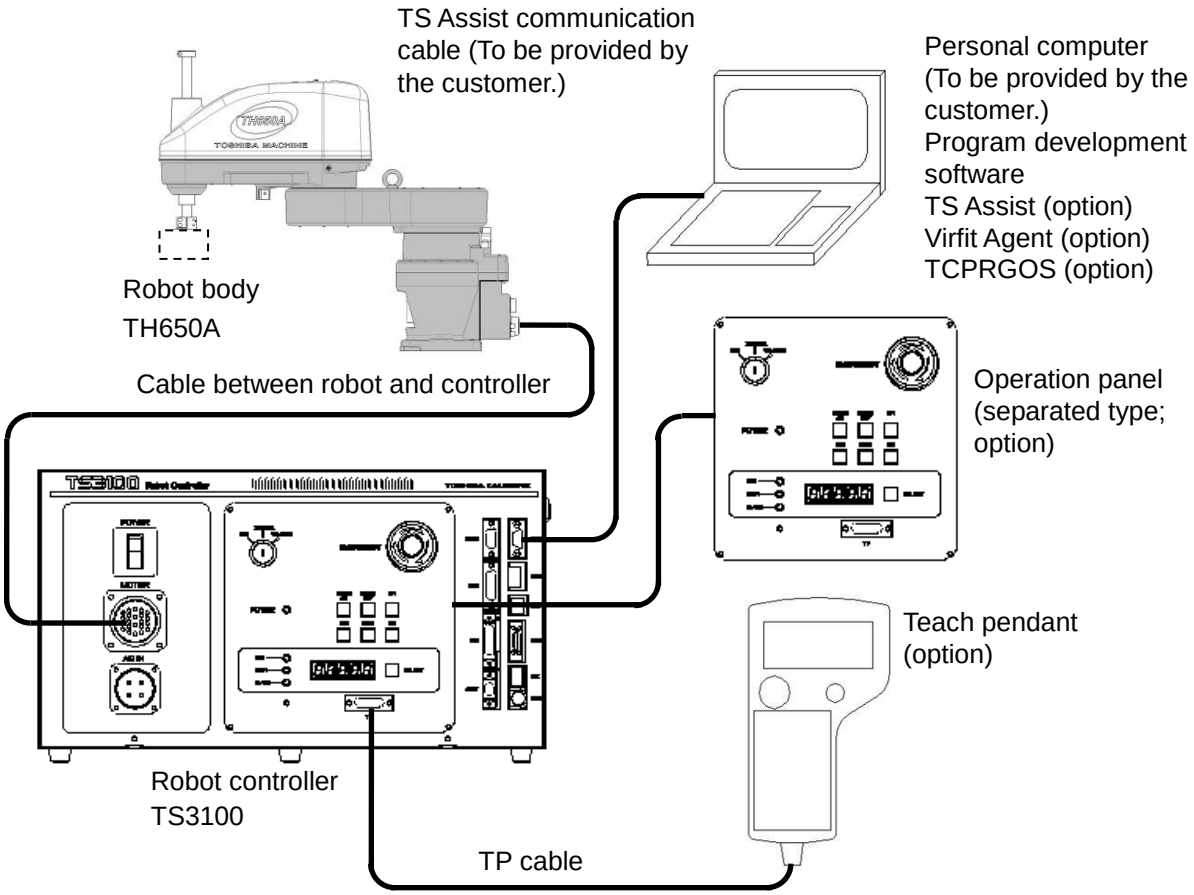
SCARA ROBOT
SPECIFICATIONS

TH650A/TS3100

August 2010

TOSHIBA MACHINE CO., LTD.

1. Structure of Robot Equipment



Structural drawing of robot equipment

[Standard equipment]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Robot Body	TH650A	1	
2	Cable between robot and controller	(5 m)	1	
3	Robot controller	TS3100	1	
4	SYSTEM connector	SYSTEM	1	Standard accessory
5	EMS connector	EMS	1	Standard accessory
6	Dummy plug for teach pendant		1	Standard accessory
7	System disk		1	Standard accessory
8	Master mode selector key		1	Standard accessory
9	High speed input signal connector (TRIG)		1	Standard accessory D-SUB15PIN
10	Power connector (with clamp)	ACIN	1	Standard accessory
11	Arm clamp		1	Standard accessory
12	Character specification	English version		
13	Polarity of controller	Minus (-) common		

[Robot Mechanical Option]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Z-axis long stroke 400 mm	Z		
2	Ceiling mount (Up-side-Down)	T		
3	Specifications pursuant to CE marking	E		
4				
5				

[Optional specifications (dust-proof and clean specifications)]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Clean Z-axis grease			
2	Z-axis bellows	B		
3	Z-axis upper cap for second arm	C		
4	Air Purge			
5	Clean specification (ISO Clean Class 3)	CRB		
6	IP65 specification	IP		

[Optional equipment (Electrical side)]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Teach pendant (5 m)	TP1000		
2		TP3000		
3	Extended cable for Teach pendant			10 m/15 m
4	Polarity of controller	Type-P		Plus(+) common
5	Cable between robot and controller			8 m/10 m/15 m/25 m
6	Tool air piping (Cannon connector type)	CN0		Standard-SUB
7	External input signal cable	INPUT		Cable length: 6 m
8	External output signal cable	OUTPUT		Cable length: 6 m
9	External I/O signal cable	SYSTEM		Cable length: 6 m
10	I/O signal connector	SYSTEM		Separate item
11	Use of lithium battery			

[Controller Option]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Separated operation panel			
2	Controller side bracket			2 pcs. per set
3	Controller (longitudinal)			
4	Addition of extension I/Os	TR48DIOCN-1		Type-N
5		TR48DIOC-1		Type-P
6	Program development software	TS Assist		With instruction manual
7		Virfit Agent		With instruction manual
8		TCPRGOS		With instruction manual
9	TCPRGOS cable			
10	RS-232 Port	COM2		
11	Safety box for control category3	TS3SFB		ISO13849-1
12	Conveyor synchronization function			
13	Latch function			
14	Network function	Profibus		*1
15		DeviceNet		
16		CC-Link		
17		EtherNet/IP		
		EtherCAT		
		PROFINET		

*1: For fieldbus slave modules, any of the six types, Profibus, DeviceNet, CC-Link, EtherNet/IP, EtherCAT and PROFINET, can be selected. It is necessary to select which fieldbus to use when an order is made.

[Documents]

No.	Name of Equipment	Type	Q'ty	Remarks
1	Specifications manual		1	This manual
2	Complete instruction manual (DVD)		1	Japanese version and English version

Standard instruction manual (Total of nine documents):

Alarm manual, Operator's manual, Robot language manual, Interface manual, Transportation and installation manual, Maintenance manual, Safety manual, Communication manual, User parameter manual.

Option instruction manual (Total of nine documents):

Dust-&drip-proof type industrial robot specifications manual, Clean type industrial robot specifications manual, I/O cables manual, Vision sensor + conveyor synchronization function manual, Simple plc function manual, Field bus slave function manual, Conveyor synchronization function manual,TS3SFB unit manual, TP3000 operator's manual, Additional function manual.

2. Robot Specifications

2.1 Robot TH650A Specification

No	Item		Specification	Remarks
1	Type		Horizontal multi-joint	
2	No. of controlled axes		4 axes	
3	Arm length	Full length	650 (mm)	
		Arm 1	300 (mm)	
		Arm 2	350 (mm)	
4	Working envelope	Axis 1	±160 (deg)	
		Axis 2	±143 (deg)	
		Axis 3	0 to 200 (mm)	
		Axis 4	±360 (deg)	
5	Maximum speed	Axis 1	340 (deg/sec)	
		Axis 2	600 (deg/sec)	
		Axis 3	2050 (mm/sec)	
		Axis 4	1700 (deg/sec)	
		Composite	7.52 (m/sec)	Axes 1 and 2 composition
6	Maximum payload mass		10 (kg)	*1
7	Cycle time (payload: 2 kg)		0.31 (sec)	*2
8	Permissible load inertia		0.1 (kgm^2)	*1
9	Positioning repeatability	X-Y	±0.01 (mm)	*3
		Z (axis 3)	±0.01 (mm)	
		C (axis 4)	±0.004 (deg)	
10	Drive system		AC Servo Motor for all axis	
11	Robot body	Mass	52 (kg)	
		Painting color	Body: Light-gray Arm cover: White	*4
12	Power supply		3.5 kVA	

*1 : The speed and acceleration rates are limited depending on motion patterns, payload mass, and offset value.

*2 : Continuous operation of standard cycle motion pattern is not possible beyond the effective load ratio. (Horizontal 300 mm, vertical 25 mm, round-trip, coarse positioning)

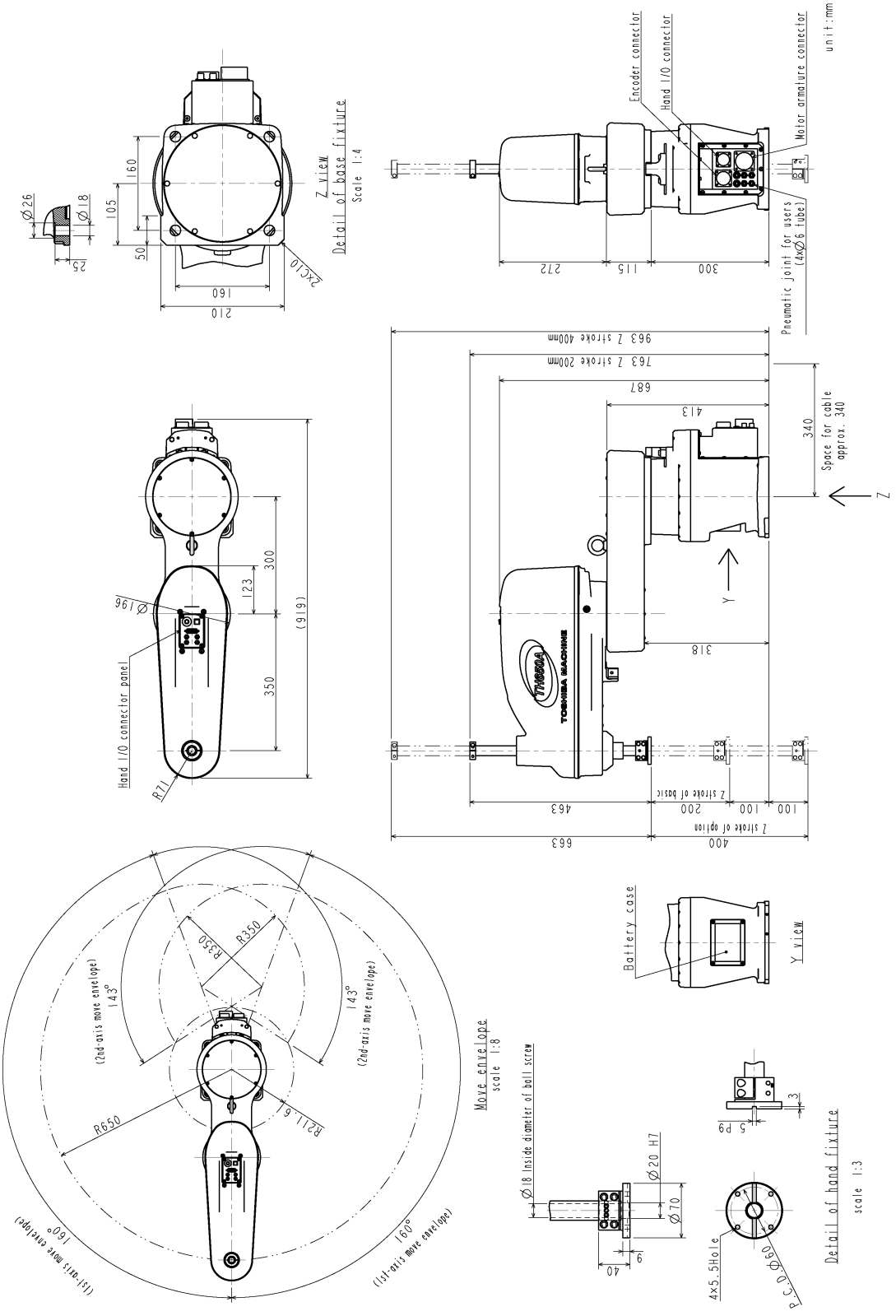
*3 : One way positioning repeatability when the environment temperature is constant at 20 degrees Celsius. The specification value may be exceeded depending on the moving pattern, load mass, and offset amount. Absolute position accuracy is not ensured. Positioning repeatability about X-Y and C is value in case of Z-axis upper side. Trajectory accuracy is not ensured.

*4: The robot painting color may vary depending on the production lot. It does not affect the quality of the product.

⚠ CAUTION

- Vibrations may occur depending on the robot posture. In such a case, reduce the acceleration.
- Before moving the axes 1, 2, and 4, ensure the Z-axis (axis 3) is at its highest position possible.
  If the axes 1, 2, and 4 are moved while the Z-axis is lowered, the ball screw spline (Z-axis shaft) may be damaged prematurely.
  If it is necessary to move the axes 1, 2, and 4 while the Z-axis is lowered, adjust the operation speed and acceleration using the commands SPEED, ACCEL, DECEL, and PAYLOAD to prevent vibrations of the ball screw spline.
  Be very careful not to collide with an object when moving the axes 1, 2, and 4 while the Z-axis is lowered.
  Even though the axes 1, 2, and 4 are moved slowly, the ball screw spline (Z-axis shaft) may be damaged due to collision with an object before the alarm is triggered.
- Cable duct may contact with second arm by duct deflection when wires and pipes are fixed on cable duct.
- Using an alkaline battery under high temperature may increase the risks of battery fever, leakage, and burst. It may also decrease the battery's capability and lifespan.
  Consult with us when you need to use the robot under high temperature conditions.

2.2 External view TH650A



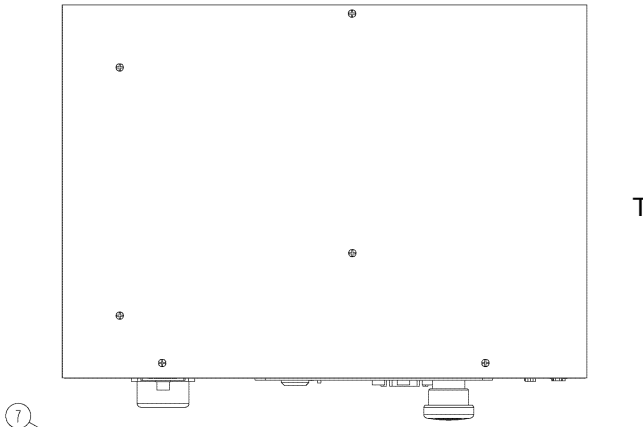
3. Controller Specifications

3.1 Controller TS3100 Specifications

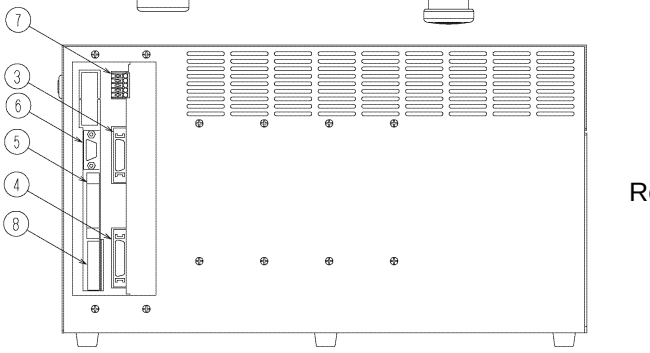
No.	Item		Specification	Remarks
1	No. of controlled axes		No. of simultaneously controlled axes: 6 axes	
2	Motion mode		PTP (point-to-point), CP (continuous path; straight line, circular), short-cut, arch	
3	Servo system		Digital servo	
4	Storage capacity		Total: Approx. 12,800 points + 25,600 steps1 program: Approx. 2,000 points + 3,000 steps	1.5 M bytes
5	No. of registrable programs		Max. 256 (User file: 247, system file: 9)	
6	Auxiliary memory		USB memory	
7	Storage		Battery backup RAM	
8	Position detection		By absolute encoder	
9	Teaching method	Teaching points	Remote: To be guided through the teach pendant.	
			Coordinate: Coordinates X, Y, Z, C and T are entered through the teach pendant.	
			Servo-free: Arms are moved by operator's hands.	
		Program input	Input through the teach pendant.	
10	External input/output signals		32 inputs/32 outputs	
11	Hand control signal		8 inputs and 8 outputs	
12	External control signal	Input	Program selection, start, stop, program reset, etc.	
		Output	Servo ON, operation ready, fault, cycle stop, etc., etc.	
13	Serial communication port		RS232C: 2 ports (general for HOST, COM1) RS232C: 2 ports (exclusive for TCPRG, and POD) RS485: 1 port (exclusive for extended I/O) RS422: 1 port (exclusive for TP1000) Ethernet: 1port	
14	Speed setting		Override /speed limit /program command:0 ~ 100% each	
15	Acceleration setting		Program command:1 ~ 100%	
16	Torque limit		Program command	
17	Teaching unit		Teach pendant	

No.	Item		Specification	Remarks
18	Coordinate system		World, work, tool, base (Base, work and tool coordinate systems can be set separately.)	
19	Motion limit		Soft limit	
20	Self-diagnostic function		Detection of various errors, etc.	
21	Interruptive function		Start of interruptive program by input signal	
22	Operation mode		Internal auto, external auto (I/O), external communication	
23	Operation method	Internal operation mode	Continuous, cycle, step, motion step	
		External operation mode	Cycle, continuous	
24	Controller	Outer dimensions	420(W)×230(H)×298(D)	
		Mass	17 (kg)	
		Painting color	White	
25	Power supply		Single-phase, AC200 V ~ 240 V, 50/60 Hz	
26	Personal computer software TS Assist		Program creation/ teaching, remote operation, etc.	
27	Program language		SCOL	

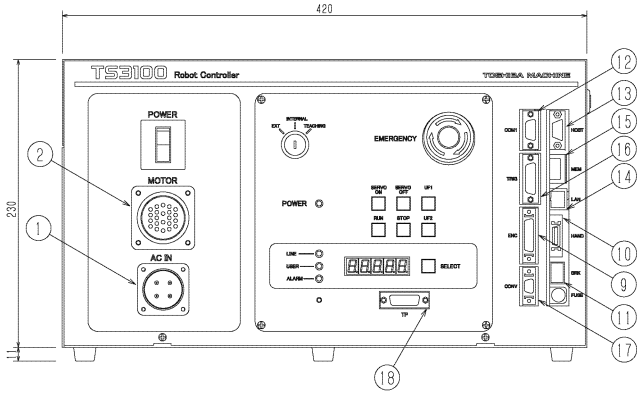
3.2 External View of Controller TS3100



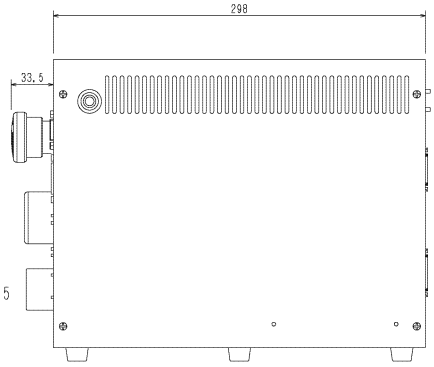
Top view



Rear view



Front view



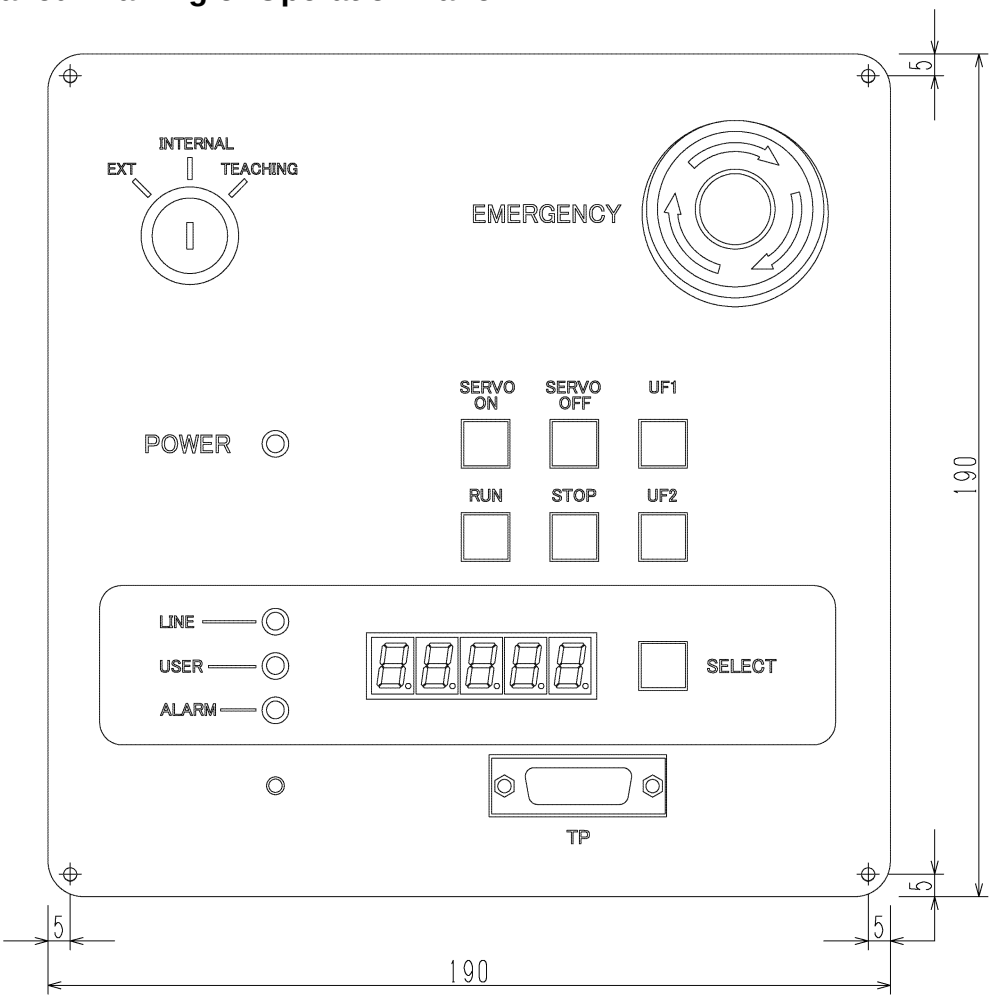
Right side view

External interface

[1]	AC IN	: Power supply
[2]	MOTOR	: Robot motor drive cable
[3]	INPUT	: External control input signal
[4]	OUTPUT	: External control output signal
[5]	SYSTEM	: External operation input/output signal
[6]	TCPRG	: Port for editing sequence program/touch panel
[7]	EXT I/O	: RS485 port for connecting TC200/terminal block I/O
[8]	EMS	: Safety signal cable
[9]	ENC	: Robot encoder cable
[10]	HAND	: Robot hand control signal
[11]	BRK	: Brake signal

[12] COM1 : Serial communication port for external equipment
[13] HOST : Serial communication port for user
[14] LAN : TCP/IP port
[15] MEM : Auxiliary memory port
[16] TRIG : High-speed input signal cable
[17] CONV : Conveyor encoder cable
[18] TP : Exclusive serial port for teach pendant

3.3 Detailed Drawing of Operation Panel



Controller TS3100 operation panel

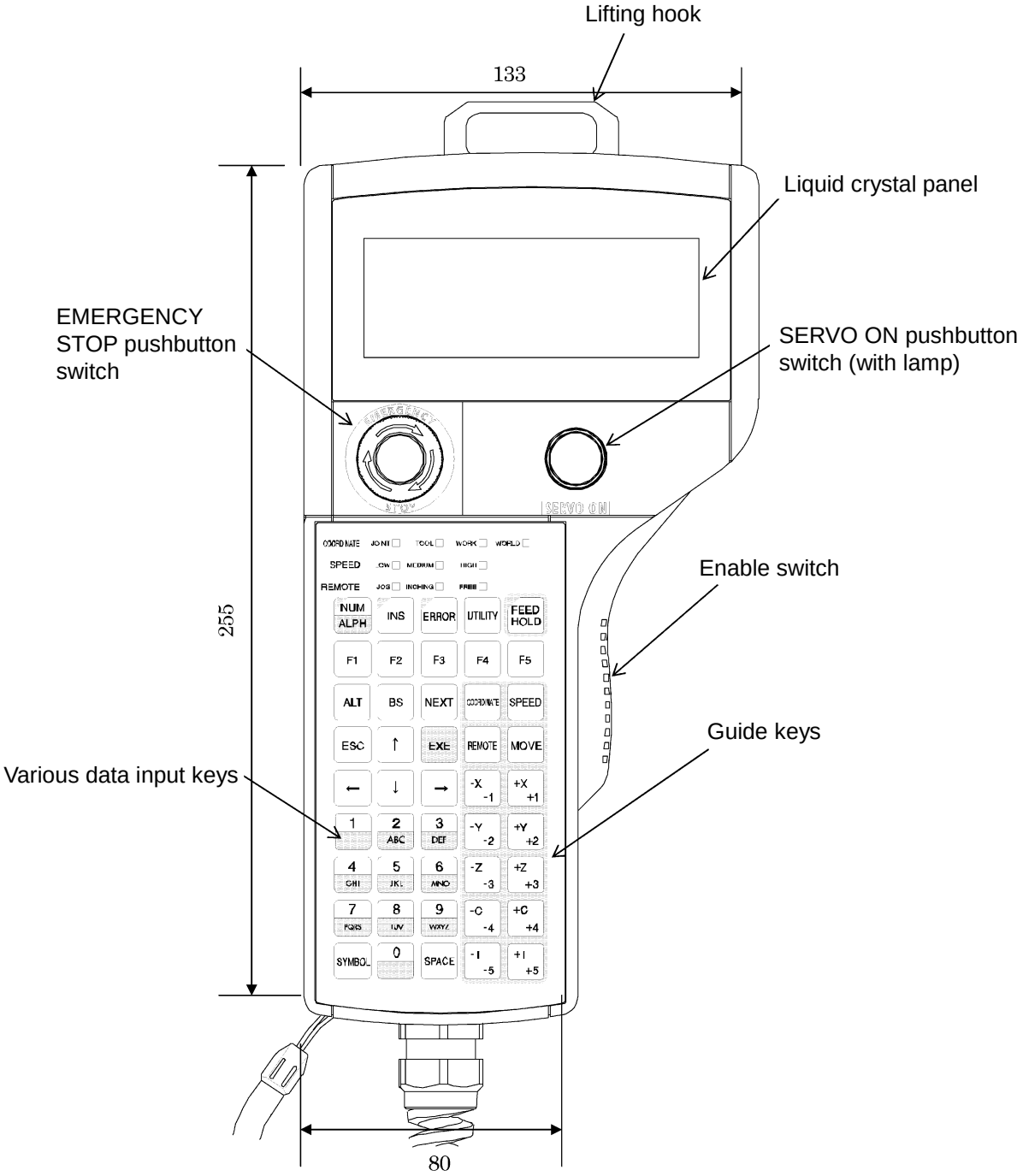
3.4 Outline Drawing of Teach Pendant

Teach Pendant (Model TP1000)

Body thickness: 48 mm (including EMERGENCY STOP button: 56 mm)

Weight: 600 g (not including cable)

Cable length: Standard 5 m



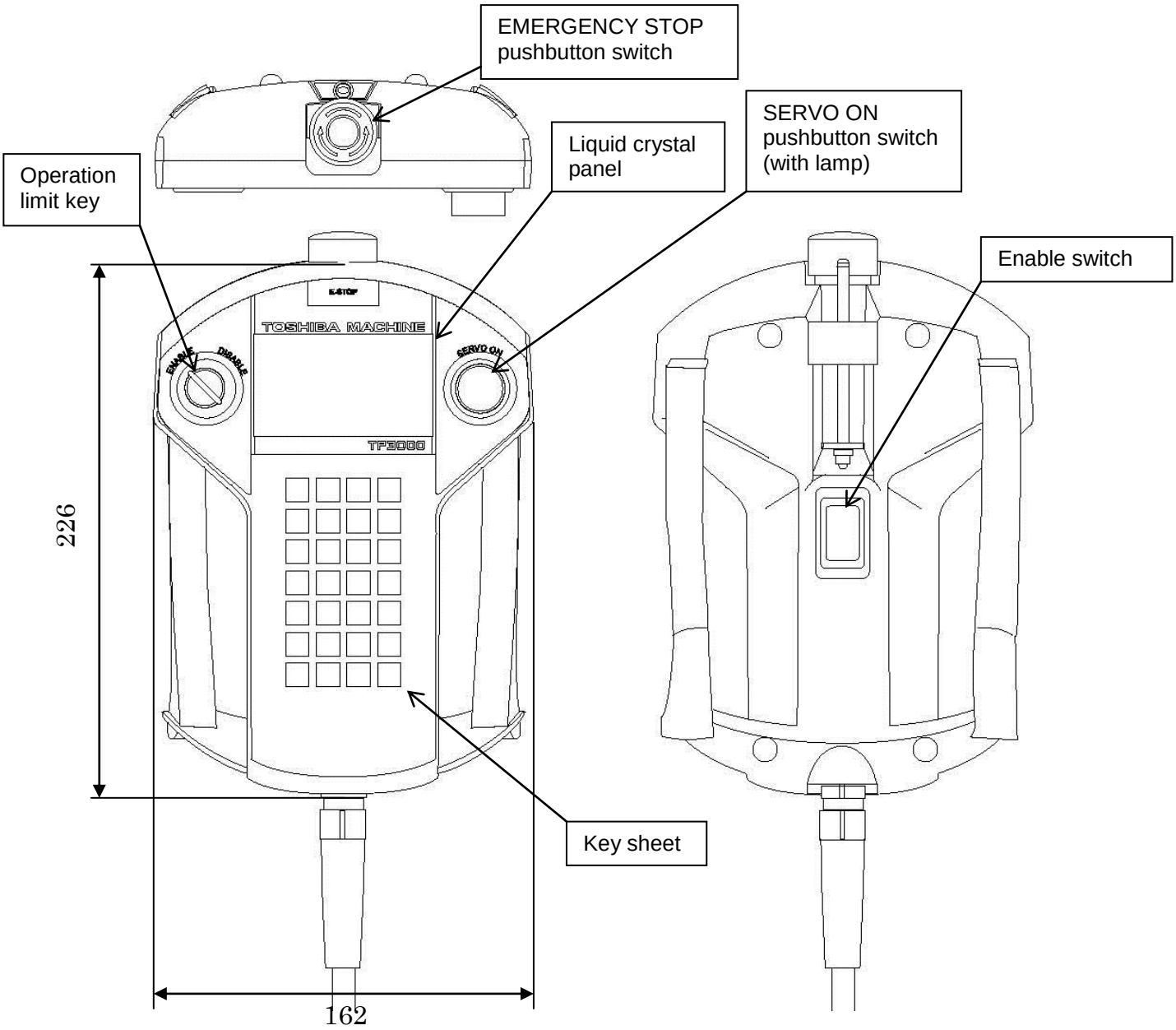
3.5 Outline Drawing of Teach Pendant

Teach Pendant (Model TP3000)

Body thickness: 55 mm (including SERVO ON pushbutton switch)

Weight: 520 g (not including cable)

Cable length: Standard 5 m



1）Software

Item	Data	Remarks
Model	TP3000	
Push-button switch	1 (SERVO ON)	
Key switch	There（2Position）ENABLE/DISABLE	
Screen size	3.4”	
Screen color	Organic EL color	
Keyboard	28（Variable）	
Data transfer interface	USB 2.0	Maintenance
Data storage media	MicroSD Card	Maintenance
Communication speed	9600～38400 bps	
Safety switch	3-position	
Emergency stop switch	1	
Backlight	There	
Protection class	IP65	IP65 non-cable connectors (D-SUB)
Cable length	Standard: 5m	
Size mm （Thickness / width / length）	226/162/55	
Mass (g)	520g	Except cable

2）Hardware

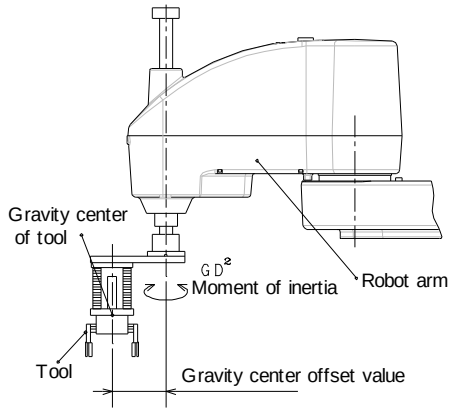
Item	Data	Remarks
Model	KeTop T20 techno	
Interface	RS422A	
Supply voltage / current	24V/250mA	
Operating temperature range	0～45°	
Impact resistance	Up to 1.5m drop height	
OS	MS Windows Embedded CE 6.0	

4. Specification of Permissible Load Conditions

4.1 Permissible Load Conditions

Load on the robot's end effectors should always fall under the values given in the table below.

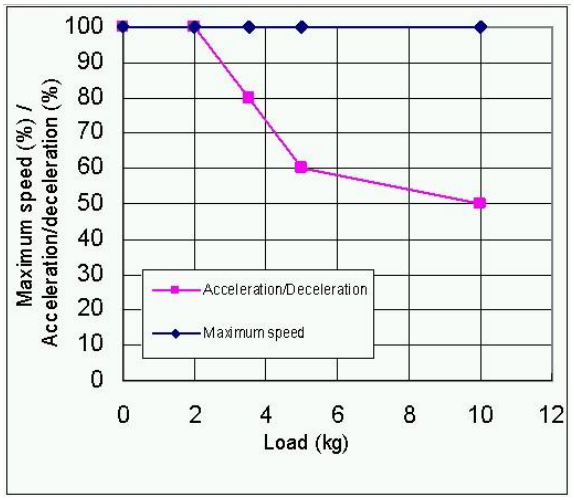
As the maximum speed and acceleration/deceleration time of the robot vary with the load conditions, the mass and offset value should be set by using the payload command in the program. Because the TH-A series is adjusted more precisely to realize high-speed operation, compared with the previous series, be sure to use the payload command. If the robot is operated, exceeding the permissible load conditions, or if the payload command is not used, the robot may operate improperly and the robot service life may be shortened. Shown below are the relationships between the acceleration and permissible load conditions.



Conditions	Allowance
Mass	Rated: 2 kg (max. 10 kg) Setting of maximum acceleration when load mass is under 2 kg.
Load inertia	Max 0.1 kg • m^2
Gravity center offset	Max 100 mm (load ≤ 10 kg)

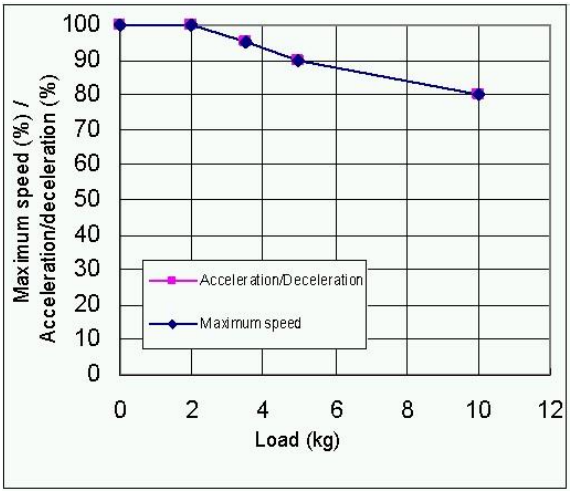
a) Unless the load offset is present, the maximum speed and acceleration/deceleration time in relation to the mass of load should be set as shown below.

Setting of maximum speed and acceleration/deceleration in relation to load mass (Axis 1)



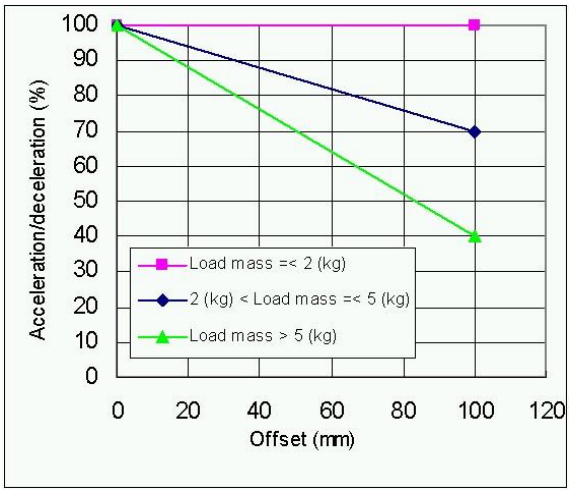
Setting of maximum speed and acceleration/deceleration in relation to load mass (Axis 2)

Setting of maximum speed and acceleration/deceleration in relation to load mass (Axis 3)

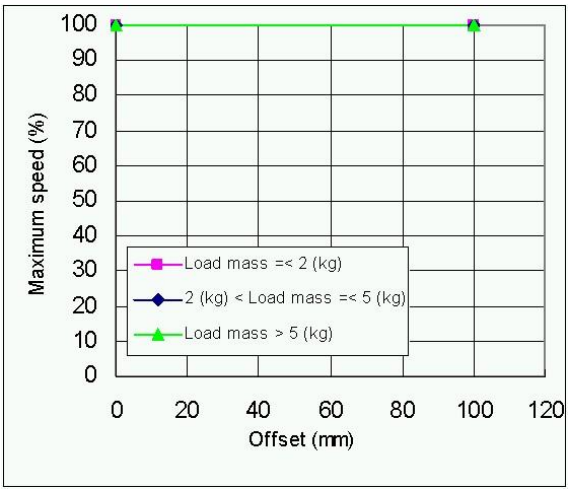


Setting of maximum speed and acceleration/deceleration in relation to load mass (Axis 4)

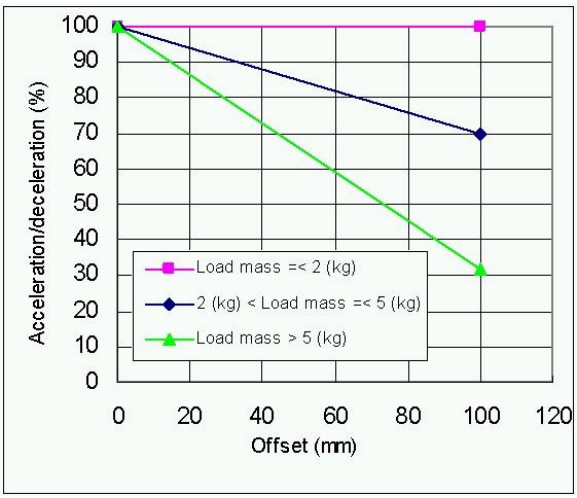
b) If the load offset is present, the offset is further limited in addition to Para. a) above. The maximum speed and acceleration/deceleration time in relation to the offset are shown below.



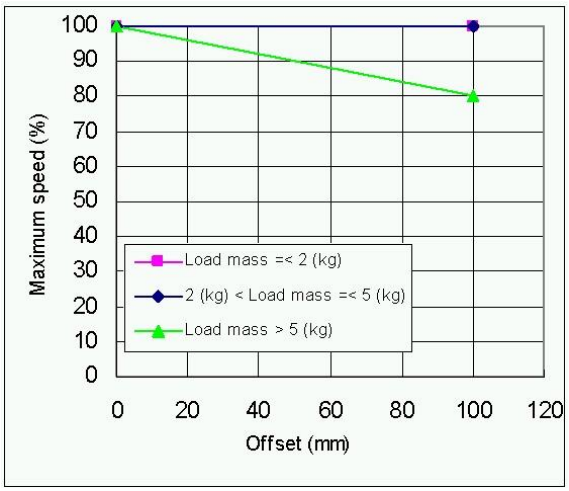
Setting of acceleration/deceleration time in relation to offset value (Axis 1)



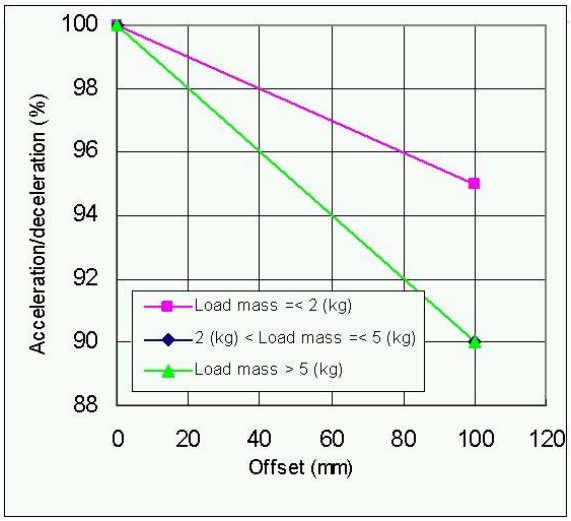
Setting of maximum speed in relation to offset value (Axis 1)



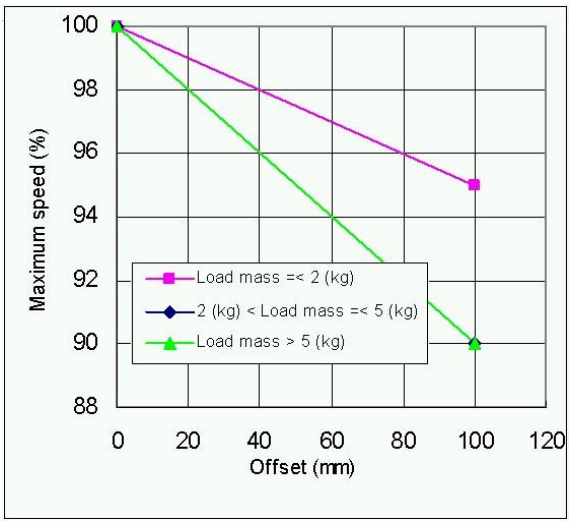
Setting of acceleration/deceleration time in relation to offset value (Axis 2)



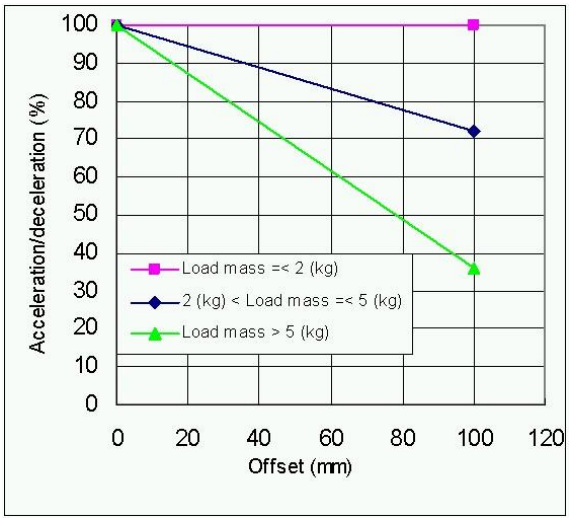
Setting of maximum speed in relation to offset value (Axis 2)



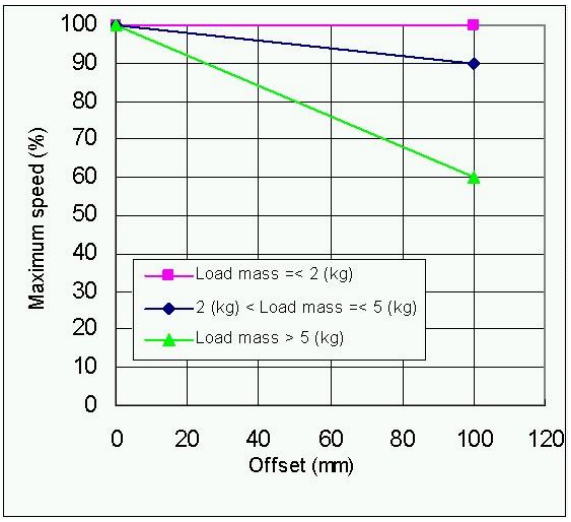
Setting of acceleration/deceleration time in relation to offset value (Axis 3)



Setting of maximum speed in relation to offset value (Axis 3)



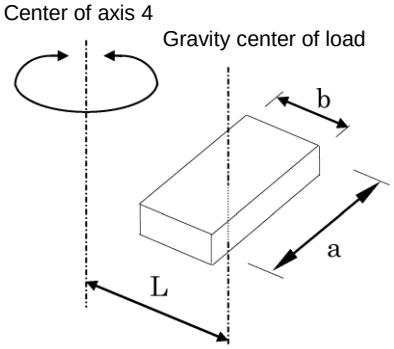
Setting of acceleration/deceleration time in relation to offset value (Axis 4)



Setting of maximum speed in relation to offset value (Axis 4)

c) Moment of inertia

Shown below is a model simplifying the robot and load, and arithmetic expression of moment of inertia of load.



L : Distance from axis 4 center to gravity center of load (m)

a : Width of load (m)

b : Length of load (m)

M : Mass of load (kg)

Moment of inertia ($kg \cdot m^2$)

$= \frac{M}{12}(a^2 + b^2) + ML^2$

5. General Specifications

a) Applicable standards

In principle, material, design and test of the equipment stipulated in these specifications shall be pursuant to the JIS, JEC and JEM standards.

b) Environmental conditions

Ambient temperature, operating temperature: 0 to 40°C (Mean value around-the-clock is 35°C or less.)

Temperature under transport and storage: –10 to 50°C

Humidity: 20 to 80 % (non-condensing)

Height above sea level: 1,000 m or less

Vibration: 0.98 m/s^2 or less

Dust: No conductive contaminant shall be contained.

Note: No special dust-proof measures are taken on the controller. When using the controller in a heavily contaminated environment, house it in a dust-proof cabinet.

Gas: No corrosive or flammable gas shall be contained.

Magnetic field: A magnetic source shall not exist nearby.

Surrounding environment No iron powder, oil, or organic solvent shall be contained.

c) In-house test

We carry out severe in-house inspection on all finished products.

d) Power supply, etc.

Power supply: Single phase, 190 to 240V AC, 50/60 Hz ±1 Hz

Instantaneous power failure: Within 2 cycles

Grounding: D-class grounding (ground resistance of 100 Ω or less)

e) Installation, piping and wiring

If the work of installation, piping and wiring is required, it shall be decided at a separate meeting.

f) Site adjustment and teaching

If the site adjustment and teaching are required, they shall be decided at a separate meeting for profit.

Then, the customer shall provide test work pieces, parts, material, power, etc., required for the operation and adjustment of the robot system by an operator, and secure an all-out cooperative relationship with the equipment furnished by Toshiba Machine.

g) Acceptance

When visual appearance and quantities of the equipment delivered to the customer as described in these specifications have been tested, the equipment shall be regarded as having been accepted finally by the customer.

h) Warranty

1. Warranty period

Toshiba Machine agrees to repair or replace as necessary all defective material or workmanship up to the period shown below, whichever comes first.

Eighteen (24) months from the date of dispatch from our plant.

Twelve (18) months from the date of machine installation at customer's job site.

4,000 running hours from the date of initial machine operation.

2. Contents of warranty

· Only the product delivered to the customer is subject to Toshiba Machine's Guarantee. Such Guarantee covers the specifications and functions as defined in the product specifications manual, catalog, instruction manual, etc. Toshiba Machine will not be liable for any secondary or incidental damage that occurs as a result of a failure in this product.

· Toshiba Machine repairs the product free of charge only when it has malfunctioned after handling or use according to the instruction manual attached to the product within the specified warranty period.

3. Exemption from responsibility

Toshiba Machine's Guarantee shall not cover the following cases.

· Incorrect use not described in the instruction manual, and trouble or damage caused by negligent use.
· Inconvenience caused by aged deterioration or long-term usage (natural fading of coating or painting, deterioration of consumable parts *1, etc.).
· Inconvenience caused by sensuous phenomena (noise generation, etc. which will not affect the function).
· Remodeling or disassembly which Toshiba Machine does not permit.
· Trouble and damage caused by insufficient maintenance/inspection or improper repair.
· Trouble and damage caused by disaster, fire or other external factor.
· Internal data such as program and point which were created by the customer.

*1 Consumable parts: Hand I/O air tube, backup battery for encoder battery, harness for the robot

4. Precautions

· Unless the robot was used pursuant to its specifications, Toshiba Machine will not guarantee the basic performance of the robot.
· If the customer did not observe the warnings and cautions described in this manual, Toshiba Machine will not assume the responsibility for any consequential accident resulting in injury or death, damage or trouble.
· Please note that the warnings, cautions and other descriptions stipulated in this manual are only those which can be assumed by Toshiba Machine as of now.

i) Other

When matters that is not mentioned in this specifications or change of specification are required, it shall be determined in consultation.

6. Robot Language SCOL

Type	Command	Purpose
Movement control commands	BREAK	Suspends movement immediately.
	CLOSE1, CLOSE2	Closes hand after completion of movement.
	CLOSEI1,	Closes hand.
	CLOSEI2	Closes hand.
	DELAY	Pauses for specified time.
	MOVE	Synchronous movement.
	MOVES	Linear interpolation movement.
	MOVEC	Circular interpolation movement.
	MOVEA	Absolute single axis movement.
	MOVEI	Relative single axis movement.
	MOVEJ	Arch movement
	OPEN1, OPEN2	Opens hand after completion of movement.
	OPENI1, OPENI2	Opens hand.
	PAUSE	Suspends a movement.
	READY	Moves to machine coordinate origin.
	RESUME	Restarts an interrupted movement.
Program control commands	FOR~TO~STEP~	Repeats an operation.
	GOTO	Branches unconditionally.
	GOTO ()	Branches in accordance with the value of an expression
	IGNORE	Cancels monitoring.
	IF~THEN~ELSE~	Judges conditions.
	NEXT	Repeats an operation.
	ON~DO~	Registers conditions monitor.
	PROGRAM	Marks beginning of program.
	RCYCLE	Label for cycle reset.
	RETURN	Returns to main program.
	STOP	Stops the program.
	WAIT	Waits for establishment of conditions.

Type	Command	Purpose
	END	End of program.
	KILL	Task standstill.
	MAXTASK	Maximum number of tasks.
	REMARK	Comments.
	SWITCH	Task change-over.
	TASK	Task start.
	TID	Task ID.
I/O control commands	BCDIN	Inputs a BCD signal.
	BCDOUT	Outputs a BCD signal.
	CR	Outputs a CR code
	DIN	Reads an input signal.
	DOUT	Outputs a signal.
	HEXIN	Reads signals in hexadecimal notation.
	HEXOUT	Outputs signals in hexadecimal notation.
	PULOUT	Outputs a pulse signal.
	RESET	Resets the controller.
	PRINT	Outputs communication data.
	INPUT	Inputs communication data.
Movement condition commands	ACCEL	Specifies acceleration (during acceleration).
	ACCUR	Specifies positioning accuracy.
	CONFIG	Specifies configuration.
	DECEL	Specifies acceleration (during deceleration).
	DISABLE	System switch off.
	ENABLE	System switch on.
	FREELOAD	Cancels load data.
	GAIN	Each axis gain.
	ONGAIN	Each axis gain ON.
	OFFGAIN	Each axis gain OFF.
	NOWAIT	Does not wait for the completion of positioning for previous movement.
	PASS	Short-cut movement parameter.
	PAYLOAD	Sets load data.
	SETGAIN	Gain of each axis.
	SMOOTH (option)	Smooth movement.
	SPEED	Specifies speed.
	MOVESYNC	Specifies movement command synchronization/unsynchronization mode.

Type	Command	Purpose
		Prohibits or allows task change-over.
	SWITCH	Torque on each axis.
	TORQUE	Specifies operating conditions.
	WITH	
Calculator commands	COS	Cosine.
	SIN	Sine.
	TAN	Tangent.
	ABS	Absolute value.
	ACOS	Arccosine.
	AND	Logical product.
	ASIN	Arcsine.
	ATAN	Arctangent.
	ATAN2	Arctangent.
	DEST	Destination position.
	EXP	Exponent to power e.
	HERE	Present position.
	INT	Changes number to an integer.
	LN	Natural logarithm.
	LOG10	Common logarithm.
	MOD	Remainder.
	NOT	Negation.
	OR	Logical sum.
	POINT	Creates positional type data.
	REAL	Changes number to a real number.
	SGN	Extracts and returns the sign.
	SQRT	Square root.
	TRANS	Creates coordinate type data.
Movement reference commands	BASE	Base coordinate system.
	MODE	System operating mode.
	MOTION	Amount of movement which has been executed.
	MOTIONT	Time expended for a motion.
	REMAIN	Amount of movement remaining to be executed.
	REMAINT	Time remaining for a motion.
	TIMER	Timer.
	TOOL	Tool coordinate system.
	WORK	Work coordinate system.

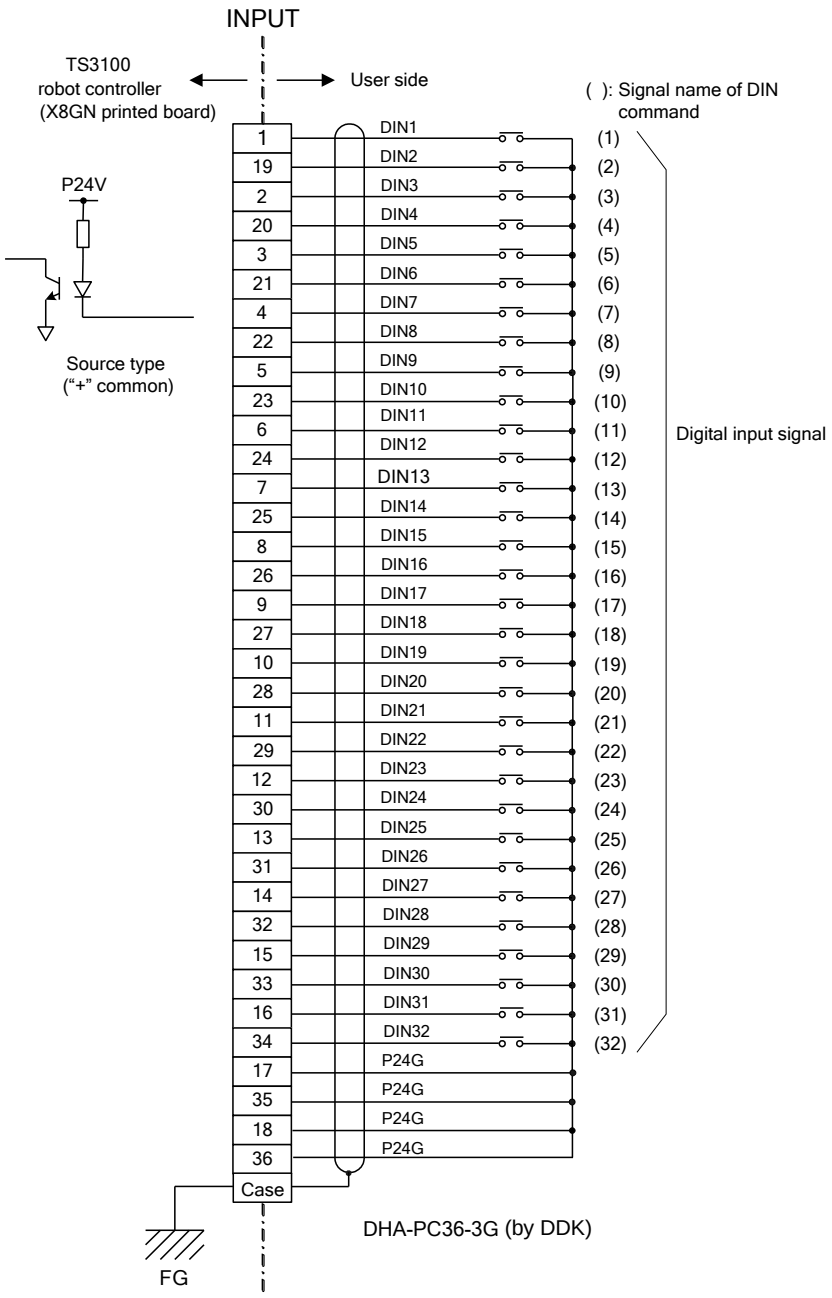
Type	Command	Purpose
Data definition commands	DATA	Starts data definition.
	DIM~AS	Array variable definition.
	GLOBAL	Global variable definition.
	RESTORE	Saves an initial value of the global variable to a file.
	SAVEEND	Saves data at power OFF.
Palletize command	INITPLT	Initializes a pallet.
	MOVEPLT	Moves to pallet specified position.
Position data latch function (Options of TS2000)	LATCH	Position latch function ON/OFF.
	LATCHTRG1~8	Detected edge direction.
	LATCHSIG1~8	Signal state.
	LATCHPSN1~8	Latched position.
System constants	COARSE	Coarse positioning accuracy.
	COM0, TP	Communication channel (teach pendant).
	COM1	Communication channel 1.
	CONT	Continuous operation mode.
	CYCLE	Cycle operation mode.
	FINE	Fine positioning accuracy.
	FREE	Undefined configuration.
	LEFTY	Left hand configuration.
	OFF	Each axis gain OFF.
	ON	Each axis gain ON.
	PAI	Pi.
	RIGHTY	Right hand configuration.
	SEGMENT	Segment operation mode.
Simplified PLC	PLCDATAR1~8	Simplified PLC interface
	PLCDATAW1~8	Simplified PLC interface

Type	Command	Purpose
Mathematical symbols	^	Exponentiation.
	–	Negative sign.
	*, /	Multiplication and division.
	+, –	Addition and subtraction.
	=	Substitution.
	= =	Equal.
	< >, > <	Not equal.
	<	Less than.
	>	Greater than.
	< =, = <	Less than or equal.
	> =, = >	Greater than or equal.
	‘	Comments.

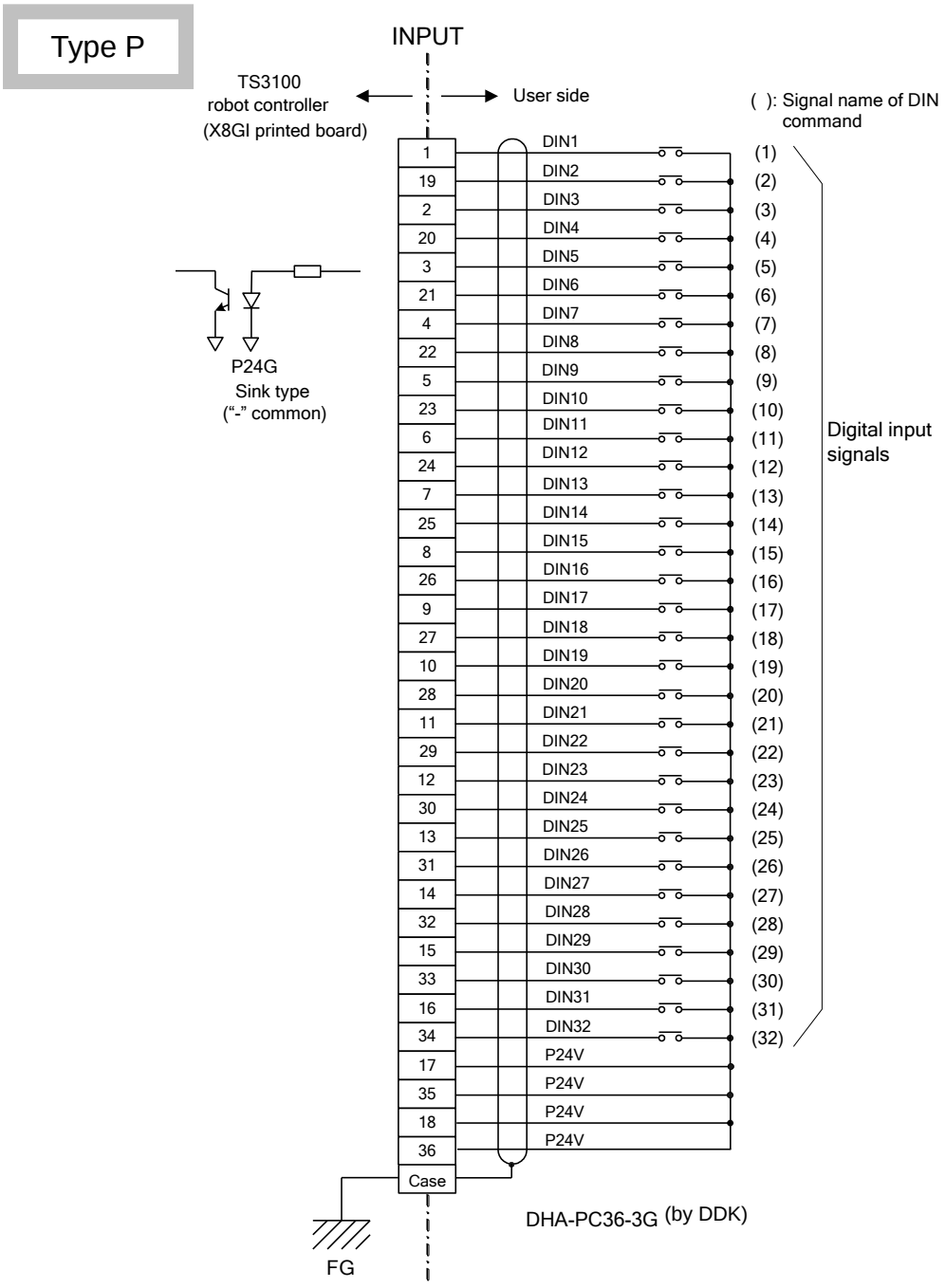
7. External Interface

7.1 External Input Signals

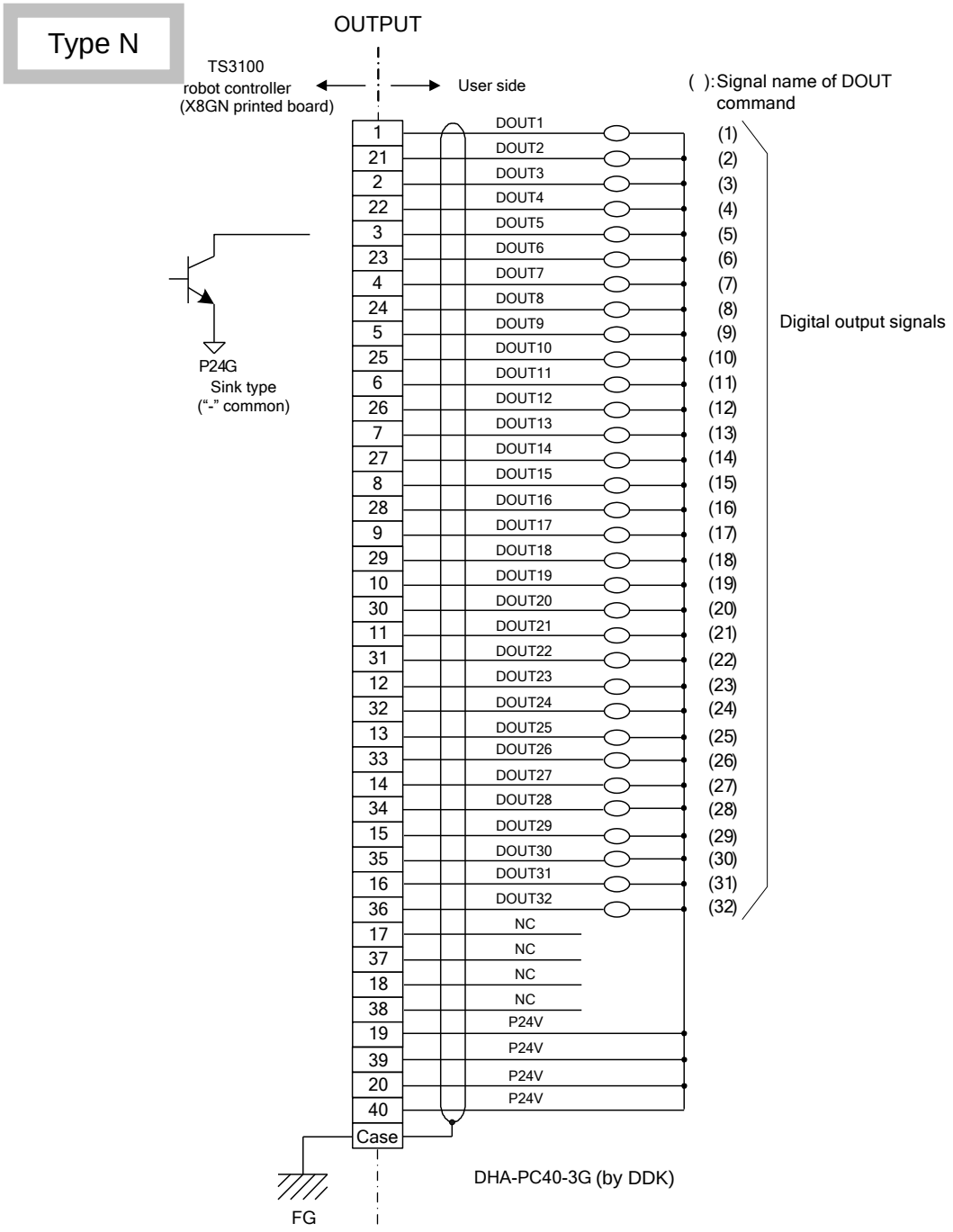
Type N



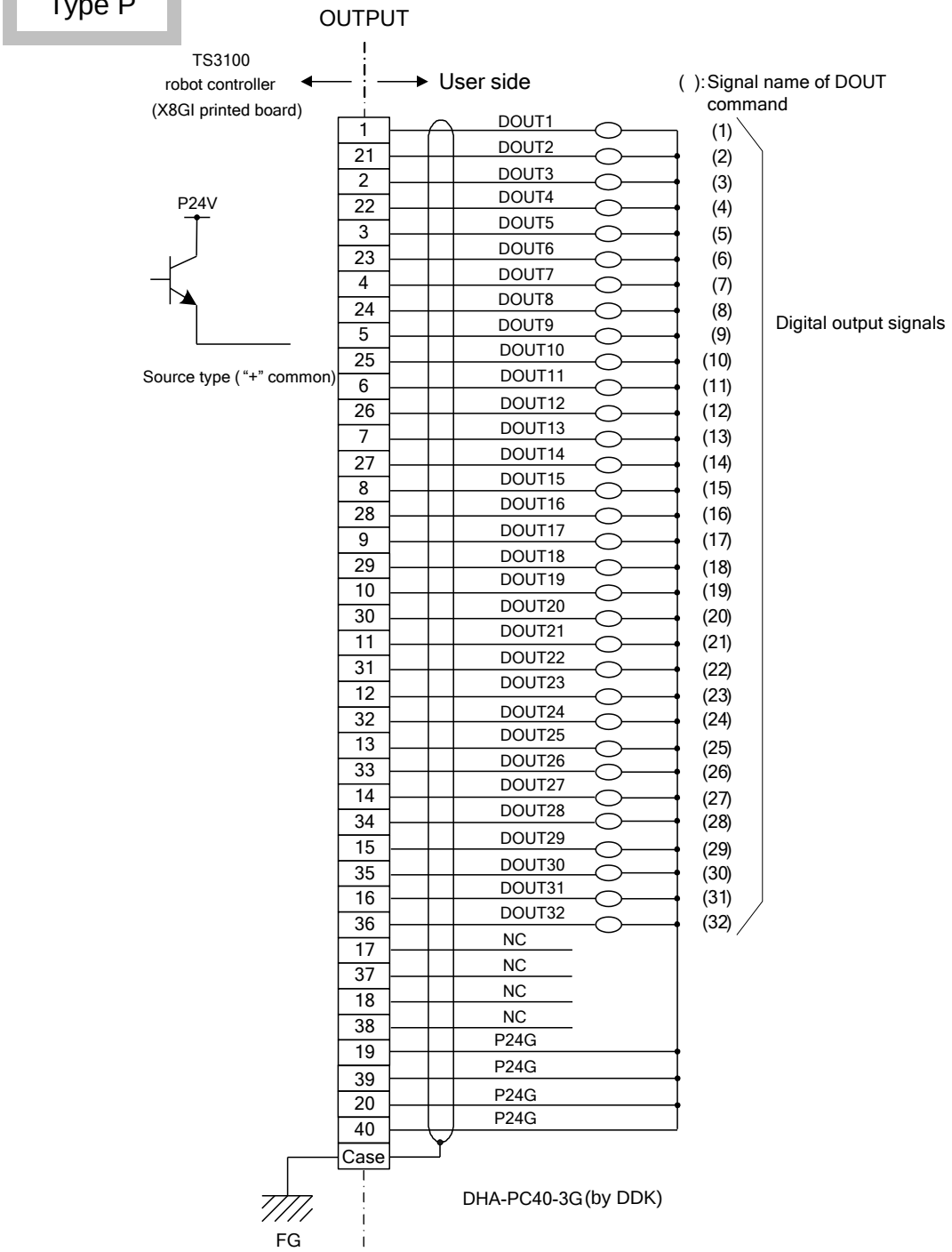
Type P


INPUT
TS3100
robot controller
(X8GI printed board)
User side
( ): Signal name of DIN command
P24G
Sink type
("-" common)
1 DIN1 (1)
19 DIN2 (2)
2 DIN3 (3)
20 DIN4 (4)
3 DIN5 (5)
21 DIN6 (6)
4 DIN7 (7)
22 DIN8 (8)
5 DIN9 (9)
23 DIN10 (10)
6 DIN11 (11)
24 DIN12 (12)
7 DIN13 (13)
25 DIN14 (14)
8 DIN15 (15)
26 DIN16 (16)
9 DIN17 (17)
27 DIN18 (18)
10 DIN19 (19)
28 DIN20 (20)
11 DIN21 (21)
29 DIN22 (22)
12 DIN23 (23)
30 DIN24 (24)
13 DIN25 (25)
31 DIN26 (26)
14 DIN27 (27)
32 DIN28 (28)
15 DIN29 (29)
33 DIN30 (30)
16 DIN31 (31)
34 DIN32 (32)
17 P24V
35 P24V
18 P24V
36 P24V
Case
Digital input signals
DHA-PC36-3G (by DDK)
FG

7.2 External Output Signals

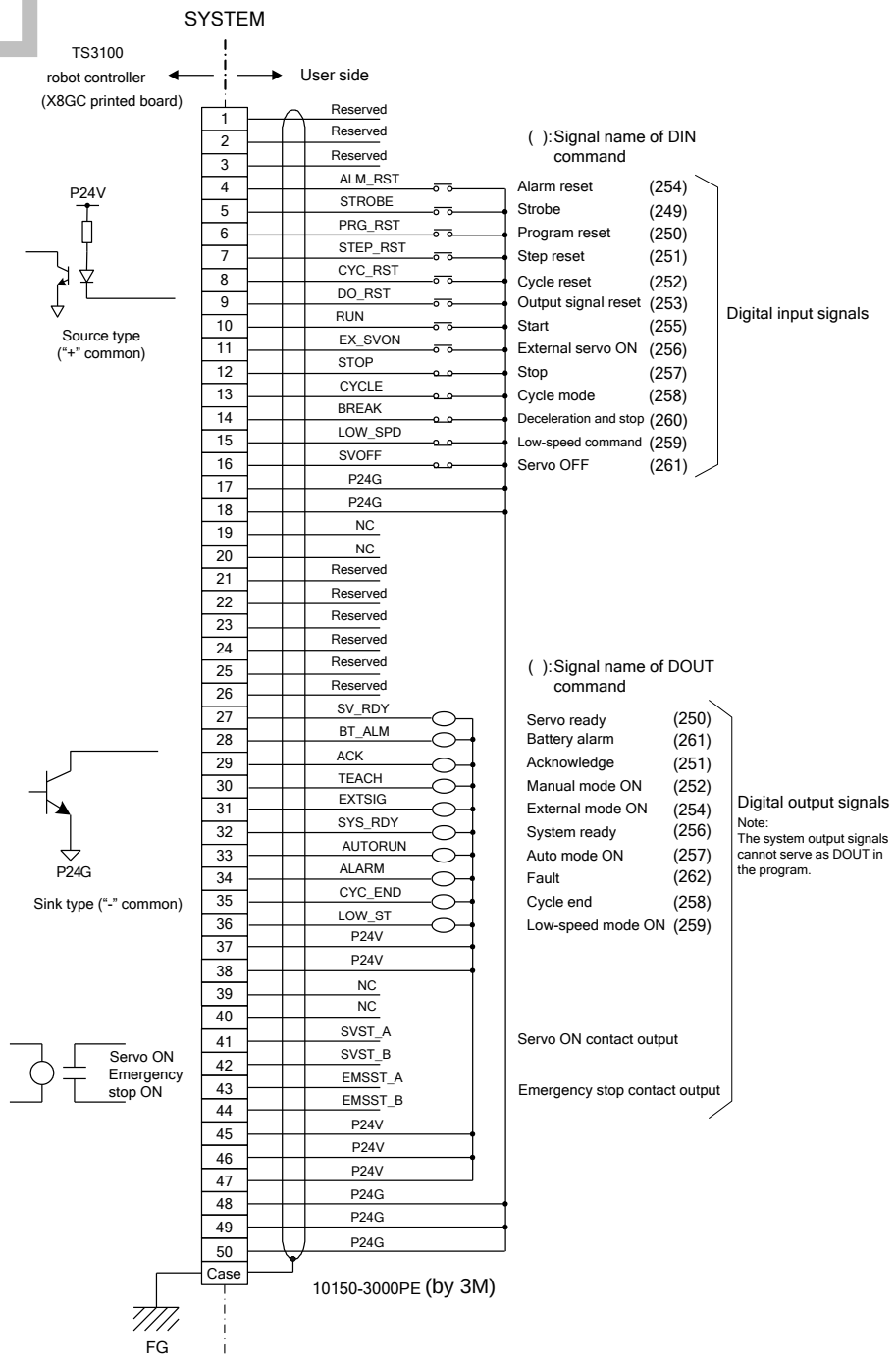


Type P

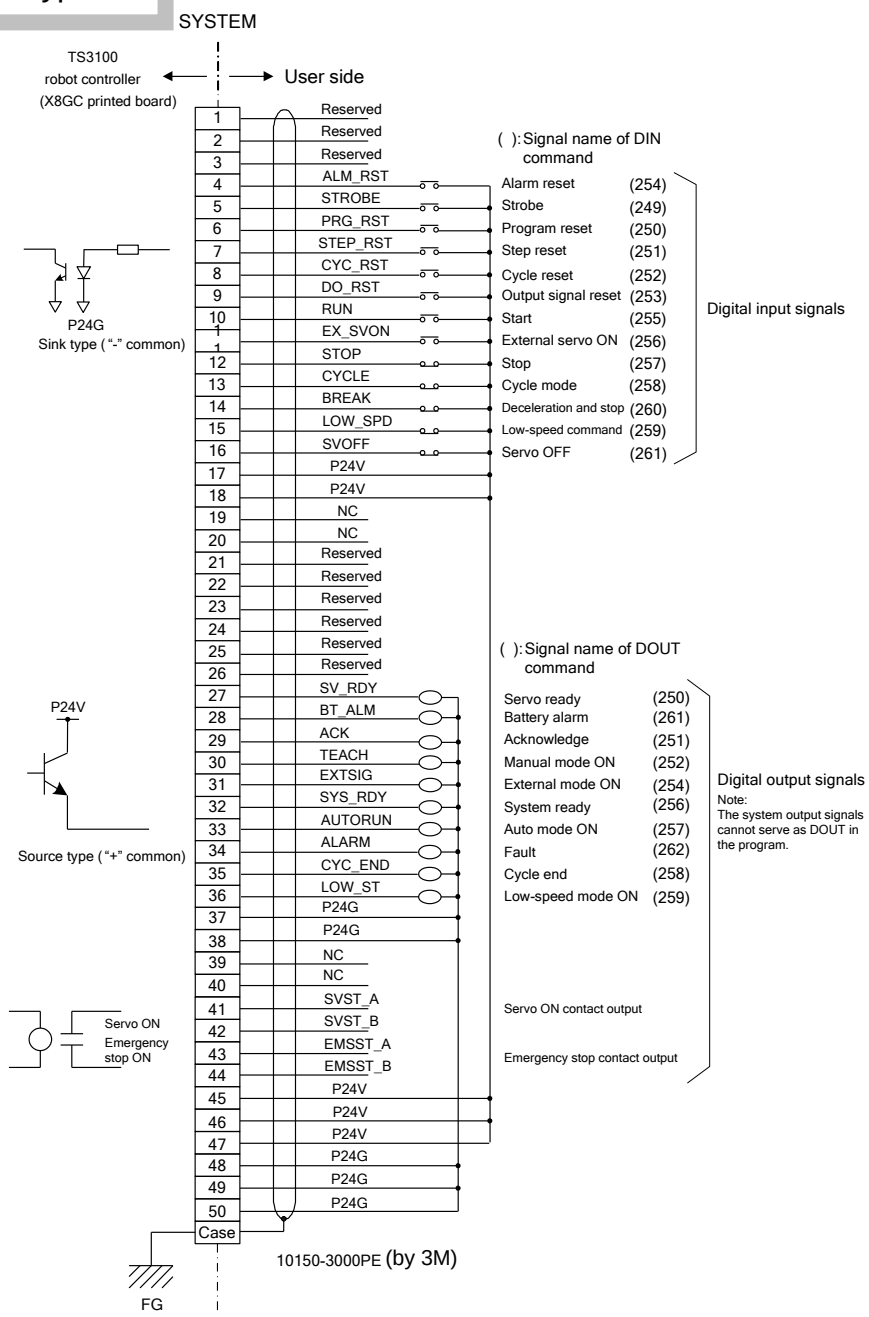

OUTPUT
TS3100
robot controller
(X8GI printed board)
User side
( ): Signal name of DOUT command
P24V
Source type ("+" common)
1 DOUT1 (1)
21 DOUT2 (2)
2 DOUT3 (3)
22 DOUT4 (4)
3 DOUT5 (5)
23 DOUT6 (6)
4 DOUT7 (7)
24 DOUT8 (8)
5 DOUT9 (9)
25 DOUT10 (10)
6 DOUT11 (11)
26 DOUT12 (12)
7 DOUT13 (13)
27 DOUT14 (14)
8 DOUT15 (15)
28 DOUT16 (16)
9 DOUT17 (17)
29 DOUT18 (18)
10 DOUT19 (19)
30 DOUT20 (20)
11 DOUT21 (21)
31 DOUT22 (22)
12 DOUT23 (23)
32 DOUT24 (24)
13 DOUT25 (25)
33 DOUT26 (26)
14 DOUT27 (27)
34 DOUT28 (28)
15 DOUT29 (29)
35 DOUT30 (30)
16 DOUT31 (31)
36 DOUT32 (32)
17 NC
37 NC
18 NC
38 NC
19 P24G
39 P24G
20 P24G
40 P24G
Case
FG
Digital output signals
DHA-PC40-3G (by DDK)

7.3 External Input/Output Signals

Type N

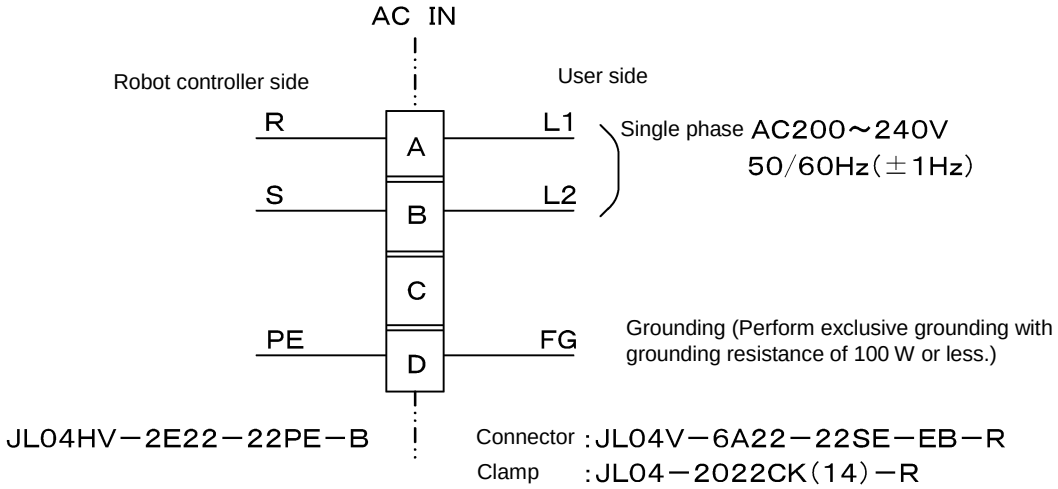


Type P

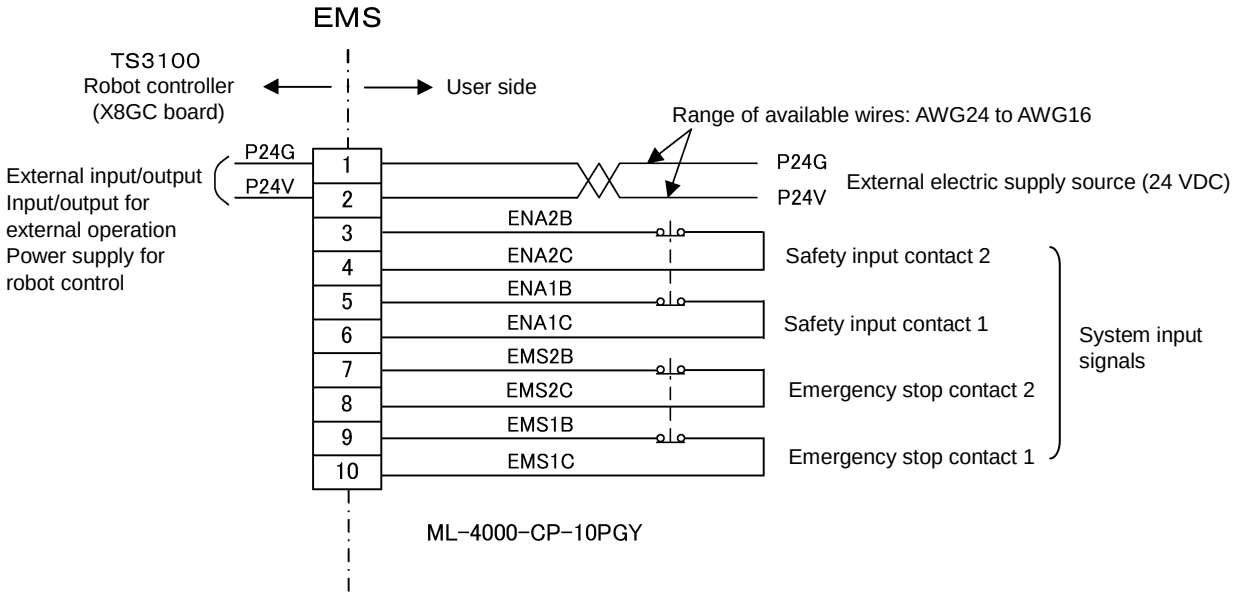

SYSTEM
TS3100
robot controller
(X8GC printed board)
User side
1 Reserved
2 Reserved
3 Reserved
4 ALM_RST
5 STROBE
6 PRG_RST
7 STEP_RST
8 CYC_RST
9 DO_RST
10 RUN
11 EX_SVON
12 STOP
13 CYCLE
14 BREAK
15 LOW_SPD
16 SVOFF
17 P24V
18 P24V
19 NC
20 NC
21 Reserved
22 Reserved
23 Reserved
24 Reserved
25 Reserved
26 Reserved
27 SV_RDY
28 BT_ALM
29 ACK
30 TEACH
31 EXTSIG
32 SYS_RDY
33 AUTORUN
34 ALARM
35 CYC_END
36 LOW_ST
37 P24G
38 P24G
39 NC
40 NC
41 SVST_A
42 SVST_B
43 EMSST_A
44 EMSST_B
45 P24V
46 P24V
47 P24V
48 P24G
49 P24G
50 P24G
Case
P24G
Sink type ("-" common)
P24V
Source type ("+" common)
Servo ON
Emergency stop ON
FG
10150-3000PE (by 3M)
( ): Signal name of DIN command
Alarm reset (254)
Strobe (249)
Program reset (250)
Step reset (251)
Cycle reset (252)
Output signal reset (253)
Start (255)
External servo ON (256)
Stop (257)
Cycle mode (258)
Deceleration and stop (260)
Low-speed command (259)
Servo OFF (261)
Digital input signals
( ): Signal name of DOUT command
Servo ready (250)
Battery alarm (261)
Acknowledge (251)
Manual mode ON (252)
External mode ON (254)
System ready (256)
Auto mode ON (257)
Fault (262)
Cycle end (258)
Low-speed mode ON (259)
Servo ON contact output
Emergency stop contact output
Digital output signals
Note:
The system output signals cannot serve as DOUT in the program.

7.4 Power Supply

7.4.1 Power supply

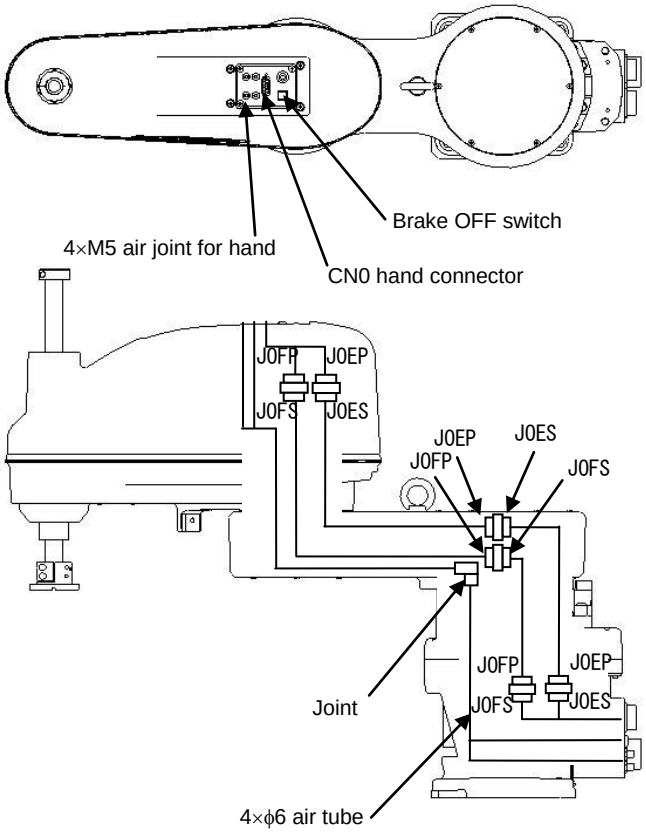


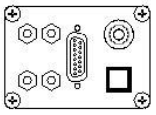
7.4.2 External Electric Supply Source



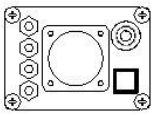
Select the most suitable power supply in accordance with the user's specification (power capacity).

7.5 Wiring and Piping for Hand Control

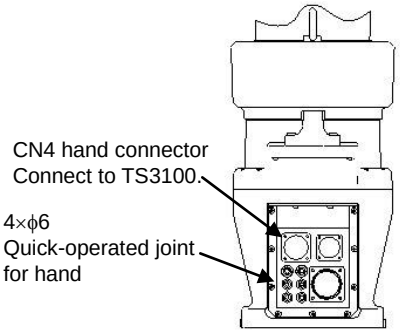




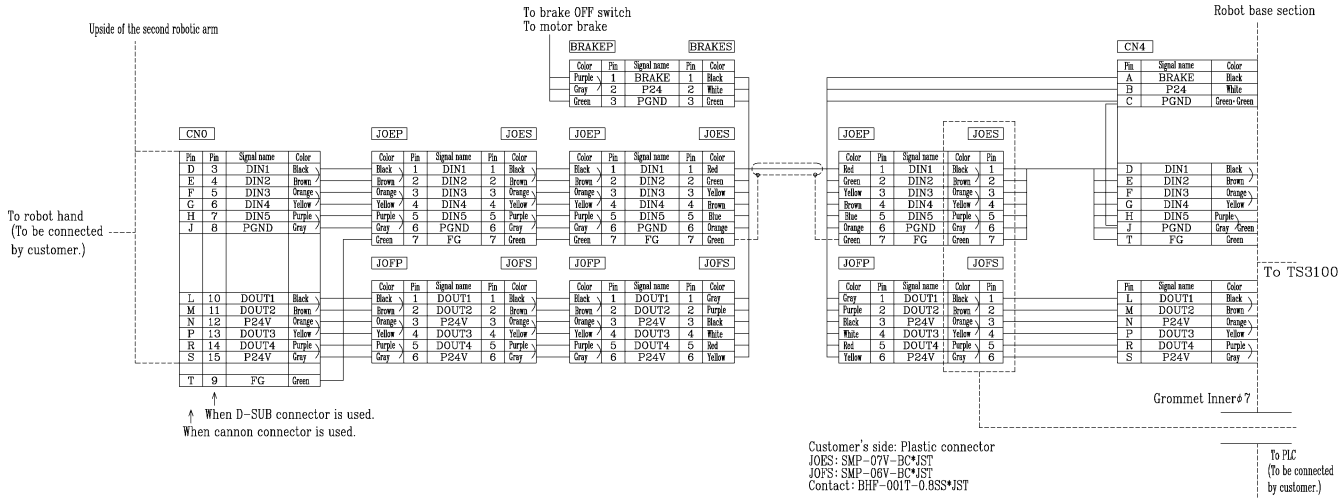
D-SUB connector (Standard)



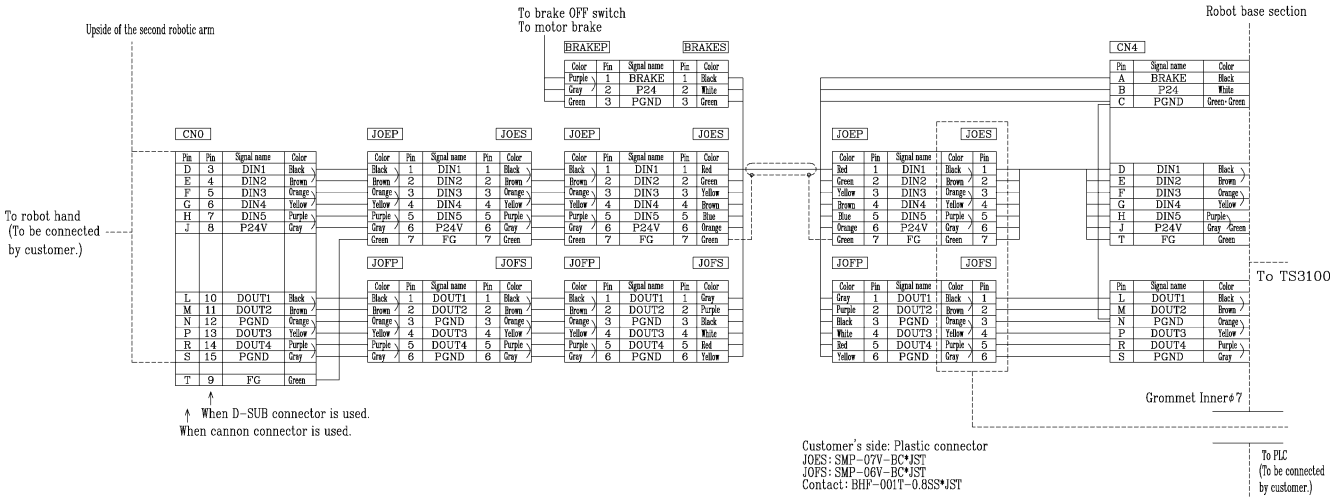
Cannon connector (option)



Type N



Type P



For the hand wiring, five (5) input signals for sensor, etc., four (4) control signals for solenoid valve, etc., and DC24 V signal (total 2A or less) are provided. Connection on the hand side is performed by using connectors on the rear side of the arm 2.
To control from the separate PLC, etc., separate connectors JOES and JOFS in the base and connect the cable running from the PLC, etc.
For the hand piping, a total of four (4) lines (ϕ6×4) are provided. Connections are made on the base rear side and upper side of the arm 2.

8. Safety Precautions

8.1 General Items

1) Transport, installation, wiring, operation, inspection and maintenance should be performed by qualified personnel well versed in the equipment. Otherwise, an electric shock, injury or fire may be caused.

2) Install safety fences so that anyone cannot approach the dangerous area. This dangerous area is the area around the robot's operating range where a person may face a dangerous condition if he or she has entered.

3) When you have to enter the dangerous area, the robot should be emergency-stopped beforehand. Install an emergency stop circuit after you have fully read and understood the controller instruction manual.

4) Provide a necessary space in the dangerous area to perform the work with safety.

5) Install the controller at a place outside the dangerous area, where an operator can watch the entire robot movements.

6) NEVER use the equipment at a place where it is exposed to water splash, in a corrosive atmosphere, in an atmosphere containing inflammable gas or metal chip, or near combustibles. Otherwise, a fire or equipment failure may be caused.

7) DO NOT place the robot near a combustible material. If it ignites due to a fault, etc., a fire will break out.

8) DO NOT operate the robot if any part is damaged or missing. Otherwise, an electric shock, fire or fault will be caused.

9) NEVER replace or modify parts other than those described in the instruction manual. Otherwise, the robot performance will deteriorate, or a fault or accident will be caused.

10) Completely connect the grounding cable. Otherwise, an electric shock or fire will be caused if a fault or fault current occurs. Also, it could cause miss-operation by noise.

11) DO NOT incinerate, disassemble or charge the battery. Otherwise, it will rupture.

12) DO NOT change the data of the system configuration file. Otherwise, the robot will operate abnormally, resulting in a damage or accident.

8.2 Storage

1) When storing the robot, firmly secure it to the base while securing the arm and base with the clamps provided as accessories.
   If the robot is just placed on the floor, it becomes unstable and will fall down.

2) DO NOT store the robot at a place where it is exposed to direct rain or water splash, or at a place containing any toxic gas or liquid.

3) Store the robot at a place where it is not directly exposed to sunlight and both the temperature and humidity are kept as specified.

4) DO NOT store the robot which has not been used for a long period of time after unpacked. If the robot has been stored over a long period of time, be sure to consult with us before operation.

8.3 Transportation and Installation

1) When installing the robot, secure it to the base completely. If it is installed incompletely, a fault or injury may be caused.

2) At the time of robot operation, sudden acceleration or deceleration is caused. When the robot is to be installed on a stand, therefore, it should be sufficiently rigid. If the robot is installed on a less rigid stand, vibration will be caused during robot operation, resulting in a fault.

3) Install the robot at a well leveled place. Otherwise, the robot performance will deteriorate, or a fault will be caused.

4) For the controller, keep a specified ample space for ventilation. Otherwise, the controller will heat and go wrong.

5) Take all necessary measures not to impose an impact on the robot during transportation. Otherwise, a fault or injury will be caused.

6) Be sure to secure the robot with attached clamps before transportation. Otherwise, you will be injured if the arm moves when the robot is lifted.

7) NEVER lift the robot by the arm. Otherwise, an excessive force will be exerted on the robot mechanism, resulting in damage of the robot.

8) When lifting the robot, lift it up slowly as the robot will tilt slightly. If it is lifted up suddenly, it will cause a very hazardous situation.

8.4 Wiring

1) Electric work should be done by a qualified electric engineer. Otherwise, a fire or electric shock will be caused.

2) Wire the robot after installation. Otherwise, an electric shock or injury will be caused.

3) Always use the master power voltage and power capacity designated by Toshiba Machine. Otherwise, the equipment will be damaged or a fire will break out.

4) Always use the designated power cables. If a cable other than the designated is used, a fire or fault will be caused.

8.5 Operation

1) DO NOT enter the dangerous area of the robot during operation. Otherwise, you will be seriously injured.

2) DO NOT leave any obstacle in the job space. If the equipment went wrong, a worker may be injured, or other serious accident may be caused.

3) Anyone other than the workers MUST NOT approach the equipment. Should he or she negligently touch a dangerous part of the equipment, he or she will get injured or involved in a serious accident.

4) NEVER perform an inappropriate operation which is not described in the instruction manual. Otherwise, the equipment will start by mistake, resulting in a personal injury or serious accident.

5) If you feel even a little that you are exposed to danger or the equipment works abnormally, press the EMERGENCY stop pushbutton switch to stop the equipment. If the equipment is used as it is, you will be injured or involved in a serious accident.

6) During operation, be sure to close the equipment cover. Should the cover be opened during operation, you will be struck by an electric shock or get injured.

7) Only a well-trained and qualified person is allowed to perform the operation. Should the equipment be operated improperly, it will start by mistake, causing a personal injury or serious accident.

8) If the equipment has malfunctioned, turn the power off, identify and remove the cause of the abnormality, maintain the peripheral equipment and completely

restore the malfunctioned equipment. Then start the equipment at a low speed. If the equipment starts, leaving the abnormality, you will be involved in a serious accident.

9) In principle, teaching operation should be performed outside the dangerous area of the robot. If it should be performed inevitably within the dangerous area, strictly observe the following matters.

[1] The teaching operation should always be performed by two (2) persons. One person performs the job and the other person watches outside the dangerous area. Also, both persons should try to prevent miss-operation with each other.

[2] The operator should do the job in an attitude ready to press the EMERGENCY stop pushbutton switch at any time. Also, he or she should perform the job at a position from which he or she can evacuate immediately at the time of an emergency after confirming the robot's operating range and shields in the surroundings.

[3] The supervisor should keep watch on the job at a position where he or she can see the entire robot system and operate the EMERGENCY stop pushbutton switch at the time of an emergency. Also, he or she should keep anyone from entering the dangerous area. If the worker or other person will not follow the instructions of the supervisor, he or she will be involved in a serious accident.

10) If an abnormality has generated or the POWER LED lamp on the control panel remains off after the main power switch of the equipment was turned on, turn off the main power immediately and confirm the wiring. Otherwise, you will be struck by an electric shock or a fire will break out.

11) Unless the robot operates toward a designated direction at manual guide, turn off the servo power. Otherwise, the robot will be damaged or you will be involved in an accident.

12) Pushbutton operations of the control panel and teach pendant should be confirmed visually. Otherwise, you will be involved in an accident due to miss-operation.

13) After the power is turned on or before the start of an automatic operation, be sure to reset a relevant program beforehand. If the continuous mode is selected for the program execution environment, the robot will collide with the peripheral equipment, resulting in a damage or accident of both.

14) Before operating the equipment, perform the following inspection.

[1] Make sure that visual appearance of the robot, controller, peripheral equipment and cables is in good condition.

[2] Make sure that no obstacle stands in or near the operating range of the robot and peripheral equipment.

[3] Make sure that the emergency stop and other safety devices operate properly.

[4] Make sure that no abnormal noise or vibration is involved in the robot operation.

If the above prior inspection is skipped, the equipment will be damaged or you will be involved in an accident.

15) The speed of test operation is initially set at 20% of the maximum robot speed.

16) The speed of automatic operation is initially set at 100% of the maximum robot speed.

8.6 Maintenance and Inspection

1) Anyone other than the qualified engineer should not perform inspection.

2) Be sure to turn off the main power of the controller before starring inspection or maintenance.

3) Perform maintenance and inspection regularly. Otherwise, the equipment will go wrong or you will be involved in an accident.

8.7 Waste Disposal

1) This equipment should be disposed of as industrial wastes. When disposing of the battery, follow the user's provided regulations.

TOSHIBA MACHINE Co., Ltd.