

RMC-500 Installation Manual

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IMR02G01-E2

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 only. For the operations, refer to separate RMC-500 Quick Operation Manual (IMR02G03-ED) and RMC-500 Parameter List (IMR02G02-ED).

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

Accessories check

RMC-500 Installation Manual (IMR02G01-E2)	1
RMC-500 Quick Operation Manual (IMR02G03-ED)	1
RMC-500 Parameter List (IMR02G02-ED)	1
Mounting brackets (with screw)	2
Ferrite core (For RMC-500 with Reference)	1
Ring core (For RMC-500 with Reference)	1
Optional (Sold separately):	
Front cover (KRB400-36)	1
Conversion cable (For B electrode: W-BK-250, For B+A electrodes: W-BK-251)	

Safety precautions



WARNING

- To prevent injury to persons, damage to 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 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 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 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 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.
- 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



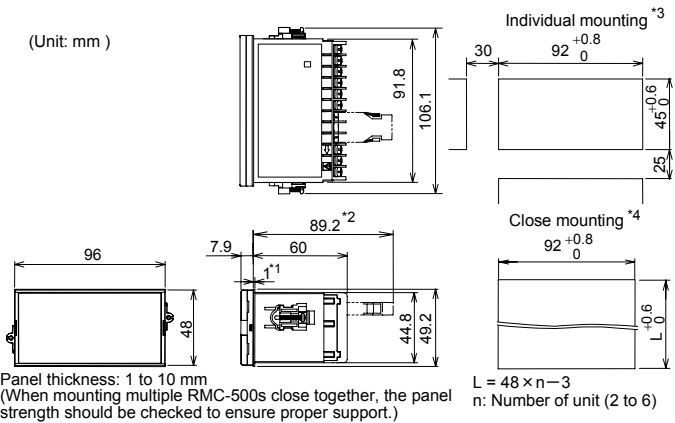
WARNING

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

1.1 Mounting Cautions

- This instrument is intended to be used under the following environmental conditions. (IEC61010-1) [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
 - 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)
- 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 25 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 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.
- 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

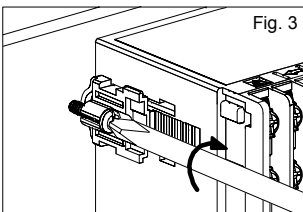
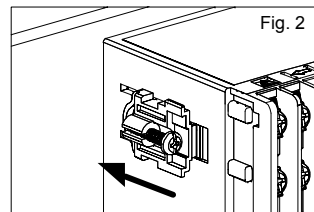
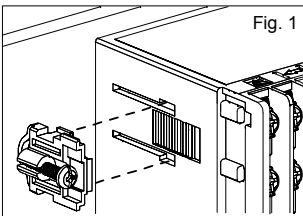


- *1 Case rubber packing
- *2 Space for connector
- *3 To keep the instrument as waterproof as possible, make sure that the panel surface has no burr or distortion where the hole is to be cut out.
- *4 Remove the case rubber packing. When the RMC-500 is mounted closely protection will be compromised and they will not meet IP66 (NEMA 4X) standards.

1.3 Procedures of Mounting and Removing

Mounting procedures

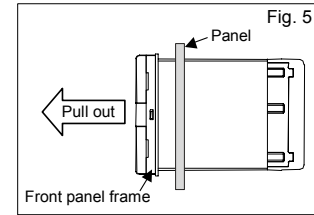
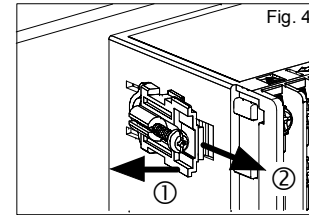
- Prepare the panel cutout as specified in 1.2 Dimensions.
- Insert the instrument through the panel cutout.
- Insert the mounting bracket into the mounting groove of the instrument. (Fig. 1)
- Push the mounting bracket forward until the bracket is firmly secured to the panel. (Fig. 2)
- Only turn one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



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.

Removal procedures

- Turn the power OFF.
- Remove the wiring.
- Loosen the screw of the mounting bracket.
- Lift the latch of the mounting bracket (1), and 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 horizontal position.
- The other mounting bracket 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. (Fig. 5)



2. WIRING



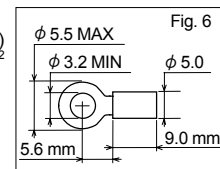
WARNING

- 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.
- If inappropriate Level sensor construction or material is selected, the instrument may malfunction and also a serious accident may happen as a result of physical or chemical reaction with the measured liquid or environment. Therefore, check whether or not appropriate Level sensor is selected prior to its connection.

2.1 Wiring Cautions

- 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 5 seconds are required as preparation time for 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 input, supply power from "SELV" circuit defined as IEC 60950-1.
- A suitable power supply should be considered in 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 x 7 (with 5.8 x 5.8 square washer)
 - Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm²
 - 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

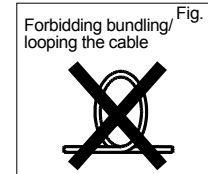


- Make sure that during field wiring parts of conductors can not come into contact with adjacent conductive parts.

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.

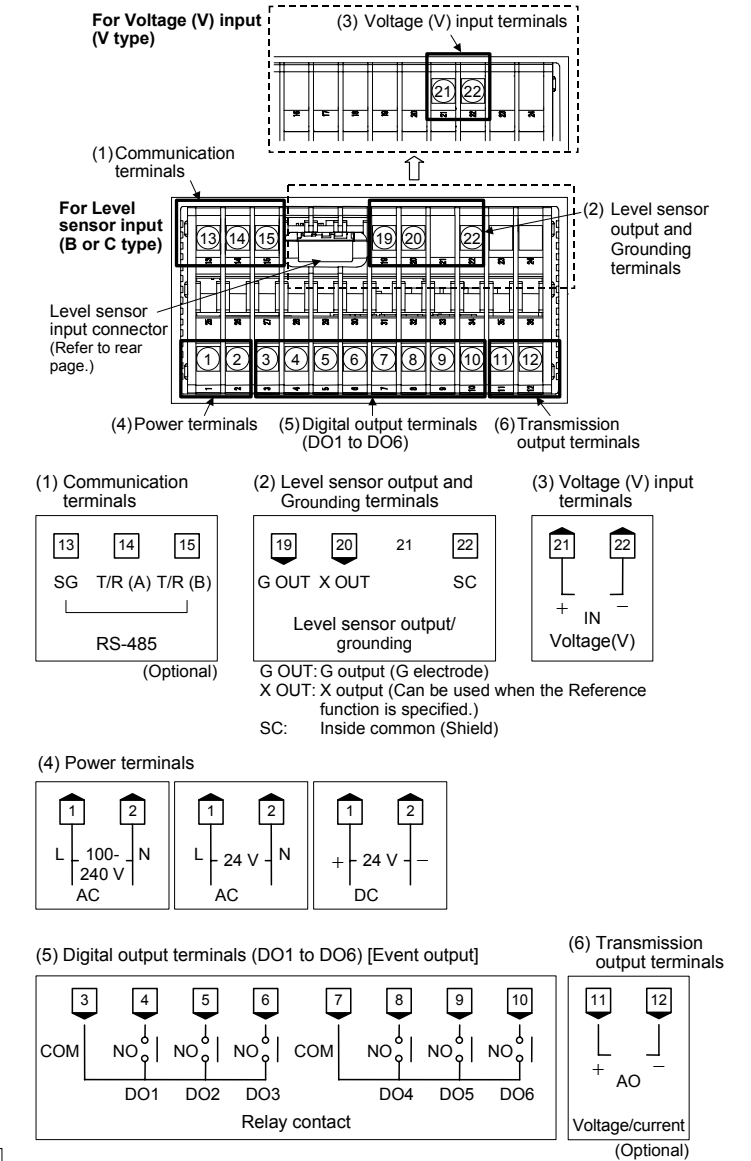
- Do not bundle or loop the input signal cable from the Level sensor. The transmission (measurement) signal may be interfered with an L (coil: inductance) component caused by this bundling or looping.



2.2 Level Sensor Connection Cautions

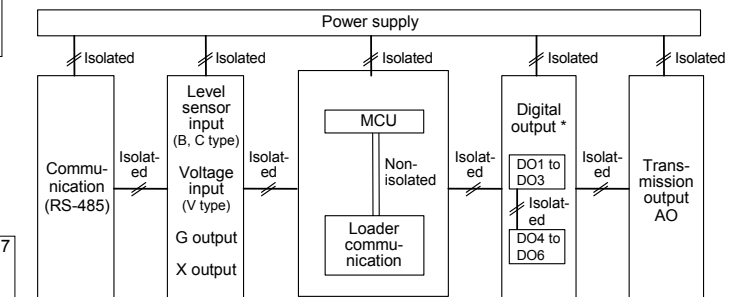
- If the Level sensor you have purchased is not intended for measurement use, do not use that Level sensor.
- There are three types of electrodes: "A," "B" and "G." "A" indicates a reference electrode, "B" indicates a measuring electrode, and "G" indicates a ground electrode. Combinations of "A+B," "B+G" and "A+B+G" are available depending on the types of Level sensor. Therefore carefully connect them.
- For grounding, select any one of "G output" and "X output" by referring to the instruction manual for the relevant connecting Level sensor. Do not ground the "G output" at the same time as the "X output." Grounding both outputs may damage the device.
- When connecting to the tank wall and ground, always directly connect G output (terminal No. 19).
 - Do not connect indirectly to the container wall, etc. through panel ground.
 - Do not directly connect G output (terminal No. 19) to the common ground terminal for various noise filters and lightning arrester.

2.3 Terminal Configuration



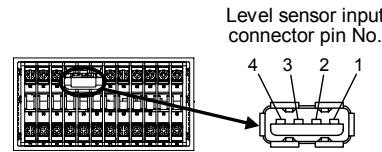
Screws are removed at the terminal of optional functions that were not specified when you placed the order.

Isolation: For isolated device input/output blocks, refer to the following



* Outputs of DO1/DO2/DO3 group and DO4/DO5/DO6 group are isolated. "DO1, DO2 and DO3" or "DO4, DO5 and DO6" use the same common terminal (No. 3 for DO1/DO2/DO3, and No. 7 for DO4/DO5/DO6) and are not isolated.

2.4 Connection to Level Sensor



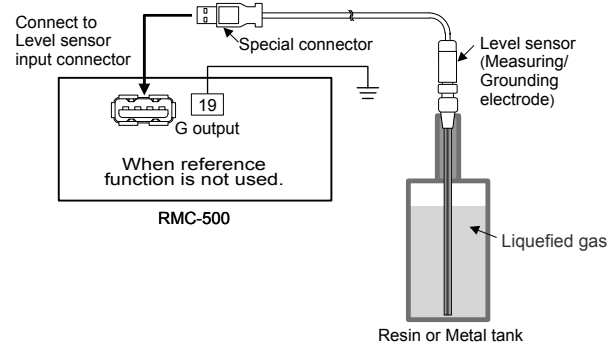
Level sensor input connector

Pin No.	Signal name	Symbol	Note
1	Grounding electrode (G output) [G electrode]	G	As pin No. 1 is internally connected to terminal No. 19.
2	Inside common (Shield)	SC	As pin No. 2 is internally connected to terminal No. 22.
3	Measuring electrode [B electrode]	B	—
4	Reference electrode [A electrode]	A	Optional

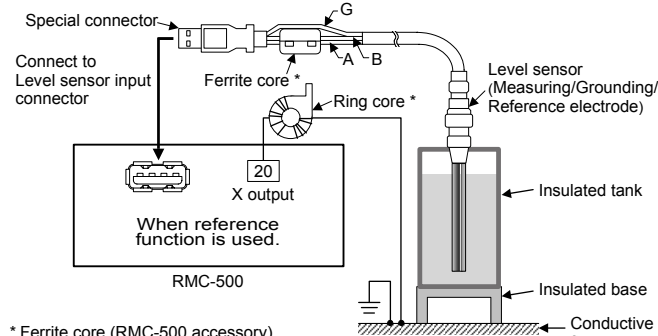
The Level sensor input connector resembles a USB connector; however, it is not a USB connector. Do not connect it to a USB device. This may cause failure.

Wiring example

Example 1: Using a CP1-E□W [2-electrode unit (Measuring/Grounding electrode), Special connector] Level sensor in a Metal tank or Resin tank



Example 2: Using a CP1-B1T [3-electrode unit (Measuring/Grounding/Reference electrode), Special connector] Level sensor in a Insulated tank

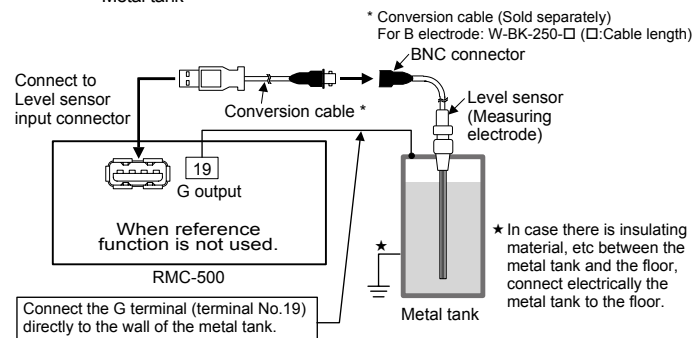


* Ferrite core (RMC-500 accessory)
Install a ferrite core on the reference cable (A) and the cable for the measurement (B).
Install the ferrite core near the special connector.

Ring core (RMC-500 accessory)
Install the ring core after winding the ground cable (unclad diameter: approximately ϕ 3 mm) 13 turns.

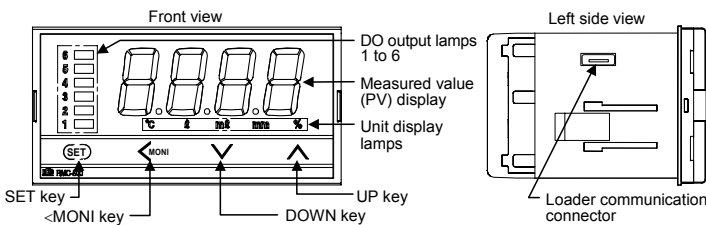
X output* (terminal No. 20) is connected to the conductive floor on which the tank is placed. If there is no conductive floor, the "X output" needs to be connected to a structural metal material which supports the floor and tank and also to a grounding cable near the tank. The connection of the "X output" is for adjusting the electric field near the tank. Therefore if the "X output" is connected only to a grounding cable, the effect of electric field adjustment may be less likely to cause the instrument to malfunction.

Example 3: Using a CP1-C□B [Measuring electrode, BNC connector] Level sensor in a Metal tank



For details of connecting the Level sensor, refer to the instruction manual for each Level sensor.

3. PARTS DESCRIPTION



Measured value (PV) display [Red]	Displays Level measured value (PV) or various parameters' symbols and set values.
Unit display lamps [Green]	The engineering unit used lights. °C, L, mL, mm, %
DO output lamps [Green] (Event output lamp)	Lights when digital output (DO) [Event output] is turned on. 1 to 6: DO1 to DO6
UP key	Use to increase a numerical value. Holding down the UP Key rapidly advances the value.
DOWN key	Use to decrease a numerical value. Holding down the DOWN Key rapidly advances the value.
-MONI key (Shift/Monitor key)	Use to change to Level 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	Use to connecting the communication converter and personal computer when loader communication is performed.

4. SPECIFICATIONS

Input

Measured Input (PV)

Input type and range:

Input type	Input range (Input span)
B type	0 to 200 pF
C type	0 to 2000 pF
V type	0 to 5 V DC (Only for converter with built-in barrier)

Level display range: 0 to 9999 (No decimal place) [The input decimal point position is selectable to decimal three places].
(Display span)
Scaling by Level display lower limit (Level display low) and Level display upper limit (Level display high) is possible. (Factory set value: 0 to 100)

Decimal point position: No decimal place, One decimal place, Two decimal places, Three decimal places

Number of input: 1 point
Sampling cycle: 0.1 seconds
Input impedance: Approx. 1 M Ω (V input)
Action at input beak: Indicates the value near 0
Input error determination point: Setting range of Input error determination point (high/low):
Level display low - (5 % of input span) to
Level display high + (5 % of input span)

Input correction

Setting range:

Input type	Input range (Input span)	Zero-point adjustment	Span-point adjustment	Empty adjustment
B type	0 to 200 pF	0 to 180 pF	3 to 200 pF	0 to 180 pF
C type	0 to 2000 pF	0 to 1800 pF	30 to 2000 pF	0 to 1800 pF
V type *	0 to 5 V DC	0 to 4.5 V DC	0.075 to 5 V DC	0 to 4.5 V DC

* Only for converter with built-in barrier

- Zero-point adjustment: Auto-zero or Manually set
- Span-point adjustment: Auto-span or Manually set
- First order lag digital filter: 0.0 to 100.0 seconds (0.0: OFF)
- Empty adjustment: If empty adjustment is performed with the measuring tank empty, the capacitance value of the empty tank will be acquired.

Reference input (REF) function [Optional]

Input range: 0 to 6 pF
Number of input: 1 point
Sampling cycle: 0.1 seconds

Output

Digital output (DO1 to DO6) [Event output]

Number of output: 6 points
Output type: Relay contact output
Contact type: 1a contact
Contact rating (Resistive load): 250 V AC 1 A, 30 V DC 0.5 A
Minimum application load: 5 V DC, 1 mA
Electrical life: 150,000 times or more (Rated load)
Mechanical life: 20 million times or more (Switching: 360 times/min, no-load)

Transmission output (AO) [Optional]

Number of outputs: 1 point, Outputs the Level measured value (PV)

Output type:

	Rating	Output range	Allowable load resistance	Out put impedance
Voltage output	0 to 5 V DC	-0.25 to +5.25 V DC	1 k Ω or more	0.1 Ω or less
	1 to 5 V DC	0.8 to 5.2 V DC		
Current output	0 to 10 V DC	-0.5 to +10.5 V DC	500 Ω or less	1 M Ω or more
	4 to 20 mA DC	3.2 to 20.8 mA DC		
	0 to 20 mA DC	0 to 21 mA DC		

Oscillation output for the measurement (G output)

Number of outputs: 1 point

Output type:

Input type	G output
B or C type	40 kHz sine-wave, 3 Vp-p
V type	There is no G output.

1/2 oscillation output (X output) [Optional]

Number of outputs: 1 point

Output type:

Input type	X output
B or C type (Reference function)	40 kHz sine-wave, 1.5 Vp-p
V type	There is no X output.

Functions

Adjustment function

- Actual liquid adjustment function (One-touch adjustment)
Zero or span adjustment: Liquid level 0 % and 100 % adjustment by front keys
PV bias: Shifts display value
Auto-span bias: When attempting Span adjustment (Auto-span) with the actual measured liquid level, the liquid level may be too low to reach the Level display high (SCH). This is the function to perform the Auto-span under such conditions.

Linearizing adjustment function

Number of linearizing points: Up to 5 points
Parameter settings: Set display values and measured values of polyline points
Number of valid linearizing points: 0 to 5 (0: OFF)
Number of valid points from linearizing point 1

Reference function [Optional]

This is a function to suppress the change in relative permittivity of the measured liquid level and the fluctuation in capacitance by electrical potential change and other external disturbances. When the reference function is not supplied, the fluctuation in the electrostatic capacitance will directly affect the measured data.

Event function

Number of events: Up to 6 points
Event type: Process high, Process low, FAIL (FAIL can set only Event 6)
When FAIL is selected, event set value and added function settings are invalid.
If the event function is not specified by initial code when the order is placed, the event type will be "Process high." The event type can be changed in "Event type" in engineering mode.
Level display low to Level display high
Hold action, Event action at input error, Interlock, Energized/de-energized (Fixed at de-energized when FAIL is selected)
Delay timer: 0.0 to 600.0 seconds
Differential gap: 0 to display span
Assignable to digital output (DO1 to DO6)

Output method:

Loader communication

Connection method: Connection with a loader communication cable for our USB converter COM-K (sold separately).

Synchronous method: Start/stop synchronous type

Communication speed: 38400 bps

Data bit configuration: Start bit: 1 Data bit: 8 Parity bit: Without Stop bit: 1 (Data bit configuration is fixed to the above value)

Maximum connections: 1 instrument (Only COM-K), Address is fixed at 0

Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)

Modbus-RTU

Host communication [Optional]

Interface: Based on RS-485, EIA standard

Communication speed: 4800 bps, 9600 bps, 19200 bps, 38400 bps

Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)

Modbus-RTU

Maximum connections: Up to 31 instruments

Termination resistor: Externally connected (Example: 120 Ω 1/2 W)

Interval time: 0 to 250 ms

Number of the communication digits: 7-digit or 6-digit

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 \pm 10 %, 60 Hz \pm 10 %
21.6 to 26.4 V AC [Including power supply voltage variation], 50/60 Hz (Rating 24 V AC)
Frequency variation: 50 Hz \pm 10 %, 60 Hz \pm 10 %
21.6 to 26.4 V DC [Including power supply voltage variation] (Rating 24 V DC)
Power consumption: 100 V AC: 7 VA or less 240 V AC: 11 VA or less
24 V AC: 8 VA or less 24 V DC: 220 mA or less
Rush current: 12 A or less

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
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: One million times
Depending on storage and operating conditions.
Data storage period: Approx. 10 years

Mounting and structure: Mounting method: Panel-mounted
Mounting orientation: Datum plane \pm 90 °
Case color: Black basic tone
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]
Panel sealing: NEMA 4X (NEMA250), IP66 (IEC60529) [Front panel]

Weight: Approx. 180 g

Standard (Pending)

Safety standards: UL: UL61010-1
cUL: CAN/CSA-C22.2 No.61010-1

CE marking *: LVD: EN61010-1

OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2,

Class II (Reinforced insulation)

EMC: EN61326-1

When using the reference function, RMC-500 complies with the requirement of CE marking by using a noise filter (ferrite and ring cores supplied with the instrument). If the reference function is not used, RMC-500 complies with CE marking without a noise filter.

5. MODEL CODE

Suffix code

RMC-500 □ □ * A □ □ - □ N □
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Input type
B: 0 to 200 pF
C: 0 to 2000 pF
V: 0 to 5 V DC
(Only for converter with built-in barrier)

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

(3) Digital output (DO1 to DO6)
A: 6 points (DO1 to DO6)
[Relay contact output]

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

(5) Communication function
N: None
5: RS-485

(6) Reference function
N: None
1: Reference function^a
^a Reference function can be specified, when Input type is "B" (0 to 200 pF) or "C" (0 to 2000 pF).

(7) Temperature correction function
N: None

(8) Quick start code
(Specify Event function/communication protocol)
N: No quick start code
(Configured at factory set value)^b
1: Specify quick start code
^b Factory set value:
DO1 to DO6 (Event 1 to 6):
Process high
Communication protocol:
RKC communication

Initial code

Initial code tells the factory to ship with each parameter preset to the values detailed as specified by the customer. Initial code is not necessarily specified when ordering, unless the preset is requested. These parameters are software selectable items and can be re-programmed in the field following procedures found in the manual.

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

(1) DO1 (Event 1), (2) DO2 (Event 2), (3) DO3 (Event 3), (4) DO4 (Event 4), (5) DO5 (Event 5), (6) DO6 (Event 6)
(7) Communication protocol
N: None
1: RKC communication
5: Modbus
H: Process high
J: Process low
K: Process high with hold action
L: Process low with hold action
3: FAIL (FAIL can set only Event 6)

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