NACHI

Standard specifications

MC10S-01

2nd edition

NACHI-FUJIKOSHI CORP.

NACHI

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1. **Outline**

NACHI ROBOT has used mechatronic techniques, cultivated throughout the last few decades, to supply robots suited for industries utilizing welding, spray painting and the material handling techniques.

"MC10S" is a 6 axes, simple structure, high speed and high accuracy robot which is optimal for material handling and other application.

Installation / Load weight	10 kg
Floor mount Inverted mount	MC10S-01

■ **Characteristic**

1. This robot is designed so that the size of the motion range is similar to that of one worker. Therefore, it becomes possible to make a compact robot cell. And, this robot is also suitable for a loading application for randomly workpieces.
2. The wide motion range lightens the limitation of the actual motion range. And examining applicability becomes easier than before.
3. The wrist and the main body become "Dust-proof / Drip-proof performance", and the application that can be applied has extended.
4. Hollow wrist construction enables smart wiring to the end effecter, and reduces customer's installation work.

2. **Basic specifications**

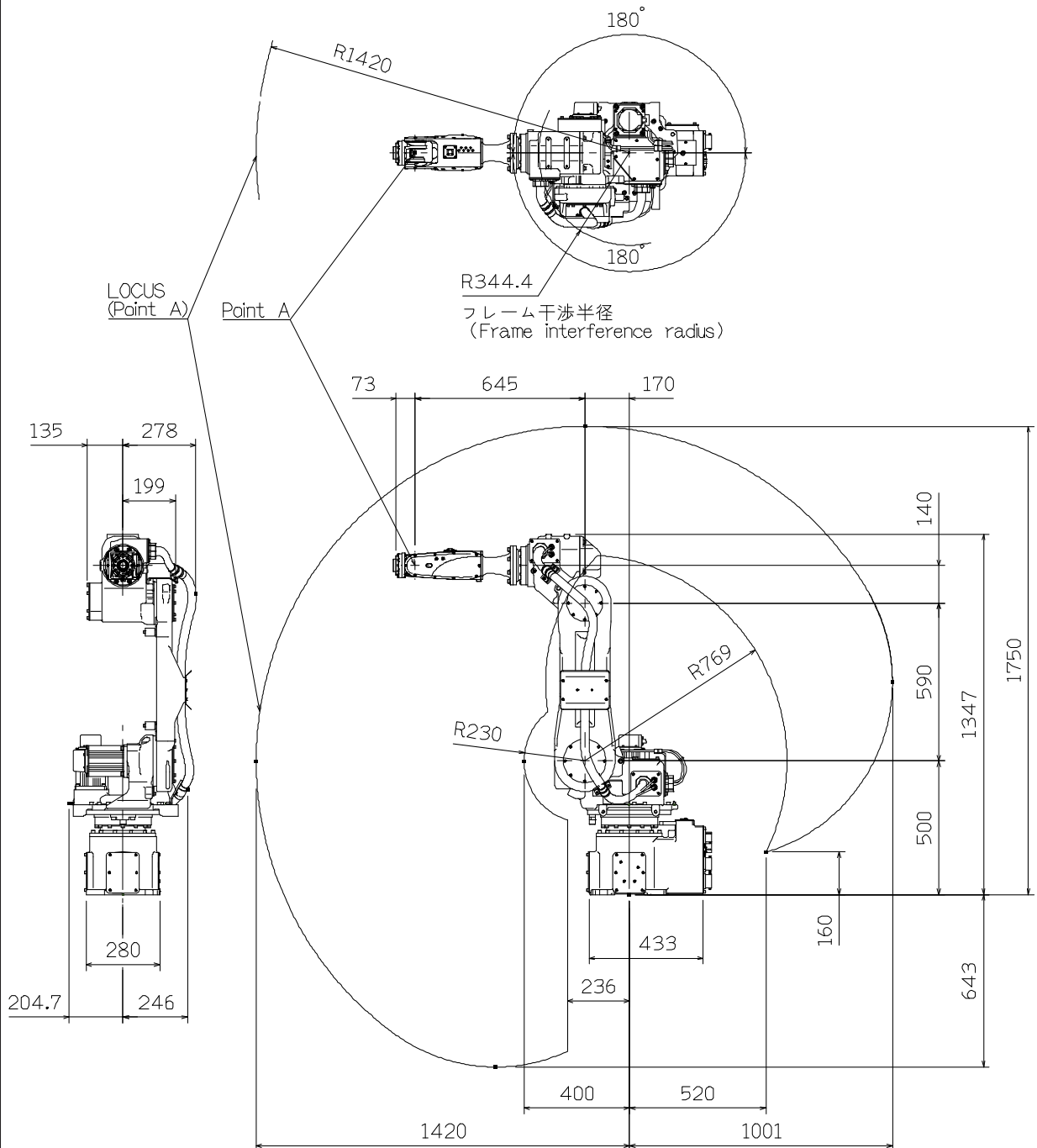| Item		Specifications
Robot model		MC10S-01
Construction		Articulated
Number of axis		6
Drive system		AC servo motor
Max. working envelope	Axis 1	±3.14rad （±180°）
	Axis 2	＋1.05〜−2.53rad（＋60〜−145°）
	Axis 3	＋4.22〜−2.58rad（＋242〜−148°）
	Axis 4	±3.32rad（±190°）
	Axis 5	±2.09rad（±120°）
	Axis 6	±6.28rad（±360°）
Max. speed	Axis 1	3.49rad/s（200°/s）
	Axis 2	2.96rad/s（170°/s）
	Axis 3	2.96rad/s（170°/s）
	Axis 4	6.98rad/s（400°/s）
	Axis 5	6.98rad/s（400°/s）
	Axis 6	13.96rad/s（800°/s）
Max. pay load		10 kg
Allowable static load torque	Axis 4	22Nm
	Axis 5	22Nm
	Axis 6	11Nm
Allowable moment of inertia [*1]	Axis 4	$0.7kgm^2$
	Axis 5	$0.7kgm^2$
	Axis 6	$0.2kgm^2$
Position repeatability [*2]		±0.06mm
Reach		1420mm
Air tube		ϕ 6×2
Application wires		10 wires
Installation		Floor mount, Inverted mount
Ambient conditions		Temperature: 0 to 45 °C [*3] Humidity: 20 to 85%RH (No dew condensation allowed) Vibration to the installation face: Not more than 0.5G ($4.9 m/s^2$)
Dust-proof / Drip-proof performance [*4]		Wrist to fore-arm : IP67 equivalent, Upper-arm to base :IP65 equivalent
Robot mass		198 kg

1 [rad] = 180 / π [°], 1 [N·m] = 1 / 9.8 [kgf·m]
- On controller display, axis 1 to 6 is displayed J1 to J6 for each.
- The specification and externals described in this specifications might change without a previous notice for the improvement.

*1: The Allowable moment of inertia of a wrist changes with load conditions of a wrist. *2: This value conforms to "JIS B 8432" standard. *3: Permitted height is not higher than 1,000m above sea level. If used in higher place, permitted temperature is affected by height. *4: Liquid such as organic compound, acidity, alkalinity, chlorine or gasoline cutting fluid which deteriorates the seal material are not available to use.

3. **Robot dimensions and working envelope**
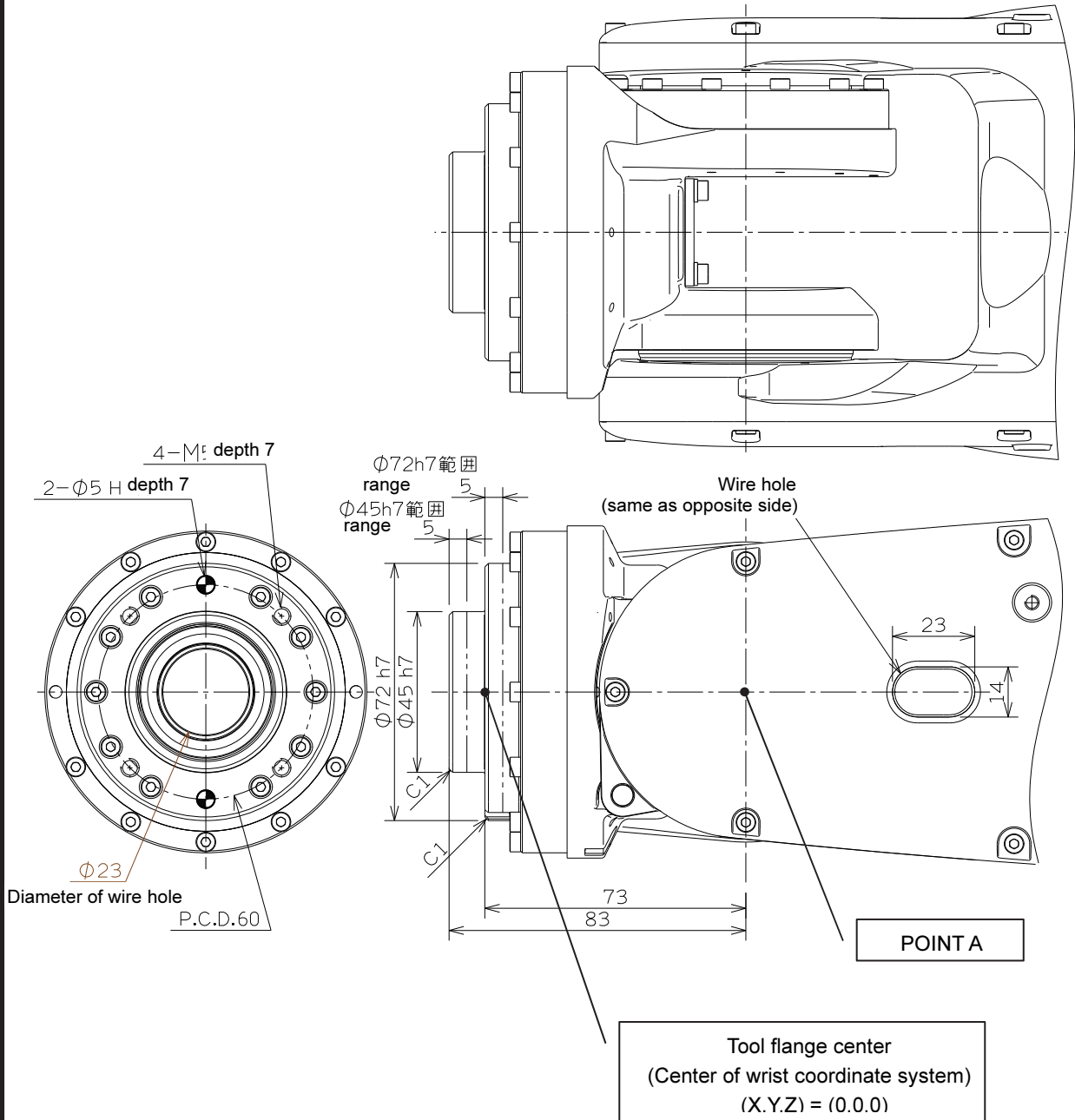
【MC10S-01】

R1420

180°

R344.4
フレーム干渉半径
(Frame interference radius)

180°

LOCUS
(Point A) Point A

73 645 170

135 278

199

140

1750

590

1347

R769

R230

500

280

160

433

204.7 246

236

643

400 520

1420 1001

4. **Detail of tool mounting plate**

For the tool fixing bolts, use the mounting P.C.D. shown in the following figure.

⚠ CAUTION	Be sure to screw the M5 tool fixing bolts in the wrist not deeper than the screw depth in the mounting face. Screwing the bolts deeper than the screw depth may damage the wrist.

【MC10S-01】

4−M5 depth 7

2−Φ5 H depth 7

Φ72h7範囲 range

Φ45h7範囲 range

5

5

Φ72 h7

Φ45 h7

C1

C1

Φ23
Diameter of wire hole

P.C.D.60

Wire hole
(same as opposite side)

23

14

73

83

POINT A

Tool flange center
(Center of wrist coordinate system)
(X.Y.Z) = (0.0.0)

5. **Installation Procedure**

5.1. Installation of robot

⚠ WARNING	To install the robot, it is important to position the robot so that no workers will get pinched by the robot inside or around a device to use the robot. The robot must not come into contact with any peripheral equipment when operating in the maximum operating range with a tool mounted on it.
⚠ WARNING	Be sure to install the robot according to the specified procedure. Otherwise it will cause the robot to move or topple over while in operation, thus inducing an imminent hazardous situation.
⚠ WARNING	To make wire connections between the robot and the controller or the peripheral equipment, fully understand the connection procedure for proper wire connections. Making wire connections according to improper procedure will cause the robot to malfunction.
⚠ WARNING	Be sure to establish a proper ground for the robot. If equipment such as a welder that causes substantial noises is needed to use, establish the specified ground for the equipment.
⚠ WARNING	During transport or installation of the robot, pay utmost care not to cause damage to wirings. Furthermore, after installing the robot, take protective measures such as using protective guards so that the wirings will not be damaged by workers or other persons, or forklift trucks or else.

■ **Installation location and ambient conditions**
Conditions (temperature, humidity, height and vibration) are written in "2. Basic Specifications".
Further ambient conditions listed below must be observed.
(1) Location with the drainage structure so that swivel base is not flooded, when the liquid such as water or cutting fluid is splashed on the robot body
(2) Location with no flammable or corrosive fluid or gas.
(3) Type D grounding (the grounding resistance is 100Ω or less) is necessary.

■ **Installation procedure**
While robot moves, large reaction force is applied to the swiveling base from all directions. Consequently, the robot should be installed in such a manner that the foundation endures reaction force caused by accelerating or decelerating the speed to lock the robot, not to mention that it endures static loads. Repair uneven spots, cracks, and others on the floor, and then install the robot by following to the table below. If thickness of floor concrete is less than needed level, an independent foundation should be constructed. Inspect the foundation prior to the robot installation, and then construct the foundation, if necessary.

Robot Model	MC10S-01
Thickness of floor concrete	Not less than 150 mm
Installation parts *1	4 bolts of M16 X 45 (JIS: Strength class 12.9) 4 plain washers of not less than 4.5 mm in thickness and HRC35 in hardness
Tightening torque *2	287 ± 30 N·m
Allowable repeated tensile *3	Approximately 10,512 N

*1 : Installation parts are not accessory of robot.
*2 : Apply a coating of lubricating oil to the threaded parts of bolts, and then tighten bolts by using torque wrench to the specified tightening torque.
*3 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

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■ Installation space

To install the robot, fix the swiveling base of the robot.

⚠ WARNING	A mechanical stopper is mounted over the axis 1 working envelope (software limit). When installing a guard fence (safety fence), please make sure to consider the motion range, wrist posture, and the shape of the end effecter.
⚠ WARNING	To operate safely, range of the motion can be restricted in axis 1, axis 2 and axis 3 (Option). Because the option parts are always necessary to restrict the motion range, do not move the standard parts (mechanical stopper block etc.) alone.

【MC10S-01】

SPECIFICATION OF WORKING ENVELOPE
仕様動作範囲
(ソフトウェアリミット)
(SOFTWEAR LIMIT)

184°
180°
R1420
LOCUS (Point A)
Point A
180°
184°
メカストッパー端
MECHANICAL STOPPER END

20

433
226
167
4-Ø18キリトオシ
280
255
226
12.5
180
190
2
25
4-M8ネジトオシ
断面A-A
Section A-A

■ Accuracy of installation surface

When installing robot, strictly observe precautions listed below to cause no deformation in the swivel base.

(1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 0.5 mm.

(2) Make the deviation in height between the 4 places of each base plate installation surface and the robot installation surface fall in the range of 0.5 mm (±0.25 mm).
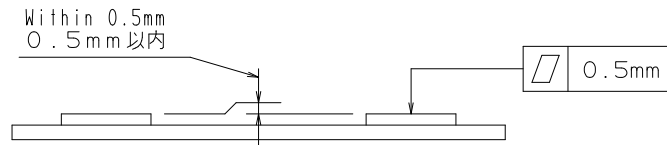
(3) If the two precautions above cannot be observed, use jack bolts to bring the four places into even contact with the installation surface.
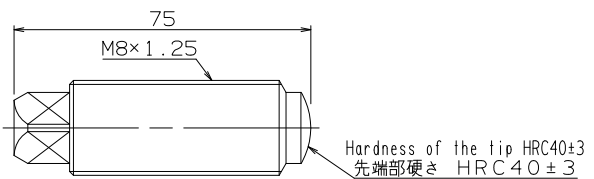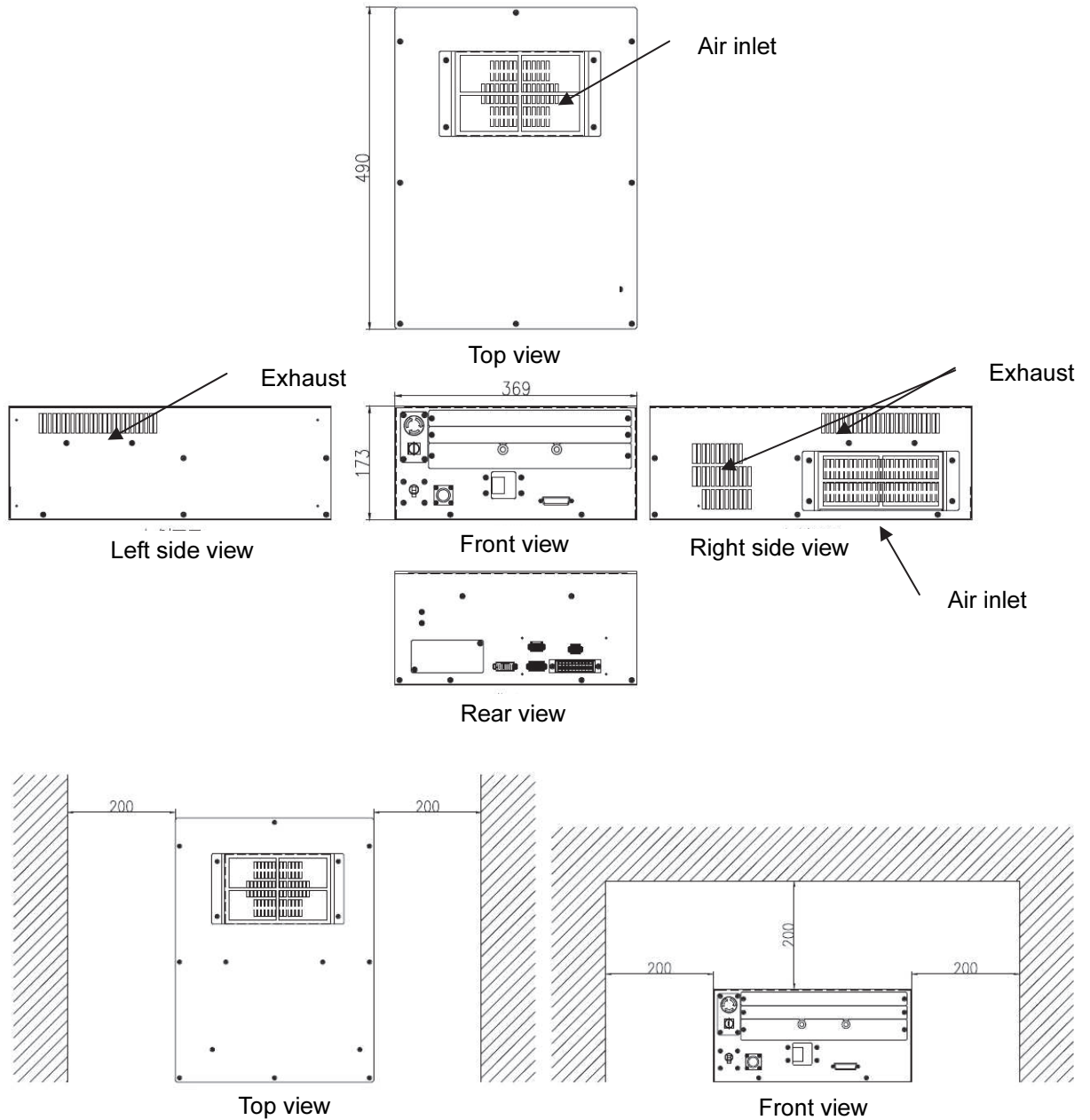
■ Maximum Robot Generative Force

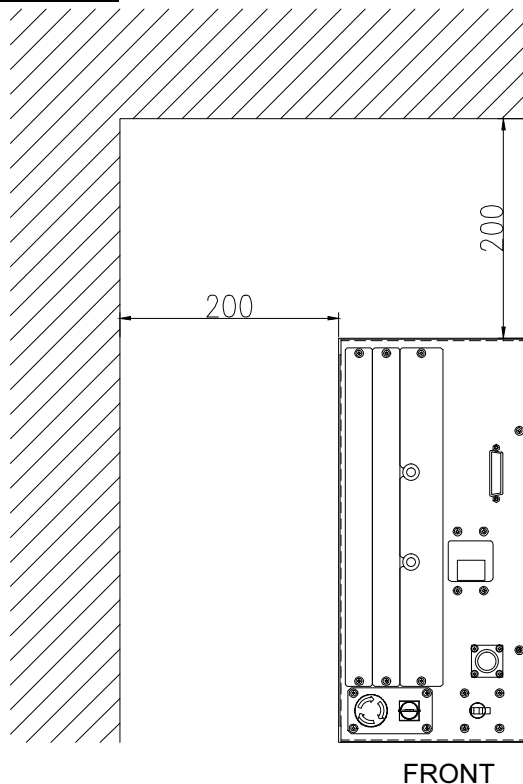| Robot type	Maximum vertical generative force FV	Maximum horizontal generative force FH	Maximum Vertical generative moment MV	Maximum horizontal generative moment MH	
MC10S-01	6,400 N	4,200 N	4,700 N·m	4,000 N·m	

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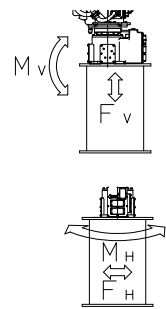
5.2. Installation of controller

Keep a clearance of at least 200 mm between the controller and the wall behind it in order to ensure proper ventilation. CFD controller is not dust-proof drip-proof. If dust-proof and drip-proof is necessary, controller protection BOX (option) is necessary.
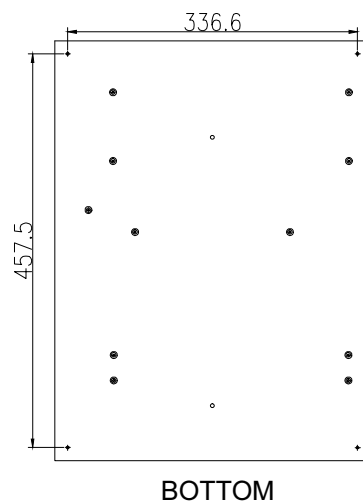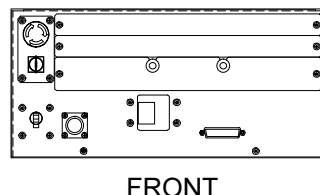
Air inlet

Top view

Exhaust

Left side view

Front view

Exhaust

Right side view

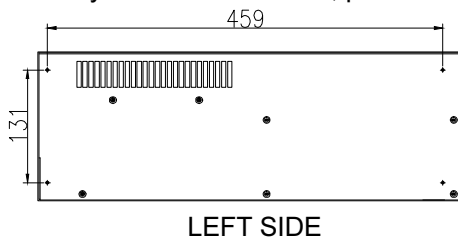Air inlet

Rear view

Top view

Front view

In case of vertical installation

200

200

FRONT

How to fix this controller

Screw holes (Size:M3) are placed like the following picture.

If it is necessary to fix this controller, please use these holes.

459

131

LEFT SIDE

FRONT

336.6

457.5

BOTTOM

6. **Maximum wrist load**

⚠ CAUTION	**Load fixed on the tip of wrist is regulated by "allowable payload mass", "allowable static load torque", and "allowable moment of inertia". Strictly keep the wrist load within each allowable value. If wrist load exceeds the allowable value, this robot is out of guarantee.** Refer to the table of "2 Basic specifications" and following figures for the detail of each specification.

■ Torque map for wrist load
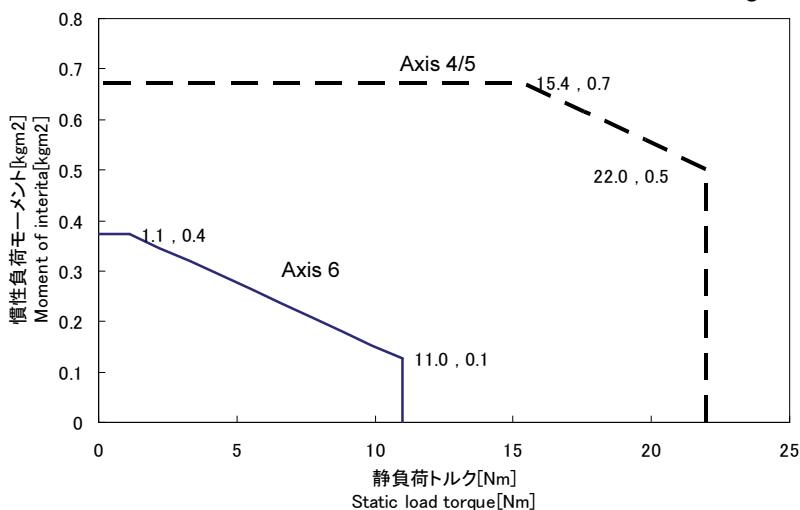C.O.G. of wrist load should exist inside the range shown below.
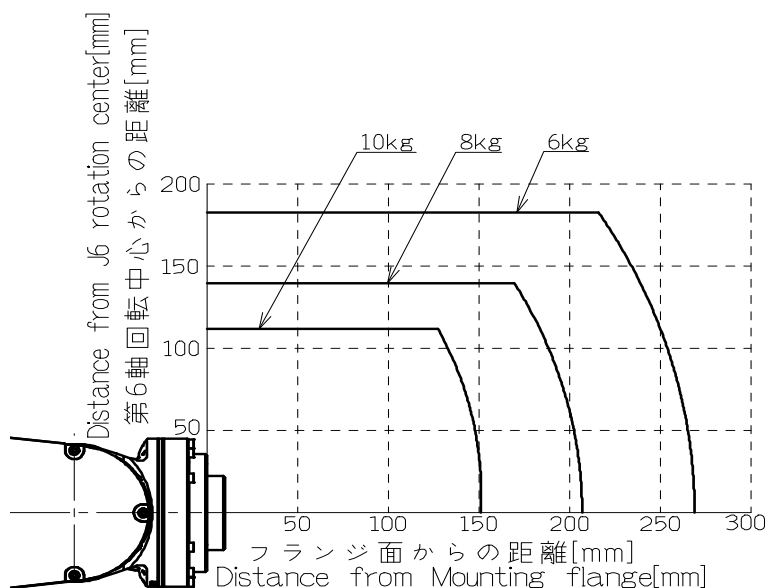
【MC10S-01】

■Moment of inertia map for wrist load
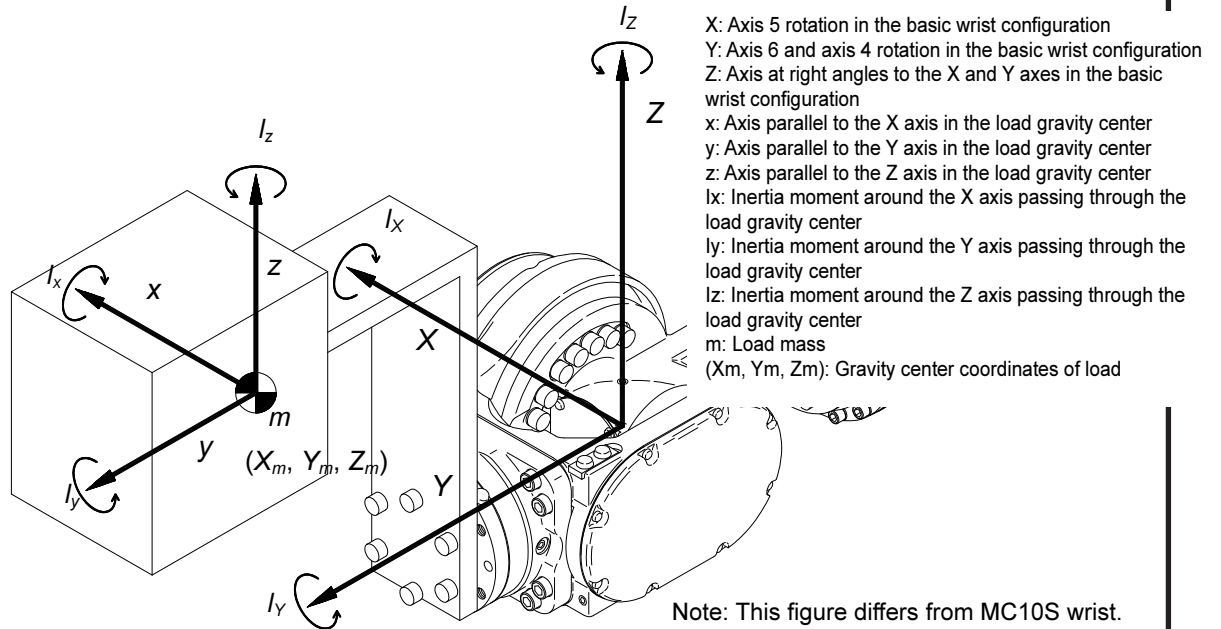Static load torque and moment of inertia of wrist load should exist inside the range shown below.

【MC10S-01】

ℹ IMPORTANT	If the moment of inertia exceeds the specification, maximum speed is automatically limited by the software to protect the robot.

■ How to calculate inertia moment of wrist axes

The following section shows general methods of calculating the inertia moment around each axis.

X: Axis 5 rotation in the basic wrist configuration
Y: Axis 6 and axis 4 rotation in the basic wrist configuration
Z: Axis at right angles to the X and Y axes in the basic wrist configuration
x: Axis parallel to the X axis in the load gravity center
y: Axis parallel to the Y axis in the load gravity center
z: Axis parallel to the Z axis in the load gravity center
Ix: Inertia moment around the X axis passing through the load gravity center
Iy: Inertia moment around the Y axis passing through the load gravity center
Iz: Inertia moment around the Z axis passing through the load gravity center
m: Load mass
(Xm, Ym, Zm): Gravity center coordinates of load

Note: This figure differs from MC10S wrist.

Inertia moment around axis 6

$$I_{J6} = I_Y = m \cdot (X_m^2 + Z_m^2) + I_y$$

Inertia moment around axis 4 and axis 5 (The inertia moment around axis 4 and axis 5 varies with axis 6 configuration. Consequently, in order to simplify the calculation, take a maximum value around the X and Z axes in above figure, as the inertia moment.)
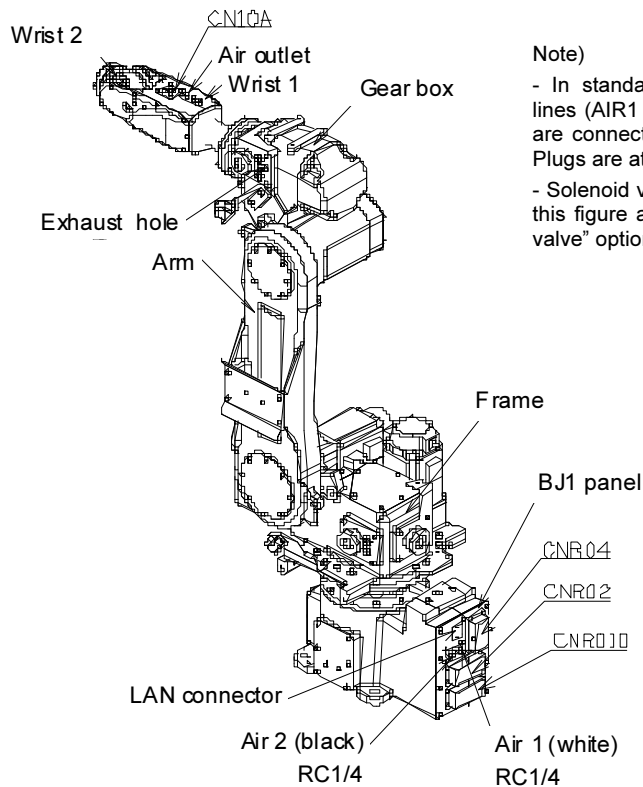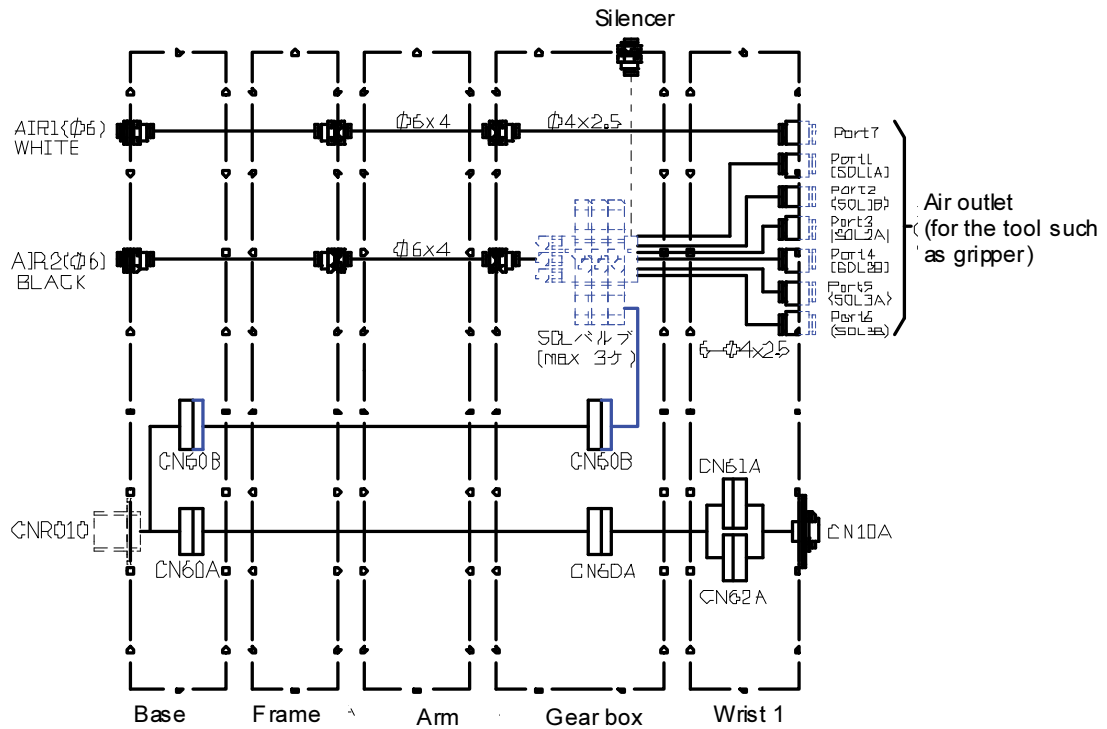
$$I_{J4J5} = \max(I_X, I_Z)$$

$$\because I_X = m \cdot (Y_m^2 + Z_m^2) + I_x$$

$$\because I_Z = m \cdot (X_m^2 + Y_m^2) + I_z$$

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7. **Application wiring and tube diagram**

■ **Solenoid valve option**

【MC10S-01】

Silencer

AIR1(Φ6)
WHITE

AIR2(Φ6)
BLACK

Φ6×4   Φ4×2.5

Φ6×4

Port7
Port1 [SOL1A]
Port2 [SOL1B]
Port3 [SOL2A]
Port4 [SOL2B]
Port5 [SOL3A]
Port6 [SOL3B]

Air outlet
(for the tool such
as gripper)

SOLバルブ
(max 3ケ)

6-Φ4×25

CN60B   CN60B   CN61A

CNR010   CN10A

CN60A   CN60A   CN62A

Base   Frame   Arm   Gear box   Wrist 1

Wrist 2

CN10A

Air outlet
Wrist 1   Gear box

Exhaust hole

Arm

Frame

BJ1 panel

CNR04

CNR02

CNR010

LAN connector

Air 2 (black)
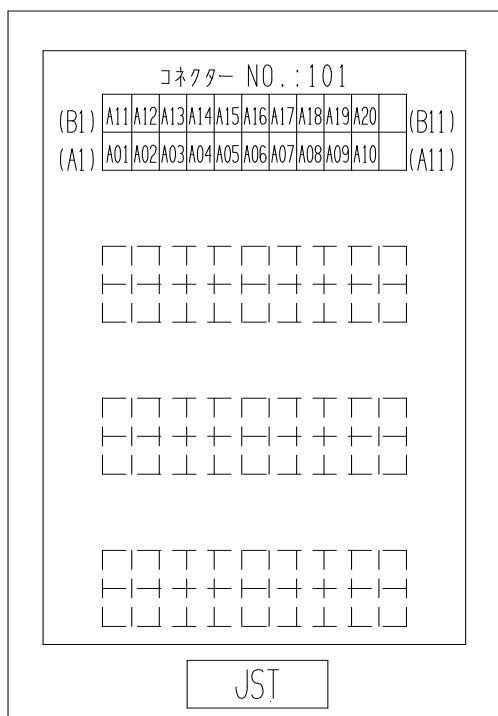RC1/4

Air 1 (white)
RC1/4

Note)

- In standard specification, only 2 air lines (AIR1 to Port1 and AIR2 to Port7) are connected directly inside gear box. Plugs are attached on air outlet.

- Solenoid valves and silencer written in this figure are mounted when "solenoid valve" option is selected.

■**Detailed diagram of application connectors**

(1) BJ1 side (connector)

コネクター NO.：101

| (B1) | A11 | A12 | A13 | A14 | A15 | A16 | A17 | A18 | A19 | A20 | (B11) |
| (A1) | A01 | A02 | A03 | A04 | A05 | A06 | A07 | A08 | A09 | A10 | (A11) |

JST

Connector for application cable
Wire-side shell: JFM-WSA-4-A (JST)
        or JFM-WSA-4-C(JST)
Guide plate A kit: FM-GPAK-4 (JST)
Receptacle housing: JFM2FDN-22V-K (JST)
Receptacle contact:
    (a) SJ2F-01GF-P1.0 (JST) (0.20 ~ 0.50 mm^2)
    (b) SJ2F-21GF-P1.0 (JST) (0.30 ~ 0.75 mm^2)
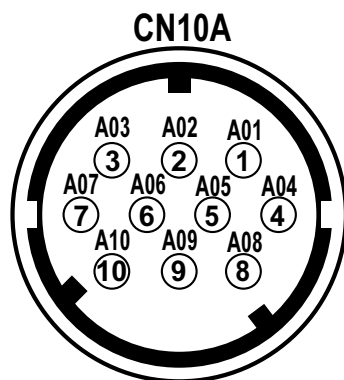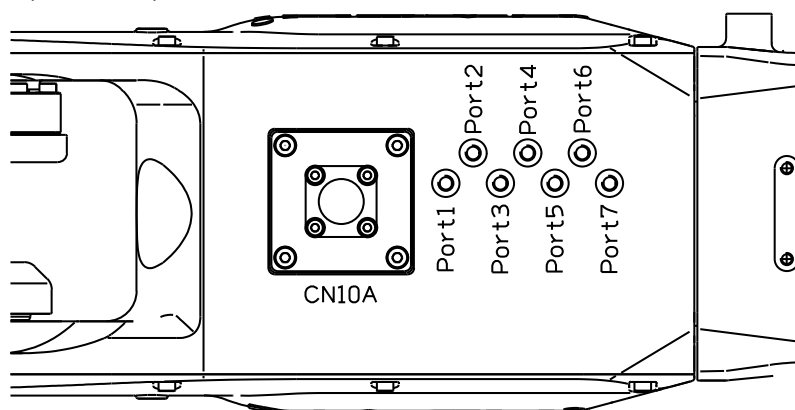Manual crimp tool:
    for (a), YRS-8861
    for (b), YRF-1120
Cable diameter suitable for wire-side shell:
    JFM-WSA-4-A (JST) ϕ26.2 ~ ϕ28.0
    JFM-WSA-4-C (JST) ϕ15.5～ϕ16.5

(This figure is drawn seeing from the backside of the robot.)

(2) Wrist side (connector)

Port1 Port2 Port3 Port4 Port5 Port6 Port7

CN10A

CN10A

A03 A02 A01
③   ②   ①
A07 A06 A05 A04
⑦   ⑥   ⑤   ④
A10 A09 A08
⑩   ⑨   ⑧

Connector CN10A on wrist 1
JAE JN1AS10ML1-R
Partner connector type
JAE JN1DS10SL2

8. **Control specification**

○; Supported, −; Setting disable (Execution enable), ×; Not supported

Functions	Abstract		Smart TP	Compact TP
Robot language	SLIM language is supported for complicate application.		○	−
Interpolation	Linear interpolation;	XYZ parallel movement on robot coordinate system (based on the world wide standard JIS B8437)	○	○
	Fixing TCP;	Changing robot attitude while fixing TCP point		
	Tool coordinate;	XYZ parallel movement on tool coordinate system		
	Circular interpolation;	Movement on circle by determined with 3 points. Start point and end point can be designated individually.		
Low speed playback	TCP speed is limited 250mm/sec under following condition. ・ Low speed signal input ・ Check GO/BACK operation ・ First step playback after STEP number is designated		○	○
Speed definition	TCP linear speed 1 - 5000mm/sec（0.1mm/sec unit） Time 0.01 - 100sec（0.01sec unit） Power ratio 1.0 - 100.0 %（0.1% unit） Tool angle speed 1 - 500deg/s (1deg/s unit)		○	○
Speed override	Playback speed can be varied 1 - 150% without changing recorded speed.		○	○
Check GO/BACK	In teach mode, recorded position can be confirmed step by step or continuously, and forward / backward. (Functions also can be played back.)		○	○
Accuracy	8 degrees (0 - 1000mm) of in position accuracy can be designated on every step. And in-position or path-through can be designated also.		○	○
Tool designation	32 different tools can be designated on every step.		○	−
Automatic tool constant calculator	Tool length (TCP position), tool weight and COG and tool moment of inertia can calculated automatically by designated program.		○	×
Self checking	Self check the error of robot and controller. (700 kind of errors)		○	○
Error detection	Check the condition of robot and controller all the time. Robot stops immediately when error happens.		○	○
Logical I/O	Maximum 2,048 logical inputs and 2,048 logical outputs are available as standard. I/O card is option.		○	○
Signal assignment	Port assignment and positive/negative logic of all I/O is available.		○	−

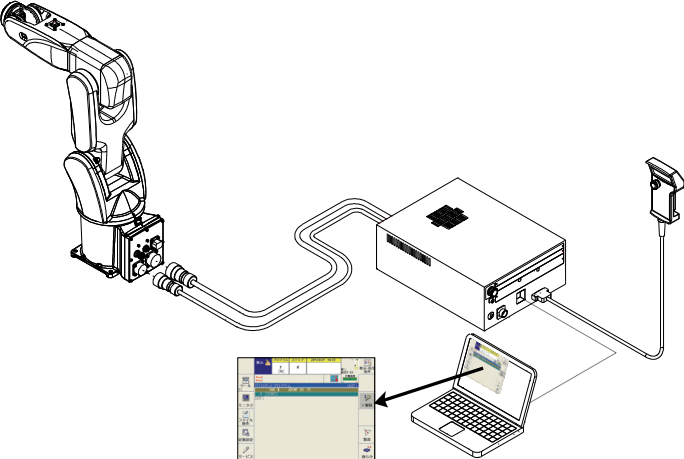O; Supported, －; Setting disable (Execution enable), ×; Not supported

Functions	Abstract	Smart TP	Compact TP

Editor	1. Screen editor
	     Addition, deletion and copy of every move step and function is available. Recorded position can be also edited.
	2. Copy utility
	     Recorded program and step can be copied.
	3. Program conversion
	     Condition & speed, each axis angle, parallel shift, etc.
	4. Program Certification
	     File directory, file verify
		O	×

Machine lock	This can check I/O by playback program, keeping robot stationary.	O	O
I/O simulation	This can check program flow by changing logical I/O from teach pendant, keeping physical I/O locked.	O	O
Memory protect	This can protect program to avoid the modification and deletion by careless operation.	O	－
Power saver	This can save energy by motor power off and brake lock after pre-determined time passed with no movement. When more time passed, fan motors inside of cabinet will stop for further power saving.	O	O
Monitor utility	Real time monitor of following data; 1. Robot program	O	O
	2. Error logging	O	O
	3. Fixed I/O	O	－
	4. General usage I/O	O	O
	5. Program queue	O	－
	6. Operating time and or so	O	－
Help message (Built-in manual)	Operations and function explanations are displayed on teach pendant. And graphical troubleshooting manual is also displayed.	O	×
Customization	Software keys are re-locatable for better operation.	O	×
Power failure backup	When main power is down while playback robot, all necessary data is back upped for easy restarting of the robot after power on.	O	O
Program queue	Up to 10 programs to be played back can be reserved.	O	－
Home position	Up to 32 home position can be defined. Home position signal is outputted.	O	－
Function commands	・ General usage signal output ・ General usage signal input ・ Program flow control (step jump/call, program jump/call) ・ Timer delay ・ Welding, and or so	O	O

		Smart TP	Compact TP
O; Supported, -; Setting disable (Execution enable), ×; Not supported			
Functions	**Abstract**		
Interface panel	Pushbuttons and lamps can be arranged on teach pendant touch panel screen. Operating switches and indicators are replaced to software, so this utility can contribute to cost down. Available to register up to 31 keys /screen * 8 screens = 248 keys	O	×
Ethernet	File upload and download via Ethernet is available. (1 port)	O	O
Built-in PLC	This is software programmable logic controller. Physical I/O board (another option) is necessary to perform I/O actually.(Refer to hardware option)	O	-
High Speed Interference Detection	In the case operation mistake or unexpected interference occurs during teaching work, this function can detect it as a contact with outside world, and stops the robot immediately.	O	O
Overhaul Prediction	This is to prevent from trouble occurrence by estimating the lifespan of bearings in each robot arm and by detecting torque over. Furthermore, this function can predict the overhaul timing of robot.	O	-
Palletizing	Palletizing and de-palletizing teaching can be programmed by easy pattern definition.	○	-
Adaptive motion control	Enabling to drive each joint softly.	○	-
Oscilloscope	Enabling to monitor the servo data such as velocity, current, etc. of each joint by graphical display on teach pendant.	○	-
Fine motion control	Enabling to improve the locus accuracy. Command is recorded in step.	○	-
User Task	Task program can be executed separately from robot program.	○	-
Language	English Japanese Chinese Korean Germany Italian Spanish	○	× (*)

(*) Japanese is KANA characters. Chinese is Pin-In alphabetic characters. Other language is English.

9. **PC tool**

No.	Item	Specification
1	FDonDesk Light (Free software)	This is the software on personal computer to do the parameter setting and robot programming of CFD controller. Data up/download is available by connecting personal computer with CFD controller via Ethernet. All of CFD operation is available, including cycle time simulation Even in case of operating high performance screen which is not supported by Compact TP, such screen is displayed on personal computer because it is connected online with robot controller.

Other than above software, we can provide "FDonDESK Pro" and "FDonDESK Regular" (option software, not free). See "10 Option specifications" for detail.

10. **Option specifications**

Robot

No.	Item	Specifications	Parts No.
1	Parts for installation *1	Chemical anchor specification (Installing plate with 4 base plates + chemical anchor bolts)	OP-F1-019
		Ore anchor specification (Installing plate with 4 base plates + ore anchor bolts)	OP-F2-015
		Robot installation bolts and washers	OPJ-F1-0051
2	Axis 1 adjustable stopper	Restriction of axis 1 operation edge (± 3.14 ± 0.79 rad, every 0.26 rad)	OP-S5-015
3	Axis 2 adjustable stopper	Restriction of axis 2 operation edge (-0.39 rad, -0.79 rad from edge)	OP-A5-019
4	Axis 3 adjustable stopper	Restriction of axis 3 operation edge (-0.44 rad, -0.87 rad from edge)	OP-A6-016
5	Zeroing pin & Zeroing block	Zeroing pin & Zeroing block	OP-T2-085
6	Hanging jig	Jig for installation of inverted mount robot	OP-S7-007
7	Solenoid valve *2	Stored in arm (1 valve)	OP-H4-005
8	Solenoid valve *2	Stored in arm (2 valves)	OP-H5-009
9	Solenoid valve *2	Stored in arm (3 valves)	OP-H6-005
10	Wires clamp *4	Clamp for wires and air tubes inside axis 6 hole Air ($\varphi 4 : 7$ lines), signals	OP-W3-012
11	ISO flange *5	P.C.D.31.5	OP-W2-012
12	Name seal for inverted mount	Name seal for MC10S-01 inverted mount	OP-N2-032
13	Vision sensor option	Application box for vision sensing system	OP-E5-007
14	Water proof coolant Paint	Water proof coolant paint for MC10S-01	OP-N5-045

*1：These parts are packed separately from the robot. (Not attached on the robot)

*2：Solenoid valve;   Type SYJ3220-5GR-M3 (SMC), 2 position double solenoid, Coil voltage DC24V, Consuming power 0.35W, With surge voltage protector circuit (no pole), No-lock push type manual operation, Without sub-plate for tube, Without bracket (The number of valves depends on the specification.)

*3; Transporting jig is accessory as standard. If another transporting jig is needed to transport the robot, please order KP-ZJ-005 (although not written in above list) to Nachi service.

*4：This option includes flange1, flange2, clamp, and bolts (4-M5x20), and positioning pin MDP-5x25. For details, refer to the instruction manual "CFD CONTROLLER TECHNICAL DOCUMENT 1 (TCFEN-155)".

*5：This option includes ISO flange and installation bolts (4-M5x15). For details, refer to the instruction manual "CFD CONTROLLER TECHNICAL DOCUMENT 1 (TCFEN-155)".

CFD Controller

No.	Item	Specifications	Parts No.	Notes
1	Mini I/O board	I/O Photo coupler 8 inputs / NPN Transistor 8 outputs	CFD-OP150-A	Mounted on sequence board of slot A
		I/O Photo coupler 8 inputs / Relay contact 8 outputs	CFD-OP150-B	
2	EtherNet/IP board	Master 1CH	CFD-OP130-A	Occupies 1 slot
		Slave 1CH	CFD-OP130-B	
		Master 1CH + Slave 1CH	CFD-OP130-C	
		Slave 2CH	CFD-OP130-D	
		Master 2CH	CFD-OP130-E	
3	DeviceNet board	Master 1CH	CFD-OP131-A	Occupies 1 slot
		Slave 1CH	CFD-OP131-B	
		Master 1CH +Slave 1CH	CFD-OP131-C	
		Slave 2CH	CFD-OP131-D	
		Master 2CH	CFD-OP131-E	
4	Digital I/O board	I/O Photo coupler 32 inputs / NPN Transistor 32 outputs	CFD-OP125-A	Occupies 1 slot
		I/O Photo coupler 64 inputs / NPN Transistor 64 outputs	CFD-OP125-B	Occupies 2 slots
		I/O Photo coupler 32 inputs / PNP Transistor 32 outputs	CFD-OP151-A	Occupies 1 slot
		I/O Photo coupler 64 inputs / PNP Transistor 64 outputs	CFD-OP151-B	Occupies 2 slots
5	CC-Link board	Both master and slave 1CH	CFD-OP98-B	Occupies 1 slot
6	PROFIBUS board	Master 1CH	CFD-OP132-A	Occupies 1 slot
		Slave 1CH	CFD-OP132-B	
		Master 1CH + Slave 1CH	CFD-OP132-C	
		Slave 2CH	CFD-OP132-D	
		Master 2CH	CFD-OP132-E	
7	PROFINET board	Slave 1CH	CFD-OP136-B	Occupies 1 slot
		Slave 2CH	CFD-OP136-D	
8	Conveyor Tracking I/F	RS422 Differential input encoder counter	CFD-OP47-A	Occupies 1 slot
9	Force sensor I/F	Force sensor unit for CFD (another box)	CFD-OP152-A	Occupies 1 slot
10	Vision sensor	Vision sensor unit for CFD (another box)	CFD-OP139-A	
11	Robot monitoring unit	Robot monitoring unit for CFD (another box)	CFD-OP145-A	
12	Brake release switch	Brake release switch (portable type)	FD11-OP90-E	
13	Controller protection BOX	Upgraded to IP54 equivalent by preparing dust-proof and drip-proof box	CFD-OP133-A	
14	UL specification	Some parts are replaced to conform to UL standard	CFD-UL-A	
	CE marking specification	Some parts are replaced to conform to European CE marking	CFD-CE-A	
	KCs specification	Some parts are replaced to conform to Korean KCs standard	CFD-KCS-A	
15	Smart TP	Cable length 4m	CFDTP-10-04M	These are selectable option. One of them must be selected.
16	Compact TP	Cable length 4m	MINITP-10-04M	
17	TP shorting plug	To disconnect teach pendant	CFD-OP153-A	
18	Teach Pendant extension cable	5m	CFDTP-RC05M	Only one cable can be added. Both side have connector
		10m	CFDTP-RC10M	
19	Motor/Encoder harness	2m	C101C-J1-02-A	Harness between robot and controller. These are selectable option. One of them must be selected.
		5m	C101C-J1-05-A	
		10m	C101C-J1-10-A	
		15m	C101C-J1-15-A	
		20m	C101C-J1-20-A	
		25m	C101C-J1-25-A	
20	I/O harness	2.5m	IOCABLE-50-02M	I/O cable between robot and controller. Controller side is separate cable. Manufacturing needs to be done by customer.
		5.5m	IOCABLE-50-05M	
		10.5m	IOCABLE-50-10M	
		15.5m	IOCABLE-50-15M	
		20.5m	IOCABLE-50-20M	
		25.5m	IOCABLE-50-25M	
21	I/O cable on robot arm	1.5m	IOCABLE-20-01M	Tool side is separate cable. Manufacturing needs to be done by customer.
	I/O connector on robot arm	Connector only Soldering type	IOCABLE-20-00	This is connector only. Manufacturing needs to be done by customer.
22	USB memory	1GByte	FD11-OP93-A	
23	FDonDESK Pro	Robot Program Simulator	FDonDESK Pro	
24	FDonDESK Regular	Robot Program Simulator	FDonDESK Regular	
25	FL-net board	2CH at maximum	CFD-OP101-A	Occupies 1 slot

No.	Item	Specifications	Parts No.	Notes
26	Additional 1 servo axis	100W motor	CFD-OP79-MC01	For servo gripper or traverse unit
		200W motor	CFD-OP79-MC02	
		400W motor	CFD-OP79-MC04	
		600W motor	CFD-OP79-MC06	

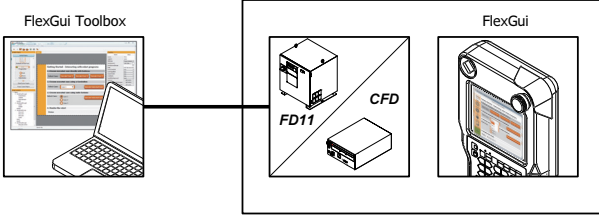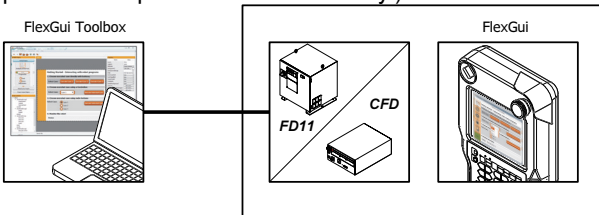DeviceNet and EtherNet/IP is a trademark of ODVA (Open DeviceNet Vender Association, Inc.).

CC-Link is a trademark of CC-Link Partner Association : CLPA.

PROFIBUS and PROFINET is a trademark of PROFIBUS & PROFINET International.

・1：Mini I/O Board
  Photo coupler input; DC24V no pole, Input resistance 3KΩ/8mA
  NPN Transistor output; DC24V NPN, output voltage DC36V, output current 100mA
  Relay contact output; Output voltage DC30V, output current 500mA
・2,3,5,6,7 and 25： each Fieldbus Board Available up to 4 channels. Maximum channel quantity may vary according to Fieldbus specification and combination with other options.
・4：Digital I/O Board
  Photo coupler input; DC24V no pole, Input resistance 3KΩ/8mA
  NPN Transistor output; DC24V NPN, output voltage DC36V output current 100mA
  PNP Transistor output; DC24V PNP, output voltage DC36V output current 100mA
・8：Conveyor synchronization I/F To perform conveyor synchronized motion, speed signal receiver board is added. Differential input (conforming to RS-422), Terminating register 100Ω (set by SW on board), Response frequency 1MHz at maximum
・10：Vision sensor can see the target such as work-piece by camera, and measure its position Additional box is necessary. So controller size changes.
・11：Robot monitoring unit can monitor the robot position and speed. Additional box is necessary. So controller size changes. When this option is used, No.9 Mini I/O board can not been used at the same time.
・17：TP shorting plug is used to connect to the controller instead of TP to short emergency stop circuit. Teaching operation is impossible by using TP shorting plug.
・18：TP cable diameter φ5.8mm, minimum bending radius 35mm
・19：Motor/Encoder harness Motor cable diameter φ16.6mm, minimum bending radius 100mm, Encoder cable diameter φ13.2mm, minimum bending radius 80mm
・20：I/O harness includes robot side connector CNR010. Cable diameter φ10.5mm, minimum bending radius 65mm.
・22：USB memory is used to backup program and constant files. Insertion port is on the front panel as standard.
・23,24："FDonDESK Pro & Regular" is the software on personal computer to do parameter setting and robot programming of CFD controller. Data up/download is available by connecting personal computer with CFD controller via Ethernet. This software is upgraded from "FDonDESK Light". "Regular" has no limitation of available robot type. "Pro" has program creation utility from CAD data and multi robot control utility compared with "Regular".
・26：Additional 1 servo axis contains servo motor and electric device to control 1 axis servo gripper or 1 axis traverse unit.

■ **FlexGui (Only Smart TP)**

The **"FlexGui"** is a function in which "Fidget" like buttons, indicators, digital displays etc, can be placed on the teach pendant screen. And it is also possible to use those fidgets with scripts and robot variables. By using this function, it becomes possible not only to make a simple and easy GUI on the teach pendant screen but also to construct a highly integrated operation panel on the screen without expensive hardware. Please use this function to reduce the cost and to make the operation interface of the robot more simple.

License	Description	Free/ Charged	License file
No (Trial version)	Pre-installed in the this controller as a demonstration version (trial version). (NOTE) The created screen cannot be saved FlexGui	Free	Not necessary
FlexGui	The created screen can be saved It is possible to connect the PC in which the FlexGui Toolbox is installed and this controller and to transfer the screen created in the FlexGui Toolbox to this controller. If there are plural CFD controllers, they must have their own exclusive license file one by one. FlexGui Toolbox FlexGui CFD FD11	Charged	Necessary
FlexGui Remote	The communication between the PC in which the FlexGui Toolbox is installed and this controller is possible. It is possible to operate this controller from the PC. If there are plural CFD controllers, they must have their own exclusive license file one by one. (Only the key operation on the screen is possible. It is not possible to operate the robot directly.) FlexGui Toolbox FlexGui CFD FD11	Charged	Necessary To use this "FlexGui Remote", the license of the "FlaxGui" is also necessary.

(NOTE) FlexGui Toolbox can be downloaded from www.flexgui.net

IMPORTANT
- Concerning how to purchase the license files, please contact our sales persons when purchasing the robot controllers.
- To purchase only the license files after purchasing the robot controller, the "FlexGui ID" displayed on the teach pendant is necessary. (See the following pages)

11. Transport procedure

⚠️ WARNING	The robot must be transported by personnel who have licenses required for slinging work, crane operation, forklift truck operation, and others.
⚠️ WARNING	To lift the robot or the controller, follow the procedures specified in the Maintenance Manual. Following any procedures other than those specified will cause the robot to topple over or drop during transport, thus resulting in accidents.
⚠️ CAUTION	During transport or installation work of the robot, pay utmost care not to cause damage to wirings. Furthermore, after installing the robot, take protective measures such as using protective guards so that the wirings will not be damaged by workers or other persons, or forklift trucks or else.

To transport the robot, make it a rule to use a crane.
First, make the robot posture to the configuration shown below and mount two carrier brackets to both sides of robot frame, and lift robot using four hanging wires. Fix brackets with two M12 X 30 bolts. The tightening torque is 116 N·m. Recommended length of the hanging wires is 3 m.

【MC10S-01】

Four hanging wires
4本吊ワイヤー
(推奨長さ3m)
(Recommended length 3m)

811

1091

485

40°

10°

搬送治具
(出荷時付属品)

重心位置
Center of gravity

39

14

2-M12x30
2-WG-F35-12
(反対側も含む)
(Including the opposite side)
締付トルク116Nm
TIGHTENING TORQUE
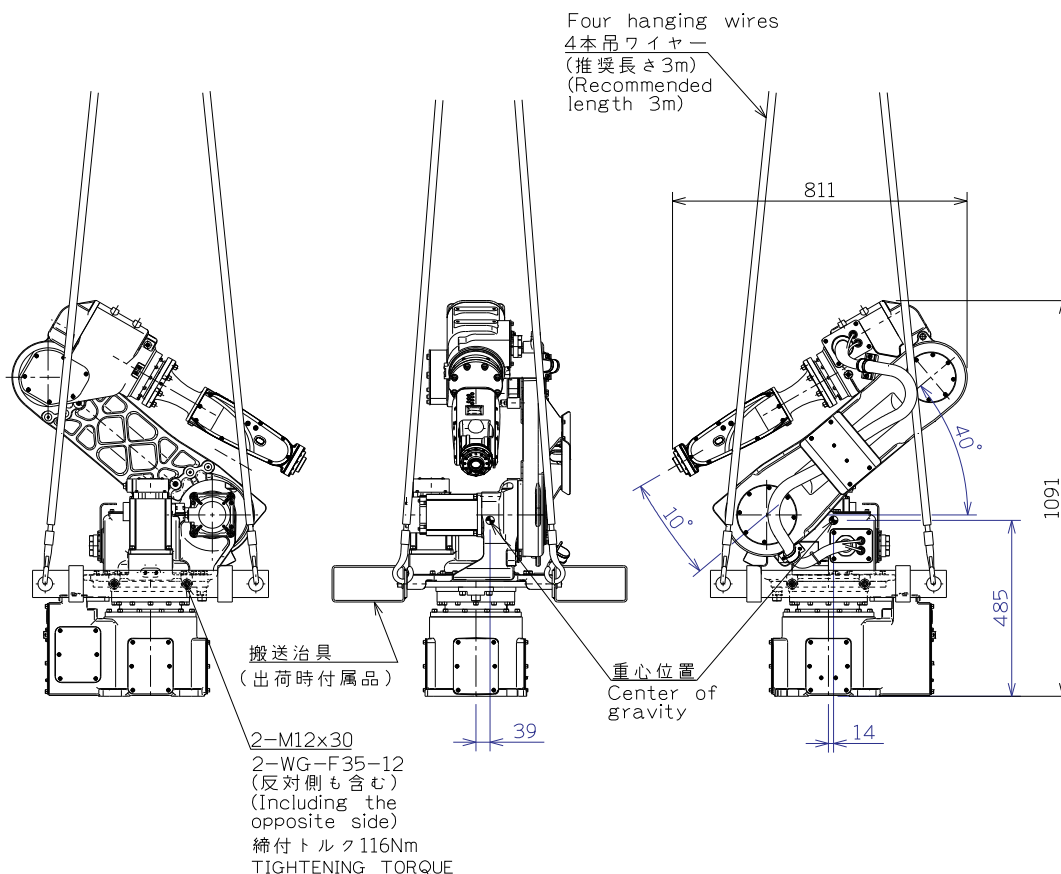
12. **Installation (specification which contains a robot)**

1.   Delivery condition

Because the expense is different, which form to choose be sufficiently examined.

Style	Condition	Details
1	Delivery on the truck	Robot is delivered on the truck near the entrance of customer's plant.
2	Delivery after installation and test-run	Robot is installed and test-run done.
3	Delivery after installation and test-run with work piece	After style 2, teaching with work piece is done.

2.   Operation and maintenance education

The special spot operation guide and the special spot preservation guide are the outside of the estimation. Also, there is schooling system in the Toyama factory, too.
Consult with each NACHI-FUJIKOSHI office for the details.

3.   The type D grounding (the grounding resistance is 100Ω or less) is necessary.

13. **Consuming power (Robot + CFD-3000 Controller)**

1.5 kVA (peak)   This value varies due to the moving pattern.

14. **Paint color**

Standard color   Munsell 10GY9/1

Water proof coolant paint option is useful for the circumstance such as that coolant splashes on robot body. Please refer to "10 Option specifications" for the type of this option.

15. **Warranty**

Elapse of 1 year after delivery.

The specifications and appearances in this document might change without a previous notice for the improvement.

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