

Temperature Controller RZ100/RZ400 Instruction Manual

All Rights Reserved, Copyright © 2015, RKC INSTRUMENT INC. IMR02Y02-E1
 Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of the instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

For detailed handling procedures and key operations, refer to separate RZ100/RZ400/RS100/RS400 Instruction Manual (IMR02Y03-ED). The manual can be downloaded from the official RKC website: http://www.rkcinst.com/english/manual_load.htm

- WARNING**
- To prevent injury to persons, damage to the instrument and equipment, a suitable external protection device shall be required.
 - All wiring must be completed before power is turned on to prevent electric shock, fire or damage to the instrument and equipment.
 - This instrument must be used in accordance with the specifications to prevent fire or damage to the 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 may 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 plant.)
 - 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 additional 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 to operating personnel.

- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- 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 dissipation.
- 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 the instrument display, do not rub with an abrasive material or push the front panel with a hard object.

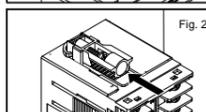
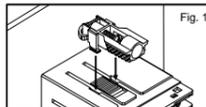
NOTICE

- 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 explanation purpose.
 - 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.
 - Various symbols are used on the equipment, they have the following meaning:
 - ~: Alternating current
 - : Reinforced insulation
 - ⚠: Safety precaution
- This symbol is used where the instruction manual needs to be consulted for the safety of operator and equipment. Carefully read the cautions in this manual before using the instrument.

1.3 Procedures of Mounting and Removing

Mounting procedures

- Prepare the panel cutout as specified in 1.2 Dimensions.
- Insert the instrument through the panel cutout.
- Insert the mounting bracket into the mounting groove of the instrument. (Fig. 1)
- Push the mounting bracket forward until the bracket is firmly secured to the panel. (Fig. 2)
- Tighten the screw for the mounting bracket with a Phillips screwdriver. Do not overtighten the screw. Recommended tightening torque: 0.15 N·m [1.5 kgf·cm]
- The other mounting bracket should be installed in the same way as described in 3 to 5.



Removal procedures

- Turn the power OFF.
- Remove the wiring.
- Loosen the screw of the mounting bracket.
- Remove the mounting bracket by pulling it up (Fig. 4 [1]) and forward (Fig. 4 [2]) while holding the rear (Fig. 3).
- The other mounting bracket(s) should be removed in the same way as described in 3 and 4.
- Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument.

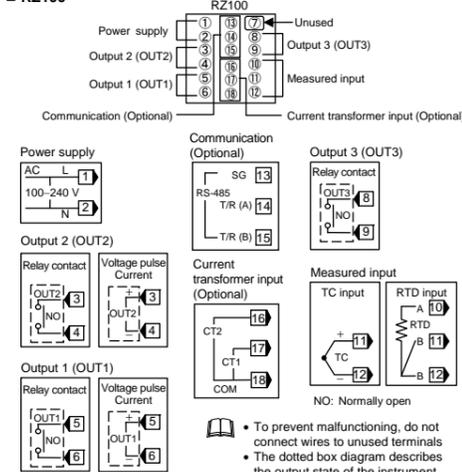


2. WIRING

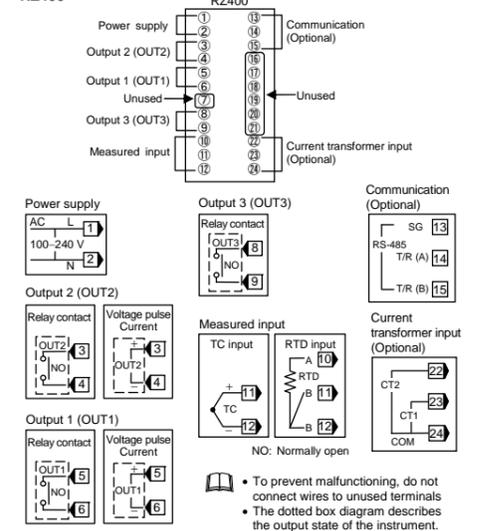
- WARNING**
- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

2.1 Terminal Configuration

RZ100



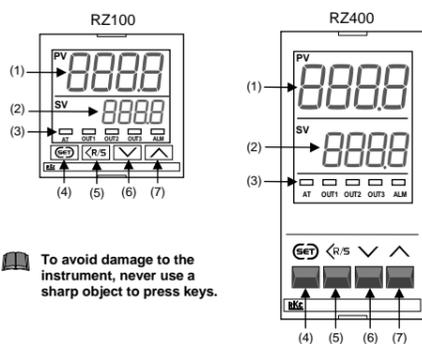
RZ400



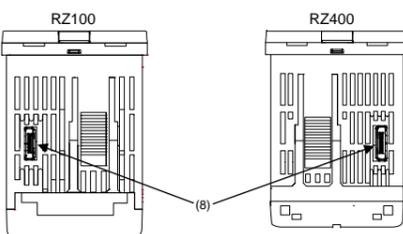
- To prevent malfunctioning, do not connect wires to unused terminals.
- The dotted box diagram describes the output state of the instrument.

3. PARTS DESCRIPTION

Front Panel View



Bottom View



(1) Measured value (PV) display [Green]	Displays Measured value (PV) or various parameter symbols.
(2) Set value (SV) display [Orange]	Displays Set value (SV) or various parameter set values.
(3) AT lamp [Green]	Flashes when Autotuning (AT) is activated. (After AT is completed: AT lamp will go out) Lights during Startup tuning (ST) execution. (After ST is completed: AT lamp will go out)
OUT1 lamp [Green]	Lights when Output 1 (OUT1) is turned on.*
OUT2 lamp [Green]	Lights when Output 2 (OUT2) is turned on.*
OUT3 lamp [Green]	Lights when Output 3 (OUT3) is turned on.*
ALM lamp [Red]	Lights when Alarm 1, Alarm 2, Heater break alarm 1 or Heater break alarm 2 is turned on.
(4) Set (SET) key	Used for calling up parameters and set value registration.
(5) Shift key	Shifts digits when settings are changed. Used to switch RUN/STOP and modes.
(6) Down key	Decreases numerals.
(7) Up key	Increases numerals.
(8) Loader communication connector	Setting and monitoring on a personal computer (PC) is possible if the controller is connected with our cable to a PC via our USB communication converter COM-K (sold separately)*. Our communication software** must be installed on the PC. * For the COM-K, refer to the official RKC website. ** Only available as a download from the official RKC website. http://www.rkcinst.com

- Control output (heat-side/cool-side), Alarm output and Heater break alarm output can be assigned to Outputs 1, 2, and 3 (OUT1, 2, and 3). Output assignment can be made in the Initial setting mode. For details, refer to separate RZ100/RZ400/RS100/RS400 Instruction Manual (IMR02Y03-ED).
- Lamp indication becomes as follows for current output.
 - For an output of less than 0%: Extinguished
 - For an output of more than 100%: Lit
 - For an output of more than 0% but less than 100%: Dimly lit.

5. MODEL CODE

Suffix code

RZ100 - □ □ □ □ * □ □ □ □ □ □ □ □ □ □
 RZ400 (1) (2) (3) (4) (5) (6) (7) (8) (9)

These codes are used for Quick start code. If not specified, these codes are not shown on the label.

- Output 1 (OUT1), N: None, M: Relay contact output, V: Voltage pulse output (0/12 V DC), 7: Current output (0 to 20 mA DC), 8: Current output (4 to 20 mA DC)
- Output 2 (OUT2), N: None, M: Relay contact output, V: Voltage pulse output (0/12 V DC), 7: Current output (0 to 20 mA DC), 8: Current output (4 to 20 mA DC)
- Output 3 (OUT3), N: None, M: Relay contact output
- Current transformer (CT) input (optional), N: None, T: CTL-6-P-N 2 points, U: CTL-12-556-10L-N 2 points
- Communication (optional), N: None, 5: RS-485 (RKC communication), 6: RS-485 (Modbus)
- Waterproof/Dustproof (optional), N: None, 1: Waterproof/Dustproof (IP66)

Quick start code 2 (Initial setting code)

□ □ □ □ □ □ □ □ □ □
 (1) (2) (3) (4) (5) (6) (7)

- Alarm 1 type, (2) Alarm 2 type
 - N: None
 - A: Deviation high
 - B: Deviation low
 - C: Deviation high/low
 - D: Deviation high with hold action
 - E: Deviation low with hold action
 - G: Deviation high/low with hold action
 - H: Process high
 - J: Process low
 - K: Process high with hold action
 - L: Process low with hold action
 - Q: Deviation high with re-hold action
 - R: Deviation low with re-hold action
 - T: Deviation high/low with re-hold action
 - U: Band (High/low individual setting)
 - V: SV high
 - W: SV low
 - X: Deviation high/low (High/low individual setting)
 - Y: Deviation high/low with hold action (High/low individual setting)
 - Z: Deviation high/low with re-hold action (High/low individual setting)
 - 0: Control loop break alarm (LBA)^a
 - 4: Monitor during RUN
- Control output assignment
 - 1: PID control: Heat-side output: Output 1 (OUT1), Cool-side output: Output 2 (OUT2)
 - 2: PID control: Heat-side output: Output 2 (OUT2), Cool-side output: Output 1 (OUT1)
 - 3: Heat-side output: Output 1 (OUT1), Cool-side output: Output 3 (OUT3)
 - 4: Heat-side output: Output 2 (OUT2), Cool-side output: Output 3 (OUT3)^b
- Output assignment of Alarm 1, (5) Output assignment of Alarm 2 (Cannot be specified if the output terminal is already specified for control output), N: No assignment, 1: Output 1 (OUT1), 2: Output 2 (OUT2), 3: Output 3 (OUT3)
- Output assignment of Heater break alarm 1, N: No assignment, 1: Output 1 (OUT1), 2: Output 2 (OUT2), 3: Output 3 (OUT3)
- Output assignment of Heater break alarm 2, N: No assignment, 1: Output 1 (OUT1), 2: Output 2 (OUT2), 3: Output 3 (OUT3)

1. MOUNTING

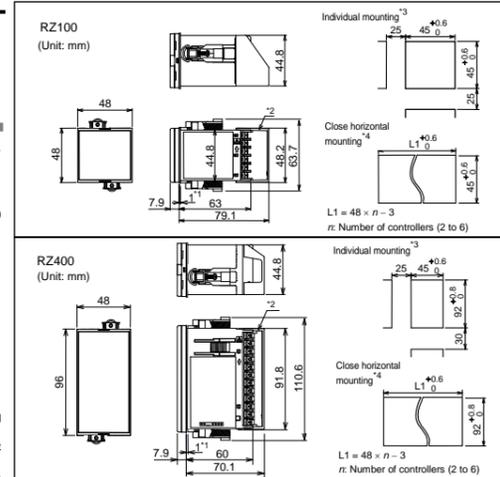
WARNING

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

1.1 Mounting Cautions

- This instrument is intended to be used under the following environmental conditions. (IEC61010-1) [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
 - Allowable ambient temperature: -10 to +55 °C
 - Allowable ambient humidity: 5 to 95 %RH (Absolute humidity: MAX. W. C 29 g/m³ dry air at 101.3 kPa)
 - Installation environment conditions: Indoor use, Altitude up to 2000 m, Short-term temporary overvoltage: 1440 V, Long-term temporary overvoltage: 490 V
 - 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.
- Use this instrument within the following environment conditions:
 - Allowable ambient temperature: -10 to +55 °C
 - Allowable ambient humidity: 5 to 95 %RH (Absolute humidity: MAX. W. C 29 g/m³ dry air at 101.3 kPa)
 - Installation environment conditions: Indoor use, Altitude up to 2000 m, Short-term temporary overvoltage: 1440 V, Long-term temporary overvoltage: 490 V
 - 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.
- 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.
- 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 operating environment.
 - 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 55 °C, cool this instrument with a forced air fan, cooler, etc. 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.
- For correct functioning mount this instrument in a horizontal position.
- In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

1.2 Dimensions



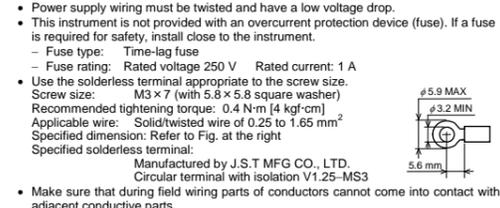
Panel thickness: 1 to 10 mm (When mounting multiple RZ100/400 controllers close together, the panel strength should be checked to ensure proper support.)

- *1 Gasket (optional)
- *2 Terminal cover (optional) [sold separately]
- *3 To keep the instrument as waterproof as possible, make sure that the panel surface has no burr or distortion where the hole is to be cut out.
- *4 Remove the gasket. When the RZ100/400 is mounted closely protection will be compromised and they will not meet IP66 standards.

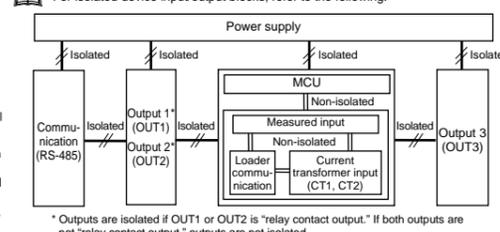
2.2 Wiring Cautions

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input 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.
- Allow approximately 5 seconds for contact output when 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.
- This instrument is not provided with an overcurrent protection device (fuse). If a fuse is required for safety, install close to the instrument.
 - Fuse type: Time-lag fuse
 - Fuse rating: Rated voltage 250 V, Rated current: 1 A
- Use the solderless terminal appropriate to the screw size.
 - Screw size: M3 x 7 (with 5.8 x 5.8 square washer)
 - Recommended tightening torque: 0.4 N·m [4 kgf·cm]
 - Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm²
 - Specified dimension: Refer to Fig. at the right
 - Specified solderless terminal:
 - Manufactured by J.S.T MFG CO., LTD.
 - Circular terminal with isolation V1.25-MS3
- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.



- If solderless terminal lugs other than the recommended dimensions are used, terminal screws may not be tightened. In that case, bend each solderless terminal lug before 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, reinforced insulation cannot be used.
- For isolated device input/output blocks, refer to the following:



4. SPECIFICATIONS

Measured input

Number of input:	1 point																												
TC input:	K, J, T, S, R, E, B, N (JIS C1602-1995), PLII (NBS), W5Re/W26Re (ASTM E889-96), U, L (DIN43710-1985)																												
RTD input:	Pt100 (JIS C1604-1997), JPt100 (JIS C1604-1997, Pt100 of JIS C1604-1981)																												
Input accuracy:	<table border="1"> <thead> <tr> <th>Input type</th> <th>Input range</th> <th>Accuracy</th> </tr> </thead> <tbody> <tr> <td rowspan="2">K, J, T, E, PLII, U, L</td> <td>Less than -100 °C</td> <td>±(2.0 °C + 1 digit)</td> </tr> <tr> <td>-100 °C or more, Less than +500 °C</td> <td>±(1.0 °C + 1 digit)</td> </tr> <tr> <td rowspan="2">R, S, N, W5Re/W26Re</td> <td>-500 °C or more</td> <td>±(0.2 % of Reading + 1 digit)</td> </tr> <tr> <td>0 °C or more</td> <td>±(2 °C + 1 digit)</td> </tr> <tr> <td rowspan="2">B</td> <td>Less than 1000 °C</td> <td>±(0.2 % of Reading + 1 digit)</td> </tr> <tr> <td>1000 °C or more</td> <td>±(2 °C + 1 digit)</td> </tr> <tr> <td rowspan="2">Pt100, JPt100</td> <td>Less than 400 °C</td> <td>±(0.2 °C + 1 digit)</td> </tr> <tr> <td>400 °C or more</td> <td>±(2 °C + 1 digit)</td> </tr> <tr> <td rowspan="2">Pt100, JPt100</td> <td>Less than 200 °C</td> <td>±(0.4 °C + 1 digit)</td> </tr> <tr> <td>200 °C or more</td> <td>±(0.2 % of Reading + 1 digit)</td> </tr> </tbody> </table>	Input type	Input range	Accuracy	K, J, T, E, PLII, U, L	Less than -100 °C	±(2.0 °C + 1 digit)	-100 °C or more, Less than +500 °C	±(1.0 °C + 1 digit)	R, S, N, W5Re/W26Re	-500 °C or more	±(0.2 % of Reading + 1 digit)	0 °C or more	±(2 °C + 1 digit)	B	Less than 1000 °C	±(0.2 % of Reading + 1 digit)	1000 °C or more	±(2 °C + 1 digit)	Pt100, JPt100	Less than 400 °C	±(0.2 °C + 1 digit)	400 °C or more	±(2 °C + 1 digit)	Pt100, JPt100	Less than 200 °C	±(0.4 °C + 1 digit)	200 °C or more	±(0.2 % of Reading + 1 digit)
Input type	Input range	Accuracy																											
K, J, T, E, PLII, U, L	Less than -100 °C	±(2.0 °C + 1 digit)																											
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	0 °C or more	±(2 °C + 1 digit)																											
B	Less than 1000 °C	±(0.2 % of Reading + 1 digit)																											
	1000 °C or more	±(2 °C + 1 digit)																											
Pt100, JPt100	Less than 400 °C	±(0.2 °C + 1 digit)																											
	400 °C or more	±(2 °C + 1 digit)																											
Pt100, JPt100	Less than 200 °C	±(0.4 °C + 1 digit)																											
	200 °C or more	±(0.2 % of Reading + 1 digit)																											
PV bias:	-1999 to +9999 °C [°F] or -199.9 to +999.9 °C [°F]																												
PV digital filter (First order lag digital filter):	0 to 100 seconds (0: Filter OFF)																												

- Sampling cycle: 0.25 seconds
- Influence of signal source resistance: Approx. 0.2 μV/Ω (TC input)
- Influence of input lead: Approx. 0.02 %/Ω of span (RTD input)
- Measured current: Approx. 800 μA (RTD input)
- Action at input break: Upscale (TC input and RTD input)
- Action at input short circuit: Downscale (RTD input)

- Current transformer (CT) input
 - Number of input: 2 points (maximum)
 - Input range: 0.0 to 30.0 A (CTL-6-P-N), 0.0 to 100.0 A (CTL-12-556-10-N)
 - Sampling cycle: 0.5 seconds

Output

- Relay contact output (1) [OUT1, 2 and 3 of RZ100; Control output, OUT3 of RZ400; Control output]:
 - Contact type: 1a contact
 - Contact rating (Resistive load): 250 V AC, 3 A, 30 V DC, 1 A
 - Electrical life: 100,000 times or more (Rated load)
 - Mechanical life: 20 million times or more (Switching: 300 times/min)
- Relay contact output (2) [OUT1 and 2 of RZ400; Control output]:
 - Contact type: 1a contact
 - Contact rating (Resistive load): 250 V AC, 3 A, 30 V DC, 1 A
 - Electrical life: 300,000 times or more (Rated load)
 - Mechanical life: 50 million times or more (Switching: 180 times/min)
- Relay contact output (3) [RZ100 and RZ400; Alarm output (including HBA output)]:
 - Contact type: 1a contact
 - Contact rating (Resistive load): 250 V AC, 1 A, 30 V DC, 0.5 A
 - Electrical life: 150,000 times or more (Rated load)
 - Mechanical life: 20 million times or more (Switching: 300 times/min)
- Voltage pulse output:
 - Output voltage: 0/12 V DC (Rated), ON voltage: 10 to 13 V
 - OFF voltage: 0.5 V or less
- Allowable load resistance: 500 Ω or more
- Current output:
 - Output current: 4 to 20 mA DC, 0 to 20 mA DC
 - Output range: 3.2 to 20.8 mA DC, 0 to 21 mA DC
 - Allowable load resistance: 500 Ω or less

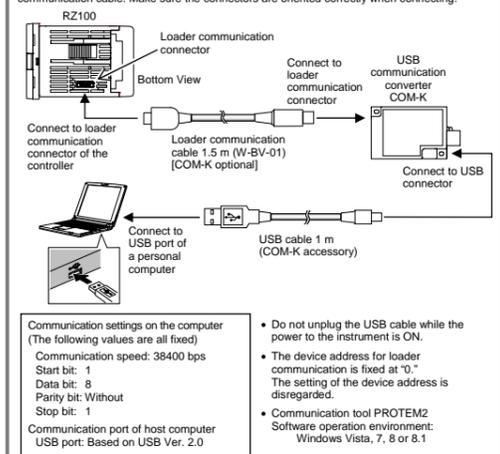
Communication

- Interface: Based on RS-485, EIA standard
- Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4) Modbus-RTU

General specifications

- Power supply voltage: 85 to 264 V AC [Including power supply voltage variation] (Rated: 100 to 240 V AC), 50/60 Hz
- Power consumption: RZ100: 5.1 VA max. (at 100 V AC), 7.6 VA max. (at 240 V AC), RZ400: 5.9 VA max. (at 100 V AC), 8.4 VA max. (at 240 V AC)
- Rush current: 5.6 A or less (at 100 V AC), 13.3 A or less (at 240 V AC)
- Memory backup: Backed up by non-volatile memory
- Number of writing: Approx. 1,000,000 times
- Data storage period: Approx. 10 years
- Weight: RZ100: Approx. 115 g, RZ400: Approx. 165 g

How to connect the controller to a PC via loader communication port



- The Loader port is only for parameter setup. Not used for data logging during operation.
- To use the loader communication, power on RZ100/400.
- Loader communication can be used on a RZ100/400 even when the Communication function (optional) is not installed.
- The loader communication corresponds to the RKC communication protocol "Based on ANSI X3.28-1976 subcategories 2.5 and A4."

6. OPERATION FLOW

