CP-UM-5376E

RN748
Motor Driver:DC/Position Proportional Converter
User's Manual

Thank you for purchasing the RN748.
Before operating the product described in this user's manual, please take note of the following points regarding safety.
Be sure to keep this manual nearby for handy reference.

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

NOTICE

Ensure that this user's manual is supplied to the user before the product is used.
Copying or duplicating this manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.
Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find any inaccuracies or omissions, please contact Yamatake Corporation.
In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

This manual explains the handling precautions, mounting, wiring, list of parameters and main specifications only.

■ Unpacking

Check the following items when removing the RN748 from its package:

Name	Part No.	Q'ty	Remarks
Mounting Bracket	81409654-001	2	
User's Manual	CP-UM-5376E	1	This manual

SAFETY PRECAUTIONS

⚠ WARNING Warnings are indicated when mishandling this product might result in death or serious injury to the user.

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

⚠WARNING

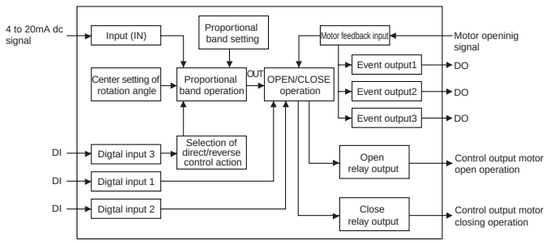
- Note that incorrect wiring of the RN748 can damage it and lead to other hazards. Check that the RN748 has been correctly wired before turning the power ON.
- Before wiring or removing/mounting the RN748, be sure to turn the power OFF. Failure to do so might cause electric shock or faulty operatoin.
- Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.
- Do not disassemble the RN748. Doing so might cause electric shock or faulty operation.

⚠CAUTION

- Do not operate the keys with a mechanical pencil or sharp-tipped object. Doing so might cause faulty operation.
- Use the RN748 within the operating ranges recommended in the specifications (for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Failure to do so might cause fire or faulty operation.
- Do not block ventilation holes. Doing so might cause fire or faulty operation.
- Wire the RN748 properly according to predetermined standards. Also wire the RN748 using specified power leads according to recognized installation methods. Failure to do so might cause electric shock, fire or faulty operation.
- Do not allow lead clippings, chips or water to enter the controller case. Doing so might cause fire or faulty operation.
- Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.
- Do not use unused terminals on the RN748 as relay terminals. Doing so might cause electric shock, fire or faulty operation.
- We recommend attaching the terminal cover (sold separately) after wiring the RN748. Failure to do so might cause electric shock.
- Use the relays within the recommended service life. Failure to do so might cause fire or faulty operation.
- Use Yamatake Corporation's "SurgeNon" if there is a risk of power surges caused by lightning. Failure to do so might cause fire or faulty operation.

Outline of functions

The RN748 calculates the MV (OUT) for the input (IN) according to the selection of direct/reverse control action, center setting of the rotation angle, and the setting of the proportional band;
it also controls the ON/OFF status of the control output on the OPEN side and the CLOSE side so that the motor opening (MFB) calculated from the motor feedback input gets closer to the MV (OUT).
The figure below shows the functional blocks of the RN748.



Mounting

■ Location

Install the controller in a location that fulfills the conditions listed below.

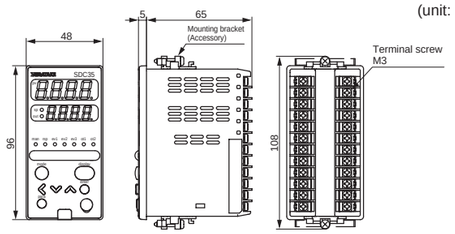
- For common mode voltages of I/O except for power supply and relay contact output, the voltage to ground is 33Vr.m.s max., 46.7V peak max., and 70Vdc max.
- Neithes highr or low temperature / humidity.
- Free from sulfide gas or corrosive gas.
- Little dust or soot.
- Locations protected from direct sunlight, wind or rain.
- Little mechanical vibration and shock.
- Not close to high voltage line, welding machine or electrical noise generating source.
- A minimum of 15 meters away from a high voltage ignition device for a boiler.
- No strong magnetic fields.
- No flammable liquid or gas.

■ Mounting Procedure

- Mounting should be horizontal so that the top is not tilted up or down more than 10 degrees.
- The mounting panel should be steel with a thickness of less than 9 mm.

■ External Dimensions

(unit: mm)

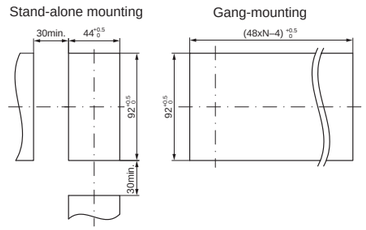


! Handling Precautions

- To fasten this controller onto the panel, tighten a mounting bracket screws, and turn one more half turn when there is no play between the bracket and panel. Excessively tightening the screws may deform the controller case.

■ Panel Cutout Dimensions

(unit: mm)



! Handling Precautions

- When three or more units are gang-mounted horizontally, the maximum allowable ambient temperature is 40°C.

Wiring

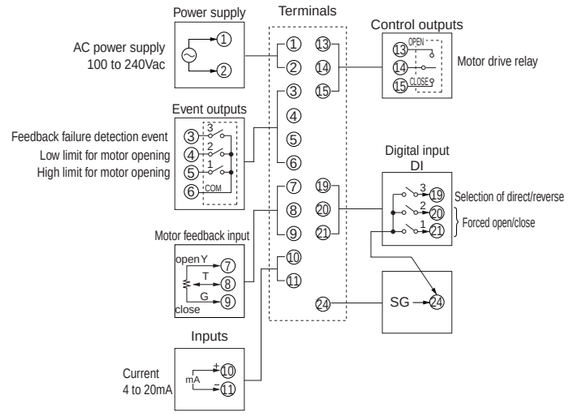
Be sure to provide a switch within operator reach for shutting OFF the main power supply to the controller in the main supply wiring.
Also, in case of AC power supply models, the main supply wiring requires a time-lagged (T) fuse (rated at 0.5A, 250 V). (IEC127)
The following table shows the meaning of the symbols in the terminal wiring label on the side of the controlle:

Symbols	Meaning
~	AC power supply
⚠	Caution, danger of electric shock
⚠	Caution

! Handling Precautions

- Before wiring the RN748, verify its model No. and terminal Nos. written on the label on the side of the body. Inspect all wiring once wiring work for the RN748 has been completed.
- Use M3 crimp-type terminal lugs for wiring to the terminals.
- Provide a distance of at least 50cm between I/O lead wires or communications lead wires and power lead wires. Also, do not pass these lead wires through the same piping or wiring duct.
- When the power supply voltage of the motor that is connected to the motor drive relay output is 100/200Vac, use an auxiliary relay externally.
- Do not wire in the same duct for the motor drive terminals (13),(14),(15) and the MFB input terminals (7),(8), (9), and also do not use 6-core cable. Failure to follow these instructions might cause controller malfunction due to noise during motor startup operation.
- Devices or equipment connected to this controller must have basic insulation appropriate for the power supply voltage and the maximum operating voltage of the I/O units.
- The controller requires a maximum of 6 seconds to start up once the power is turned ON.
  The controller can be used once it has started up. However, it is recommended to allow a warm-up time of at least 30 minutes so that it attains the specified accuracy.

● Connection of the RN748

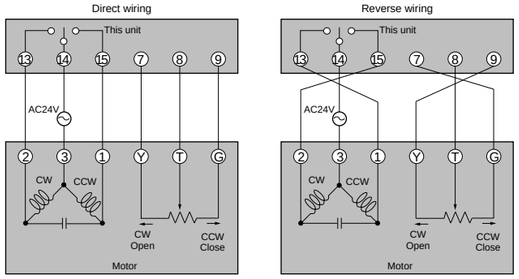


● Direct wiring and reverse wiring

For wiring between the motor and controller, two wiring methods, direct wiring and reverse wiring, are provided as described below.
With direct wiring the motor rotates clockwise (CW, ↷) as the output of the controller increases.
If the control task requires the motor to rotate counterclockwise, as for cooling control, two methods are provided as described below.

- •The wiring is not changed and the control action direction is changed on the controller side.
- •The wiring is changed to reverse wiring.

The control action (direct/reverse) can be changed on this unit.
If direct wiring is used for the wiring to the motor, the control action is simple to understand and trouble can be solved easily.
Therefore, direct wiring is secommended where possible.



CW: clockwise, ↷
CCW: counterclockwise, ↶

! Handling Precautions

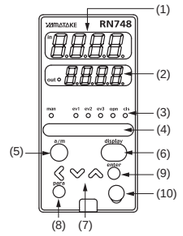
- Terminal numbers of the motor are sample numbers from the ECM3000. If you use a motor other than the ECM3000, make connections following the manual for the motor.

● I/O isolation

Items surrounded by solid lines are insulated from other signals.

Power supply	Internal Circuit	Motor drive relay output
Current input Motor feedback input		
Digital input 1 Digital input 2 Digital input 3		Event output 1 Event output 2 Event output 3

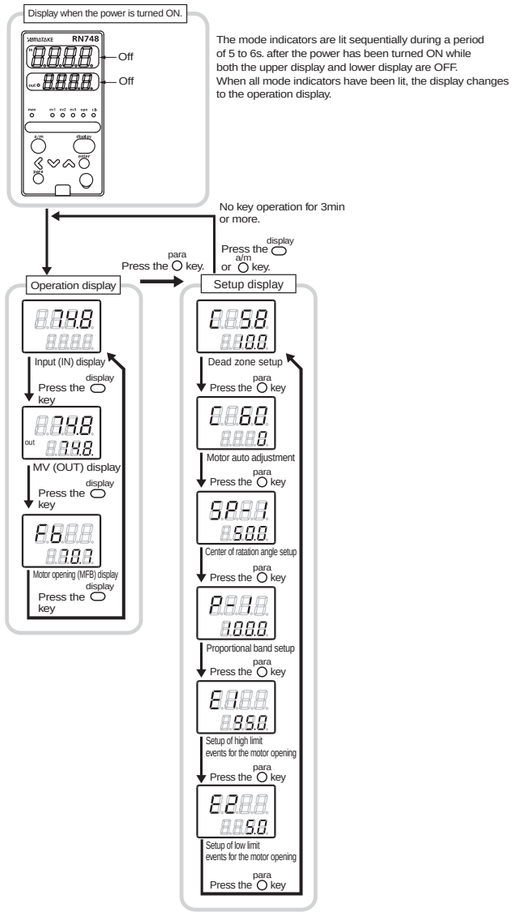
Part names and functions



(1) Upper display: Displays input values (IN) or settings.
(2) Lower display: Displays manipulated variable (OUT), motor opening (MFB) and other parameter values. When the display shows the manipulated variable (OUT), the "out" lamp lights up.
(3) Mode indicator: man: Lights when in manual mode.
ev1 to ev3: Lights when event relays are ON.
opn•cls: Lights when the control output is ON.
(4) Multi-status indicator: Through the combination of lighting conditions and lighting status , 3 priority groups can be displayed.
(5) [a/m] key: Switches between AUTO and MANUAL mode when pushed for 1s or more.
(6) [display] key: Used to change the display contents in the operation display mode. Returns display from bank setup display to operation display.
(7) <, ∨, ∧, key: Used for incrementing numeric values and performing arithmetic shift operations.
(8) [para] key: Switches the display.
(9) [enter] key: Used to set the setup values at the start of change and during the change.
(10) Loader connector: Not available.

Key operation

The following shows the key operation flow:



Handling Precautions

- When the [para] key is held down for 2 seconds or longer, "LoC" will appear. This means you are at the lock setup menu. Since there is no item to set up, press the [display] or [a/m] key to return to the operation display.

● **Setting example for position proportional control dead zone**

Display "C58" on the upper display in the setup display mode.
When the [enter]key is pressed, the numerical value on the lower display will start to flash.
Move the digit and increase/decrese the numeric value by pressing the [<][∨][∧] keys.
When the [enter] key is pressed at the desired numeric value, the flashing will stop and the data will be set.

● **Setting example for motor auto adjustment**

Display "C60" on the upper display in the setup display mode.
When the [enter]key is pressed, the numerical value on the lower display will start to flash.
Move the digit and increase/decrese the numeric value by pressing the [<][∨][∧] keys.
Set the value to "1" and press the [enter] key, and auto adjust will start.
The following items must be set up only when they are changed from their defaults: center setting of the rotation angle, proportional band setting, motor opening high/low limit event setting.

Operation preparation

■ **Selection of direct/reverse control action**

You can select reverse or direct action of the RN748 by turning dital input 3 ON or OFF (DI3: between terminals 19 and 24) .

Digital input 3 (DI3)	Control action
OFF	Direct action
ON	Reverse action

For the difference between direct and reverse action, see the figure in "Setting example for the center of rotation and proportional band" (on next page).
Furthermore, you can switch between direct and reverse action while running the RN748.

■ **Adjustment and setting**

Connect the RN748, controller, motor and other related devices correctly. Then turn the power on and make adjustments and settings in the following sequence:
(1) Do motor auto adjustment → (2) set the center of rotation angle → (3) set the proportional band → (4) set the dead zone → (5) set the high/low limit events for the motor opening.
The sections below show the details of each procedure.

■ **Motor auto adjustment**

Item	Indication	Contents	Initial value
Motor auto adjustment	C 60	0 : Stop 1 : Start	0

Handling Precautions

- Be sure to execute auto adjustment. If the device is used without doing auto adjustment, the motor may not operate properly.

• Motor auto adjustment procedures
1. Set [C60: Motor auto adjustment] to 1 and press the [enter] key. If the C60 is already set to 1, press the [enter] key twice to perform this entry.
2. Motor auto adjustment then begins.
• The upper display shows CRCL and the relay on the CLOSE side is turned ON.
• The motor rotates in the close direction, and the MFB count value is written into [Fully closed adjustment value].
• The upper display shows CRoP , and the relay on the OPEN side is turned ON.
• The motor rotates in the open direction, and the MFB count value is shown on the lower display. When the counting stops, the fully open adjustment is completed. This count value is then written into [Fully open adjustment value]. Additionally, the period of time that has elapsed from the fully closed position to the fully open position is written into [Full opening time]. However, if this time is 240.0s or longer, this parameter is set to 240.0.
• When the motor auto adjustment has been completed, the basic display screen will appear.
3. To cancel the adjustment, press the [display] key.
When motor auto adjustment starts, keys other than the [display] key, which is used to cancel the adjustment, cannot be operated. If any of the items below occurs, each value is returned to its default setting before shipment and AL10 is shown as the troubleshooting process. AL10 is cleared only when motor auto adjustment has been completed correctly or when the power is reset.
• The count value between the fully closed position and fully open position is less than 260.
• The fully closed count is greater than the fully open count.
• The period of time from the fully closed position to the fully open position is less than 5s.
• The MFB burnout alarm (AL07) continues or occurs frequently.
• The time needed for the MFB count to stop exceeds 5min.
• The MFB or open/close relay has faulty wiring.
(However, not all faulty wiring can be detected as an error.)

Handling Precautions

- If the power to the measuring instrument is turned OFF during motor auto adjustment of the position proportional control, motor auto adjustment is cancelled when the power is turned ON again.
- Even if an AUTO/MANUAL mode changeover is made during motor auto adjustment of the position proportional control, the auto adjustment continues.
- If the control output (on the OPEN or CLOSE side) is forcibly turned ON or OFF by the digital input 1 or 2 during auto adjustment of the position proportional control, the auto adjustment may continue. Even if it does not stop, the result of adjustment is incorrect. It is necessary to repeat the adjustment without forced ON/OFF.
- It is not possible to display the values saved for fully closed adjustment value, fully open adjustment value, and full opening time.

■ **Motor auto adjustment operation**

This unit has functions (AL07, AL10) that detect incorrect wiring to the motor and MFB burnout or short-circuit. In the same manner as described for direct wiring, the unit judges the reverse wiring as correct and does not give any alarm. In addition, even if MFB burnout occurs, the operation continues.
The tables below summarize characteristics of each wiring method when motor auto adjustment is made (when [C60: Motor auto adjustment] is set to [1: Start]). At this time, note that the motor is started from the fully closed position (rotated fully counterclockwise). Numeric values shown in the Lower display column of the tables are examples.

● **Correct direct wiring**

Upper display	Lit LED	Lower display	Motor motion	Remarks
CRCL ↓ CRoP	cls opn	Shows a decrease like 2000 → 1500 and becomes stable. Shows an increase like 1500→3500 and becomes stable.	CCW CW	When the motor moves CCW with "cls" lit, motor terminals 1 and 2 have direct wiring.

● **Correct reverse wiring**

Upper display	Lit LED	Lower display	Motor motion	Remarks
CRCL ↓ CRoP	cls opn	Shows a decrease like 3500 → 1500 and becomes stable. Shows an increae like 1500 → 3500 and becomes stable.	CW CCW	When the motor moves CW with 1 and 2 and G and Y connected reversely, with "cls" lit, motor terminals 1 and 2 have reverse wiring.

● **Alarm indications and causes due to incorrect wiring**

Upper display	Lit LED	Lower display	Motor motion	Alarm indication	Cause
CRCL ↓ CRoP	cls opn	Increases and then stops. Decreases and then stops.	CCW CW	AL10	G and Y are connected reversely.
CRCL ↓ CRoP	cls opn	Increases and then stops. Decreases and then stops.	CCW CW	None. However, the MFB value does not match the motor opening.	T and G are connected reversely.
CRCL ↓ CRoP	cls opn	Decrease or increase in unclear. (Motor motion is changed before fully closed or opened.	CCW CW	AL10 or none.	T and Y are connected reversely.
CRCL ↓ CRoP	cls opn	Increases and then stops. Decreases and then stops.	CW CCW	AL10	1 and 2 are connected reversely.
CRCL ↓ CRoP	cls opn	Increases and then stops. Decreases and then stops.	CW CCW	AL10	1 and 2 connected reversely; T and G are connected reversely.
CRCL ↓ CRoP	cls opn	Decrease or increase is unclear. (Motor motion is changed before fully closed or opened.)	CW CCW	AL10 or none.	1 and 2 connected reversely; T and G connected reversely.

■ **Setting the center of rotation angle**

When the center of the rotation angle is identical to the input (IN), the MV (OUT) is 50%.
For details refer to:
Setting example "for the center of ratation and proportional band"

Item	Indication	Contents	Initial value
Center of rotation angle	SP-1	0.0 to 100.0%	50.0%

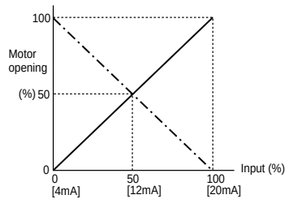
■ **Setting the proportional band**

When the input (IN) has changed by the amount of the proportional band setting, the MV (OUT) changes in a range between 0 and 100%.
For details refer to:
Setting example "for the center of ratation and proportional band" below.

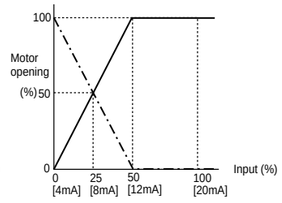
Item	Indication	Contents	Initial value
Center of rotation angle	P-1	0.1 to 999.9%	100.0%

■ **Setting example for the center of rotation and proportional band**

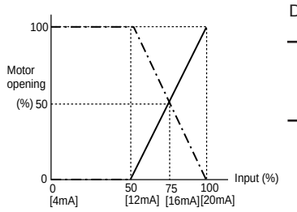
1. Center of rotation angle: 50% (12mA)
Proportional band: 100% (16mA)



2. Center of rotation angle: 25% (8mA)
Proportional band: 50% (8mA)



3. Center of rotation angle: 75% (16mA)
Proportional band: 50% (8mA)

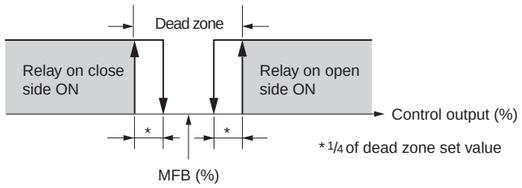


Definition:
——— Direct action (Motor opening direction on input increase)
—·—·— Reverse action (Motor closing direction on input increase)

■ **Setting the dead zone**

Item	Indication	Contents	Initial value
Dead zone	C 50	0.5 to 25.0%	10.0%

This is for setting the dead zone between motor opening and motor closing in position proportional control.
For setting reference, the dead zone changes when the manual output is at a constant rate. The value that is obtained when the hunting of the motor stops, is the minimum value of the dead zone. If exactly the minimum value is set, the motor is always moving, causing the service life of the motor to be extremely shortened. The default setting before shipment is 10.0%. With this default value as a reference, the value can be set correctly by taking the control results and service life of the motor into consideration.

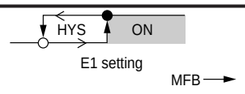
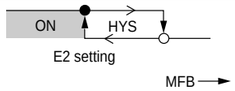


■ **Setting the high/low limit for motor opening**

Event output 1 goes ON when the motor opening is above the value set for the motor opening high limit event (E1).
Event output 2 goes ON when the motor opening is below the value set for the motor opening high limit event (E2).
This setting is not essential for position proportional control.

Item	Indication	Contents	Initial value
High limit for motor opening	E1	-199.9% to +999.9%	95.0%
Low limit for motor opening	E2	-199.9% to +999.9%	5.0%

The figure below shows the details of the event output action.
The hysteresis (HYS) for ON/OFF is fixed at 0.5% and the change from OFF to ON includes a delay of 5s.

Operation type	Direct action ● Shows that the ON/OFF is changed at this value. ❍ Shows that the ON/OFF is changed at a point that "1U" is added to this value.
High limit for motor opening	
Low limit for motor opening	

Operation

■ **Operation displays**

When the [Display] key is pressed, the item that is displayed changes.

Item	Upper display	Lower display	Out lamp
Input	• Input value (IN) • -10.0 to +110.0% • Setting is disabled	• OFF	OFF
MV (manipulated variable)	• Input value(IN) • -10.0 to +110.0% • Setting is disabled	• MV (OUT) • -10.0 to +110.0% • Setting is disabled in AUTO mode. (Numeric value does not flash.) • Setting is enabled in MANUAL mode. (Numeric value flashes)	Lit
Motor opening	• Fb	• Motor opening (MFB) • -10.0 to +110.0% • Setting is disabled. • For estimation, flashing value from 0.0 to 100%	OFF

! Handling Precautions
- MV(OUT) contains an error of ±0.1% or less caused by factors like the center of rotation angle and the calculation of the proportional band.

■ **AUTO/MANUAL mode selection**

Press the [a/m] key, and "d1.on" or "d1.oF" will start flashing on the lower display. If the [a/m] key is held down for 1s or longer, the display stays lit up, the mode switches between AUTO and MANUAL, and the Man lamp goes on or off.
When the mode switches from AUTO to MANUAL, the MV from AUTO mode is retained in manual mode.
In MANUAL mode, you can change the MV (OUT) using the [<], [∨] and [∧] keys.
The table below shows the difference between the two modes.

	AUTO mode	MANUAL mode
MV (OUT)	Changes with the input (IN)	Can be changed manually on the MV (OUT) display
Man lamp	OFF	Lit
Display just after switching	Input (IN) display	MV (OUT) display

! Handling Precautions
- When power is turned on, the AUTO/MANUAL mode that was active before power off is retained. However, if the mode before power off was MANUAL mode, the MV(OUT) is 0.0% regardless of its value before power off.

■ **Multi-Status display**

There are three types of display status depending on the condition.

	Lighting condition	Lighting status
Priority 1	Forced operation of control output (on the OPEN side or CLOSE side) by digital input 1/2 (DI1/2)	The whole display blinks.
Priority 2	Conditions other than the above, but an alarm occurs	The lighted portion moves alternately right and left.
Priority 3	Conditions other than the above	MV (OUT) is displayed in a bar graph in which one LED lights up for every 10%.

■ **Forced opening/closing**

You can change the status of the control output (on the OPEN side or CLOSE side) according to the status of digital input 1 (DI1: between terminals 21 and 24) and digital input 2 (DI2: between terminals 20 and 24).

Digital input 1 (DI1)	Digital input 2 (DI2)	Control output (on the OPEN side/CLOSE side) status
OFF	OFF	Normal operation
ON	OFF	Forced open action (Forced ON on the OPEN side; forced OFF on the CLOSE side)
OFF	ON	Forced close action (Forced OFF on the OPEN side; forced ON on the CLOSE side)
ON	ON	Halt (Forced OFF on the OPEN side; forced OFF on the CLOSE side)

! Handling Precautions
- The table below shows the priority of control output (on the OPEN side/CLOSE side).

Priority	Control output (on the OPEN or CLOSE side) status
Priority 1 (top priority)	Forced ON/OFF operation by digital input 1/2
Priority 2	Auto adjustment
Priority 3	MANUAL mode
Priority 4	Normal position proportional control

■ **Estimated position proportional control**

When any motor feedback input failure is detected due to a break in the Y/T/G lines for motor feedback input or deterioration of motor potentiometer, estimated position proportional control operates. If the motor feedback input failure is cleared, the normal position proportional control resumes.
Event output 3 is ON during estimated position proportional control; it is OFF in other cases.

Note

If estimated position proportional control is activated with a high frequency, the probable causes are:
- Auto adjustment was not implemented or failed.
- Deterioration or insufficient resolution of the motor potentiometer.
- Connection failure of the motor feedback input.

Alarm code table

Alarm code	Failure name	Cause	Corrective action
AL01	PV input failure (over range)	Sensor line break, incorrect wiring	Check wiring
AL02	PV input failure (under range)	Sensor line break, incorrect wiring	
AL07	MFB input failure	Motor line break, incorrect wiring	Check wiring or confirm the MFB input.
AL10	Motor adjustment failure	Motor line break, incorrect wiring, motor power supply failure.	Check wiring, confirm the motor power supply, readint.
AL20	A/D conversion failure	Defective A/D converter	Replace unit.
AL95	Parameter failure	•Power turned OFF while fixing data •Data corrupted due to noise, etc.	•Re-start the system. •Reset data or replace unit. (AL95/97: setting data, AL96/98: adjustment data) •Replace unit
AL96	Adjustment data failure	•Power turned OFF while fixing data •Data corrupted due to noise, etc.	
AL97	Parameter failure (RAM area)	Data corrupted due to noise, etc.	
AL98	Adjustment data failure (RAM area)	Data corrupted due to noise, etc.	
AL99	ROM failure	ROM (memory) error	•Re-start the system. •Replace unit.

Maintenance

Cleaning : When wiping off the RN748, use a soft and dry cloth.
Parts replacement : Do not replace the parts.
Fuse replacement : When replacing the fuse, make sure that the replacement fuse complies with all applicable safety standards:
IEC127, delayed cutoff speed type (T), rated voltage 250V, rated current 0.5A.

Model selection table

Basic model No.	Additions	Specifications
RN748A00		Size 48 x 96 mm 100 to 240 Vac Motor drive relay output, MFB is added Event relay output, 3 points Digital input, 3 points
	00	No additional treatment
	D0	Inspection certificate provided
	Y0	Complyies with traceability certification

Specifications

- PV Inputs
  - DC current: 4 to 20mA
  - Sampling cycle: 100ms
  - Indication accuracy: ±0.1%FS±1digit (at ambient temperature 23±2°C)
  - Input impedance: Max. 100Ω
  - Burnout indication: Down scale + AL02
- Digital input
  - Input type: Dry contact or open collector
  - Allowable ON contact resistance: Max.250Ω
  - Allowable OFF contact resistance: Min.100kΩ
  - Allowable ON residual voltage: Max.1.0V
  - Terminal current (ON): Approx.7.5mA (in case of short circuit). Approx.5.0mA (in case of contact resistance 250Ω)
  - Minimum hold time: 200ms or more
- Motor feedback potentiometer input
  - Allowable resistance: 100 to 2500Ω
  - Detection of line break: Displays AL07.
- Motor drive relay output
  - Contact rating: 250Vac 8A (resistive load)
  - Life: Min. 120,000 operations
  - Min. switching specifications: 24V dc, 40mA
- Event relay outputs (ev1 to 3)
  - Contact rating: 250Vac/30Vdc 2A (resistive load)
  - Life: Min. 100,000 operations
  - Min. switching specifications: 5V, 10mA (reference value)
- Environmental conditions
  - Operating conditions
    - Ambient temperature: 0 to 50°C (gang-mounted: 0 to 40°C)
    - Ambient humidity: 10 to 90%RH (non-condensing)
    - Rated power supply voltage: 100 to 240Vac, 50/60Hz
    - Power supply voltage range: 85 to 264Vac, 50/60±2Hz
  - Transport conditions
    - Ambient temperature: –20 to +70°C
    - Ambient humidity: 10 to 95%RH (non-condensing)
- Other specifications
  - Power consumption: Max. 12VA
  - Insulation resistance: 20MΩ min. by 500Vdc megger between power terminal and secondary terminal
  - Dielectric strength: 1500Vac for one minute between power terminal and secondary terminal
  - Inrush current at application of power: Max. 20A
  - Non-detected power failure time: Max. 20ms
  - Altitude: Max. 2,000m
  - Weight: Approx. 250g (with the dedicated mounting bracket)
  - Terminal screw tightening torque: 0.4 to 0.6N•m
  - Applicable standards: EN61010-1, EN61326-1
  - Overvoltage category: Category II (IEC60364-4-443, IEC60664-1)
  - Allowable pollution degree: Pollution degree 2

Accessories and optional parts

Name	Model No.
Mounting bracket	81409654-001(Accessory)
Hard cover	81446915-001
Terminal cover	81446912-001

YAMATAKE *Specifications are subject to change without notice.*
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URL: http://www.yamatake.com
Printed on recycled paper. (04)

Printed in Japan.
1st Edition: Issued in Apr. 2005 (E)