YAMAHA MOTOR CO., LTD.

YAMAHA SINGLE-AXIS ROBOT CONTROLLER

SRCD/SRCP

Pulse Train Mode

User's Manual

ENGLISH E

E86-Ver. 2.01

Introduction

Thank you for purchasing the YAMAHA robot controller SRCP/SRCD series.

The SRCP/SRCD series controller can be used with a YAMAHA single-axis robot of the PHASER series or FLIP-X series to perform various tasks in FA (factory automation) applications such as pick and place work on conveyor lines, semiconductor manufacturing equipment and assembly machines.

This supplementary manual explains wiring methods, specifications and operation parameters needed for the SRCP/SRCD series to control the robot position by pulse train input from the host unit.

- For information on how to install the SRCP/SRCD series controller and safety precautions, see the "YAMAMA Single-axis Controller SRCP Series User's Manual" or "YAMAMA Single-axis Controller SRCD Series User's Manual" (hereafter called "Controller User's Manual"). Before using the SRCP/SRCD series controller, first read the controller user's manual and this supplementary manual carefully until you thoroughly understand the contents and can comply with all instructions.

- Even after reading this manual, keep it in a safe, easily accessible location so it can be referred to when needed.

- The contents of this manual are subject to change without prior notice.

- Every effort was made to ensure the contents of this manual are complete. However, please contact us if errors, ambiguities or possible trouble points are found.

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MEMO

General Contents

MEMO

1-1 SRCP/SRCD series functions and features

■ Variation

Series name	Type	Operable robot
SRCP series	SRCP-05, 05A, 10, 10A, 20, 20A	PHASER series
SRCD series	SRCD-05, 05A, 10, 10A, 20, 20A	FLIP-X series

* Use a correct combination of robot and controller.

■ Control mode

The following two control modes can be selected by setting a parameter (PRM64: Input type).

Control mode	Description	PRM64
Normal mode	Allows point movement and programmed operation by custom command input.	0 (Default)
Pulse train mode	Position control by pulse train input.	1: Phase A / Phase B input 2: Pulse / code input 3: CW / CCW input

* For details on normal mode, refer to the controller user's manual.
* Control mode is switched after restarting the controller.

1-2 Pulse train mode functions and features

■ Return to origin

A custom input for return-to-origin is provided. Each time this is input, the robot moves and stops at the same origin position after detecting a torque generated when the robot reaches stroke end.

* On the PHASER series robots, the magnetic poles are simultaneously detected during return-to-origin.

■ Electronic gear function

This function allows the robot to move at a rate equal to the number of pulses that is determined by multiplying the input command pulse count by the electronic gear ratio.

This function is effective in the following cases.

- When the pulse output from the host device is insufficient.
- When you want to set an optional movement distance per pulse.

The electronic gear ratio is set by entering a parameter value.

■ Feedback pulse output

Can output position data as differential output.

Allows the host device to detect the robot’s current position in real time.

■ TPB

The TPB programming unit allows:

- Changing parameters
- Checking the alarm history
- Monitoring I/O information

MEMO

■ SRCP/SRCD series basic specifications

Item					Description	
Series name					SRCP series	SRCD series
Basic specifications	Dimensions				W78 × H250 × D157 mm	
	Weight				1.5 kg	
	Power voltage				AC 200 to 230V ±10%, single phase 50/60Hz	
	Operating/storage temperature				0 to 40 °C / -10 to 65 °C	
	Operating humidity				35 to 85 % RH (no condensation)	
Axis control	Control axis				1 axis	
	Control system				Full-digital software AC servo	
	Position detection method				Magnetic linear scale	Resolver
	Speed setting				1 to 100% in 1% steps	
	Acceleration setting				Automatic setting based on robot type and payload 1 to 100% in 1% steps by acceleration parameter setting	
	Servo adjustment				Adjustable by parameters (special setting) such as servo gain and current limit.	
Memory	ROM				256KB (with CPU)	
	RAM				128KB with lithium battery backup (battery life: 5 years) Retains programs, point data, parameters and error records.	
	Number of program steps				Up to 3000 steps in total; 255 steps per program	
	Number of programs				100	
	Number of points				1000	
	Number of multitasks				4	
	Point teaching method				MDI (coordinate value input), remote teaching, direct teaching	
Command mode	I/O	Normal mode			Robot operation by dedicated command input	
		Pulse Train Mode	Type		1: phase A/phase B, 2: pulse/code, 3: CW / CCW One of the above should be selected.	
			Mode		Line driver (+5V)	
			Resolution		1µm	16384 pulses/rev
			Frequency		Maximum 2 Mpps (line driver)	
	Serial communication (RS-232C)				1: Data transmit/receive, parameter setting and robot operation by communication commands 2: Data transmit/receive, parameter setting, point teaching and robot operation by TPB (option)	
I/O interface	Normal mode	Sequence input			Absolute movement (ABS-PT), relative movement (INC-PT), auto program run (AUTO-R), step run (STEP-R), return-to-origin (ORG-S), reset (RESET), servo ON (SERVO), interlock (LOCK), general-purpose input: 8 points (DI0 to 7)	
		Sequence output			Ready (READY), busy (BUSY), End (END), general-purpose output: 5 points (DO0 to 4), open collector output	
	Pulse train mode	Sequence input			Servo ON (SERVO), return-to-origin input (ORG-S), pulse inhibit (INH), deviation clear (PCLR), alarm reset (RESET), general-purpose input: 8 points (DI0 to 7)	
		Sequence output			Alarm (ALM), servo ready (SRDY), positioning completion (IN-POS), general-purpose output: 5 points (DO0 to 4), open collector output	
		Command pulse input		Name	PULS+, PULS-, DIR+, DIR-	
				Type	One of the above should be selected.	
				Mode	Line driver (+5V)	
	Feedback pulse output			Name	PA+, PA-, PB+, PB-, PZ+, PZ-, PZM+*, PZM-*	
				Type	phase A/phase B	
				Mode	Line driver (+5V)	
	Power supply for sequence I/O				External DC +24V input for sequence input/output	
Function	Protective function				Overcurrent, overload, broken wire detection, runaway check, etc.	
	Network option				CC-Link, DeviceNet, EtherNet, PROFIBUS	

* PZM+ and PZM- are available only for the SRCP series. These are unavailable for the SRCD series.

MEMO

3-1 Installation and connection

For information on how to install the controller and to connect it to the power supply and robot, refer to the controller user's manual.

3-2 I/O specifications and wiring

■ I/O signal table

[EXT.CN]

No.	Signal name	Meaning	Description	Type
1 2	EMG1 EMG2	Emergency stop input 1 Emergency stop input 2	Use these terminals to trigger an external safety device (safety enclosure, manual switch, etc.) to stop the robot immediately. Using a relay with load contact capacity of 50mA or more is recommended. Opening the contact between EMG and EMG2 shuts off the servo power supply, and the status shifts to "Servo OFF and "Alarm ON".	Emergency stop input
3 4	24V 24G	Signal input for sequence I/O	DC 24V input terminals for sequence input. Connect the positive (+) polarity of a DC 24 V power supply to "24V", and the negative (-) polarity to "24G".	Power supply input for I/O

Mating connector number : 733-104 (WAGO); supplied
On-board connector number : 733-364

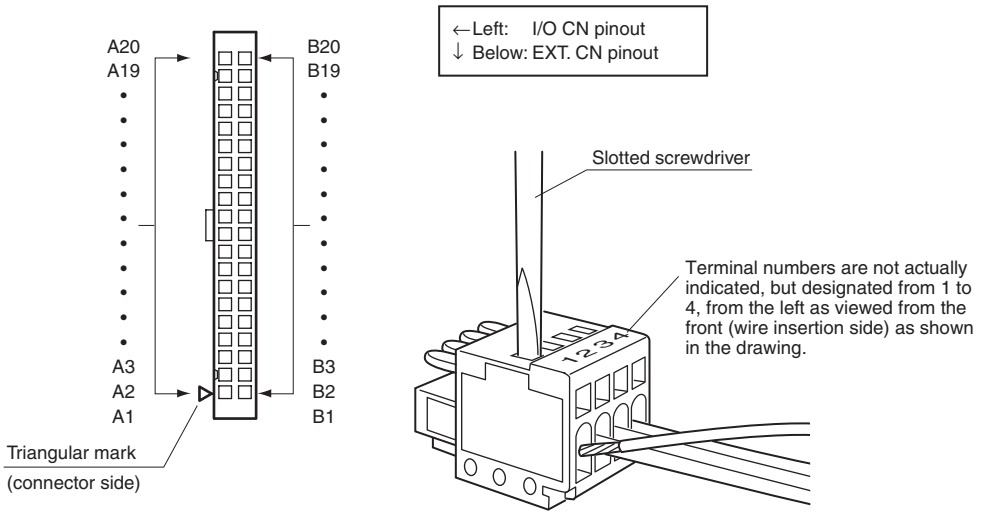
[I/O.CN]

No.	Signal name	Meaning	Description	Type
A1 B1 A2	(NC)	(Reserved)	Do not use.	–
B2	PCLR	Deviation clear input	When ON, ignores command pulses and clears deviation counter. Requires an input pulse of at least 1ms duration. Input pulse shorter than this may not clear counter.	Sequence input
A3	ORG-S	Return-to-origin input	Switching from OFF to ON starts return-to-origin. Stops if switched to OFF. Command pulse inputs are ignored during return-to-origin. This input also detects the magnetic poles simultaneously with return-to-origin. (only on PHASER series)	
B3	RESET	Alarm reset input	Alarm is reset at ON, Alarm cannot be reset if ON duration is shorter than 130ms.	
A4	SERVO	Servo ON input	Servo turns on at ON and turns off at OFF.	
B4	INH	Command pulse prohibit input	At ON, obeys command pulse if SERVO input is ON (servo-ON). When switched to OFF, stops at that point and ignores command pulses. Can be set to enable/disable by setting PRM69. (Default setting = disable)	
A5	DI0	General-purpose input 0	General-purpose input: 8 points No assign function.	
B5	DI1	General-purpose input 1		
A6	DI2	General-purpose input 2		
B6	DI3	General-purpose input 3		
A7	DI4	General-purpose input 4		
B7	DI5	General-purpose input 5		
A8	DI6	General-purpose input 6		
B8	DI7	General-purpose input 7		

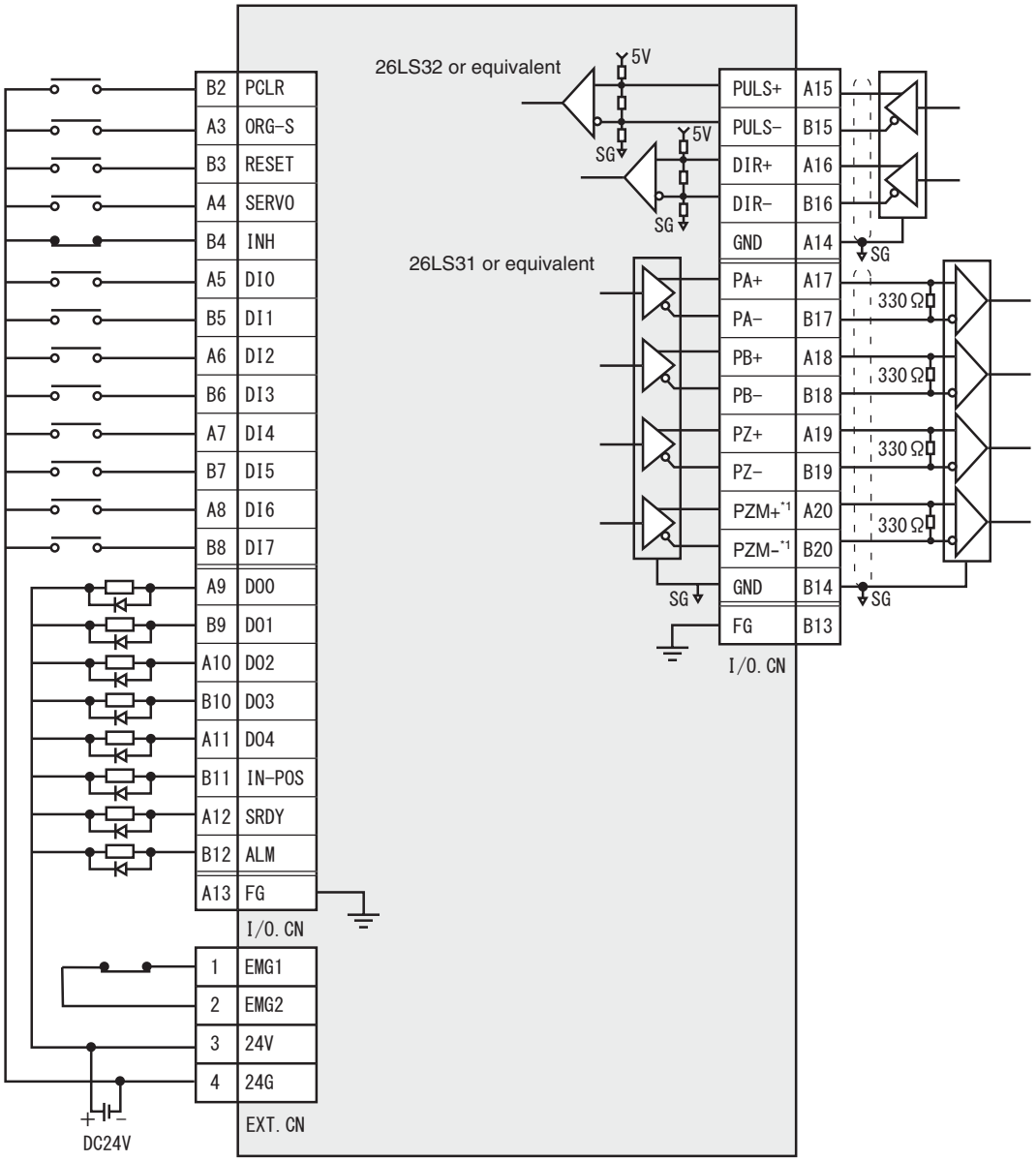
No.	Signal name	Meaning	Description	Type
A9	DO0	General-purpose output 0	General-purpose output: 5 points Assign function Return-to-origin completed output (Can be set with DO4 and PRM33.) Servo ON status output (Can be set with DO3 and PRM46.) Magnetic pole detection completed output (Can be set with DO2 and PRM73.)	Sequence output
B9	DO1	General-purpose output 1		
A10	DO2	General-purpose output 2		
B10	DO3	General-purpose output 3		
A11	DO4	General-purpose output 4		
B11	IN-POS	In-position output	Sets to ON if accumulated pulses in deviation counter are within ±value of PRM6 setting.	
A12	SRDY	Servo ready output	Turns on at servo-ON if command pulse inputs are possible.	
B12	ALM	Alarm output	Turns off in emergency stop or if alarm occurs.	
A13 B13	FG	Frame ground	Internally connected to the ground terminal.	FG
A14 B14	GND	Signal ground	Internal signal ground terminal. This is insulated from power supply (24G) for sequence I/O signals.	GND
A15 B15	PULS+ PULS-	Command pulse input	Command pulse input terminal. Input voltage should be 5V±10%. 3 command types selectable with PRM64 (Input type). (1) Phase A / phase B input, (2) Pulse / code input, (3) CW / CCW input	Pulse input
A16 B16	DIR+ DIR-	Command direction input		
A17	PA+	Feedback pulse output	Outputs feedback pulses (Phase A, Phase B, Phase Z, Phase ZM) as differential output. * Phase ZM is output only when using the SRCP series.	Pulse output
B17	PA-			
A18	PB+			
B18	PB-			
A19	PZ+			
B19	PZ-			
A20	PZM+*			
B20	PZM-*			

Mating connector number : XG4M-4030-U (OMRON) MIL type
On-board connector number : XG4C-4034

■ Connector pinout



■ I/O wiring diagram



SRCP controller

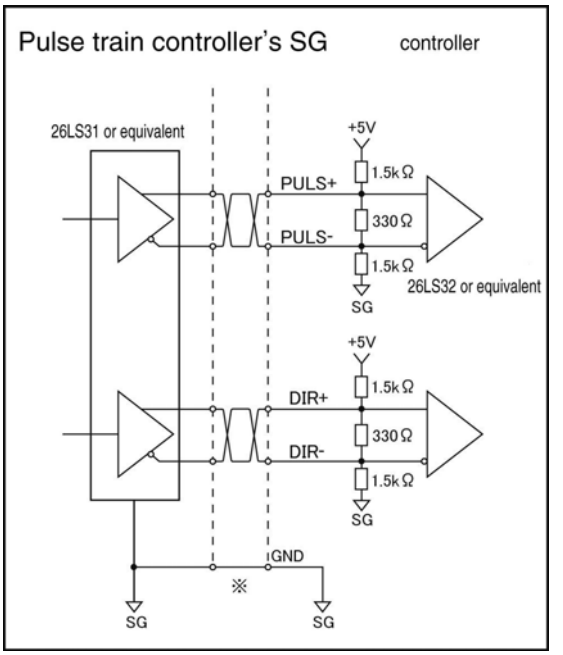
* In the SRCP/SRCD series, the I/O pins have different functions and meanings in each control mode.

*1: PZM+ and PZM- are available only for the SRCP series. These are unavailable for the SRCD series.

■ Pulse circuit description

[Line driver input]

The line receiver used here is the 26LS32or equivalent item. A maximum pulse input of 2Mpps is allowed here. Use a twisted-pair cable to make the connection.



* The robot controller's SG must be connected to the pulse train controller's SG . The SG terminals (pin No. A14 and B14) are isolated from 24G (pin No. 4 of EXT. CN). Wire each of them securely.

■ Sequence I/O circuit description

Sequence I/O is equivalent to custom and general-purpose I/O in normal mode. For detailed description of the sequence I/O circuit, refer to section 3-4-2, "I/O circuit and connection example", in the controller user's manual.

■ Signal description

Deviation clear input (PCLR)	Pin No. B2 (I/O.CN)	Sequence input

[Function]

- At ON ignores input pulses and clears the deviation counter.
  * This signal must be ON at least 1ms or more. A pulse shorter than this may not clear the counter.

Return-to-origin input (ORG-S)	Pin No. A3 (I/O.CN)	Sequence input

[Function]

- Starts return-to-origin at ON and stops at OFF.
- Return-to-origin is performed by stroke-end torque detection method, in which the robot stops at the same origin position by reversing the movement after striking the mechanical stopper.
  * Do not use with a system that stops during torque detection. Doing so will cause alarms and in worst cases will damage the motor. When repeating return-to-origin is unavoidable, hold for at least 5 seconds before repeating return-to-origin.
- The return-to-origin direction can be changed with the PRM5 (Return-to-origin direction) parameter.
  * On the PHASER series robots, the magnetic poles are simultaneously detected during return-to-origin.
  * Pulse input is disabled during return-to-origin,
  * Always make sure the robot is in stop before performing return-to-origin,

Alarm reset input (RESET)	Pin No. B3 (I/O.CN)	Sequence input

[Function]

- Clears the alarm at ON. (Input of 130ms or longer duration is required.)
  * Some alarms can only be cleared by turning the power off and then on again.

Servo ON input (SERVO)	Pin No. A4 (I/O.CN)	Sequence input

[Function]

- Servo turns on at ON and pulse inputs are accepted.
  * In the PHASER series, a high pitched noise is heard for about 0.5 to 2 seconds after the first servo-ON input and then the servo turns on. This noise is produced by moving the robot a small distance in order to acquire information for controlling the robot and is not an error.

Command pulse inhibit input (INH)	Pin No. B4 (I/O.CN)	Sequence input

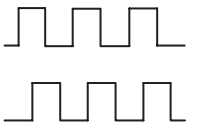
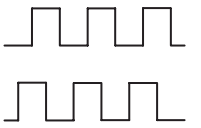
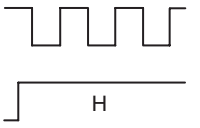
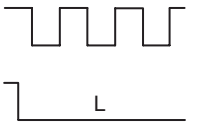
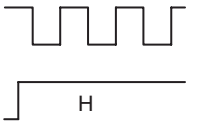
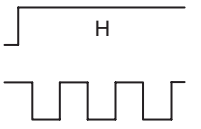
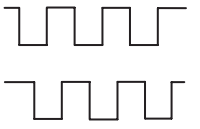
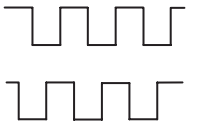
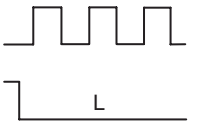
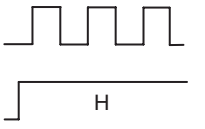
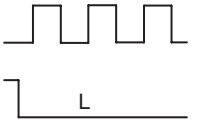
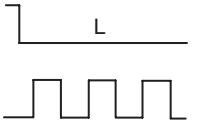
[Function]

- If the servo input is ON, then command pulses are accepted at ON and the robot moves as to those pulses.
- When this input is set to OFF, the command pulse inputs are disabled, the robot stops and sets to servo-lock.
- Can be disabled by setting the parameter (PRM69: INH input). (Default setting = disable)

Command pulse input Command direction input	Pin No. A15, B15, A16, B16 (I/O.CN)	Pulse input

[Function]

- The input type of these signals is changed by setting PRM64 (Input type)

Logic	PRM64	Command pulse format	Input pin	CW direction	CCW direction
Positive logic	1	Phase A / Phase B	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		
	2	Pulse code	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		
	3	CW / CCW	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		
Negative logic	1	Phase A / Phase B	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		
	2	Pulse code	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		
	3	CW / CCW	A15: PULS+ B15: PULS- A16: DIR+ B16: DIR-		

* Change to positive or negative logic with the PRM66 (Input pulse logic) parameter.

* When "phase A / phase B" input is selected, 1×, 2× or 4× are selectable with the PRM65 (Input pulse evaluation) parameter.

In-position output (IN-POS)	Pin No. B11 (I/O.CN)	Sequence output

- Sets to ON when deviation counter accumulated pulses are within the setting by PRM6 (positioning completed pulse).
- Sometimes continually remains ON, when command speed is low or PRM6 is a large value.

Servo ready output (SRDY)	Pin No. A12 (I/O.CN)	Sequence output

- Turns ON with servo input at ON, when command pulse inputs can be accepted.
  * Sets to OFF when pulse inputs are prohibited by INH input.
  * Sets to OFF while return-to-origin is run by ORG-S input.

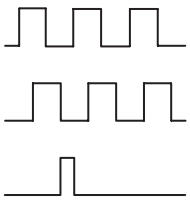
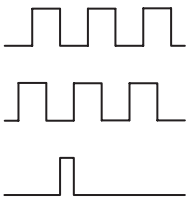
Alarm output (ALM)	Pin No. B12 (I/O.CN)	Sequence output

- Sets to OFF when SRCP/SRCD series controller detects an error.
- Sets to OFF during emergency stop.

Feedback pulse output	Pin No. A17, B17, A18, B18, A19, B19, A20, B20 (I/O.CN)	Pulse output

• Outputs current position information as differential output.

■Pulse output and phase

Output pin	CW direction	CCW direction
A17:PA+ B17:PA- A18:PB+ B18:PB- A19:PZ+ B19:PZ-		

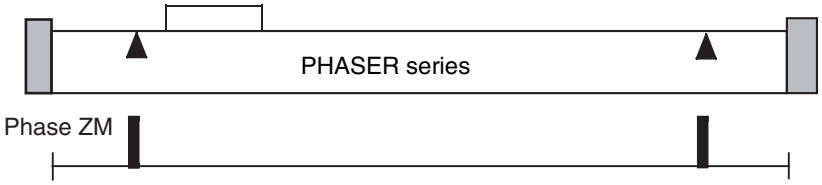
■Output pulse count and Z-phase output timing

Series	Number of output pulses	Z phase output timing
PHASER series	1 [pulses/μm]	Every 1024 μm
FLIP-X series	16384/4 [pulses/rev]	Each1/4 motor rotation

* Number shown is output pulse count after being multiplied by 4.

■ Phase ZM

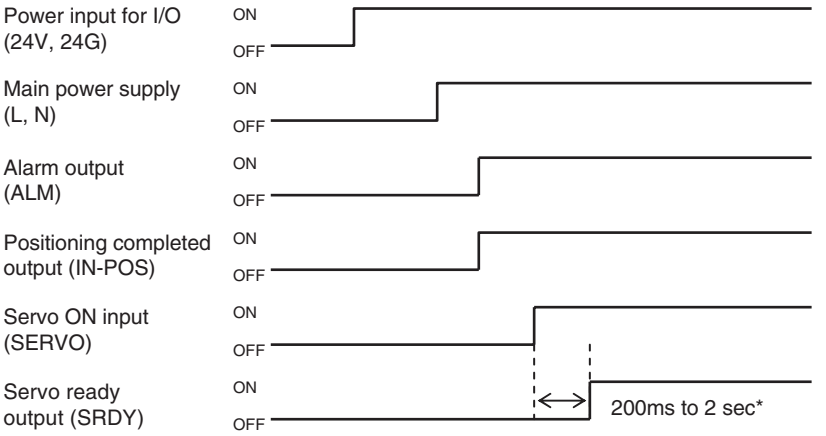
Phase ZM is output at the magnetic pole detection points of the PHASER series. Refer to the drawing below.



▲ : Magnetic pole detection point

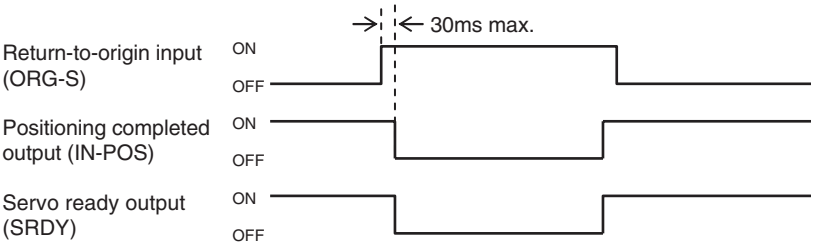
■ Signal timing

● Power-ON to pulse input



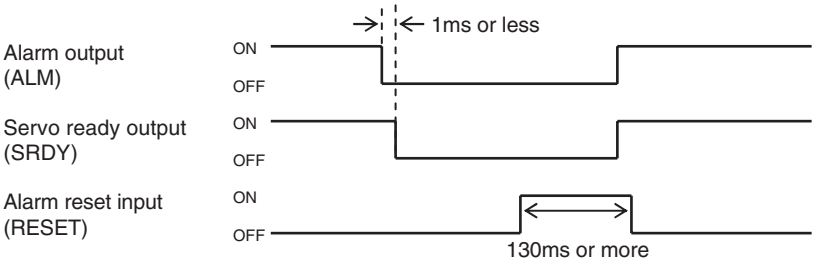
- Power input for I/O must always be set to ON before turning on main power supply.
- Pulse inputs can be accepted when Servo ready (SRDY) is ON.
- Duration from Servo-ON input to pulse ready output may change due to robot model or operating status.

● Return to origin



- On the PHASER series, the magnetic pole is also detected during return-to-origin.
- Pulse input is disabled during return-to-origin,
- Always make sure the robot is in stop before starting return-to-origin,

● Alarm output and reset



- Some alarms can be cancelled by an alarm reset input and some cannot. For more details, refer to "6-2 Alarm list".
- In normal mode, alarm can only be canceled by turning the power off and then on again.

4-1 Setup for operation

After correctly installing and connecting the controller to the robot, turn on the power and then make ready for operation.

[Initial setting]

- The normal mode is the default (factory) setting. To use in the pulse train mode, make the mode setting after first turning the power on.(PRM64: Input type)
- To make the mode setting, unplug the I/O.CN connector and set in emergency stop. In the normal mode, the servo turns on when the power is turned on while NOT in emergency stop.
- After making the setting, turn the power off and then on again.

[Operation check]

- After checking that there are no alarms after power is turned on, turn the servo on.
- Operate in jog with a pulse input from the host device, and check that there are no malfunctions.

[Parameter settings]

- Set the parameters as needed to match the usage conditions.
- Always be sure to turn the power off and then on again after changing parameters that require power be turned on again.

[Magnetic pole detection]

- When using the SRCP series controller to operate a PHASER series robot, the magnetic poles must first be detected before beginning the robot operation. Failure to do so may trigger alarms and lead to operating malfunctions. Use the following methods to detect the magnetic poles.
  Return-to-origin (ORG-S)
  Passing through phase ZM during position control by pulse train input

* For more information, refer to "4.3 Magnetic pole detection".

[Trial operation]

- Start trial operation after checking that safety devices such as emergency stop are functioning correctly.
- Using no workpiece or a dummy workpiece, check that operation is normal with a pulse input supplied from the host device.

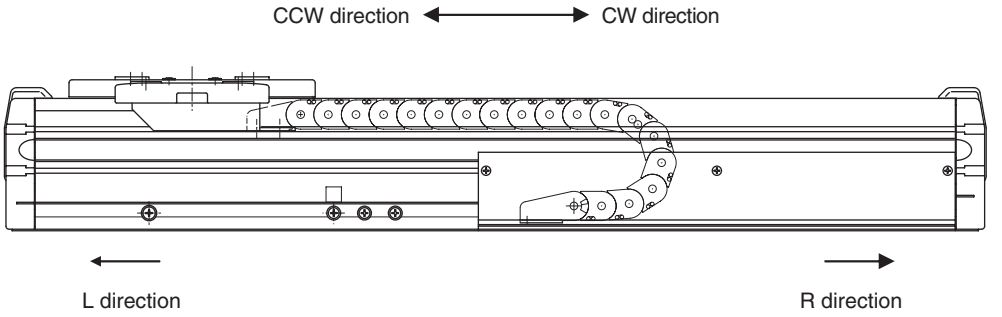
[Gain adjustment]

- Each YAMAHA single-axis series robot is set at the factory with its own optimal characteristic gain parameter. In the event that the gain must be adjusted to improve work throughput, we recommend adjusting the position control system gain parameter. However, use plenty of caution since an extreme gain setting will trigger alarms and cause breakdowns.

4-2 Defining the CW and CCW directions

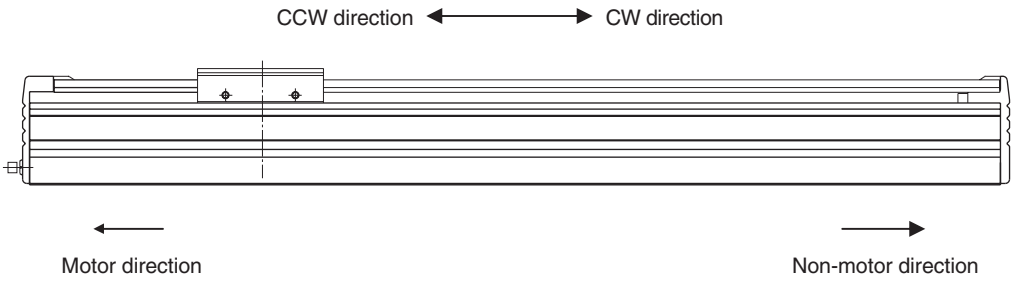
The following descriptions define the direction the robot moves versus the input pulses.

■ PHASER series



- On the PHASER series, the CW direction is to the right when viewed from the cable carrier side.

■ FLIP-X series



- On the FLIP-X series, CW is the clockwise direction as seen from the load, and CCW is the counterclockwise direction.

4-3 Magnetic pole detection

When using the SRCP series controller to operate a PHASER series robot, the magnetic poles must first be detected before beginning the robot operation. Failure to do so may trigger alarms and lead to operating malfunctions. Use the following methods to detect the magnetic poles.

- Return-to-origin (ORG-S)
- Passing through phase ZM during position control by pulse train input

The magnetic pole detection method can be selected by setting a parameter. When the detection is complete, the result is also output as general-purpose output by the parameter setting.

(PRM73: Magnetic pole detection method selection)

■ Return-to-origin (ORG-S)

The magnetic poles are automatically detected when the robot passes through phase ZM during return-to-origin by ORG-S input.

■ Passing through phase ZM during position control by pulse train input

The magnetic poles are detected when the robot passes through or stops at phase ZM during position control by pulse train input.

* When the robot passes through phase ZM, the speed must be lower than 100 [mm/s]. Higher speeds may cause the magnetic pole detection to fail.
* Magnetic poles are not detected during servo OFF.
* This function was added to the controller version V24.16 or later.

4-4 Electronic gear function

This function allows the robot to move at a rate equal to the number of pulses that is determined by multiplying the input command pulse count by the electronic gear ratio.

This function is effective in the following cases.

- When the pulse output from the host device is insufficient.
- When you want to set an optional movement distance per pulse.

■ Setting examples

1. To move the MR16T (PHASER series) robot at a speed of 2000 millimeters per second [mm/s] with input pulses at a frequency of 500kpps:

   Here, by setting the resolution [mm/pulse] as a, the input frequency [pps] as P, the movement speed [mm/s] as V, and the electronic gear ratio as G (=G1/G2), V can then be expressed as follows.

   $V = G \times (P \times a)$ (1)

   Since the PHASER series resolution is 1μm and since a = 0.001 [mm/pulse] then by applying formula (1) we obtain:

   $G = 4$

   So setting an electronic gear ratio of G1:G2 = 4 : 1 allows robot movement at a speed of 2000 [mm/s].

2. To move the F14-20 (FLIP-X series) robot a distance of 1 [μm] per pulse:

   Here, by setting the resolution [mm/pulse] as a, the lead length [mm/rev] as L, and pulses per 1 motor revolution [pulses/rev] as n, and the electronic gear ratio as G, the resolution a can then be expressed as follows.

   $a = L / n$ (2)

   Since the distance moved per 1 pulse is 0.001 [mm], an electronic gear ratio that satisfies the following relation must be set.

   $0.001 = G \times a$ (3)

   an electronic gear ratio G which implements the above is needed.

   On the F14-20 robot, L = 20 [mm], and n = 16384 [pulses/rev], so by applying formulas (2) and (3) we obtain:

   $G = 16384 / 20000$

   So setting an electronic gear ratio of G1: G2 = 16384 : 20000 allows robot movement at 1 [μm] per pulse.

CAUTION

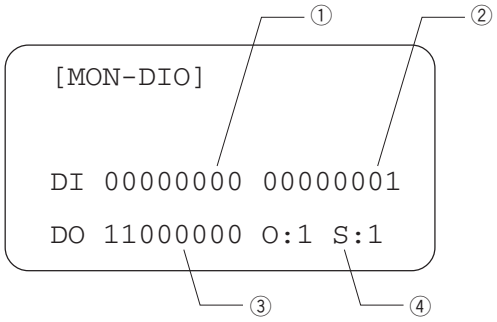
- **When the pulse input type is "phase A / phase B", the electronic gear ratio G is (G1/G2) multiplied by the PRM65 (Input pulse evaluation) value.**
- **Do not set a frequency or electronic gear ratio that exceeds the maximum robot speed (PRM44).**
- **Operation cannot be guaranteed when the electronic gear is set to an extreme value. Make sure this setting does not exceed a range of $1/20 \leqq (G1/G2) \leqq 100$.**

4-5 Monitor function

■ Monitoring the I/O signals

The sequence I/O status can be monitored on the TPB.

[Display screen]



* For information on how to display the monitor screen, refer to section 10-2, "DIO Monitor Display", in the controller user's manual.

[Description]

Column ① (Input 1)

DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
General-purpose input 7	General-purpose input 6	General-purpose input 5	General-purpose input 4	General-purpose input 3	General-purpose input 2	General-purpose input 1	General-purpose input 0

Column ② (Input 2)

INH	ORG-S	RESET	(NC)	PCLR	(NC)	(NC)	SERVO
Command pulse inhibit input	Return-to-origin input	Alarm reset input	(Empty)	Deviation clear input	(Empty)	(Empty)	Servo ON input

Column ③ (Output)

ALM	SRDY	IN-POS	DO4	DO3	DO2	DO1	DO0
Alarm output	Servo ready output	In-position output	General-purpose output 4	General-purpose output 3	General-purpose output 2	General-purpose output 1	General-purpose output 0

Column ④

O: Origin sensor status

0	OFF (close)
1	ON (open)

S: Servo status

0	Servo OFF
1	Servo ON

MEMO

Chapter 5 Parameters

5-1 Parameter setting

For information on how to set parameters with the TPB, refer to "5-1 Setting parameters" in the SRCP controller user's manual. A TPB version of V12.50 or higher is required.

5-2 Parameter list

- Some parameters become effective by turning the power off and then on again. After changing those parameters be sure to turn the power off once and then back on again.
- The shaded PRM (parameter) numbers are hidden parameters and usually cannot be displayed on the TPB. See "10-5-1 Viewing hidden parameters" in the SRCP controller user's manual for information on how to write and display these parameters.
- The alphabet letters in the "Relevant control mode" column mean as follows: S is normal mode and P is pulse train mode.
- The alphabet letter "R" in the "Setting range" column signifies a read-only parameter.
- The asterisk (*) indicates the value differs according to the robot.

■ PRM1 (Common parameters)

PRM No.	Parameter name	Setting range	Default value	Unit	Relevant control mode, etc.	Power off and on
0	Robot type number	R	*	–	Common	
1	(+) Soft limit	-9999 to 9999	*	mm	S	
2	(–) Soft limit	-9999 to 9999	*	mm	S	
3	Payload	*	0	Kg	S	
4	Acceleration	1 to 200	100	%	S	
5	Return-to-origin direction	0 or 1	*	–	Common	
6	Positioning completed pulse	1 to 4000	80	Pulse	Common	
7	I/O point movement command speed	0 to 100	100	%	S	
8	No. of conditional input points	1 to 8	4	Point	S	
9	MOVF speed	1 to *	10	mm/s	S	
10	Return-to-origin speed	1 to 100	20	mm/s	Common	
11	No. of encoder pulses (after multiplied 4)	–	*	Pulse	Common	
12	Lead length	–	*	.01mm	Common	
13	Origin detection method	0 to 1	1	–	Common	
14	Overload current	1 to 10000	*	–	Common	
15	Overload time	1 to 10000	*	–	Common	
16	Current limit	1 to 40959	*	–	Common	
17	Speed proportional gain (Kvp)	300 to 90000	*	–	Common	
18	Speed integration gain (Kvi)	200 to 60000	*	–	Common	
19	Position proportional gain (Kpp)	1 to 1000	*	–	Common	
20	OUT valid position	0 to 9999	1	mm	S	
21	Position data unit	0 to 3	0	–	S	
22	English/Japanese selection	0 to 1	0	–	Common	
23	Payload-dependent acceleration coefficient	1 to 255	*	%	S	
24	Teaching count data	–	0	–	S	
25	(Not used)	–	–	–	–	
26	Teaching movement data	–	100	%	S	
27	Teaching movement data 1	1 to 100	100	%	S	
28	Teaching movement data 2	1 to 100	50	%	S	
29	Teaching movement data 3	1 to 100	10	%	S	
30	Maximum program speed	1 to 100	100	%	S	
31	Mechanical lock detection level	0 to 255	255	.01s	Common	

32	Alarm number output	0 to 1	0	–	S	
33	Output accompanying return-to-origin	0 to 3	2	–	Common	
34	System mode selection	–	0	–	S	
35	Origin shift	-9999 to 9999	0	.01mm	S	Required
36	Origin search data	*	*	–	Common	
37	QP band width	*	*	Pulse	S	
38	Speed gain compensation gain	*	0	–	S	
39	Control mode selection	–	*	–	S	
40	RESET execution conditions selection	0 to 2	2	–	S	
41	I/O point movement command speed 1	1 to 100	10	%	S	
42	I/O point movement command speed 2	1 to 100	30	%	S	
43	I/O point movement command speed 3	1 to 100	70	%	S	
44	Maximum speed setting	*	*	mm/s, rpm	Common	
45	Feed forward gain (Kff)	–	0	–	Common	
46	Servo status output	0 to 1	0	–	Common	
47	Communication parameter setting	–	0	–	S	
48	Pre-operation action selection	0 to 3	1	–	S	
49	Controller version	R	*	–	Common	
50	Deceleration	1 to 100	100	%	S	
51	First program number	0 to 99(RO)	0	–	S	
52	Hold gain	–	*	–	S	
53	Zone output selection	0 to 255	0	–	S	
54	Magnetic detection level	–	*	–	Common	
55	Magnetic position	0 to 359	0	–	Common	
56	Controller version 2	R	*	–	Common	
57	Servo control processing selection*	–	2	–	Common	
58	(Not used)	–	0	–	Common	
59	(Not used)	–	0	–	Common	

■ PRM2 (Pulse train mode parameters)

PRM No.	Parameter name	Setting range	Default value	Unit	Relevant control mode, etc.	Power off and on
64	Input type	0 to 3	0	–	P	Required
65	Input pulse evaluation	1 to 4	4	–	P	Required
66	Input pulse logic	0 to 1	0	–	P	Required
67	E-gear 1 (G1)	1 to 32767	1	–	P	Required
68	E-gear 2 (G2)	1 to 32767	1	–	P	Required
69	INH input	0 to 1	1	–	P	Required
70	Servo-off sequence	0 to 3	0	–	P	Required
71	POS-deviation limit	0 to 32767	1000	256 pulses	P	–
72	Function select 1	0 to 3	0	–	P	Required
73	Magnetic pole detection method selection*	0 to 2	1	–	P	Required

* PRM57 and PRM73 are not used with the SRCD series.

5-3 Parameter description

This section describes parameters required for operation in pulse train mode.

- For other parameters not listed below, refer to "5-2 Parameter description" in the SRCP controller user's manual.
- The shaded PRM (parameter) numbers are hidden parameters and usually cannot be displayed on the TPB. See "10-5-1 Viewing hidden parameters" in the SRCP controller user's manual for information on how to write and display these parameters.

■ Return-to-origin parameters

PRM5	Return-to-origin direction	Input range	Default value	Unit
		0 to 1	–	–

Set the return-to-origin direction in which the robot moves with an ORG-S input.

Setting value	PHASER Series	FLIP-X Series
0	L side	Motor side
1	R side	Motor opposite side

PRM10	Return-to-origin speed	Input range	Default value	Unit
		1 to 100	20	mm/s

Sets the movement speed during return-to-origin with an ORG-S input.

* An alarm might trigger on some robots during return-to-origin if the return-to-origin speed was raised. Use the initial settings as much as possible.

■ Operation adjustment parameters

PRM6	Positioning completed pulse	Input range	Default value	Unit
		1 to 4000	80	Pulse

- The in-position (IN-POS) output turns ON when pulses accumulated in the deviation counter are within the ± setting value. The positioning completed pulse exerts no effect on the final positioning precision.

PRM17 PRM18	Speed proportional gain Speed integration gain	Input range	Default value	Unit
		–	–	–

These parameters set the response of the speed control system.

- The default value varies with each robot but the ratio of PRM17 to PRM18 is 3 : 2.

* Each YAMAHA single-axis series robot is set at the factory with its own optimal characteristic gain parameter as the default. In the event that the gain must be adjusted to improve work throughput, we recommend adjusting the position control system gain parameter. However, use plenty of caution since an extreme gain setting will trigger alarms and cause breakdowns.

PRM19	Position proportional gain	Input range	Default value	Unit
		–	–	–

Sets the response of the position control system.

- The default value varies with each robot. A value optimized for the maximum allowable load of each robot is registered.
- Generally input a value between the default value and 128.

PRM45	Feed forward gain	Input range	Default value	Unit
		–	0	–

Sets the feed forward gain of the position control system,

- Enter 2560 when using 100% of feed forward.
- Using feed forward gain improves the response. However, this has little effect on robots already having sufficiently high position proportional gain. Also, setting a high value may cause machine vibrations. Do not enter a value higher than 2000.

■ Pulse train mode parameters

PRM64	Input type	Input range	Default value	Unit
		0 to 3	0	–

Switches the mode and selects the input type for pulse train mode.

Setting value	Description
0	Normal mode
1	Phase A / phase B (pulse train mode)
2	Pulse train / code input (pulse train mode)
3	CW / CCW input (pulse train mode)

* For information on each input form, refer to "signal description" in "3-2 I/O specifications and wiring".

PRM65	Input pulse evaluation	Input range	Default value	Unit
		1 to 4	4	–

Selects the multiplication factor when the pulse input type is "phase A / phase B".

Setting value	Description
1	1× (multiplied by 1)
2	2× (multiplied by 2)
3	4× (multiplied by 4)
4	

PRM66	Input pulse logic	Input range	Default value	Unit
		0 to 1	0	–

Selects the command pulse logic.

Setting value	Description
0	Positive logic
1	Negative logic

* For information on the positive and negative logic, refer to "signal description" in "3-2 I/O specifications and wiring".

PRM67 PRM68	E-gear 1 (G1) E-gear 2 (G2)	Input range	Default value	Unit
		1 to 32767	1	–

Sets the movement distance (pulse rate) per 1 command pulse. Here,

- E-gear 1 is the numerator in the electronic gear ratio (=G1/G2), while E-gear 2 is the denominator.
- Make sure the setting is within a range of $1/20 \leqq (G1/G2) \leqq 100$.

* See "4-4 Electronic gear function" for information on how to set the electronic gear.

PRM69	INH input	Input range	Default value	Unit
		0 to 1	1	–

Enables/disables the INH input.

Setting value	Description
0	Enable
1	Disable

PRM70	Servo-off sequence	Input range	Default value	Unit
		0 to 3	0	–

Sets the deviation counter processing when an alarm or servo-OFF occurs.

Setting value	Description
0	Clears the deviation counter when an alarm or servo-OFF occurs.
1	Clears the deviation counter only when an alarm occurs.
2	Clears the deviation counter only when servo-OFF occurs.
3	Holds the deviation counter even when an alarm or servo-OFF occurs.

* Caution: If the deviation counter is not cleared then the next time the servo turns on, the robot will suddenly move by an amount equal to the number of accumulated pulses in the counter.

PRM71	POS-deviation limit	Input range	Default value	Unit
		0 to 32767	1000	×256 Pulse

Sets the alarm level for detecting values outside the deviation limit.

PRM72	Function select 1	Input range	Default value	Unit
		0 to 3	0	–

Selects a method for resetting alarms relating to input (emergency stop, DC24V supply) to EXT.CN.

Setting value	Description
0	Alarm reset input is required after canceling emergency stop and/or supplying 24 volts DC input.
1	Alarm reset input is required after supplying 24 volts DC input, but emergency stop is automatically reset after being cancelled.
2	Alarm reset input is required after canceling emergency stop, but 24 volts DC input is automatically reset after being input.
3	Auto reset after canceling emergency stop and/or supplying 24V DC input.

* This function was added to the controller version V24.07 or later.

PRM73	Magnetic pole detection method selection	Input range	Default value	Unit
		0 to 2	1	–

Selects the magnetic pole detection method.

Setting value	Description
0	Detects the magnetic poles only during return-to-origin.
1	Detects the magnetic poles during return-to-origin and during motion by pulse train input.
2	Detects the magnetic poles during return-to-origin and during motion by pulse train input. DO2 turns ON when detection is complete.

* This function was added to the controller version V24.16 or later.
* This parameter is effective only for the SRCP series.

MEMO

Chapter 6 Alarms

The SRCP/SRCD series controllers turns off the alarm output (ALM) when an error is detected.

To cancel the alarm:

- Turn the power off and then on again.
- Apply the alarm reset input (RESET) for at least the specified period of time.

(Note that some alarms can only be canceled by turning the power off and then on again.)

* Canceling the alarm while servo-on input (SERVO) is on is dangerous, as it allows the servo to turn on immediately. First turn the servo OFF and then cancel the alarm after checking that conditions are safe.

6-1 Checking the alarm

When an alarm occurs, check its status using the following method.

■ Alarm history

The SRCP/SRCD series stores data on the last 100 alarms that occurred. To check this alarm history on the TPB, see the "13-4 Viewing alarm history" in the SRCP controller user's manual.

* When an alarm that requires the power to be turned on again occurs, an alarm message appears along with an alarm buzzer after connecting the TPB.

■ Status LED indication

The LED on the front panel indicated the controller status.

LED display	Controller status
LED OFF	Power OFF
Green LED ON	Servo ON
Red LED ON	Indicate alarm cannot be cancelled by alarm reset. (Power must be turned off and then on again.)
Green and red LEDs flash (0.5 sec.)	Indicates that the robot is in emergency stop or that alarm can be cancelled by alarm reset.
Green LED flashes (1.5 sec) and red LED flashes (0.5 sec)	Servo OFF

6-2 Alarm list

■ Alarm message

No.	Message	Description	Power off and then on
01	OVER LOAD	Motor overload	Not required
02	OVER CURRENT	Motor drawing excess current	Required
03	OVER HEAT	Transistor heatsink temperature exceeds 90°C.	Required
04	POWER DOWN	Supply voltage is less than 85% of rated value.	Required
05	BATT.LOW-VOLTAGE	Voltage drop in system backup battery.	Required
06	24V POWER OFF	24 volt power is not supplied.	Not required
07	P.E.COUNTER OVER	Position deviation counter overflow.	Not required
08	PNT DATA DESTROY	Point data was destroyed.	Required
09	PRM DATA DESTROY	Parameter data was destroyed.	Required
10	PGM DATA DESTROY	Program data was destroyed.	Required
11	SYSTEM FAULT	Software operation out of control.	Required
12	BAD ORG-SENSOR	Origin sensor is defective.	Required
13	–	(Not used)	–
14	FEEDBACK ERROR 1	Control error detected.	Not required
15	FEEDBACK ERROR 2	Position signal wire is broken or disconnected.	Required
16	ABNORMAL VOLTAGE	Excessive voltage occurred.	Required
17	SYSTEM FAULT 2	LSI error in controller	Required
18	FEEDBACK ERROR 3	Mechanical lockup	Not required
19	SYSTEM FAULT 3	CPU error detected.	Required
20	–	(Not used)	–
21	–	(Not used)	–
22	VERSION MISMATCH	Version does not match.	Required
23	–	(Not used)	–
24	–	(Not used))	–
25	–	(Not used)	–
26	FEEDBACK ERROR 4	Motor wire is broken or disconnected, or miswired.	Not required
27	POLE SEARCH ERROR	Failed to detect magnetic pole.	Required

* In normal mode, alarms can be cancelled only after turning the power off and then back on again.
* For more details on alarms, refer to the SRCP controller user's manual.

■ Error message

Error number 38	Message	Pulse input mode
	Cause	A movement command that can be run only in normal mode was run while in pulse train mode.

* This message is only a warning and the alarm output (ALM) does not turn OFF.

6-3 Troubleshooting

■ Alarms

* For details on alarms, refer to the SRCP controller user's manual.

■ Troubleshooting

No.	Problem	Possible cause	Checkpoints	Corrective action
1	Robot won't move even with pulse input	SERVO (Servo ON input) is OFF.	• Connect the TPB, monitor the I/O information, and check the servo input on/off operation. • Check the status LED	• Set servo signal to ON • Correct the wiring
		In emergency stop	• Check the status LED	• Set emergency stop input to ON. • Correct the wiring
		PCLR (Deviation clear input) is ON.	• Connect the TPB, monitor the I/O information, and check the PCLR input on/off operation.	• Set the PCLR signal to OFF. • Correct the wiring
		INH (command pulse inhibit input) is OFF.	• Connect the TPB, monitor the I/O information, and check the INH input on/off operation.	• Set INH signal to ON. • Correct the wiring • Set PRM69 to1and disable INH input.
		ORG-S (Return-to-origin input) is ON.	• Connect the TPB, monitor the I/O information, and check the ORG-S input on/off operation.	• Set ORG-S signal to OFF. • Correct the wiring
		Alarm issued in controller	• Connect the TPB and check the alarm that was issued. • Check the status LED.	• Refer to the SRCP controller user's manual and troubleshoot that alarm.
		Wrong command pulse setting.	• Connect the TPB, and check the PRM64 (Input type) and PRM66 (Input pulse logic).	• Make setting according to host device command pulses.
2	Robot operation is unstable	No magnetic pole detection (SRCP series only)	• After turning on power check that ORG-S (Return-to-origin input) has been executed.	• After turning on power, setup a system for executing ORG-S.
		Gain is wrong		• Adjust gain manually.
		Robot and controller don't match each other	• Connect the TPB and check the robot type and controller version.	• Initialize the parameter. • Replace the controller
3	Abnormal sound can be heard.	Gain is wrong		• Adjust gain manually.
		Robot and controller don't match each other	• Connect the TPB and check the robot type and controller version.	• Initialize the parameter. • Replace the controller

Revision record

Manual version	Issue date	Description
Ver. 1.10	Feb. 2004	English manual Ver. 1.10 is based on Japanese manual Ver. 1.10.
Ver. 1.30	Oct. 2004	English manual Ver. 1.30 is based on Japanese manual Ver. 1.30.
Ver. 2.00	Apr. 2006	English manual Ver. 2.00 is based on Japanese manual Ver. 2.01.
Ver. 2.01	May 2007	English manual Ver. 2.01 is based on Japanese manual Ver. 2.01.

Supplementary Manual

YAMAHA Robot Controller **SRCP/SRCD Series**

Pulse Train Mode

May 2007
Ver. 2.01
This manual is based on Ver. 2.01 of Japanese manual.

IM Operations