placing heavy objects on it, or pinching it, could result in electric leakage or defective conduction that lead to fire, electric shock, or abnormal operation, etc.
- Do not apply external magnetic fields while the counter and sensor head are in operation. Unintentional operation could result in damage to the device or in injury.
- Use a safety circuit or device designed to avoid damage to devices or accident, etc., when equipment is stopped due to emergency stops, blackouts, or other abnormal system events.
- Do not lay the product wiring parallel to or alongside power lines or high-voltage lines. This could result in errors in operation for the counter and sensor head due to noise.
- Use care when wiring to avoid mistaking the polarity of the wiring. A mistake could result in damage to the counter and sensor head.

● For the Mini Guide Slider body “Safety Precautions” and “Handling Instructions and Precautions,” see “Catalog No.C2188, Mini Guide Sliders.”

● For the Rod Slider body “Safety Precautions” and “Handling Instructions and Precautions,” see “Catalog No.BK-UC003 Actuators General Catalog,” p.57 in Safety Precautions or p.892 and later.

CAUTION

- Do not use the product in locations that are subjected to direct sunlight (ultraviolet ray), to dust, salt, iron powder, or high humidity, or in media or ambient atmospheres that include organic solvents, phosphate ester type hydraulic oil, sulfur dioxide, chlorine gas, acids, etc. It could lead to an early shutdown of some functions or a sudden degradation of performance, and result in reduced operating life. For materials used, see Major Parts and Materials.
- When mounting the product, leave room for adequate working space around it. Failure to ensure adequate working space will make it more difficult to conduct daily inspections or maintenance, which could eventually lead to system shutdown or damage to the product.
- Do not use the counter and sensor head in locations that are subject to large current or strong magnetic fields. This could lead to defective operation.
- Do not sit on the product, use it for standing on, place objects on it, or cause scratches, dents, or deformation in the product. Product damage or breakage could result in operation shutdown or deterioration of performance.
- For installation, adjustment, or other operations, post a warning sign prohibiting sudden supplies of air or electric power, etc. during operation. Sudden supply of air or electric power, etc., could result in electric shock or injury due to sudden equipment movement.
- When handling the counter, sensor head, or humidity correction unit, do not strike, drop, or bump them, or apply excessive shocks (294 m/s² or more). Even if they do not appear damaged, internal parts could be damaged, resulting in defective operation.
- Do not short the load.
Switching on sensor output while in a load-shortened state could result in overcurrent that damages the sensor head.
Example of load short circuit: Output lead wire for sensor output is directly connected to the power source.
- When the sensor head is fixed in place, use an M2 screw, with a tightening torque of 0.11 N·m.
If tightened in excess of the tightening torque, the sensor head or other parts may be damaged.
Always shut off the power before connecting the sensor head and counter. Connecting the sensor head while the power is switched on could result in voltage surge, etc., that causes defective operation of the counter.
- Do not pull on the counter and sensor head cables, carry the product around by the cables, or place heavy objects or apply excessive loads on the cables.
This could result in electric leakage or defective conduction that lead to fires, electric shocks, or abnormal operation, etc.
- Always use the designated sensor head and humidity correction unit with the counter. Use of a non-designated unit could cause defective operation.

ATTENTION

- When considering the possibility of using this product in situations or environments not specifically noted in the Catalog or Owner's Manual, or in applications where safety is an important requirement, such as in an airplane facility, combustion equipment, leisure equipment, safety equipment and other places where human life or assets may be greatly affected, take adequate safety precautions such as application with enough margins for ratings and performance or fail-safe measures. Be sure to consult us with such applications.
- Always check the Catalog and other reference materials for product wiring.
- Use a protective cover or other device to isolate the operating parts of mechanical devices, etc., and prevent direct human body contact.
- Do not use control configurations that would let workpieces fall during a power outage.
Build controls that prevent falling workpieces, etc., when the power to mechanical devices cuts out, or during emergency stops.
- When handling the product, wear protective gloves, safety glasses, safety shoes, etc. to keep safety.
- When the product can no longer be used or is no longer needed, dispose of it appropriately as industrial waste.
- Pneumatic equipment can exhibit degraded performance and function over its operating life. Always conduct daily inspections of the pneumatic equipment, and confirm that all requisite system functions are satisfied, to prevent accidents from happening.
- For inquiries about the product, consult your nearest Koganei sales office, or Koganei overseas department. The address and telephone number is shown on the back cover of this manual or catalogs.

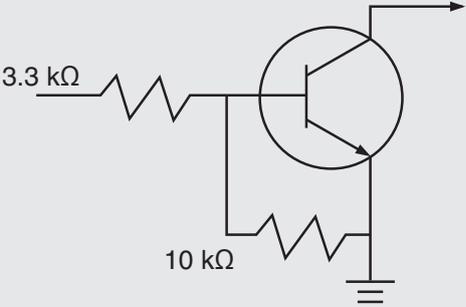
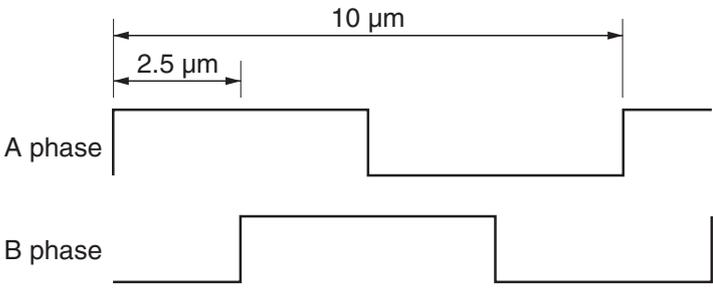
OTHERS

- Always observe the following items.
 1. When using this product in pneumatic systems, always use genuine KOGANEI parts or compatible parts (recommended parts).
When conducting maintenance and repairs, always use genuine KOGANEI parts or compatible parts (recommended parts). Always observe the required methods and procedure.
 2. Do not attempt inappropriate disassembly or assembly of the product relating to basic configurations, or its performance or functions.

Koganei cannot be responsible if these items are not properly observed.

2 Specifications

● Sensor head

Model	ZMA1□			
Power supply voltage	24VDC±5%			
Consumption current	100 mA MAX.			
Detection type	Optical linear encoder			
Signal output	<p>A phase and B phase: open collector output, I_c=20 mA (MAX.) Residual voltage 0.3V or below (when I_c=20 mA)</p> 			
Output waveform	 <p style="text-align: center;">Phase of A & B phases' open collector output</p>			
Pin assignment	24V	GND	A phase	B phase
	Brown	Blue	Black	White
Minimum resolution	2.5 μm (with quad)			
Accuracy	Measurement length: ±0.013± (L×0.0002) mm for L mm (at ambient temperature 23°C and ambient humidity 50% RH)			
Maximum response frequency	600 kHz (Maximum response speed: 1500 mm/s)			
Maximum transmission distance	25 m (when using Koganei connecting cable and Koganei counter)			
Mounting method	Side mounting on cylinder (shipped with assembled)			
Operation indicator	Red LED on encoder lights up when power is supplied			
Cable	Heat-resistant, oil-resistant vinyl sheath instrumentation-use cable φ4.5 0.15 mm ² 4-lead twisted pair shield 3000 mm with 4P connector			
Insulation resistance	100 MΩ or more at 500VDC megger			
Dielectric strength	500VAC 1 minute			
Shock resistance	30G, damping time: 11 ms			
Environmental protection	None			
Vibration resistance	5G, 20 to 250 Hz			
Operating temperature and humidity range	0 to 60°C, 90% RH or less (no condensation and freezing)			
Storage temperature and humidity range	-20 to 60°C, 90% RH or less (no condensation and freezing)			
Materials	Case: PBT			
Mass	100 g (including cables)			
Connecting cable (Options)	ZMK1-3L : 3 m			
	ZMK1-5L : 5 m			

● Counter

Model		ZMC1		
Power supply	Voltage	24VDC±3%		
	Consumption current	100 mA MAX. (Not including current supplied to sensor)		
	Sensor supply voltage	24VDC		
Display	Numeric display	When distance display mode in effect: Displays distance as “****” (mm) within effective range		
		When speed display mode in effect: Displays average speed in setting range as “****” (mm/s) (Mode LED indicator: Green LED lights up) (See p.6 (1) in “Display accuracy”)		
		When time display mode in effect: Displays required time of setting range as “****” (s) (Mode LED indicator: Green LED blinking) (See p.6 (2) in “Display accuracy”)		
	Mode LED indicator	When zone, temperature correction, and humidity correction setting in effect, green LED lights up		
Operation indicator	Red LED lights up when each switch outputs ON			
Operation mode	Detecting mode	Normal detecting mode		
	Setting mode	Zone signal output setting, temperature correction setting, humidity correction setting, display inversion setting		
	Display setting mode	Distance display, speed display, time display		
Input signal	Count input	Count input by connecting sensor head		
	Reset input	Reset LCD display, 10 ms or more, 0.5VDC or less		
SW output	Number of outputs: 4	Zone output OUT 1	Outputs in range of set threshold values	
		Start point output OUT 2	Outputs when stop output is ON, and when distance display is within ±“_0.25”(Corresponds to previous cylinder with magnet's start point side sensor)	
		End point output OUT 3	Outputs when stop output is ON, and when distance display is ±“_0.26” or more (or less)	
		Stop output OUT 4	Outputs when there is no displacement exceeding 0.25 mm within 0.1 s (See p.6 (3) “Display accuracy”)	
	Output method	NPN open collector output		
	Load voltage	30VDC MAX.		
	Load current	50 mA MAX.		
	Internal voltage drop	0.3V MAX. (at 5 mA)		
	Response time	100 ms or less (Including cylinder stop output judgment time)		
	Setting	Setting by main unit key	See p.14	
Setting by external communication		See p.16		
Environment	Operating temperature range	0 to 50°C (no condensation and freezing)		
	Storage temperature range	-10 to 70°C (no condensation and freezing)		
	Noise resistance	EN61000-4-4, EFT/B level, DATA: ±1 KV (level 2)		
	Dielectric strength	500VAC 1 minute		
	Insulation resistance	100 MΩ or over at 500VDC megger		
	Vibration resistance	10 to 55 Hz 2 hours in each XYZ direction		
Shock resistance	294.2 m/s ² (5 times each)			
Others	Materials	Case: PBT		
	Mass	60 g (excluding cables and mounting parts)		
Options	Cable (provided)	Power cable	-3LE : 3 m	-5LE : 5 m
		Input/output/communication cable	-3LD : 3 m	-5LD : 5 m
	Connecting cable (sold separately)	Power cable	ZMK2-3L : 3 m	ZMK2-5L : 5 m
		Humidity correction unit	ZMK3-3L : 3 m	ZMK3-5L : 5 m
	Mounting parts (provided)	Mounting bracket		-B
		Panel mounting parts		-P
		Panel mounting parts (with protective front cover)		-P-C
	Mounting parts (sold separately)	Mounting bracket		PSU-BR
Panel mounting parts		PM100		
Protective front cover		KB100		

● Humidity correction unit

Model	ZMH1		
Power supply voltage	5VDC±5%		
Consumption current	0.6 mA MAX.		
Output voltage	10 mV/%RH		
Pin assignments	5V: brown	GRD: blue	Analog output: black
Cable	Oil-resistant & bending-resistant, PCCV, ϕ 2.6, 0.15 mm ² , 3-lead, 3000 mm, with 3P connector		
Nominal accuracy	±5%		
Response time	1 min (with 30% RH↔85% RH as 100, a 90% arrival time of it)		
Operating temperature range	0 to 50°C (no condensation and freezing)		
Storage temperature range	-20 to 60°C (no condensation and freezing)		
Vibration resistance	5 to 55 Hz, Amplitude: 2 mm, 2 hours in each XYZ direction		
Shock resistance	980 m/s ² , 6 ms, 3 times in each XYZ direction		
Materials	Case: POM		
Mass	70 g (including cables)		

3 Precautions

● Mounting

1. The sensor is not equipped with environmental protection. It is not suitable for use in dusty locations, or in locations subject to oil or coolant dripping, etc. If using the sensor in such locations, protect it with a cover.
2. An optical linear encoder method is used. Accurate detection cannot be performed if the detector part is directly irradiated by a light source of 750 lux or more. The 750 lux environment is a normal working condition for visual operations in general manufacturing processes (JIS Z9110).
3. Do not pull hard on the sensor cable.

● Wiring

1. The sensor is shipped with a connector with loose end wires. Proceed with wiring based on a full understanding of the wiring instructions to avoid mis-wiring.
2. When using the unit, always ground the shield cable.
3. When using equipment (such as a switching regulator, inverter motor, etc.) that could be a source of noise near the sensor mounting portion, always be sure to ground the equipment frame ground (F.G.) terminal.
4. To prevent mis-counts due to noise, wire the sensor cable separately from other power lines or AC-type valves.
5. After wiring is completed, check the proper connection.
6. Be sure to connect all connectors before switching the power ON.
7. Check the power supply fluctuations to ensure that power input does not exceed the rated values.
8. Avoid use during the transition state (lasting 1 s) after power switched ON.
9. If using extension cables, always use Koganei connecting cables to avoid mis-counts due to noise.

● Receiving circuit

1. When using a counter purchased on the market, be particularly careful regarding the response frequency. It cannot count when the cylinder speed exceeds the counter response frequency. The Koganei counter response frequency of 600 kHz corresponds to the cylinder speed of 1500 mm/s (including popping out and bouncing).
2. If not using a Koganei counter, give particular consideration to noise in the output signal from the sensor, and install a filter, etc., in the receiving circuit.

● Maintenance

When using the stroke sensor in an environment subject to splashing coolant or to dust, accurate detection will fail when the sensor head detector surface or scale becomes dirty. We recommend following the cleaning instructions on p.6 (below) and performing periodic maintenance.

● Detection accuracy

1. Since whole system accuracy after mounting on the device may change depending on the mounting conditions and environment, you will need to perform calibration of the device as a system.
2. The sensor scale tape can expand or contract depending on the temperature and humidity. Please use the expansion/contraction value below as a guide. The expansion and contraction value based on temperature and humidity should be added.
 - 1) Each time the temperature rises from the reference temperature of 23°C by 10°C, the sensor scale tape expands by 0.0018 mm (per 10 mm).
(Measurement value shortens by approx. 0.0018 mm [per 10 mm].)
 - 2) Each time humidity rises from the reference humidity of 50% RH by 10% RH, the sensor scale tape expands by 0.0012 mm (per 10 mm).
(Measurement value shortens by approx. 0.0012 mm [per 10 mm].)

※The Koganei dedicated counter **ZMC1** can automatically correct the humidity level when used together with the separate humidity correction unit **ZMH1**.
3. When using the cylinder internal stopper as the reference point, deformation of the cylinder's internal bumper may cause changes in the reference point. In this case, either use a stroke adjusting cylinder that uses a metal stopper, or install an external metal contact stopper. In addition, since wear on the stopper can cause changes, we recommend periodic maintenance.

● Display accuracy

1. The speed display mode displays the average speed of the speed measurement range that you have set, under the following conditions.
If the required time for the setting range is 0.05 s or more, the display speed can show an error of $\pm 5\%$ and ± 1 digit from the actual speed.
2. The time display mode displays the time required for the speed measurement range that you have set. However, the sampling time (2 ms) of the counter is a display error.
3. Since stop output (stop judgment) is delivered when there is no displacement exceeding 0.25 mm within 0.1 s, stop output is delivered even if the cylinder continues to move within a range of 2.5 mm/s. Note that distance measurement is performed.

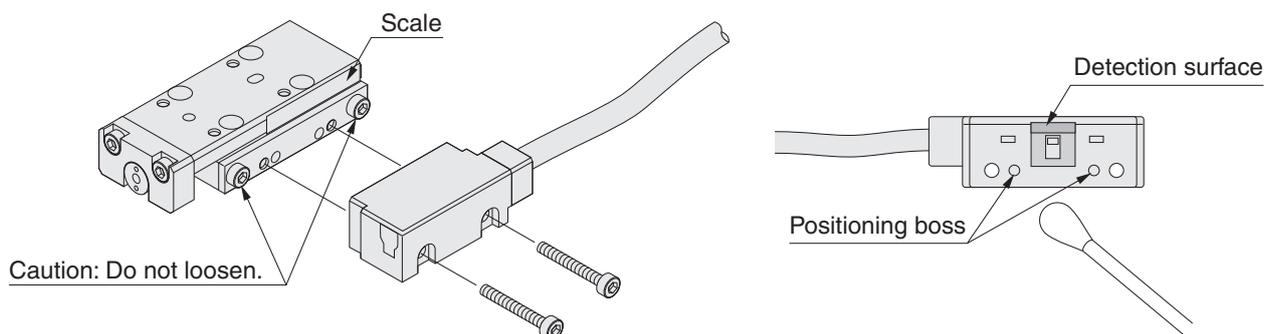
● General

1. Do not use a needle tip or other sharply pointed object to operate the counter keys.

● Cleaning instructions

Since the stroke sensor is an optical linear encoder, a dirty detecting surface can obstruct correct detection. Follow the instructions below, and we recommend periodic maintenance.

1. Turn OFF the power to the sensor head.
2. Remove the fixture securing the cylinder in place.
3. Loosen the hex socket head screw securing the sensor in place, and remove the sensor from the cylinder.
Do not loosen the hex socket head screws marked in yellow that secure the adaptor plate in place.
4. Use a cotton swab that has been soaked in ethanol to perform cleaning on the sensor detection surface.
Avoid causing scratches in the sensor detection surface. This could prevent accurate detection. In addition, be careful to avoid letting ethanol get inside the sensor head.
5. Use a paper towel soaked in ethanol to perform cleaning on the scale.
6. Apply adhesive to the first three threads or so of the hex socket head screw for securing the sensor in place, align the sensor positioning boss to the adaptor plate positioning hole, and tighten the hex socket head screw. (Tightening torque: 11 N·cm)
Recommended adhesive: ThreeBond 1324N
7. Attach the fixture to the cylinder.
8. Check that the ethanol has dried off, and then turn ON the power to the sensor head.



4 Mounting

● Connection instructions for power supply connector

When the power cable (including the connecting cable) is delivered, the mini clamp wire mounting plug and mini clamp wire mounting socket are not yet connected. As a result, follow the instructions below to connect them. Moreover, if performing a reconnection for the purposes of length adjustment, use the instructions below for the connection.

1. For the reconnection, always use the mounting plug or socket shown below.

Mini clamp wire mounting plug 4P Model: **FS1U-4M**

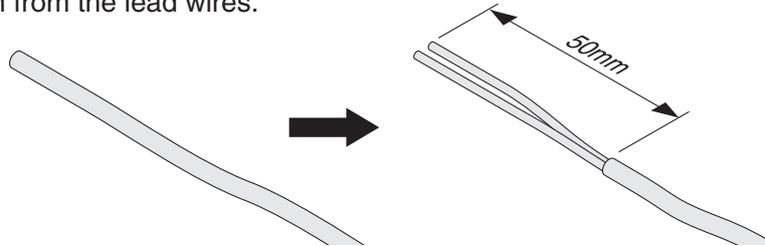
Mini clamp wire mounting socket 4P Recommended Model: 37304-3101-000FL (Manufactured by 3M)

2. Check that the cover of the mini clamp wire mounting plug (the part where lead wires are to be inserted) is protruding from the body of mini clamp wire mounting plug. It cannot be used if it's flat and placed at the same level against the body.



3. Cut the connecting power cable to the required length.

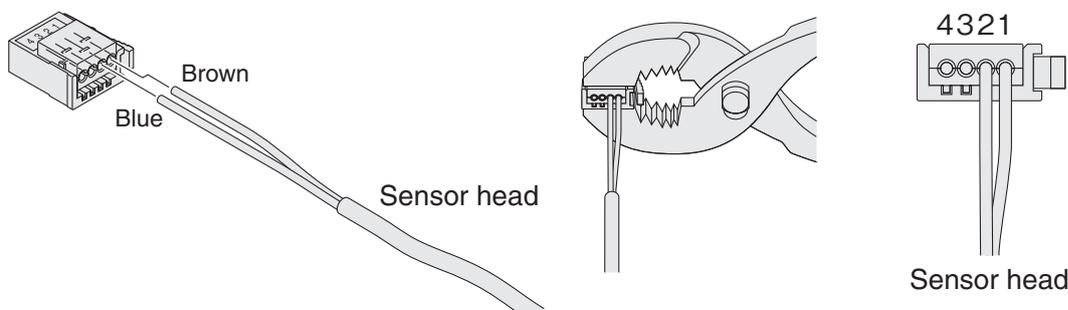
Remove the outer sheath for 50 mm from the tip of the cable, to expose the lead wires. At this time, do not remove the insulation from the lead wires.



4. Follow the instructions in the table to insert the lead wires into the hole in the cover of mini clamp wire mounting plug. Look through the top of the semi-transparent cover to check that the lead wires have been firmly inserted all the way to the back. (Insertion is about 9 mm.)

Use caution in making the connections, since switching on the power with mistakes in the connections will damage the sensor head and counter.

No. on the connector	Signal name	Color of lead wire
1	Counter power supply (+)	Brown
2	Counter power supply (0V)	Blue
3	NC	—
4	NC	—



5. Taking care to avoid letting the lead wires slip out from the mini clamp wire mounting plug, use pliers or some other hand tool to crimp the cover and mini clamp wire mounting plug body, and push the cover into the mini clamp wire mounting plug body. Limit the crimping force to 980.7 N. When the cover is flat and placed at the same level against the mini clamp wire mounting plug body, the connection is complete.
6. Use the same process for the mini clamp wire mounting socket.
7. Check one more time that the wiring is correct.

● **Connection instructions for the sensor head connector**

When the sensor head cable is delivered, the mini clamp wire mounting plug is not yet connected. As a result, follow the instructions below to connect it. Moreover, if performing a reconnection for the purposes of length adjustment, use the instructions below for the connection. If you want to extend the sensor head cable, follow the “Connection instructions for sensor head connecting connector” on p.10-p.11 to connect the male straight connector to the sensor head cable, and the female connecting connector to one end of the sensor head connecting cable.

1. For the reconnection, always use the mounting plug shown below.

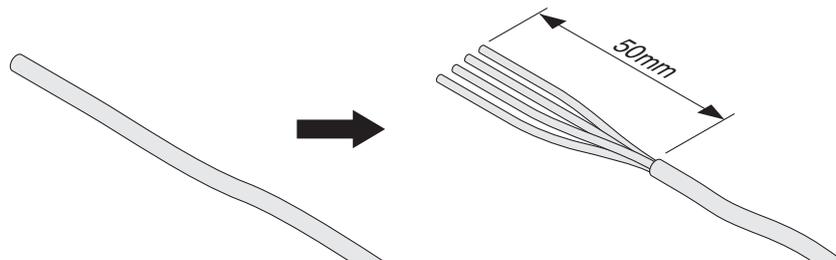
Mini clamp wire mounting plug 4P Model: **FS1U-4M**

2. Check that the cover of the mini clamp wire mounting plug (the part where lead wires are to be inserted) is protruding from the body of mini clamp wire mounting plug. It cannot be used if it's flat and placed at the same level against the body.



3. Cut the sensor head cable to match the required length.

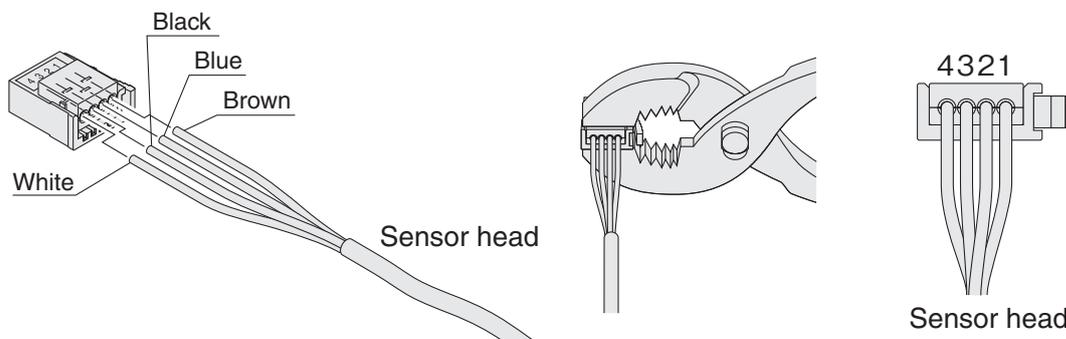
Remove the outer sheath for 50 mm from the tip of the cable, to expose the lead wires. At this time, do not remove the insulation from the lead wires. Take suitable measures to ground the shield wire.



4. Follow the instructions in the table to insert the lead wires into the hole in the cover of mini clamp wire mounting plug. Look through the top of the semi-transparent cover to check that the lead wires have been firmly inserted all the way to the back. (Insertion is about 9 mm.)

Use caution in making the connections, since switching on the power with mistakes in the connections will damage the sensor head and counter.

No. on the connector	Signal name	Color of lead wire
1	Sensor head power supply (+)	Brown
2	Sensor head power supply (0V)	Blue
3	Count output A phase	Black
4	Count output B phase	White



5. Taking care to avoid letting the lead wires slip out from the mini clamp wire mounting plug, use pliers or some other hand tool to crimp the cover and mini clamp wire mounting plug body, and push the cover into the mini clamp wire mounting plug body.

Limit the crimping force to 980.7 N. When the cover is flat and placed at the same level against the mini clamp wire mounting plug body, the connection is complete.

6. Check one more time that the wiring is correct.

● **Connection instructions for humidity correction unit connector**

When the humidity correction unit cable and the humidity correction unit connecting cable are delivered, the mini clamp wire mounting plug and mini clamp wire mounting socket are not yet connected. As a result, follow the instructions below to connect them. Moreover, if performing a reconnection for the purposes of length adjustment, use the instructions below for the connection.

1. For the reconnection, always use the mounting plug or socket shown below.

Mini clamp wire mounting plug 3P Model: **FS1U-3M**

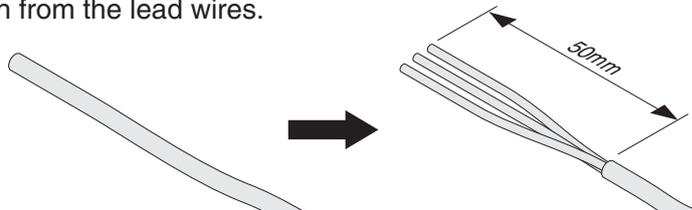
Mini clamp wire mounting socket 3P Recommended Model: 37303-3101-000FL (Manufactured by 3M)

2. Check that the cover of the mini clamp wire mounting plug (the part where lead wires are to be inserted) is protruding from the body of mini clamp wire mounting plug. It cannot be used if it's flat and placed at the same level against the body.



3. Cut the humidity correction unit cable and the humidity correction unit connecting cable to match the required length.

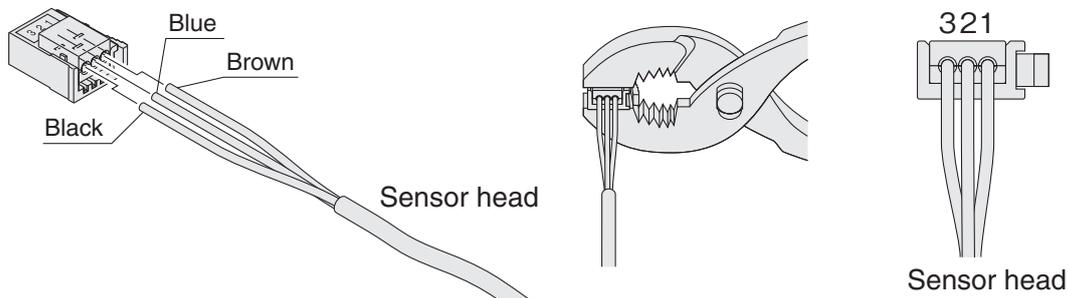
Remove the outer sheath for 50 mm from the tip of the cable, to expose the lead wires. At this time, do not remove the insulation from the lead wires.



4. Follow the instructions in the table to insert the lead wires into the hole in the cover of mini clamp wire mounting plug. Look through the top of the semi-transparent cover to check that the lead wires have been firmly inserted all the way to the back. (Insertion is about 9 mm.)

Use caution in making the connections, since switching on the power with mistakes in the connections will damage the sensor head and counter.

No. on the connector	Signal name	Color of lead wire
1	Correction unit power supply (+)	Brown
2	Correction unit power supply (0V)	Blue
3	Correction unit output	Black



5. Taking care to avoid letting the lead wires slip out from the mini clamp wire mounting plug, use pliers or some other hand tool to crimp the cover and mini clamp wire mounting plug body, and push the cover into the mini clamp wire mounting plug body. Limit the crimping force to 980.7 N. When the cover is flat and placed at the same level against the mini clamp wire mounting plug body, the connection is complete.
6. Use the same process for the mini clamp wire mounting socket.
7. Check one more time that the wiring is correct.

● **Caution**

1. The humidity correction unit is used to correct scale tape expansion due to humidity. Install it as near to the sensor head as possible.
2. Application in locations where extreme condensation is possible, or in locations where water or salt water can intrude can result in deterioration of the element.

● **Connection instructions for input/output/communication cable**

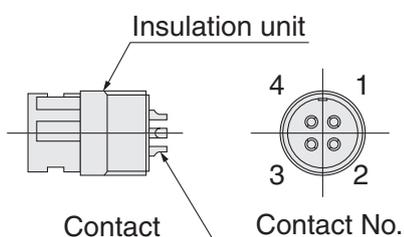
Follow the instructions below to connect your device with the input/output/communication cable.

No. on the connector	Signal name	Color of lead wire
1	Input signal 1: reset	Red
2	NC	—
3	Output signal 1: Zone signal	White
4	Output signal 2: Start point signal	Green
5	Output signal 3: End point signal	Yellow
6	Output signal 4: Stop signal	Brown
7	RS232C : 0V	Black
8	RS232C : RXD	Blue
9	RS232C : TXD	Brown

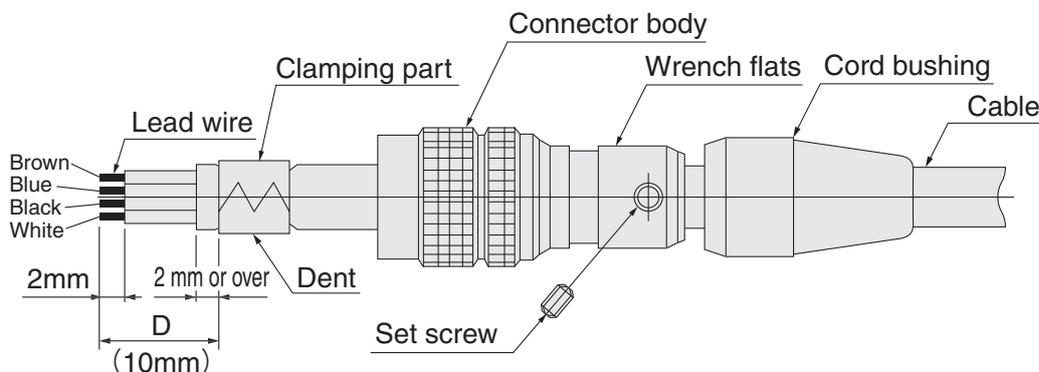
● **Connection instructions for sensor head connecting connector**

When the sensor head connecting cable is delivered, the male straight connector and the female connecting connector are not yet connected. As a result, follow the instructions below to connect them.

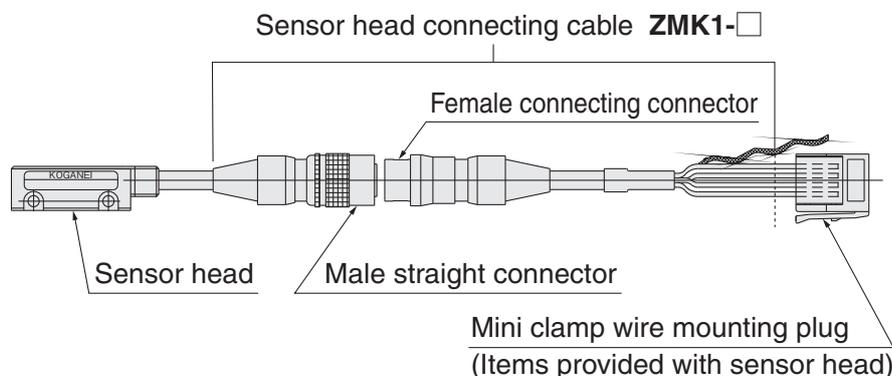
1. Pass the sensor head cable through the cord bushing and connector body, and solder it to the insulation unit contact.
Use caution in making the connections, since switching on the power with a mistake in the connection could cause damage to the sensor head and counter.
2. Solder the lead wire to the contact, and then use the crimping tool (Hirose Electric HR 10A-TC-02) or pliers to crimp the clamping part provided to the sensor head connecting cable. After crimping, the outer diameter should be approx. $\phi 5.3$. At this time, wrap the shield net wire into the sheath, use the clamping part to hold, and crimp in place.
3. Check one more time that the wiring is correct.



No. of the contact	Color of lead wire
1	Brown
2	Blue
3	Black
4	White



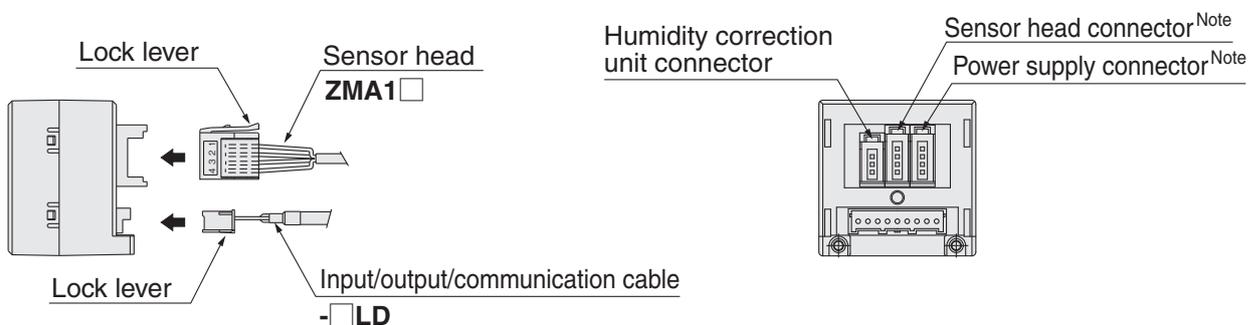
4. Screw the insulation unit thread into the connector body. Use a wrench to tighten to 1.5 N·m. When tightening the connector body, first slacken D portion (10 mm) to avoid applying a load on the soldered wiring, and then perform the tightening.
5. Tighten the set screw so that the tip of the set screw touches the clamping part's either dent located in 2 places. Use a tightening torque of 0.3 N·m for the mounting screw.
6. Finally, cover the connector body with the cord bushing.
7. Use the same process for the female connecting connector.



● **Installing and removing of power supply, sensor head, humidity correction unit, and input/output/communication cables**

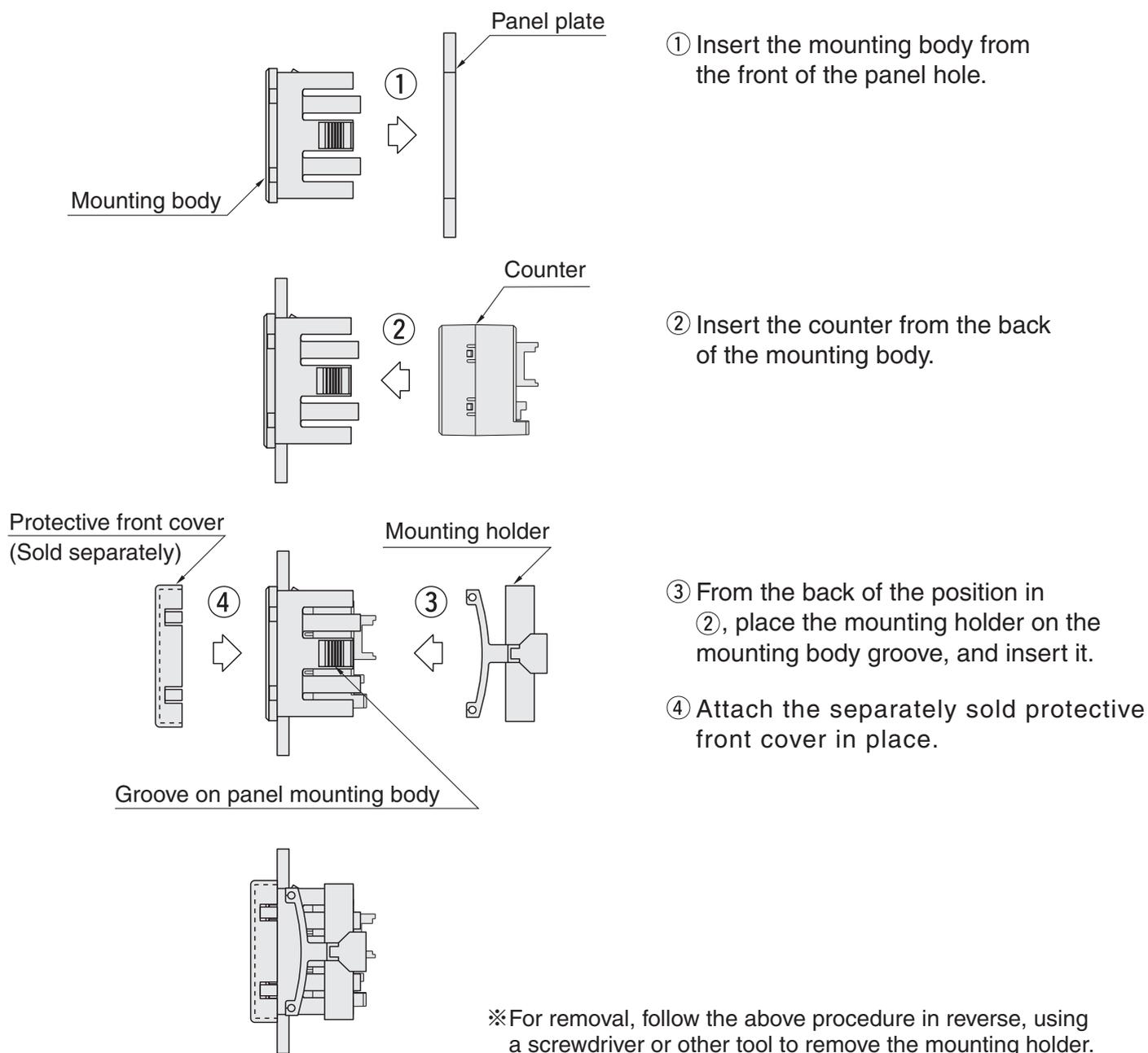
When installing the power supply, sensor head, humidity correction units, and input/output/communication cables, align the lock lever position as shown in the diagram, and insert until it locks against the connector on the counter side.

To remove, push down on the lock lever and then pull out the mini clamp wire mounting plug. At this time, be careful to avoid applying excessive force to the lead wire.

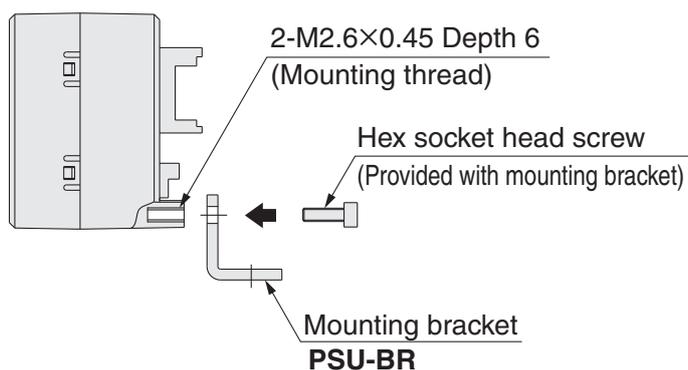


Note: Always be sure to check that the sensor head connector and power supply connector are not connected the wrong way.

● Attaching the panel mounting parts and protective front cover



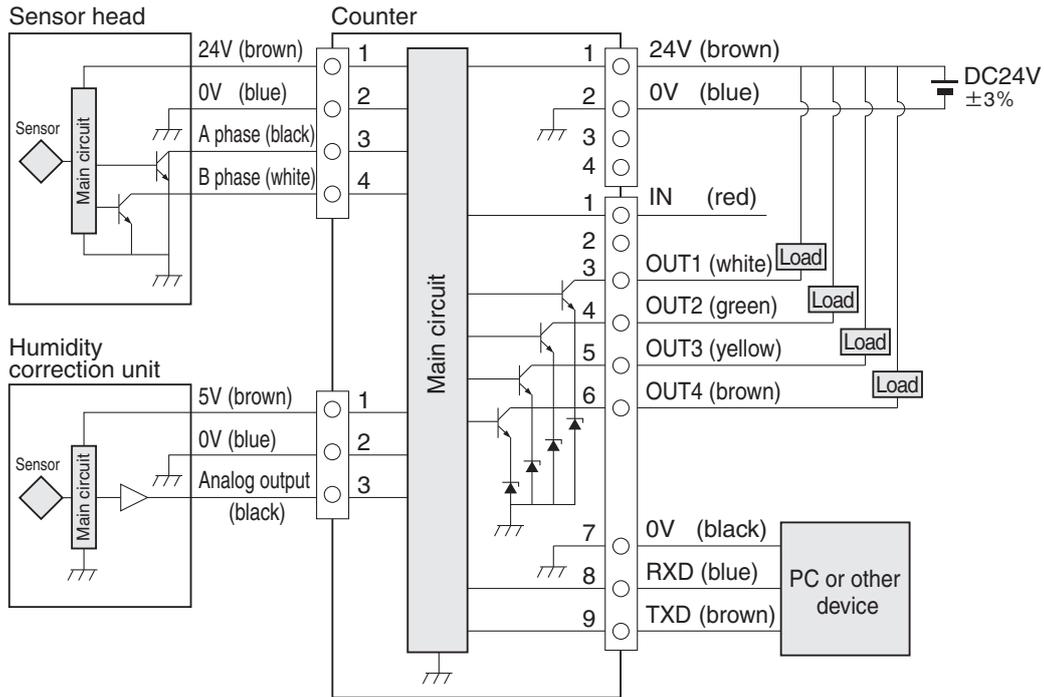
● Attaching the mounting bracket



Use the hex socket head screws (M2.6×0.45 length 5 mm) to mount the mounting bracket into the mounting holes on the back of the counter. The tightening torque should be 0.32 N·m.

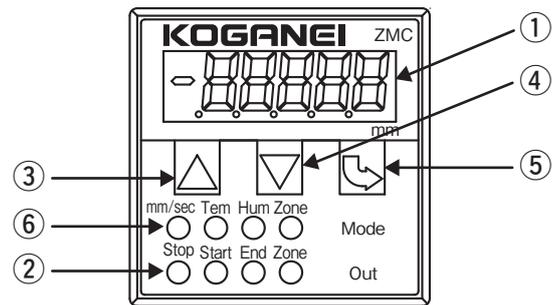
5 Internal Circuit

Stroke sensor counter block diagram



6 Major Parts and Functions

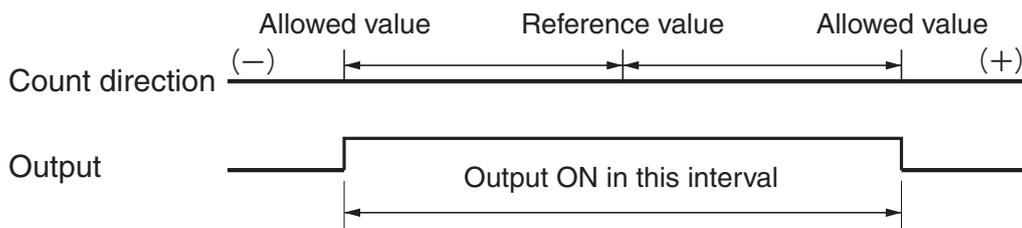
No.	Name	Description
①	LCD display	Displays distance, speed, time, and errors, etc.
②	Switch output indicator lamp (red)	Lights up when switch output is ON
③	UP key	Used when adjusting setting value upward
④	DOWN key	Used when adjusting setting value downward
⑤	Mode key	Used for all types of settings
⑥	Mode LED indicator (green)	Lights up when mode setting is performed



7 Output Mode

● Zone output

When the counter value is within the reference value \pm allowed value, the output is ON.



Note: Since the counter sampling interval is 2 ms, a maximum 2 ms delay occurs in output.

(If it passes from the (-) allowed value through the (+) allowed value in 2 ms or less, output may not occur.)

8 Settings

● Caution

If there is a mistake in the wiring of the power supply, sensor head, humidity correction unit, or input/output/communication cables, this could cause damage to both the sensor head and counter. As a result, always check the wiring before switching ON the power.

■ Setting preparation

- Connect the connector to the sensor head (humidity correction unit).
(See p.8 “Connection instructions for the sensor head connector” and p.9 “Connection instructions for humidity correction unit connector”.)
- Connect the power supply and sensor head to the counter.
(See p.11 “Installing and removing power supply, sensor head, humidity correction unit, and input/output/communication cables”.)
- If necessary, connect the input/output/communication cable, and humidity correction unit.
(See p.11 “Installing and removing power supply, sensor head, humidity correction unit, and input/output/communication cables”.)

■ Setting procedure

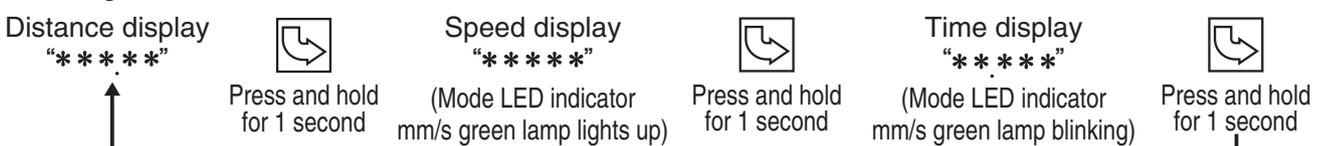
<General flow>

- Turn on the power. Since “oFF” is displayed on the LCD display, use either a push button (simultaneously press the UP key and DOWN key), an input signal (IN1), or RS232C communication (command: @RES) to reset the LCD display to “_ _0.00”.

LCD display	Description	Default value
	Detecting mode	
	Zone signal setting	Reference value: 10 Allowed value: ±0.05
	Temperature correction setting	28°C
	Humidity correction setting	60% RH
	“+” “-” display inversion setting	“+”
	Speed measurement range setting	L1=0 L2=5

<Settings of LCD display description>

- In detecting mode



Remarks: “_” (underlined part) shows that LCD is not displayed.

<Zone signal setting>

	Button operation	Display after operation	Mode LED indicator	Remarks
1		<u>z</u> on__		
2	△ or ▽	<u>z</u> onon	Zone (green) LED lights	Enables zone setting.
3	↵	(Initial value: 10.00)	↓	Performs input of reference value.
4	△ or ▽	*****		Changes to desired setting value.
5	↵	(Initial value: ±0.05)		Performs input of allowed value.
6	△ or ▽	*****		Changes to desired setting value. (±) input.
7	↵	<u>z</u> on__		Completes the setting, and moves to temperature correction setting 1.

<Temperature correction setting>

	Button operation	Display after operation	Mode LED indicator	Remarks
1		<u>t</u> EP__		
2	△ or ▽	<u>t</u> EPon	Tem (green) LED lights up	Enables temperature correction setting.
3	↵	(Initial value: 28.0)	↓	Performs input of ambient temperature.
4	△ or ▽	__***		Changes to desired setting value.
5	↵	<u>t</u> EP__		Completes the setting, and moves to humidity correction setting 1.

<Humidity correction setting>

	Button operation	Display after operation	Mode LED indicator	Remarks
1		<u>h</u> un__		
2	△ or ▽	<u>h</u> unon	Hum (green) LED lights up	Enables humidity correction setting.
3	↵	(Initial value: 60.0)	↓	Performs input of ambient humidity.
4	△ or ▽	__***		Changes to desired setting value. To use the "humidity correction unit" for automatic humidity setting, set to "__00.0".
5	↵	<u>h</u> un__		Completes the setting, and moves to "+/-" display inversion setting 1.

<"+/-" display inversion setting>

	Button operation	Display after operation	Mode LED indicator	Remarks
1		"000.00" blinking	—	
2	△ or ▽	"-000.00" blinking	—	Selects either "+ increment" or "- increment".
3	↵	"000.00" lights up	—	Completes the setting, and moves to speed measurement range setting 1.

<Speed measurement range setting>

	Button operation	Display after operation	Mode LED indicator	Remarks
1		<u>s</u> Pd__	—	
2	△ or ▽	<u>s</u> PdL1	—	
3	↵	(Initial value: 0.00)	—	Performs input of position 1.
4	△ or ▽	*****	—	Changes to desired setting value.
5	↵	<u>s</u> PdL2	—	
6	↵	(Initial value: 5.00)	—	Perform input of position 2.
7	△ or ▽	*****	—	Changes to desired setting value.
8	↵	<u>s</u> Pd__	—	Completes the setting, and moves to detecting mode.

Remarks: "_" (underlined part) shows that LCD is not displayed.

9 Error Display

Display	Error description	Error cancel
E - 1	Switch output is an overcurrent.	Correct the error, and then press  key.

10 Communication Settings

● Computer system

Main unit: PC-98 Series (excluding PC-98LT) and DOS/V machine

Operating system: Windows95 and later

● Software:

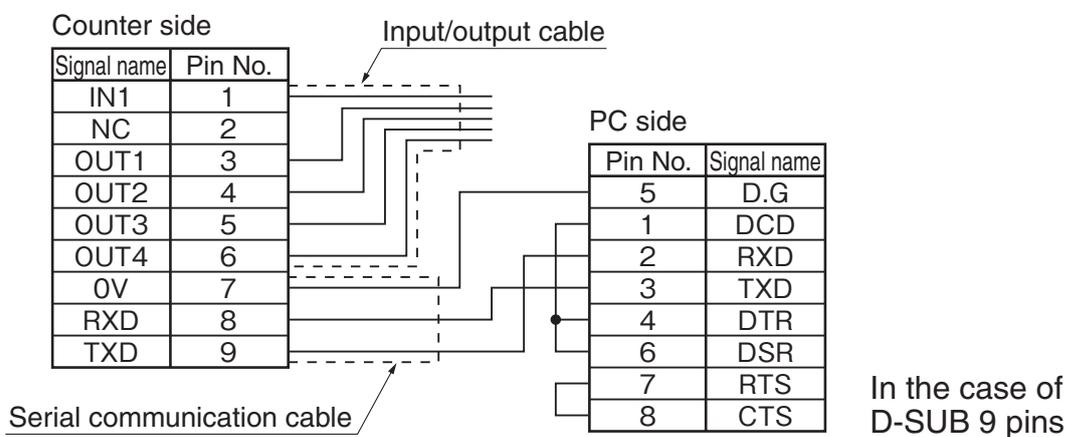
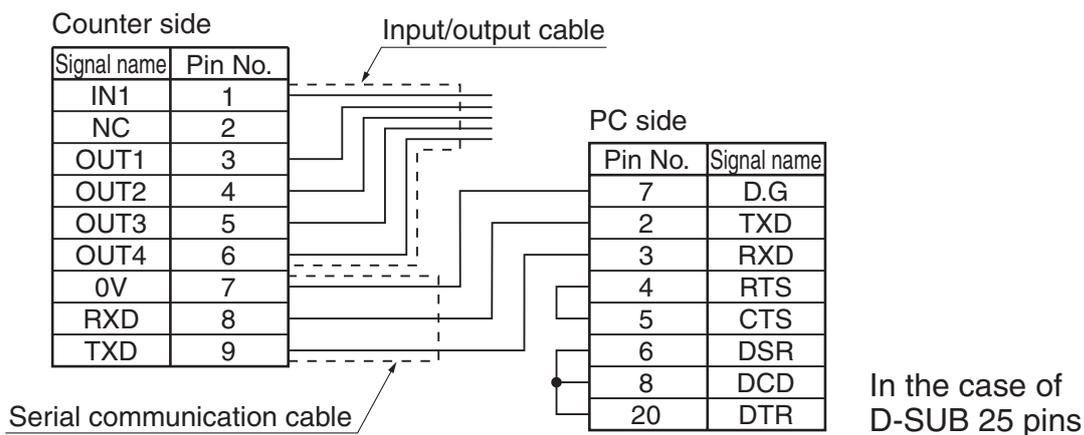
Hyperterminal as standard with Windows95 and later.

※Windows is the registered trademark of the U.S. Microsoft Corp.

● Communication parameter

Baud rate	9600
Stop bit length	One bit
Parity setting	ODD
Parity check	On
Data bit length	8 bits
Communication method	Full duplex
Return key transmission	CR code and LF code

● Communication cable specification and connection



● **Communication command**

@A

Function: Calls up current measurement value (distance).
 Sending example: @A [c/r][l/f]
 Receiving example: 123.45 [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type

@B

Function: Calls up current measurement value (speed).
 Sending example: @B [c/r][l/f]
 Receiving example: 01234 [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type

@C

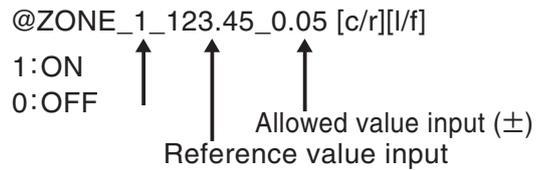
Function: Calls up current measurement value (time).
 Sending example: @C [c/r][l/f]
 Receiving example: 12.345 [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type

@RES

Function: Inputs reset signal and sets LCD display to “_ _0.00”.
 Sending example: @RES [c/r][l/f]
 Receiving example: OK [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type

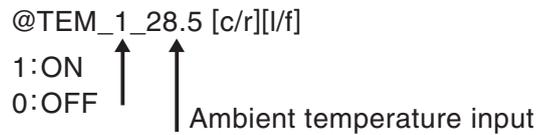
@ZONE

Function: Sets the ZONE function.
 Sending example: @ZONE_1_123.45_0.05 [c/r][l/f]
 Receiving example: OK [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type



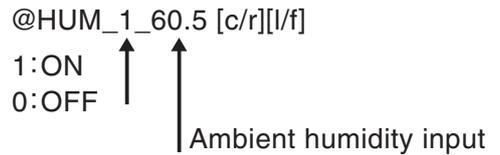
@TEM

Function: Sets the temperature correction function.
 Sending example: @TEM_1_28.5 [c/r][l/f]
 Receiving example: OK [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type



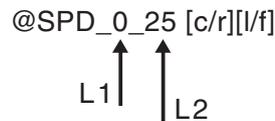
@HUM

Function: Sets the humidity correction function.
 Sending example: @HUM_1_60.5 [c/r][l/f]
 Receiving example: OK [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type



@SPD

Function: Sets the speed measurement range.
 Sending example: @SPD_0_25 [c/r][l/f]
 Receiving example: OK [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type



@SETUP

Function: Displays the current setting value.
 Sending example: @SETUP [c/r][l/f]
 Receiving example: ZONE = OFF [c/r][l/f]
 STD = 10.00 [c/r][l/f]
 PMT = 0.05 [c/r][l/f]
 TEMP = OFF [c/r][l/f]
 TEP = 28.0 [c/r][l/f]
 HUMD = OFF [c/r][l/f]
 HUM = 60.0 [c/r][l/f]
 DIS = OFF [c/r][l/f]
 L1 = 0.0 [c/r][l/f]
 L2 = 5.0 [c/r][l/f]
 Receiving example: NG [c/r][l/f]
 31: illegal type

@DIS

Function: Turns off the LCD backlight, and locks the key button. (Display LED and communication are functioning.)

Sending example: @DIS_1 [c/r][l/f] @DIS_1 [c/r][l/f]

Receiving example: OK [c/r][l/f]

Receiving example: NG [c/r][l/f]

31: illegal type

↑ 1: ON
0: OFF

● Communication error codes

30 : buffer over [c/r][l/f]

Communication buffer has overflowed. Input a line return code before the buffer overflows.

31 : illegal type [c/r][l/f]

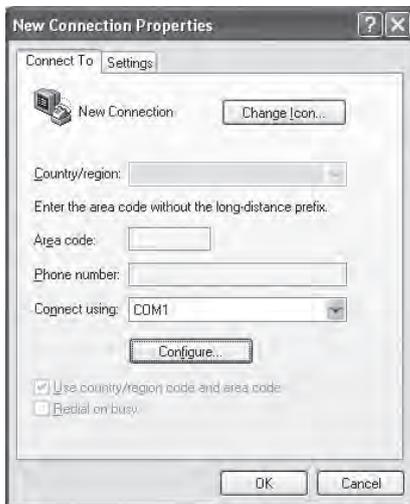
Cannot find a matching communication command. Check the communication command.

32 : data error [c/r][l/f]

Command argument value is not correct. Input a setting value that is possible.

● Setting method for hyper terminal

Figure 1



In **File-Properties**, the above window opens. Set the **Connection Method**. Click **Modem Setting**.

Figure 2

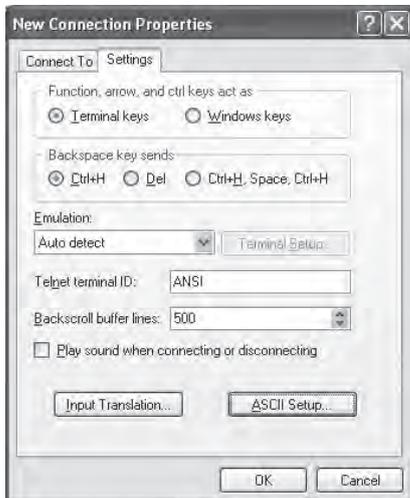


Set the baud rate as shown in Figure 2.

Transmission rate (B) : 9600
Data bit (D) : 8
Parity (P) : Odd
Stop bit (S) : 1
Flow control (F) : Xon/Xoff

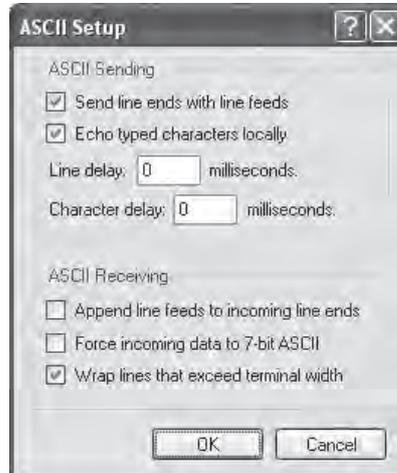
When the setting is complete, click **OK**.

Figure 3



Click the **Setting** tag in Figure 1 to display Figure 3. Then, click the **ASCII Setup** button.

Figure 4



Set as shown in Figure 4, and click **OK**. The screen returns to Figure 3. Click **OK** again.

If you have questions about the contents of this manual, or about other technical issues, please consult the OVERSEAS DEPARTMENT at the address and telephone number shown below.

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Stroke Sensors

Owner's Manual

January 2010 , Ver. 1.0 Y143028

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