# RCX141/RCX142

RCX141 and RCX142 are highly functional multi-axes controllers that can control up to 4 axes. RCX141 can control linear single axis robots as well as single axis cartesian robots of PHASER series and X series at the same time. RCX142 is a complete absolute model which requires no origin return function. Its absolute function retention time is doubled as compared with the conventional RCX40 model, assuring higher reliability and improved ease of use.

Features

1 Possibility control single axis and Cartesian robots of PHASER series / X series at the same time (RCX141)

Capable of controlling the PHASER series and X series robots at the same time. Usable in such way that has not been possible as to arrange the high speed PHASER series for the XY axis and the ball screw drive type X series with high thrust power for the Z axis.
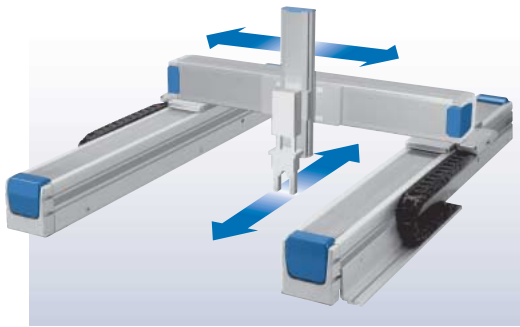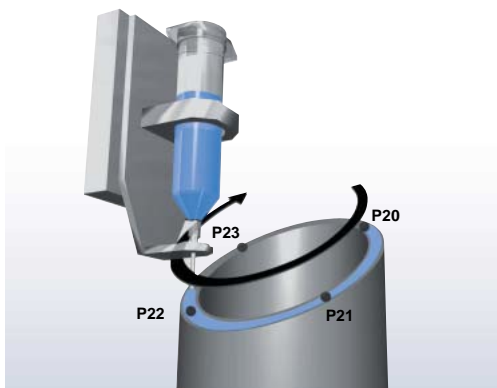
RCX142

RCX141

2 Completely absolute (RCX142)

Complete absolute specification requiring no origin return when the power is turned ON. Owing to improvement of circuit specification, the number of required batteries is half of that for the conventional model. The data retention time is 680 hours (twice longer than our conventional model). A resolver is used for the motor position detector to provide high reliability and environment resistance.

3 3D circular interpolation control

2D and 3D linear and circular interpolation ARC control are possible, making the RCX141 controller ideal for sealing work, etc.
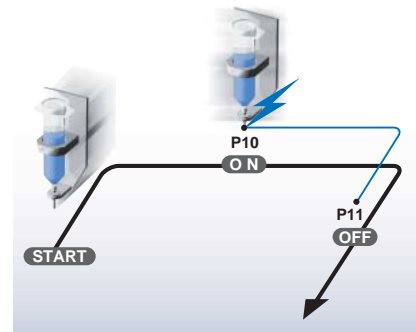
P20

P23

P22   P21

4 Passing point output control

When using interpolation function, general purpose output ON/OFF operation at the specified point can be controlled without stopping the axis operation.
As the discharge function can be turned ON/OFF with the axis operating during sealing, smooth and stable application is available.
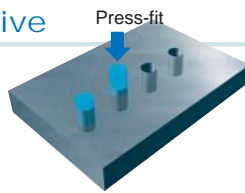
P10
ON
P11
OFF
START

5 Area check output function

This function provides an output signal when the robot enters a preset area. Up to four areas can be specified.

P1
OFF
OFF
ON
P2
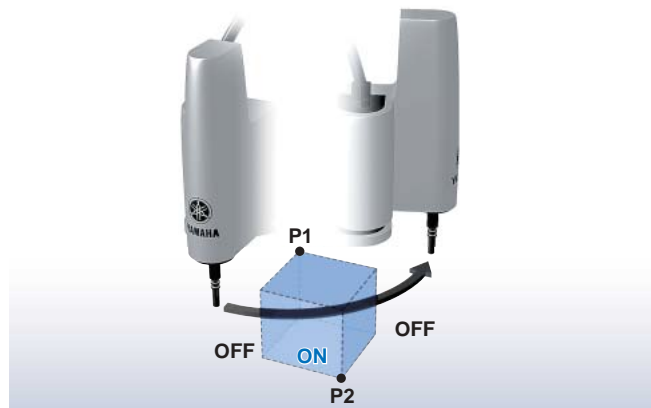
6 Torque limiting drive

Press-fit

The motor torque can be limited with the command option of DRIVE statement during grasping and press-fitting operations.

7 Dual-synchronous drive

Equipped with the dual drive function to control 2 axis in synchronization, which is of effective use for carrying heavy items and long stroke operation with the Cartesian robot. This function enables good use of high speed, acceleration/deceleration features of the YAMAHA robots.

(Note : For the dual drive function, custom order arrangement is required. For more information, contact YAMAHA MOTOR Co.,Ltd.)
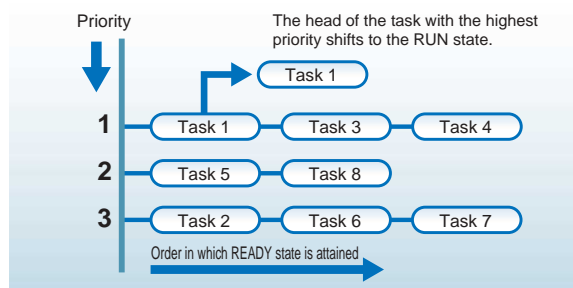
● Dual-synchronous drive example
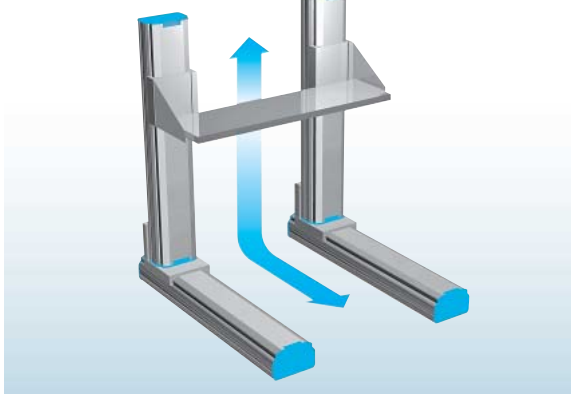
8 Multitask function

This function executes multiple tasks (up to eight tasks)
Multiple tasks will switch with the timesharing method. However, a priority can be assigned to each task. This priority can also be changed while tasks are running. The multitask function simplifies the entire system's control configuration and also improves the operation efficiency.

● Task scheduling

Priority

The head of the task with the highest priority shifts to the RUN state.

Task 1

1 Task 1 — Task 3 — Task 4

2 Task 5 — Task 8

3 Task 2 — Task 6 — Task 7

Order in which READY state is attained

9 Sequence program

In addition to the standard tasks, a task to control input/output (parallel, serial, memory, timer) can be executed independently. As the sequence program is effective in the manual mode as well, it is usable to construct the safety system linked with the peripheral equipment.

10 2-robot control, auxiliary axis control

By assigning the main and sub operations, double robot control can be handled.
With a multi-task unit used together, RCX141 / 142 controller enables advanced, smooth linkage of 2 robots.
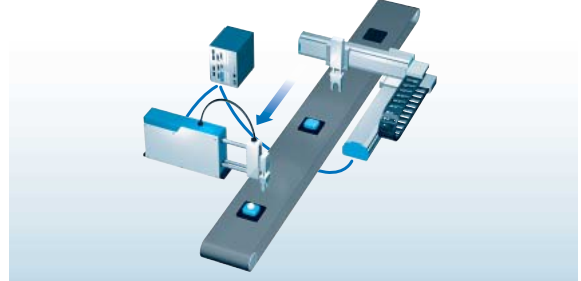
11 Various options and extensive usage

RCX141 / 142 accommodates installation of up to 4 option boards. The parallel I/O boards (NPN, PNP) and network options (CC-Link, DeviceNet, Profibus, Ethernet) are selectable. Also, with an external motor connected, it is possible to install a multi-drop board which enables extension of up to 8 axes.

(Note : For the multi-drop system construction, please consult YAMAHA MOTOR Co.,Ltd.)

● Example of multi drop construction
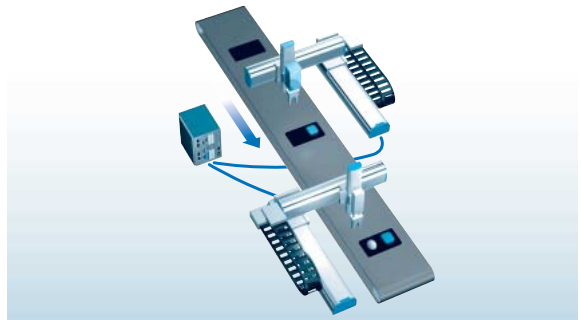
12 Capable of using additional function of "YC-Link option" for additional axis

Using an optional YC-Link, the RCX series controller and SR1 series single axis controller can be linked easily. If necessary, by linking some controllers, it is possible to control up to 8 axes (Max. 6 axes for simultaneous control).

MPB

YC-Link option

13 CE Marking

CE Marking compatible new models have been added to our lineup in response to various demand. YAMAHA Robots will exhibit higher performance with the new RCX141-E&RCX142-E.
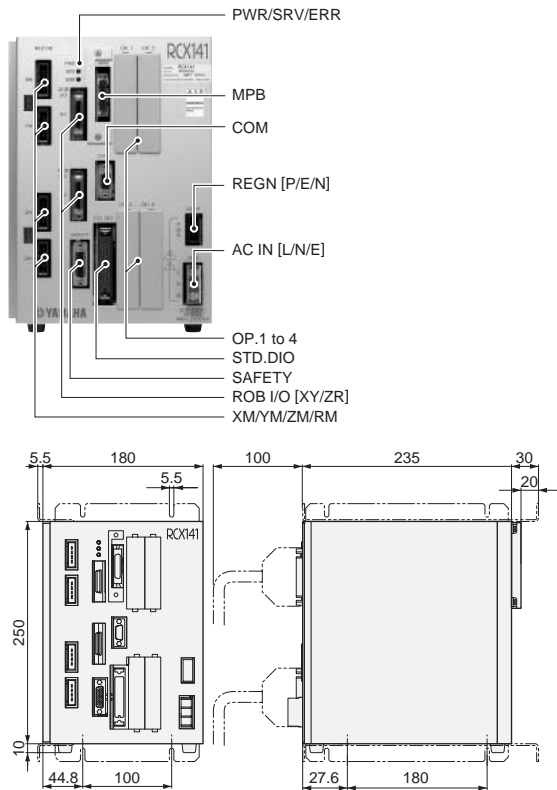
RCX141 / 142 ordering method

RCX142 - E Note 2 - R - N1 - - S Note 2

Controller	Usable for CE	Regenerative unit	Option I/O	Network Option	Battery

Controller
- RCX141
- RCX142
- (RCX142-T Note 1)

Usable for CE
- No entry : Standard
- E : CE specification

Option I/O
- N, P Note 5 : Stadard I/O 16/8
- N1, P1 : 40/24
- N2, P2 : 64/40
- N3, P3 : 88/56
- N4, P4 : 112/72

Regenerative unit
- No entry : None
- R : RGU2 Note 3
- R3 RGU3 Note 4

Network Option
- No entry : None
- CC : CC-Link
- DN : DeviceNet
- PB : Profibus
- EN : Ethernet
- YC : YC-Link Note 6

Battery
- No entry : None Note 7
- S : RCX142 Standard specifications
  1 to 2 axes: 1 pc / 3 to 4 axes: 2 pcs
  (Retention time: 680 hours)
- W : Doubled capacity specification
  1 to 2 axes: 2 pcs / 3 to 4 axes: 4 pcs
  (Retention time: 1360 hours)

Note 1 : RCX142-T is a controller exclusively for YK120X / YK150X.
Note 2 : It will be a customer's choice.
Note 3 : RGU-2 is necessary when operating a model specified by YAMAHA or a load with a large inertia.
Note 4 : Use RGU3 for YK550X / YK500XG / YK600XG.
Note 5 : Use N to N4 when NPN is selected on the I/O board, and P to P4 when PNP is selected.
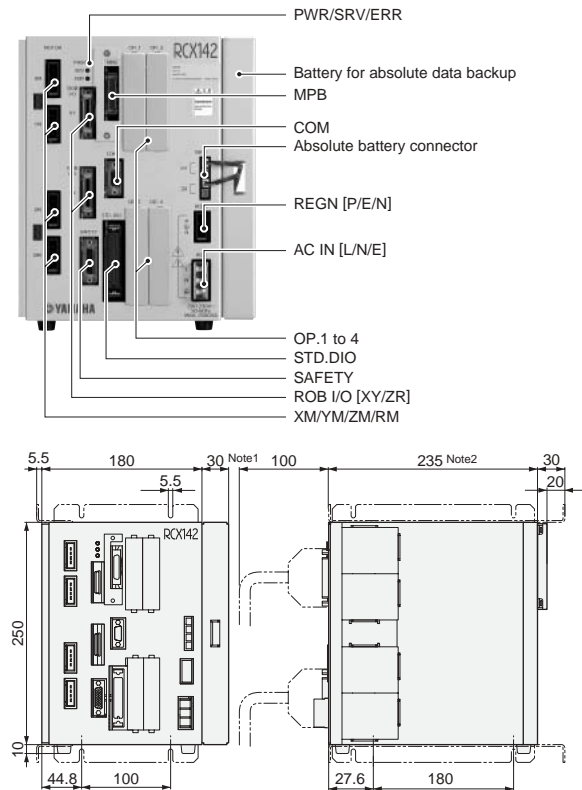Note 6 : Available only for the master.
Note 7 : No entry for RCX141.

RCX141 / 142 basic specifications

	Item	Model	RCX141	RCX142	RCX142-T
Axis control	Number of controllable axes		4 axis maximum		
	Number of controllable robots		PHASER / FLIP-X / XY-X / YK-X / YP-X	FLIP-X / XY-X / YK-X(exclude YK120X / YK150X) / YP-X	YK120X / YK150X
	Driving system		AC full digital servo		
	Position detection method		Resolver, magnetic type linear scale	Resolver	
	Drive method		PTP (point to point) motion, Arch motion, linear interpolation, circular interpolation		
	Coordinates		Indirect coordinates, Cartesian coordinates		
	Position indication units		Pulses, mm (millimeters), deg (degrees)		
	Speed setting		1% to 100% (Setting by 1% unit, changeable in the program)		
	Acceleration setting		Automatic acceleration setting based on robot model type and end mass parameter		
			Setting based on acceleration and deceleration parameter (1% unit setting, changeable by programming)		
			Zone control (Optimized speed suitable for the arm position only with the SCARA robot)		Zone control (Optimum speed according to the arm position)
	Origin		Incremental method (origin return required)	Absolute method (origin return not required)	
Program	Program language		YAMAHA BASIC (Conforming to JIS B8439 SLIM Language)		
	Multitasks		8 tasks maximum		
	Sequence program		1 program		
	Memory size		364KB : Total of program and point data, 84KB : Available size for program when maximum numbers of points is used		
	Programs		100 program 9,999 : maximum lines per program 98KB : maximum capacity per program		
	Points		10,000 points : maximum numbers of points		
External input/output	Point-data input method		MDI(coordinate data input), Direct teaching, Teaching playback, off-line teaching (data input from outside)		
	Memory Backup		Lithium battery (service life 4 years at 0℃ to 40℃)		
	STD.DIO	I/O input	General input : 16 points , dedicated input 9 points (NPN/PNP specifications selectable)		
		I/O output	General output : 8 points , dedicated output 11 points		
	SAFETY	Emergency stop input	Relay contact		
		Service mode input	1 point (NPN/PNP specification is set according to STD. DIO setting)		
	Brake output		Relay contact		
	Origin sensor input		B contact sensor for DC24V connected		
	External communications		RS232C : 1CH (D-SUB9 (female)) RS422 : 1CH (for MPB only)		
Basic specifications	Maximum power consumption		2500VA		300VA
	Dimensions / Weight		W180 x H250 x D235mm / 6.5kg		
	Power supply voltage		Single phase AC200 to 230V, plus-minus 10 percent maximum (50/60Hz)		
General specifications	Operating temperature / Storage temperature		0℃ to 40℃ / -10℃ to 65℃		
	Operating humidity		35% to 85% RH (non-condensing)		
	Battery for absolute data backup		—	Ni-Cd battery charging method (Trickle charging), 2000mAh, data retention time of 680 hours	
Options	Parallel DIO board		General-purpose input 24 points / board		
			General-purpose output 16 points / board (4 boards maximum, compatible with NPN/PNP specifications)		General-purpose output 16 points / board (2 boards maximum, compatible with NPN/PNP specifications)
	CC-Link		Dedicated input 11 points, dedicated output 11 points General input 96 points, general output 96 points		
	DeviceNet		Dedicated input 11 points, dedicated output 11 points General input 96 points, general output 96 points		
	Profibus		Dedicated input 11 points, dedicated output 11 points General input 96 points, general output 96 points		
	Ethernet		Conforming to IEEE802.3, 10Mbps (10BASE-T)		
	Programing unit		MPB, MPB-E2		
	Software for PC		VIP		

RCX141 part names / dimensions

- PWR/SRV/ERR
- MPB
- COM
- REGN [P/E/N]
- AC IN [L/N/E]
- OP.1 to 4
- STD.DIO
- SAFETY
- ROB I/O [XY/ZR]
- XM/YM/ZM/RM

5.5 | 180 | 100 | 235 | 30
5.5 | 20
250
10
44.8 | 100 | 27.6 | 180

RCX142 part names / dimensions

- PWR/SRV/ERR
- Battery for absolute data backup
- MPB
- COM
- Absolute battery connector
- REGN [P/E/N]
- AC IN [L/N/E]
- OP.1 to 4
- STD.DIO
- SAFETY
- ROB I/O [XY/ZR]
- XM/YM/ZM/RM

5.5 | 180 | 30 Note1 | 100 | 235 Note2 | 30
5.5 | 20
250
10
44.8 | 100 | 27.6 | 180
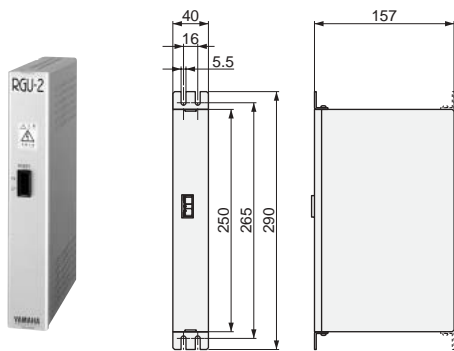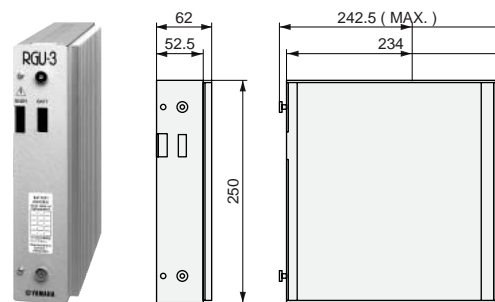
Note1 : The upper section is 30mm when the battery is mounted.
48mm when regeneration unit RGU2 and battery are mounted.
62mm when regeneration unit RGU3 and battery are mounted.
Note2 : 242.5mm when regeneration unit RGU3 is mounted.

RGU2 dimensions

40
16
5.5
157
250
265
290

RGU3 dimensions

62
52.5
242.5 (MAX.)
234
250

RCX221 / 222 / 141 / 142 installation examples

■ RCX141 / 142 Precautions for installation
(1) Provide at least 50mm or more space to the top and sides of the controller.
(2) Make sure that the heat-sink on the side of the controller is not obstructed.
(3) Make sure that the fan on the back of the controller is not obstructed.Provide at least 30mm or more space at the back of the controller.
Note : The figure shows RCX141, but the same installation method is applicable to RCX142.

■ RCX221 / 222 Precautions for installation
(1) Provide at least 50mm or more space to the top and sides of the controller.
(2) Make sure that the heat-sink on the side of the controller is not obstructed.
(3) To prevent obstructing the fan at the bottom of the controller, provide at least 17mm or more space to the bottom.
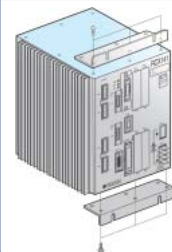Note : The figure shows RCX141, but the same installation method is applicable to RCX221 / 222.
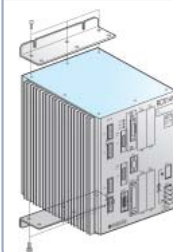(The unit marked with [Note 1] cannot be installed on the side.)

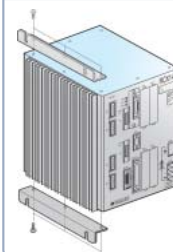● With rubber feet installed (Standard)
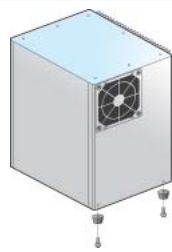
● With L-shaped stay installed on front

● With L-shaped stay installed on back

● With L-shaped stay installed on side

RCX141 / 142 command list

General commands

Command	Function
DECLARE	Specify label in shared external program
DEF FN	Define user function
DIM	Array variable declaration statement
FOR	Repeat command
GOSUB	Call subroutine
GOTO	Unconditionally jump to specified label
HALT	Stop and reset program execution
HOLD	Temporarily stop program execution
IF THEN ELSE	Conditional branch instruction
LET	Assignment statement
ON GOSUB	Call specified subroutine
ON GOTO	Unconditionally jump to specified label
REM,'	Define comment
SELECT CASE	Execute specified block
SWI	Switch execution program
WHILE	Conditional repeat instruction
*CHARACTER STRING:	Define label name

Robot movement

DRIVE	PTP absolute movement of specified axis
DRIVEI	PTP relative movement of specified axis
MOVE P	PTP absolute movement on all axes
MOVE L	Three-dimensional linear interpolation movement
MOVE C	Three-dimensional arc interpolation movement
MOVEI P	PTP relative position movement on all axes
PMOVE	Move to pallet point
SERVO	Servo ON/OFF for all axes or specified axis
SPEED	Set movement speed

Input/output control

DELAY	Standby time setting
DO	Specified bit output to specified por
MO	Specified bit output from internal simulation port
RESET	Specified output OFF
SET	Specified bit output from specified port (with timeout)
WAIT	Conditional input/output standby (with timeout)

MPB control

PRINT	Display specified data on MPB screen
INPUT	Wait for MPB keyboard input
SEND	MPB keyboard input of specified file

RS-232C communication support control

SEND	Input/output to specified file from communication port

Coordinate control

CHANGE	Change hand coordinate system
HAND	Define hand coordinate
RIGHTY/LEFTY	Change right-handed/left-handed system
SHIFT	Specify shift coordin

Date/time setting

DATE $, TIMER $, TIMER	

Parameter change

ACCEL	Change acceleration coefficient for all axes or specified axis
ARCH	Change arch position parameter for specified axis
AXWGHT	Change tip weight parameter for specified axis
ONLINE/OFFLINE	Change RS-232C communication mode
OUTPOS	Change out effective position for specified axis
TOLE	Change positioning tolerance for specified axis
WEIGHT	Change tip weight para

Procedure

CALL	Call sub-procedure
EXIT SUB	End sub-procedure
SUB	Define sub-procedure
SHARED	Define common variables in sub-procedure

Task control

CHGPRI	Change operation task priority
CUT	Forcibly end task
EXIT TASK	Self-end of task
RESTART	Restart temporarily stopped task
START	Start specified task
SUSPEND	Suspend task

Error control

ERL	Error occurrence line function
ERR	Error code function
ON ERROR GOTO	Jump to error processing routine
RESUME	Restart program after error recovery processing

Point functions

JTOXY	Convert pulse value data into cartesian coordinate data
LOCx	Specify point data for each axis
Pn	Define point data (n = point number)
PPNT	Read data on specified pallet nu
Sn	Define shift coor (n = 0 to 9)
WHERE	Read current robot position
XYTOJ	Convert cartesian coordinate data into pulse data

Arithmetic functions

ABS,ARMCND,ATN,COS,DEGRAD,INT,LSHIFT,RADDEG,RSHIFT,SIN,SQR,TAN

Character string functions

CHR $, LEFT $, LEN, MID $, ORD, RIGHT $, STR $, VAL

RCX141 / 142 sequence

Sequence program input/output variables

Command	Function
DI (mb)	Input variable
DO (mb)	Output variable
MO (mb)	Internal auxiliary output variable
LO (mb)	Arm lock output variable
TO (mb)	Timer output variable

Sequence program timer definition

TIMmb=<expression>	Timer output variable

Sequence program logical operators

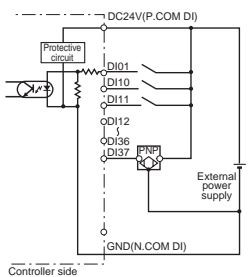|	
OR,|	Logical OR
AND, &	Logical AND
NOT, ~	Logical NOT

m : port No.   b : bit No.

RCX141 / 142 example of input signal connection
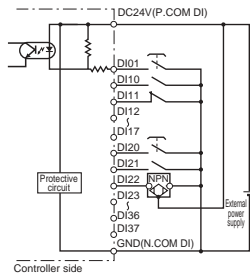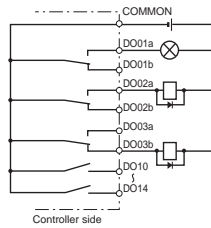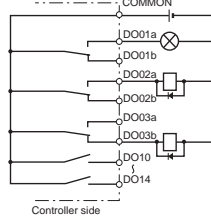
● NPN specification

● PNP specification

RCX141 / 142 example of output signal connection
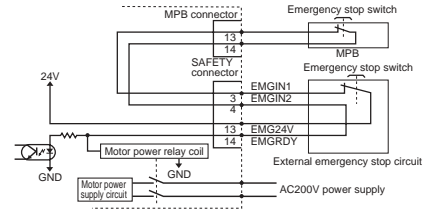
● NPN specification
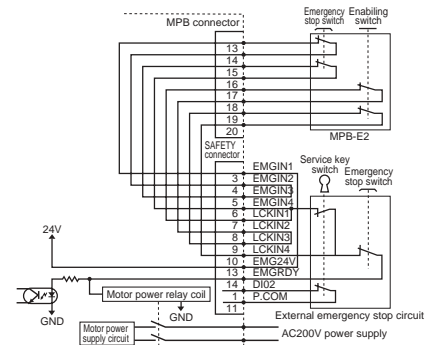

● PNP specification

RCX141 / 142 emergency input signal connections

● Connections using the standard MPB programming unit with external emergency stop circuit

● Connections using the MPB-E2 enabling switch compatible programming unit with external emergency stop circuit (PNP specification)

RCX141 / 142 connector I/O signals

STD.DIO

PIN	I/O No.	Signal name	
		RCX141	RCX142
1	DI05	I/O command execution trigger input	
2	DI01	Servo ON	
3	DI10	Sequence control	
4	DI11	Interlock	
5	DI12	Program start	
6	DI13	AUTO mode	
7	DI14	spare	
8	DI15	Program reset	
9	DI16	MANUAL mode	
10	DI17	Return-to-origin	Absolute reset
11 to 18	DI20 to DI27	General input 20 to 27	
19 to 26	DI30 to DI37	General input 30 to 37	
27	COMMON	Relay common	
28	DO01b	CPU OK(B contact)	
29	DO01a	CPU OK(A contact)	
30	DO02b	Servo ON(B contact)	
31	DO02a	Servo ON(A contact)	
32	DO03b	Alarm(B contact)	
33	DO03a	Alarm(A contact)	
34	DO10	AUTO mode	
35	DO11	Return-to-origin complete	
36	DO12	Sequence program in-progress	
37	DO13	Robot program in-progress	
38	DO14	Program reset status	
39 to 46	DO20 to DO27	General output 20 to 27	
47 / 48	DC24V	DC+24V(P.COM DI)	
49 / 50	GND	GND(N.COM DI)	

Note : For the standard I/O [connector name : STD. DIO], either NPN or PNP is selectable at the time of shipping.
Note : DC24V is internally connected with P.COM terminal of Safety connector.
Note : GND is internally connected with N.COM terminal of Safety connector.

OP.DIO

Option I/O module N1

PIN	I/O No.	Signal name
1	P.COMDI	P.COM DI
2	N.COMDI	N.COM DI
3 to 10	DI40 to DI47	General input 40 to 47
11 to 18	DI50 to DI57	General input 50 to 57
19 to 26	DI60 to DI67	General input 60 to 67
27	P.COMA	P.COMA
28 to 35	DO30 to DO37	General output 30 to 37
36	N.COMA	N.COMA
37	P.COMB	P.COMB
38 to 45	DO40 to DO47	General output 40 to 47
46	N.COMB	N.COMB
47 to 50	NC	No connection

Note : Option I/O module is incorporated in RCX141/142 before shipment.

SAFETY

PIN	MPB connected		MPB-E2 connected	
	I/O No.	Signal name	I/O No.	Signal name
1	DI02	SERVICE mode	DI02	SERVICE mode
2	NC	NC	NC	NC
3	EMGIN1	Emergency stop input 1	EMGIN1	Emergency stop input 1
4	EMGIN2	Emergency stop input 2	EMGIN2	Emergency stop input 2
5	NC	NC	EMGIN3	Emergency stop input 3
6	NC	NC	EMGIN4	Emergency stop input 4
7	NC	NC	LCKIN1	Enabling switch input 1
8	NC	NC	LCKIN2	Enabling switch input 2
9	NC	NC	LCKIN3	Enabling switch input 3
10	NC	NC	LCKIN4	Enabling switch input 4
11	P.COM	DC+24V(P.COM DI)	P.COM	DC+24V(P.COM DI)
12	N.COM	GND(N.COM DI)	N.COM	GND(N.COM DI)
13	EMG24V	Emergency stop input supply	EMG24V	Emergency stop input supply
14	EMGRDY	Emergency stop READY signal	EMGRDY	Emergency stop READY signal
15	NC	No connection	NC	No connection