

azbil

High-Accuracy Position Sensors

K1G Series



New High-Performance Laser Sensors.

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.

K1G series

See what you previously couldn't. >> 03

Minute variations not visible with conventional sensors can now be reliably detected.



| K1G-S07 |
Measurement Width 7 mm

| K1G-S15 |
Measurement Width 15 mm

| K1G-C04 |
4-channel controller

Easily mounts anywhere.

>> 05

Compact dimensions are achieved by slim sensor head design.

Less wasted time.

>> 07

Comes with a full range of functions to help cut job time for design, installation, and maintenance.

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 K1G series.

Resolution:
0.1 μm

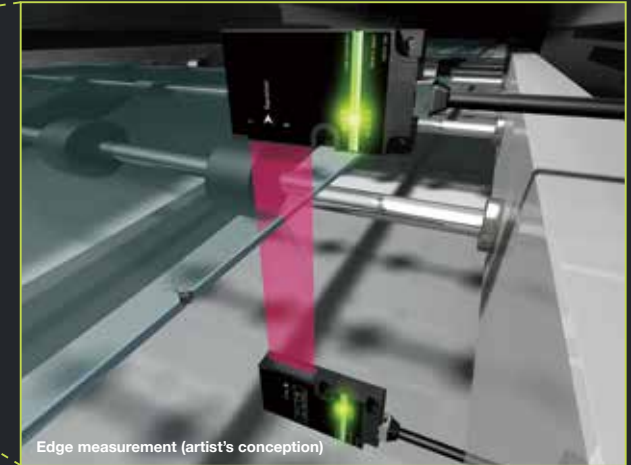
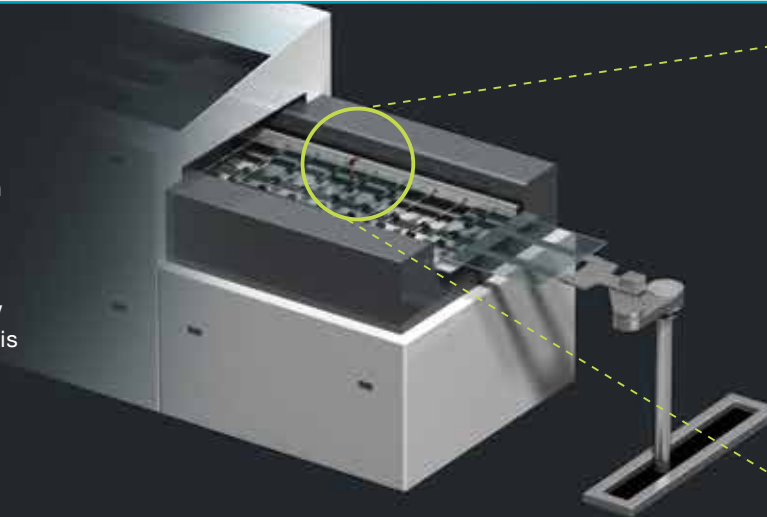
Measurement
period: 250 μs





In-line inspection of glass edges

Up until now glass edges and surfaces were checked offline by operators for defects such as chips. The K1G series, 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.

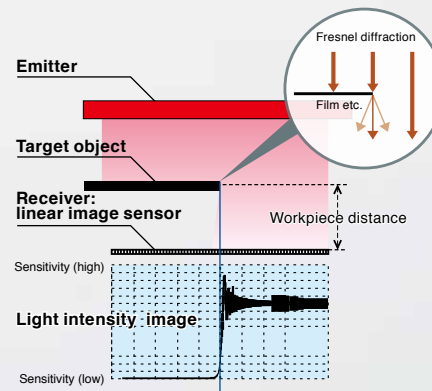


Edge measurement (artist's conception)

0.1 μm resolution —the highest level in its class!

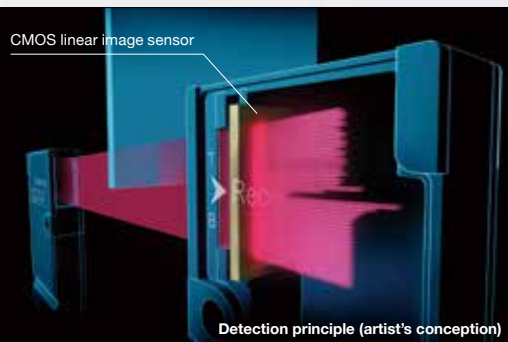
Azbil's unique FDN algorithm, which utilizes Fresnel diffraction phenomena and sophisticated high resolution technologies, has achieved detection accuracy down to 0.1 μm with repeatability accuracy to 1 μm .

- 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.



250 μs measurement period, the fastest in its class.

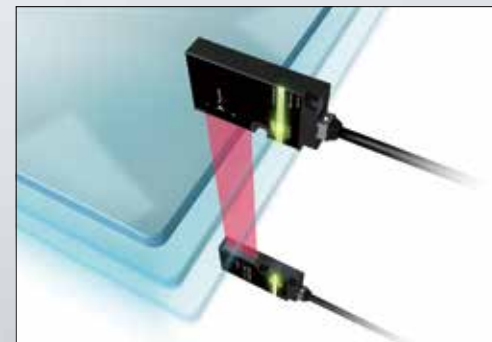
Dual-engine architecture allows the integrated FDN algorithm to process huge amounts of data at high speed. By means of multitasking, processing speed is accelerated to approximately four times that of conventional models.



Detection principle (artist's conception)

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.



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.

8 mm thin!

K1G-S07

Have you encountered “doesn’t fit” or
“can’t measure” problems due to sensor size?
K1G series designers made ultra-slimness
a high priority.

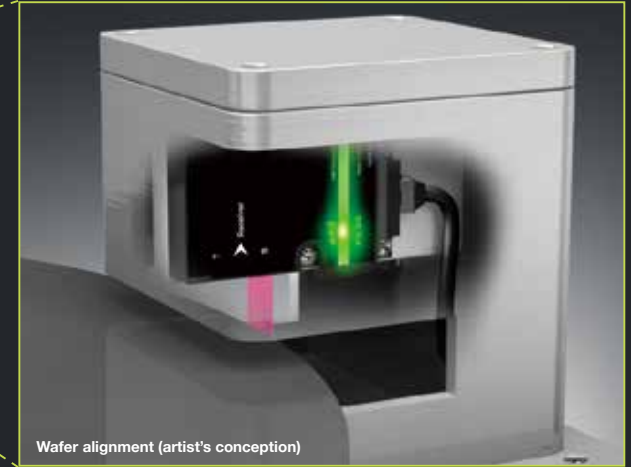
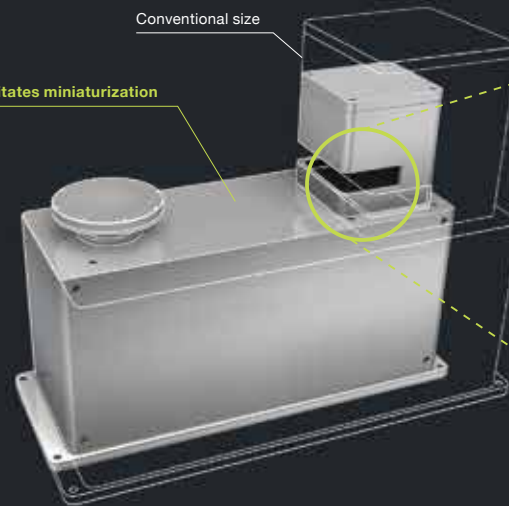




Wafer alignment in IC manufacturing

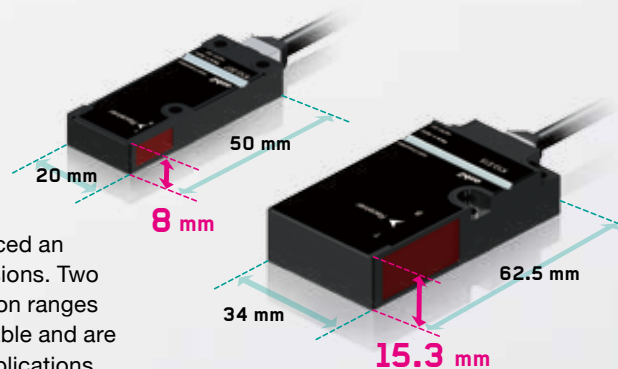
A small sensor head allows a small alignment unit, helping to reduce the overall equipment footprint.

Facilitates miniaturization



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.



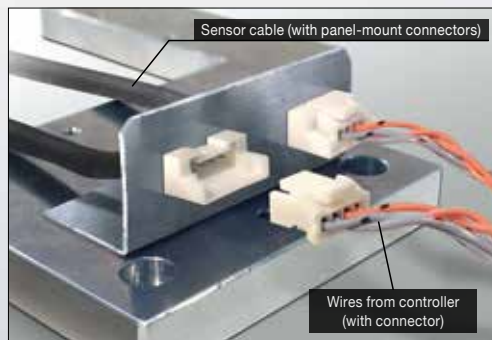
Panel-mount multi-channel controller

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



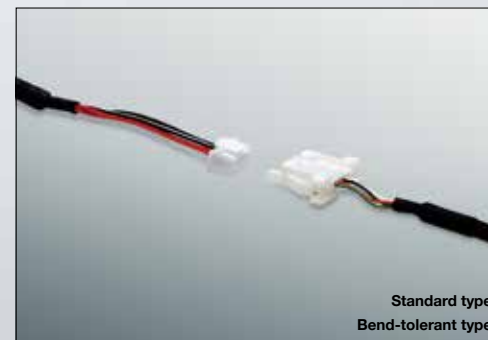
Up to 25 meter cable extension

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.



Sensor cable relay connectors

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

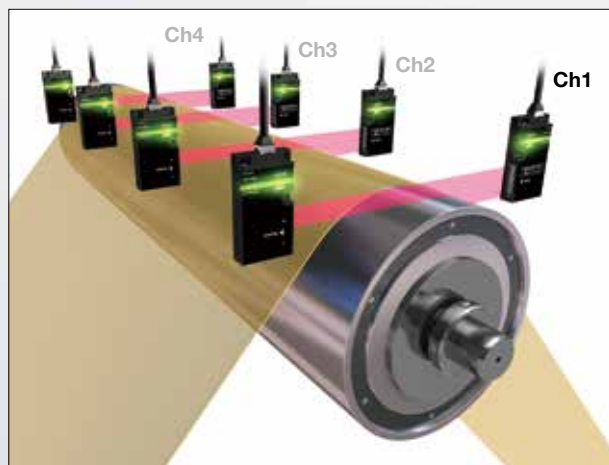


Less wasted time.

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

Built-in test mode

K1G series controllers include a "test mode" to allow you to freely switch between analog and digital output, so that connections can be checked before the start of equipment operation.



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

AO1: Ch2 - Ch1, AO2: Ch3 - Ch1, AO3: Ch4 - Ch1

$$AO4: \frac{(Ch2 + Ch3 + Ch4)}{3} - Ch1$$

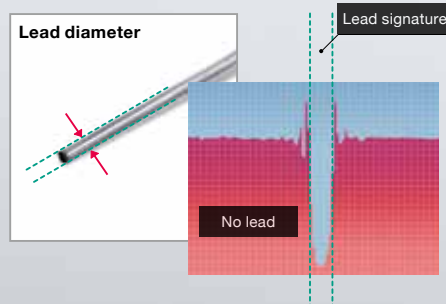


Sensor selection and equipment design

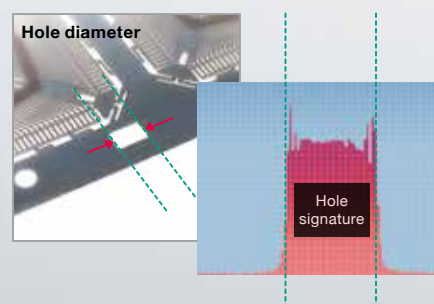
Various built-in measurement modes

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.

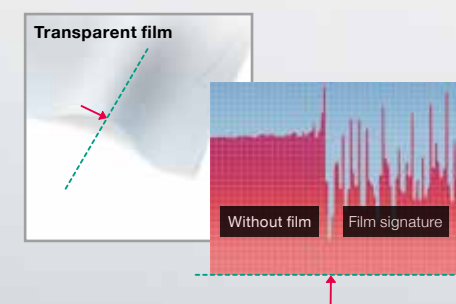
Blocked light width measurement



Entering light width measurement



Edge position measurement





Enhanced light-axis adjustment function

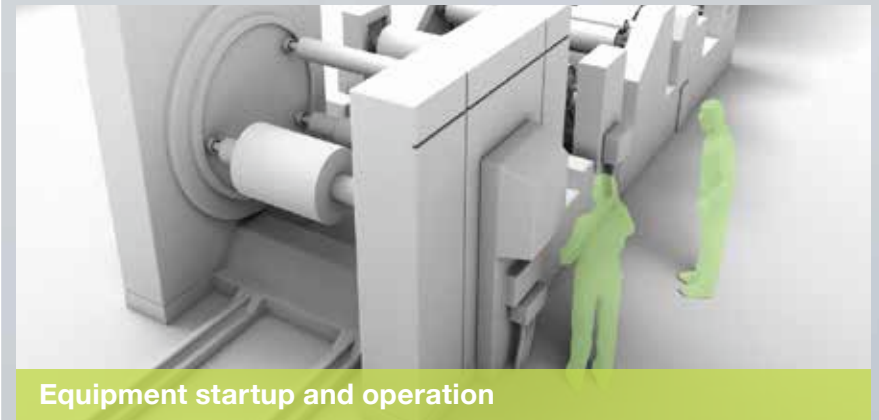
The light-axis alignment function is an advance over that of conventional models. A light reception indicator mounted on the sensor head significantly cuts the time needed for alignment.

Dust detection function

If dust on the receiver or ambient light interference is detected, output notifies the user before the problem affects measurement, allowing timely preventive maintenance. The function also helps to cut time spent on unneeded maintenance.



Sensor installation



Equipment startup and operation



Special setup tool collects measured data

Measurement data can be acquired every 250 μ s, and measurement status can be checked without connecting to a host device, allowing smooth equipment startup.



Incoming light distribution when event occurred



Before event occurrence

After event occurrence

Measurement data before and after event occurrence

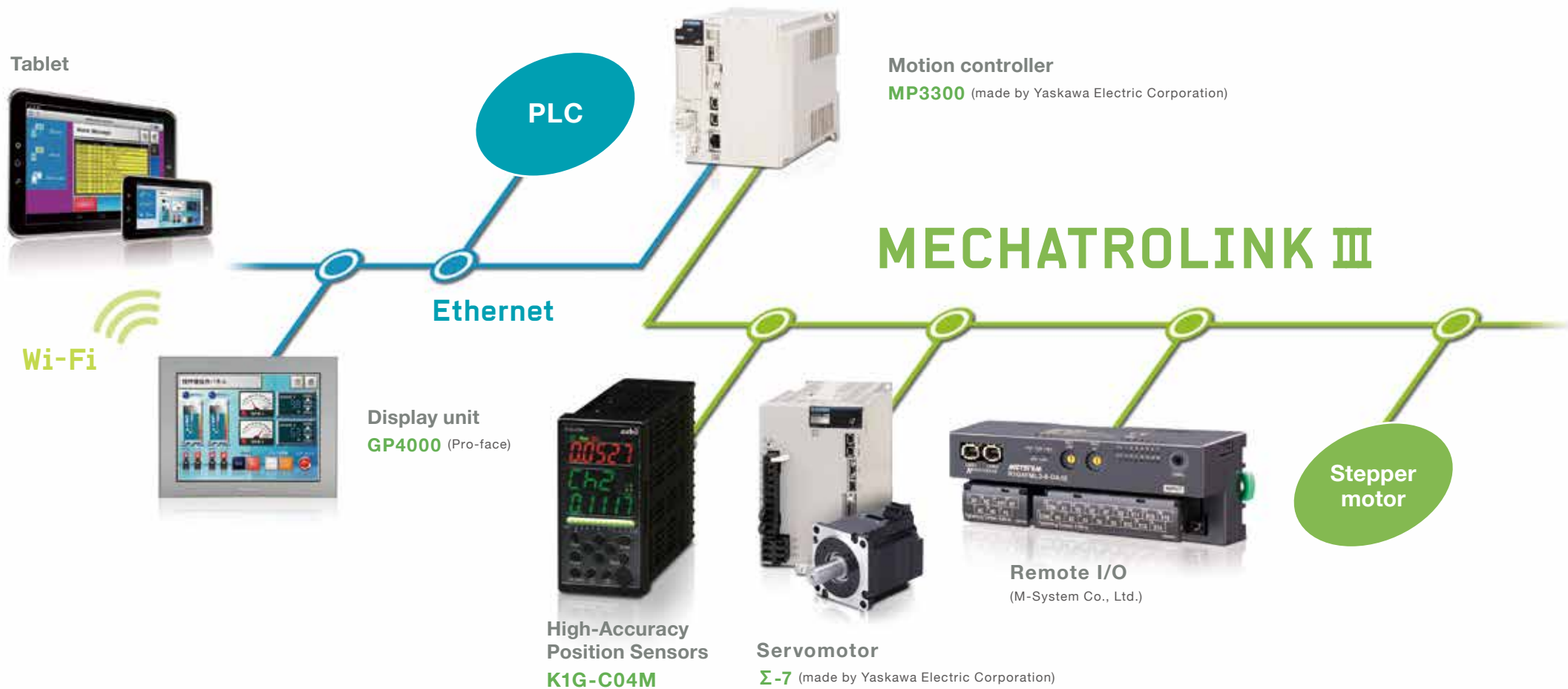
Abnormal state when event occurred

| Time | Value | Time | Value |
|---------|-------|---------|-------|
| 0:00:00 | 0.000 | 0:00:00 | 0.000 |
| 0:00:01 | 0.000 | 0:00:01 | 0.000 |
| 0:00:02 | 0.000 | 0:00:02 | 0.000 |
| 0:00:03 | 0.000 | 0:00:03 | 0.000 |
| 0:00:04 | 0.000 | 0:00:04 | 0.000 |
| 0:00:05 | 0.000 | 0:00:05 | 0.000 |
| 0:00:06 | 0.000 | 0:00:06 | 0.000 |
| 0:00:07 | 0.000 | 0:00:07 | 0.000 |
| 0:00:08 | 0.000 | 0:00:08 | 0.000 |
| 0:00:09 | 0.000 | 0:00:09 | 0.000 |
| 0:00:10 | 0.000 | 0:00:10 | 0.000 |
| 0:00:11 | 0.000 | 0:00:11 | 0.000 |
| 0:00:12 | 0.000 | 0:00:12 | 0.000 |
| 0:00:13 | 0.000 | 0:00:13 | 0.000 |
| 0:00:14 | 0.000 | 0:00:14 | 0.000 |
| 0:00:15 | 0.000 | 0:00:15 | 0.000 |
| 0:00:16 | 0.000 | 0:00:16 | 0.000 |
| 0:00:17 | 0.000 | 0:00:17 | 0.000 |
| 0:00:18 | 0.000 | 0:00:18 | 0.000 |
| 0:00:19 | 0.000 | 0:00:19 | 0.000 |
| 0:00:20 | 0.000 | 0:00:20 | 0.000 |
| 0:00:21 | 0.000 | 0:00:21 | 0.000 |
| 0:00:22 | 0.000 | 0:00:22 | 0.000 |
| 0:00:23 | 0.000 | 0:00:23 | 0.000 |
| 0:00:24 | 0.000 | 0:00:24 | 0.000 |
| 0:00:25 | 0.000 | 0:00:25 | 0.000 |

Sophisticated built-in event log function

The controller can save measurement data from 32 points before and after the occurrence of an event, as well as the incoming light distribution when the event occurred. This allows investigation of the cause of an event while still in the field and also reduces troubleshooting time.

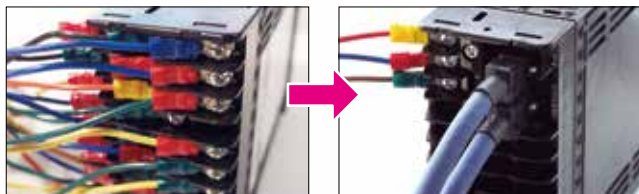
Stepping up to a new level of measurement.



Multi-channel controller supports the Mechatrolink-III open field network.
This allows the transfer of measurement data over communication networks
and will open up a host of new applications and advantages.

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.



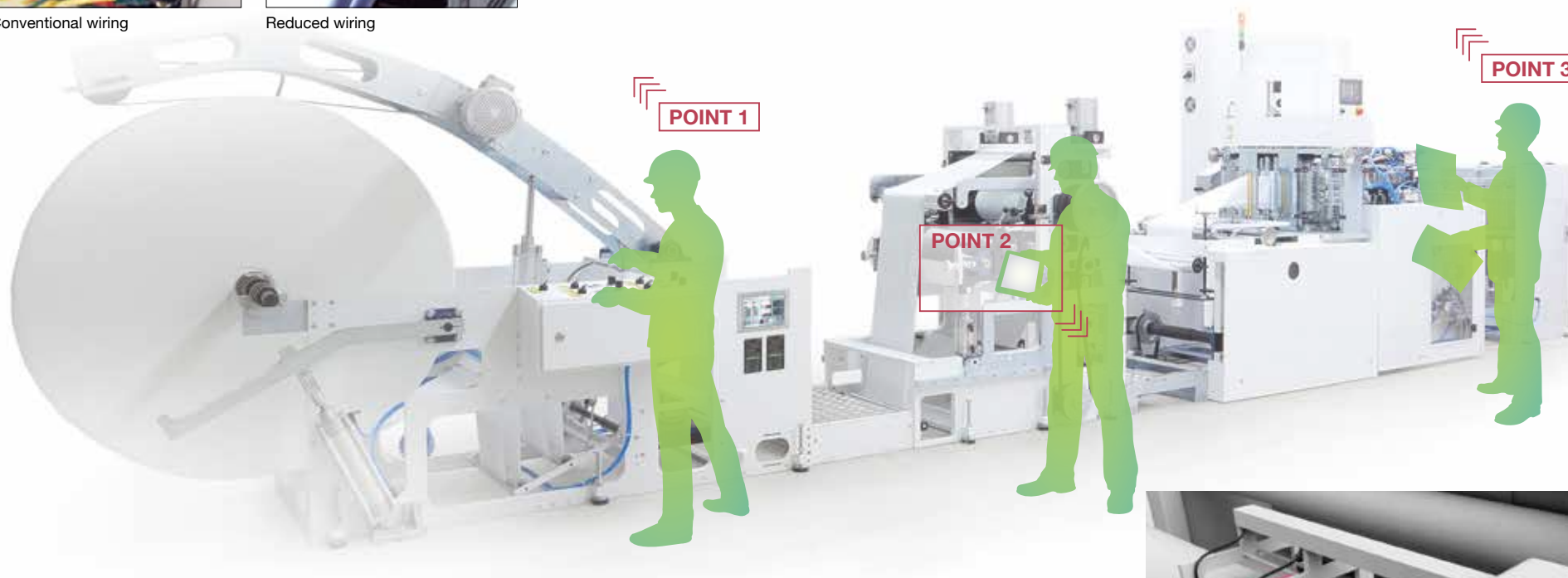
Conventional wiring

Reduced wiring



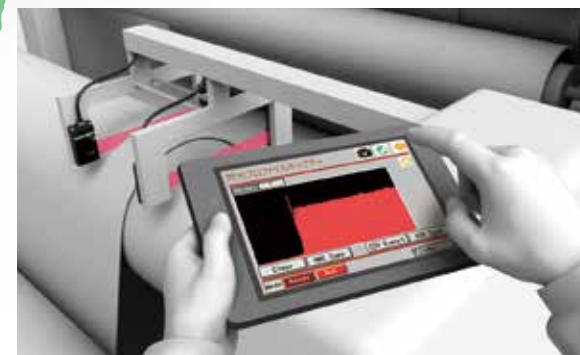
POINT 3 Synchronization between channels

To guarantee data synchronization, Mechatrolink-III 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.



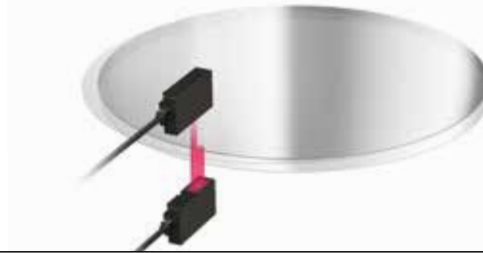
POINT 2 User-friendly setup and adjustment with HMI

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.



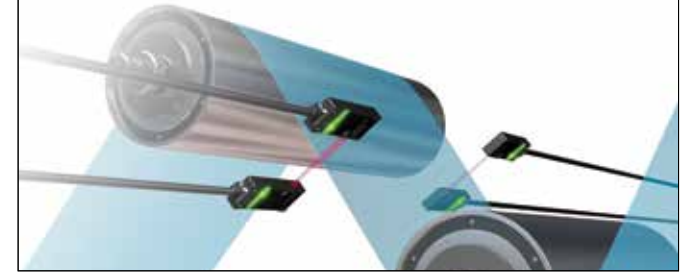
■ Wafer alignment

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 μ s.

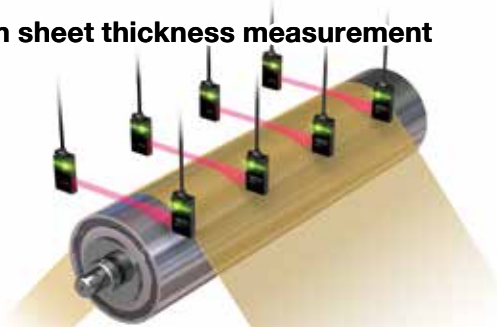


■ Film meander measurement

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

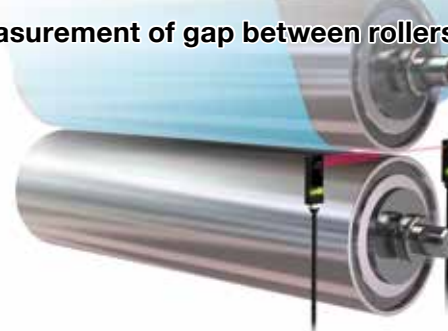


■ Film sheet thickness measurement



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

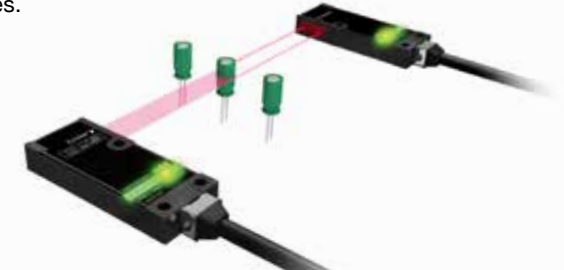
■ Measurement of gap between rollers



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 μ m, 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.

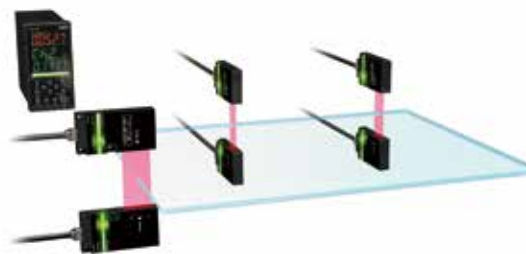


■ Measuring the inner diameter of pressed material

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



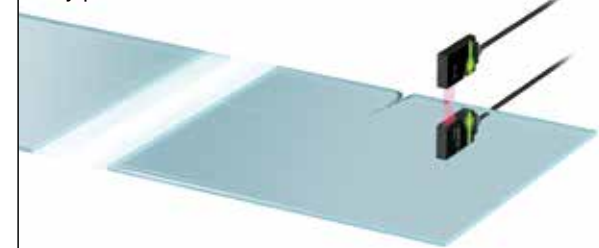
■ XY θ measurement of glass substrates



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

■ Detection of glass substrate irregularities

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



Specifications

Sensor heads

| Catalog listing | K1G-S07 | K1G-S15 |
|---------------------------------------|---|---|
| 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 of measurement beam | |

*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 of measurement beam |

SD: Emitter-receiver distance **WD:** Object-receiver distance

Junction cables

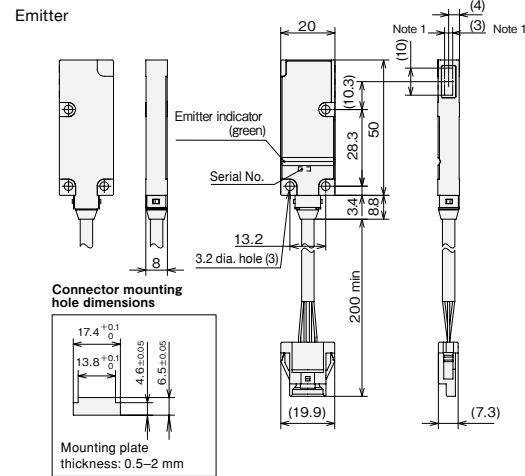
| Appearance | Catalog listing (cable length in parentheses) | Type | Description |
|---|--|---------------------|-----------------------|
|  | K1G-L □ □ *3 | Standard cable | K1G-L01 (1 m) |
| | | | K1G-L03 (3 m) |
| | | | K1G-L05 (5 m) |
| | | | K1G-L10 (10 m) |
| | | | K1G-L25 (25 m) |
|  | K1G-R □ □ *3 | Bend-tolerant cable | K1G-R01 (1 m) |
| | | | K1G-R03 (3 m) |

*3: □ □ stands for cable length.

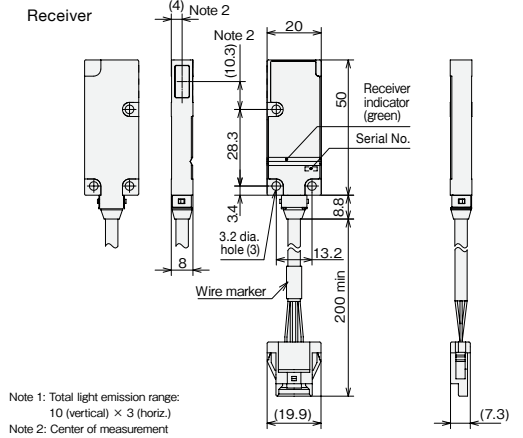
*4: "S" is appended to shielded cable model numbers. Ex.: **K1G-L01S**

Sensor head external dimensions (unit: mm)

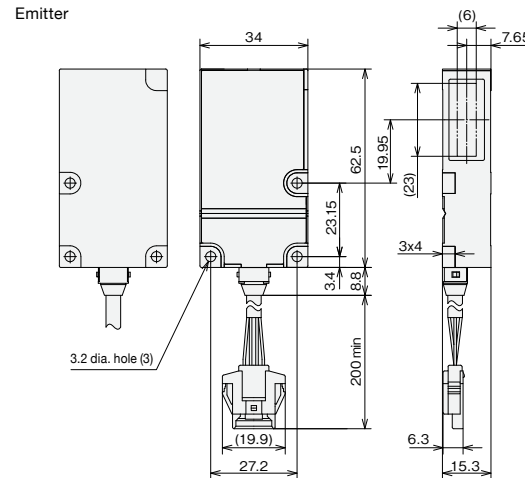
K1G-S07 Emitter



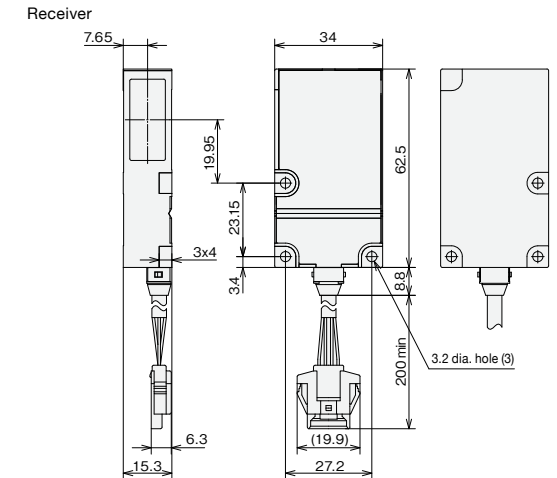
Receiver



K1G-S15 Emitter

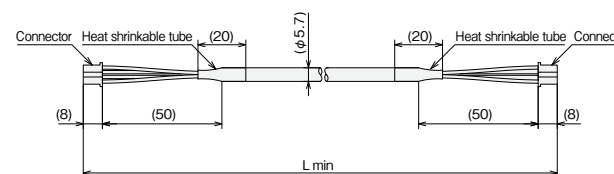


Receiver

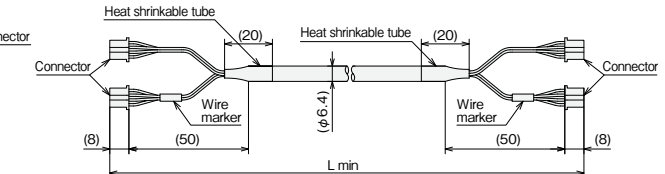


Junction cable external dimensions (unit: mm)

K1G-L □ □




K1G-R □ □



Specifications

Controllers

| Catalog listing | | | K1G-C04 / K1G-C04G | K1G-C04M / K1G-C04MG |
|---|-------------------|--------------|---|----------------------|
| 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 μs / 500 μs / 1 ms (switchover) *1 *3 | |
| 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) *2 | — |
| 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 |
| 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/s ² (10 to 60 Hz), 2 h each in X, Y and Z directions | |
| Protection circuit | | | Power reverse connection protection | |

Controller options

| Appearance | Catalog listing | Description |
|---|-----------------|--|
|  | 81441421-001 | Front protective cover for controllers |

* 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: Output is not open collector.

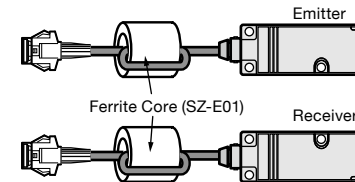
Note: For products with CE or KC marking, contact the closest Azbil branch or sales office.

* 3: For CE-marked and KC-marked models (K1G-C04_G), a measurement cycle of 250 μs cannot be selected.

Be sure to observe the wiring and setup details described in the installation procedure below. (Otherwise, the device will not satisfy the required level of compliance with the EMC Directive.)

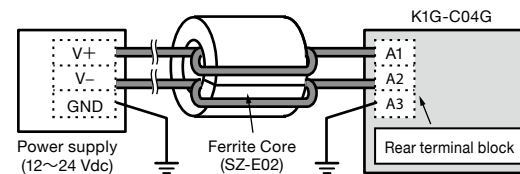
Sensor heads:

- Attach the SZ-E01 ferrite core to the sensor head (receiver) cable making 2 turns (1 loop).
- Attach the SZ-E01 ferrite core to the sensor head (emitter) cable making 2 turns (1 loop).



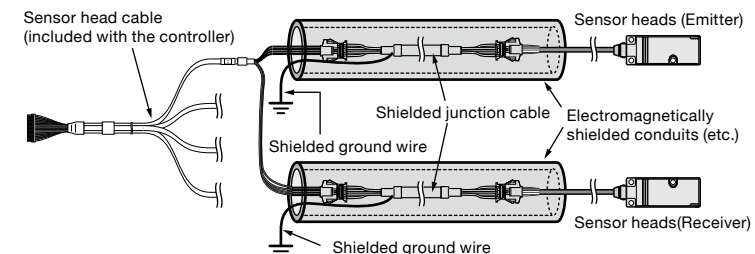
Controller:

- Attach the SZ-E02 ferrite core to the power wires (provided by the customer) to the controller making 2 turns (1 loop).



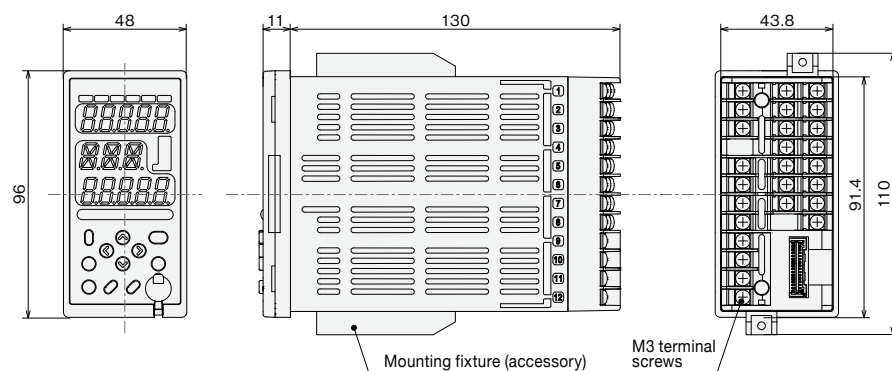
Shielded junction cables:

- 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 shielded ground wire of the junction cable.

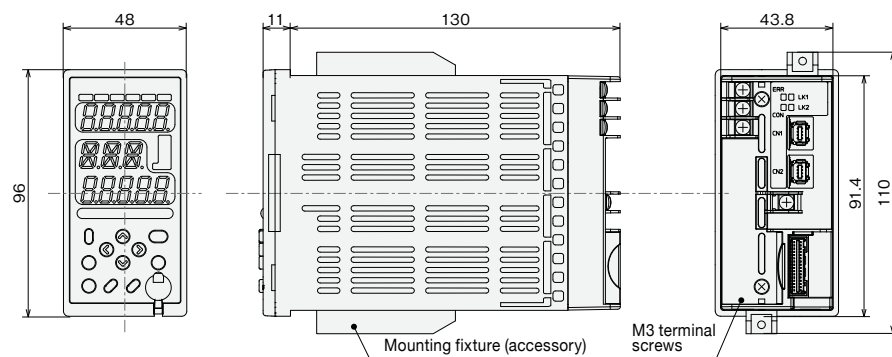


Controller dimensions (unit: mm)

K1G-C04



K1G-C04M



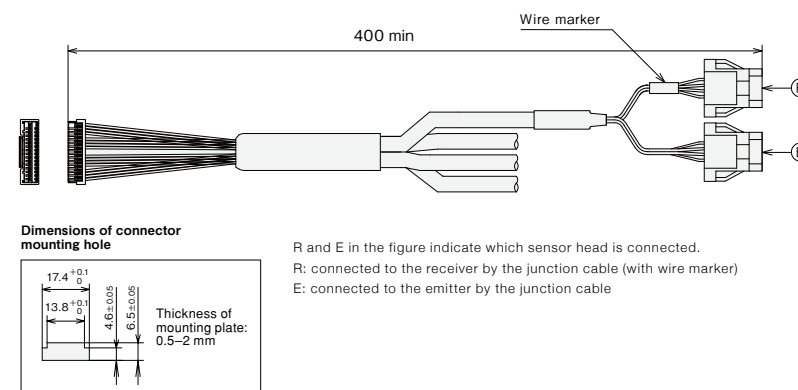
K1G-C04 Terminal arrangement

| Terminal No. | A | C | F |
|--------------|---------------|------------------------|-------|
| 1 | Power, 24 Vdc | RS-485 DA | AO1 + |
| 2 | Power, 0V | RS-485 DB | AO1 - |
| 3 | FG | RS-485 SG | AO2 + |
| 4 | DO1 | DI1 | AO2 - |
| 5 | DO2 | DI2 | AO3 + |
| 6 | DO3 | DI3 | AO3 - |
| 7 | DO4 | DI4 | AO4 + |
| 8 | DO5 | — | AO4 - |
| 9 | DO6 | Sensor head connection | |
| 10 | DO7 | | |
| 11 | DO8 | | |
| 12 | — | | |

K1G-C04M Terminal arrangement

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

Sensor head cable external dimensions (unit: mm)



Special accessories for K1G

| Appearance | Catalog listing | Description |
|------------|---------------------|---|
| | SZ-D01 | Settings display unit (5.7 inch) |
| | | Special stand |
| | | Loader cable This cable is necessary for connecting the K1G to the settings display unit. |
| | 81442773-001 | DC jack cable The cable is necessary for connecting the AC adapter with the setting display. |
| | 81446957-001 | AC adapter (AC 100 -240 V / DC 24 V) |

K1G series

Sensors

K1G-S07 | Measurement Width 7 mm **K1G-S15** | Measurement Width 15 mm

Controllers

K1G-C04 | 4-channel controller

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<http://www.azbil.com/products/bi/order.html>

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Azbil Corporation

Advanced Automation Company

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