IAI
Quality and Innovation

Table Top Type Robot TT

First Step Guide　Second Edition

Thank you for purchasing our product.
Make sure to read the Safety Guide and detailed Instruction Manual (CD) included with the product in addition to this First Step Guide to ensure correct use.
This Instruction Manual is original.

⚠ Warning : Operation of this equipment requires detailed installation and operation instructions which are provided on the CD included in the box this device was packaged in. It should be retained with this device at all times.
A copy of the CD Manual can be requested by contacting your nearest IAI Sales Office listed at the back cover of the Instruction Manual or on the First Step Guide.

Product Check

This product is comprised of the following parts if it is of standard configuration.
If you find any fault in the contained model or any missing parts, contact us or our distributor.

1. Parts (The option is excluded.)

No.	Part Name	Model
1	Robot Main Body (with a built-in controller)	Refer to “How to read the model plate” and “How to read the model of the controller.”
Accessories		
2	Power Supply Plug	AP-400-C　(Manufacturer: Yamate Electric Co., Ltd.)
3	I/O Flat Cable	CB-DS-PIO020
4	First Step Guide	
5	Operation Manual (CD)	
6	Safety Guide	

2. Optional Components

No.	Part Name	Model
1	Main Body Mounting Bracket (with set bolts and nuts)	TT-FT

3. Teaching Tool (Option)

The personal computer application software or teaching pendant is required for the operations including program creation and setup such as position setting and parameter setting with teaching. Use either of them.

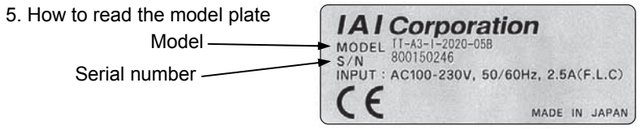
No.	Part Name	Model	Remarks
1	PC Software (with RS232C Cable + Emergency Stop Box)	IA-101-X-MW	RS232C→RS232C*1
2	PC Software (USB conversion adapter + RS232C cable + Cable and Emergency Stop Box)	IA-101-X-USB MW	USB→RS232C*1
3	PC Software (with USB Cable + Dummy Plug)	IA-101-TT-USB	USB→USB*1
4	Teaching pendant	SEL-T	—
5	Teaching pendant (with deadman switch)	SEL-TD	—
6	Teaching pendant	IA-T-X	—
7	Teaching pendant (with deadman switch)	IA-T-XD	—

*1　The communication port on the left is for the personal computer and on the right is for the TT.

4. Operation manuals related to this product, which are contained in the CD.

No.	Name	Manual No.
1	Table Top Type Robot TT Operation Manual	ME0149
2	PC software IA-101-X-MW Operation Manual	ME0154
3	Teaching pendant SEL-T/TD Operation Manual	ME0183
4	Teaching pendant IA-T-X/XD Operation Manual	ME0160
5	DeviceNet Operation Manual	ME0124
6	CC-Link Operation Manual	ME0123
7	PROFIBUS-DP Operation Manual	ME0153
8	X-SEL Ethernet Operation Manual	ME0140

5. How to read the model plate



6. How to read the Model No.

Model No. Example　TT ① − A3 ② − I ③ − 2020 ④ − 05B ⑤ − DV ⑥

①Series	②Type	③Encoder type	④XY Stroke	⑤Z Stroke	⑥Option
TT (Normal)	A2:Gate Type with 2-axis C2:Cantilever Type with 2-axis	I: Incremental	2020 200×200mm 4040 400×400mm	- 05B 50mm 10B 100mm	DV:DeviceNet Specifications CC:CC-Link Specifications PR:PROFIBUS Specifications ET :Ethernet Specifications FT :Main Body Mounting Bracket included P :I/O PNP Specifications
	A3:Gate Type with 3-axis C3:Cantilever Type with 2-axis				

Basic Specifications

[Common Specifications]

Item	Specifications
Surrounding air temperature・humidity	0 to 40°C, Room Humidity 20% to 85% or less
Motor Type	Pulse Motor (Servo Control)
Position detection method	Incremental Encoder
Driving System	Ball Screw (ϕ10mm, Rolled C10), Ball Screw Lead 6mm
Positioning Repeatability	± 0.02mm
Backlash	0.1mm or less
Guide	Direct Driven Infinite Circulation Type
Allowable Load Moment*1	Ma:6.5N•m　Mb:9.3N•m　Mc:16.4N•m

*1　Value found on the assumption of the life of 5000 km run

[Individual Mechanism Specifications]

Type		Stroke (mm) X Axis	Stroke (mm) Y Axis	Stroke (mm) Z Axis	Max. Speed for each axes (mm/sec) X Axis	Max. Speed for each axes (mm/sec) Y Axis	Max. Speed for each axes (mm/sec) Z Axis	Acceleration/ Deceleration (G)	Max. Load Capacity (kg)*2 X Axis	Max. Load Capacity (kg)*2 Y Axis	Max. Load Capacity (kg)*2 Z Axis	Weight (kg)	Model
Gate Type with	2-axis	200	200	-	300			0.3	10	5	-	14.8	TT-A2-I-2020
		400	400	-								33	TT-A2-I-4040
	3-axis	200	200	50	300		280	0.3	10	-	2	16.5	TT-A3-I-2020-05B
				100	300								TT-A3-I-2020-10B
		400	400	50	300		280					35	TT-A3-I-4040-05B
				100	300								TT-A3-I-4040-10B
Cantilever Type with	2-axis	200	200	-	300			0.2	-	4	-	16.3	TT-C2-I-2020
		400	400	-								35	TT-C2-I-4040
	3-axis	200	200	50	300		280	0.2	-	-	2	18	TT-C3-I-2020-05B
				100	300								TT-C3-I-2020-10B
		400	400	50	300		280					37	TT-C3-I-4040-05B
				100	300								TT-C3-I-4040-10B

*2　The load capacity in the case of rated acceleration is shown (Gate Type: 0.3G, Cantilever Type: 0.2G)

[Controller Specifications]

Item		Specifications	
Number of axes		2-axis	3-axis
Supply voltage		Single-phase 100 to 115VAC, 200 to 230VAC ± 10%	
Power frequency		50Hz/60Hz	
Power-source capacity	100VAC	150VA	210VA
	200VAC	155VA	215VA
Maximum Current*3		3A (100VAC), 1.6A (200VAC)	4.2A (100VAC), 2.2A (200VAC)
Rush Current*4		15A (100VAC), 30A (200VAC)	
Leakage Current		0.75mA	
Insulation Strength		2000VAC for 1 min.	
Momentary Power Interruption Tolerance		500μs or more	
Speed Setting		1 to 300mm/sec	
Acceleration Setting		0.01G to 0.3G	
Program language		Super SEL language	
Number of programs (Number of multitask programs)		64 programs (16 programs)	
Number of program steps		6000 steps (Total)	
Number of positions		3000 positions (Total)	
Program Startup		Special Digital Switch + Special Start Switch	
Data storage device		Flash ROM + SRAM*5	
Standard I/O Board		16 Input Points / 16 Output Points	
Applicable Field Bus		DeviceNet / CC-Link / PROFIBUS / Ethernet	
Protective functions		Over-voltage, motor over current, motor overload, driver temperature abnormality, encoder abnormality, etc.	

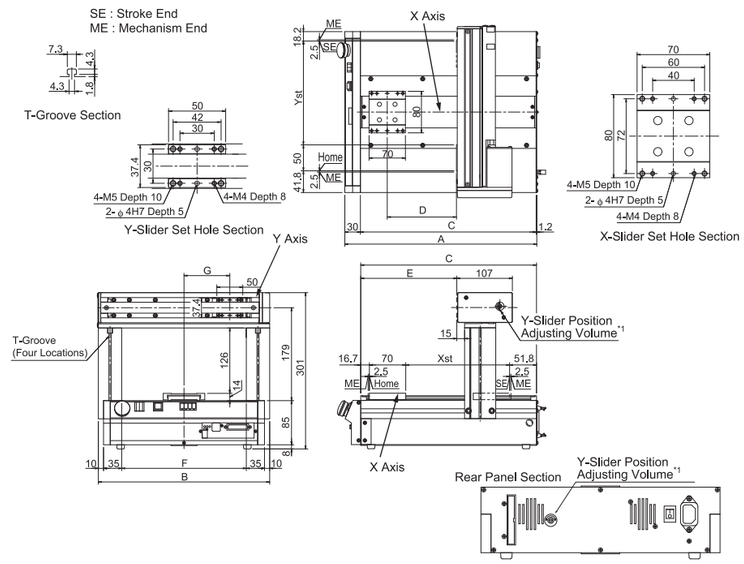
*3　The current reaches its maximum level when the servo-motor exciting phase is detected which is to be performed in the first servo-motor turning ON processing after the power injection. (Normal: Approx. 1 to 2 sec, Max.: 10 sec)

*4　Rush current at the power connection continues for about 20 msec. Consider the safety rate at the time when rush current passes. The rush current value varies depending on the impedance of the power line.

*5　The SRAM data is not battery backed up. Accordingly, when the power is turned off, the data of flags and variables used in the program, are not saved. Take the greatest care.
The same procedure is applied when the program or position data is not written on the Flash ROM.

External Dimensions

[Gate Type with 2-axis　TT-A2]

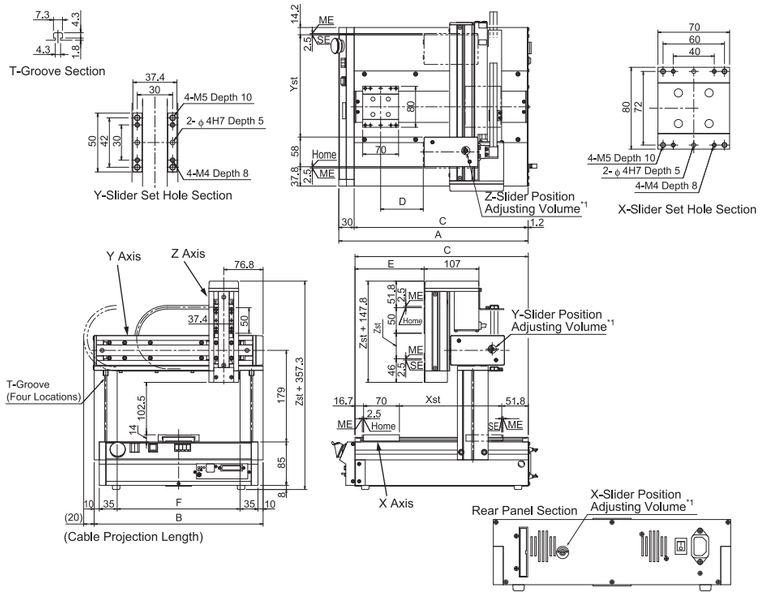


*1　Fine slider adjustment (for manual tweaking of position).

(Unit mm)

Model	A	B	C	D	E	F	G	Xst	Yst
TT-A2-I-2020	369.7	330	338.5	133.3	185	240	88.2	200	200
TT-A2-I-4040	569.7	530	538.5	333.3	385	440	188.2	400	400

[Gate Type with 3-axis　TT-A3]

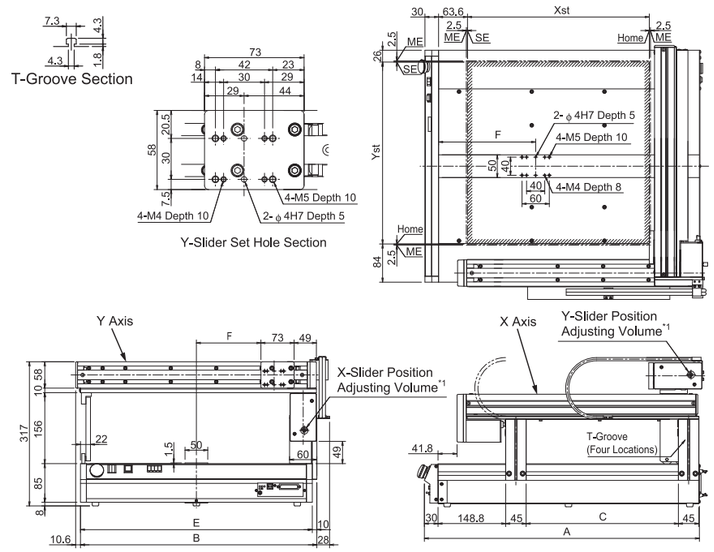


*1　Fine slider adjustment (for manual tweaking of position).

(Unit mm)

Model	A	B	C	D	E	F	Xst	Yst	Zst
TT-A3-I-2020-05B	369.7	330	338.5	83.3	135	240	200	200	50
TT-A3-I-2020-10B	369.7	330	338.5	83.3	135	240	200	200	100
TT-A3-I-4040-05B	569.7	530	538.5	283.3	335	440	400	400	50
TT-A3-I-4040-10B	569.7	530	538.5	283.3	335	440	400	400	100

[Cantilever Type with 2-axis TT-C2]

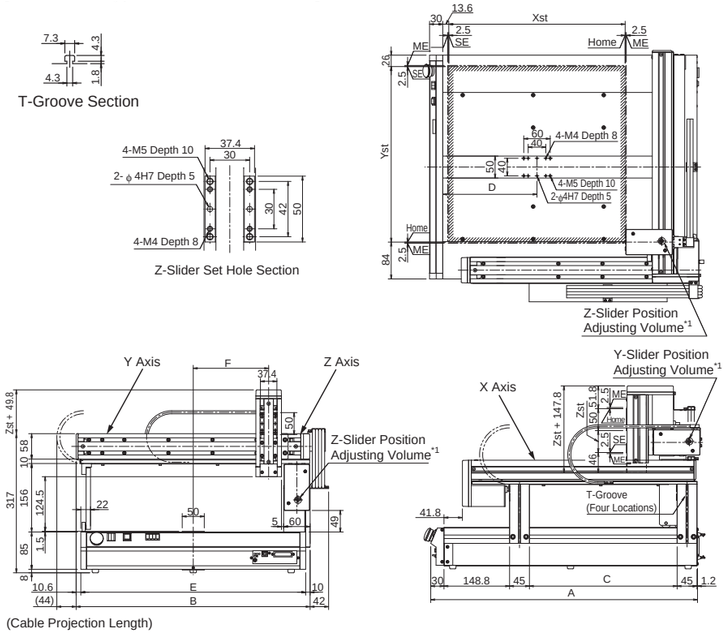


*1 Fine slider adjustment (for manual tweaking of position).

(Unit mm)

Model	A	B	C	D	E	F	Xst	Yst
TT-C2-I-2020	405	320	135	120	310	42	200	200
TT-C2-I-4040	605	520	335	213.6	510	142	400	400

[Cantilever Type with 3-axis TT-C3]



*1 Fine slider adjustment (for manual tweaking of position).

(Unit mm)

Model	A	B	C	D	E	F	Xst	Yst	Zst
TT-C3-I-2020-05B	405	330.6	135	120	310	71	200	200	50
TT-C3-I-2020-10B	405	330.6	135	120	310	71	200	200	100
TT-C3-I-4040-05B	605	530.6	335	213.6	510	171	400	400	50
TT-C3-I-4040-10B	605	530.6	335	213.6	510	171	400	400	100

Installation Environment

Do not use this product in the following environment:

- Location where the surrounding air temperature exceeds the range of 0 to 40°C
- Location where condensation occurs due to abrupt temperature changes
- Relative humidity less than 20%RM or greater than 85%RM
- Location exposed to corrosive gases or combustible gases
- Location exposed to significant amount of dust, salt or iron powder
- Location subject to direct vibration or impact
- Location exposed to direct sunlight
- Location where the product may come in contact with water, oil or chemical droplets

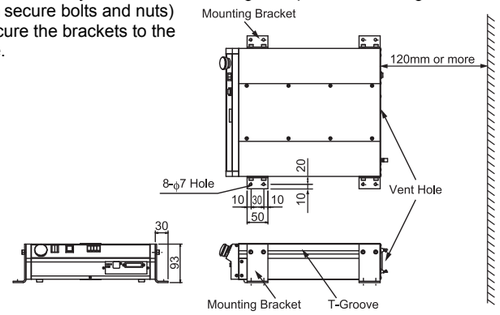
When using the product in any of the locations specified below, provide a sufficient shield.

- Location subject to electrostatic noise
- Location where high electrical or magnetic field is present
- Location with the mains or power lines passing nearby

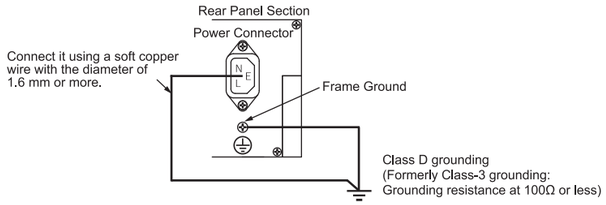
Installation and Noise Elimination

1. There is a cooling vent hole on the main body's rear panel section. Do not close the vent hole when the main body is installed.

2. When it required to fix the main body, fix it as follows using the optional mounting brackets (Model TT-FT: 4 sets with secure bolts and nuts) User supplied bolts to secure the brackets to the mounting surface or table.

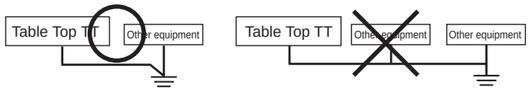


3. Protective Ground



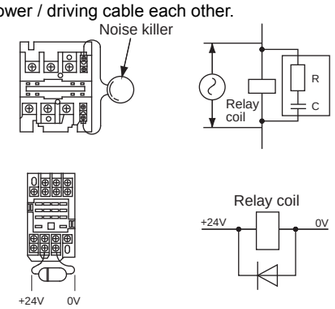
4. Noise Elimination Grounding (Frame Ground)
Connect it using a soft copper wire with the diameter of 1.6 mm or more to the frame ground on the main body (Refer to the above figure).

Do not share the ground wire with or connect to other equipment. Ground each controller. The same procedure is applied for the protective ground.



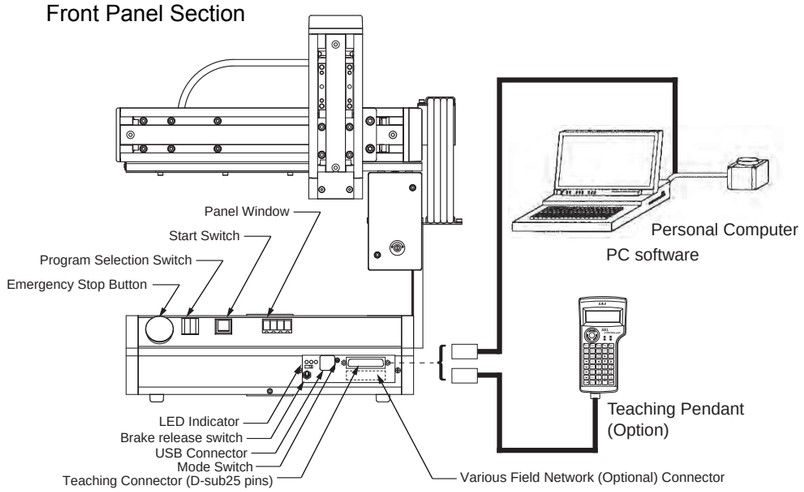
5. Precautions Regarding wiring Method
Separate the I/O cable, communication line and power / driving cable each other.

6. Noise Sources and Elimination
Carry out noise elimination measures for power devices on the same power path and in the same equipment. The following are examples of measures to eliminate noise sources:
①AC solenoid valves, magnet switches and relays
[Measure] Install a Noise killer parallel with the coil.
②DC solenoid valves, magnet switches and relays
[Measure] Install a diode parallel with the coil. Use a DC relay with a built-in diode.

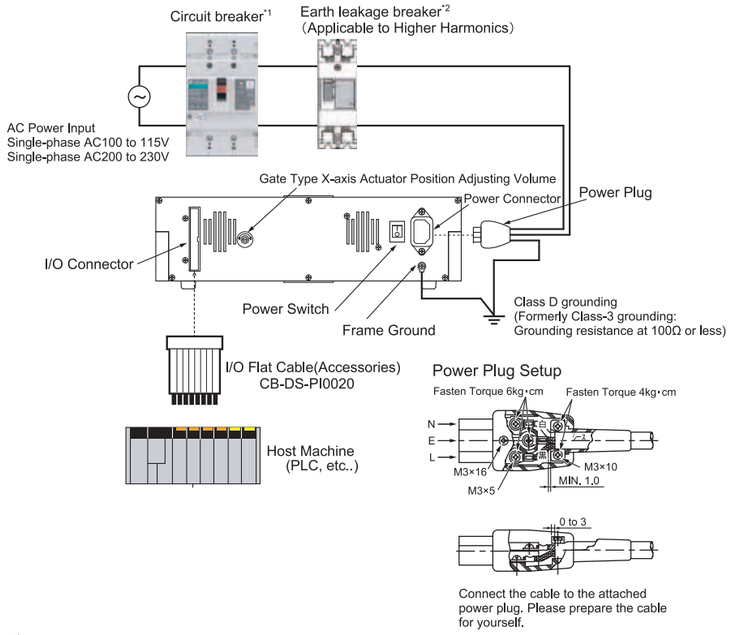


Connection Diagram

Front Panel Section



Rear Panel Section



*1 For the selection of the circuit breaker, perform it according to the following items.
Breaker Teaching pendant Value > Power Capacity ÷ AC Input Voltage
(Refer to the item for the controller specifications for the power capacity).
- The current reaches the maximum level when the servo-motor is turned on and the servo-motor exciting phase is detected. Select the circuit breaker rated current that does not trip the maximum current.
- Select the circuit breaker that does no trip with the rush current described in the controller specifications.
(Refer to the operating characteristic curve described in the manufacturer's catalog.)
- For the rated breaking current for the circuit breaker, select the breaking current value with which the current can be securely broken down even when short-circuit current passes.
Rated Breaking Current > Short-circuit Current = Primary Power Supply Capacity/Power Voltage.
- Select the breaking current value for the circuit breaker leaving some margin.

*2 When the leakage breaker is to be installed, it is required to select it with the purpose clarified such as protection from fire or human body protection.
Measure the leakage current at the location where the leakage breaker has been installed.
Use the "applicable to higher harmonics type" leakage breaker.

I/O Signals

Input

Pin No.	Electric wire color	Port No.	Function in Standard Setting (in Delivery)
1	BR 1	–	I/O Power Source +24V
2	RD 1	016	Universal Input
3	OR 1	017	Universal Input
4	YW 1	018	Universal Input
5	GN 1	019	Universal Input
6	BL 1	020	Universal Input
7	PL 1	021	Universal Input
8	GY 1	022	Universal Input
9	WT 1	023	Universal Input
10	BK 1	024	Universal Input
11	BR 2	025	Universal Input
12	RD 2	026	Universal Input
13	OR 2	027	Universal Input
14	YW 2	028	Universal Input
15	GN 2	029	Universal Input
16	BL 2	030	Universal Input
17	PL 2	031	Universal Input

Remarks: It is set to the universal input when it is delivered. However, the change of the input function is available with the I/O parameter setting.

Parameter*1 No.	Parameter Name	Remarks
30	Input function select 000*2	1: Program Start
31	Input function select 001	0: Universal Input 1: Software Reset
32	Input function select 002	0: Universal Input 1: Servo ON signal
33	Input function select 003	0: Universal Input 1: Program automatically started when the power ON is reset in AUTO mode and software is reset 2: Automatic Starting Program Signal
34	Input function select 004	0: Universal Input 1: All servo-axes soft interlock (OFF level)
35	Input function select 005	0: Universal Input 1: Pause Release (ON edge)
36	Input function select 006	0: Universal Input 1: Pause Signal (OFF level)
37	Input function select 007*3	0: Universal Input 1: Program No. appointment (LSB)
38	Input function select 008*3	0: Universal Input 1: Program No. appointment(The second bit)
39	Input function select 009*3	0: Universal Input 1: Program No. appointment(The third bit)
40	Input function select 010*3	0: Universal Input 1: Program No. appointment(The fourth bit)
41	Input function select 011*3	0: Universal Input 1: Program No. appointment(The fifth bit)
42	Input function select 012*3	0: Universal Input 1: Program No. appointment(The sixth bit)
43	Input function select 013*3	0: Universal Input 1: Program No. appointment(MSB : The seventh bit) 2: Error Reset (ON edge)
44	Input function select 014	0: Universal Input 1: Driving Power Interruption Cancellation Input (ON Edge)
45	Input function select 015	0: Universal Input 1: All Effective Axes Homing (ON Edge) 2: All Increment Effective Axes Homing (ON Edge)

*1 Set the input functions using the I/O parameter Nos. 30 to 45 (Input Function Selection 000 to 015) and set the port Nos. that assign the each of the set functions, using the I/O parameter Nos. 282 to 298.
*2 If the input function selection 000 (program start) is assigned to any port except for the Port No. 000, the start switch on the front panel is disabled.
*3 When the input function selection 007 to 013 (program No. designating digital switch) are assigned to any port except for the port Nos. 007 to 013, the program change digital switch on the front panel is disabled.

Output

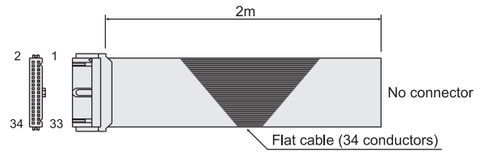
Pin No.	Electric wire color	Port No.	Function in Standard Setting (in Delivery)
18	GY 2	316	Universal Output
19	WT 2	317	Universal Output
20	BK 2	318	Universal Output
21	BR 3	319	Universal Output
22	RD 3	320	Universal Output
23	OR 3	321	Universal Output
24	YW 3	322	Universal Output
25	GN 3	323	Universal Output
26	BL 3	324	Universal Output
27	PL 3	325	Universal Output
28	GY 3	326	Universal Output
29	WT 3	327	Universal Output
30	BK 3	328	Universal Output
31	BR 4	329	Universal Output
32	RD 4	330	Universal Output
33	OR 4	331	Universal Output
34	YW 4	–	I/O Power Source 0V

Remarks: It is set to the universal output when it is delivered. However, the change of the output function is available with the parameter setting.

Parameter*4 No.	Parameter Name	Function
46 331	Output function select 300*5 Output function select 300 (Area 2)	0: Universal Output 1: Error Output at the operation cancellation level or more (ON) 2: Error Output at the operation cancellation level or more (OFF) 3: Error Output at the operation cancellation level or more + emergency stop output (ON) 4: Error Output at the operation cancellation level or more + emergency stop output (OFF)
47 332	Output function select 301*5 Output function select 301 (Area 2)	0: Universal Output 1: READY Output (PIO Trigger Program Operation Available) 2: READY Output (PIO Trigger Program Operation Available) and without occurrence of any error at the operation cancellation level or more 3: READY Output (PIO Trigger Program Operation Available) and READY Output (PIO Trigger Program Operation Available, and without occurrence of any error at the cold start level or more or more level or more
48 333	Output function select 302*5 Output function select 302 (Area 2)	0: Universal Output 1: Emergency-stop output(ON) 2: Emergency-stop output(OFF)
49 334	Output function select 303*5 Output function select 303 (Area 2)	0: Universal Output 1: AUTO Mode Output 2: Output during the Automatic Operation (In addition, when the parameter No. 12 is set to "1")
50 335	Output function select 304*5 Output function select 304 (Area 2)	0: Universal Output 1: Output at the time of "All Effective Axes Homing (=0)" 2: Output when all the effective axes homing is completed 3: Output when all the effective axes home preset coordinates are set
51 336	Output function select 305 Output function select 305 (Area 2)	0: Universal Output 2: Output during the first axis servo ON
52 337	Output function select 306 Output function select 306 (Area 2)	0: Universal Output 2: Output during the second axis servo ON
53 338	Output function select 307 Output function select 307 (Area 2)	0: Universal Output 2: Output during the third axis servo ON
54 339	Output function select 308 Output function select 308 (Area 2)	0: Universal Output
55 340	Output function select 309 Output function select 309 (Area 2)	0: Universal Output
56 341	Output function select 310 Output function select 310 (Area 2)	0: Universal Output
57 342	Output function select 311 Output function select 311 (Area 2)	0: Universal Output
58 343	Output function select 312 Output function select 312 (Area 2)	0: Universal Output
59 344	Output function select 313 Output function select 313 (Area 2)	0: Universal Output
60 345	Output function select 314 Output function select 314 (Area 2)	0: Universal Output
61 346	Output function select 315 Output function select 315 (Area 2)	0: Universal Output

*4 Set the output functions using the I/O parameter Nos. 46 to 61 (Output Function Selection 300 to 315) and set the port Nos. that assign the each of the set functions, using the I/O parameter Nos. 299 to 314. Also, setting the output functions using the I/O parameter Nos. 331 to 346 (Output Function Selection 300 Area 2 to 315 Area 2) and setting the Port Nos. that assign the each of the set functions, using the I/O parameter Nos. 315 to 330, are available.
When the system output signal is output to the I/Os on the above table, use the Output Function Selection Area 2.
*5 Because the output function selections 300 to 304 are allocated to the LEDs on the panel window, when the parameters of 46 to 50 are set to universal output, or the Port No. allocation is changed using the parameter 299 to 303 settings, the LEDs are disabled.

I/O Flat Cable (Accessories) CB-DS-PIO020

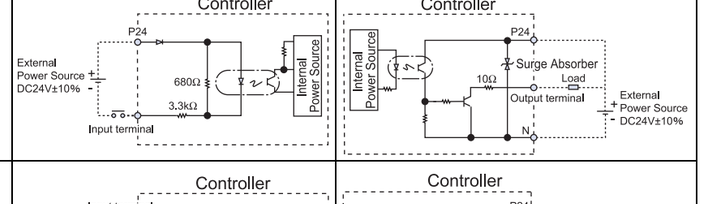


No.	Color	Wirings	No.	Color	Wirings
1	BR 1	Flat cable (Press welding)	18	GY 2	Flat cable (Press welding)
2	RD 1		19	WT 2	
3	OR 1		20	BK 2	
4	YW 1		21	BR 3	
5	GN 1		22	RD 3	
6	BL 1		23	OR 3	
7	PL 1		24	YW 3	
8	GY 1		25	GN 3	
9	WT 1		26	BL 3	
10	BK 1		27	PL 3	
11	BR 2		28	GY 3	
12	RD 2		29	WT 3	
13	OR 2		30	BK 3	
14	YW 2		31	BR 4	
15	GN 2		32	RD 4	
16	BL 2		33	OR 4	
17	PL 2		34	YW 4	

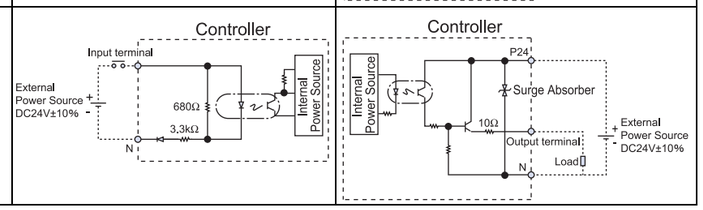
I/O Specifications

Specifications	Input section			Output section	
	Item		Specifications	Item	Specifications
	Input voltage		24VDC±10%	Load voltage	24VDC
	Input current		7mA 1 circuit	Peak load electric current	100mA/1 point 400mA/8 ports※6
	ON/OFF Voltage	NPN	ON Voltage : MIN. 16VDC OFF Voltage : MAX. 5VDC	Leak current	MAX. 0.1mA/1 point
		PNP	ON Voltage : MIN. 8VDC OFF Voltage : MAX. 19VDC	※6 The total of load current reaches max. 400mA every 8 ports from output port No. 300.	

NPN



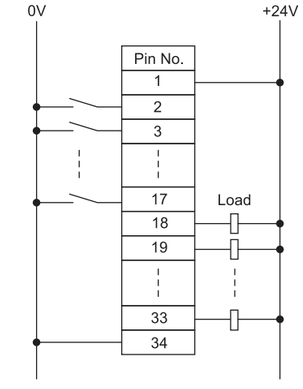
PNP



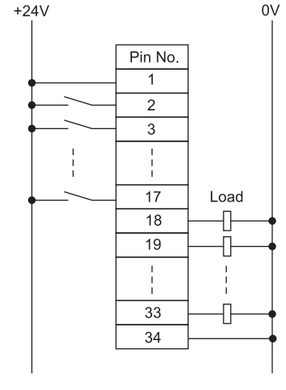
For the input and output, an equivalent circuit expressing the logic is used.

I/O Circuit Diagrams

NPN Specifications

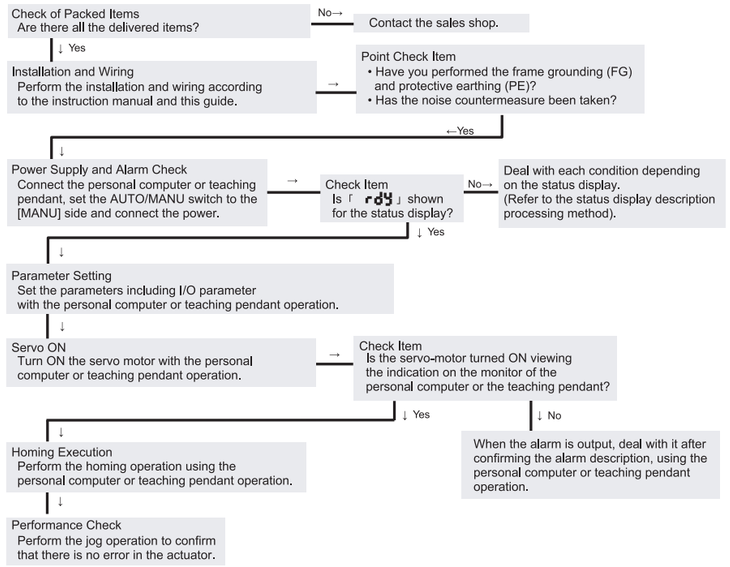


PNP Specifications



Starting Procedures

When using this product for the first time, make sure to avoid mistakes and incorrect wiring by referring to the procedure below.



Set-up for operation is completed.

Troubleshooting

The following alarm displays are frequently generated at the start-up operation.
Deal with each of them referring to the following table.

Status display	Status contents	Cause and Remedy
ErG	During Emergency-stop	It is not an alarm. • It is caused when the emergency stop button is not cleared on the front panel. Clear it. • It is generated when the emergency stop switch in the teaching pendant or the personal computer application software is not cancelled. In such case, cancel it. • It is generated when the personal computer cable is not connected to the emergency stop box.
dSF	Deadman switch OFF	It is not an alarm. • It generated when the AUTO/MANU switch has been set to “MANU” and the personal computer or the teaching pendant is not connected. Connect the personal computer or the teaching pendant or set the AUTO/MANU switch to “AUTO”. • When the actuator is to be started up, hold the deadman switch on the teaching pendant to turn it on.
ACF	AC Power Interruption Momentary Power Failure Power Voltage Drop	It is generated when the power voltage is not supplied. Check the power supply.
EE69	24V /O Error	It is generated when the +24V power for I/O is not supplied. Check the power supply. (Procedure for starting up I/O 24V power unit without connection) Set both the I/O parameter No. 10 and No. 12 to “0”. In this case, the I/O connection is invalid.
EdS□	Field Bus Error	It is generated when the field bus link connection is not established. Check the link cable connection, I/O parameter and PLC parameter settings. (How to start up the controller without connecting the field bus) Set both the I/O parameter No. 10 and No. 12 to “0”.

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