No. CP-SP-1397E

K1G Series High-Accuracy Position Sensor Global Model

User's Manual

There are eight different manuals related to the K1G series. Read them as necessary for your specific requirements. (☞ P. iii)

Photo of K1G-S07

Photo of K1G-C04

This user's manual describes instrumentation that uses the K1G-C04G, K1G-C04MG and K1G-C04EG, which are CE- and KC-marked controllers. Please make sure to follow the instructions for instrumentation given in chapter 2, INSTALLATION AND WIRING. The measurement cycle of 250 μs cannot be selected for these controllers.

Azbil Corporation

Please read “Terms and Conditions” from the following URL before ordering and use.

http://www.azbil.com/products/factory/order.html

NOTICE

Be sure that the user receives this manual before the product is used.

Copying or duplicating this user’s manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

In no event is Azbil Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

The safety precautions explained in the following section aim to prevent injury to the operator and others, and to prevent property damage.

⚠WARNING	Warnings are indicated when mishandling this product might result in death or serious injury.
⚠CAUTION	Cautions are indicated when mishandling this product might result in minor injury to the user, or physical damage to the product.

⚠ ⚠ ⚠ : Use caution when handling the product.

🛇 🛇 🛇 : The indicated action is prohibited.

❗ : Always follow the indicated instructions.

	⚠WARNING
⚠	This device is a JIS class 1 laser product. As this device's emitter uses a semiconductor laser, observe the following cautions. • Do not disassemble or modify sensor heads. • Do not look into the laser beam directly. • Do not look into the laser beam through a lens or other optical device.
❗	Take sufficient safety measures to prevent damage or loss in the unlikely event that this device malfunctions.
🛇	Do not use this device for safety circuits designed for protection of the human body.
🛇	Do not disassemble. Disassembly may cause electric shock or device failure.
🛇	Do not use this device in atmospheres containing corrosive or flammable gas, liquids, or powder.
⚠	Before removing, mounting, or wiring this device, be sure to turn off the power to the device and all connected devices. Failure to do so may cause electric shock.
❗	Be sure to check that the device has been correctly wired before turning on the power. Incorrect wiring of the module can damage it or lead to hazardous conditions.
🛇	Do not touch electrically charged parts such as the power terminals. There is a risk of electric shock.
❗	Firmly tighten the terminal screws to a torque of 0.4–0.6 N·m. If tightening is insufficient there is a risk of electric shock or fire.

⚠WARNING

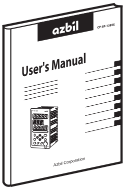
⊘	Do not use unused terminals on the device as relay terminals. Doing so may result in electric shock, fire or device failure.
❗	In the following cases, turn off the power immediately and stop using the device. • If the device gets wet (with water or another liquid). • If the device is damaged. • If the device produces an unusual smell or smoke.

⚠CAUTION

⊘	The power supply rating for this device is 12–24 V DC. Do not apply 100–240 V AC. Doing so may cause device failure or fire.
❗	Use this device within the operating ranges given in the specifications for temperature, humidity, voltage, vibration, shock, mounting orientation, atmosphere, etc. Otherwise, fire or device failure could result.
⊘	Do not block ventilation holes. Doing so may cause fire or device failure.
❗	Wire this device properly, according to the directions, using the specified power source and wiring methods. Failure to do so may cause fire or device failure.
⊘	Do not allow wire clippings, metal shavings, water, etc., to enter the device's case. They may cause fire or device failure.
❗	If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Failure to do so may cause fire or device failure.
❗	When discarding this device, dispose of it as industrial waste, following local regulations.
❗	At the time of disposal, do not allow the optical surfaces to be exposed to direct sunlight in order to prevent concentration of the sunlight, which could cause a fire.
⊘	Do not try to modify or fabricate the connectors and junction cable. Doing so may cause device failure, abnormal laser beam emission, or fire.
⊘	Take care that cables are not pinched or caught on something. There is a danger of disconnection.
❗	Connect the controller’s frame ground terminals to the ground (for K1G-C04MG, that includes the frame ground for MECHATROLINK-III, and for K1G-C04EG it includes the frame ground for EtherCAT). If the terminals are not grounded, electromagnetic interference may result.

THE ROLE OF THIS MANUAL

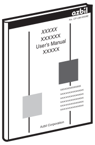
A total of 8 different manuals are available for the K1G series. Read them as necessary for your specific requirements.
If a manual you require is not available, contact the Azbil Group or its dealer.



K1G Series High-Accuracy Position Sensor Global Model User's Manual

Manual No. CP-SP-1397E

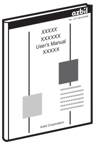
This manual describes the hardware and all functions of the K1G.
Personnel in charge of the design, manufacture, operation, or maintenance of equipment that incorporates this device, or the design of communication software for equipment that uses this device's serial communication function, should read this manual thoroughly.



K1G High-Accuracy Position Measurement Sensor MECHATROLINK-Ⅲ Communication Manual

Manual No. CP-SP-1386E

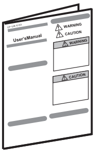
This manual describes the MECHATROLINK-III communication specifications.



K1G Series High-Accuracy Position Sensor User's Manual for EtherCAT Communication

Manual No. CP-SP-1419E

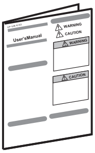
This manual describes EtherCAT communications specifications.



K1G Series High-Accuracy Position Sensor Controller User's Manual

Manual No. CP-UM-5783JE

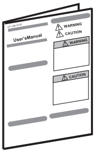
Personnel in charge of the design or configuration of equipment that incorporates this device should read this manual thoroughly. The manual covers safety precautions, installation, wiring, and primary specifications.



K1G Series High-Accuracy Position Sensor Head User's Manual

Manual No. UM-5784JE

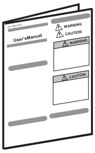
Personnel in charge of the design or manufacture of equipment that incorporates the sensor heads should read this manual thoroughly. It covers safety precautions, installation, wiring, and primary specifications.



Handling Precautions for the SZ-D01 Configuration Tool for K1G Series High-Accuracy Position Sensors

Manual No. UM-5785JE

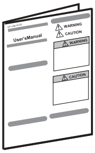
Personnel who use the configuration tool for K1G sensors should read this manual. The manual covers safety precautions, installation, and wiring.



Handling Precautions for K1G Series High-Accuracy Position Sensor Junction Cables

Manual No. UM-5787JE

Personnel in charge of the design or manufacture of equipment that incorporates these cables should read this document thoroughly. It contains safety precautions.



Attachment Instructions for Ferrite Core and Shielded Junction Cables for K1G Series High-Accuracy Position Sensors

Manual No. CP-UM-5810JE

Please read this manual if you use a CE- or KC-marked global model of the K1G series. This manual covers safety precautions, installation, and wiring.

Introduction

Thank you for purchasing this Azbil Corporation product. This manual contains information for ensuring the safe and correct use of the product.
It should be read by those who design or maintain a control panel or other equipment that uses this product.
Also, the manual provides necessary information for installation, maintenance, and troubleshooting. Be sure to keep the manual nearby for handy reference.

CONVENTIONS USED IN THIS MANUAL

	: Indicates a tip for configuration or operation.
! Handling Precautions	: Pay attention to the indicated points when handling the product.
☞	: Refer to the indicated item or page.
1 2 3	: Numbers indicate steps in a procedure.
8888	: This font indicates what is shown on the 7-segment display.
○ Para ⌃/⌄	: Keys on the operating panel

NOTES ON LASERS

⚠ WARNING

This set of sensor heads is a class 1 laser product using a semiconductor laser as the light source.
For this reason, note the following.
- Do not disassemble or modify sensor heads.
- Do not look into the laser beam directly.
- Do not look into the laser beam through a lens or other optical device.

Sensor head model No.		**K1G-S07**	**K1G-S15**
Emission wavelength		650 nm	
Output		Less than 0.39 mW	
Pulse width		25 µs	100 µs
Laser class	JIS standards	Class 1 laser product (JIS C)	
	IEC 60825-1	Class 1 Laser Product	
	FDA (CDRH) Part 1040.10	Class 1 Laser Product *	

* The class is based on the IEC 60825-1 standard, following Laser Notice No. 50 of the Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA).

HANDLING PRECAUTIONS

- As part of setup work or operation, check that this device is operating properly.
- If this device is used in combination with other devices, its functions and performance may not meet specifications, depending on the operating conditions and environment. Consider the combination carefully before use.

INSTALLATION ENVIRONMENT

To ensure the safe and correct use of the product, do not install it where it will be exposed to any of the following:

- Outdoor weather
- Direct vibration or shock
- Corrosive or combustible gas
- Steam, dust, or oily smoke
- Water, oil, organic solvents such as thinner, or other chemical substances used in processing (direct exposure)
- Sources of electrical noise
- Strong magnetic fields
- Sunlight or other strong light

EFFECTS OF DIRT OR AMBIENT LIGHT INTERFERENCE

Proper measurement may not be possible due to dirt or interference from ambient light.

- Do not allow dust, dirt, water, oil, or fingerprints to remain on the light-emitting or receiving surfaces of the sensor heads.
  After turning off the laser, clean the affected surface with a soft dust-free cloth.
- Use some kind of shielding to prevent external light with a wavelength of around 650 nm from striking the light-receiving surface of the sensor head.

PRECAUTIONS FOR WIRING

	⚠WARNING
⚠	Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices. Failure to do so may result in electric shock.
!	Be sure to check that the device has been correctly wired before turning on the power. Incorrect wiring of the module can damage it or lead to hazardous conditions.
⊘	Do not touch electrically charged parts such as the power terminals. There is a risk of electric shock.
⊘	Do not disassemble. Disassembly may cause device failure.
!	Firmly tighten the terminal screws to a torque of 0.4–0.6 N·m. If tightening is insufficient there is a risk of electric shock or fire.
⊘	Do not use unused terminals on the device as relay terminals. Doing so may result in electric shock, fire or device failure.

	⚠CAUTION
!	Wire this device using the specified power source and recognized installation methods. Otherwise there is a risk of electric shock, fire, or device failure.
⊘	Do not allow wire clippings, metal shavings, or water to enter the device's case. They may cause fire or device failure.
!	Connect the controller’s frame ground terminals to the ground (for K1G-C04MG, that includes the frame ground for MECHATROLINK-III, and for K1G-C04EG it includes the frame ground for EtherCAT). If the terminals are not grounded, electromagnetic interference may result.

- Before wiring, be sure to check the model number and terminal numbers, referring to the label on the side of the device. After wiring, be sure to check that there are no mistakes.
- For screw terminal connections, use crimp terminals that are the correct size for M3 screws. The tightening torque for terminal screws is 0.4 to 0.6 N·m.
- The I/O signal wires should be at least 50 cm away from power wiring for motors, etc., and from power lines. Also, do not put these two types of wires in the same conduit or wiring duct.
- Be careful not to allow crimp terminal lugs, etc., to touch adjacent terminals.
- Make sure that connected devices or equipment have a basic level of insulation suitable for the maximum voltages of this device’s power source and input/output components.

CABLES FOR THE K1G

Use JCS4364-compliant instrument cable or equivalents for K1G-C04G inputs and outputs (twisted shielded instrument cable).
The following cables are recommended.

Fujikura Ltd.	2 cores	IPEV-S-0.9 mm^2 ×1P
	3 cores	ITEV-S-0.9 mm^2 ×1T
Hitachi Metals, Ltd.	2 cores	KPEV-S-0.9 mm^2 ×1P
	3 cores	KTEV-S-0.9 mm^2 ×1T

If there is relatively little electromagnetic induction, shielded multi-core microphone cables (MVVS) can be used.
Use power cables with a nominal cross-sectional area of 0.75–2.00 mm^2, a rated voltage of 300 V or more, and a rated temperature of 60 °C or more.
If off-the-shelf cable is used, the equivalent of CVV or VCT cable is recommended.
Use cables whose cross-sectional area is suitable for the crimp terminal lugs used.
Cable length must be no longer than 30 m.

COMMUNICATION CABLES FOR MECHATROLINK-III

Use industrial mini I/O connectors for the communication cable of the MECHATROLINK-III that connects to the K1G-C04MG. RJ-45 connectors are not compatible.

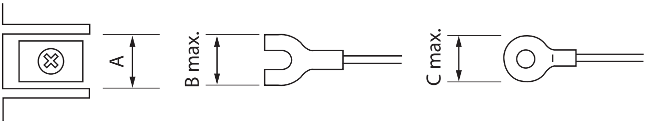
COMMUNICATION CABLES FOR ETHERCAT

For the EtherCAT communication cable connected to the K1G-C04EG, use a Cat 5e or higher STP cable. The use of a double-shielded STP cable is recommended in an environment with heavy electrical noise (for example, an FA equipment environment).

TERMINAL CONNECTION

⚠ **WARNING**	
❗	Firmly tighten the terminal screws to a torque of 0.4–0.6 N·m. If tightening is insufficient there is a risk of electric shock or fire.
⃠	Do not use unused terminals on the device as relay terminals. Doing so may result in electrical shock, fire or device failure

For controller connections, use crimp terminals compatible with M3 screws.



Compatible screw	Terminal dimensions (mm)			Recommended crimp terminal (JIS standards)	Compatible wire size
	A	B	C		
M3	6.1	5.8	5.8	RAV1.25-3	0.3–1.3 mm^2 22–16 AWG

! Handling Precautions

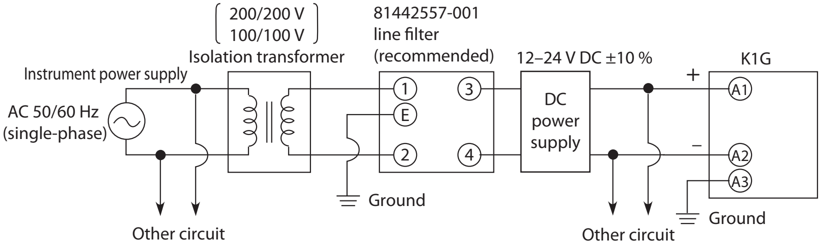
- In a place subject to vibration or shock, be sure to use round crimp terminals to prevent disconnection.
- Be careful not to allow crimp terminal lugs to touch adjacent terminals.
- The tightening torque for terminal screws is 0.4 to 0.6 N·m.

WIRING OF THE POWER AND GROUND

⚠ WARNING

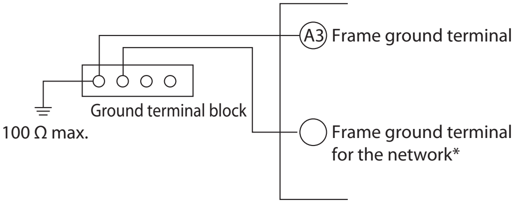
Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices.
Failure to do so may result in electric shock.

The power supply rating for this device is 12–24 V DC. Do not apply 100–240 V AC. Doing so may cause device failure or fire.



Use the frame ground terminals of this device (A3 and the network frame ground terminals*) for one ground connection only. Do not run wiring across to other terminals. If it is difficult to wire the shielded cable, etc., use a separate ground terminal (earth bar).

Ground type: 100 Ω max.
Ground wire: annealed copper wire with a cross sectional area of 2 mm^2 min. (14 AWG)
Ground wire length: 20 m max.



*K1G-C04MG: terminal C7. K1G-C04EG: terminal C1
The K1G-C04G has no network frame ground terminal.

WARM-UP

After the power has been turned on, wait for at least 30 minutes before use.
Because the device's circuitry does not stabilize immediately after the power has been turned on, the measured value may change gradually.

POWER-ON RESET

The device begins making measurements about one second after the power has been turned on.
After the output response time has passed, analog output (AO) or digital output (DO) begins.

A request to establish a MECHATROLINK-III communications connection can be accepted about one second after the power has been turned on.

For EtherCAT communication, check the specifications of the master device that the K1G is used with, and verify the startup operation of the actual device before use.

Contents

Introduction

1

WHAT TO KNOW BEFORE USE

This chapter gives an overview of K1G series sensors and the names and functions of their parts.

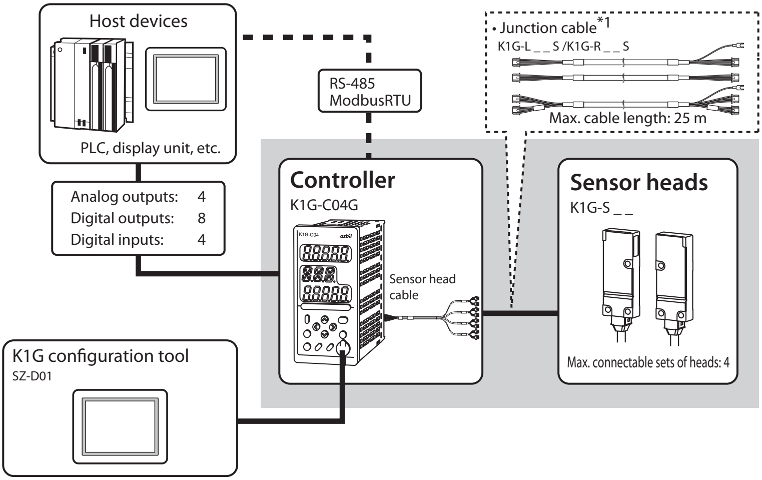
1-1 About the K1G Series

SYSTEM CONFIGURATION

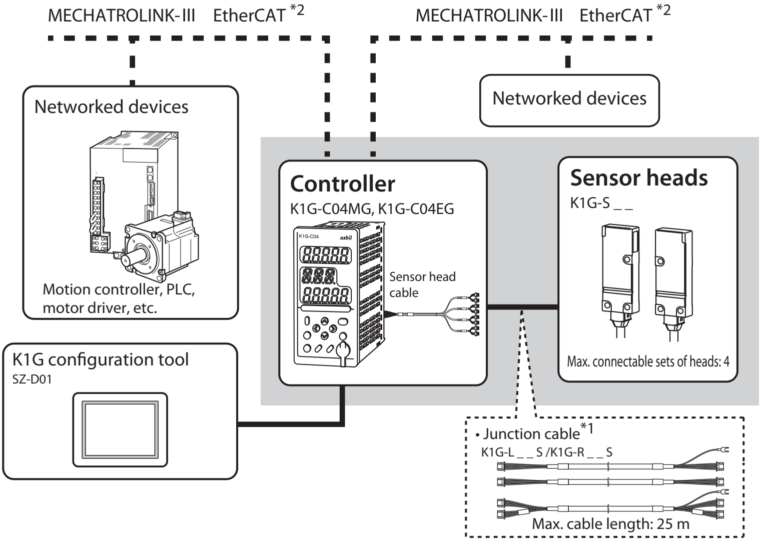
The K1G series features a semiconductor laser emitter and a receiver with a line image sensor. These two sensor heads measure the position of a workpiece that is between them.

● If K1G-C04G is used

*1 Necessary for connecting the sensor head cable to the sensor heads



● If K1G-C04MG or K1G-C04EG is used



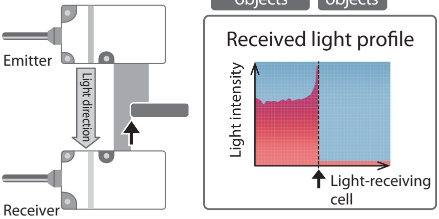
*1 Necessary for connecting the sensor head cable to the sensor heads

*2. The K1G-C04MG supports MECHATROLINK-III communication and the K1G-C04EG supports EtherCAT communication.

EXAMPLES OF K1G MEASUREMENTS

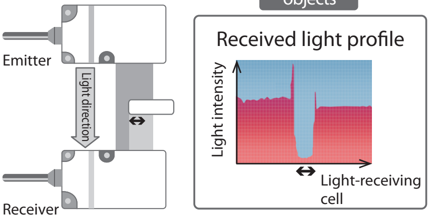
Determining edge position

Edge measurement **Transparent objects** **Opaque objects**



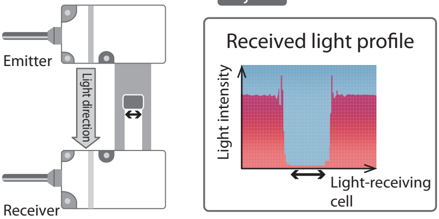
Sensing the edge's status

Edge width measurement **Transparent objects**



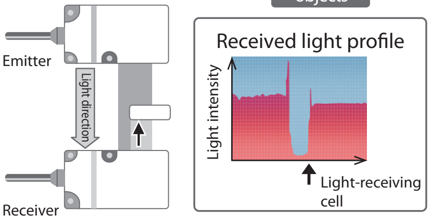
Measuring blocked light width

Width measurement **Opaque objects**



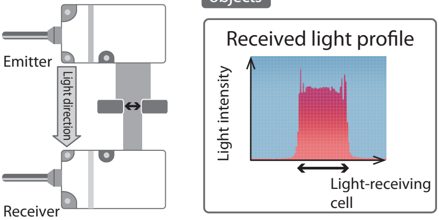
Sensing the edge's status

Second edge measurement **Transparent objects**



Measuring width of light through gap

Gap measurement **Opaque objects**



Types of object

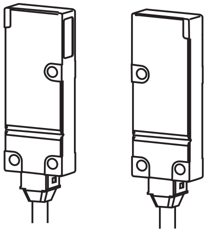
▭ Transparent object

▬ Opaque object

1-2 Check of Included Items

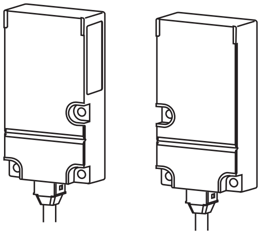
SENSOR HEADS

Model No. **K1G-S07**
(measurement width: 7 mm)



Emitter (1)
Receiver (1)
FDA label (1)
User's manual, No. CP-UM-5784JE

Model No. **K1G-S15**
(measurement width: 15 mm)

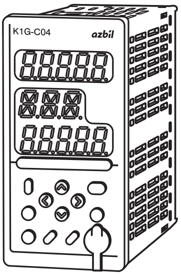


Emitter (1)
Receiver (1)
FDA label (1)
User's manual, No. CP-UM-5784JE

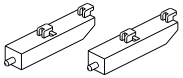
Note: This product has been registered with the FDA (CDRH). It includes a label indicating compliance with FDA standards. In the case of export to the United States, attach the label to the product.

CONTROLLER

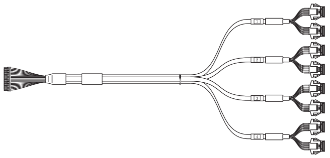
Model No. **K1G-C04G, K1G-C04MG** (for 4 channels)



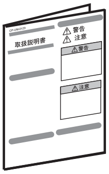
Controller



Mounting brackets (2)



Sensor head cable (1)



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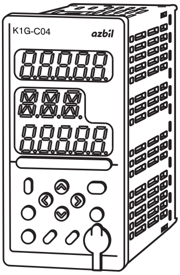
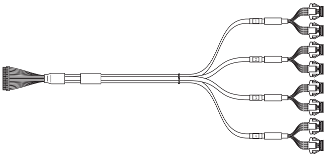
User's manual, No. CP-UM-5810JE

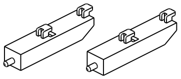
Model No. **K1G-C04EG** (for 4 channels)



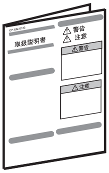
Controller



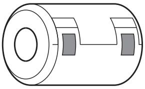
Sensor head cable (1)



Mounting brackets (2)



User's manual, No. CP-UM-5810JE
No. CP-UM-5910JE



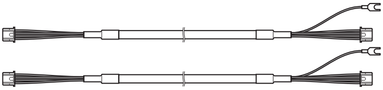
SZ-E02
Ferrite Core (2)

SHIELDED JUNCTION CABLE

The standard model or bend-tolerant model can be selected according to the installation conditions.
Necessary for connection of the sensor head cable to the sensor heads.
Shielded cables are also available.

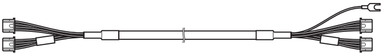
Model No. **K1G-L _ _ S:**
(Shielded, standard type)

K1G-L01S: 1 m (2 cables)
K1G-L03S: 3 m (2 cables)
K1G-L05S: 5 m (2 cables)
K1G-L10S: 10 m (2 cables)
K1G-L25S: 25 m (2 cables)



Model No. **K1G-R _ _ S:**
(Shield, Bend-tolerant type)

K1G-R01S: 1 m (1 cable)
K1G-R03S: 3 m (1 cable)



Handling Precautions

- If the cable is installed on a movable part, a bend-tolerant cable should be used.

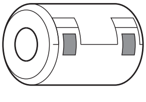
FERRITE CORE

Be sure to attach the ferrite core to the sensor head cable and the power cable of the controller.

Model No. **SZ-E _ _**

SZ-E01:
For sensor heads (2 cores)
Wire bundle diameter: 8.5 to 9.5 mm

SZ-E02:
For power cable
Wire bundle diameter: 20 mm max.



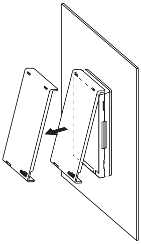
Ferrite core

1-3 Optional Parts

FRONT PANEL PROTECTIVE COVER FOR CONTROLLERS

This cover protects the controller front panel and prevents operator errors. It can be opened and closed.

Model No. **81441421-001**



NOISE FILTER

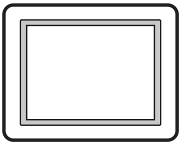
If there is a considerable amount of electrical noise from the power supply, a noise filter is used in combination with an isolation transformer.
Choose the proper type according the noise.

Model No. **81442557-001**	Model No. **81446365-001**
Line filter	CR filter: for quick-rising noise

K1G CONFIGURATION TOOL

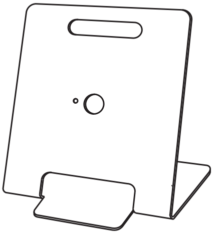
This tool especially made for the K1G series is used for setup, parameter configuration, and monitoring.

Model No. **SZ-D01**



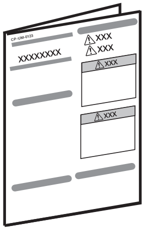
Display unit (5.7 inches)

Configuration device with touch panel.

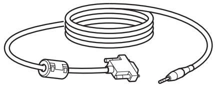


Stand

Used for installation of the display unit.



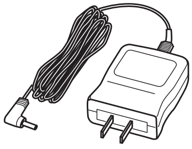
User's manual, No. CP-UM-5785JE



Loader cable

Connects the controller and display unit.

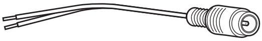
Model No. **81446957-001**



AC adapter (100–240 V AC / 24 V DC)

Supplies the power to the display unit.

Model No. **81442773-001**



DC jack cable

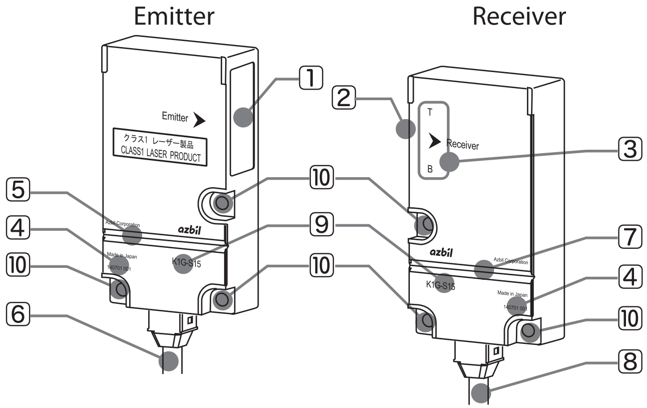
Connects the AC adapter to the display unit.

1-4 Names and Functions of Parts

SENSOR HEADS

! Handling Precautions

- Be sure that the emitter and receiver have the same serial number.
  If an emitter and receiver with different numbers are used, the product may not meet the listed specifications.



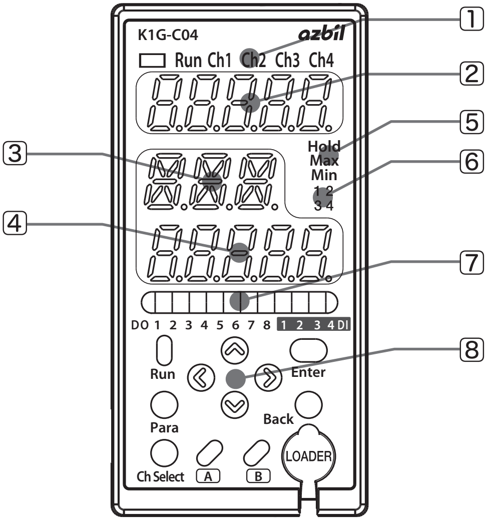
Example: K1G-S15

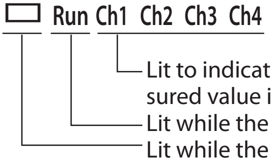
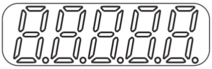
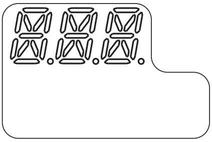
Name		Description
①	Light-emitting surface	Laser beam emitting surface
②	Light-receiving surface	Laser beam receiving surface
③	Orientation indicator	T: Top, B: Bottom
④	Serial No.	Be sure that the emitter and receiver have the same serial number
⑤	Light emission indicator	Lit when the laser beam is emitted*
⑥	Emitter cable	Black
⑦	Light reception indicator	Used for adjusting the beam alignment
⑧	Receiver cable	Black
⑨	Model No.	
⑩	Mounting holes	Thru-holes for M3 screws

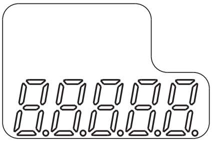
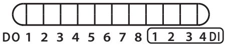
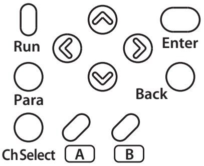
* When the power is first turned on, the indicator may light up temporarily, but the laser beam is not emitted at this time.

CONTROLLER

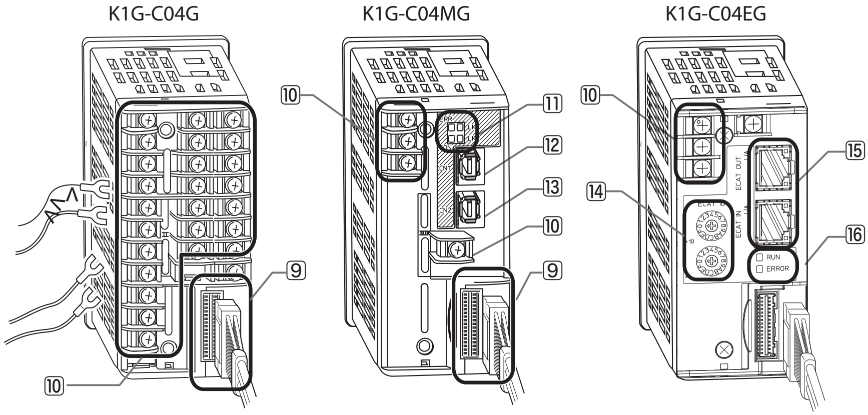
Front



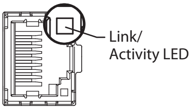
Name		Description
1	Operation and channel indicators	 Lit to indicate which channel's measured value is displayed on display 1. Lit while the status is "Run." Lit while the controller is operating properly.
2	Display 1	Displays the measured value. 
3	Auxiliary display	Displays a setting that is being checked or changed. 

Name		Description
④	Display 2	Displays the measured value. 
⑤	Status indicators	Indicate the operating status of the channel selected for display 1. **Hold** — Lit when the status of the measured value is "Hold." **Max** — Lit when the max. digital input (DI) constant output function is used. **Min** — Lit when the min. digital input (DI) constant output function is used.
⑥	Sensor connection indicators	Indicate channel(s) to which sensor heads are connected. 1 2 3 4
⑦	Digital input/output indicator	Indicates digital I/O status by lighting up when digital I/O is on. 
⑧	Key functions	◁ △ ▷ ▽ : Used for changing a value, etc., during setting **Run** : Used for Run/Ready switching **Para** : Used for switching to the display for changing settings **Enter** : Used for confirming an operation setting **Back** : Use for cancellation **Ch Select** : Used for switching between channels **A** : Used for tuning **B** : Cancels EPS filtering. 

Back



Name		Description
⑨	Sensor head cable connector	Connects the included sensor head cable and controller.
⑩	Terminals	Used for wiring of the power and input/output signal wires.
⑪	LEDs for MECHATROLINK-III	ERR ☐ ☐ LK1 CON ☐ ☐ LK2 LK1 (link 1, green): Lit when link CN1 is established LK1 (link 2, green): Lit when link CN2 is established ERR (error, red): Lit when an error occurs with MECHATROLINK-III CON (connection, green): Lit when a connection is established
⑫	Connector 1 for MECHATROLINK-III	-
⑬	Connector 2 for MECHATROLINK-III	-
⑭	ECAT ID setting switch	Sets the ECAT ID in two hexadecimal digits X10: 2nd digit X1: 1st digit

Name		Description
⑮	RJ45 port	Connects the network cable for EtherCAT communication.  ECAT OUT: EtherCAT communication OUT port ECAT IN: EtherCAT communication IN port Link/Activity indicator: Green Shows the state of the EtherCAT communication port physical link and data transmission.
⑯	EtherCAT RUN/ERROR LED	☐ RUN ☐ ERROR RUN indicator: Green Indicates the state of EtherCAT communication. ERROR indicator: Red Indicates an EtherCAT error.

DETAILS ON ETHERCAT INDICATORS

Types of indicator states

Indicator states	Definition
Off	Constantly OFF
Flickering	ON for 50 ms and OFF for 50 ms
Blinking	ON for 200 ms and OFF for 200 ms
Single Flashes	ON for 200 ms and OFF for 1000 ms
Double Flashes	ON for 200 ms and OFF for 200 ms and ON for 200 ms and OFF for 1000 ms
On	Constantly ON

Link/Activity LED: Green

Indicator states	Description
Off	No link
On	Link but no communication activity
Flickering	Link with communication activity

RUN LED: Green

Indicator states	Description	Description
Off	INIT	No communication is available.
Blinking	PRE-OPERATIONAL	Only mailbox communication is available.
Single Flashes	SAFE-OPERATIONAL	Process (input) data communication and mailbox communication are available.
On	OPERATIONAL	Process (input and output) data communication and mailbox communication are available.

ERROR LED: Red

Indicator states	Description	Description
Off	No error	There is no EtherCAT error, or the device is not communicating.
Blinking	EtherCAT communication setting error	Invalid configuration for EtherCAT communication. Change the settings.
Single Flashes	Device behavior error	There is a controller application error.
Double Flashes	Process data watchdog timeout or EtherCAT watchdog timeout	Sync Manager Watchdog timeout or EtherCAT communication timeout has occurred. Check the communication cable connections.
On	PDI watchdog timeout	PDI Watchdog timeout has occurred. There is a problem with the device. If the controller does not return to normal after the power is turned off and back on, replace the device.

INSTALLATION AND WIRING

2

This chapter describes installation and wiring of the sensor heads and controller.

2-1 Installing the Sensor Heads

SAFETY PRECAUTIONS

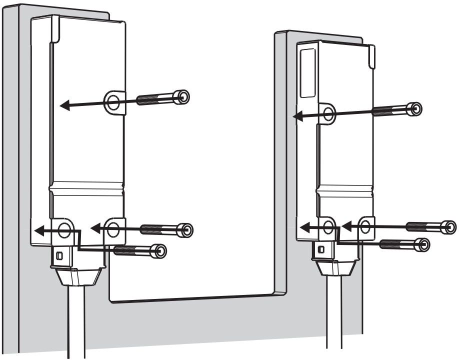
⚠WARNING

⃠ Do not do work while power is supplied.
There is a risk of electric shock or device failure.

⃠ Do not use this device in atmospheres containing corrosive or flammable gas, liquids, or powder.

1 Install the emitter and receiver so that the light-emitting and receiving surfaces face each other

Secure the sensor heads to a jig, etc. using commercially available M3 screws, working from the sensor side.



Tightening torque: 0.5 N·m max.

Handling Precautions

- Secure the cable in a way that avoids stress where it exits the device and near the connector.
- Do not touch the optical surfaces during installation.
- Be sure that the emitter and receiver have the same serial number.
  If an emitter and receiver with different numbers are used, the product may not meet the listed specifications.
- Attach the sensor heads securely so that they will not come loose by vibration or shock.
- Install so that the workpiece does not come into contact with the sensor heads.
- Do not remove the sensor heads while power is being supplied.
- Pay attention to the orientation of the emitter and receiver during installation.

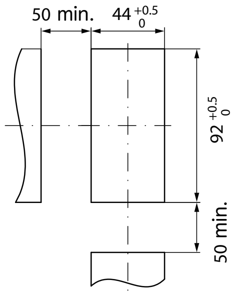
2-2 Install the controller in the panel.

1 Make a cutout in the panel

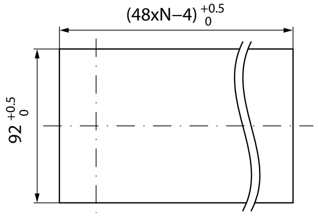
The controller is a panel-mount type.
Make a cutout in the panel according to the following dimensions.

Unit: mm

Individual mounting



Gang-mounting



Note: N represents the number of controllers.

! Handling Precautions

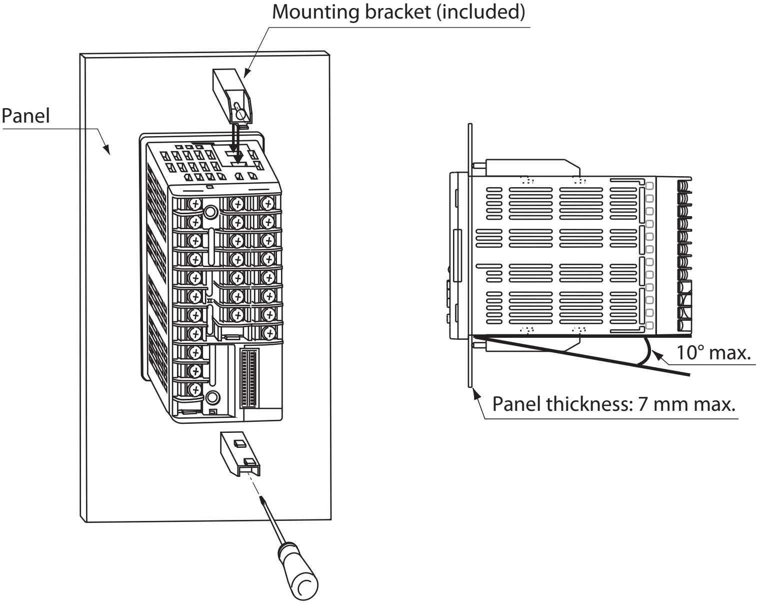
- If three or more units are gang-mounted, the ambient temperature should not exceed 35 °C.
- During installation, leave clearance of at least 50 mm above and below.

2 Insert the controller into the cutout

Insert the controller from the front side of the panel.

3 Attach the mounting brackets

Attach the included mounting brackets to the top and bottom of the controller. Attach the bottom bracket first.



4 Tighten the screws

Tighten the screws of the mounting brackets until there is no more play between the bracket and screw and panel, and then turn one revolution more only.

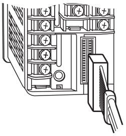
! Handling Precautions

- Excessive tightening of the screws can deform the controller case.
- The mounted controller should not be inclined from the horizontal by more than 10 degrees upward or downward.
- The mounting panel should be made of a rigid material 7 mm thick or less.

2-3 Connecting the Sensor Heads

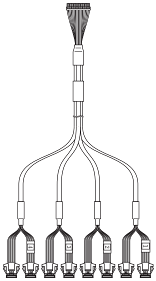
1 Attach the cables

! Precautions for wiring



- Secure the cable in a way that avoids stress where it exits the device and near the connector.

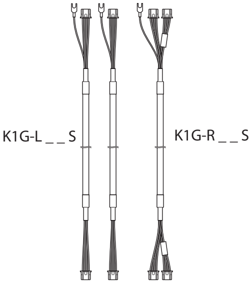
● Sensor head cable



● Sensor head cable

Cable length: 0.4 m
Connector type: socket (panel-mount)
Bend radius: R30
Identification: Each branched cable has a channel No.
The cables for the receiver have an identifying mark.

● Junction cable



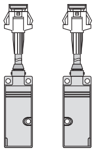
● Junction cable

Cable length: 1–25 m (standard model)
1–3 m (bend-tolerant model)
Connector type: Socket
Bend radius: R35 (K1G-L _ _ S)
R40 (K1G-R _ _ S)
Identification: Bend-tolerant cables for the receiver have an identifying mark.

! Handling Precautions

- The junction cable cannot be connected to another junction cable.

● Sensor heads



● Sensor heads

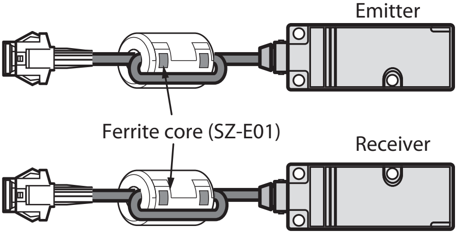
Cable length: 0.2 m
Connector type: Socket (panel-mount)
Bend radius: R30
Identification: The receiver has an identification mark.

! Handling Precautions

- After operation has begun, in order to switch to a different sensor head model it is necessary to reset the sensor head settings.
☞ P. 4-106

2 Attaching ferrite cores

Attach the SZ-E01 ferrite cores to the cables of the sensor heads (emitter and receiver), making 2 turns (1 loop).
Run the cable and attach it in a way that avoids tension where the cable enters the sensor head.

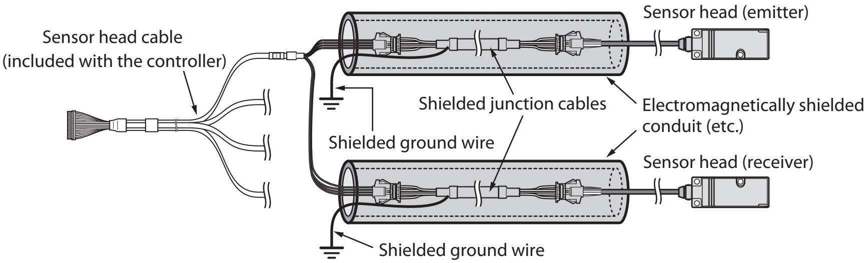


3 Connecting shielded junction cables

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 shielded ground wire of the junction cable. (A spade terminal compatible with M3 screws is attached to the end of the shielded ground wire.)

In the case of K1G-L _ _ S, the junction cables for the emitter and receiver can be put in the same electromagnetically shielded conduit (etc.). In this case, ground all shielded ground wires.



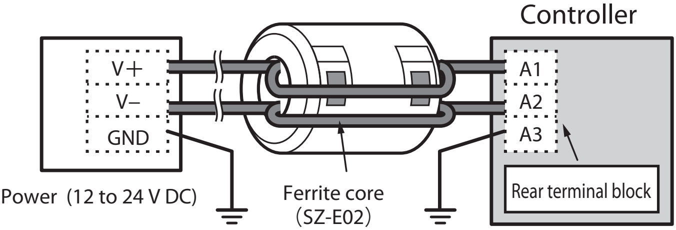
2-4 Wiring the Controller (all models)

ATTACHING THE FERRITE CORE

Attach the SZ-E02 ferrite core to the power wires (not included with the product) to the controller, making 2 turns (2 passes through the core) for the K1G-C04G and K1G-C04MG and 3 turns for the K1G-C04EG. Both power wires (V+ and V-) must be passed through the core.

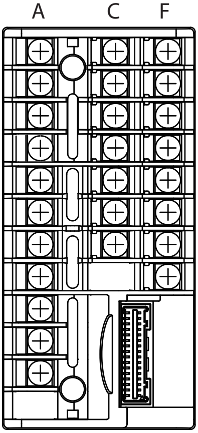
Connect the controller's frame ground terminal (A3) to the frame ground of the equipment.

After attaching the ferrite core, run the power wires and connect them.



2-5 Wiring the Controller (K1G-C04G)

TERMINAL LAYOUT



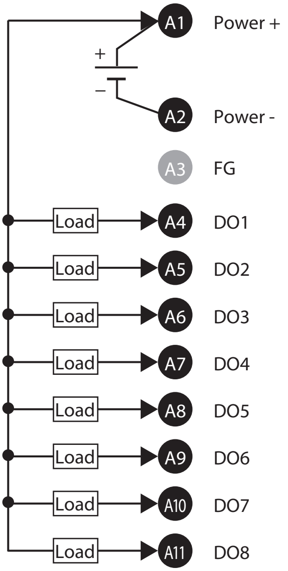
	A		C		F	
1	Power +	Power supply	DA	Communication	AO1 +	Analog output
2	Power -		DB		AO1 -	
3	FG		SG		AO2 +	
4	DO1	Output	DI1	Input	AO2 -	
5	DO2		DI2		AO3 +	
6	DO3		DI3		AO3 -	
7	DO4		DI4		AO4 +	
8	DO5		(Empty)		AO4 -	
9	DO6		Sensor head cable connector			
10	DO7					
11	DO8					
12	(Empty)					

! Handling Precautions

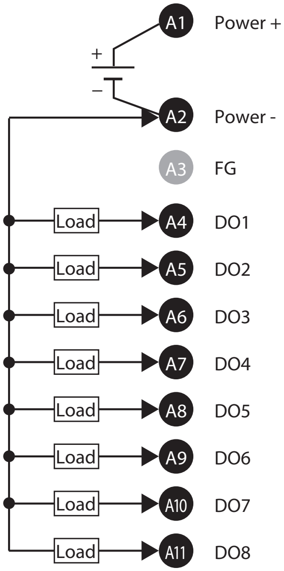
- Be sure to check that the module has been correctly wired before turning on the power. Mistakes in wiring can damage the device.
- Connect the controller's frame ground terminal (A3) to the frame ground of the equipment.

WIRING OF DIGITAL OUTPUT (DO)

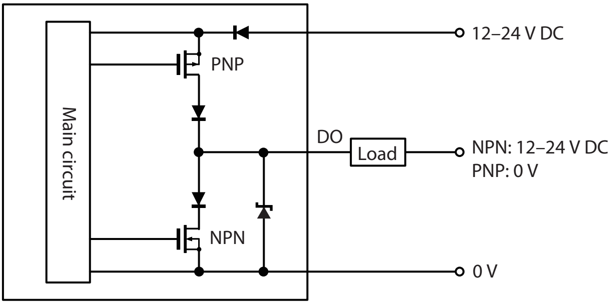
When NPN is selected



When PNP is selected



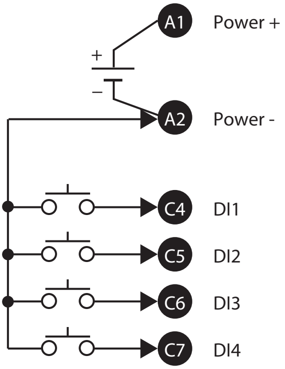
Output circuit



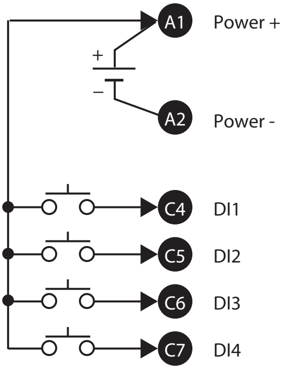
Output current (source or sink):	1 to 10 mA (per output)
ON-state voltage drop:	2 V max.
OFF-state leakage current:	0.3 mA max.
Common type:	8 (shared with power terminals)

WIRING OF DIGITAL INPUT (DI)

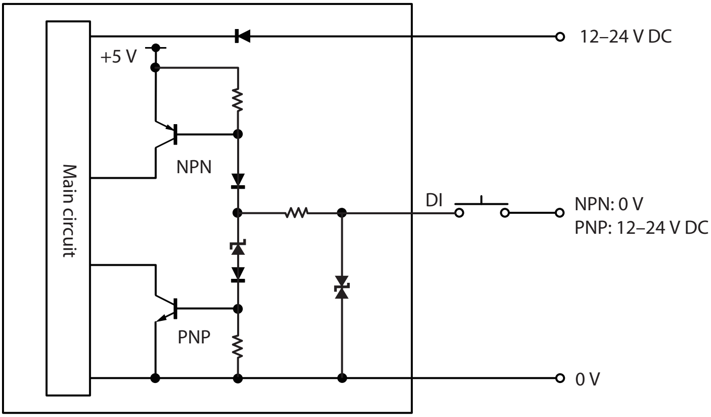
When NPN is selected



When PNP is selected



Input circuit

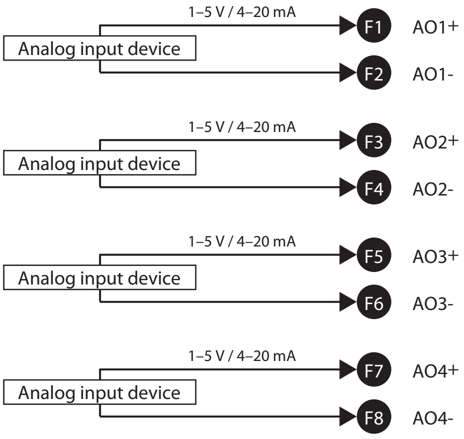


! Handling Precautions

- Do not connect digital outputs (DOs) and digital inputs (DIs) directly. To make a connection between them, install pull-up resistors for NPN or pull-down resistors for PNP in the external circuit. Select pull-up resistors or pull-down resistors so that the load current is about 10 mA.

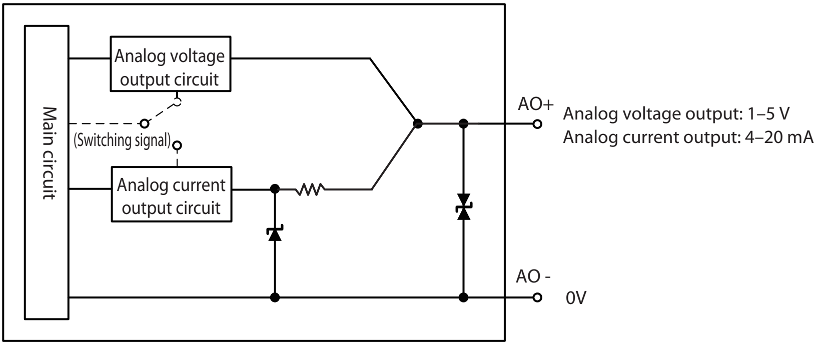
Input current NPN: Approx. 3 mA
PNP: Approx. 1 mA (at 12 V DC)
Approx. 4 mA (at 24 V DC)
Min. input time: 12 ms (at a 500 µs measurement cycle)
24 ms (at a 1 ms measurement cycle)
Common type: 4 (shared with power terminals)

WIRING OF ANALOG OUTPUT (AO)



Note: AO1-, AO2-, AO3-, and AO4- are all connected inside this device.

Analog output circuit


Main circuit
Analog voltage output circuit
(Switching signal)
Analog current output circuit
AO+
Analog voltage output: 1–5 V
Analog current output: 4–20 mA
AO -
0V

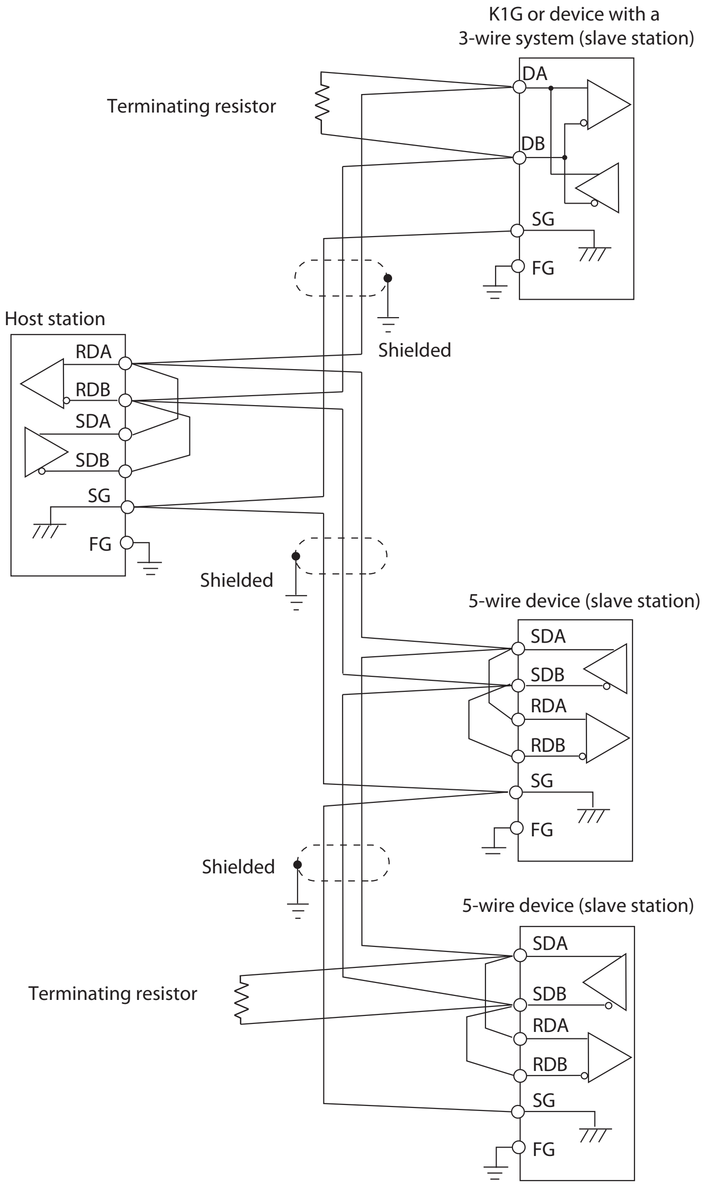
Handling Precautions

- If the analog outputs of the K1G and another device are connected to the same analog input device, the K1G's output signal may become unreliable due to factors such as the current coming from other circuits. In this case, attach an isolator between the K1G and the analog input device.

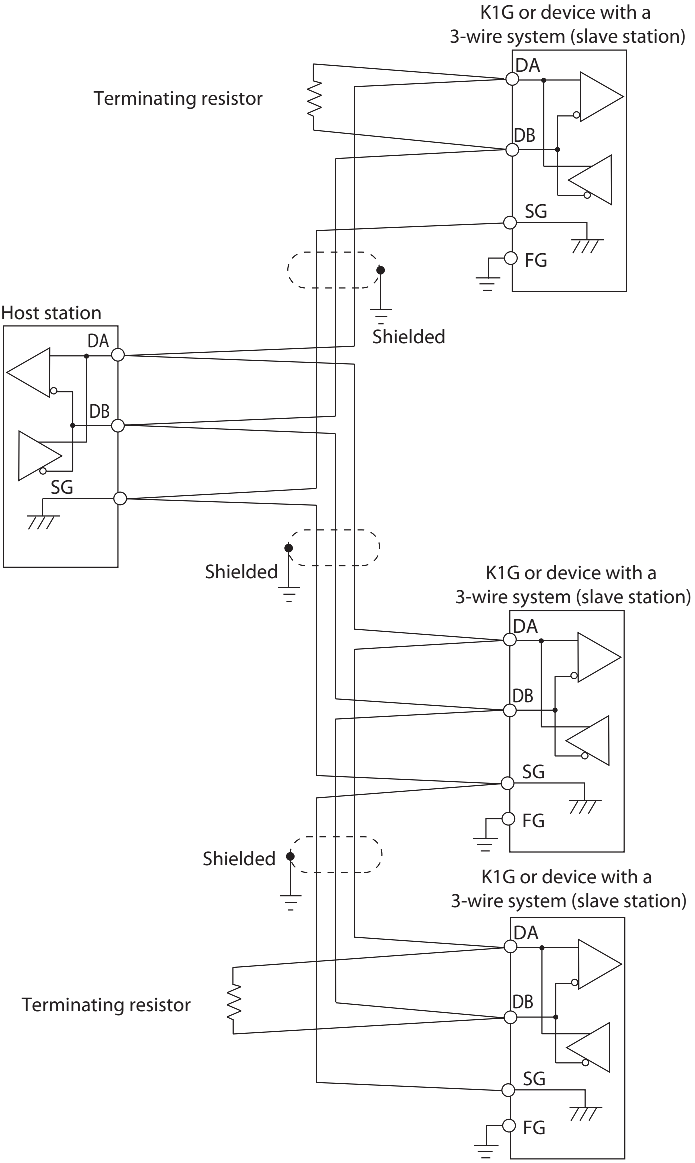
Load resistance: 10 kΩ min. (with voltage output)
250 Ω +1 % max. (with current output)

RS-485 COMMUNICATIONS

● If devices with 3-wire and 5-wire systems are both used

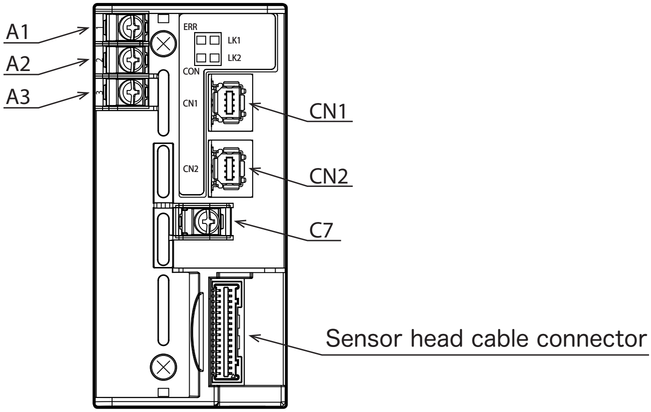


● When only devices with a 3-wire system are used



2-6 Wiring the Controller (K1G-C04MG)

TERMINAL LAYOUT



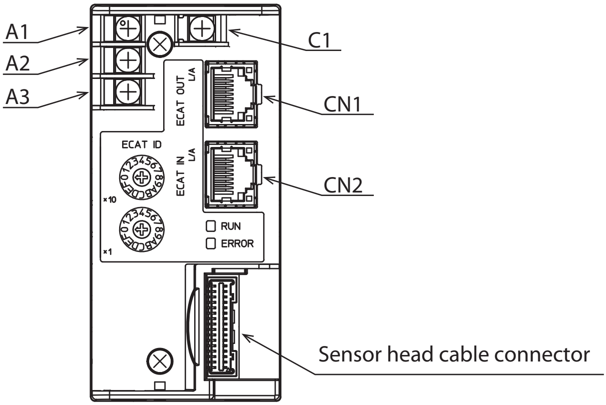
Power supply		MECHATROLINK-III	
A1	Power +	CN1	Connector 1
A2	Power -	CN2	Connector 2
A3	FG	C7	FG

[!] Handling Precautions

- Be sure to check that the module has been correctly wired before turning on the power. Mistakes in wiring can damage the device.
- Connect the controller's frame ground terminals (A3 and C7) to the frame ground of the equipment.

2-7 Wiring the Controller (K1G-C04EG)

TERMINAL LAYOUT



Power supply		EtherCAT	
A1	Power +	CN1	ECAT OUT
A2	Power -	CN2	ECAT IN
A3	FG	C1	FG

! Handling Precautions

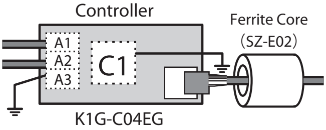
- Be sure to check that the module has been correctly wired before turning on the power. Mistakes in wiring can damage the device.
- There are two types of EtherCAT communication port: host (ECAT IN) and slave (ECAT OUT) If the cable is connected to the wrong port, the device cannot communicate.
- Connect the controller's frame ground terminals (A3 and C1) to the frame ground of the equipment.

WIRING METHOD

To use the K1G-C04EG properly, be sure to follow the wiring method described below.

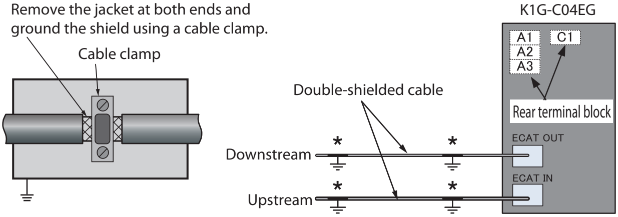
● Sensor head cable

- Attach the ferrite cores to the sensor head cables.



● Communication cable

- 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).



* Shielded cable grounding method

For more general information on how to install EtherCAT products, please refer to ETG.1600, EtherCAT Installation Guideline, issued by EtherCAT Technology Group.

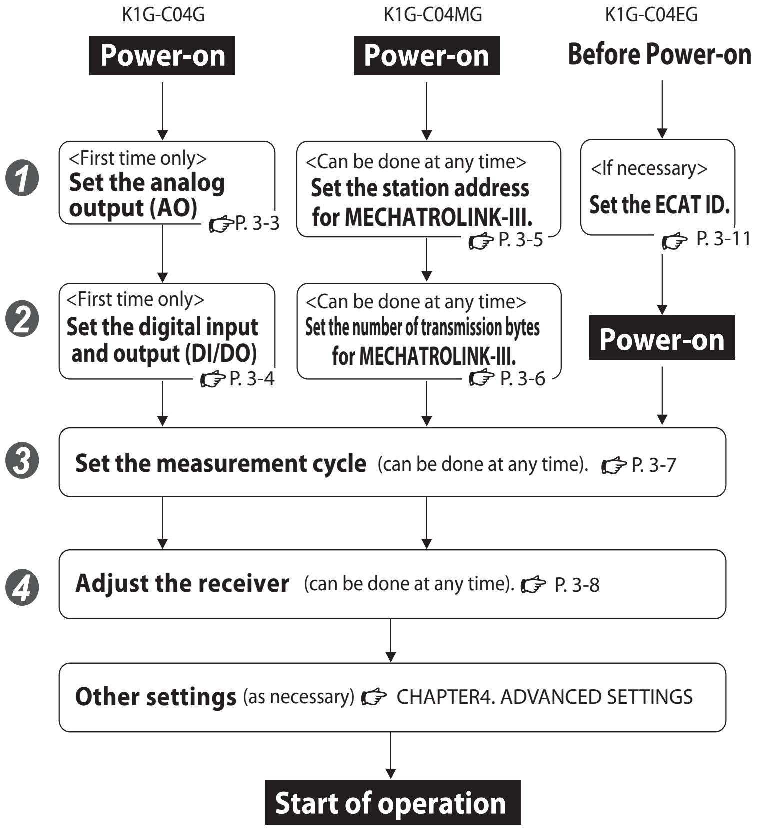
If the controller is used in an environment with a large amount of electromagnetic noise, take the necessary countermeasures in the following ways.

- Move the controller and cables away from the noise source.
- Make more turns (2) when attaching the ferrite cores to the sensor head cables.

INITIAL SETUP 3

The chapter describes the initial setup after the power to the controller has been turned on for the first time.

Initial Setup Flowchart


K1G-C04G
K1G-C04MG
K1G-C04EG
Power-on
Power-on
Before Power-on
❶
<First time only>
Set the analog output (AO)
☞P. 3-3
<Can be done at any time>
Set the station address for MECHATROLINK-III.
☞P. 3-5
<If necessary>
Set the ECAT ID.
☞ P. 3-11
❷
<First time only>
Set the digital input and output (DI/DO)
☞P. 3-4
<Can be done at any time>
Set the number of transmission bytes for MECHATROLINK-III.
☞P. 3-6
Power-on
❸
Set the measurement cycle (can be done at any time). ☞P. 3-7
❹
Adjust the receiver (can be done at any time). ☞ P. 3-8
Other settings (as necessary) ☞ CHAPTER4. ADVANCED SETTINGS
Start of operation

After steps ① and ② are complete, the wiring status can be checked in user test mode. ☞ P. 4-96

K1G-C04G:	After unpacking, when the power has been turned on for the first time, analog output as well as digital input and output should be configured. At the second power-on and later, the initially configured settings will automatically be used. To change these settings, return all settings to the default values.
K1G-C04MG:	After unpacking, when the power has been turned on for the first time, the station address and the number of transmission bytes for MECHATROLINK-III should be configured. These settings can be changed at any time.
K1G-C04EG:	Before power-on, if use of the ECAT ID is necessary, set the ID using the ECAT ID setting switches on the back of the device. When the power is turned on for the first time, set the measurement cycle before use.

☞ 4-10 Returning All Settings to the Defaults (P. 4-114)

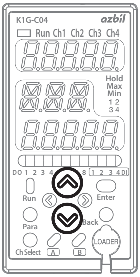
3-1 Analog Output (AO) Settings

Set the analog output (AO) (for K1G-C04G)

Power-on ❶②③④ ▶ Start of operation

Analog output settings applies to all channels.
The parameters cannot be changed for individual channels.

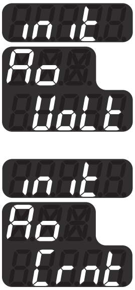
1 Select the output method



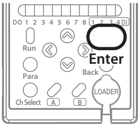
Select UoLt or Crnt using ▲/▼.

Parameter	Description
UoLt	Voltage output (1–5 V)
Crnt	Current output (4–20 mA)

Display



2 Save the parameter



Press ○ Enter to save it.

To change the analog output method, return all settings to the default values.
☞ 4-10 Returning All Settings to the Defaults (P. 4-114)

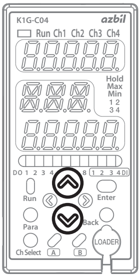
3-2 Digital Input/Output (DI/DO) Settings

Set the digital input and output (DI/DO) (for K1G-C04G)

Power-on ① **②** ③ ④ ▶ Start of operation

The digital input/output applies to all channels.
The parameters cannot be changed for individual channels.

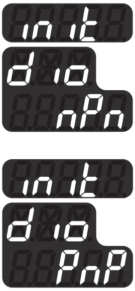
1 Select the input/output method



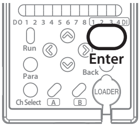
Select nPn or PnP using ▲/▼.

Parameter	Description
nPn	NPN input/output
PnP	PNP input/output

Display



2 Save the parameter



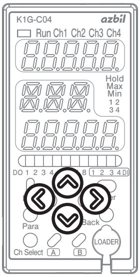
Press Enter to save it.

To change the digital input/output settings, return all settings to the default values.
☞ 4-10 Returning All Settings to the Defaults (P. 4-114)

3-3 Setting the Station Address for MECHATROLINK-III

Set the station address (for K1G-C04MG)
Power-on
1
2
3
4
Start of operation

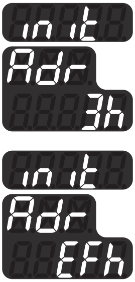
1 Select the station address.



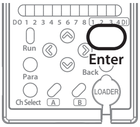
Select the station address using ∧/∨ «/».

Parameter	Description
3h to EFh	Station address

Display



2 Save the address



Press Enter to finalize your selection.

The station address for MECHATROLINK-III can be changed after the initial setup is completed.

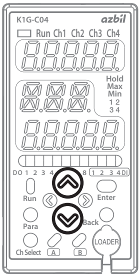
☞ 4-9 Changing MECHATROLINK-III Communication Settings (P. 4-108)

3-4 Setting the Number of Transmission Bytes for MECHATROLINK-III

Set the number of transmission bytes (for K1G-C04MG)

Power-on ① **②** ③ ④ ▶ Start of operation

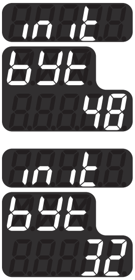
1 Select the number of transmission bytes



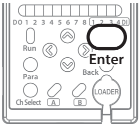
Choose 48 or 32 using ︽/︾.

Parameter	Description
48	No. of transmission bytes 48
32	No. of transmission bytes 32

Display



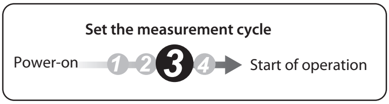
2 Save the number of transmission bytes



Press ⬭ Enter to finalize your selection.

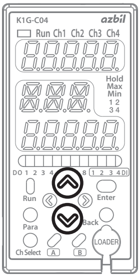
The number of transmission bytes for MECHATROLINK-III can be changed after the initial setup is completed.
☞ SETTING THE NUMBER OF TRANSMISSION BYTES FOR MECHATROLINK-III (P. 4-111)

3-5 Setting the Measurement Cycle



The measurement cycle applies to all channels.
This parameter cannot be changed for individual channels.

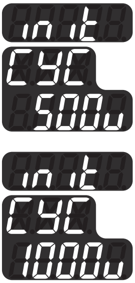
1 Select the parameter



Select 500u or 1000u, using ⏶/⏷.

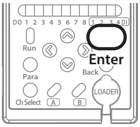
Parameter	Description
500u	500 µs
1000u	1 ms

Display



The selectable measurement cycle varies depending on the length of the junction cable.
☞ 7-2 Controllers (P. 7-5)

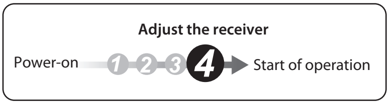
2 Save the parameter



Press Enter to save it.

The measurement cycle can be changed after the initial setup is completed.
☞ Changing the Measurement Cycle (P. 4-15)

3-6 Receiver adjustment

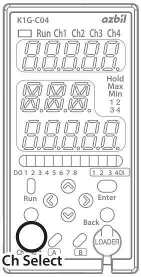


Handling Precautions

- Make sure that there is no workpiece before starting.
- If the laser beam emitting surface or receiving surface is dirty, beam alignment and intensity adjustment cannot be done correctly.
- If the sensor heads are misaligned, moved, or replaced, the sensitivity should be readjusted.

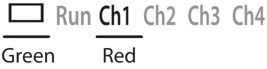
For readjustment, the mode must be switched to Ready.
☞ How to switch between Run/Ready modes (P. 4-4)

1 Select the channel No.



Select the channel No. using ○ Ch Select.

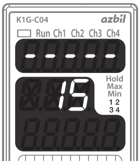
Display



The number of the selected channel is lit.

2 Adjust the sensor head position

Display (when the K1G-S15 is connected)



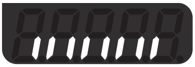
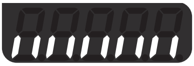
← 「————」

← 15 (“07” is displayed when the K1G-S07 is connected)

← See the description below.

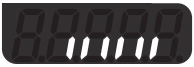
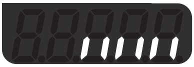
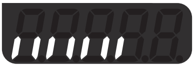
During readjustment, display 1 shows the measured value.

The beam is aligned (receiver adjustment is possible).

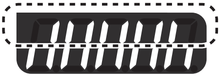
	If the LED bar shown on the left is lit, the receiver can be adjusted. Measurement can begin.
	There is a big margin. Receiver adjustment is possible.

The beam is not aligned (receiver adjustment is not possible).

Check the emitter and receiver positions, and the beam angle.

	The light intensity at the receiver is insufficient.
	The laser beam is offset to the bottom side (B) of the receiver.
	The laser beam is offset to the top side (T) of the emitter.

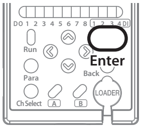
During intensity readjustment or a beam alignment check

	The upper part of the display shows the light intensity after adjustment.

During receiver adjustment, the light reception indicator works as shown below.

	Receiver adjustment is possible.	Receiver adjustment is not possible.
Selected channel	Lit	Off
Unselected channel	Lit	

3 Align the beam

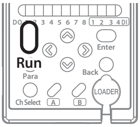


When the beam is aligned, press Enter.

Handling Precautions

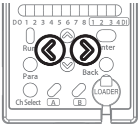
- Beam alignment and intensity adjustment is necessary for every connected channel. Measurement is not possible with unadjusted sensor heads.

4 Complete the adjustments



Press Run for at least 3 seconds to end the adjustment.

5 Choose whether to save the adjustment data

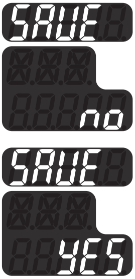


Select whether to save it using «/».

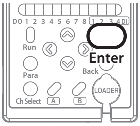
Parameter	Description
no	Do not save adjustments
YES	Save adjustments.

Note: If "no" is selected, and the power is turned off, the changed parameters will be lost.

Display

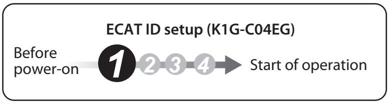


6 Start measurement

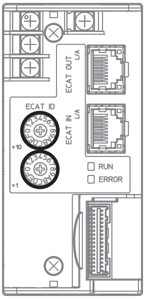


Press Enter to begin measurement.

3-7 Setting the ECAT ID (for K1G-C04EG only)

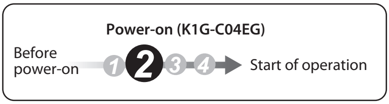


1 Set the ID using the ECAT ID setting switches



Change the settings using a screwdriver (factory default: 00)

Parameter	Description
00	ECAT ID is not used
01 to FF	The set value is used as the ECAT ID



2 Turn on the power

The setting for the ECAT ID is read only when the power is turned on. Even if the setting is changed during operation, the ECAT ID does not reflect the new setting. To apply a new ID, turn the power off and back on.

✎ MEMO

ADVANCED SETTINGS

4

This chapter describes various functions of the K1G series.
As needed, the settings should be changed.

In this chapter, the following icons indicate the mode in which settings can be changed.

Ready : Settings can be changed in Ready mode.

Run : Settings can be changed in Run mode.

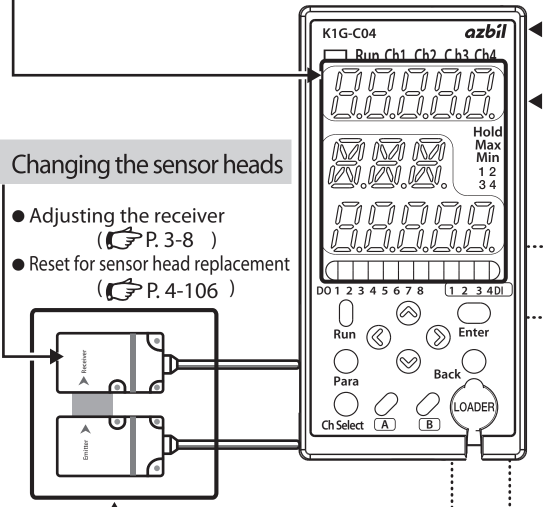
4-1 Settings that Can Be Changed

CHANGING THE INITIAL SETTINGS

To change the initial settings configured in chapter 3, see the pages indicated below.

Changing the display

- Changing the display type (☞ P. 4-5)
- Changing the display resolution (☞ P. 4-8)



Changing DI/DO and AO operation

- Changing the DI settings (☞ P. 4-36)

<Default setting>

DI1: **Ch1 zero adjustment input**
DI2: **Ch2 zero adjustment input**
DI3: **Ch3 zero adjustment input**
DI4: **Ch4 zero adjustment input**

- Changing the DO settings (☞ P. 4-40)

<Default setting>

DO1: **Ch1 Pass output**
DO2: **Ch1 Out output**
DO3: **Ch2 Pass output**
DO4: **Ch2 Out output**
DO5: **Ch3 Pass output**
DO6: **Ch3 Out output**
DO7: **Ch4 Pass output**
DO8: **Ch4 Out output**

- Changing the AO settings (☞ P. 4-25)

<Default setting>

AO1: **Ch1 calculation output**
AO2: **Ch2 calculation output**
AO3: **Ch3 calculation output**
AO4: **Ch4 calculation output**

Changing the sensor heads

- Adjusting the receiver (☞ P. 3-8)
- Reset for sensor head replacement (☞ P. 4-106)

Changing the measurement conditions

- Changing the measurement mode (☞ P. 4-11)
  <Default setting> **Opaque object edge position (top)**
- Changing the measurement cycle (☞ P. 4-15)
  <Default setting> **Initially specified value**
- Changing the No. of moving averages (☞ P. 4-18)
  <Default setting> **64**
- Changing the edge detection threshold
  <Default setting> **25 %** (☞ P. 4-21)

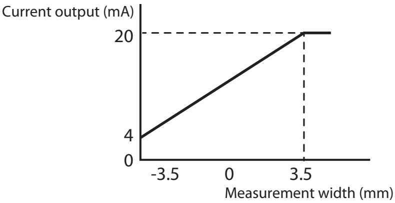
Settings for MECHATROLINK-III

- Changing the Station Address (☞ P. 4-108)
- Changing the Number of Transmission Bytes (☞ P. 4-111)

Changing the AO range

- Changing the analog output (AO) range . . . . (☞P. 4-25)
- Changing the measurement zero adjustment value . (☞P. 4-29)
- Changing (reversing) the output polarity. . . . . (☞P. 4-33)

Initial setting



Enabling disabled functions

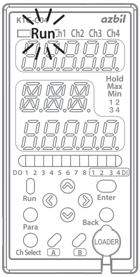
- Calculations that use measured values of channels . . (☞P. 4-61)
- Working distance (WD) setting function. . . . . (☞P. 4-76)
- PV hold . . . . (☞P. 4-79)
- EPS filtering . . . . (☞P. 4-83)
- Smudge detection . . . . (☞P. 4-90)
- Event log function. . . . . (☞P. 4-95)
- Power saving. . . . . (☞P. 4-98)
- Keylock . . . . (☞P. 4-102)

Other

- Test mode . . . . (☞P. 4-96)
- Reverting all settings to the defaults . . . . (☞P. 4-114)

HOW TO SWITCH BETWEEN RUN/READY MODES

● How to check the current mode



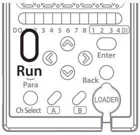
To learn the current mode, check the operation indicator.
If the LED is lit, the mode is "Run" (measuring).

On the following pages, in order to indicate which mode allows a setting change, one of the following icons is shown for each setting.

Ready : Settings can be changed in Ready mode.

Run : Settings can be changed in Run mode.

● How to switch between modes



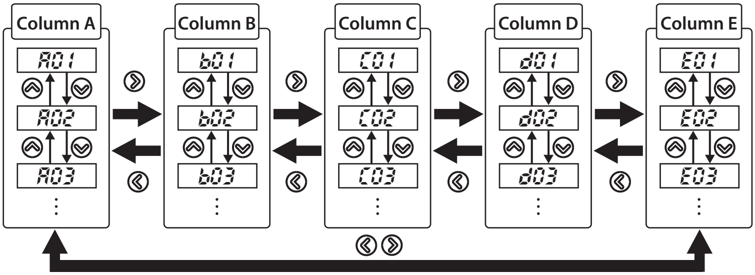
Pressing the Run key for 3 seconds or more switches between Run and Ready.

● Input/output operations in Ready mode.

Analog output (AO):	continues as it was before the mode change.
Digital input (DI):	operates when there is input.
Digital output (DO):	is forced OFF.

Note: For the K1G-C04MG and K1G-C04EG, network communication (K1G-C04MG: MECHATROLINK-III, K1GC04EG: EtherCAT) is available regardless of whether the device is in Run or Ready mode. However, since the settings might be changed accidentally, keep the controller in Run mode while the equipment is operating.

PARAMETER CONFIGURATION



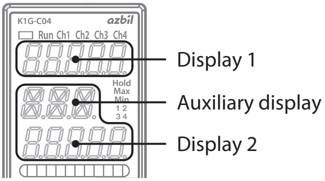
After switching to another column, the new column's [01] row is always displayed first.
Example: If [A03] is displayed and the column is changed to column B, [b01] is shown.
☞ P. 9-10 (for details)

4-2 Changing the Display

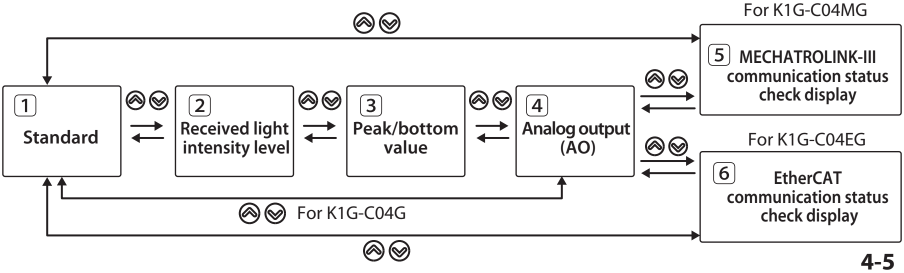
CHANGING THE TYPE OF DISPLAY

Run

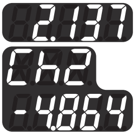
The contents of the display while the controller is in Run mode can be selected according to the intended use. There are four display types for the K1G-C04G, and five types for the K1G-C04MG and K1G-C04EG.



Display type	Display 1	Auxiliary display	Display 2
① Standard	The measured value for the selected channel Channels can be switched by pressing ○ Ch Select .	Shows which channel's measured value is shown on display 2.	Measured values of channels that are not selected on display 1.
② Received light intensity level		bAr	The bar graph shows the intensity of the light received on the selected channel.
③ Peak/bottom value		PE (peak)or bt (bottom)	The peak or bottom value for the selected channel
④ Analog output (AO)		Ao 1 Ex.: Channel 1	The analog output value for the selected channel
⑤ MECHATROLINK-III communication status check display (for K1G-C04MG only)		Con (connected) or - - - (not connected)	MECHATROLINK-III error status.
⑥ EtherCAT communication status check display (for K1G-C04EG only)		Indicates the state of EtherCAT communication or whether the link to ECAT IN is established.	Indicates a node address or whether the link to ECAT OUT is established.


For K1G-C04MG
① Standard
② Received light intensity level
③ Peak/bottom value
④ Analog output (AO)
⑤ MECHATROLINK-III communication status check display
For K1G-C04EG
⑥ EtherCAT communication status check display
For K1G-C04G

① Standard



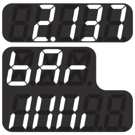
Display 1 shows the measured value from the selected channel. The auxiliary display shows the channel number of other channels, and display 2 shows measured values from these channels. If there are several unselected channels, the channels and measured values are switched automatically every 2 seconds. For the K1G-C04EG, the state of EtherCAT communication is also displayed. The display is the same as that explained in [6], "EtherCAT communication status check display." The display can be switched manually by pressing «/».

If no measurement parameters are assigned to channels other than the selected one:

· For the K1G-C04G and K1G-C04MG
The auxiliary display and display 2 show nothing.

· For the K1G-C04EG
The auxiliary display and display 2 show the state of EtherCAT communication.

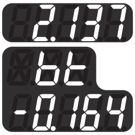
② Received light intensity level



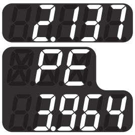
Display 1 shows the measured value from the selected channel. The auxiliary display says "bAr." The bar graph on Display 2 shows the intensity of light received during measurement.

For the meaning of the bars, ☞ refer to 3-6, "Receiver adjustment."
Note that the intensity of light received cannot be adjusted from this display.

③ Peak/bottom value

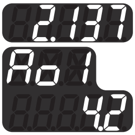


Display 1 shows the measured value from the selected channel. The auxiliary display and display 2 show the peak or bottom value. The peak and bottom values can be switched by pressing «/».

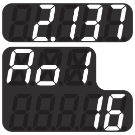


When the auxiliary display says "PE," display 2 shows the peak value. When the auxiliary display says "bt," display 2 shows the bottom value. Pressing ○ Back will clear the values.

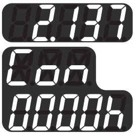
④ Analog output (AO)



Display 1 shows the measured value from the selected channel. The auxiliary display shows the terminal number of an analog output terminal. While measurement is in progress, display 2 shows the analog output (1.0–5.0 for voltage, 4–20 for current).



⑤ MECHATROLINK-III communication status check display (for K1G-C04MG only)



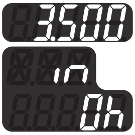
Display 1 shows the measured value from the selected channel. The auxiliary display shows the connection status of MECHATROLINK-III communication. When connected, "Con" is displayed. When disconnected, "- - -" is displayed. Display 2 shows the error status of MECHATORLINK-Ш communication.

For details on the error status, refer to K1G Series High-Accuracy Position Sensor MECHATROLINK-III Communication Manual (No. CP-SP-1386E).

⑥ EtherCAT communication status check display (for K1G-C04EG only)

Display 1 shows the measured value from the selected channel. The auxiliary display and display 2 show either the EtherCAT status*1 or link status.*2 Switch between them by pressing «/».

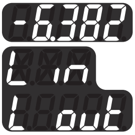
*1. EtherCAT status



The auxiliary display shows the status of EtheCAT communication. Display 2 shows the node address.

Auxiliary display	Description
in	The device is in the Init state.
Po	The device is in the Pre-Operational state.
So	The device is in the Safe-Operational state.
oP	The device is in the Operational state.
Ein	An error occurred in the Init state.
EPo	An error occurred in the Pre-Operational state.
ESo	An error occurred in the Safe-Operational state.
EoP	An error occurred in the Operational state.

*2. Link status



The auxiliary display shows whether the link to the RJ45 connector for ECAT IN is established. If the link is established, "L in" is displayed. If not, "- in" is displayed.

Display 2 shows whether the link to the RJ45 connector for ECAT OUT is established. If the link is established, "L out" is displayed. If not, "-out" is displayed.

CHANGING THE DISPLAY RESOLUTION

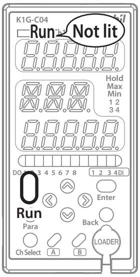
Ready

Changes the display of digits after the decimal point.

The display resolution applies to all channels.
This parameter cannot be changed for each channel.

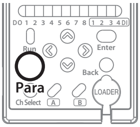
Procedure

1 Check that the mode is "Ready"



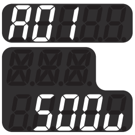
If "Run" is lit, press ▯ Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

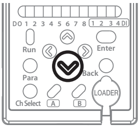


Press ○ Para.

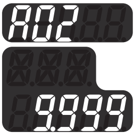
Display



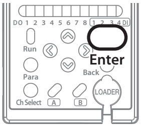
3 Select A02 (display resolution)



Select A02 by pressing ⌄.

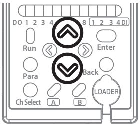


4 Enter A02



Press Enter to finalize your selection of A02.

5 Select the parameter

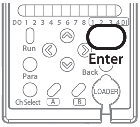


Select one of the following by pressing ▲/▼.

Parameter	Display range [mm]	Default setting
99.9	-99.9 to +99.9	
99.99	-99.99 to +99.99	
9.999	-9.999 to +9.999	✔
9.9999	0.0000 to 9.9999	

If 4 digits are shown after the decimal point, the display range is 0.0000 to 9.9999.
Note that the analog output (AO) range, and also the digital output (DO) threshold, are not changed automatically.

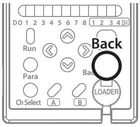
6 Finalize your parameter selection



Press Enter to finalize your selection.

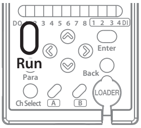
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

7 Exit the display for changing settings



Press ○ Back .

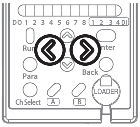
8 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

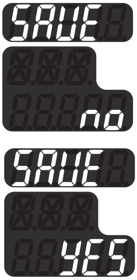


Choose whether to save by pressing 《/》.

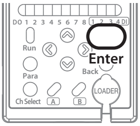
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



8-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

4-3 Changing the Measurement Settings

CHANGING THE MEASUREMENT MODE

Ready

The measurement mode can be selected from ten types according to the object type, the application, and the object's direction of approach.

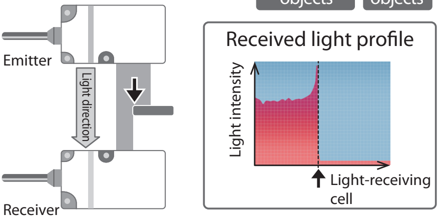
Measurement mode		Object type	Measurement orientation
1	Edge measurement	Opaque object	Top
2			Bottom
3		Transparent object	Top
4			Bottom
5	Width measurement	Opaque object	-
6	Gap measurement		-
7	Edge width measurement	Transparent object	Top
8			Bottom
9	Measurement of second edge		Top
10			Bottom

Edge measurement

Determining edge position

Transparent objects

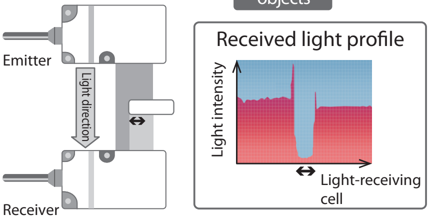
Opaque objects



Edge width measurement

Sensing the edge's status

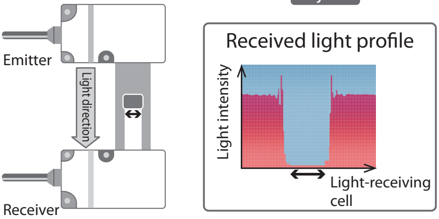
Transparent objects



Width measurement

Measuring blocked light width

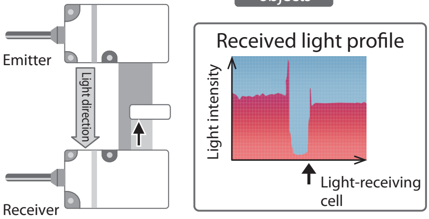
Opaque objects



Second edge measurement

Sensing the edge's status

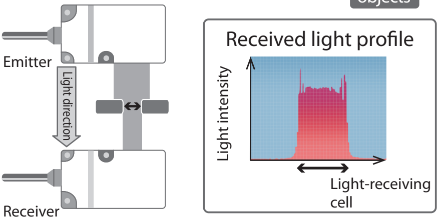
Transparent objects



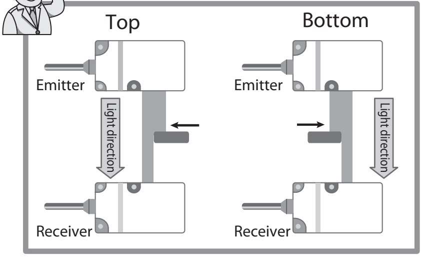
Gap measurement

Measuring width of light through gap

Opaque objects

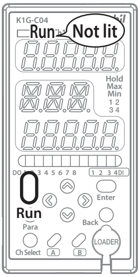


Measurement orientation



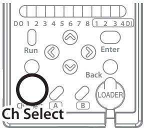
Procedure

1 Check that the mode is "Ready"



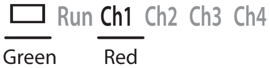
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



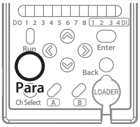
Select the channel No. by pressing Ch Select.

Display



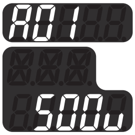
The number of the selected channel is lit.

3 Switch to the display for changing settings

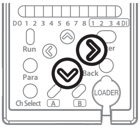


Press Para.

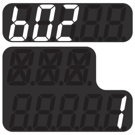
Display



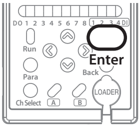
4 Select b02 (measurement mode)



Press ⊙ to select b01, and then press ⊙ to select b02.

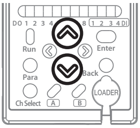


5 Enter b02



Press Enter to finalize your selection of b02.

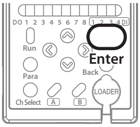
6 Select the parameter



Select one of the following by pressing ∧/∨.

Parameter	Measurement mode	Object type	Measurement orientation	Default setting
1	Edge measurement	Opaque object	Top	✔
2			Bottom	
3		Transparent object	Top	
4			Bottom	
5	Width measurement	Opaque object	-	
6	Gap measurement		-	
7	Edge width measurement	Transparent object	Top	
8			Bottom	
9	Measurement of second edge		Top	
10			Bottom	

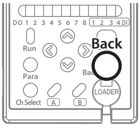
7 Finalize your parameter selection



Press Enter to finalize your selection.

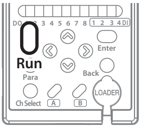
To change another setting, select the desired item by pressing ∧/∨ or «/».

8 Exit the display for changing settings



Press ○ Back .

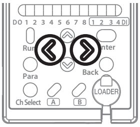
9 Start measuring



To start measuring, press ▯ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

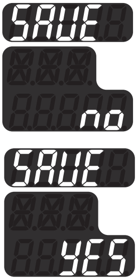


Choose whether to save by pressing ≪/≫.

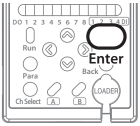
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring



Press ⬭ Enter to finalize your selection and start measuring.

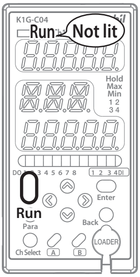
CHANGING THE MEASUREMENT CYCLE

Ready

The measurement cycle applies to all channels.
This parameter cannot be changed for each channel.

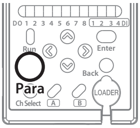
Procedure

1 Check that the mode is "Ready"



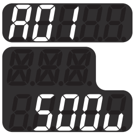
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select A01 (measurement cycle)

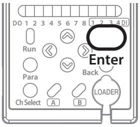


Press Para to select A01.

Display

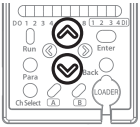


3 Enter A01



Press Enter to finalize your selection.

4 Select the parameter

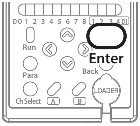


Select one of the following by pressing ⏶/⏷.

Parameter	Description	Default setting
500u	500 µs	✔
1000u	1 ms	

The list of selectable measurement cycles varies depending on the cable length.
☞ 7-2 Controllers (P. 7-5)

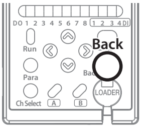
5 Finalize your parameter selection



Press Enter to finalize your selection.

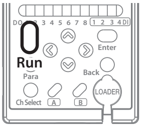
To change another setting, select the desired item by pressing ⏶/⏷ or ⏴/⏵.

6 Exit the display for changing settings



Press Back .

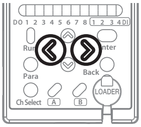
7 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

7-1 Choose whether to save the parameter

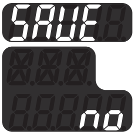


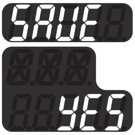
Choose whether to save by pressing 《/》.

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

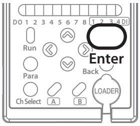
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





7-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

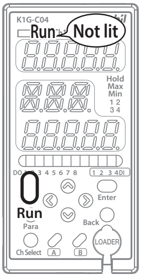
CHANGING THE NO. OF MOVING AVERAGES

Ready

A moving average is calculated from the measured data.
If more moving averages are calculated, the measurements become more reliable, but the response becomes slower.

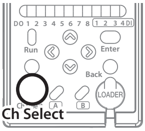
Procedure

1 Check that the mode is "Ready"



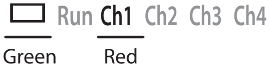
If "Run" is lit, press ⬯ **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



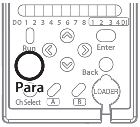
Select the channel No. by pressing ○ **Ch Select**.

Display



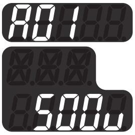
The number of the selected channel is lit.

3 Switch to the display for changing settings

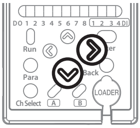


Press ○ **Para**.

Display

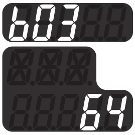


4 Select b03 (number of moving averages)



Press ▷ to select b01, and then press ▽ to select b03.

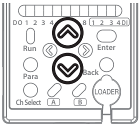
Display



5 Enter b03

Press Enter to finalize your selection of b03.

6 Set the parameter.

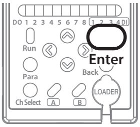


By pressing △/▽, select a value from 1–500.
Press ◁/▷ to move the cursor to another digit.

Parameter	Display range [mm]	Default setting
1–500	1–500 (in increments of 1)	64

If the parameter is set to 1, no moving average will be set.

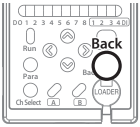
7 Finalize your parameter value selection



Press Enter to finalize your selection.

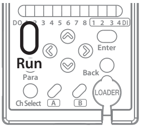
To change another setting, select the desired item by pressing △/▽ or ◁/▷.

8 Exit the display for changing settings



Press ○ **Back** .

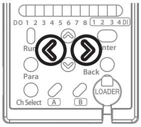
9 Start measuring



To start measuring, press ▯ **Run** for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

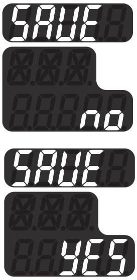


Choose whether to save by pressing ≪/≫.

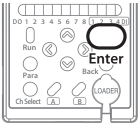
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring



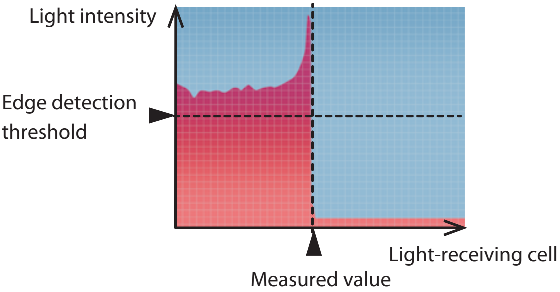
Press ⬭ **Enter** to finalize your selection and start measuring.

CHANGING THE EDGE DETECTION THRESHOLD

Ready

The edge detection threshold is used to judge whether or not light is blocked.
With the level of incoming light used for intensity adjustment as 100 %, if the amount of received light is less than the edge detection threshold, the light is judged to be blocked.

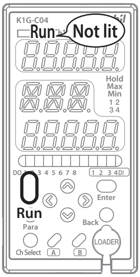
Received light profile



When the measurement mode (b02) is set (☞P. 4-11), the edge detection threshold is also automatically set.
For basic measurement, it is not necessary to change the edge detection threshold.
25 % for opaque objects
75 % for transparent objects

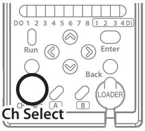
Procedure

1 Check that the mode is "Ready"



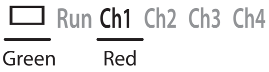
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



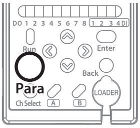
Select the channel No. by pressing ○ Ch Select.

Display



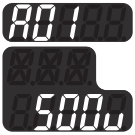
The number of the selected channel is lit.

3 Switch to the display for changing settings

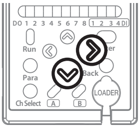


Press ○ Para.

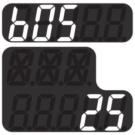
Display



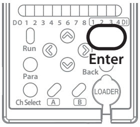
4 Select b05 (edge detection threshold)



Press 〉 to select b01, and then press ∨ to select b05.

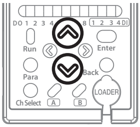


5 Enter b05



Press ⬭ Enter to finalize your selection of b05.

6 Set the parameter

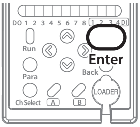


Press ⌃/⌄ to select a value from 5 to 95.

Parameter	Description	Object type	
		Opaque object	Transparent object
5-95	5–95 % (in increments of 1 %)	25	75

Press «/» to move the cursor to another digit.

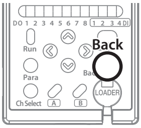
7 Finalize the parameter value



Press Enter to finalize the selected value.

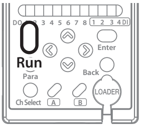
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

8 Exit the display for changing settings



Press Back.

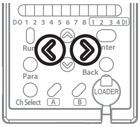
9 Start measuring



To start measuring, press **Run** for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

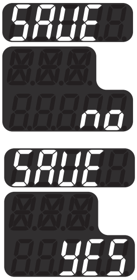


Choose whether to save by pressing « / ».

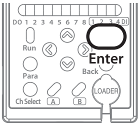
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring



Press **Enter** to finalize your selection and start measuring.

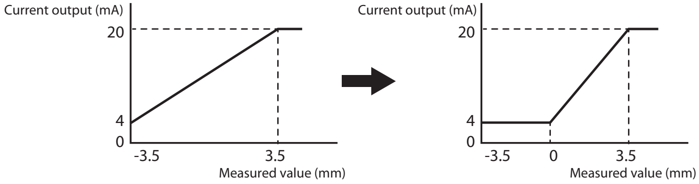
4-4 Changing the Analog Output (AO) Settings

CHANGING THE ANALOG OUTPUT (AO) RANGE

Ready

The analog output range can be changed.
By using this function to narrow the measurement range, it is possible to obtain analog output with better resolution. The AO corresponds to changes in the measured value.

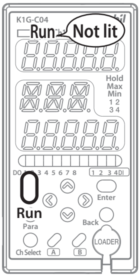
Example of AO output range change (for K1G-S07)



The analog output range can also be changed using the controller keys.
☞ 9-2 Configuration Flowcharts (P. 9-7)

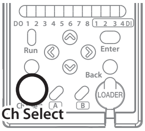
Procedure

1 Check that the mode is "Ready"



If "Run" is lit, press ▯ Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed

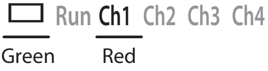


Select the channel No. by pressing ○ Ch Select.

Correspondence of channels and analog outputs

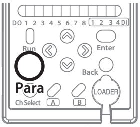
Channel	Analog output
Ch1	A01
Ch2	A02
Ch3	A03
Ch4	A04

Display



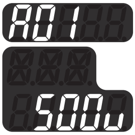
The number of the selected channel is lit.

3 Switch to the display for changing settings

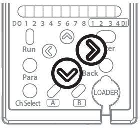


Press ○ Para .

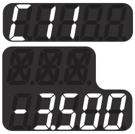
Display



4 Select C11 (analog output range low limit)

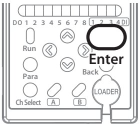


Press ▷ to select C01, and then press ▽ to select C11.



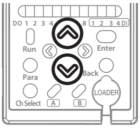
With K1G-S07

5 Enter C11



Press ⬭ Enter to finalize your choice of C11.

6 Set the parameter

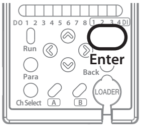


By pressing △/▽, select a value from -99.999–99.999.

Sensor heads	Parameter	Description	Default setting
K1G-S07	-99.999–99.999	−99.999 to +99.999 [mm] (in increments of 1 µm)	-3.500
K1G-S15	-99.999–99.999	−99.999 to +99.999 [mm] (in increments of 1 µm)	-7.500

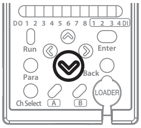
Press ◁/▷ to move the cursor to another digit.

7 Finalize your parameter selection

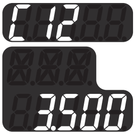


Press ⬭ Enter to finalize your parameter selection.

8 Select C 12 (analog output high limit)

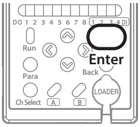


Press ∨ to select C 12.



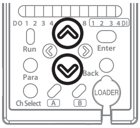
With K1G-S07 sensor

9 Enter C 12



Press ⬭ Enter to finalize your choice of C 12.

10 Set the parameter



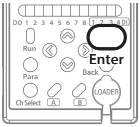
By pressing ∧/∨, select a value from -99.999–99.999.

Sensor heads	Parameter	Description	Default setting
K1G-S07	-99.999–99.999	–99.999 to +99.999 [mm] (in increments of 1 µm)	3.500
K1G-S15	-99.999–99.999	–99.999 to +99.999 [mm] (in increments of 1 µm)	7.500

Press «/» to move the cursor to another digit.

Set the parameters such that: C 11 (low limit) < C 12 (high limit)

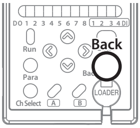
11 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

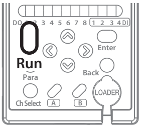
To change another setting, select the desired item by pressing ︽/︾ or «/».

12 Exit the display for changing settings



Press ○ Back .

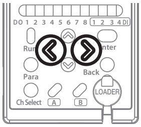
13 Start measuring



To start measuring, press ▯ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

13-1 Choose whether to save the parameter

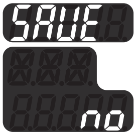


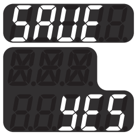
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

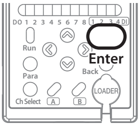
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





13-2 Finalize your selection and start measuring



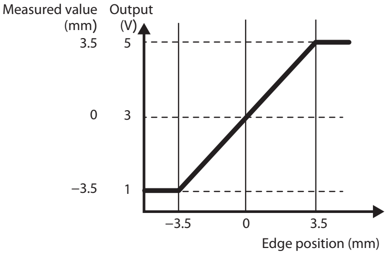
Press ⬭ Enter to finalize your selection and start measuring.

CHANGING THE ZERO ADJUSTMENT VALUE

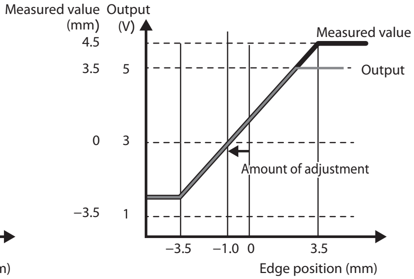
Ready **Run**

This function configures the zero point of measurement.

K1G-S07 (voltage output)
(zero adjustment value: 0.000 mm)



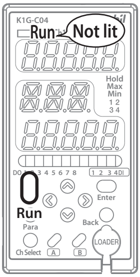
K1G-S07 (voltage output)
(zero adjustment value: -1.000 mm)



After the zero adjustment, change the analog output (AO) range so that the analog output correctly corresponds to the measured value.
☞P. 4-25
In addition, check the digital output (DO) high and low thresholds.

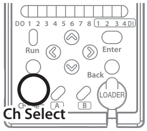
Procedure

1 Check that the mode is "Ready"



If "Run" is lit, press **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



Select the channel No. by pressing **Ch Select**.

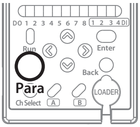
Display

▭ Run **Ch1** Ch2 Ch3 Ch4

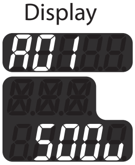
Green Red

The number of the selected channel is lit.

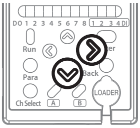
3 Switch to the display for changing settings



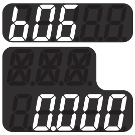
Press ○ Para .



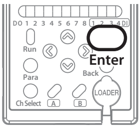
4 Select b06 (zero adjustment value)



Press (>) to select b01, and then press (∨) to select b06.

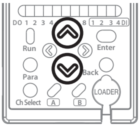


5 Enter b06



Press ⬭ Enter to finalize your choice of b06.

6 Set the parameter



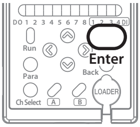
By pressing (∧)/(∨), select one of the following.

Sensor heads	Parameter	Description	Default setting
K1G-S07	-3.500–3.500	-3.500 to +3.500 [mm] (in increments of 1 µm)	0.000
K1G-S15	-7.500–7.500	-7.500 to +7.500 [mm] (in increments of 1 µm)	0.000

Press (<)/(>) to move the cursor to another digit.

With the K1G-S07, for a measurement range of 0.000– 7.000 [mm], set the parameter to 3.500.

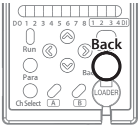
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.

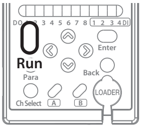
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

8 Exit the display for changing settings



Press Back .

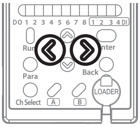
9 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

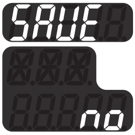


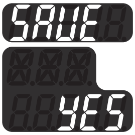
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

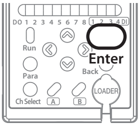
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





9-2 Finalize your selection and start measuring



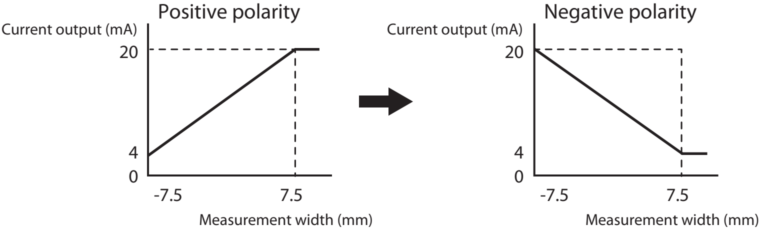
Press ⬭ Enter to finalize your selection and start measuring.

SETTING REVERSE POLARITY

Ready

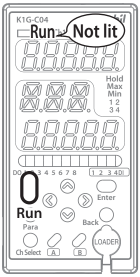
The analog output (AO) polarity can be reversed.

AO polarity example (for K1G-S15)



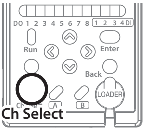
Procedure

1 Check that the mode is "Ready"



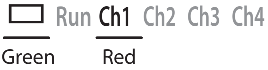
If "Run" is lit, press **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



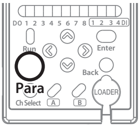
Select the channel No. by pressing **Ch Select**.

Display



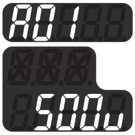
The number of the selected channel is lit.

3 Switch to the display for changing settings

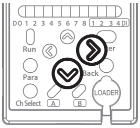


Press ○ Para .

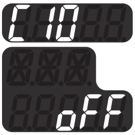
Display



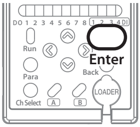
4 Select C 10 (analog output reverse polarity)



Press ▷ to select C0 1, and then press ▽ to select C 10.

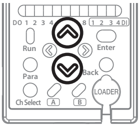


5 Enter C 10



Press ⬭ Enter to finalize your choice of C 10.

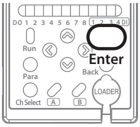
6 Set the parameter



Press △/▽ to select oFF or on.

Parameter	Description	Default setting
oFF	Disabled (positive polarity)	✔
on	Enabled (negative polarity)	

7 Finalize your parameter selection

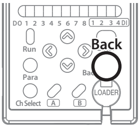


Press ⬭ Enter to finalize your parameter selection.

To change another setting, select the desired item by pressing ︽/︾ or «/».

8

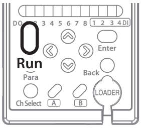
Exit the display for changing settings



Press ○ Back .

9

Start measuring

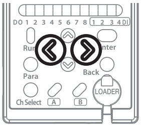


To start measuring, press ⬯ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1

Choose whether to save the parameter

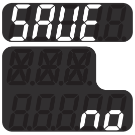


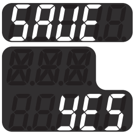
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

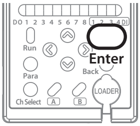
Display





9-2

Finalize your selection and start measuring



Press ⬭ Enter to finalize your selection and start measuring.

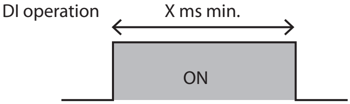
4-5 Using Digital Input (DI) and Digital Output (DO)

CHANGING DIGITAL INPUT (DI) SETTINGS

Up to 4 digital inputs can be used.
Channels and event types can be combined freely.

DI operation type	Operation
Zero adjustment input	When DI is turned ON, the zero point for measurement is changed. (☞Changing the zero adjustment value (P. 4-29))
Input for cancellation of EPS filter output hold	While DI is ON, EPS filter output hold is canceled. (☞Setting EPS filters (P. 4-83))
Input to forcibly cancel EPS filter output hold	When DI is turned ON, EPS filter output hold is forcibly canceled. (☞Setting EPS filters (P. 4-83))
Event log start input	When DI is turned ON, the event log function is activated. (☞Configuring the event log function (P. 4-95))
Input for PV hold	Used for the PV hold function. (☞ Configuring the PV hold function (P. 4-79))
Laser start input	While DI is ON, the laser beam is emitted. (☞ 9-7 Important Notes for Restarting the Laser Beam (P. 9-31))
Calculation OFF input	While DI is ON, calculation is suspended. Note: While DI is ON, the PV, AO, and DO are not updated.

DI operating conditions



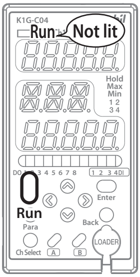
The minimum input time (X ms) varies
depending on the selected measurement cycle.
12 ms: when 500 μs is selected
24 ms: when 1 ms is selected

"PV" refers to the output after calculation.
☞ 9-3 Processing Flowchart (P. 9-12)

Procedure

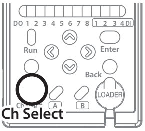
Ready

1 Check that the mode is "Ready"



If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

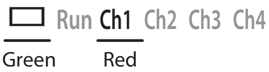
2 Select the channel whose settings will be changed



Select the channel No. by pressing Ch Select.

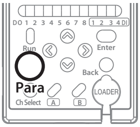
Channel	Digital input
Ch1	DI1
Ch2	DI2
Ch3	DI3
Ch4	DI4

Display



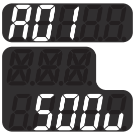
The number of the selected channel is lit.

3 Switch to the display for changing settings

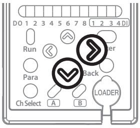


Press Para.

Display

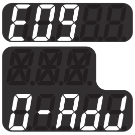


4 Select E09 (DI function selection)

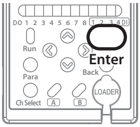


Press › to select E01, and then press ⌄ to select E09.

Display

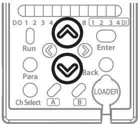


5 Enter E09



Press Enter to finalize your choice of E09.

6 Select the parameter



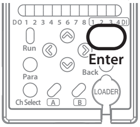
Press ▲/▼ to select one of the following parameters.

Parameter	Channel	Description	Default setting
0-AdJ	Specified channel	Zero adjustment input	✔
EPS		Input to cancel EPS filter output hold	
PV-h		Input for PV hold	
ALL 0-AdJ	All channels	Zero adjustment input	
ALL EPS		Input to cancel EPS filter output hold	
ALL PV-h		Input for PV hold	
ALL F-EPS		Input to forcibly cancel EPS filter output hold	
ALL Ld-on		Laser start input	
ALL do-oF		Calculation OFF input	
ALL LoG		Event log start input	

! Handling Precautions

- When using all-channel EPS filter output hold cancellation input (DI) to cancel the EPS filter on all channels, do not assign EPS hold cancellation input to another DI also.
- When using all-channel PV hold input (DI), do not assign PV hold input to another DI also.
- If the laser start input is assigned to multiple DIs, the laser beam will be emitted only when all of those DIs are ON.
- If calculation OFF input is assigned to multiple DIs, calculation will be stopped if any one of those DIs is ON.

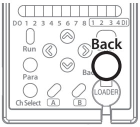
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.

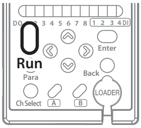
To change another setting, select the desired item by pressing ⮝/⮟ or ⮜/⮞.

8 Exit the display for changing settings



Press ○ Back .

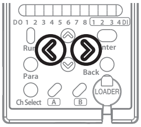
9 Start measuring



To start measuring, press ⬯ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

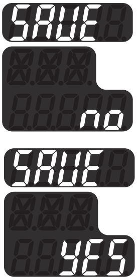


Choose whether to save by pressing ⮜/⮞.

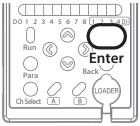
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring

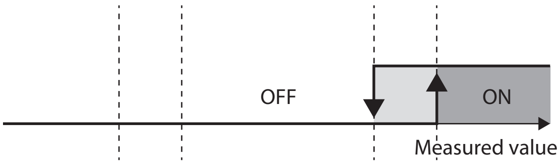
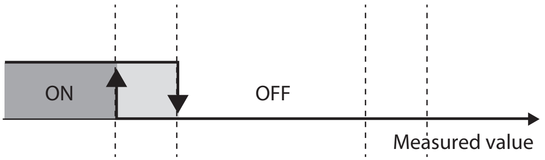
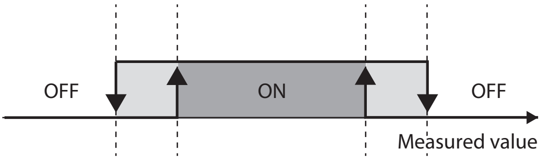
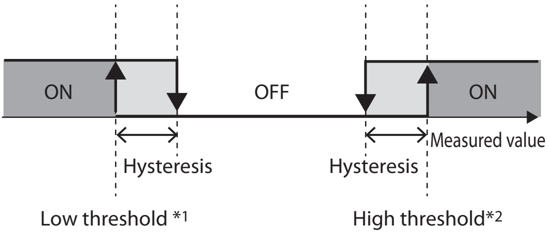


Press ⬭ Enter to finalize your selection and start measuring.

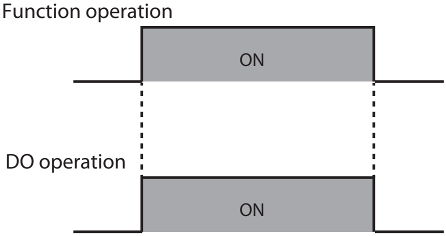
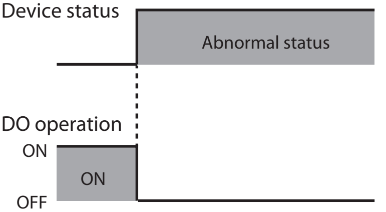
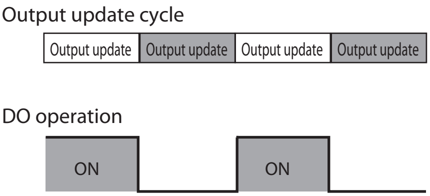
DIGITAL OUTPUTS (DO)

Up to 8 digital outputs can be used.
Channels and event types can be combined freely.

● Using outputs during measurement

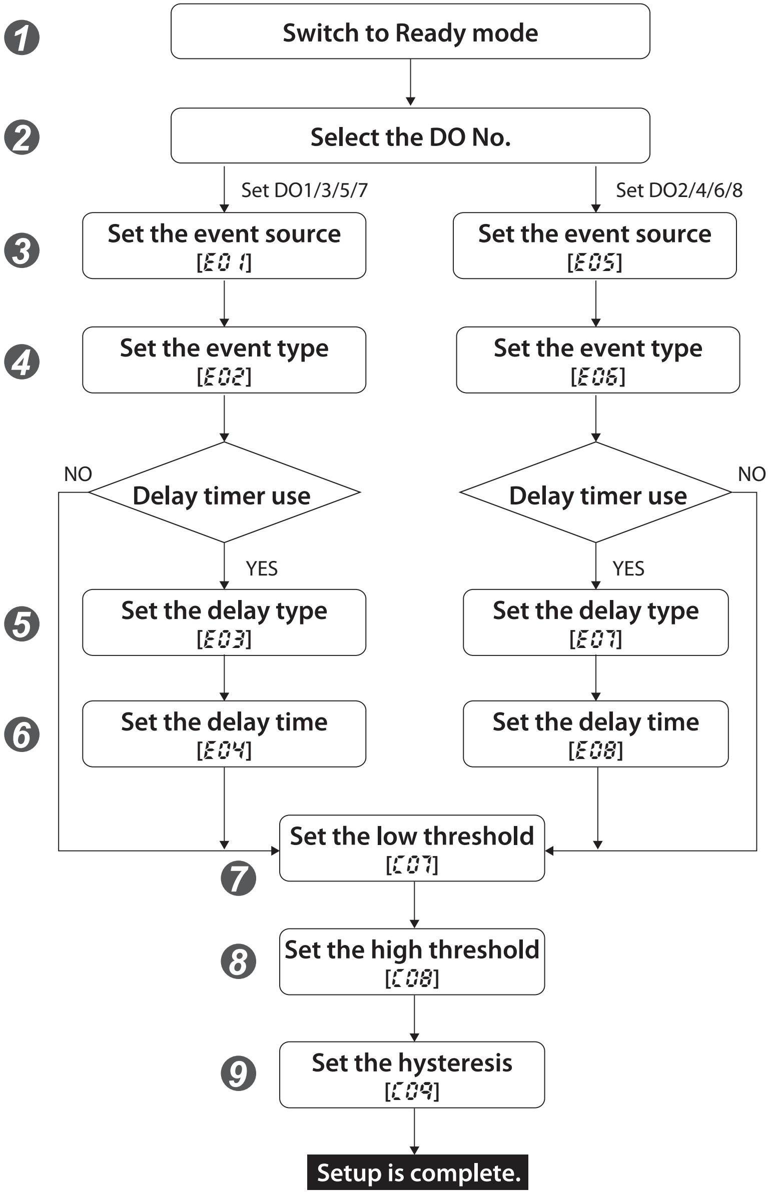
DO operation type	Operation image	Setting method
High		☞ P. 4-42
Low		
Pass		
Out	 ON OFF ON Measured value Hysteresis Hysteresis Low threshold *1 High threshold*2 *1. DO changes when the measured value is less than the low threshold. *2. DO changes when the measured value is greater than the high threshold.	

● Using special outputs

DO operation type	Operation diagram	Setting method
Smudge detection ☞P. 4-90		☞P. 4-53
EPS event ☞P. 4-83		
"Hold" state ☞P. 4-79		
Normal operation In the event of a controller error or sensor head disconnection, the output will turn OFF.	 Device status Abnormal status DO operation ON ON OFF If an error occurs, the OFF-state continues until power is again supplied and normal operation resumes.	
Output update cycle DO turns ON and OFF repeatedly as analog and digital output is updated.	 Output update cycle Output update Output update Output update Output update DO operation ON ON	

SETTING THE DIGITAL OUTPUT (DO) OPERATION TYPE: HIGH/LOW/PASS/OUT

Configuration flowchart

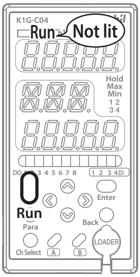


Switch to Ready mode

Procedure

Ready

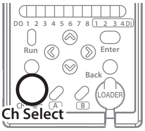
1 Check that the mode is "Ready"



If "Run" is lit, press **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

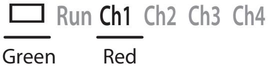
Select the DO No.

2 Select the digital output (channel) No.



Select the channel No. by pressing **Ch Select**.

Display

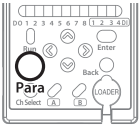


The number of the selected channel is lit.

Correspondence of channels and DO numbers

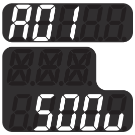
Channel	Selectable digital outputs	
Ch1	DO1	DO2
Ch2	DO3	DO4
Ch3	DO5	DO6
Ch4	DO7	DO8

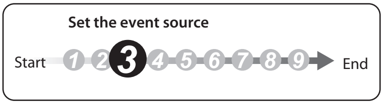
3 Switch to the display for changing settings



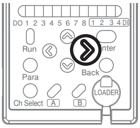
Press **Para**.

Display

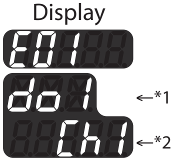


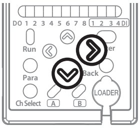


4 Select EO1 or EO5 (event source)

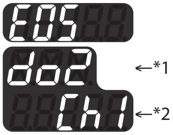


To select EO1,
press » to display EO1.



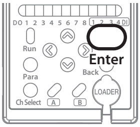


To select EO5,
press » to select EO1, and then press ︾ to display EO5.



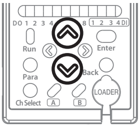
*1. The selected No. is displayed.
*2. The selected channel is displayed.

5 Enter EO1 (or EO5)



Press ⬭ Enter to finalize your choice of EO1/EO5.

6 Select the parameter

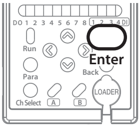


Select one of the following by pressing ︽/︾.

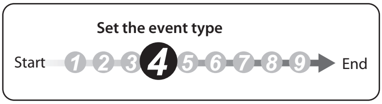
Parameter	Description
Com	All channels (OR output)
Ch1	Ch1 (for PV1)
Ch2	Ch2 (for PV2)
Ch3	Ch3 (for PV3)
Ch4	Ch4 (for PV4)

The default selection is the channel selected in step 2 above.

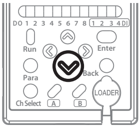
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.



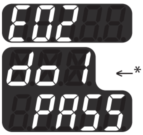
8 Select E02 or E06 (event type)

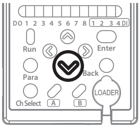


To select E02,

press ⌄.

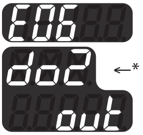
Display





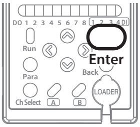
To select E06,

press ⌄.



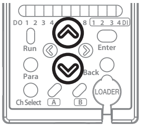
*The selected No. is displayed.

9 Enter E02 (or E06)



Press Enter to finalize your choice of E02 or E06.

10 Select the parameter

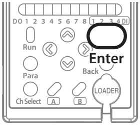


Select one of the following by pressing ⌃/⌄.

Parameter	Description	Default setting
PASS	Pass	✔ (E02)
out	Out	✔ (E06)
hi	High	
Lo	Low	
EPS	EPS event	
hoLd	Holding	
LiGht	Smudge	
triG	Output update	
GoinG	Normal operation	

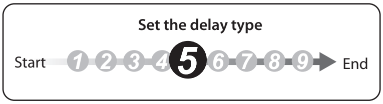
▨ Do not select shaded parameters.

11 Finalize your parameter selection

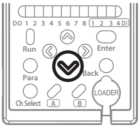


Press Enter to finalize your parameter selection.

To use the delay timer, go to step 12.
If it is not used, go to step 20 (☞ P. 4-49).

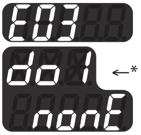


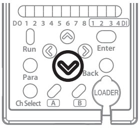
12 Select E03 or E07 (delay setting)



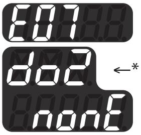
To select E03,
press ∨.

Display



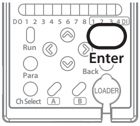


To select E07,
press ∨.



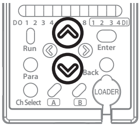
*The selected No. is displayed.

13 Finalize your parameter selection



Press Enter to finalize your parameter selection.

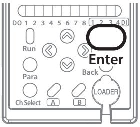
14 Select the parameter



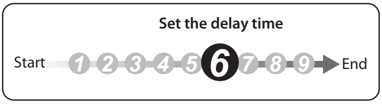
Select one of the following by pressing ▲/▼.

Parameter	Description	Default setting
nonE	No timer	✔
on-d	ON-delay timer	
oF-d	OFF-delay timer	

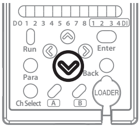
15 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

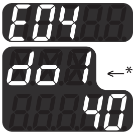


16 Select E04 or E08 (delay time)

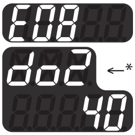


To select E04,
press ▼.

Display

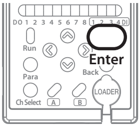


To select E08,
press ▼.



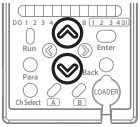
*The selected No. is displayed.

17 Enter E04 (or E08)



Press Enter to finalize your choice of E04 or E08.

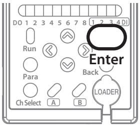
18 Select the parameter



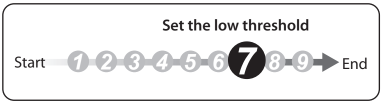
Select one of the following by pressing ▲/▼.

Parameter	Description	Default setting
10	10 ms	
20	20 ms	
30	30 ms	
40	40 ms	✔
50	50 ms	
60	60 ms	
70	70 ms	

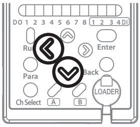
19 Finalize your parameter selection



Press Enter to finalize your parameter selection.

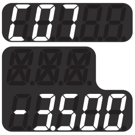


20 Select C07 (low threshold)

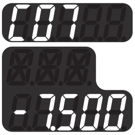


Press « to select C01, and then press ∨ to select C07.

Display

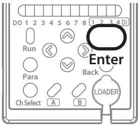


With K1G-S07 sensor



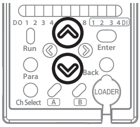
With K1G-S15 sensor

21 Enter C07



Press Enter to finalize your choice of C07.

22 Set the parameter

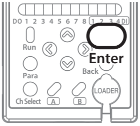


By pressing ∧/∨, select a value from -99.999–99.999.

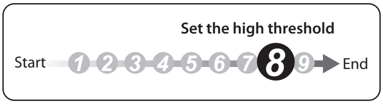
Sensor heads	Parameter	Description	Default setting
K1G-S07	-99.999–99.999	-99.999 to +99.999 [mm] (in increments of 1 µm)	-3.500
K1G-S15	-99.999–99.999	-99.999 to +99.999 [mm] (in increments of 1 µm)	-7.500

Press «/» to move the cursor to another digit.

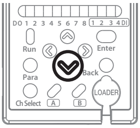
23 Finalize your parameter selection



Press Enter to finalize your parameter selection.

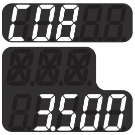


24 Select C08 (high threshold)

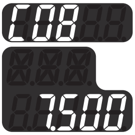


Press ▽ to select C08.

Display

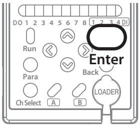


With K1G-S07 sensor



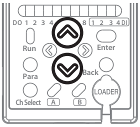
With K1G-S15 sensor

25 Enter C08



Press ⬭ Enter to finalize your choice of C08.

26 Set the parameter

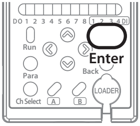


By pressing △/▽, select a value from -99.999–99.999.

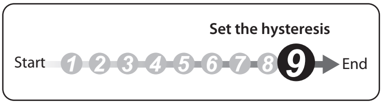
Sensor heads	Parameter	Description	Default setting
K1G-S07	-99.999–99.999	-99.999 to +99.999 [mm] (in increments of 1 µm)	3.500
K1G-S15	-99.999–99.999	-99.999 to +99.999 [mm] (in increments of 1 µm)	7.500

Press ◁/▷ to move the cursor to another digit.

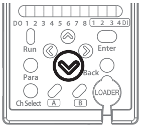
27 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

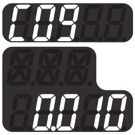


28 Select C09 (hysteresis)

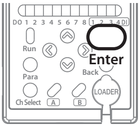


Press ▽ to select C09.

Display

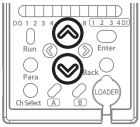


29 Enter C09



Press Enter to finalize your choice of C09.

30 Set the parameter

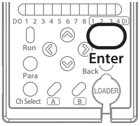


By pressing △/▽, select a value from 0.010- 1.000.

Parameter	Description	Default setting
0.010– 1.000	Settable in increments of 1 µm	0.010

Press ◁/▷ to move the cursor to another digit.

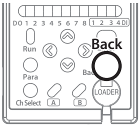
31 Finalize your parameter selection



Press Enter to finalize your parameter selection.

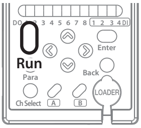
To change another setting, select the desired item by pressing ︽/︾ or «/».

32 Exit the display for changing settings



Press Back .

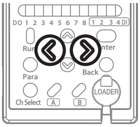
33 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

33-1 Choose whether to save the parameter

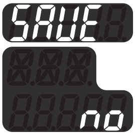


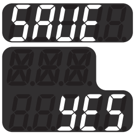
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

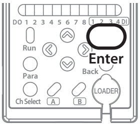
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





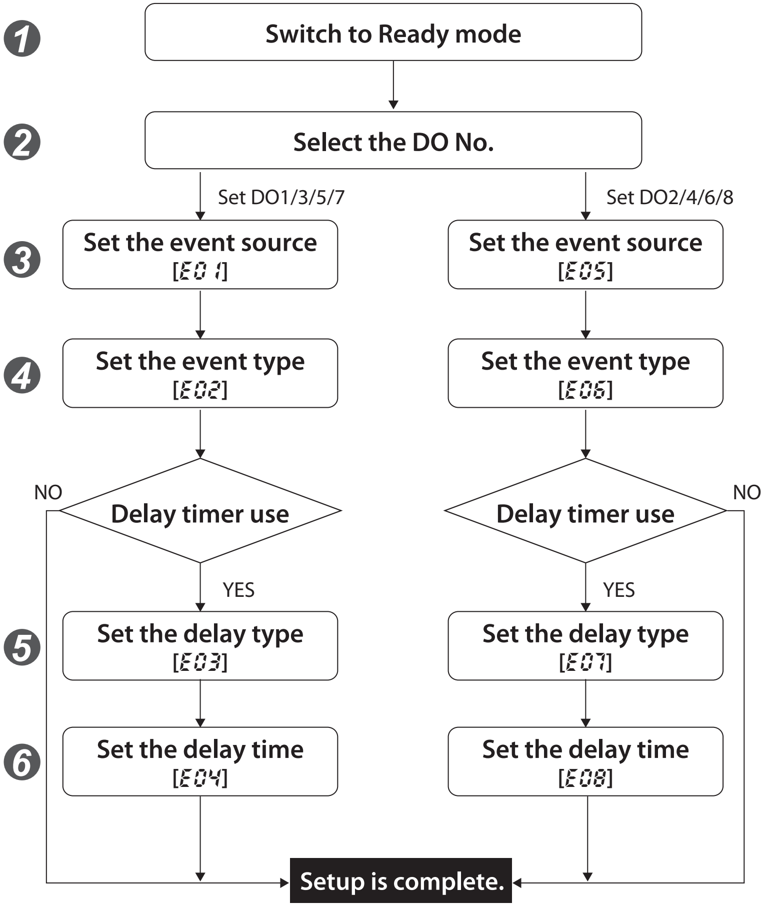
33-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

SETTING SPECIAL OUTPUTS

Configuration flowchart



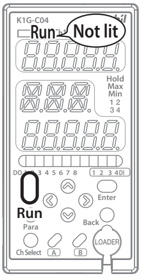
Switch to Ready mode

Start 1 2 3 4 5 6 End

Ready

Procedure

1 Check that the mode is "Ready"

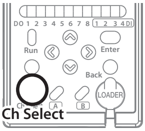


If "Run" is lit, press **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

Select the DO No.

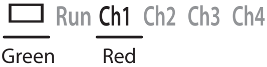
Start 1 2 3 4 5 6 End

2 Select the digital output (channel) No.



Select the channel No. by pressing **Ch Select**.

Display

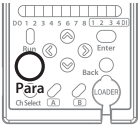


The number of the selected channel is lit.

Correspondence of channels and DO numbers

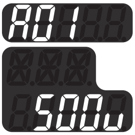
Channel	Selectable digital outputs	
Ch1	DO1	DO2
Ch2	DO3	DO4
Ch3	DO5	DO6
Ch4	DO7	DO8

3 Switch to the display for changing settings



Press **Para**.

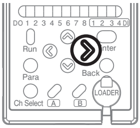
Display



Set the event source

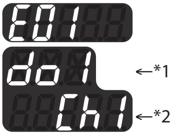
Start 1 2 **3** 4 5 6 End

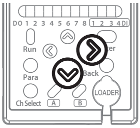
4 Select E01 or E05 (event source)



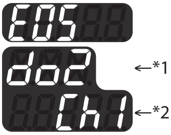
To select E01,
press ▷ to display E01.

Display



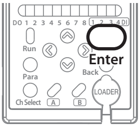


To select E05,
press ▷ to select E01, and then press ∨ to display E05.



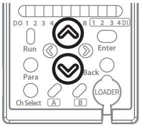
*1. The selected No. is displayed.
*2. The selected channel is displayed.

5 Enter E01 (or E05)



Press ⬭ Enter to finalize your choice of E01/E05.

6 Select the parameter

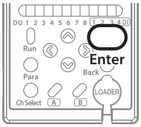


Select one of the following by pressing ∧/∨.

Parameter	Description
Com	All channels (OR output)
Ch1	Ch1 (for PV1)
Ch2	Ch2 (for PV2)
Ch3	Ch3 (for PV3)
Ch4	Ch4 (for PV4)

The default selection is the channel selected in step 2 above.

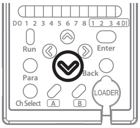
7 Finalize your parameter selection



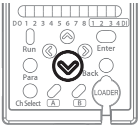
Press Enter to finalize your parameter selection.

Set the event type
Start
1
2
3
4
5
6
End

8 Select E02 or E06 (event type)

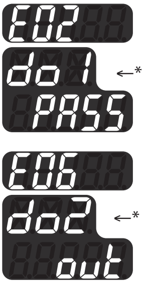


To select E02,
press ▽.



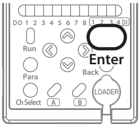
To select E06,
press ▽.

Display



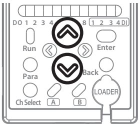
*The selected No. is displayed.

9 Enter E02 (or E06)



Press Enter to finalize your choice of E02 or E06.

10 Select the parameter

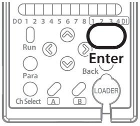


Select one of the following by pressing △/▽.

Parameter	Description	Default setting
PASS	Pass	✔ (E02)
out	Out	✔ (E06)
hi	High	
Lo	Low	
EPS	EPS event	
hoLd	Holding	
LiGht	Smudge	
triG	Output update	
GoinG	Normal operation	

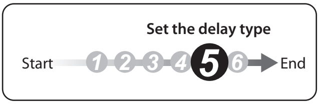
▨ Do not select shaded parameters.

11 Finalize your parameter selection

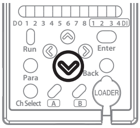


Press Enter to finalize your parameter selection.

To use the delay timer, go to step **12**.
If the timer is not needed, setting is complete.

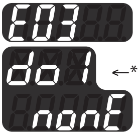


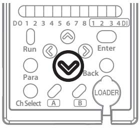
12 Select E03 or E07 (delay setting)



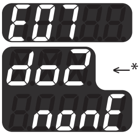
To select E03,
press ∨.

Display



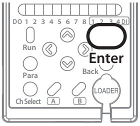


To select E07,
press ∨.



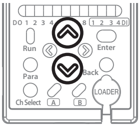
*The selected No. is displayed.

13 Finalize your parameter selection



Press Enter to finalize your parameter selection.

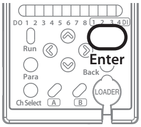
14 Select the parameter



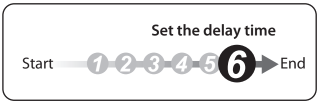
Select one of the following by pressing ⌃/⌄.

Parameter	Description	Default setting
nonE	No timer	✔
on-d	ON-delay timer	
oF-d	OFF-delay timer	

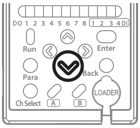
15 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

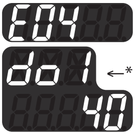


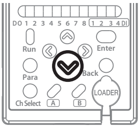
16 Select E04 or E08 (delay time)



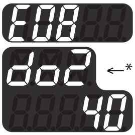
To select E04,
press ⌄.

Display



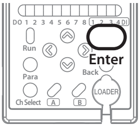


To select E08,
press ⌄.



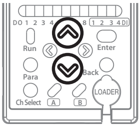
*The selected No. is displayed.

17 Enter E04 (or E08)



Press Enter to finalize your choice of E04 or E08.

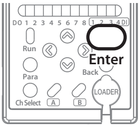
18 Select the parameter



Select one of the following by pressing ⌃/⌄.

Parameter	Description	Default setting
10	10 ms	
20	20 ms	
30	30 ms	
40	40 ms	✔
50	50 ms	
60	60 ms	
70	70 ms	

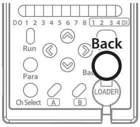
19 Finalize your parameter selection



Press Enter to finalize your parameter selection.

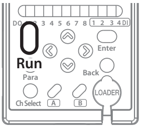
To change another setting, select the desired item by pressing ⌃/⌄ or ‹/›.

20 Exit the display for changing settings



Press Back .

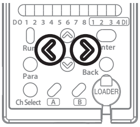
21 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

21-1 Choose whether to save the parameter

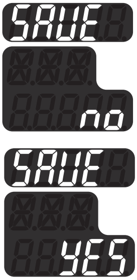


Choose whether to save by pressing ≪/≫.

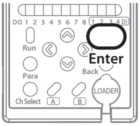
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



21-2 Finalize your selection and start measuring

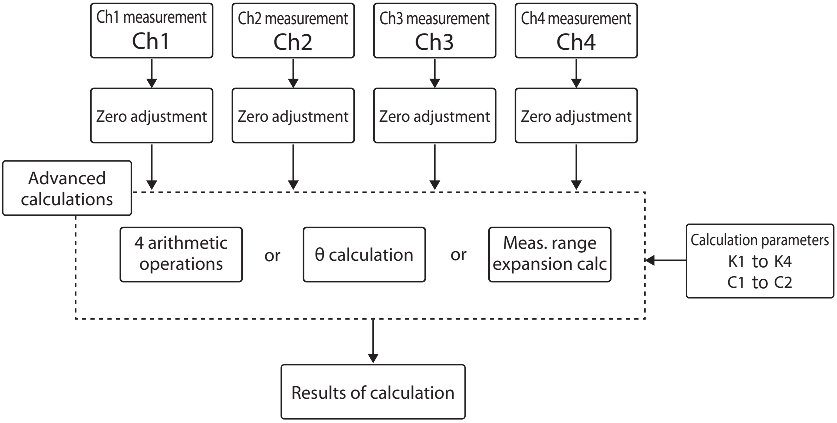


Press Enter to finalize your selection and start measuring.

4-6 Calculations that Use Measured Data

OVERVIEW OF CALCULATIONS

The controller can execute various calculations based on the measured data from the channels.



Handling Precautions

- The following calculations are not possible with a measurement cycle of 250 µs. If this speed is specified, the controller will perform no calculation.
  - θ calculation
  - Measurement range expansion calculation

If advanced calculations are used, check the analog output (AO) range and the high and low thresholds for digital output (DO).

SETUP OF THE FOUR ARITHMETIC OPERATIONS

Ready

The basic arithmetic operations can be executed on the measured data from 4 channels after their zero point has been adjusted.

These operations are used for width measurement of a workpiece, averaging of channel data, etc.

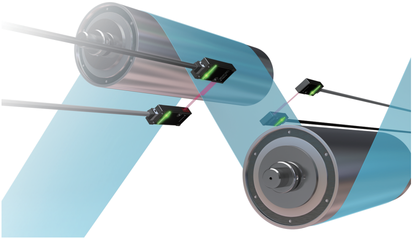
The basic arithmetic operations use the following formula:

$$\frac{(K1 \times Ch1 + K2 \times Ch2 + K3 \times Ch3 + K4 \times Ch4)}{C2} + C1$$

Ch1–Ch4: Measured values from channels
K1–K4: Multiplier
C1: Addition/subtraction parameter
C2: Division parameter

Parameter samples

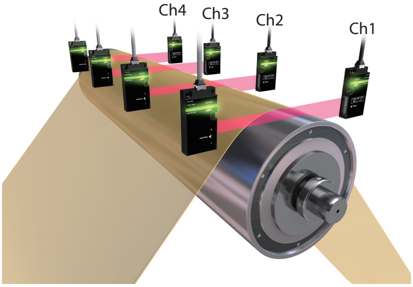
Calculating variations in workpiece width using two sensors



K1: -1
K2: -1
K3: 0
K4: 0
C1: 0.000
C2: 1

Note: Channels 1 & 2 are used.

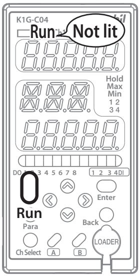
Calculating the average of channels 2, 3, and 4 and the difference between the average and channel 1.



K1: 3
K2: -1
K3: -1
K4: -1
C1: 0.000
C2: 3

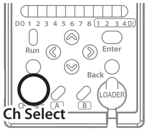
Procedure

1 Check that the mode is "Ready"



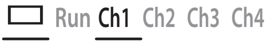
If "Run" is lit, press ▯ **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



Select the channel No. by pressing ○ **Ch Select**.

Display

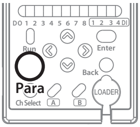


Green Red

The number of the selected channel is lit.

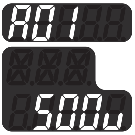
If channel 1 is selected, analog output 1 is set.

3 Switch to the display for changing settings

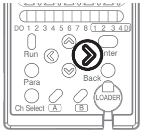


Press ○ **Para**.

Display

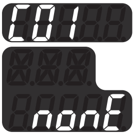


4 Select C01 (inter-channel calculation)

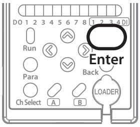


Press ⊙ to select C01.

Display

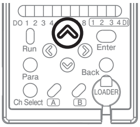


5 Enter C01



Press Enter to finalize your choice of C01.

6 Select parameter F-4Ch

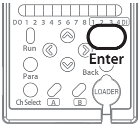


Select F-4Ch by pressing ⋀.

Parameter	Description	Default setting
none	Disabled	✔
F-4Ch	Four arithmetic operations	
F-AnG	θ calculation	
F-Eht	Measurement range expansion calculation	

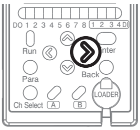
▨ Do not select shaded parameters.

7 Finalize your parameter selection



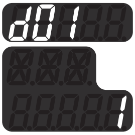
Press Enter to finalize your parameter selection.

8 Select d01 (calculation parameter K1)

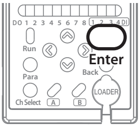


Press ≫ to select d01.

Display

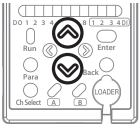


9 Enter d01



Press Enter to finalize your choice of d01.

10 Set the parameter

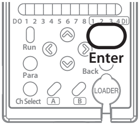


Set a value from -1000–1000 by pressing ▲/▼.

Item	Parameter	Description	Default setting
d01	-1000–1000	K1: Multiplier for Ch1	1

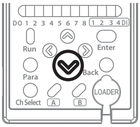
◀/▶ to move the

11 Finalize your parameter selection



Press Enter to finalize your parameter selection.

12 Set d02–d06 (calculation parameters K2, K3, K4, C1, C2)

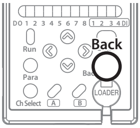


For the setup procedure, see steps **8–11** for d01.
In step **8**, press ▼ to select d02–d06.

Item	Parameter	Description	Default setting
d02	-1000–1000	K2: Multiplier for Ch2	1
d03	-1000–1000	K3: Multiplier for Ch3	1
d04	-1000–1000	K4: Multiplier for Ch4	1
d05	-9.999–9.999	C1: Addition-subtraction parameter	0.000
d06	1–10000	C2: Division parameter	4

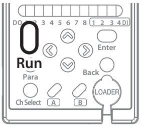
To change another setting, select the desired item by pressing ︽/︾ or 《/》.

13 Exit the display for changing settings



Press ○ Back .

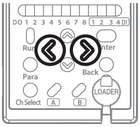
14 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

14-1 Choose whether to save the parameter

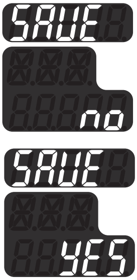


Choose whether to save by pressing 《/》.

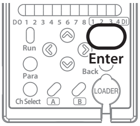
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



14-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

SETUP OF Θ CALCULATION

Ready

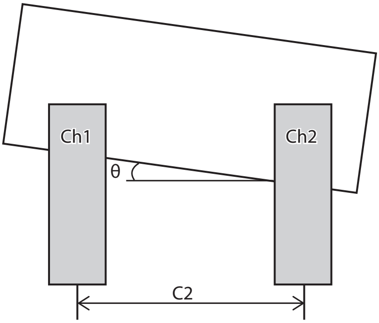
The tilt angle (θ) of the edge is calculated from edge position measurement by sensor heads on two channels.

θ calculation can be done with channels 1 and 2 or with channels 3 and 4. θ calculation uses the following formula:

Channels 1 and 2

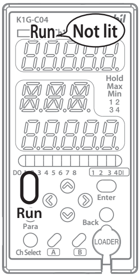
$$\theta = K1\times\frac{180}{\pi}\times\ \tan^{-1}\left(\frac{Ch1-Ch2}{C2}\right)$$

Ch1, Ch2: Measured values
K1: Multiplier for angle
C2: Distance between channel 1 and 2 sensors



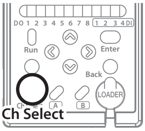
Procedure

1 Check that the mode is "Ready"



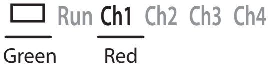
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



Select the channel No. by pressing ○ Ch Select.

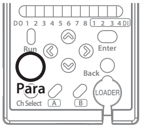
Display



The number of the selected channel is lit.

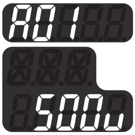
This function can be used for channels 2 and 4 only.
If channel 1 or 3 is selected, nothing is displayed for the parameter setting.

3 Switch to the display for changing settings

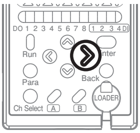


Press ○ Para.

Display

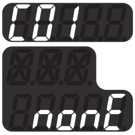


4 Select C01 (inter-channel calculation)

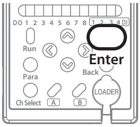


Press ⟩ to select C01.

Display

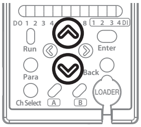


5 Enter C01



Press ⬭ Enter to finalize your choice of C01.

6 Select parameter F-AnG

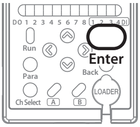


Select F-AnG by pressing ▲/▼.

Parameter	Description	Default setting
nonE	Disabled	✔
F-4Ch	Four arithmetic operations	
F-AnG	θ calculation (channels 2 or 4 only can be selected)	
F-EHt	Measurement range expansion calculation	

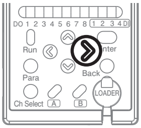
▨ Do not select shaded parameters.

7 Enter parameter F-AnG



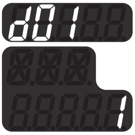
Press Enter to finalize your parameter selection.

8 Select d01 (calculation parameter K1)

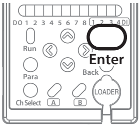


Press ▶ to select d01.

Display

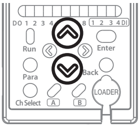


9 Enter d01



Press Enter to finalize your choice of d01.

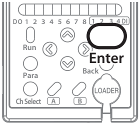
10 Set the parameter



Set a value from -1000–1000 by pressing ⌃/⌄.
Press «/» to move the cursor to another digit.

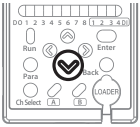
Item	Parameter	Description	Default setting
d01	-1000–1000	K1: Multiplier parameter for angle	1

11 Finalize your parameter selection



Press Enter to save it.

12 Set d06 (calculation parameter C2)

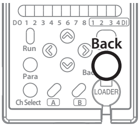


For the setup procedure, see steps **8**–**11** for d01.
In step **8**, press ⌄ to select d06.

Item	Parameter	Description	Default setting
d06	1–10000	C2: Distance between sensors	4

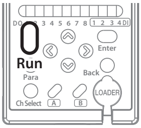
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

13 Exit the display for changing settings



Press Back .

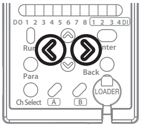
14 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

14-1 Choose whether to save the parameter

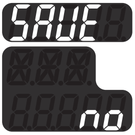


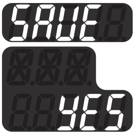
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

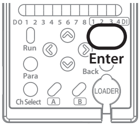
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





14-2 Finalize your selection and start measuring



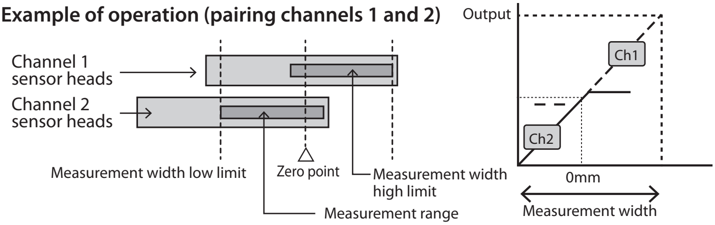
Press Enter to finalize your selection and start measuring.

SETTING THE MEASUREMENT RANGE EXPANSION CALCULATION

Ready

Output to expand the measurement range is calculated from edge position measurements by two pairs of sensor heads. This function is used for measuring a width of 15 mm or more.
The measurement range expansion calculation can be done using channels 1 & 2 or using channels 3 & 4.

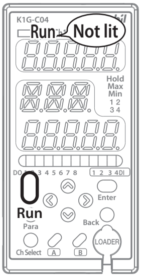
Example of operation (pairing channels 1 and 2)



After installation of the sensor heads, executing zero adjustment for both channels is necessary to set the zero points for measurement.
☞ Changing the zero adjustment value (P. 4-29)

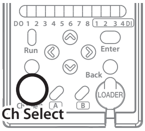
Procedure

1 Check that the mode is "Ready"



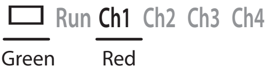
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



Select the channel No. by pressing Ch Select .

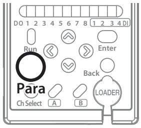
Display



The number of the selected channel is lit.

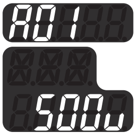
This function uses channels 2 or 4 only.
If channel 1 or 3 is selected, nothing is displayed for the parameter setting.

3 Switch to the display for changing settings

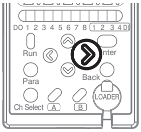


Press ○ Para.

Display

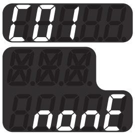


4 Select C01 (inter-channel calculation)

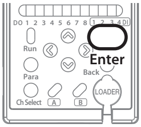


Press » to select C01.

Display

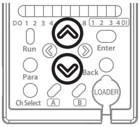


5 Enter C01



Press ⬭ Enter to finalize your choice of C01.

6 Select parameter F-EHt

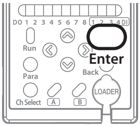


Select F-EHt by pressing ⌃/⌄.

Parameter	Description	Default setting
nonE	Disabled	✔
F-4Ch	Four arithmetic operations	
F-AnG	θ calculation	
F-EHt	Measurement range expansion calculation (channels 2 or 4 only can be selected)	

▨ Do not select shaded parameters.

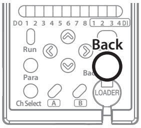
7 Enter F-EHt



Press ⬭ Enter to finalize your selection.

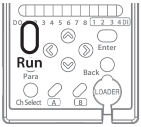
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

8 Exit the display for changing settings



Press ○ Back .

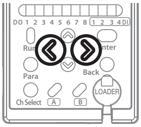
9 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

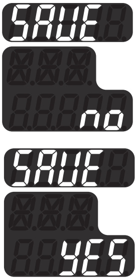


Choose whether to save by pressing ≪/≫.

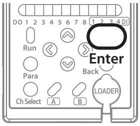
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring



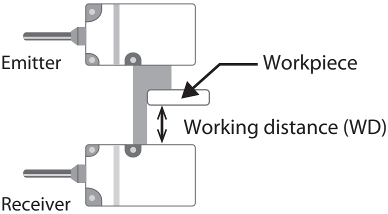
Press Enter to finalize your selection and start measuring.

4-7 Using Special Functions

SETTING A WORKING DISTANCE (WD)

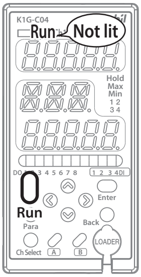
Ready

This function can be used for future K1G products. It will not improve the accuracy of position measurement if it is used with model K1G-S07 or K1G-S15.



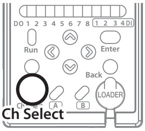
Procedure

1 Check that the mode is "Ready"



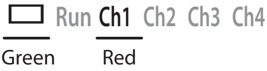
If "Run" is lit, press ⬯ **Run** for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



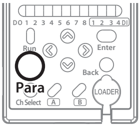
Select the channel No. by pressing ○ **Ch Select**.

Display



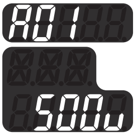
The number of the selected channel is lit.

3 Switch to the display for changing settings

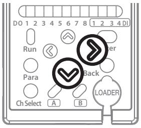


Press ○ **Para**.

Display

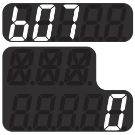


4 Select b07 (working distance)

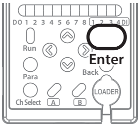


Press (>) to select b01, and then press (∨) to select b07.

Display

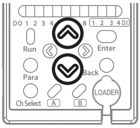


5 Enter b07



Press Enter to finalize your choice of b07.

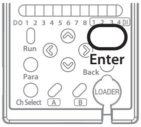
6 Set the parameter



Set one of the following by pressing (∧)/(∨).

Sensor head	Parameter	Description	Default setting
All models	0–9	Disabled	0
K1G-S07	10–500	10–500 [mm] (set in increments of 1 mm)	-
K1G-S15	10–1500	10–1500 [mm] (set in increments of 1 mm)	-

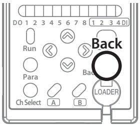
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.

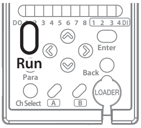
To change another setting, select the desired item by pressing ︽/︾ or «/».

8 Exit the display for changing settings



Press ○ **Back** .

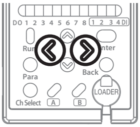
9 Start measuring



To start measuring, press ⬯ **Run** for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

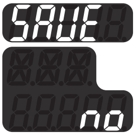


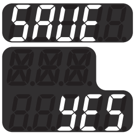
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

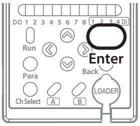
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





9-2 Finalize your selection and start measuring



Press ⬭ **Enter** to finalize your selection and start measuring.

CONFIGURING THE PV HOLD FUNCTION

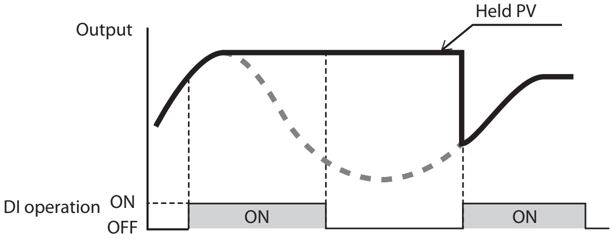
Ready

When the PV hold input is set for a digital input (DI), if the digital input is ON, the PV is held at the maximum (or minimum) value whenever it is updated.
If the digital input (DI) turns OFF, the maximum (or minimum) PV will no longer be updated, but the PV will continue to be held until the input turns ON again.

! Handling Precautions

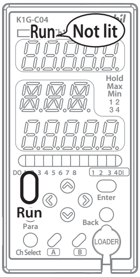
- During initialization, for example, after the power is turned on, the PV is held at 0. If this will cause a problem, cancel the hold status using the host controller.

Example of operation when digital input (DI) maximum hold is selected



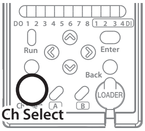
Procedure

1 Check that the mode is "Ready"



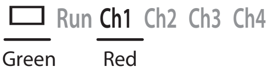
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



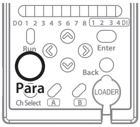
Select the channel No. by pressing Ch Select.

Display



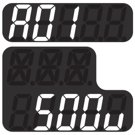
The number of the selected channel is lit.

3 Switch to the display for changing settings

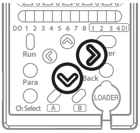


Press ○ Para.

Display

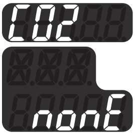


4 Select C02 (hold setting)

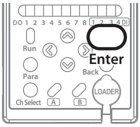


Press ▷ to select C01, and then press ▽ to select C02.

Display

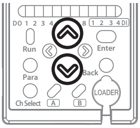


5 Enter C02



Press ⬭ Enter to finalize your choice of C02.

6 Select the parameter

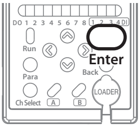


Select one of the following by pressing △/▽.

Parameter	Description	Default setting
nonE	Disabled	✔
PU-h1	Digital input (DI) max. value hold function	
PU-h2	Digital input (DI) min. value hold function	
EPS-1	EPS filter 1	
EPS-2	EPS filter 2	
EPS-3	EPS filter 3	
EPS-4	EPS filter 4	
EPS-5	EPS filter 5	

▨ Do not select shaded parameters.

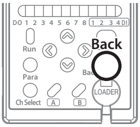
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.

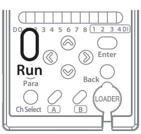
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

8 Exit the display for changing settings



Press Back .

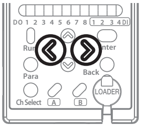
9 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

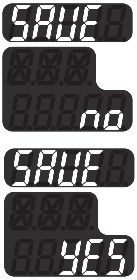


Choose whether to save by pressing «/».

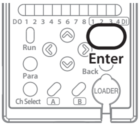
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



9-2 Finalize your selection and start measuring

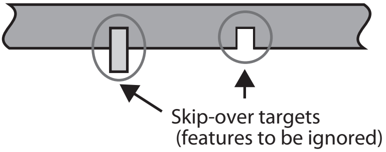


Press Enter to finalize your selection and start measuring.

SETTING EPS FILTERS

Ready

If there is a sudden change in the position of a workpiece's edge, an EPS filter can cope with this change by holding the output steady to prevent a change in the PV and analog output.
Five types of ESP filter are selectable to suit various purposes.



● EPS filter 1

With zero change in the measured value as a basis, if the measured value exceeds the skip-over size, the output will be held.
If the measured value returns to the skip-over size or less, output will not be held.
EPS filter 1 does not use the number of delays.
The hold state can be canceled by pressing the B key on the controller.

● EPS filters 2–5

If there is a sudden change in the position of the edge, the output is held steady.
The conditions for holding the output are configured using the number of delays and the skip-over size. If the measured value exceeds the skip-over size within the delay time (= measurement cycle × number of delays), the output is held steady.
The cancellation timing and conditions are shown below.

Filter name	Cancellation timing	Cancellation conditions
EPS filter 2	When a fixed period (4 times the delay time) has passed. ☞ P. 4-83	When the held value and the actual value after the delay are compared, the difference is less than the skip-over size.
EPS filter 3		The hold status is canceled regardless of the measured value.
EPS filter 4	When the EPS hold cancellation input set for the digital input (DI) is turned ON	When the skip-over size is no longer exceeded
EPS filter 5		The hold status is canceled regardless of the measured value.
All filters	When the B key on the controller is pressed.	The hold status is canceled regardless of the measured value.
	When the EPS hold forced cancellation input set for the digital input (DI) is turned ON	

● Setup example for EPS filters 2–5

Skip-over setting for when the edge position changes to negative

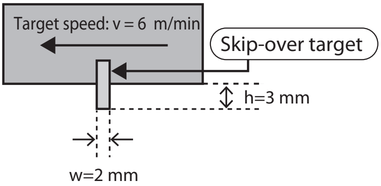
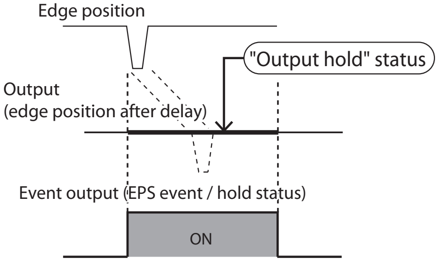


Diagram of operation after setup


Edge position
"Output hold" status
Output
(edge position after delay)
Event output (EPS event / hold status)
ON

1 Calculate the time it takes for something that should be ignored to pass by

v = 6 m/min = 100 mm/s
Passing time = w/v = 2/100 = **20 ms**

2 Set the number of delays (C03: No. of EPS filter delays)

For the delay time, use about half of the passing time calculated in step **1** as a rough estimate.
Delay time = Measurement cycle × No. of delays

Measurement cycle (A01)	No. of delays (rough estimate)
500 µs	**20**
1 ms	**10**

3 Set the skip-over size (C04: EPS filter size)

Set it using about half of the length (h) as a rough estimate.
Length of the target to ignore = 3.0 mm
Skip-over size = **1.5 mm**

4 Set the skip-over direction (C05: EPS filter direction)

Select drop (concave direction).

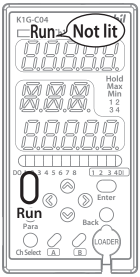
5 Set the filter hold type (C06: EPS filter output hold)

Select on (enabled).

Procedure

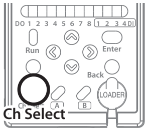
Ready

1 Check that the mode is "Ready"



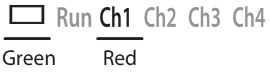
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



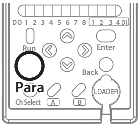
Select the channel No. by pressing Ch Select.

Display



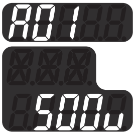
The number of the selected channel is lit.

3 Switch to the display for changing settings

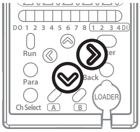


Press Para.

Display

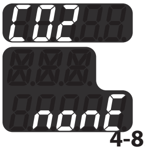


4 Select C02 (hold setting)

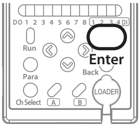


Press ≫ to select C01, and then press ︾ to select C02.

Display

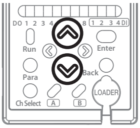


5 Enter C02



Press Enter to finalize your choice of C02.

6 Select the parameter

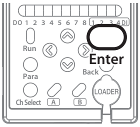


Select the parameter by pressing ▲/▼.

Parameter	Description	Default setting
nonE	Disabled	✔
PU-h1	Digital input (DI) max. value hold function	
PU-h2	Digital input (DI) min. value hold function	
EPS-1	EPS filter 1	
EPS-2	EPS filter 2	
EPS-3	EPS filter 3	
EPS-4	EPS filter 4	
EPS-5	EPS filter 5	

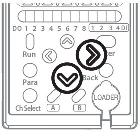
▨ Do not select shaded parameters.

7 Finalize your parameter selection



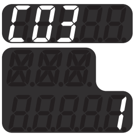
Press Enter to finalize your parameter selection.

8 Select C03 (No. of EPS filter delays)

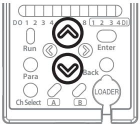


Press ▶ to select C01, and then press ▼ to select C03.

Display



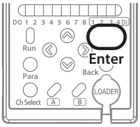
9 Set the parameter



Select one from 1–256 by pressing ∧/∨.

Parameter	Description	Default setting
1–256	1-256 (times)	1

10 Finalize your parameter selection



Press Enter to finalize your parameter selection.

11 Set C04–C06 (EPS filter size / EPS filter direction / EPS filter output hold)

For the setup procedure, see steps **8**–**10** for C03.
In step **8**, press ∨ to select C04–C06.

C04: EPS filter size (skip-over size)

Parameter	Description	Default setting
0.100–50.000	0.1–50.000 [mm]	0.100

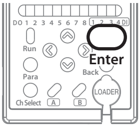
C05: EPS filter direction (skip-over direction)

Parameter	Description	Default setting
both	Concave and convex	✔
riSE	Convex	
droP	Concave	

C06: EPS filter output hold (enabled/disabled)

Parameter	Description	Default setting
oFF	Disabled	
on	Enabled	✔

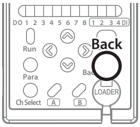
12 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

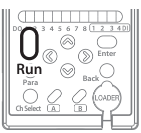
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

13 Exit the display for changing settings



Press ○ Back .

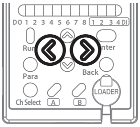
14 Start measuring



To start measuring, press 0 Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

14-1 Choose whether to save the parameter



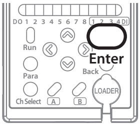
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display

14-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

CHANGING SMUDGE DETECTION FUNCTION SETTINGS

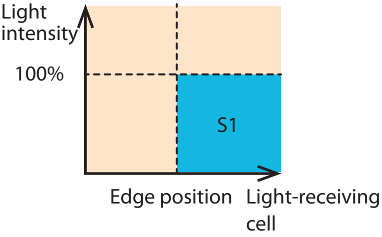
Ready

A change in the amount of received light caused by a smudge (foreign matter) on the sensing surface or interference from ambient light can be detected and sent to the host device. The light intensity change rate calculated by the following formula is used as an index that indicates the significance of the effect from a smudge or interference from ambient light.

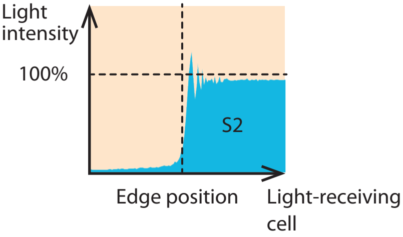
$$\text{Light intensity change rate} = (S2/S1) \times 100$$

S1 is the total light intensity estimated from the edge position and S2 is the total light intensity in the profile of received light.

Total light intensity estimated from the edge position

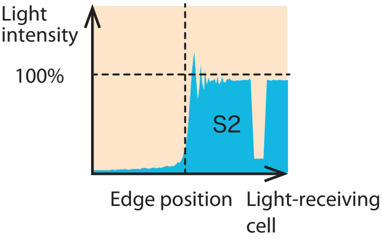


Total light intensity in the profile of received light



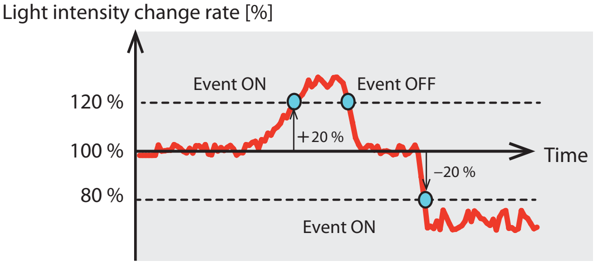
If there is a shadow in the profile of received light due to a smudge on the light-receiving surface, S2 will decrease, and thus the light intensity change rate will be lower.

A decrease in total light intensity caused by a smudge



To enable the smudge detection function, set the smudge detection threshold to 1 to 100 %. If the light intensity change rate of 100 % shifts by an amount that is more than the smudge detection threshold, the controller judges that there is a smudge.
If the smudge detection threshold is set to 0 %, this function will be disabled. In this case, regardless of the amount of light received, the controller will not detect a smudge.

Example of smudge detection: If the smudge detection threshold is set to 20 %



! Handling Precautions

- This function is available if a measurement mode for opaque objects is selected.

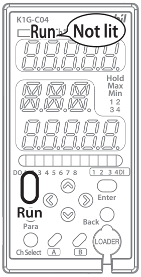
● If the gap for entry of light is not wide enough, smudge detection will be unreliable. Under the following conditions, regardless of light intensity, “smudge detected” events will be forcibly cleared.

Measurement mode	K1G-S07	K1G-S15
Opaque object edge position (top)	The edge position is less than 1.5 mm from the bottom.	The edge position is less than 2.0 mm from the bottom.
Opaque object edge measurement (bottom)	The edge position is less than 1.5 mm from the top.	The edge position is less than 2.0 mm from the top.
Opaque object width measurement	The width of blocked light is greater than 4 mm.	The width of blocked light is greater than 11 mm.
Opaque object gap measurement	The gap for entry of light is less than 1.5 mm.	The gap for entry of light is less than 2.0 mm.

● Setting the smudge detection threshold to 10 % or greater is recommended. Setting a smaller threshold will make detection of a slight smudge possible, but false detection could result depending on the measurement environment. Check the operation with the actual device and specify an appropriate value.

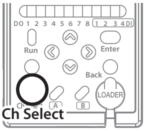
Procedure

1 Check that the mode is "Ready"



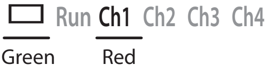
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Select the channel whose settings will be changed



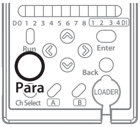
Select the channel No. by pressing Ch Select.

Display



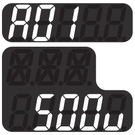
The number of the selected channel is lit.

3 Switch to the display for changing settings

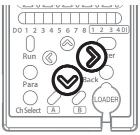


Press Para .

Display

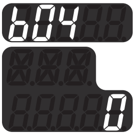


4 Select b04 (smudge detection threshold)

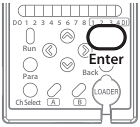


Press ⟩ to select b01, and then press ⌄ to select b04.

Display



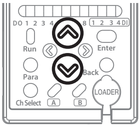
5 Enter b04



Press Enter to finalize your choice of b04.

Digital output (DO) must be configured in order to use the smudge detection function. ☞ P. 4-41

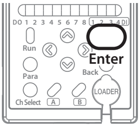
6 Set the parameter



Set one of the following by pressing ▲/▼.

Parameter	Description	Default setting
0	Disabled	✔
1– 100	1–100 % (set in increments of 1 %)	

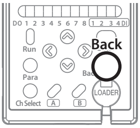
7 Finalize your parameter selection



Press Enter to finalize your parameter selection.

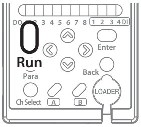
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

8 Exit the display for changing settings



Press Back .

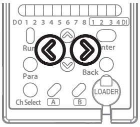
9 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

9-1 Choose whether to save the parameter

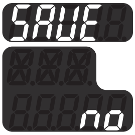


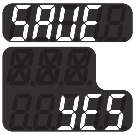
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

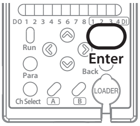
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





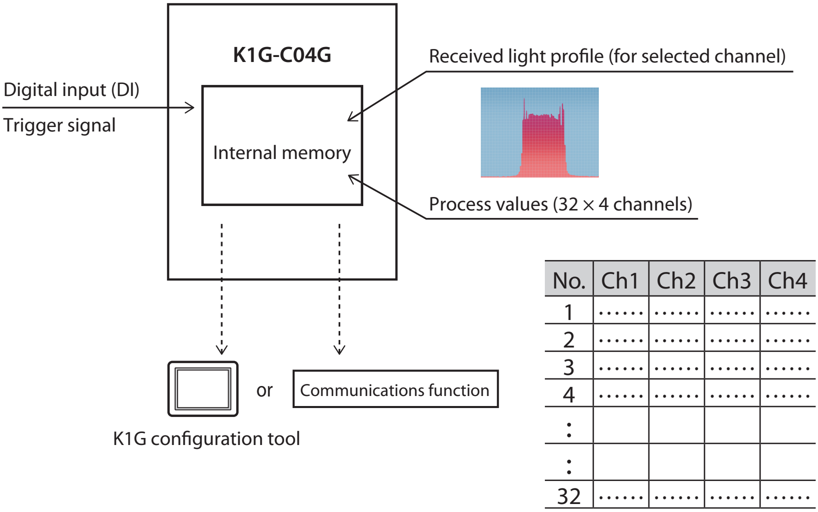
9-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

CONFIGURING THE EVENT LOG FUNCTION

The event log function, triggered when the specified trigger signal turns ON, saves a received light profile for the selected single channel (normalized light intensities) and the process values from all channels (32 × 4 channels) to the controller.
To check the event log settings and saved data, the K1G configuration tool or the communication function is used.



No.	Ch1	Ch2	Ch3	Ch4
1	……	……	……	……
2	……	……	……	……
3	……	……	……	……
4	……	……	……	……
:				
:				
32	……	……	……	……

The event log records only the log data from the first occurrence of the event. Later occurrences of the event are ignored.
If one of the settings related to the event log is changed by a host device, the event log will be cleared.

Necessary settings for the use of the event log function

Item	Explanation	Setting method
Trigger signal	Selects the DI operation type used as the trigger signal.	SZ-D01 configuration tool or by communication
Trigger target	Select the channel of the trigger.	
Trigger type	Select the type of event that will act as the trigger.	
Capture channel	Select the source channel for the received light profile.	
Event log point	Select the ratio of process values to obtain before and after the trigger.	

4-8 Other Functions

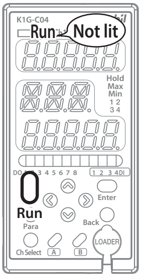
TEST MODE

Ready

After power-on and after the initial setup is complete, the wiring can be checked by using analog and digital output.

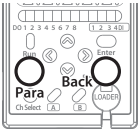
Procedure

1 Check that the mode is "Ready"



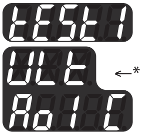
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Press the [Para] and [Back] keys for at least 3 seconds at the same time



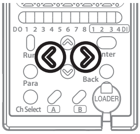
Press Para and Back for at least 3 seconds at the same time.

Display

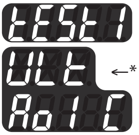


* The analog output type selected at the initial setup is displayed.

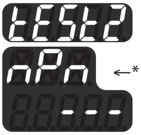
3 ≪/≫ Select analog output check and digital output check



Analog output check

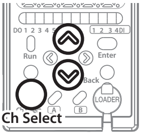


Digital output check



* The analog and digital output types selected at the initial setup are displayed.

4 Check the wiring

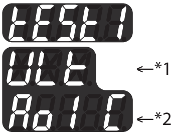


Check analog output (AO).

Change the analog output status for the selected channel by pressing ⏶/⏷.

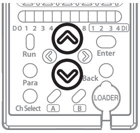
Change the analog output number by pressing ○ Ch Select .

Display



*1. The output method is displayed.
  ULt: Voltage output
  Cur: Current output

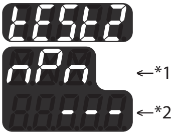
*2. The analog output status is displayed.
  Ao_h: 5 V or 20 mA
  Ao_C: 3 V or 12 mA
  Ao_L: 1 V or 4 mA
  "_" represents the selected channel No.



Check digital output (DO).

Change the digital output status for the selected No. by pressing ⏶/⏷.

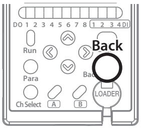
Display



*1. The output type is displayed.
  nPn: NPN output
  PnP: PNP output

*2. The digital output status is displayed.
  do1–do8: Digital output Nos.
  ALL: All outputs are ON
  - - -: All outputs are OFF

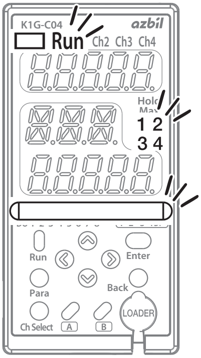
5 Quit the test mode



Press ○ Back to exit.

SAVING ELECTRICITY

Ready



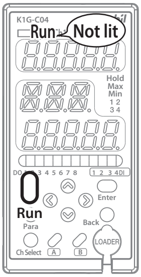
In power-saving mode, the sensor heads and controller each reduce current consumption.

Sensor heads: The light reception indicator only is turned off while power-saving mode is enabled. In this case, the indicator is also not lit during receiver adjustment.

Controller: After the power-saving mode is enabled, if there is no key operation for 20 seconds or longer in Run mode, power saving mode is applied automatically. In power-saving mode, all indicators are off except those that are shown as lit in the figure on the left. Pressing any key temporarily cancels power-saving mode.

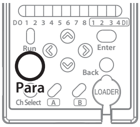
Procedure

1 Check that the mode is "Ready"



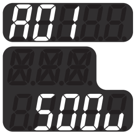
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

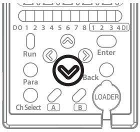


Press Para.

Display



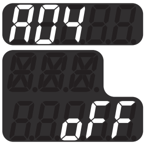
3 Select A04 (controller power-saving mode) and A05 (sensor head power-saving mode)

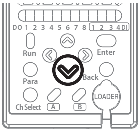


For the controller

Press ⌄ to select A04.

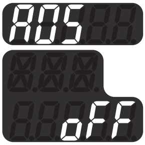
Display



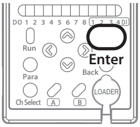


For the sensor heads

Press ⌄ to select A05.

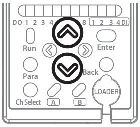


4 Enter A04/A05



Press Enter to finalize your choice of A04 or A05.

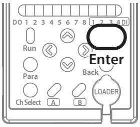
5 Select the parameter



Select oFF or on by pressing ⌃/⌄.

Parameter	Description	Default setting
oFF	Power-saving mode disabled	✔
on	Power-saving mode enabled	

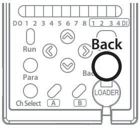
6 Finalize your parameter selection



Press Enter to finalize your parameter selection.

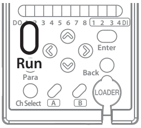
To change another setting, select the desired item by pressing ⌃/⌄ or «/».

7 Exit the display for changing settings



Press ○ Back .

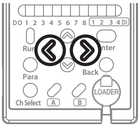
8 Start measuring



To start measuring, press ○ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

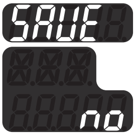


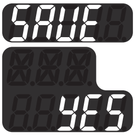
Choose whether to save by pressing «/».

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

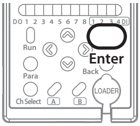
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



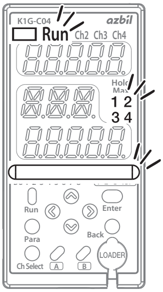


8-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

9 Transition to power-saving mode



If no key is pressed for 20 seconds or longer, power-saving mode goes into effect automatically.

CONFIGURING THE KEY LOCK

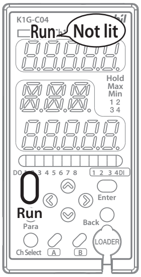
Ready

This function prevents wrong settings due to key operation by disabling all keys on the controller in Run mode.
The key lock goes into effect 60 seconds after the mode has been switched to Run.

The key lock setting applies to all channels.
This parameter cannot be changed for individual channels.

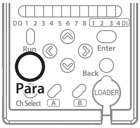
Procedure

1 Check that the mode is "Ready"



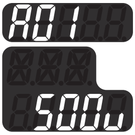
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

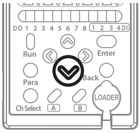


Press Para.

Display

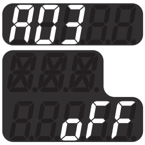


3 Select A03 (key lock)

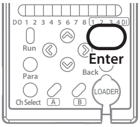


Press ▼ to select A03.

Display

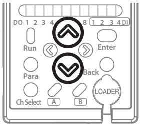


4 Enter A03



Press Enter to finalize your choice of A03.

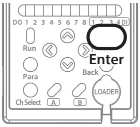
5 Select the parameter



Select oFF or on by pressing ▲/▼.

Parameter	Description	Default setting
oFF	Key lock disabled	✔
on	Key lock enabled	

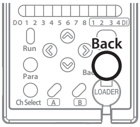
6 Finalize your parameter selection



Press Enter to finalize your parameter selection.

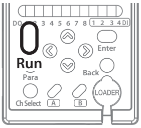
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

7 Exit the display for changing settings



Press ○ Back .

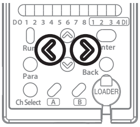
8 Start measuring



To start measuring, press ▯ Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

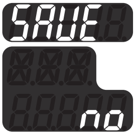


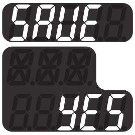
Choose whether to save by pressing ≪/≫.

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

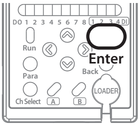
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





8-2 Finalize your selection and start measuring



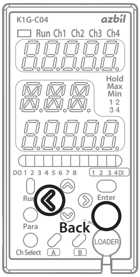
Press ⬭ Enter to finalize your selection and start measuring.

CANCELING THE KEY LOCK

Ready

Procedure

1 Canceling the key lock temporarily



Press « for at least 2 seconds while pressing ○ Back .

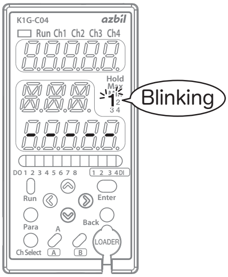
The key lock will go into effect again in 60 seconds.
If necessary, disable it by changing the parameter to "Key lock disabled."

RESETTING WHEN CHANGING THE SENSOR HEADS

After the initial setup is complete, in order to switch to a different sensor head model it is necessary to reset the sensor head settings.

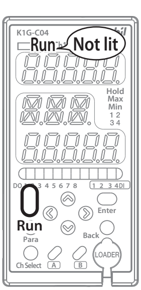
Procedure

1 Check that the sensor connection indicator of the channel whose sensor heads have been replaced is blinking



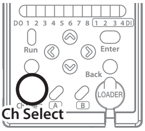
If a reset of the sensor head settings is needed, the sensor connection indicator blinks and display 2 shows -----.

2 Check that the mode is "Ready"



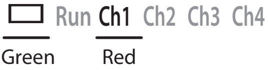
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

3 Select the channel to be reset



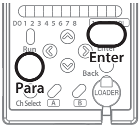
Select the channel No. by pressing ○ Ch Select.

Display



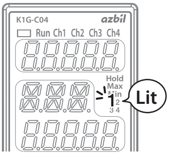
The number of the selected channel is lit.

4 Press the [Para] and [Enter] keys at the same time for at least 3 seconds



Press ○ Para and ⬭ Enter for at least 3 seconds at the same time.

5 Check that the sensor connection indicator of the channel whose sensor heads have been replaced is lit



After the resetting, adjust the receiver.

After receiver adjustment, the following parameters must be reset.

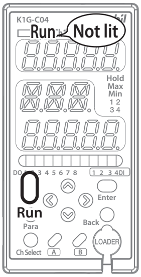
• Zero adjustment value [b06]	☞ P. 4-29
• Working distance (WD) [b07]	☞ P. 4-76
• Low threshold [C07]	☞ P. 4-42
• High threshold [C08]	☞ P. 4-42
• Analog output range low limit [C 11]	☞ P. 4-25
• Analog output range high limit [C 12]	☞ P. 4-25

4-9 Changing MECHATROLINK-III Communication Settings

SETTING THE STATION ADDRESS FOR MECHATROLINK-III

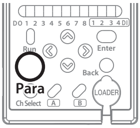
Procedure

1 Check that the mode is "Ready"



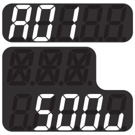
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

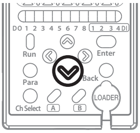


Press Para.

Display

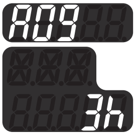


3 Select A09

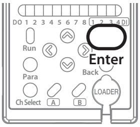


Press ⌄ to select A09.

Display

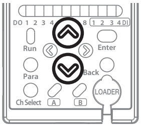


4 Enter A09



Press Enter to finalize your choice of A09.

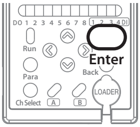
5 Set the parameter



Set the address using ⌃/⌄.

Parameter	Description	Default setting
3h - EFh	3 - 239	3h

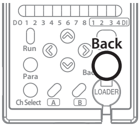
6 Finalize your parameter selection



Press Enter to finalize your parameter selection.

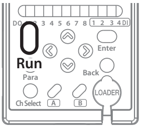
To change another setting, select the desired item by pressing ⌃/⌄ or 〈/〉.

7 Exit the display for changing settings



Press ○ Back .

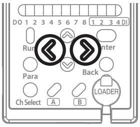
8 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

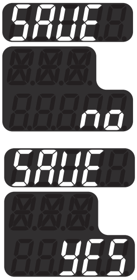


Choose whether to save by pressing «/».

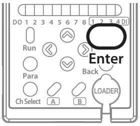
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



8-2 Finalize your selection and start measuring

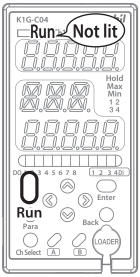


Press Enter to finalize your selection and start measuring.

SETTING THE NUMBER OF TRANSMISSION BYTES FOR MECHATROLINK-III

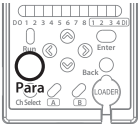
Procedure

1 Check that the mode is "Ready"



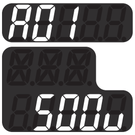
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

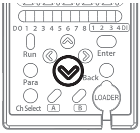


Press Para.

Display

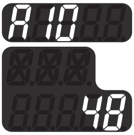


3 Select A 10

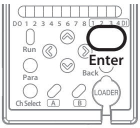


Press ∨ to select A 10.

Display

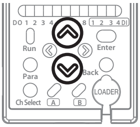


4 Enter A 10



Press Enter to finalize your choice of A 10.

5 Set the parameter

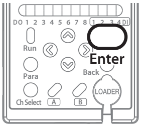


Select one of the following by pressing ⌃/⌄.

Parameter	Description	Default setting
32	32 transmission bytes	
48	48 transmission bytes	✓

For the number of transmission bytes, see user's manual No. CP-SP-1386E..

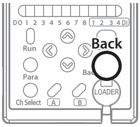
6 Finalize your parameter selection



Press ⬭ Enter to finalize your parameter selection.

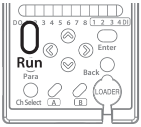
To change another setting, select the desired item by pressing ⌃/⌄ or 〈/〉.

7 Exit the display for changing settings



Press ○ Back .

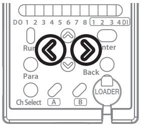
8 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter



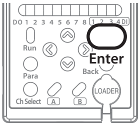
Choose whether to save by pressing ≪/≫.

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display

8-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

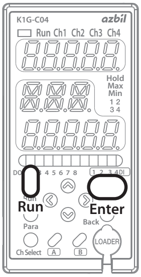
4-10 Returning All Settings to the Defaults

! Handling Precautions

- All settings will be cleared and returned to the defaults.

Procedure

1 Restore all default settings



While Run and Enter are being pressed at the same time, turn the power on.

Do the initial setup again. For more information on the initial setup, see the following.

☞ Initial Setup Flowchart (P. 3-2)

5

COMMUNICATION SETTINGS (CONNECTION TO OTHER DEVICES)

This chapter describes RS-485 communications (Modbus/RTU) with other devices.

For connection to MECHATROLINK-Ⅲ, see User's Manual No. CP-SP-1386E.

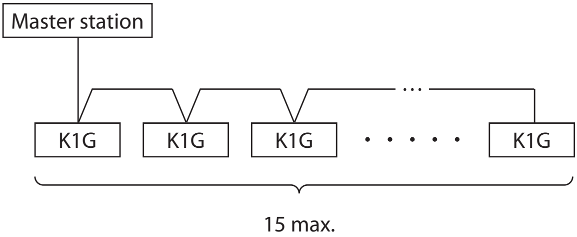
For connection to EtherCAT, see user's manual No. CP-SP-1419E.

5-1 Overview of Communications

This device is compatible with RS-485 and can communicate with host devices such as a PC or PLC using a user-created communications program.
Reading and writing of most parameters between the master station and the controller can be done through communication.

- **Communication protocol:** **Modbus/RTU**
- **No. of connectable controllers:** **Up to 15 K1G controllers can be connected to a single master station.**

RS-485 communications



SETTINGS

For Modbus communication, configure the following in advance.

Description	Parameter	Default setting
Station address ☞ P. 5-4	0: No communication 0– 127	0
Transmission speed ☞ P. 5-7	9.6: 9600 bps 19.2: 9200 bps 38.4: 38,400 bps 115.2: 115,200 bps	9.6
Parity, stop bits ☞ P. 5-10	nonE: No parity (2 stop bits) EUEn: Even parity (1 stop bit) odd: Odd parity (1 stop bit)	nonE

COMMUNICATION PROCEDURE

1 **An instruction message is sent from the host device (master station) to the desired single controller (slave station).**

2 **The K1G controller (slave station) reads or writes data in accordance with the instruction message.**

3 **The K1G controller (slave station) sends back a response message related to the requested processing.**

4 **The master station receives the response message.**

! Handling Precautions

- In the case of Modbus communications, the communications address (parameter) to the controller set on the host device may change to [address – 1] in a message.
  Example: If the communication address (parameter) is set to 1001 on the host device, it changes to 1000 in the message.

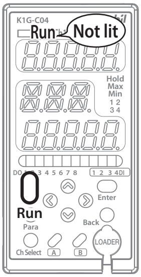
  The K1G controller sends/receives messages to/from specified communication addresses (parameters).
  Take the host device's specifications into account when using the controller.

5-2 Changing the Communications Conditions

SETTING THE STATION ADDRESS

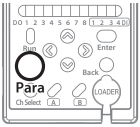
Procedure

1 Check that the mode is "Ready"



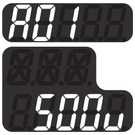
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

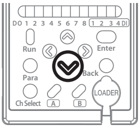


Press Para.

Display

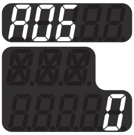


3 Select A06

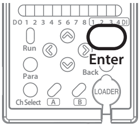


Press ⌄ to select A06.

Display

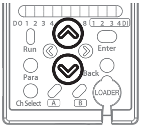


4 Enter A06



Press Enter to finalize your choice of A06.

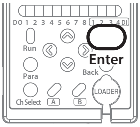
5 Set the parameter



By pressing ▲/▼, select a value from 0–127.

Parameter	Description	Default setting
0- 127	0–127 (0: Communication is disabled)	0

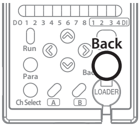
6 Finalize your selection



Press Enter to finalize your selection.

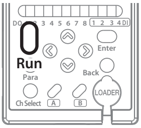
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

7 Exit the display for changing settings



Press ○ **Back** .

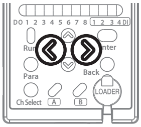
8 Start measuring



To start measuring, press ▯ **Run** for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

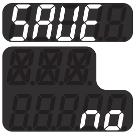


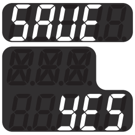
Choose whether to save by pressing ≪/≫.

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

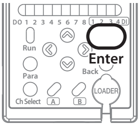
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





8-2 Finalize your selection and start measuring

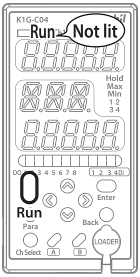


Press ⬭ **Enter** to finalize your selection and start measuring.

SETTING THE TRANSMISSION SPEED

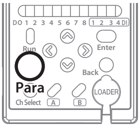
Procedure

1 Check that the mode is "Ready"



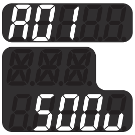
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

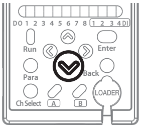


Press Para .

Display

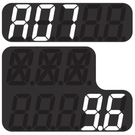


3 Select A07

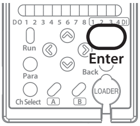


Press ⌄ to select A07.

Display

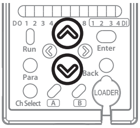


4 Enter A07



Press Enter to finalize your choice of A07.

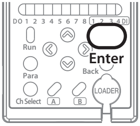
5 Select the parameter



Select one of the following by pressing ⏶/⏷.

Parameter	Description	Default setting
9.6	9600 bps	✔
19.2	19200 bps	
38.4	38,400 bps	
115.2	115,200 bps	

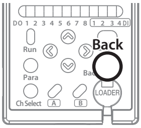
6 Finalize your parameter selection



Press Enter to finalize your parameter selection.

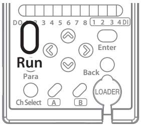
To change another setting, select the desired item by pressing ⏶/⏷ or ⏴/⏵.

7 Exit the display for changing settings



Press Back.

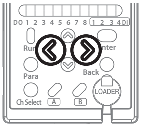
8 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

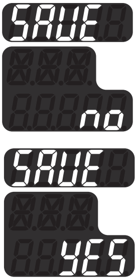


Choose whether to save by pressing 《/》.

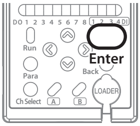
Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display



8-2 Finalize your selection and start measuring

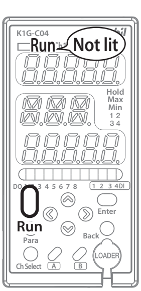


Press Enter to finalize your selection and start measuring.

SETTING THE COMMUNICATIONS FORMAT (PARITY AND STOP BITS)

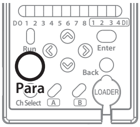
Procedure

1 Check that the mode is "Ready"



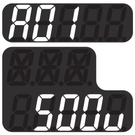
If "Run" is lit, press Run for 3 seconds or longer, and then check that "Run" is not lit (= Ready mode).

2 Switch to the display for changing settings

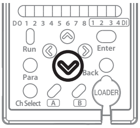


Press Para .

Display

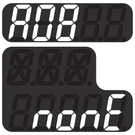


3 Select A08

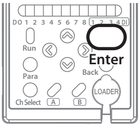


Press ⌄ to select A08.

Display

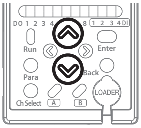


4 Enter A08



Press Enter to finalize your choice of A08.

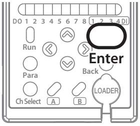
5 Select the parameter



Select one of the following by pressing ▲/▼.

Parameter	Description	Default setting
nonE	No parity (2 stop bits)	✔
EUEn	Even parity (1 stop bit)	
odd	Odd parity (1 stop bit)	

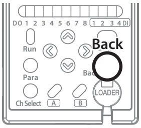
6 Finalize your parameter selection



Press Enter to finalize your parameter selection.

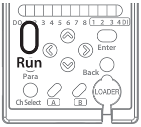
To change another setting, select the desired item by pressing ▲/▼ or ◀/▶.

7 Exit the display for changing settings



Press Back .

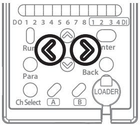
8 Start measuring



To start measuring, press Run for 3 seconds or longer.

(The following procedure is followed if a parameter has been changed.)

8-1 Choose whether to save the parameter

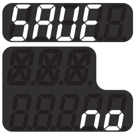


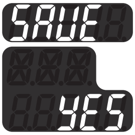
Choose whether to save by pressing ≪/≫.

Parameter	Description
no	Setting is not saved.
YES	Setting is saved.

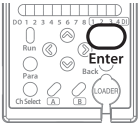
Note: If "no" is selected and the power is turned off, the changed parameter will not be saved.

Display





8-2 Finalize your selection and start measuring



Press Enter to finalize your selection and start measuring.

5-3 Message Format

All messages use binary data.
A Modbus/RTU message consists of (1)–(5) below.

(5)	(1)	(2)	(3)	(4)	(5)
Start	1 byte	1 byte	n bytes (1 byte or more)	2 bytes	End

(1) Station address

The K1G controller creates a response message only if its station address is in the received message. In the message, the station address is 1 byte.
However, if the station address is 0, even if the addresses match, there is no response to the message.
In its response, the K1G controller returns the same station address as that in the received message.

(2) Function codes

The K1G controller then executes the processing indicated by the received function code.
If processing is successfully completed, the received function code will be returned.
If processing is not successfully completed and a response indicating an error is returned, the MSB* of the received function code will be set to "1" and returned.
*Most significant bit

(3) Data

Data corresponding to the function code is added.
The data types handled by this controller are 16-bit data (2 bytes) and 32-bit data (4 bytes).
The data size of an address is 16 bits. In the case of 32-bit data, 2 addresses compose one data record.

● Data format

- 16-bit data (2 bytes)

  The first 8 bits are assigned to the first byte and the last 8 bits to the last byte.

Example: If the 16-bit data is 1234

Byte	Data (hex)	Description
1st	12	First 8 bits of data
2nd	34	Last 8 bits of data

- 32-bit data (4 bytes)
  The last16 bits are assigned to the address with the smaller number and the first 16 bits to the address with the larger number.
  The byte data order for each address is the same as that of 16-bit data.

Example: If the 32-bit data is 12345678 (addresses 0000–0001)

Address (HEX)	Data (HEX)	Description	Byte	Data (HEX)	Description
0000	5678	Last 16 bits of data	1st	56	First 8 bits of address 0000
			2nd	78	Last 8 bits of address 0000
0001	1234	First 16 bits of data	3rd	12	First 8 bits of address 0001
			4th	34	Last 8 bits of address 0001

- How to handle negative values
  Negative values are expressed in 2's complement format.
  The inverted bits of a positive value plus "1" means a negative value.

Example: If the 16-bit data is -1

1 (positive) = 01	0000000000000001
↓	
1's complement (inverted)	1111111111111110
↓	
2's complement (1's complement + 1) = -1 = FF	1111111111111111

(4) Check code (CRC)

CRC check codes are added to both command and response messages by using Modbus/RTU communication protocol.

The section from the station address to just before the check code in the message is included in the calculation.

For calculation, the binary data in the message is used without change. The check code is 16-bit data and can be calculated using the C programming language function "get_crc16()" shown in the following section. In a message, the first bytes of the code follow the last bytes. This order is the reverse of that of other 16-bit data.

Example: If the check code is 1234

Byte	Data (hex)	Description
1st	34	Last 8 bits of the data
2nd	12	First 8 bits of the data

<Sample of CRC check code calculation>

```
/*******************************************
[Argument 1] Character string length (No. of bytes)
[Argument 2] Character string's head pointer
[Function value] Calculation result
*******************************************/
UH get_crc16(INT len, UB *p)
{
    UH dt_16;
    UH next;
    UH carry;
    INT i;

    dt_16 = 0xffff;
    while (len > 0) {
        next = (UH)*p;
        dt_16 ^= next;
        for (i = 0; i < 8; i++) {
            carry = (UH)(dt_16 & 0x0001);
            dt_16 >>= 1;
            if (carry != 0) {
                dt_16 ^= 0xA001;
            }
        }
        p++;
        len--;
    }
    return dt_16;
}
```

(5) Start and end

In the Modbus/RTU communication protocol, a silent interval (non-communication time) equivalent to at least 3.5 characters is required for both the start and end of a command message and response message. However, the following specifications apply to the K1G controller.

Transmission speed	Silent interval
9,600 bps	8 ms
19,200 bps	4 ms
38,400 bps	2 ms
115,200 bps	1 ms

5-4 Function Codes

LIST OF FUNCTION CODES

The following function codes are available for the controller.

Code (hex)	Function name	Description
03	Continuous data read	Reads the specified No. of continuous data records from the specified address.
10	Continuous data write	Writes the specified No. of continuous data records from the specified address.

CONTINUOUS DATA READ (FUNCTION CODE: 03)

Reads the specified No. of continuous data records from the specified address.
Up to 125 data records can be read with a single instruction message.

● Command format

Station	Function code	DATA		CRC
		Address	No. of data records	
(1)	(2)	(3)	(4)	(5)
1 byte	1 byte	2 bytes	2 bytes	2 bytes

(1) Station address
(2) Function code: 03
(3) Starting address for reading data
(4) No. of read data records (addresses)
(5) Check code (CRC)

● Response format (for a normal response)

Station	Function code	DATA				CRC
		Byte	1st data record		Nth data record	
(1)	(2)	(3)	(4)	…	(5)	(6)
1 byte	1 byte	1 byte	2 bytes		2 bytes	2 bytes

(1) Station address
(2) Function code: 03
(3) No. of read data bytes: double the sum of (4)+(5)
(4) 1st data record
(5) Nth data record
(6) Check code (CRC)

☞ Exception responses (P. 5-18)

CONTINUOUS DATA WRITE FUNCTION (FUNCTION CODE: 10)

Writes the specified No. of continuous data records from the specified address.
Up to 123 data records can be written with a single instruction message.
If settings are changed in Run mode, an amount of time equivalent to 128 samples (128 × sampling time) will be spent in Ready mode to apply the changed settings, and then the mode will return to Run.

● Command format

Station	Function code	DATA						CRC
		Address	No. of data records	Byte	1st data record		Nth data record	
(1)	(2)	(3)	(4)	(5)	(6)	…	(7)	(8)
1 byte	1 byte	2 bytes	2 bytes	1 byte	2 bytes		2 bytes	2 bytes

(1) Station address
(2) Function code: 10
(3) Starting address for writing data
(4) No. of write data records (No. of addresses)
(5) No. of write data bytes: double the sum of (6)+(7)
(6) 1st data record
(7) Nth data record
(8) Check code (CRC)

● Response format (for a normal response)

Station	Function code	DATA		CRC
		Address	No. of data records	
(1)	(2)	(3)	(4)	(5)
1 byte	1 byte	2 byte	2 byte	2 byte

(1) Station address
(2) Function code: 10
(3) Starting address for writing data
(4) No. of write data records
(5) Check code (CRC)

☞ Exception responses (P. 5-18)

EXCEPTION RESPONSES

If the controller was not able to process the received function code successfully, it will return an exception response according to the Modbus communications protocol.
An error involving any function code results in the exception response.

● Format of the exception response

Station	Function code	Error code	CRC
(1)	(2)	(3)	(4)
1 byte	1 byte	1 byte	1 byte

(1) Station address
(2) Function code: Continuous read data = 03 (hex): 83 (hex)
Continuous write data = 10 (hex): 90 (hex)
Note: The command's function code + 80
(3) Error code: See the list of error codes.
(4) Check code (CRC)

List of error codes

Code (hex)	Name	Description
01	Illegal function	Unsupported function code
02	Illegal data address	Data address error (inaccessible area) Error in the number of data records (the No. is out of range, inaccessible area)
03	Illegal data	The written value is out of range. Error in the number of bytes of the function code. Error in the number of data records or bytes. Writing or reading is prohibited due to instrument conditions.
10	Application error 1	Reserved
11	Application error 2	Reserved
12	Application error 3	High-speed trend overrun error
13	Application error 4	Write mode error
14	Application error 5	Reserved
15	Application error 6	Reserved

SZ-D01 CONFIGURATION TOOL

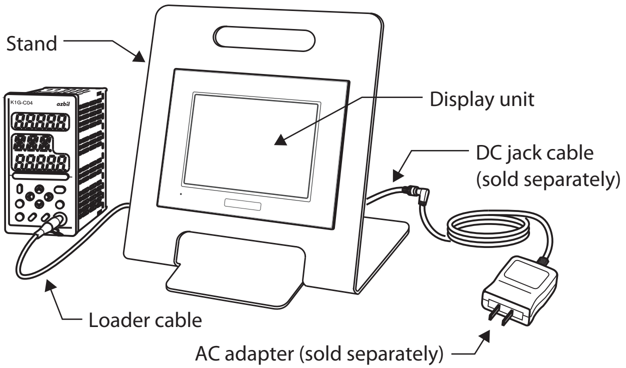
6

This chapter describes the SZ-D01 configuration tool.
Before use, please read “Handling Precautions for the SZ-D01 Configuration Tool for K1G Series High-Accuracy Position Sensors” (manual No. CP-UM-5785JE), which is included with the SZ-D01.
Also, read “GP-4201TM/4301TM Installation Guide” and “Warning/Caution Information” (both included with the display unit) in order to use the equipment correctly.

6-1 System Configuration

SYSTEM CONFIGURATION

The SZ-D01 configuration tool consists of a display unit with the pre-installed dedicated software, stand, cables, etc.



FUNCTIONS

Item		Description
Setting/Adjustment		Setup of various parameters and receiver adjustment.
Monitoring	Trend monitor	Collects data from 4 channels on a 1 s (minimum) cycle and displays data in a graph format.
	High-speed trend	Collects data from 1 channel 40000 times during the measurement cycle (500 µs/1 ms) set for the K1G, and displays the data in a graph format.
Event Log		Reads out and displays various event log settings and data collected and saved to the controller by the event log function.
Other		I/O test, Replacement procedure, Application specific setting.

STORING DATA IN A USB FLASH DRIVE

The settings and acquired monitoring data, etc., can be saved to a USB storage device (not included).

An operational check has been done with the following USB flash drives connected to the display unit.

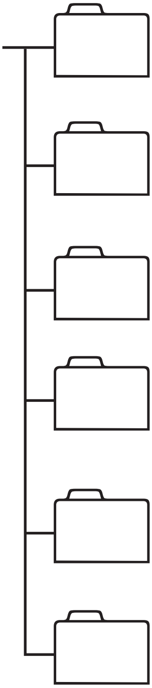
Manufacturer	Product name	Capacity
Buffalo Inc.	RUF-C/U2	1 GB
	RUF-C256M/U2	256 MB
Green House Co., Ltd.	GH-UFD1GSLT	1 GB
Transcend Japan	JFV10	1 GB

Depending on the production date, some USB flash drives cannot be used due to a change in manufacturing specifications.

Because of this, do an operational check before use.

● Data storage directories

Data stored in a USB flash drive will be saved as shown below.



Folder name：CAPTURE
Stores captured image files.
File name： CP _ _ _ _ _ .JPG

Folder name：EVENT
Stores PV trend data collected by the event log function.
File name： EV _ _ _ _ _ .BIN / EV _ _ _ _ _ .CSV

Folder name：HTREND
Stores PV trend data collected by high-speed trend monitoring.
File name： HT _ _ _ _ _ .BIN/ HT _ _ _ _ _ .CSV

Folder name：PROFILE
Stores profiles of received light collected by the event log function.
File name： LP _ _ _ _ _ .BIN / LP _ _ _ _ _ .CSV

Folder name：SAMP01
Stores numeric data collected by trend monitoring.
File name： SA _ _ _ _ _ .CSV

Folder name：SETTING
Parameters
File name： SD _ _ _ _ _ .BIN / SD _ _ _ _ _ .CSV

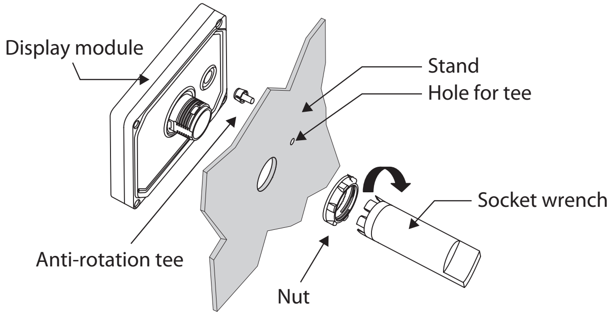
Note: _ _ _ _ _ represents a number.

6-2 Installation and Wiring

For installation and wiring, see also user's manual GP-4201TM/4031TM, which is included with the display unit.

ATTACHING THE DISPLAY UNIT TO THE STAND

1 Attach the anti-rotation tee to the display module. Insert the display module connector and tee into the appropriate holes in the stand. Attach the nut to the display module connector and tighten it using the included socket wrench



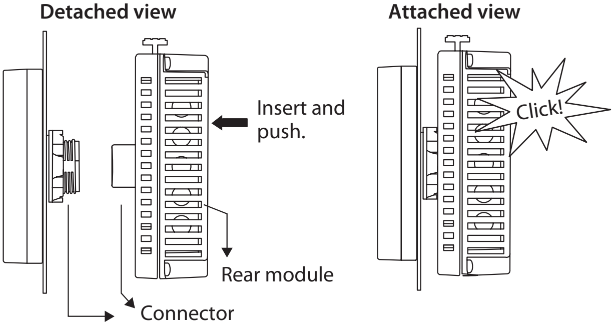
ⓘ Handling Precautions

- Tightening torque: 1.2–2 N·m.

2 Insert the rear module connector into the display module connector until the modules are properly combined.

ⓘ Handling Precautions

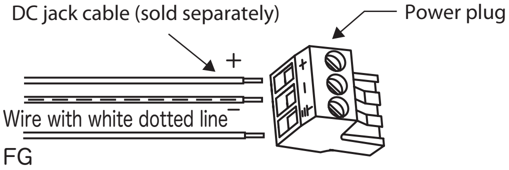
- When combining the two modules, take care to orient them as shown in the figure below. If the orientation is wrong, the connectors may be damaged.



POWER WIRING

1 Connect the DC jack cable (sold separately) to the power plug

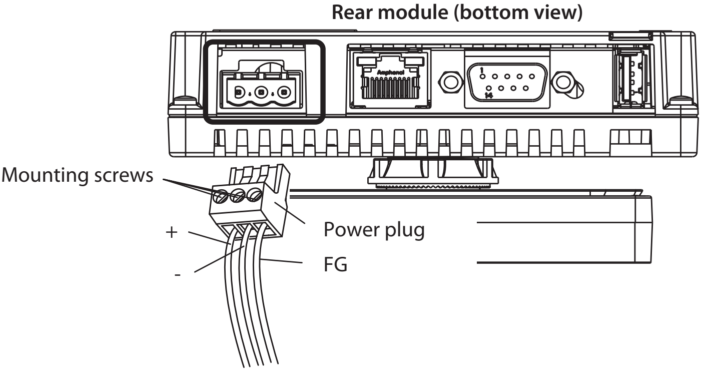
For the mounting screws, use a flat-tip screwdriver whose tip size is 0.6 x 3.5 mm.



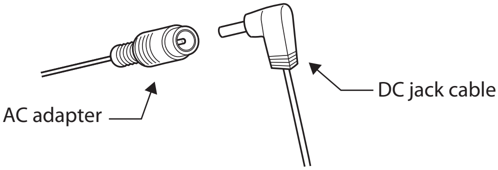
! Handling Precautions

- Tightening torque: 0.5–0.6 N·m
- Do not solder the cable connections.

2 Connect the wired power plug to the display unit

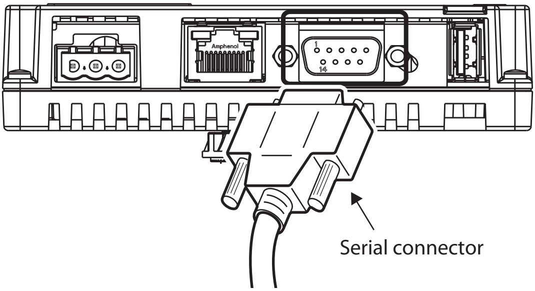


3 Connect the DC jack cable to the AC adapter (both sold separately)

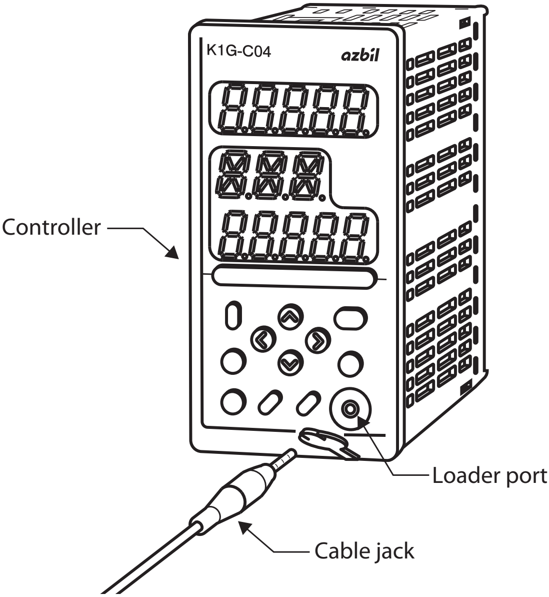


CONNECTING THE LOADER CABLE

1 Connect the serial connector on the loader cable to the display unit

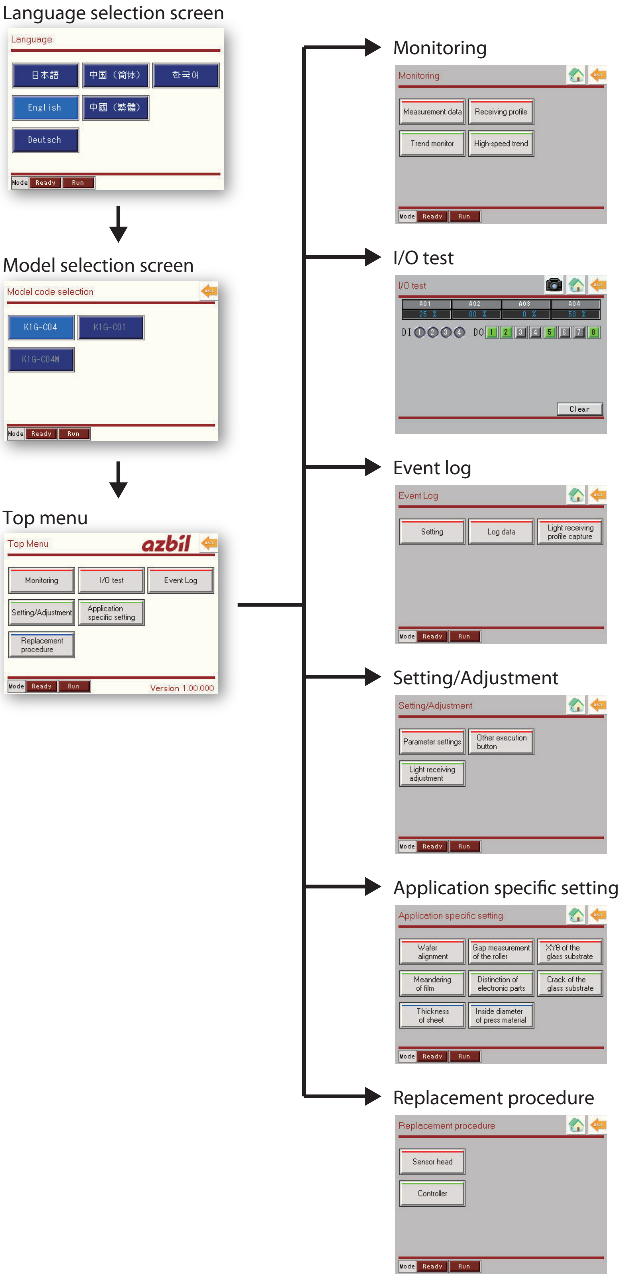


2 Connect the loader cable jack to the loader port on the controller

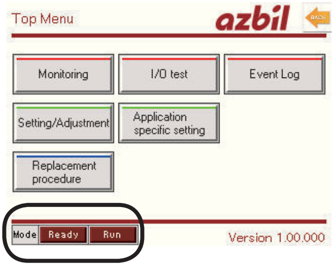


6-3 Basic Operation and Functions

SCREEN TRANSITION DIAGRAM



SWITCHING THE MODE



Ready and Run modes can be checked and changed.
Before changing other settings, change the mode to Ready.

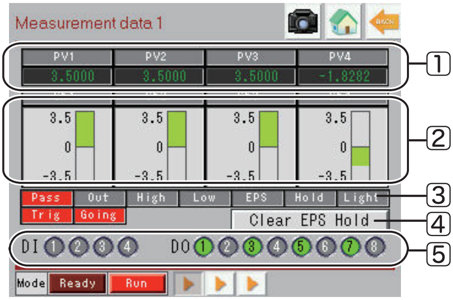
ICONS

Icon	Name	Description
🏠	Top	Redisplays the top menu screen.
BACK	Back	Moves the display one level above the current one.
▶	Next	Moves the display to the next settings screen.
📷	Camera	Captures a screen and stores it in a USB flash drive.
🚫	Camera NG	Screen capture function is OFF. Connect a USB flash drive as needed.
🔍	Loupe	Zooms into and out of the trend monitoring screen.
🔄	Change	Changes between screen display modes.
! HELP	Help	Shows further notes.

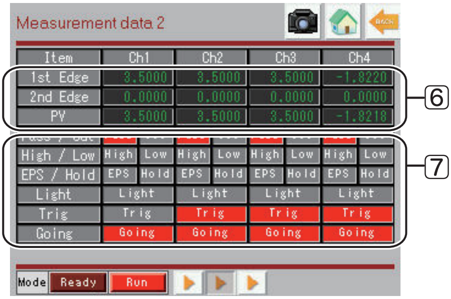
MONITORING

● Measurement data

The measurements on each channel, event status, etc., can be checked.



PV1	PV2	PV3	PV4
3.5000	3.5000	3.5000	-1.8282

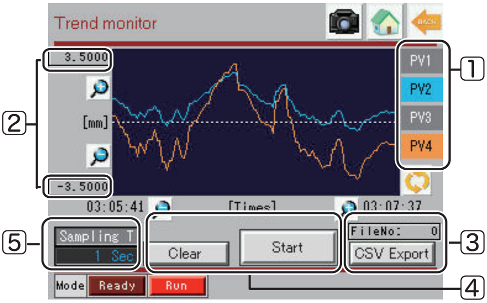


Item	Ch1	Ch2	Ch3	Ch4
1st Edge	3.5000	3.5000	3.5000	-1.8220
2nd Edge	0.0000	0.0000	0.0000	0.0000
PV	3.5000	3.5000	3.5000	-1.8218
High / Low	High Low	High Low	High Low	High Low
EPS / Hold	EPS Hold	EPS Hold	EPS Hold	EPS Hold
Light	Light	Light	Light	Light
Trig	Trig	Trig	Trig	Trig
Going	Going	Going	Going	Going

①	PV on each channel
②	Measured value on each channel in bar graph format
③	ON/OFF status of events (red = ON)
④	Forces cancellation of EPS filter output hold
⑤	Digital I/O status (green = ON)
⑥	Edge position and PV on each channel
⑦	Each channel's status and event activity (red = ON)

● Trend monitor

Displays the measurements on as many as 4 channels in graph format.

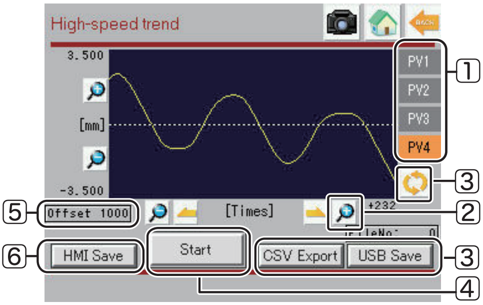


①	The PV to be displayed can be selected. (gray = not selected)
②	Changes the scale of the vertical axis (measurement range).
③	Saves acquired data to the USB storage device.
④	Starts and stops measurement. Pressing the Clear button deletes trend data.
⑤	Changes the sampling time. *

* Unit: seconds. Range: 0 to 65535 (when 0 is specified, there is no sampling)

● High-speed trend monitor

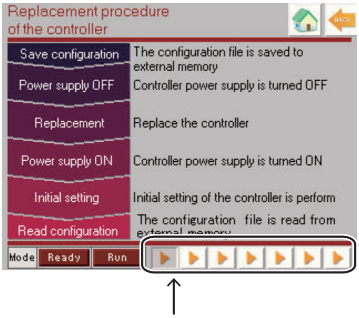
Obtains data from 1 channel 40000 times per measurement cycle and displays the data in graph format.



1	Selects the channel from which to obtain data (gray = not selected)
2	This value is the maximum position from the offset that can be displayed. This display high limit can be changed by pressing 🔍.
3	Saves acquired data to the USB storage device. By switching between Save and Load using the 🔄 icon, the data stored on the USB storage device can be displayed.
4	Starts and stops measurement.
5	Changes the data display low limit.
6	Saves the acquired data to the display unit.

REPLACEMENT PROCEDURE

Pressing an icon like this one ▶ displays the corresponding step of the procedure.



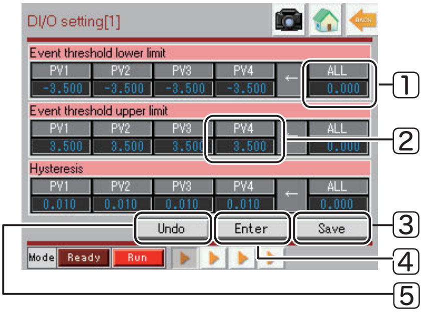
Save configuration	The configuration file is saved to external memory
Power supply OFF	Controller power supply is turned OFF
Replacement	Replace the controller
Power supply ON	Controller power supply is turned ON
Initial setting	Initial setting of the controller is perform
Read configuration	The configuration file is read from external memory

Pressing an icon displays the corresponding step of the procedure.

SETTINGS/ADJUSTMENTS

Various parameters can be changed and light reception can be adjusted.

● Settings screen

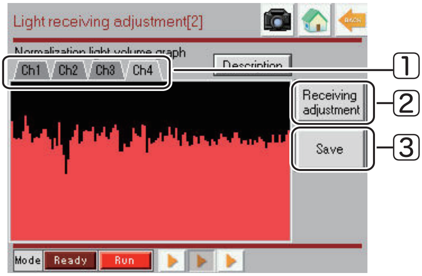


	PV1	PV2	PV3	PV4		ALL
Event threshold lower limit	-3.500	-3.500	-3.500	-3.500	←	0.000
Event threshold upper limit	3.500	3.500	3.500	3.500		0.000
Hysteresis	0.010	0.010	0.010	0.010	←	0.000

1	To configure all channels at the same time, touch and change the value under ALL.
2	To configure an individual channel, touch and change the relevant value.
3	Saves changed settings to the controller.
4	Finalizes a changed setting.
5	Undoes the preceding change.

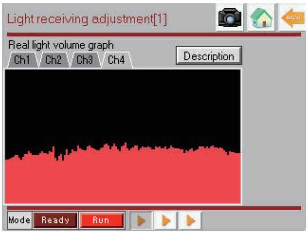
In Ready mode, the changed setting can be saved to the controller.

● Receiver adjustment screen

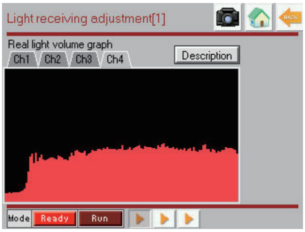


1	Changes between the graphs for each channel.
2	Adjusts the received light.
3	Saves the adjustment data to the controller.

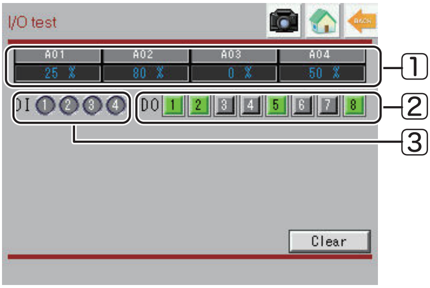
Waveform example:
receiver adjustment is possible.



Waveform example:
receiver adjustment is not possible.



I/O TEST

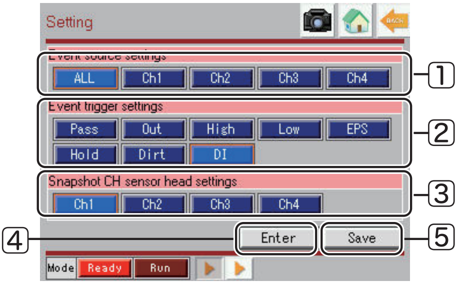


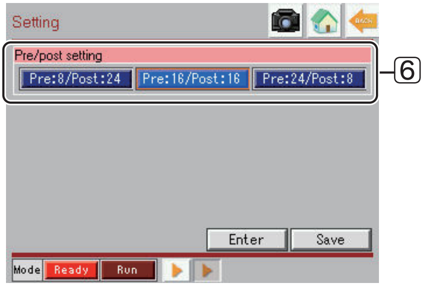
①	Analog output (AO) can be changed to the desired value. To change a value, touch it and then use the numeric keys.
②	Touching a digital output (DO) number forces that output to turn ON (green = ON)
③	The digital input (DI) status can be checked (green = ON)

EVENT LOG

Event log settings and acquired data can be checked.

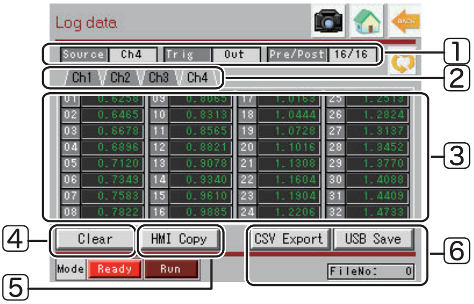
● Settings screen





①	Selects the trigger target channel.
②	Selects the DI operation type used as the trigger signal.
③	Selects the source channel for the received light profile.
④	Finalizes the settings.
⑤	Saves the settings.
⑥	For the acquired process values, selects the ratio of before-trigger values to after-trigger values from among three ratios. Pre: process values acquired before the trigger Post: process values acquired after the trigger (32 values in total)

Log data



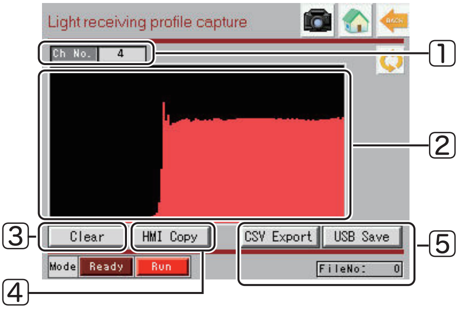
Source Ch4 | Trig Out | Pre/Post 16/16

01	0.6258	09	0.8065	17	1.0163	25	1.2513
02	0.6465	10	0.8313	18	1.0444	26	1.2824
03	0.6678	11	0.8565	19	1.0728	27	1.3137
04	0.6896	12	0.8821	20	1.1016	28	1.3452
05	0.7120	13	0.9078	21	1.1308	29	1.3770
06	0.7349	14	0.9340	22	1.1604	30	1.4088
07	0.7583	15	0.9610	23	1.1904	31	1.4409
08	0.7822	16	0.9885	24	1.2206	32	1.4733

FileNo: 0

1	Displays log activation conditions.
2	Switches the channel to display log data.
3	Displays the 32 values measured before and after log activation.
4	Deletes acquired data.
5	Copies acquired data to the memory (RAM) of the display unit.
6	Saves acquired data to the USB storage device. By switching between Save and Load using the Change icon, data stored on the USB storage device can be displayed.

Light receiving profile capture



Ch No. 4

FileNo: 0

1	Displays the channel No. of the acquired data.
2	Displays the acquired received light profile.
3	Deletes acquired data.
4	Copies acquired data to the display unit.
5	Saves the acquired data to the USB storage device. By switching between Save and Load using the Change icon, data stored on the USB storage device can be displayed.

PERFORMANCE SPECIFICATIONS FOR THE DISPLAY UNIT

Display device	TFT color LCD
Display size	5.7 inches
No. of display dots	320 × 240 (QVGA)
Displayed colors	65356
Backlight	White LED (cannot be changed)
Brightness adjustment	16 levels (adjustable by the touch panel)
External data storage	USB 2.0 connector: Type A (1) Supply voltage: 5 V DC ±5 % Max. communication distance: 3 m
Supported languages	Japanese, English, Korean, Chinese (simplified & traditional), German
Backup memory	128 Kbyte
Rated voltage	24 V DC
Power consumption	6.8 W max.

7

SPECIFICATIONS

This chapter gives the specifications for the K1G series.

7-1 Sensor Heads

SPECIFICATIONS

Model No.		K1G-S07	K1G-S15
Connectable controller		K1G-C04 _ G	
Sensing method		Thru-scan	
Sensing distance		10–500 mm	10–1000 mm
Measurement width		7 mm	15 mm
Light source		Red semiconductor laser (peak wavelength: 650 nm), JIS class 1	
Standard target object		Opaque knife edge	
Repeatability		±1 μm max.*1	
Moving accuracy		±20 μm max. for a movement of 0.5 mm*2	
Indicators	Emitter	Laser emission indicator (green LED)	
	Receiver	Normal operation / beam alignment indicator (green LED)	
Operating environment	Operating temperature	0–50 °C	
	Storage temperature	-20 to +70 °C (without freezing)	
	Operating ambient humidity	30–85 % RH (without condensation)	
	Vibration resistance	$9.8\ \text{m/s}^2$ (10 to 55 Hz for 2 h each in x, y, and z directions)	
	Protective structure	IP40 (IEC standard)	
Material	Controller	PPS	
	Light-emitting and receiving surfaces	Glass	
	Cable	PVC	

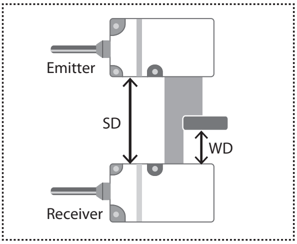
*1. The accuracy specifications are under the conditions shown below, at an ambient temperature of 23 ±2 °C.

Model No.	SD	WD	Workpiece position	No. of moving averages
K1G-S07	20 mm	10 mm	Center of measurement width	64
K1G-S15	100 mm	50 mm	1.0 mm from center of measurement width	

*2. The accuracy specifications are under the conditions shown below, at an ambient temperature of 23 ±2 °C.

Model No.	SD	WD	Workpiece position
K1G-S07	20 mm	10 mm	Center of measurement width
K1G-S15	100 mm	50 mm	1.0 mm from center of measurement width

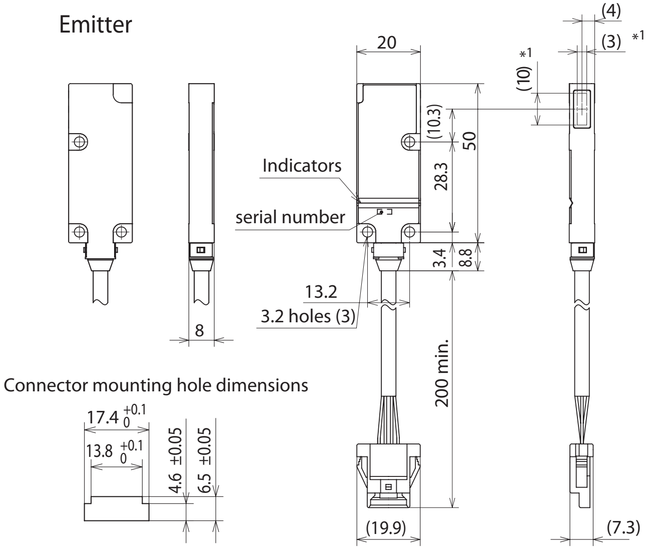
SD: sensing distance (emitter to receiver)
WD: working distance (target object to receiver)

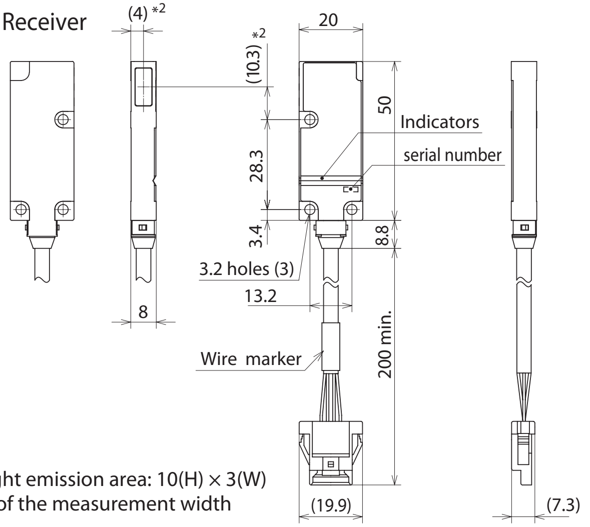


EXTERNAL DIMENSIONS

K1G-S07 (sensor heads)

Unit: mm





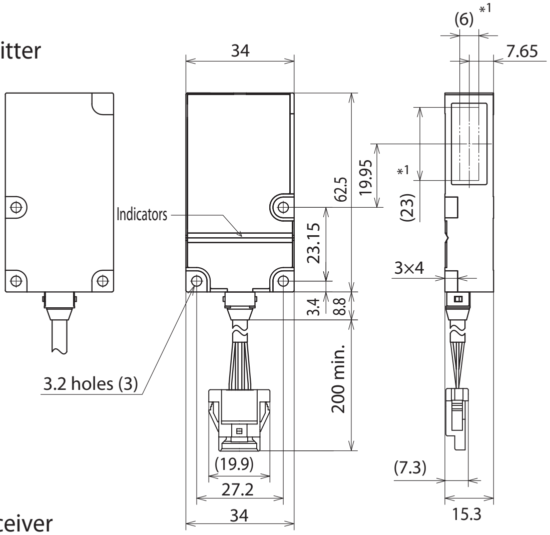
*1 Total light emission area: 10(H) × 3(W)

*2 Center of the measurement width

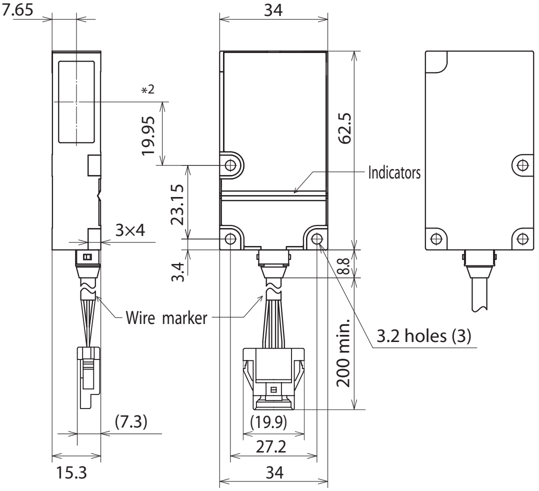
K1G-S15 (sensor heads)

Unit: mm

Emitter



Receiver



*1 Total light emission area: 23(H) × 6(W)

*2 Center of the measurement width

7-2 Controllers

SPECIFICATIONS

Model No.		**K1G-C04G**	**K1G-C04MG**	**K1G-C04EG**
Compatible sensor		K1G-S _ _		
Max. pairs of sensor heads		4		
Junction cable		K1G-L _ _S, K1G-R _ _ S		
Min. display unit		0.1 µm		
Display range	With KG-S07	±3.5 mm		
	With KG-S15	± 7.5 mm		
Measurement cycle (output update cycle)		500 µs / 1 ms (switchable)*1		
Analog output		4 1–5 V (voltage output) or 4–20 mA (current output) Load resistance: 10 kΩ min. (with voltage output) 250 Ω +1 % max. (with current output)	-	
Digital output *2		8 common outputs (shared with power terminals) NPN or PNP output (selectable) Output current: 1–10 mA (each output) ON-state voltage drop: 2 V max. OFF-state leakage current: 0.3 mA max.	-	
Digital input		4 common outputs (shared with power terminals) Non-voltage contacts and open collector NPN or PNP output (selectable) Input current: Approx. 4 mA max. Min. input time: 12 ms (at a 500 µs measurement cycle) 24 ms (at a 1 ms measurement cycle)	-	
Communications function		RS-485 (Modbus RTU)	MECHATROLINK-III	EtherCAT
Supply power		12–24 V DC ±10 %		
Current consumption		1 A max. at 24 V, 2 A max. at 12 V		
Inrush current		20 A (0.2 s) max.		
Operating temperature		0–50 °C (0–35 °C when 3 or more units are gang-mounted)		
Storage temperature		-20 to +70 °C (without freezing)		
Operating ambient humidity		30–85 % RH (without condensation)		
Vibration resistance		2 m/s^2 (10 to 60 Hz for 2 h each in x, y, and z directions)		
Shock resistance		10 m/s^2, 3 times in x, y, and z directions		
Protection circuit		Power miswiring protection		
Pollution degree		Pollution degree 2		

*1. The list of selectable measurement cycles varies depending on the cable length.
See the following table to select the cable length corresponding to the desired measurement cycle.

Model No.	Measurement cycle	
	500 µs	1 ms
K1G-L _ _ S	20 m max.	25 m max.
K1G-R_ _ S	5 m max.	10 m max.

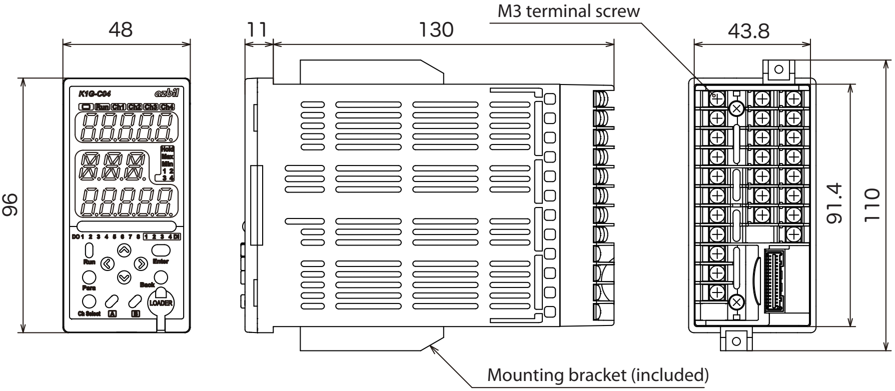
Note: The listed lengths are for junction cables. ☞ P. 7-8

*2. Not open collector output.

EXTERNAL DIMENSIONS

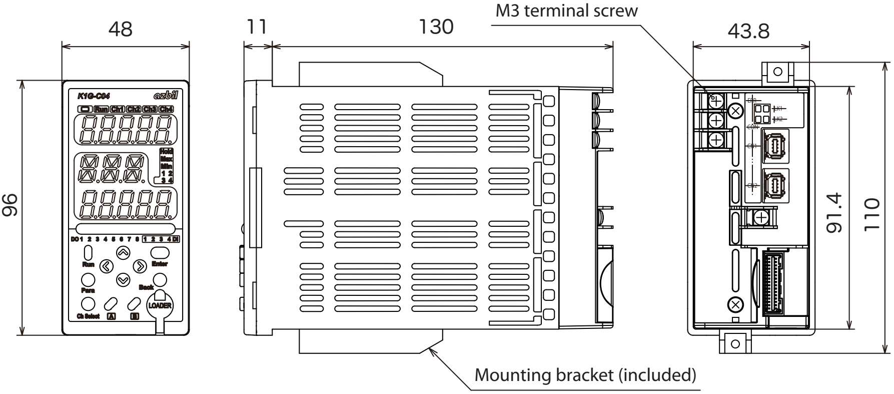
● K1G-C04G (controller)

Unit: mm



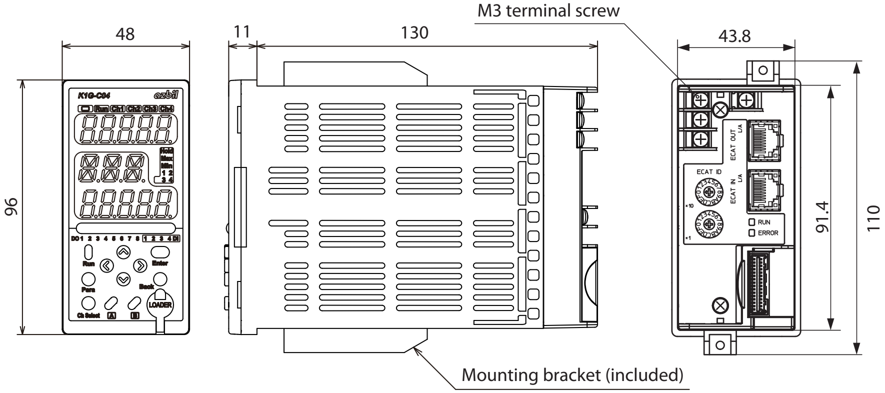
● K1G-C04MG (controller)

Unit: mm



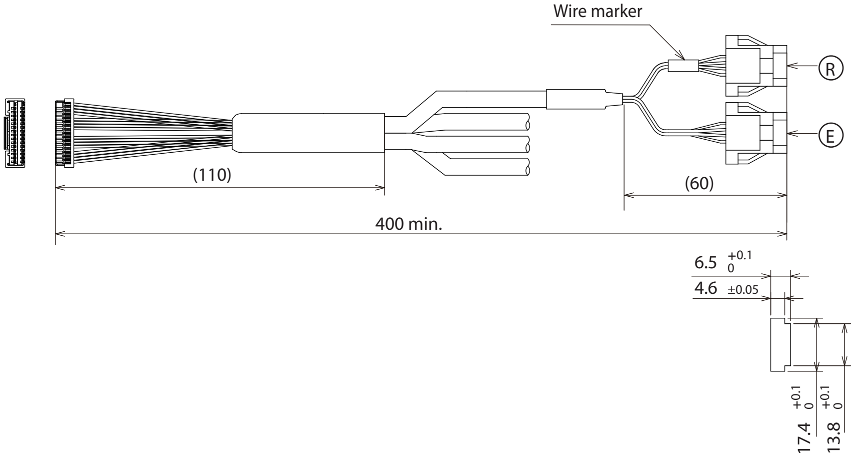
● K1G-C04EG (controller)

Unit: mm



● Sensor head cable

Unit: mm



7-3 Junction Cables

SPECIFICATIONS

● Standard model

Model No.	K1G-L01S	K1G-L03S	K1G-L05S	K1G-L10S	K1G-L25S
Cable length (L)	1 m	3 m	5 m	10 m	25 m

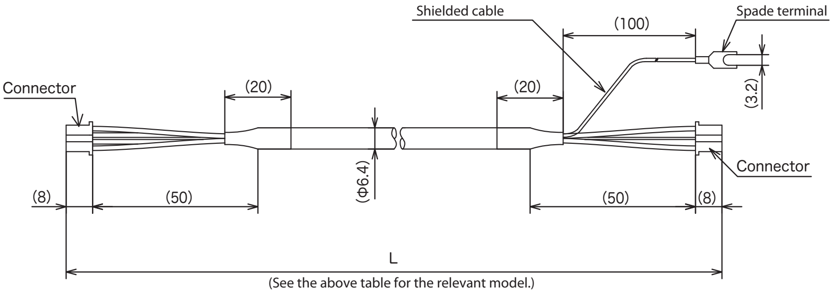
● Bend-tolerant model

Model No.	K1G-R01S	K1G-R03S
Cable length (L)	1 m	3 m

EXTERNAL DIMENSIONS

● Standard model

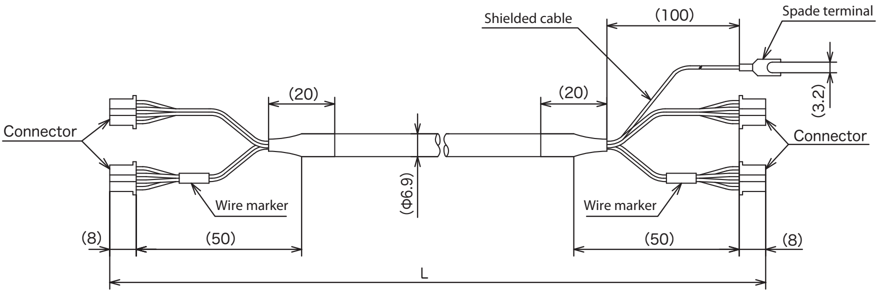
Unit: mm



(See the above table for the relevant model.)

● Bend-tolerant model

Unit: mm



(See the above table for the relevant model.)

7-4 Ferrite core

SPECIFICATIONS

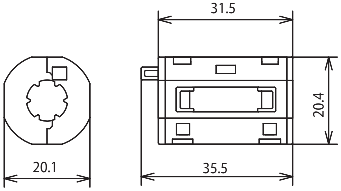
Model No.		SZ-E01	SZ-E02
Material	Ferrite core	Soft ferrite	
	Case	PA66 Color: Light gray Flammability standard: UL94 V-0	
Wire bundle diameter		8.5 to 9.5 mm	20 mm max.

SZ-E01 is equivalent to GRFC-9 made by Kitagawa Industries Co., Ltd.
SZ-E02 is equivalent to RFC-20 made by Kitagawa Industries Co., Ltd.

EXTERNAL DIMENSIONS

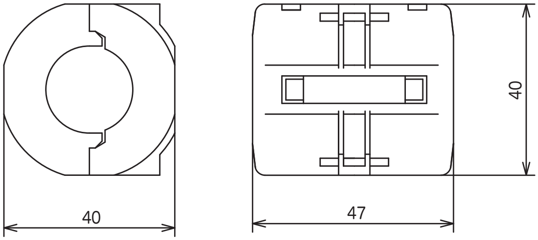
● SZ-E01

unit: mm



● SZ-E02

unit: mm



✎ **MEMO**

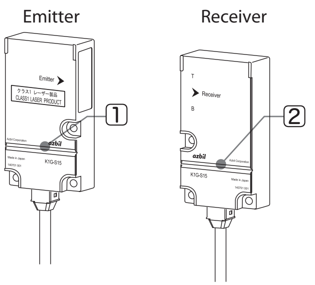
TROUBLE SHOOTING 8

This chapter tells how to determine the causes of problems
that may arise while using K1G series sensors,
and what corrective actions to take.

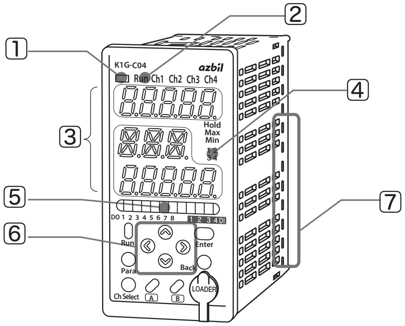
Troubleshooting

FREQUENTLY ASKED QUESTIONS

Sensor Heads



Controller



● Problems with the sensor heads

No.	Problem	What to check	Corrective action	Reference page
①	Emitter indicator does not light up.	Wiring for the emitter	Correct the wiring.	☞ P. 2-7
②	Receiver indicator does not light up.	Wiring for the receiver	Correct the wiring.	☞ P. 2-5
		Optical axis position (in Ready mode)	Adjust the optical axis position correctly.	☞ P. 3-8
		Power-saving mode	Turn off power-saving mode.	☞ P. 4-98

● Problems with the controller

No.	Problem	What to check	Corrective action	Reference page
-	The display is blank.	Power wiring for the controller	Correct the wiring.	☞ P. 2-7
①	The operation indicator is not lit.	-	Contact the azbil Group.	-
②	The mode cannot be switched to Run.	Initial setup completion	Complete the initial setup.	☞ P. 3-3
③	No values are displayed.	Power-saving mode	Turn off power-saving mode.	☞ P. 4-98
	The displayed value does not change.	Calculation OFF input is enabled.	Disable calculation OFF input.	☞ P. 4-36
		Hold function status (is "Hold" status indicator lit?)	Disable the hold function.	☞ P. 4-36 P. 4-79

No.	Problem	What to check	Corrective action	Reference page
④	A sensor connection indicator is blinking.	Initial setup completion	Adjust the receiver of the blinking channel.	☞ P. 3-8
		Were sensor heads replaced?	Reset, then adjust position of optical axis.	☞P.4-106
	A sensor connection indicator is not lit.	Wiring for the sensor heads	Correct the wiring.	☞ P. 2-5
⑤	DO signal is not output.	Wiring for the DO signal	Correct the wiring.	☞ P. 2-9
		Ready mode.	Switch the mode to Run.	☞ P. 4-4
	There is no response to DI signal input.	Wiring for the DI signal	Correct the wiring.	☞ P. 2-10
		Calculation OFF input is enabled.	Disable calculation OFF input.	☞ P. 4-36
⑥	Keys do not operate.	Key lock	Disable the key lock.	☞P.4-105
	Cannot set parameters.	Run mode	Switch the mode to Ready.	☞ P. 4-4
⑦	AO signal is not output.	Wiring for the AO signal	Correct the wiring.	☞ P. 2-11
	The AO signal does not change.	Ready mode.	Switch the mode to Run.	☞ P. 4-4
		Calculation OFF input is enabled.	Disable calculation OFF input.	☞ P. 4-36
		Hold function status (is "Hold" status indicator lit?)	Disable the hold function.	☞ P. 4-36 P. 4-79

● Measurement problems

No.	Problem	What to check	Corrective action	Reference page
①	Measured values fluctuate.	Smudge on the sensor heads	Wipe with a soft dust-free cloth.	☞ P. vi
②		Vibration of the workpiece	Reexamine the measurement position, etc.	-
③		Sensor head optical axis alignment	Check the optical axes and adjust the receiver.	☞ P. 3-8
④		Workpiece settings	Adjust the settings.	☞ P. 4-11
⑤		Ambient light interference	Reexamine the measurement position, etc.	-
⑥	The measured value is not correct.	Smudge on the sensor heads	Wipe with a soft dust-free cloth.	☞ P. vi
⑦		Workpiece settings	Adjust the settings.	☞ P. 4-11
⑧		Zero adjustment	Check the zero adjustment setting.	☞ P. 4-29
⑨	The DO for measurement status is not correct.	DO settings	Check DO operation type, thresholds, etc.	☞ P. 4-42
⑩		Selected channel	Check the setting for the selected channel.	☞ P. 4-42

● Communication problems

No.	Problem	What to check	Corrective action	Reference page
①	RS-485 communication is not working normally.	Wiring for communications	Correct the wiring.	☞ P. 2-12
②		Communication settings	Check communication-related settings.	☞ P. 5-2
③	MECHATROLINK-III communication is not working normally.	Cable connection status (check link indicators LK1 and LK2).	Insert the connector until it clicks.	☞ P. 2-14
④		Station address and No. of transmission bytes	Correct the relevant settings including those of the master station and other devices.	☞ P.4-108 ☞ P.4-111
⑤	EtherCAT communication is not working properly.	Check the Link/Activity indicator to check the communication cable connections.	Insert the connector until it clicks.	☞ P. 2-15
⑥		Check the RUN and ERROR indicators.	Determine the state of EtherCAT communication from the indicators and take appropriate countermeasures.	☞ P. 1-14
⑦		Check the settings of the ECAT ID setting switches.	Check the master device for the ID of other slave devices and specify a unique ID.	☞ P. 3-11
⑧		Check if there is a source of heavy electrical noise in the environment.	Reexamine the instrumentation method.	☞ P. 2-16

● Error massages

Display 1	Display 2	Error	Corrective action
Error	1	System error	Replace the controller.
	2	System error	
	4	System error	
	8	Data corruption in EE-PROM	Contact the azbil Group.
	16	Channel 1 sensor head disconnection	Check the relevant cables, etc., and replace the sensor heads if necessary. If multiple sensor head sets are used, unless all of them are disconnected, "Error" will not be displayed.
	32	Channel 2 sensor head disconnection	
	64	Channel 3 sensor head disconnection	
	128	Channel 4 sensor head disconnection	
	256	MECHATROLINK-III error	Check the MECHATROLINK-III communication configuration, referring to user's manual No. CP-SP-1386E. Also, check the relevant settings for the master station.
	512	EtherCAT communication error	Replace the controller.

Note: If multiple errors occur at the same time, the sum of the error codes will be displayed.

APPENDIX 9

Parameters, 7-segment LED characters and numbers, etc.

9-1 Parameters

Display	Description	Parameter	Default setting	Reference page
A01	Measurement cycle	500u: 500 µs 1000u: 1 ms	500	☞ P. 4-15
A02	Display resolution	99.9: 1 digit after the decimal point 99.99: 2 digits after the decimal point 9.999: 3 digits after the decimal point 9.9999: 4 digits after the decimal point	9.999	☞ P. 4-8
A03	Key lock	oFF: Disabled on: Enabled	oFF	☞ P. 4-102
A04	Controller power-saving mode	oFF: Disabled on: Enabled	oFF	☞ P. 4-98
A05	Sensor head power-saving mode	oFF: Disabled on: Enabled	oFF	☞ P. 4-98
A06	Station address	0– 127 (0: communication is disabled)	0	☞ P. 5-4
A07	Transmission speed	9.6: 9.6 kbps 19.2: 19.2 kbps 38.4: 38.4 kbps 115.2: 115.2 kbps	9.6	☞ P. 5-7
A08	Communication format	nonE: No parity (2 stop bits) EUEn: Even parity (1 stop bit) odd: Odd parity (1 stop bit)	nonE	☞ P. 5-10
A09	MECHATROLINK-III address	3h to EFh Note: "3" is displayed on the K1G-C04G, but it cannot be changed.	3h	☞ P. 4-108 ☞ CP-SP-1386E
A10	No. of transmission bytes for MECHATROLINK-III Note: This parameter will not be displayed on the K1G-C04G.	48: 48 byte 32: 32 byte	48	☞ P. 4-111 ☞ CP-SP-1386E
b01	Sensor head type (display only, unchangeable)	- -: Not connected 07: K1G–S07 15: K1G–S15	-	-

Display	Description	Parameter				Default setting	Reference page
b02	Measurement mode		Measurement mode	Target object type	Measurement orientation	1	☞ P. 4-11
		1	Edge measurement	Opaque object	Top		
		2			Bottom		
		3		Transparent object	Top		
		4			Bottom		
		5	Width measurement	Opaque object	-		
		6	Gap measurement		-		
		7	Edge width measurement	Transparent object	Top		
		8			Bottom		
		9	Measurement of second edge		Top		
		10			Bottom		
b03	No. of moving averages	1–500				64	☞ P. 4-18
b04	Smudge detection threshold	1– 100 (%) (0: disabled)				0	☞ P. 4-90
b05	Edge detection threshold	5–95 (%)				25	☞ P. 4-21
b06	Zero adjustment value	With K1G-S07 sensor: -3.500–3.500 (mm)				0.000	☞ P. 4-29
		With K1G-S15 sensor: -7.500–7.500 (mm)					
b07	Working distance (WD) * This parameter is displayed but the function is not yet implemented.	All models: 0–9 (disabled)				0	☞ P. 4-76
		With K1G-S07 sensor: 10–500 (mm)					
		With K1G-S15 sensor: 10– 1500 (mm)					
C01	Inter-channel calculation	nonE: Disabled				nonE	☞ P. 4-62
		F-4Ch: Four arithmetic operations					
		F-AnG: θ calculation (channel 2 or 4 only can be selected)					
		F-EHt: Measurement range expansion calculation (channel 2 or 4 only can be selected)					
C02	Hold setting	nonE: disabled				nonE	☞ P. 4-79
		PU-h1: Digital input (DI) max. value hold function					
		PU-h2: Digital input (DI) min. value hold function					
		EPS- 1:EPS filter 1					
		EPS-2:EPS filter 2					
		EPS-3:EPS filter 3					
		EPS-4:EPS filter 4					
		EPS-5:EPS filter 5					

Display	Description	Parameter	Default setting	Reference page
C03	No. of EPS filter delays	1–256	1	☞ P. 4-83
C04	EPS filter size	0.100–50.000 (mm)	0.100	☞ P. 4-83
C05	EPS filter direction	both:Concave and convex	both	☞ P. 4-83
		rISE:Convex		
		droP:Concave		
C06	EPS filter output hold	oFF: Disabled	on	☞ P. 4-83
		on: Enabled		
C07	Low threshold	With K1G-S07: - 99.999 to + 99.999 (mm)	- 3.500	☞ P. 4-42
		With K1G-S15: - 99.999 to + 99.999(mm)	- 7.500	
C08	High threshold	With K1G-S07: - 99.999 to +99.999 (mm)	3.500	☞ P. 4-42
		With K1G-S15: - 99.999 to +99.999(mm)	7.500	
C09	Hysteresis	0.010– 1.000 (mm)	0.010	☞ P. 4-42
C10	Analog output reverse polarity	oFF: disabled (positive polarity)	oFF	☞ P. 4-33
		on: enabled (negative polarity)		
C11	Analog output range low limit	With K1G-S07: - 99.999 to + 99.999 (mm)	- 3.500	☞ P. 4-25
		With K1G-S15: - 99.999 to + 99.999 (mm)	- 7.500	
C12	Analog output range high limit	With K1G-S07: - 99.999 to + 99.999 (mm)	3.500	☞ P. 4-25
		With K1G-S15: - 99.999 to + 99.999 (mm)	7.500	
d01	Calculation parameter K1	- 1000 to + 1000	1	☞ P. 4-62
d02	Calculation parameter K2	- 1000 to + 1000	1	☞ P. 4-62
d03	Calculation parameter K3	- 1000 to + 1000	1	☞ P. 4-62
d04	Calculation parameter K4	- 1000 to + 1000	1	☞ P. 4-62
d05	Calculation parameter C1	-9.999 to +9.999	0.000	☞ P. 4-62
d06	Calculation parameter C2	1– 10000	4	☞ P. 4-62
E01	Event source	Com: All channels (OR output)	Selected channel	☞ P. 4-42
		Ch1: Channel 1 (for PV1)		
		Ch2: Channel 2 (for PV2)		
		Ch3: Channel 3 (for PV3)		
		Ch4: Channel 4 (for PV4)		
E02	Event type	PASS: Pass	PASS	☞ P. 4-42
		out: Out		
		hi: High		
		Lo: Low		
		EPS: EPS event		
		hoLd: Holding		
		LiGht: Smudge		
		triG: Output update		
		GoinG: Normal operation		

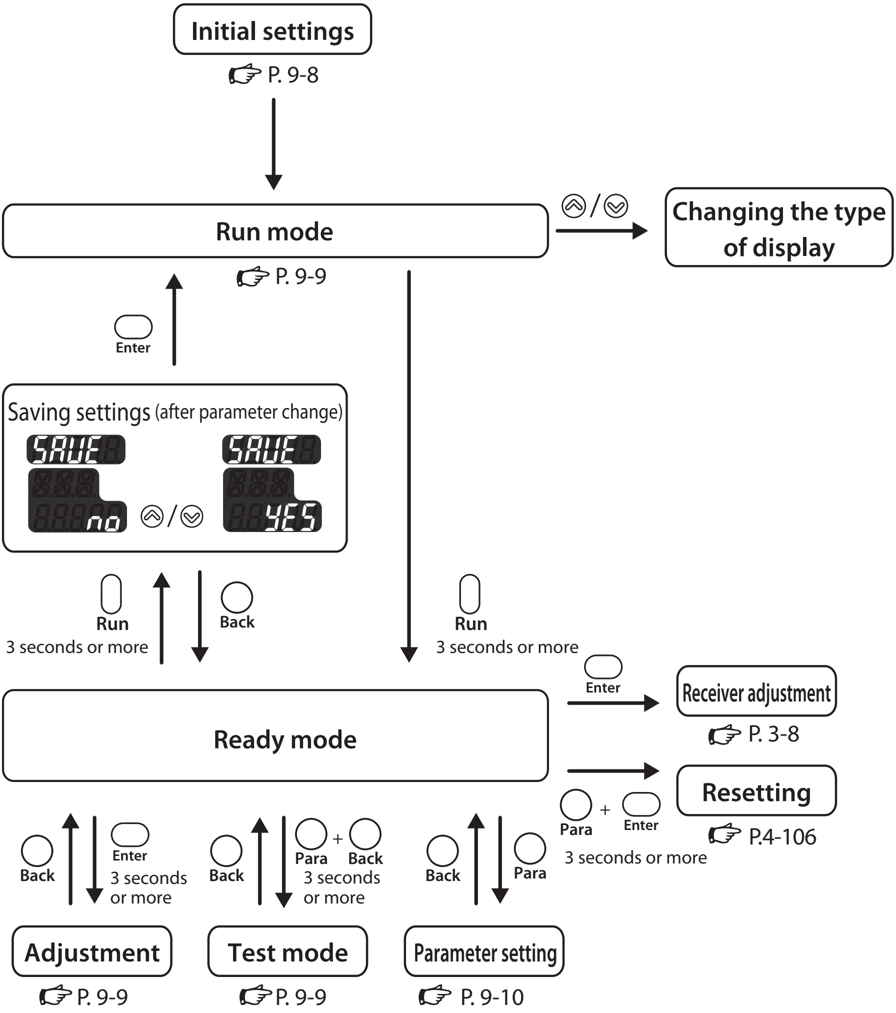
Dis-play	Description	Parameter	Default setting	Reference page
E03	Delay setting	nonE: Disabled	nonE	☞ P. 4-42
		on-d: ON delay		
		oF-d: OFF delay		
E04	Delay time	10: 10 (ms)	40	☞ P. 4-42
		20: 20 (ms)		
		30: 30 (ms)		
		40: 40 (ms)		
		50: 50 (ms)		
		60: 60 (ms)		
		70: 70 (ms)		
E05	Event source	Com: All channels (OR output)	Selected channel	☞ P. 4-42
		Ch 1: Channel 1 (for PV1)		
		Ch2: Channel 2 (for PV2)		
		Ch3: Channel 3 (for PV3)		
		Ch4: Channel 4 (for PV4)		
E06	Event type	PASS: Pass	out	☞ P. 4-42
		out: Out		
		hi: High		
		Lo: Low		
		EPS: EPS event		
		hoLd: Holding		
		LiGht: Smudge		
		triG: Output update		
		GoinG: Normal operation		
E07	Delay setting	nonE: Disabled	nonE	☞ P. 4-42
		on-d: ON delay		
		oF-d: OFF delay		
E08	Delay time	10: 10 (ms)	40	☞ P. 4-42
		20: 20 (ms)		
		30: 30 (ms)		
		40: 40 (ms)		
		50: 50 (ms)		
		60: 60 (ms)		
		70: 70 (ms)		

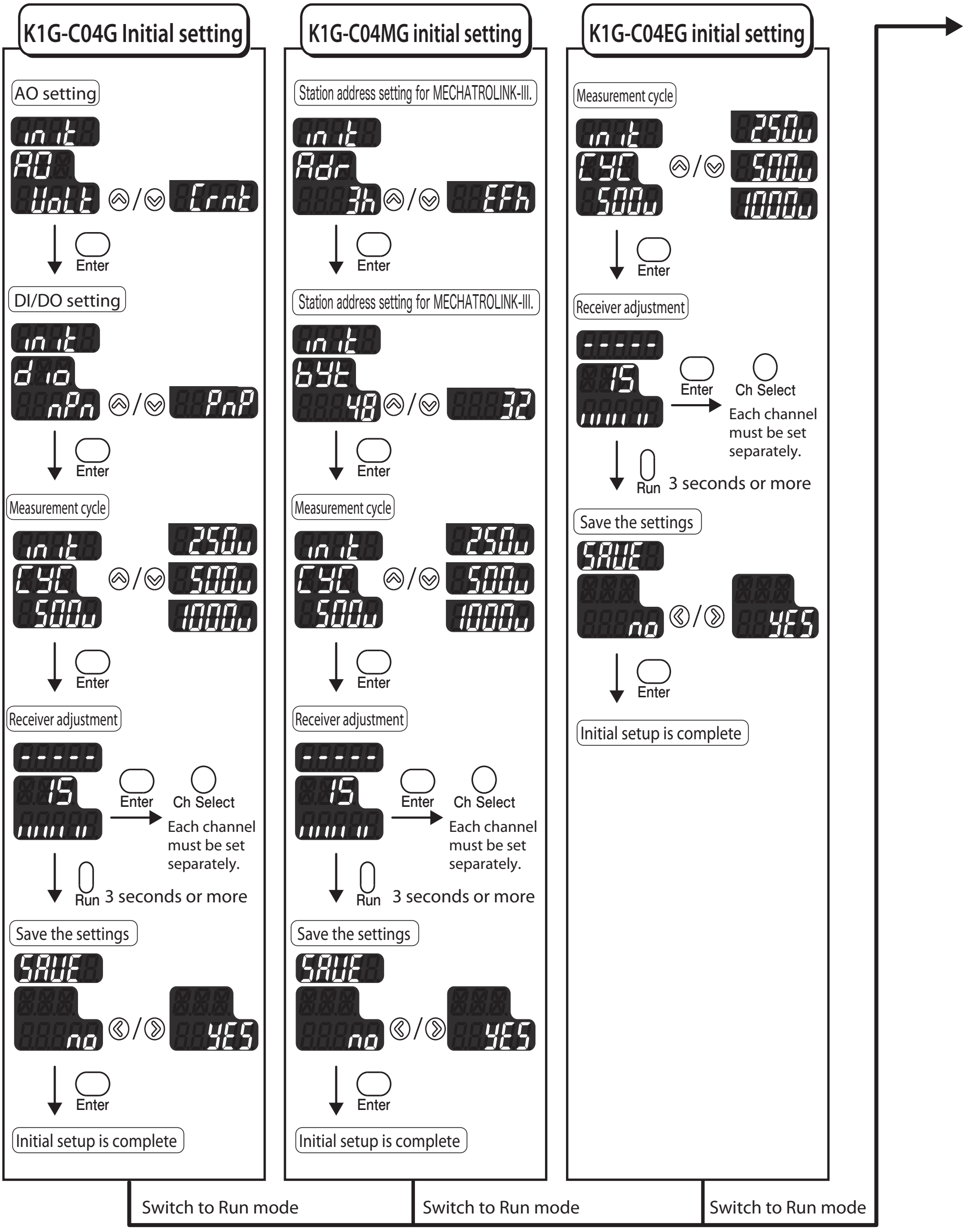
Display	Description	Parameter		Default setting	Reference page
E09	DI function selection	0-AdJ:	Zero adjustment for the specified channel	0-AdJ	☞ P. 4-36
		EPS:	EPS hold cancellation input for the specified channel		
		PU-h:	PV hold input for the specified channel		
		ALL 0-AdJ:	Zero adjustment for all channels		
		ALL EPS:	EPS hold cancellation input for all channels		
		ALL PU-h:	PV hold input for all channels		
		ALL F-EPS:	Forced EPS hold cancellation input for all channels		
		ALL Ld-on:	Laser start input for all channels		
		ALL do-oF:	Calculation OFF input for all channels		
		ALL LoG:	Event log start input for all channels		

9-2 Configuration Flowcharts

OVERALL FLOWCHART

For details, see the page noted under the item.

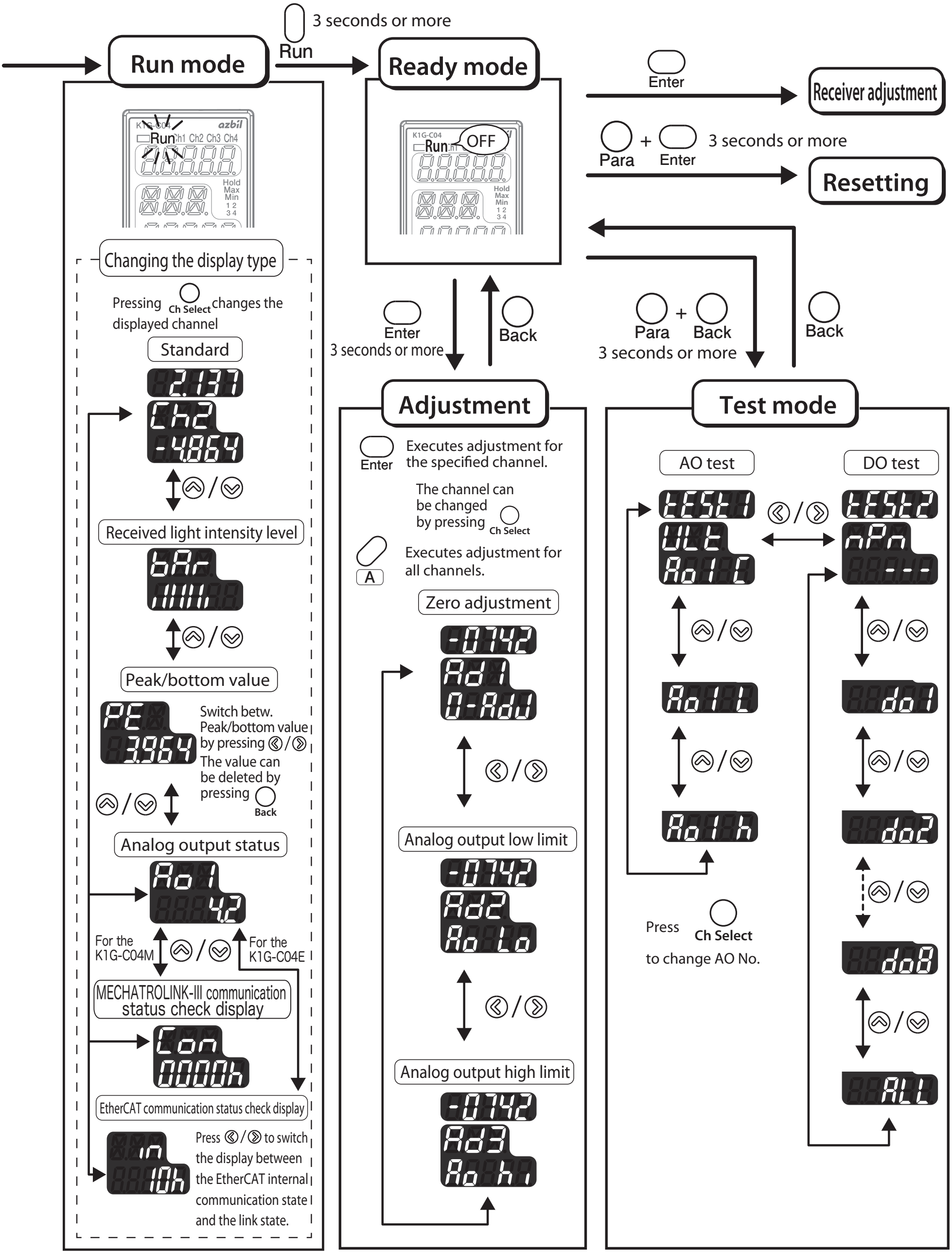



K1G-C04G Initial setting
AO setting
init
AO
VoLt
Crnt
Enter
DI/DO setting
init
dio
nPn
PnP
Enter
Measurement cycle
init
CYC
500u
250u
500u
1000u
Enter
Receiver adjustment

15
Enter
Ch Select
Each channel must be set separately.
Run
3 seconds or more
Save the settings
SAVE
no
YES
Enter
Initial setup is complete
K1G-C04MG initial setting
Station address setting for MECHATROLINK-III.
init
Adr
3h
EFh
Enter
Station address setting for MECHATROLINK-III.
init
bYt
48
32
Enter
Measurement cycle
init
CYC
500u
250u
500u
1000u
Enter
Receiver adjustment

15
Enter
Ch Select
Each channel must be set separately.
Run
3 seconds or more
Save the settings
SAVE
no
YES
Enter
Initial setup is complete
K1G-C04EG initial setting
Measurement cycle
init
CYC
500u
250u
500u
1000u
Enter
Receiver adjustment

15
Enter
Ch Select
Each channel must be set separately.
Run
3 seconds or more
Save the settings
SAVE
no
YES
Enter
Initial setup is complete
Switch to Run mode
Switch to Run mode
Switch to Run mode



Run 3 seconds or more

Enter

Para + Enter 3 seconds or more

Enter 3 seconds or more

Back

Para + Back 3 seconds or more

Back

Pressing Ch Select changes the displayed channel

Switch betw. Peak/bottom value by pressing ≪/≫ The value can be deleted by pressing Back

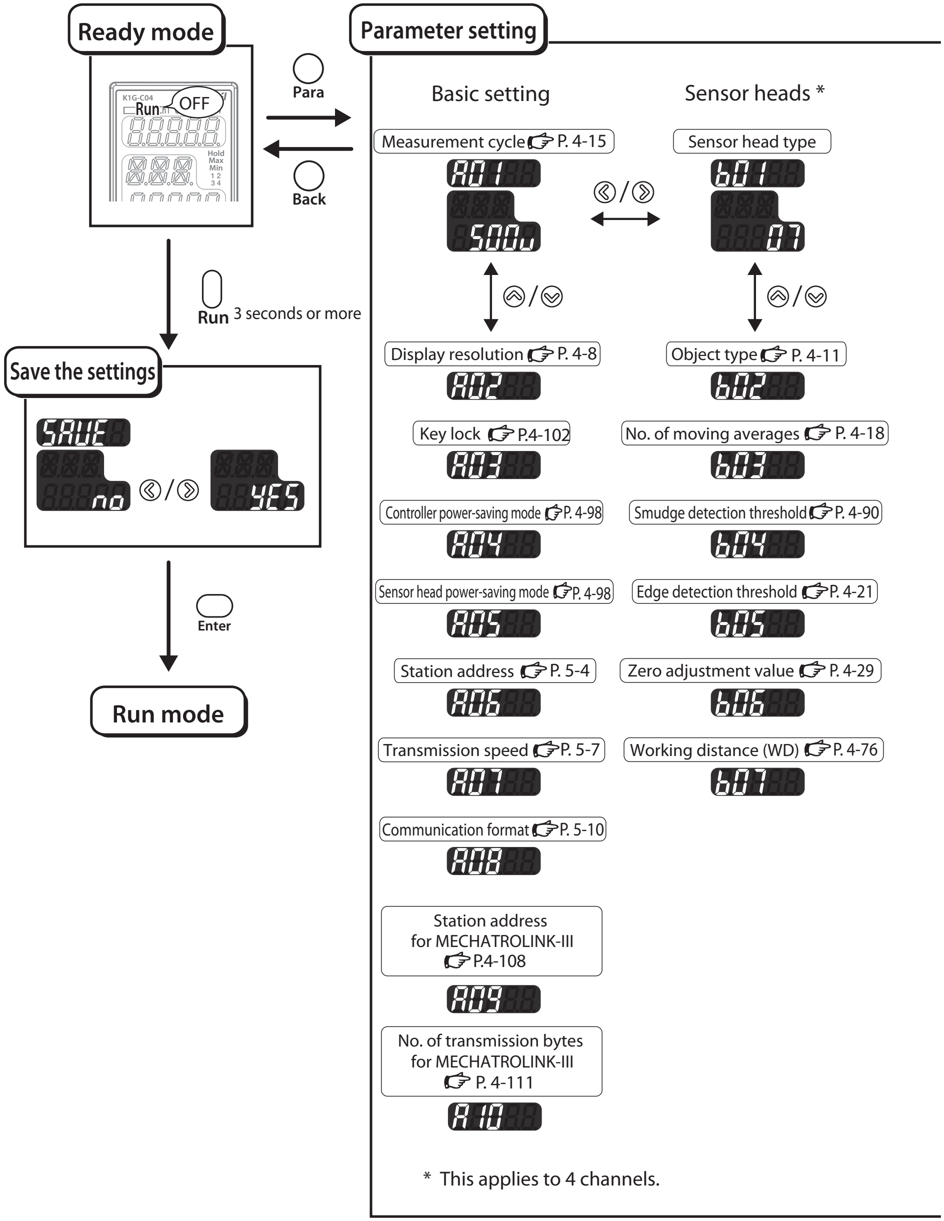
Press ≪/≫ to switch the display between the EtherCAT internal communication state and the link state.

Enter Executes adjustment for the specified channel.

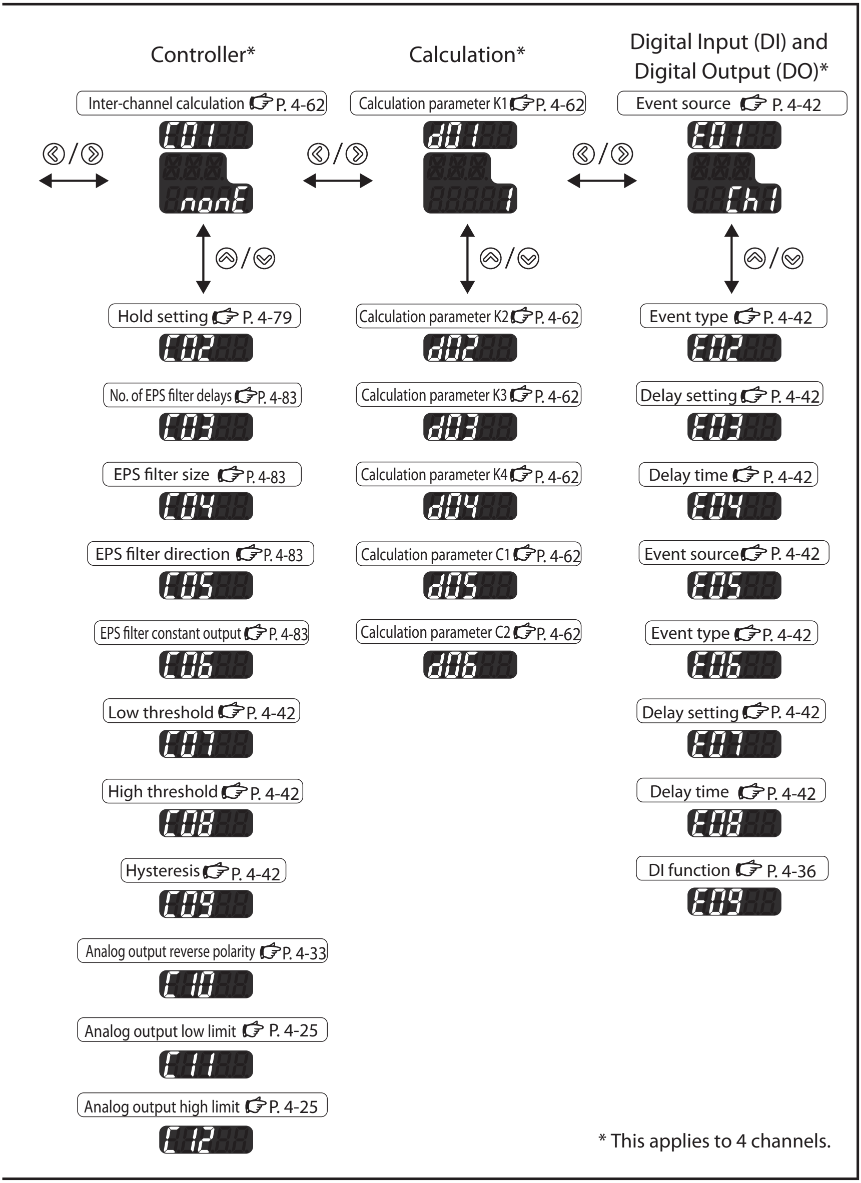
The channel can be changed by pressing Ch Select

A Executes adjustment for all channels.

Press Ch Select to change AO No.

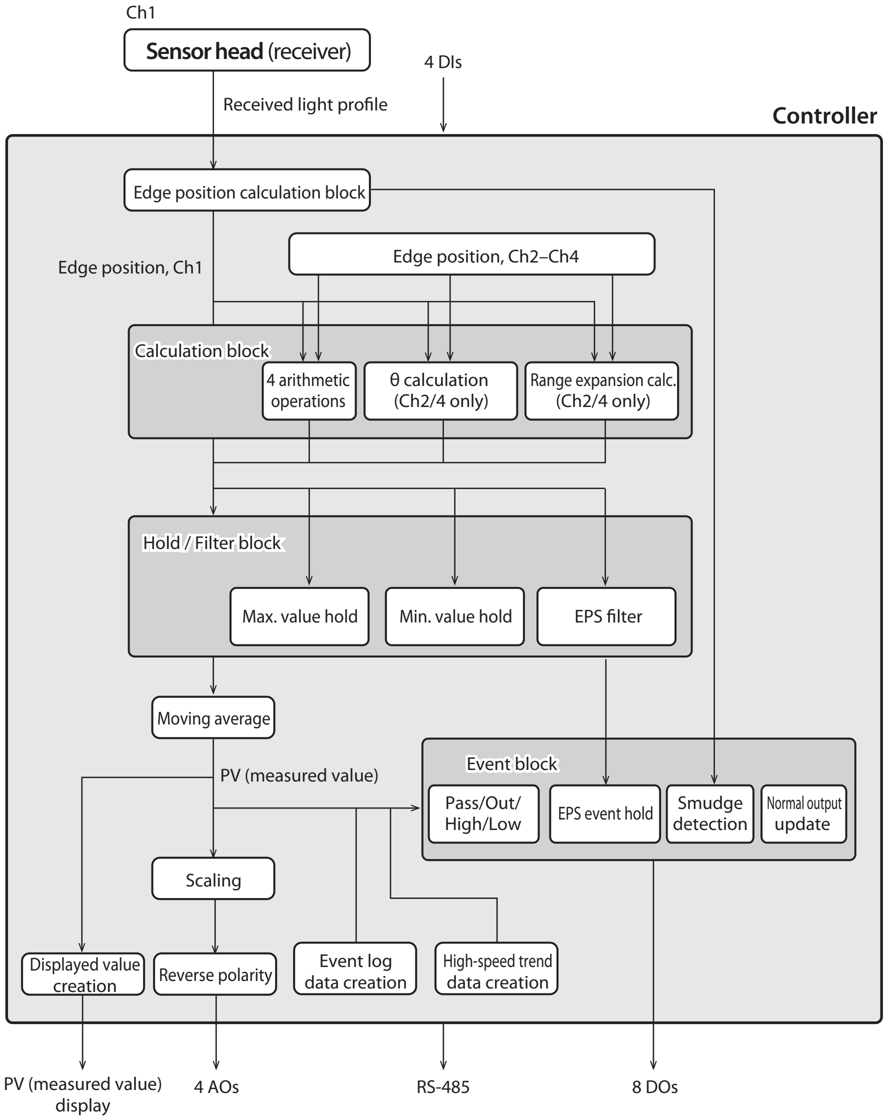

Ready mode
K1G-C04
Run
OFF
Hold
Max
Min
1 2
3 4
Para
Back
Run 3 seconds or more
Save the settings
SAVE
no
YES
Enter
Run mode
Parameter setting
Basic setting
Sensor heads *
Measurement cycle P. 4-15
A01
500u
Display resolution P. 4-8
A02
Key lock P.4-102
A03
Controller power-saving mode P. 4-98
A04
Sensor head power-saving mode P. 4-98
A05
Station address P. 5-4
A06
Transmission speed P. 5-7
A07
Communication format P. 5-10
A08
Station address for MECHATROLINK-III P.4-108
A09
No. of transmission bytes for MECHATROLINK-III P. 4-111
A10
Sensor head type
b01
07
Object type P. 4-11
b02
No. of moving averages P. 4-18
b03
Smudge detection threshold P. 4-90
b04
Edge detection threshold P. 4-21
b05
Zero adjustment value P. 4-29
b06
Working distance (WD) P. 4-76
b07

* This applies to 4 channels.


Controller*
Calculation*
Digital Input (DI) and Digital Output (DO)*
Inter-channel calculation P. 4-62
C01 nonE
Hold setting P. 4-79
C02
No. of EPS filter delays P. 4-83
C03
EPS filter size P. 4-83
C04
EPS filter direction P. 4-83
C05
EPS filter constant output P. 4-83
C06
Low threshold P. 4-42
C07
High threshold P. 4-42
C08
Hysteresis P. 4-42
C09
Analog output reverse polarity P. 4-33
C10
Analog output low limit P. 4-25
C11
Analog output high limit P. 4-25
C12
Calculation parameter K1 P. 4-62
d01 1
Calculation parameter K2 P. 4-62
d02
Calculation parameter K3 P. 4-62
d03
Calculation parameter K4 P. 4-62
d04
Calculation parameter C1 P. 4-62
d05
Calculation parameter C2 P. 4-62
d06
Event source P. 4-42
E01 Ch1
Event type P. 4-42
E02
Delay setting P. 4-42
E03
Delay time P. 4-42
E04
Event source P. 4-42
E05
Event type P. 4-42
E06
Delay setting P. 4-42
E07
Delay time P. 4-42
E08
DI function P. 4-36
E09

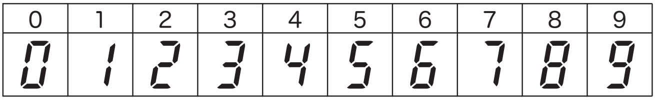
* This applies to 4 channels.

9-3 Processing Flowchart



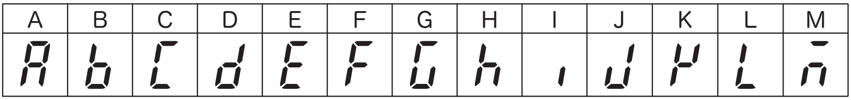
9-4 Alphanumeric Characters

The 7-segment LED display of the controller shows numbers as follows.

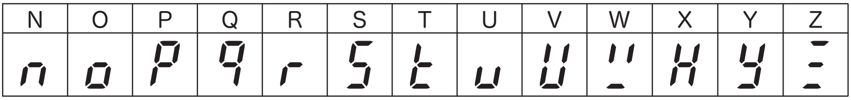


0	1	2	3	4	5	6	7	8	9

Alphabetic characters appear as follows on the LED display.



A	B	C	D	E	F	G	H	I	J	K	L	M



N	O	P	Q	R	S	T	U	V	W	X	Y	Z

9-5 If the Product Is Used Outside Japan

CE MARK AND KOREA CERTIFICATION MARK

This product complies with the RoHS Directive (EN 50581: 2012). This product complies with the EMC Directive (EN 61326-1: 2013) for the instrumentation described in Chapter 2, INSTALLATION AND WIRING. This product complies with KC marking (Korean Radio Waves Act) for the instrumentation described in Chapter 2, INSTALLATION AND WIRING.

IF THE PRODUCT IS USED IN THE UNITED STATES

If equipment incorporating this device is exported to the United States, it will be subject to U.S. FDA laser safety requirements.

This product has been registered with the FDA (CDRH).

It includes a label indicating compliance with FDA standards. In the case of export to the United States, attach the label to the product.

9-6 Communication Parameters

DETAILS ON COMMUNICATIONS DATA

Definitions of items in the tables below are as follows.

Address : Controller memory address (hexadecimal)

Size : Parameter size (number of addresses)
1 : (16-bit data)
2 : (32-bit data)

Access rights : Parameter access rights
R : read
W : write

Change enabled mode : The mode in which parameters can be written
RDY : Ready mode
RUN : Run mode
UT : UserTest mode

FOR MONITORING

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
1000	2	R	-	PV1	Integer, ± 999999 (in 0.1 µm increments)
1002	2	R	-	PV2	Integer, ± 999999 (in 0.1 µm increments)
1004	2	R	-	PV3	Integer, ± 999999 (in 0.1 µm increments)
1006	2	R	-	PV4	Integer, ± 999999 (in 0.1 µm increments)
1008	1	R	-	Event occurrence (channels 1–4, OR)	Table 1-A
1009	1	R	-	Ch1 event occurrence	Table 1-A
100A	1	R	-	Ch2 event occurrence	Table 1-A
100B	1	R	-	Ch3 event occurrence	Table 1-A
100C	1	R	-	Ch4 event occurrence	Table 1-A
100D	1	R	-	DI status	Table 1-B
100E	1	R	-	DO status	Table 1-C
100F	1	R	-	Controller status	Table 1-D
1010	1	R	-	Error status bit	Table 1-E
1011	1	R	-	Sensor head pair 1 status	Table 1-F
1012	1	R	-	Sensor head pair 2 status	Table 1-F
1013	1	R	-	Sensor head pair 3 status	Table 1-F
1014	1	R	-	Sensor head pair 4 status	Table 1-F

Table 1-A

Assignment	Event occurrence status
Bit 0	Pass event occurrence
Bit 1	Out event occurrence
Bit 2	High event occurrence
Bit 3	Low event occurrence
Bit 4	EPS event occurrence
Bit 5	Hold event occurrence
Bit 6	Smudge detection event occurrence
Bit 7	Output update event occurrence
Bit 8	Normal operation event occurrence
Bits 9–15	No assignment (always 0)

Note: 1 = event occurrence, 0 = no occurrence

Table 1-B

Assignment	Event occurrence
Bit 0	DI1: ON =1, OFF = 0
Bit 1	DI2: ON =1, OFF = 0
Bit 2	DI3: ON =1, OFF = 0
Bit 3	DI4: ON =1, OFF = 0
Bits 4–15	No assignment (always 0)

Table 1-C

Assignment	Event occurrence
Bit 0	DO1: ON =1, OFF = 0
Bit 1	DO2: ON =1, OFF = 0
Bit 2	DO3: ON =1, OFF = 0
Bit 3	DO4: ON =1, OFF = 0
Bit 4	DO5: ON =1, OFF = 0
Bit 5	DO6: ON =1, OFF = 0
Bit 6	DO7: ON =1, OFF = 0
Bit 7	DO8: ON =1, OFF = 0
Bits 8–15	No assignment (always 0)

Table 1-D

Assignment	Controller status
Bit 0	No error
Bit 1	Partial sensor head disconnection
Bit 2	Device failure

Table 1-E

Assignment	Error status bit
Bit 0	CPU in infinite loop
Bit 1	FPGA malfunction
Bit 2	ROM error
Bit 3	EEPROM error
Bit 4	Ch1 sensor head disconnection
Bit 5	Ch2 sensor head disconnection
Bit 6	Ch3 sensor head disconnection
Bit 7	Ch4 sensor head disconnection
Bit 8	Bit 8 MECHATROLINK-III communication error
Bits 9–15	No assignment (always 0)

Note: 1 = event occurrence, 0 = no occurrence

Table 1-F

Value	Sensor head status
0	Not connected
1	Not adjusted
2	In use
3	Wrong connection
4	Disconnected
5	Prohibited

FOR SETTINGS

● Shared settings

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
2000	1	R/W	RUN, RDY	Measurement cycle	1: 500 µs 2: 1000 µs
2001	1	R/W	RUN, RDY	Display resolution	No. of digits after the decimal point 0: 3 1: 2 2: 1 3: 4
2002	1	R/W	RUN, RDY	Key lock	0: disabled 1: enabled
2003	1	R/W	RUN, RDY	Controller power-saving mode	0: disabled 2: enabled
2004	1	R/W	RUN, RDY	Sensor head power-saving mode	0: disabled 3: enabled
2005	1	R/W	RUN, RDY	Station address	0–127 (0: RS-485 disabled)
2006	1	R/W	RUN, RDY	Transmission speed	0: 9.6 kbps 1: 19.2 kbps 2: 38.4 kbps 3: 115.2 kbps
2007	1	R/W	RUN, RDY	Communications format (parity)	0: None 1: Even 2: Odd
2008	1	R/W*1	RUN, RDY	MECHATROLINK-III address	03-EF(HEX)
20A1	1	R/W*2	RUN, RDY	No. of transmission bytes for MECHATROLINK-III	2: 32 bytes 3: 48 bytes

*1. "R" (READ) only in the case of K1G-C04G.

*2. No access in the case of K1G-C04G.

● Individual channel settings

Ch1 address (hex)	Ch2 address (hex)	Ch3 address (hex)	Ch4 address (hex)	Size	Access rights	Change enabled mode	Description	Notes
2009	2010	2017	201E	1	R	-	Sensor head type	0: Not connected 1: K1G-S07 2: K1G-S15
200A	2011	2018	201F	1	R/W	RUN, RDY	Workpiece	Table 2-A
200B	2012	2019	2020	1	R/W	RUN, RDY	No. of moving averages	1–500
200C	2013	201A	2021	1	R/W	RUN, RDY	Smudge detection threshold	0–100 %
200D	2014	201B	2022	1	R/W	RUN, RDY	Edge detection threshold	5–95 %
200E	2015	201C	2023	1	R/W	RUN, RDY	Zero adjustment value	Integer, -3500 to +3500 µm Integer, -7500 to +7500 µm
200F	2016	201D	2024	1	R/W	RUN, RDY	Working distance (WD)	S07: 0–500 S15: 0–1500, 0–9: Invalid

● Individual PV settings

PV1 address (hex)	PV2 address (hex)	PV3 address (hex)	PV4 address (hex)	Size	Access rights	Change enabled mode	Description	Notes
2025	2035	2045	2055	1	R/W	RUN, RDY	Inter-channel calculation	0: No calculation 1: Four arithmetic operations 2: θ calculation* 3: Measurement range expansion calculation*
2026	2036	2046	2056	1	R/W	RUN, RDY	Hold setting	Table 2-B
2027	2037	2047	2057	1	R/W	RUN, RDY	No. of EPS filter delays	1–256
2028	2038	2048	2058	1	R/W	RUN, RDY	EPS filter size	Integer, 100 to 50000 µm
2029	2039	2049	2059	1	R/W	RUN, RDY	EPS filter direction	0: Concave and convex 1: Convex 2: Concave
202A	203A	204A	205A	1	R/W	RUN, RDY	EPS filter output hold	0: Disabled 1: Enabled
202B	203B	204B	205B	2	R/W	RUN, RDY	Low threshold	Integer, -99999 to +99999 µm
202D	203D	204D	205D	2	R/W	RUN, RDY	High threshold	Integer, -99999 to +99999 µm
202F	203F	204F	205F	1	R/W	RUN, RDY	Hysteresis	Integer, 10 to 1000 µm
2030	2040	2050	2060	1	R/W	RUN, RDY	Analog output reverse polarity	0: Disabled 1: Enabled
2031	2041	2051	2061	2	R/W	RUN, RDY	Analog output range low limit	Integer, -99999 to +99999 µm
2033	2043	2053	2063	2	R/W	RUN, RDY	Analog output range high limit	Integer, -99999 to +99999 µm
2065	206B	2071	2077	1	R/W	RUN, RDY	Calculation parameter K1	-1000 to +1000
2066	206C	2072	2078	1	R/W	RUN, RDY	Calculation parameter K2	-1000 to +1000
2067	206D	2073	2079	1	R/W	RUN, RDY	Calculation parameter K3	-1000 to +1000
2068	206E	2074	207A	1	R/W	RUN, RDY	Calculation parameter K4	-1000 to +1000
2069	206F	2075	207B	1	R/W	RUN, RDY	Calculation parameter C1	Integer, -99999 to +99999 µm
206A	2070	2076	207C	1	R/W	RUN, RDY	Calculation parameter C2	1 to 10000

* "2" and "3" can be set for PV2 or PV4 only.

● DI and DO settings

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
207D	1	R/W	RUN, RDY	DO1 Event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
207E	1	R/W	RUN, RDY	DO1 event type	Table 2-C
207F	1	R/W	RUN, RDY	DO1 delay setting	0: No delay 1: ON delay 2: OFF delay
2080	1	R/W	RUN, RDY	DO1 delay time	Table 2-D
2081	1	R/W	RUN, RDY	DO2 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
2082	1	R/W	RUN, RDY	DO2 event type	Table 2-C
2083	1	R/W	RUN, RDY	DO2 delay setting	0: No delay 1: ON delay 2: OFF delay
2084	1	R/W	RUN, RDY	DO2 delay time	Table 2-D
2085	1	R/W	RUN, RDY	DI1 function selection	Table 2-E
2086	1	R/W	RUN, RDY	DO3 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
2087	1	R/W	RUN, RDY	DO3 event type	Table 2-C
2088	1	R/W	RUN, RDY	DO3 delay setting	0: No delay 1: ON delay 2: OFF delay
2089	1	R/W	RUN, RDY	DO3 delay time	Table 2-D
208A	1	R/W	RUN, RDY	DO4 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
208B	1	R/W	RUN, RDY	DO4 event type	Table 2-C
208C	1	R/W	RUN, RDY	DO4 delay setting	0: No delay 1: ON delay 2: OFF delay
208D	1	R/W	RUN, RDY	DO4 delay time	Table 2-D
208E	1	R/W	RUN, RDY	DI2 function selection	Table 2-E

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
208F	1	R/W	RUN, RDY	DO5 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
2090	1	R/W	RUN, RDY	DO5 event type	Table 2-C
2091	1	R/W	RUN, RDY	DO5 delay setting	0: No delay 1: ON delay 2: OFF delay
2092	1	R/W	RUN, RDY	DO5 delay time	Table 2-D
2093	1	R/W	RUN, RDY	DO6 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
2094	1	R/W	RUN, RDY	DO6 event type	Table 2-C
2095	1	R/W	RUN, RDY	DO6 delay setting	0: No delay 1: ON delay 2: OFF delay
2096	1	R/W	RUN, RDY	DO6 delay time	Table 2-D
2097	1	R/W	RUN, RDY	DI3 function selection	Table 2-E
2098	1	R/W	RUN, RDY	DO7 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
2099	1	R/W	RUN, RDY	DO7 event type	Table 2-C
209A	1	R/W	RUN, RDY	DO7 delay setting	0: No delay 1: ON delay 2: OFF delay
209B	1	R/W	RUN, RDY	DO7 delay time	Table 2-D
209C	1	R/W	RUN, RDY	DO8 event source	0: Any 1: Ch1 2: Ch2 3: Ch3 4: Ch4
209D	1	R/W	RUN, RDY	DO8 event type	Table 2-C
209E	1	R/W	RUN, RDY	DO8 delay setting	0: No delay 1: ON delay 2: OFF delay
209F	1	R/W	RUN, RDY	DO8 delay time	Table 2-D
20A0	1	R/W	RUN, RDY	DI4 function selection	Table 2-E

Table 2-A

Value	Workpiece
1	Opaque object edge measurement (top)
2	Opaque object edge measurement (bottom)
3	Transparent object edge measurement (top)
4	Transparent object edge measurement (bottom)
5	Opaque object width measurement
6	Opaque object gap measurement
7	Transparent object edge width measurement (top)
8	Transparent object edge width measurement (bottom)
9	Transparent object 2nd edge position measurement (top)
10	Transparent object 2nd edge position measurement (bottom)

Table 2-B

Value	Hold setting
0	No hold
1	External input max. value hold
2	External input min. value hold
3	EPS filter 1
4	EPS filter 2
5	EPS filter 3
6	EPS filter 4
7	EPS filter 5

Table 2-C

Value	Event type
0	Pass
1	Out
2	High
3	Low
4	EPS event
5	Hold
6	Smudge detection
7	Output update
8	Normal operation

Table 2-D

Value	Delay time
0	10 ms
1	20 ms
2	30 ms
3	40 ms
4	50 ms
5	60 ms
6	70 ms

Table 2-E

Value	DI signal function selection
0	Zero adjustment input
1	Input to cancel EPS filter output hold
2	Input for PV hold
3	Zero adjustment input for all channels
4	Input to cancel EPS filter output hold for all PVs
5	PV hold input for all PVs
6	Input to forcibly cancel EPS filter output hold
7	Laser start input
8	Calculation OFF input
9	Event log start input

FOR CHANNELS 1–4

Ch1 address (hex)	Ch2 address (hex)	Ch3 address (hex)	Ch4 address (hex)	Size	Access rights	Change enabled mode	Description	Notes
3000	4000	5000	6000	1	R	-	1st edge position cell No.	
3001	4001	5001	6001	1	R	-	2nd edge position cell No.	
3002	4002	5002	6002	2	R	-	Actual 1st edge position	Integer, ± 999999 (in 0.1 µm increments)
3004	4004	5004	6004	2	R	-	Actual 2nd edge position	Integer, ± 999999 (in 0.1 µm increments)
3006	4006	5006	6006	2	R	-	1st edge position	Integer, ± 999999 (in 0.1 µm increments)
3008	4008	5008	6008	2	R	-	2nd edge position	Integer, ± 999999 (in 0.1 µm increments)
300A	400A	500A	600A	2	R	-	PV before hold	Integer, ± 999999 (in 0.1 µm increments)
300C	400C	500C	600C	2	R	-	PV after hold	Integer, ± 999999 (in 0.1 µm increments)
300E	400E	500E	600E	2	R	-	PV after moving average	Integer, ± 999999 (in 0.1 µm increments)
3010	4010	5010	6010	2	R	-	Displayed value	Value displayed on controller without decimal point
3012	4012	5012	6012	2	R	-	Bottom value	Value displayed on controller without decimal point
3014	4014	5014	6014	2	R	-	Peak value	Value displayed on controller without decimal point
3016	4016	5016	6016	1	R	-	Analog output level	Percentage (0–100 %)
3017	4017	5017	6017	1	R	-	Event data	Table 3-A
3018	4018	5018	6018	1	R	-	1/8 of actual light intensity	Table 3-B
3019	4019	5019	6019	1	R	-	1/8 of normalized light intensity	Table 3-C
301A	401A	501A	601A	2	R	-	Total normalized light intensity	Integer
301C	401C	501C	601C	2	R	-	Estimated normalized light intensity	Integer
301E	401E	501E	601E	1	R	-	Normalized light intensity change rate	Percentage

Table 3-A

Assignment	Event data
Bit 0	Pass event occurrence
Bit 1	Out event occurrence
Bit 2	High event occurrence
Bit 3	Low event occurrence
Bit 4	EPS event occurrence
Bit 5	Hold event occurrence
Bit 6	Smudge detection event occurrence
Bit 7	Output update event occurrence
Bit 8	Normal operation event occurrence
Bits 9–15	No assignment (always 0)

Note: 1 = event occurrence, 0 = no occurrence

Table 3-B

Assignment	Actual light intensity distribution
Bit 0	Light intensity at the top margin is sufficient for receiver adjustment.
Bit 1	Light intensity at all cells in block 1 is sufficient for receiver adjustment (top).
Bit 2	Light intensity at all cells in block 2 is sufficient for receiver adjustment.
Bit 3	Light intensity at all cells in block 3 is sufficient for receiver adjustment.
Bit 4	Light intensity at all cells in block 4 is sufficient for receiver adjustment.
Bit 5	Light intensity at all cells in block 5 is sufficient for receiver adjustment.
Bit 6	Light intensity at all cells in block 6 is sufficient for receiver adjustment.
Bit 7	Light intensity at all cells in block 7 is sufficient for receiver adjustment.
Bit 8	Light intensity at all cells in block 8 is sufficient for receiver adjustment (bottom).
Bit 9	Light intensity at the bottom margin is sufficient for receiver adjustment.
Bits 10–15	No assignment (always 0)

Notes 1. A block is 1/8 of the measurement range. The number of cells differs for S07 and S15.
2. If receiver adjustment is possible, the value is 1. If not, the value is 0.

Table 3-C

Assignment	Normalized light intensity distribution
Bit 0	Not used (always 0)
Bit 1	Normalized light intensity in block 1 is 80 to 120 % (top).
Bit 2	Normalized light intensity in block 2 is 80 to 120 %.
Bit 3	Normalized light intensity in block 3 is 80 to 120 %.
Bit 4	Normalized light intensity in block 4 is 80 to 120 %.
Bit 5	Normalized light intensity in block 5 is 80 to 120 %.
Bit 6	Normalized light intensity in block 6 is 80 to 120 %.
Bit 7	Normalized light intensity in block 7 is 80 to 120 %.
Bit 8	Normalized light intensity in block 8 is 80 to 120 % (bottom).
Bits 9–15	No assignment (always 0)

Notes 1. A block is 1/8 of the measurement range. The number of cells differs for S07 and S15.
2. If receiver adjustment is possible, the value is 1. If not, the value is 0.

FOR LIGHT INTENSITY

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
7000	1	W	RDY, RUN	Type of light intensity data to acquire	Table 4-A
7100	1	R	-	Data for cell 1 Top	Type of light intensity data specified by 7000
7101	1	R	-	Data for cell 2	Type of light intensity data specified by 7000
7102	1	R	-	Data for cell 3	Type of light intensity data specified by 7000
7103	1	R	-	Data for cell 4	Type of light intensity data specified by 7000
7104	1	R	-	Data for cell 5	Type of light intensity data specified by 7000
7105	1	R	-	Data for cell 6	Type of light intensity data specified by 7000
7106	1	R	-	Data for cell 7	Type of light intensity data specified by 7000
⋮	⋮	⋮	⋮	⋮	⋮
71FF	1	R	-	Data for cell 256 Bottom	Type of light intensity data specified by 7000

Note: When the K1G-S07 is connected, 7180–71FF are 0.

Table 4-A

Value	Type of light intensity data to acquire
0	Return a response without acquiring data.
1	Channel 1: normalized light intensity
2	Channel 2: normalized light intensity
3	Channel 3: normalized light intensity
4	Channel 4: normalized light intensity
5	Channel 1: actual light intensity when the laser diode (LD) = ON
6	Channel 2: actual light intensity when the LD = ON
7	Channel 3: actual light intensity when the LD = ON
8	Channel 4: actual light intensity when the LD = ON
9	Channel 1: actual light intensity when the LD = OFF
10	Channel 2: actual light intensity when the LD = OFF
11	Channel 3: actual light intensity when the LD = OFF
12	Channel 4: actual light intensity when the LD = OFF
13	Channel 1: normalized parameter
14	Channel 2: normalized parameter
15	Channel 3: normalized parameter
16	Channel 4: normalized parameter
17 and later	Message is ignored.

FOR ADJUSTMENT

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
8000	1	W	RDY, RUN	Receiver adjustment	Table 5-A
8001	1	R	-	Channel 1: adjustment result	0: Adjustment in progress 1: Succeeded 2: Failed
8002	1	R	-	Channel 2: Adjustment result	0: Adjustment in progress 1: Succeeded 2: Failed
8003	1	R	-	Channel 3: Adjustment result	0: Adjustment in progress 1: Succeeded 2: Failed
8004	1	R	-	Channel 4: Adjustment result	0: Adjustment in progress 1: Succeeded 2: Failed
8100	1	W	RDY, RUN	Zero adjustment	Table 5-A
8101	1	R	-	Channel 1 zero adjustment result	0: Adjustment in progress 1: Complete
8102	1	R	-	Channel 2 zero adjustment result	0: Adjustment in progress 1: Complete
8103	1	R	-	Channel 3 zero adjustment result	0: Adjustment in progress 1: Complete
8104	1	R	-	Channel 4 zero adjustment result	0: Adjustment in progress 1: Complete
8200	1	W	RDY, RUN	Analog output low limit adjustment	Table 5-A
8201	1	R	-	Channel 1 analog output low limit adjustment result	0: Adjustment in progress 1: Complete
8202	1	R	-	Channel 2 analog output low limit adjustment result	0: Adjustment in progress 1: Complete
8203	1	R	-	Channel 3 analog output low limit adjustment result	0: Adjustment in progress 1: Complete
8204	1	R	-	Channel 4 analog output low limit adjustment result	0: Adjustment in progress 1: Complete
8300	1	W	RDY, RUN	Analog output high limit adjustment	Table 5-A
8301	1	R	-	Channel 1 analog output high limit adjustment result	0: Adjustment in progress 1: Complete
8302	1	R	-	Channel 2 analog output high limit adjustment result	0: Adjustment in progress 1: Complete
8303	1	R	-	Channel 3 analog output high limit adjustment result	0: Adjustment in progress 1: Complete

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
8304	1	R	-	Channel 4 analog output high limit adjustment result	0: Adjustment in progress 1: Complete
8400	1	W	See table mentioned at right	Controller mode change	Table 5-B2
8401	1	R	-	Controller mode	Current mode Table 5-B1
8402	1	W	RUN	Return to Run mode	1: Execute
8500	1	W	RDY	Save data to EEPROM	1: Execute
8501	1	R	-	Progress of data copy to EEPROM	0: In progress 1: Complete
8600	1	W	RUN	Forcibly cancel EPS filter output hold	1: Execute
8700	1	W	RDY, RUN	Event log start	1: Execute
8800	1	W	RDY, RUN, UT	Channel change	Table 5-C
8801	1	R	-	Channel selection status	Table 5-C
8900	1	W	RUN	Peak/bottom value switch	0: Peak 1: Bottom
8901	1	W	RUN	Peak/bottom value deletion	1: Execute
8A00	1	W	RUN	Disabling of key lock	"1" disables
8A01	1	R	-	Key lock status	0: Key lock off 1: Key lock on
8B00	1	W	RUN	Disabling of controller power-saving	"1" disables
8B01	1	R	-	Sleep status	0: Sleep off 1: Sleep on
8C00	1	W	RDY, RUN	(Reserved)	Do not write data.
8C01	1	R	-	(Reserved)	0 can be read.
8D00	1	W	RDY, RUN	Laser emission stop	1: Laser stop 0: Laser start
8D01	1	R	-	Laser status	0: Laser ON 1: Laser OFF
8E00	1	W	All	Disabling of all keys	1: Disables all keys 0: Enables all keys
8E01	1	R	-	Status of key disabling	1: All keys are enabled 0: All keys are disabled
8E02	1	W	RDY	Sensor head recognition	Table 5-D
8F00	1	W	UT	AO1 test output	Value to be written to AO (0–100 %)

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
8F01	1	W	UT	AO2 test output	Value to be written to AO (0–100 %)
8F02	1	W	UT	AO3 test output	Value to be written to AO (0–100 %)
8F03	1	W	UT	AO4 test output	Value to be written to AO (0–100 %)
8F04	1	W	UT	DO test output	Bits 0–7 are assigned to DO1–DO8.

Table 5-A

Value	Operation
0	Take no action but return a response.
1	Channel 1: execute
2	Channel 2: execute
3	Channel 3: execute
4	Channel 4: execute
5	All channels: execute
6 and later	An error message is returned.

Table 5-B1 When data is read

Value	Mode
0	FirstBoot mode
1	Ready mode
2	Run mode
3	Test mode
4	Failure mode
5	Adjust mode
6	Config mode

Table 5-B2 Mode correspondence table for changing the mode using communication when data is written

Current mode	Target mode		
	Ready	Run	Test
Ready	-	✔	✔
Run	✔	-	✔
UserTest	✔	✔	-

If the mode is changed to a mode indicated as -, an application error will occur.

Table 5-C

Value	Channel selection
0	Take no action but return a response.
1	Channel 1: select
2	Channel 2: select
3	Channel 3: select
4	Channel 4: select
5 and later	An error message is returned.

Table 5-D

Value	Sensor head recognition
0	Take no action but return a response.
1	Channel 1: recognize
2	Channel 2: recognize
3	Channel 3: recognize
4	Channel 4: recognize
5 and later	An error message is returned.

FOR SPECIAL FUNCTIONS

● Shared settings

Address (hex)	Size	Access rights	Change enabled mode	Description	Notes
F000	1	R/W	RDY	Output type (1): voltage/current	0: Voltage output 1: Current output *
F001	1	R/W	RDY	Output type (2): NPN/PNP	0: NPN 1: PNP *
F002	1	R/W	RDY, RUN	Event source	0: Any 1: CH1 2: CH2 3: CH3 4: CH4
F003	1	R/W	RDY, RUN	Event type	Table 6-A
F004	1	R/W	RDY, RUN	Designation of channel for sensor head snapshot	1: CH1 2: CH2 3: CH3 4: CH4
F005	1	R/W	RDY, RUN	Trigger point setting	Table 6-B
F006	1	R/W	RDY, RUN	High-speed trend channel	1: CH1 2: CH2 3: CH3 4: CH4
F007	1	R/W	RDY, RUN	Re-sampling counter	1 to 4000

* When a parameter is written, add AA00 in hexadecimal (43520 in decimal) to it.

Event log data for individual PVs

PV1 address (hex)	PV2 address (hex)	PV3 address (hex)	PV4 address (hex)	Size	Access rights	Change enabled mode	Description
F100	F200	F300	F400	2	R	-	Event log PV time 01
F102	F202	F302	F402	2	R	-	Event log PV time 02
F104	F204	F304	F404	2	R	-	Event log PV time 03
F106	F206	F306	F406	2	R	-	Event log PV time 04
F108	F208	F308	F408	2	R	-	Event log PV time 05
F10A	F20A	F30A	F40A	2	R	-	Event log PV time 06
F10C	F20C	F30C	F40C	2	R	-	Event log PV time 07
F10E	F20E	F30E	F40E	2	R	-	Event log PV time 08
F110	F210	F310	F410	2	R	-	Event log PV time 09
F112	F212	F312	F412	2	R	-	Event log PV time 10
F114	F214	F314	F414	2	R	-	Event log PV time 11
F116	F216	F316	F416	2	R	-	Event log PV time 12
F118	F218	F318	F418	2	R	-	Event log PV time 13
F11A	F21A	F31A	F41A	2	R	-	Event log PV time 14
F11C	F21C	F31C	F41C	2	R	-	Event log PV time 15
F11E	F21E	F31E	F41E	2	R	-	Event log PV time 16
F120	F220	F320	F420	2	R	-	Event log PV time 17
F122	F222	F322	F422	2	R	-	Event log PV time 18
F124	F224	F324	F424	2	R	-	Event log PV time 19
F126	F226	F326	F426	2	R	-	Event log PV time 20
F128	F228	F328	F428	2	R	-	Event log PV time 21
F12A	F22A	F32A	F42A	2	R	-	Event log PV time 22
F12C	F22C	F32C	F42C	2	R	-	Event log PV time 23
F12E	F22E	F32E	F42E	2	R	-	Event log PV time 24
F130	F230	F330	F430	2	R	-	Event log PV time 25
F132	F232	F332	F432	2	R	-	Event log PV time 26
F134	F234	F334	F434	2	R	-	Event log PV time 27
F136	F236	F336	F436	2	R	-	Event log PV time 28
F138	F238	F338	F438	2	R	-	Event log PV time 29
F13A	F23A	F33A	F43A	2	R	-	Event log PV time 30
F13C	F23C	F33C	F43C	2	R	-	Event log PV time 31
F13E	F23E	F33E	F43E	2	R	-	Event log PV time 32

● Event log snapshot data

Address (hex)	Size	Access rights	Change enabled mode	Description
F500	1	R	-	Event log snapshot cell 1
F501	1	R	-	Event log snapshot cell 2
⋮	⋮	⋮	⋮	⋮
F5FE	1	R	-	Event log snapshot cell 255
F5FF	1	R	-	Event log snapshot cell 256

Table 6-A

Value	Event log trigger setting
0	Pass event occurrence
1	Out event occurrence
2	High event occurrence
3	Low event occurrence
4	ESP event occurrence
5	Hold state occurrence
6	Smudge detection (abnormal light intensity)
7	Event log start input ON

Table 6-B

Value	Event log trigger point setting
0	25 % (8 points before, 24 points after trigger)
1	50 % (16 points before and after trigger)
2	75 % (24 points before, 8 points after trigger)

9-7 Important Notes for Restarting the Laser Beam

This device can control the state of laser beam emission using laser start input, RS-485 communication, and setting tool communication functions. These functions can be used to restart laser emission as follows.

Example: Using laser start input

Initial status is RUN mode and laser start input is ON.

1. Stop control operation that uses analog output.
2. Turn off laser start input to turn the laser beam off (analog output becomes invalid).
3. Change to READY mode to prepare for laser beam start.
4. Turn on laser start input to start measurement.
5. Change to RUN mode (analog output becomes valid).
6. Wait for the circuits to stabilize (approximately 30 minutes, the same as the warm-up time).
7. Start control operation that uses analog output.

"Invalid" analog output is the state in which analog output is not updated, and "valid" is the state in which analog output is updated according to the results of measurement.

If the circuit stabilization time (above, **6**) is not sufficient, measurements that do not satisfy the accuracy specification may be reflected in the analog output. For controllers manufactured in and after September 2017, by following **step 4** above and turning on laser start input, analog output becomes valid. (**Steps 3** and **5** can be omitted.) However, make sure that the circuit stabilization time is sufficient.

✎ MEMO

Revision History of CP-SP-1397E

Printed	Edn.	Revised pages	Description
Sep. 2016	**1**		
June 2017	**2**	ii	A caution was added to “CAUTIONS AND WARNINGS.”
		iv	Descriptions in “THE ROLE OF THIS MANUAL” were changed.
		viii	“COMMUNICATION CABLES FOR EtherCAT” was added.
		ix	Descriptions in “WIRING OF THE POWER AND GROUND” were changed.
		x	A description was added to “POWER-ON RESET.”
		1-2	“If K1G-C04MG is used" was changed to “If K1G-C04MG or K1G-C04EG is used.”
		1-4 to 1-5	Descriptions were changed.
		1-12	A drawing of the back of K1G-C04EG was added.
		1-13	Descriptions of RJ45 ports and EtherCAT RUN/ERROR LEDs were added to the table.
		2-15	Section 2-7, “Wiring the Controller (K1G-C04EG),” was added.
		3-2	Descriptions and the flowchart in “Initial Setup Flowchart” were changed.
		3-11	Section 3-7, “Setting the ECAT ID (for K1G-C04EG only),” was added.
		4-4	Descriptions in “Input/output operations in Ready mode” were changed.
		4-5 to 4-7	Descriptions were changed.
		4-8 to	Page numbers were formerly 4-6 and following
		4-90	Descriptions in "CHANGING SMUDGE DETECTION FUNCTION SETTINGS” were changed.
		5-1	A description was added.
		7-5	K1G-C04EG was added to the table.
		7-7	Drawings of K1G-C04EG (controller) were added.
		8-5	EtherCAT communication problems were added to “TROUBLE SHOOTING.”
		8-6	ERROR 512 was added.
		9-2	The note for A10 was changed.
		9-8	A flowchart for K1G-C04E initial setting was added.
		9-9	“EtherCAT communication status check display” was added.
July 2018	**3**	4-36	A reference was added for laser start input in the table.
		9-31	Section 9-7, "Important Notes for Restarting the Laser Beam," was added.

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