Pressure Indicator

PG500 Installation Manual

IMR02F01-E4

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

This manual describes the mounting, wiring and specifications.

For the operations, refer to **PG500 Operation Manual (IMR02F02-E□)**.
For the communication (Optional), refer to the **PG500 Communication Quick Instruction Manual (IMR02F03-E□)** or the separate **PG500 Communication Instruction Manual (IMR02F04-E□)**.
The manuals can be downloaded from the official RKC website:
http://www.rkcinst.com/english/manual_load.htm.

■ Accessories check

PG500 Installation Manual (IMR02F01-E4)	1
PG500 Operation Manual (IMR02F02-E□)	1
PG500 Communication Quick Instruction Manual (IMR02F03-E□) *	1
Mounting brackets (with screw)	2
Unit seal (SAP-368)	1

* Only PG500 provided with the communication function

■ Safety precautions

WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take adequate measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  – If input/output or signal lines within the building are longer than 30 meters.
  – If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage or failure, protect the power line and the input/output lines from high currents with a protection device such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

1. MOUNTING

WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

1.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions. **(IEC61010-1)** [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

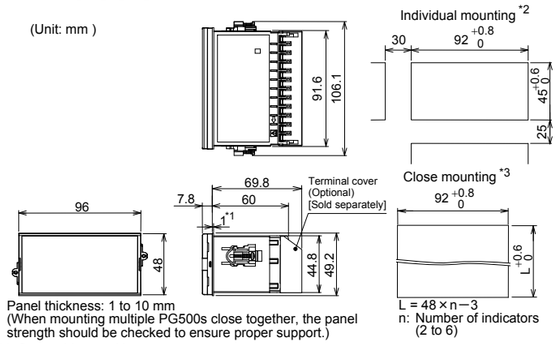
(2) Use this instrument within the following environment conditions.
- Allowable ambient temperature: −10 to +50 °C
- Allowable ambient humidity: 5 to 95 % RH
  (Absolute humidity: MAX. W. C 29.3 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions: Indoor use, Altitude up to 2000 m

(3) Avoid the following conditions when selecting the mounting location:
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Exposure to direct sunlight.
- Excessive heat accumulation.

(4) Mount this instrument in the panel considering the following conditions:
- Ensure at least 50 mm space on top and bottom of the instrument for maintenance and environmental reasons.
- Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, or the like. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  High voltage equipment: Do not mount within the same panel.
  Power lines: Separate at least 200 mm.
  Rotating machinery: Separate as far as possible.
- Mount this instrument in the horizontal direction for panel. If you did installation except a horizontal direction, this causes malfunction.
- If this instrument is permanently connected to equipment, it is important to include a switch or circuit-breaker into the installation. This should be in close proximity to the equipment and within easy reach of the operator. It should be marked as the disconnecting device for the equipment.

1.2 Dimensions

(Unit: mm)



Panel thickness: 1 to 10 mm
(When mounting multiple PG500s close together, the panel strength should be checked to ensure proper support.)

L = 48 × n − 3
n: Number of indicators (2 to 6)

*1 Case rubber packing

*2 When cutting out each mounting hole through a panel for individual mounting, observe that there is no bur or distortion along the panel cutout surface, or there is no bend on the panel surface. If so, the water resistant characteristics may worsen.

*3 Remove the case rubber packing. Because of closely mounting the PG500s, protection will be compromised and not meet IP66 (NEMA 4X) by close mounting.

1.3 Procedures of Mounting and Removing

■ Mounting procedures

1. Prepare the panel cutout as specified in **1.2 Dimensions**.
2. Insert the instrument through the panel cutout.
3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 1)
4. Push the mounting bracket forward until the bracket is firmly secured to the panel. (Fig. 2)
5. Only turn one full revolution after the screw touches the panel. (Fig. 3)
6. The other mounting bracket should be installed the same way described in ***3***. to ***5***.

Fig. 1

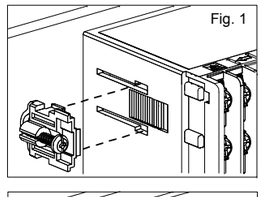


Fig. 2

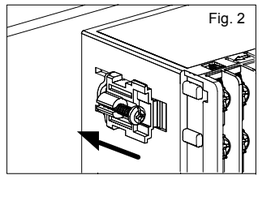
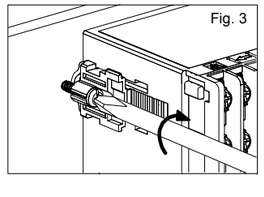


Fig. 3



The front of the instrument conforms to **IP66 (NEMA4X)** when mounted on the panel. For effective waterproof/dustproof, the rubber packing must be securely placed between instrument and panel without any gap. If rubber packing is damaged, please contact RKC sales office or the agent.

■ Removing procedures

1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket.
4. Lift the latch of the mounting bracket (①), then pull the mounting bracket (②) to remove it from the case. (Fig. 4)

Use long-nose pliers to remove mounting brackets from the instrument that is installed in a narrow place or installed tightly in a vertical position.

5. The other mounting bracket should be removed in the same way as described in ***3***. and ***4***.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 5)

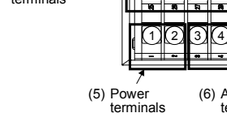


Fig. 4

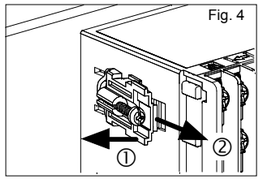
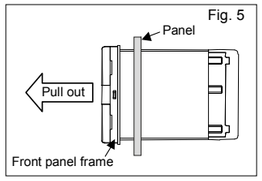


Fig. 5



2. WIRING

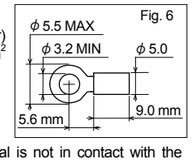
WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

2.1 Wiring Cautions

- Use a shielded cable for connection with the pressure sensor.
- To avoid noise induction, keep communication signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  – Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  – Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  – Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- About five seconds are required as preparation time for contact output every time the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- A suitable power supply should be considered in the end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).
- This instrument is not furnished with a power supply switch or fuse. Therefore, if a fuse or power supply switch is required, install close to the instrument.
  Recommended fuse rating: Rated voltage 250 V, Rated current 1 A
  Fuse type: Time-lag fuse
- Use the solderless terminal appropriate to the screw size.
  Screw size: M3 × 7 (with 5.8 × 5.8 square washer)
  Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm^2
  Specified dimension: Refer to Fig. 6
  Recommended tightening torque: 0.4 N·m (4 kgf·cm)
  Specified solderless terminals:
  Manufactured by J.S.T MFG CO., LTD.
  Circular terminal with isolation V1.25–MS3

Fig. 6

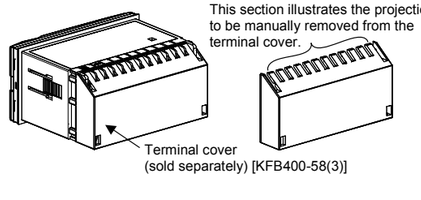


- Make sure that the any wiring such as solderless terminal is not in contact with the adjoining terminals.

If solderless terminal lugs other than those in not specified dimensions are used, terminal screws may not be tightened. In such a case, bend each solderless terminal lug in advance and then conduct wiring. If the terminal screw is forcibly tightened, it may be damaged.

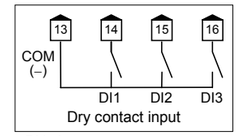
Up to two solderless terminal lugs can be connected to one terminal screw. However, in this case, reinforced insulation cannot be used.

Caution for the terminal cover usage:
If each solderless terminal lug touches the terminal cover, remove each projection from the terminal cover by manually bending it in front and in rear until broken.



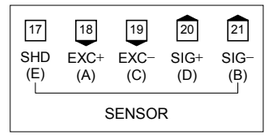
2.2 Terminal Configuration

(1) Digital input terminals

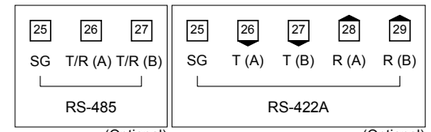


DI1: Auto zero
DI2: Hold reset
DI3: Interlock release

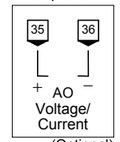
(2) Pressure sensor input terminals



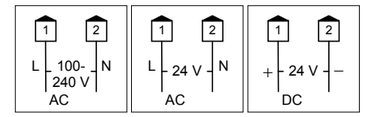
(3) Communication terminals



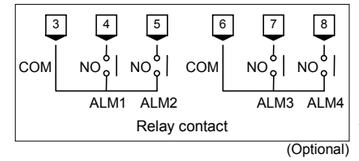
(4) Transmission output terminals



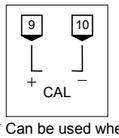
(5) Power terminals



(6) Alarm output terminals



(7) Calibration output terminals *

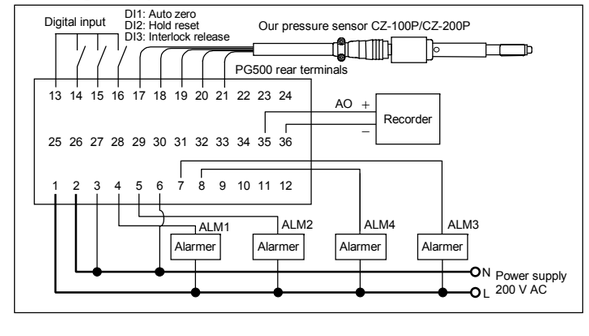


* Can be used when the PG500X is specified. However, disabled if the pressure sensor does not have built-in resistance for sensitivity adjustment.

Input/Output Isolation:
——: Isolated from each other circuit blocks.
———: Not isolated between inputs (or outputs).

Power supply	Transmission output (AO) Calibration output
Pressure sensor input	Alarm 1 output (ALM1)
Digital input 1 (DI1)	Alarm 2 output (ALM2)
Digital input 2 (DI2)	Alarm 3 output (ALM3)
Communication	Alarm 4 output (ALM4)

■ Wiring example



2.3 Connection to Pressure Sensor

■ Terminal number and signal details

Pressure sensor input terminals

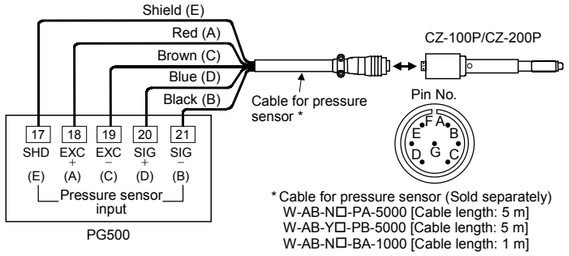
Pin No.	Signal name	Symbol
17	Shield	SHD (E)
18	Sensor supply voltage	EXC+ (A)
19	Sensor supply voltage	EXC– (C)
20	Sensor signal input	SIG+ (D)
21	Sensor signal input	SIG– (B)

Calibration output terminals *

Pin No.	Signal name	Symbol
9	Calibration output	CAL+
10	Calibration output	CAL–

*Can be used when the PG500X is specified. However, disabled if the pressure sensor does not have built-in resistance for sensitivity adjustment.

■ Connection to our CZ-100P/CZ-200P



* Cable for pressure sensor (Sold separately)
W-AB-N□-PA-5000 [Cable length: 5 m]
W-AB-Y□-PB-5000 [Cable length: 5 m]
W-AB-N□-BA-1000 [Cable length: 1 m]

☞ For details on the CZ-100P/CZ-200P, refer to the **CZ-100P/PCT-300 Resin Pressure Measuring System Instruction Manual (IM100CZ04-E□), CZ-200P Instruction Manual (IM100CZ08-E□)**.

📖 For the connection of pressure sensor made by other companies, refer to the instruction manual for the respective pressure sensor.

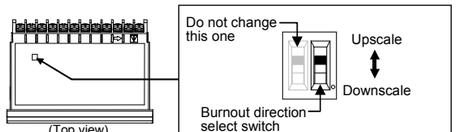
3. BURNOUT DIRECTION SETTING

Burnout direction is selected by the burnout direction select switch and Burnout direction (brKS) of parameter. It is necessary to set both setting switch and parameter.

📖 **Burnout function may not work properly if settings of "Burnout direction select switch" and "Burnout direction" parameter (brKS) do not match each other.**

● Burnout direction select switch

Turn the right side switch by a small screwdriver.

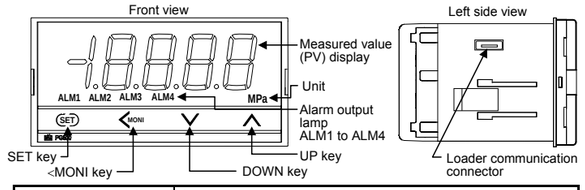


● Burnout direction (brKS) in engineering mode F21

Name	Symbol	RKC Identifier	Modbus register address HEX	Modbus register address DEC	Attribute	Data range	Factory set value
Burnout direction	brKS (brKS)	IB	010A	266	R/W	0: Upscale 1: Downscale	0

☞ For the parameter setting and communication data (Optional), refer to the **PG500 Operation Manual (IMR02F02-E□)** and **PG500 Communication Quick Instruction Manual (IMR02F03-E□)**.

4. PARTS DESCRIPTION



Measured value (PV) display [Red]	Displays Measured value (PV) or various parameters' symbols and set values.
Unit	Unit of Measured value (PV). If unit is other than MPa, stick an attached unit seal in accord with a unit to use.
Alarm output lamp [Red]	Lights when alarm output is turned on. ALM1 to ALM4: Alarm 1 output to Alarm 4 output
UP key	Use to increase a numerical value.
DOWN key	Use to decrease a numerical value.
<MONI key (Shift/Monitor key)	Use to change to Measured value (PV). Use to start changing settings. Use to move to a different digit when changing a setting.
SET key	Used for parameter calling up and set value registration.
Loader communication connector	Cannot be used in this specification. (For RKC maintenance)

5. SPECIFICATIONS

■ Input

Measured Input (PV)

Sensor type: Strain gauge type of pressure sensor
Input range: * Including zero point adjustment range

Gain setting range of pressure sensor	Input range *
0.500 to 0.999 mV/V	–6.0 to +15.9 mV
1.000 to 1.999 mV/V	–9.8 to +25.9 mV
2.000 to 2.999 mV/V	–12.3 to +32.6 mV
3.000 to 4.000 mV/V	–16.1 to +42.5 mV

Display range limit: –9999 to +19999 (No decimal place)
–999.9 to +1999.9 (One decimal place)
–99.99 to +199.99 (Two decimal places)
–9.999 to +19.999 (Three decimal places)
Decimal point position: No decimal place, One decimal place, Two decimal places, Three decimal places
Number of input: 1 point
Sampling cycle: 100 ms ± 0.3 %
Input impedance: 1 MΩ or more
Action at input beak: Upscale or downscale
Input break is detected by input line and sensor power line
Action at input error: Setting range of Input error determination point (high/low):
Pressure display low − (5 % of input span) to
Pressure display high + (5 % of input span)

Input correction:
• Zero-point calibration: Manually set or Auto zero
Manually set: –Input span to +Input span
Auto zero: –5.0 to +5.0 mV (Input conversion)
• PV ratio: 0.500 to 1.500
Manually set or Auto calibration (Functions when a resistance for sensitivity adjustment built-in pressure sensor is used)
• Gain setting range: Gain setting decimal point position is three decimal places (Factory set value):
0.500 to 4.000 mV/V
Gain setting decimal point position is four decimal places
0.5000 to 1.9999 mV/V
• Shunt resistance output value:
40.0 to 100.0 % (Functions when a resistance for sensitivity adjustment built-in pressure sensor is used)
• Linearize: Use to correct the non-linear nature of our pressure sensor CZ-100P/CZ-200P.
Select the linearizing type symbol engraved on the rated nameplate attached to the CZ-100P or CZ-200P housing.
• First order lag digital filter:
0.0 to 100.0 seconds (0.0: OFF)

Digital input (DI1 to DI3)

Number of input: 3 points
Input method: Dry contact input
Open state: 500 kΩ or more
Close state: 500 Ω or less
Contact current: 5 mA or less
Voltage at open: Approx. 5 V DC
Capture judgment time: 50 ms
Function: Auto zero (DI1), Hold reset (DI2), Interlock release (DI3)

■ Output

Power supply for strain gauge type of pressure sensor (Sensor power supply)

Rated voltage: 7.7 V DC
Rated current 30 mA max.

Alarm output (ALM1 to ALM4) [Optional]

Number of output: 4 points
Contact type: 1a contact
Contact rating (Resistive load):
250 V AC 1 A, 30 V DC 1 A
Electrical life: 300,000 times or more (Rated load)
Mechanical life: 20 million times or more (Switching: 300 times/min)

Transmission output (AO) [Optional]

Number of outputs: 1 point, Outputs the Measured value (PV)
Output type:

Rating		Output range	Allowable load resistance	Out put impedance
Voltage output	0 to 1 V DC	–0.05 to +1.05 V DC	1 kΩ or more	0.1 Ω or less
	0 to 5 V DC	–0.25 to +5.25 V DC		
	1 to 5 V DC	0.8 to 5.2 V DC		
	0 to 10 V DC	–0.5 to +10.5 V DC		
	0 to 10 mV DC	–0.5 to +10.5 mV DC	20 kΩ or more	Approx. 10 Ω
	0 to 100 mV DC	–5 to +105 mV DC		
Current output	4 to 20 mA DC	1 to 21 mA DC	600 Ω or less	1 MΩ or more
	0 to 20 mA DC	0 to 21 mA DC		

■ Performance (at the ambient temperature 23 ± 2 °C)

Input

Accuracy: 0.1 % of input span (excluding the sensor power supply)
Noise rejection: Normal mode: 40 dB or more (50/60Hz)
Common mode: 120 dB or more (50/60Hz)
A/D conversion: 1/80000

Transmission output (AO)

Accuracy: 0.1 % of span
Output resolution: Approx. 1/4000

Influence

Influence of ambient temperature (–5 to +50 °C):
Input: ±0.006 % /°C of input span
Sensor power: ±0.013 %/°C of output span
Influence of physical orientation (±90 °):
Input: Less than ±0.1 % of input span (excluding the Sensor power supply)
Output: Less than ±0.3 % of output span

■ Functions

Peak/bottom hold function

Peak/bottom hold: The peak hold/bottom hold function is used to store (hold) the maximum (peak) and minimum (bottom) Measured values (PV).

Alarm function [Optional]

Number of alarms: Up to 4 points
Alarm type: Process high, Process low
Alarm setting range Same as input range
Additional function: Hold action, Alarm action at input error, Interlock, Energized/De-energized
Delay timer: 0.0 to 600.0 seconds
Differential gap: 0 to Input span
Output method: Assignable to alarm output (ALM1 to ALM4)

Host communication [Optional]

Interface: Based on RS-485 or RS-422A, EIA standard
Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
Modbus-RTU
Communication speed: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps
Maximum connections: Up to 31 instruments
Termination resistor: Externally connected
Interval time: 0 to 250 ms

■ Self-diagnostic Function (FAIL)

Control stop (Error number is displayed [Operation: Possible]):
Adjustment data error (Error code 1)
Back-up error (Error code 2)
A/D conversion error (Error code 4)
Watchdog timer error (Error code 128)
Program error (stack) (Error code 256)
Program error (busy) (Error code 2048)
Action stop (Error number is not displayed [Operation: Impossible]):
Power supply voltage monitoring error, RAM check error
Instrument status: When a self-diagnostic error occurs: All the output is OFF
Display: In an error is detected by the self-diagnostic function, the "Err" and error code are displayed alternately on the display unit.
Output: Same as power OFF
Recovery: First, remove all of the causes of the defect by making a correct diagnosis, and then turn on the instrument power again for recovery.

■ General specifications

Power supply voltage: 90 to 264 V AC [Including power supply voltage variation], 50/60 Hz (Rating 100 to 240 V AC)
Frequency variation: 50 Hz±10 %, 60 Hz±10 %
21.6 to 26.4 V AC [Including power supply voltage variation], 50/60 Hz (Rating 24 V AC)
Frequency variation: 50 Hz±10 %, 60 Hz±10 %
21.6 to 26.4 V DC [Including power supply voltage variation] (Rating 24 V DC)
Power consumption: 100 V AC: 6.5 VA or less 240 V AC: 10.0 VA or less
24 V AC: 7.0 VA or less 24 V DC: 210 mA or less
Rush current: 12 A or less
Allowable ambient temperature:
–10 to +50 °C
Allowable ambient humidity:
5 to 95 % RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)
Installation environment conditions:
Indoor use, Altitude up to 2000 m
Insulation resistance: Between measuring terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply and measuring terminals:
20 MΩ or more at 500 V DC
When grounding is not provided: Between panels
Withstand voltage:

Time: 1 min	①	②	③	④	⑤
① Grounding terminal					
② Power terminal	1500 V AC				
③ Measured input and sensor power supply terminals	1500 V AC	2300 V AC			
④ Alarm output terminal	1500 V AC	2300 V AC	2300 V AC		
⑤ Transmission output terminal	1500 V AC	2300 V AC	1500 V AC		
⑥ Communication and digital input terminals	1500 V AC	2300 V AC	510 V AC	2300 V AC	1000 V AC

Power failure: A power failure of 20 ms or less will not affect the control action.
Memory backup: Backed up by non-volatile memory
Number of writing:
User setting data: Ten quadrillion (10^{16}) times (FRAM)
Adjustment and factory setting data: Approx. 100,000 times (EEPROM)
Depending on storage and operating conditions.
Data storage period: Approx. 10 years
Mounting and structure: Mounting method: Panel-mounted
Case color: Black
Front panel material: PC [Flame retardancy: UL94 V-1]
Case material: PPE [Flame retardancy: UL94 V-1]
Panel sheet: material: PET [Flame retardancy: V-1]
Weight: Approx. 200 g

■ Standard

Safety standards: UL: UL61010-1
cUL: CAN/CSA-C22.2 No.61010-1
CE marking: LVD: EN61010-1
OVERVOLTAGE CATEGORYII,
POLLUTION DEGREE 2,
Class II (Reinforced insulation)
EMC: EN61326-1
C-Tick: EN55011
Panel sealing: NEMA 4X (NEMA250), IP66 (IEC60529) [Front panel]

6. MODEL CODE

■ Suffix code

PG500 □ □ ∗ □ -□ -□ □ -□ □ □ □ /Y
(1) (2) (3) (4) (5) (6) (7) (8) (9)(10)(11)

(7) to (11): Indicates a specification code to be optional specified. If this section is blank, this means that no code is described on the nameplate.

(1) Input type
A: Resin pressure sensor CZ-100P/CZ-200P (RKC product) [Standard]
B: Resin pressure sensor CZ-100P/CZ-200P (RKC product) [Explosionproof specification type]
C: Resin pressure sensor CZ-100P/CZ-200P (RKC product) [Standard]
Loose nut: 0.0 to 0.5 MPa, Fixed nut : 0 to 5 MPa
D: Resin pressure sensor CZ-100P/CZ-200P (RKC product) [Explosionproof specification type]
Loose nut: 0.0 to 0.5 MPa, Fixed nut: 0 to 5 MPa]
X: 3.33 mV/V output type (Pressure sensor made by other companies)

(2) Power supply voltage
3: 24 V AC/DC 4: 100 to 240 V AC

(3) Alarm output (ALM1 to ALM4)
N: None 2: 2 points (ALM1, ALM2) 4: 4 points (ALM1 to ALM4)
1: 1 point (ALM1) 3: 3 points (ALM1 to ALM3)

(4) Transmission output (AO)
N: None 5: Voltage output (0 to 10 V DC)
1: Voltage output (0 to 10 mV DC) 6: Voltage output (1 to 5 V DC)
2: Voltage output (0 to 100 mV DC) 7: Current output (0 to 20 mA DC)
3: Voltage output (0 to 1 V DC) 8: Current output (4 to 20 mA DC)
4: Voltage output (0 to 5 V DC)

(5) Communication function
N: None 4: RS-422A 5: RS-485

(6) Quick start code
N: No quick start code (Configured at factory set value) *
1: Specify quick start code (Alarm function code)
* Factory set value:
Alarm 1: Process high alarm (without hold action) Alarm 3: No alarm
Alarm 2: Process low alarm (without hold action) Alarm 4: No alarm

(7) Alarm 1 function (AL1), (8) Alarm 2 function (AL2),
(9) Alarm 3 function (AL3), (10) Alarm 4 function (AL4) [Quick start code]
No code: No specify quick start code
N None J: Process low L: Process low with hold action
H: Process high K: Process high with hold action

(11) Instrument specification
Y: Version symbol

RKC RKC INSTRUMENT INC.
The first edition: OCT. 2007 [IMQ01]
The fourth edition: JUN. 2014 [IMQ00]
HEADQUARTERS: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO 146-8515 JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799) E-mail: info@rkcinst.co.jp
FAX: 03-3751-8585 (+81 3 3751 8585) Website: http://www.rkcinst.com/
JUN. 2014

Pressure Indicator

PG500 Communication Quick Instruction Manual

 IMR02F03-E3

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.
This manual describes the connection method with host computer, communication parameters and communication data of the PG500.

For detailed host communication such as protocol description, refer to the **PG500 Communication Instruction Manual (IMR02F04-E□)**.
The manual can be downloaded from the official RKC website:
http://www.rkcinst.com/english/manual_load.htm.

1. CONNECTION TO HOST COMPUTER

WARNING

To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

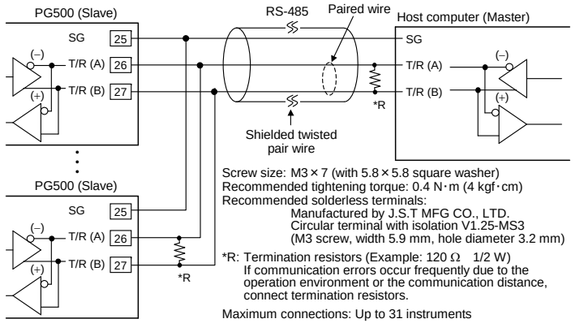
The cable and termination resistor (s) must be provided by the customer.

1.1 RS-485

■ **Communication terminal number and signal details**

Terminal No.	Signal name	Symbol
25	Signal ground	SG
26	Send/Receive data	T/R (A)
27	Send/Receive data	T/R (B)

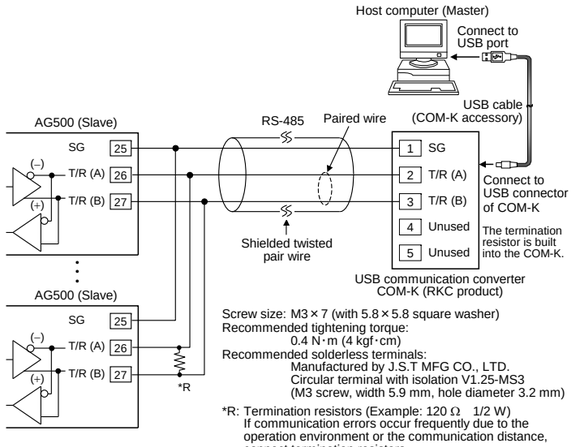
■ **When the interface of host computer (Master) is RS-485**



Screw size: M3 × 7 (with 5.8 × 5.8 square washer)
Recommended tightening torque: 0.4 N·m (4 kgf·cm)
Recommended solderless terminals:
Manufactured by J.S.T MFG CO., LTD.
Circular terminal with isolation V1.25-MS3
(M3 screw, width 5.9 mm, hole diameter 3.2 mm)
*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.
Maximum connections: Up to 31 instruments

■ **When the host computer (Master) has a USB connector**

Connect the USB communication converter between the host computer and the PG500.



Screw size: M3 × 7 (with 5.8 × 5.8 square washer)
Recommended tightening torque: 0.4 N·m (4 kgf·cm)
Recommended solderless terminals:
Manufactured by J.S.T MFG CO., LTD.
Circular terminal with isolation V1.25-MS3
(M3 screw, width 5.9 mm, hole diameter 3.2 mm)
*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.
Maximum connections: Up to 31 instruments

For the COM-K, refer to the **COM-K Instruction Manual (IMR01Z01-E□)**.

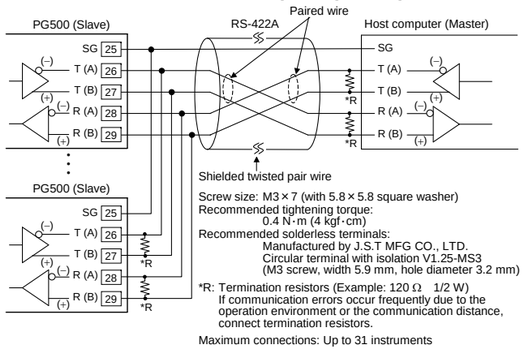
1.2 RS-422A

■ **Communication terminal number and signal details**

Terminal No.	Signal name	Symbol
25	Signal ground	SG
26	Send data	T (A)
27	Send data	T (B)

Terminal No.	Signal name	Symbol
28	Receive data	R (A)
29	Receive data	R (B)

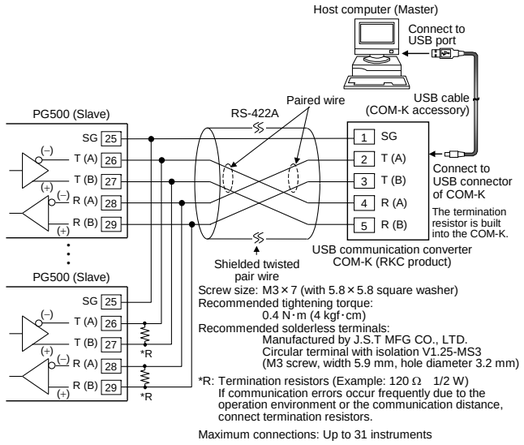
■ **When the interface of host computer (Master) is RS-422A**



Screw size: M3 × 7 (with 5.8 × 5.8 square washer)
Recommended tightening torque: 0.4 N·m (4 kgf·cm)
Recommended solderless terminals:
Manufactured by J.S.T MFG CO., LTD.
Circular terminal with isolation V1.25-MS3
(M3 screw, width 5.9 mm, hole diameter 3.2 mm)
*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.
Maximum connections: Up to 31 instruments

■ **When the host computer (Master) has a USB connector**

Connect the USB communication converter between the host computer and the PG500.



Screw size: M3 × 7 (with 5.8 × 5.8 square washer)
Recommended tightening torque: 0.4 N·m (4 kgf·cm)
Recommended solderless terminals:
Manufactured by J.S.T MFG CO., LTD.
Circular terminal with isolation V1.25-MS3
(M3 screw, width 5.9 mm, hole diameter 3.2 mm)
*R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.
Maximum connections: Up to 31 instruments

For the COM-K, refer to the **COM-K Instruction Manual (IMR01Z01-E□)**.

2. SETTING

To establish communication parameters between host computer and PG500, it is necessary to set the following parameters.

When all communication parameter settings have been completed, turn the power off and then on to make the new set values take effect.

This section describes the parameters to need setting for communication. For the mode/parameters transfer and data setting, refer to the **PG500 Operation Manual (IMR02F02-E□)**.

■ **Description of each parameters**

● **Engineering mode F60**

Symbol	Name	Data range	Description	Factory set value
CMP (CMP)	Communication protocol	0: RKC communication 1: Modbus	Use to select a protocol of communication function.	0

● **Setup setting mode**

Symbol	Name	Data range	Description	Factory set value
Add (Add)	Device address (Slave address)	0 to 99 Maximum connections: Up to 31 instruments	Do not use the same device address for more than one instrument in multi-drop connection. Each instrument must have a unique address in multi-drop connection. In Modbus communication, communication is not possible when the address is 0.	0
bPS (bPS)	Communication speed	1.2: 1200 bps 2.4: 2400 bps 4.8: 4800 bps 9.6: 9600 bps 19.2: 19200 bps 38.4: 38400 bps	Set the same communication speed for both the PG500 (slave) and the host computer (master).	9.6
bIT (bIT)	Data bit configuration	Refer to **Data bit configuration table**	Set the same data bit configuration for both the PG500 (slave) and the host computer (master).	8n1
InT (InT)	Interval time	0 to 250 ms	The interval time for the PG500 should be set to provide a time for host computer to finish sending all data including stop bit and to switch the line to receive status for the host.	10

Data bit configuration table

Set value	Data bit	Parity bit	Stop bit
8n1	8	Without	1
8n2	8	Without	2
8E1	8	Even	1
8E2	8	Even	2
8o1	8	Odd	1
8o2	8	Odd	2

Set value	Data bit	Parity bit	Stop bit
7n1 *	7	Without	1
7n2 *	7	Without	2
7E1 *	7	Even	1
7E2 *	7	Even	2
7o1 *	7	Odd	1
7o2 *	7	Odd	2

* When the Modbus communication protocol selected, this setting becomes invalid.

Interval time:
The interval time for the PG500 should be set to provide a time for host computer to finish sending all data including stop bit and to switch the line to receive status for the host. If the interval time between the two is too short, the PG500 may send data before the host computer is ready to receive it. In this case, communication transmission cannot be conducted correctly.

3. COMMUNICATION REQUIREMENTS

■ **Processing times during data send/receive**

When the host computer is using either the polling or selecting procedure for communication, the following processing times are required for PG500 to send data:
- Response wait time after PG500 sends BCC in polling procedure
- Response wait time after PG500 sends ACK or NAK in selecting procedure

Response send time is time when interval time is set at 0 ms.

RKC communication (Polling procedure)

Procedure details	Time
Response send time after PG500 receives ENQ	3 ms max.
Response send time after PG500 receives ACK	3 ms max.
Response send time after PG500 receives NAK	3 ms max.
Response send time after PG500 sends BCC	1 ms max.

RKC communication (Selecting procedure)

Procedure details	Time
Response send time after PG500 receives BCC	34 ms max.
Response wait time after PG500 sends ACK	1 ms max.
Response wait time after PG500 sends NAK	1 ms max.

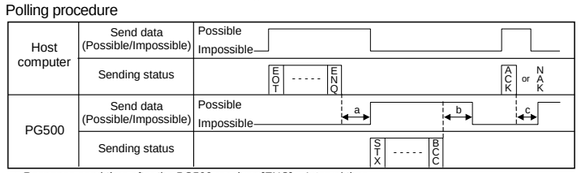
Modbus

Procedure details	Time
Read holding registers [03H] Response send time after the slave receives the query message (When 125 registers are collectively read)	360 ms max.
Preset single register [06H] Response send time after the slave receives the query message	25 ms max.
Diagnostics (loopback test) [08H] Response send time after the slave receives the query message	15 ms max.
Preset multiple registers [10H] Response send time after the slave receives the query message (When 123 registers are collectively write)	360 ms max.

■ **RS-485 (2-wire system) send/receive timing (RKC communication)**

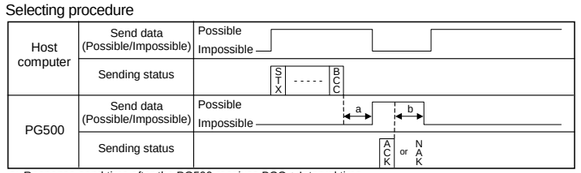
RS-485 communication is conducted through two wires, therefore the transmission and reception of data requires precise timing.

Polling procedure



a: Response send time after the PG500 receives [ENQ] + Interval time
b: Response send time after the PG500 sends BCC
c: Response send time after the PG500 receives [ACK] + Interval time or
Response send time after the PG500 receives [NAK] + Interval time

Selecting procedure



a: Response send time after the PG500 receives BCC + Interval time
b: Response wait time after the PG500 sends ACK or Response wait time after the controller sends NAK

To switch the host computer from transmission to reception, send data must be on line.

The following processing times are required for the PG500 to process data.
- In Polling procedure, Response wait time after the PG500 sends BCC
- In Selecting procedure, Response wait time after the PG500 sends ACK or NAK

■ **RS-422A/RS-485 fail-safe**

A transmission error may occur with the transmission line disconnected, shorted or set to the high-impedance state. In order to prevent the above error, it is recommended that the fail-safe function be provided on the receiver side of the host computer. The fail-safe function can prevent a framing error from its occurrence by making the receiver output stable to the MARK (1) when the transmission line is in the high-impedance state.

■ **Modbus data processing precautions**

- The numeric range of data used in Modbus protocol is 0000H to FFFFH. Only the set value within the setting range is effective.
  FFFFH represents –1.
- Data with decimal point is treated as data without decimal point on the Modbus protocol.
- If data (holding register) exceeding the accessible address range is accessed, an error response message is returned.
- Read data of unused item is a default value.
- Any attempt to write to an unused item is not processed as an error. Data can not be written into an unused item.
- If data range or address error occurs during data writing (Write Action), it is not processed as an error. Normal data is written in data register but data with error is not written; therefore, it is recommended to confirm data of changed items after the data setting.
- An attribute of the item for functions which are not in the indicator is RO (read only). If read action to this item is performed, the read data will be "0." If write action to this item is performed, no error message is indicated and no data is written.
- Commands should be sent at time intervals of 30 bits after the master receives the response message.
- Error code

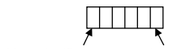
Problem	Possible cause	Solution
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When the mismatched address is specified	Confirm the address of holding register
Error code 3	When the specified number of data items in the query message exceeds the maximum number of data items available	Confirm the setting data
Error code 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, please contact RKC sales office or the agent.

4. COMMUNICATION DATA LIST

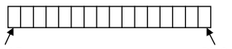
The communication data map shows data which can be used for communication between the host computer and PG500.

Explanation of data map items
- Modbus register address
  HEX: Hexadecimal DEC: Decimal
- Attribute (A method of how communication data items are read or written when viewed from the host computer is described)
  RO: Only reading data is possible (Host computer ← PG500)
  R/W: Reading and writing data is possible (Host computer ↔ PG500)
- Data

RKC communication
ASCII code data of 6 digits



Modbus
16-bit data



Name	RKC Identifier	Modbus register address HEX	Modbus register address DEC	Attribute	Data range	Factory set value
Model code	ID	—	—	RO	Model character code (32-digit)	—
ROM version monitor	VR	—	—	RO	Version of ROM built-in the instrument (9-digit)	—
Measured value (PV)	M1	00E0	224	RO	Pressure display low to Pressure display high	—
Burnout state monitor	B1	00E1	225	RO	0: OFF 1: ON	—
Alarm 1 state monitor	AA	00E2	226	RO	0: OFF 1: ON	—
Alarm 2 state monitor	AB	00E3	227	RO		—
Alarm 3 state monitor	AC	00E4	228	RO		—
Alarm 4 state monitor	AD	00E5	229	RO		—
Unused	—	00E6	230	—	—	—
Unused	—	00E7	231	—	—	—
Peak hold monitor	HP	00E8	232	RO	Pressure display low to Pressure display high	—
Bottom hold monitor	HQ	00E9	233	RO	At input break: Display range limit	—

Name	RKC Identifier	Modbus register address HEX	Modbus register address DEC	Attribute	Data range	Factory set value
Error code	ER	00EA	234	RO	RKC communication 1: Adjustment data error 2: Back-up error 4: A/D conversion error 16: Auto zero/auto calibration error 128: Watchdog timer error 256: Program error (stack) 2048: Program error (busy)	—
					Modbus (Bit data) Bit 0: Adjustment data error Bit 1: Back-up error Bit 2: A/D conversion error Bit 3: Unused Bit 4: Auto zero/auto calibration error Bit 5, Bit 6: Unused Bit 7: Watchdog timer error Bit 8: Program error (stack) Bit 9: Unused Bit 10: Unused Bit 11: Program error (busy) Bit 12 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 2455]	—
Digital input (DI) state monitor	L1	00EB	235	RO	RKC communication Least significant digit: The state of auto zero (DI1) 2nd digit: The state of hold reset (DI2) 3rd digit: The state of Interlock release (DI3) 4th digit to Most significant digit: Unused Data 0: Contact open 1: Contact closed	—
					Modbus (Bit data) Bit 0: The state of auto zero (DI1) Bit 1: The state of hold reset (DI2) Bit 2: The state of Interlock release (DI3) Bit 3 to Bit 15: Unused Data 0: Contact open 1: Contact closed [Decimal number: 0 to 7]	—
Alarm output state monitor	Q1	00EC	236	RO	RKC communication Least significant digit to 4th digit: The state of Alarm 1 output to Alarm 4 output 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
					Modbus (Bit data) Bit 0 to Bit 3: The state of Alarm 1 output to Alarm 4 output Bit 4 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 15]	—
Integrated operating time monitor	UT	00ED	237	RO	0 to 19999 hours	—
Unused	—	00EE	238	—	—	—
Unused	—	00EF	239	—	—	—
Auto zero	AZ	00F0	240	R/W	0: Normal state 1: Auto zero execution When "1" is written, auto zero starts. When done, the value reverts to "0." 3: Error When "0" is written, returns to a normal state.	0
Auto calibration [1]	FS	00F1	241	R/W	0: Normal state 1: Auto calibration execution When "1" is written, auto calibration starts. When done, the value reverts to "0." 3: Error When "0" is written, returns to a normal state.	0
Hold reset	HR	00F2	242	R/W	0: Hold reset execution 1: Hold state When "0" is written, the hold reset is performed. When done, the value reverts to "1."	1
Interlock release [2]	IR	00F3	243	R/W	0: Interlock release execution 1: Interlock state When "0" is written, the interlock is released. When done, the value reverts to "1."	1
Alarm 1 set value [3]	A1	00F4	244	R/W	Pressure display low to Pressure display high Varies with the setting of the Input decimal point position. Signals are output from the alarm outputs (ALM1 to ALM4) if exceeding the alarm set value.	50
Alarm 2 set value [3]	A2	00F5	245	R/W		0
Alarm 3 set value [3]	A3	00F6	246	R/W		50
Alarm 4 set value [3]	A4	00F7	247	R/W		50
Unused	—	00F8	248	—	—	—
Unused	—	00F9	249	—	—	—

[1] This item is valid when using resistance for sensitivity adjustment built-in pressure sensor.
[2] This item is invalid when the alarm 1 to 4 Interlock are set to "0: Unused."
[3] This item is invalid when the alarm type is set to "0: None."

Name	RKC Identifier	Modbus register address HEX	Modbus register address DEC	Attribute	Data range	Factory set value
Input type	XI	00FA	250	R/W	0 to 4 Refer to **Input type and factory set value table**.	Based on model code.
Gain setting	GA	00FB	251	R/W	0.500 to 4.000 mV/V or 0.5000 to 1.9999 mV/V * Varies with the setting of the Gain setting decimal point position.	Refer to **Input type and factory set value table**
Display unit	PU	00FC	252	R/W	0: Kgf/cm^2 2: bar 1: MPa 3: psi	1
Input decimal point position	XU	00FD	253	R/W	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places	0
Pressure display high	XV	00FE	254	R/W	Pressure display low to 19999 Varies with the setting of the Input decimal point position.	50
Pressure display low	XW	00FF	255	R/W	0 to Pressure display high Varies with the setting of the Input decimal point position.	0
Linearizing type	LI	0100	256	R/W	0 to 20 *	0
PV bias	PB	0101	257	R/W	–Input span to +Input span Varies with the setting of the Input decimal point position.	0
PV digital filter	F1	0102	258	R/W	0.0 to 100.0 seconds (0.0: Unused)	0
PV ratio	PR	0103	259	R/W	0.500 to 1.500 *	1.000
Unused	—	0104	260	—	—	—
Set lock level	LK	0105	261	R/W	RKC communication Least significant digit: Items other than alarm set value. 2nd digit: Alarm set value 3rd digit to Most significant digit: Unused Data 0: Unlock 1: Lock	0
					Modbus (Bit data) Bit 0: Items other than alarm set value. Bit 1: Alarm set value Bit 2 to Bit 15: Unused Data 0: Unlock 1: Lock [Decimal number: 0 to 3]	0
Display timer	TL	0106	262	R/W	0.1 to 10.0 seconds	0.1
PV display condition	DU	0107	263	R/W	RKC communication 0 to 63 (Decimal) Set the bit data (Refer to Modbus) after converting it to decimal.	0
					Modbus (Bit data) Bit 0: Minus display of PV value Bit 1: Input error Bit 2: Alarm 1 occurs Bit 3: Alarm 2 occurs Bit 4: Alarm 3 occurs Bit 5: Alarm 4 occurs Bit 6 to Bit 15: Unused Data Bit 0 0: Minus display 1: Non-minus display Bit 1 to Bit 5 0: Non-flashing display 1: Flashing display [Decimal number: 0 to 63]	0

* The setting value varies depending on using pressure sensor.

Data name	When using our CZ-100P or CZ-200P	When using resistance for sensitivity adjustment built-in pressure sensor
Gain setting	Refer to ● **Gain setting and linearizing type** of **PG500 Operation Manual (IMR02F02-E□)**.	Set the appropriate gain setting value.
Linearizing type		Use a factory set value of "0."
PV ratio	[Explosionproof specification type] Set the desired correction factor of our safety barrier RZB-001 to the PV ratio (Pr). Thus, an indicated error caused by the use of the safety barrier is corrected. The correction factor is described in the nameplate attached to the safety barrier (RZB-001).	The result obtained by auto calibration is reflected to the PV ratio (Pr). Manual full scale adjustment can be performed by changing this PV ratio value.
	[Non-explosionproof specification type] Use a factory set value of "1.000."	

Input type and factory set value table

Set value	Input type	Factory set value of gain setting (mV/V)
0	Our CZ-100P/CZ-200P (Standard)	1.500
1	Our CZ-100P/CZ-200P (Explosionproof)	1.500
2	Our CZ-100P/CZ-200P (Standard) [Loose nut: 0.0 to 0.5 MPa, Fixed nut: 0 to 5 MPa]	0.650
3	Our CZ-100P/CZ-200P (Explosionproof) [Loose nut: 0.0 to 0.5 MPa, Fixed nut: 0 to 5 MPa]	0.650
4	3.33 mV/V output type (Pressure sensor made by other companies)	3.330

Name	RKC Identifier	Modbus register address HEX	Modbus register address DEC	Attribute	Data range	Factory set value
Input error determination point (high)	AV	0108	264	R/W	Pressure display low – (5 % of input span) to Pressure display high + (5 % of input span) Varies with the setting of the Input decimal point position.	53
Input error determination point (low)	AW	0109	265	R/W		–2
Burnout direction	IB	010A	266	R/W	0: Upscale 1: Downscale Setting of a barn out direction select switch is necessary to select a barn out direction. For the switch setting, refer to the **PG500 Installation Manual (IMR02F01-E□)**.	0
Gain setting decimal point position	GS	010B	267	R/W	3: Three decimal places 4: Four decimal places	3
Unused	—	010C	268	—	—	—
Shunt resistance output value [1]	OR	010D	269	R/W	40.0 to 100.0 %	80.0
Transmission output scale high	HV	010E	270	R/W	Transmission output scale low to Pressure display high Varies with the setting of the Input decimal point position.	50
Transmission output scale low	HW	010F	271	R/W	Pressure display low to Transmission output scale high Varies with the setting of the Input decimal point position.	0
Transmission output timer	TO	0110	272	R/W	0.1 to 10.0 seconds	0.1
Alarm 1 type	XA	0111	273	R/W	0: None 1: Process high 2: Process low	Based on model code [2]
Alarm 1 hold action	WA	0112	274	R/W	0: OFF 1: Hold action ON	Based on model code [2]
Alarm 1 interlock	QA	0113	275	R/W	0: Unused (OFF) 1: Used	0
Alarm 1 energized/ de-energized	NA	0114	276	R/W	0: Energized 1: De-energized	0
Alarm 1 differential gap	HA	0115	277	R/W	0 to Input span Varies with the setting of the Input decimal point position.	2
Alarm 1 delay timer	TD	0116	278	R/W	0.0 to 600.0 seconds	0.0
Alarm 1 action at input error	OA	0117	279	R/W	0: Normal alarm action 1: Forced alarm ON when temperature measured value exceeds the input error determination point (high or low limit).	0
Alarm 2 type	XB	0118	280	R/W	Same as Alarm 1 type	
Alarm 2 hold action	WB	0119	281	R/W	Same as Alarm 1 hold action	
Alarm 2 interlock	QB	011A	282	R/W	Same as Alarm 1 interlock	
Alarm 2 energized/ de-energized	NB	011B	283	R/W	Same as Alarm 1 energized/ de-energized	
Alarm 2 differential gap	HB	011C	284	R/W	Same as Alarm 1 differential gap	
Alarm 2 delay timer	TG	011D	285	R/W	Same as Alarm 1 delay timer	
Alarm 2 action at input error	OB	011E	286	R/W	Same as Alarm 1 action at input error	
Alarm 3 type	XC	011F	287	R/W	Same as Alarm 1 type	
Alarm 3 hold action	WC	0120	288	R/W	Same as Alarm 1 hold action	
Alarm 3 interlock	QC	0121	289	R/W	Same as Alarm 1 interlock	
Alarm 3 energized/ de-energized	NC	0122	290	R/W	Same as Alarm 1 energized/ de-energized	
Alarm 3 differential gap	HC	0123	291	R/W	Same as Alarm 1 differential gap	
Alarm 3 delay timer	TH	0124	292	R/W	Same as Alarm 1 delay timer	
Alarm 3 action at input error	OC	0125	293	R/W	Same as Alarm 1 action at input error	
Alarm 4 type	XD	0126	294	R/W	Same as Alarm 1 type	
Alarm 4 hold action	WD	0127	295	R/W	Same as Alarm 1 hold action	
Alarm 4 interlock	QD	0128	296	R/W	Same as Alarm 1 interlock	
Alarm 4 energized/ de-energized	ND	0129	297	R/W	Same as Alarm 1 energized/ de-energized	
Alarm 4 differential gap	HD	012A	298	R/W	Same as Alarm 1 differential gap	
Alarm 4 delay timer	TI	012B	299	R/W	Same as Alarm 1 delay timer	
Alarm 4 action at input error	OD	012C	300	R/W	Same as Alarm 1 action at input error	
Unused	—	012D ⋮ 013A	301 ⋮ 314	—	—	—

[1] This item is valid when using resistance for sensitivity adjustment built-in pressure sensor.
[2] When not specifying: Alarm 1: Process high (without hold action) Alarm 3: No alarm
Alarm 2: Process low (without hold action) Alarm 4: No alarm

5. HOW TO USE MODBUS DATA MAPPING

In this communication, it is possible to continuously read/write data by freely specifying 16 sets of data.
Register address to specify mapping data: **1000H to 100FH**
Register address to actually read/write data: **1500H to 150FH**
Register address of data which can be mapped: Refer to **4. COMMUNICATION DATA LIST**.

Example: When mapping Measured value (PV), Alarm 1 state monitor, Alarm 2 state monitor and Alarm output state monitor to the register addresses from 1500H to 1503H

For data mapping Factory set value: (–1: No mapping) Name	Register address HEX	Register address DEC
Setting 1 (For 1500H)	1000	4096
Setting 2 (For 1501H)	1001	4097
Setting 3 (For 1502H)	1002	4098
Setting 4 (For 1503H)	1003	4099
⋮	⋮	⋮
Setting 16 (For 150FH)	100F	4111

Mapping data Name	Register address HEX	Register address DEC
Measured value (PV)	00E0	224
Alarm 1 state monitor	00E2	226
Alarm 2 state monitor	00E3	227
Alarm output state monitor	00EC	236

Write to 1000H to 1003H.

1. The register address, "00E0H" of the "Measured value (PV)" to be mapped is written to register address setting 1 (1000H).
2. The register address, "00E2H" of the "Alarm 1 state monitor" to be mapped is written to register address setting 2 (1001H).
3. The register address, "00E3H" of the "Alarm 2 state monitor" to be mapped is written to register address setting 3 (1002H).
4. The register address, "00ECH" of the "Alarm output state monitor" to be mapped is written to register address setting 4 (1003H).
5. The assignment of the register addresses from 1500H to 1503H from/to which data is actually read/written becomes as follows.

Register address HEX	Register address DEC	Name
1500	5376	Measured value (PV)
1501	5377	Alarm 1 state monitor
1502	5378	Alarm 2 state monitor
1503	5379	Alarm output state monitor

High-speed communication is performed by reading or writing data in the consecutive register addresses from 1500H to 1503H.

6. COMMUNICATION SPECIFICATIONS

Interface: Based on RS-422A or RS-485, EIA standard
Synchronous method: Start-stop synchronous type
Communication speed: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps
Data bit configuration:
Start bit: 1
Data bit: RKC communication: 7 or 8
Modbus: 8
Parity bit: Without, Odd or Even
Stop bit: 1 or 2
Connection method: RS-422A: 4-wire system, half-duplex multi-drop connection
RS-485: 2-wire system, half-duplex multi-drop connection
Protocol:
- RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
  Error control: Vertical parity (With parity bit selected)
  Horizontal parity (BCC check)
  Communication code: ASCII 7-bit code
  Xon/Xoff control: None
- Modbus
  Signal transmission mode: Remote Terminal Unit (RTU) mode
  Function code: 03H (Read holding registers)
  06H (Preset single register)
  08H (Diagnostics: loopback test)
  10H (Preset multiple registers)
  Error check method: CRC-16

Maximum connections: Up to 31 instruments
Termination resistor: Externally connected (Example: 120 Ω 1/2 W)
Data mapping function: Up to 16 items (Only Modbus)
Interval time: 0 to 250 ms
Signal logic: RS-422A, RS-485

Signal voltage	Logic
V (A) – V (B) ≥ 2 V	0 (SPACE)
V (A) – V (B) ≤ –2 V	1 (MARK)

Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

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HEADQUARTERS: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO 146-8515 JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799) E-mail: info@rkcinst.co.jp
FAX: 03-3751-8585 (+81 3 3751 8585) Website: http://www.rkcinst.com/
JUN. 2014

Pressure Indicator

PG500 Operation Manual

 IMR02F02-E3

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

This manual describes the operation method of the PG500.

For the installation, the parts description, the specifications and the communication function (Optional), please read if necessary the following separate manuals.

- PG500 Installation Manual (IMR02F01-E□): Enclosed with PG500
- PG500 Communication Quick Instruction Manual (IMR02F03-E□): Enclosed with PG500 *
- PG500 Communication Instruction Manual (IMR02F04-E□): Separate volumes

* Only PG500 provided with the communication function.

The manuals can be downloaded from the official RKC website: http://www.rkcinst.com/english/manual_load.htm.

1. HANDLING PROCEDURES

Mounting and wiring → Refer to **PG500 Installation Manual (IMR02F01-E□)**

↓

Power ON

↓

Setting of usage condition → Set the parameters for sensor's usage condition in setup setting mode. Refer to **4.2 Setup Setting Mode**

↓

Setting of operating condition → Set the parameters for instrument's basic functions in engineering mode. Refer to **4.4 Engineering Mode**

↓

Zero/full scale point adjustment → Execute the auto zero function (Zero point adjustment) and auto calibration (Full scale point adjustment) function. Refer to **4.3 Parameter Setting Mode**

Before operating the instrument for the first time after purchase or pressure sensor exchange, always adjust the zero point and full scale point.

↓

Setting of alarm → Set the alarm set value. Refer to **4.3 Parameter Setting Mode**

↓

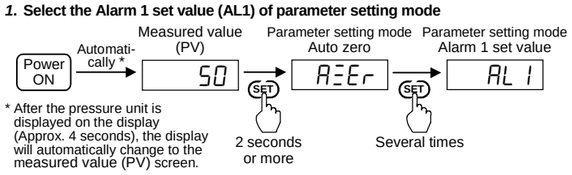
Operation start

2. CHANGING DATA SETTINGS

- To store a new value for the parameter, always press the SET key.
- After a new value is displayed on the display by using UP and DOWN keys, if no key operation is performed within 1 minute without pressing SET key, this instrument returns to the Measured value (PV) screen and the set value will not be changed.

Example: Changing the alarm 1 set value (AL1) to 20 MPa

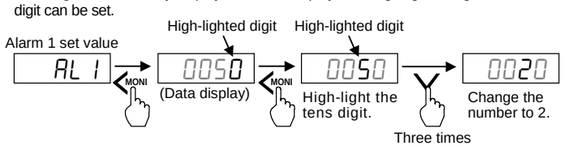
***1.* Select the Alarm 1 set value (AL1) of parameter setting mode**



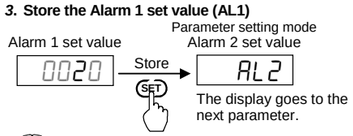
* After the pressure unit is displayed on the display (Approx. 4 seconds), the display will automatically change to the measured value (PV) screen.

***2.* Change the Alarm 1 set value (AL1) to 20 MPa**

Pressing the <MONI key displays the data display. The high-lighted digit indicates which digit can be set.



***3.* Store the Alarm 1 set value (AL1)**

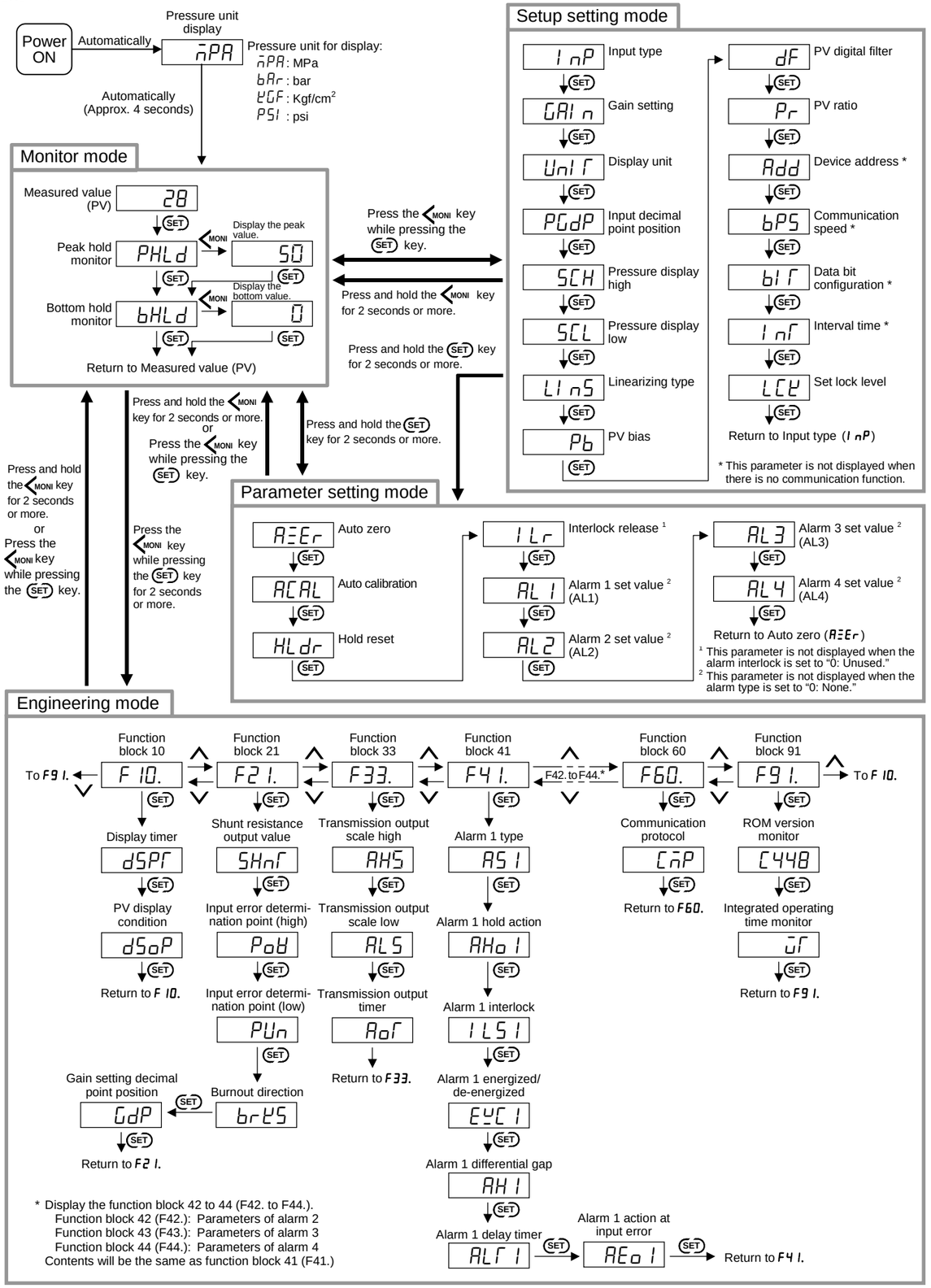


Other data can also be set by the same procedures as described in steps ***1*** to ***3***.

3. TRANSFER TO EACH MODE AND PARAMETER

This instrument return to Measured value (PV) screen, if key operation within 1 minute is not performed.

Any parameter which is not used in the PG500 will not be displayed except for parameters in engineering mode.



* Display the function block 42 to 44 (F42. to F44.).
Function block 42 (F42.): Parameters of alarm 2
Function block 43 (F43.): Parameters of alarm 3
Function block 44 (F44.): Parameters of alarm 4
Contents will be the same as function block 41 (F41.)

4. PARAMETER LIST

4.1 Monitor Mode

Symbol	Name	Data range	Description
—	Measured value (PV)	Pressure display low to Pressure display high	Display the Measured value (PV).
PHLd (PHLd)	Peak hold monitor *	Pressure display low to Pressure display high At input break: Display range limit	Display the maximum value of Measured value (PV).
bHLd (bHLd)	Bottom hold monitor *		Display the minimum value of Measured value (PV).

* The hold reset function can be executed by Hold reset (HLdr) in parameter setting mode and Digital input 2 (DI2, terminal Nos. 13 and 15). Reset also takes place when the power is turned off, or when the set value of Input type (InP), Gain setting (GAIn), Display unit (UnIT), Input decimal point position (PGdP) or Linearizing type (LInS) is changed.

4.2 Setup Setting Mode

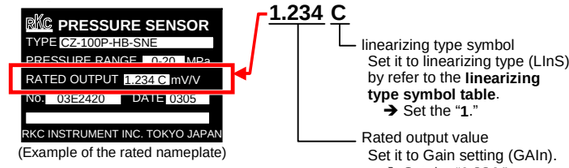
Symbol	Name	Data range	Description	Factory set value
InP (InP)	Input type	0 to 4 Refer to **Input type and factory set value table**	Use to select the input type.	Based on model code.
GAIn (GAIn)	Gain setting	0.500 to 4.000 mV/V or 0.5000 to 1.9999 mV/V Varies with the setting of the Gain setting decimal point position.	Use to set the gain of pressure sensor. CZ-100P/CZ-200P: Refer to ● **Gain setting and linearizing type**	Refer to **Input type and factory set value table**
UnIT (UnIT)	Display unit	0: Kgf/cm² 2: bar 1: MPa 3: psi	Use to select the display unit for input.	1
PGdP (PGdP)	Input decimal point position	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places	Use to select the decimal point position of the input display value.	0
SCH (SCH)	Pressure display high	Pressure display low to 19999 Varies with the setting of the Input decimal point position.	Use to set the high limit of the pressure display range.	50
SCL (SCL)	Pressure display low	0 to Pressure display high Varies with the setting of the Input decimal point position.	Use to set the low limit of the pressure display range.	0
LInS (LInS)	Linearizing type	0 to 20 Resistance for sensitivity adjustment built-in pressure sensor: Use a factory set value of "0."	Use to set the linearizing type of our CZ-100P/CZ-200P. CZ-100P/CZ-200P: Refer to ● **Gain setting and linearizing type**	0

Input type and factory set value table

Set value	Input type	Factory set value of gain setting (mV/V)
0	Our CZ-100P/CZ-200P (Standard)	1.500
1	Our CZ-100P/CZ-200P (Explosionproof)	1.500
2	Our CZ-100P/CZ-200P (Standard) [Loose nut: 0.0 to 0.5 MPa, Fixed nut: 0 to 5 MPa]	0.650
3	Our CZ-100P/CZ-200P (Explosionproof) [Loose nut: 0.0 to 0.5 MPa, Fixed nut: 0 to 5 MPa]	0.650
4	3.33 mV/V output type (Pressure sensor made by other companies)	3.330

● **Gain setting and linearizing type (Only our pressure sensor CZ-100P/CZ-200P)**

Set the rated output value (mV/V) and linearizing type symbol to Gain setting (GAIn) and linearizing type (LInS) engraved on the rated nameplate attached to the pressure sensor housing.



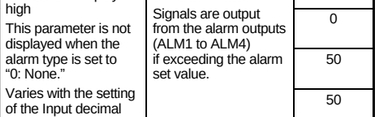
(Example of the rated nameplate)

Linearizing type symbol table

Set value	Linearizing type symbol	Set value	Linearizing type symbol	Set value	Linearizing type symbol
0	No symbol	7	J	14	S
1	C	8	K	15	T
2	D	9	L	16	U
3	E	10	M	17	V
4	F	11	P	18	W
5	G	12	Q	19	X
6	H	13	R	20	Y

The rated output value (mV/V) of the CZ-100P/CZ-200P is when the cable is at a length of 5 m. When the cable is extended or a cable of a different manufacturer is used, the gain value must be corrected and changed.
For details, refer to the **CZ-100P/PCT-300 Resin Pressure Measuring System Instruction Manual (IM100CZ04-E□)** or **CZ-200P Instruction Manual (IM100CZ08-E□)**.

Symbol	Name	Data range	Description	Factory set value
Pb (Pb)	PV bias	–Input span to +Input span Varies with the setting of the Input decimal point position.	PV bias adds bias to the Measured value (PV). Manual zero adjustment can be performed.	0
dF (dF)	PV digital filter	0.1 to 100.0 seconds oFF: Unused	This item is the time of the first-order lag filter eliminate noise against the measured input.	oFF
Pr (Pr)	PV ratio	0.500 to 1.500 The setting value varies depending on using pressure sensor. Refer to ● **PV ratio**.	PV ratio is a multiplier to be applied to the Measured value (PV). Manual full scale adjustment can be performed.	1.000
Add (Add)	Device address	This parameter is displayed when there is the communication function [Optional]. Refer to the **PG500 Communication Quick Instruction Manual (IMR02F03-E□)**.		
bPS (bPS)	Communication speed			
bIT (bIT)	Data bit configuration			
Int (InT)	Interval time			
LCK (LCK)	Set lock level	0: Unlock 1: Lock Set to "0" or "1" for each digit.	The set lock level restricts parameter setting changes by key operation (Set data lock function).	0000



● PV ratio

[When using our CZ-100P or CZ-200P]

- Explosionproof specification type

Set the desired correction factor of our safety barrier RZB-001 to the PV ratio. Thus, an indicated error caused by the use of the safety barrier is corrected.

The correction factor is described in the nameplate attached to the safety barrier (RZB-001).

- Non-explosionproof specification type

As the PV ratio, use a factory set value of "1.000" with this value left intact.

[When using resistance for sensitivity adjustment built-in pressure sensor]

The result obtained by auto calibration is reflected to the PV ratio. Manual full scale adjustment can be performed by changing this PV ratio value.

4.3 Parameter Setting Mode

Symbol	Name	Data range	Description	Factory set value
AZEr (AZEr)	Auto zero *	–5.0 to +5.0 mV (Input conversion)	Adjust the zero point of the Measured value (PV). Refer to ● **Auto zero**.	—
ACAL (ACAL)	Auto calibration	— This parameter is valid when using resistance for sensitivity adjustment built-in pressure sensor.	Adjust the full scale point of the Measured value (PV). Refer to ● **Auto calibration**.	—
HLdr (HLdr)	Hold reset *	—	Peak hold/bottom hold value is reset.	—
	[Procedure] Measured value (PV) → Auto zero → Hold reset → Hold is reset 2 seconds or more; Several times; Press the ∧ key while pressing the ∨key.			
ILr (ILr)	Interlock release *	— This parameter is not displayed when the alarm 1 to 4 Interlock are set to "0: Unused."	If the alarm state is interlocked, interlock can be released. The interlock states of all alarms are released.	—
	[Procedure] Measured value (PV) → Auto zero → Interlock release → Interlock is released. 2 seconds or more; Several times; Press the ∧ key while pressing the ∨key.			
AL1 (AL1)	Alarm 1 set value (AL1)	Pressure display low to Pressure display high This parameter is not displayed when the alarm type is set to "0: None." Varies with the setting of the Input decimal point position.	Use to set the set value of the alarm action. Signals are output from the alarm outputs (ALM1 to ALM4) if exceeding the alarm set value.	50
AL2 (AL2)	Alarm 2 set value (AL2)			0
AL3 (AL3)	Alarm 3 set value (AL3)			50
AL4 (AL4)	Alarm 4 set value (AL4)			50

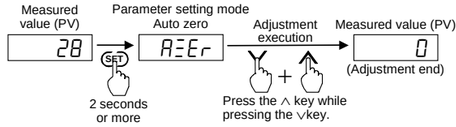
* The auto zero, hold reset and interlock release functions can be executed by turning on the digital input.
DI1 (Terminal Nos. 13 and 14): Auto zero DI2 (Terminal Nos. 13 and 15): Hold reset
DI3 (Terminal Nos. 13 and 16): Interlock release

☞ For the digital input, refer to the **PG500 Installation Manual (IMR02F01-E□)**.

● Auto zero

Auto zero is used to automatically set the PV bias (Pb) so that the Measured value (PV) will be 0.

1. Make sure that the pressure sensor is installed on the equipment.
2. Rise the temperature of the equipment installed with the pressure sensor up to the temperature during operation.
3. Set the pressure sensor to the no-load state.
4. Press the UP key while pressing the DOWN key displaying the Auto zero screen automatically starts auto zero operation. If this auto zero operation normally end, the screen returns to the Measured value (PV) screen.



📖 If error occur, the "AZEr" and "Err" are displayed alternately on the PV display unit. Press any of the keys (SET key, <MONI key, DOWN key or UP key) to clear the error and return to the Measured value (PV) screen.

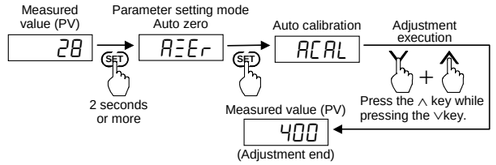
📖 The result of auto zero adjustment is also reflected to the PV bias (Pb) value. Manual zero point adjustment can be performed by changing this PV bias value.

📖 The auto zero can be executed by digital input 1 (DI1, terminal Nos. 13 and 14).

● Auto calibration (Only resistance for sensitivity adjustment built-in pressure sensor)

Auto calibration is used to automatically set the PV ratio (Pr) so that the Measured value (PV) will be the pressure of the Shunt resistance output value (SHnT).

1. Make sure that the pressure sensor (resistance for sensitivity adjustment built-in pressure sensor) is installed on the equipment.
2. Rise the temperature of the equipment installed with the pressure sensor up to the temperature during operation.
3. Press the UP key while pressing the DOWN key displaying the Auto calibration screen automatically starts auto calibration operation. If this auto calibration operation normally end, the screen returns to the Measured value (PV) screen.



📖 If error occur, the "ACAL" and "Err" are displayed alternately on the PV display unit. Press any of the keys (SET key, <MONI key, DOWN key or UP key) to clear the error and return to the Measured value (PV) screen.

📖 For this product, in order to generate the R-cal output it is not necessary to short the cables (CAL+ and CAL–) on the pressure sensor side.

📖 The result obtained by auto calibration is reflected to the PV ratio value. Manual full scale point adjustment can be performed by changing this PV ratio value.

4.4 Engineering Mode

⚠ WARNING

Parameters in the Engineering mode (F10 to F91) should be set according to the application before setting any parameter related to operation. Once the Parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.

📖 All parameters of the engineering mode are displayed regardless of the instrument specification.

Symbol	Name	Data range	Description	Factory set value
F10. (F10)	Function block 10	This is the first parameter symbol of function block 10.		
dSPT (dSPT)	Display timer	0.1 to 10.0 seconds	Use to set the time during which the displayed value is changed.	0.1
dSoP (dSoP)	PV display condition	0 to 63 (Decimal) Bit 0: Minus display of PV value Bit 1: Input error* Bit 2: Alarm 1 occurs Bit 3: Alarm 2 occurs Bit 4: Alarm 3 occurs Bit 5: Alarm 4 occurs Data Bit 0 0: Minus display 1: Non-minus display Bit 1 to Bit 5 0: Non-flashing display 1: Flashing display	Sets the condition for flashing display of the Measured value (PV) and minus display of the Measured value (PV). When an alarm occurs and flashing is enabled, the Measured value (PV) and alarm number are alternately displayed. Bit data 000000 Bit 5 ····· Bit 0 Set the bit data after converting it to decimal.	0

* When flashing is enabled, the Measured value (PV) flashes at the following times:
- Measured value (PV) exceeds the pressure display high /low.
- Measured value (PV) exceeds the input error determination point (high/low limit).

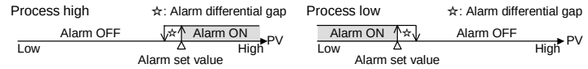
Symbol	Name	Data range	Description	Factory set value
F21. (F21)	Function block 21	This is the first parameter symbol of function block 21.		
SHnT (SHnT)	Shunt resistance output value	40.0 to 100.0 % This parameter is valid when using resistance for sensitivity adjustment built-in pressure sensor.	It is set "What percentage of the rated output" is output when the full scale point of the Measured value (PV) is adjusted by auto calibration.	80.0
PoV (PoV)	Input error determination point (high) [1]	Pressure display low – (5 % of input span) to Pressure display high + (5 % of input span)	If the Measured value (PV) is above the Input error determination point (high), alarm action at input error will be taken.	53
PUn (PUn)	Input error determination point (low) [1]	Pressure display low – (5 % of input span) to Pressure display high + (5 % of input span)	If the Measured value (PV) is below the Input error determination point (low), alarm action at input error will be taken.	–2
brKS (brKS)	Burnout direction [2]	0: Upscale 1: Downscale	Use to select burnout direction in input break.	0
GdP (GdP)	Gain setting decimal point position	3: Three decimal places 4: Four decimal places	Use to select the decimal point position of the gain setting value.	3
F33. (F33)	Function block 33	This is the first parameter symbol of function block 33.		
AHS (AHS)	Transmission output scale high [1]	Transmission output scale low to Pressure display high	Use to set a scale high limit value of the transmission output.	50
ALS (ALS)	Transmission output scale low [1]	Pressure display low to Transmission output scale high	Use to set a scale low limit value of the transmission output.	0
AoT (AoT)	Transmission output timer	0.1 to 10.0 seconds	Use to set the time during which the transmission output value is changed.	0.1
F41. (F41) ⋮ F44. (F44)	Function block 41 ⋮ Function block 44	This is the first parameter symbol of function block 41 to 44. F41: Parameters of alarm 1 F43: Parameters of alarm 3 F42: Parameters of alarm 2 F44: Parameters of alarm 4		
AS1 (AS1) ⋮ AS4 (AS4)	Alarm 1 type ⋮ Alarm 4 type	0: None 1: Process high 2: Process low	Use to select the action type of the alarm.	Based on model code [3]
AHo1 (AHo1) ⋮ AHo4 (AHo4)	Alarm 1 hold action ⋮ Alarm 4 hold action	0: OFF 1: Hold action ON	Use to select the hold action for the alarm.	Based on model code [3]
ILS1 (ILS1) ⋮ ILS4 (ILS4)	Alarm 1 interlock ⋮ Alarm 4 interlock	0: Unused (OFF) 1: Used	Use to select the interlock function for the alarm.	0
EXC1 (EXC1) ⋮ EXC4 (EXC4)	Alarm 1 energized/ de-energized ⋮ Alarm 4 energized/ de-energized	0: Energized 1: De-energized	Use to select the alarm energized or de-energized.	0
AH1 (AH1) ⋮ AH4 (AH4)	Alarm 1 differential gap ⋮ Alarm 4 differential gap	0 to Input span	Use to set a differential gap of the alarm.	2
ALT1 (ALT1) ⋮ ALT4 (ALT4)	Alarm 1 delay timer [1] ⋮ Alarm 4 delay timer [1]	0.0 to 600.0 seconds	Alarm delay timer is to set an output delay time for alarm outputs	0.0
AEo1 (AE01) ⋮ AEo4 (AE04)	Alarm 1 action at input error ⋮ Alarm 4 action at input error	0: Normal alarm action 1: Forced alarm ON when temperature measured value exceeds the input error determination point (high or low limit).	Alarm action at input error is to select the alarm action when the Measured value (PV) reaches the input error determination point (high or low limit).	0
F60. (F60)	Function block 60	This is the first parameter symbol of function block 60.		
CMP (CMP)	Communication protocol	0: RKC communication 1: Modbus	Use to select a protocol of communication function.	0
F91. (F91)	Function block 91	This is the first parameter symbol of function block 91.		
C448 (C448)	ROM version monitor	0 to 999 (C448-□□□)	Displays the version of the ROM on the instrument.	—

[1] Varies with the setting of the Input decimal point position.
[2] Setting of a barn out direction select switch is necessary to select a barnout direction. For the switch setting, refer to the **PG500 Installation Manual (IMR02F01-E□)**.
[3] When not specifying: Alarm 1: Process high (without hold action) Alarm 3: No alarm
Alarm 2: Process low (without hold action) Alarm 4: No alarm

Symbol	Name	Data range	Description	Factory set value
uT (WT)	Integrated operating time monitor	0 to 19999 hours	Displays the integrated total operating time of the instrument.	—

■ Alarm function [Optional]

Action: When the Measured value (PV) reaches the alarm set value, alarm ON occurs.



● Alarm hold action

When hold action is ON, the alarm action is suppressed at start-up (Power ON) until the measured value has entered the non-alarm range.

● Alarm interlock

The alarm interlock function is used to hold the alarm state even if the Measured value (PV) is out of the alarm area after its entry into the area once.

● Alarm differential gap

It prevents chattering of alarm output due to the measured value fluctuation around the alarm set value.

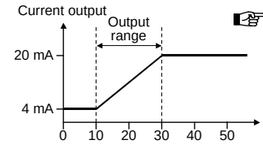
● Alarm delay timer

When an alarm condition becomes ON status, the output is suppressed until the delay timer set time elapses. After the time is up, if the alarm output is still ON status, the output will be produced.

■ Transmission output function (AO) [Optional]

The transmission output function is used to output any Measured value (PV) as the voltage/current output. In addition, any range of the Measured value (PV) can be output with the transmission output scale low and transmission output scale high set.

Example: When a Measured value (PV) of 10 to 30 MPa needs to be recorded on a recorder at an pressure range of 0 to 50 MPa.
Output type: Current output, 4 to 20 mA DC
Transmission output scale high (AHS): 30 MPa
Transmission output scale low (ALS): 10 MPa



☞ For the Transmission output (AO) type (rating, output range), refer to **PG500 Installation Manual (IMR02F01-E□)**.

5. ERROR DISPLAYS

■ Display when input error occurs

📖 **Prior to replacing the sensor, always turn OFF the power.**

Display	Description	Action (Output)	Solution
PV [Flashing] *	PV exceeds the Pressure display high /low.	Output depending on the alarm action at input error	Check input type, input range, sensor and sensor connection.
	PV exceeds the input error determination point (high/low limit).		
	Flashes when any of Alarms 1 to 4 has occurred. (The PV and alarm number are displayed alternately)	Output depending on the normal alarm action	
oooo [Flashing]	Over-scale PV is above the Pressure display high + (5 % of input span).	Output depending on the alarm action at input error	
uuuu [Flashing]	Underscale PV is below the Pressure display low – (5 % of input span)		

* The PV flashes depending on the PV display condition (dSoP) of engineering mode F10.

■ Self-diagnostic error

In an error is detected by the self-diagnostic function, the "Err" and error code are displayed alternately on the PV display unit. If two or more errors occur simultaneously, the total summation of these error codes is displayed.

Solution: Turn off the power at once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.

PV display	Description	Action
1	Adjustment data error	Display: Error display (Err and error number) Output: All the output is OFF (Same as power OFF) Communication: Send the error code
2	Back-up error	
4	A/D conversion error	
128	Watchdog timer error	
256	Program error (stack)	
2048	Program error (busy)	
All display is OFF	Power supply voltage monitoring error	Display: All display is OFF Output: All output OFF Communication: Stop
	RAM check error	

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HEADQUARTERS: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO 146-8515 JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799) E-mail: info@rkcinst.co.jp
FAX: 03-3751-8585 (+81 3 3751 8585) Website: http://www.rkcinst.com/