



K1G

High-accuracy position sensors

ELECTRONIC
EQUIPMENT

ACOUSTIC

WEIGHING

ANTI-TILTING

VALVES

TEMPERATURE

DETECT
A FIRE®

FLOW/
RATE

DENSITY

INTERFACE

PRESSURE

LEVEL

TF
184



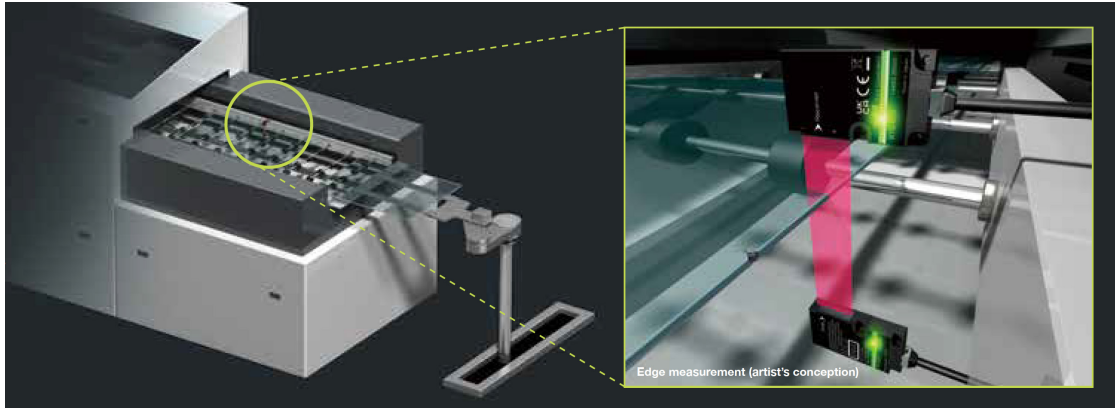
Performance and functions far exceed conventional norms, allowing you to make the measurements you want.

A combination of a CMOS linear image sensor and collimated lasers ensures high-accuracy workpiece position measurement.

See what you previously couldn't

Tiny variations and high-speed fluctuations overlooked by conventional sensors can now be reliably detected and visualized by the Model K16.

Resolution: 0.1 μm **Measurement period:** 250 μs



In-line inspection of glass edges

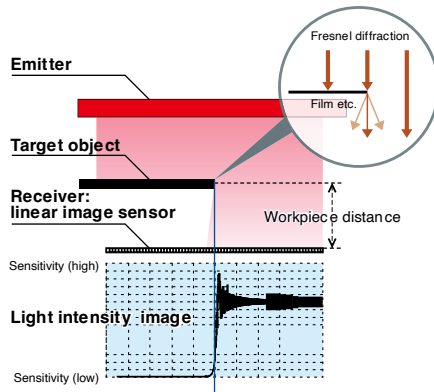
Up until now glass edges and surfaces were checked offline by operators for defects such as chips. The Model K16, however, makes high-speed in-line

measurements with a high degree of accuracy. This means that fast, highly accurate glass measurements can now be made regardless of how the edge surface is processed.

0.1 μm resolution - the highest level in its class!

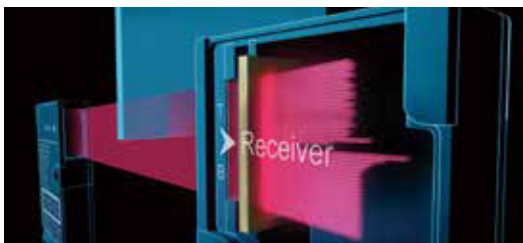
Azbil's unique FDN algorithm, which utilizes Fresnel diffraction phenomena and sophisticated high resolution technologies, has achieved detection accuracy down to 0.1 μm with repeatability accuracy to 1 μm .

- *Fresnel diffraction: Light is diffracted by the edges of thin objects such as knives and films. The intensity distribution of diffracted light at the receiver depends on the working distance between the target object and the receiver*
- *FDN is Azbil's Fresnel diffraction - based sub-pixel processing algorithm*



Detection principle works well for transparent object detection

We developed a special lens to achieve almost perfectly parallel optical light, and then added a CMOS linear sensor as the light-sensitive element to enable visual perception of workpiece position.



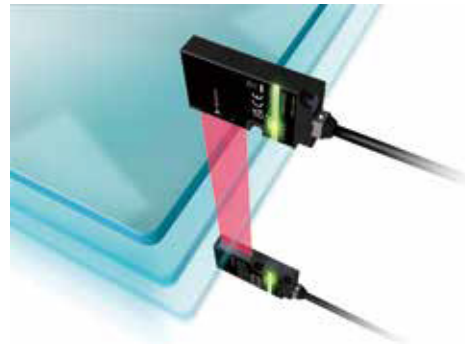
250 μs measurement period, the fastest in its class

Dual-engine architecture allows the integrated FDN algorithm to process huge amounts of data at high speed. By means of multitasking, processing speed is accelerated to approximately four times that of conventional models.



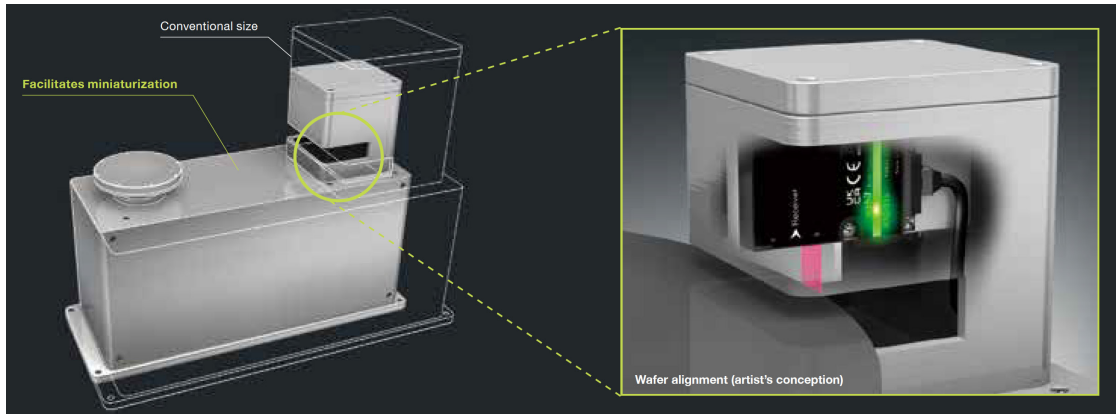
Workpiece distance setting

A built-in function adjusts for minute offsets caused by fluctuations in workpiece position, resulting in highly advanced, more accurate detection.



Easily mounts anywhere

Have you encountered “doesn’t fit” or “can’t measure” problems due to sensor size? Model K16-S designers made ultra-slimness a high priority.

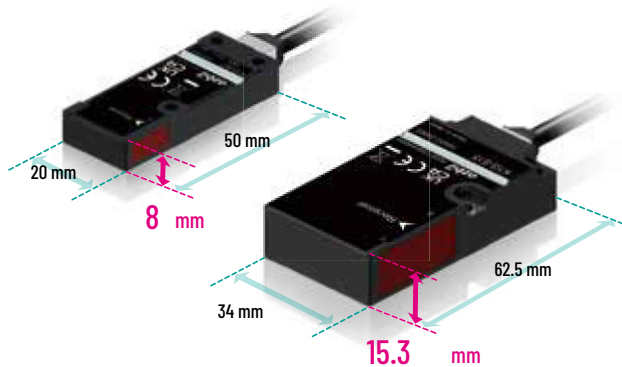


Wafer alignment in IC manufacturing

A small sensor head allows a small alignment unit, helping to reduce the overall equipment footprint.

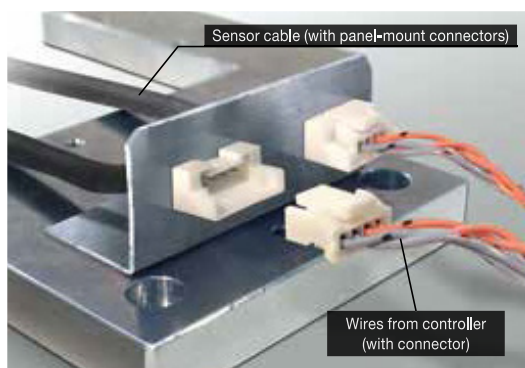
Ultra-thin sensor head

Meticulous efforts have produced an ultra-thin head in all its dimensions. Two sensor models, having detection ranges of 7 mm and 15 mm, are available and are ideal for a wide diversity of applications.



Sensor cable relay connectors

With easy installation and maintenance in mind, we designed panel-mount connectors.



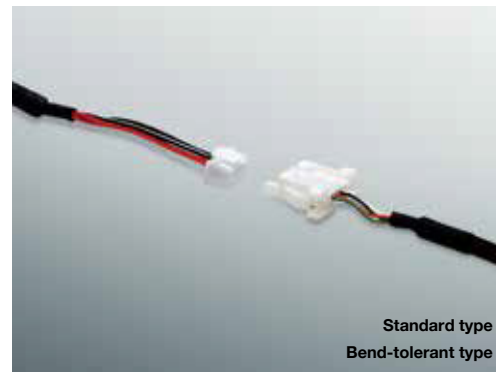
Panel-mount multi-channel controller

A single controller can connect to as many as four sensor heads. Two types of sensor head can be used together.



Up to 25 meter cable extension

The maximum cable extension distance is now dramatically improved compared with conventional products. Installation points are easy to find when there are no worries about cable length.



Less wasted time

The Model K1G is equipped with a host of functions to fully streamline your work time before and after measurement.

1



Sensor selection and equipment

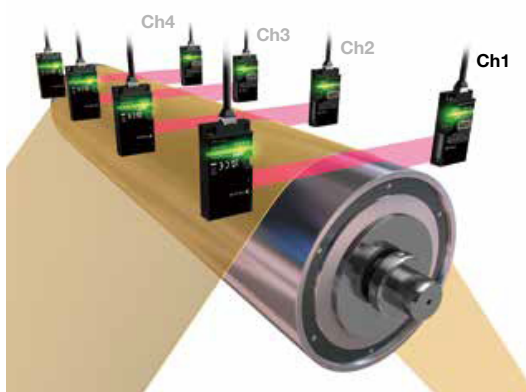
Built-in multi-calculation functions

Multi-channel controllers help calculate data between channels. This cuts the time needed to write programs for host computing equipment and enables easy measurement of thicknesses and widths.

Output of processed results

A01: Ch2 - Ch1, A02: Ch3 - Ch1, A03: Ch4 - Ch1

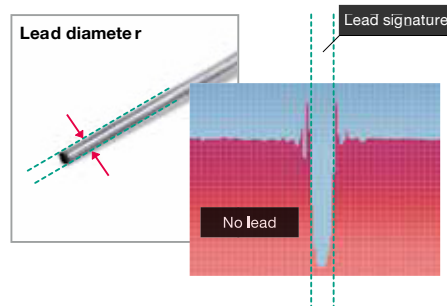
A04: $\frac{(Ch2 + Ch3 + Ch4)}{3} - Ch1$



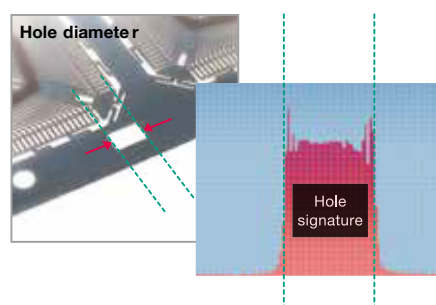
Various built-in measurement modes

One sensor can measure up to two positions at the same time. This means that a single device can handle different applications including workpiece edge position, edge dimensions, hole diameter, and many others, eliminating the trouble of selecting devices.

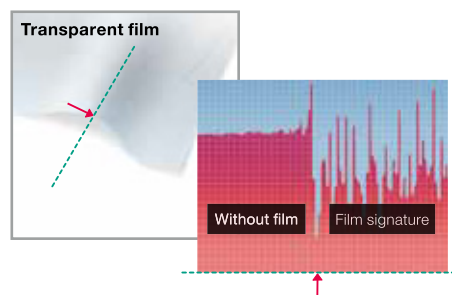
Blocked light width measurement



Entering light width measurement



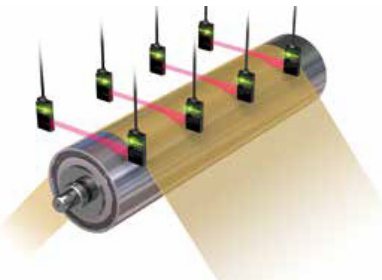
Edge position measurement



Typical applications

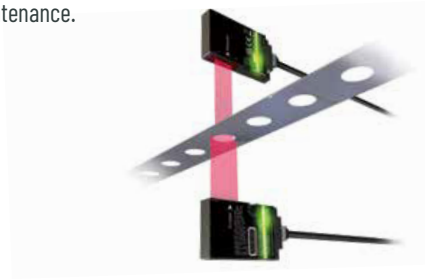
Film sheet thickness measurement

A controller can connect to as many as four sensor channels to provide simultaneous measurement of multiple points, delivering even more accurate measurements.



Measuring the inner diameter of pressed material

The 0.1 μm resolution allows for highly accurate measurement. A built-in function for detecting foreign matter on the sensor head is helpful for preventive maintenance.



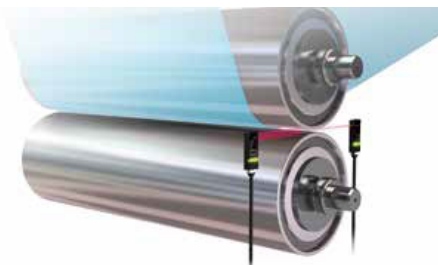
Wafer alignment

Highly transparent glass or gallium arsenic wafers can be reliably measured with a high degree of accuracy. 450 mm wafer notches can also be measured with good reliability at a measuring cycle of 250 μs .



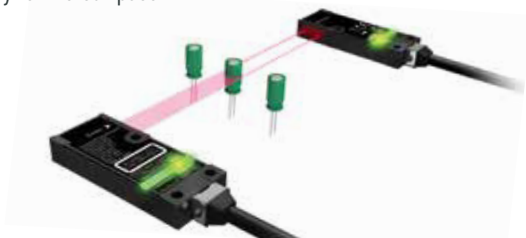
Measurement of gap between rollers

A combination of collimated lasers and image sensor gives measurements of workpiece edge position with a high degree of accuracy.



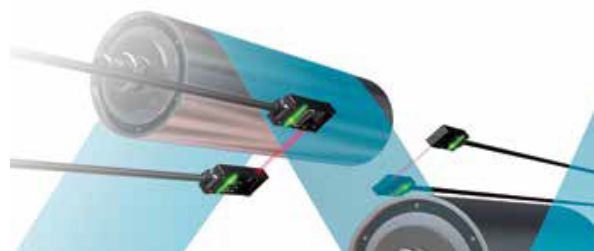
Detection of intermixed electronic components

At a resolution of 0.1 μm , measurements can be made with a high degree of accuracy. A small sensor head means that in-line measurements can be made in very restricted spaces.



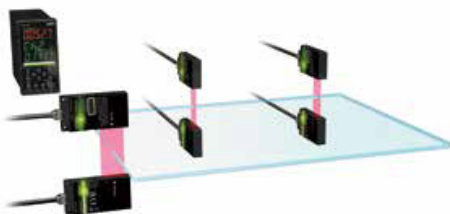
Film meander measurement

By using both of the sensor head channels, the controller's calculation function can simultaneously measure film meander and film width.



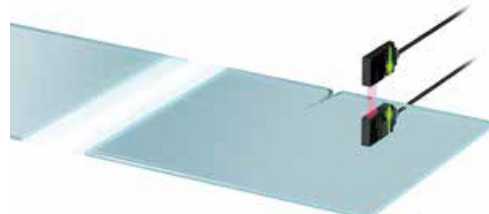
XYO measurement of glass substrates

By connecting sensors on three channels to a multichannel controller, the displacement (X, Y, O) of a glass substrate can be calculated without programming.



Detection of glass substrate irregularities

The response speed of 250 μs ensures detection of any irregularities on glass substrates while they are being transported. The event log function allows quick analysis if any problem occurs.



Various interfaces

There's no need to worry about how to connect to a host device. Simply select the interface that is best for your system environment.

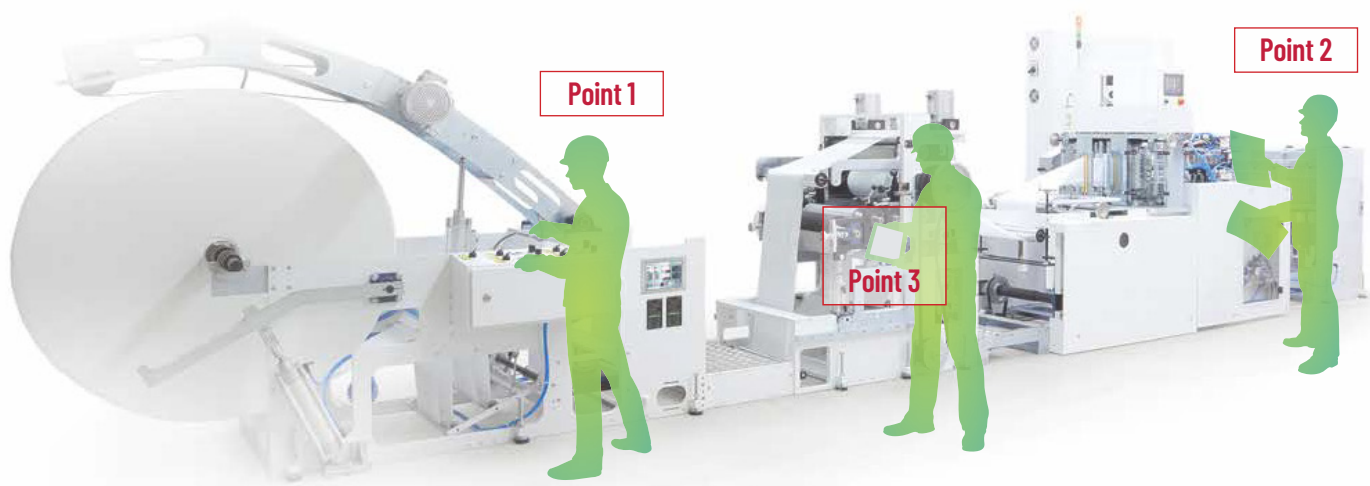


Stepping up to a new level of measurement

The multi-channel controller now supports open field networks, providing new value by bringing measurement data online.



Points



Point 1

Small footprint and less wiring

High-speed communications to a maximum of 100 Mbps and high reliability protocols allow the transfer of measurement data over communication networks. Since input and output require only two wires, the number of wires and space for installation can be greatly reduced.



Conventional wiring



Reduced wiring

Point 3

Node synchronization

To guarantee data synchronization, MECHATROLINK-III/EtherCAT allows easy extraction of synchronized data from all devices on the network. This, for example, allows checking of operations after tooling changes and efficient pinpointing of any trouble that might occur.



Point 2

User-friendly setup and adjustment with HMI

Using the Pro-face GP4000 series allows the setting and checking of all parameters used by the K1G series. The Pro-face Remote HMI, on the other hand, allows setting and checking of parameters using a Wi-Fi-equipped tablet.



Specifications

Sensor heads

Shape		
Compatible controllers	K1G-C04 ..	
Detection type	Thru-scan (Emitter, Receiver set)	
Sensing distance	10 to 500 mm	10 to 1000 mm
Sensing width	7 mm	15 mm
Light source	Red semiconductor laser (light emission peak 650 nm), JIS Class 1	
Standard target	Opaque knife edge	
Repeatability	±1 µm or less *1	
Moving accuracy	20 µm or less when moved 0.5 mm *2	
Temperature characteristics of sensor	0.1%F.S./°C	
Indicator lamp	Operation indicator: yellow LED	
Operating temperature	0 to 50°C	
Storage temperature	-20 to 70 °C (without freezing)	
Operating humidity	30 to 85 % RH (without condensation)	
Vibration resistance	9.8 m/s ² (10 to 55 Hz), 2 h each in X, Y and Z directions	
Protective structure	IP40 (IEC standard)	
Connection type	220 mm connector cable	

*1. Accuracy specifications are for 23±2 °C under the conditions below

Catalog listing	SD	WD	Object position	Averaged trials
K1G-S07	20 mm	10 mm	Center of measurement beam	64
K1G-S15	100 mm	50 mm	1 mm position from center	

*2. Accuracy specifications are for 23±2 °C under the conditions below

Catalog listing	SD	WD	Object position
K1G-S07	20 mm	10 mm	Center of measurement beam
K1G-S15	100 mm	50 mm	1 mm position from center

SD: Sensing distance WD: Object-receiver distance

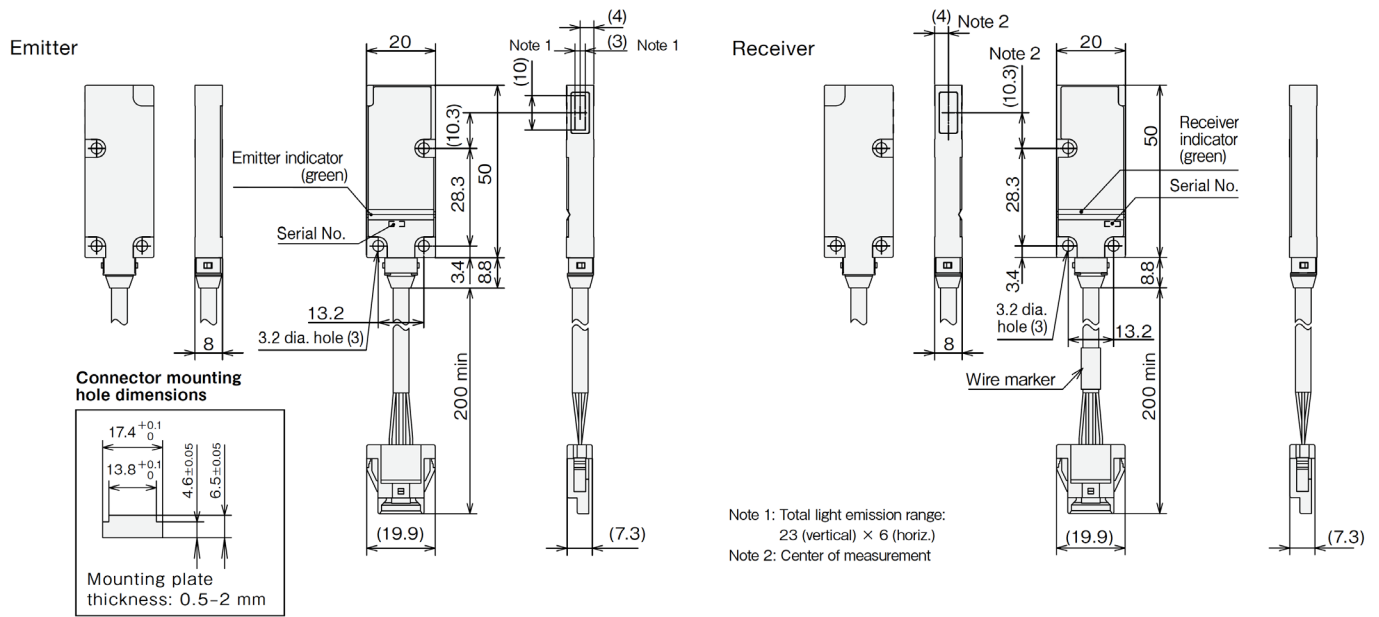
Junction cables

Appearance	Catalog listing (cable length in parentheses)	Type	Description
	K1G-L _ _ *3	Standard cable	Standard junction cables (2)
	K1G-R _ _ *3	Bendtolerant cable	Bend-tolerant junction cable (1)

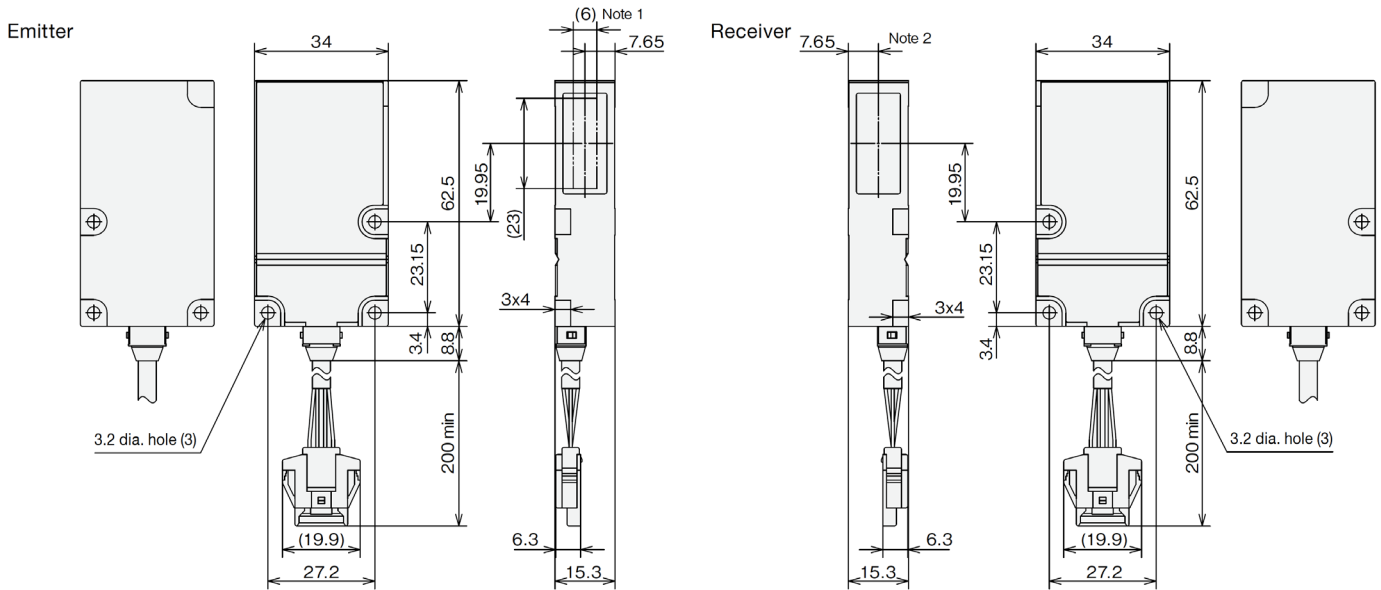
*3: stands for cable length. *4: "S" is appended to shielded cable model numbers. Ex.: K1G-L01S

Sensor head external dimensions (unit: mm)

Model K1G-S07

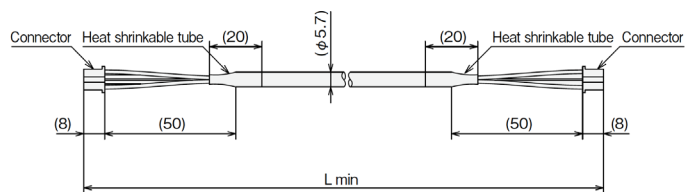


Model K1G-S15

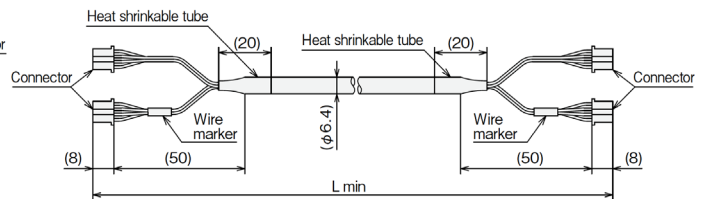


Junction cable external dimensions (unit: mm)

Model K1G-L _ _



Model K1G-R _ _



Controllers

Catalog listing			K1G-C04	K1G-C04M	K1G-C04E K1G-C04E-001	*4	
	CE-marked and KC-marked models		*2	K1G-C04G	K1G-C04MG	K1G-C04EG K1G-C04EG-001	*4
Shape							
Compatible sensor			K1G-S _ _				
Max. number of connected sensors			4				
Reading	Min. display unit		0.1 μm				
	Display range	With K1G-S07	0 to 7 mm or -3.5 to +3.5 mm can be selected				
		With K1G-S15	0 to 15mm or -7.5 to +7.5 mm can be selected				
Measurement cycle (Output update cycle)			250 μ s / 500 μ s / 1 ms (switchover) *1 *2				
Analog output			4 outputs: 4 -20 mA or 1 -5 V (all outputs are switched over at once)	-	-		
Digital output			8 outputs: NPN or PNP transistor (all outputs are switched over at once) *3	-	-		
Digital input			4 inputs: non-voltage contacts and NPN or PNP open collector (all points are switched over at once)	-	-		
Communications			RS -485 (Modbus RTU)	MECHATROLINK-III	EtherCAT		
Supply power			DC12 to 24V ± 10%				
Operating temperature			0 to 50 °C (0 to 35 °C if gang-mounted)				
Storage temperature			-20 to 70 °C (without freezing)				
Operating humidity			30 to 85 % RH (without condensation)				
Vibration resistance			2 m/s2 (10 to 60 Hz), 2 h each in X, Y and Z directions				
Protection circuit			Power reverse connection protection				

*1: The measurement cycles that can be selected vary depending on the cable length. Refer to the table below to select the right cable length for the desired measurement cycle.

Catalog listing	Measurement interval		
	250 µs	500 µs	1 ms
K1G-L _ _	5 m or less	20 m or less	25 m or less
K1G-R _ _	3 m or less	5 m or less	10 m or less

*2: Two ferrite cores (SZ-E02) are included with CE-marked and KC-marked models (Model K1G-C04_G). Be sure to observe the wiring and setup details described in the installation procedure

*3: Output is not open collector.

*4: The communication functions of EtherCAT models differ as follows:

EtherCAT models' communication function comparison

Catalog listing	EtherCAT model name	Process data - Monitor area		Edge position	Parameter data - Setting area - Received light amount area - Adjustment area	
		Read	Write		Read	Write
K1G-C04E(G) *9	Standard model	OK	X *7	X	X	X
K1G-C04E(G)-001 *9	SDO communication model	OK	X *7	OK	OK *8	OK *8

*5: For details on the monitor, setting, amount of light received, and adjustment areas, refer to Chapter 9-6, "Communication parameters" in the relevant model's User's Manual (CP-SP-1385 or CP-SP-1397), and to the User's Manual for EtherCAT Communication (CP-SP-1483) for SDO communication models.

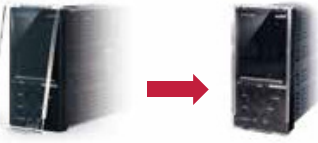
*6: First edge position (Ch 1-4) data, second edge position (Ch 1-4) data.

*7: Only DI (Digital Input) status can be written.

*8: For details on whether specific data can be written or read, refer to the User's Manual for EtherCAT Communication (CP-SP-1483) for SDO communication models.

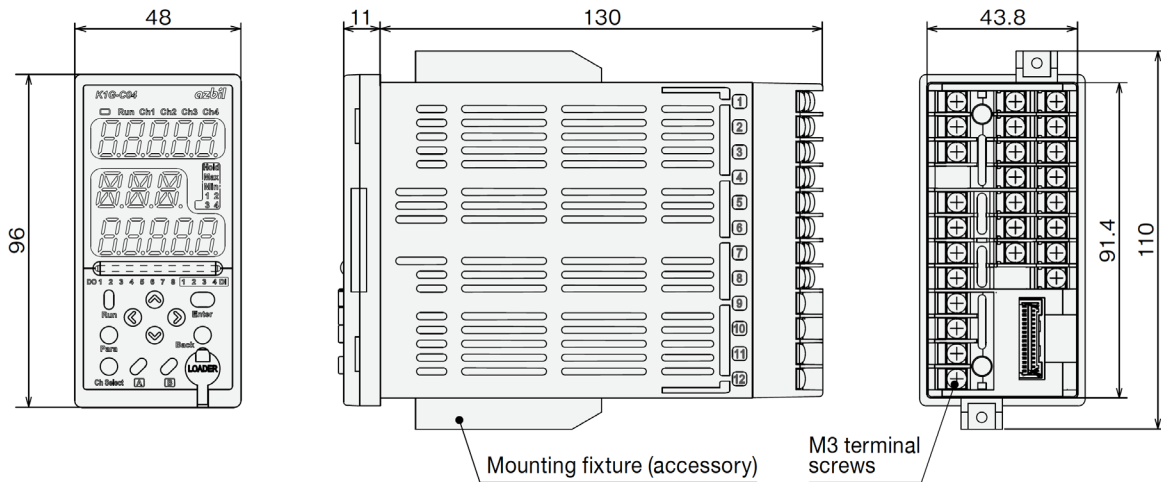
*9: Note that Model K1G-C04E(G) and Model K1G-C04E(G)-001 support different EtherCAT communication ESI files.

Options

Appearance	Catalog listing	Description
	81441421-001	Front protective cover for controllers
	SZ-A03	Sensor head cable (spares can be purchased separately)
	SZ-E01	Ferrite cores for sensor heads (2 cores are included)
	SZ-E02	Ferrite cores controller (1 core is included)

Controller dimensions (unit: mm)

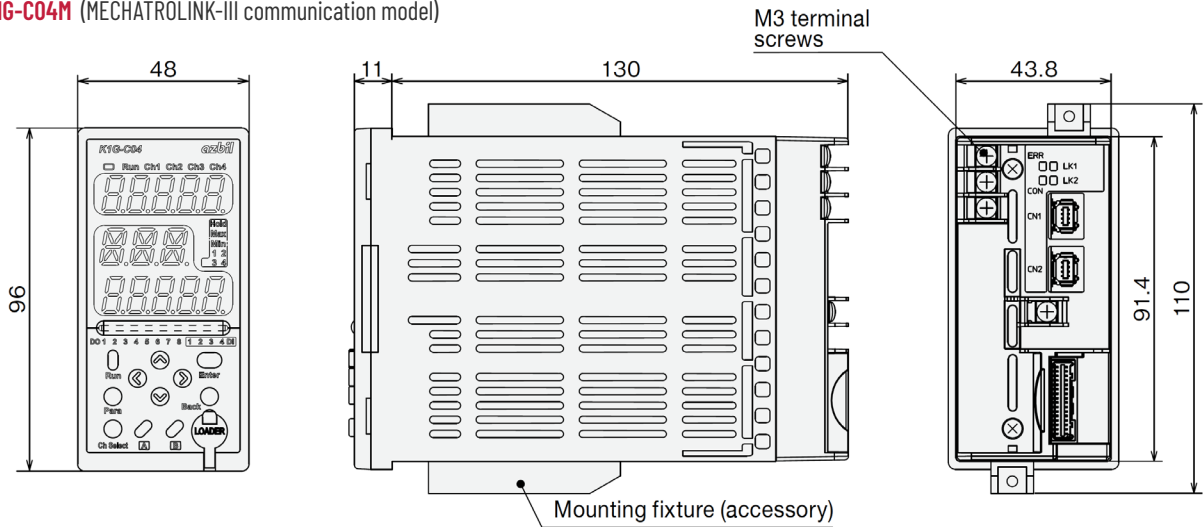
Model K16-C04



Model K16-C04 Terminal arrangement

Terminal No.	A	C	F
1	Power, 24 Vdc	RS-485 DA	A01 +
2	Power, 0V	RS-485 DB	A01 -
3	FG	RS-485 SG	A02 +
4	D01	DI1	A02 -
5	D02	DI2	A03 +
6	D03	DI3	A03 -
7	D04	DI4	A04 +
8	D05	-	A04 -
9	D06	Sensor head connection	
10	D07		
11	D08		
12	-		

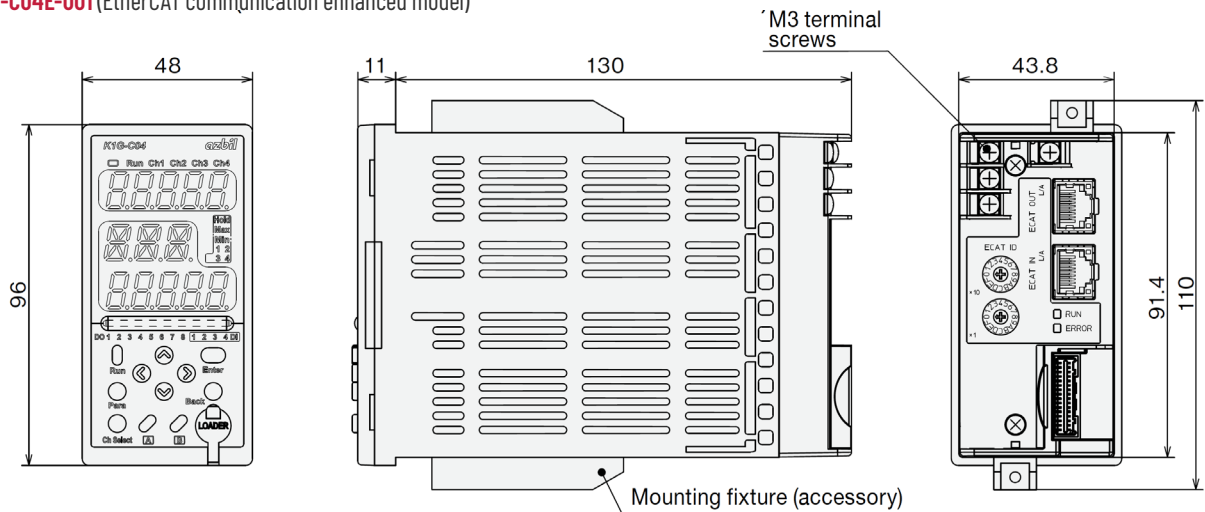
Model K16-C04M (MECHATROLINK-III communication model)



Model K16-C04M Terminal arrangement

Power		MECHATROLIN-III	
A1	Power+	CN1	Connector 1
A2	Power-	CN2	Connector 2
A3	FG	C7	FG

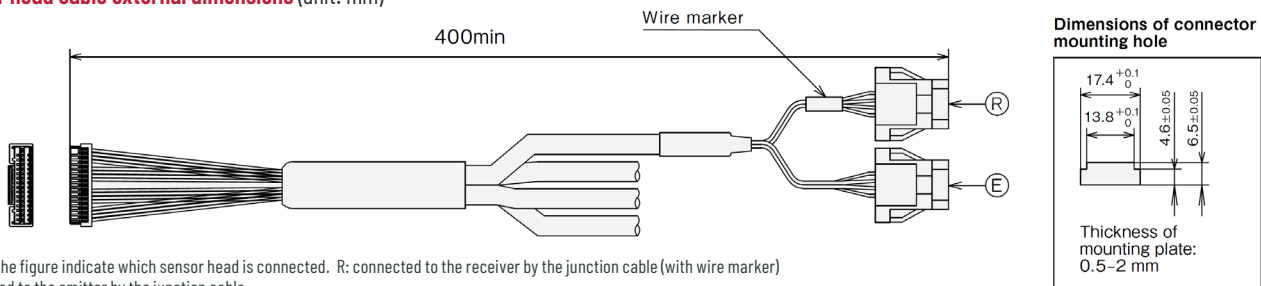
Model K16-C04E (EtherCAT communication standard model)
Model K16-C04E-001 (EtherCAT communication enhanced model)



Model K16-C04E(-001) Terminal arrangement

Power		EtherCAT	
A1	Power+	C1	EtherCAT FG
A2	Power-		
A3	FG		

Sensor head cable external dimensions (unit: mm)



R and E in the figure indicate which sensor head is connected. R: connected to the receiver by the junction cable (with wire marker)
 E: connected to the emitter by the junction cable

Wiring/connecting a CE- or KC-marked product (Model K1G-C04_G)

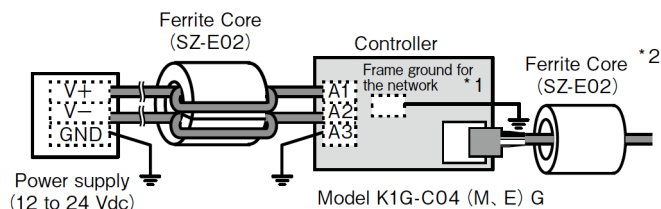
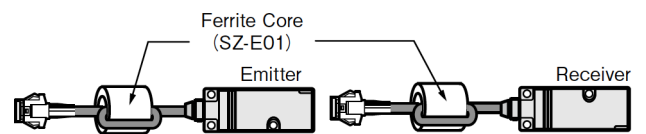
Attaching ferrite cores

For Model K1G-C04G and Model K1G-C04MG

- Attach the SZ-E02 ferrite core to the power wires (not included with the product) to the controller making 2 turns (1 loop). In this case, the both power wires (V+ and V-) must be looped.

For Model K1G-C04EG

- Attach the SZ-E02 ferrite core to the power wires (not included with the product) to the controller making 3 turns (2 loop). In this case, the both power wires (V+ and V-) must be looped.
- Attach the SZ-E02 ferrite core to the sensor head cable, making 1 pass through the core.



*1 Model K1G-C04MG: terminal C7. Model K1G-C04EG: terminal C1

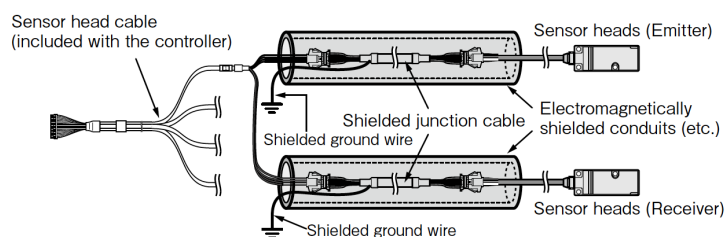
*2 Model K1G-C04EG only

For all models

- Attach the SZ-E01 ferrite cores to the cables of the sensor heads (emitter and receiver), making 2 turns (2 passes through the core).

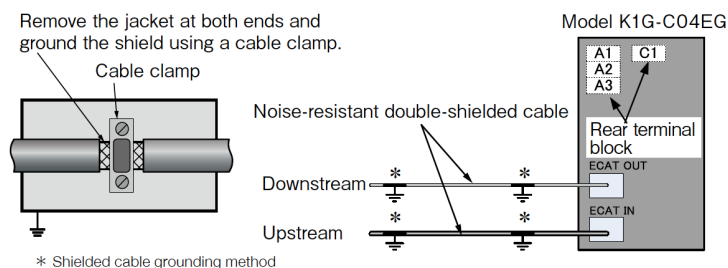
Connecting shielded junction cables

- Connect the junction cable to the connectors at the controller end and the sensor head end, and cover the cable including both connectors with an electromagnetically shielded conduit or the like.
- Ground the junction cable shield wire.



Connecting EtherCAT communication cables (for Model K1G-C04EG / Model K1G-C04EG-001 only)

- Use a noise-resistant double-shielded cable (not included with the product) for communication.
- Remove the jacket at both ends and ground the shield using a cable clamp (not included).



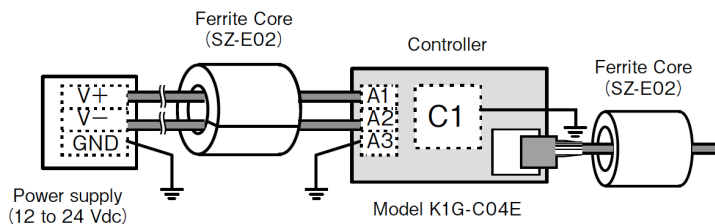
* Shielded cable grounding method

Please refer to instruction manual CP-UM-5810JE, Attachment Instructions for Ferrite Core and Shielded Junction Cables for K1G Series High-Accuracy Position Sensors, for more details.

Wiring and connecting Model K1G-C04E / Model K1G-C04EG-001 (EtherCAT)

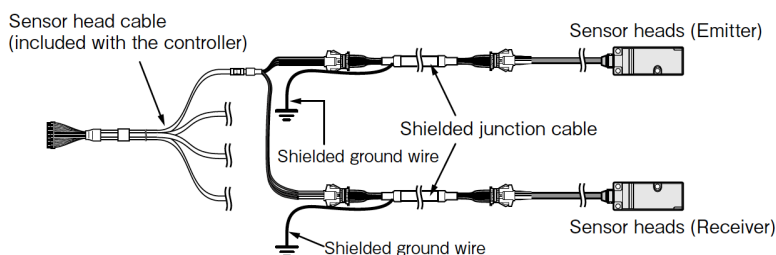
Attaching ferrite cores

- Attach the ferrite cores (included) to the power wires of the controller (not included).
- Attach the ferrite cores to the sensor head cables



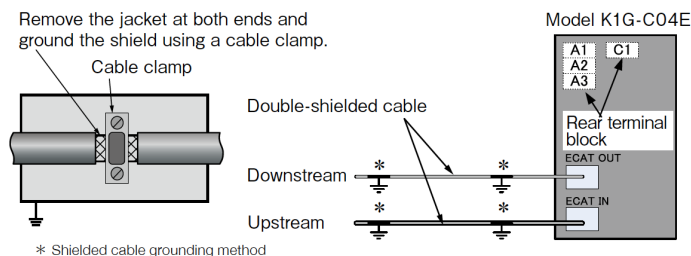
Connecting shielded junction cables

- Use a shielded junction cable (Model K1G-L_ _S or Model K1G-R_ _S)
- Ground the shielded wire of the junction cable



Connecting EtherCAT communication cables

- Use a double-shielded cable (not included) for communication.
- Remove the jacket at both ends and ground the shield using a cable clamp (not included).



Please refer to K1G Series Controller Model K1G-C04E Precautions for Use (CP-UM-5916JE) for details.

Appendix

Mounting the sensor head

This section provides information on various parts that may be necessary for installation and maintenance.

Please select and use the parts that are appropriate for your purposes

and usage environment.

Consider using a simple adjustable unit for positioning in order to easily fine-tune sensor attachment locations or modify the setup.

Hardware combination example

