



CFD CONTROLLER TECHNICAL DOCUMENT 1

	Item	Part No.
1	MZ series Adjustable stopper	OP-S5-022(MZ07), OP-S5-026(MZ04)
2	MZ series Transfer jig	OP-S2-042(MZ07), OP-S2-044(MZ04)
3	MZ series Tools	OP-T2-078(MZ07), OP-T2-089(MZ04)
4	MZ series IP67 set	OP-H9-004(MZ07)
5	MZ series Solenoid valve	MZ07 : OP-H4-004, OP-H5-008, OP-H6-004 MZ04 : OP-H4-006, OP-H5-010
6	MZ series Wires clamp	OP-W3-012(MZ07), OP-W3-016(MZ04)
7	MZ series ISO flange	OP-W2-012(MZ07), OP-W2-013(MZ04)
8	MZ series Standard gripper	MZ07 : OP-F10-002, -003, -004, -005, -006, -007, -008 MZ04 : OP-F10-009, -010, -011, -012
9	Brake release switch	FD11-OP90-E
10	Controller protection box	CFD-OP133-A
11	Teach pendant additional cable	CFDTP-RC##M
12	MZ series Motor / Encoder additional harness	Z102C-00##-A
13	MZ series I/O harness	IOCABLE-10-02M,05M,10M,15M,20M,25M
14	MZ series I/O cable on robot arm	IOCABLE-20-01M
	MZ series I/O connector on robot arm	IOCABLE-20-00
15	USB memory	FD11-OP93-A
16	Vision sensor	CFD-OP139-A
17	Force sensor	CFD-OP152-A
18	Conveyor tracking interface	CFD-OP47-A
19	1 additional servo axis	CFD-OP79-A
20	100VAC Power source voltage	CFD-OP154-A
21	Robot Monitoring Unit	CFD-OP145-A
22	CE marking specification	CFD-CE-A
23	External operation panel connection terminal block	CFD-OP20-A

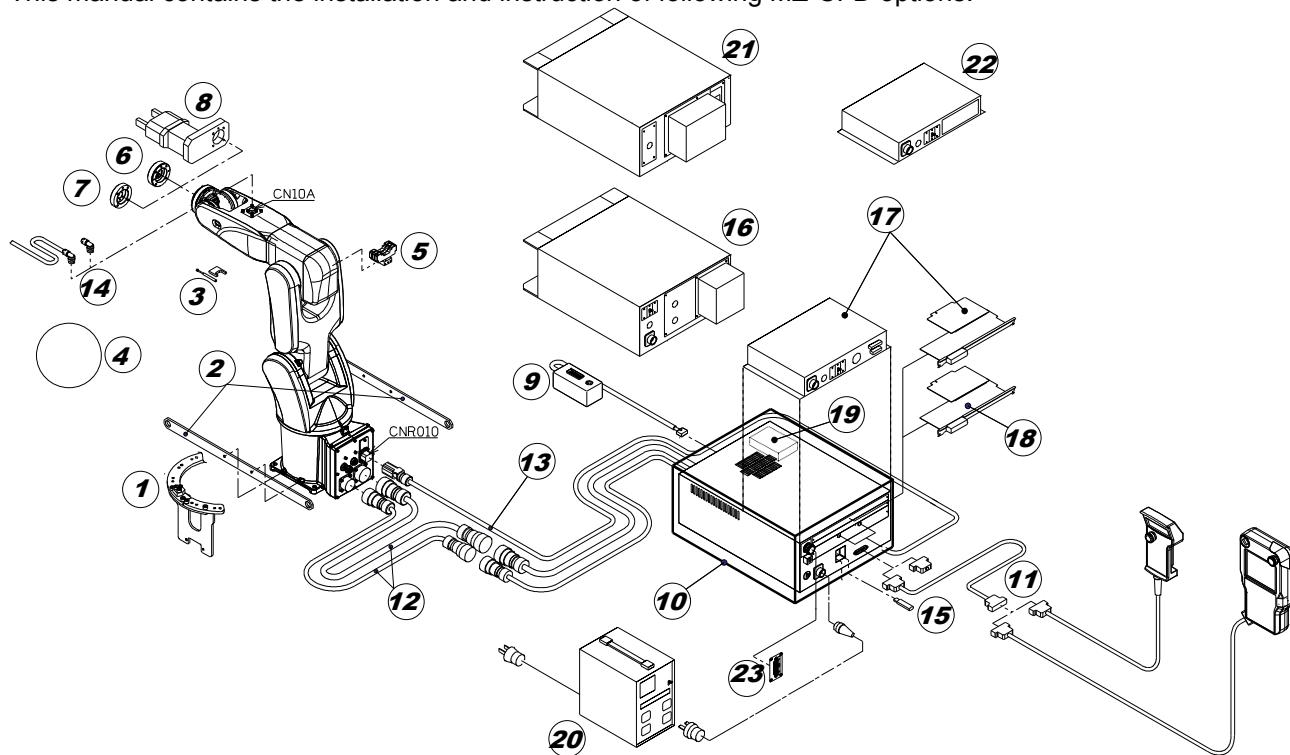
11th edition

- Before attempting to operate the robot, please read through this operating manual carefully, and comply with all the safety-related items and instructions in the text.
- The installation, operation and maintenance of this robot should be undertaken only by those individuals who have attended one of our robot course.
- When using this robot, observe the law related with industrial robot and with safety issues in each country.
- This operating manual must be given without fail to the individual who will be actually operating the robot.
- Please direct any queries about parts of this operating manual which may not be completely clear or any inquiries concerning the after-sale service of this robot to any of the service centers listed on the back cover.

NACHI-FUJIKOSHI CORP.

C O N T E N T S

This manual contains the installation and instruction of following MZ-CFD options.



No.	日本語名 JAPANESE	英語名 ENGLISH
1	MZ シリーズ 可変ストッパー	MZ series Adjustable stopper
2	MZ シリーズ 搬送ジグ	MZ series Transfer jig
3	MZ シリーズ 付属工具	MZ series Tools
4	MZ シリーズ IP67 強化セット	MZ series IP67 set
5	MZ シリーズ 内蔵ソレノイドバルブ	MZ series Solenoid valve
6	MZ シリーズ 手首配線クランプ	MZ series Wires clamp
7	MZ シリーズ ISO フランジ	MZ series ISO flange
8	MZ シリーズ 標準ハンド	MZ series Standard gripper
9	ブレーキ解除スイッチ	Brake release switch
10	コントローラ保護 BOX	Controller protection box
11	ティーチペンダント延長ケーブル	Teach pendant additional cable
12	MZ シリーズ モータ／エンコーダ延長ハーネス	MZ series Motor / Encoder additional harness
13	MZ シリーズ I/O ハーネス	MZ series I/O harness
14	MZ シリーズ アーム上 I/O ケーブル	MZ series I/O cable on robot arm
	MZ シリーズ アーム上 I/O コネクタ	MZ series I/O connector on robot arm
15	USB メモリ	USB memory
16	視覚センサ	Vision sensor
17	力センサ	Force sensor
18	コンベア同期インターフェース	Conveyor tracking interface
19	サーボ1軸追加	1 additional servo axis
20	電源電圧変更(AC100V)	100VAC Power source voltage
21	ロボット監視装置(RMU)	Robot Monitoring Unit
22	CE 仕様	CE marking specification
23	外部操作パネル接続端子台	External operation panel connection terminal block

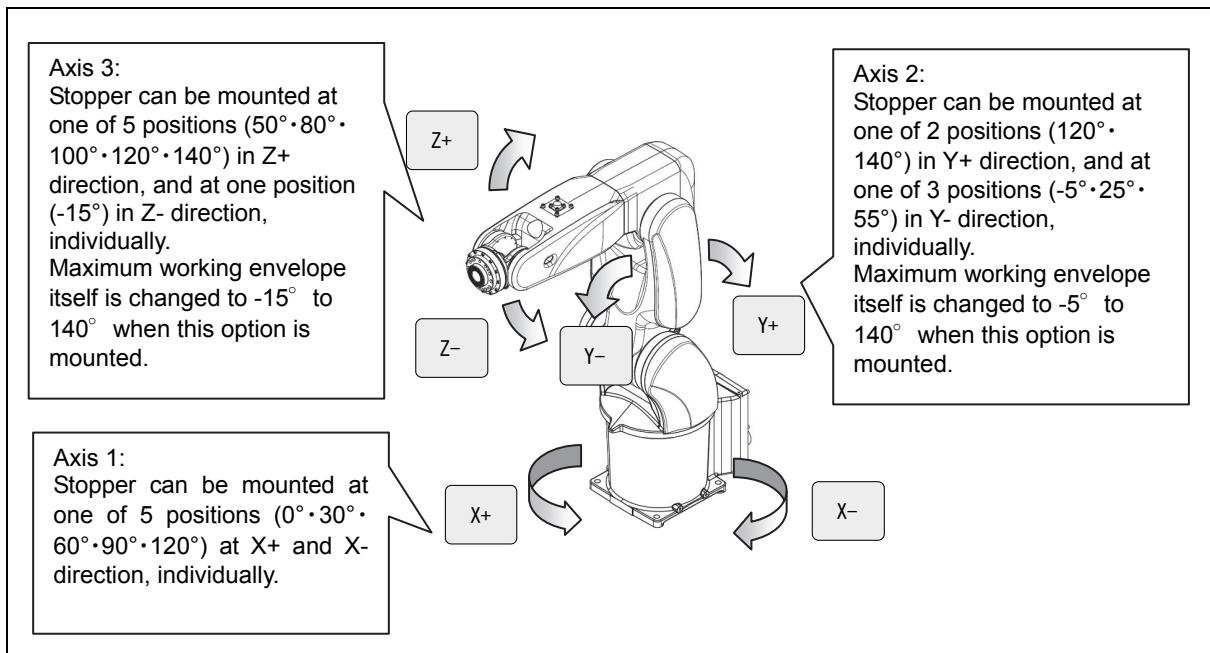
Left No. of above table is chapter No. of this manual.

Chapter1 MZ series Adjustable Stopper

This option is used to limit the working envelope by changing the mechanical stopper position. Plural holes are prepared on attachment plate. Customer can select any stopper position among them. This option contains the all parts to change the mechanical stopper position of axis 1, 2 and 3. Each axis stopper can be mounted individually. In case of axis 2 and 3, maximum working envelope itself is changed when this option is mounted.

1.1 MZ07 series / MZ03EL

Name	Specification	Parts No.	Notes
Adjustable Stopper	For axis 1, 2 and 3	OP-S5-022	MZ07 series MZ03EL



Working envelope limited by adjustable stopper

WARNING	With stoppers dismounted, do not operate the robot. Doing so may result in damage to the peripheral equipment, or death or serious injury.
WARNING	Mechanical stopper should be mounted outside the working envelope defined by the software and the over-travel limit switch (another option). Software limit (= working envelope) must be changed without fail. If not changed, mechanical stopper may be damaged.
WARNING	Mechanical stopper is the safe guard to limit the working envelope. This must be fixed by tightening the specified torque, using torque wrench. If not fixed correctly, mechanical stopper may fall off and be scattered, thus resulting in damage to the peripheral equipment, or death or serious injury.

1.1.1 Axis 1 Adjustable Stopper

How to install

Step	Work performed
1	At first, please determine the position where the adjustable stopper is mounted.
2	Move axis 1 to the reference position.
3	Turn off the controller power.
4	<p>Mount following parts to robot body in order.</p> <ul style="list-style-type: none"> • Bracket ×2 (L/R) • Plate A ×1 • Plate B ×2 (L/R)
5	<p>Tighten pushing bolts from both sides against robot body in order to fix the adjustable stopper unit.</p> <ul style="list-style-type: none"> • Pushing block x2 (L/R)

	<p>Mount stopper block at designated position.</p> <ul style="list-style-type: none"> • Stopper block x1 • Stopper rubber x1 • Collar x1 <p>(these number is for one side)</p> <p>If either side is same as standard working envelope, it's unnecessary to mount stopper block there.</p>	<p><u>Positions to mount stopper block</u></p>
6		<p>M3X10 Tightening torque 1.77Nm M3 washer Collar Stopper rubber Stopper block 2-M8X15 Tightening torque 26.1Nm</p> <p>X+ Direction X- Direction</p> <p><u>Stopper rubber assembling</u></p>
7	Turn on the controller power.	
8	Change the software limit parameter according to the new working envelope. Refer to the instruction manual "SETUP", "Chapter 4 Setup"	

1.1.2 Axis 2 Adjustable Stopper

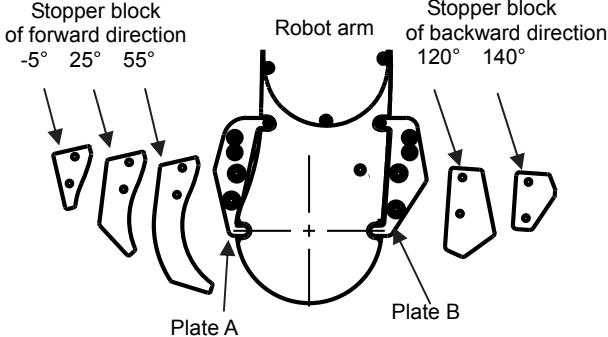
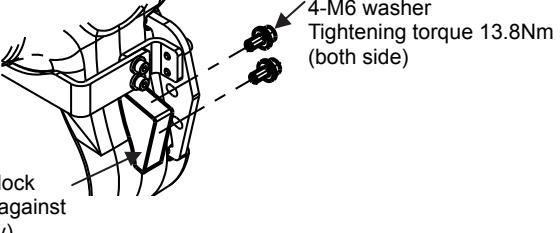
How to install



WARNING

Maximum working envelope itself is changed to -5° to 140° when this option is mounted. Stopper block must be mounted on both end position (-5°, +140°) even when it is unnecessary to change working envelope. If robot is operated with stoppers dismounted, this may result in damage to the robot body or peripheral equipment, or death or serious injury.

Step	Work performed
1	At first, please determine the position where the adjustable stopper is mounted.
2	Move axis 2 to the reference position.
3	Turn off the controller power.
4	<p>Mount following parts to robot body in order.</p> <ul style="list-style-type: none"> • Collar x2 • Plate A x1 • Plate B x1 <p>2-M4X30 (removed on both side)</p> <p>Collar (mounted on both side)</p> <p>Plate A</p> <p>2-M4X40 Tightening torque 3.63Nm (both side)</p> <p>Plate B</p> <p><u>Push the plates to the arrow direction and fix them</u></p>
5	<p>Mount following parts to robot body in order.</p> <ul style="list-style-type: none"> • Bracket B x2 • Bracket A x1 <p>Bracket B (mounted on both side)</p> <p>4-M5X15 4-M5 washer Tightening torque 8.1Nm (both side)</p> <p>Press bracket A against robot body</p> <p>Plate A</p> <p>Bracket A</p> <p>4-M5X12 4-M5 washer Tightening torque 8.1Nm (both side)</p> <p><u>Press bracket A against robot body</u></p>

	<p>One stopper block is prepared for one location (limit angle). Select one for forward direction and one for backward direction. Mount them on each plate with pushing against each plate.</p>
6	 <p>Stopper block of forward direction -5° 25° 55°</p> <p>Robot arm</p> <p>Stopper block of backward direction 120° 140°</p> <p>Plate A</p> <p>Plate B</p> <p><u>One stopper block for one location (limit angle)</u></p>  <p>Stopper block (pressed against robot body)</p> <p>4-M6X15 4-M6 washer Tightening torque 13.8Nm (both side)</p> <p><u>Assembling stopper block</u></p>
7	Turn on the controller power.
8	Change the software limit parameter according to the new working envelope.  Refer to the instruction manual "SETUP", "Chapter 4 Setup"

1.1.3 Axis 3 Adjustable Stopper

How to install

WARNING	Maximum working envelope itself is changed to -15° to 140° when this option is mounted. Stopper block must be mounted on both end position (-15°, +140°) even when it is unnecessary to change working envelope. If robot is operated with stoppers dismounted, this may result in damage to the robot body or peripheral equipment, or death or serious injury.
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Step	Work performed
1	At first, please determine the position where the adjustable stopper is mounted.
2	Move axis 3 to the reference position.
3	Turn off the controller power.
4	<p>Mount following parts to robot body in order.</p> <ul style="list-style-type: none"> •Plate A x1 •Plate B x1 •Plate C x1 •Collar A x4 •Plate D x1 •Collar B x3 <p style="text-align: center;"> 4-M5X10 4-M5 washer Tightening torque 8.1Nm Plate A Collar B (3 places) Collar A (4 places) Plate D 4-M5X25 Tightening torque 8.1Nm 3-M4X15 Tightening torque 3.63Nm </p>
5	<p>Press pushing block against robot body by tightening pushing bolts in order to fix the adjustable stopper unit. (Tighten pushing bolts after adjustable stopper unit is fixed on robot body.)</p> <ul style="list-style-type: none"> •Block x2 (L/R) •Pushing block x2(L/R) <p style="text-align: center;"> Plate A Plate B 4-M5X15 4-M5 washer Tightening torque 8.1Nm (for pushing block) (both side) 4-M5X15 Tightening torque 8.1Nm (for pushing block) (both side) Pushing bolt 4-M4X20 4-M4 nut (both side) Pushing block (mounted on both side) Block (mounted on both side) </p>

	<p>Mount stopper block for downward direction at -15° position.</p> <p>Mount stopper block for upward direction at one position among 5 locations.</p> <p>• Stopper block x2</p>	<p>Positions to mount stopper block (upward direction)</p> <p>Position to mount stopper block (downward direction)</p> <p>80°, 100°, 120°, 140°, 50°, -15°</p>
6		<p><u>Positions to mount stopper block</u></p> <p>Plate B</p> <p>Stopper block</p> <p>2-M6X15 Tightening torque 13.8Nm</p>
7	Turn on the controller power.	
8	Change the software limit parameter according to the new working envelope. Refer to the instruction manual "SETUP", "Chapter 4 Setup"	

1.2 MZ04 series

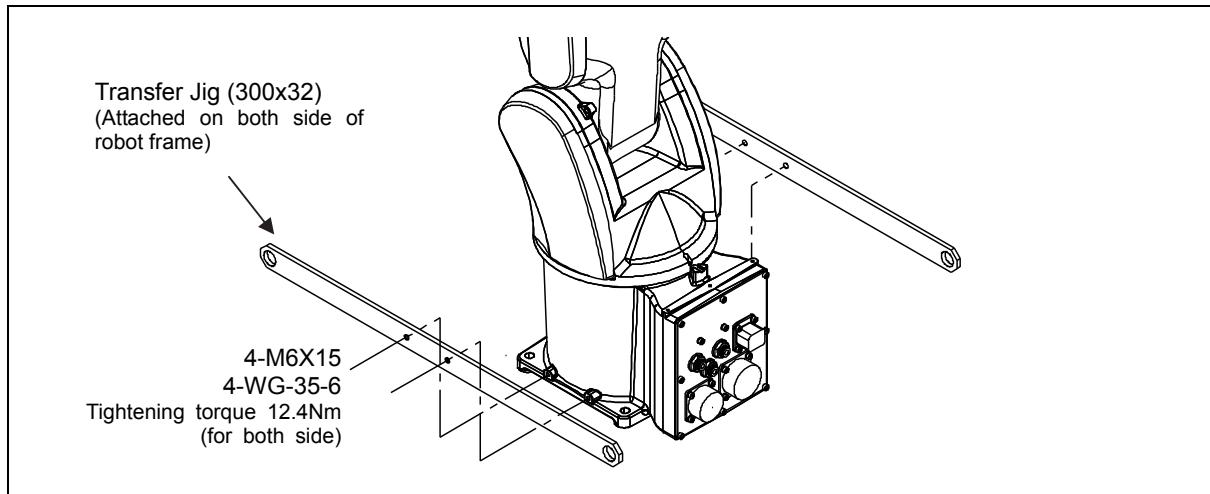
Name	Specification	Parts No.	Notes
Adjustable Stopper	For axis 1, 2 and 3	OP-S5-026	MZ04 series

Chapter2 MZ series Transfer Jig

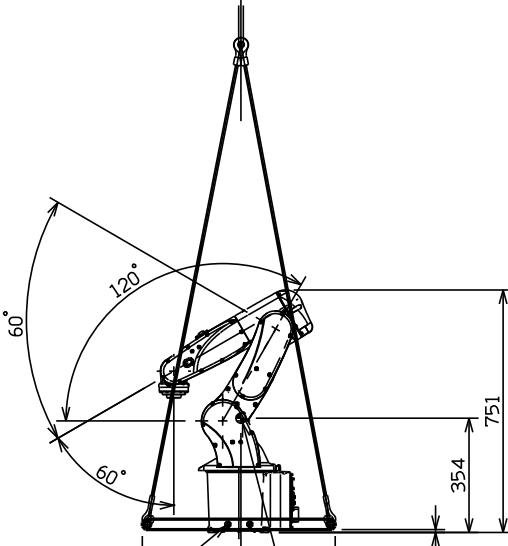
This option is used for transferring robot in safe.

2.1 MZ07 series / MZ03EL

Name	Specification	Parts No.	Notes
Transfer Jig	<ul style="list-style-type: none"> Transferring by crane Changing robot posture for Inverted installation Changing robot posture for Wall mount installation 	OP-S2-042	MZ07 series MZ03EL



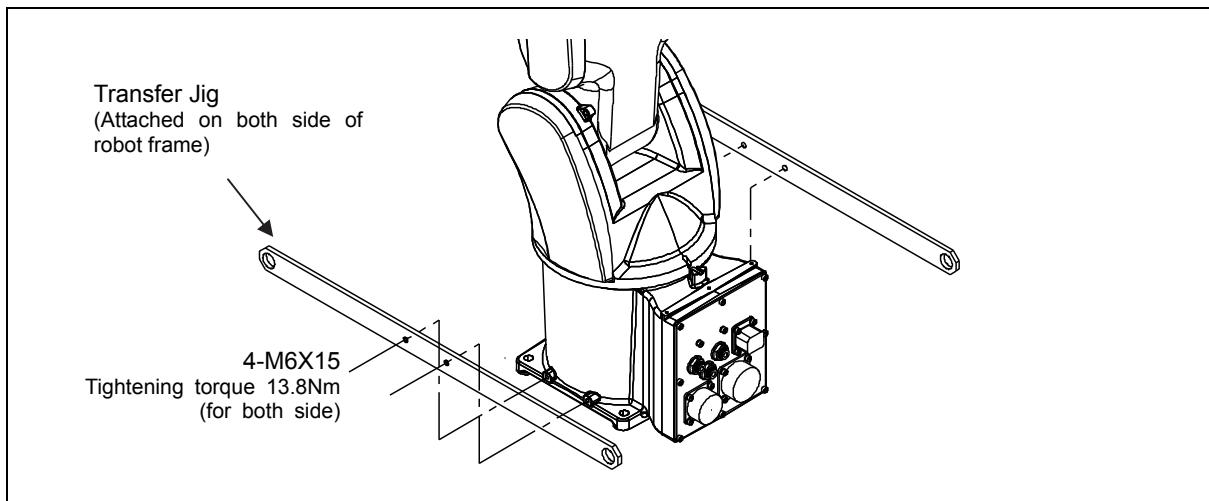
Transfer Jig

 CAUTION	<p>To transfer the robot, use a <u>crane</u>. Make the robot posture to be transferred in safe.</p> <p>For detail, please refer to the instruction manual "MANIULATOR" MZ07-01[CFD].</p>	 <p>(Reference) Posture for transferring</p>
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 CAUTION	<p>After installing the robot, remove the transfer jig.</p>
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2.2 MZ04 series

Name	Specification	Parts No.	Notes
Transfer Jig	<ul style="list-style-type: none"> Transferring by crane Changing robot posture for Inverted installation Changing robot posture for Wall mount installation 	OP-S2-044	MZ04 series



Transfer Jig

CAUTION 	<p>To transfer the robot, use a crane. Make the robot posture to be transferred in safe.</p> <p>For detail, please refer to the instruction manual "MANIULATOR" MZ04-01[CFD].</p>
	<p>2 x 2-M6X15 (反対側含む) 締付トルク 13.8N・m</p> <p>Tightening torque 13.8Nm</p> <p>The center of gravity</p> <p>(Reference) Posture for transferring</p>

CAUTION 	After installing the robot, remove the transfer jig.
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Chapter3 MZ series Zeroing Pin

This option is used to find reference position (for registering encoder correction value) for example when after replacing the robot.

This option contains some pins and blocks to find “reference position” of each axis.

Name	Specification	Parts No.	Notes
Tools	Zeroing pin and zeroing block	OP-T2-078	MZ07 series MZ03EL
Tools	Zeroing pin and zeroing block	OP-T2-089	MZ04 series

For detail, please refer to the instruction manual “MANIPULATOR”

MZ07 series / MZ03 EL
“MANIULATOR MZ07-01[CFD]”, “3.2.4 Encoder Correction”.

MZ04 series
“MANIULATOR MZ04-01[CFD]”, “3.2.4 Encoder Correction”.



Example of zeroing pin and zeroing block (one part)

NOTE

Chapter4 MZ series IP67 Set

This option is used to enhance the drip proof performance by air purge in robot body.

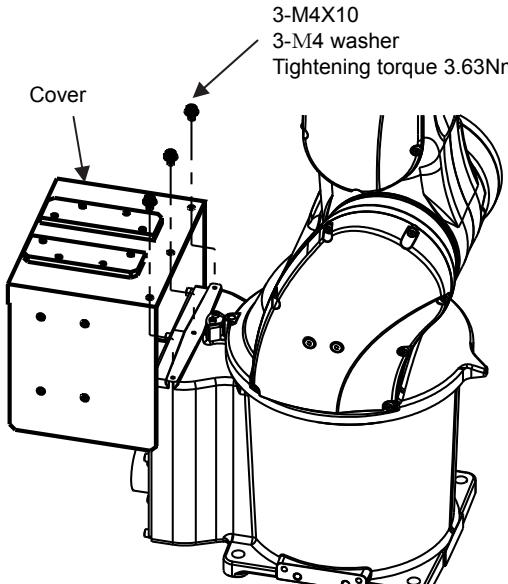
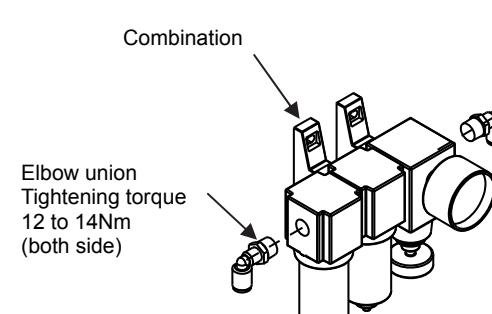
4.1 MZ07 series / MZ03EL

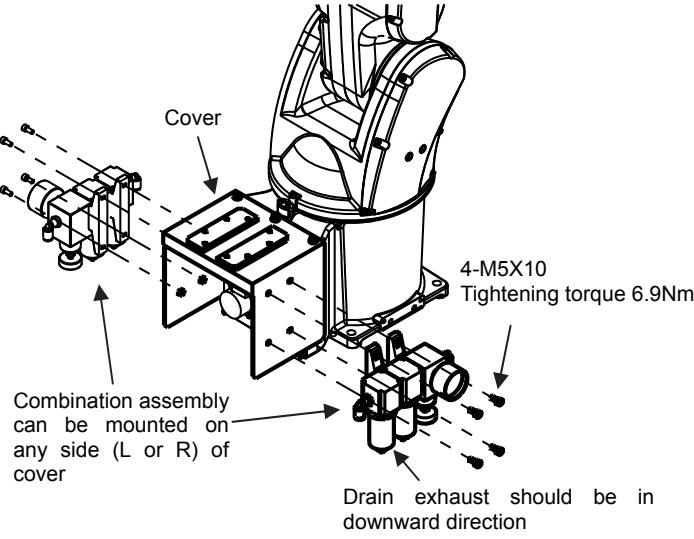
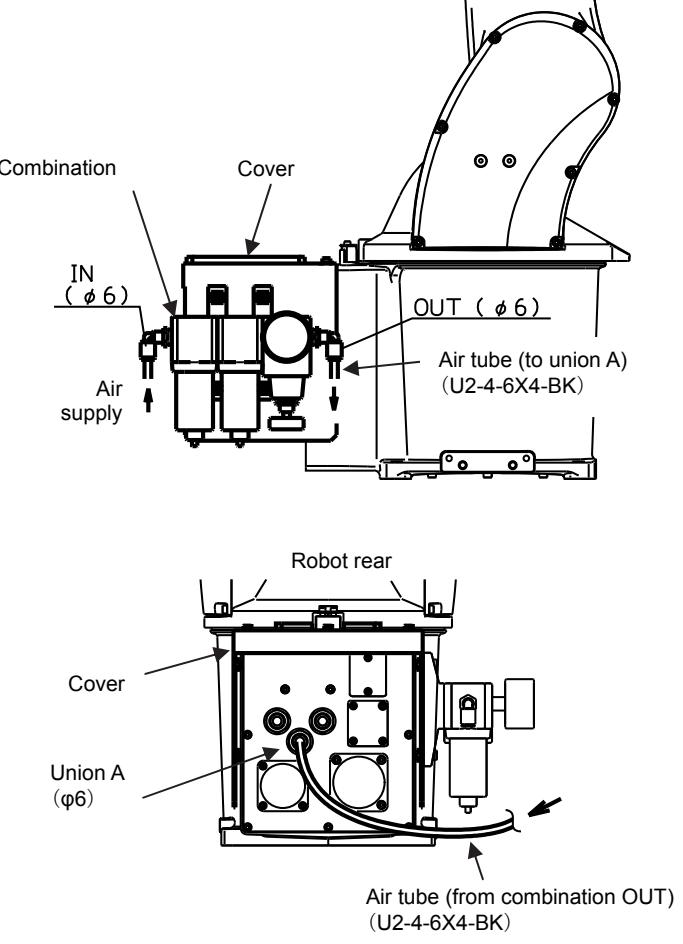
Name	Specification	Parts No.	Notes
IP67 Set	Air purge unit in robot body	OP-H9-004	MZ07 series MZ03EL

Main contained parts

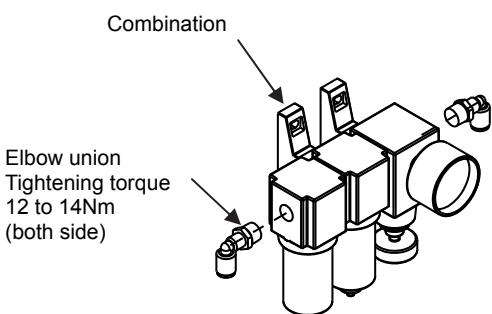
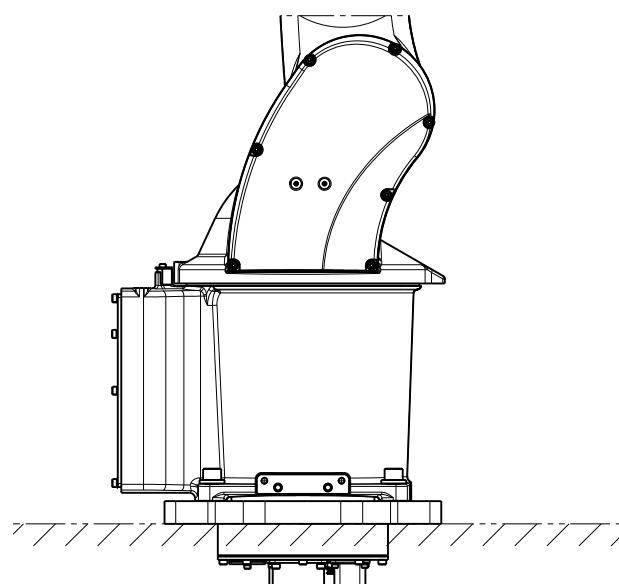
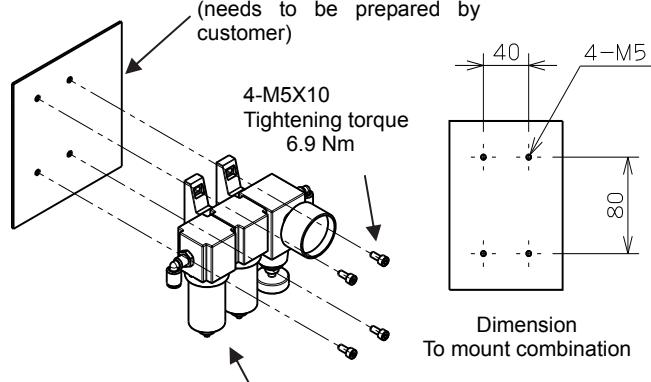
Name	Manufacture	Type	Q'ty	Specification
Combination	CKD	C1000-8-W-FL418172	1	Filter, Oil mist filter and Precision regulator
Cover	Fujikoshi	UMMZ07-01H9-011	1	In case of cable bottom connection, this part is unnecessary

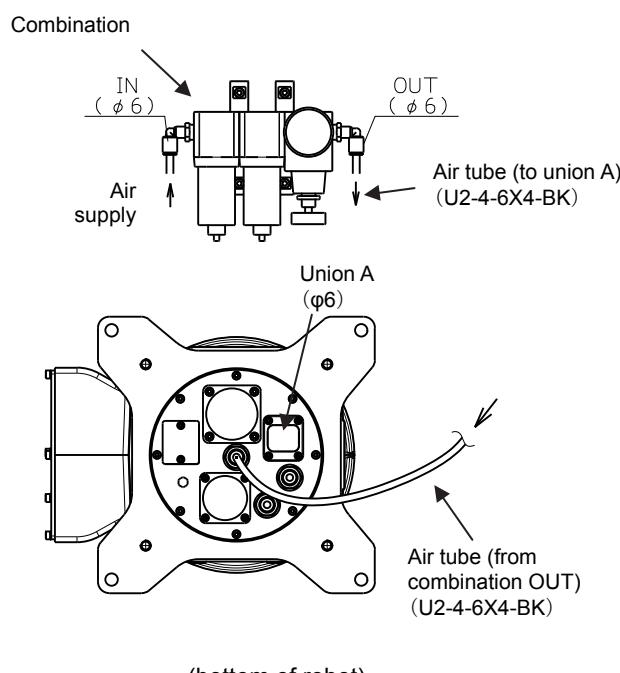
How to install (in case of cable rear connection)

Step	Work performed
1	Move robot to the reference position.
2	Turn off the controller power.
3	<p>Mount following parts to robot body.</p> <ul style="list-style-type: none"> • Cover x1  <p>3-M4X10 3-M4 washer Tightening torque 3.63Nm</p> <p>Cover</p>
4	<p>Assemble following parts.</p> <ul style="list-style-type: none"> • Combination x1 • Elbow union (KQ2L06-2) x2  <p>Combination</p> <p>Elbow union Tightening torque 12 to 14Nm (both side)</p> <p><u>Combination assembly</u></p>

5	<p>Mount combination assembly to cover. Combination assembly can be mounted on any side (L or R) of cover.</p>  <p><u>Mounting of combination assembly</u></p>
6	<p>Connect air tube.</p>  <p><u>Air tube connection (in case that combination was mounted on right side)</u></p>
7	<p>Set the pressure gauge to 0.003MPa.</p>

How to install (in case of cable bottom connection)

Step	Work performed
1	Move robot to the reference position.
2	Turn off the controller power.
3	<p>Assemble following parts.</p> <ul style="list-style-type: none"> • Combination x1 • Elbow union (KQ2L06-2) x2 
4	<p>Mount combination assembly to the bottom of robot near cable inlet.</p>  <p>Combination mounting panel (needs to be prepared by customer)</p> <p>4-M5X10 Tightening torque 6.9 Nm</p> <p>Dimension To mount combination</p> <p>40</p> <p>80</p> <p>Drain exhaust should be in downward direction</p> 

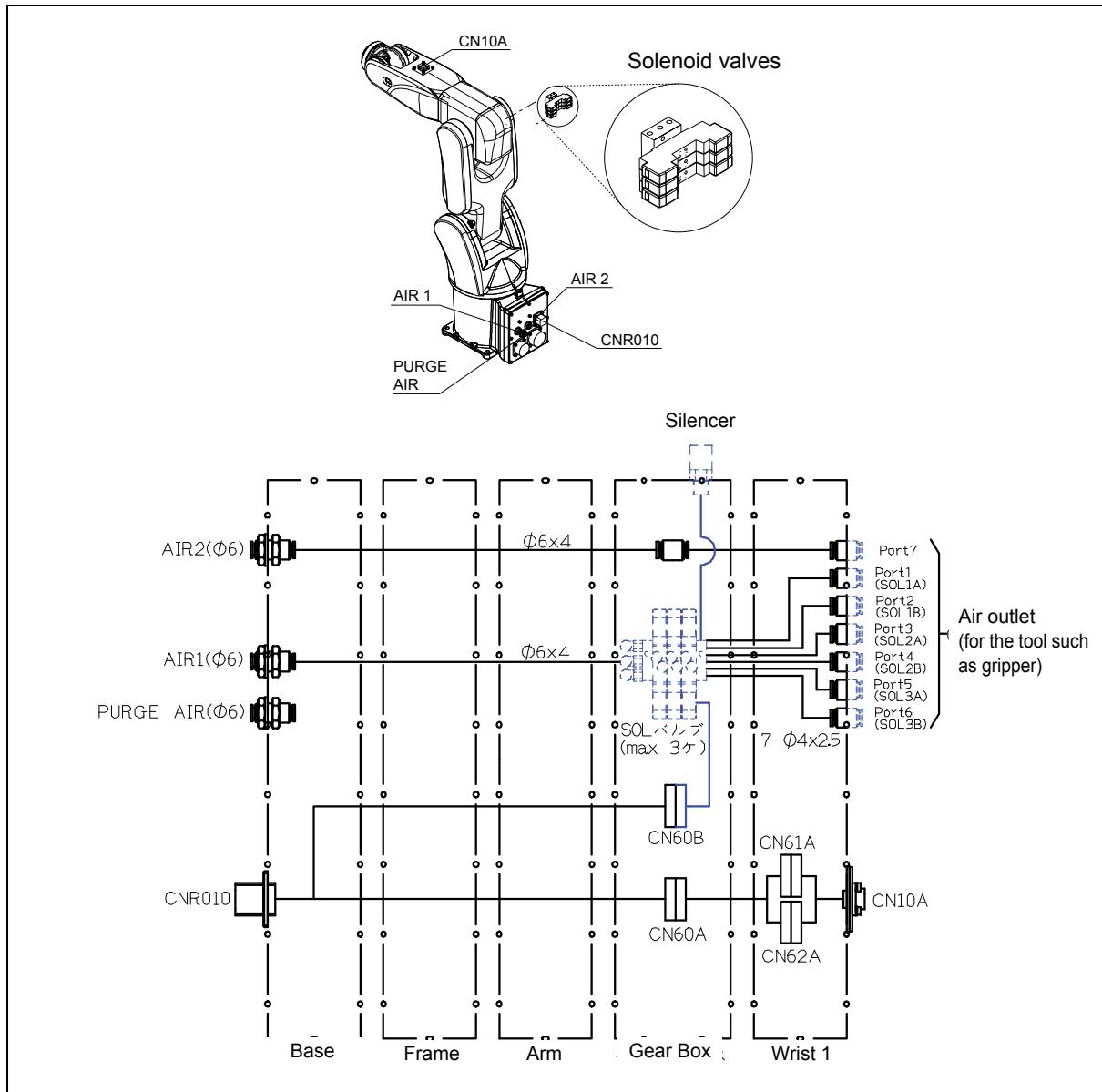
	Connect air tube.
5	 <p>Combination IN (φ6) OUT (φ6) Air supply Union A (φ6) Air tube (to union A) (U2-4-6X4-BK) Air tube (from combination OUT) (U2-4-6X4-BK)</p> <p>(bottom of robot)</p>
6	Set the pressure gauge to 0.003MPa.

Chapter5 MZ series Solenoid Valve

This option is solenoid valves to drive pneumatic grippers, and mounted in robot arm.

5.1 MZ07 series / MZ03EL

Name	Specification	Parts No.	Notes
Solenoid Valve (no pole type)	1 valve	OP-H4-004	SOL1 only
	2 valves	OP-H5-008	SOL1, SOL2
	3 valves	OP-H6-004	SOL1, SOL2, SOL3



< Air source >

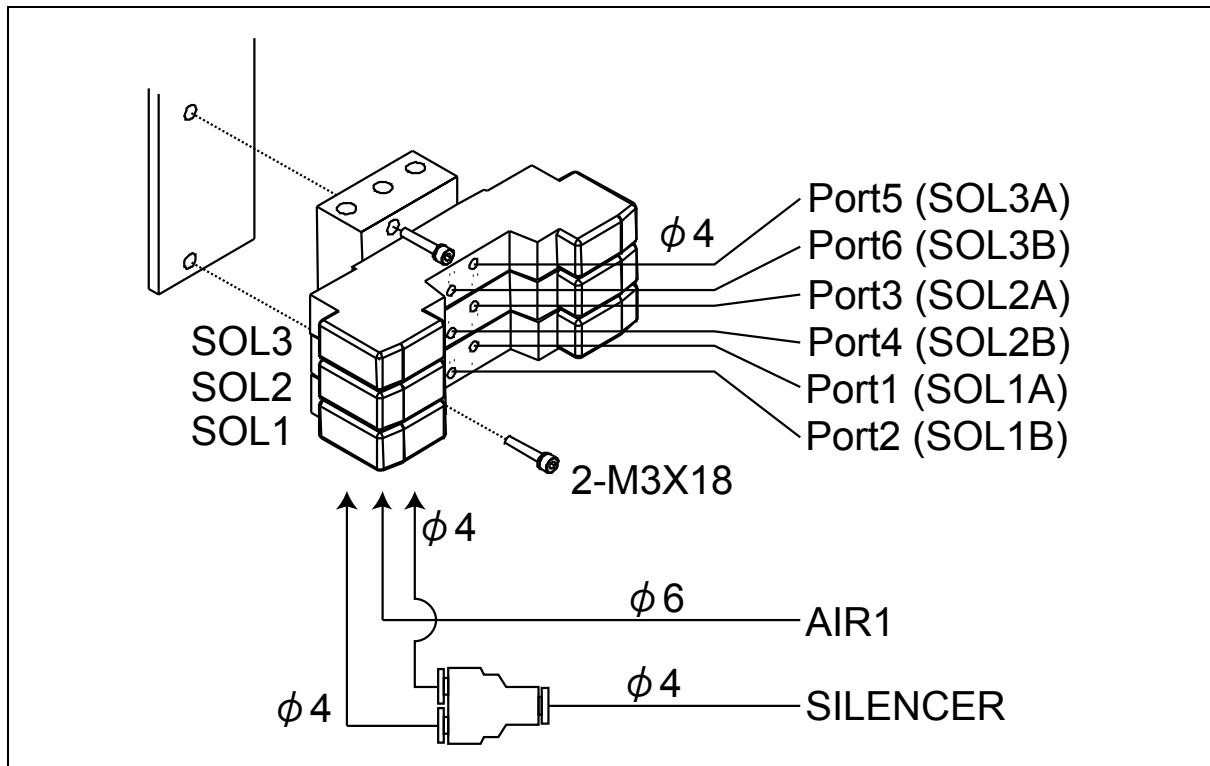
- Please attach air filter in air source. Filtering grade must be 5μm or less.
- Air parts may be damaged if compressed air source contains too much drain. Please attach air dryer and drain catcher before air filter.
- If compressed air source contains chemical medicines, oil including organic solvent, salt, corrosion gas and or so, it will cause the destruction or malfunction of valves. Please do not use such air.
- Please refer to the catalog of valve manufacturer for further detail.

	<ul style="list-style-type: none"> - 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, silencer and cable (CN60B to solenoid valve) are pre-installed when "solenoid valve" option is selected. - CNR010 connector is another option. Please refer to "Chapter 11 I/O harness".
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Main contained parts				
Name	Manufacture	Type	Q'ty	Specification
Solenoid valve	SMC	SYJ3220-5GR-M3	1~3	<ul style="list-style-type: none"> • Pressure range 0.1 to 0.5MPa • 2 position double solenoid • Coil voltage DC24V • With surge absorber (no pole) • With lead wire 300mm
Silencer	SMC	AN15-02	1	

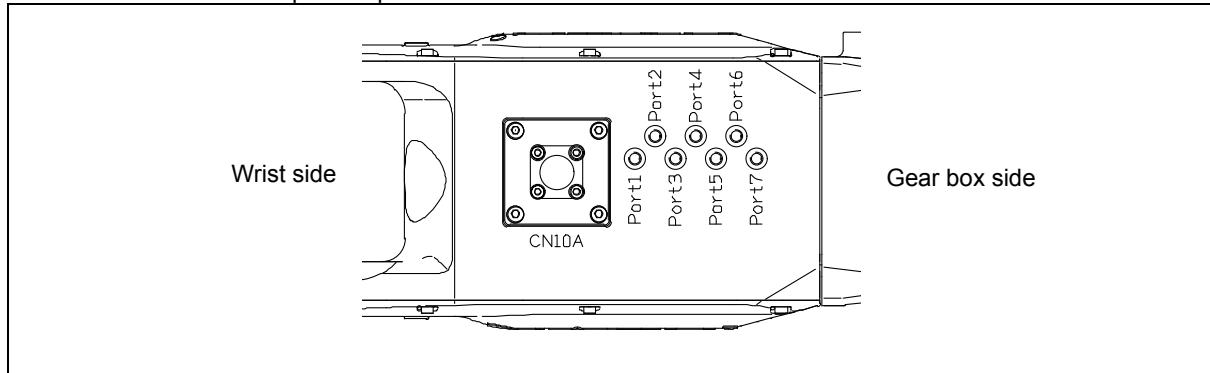
Arrangement of solenoid valves (Example)

Up to 3 solenoid valve are mounted in robot arm.



Port 1 to Port 6 on Robot Arm

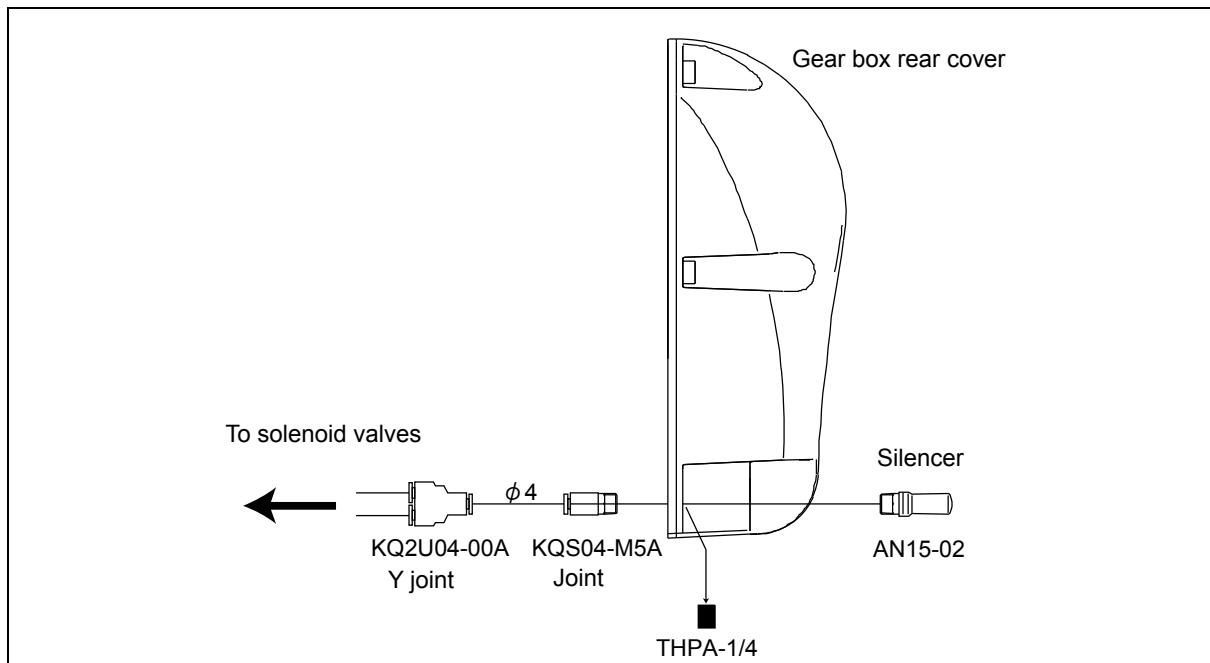
Please connect air tubes top these ports.

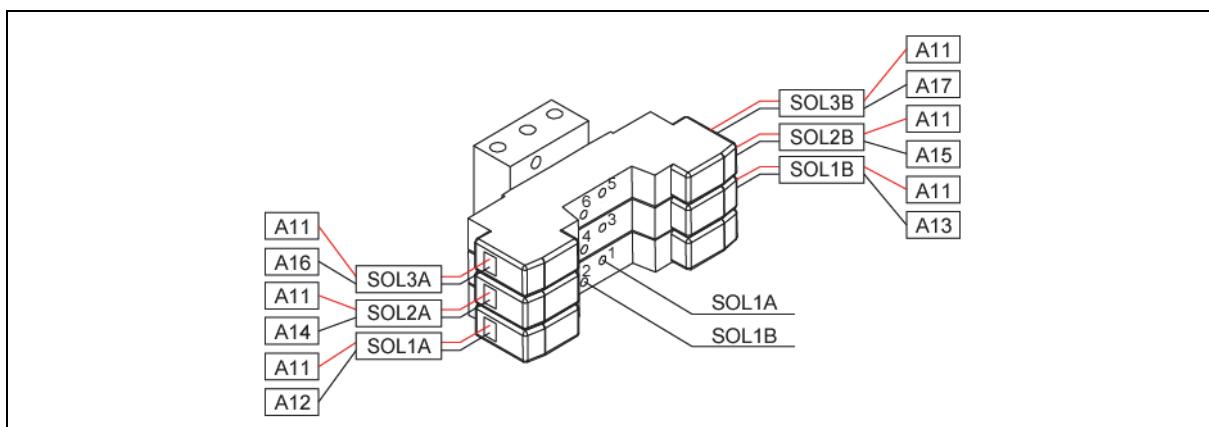
**(Reference) Available port**

Model	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6
OP-H4-004	SOL1 A	SOL1 B	—	—	—	—
OP-H5-008	SOL1 A	SOL1 B	SOL2 A	SOL2 B	—	—
OP-H6-004	SOL1 A	SOL1 B	SOL2 A	SOL2 B	SOL3 A	SOL3 B

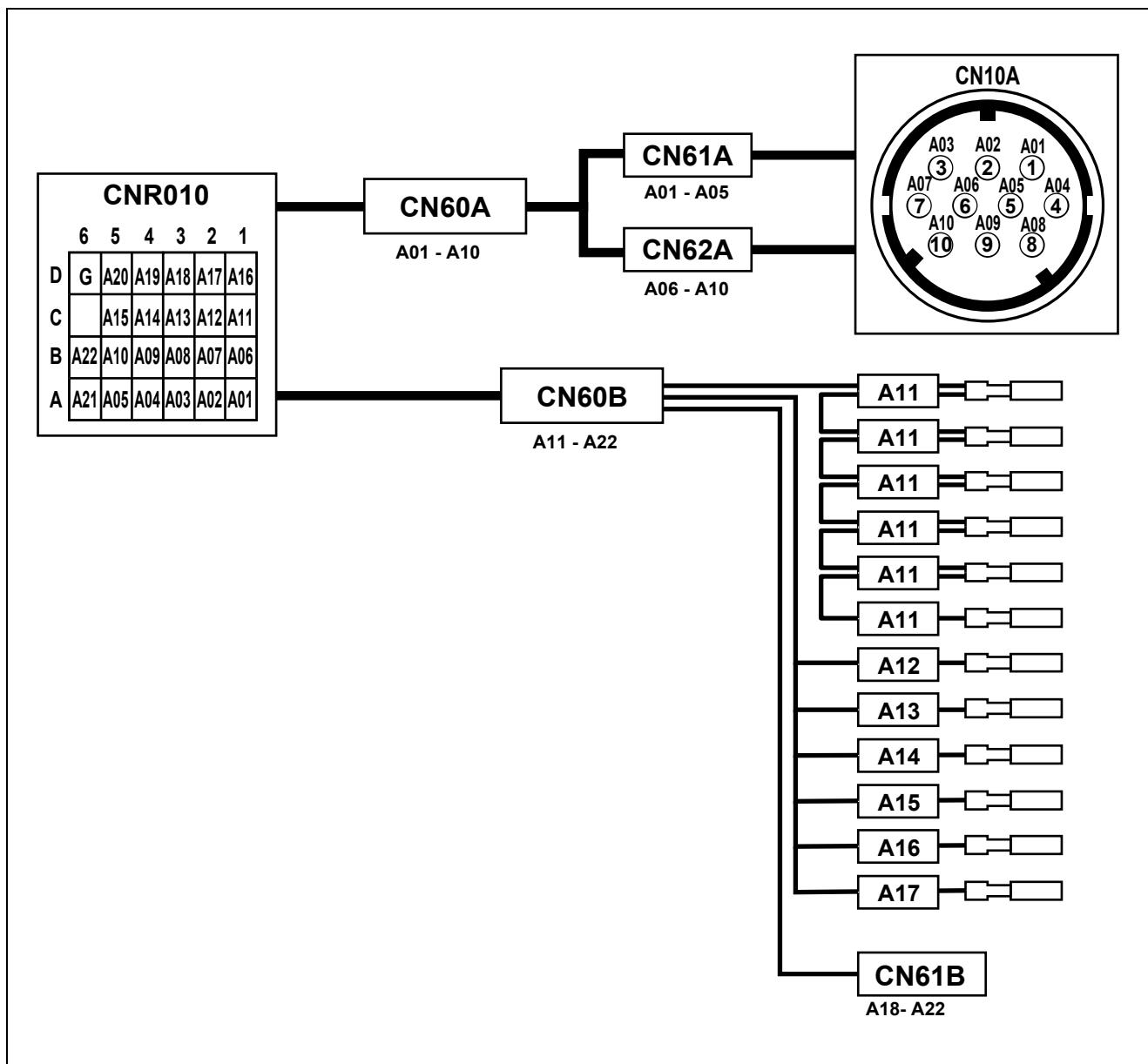


When solenoid valves are not mounted, Port1 is directly connected to AIR1, and Port 7 is directly connected to AIR2.

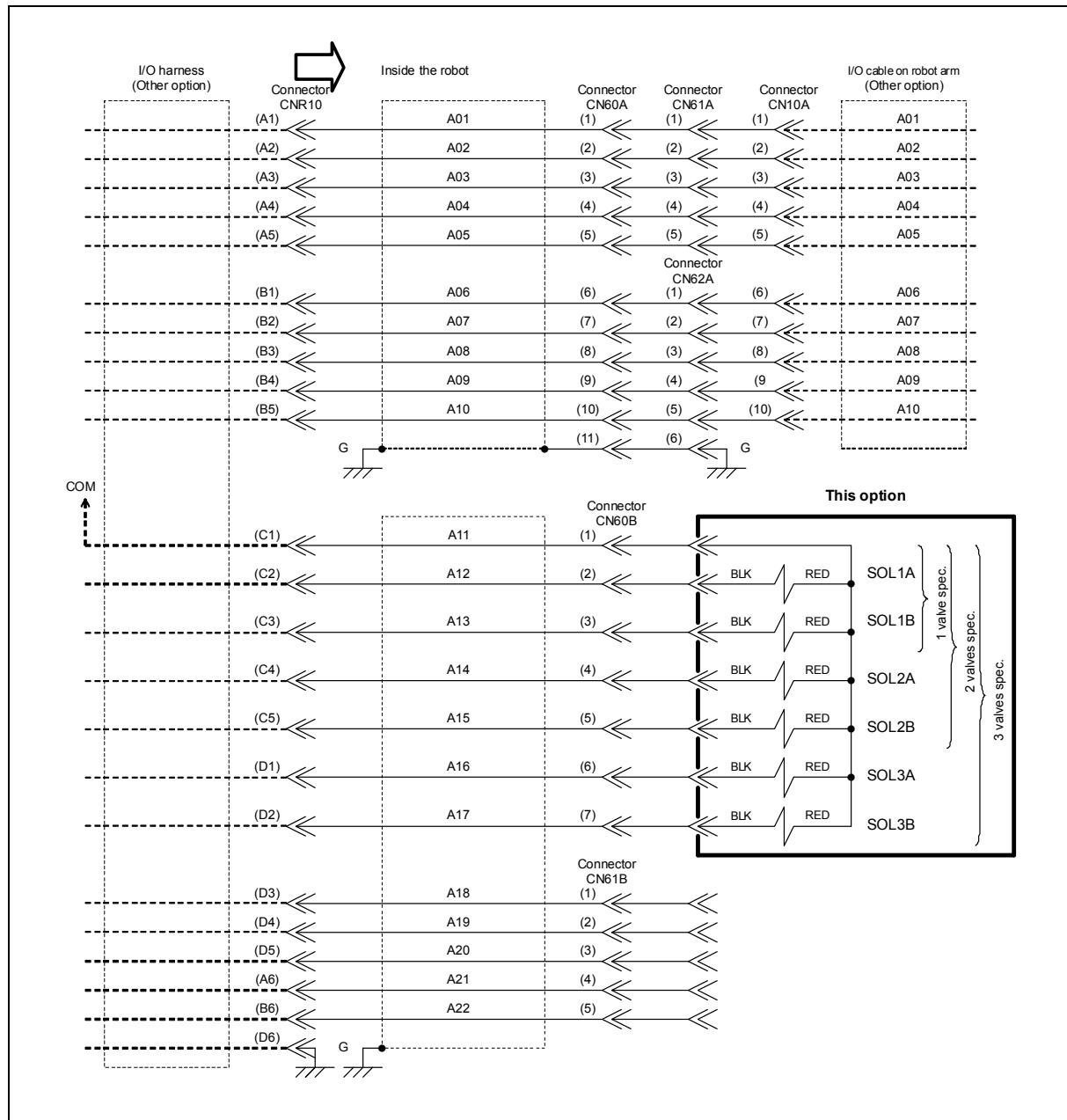
Connection of silencer

Electric wiring

Electric wiring of solenoid valves

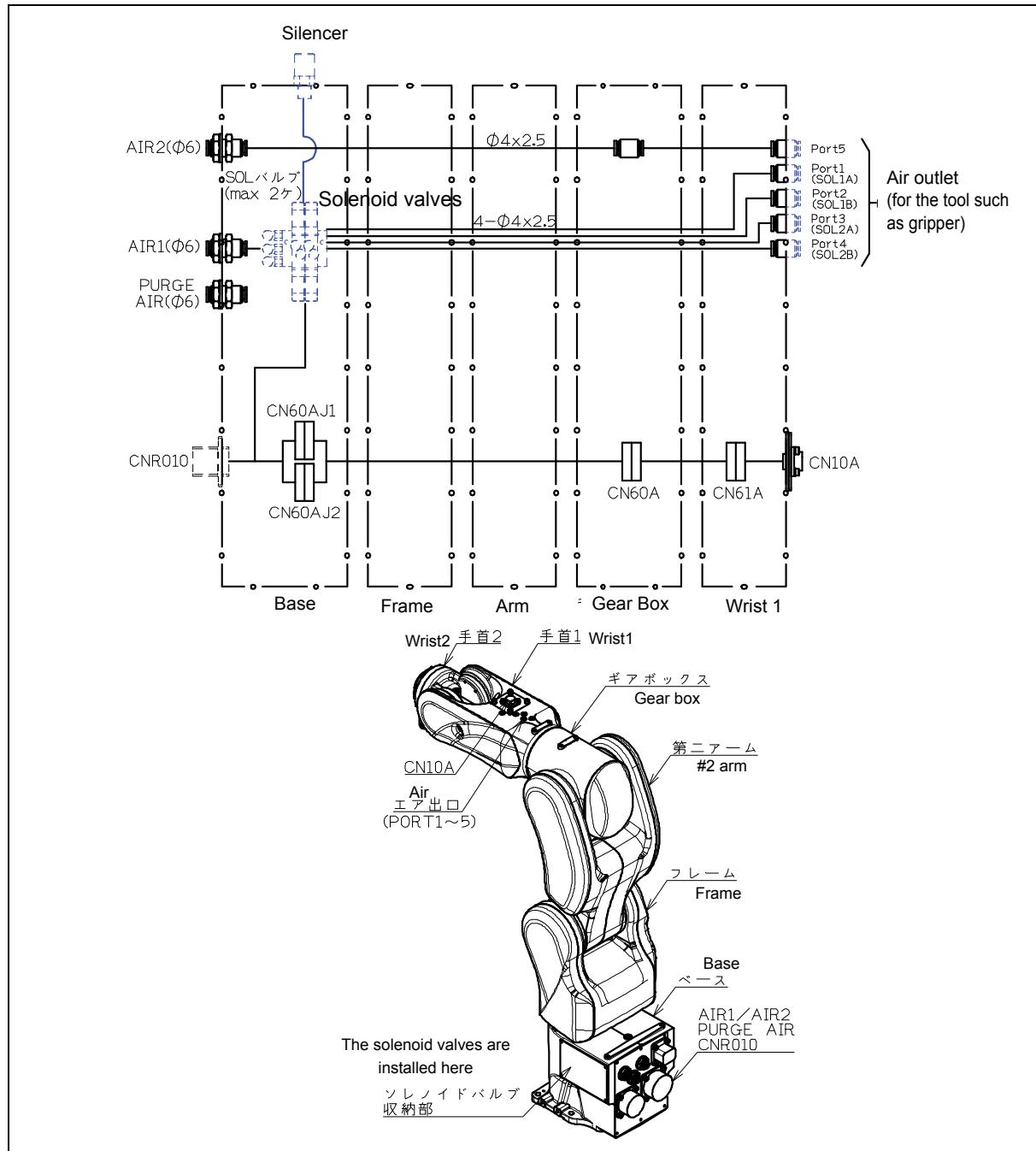


Electric wiring in robot arm



5.2 MZ04 series

Name	Specification	Parts No.	Notes
Solenoid Valve (no pole type)	1 valve	OP-H4-006	SOL1 only
	2 valves	OP-H5-010	SOL1, SOL2



< Air source >



- Please attach air filter in air source. Filtering grade must be $5\mu\text{m}$ or less.
- Air parts may be damaged if compressed air source contains too much drain. Please attach air dryer and drain catcher before air filter.
- If compressed air source contains chemical medicines, oil including organic solvent, salt, corrosion gas and or so, it will cause the destruction or malfunction of valves. Please do not use such air.
- Please refer to the catalog of valve manufacturer for further detail.

POINT

- In standard specification, only 2 air lines (AIR1 to Port1 and AIR2 to Port5) are connected directly inside gear box. Plugs are attached on air outlet.
- Solenoid valves and silencer are pre-installed when “solenoid valve” option is selected.
- CNR010 connector is another option. Please refer to “Chapter 11 I/O harness”.

Main contained parts

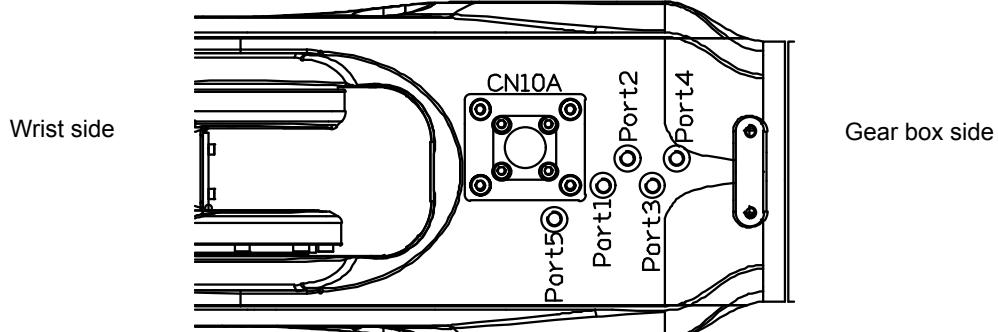
Name	Manufacture	Type	Q'ty	Specification
Solenoid valve	SMC	SYJ3220-5GR-M3	1~2	<ul style="list-style-type: none"> • Pressure range 0.1 to 0.5MPa • 2 position double solenoid • Coil voltage DC24V • With surge absorber (no pole) • With lead wire 300mm
Silencer	SMC	AN15-02	1	

Arrangement of solenoid valves (Example)

Up to 2 solenoid valve are mounted in robot arm.

Port 1 to Port 5 on Robot Arm

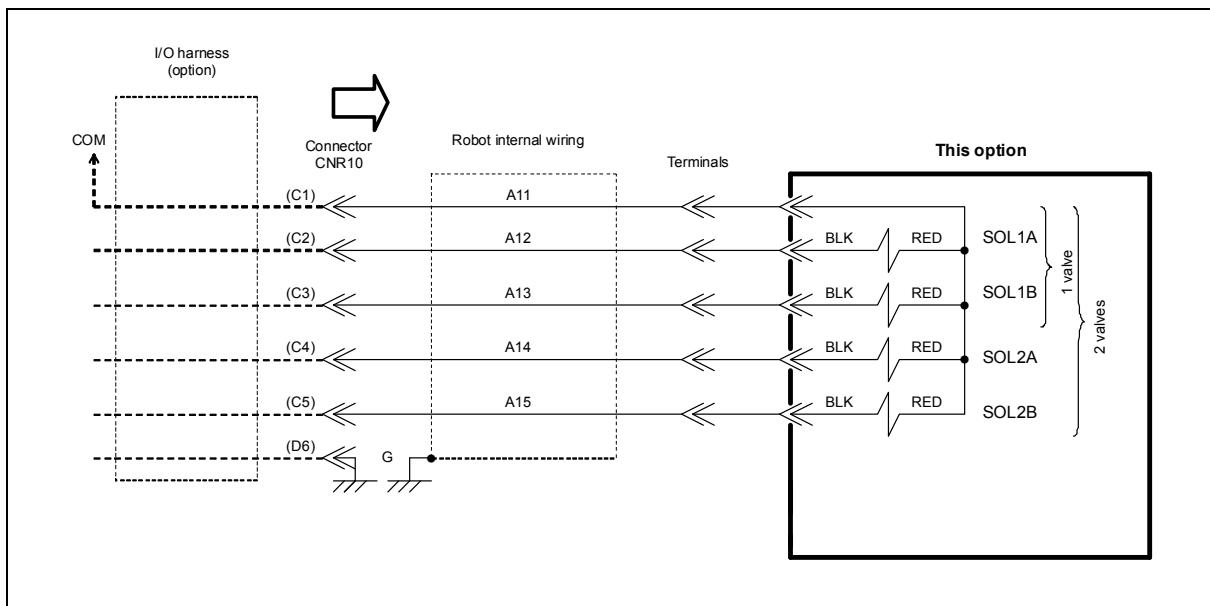
Please connect air tubes top these ports.

**(Reference) Available port**

Model	Port 1	Port 2	Port 3	Port 4
OP-H4-006	SOL1 A	SOL1 B	—	—
OP-H5-010	SOL1 A	SOL1 B	SOL2 A	SOL2 B

POINT

When solenoid valves are not mounted, Port1 is directly connected to AIR1, and Port 5 is directly connected to AIR2.



Internal wiring connection diagram (Only around the solenoid valves)

Chapter6 MZ series Wires Clamp

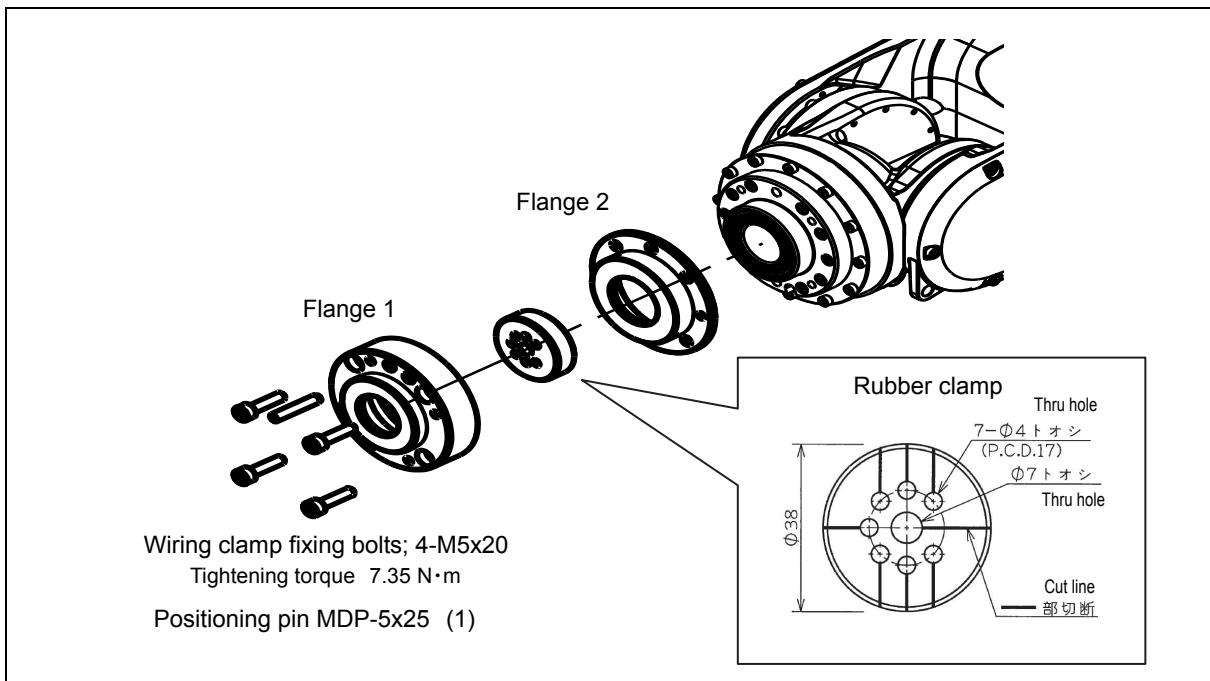
This option is used to fix wires and air tubes in the wrist hollow in order not to move in the hollow. 7 holes for air ($\phi 4$) and 1 hole for electric wire ($\phi 7$) are prepared. Please utilize them.

6.1 MZ07 series / MZ03 EL

Name	Parts No.	Notes
Wires Clamp	OP-W3-012	Flange1, flange2, clamp, bolts(4-M5x20), and positioning pin(1-MDP-5x25) are included. Tool fixing bolts and tool positioning pin should be prepared by customers.

Main contained parts

Name	Manufacture	type	Q'ty	Specification
Flange 1	Fujikoshi	UMMZ07-01W3-011	1	$\phi 72$ H=21
Flange 2	Fujikoshi	UMMZ07-01W3-012	1	$\phi 72$ H=13.5
Rubber clamp	Fujikoshi	UMMZ07-01W3-141	1	$\phi 38$ Chloroprene rubber



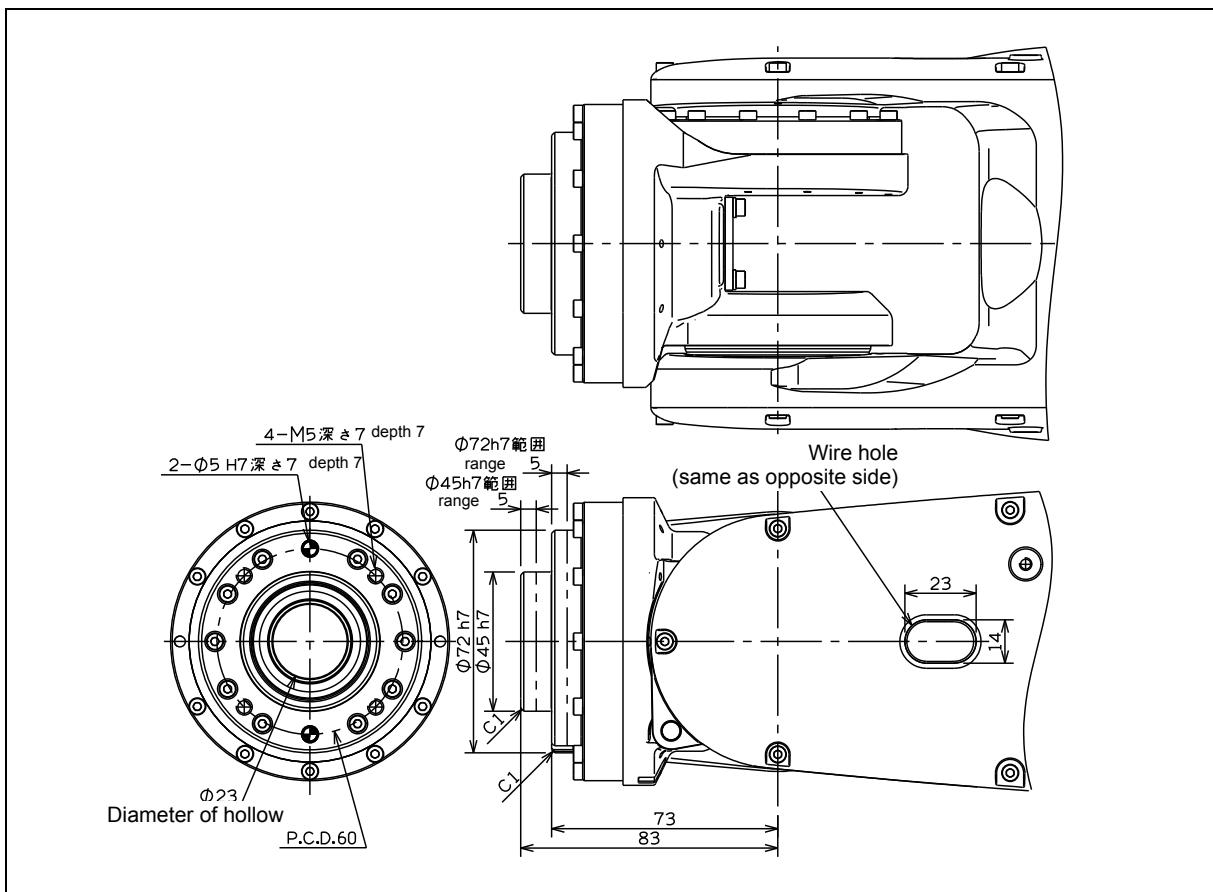
Wiring Clamp

How to install

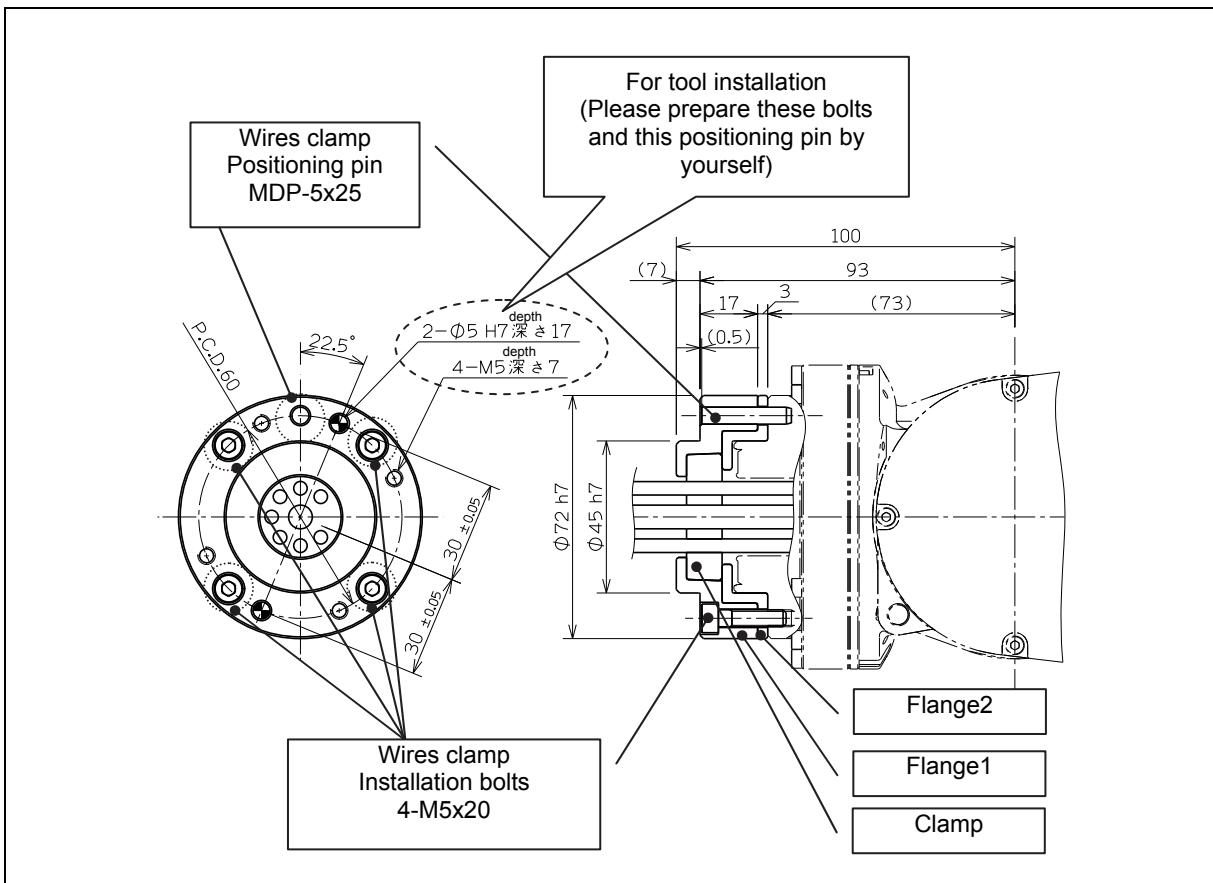
Step	Work performed
1	Pierce all wires and tubes in hollow in wrist.
2	Pierce all wires and tubes to "Flange 2".
3	Pierce all wires and tubes to "Rubber clamp". This work is very easy because "Rubber clamp" has cut line as shown in the figure.
4	Pierce all wires and tubes to "Flange 1" and place it on "Rubber clamp". At last fix them with bolts.



Be sure to screw M5 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.



Dimension of wrist



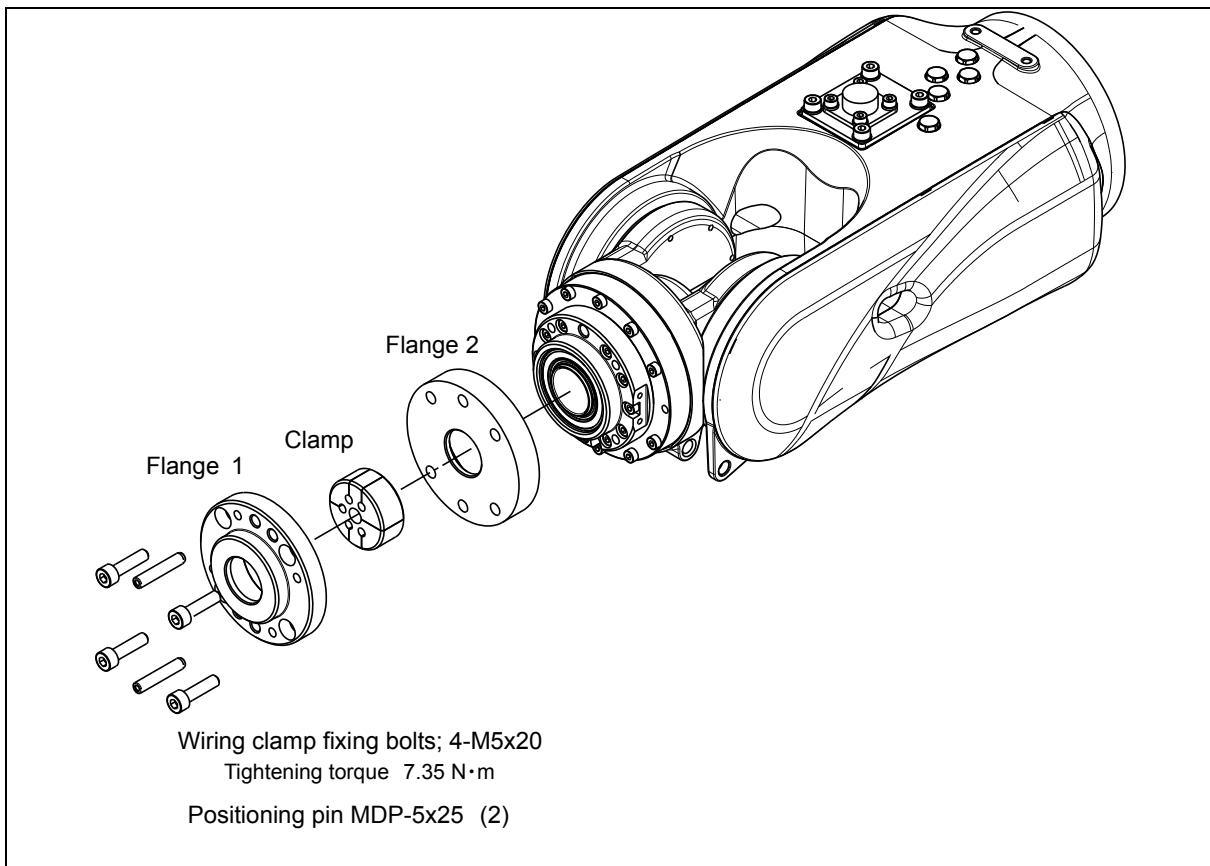
When this option is installed

6.2 MZ04 series

Name	Parts No.	Notes
Wires Clamp	OP-W3-016	Flange1, flange2, clamp, bolts(4-M5x20), and positioning pin(2-MDP-5x25) are included. Tool fixing bolts and tool positioning pin should be prepared by customers.

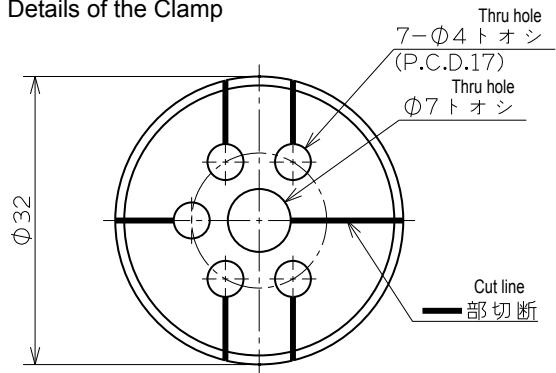
Main contained parts

Name	Manufacture	type	Q'ty	Specification
Flange 1	Fujikoshi	UMMZ04-01W3-011	1	$\phi 66 H=16$
Flange 2	Fujikoshi	UMMZ04-01W3-012	1	$\phi 66 H=12$
Rubber clamp	Fujikoshi	UMMZ04-01W3-141	1	$\phi 32$ Chloroprene rubber



Wiring Clamp

Details of the Clamp

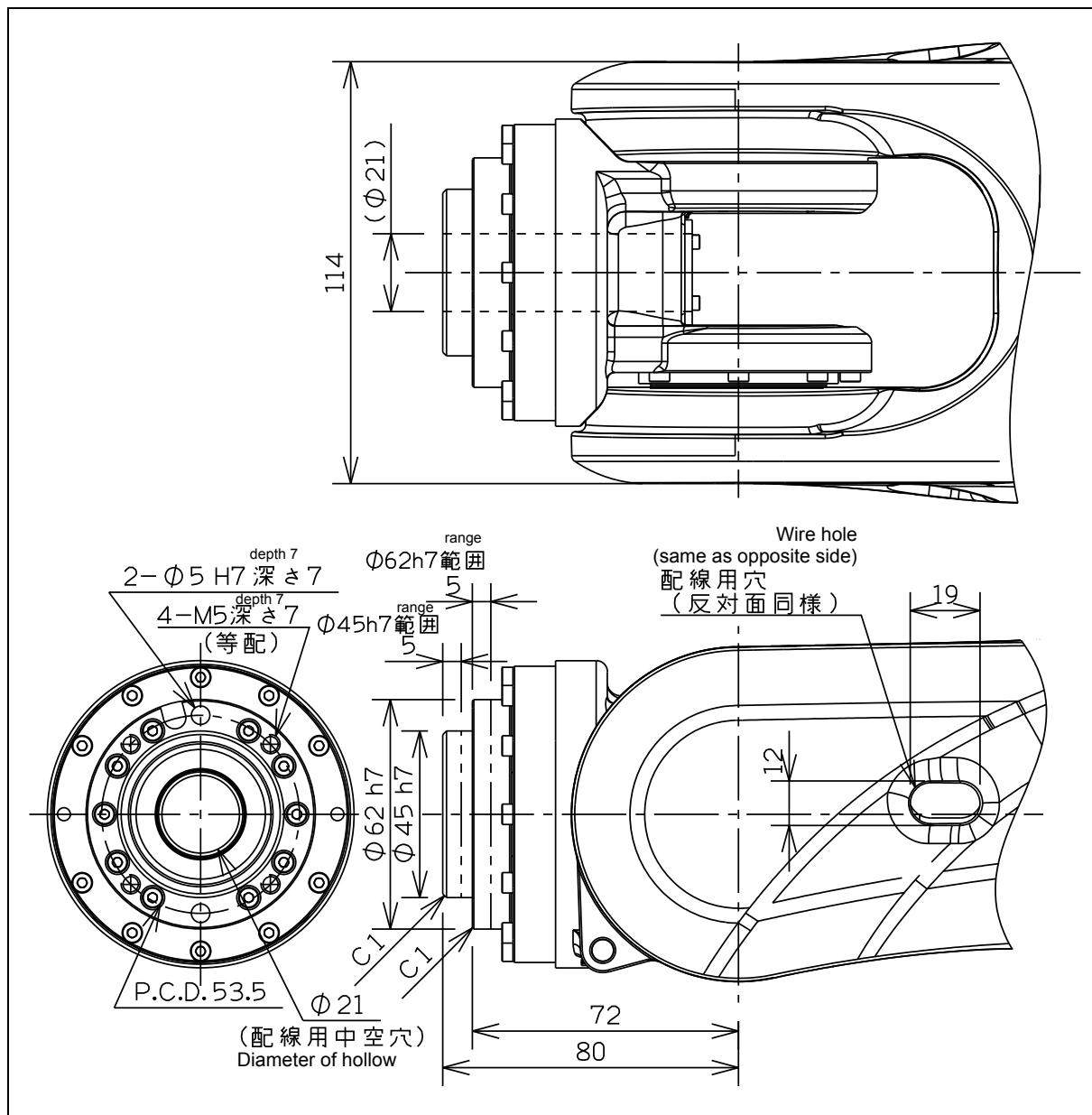


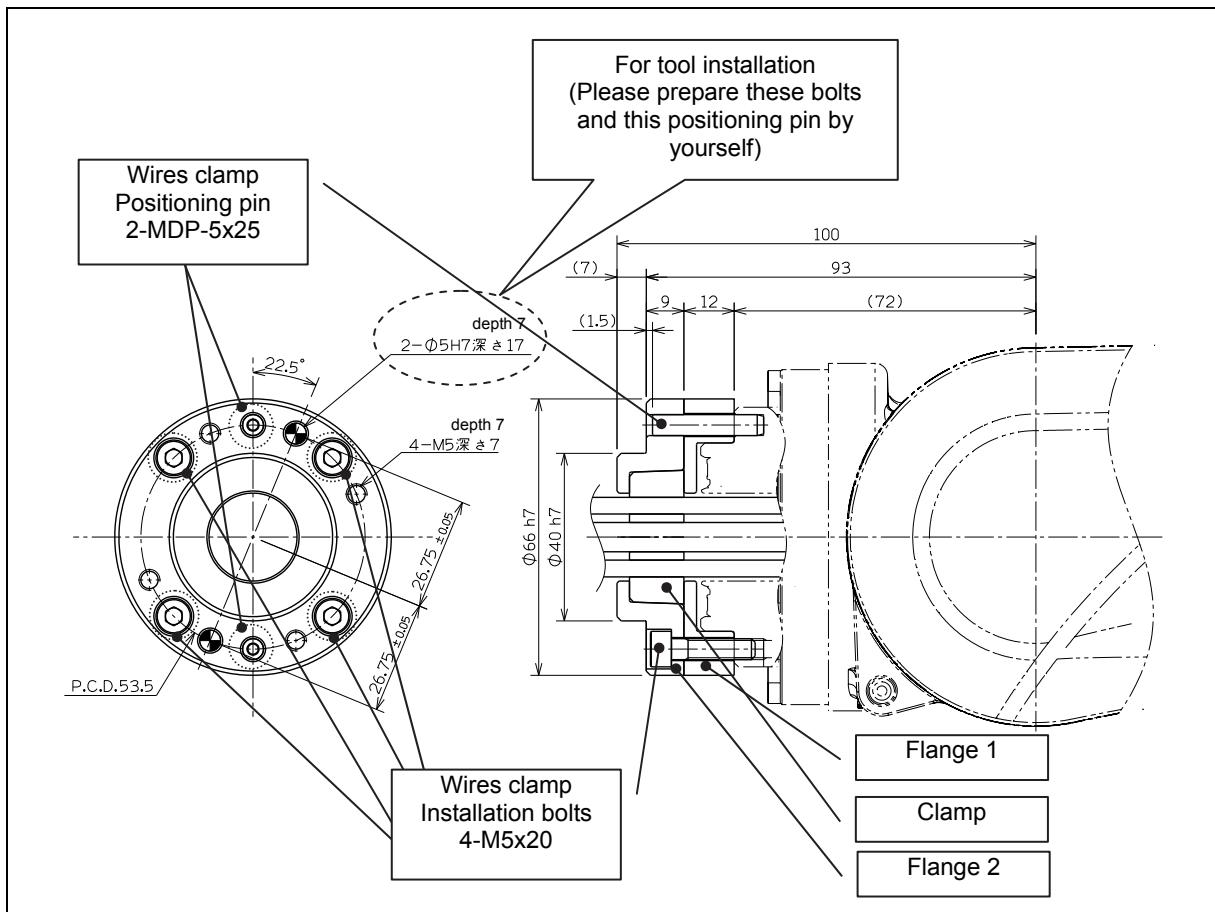
How to install

Step	Work performed
1	Pierce all wires and tubes in hollow in wrist.
2	Pierce all wires and tubes to "Flange 2".
3	Pierce all wires and tubes to "Rubber clamp". This work is very easy because "Rubber clamp" has cut line as shown in the figure.
4	Pierce all wires and tubes to "Flange 1" and place it on "Rubber clamp". At last fix them with bolts.



Be sure to screw M5 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.





When this option is installed

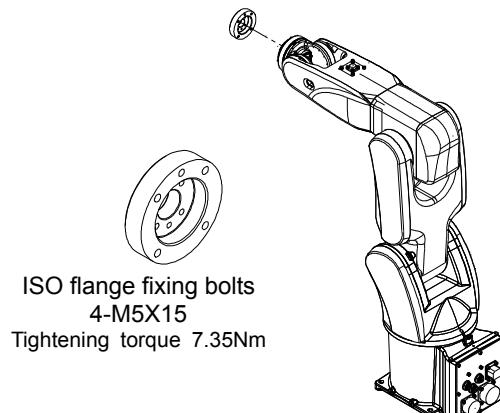
NOTE

Chapter7 MZ series ISO Flange

7.1 MZ07 series / MZ03 EL

This option is used to convert P.C.D. (Pitch Circle Diameter) on wrist top from standard 60mm to ISO 31.5mm.

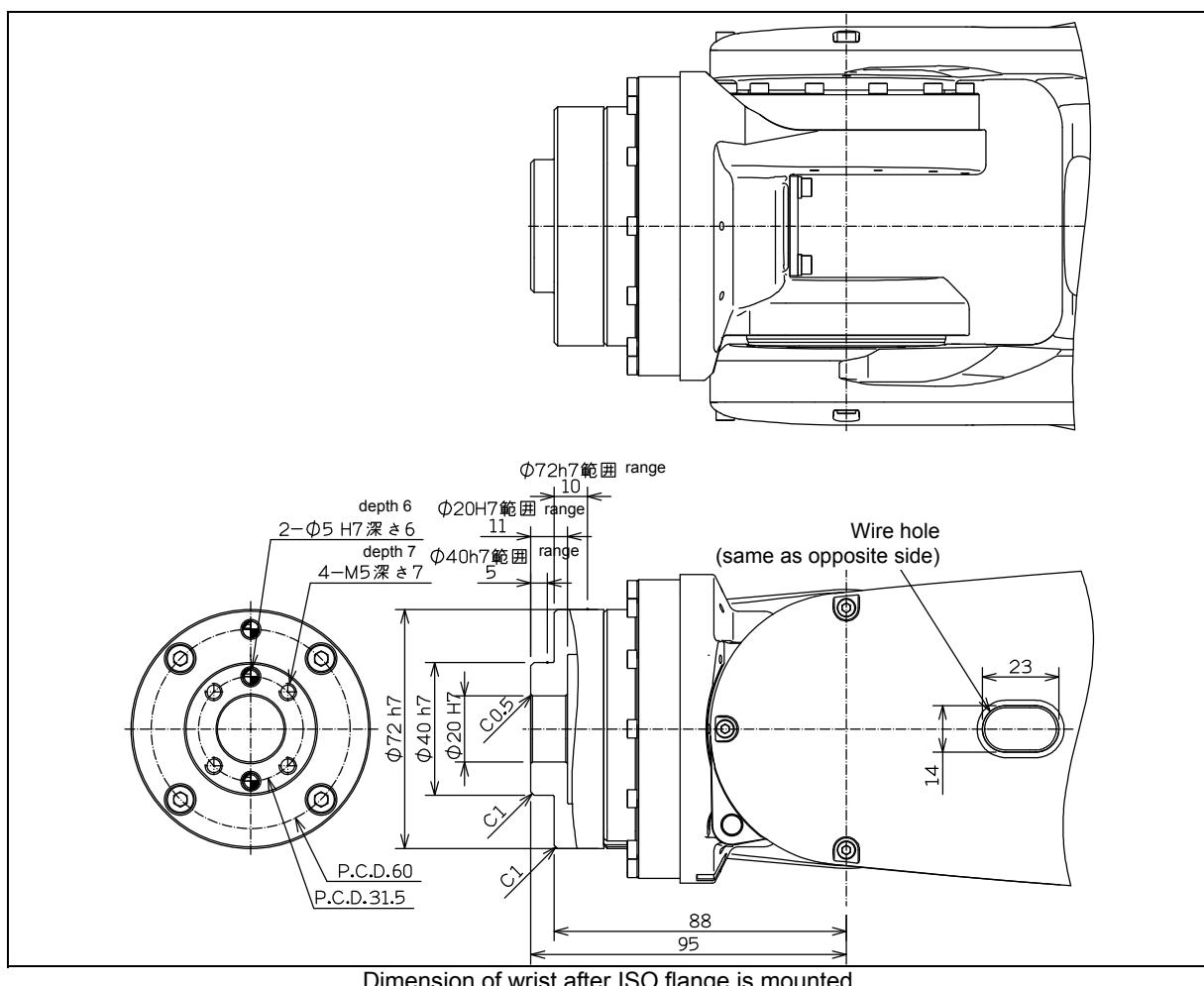
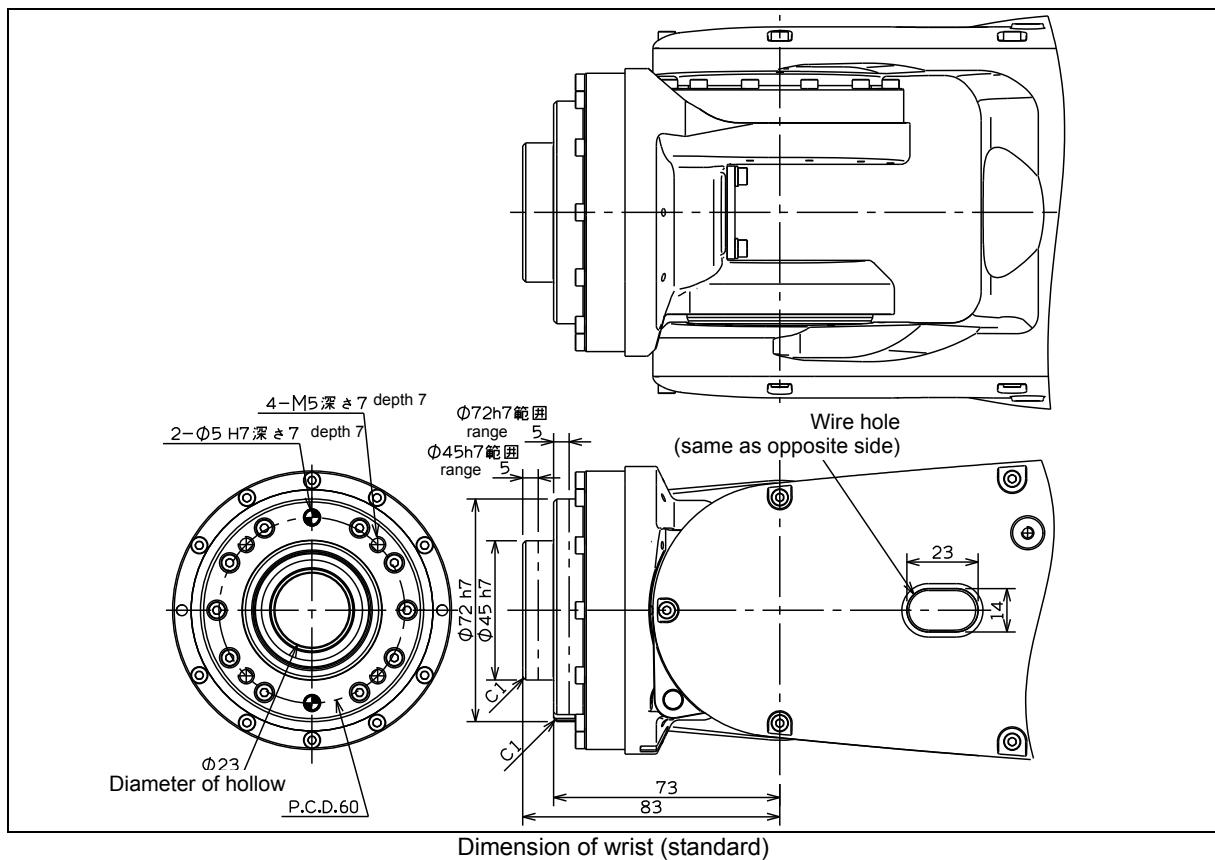
Name	Specification	Parts No.	Notes
ISO Flange	For P.C.D 31.5	OP-W2-012	MZ07 series MZ03EL



ISO Flange



Be sure to screw M5 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.

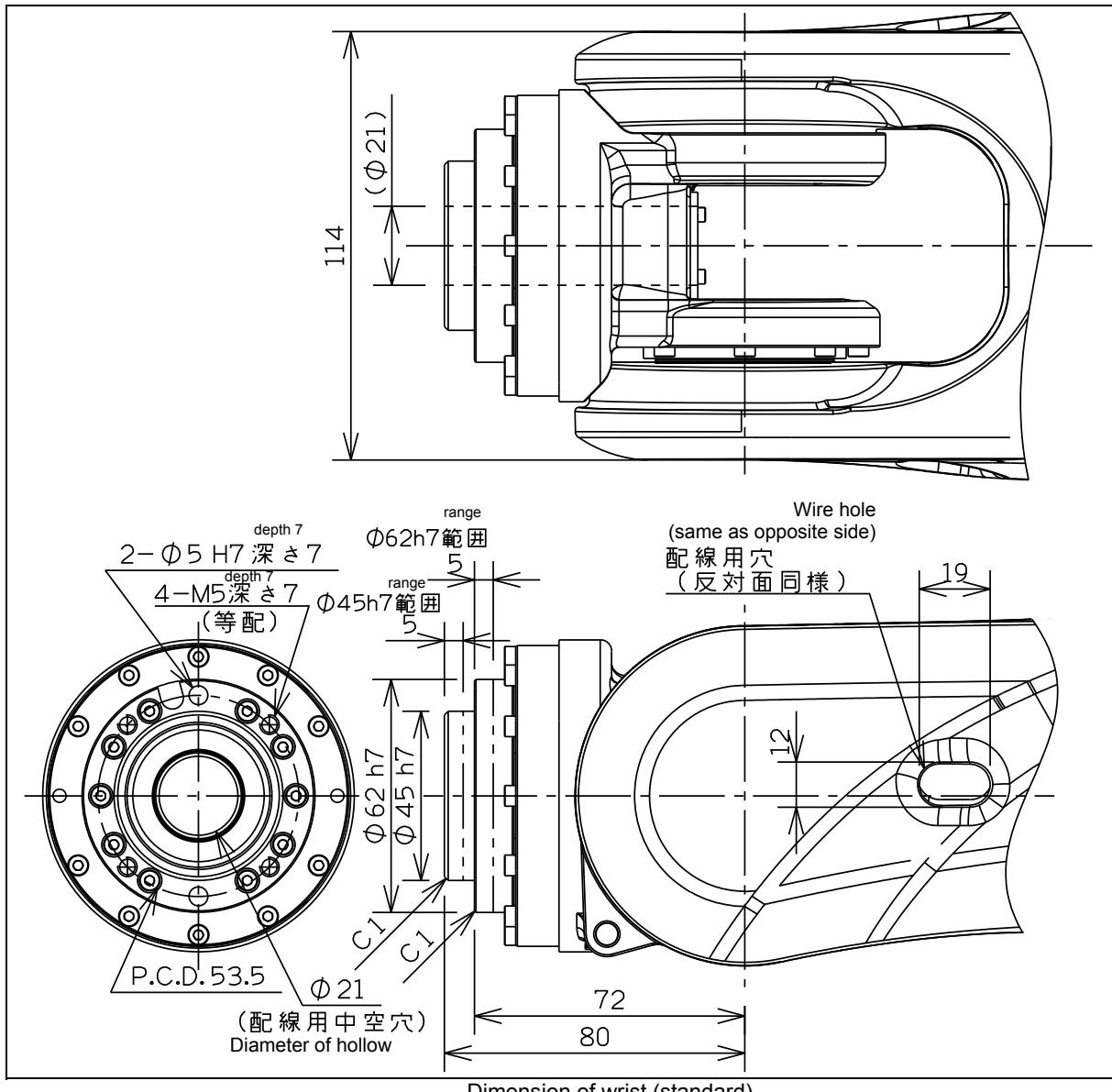


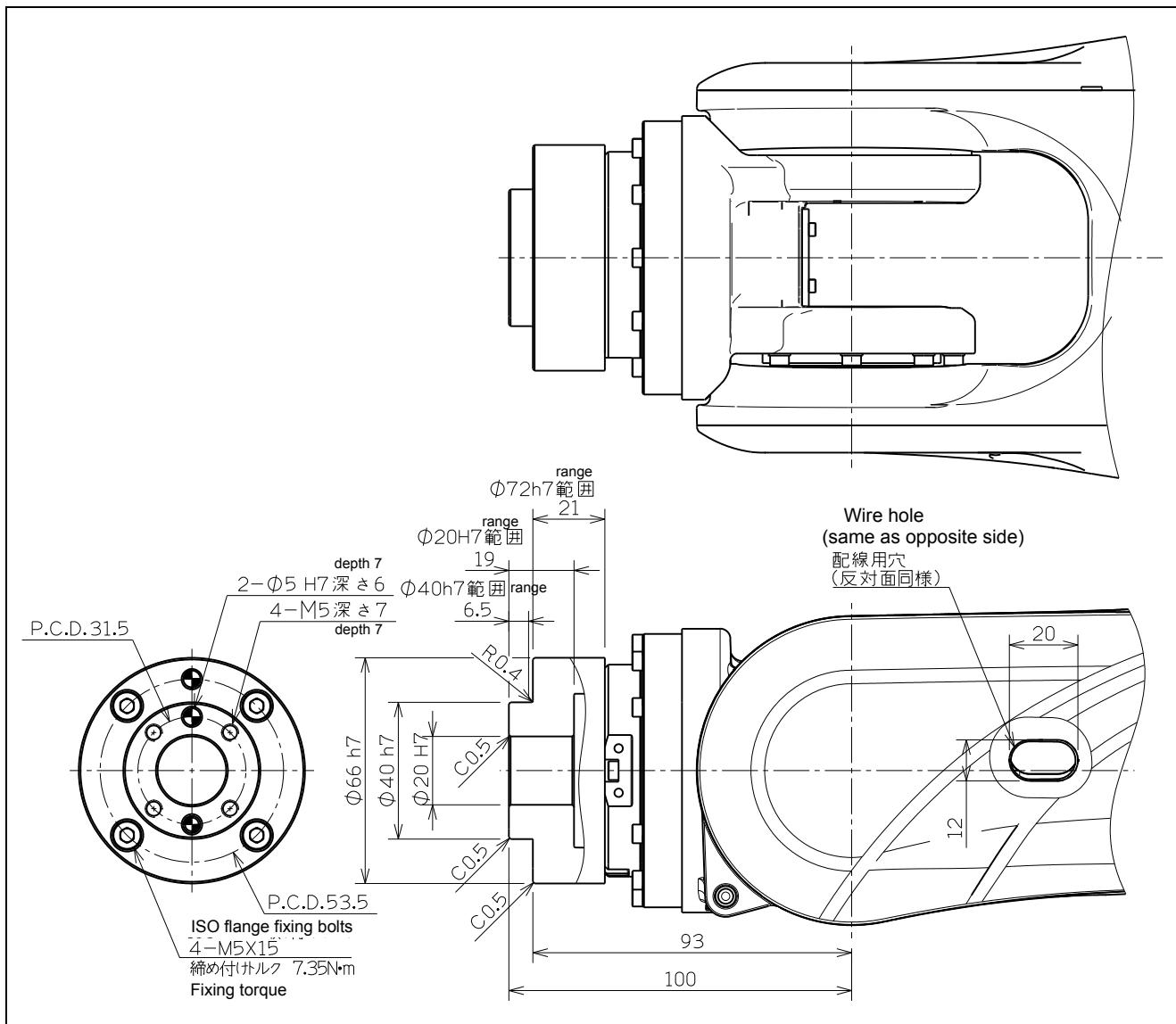
7.2 MZ04 series

Name	Specification	Parts No.	Notes
ISO Flange	For P.C.D 31.5	OP-W2-013	MZ04 series



Be sure to screw M5 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.





Dimension of wrist after ISO flange is mounted

Chapter8 MZ series Standard Gripper

8.1 MZ07 series

8.1.1 Outline

This option is pneumatic grippers mounted on robot wrist.

7 kinds of gripper are prepared. Please select one or more among them. Gripper can be mounted in flexible direction on an accessory plate. Wires and air tubes can be routed very smartly because robot wrist has a hollow in it. We recommend the routing method written in this chapter.

Fingers need to be prepared by customer. Those are not accessories of this option.

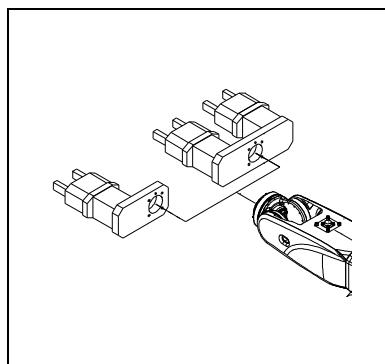
Name	Specification	Parts No.	Mass *1	MZ07*-01	MZ03EL-01
Standard Gripper	Parallel gripper single S	OP-F10-002	2.1 kg	<input type="radio"/>	<input type="radio"/>
	Parallel gripper double S	OP-F10-003	3.8 kg	<input type="radio"/>	—
	Parallel gripper single M	OP-F10-004	2.8 kg	<input type="radio"/>	—
	Three fingers single S	OP-F10-005	0.76 kg (1.21 kg) *2	<input type="radio"/>	<input type="radio"/>
	Three fingers double S	OP-F10-006	1.14 kg (1.59 kg) *2	<input type="radio"/>	—
	Three fingers single M	OP-F10-007	1.0 kg (1.65 kg) *2	<input type="radio"/>	<input type="radio"/>
	Three fingers double M	OP-F10-008	1.5 kg (2.11 kg) *2	<input type="radio"/>	—

*1 This mass does not include the mass of the work-piece and the fingers.

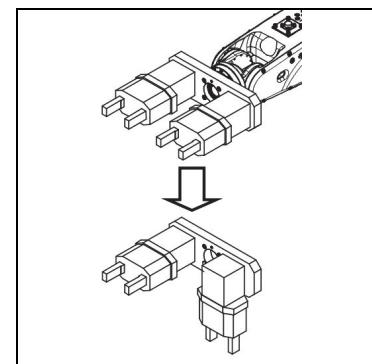
*2 The values in () are values when elbow bracket is installed.



Parallel gripper and 3 fingers gripper



Single gripper and double grippers



Flexible mounting of gripper

8.1.2 Specifications

Parallel gripper / Three fingers chuck specification table

	Parallel gripper S	Parallel gripper M	Threes fingers chuck S	Threes fingers chuck S
Actuator	Air (From 0.3 to 0.7Mpa)			
Environment temperature (°C)	5 to 60			
Movement stroke (mm)	24	30	8	10
Cylinder diameter (mm)	φ32	φ40	φ32	φ40
Holding power (N) *When 0.5MPa	300	600	170	310
Rod diameter (mm)	φ16	φ20	φ10	φ12
Internal capacity [back and forward] (cm ³ /1 time)	25.3	49.5	7.7	15.6
Repeatability (mm)	±0.01			
Mass (kg)	1.36	1.95	0.24	0.36

(NOTE)

- The holding power in this table is close direction.
- If the environmental temperature is 45°C or more, the actuator air pressure must be 0.5MPa or less.
- The air must be dry air.

Main contained parts

Specification	Name	Manufacture	Type	Q'ty	Notes
Parallel gripper single S	Parallel gripper	--	HK-32MS	1	
	Attachment plate	Fujikoshi	UMMZ07-01F10-201	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Parallel gripper double S	Parallel gripper	--	HK-32MS	2	
	Attachment plate	Fujikoshi	UMMZ07-01F10-301	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、3.0m
Parallel gripper single M	Parallel gripper	--	HK-40MS	1	
	Attachment plate	Fujikoshi	UMMZ07-01F10-401	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Three fingers single S	Three fingers gripper	--	CKL-32AS	1	
	Attachment plate	Fujikoshi	UMMZ07-01F10-501	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Three fingers double S	Three fingers gripper	--	CKL-32AS	2	
	Attachment plate	Fujikoshi	UMMZ07-01F10-601	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、3.0m
Three fingers single M	Three fingers gripper	--	CKL-40AS	1	
	Attachment plate	Fujikoshi	UMMZ07-01F10-701	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Three fingers double M	Three fingers gripper	--	CKL-40AS	2	
	Attachment plate	Fujikoshi	UMMZ07-01F10-801	1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、3.0m

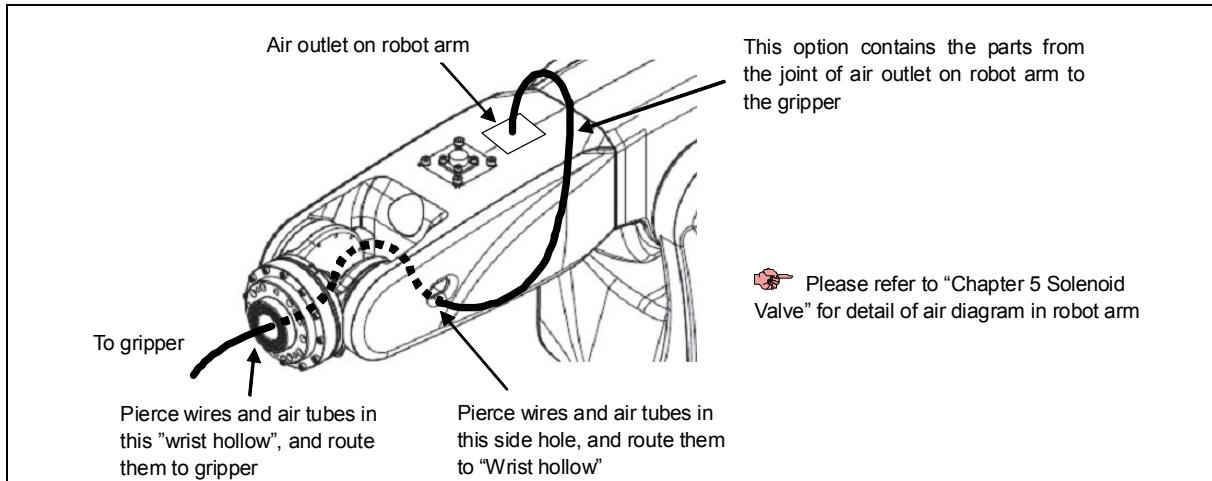
8.1.3 How to install

Mount grippers by following to the procedure written below.
This is recommended procedure that utilizes the wrist hollow.

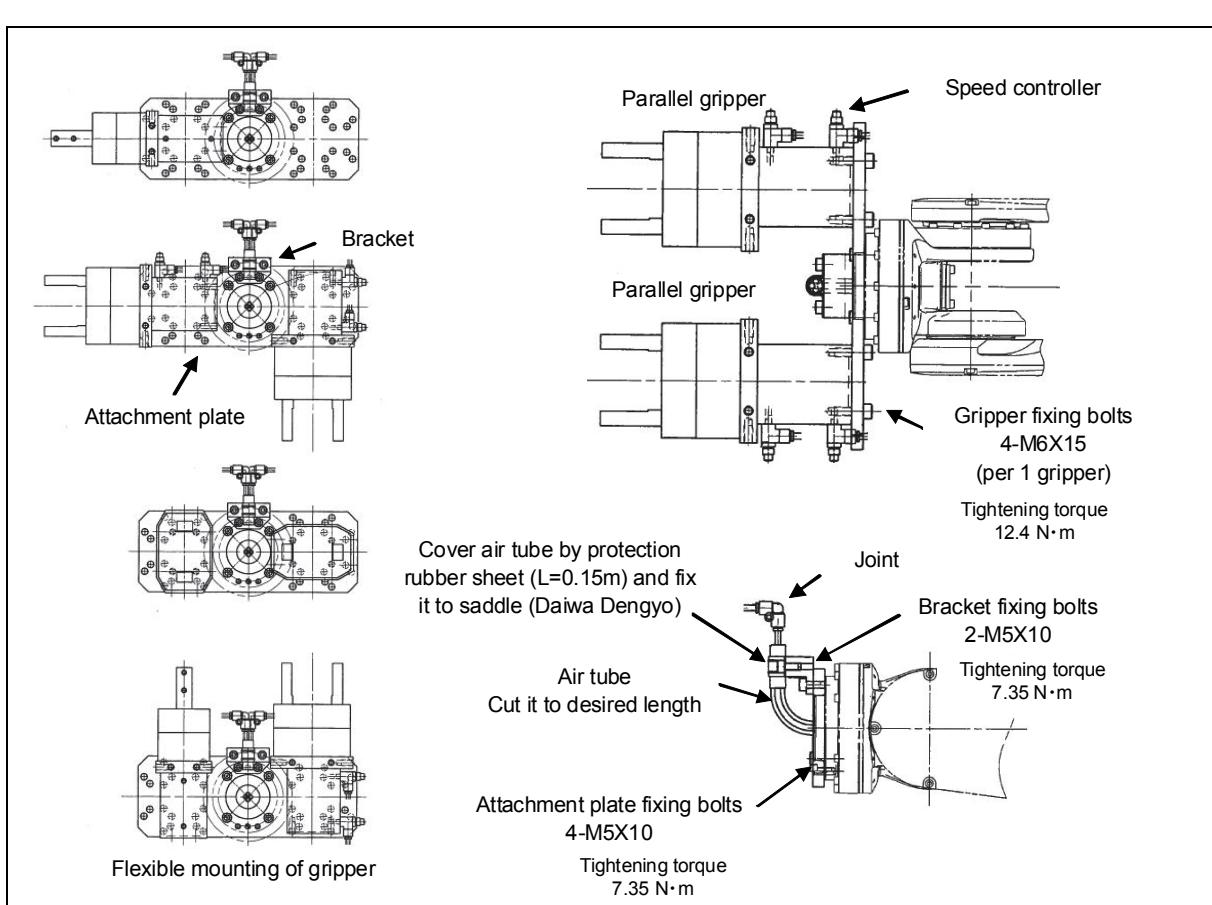
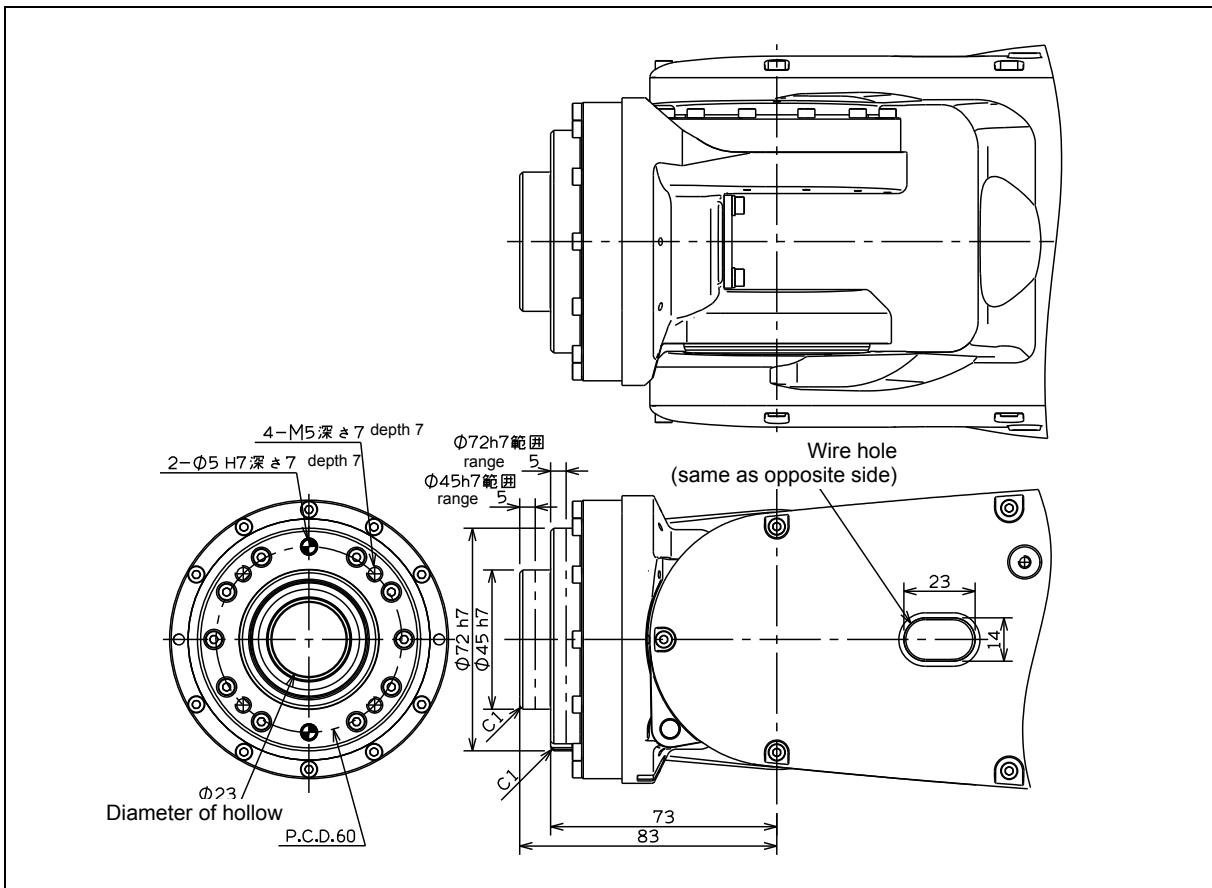
Step	Work performed
1	Move robot by manual operation to the posture where the tool can be mounted in safe.
2	Push emergency stop button.
3	Mount "Attachment plate" on the wrist top.
4	Mount "Gripper" on "Attachment plate".
5	Connect air tubes from outlet on robot arm to "Gripper". Robot wrist has hollow in it, wires and air tubes can be routed very smartly. Please refer to the figures below.
6	Wrist may move widely. By considering the real movement, keep the spare length of wires and air tubes and bind and fix them with cable band.
7	Operate the robot actually, and adjust the length.


CAUTION

- Be sure to screw M5 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.
- It is recommended to set the mass and the center of gravity using the "Automatic CoG measurement function". For details, refer to the following document.
"CFD CONTROLLER INSTRUCTION MANUAL : SETUP MANUAL"(TCFEN-159)
"Chapter 3 Setup"

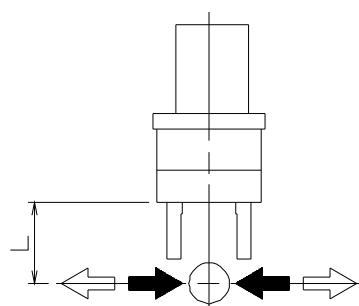
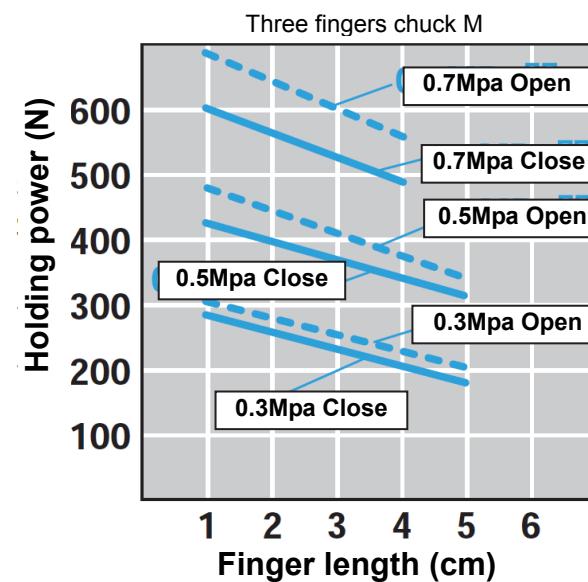
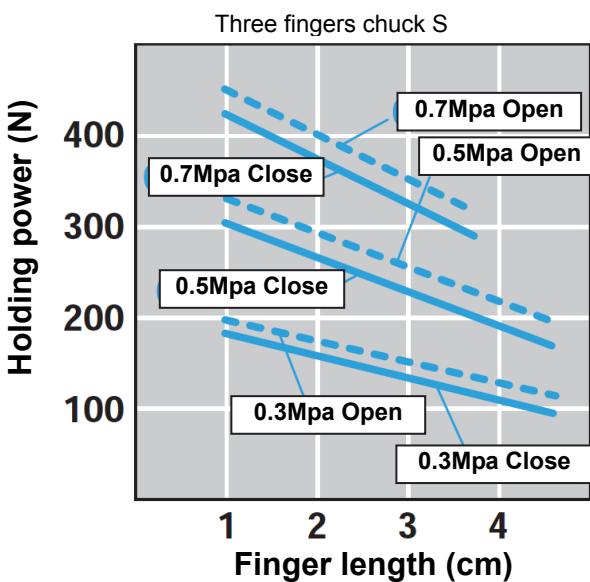
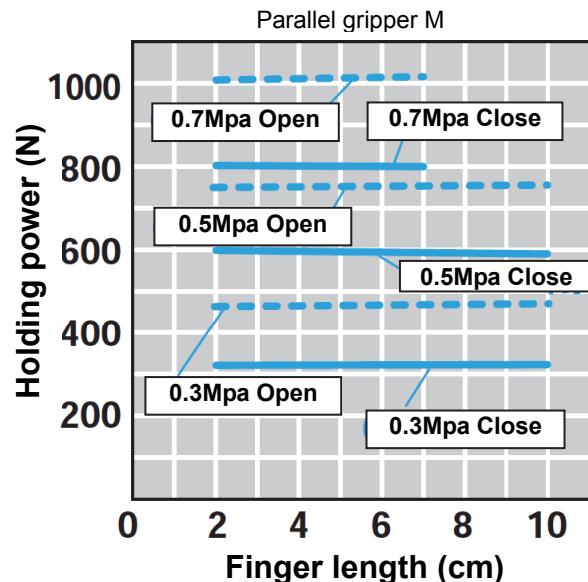
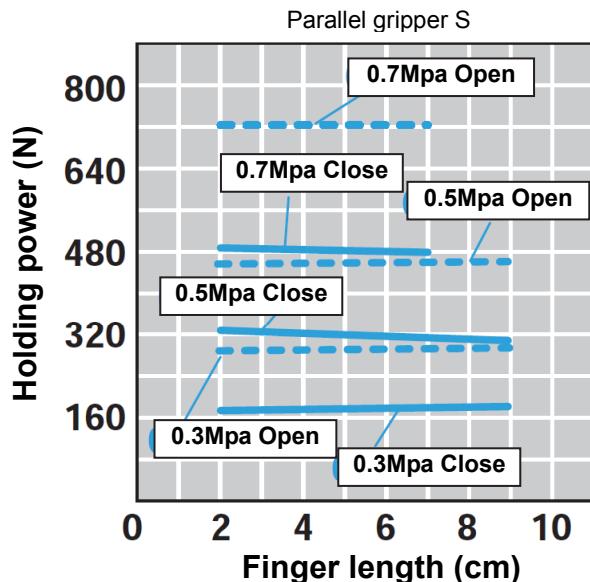


Routing example of wires and air tubes from robot arm to wrist top (Recommended)



8.1.4 Holding power

These graphs show the total holding power of the all fingers of the gripper.

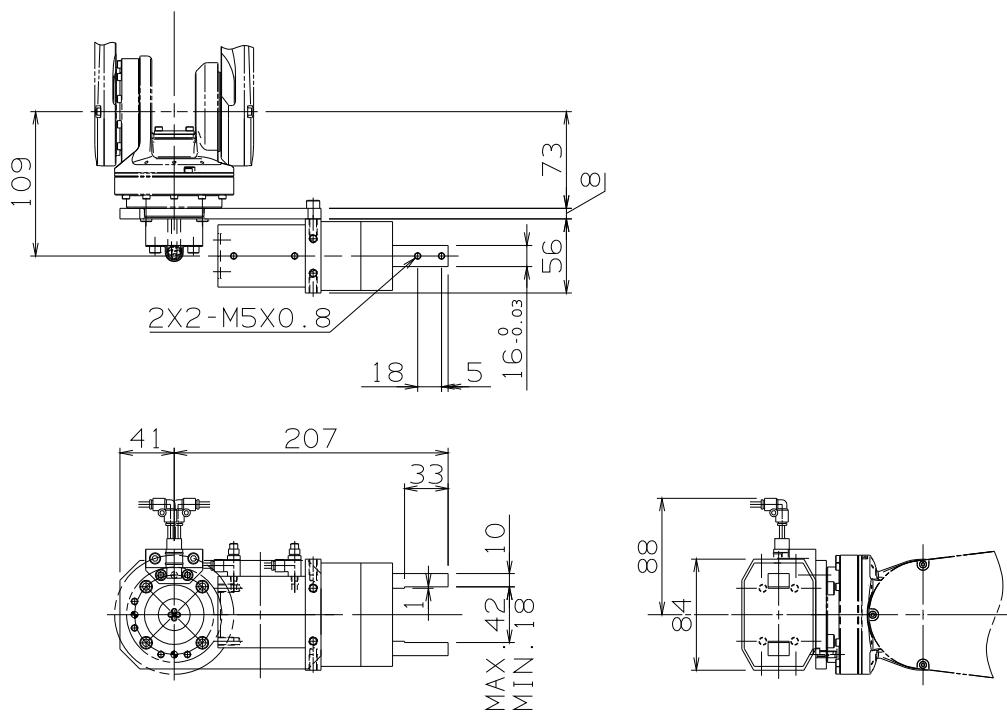


(NOTE)

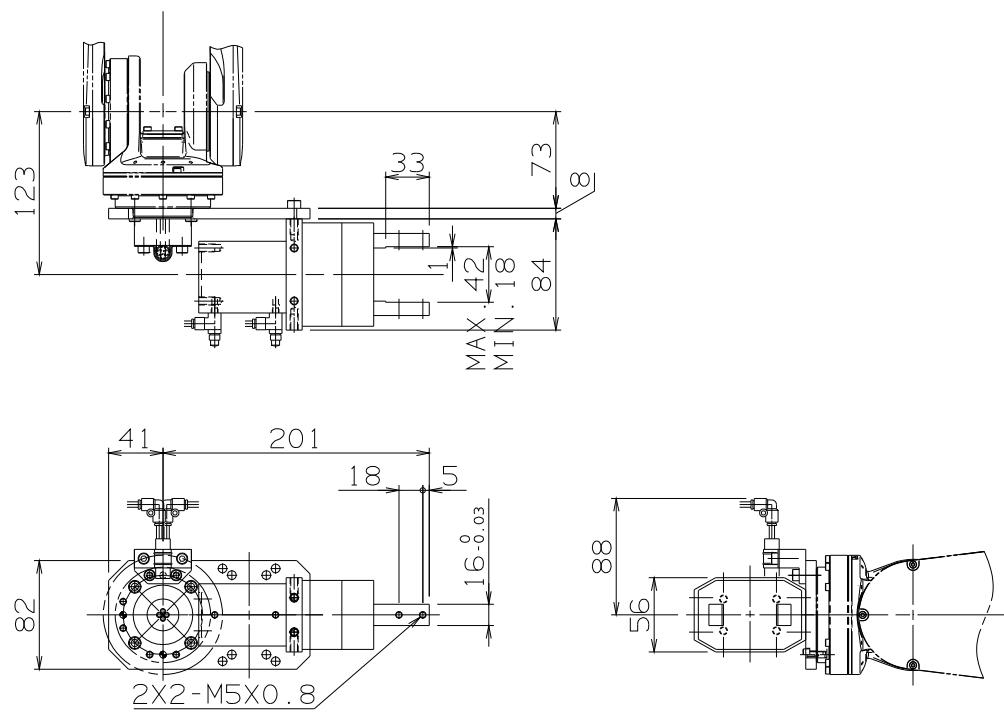
The length of the fingers "L" must be within the area shown by the lines in the graphs. (Solid lines or dotted lines)

Open direction (←)
Close direction (→)

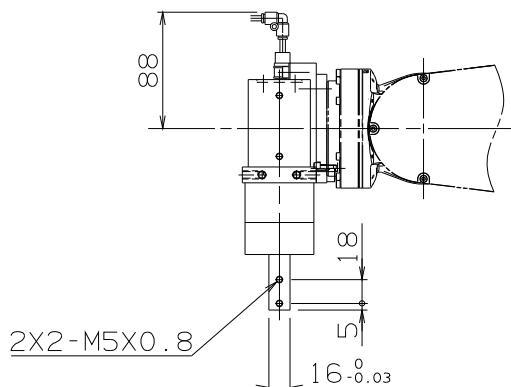
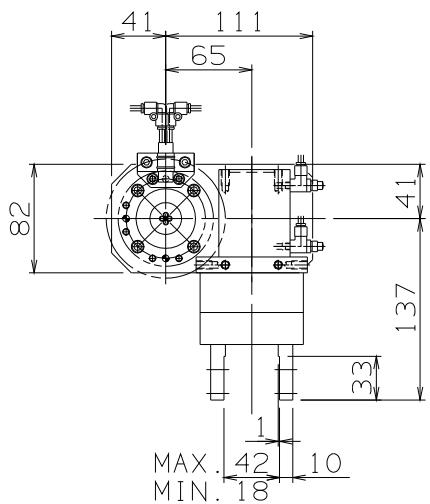
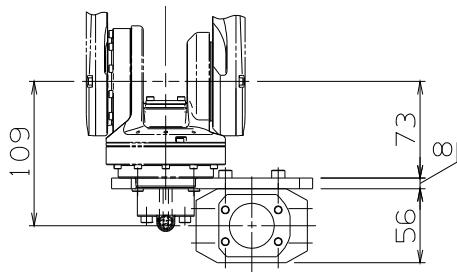
8.1.5 Parallel gripper single S (1)



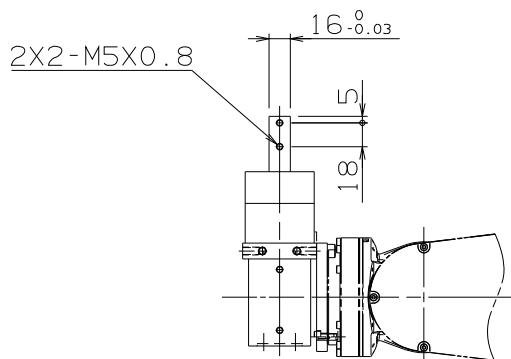
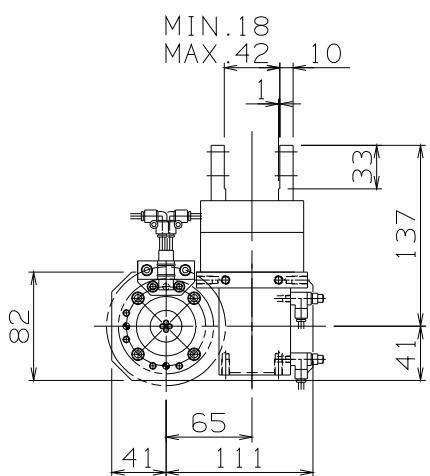
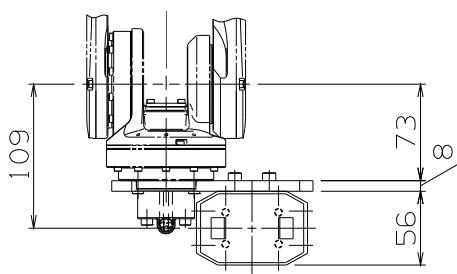
8.1.6 Parallel gripper single S (2)



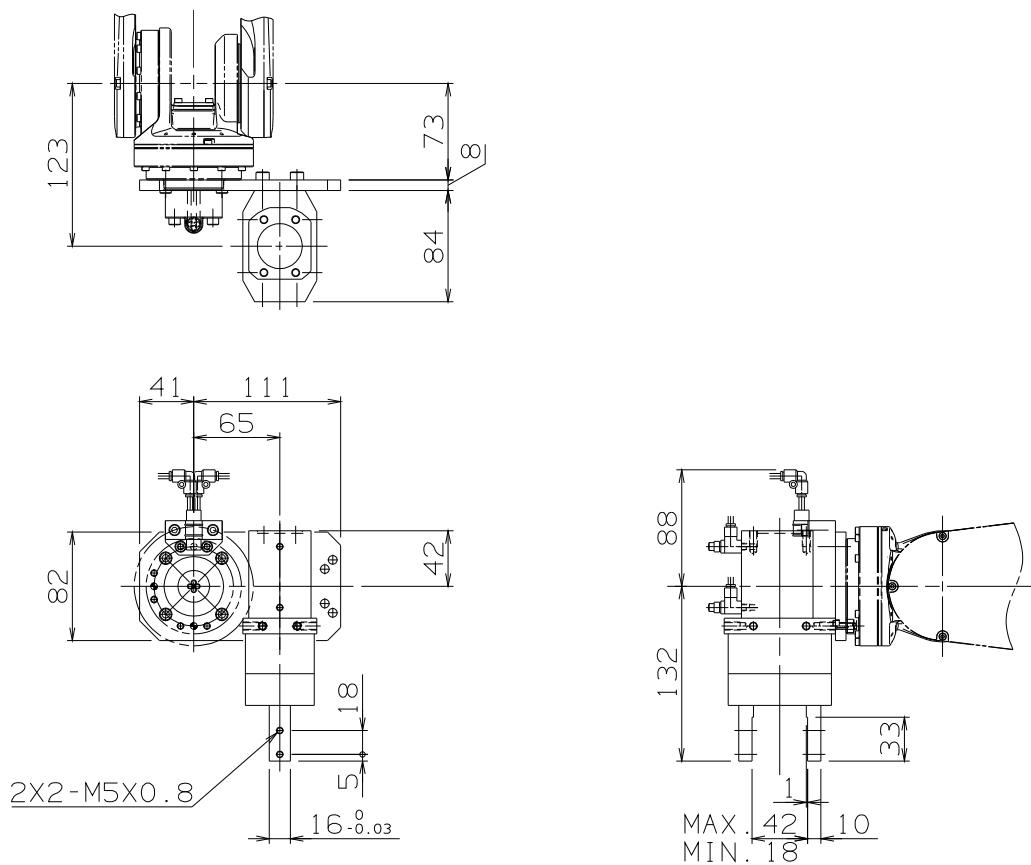
8.1.7 Parallel gripper single S (3)



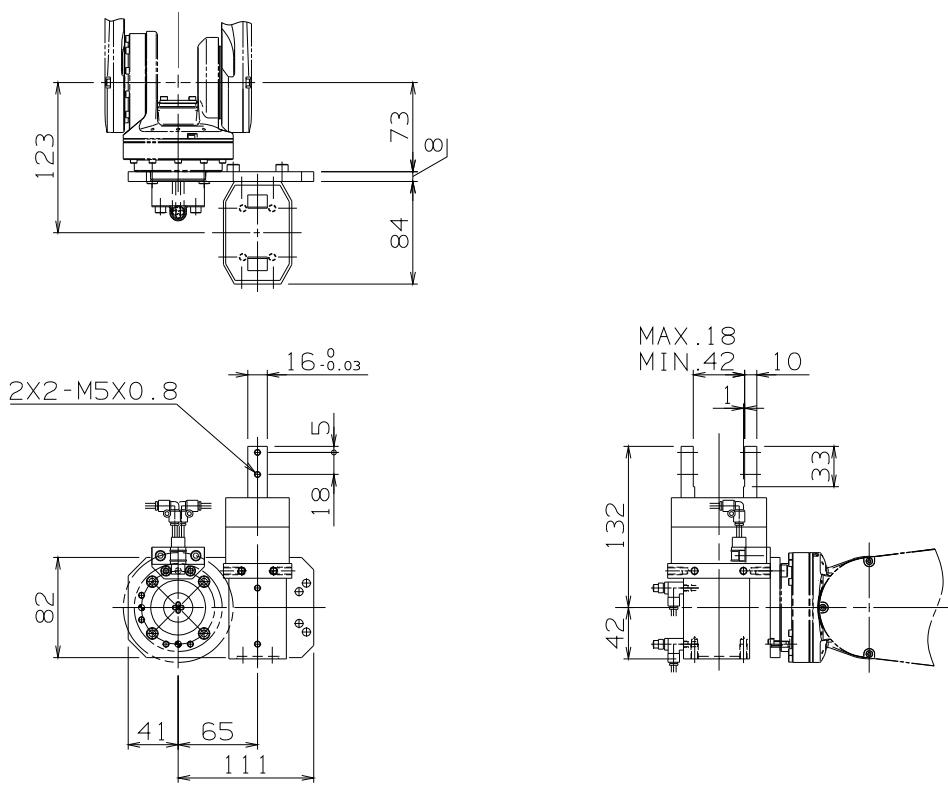
8.1.8 Parallel gripper single S (4)



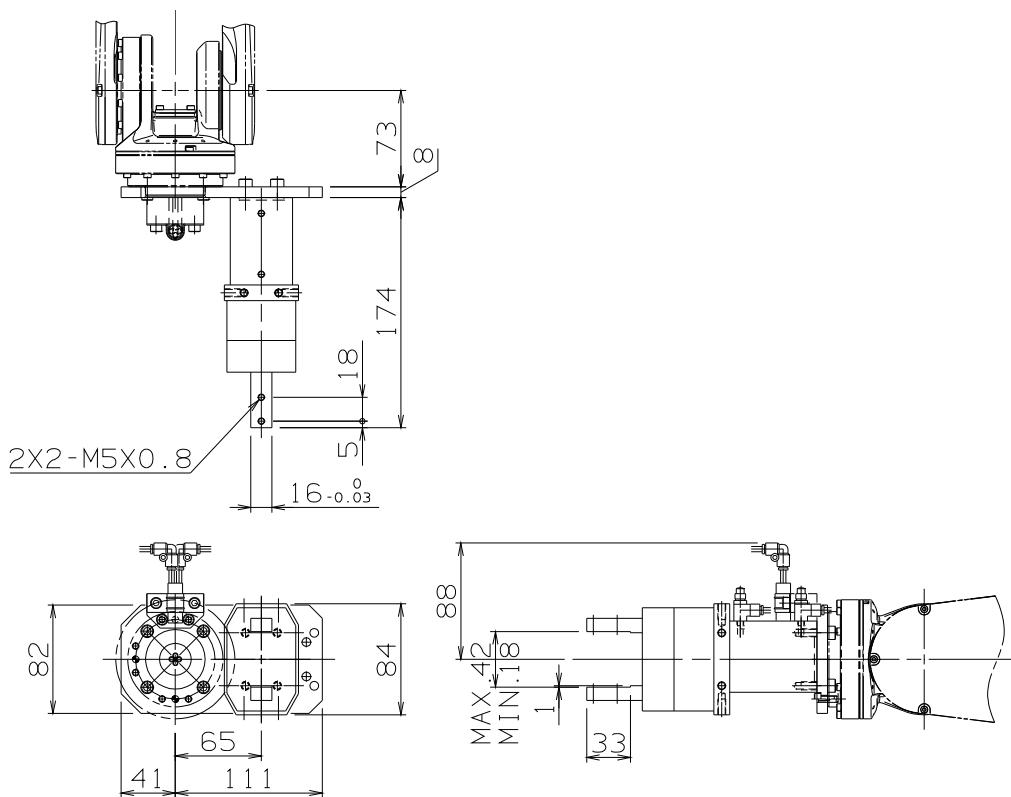
8.1.9 Parallel gripper single S (5)



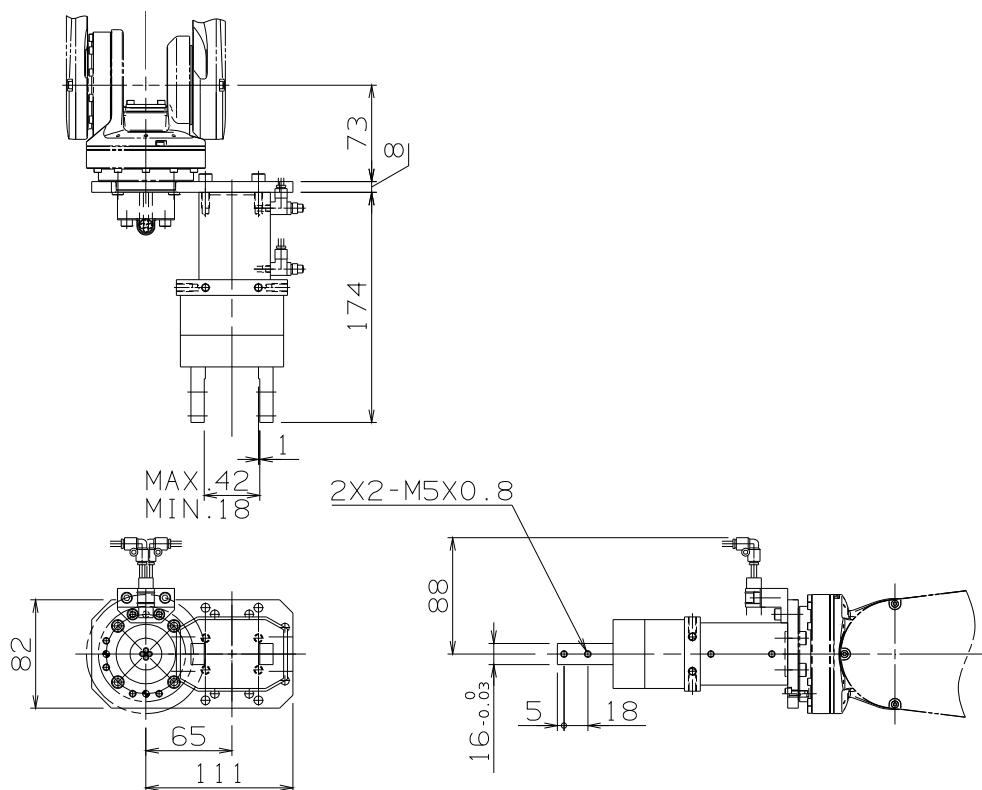
8.1.10 Parallel gripper single S (6)



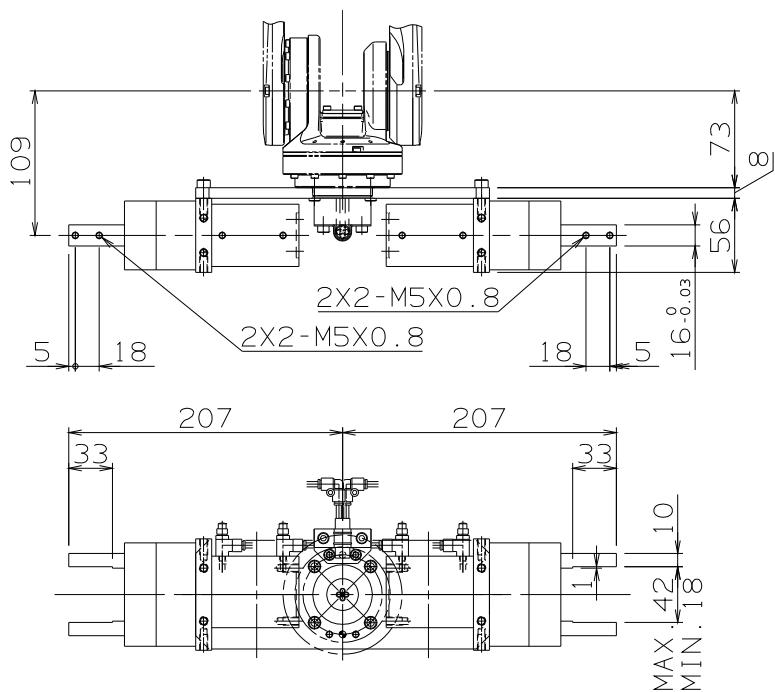
8.1.11 Parallel gripper single S (7)



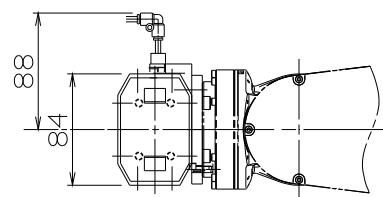
8.1.12 Parallel gripper single S (8)



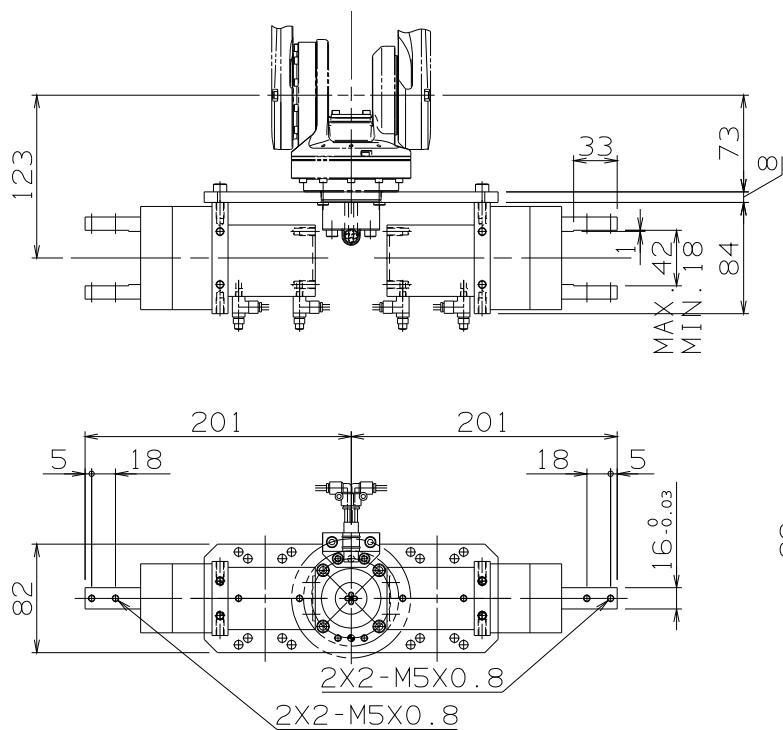
8.1.13 Parallel gripper double S (1)



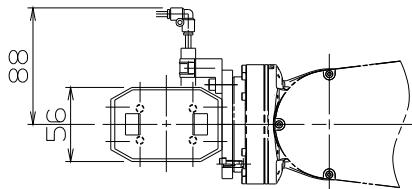
Left/right gripper can be installed independently with free direction.



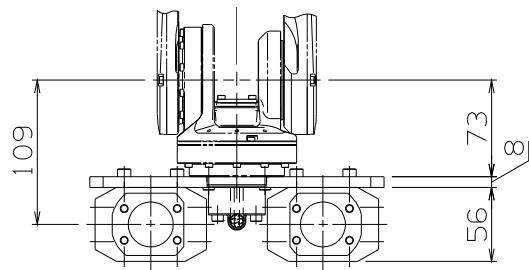
8.1.14 Parallel gripper double S (2)



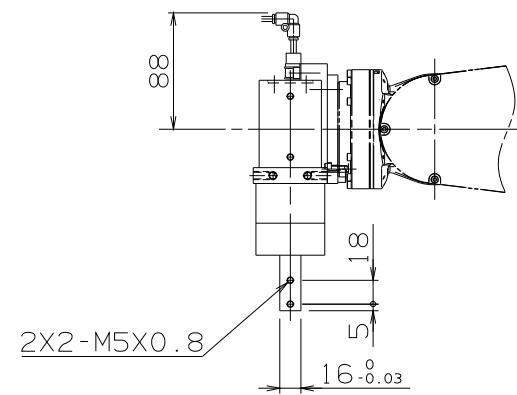
Left/right gripper can be installed independently with free direction.



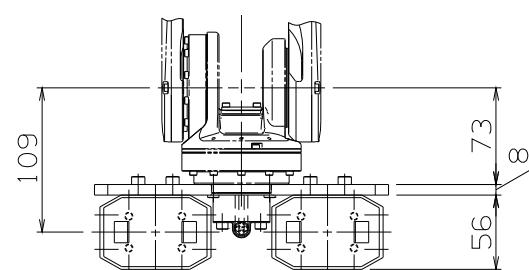
8.1.15 Parallel gripper double S (3)



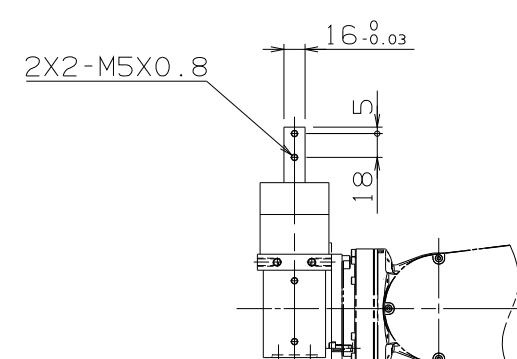
Left/right gripper can be installed independently with free direction.



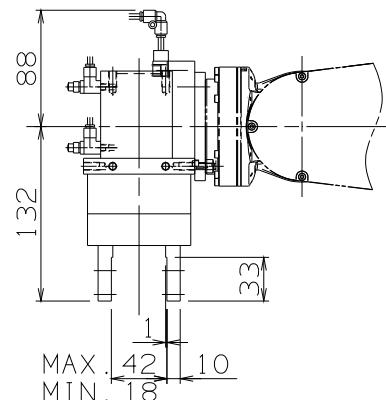
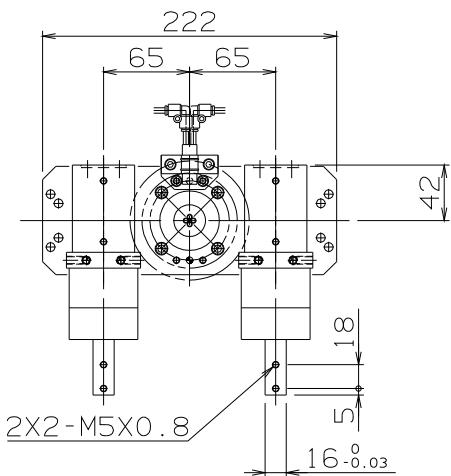
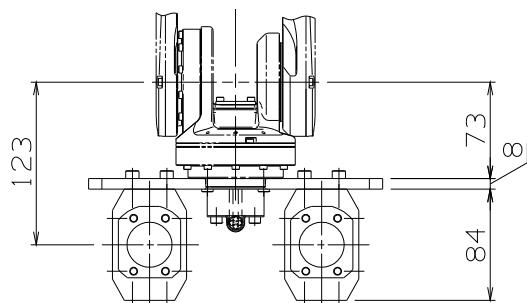
8.1.16 Parallel gripper double S (4)



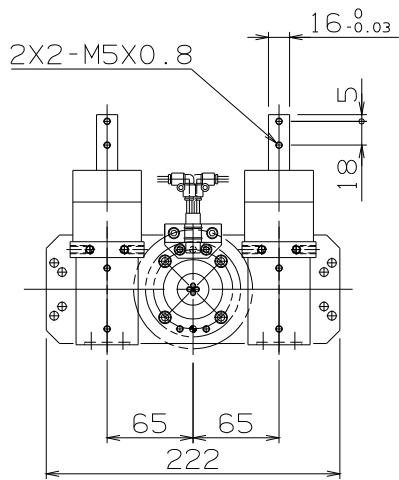
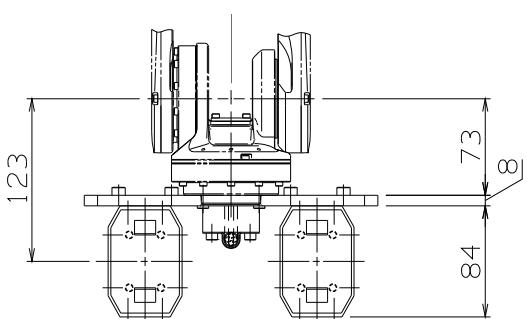
Left/right gripper can be installed independently with free direction.



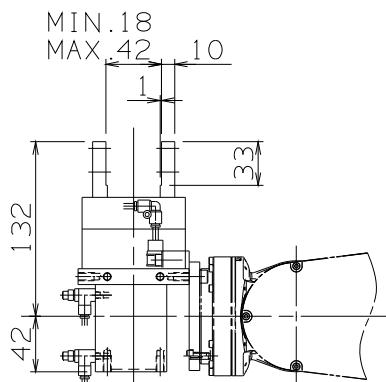
8.1.17 Parallel gripper double S (5)



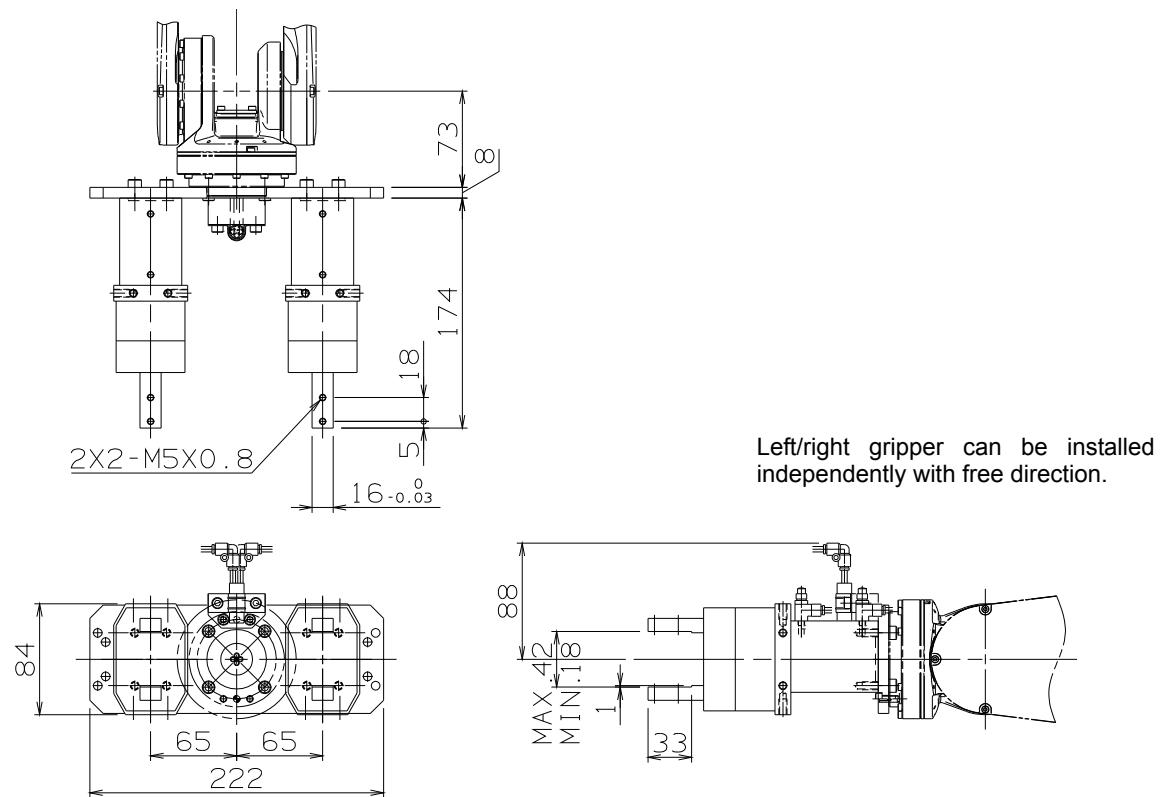
8.1.18 Parallel gripper double S (6)



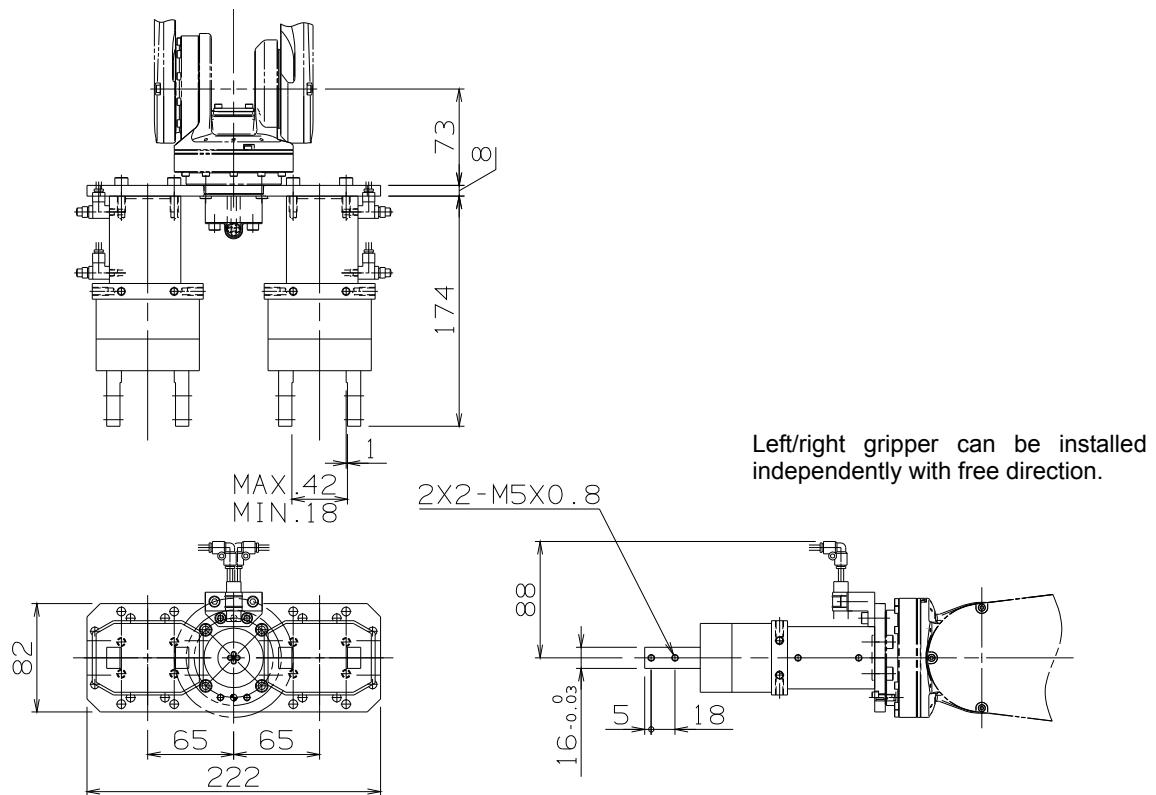
Left/right gripper can be installed independently with free direction.

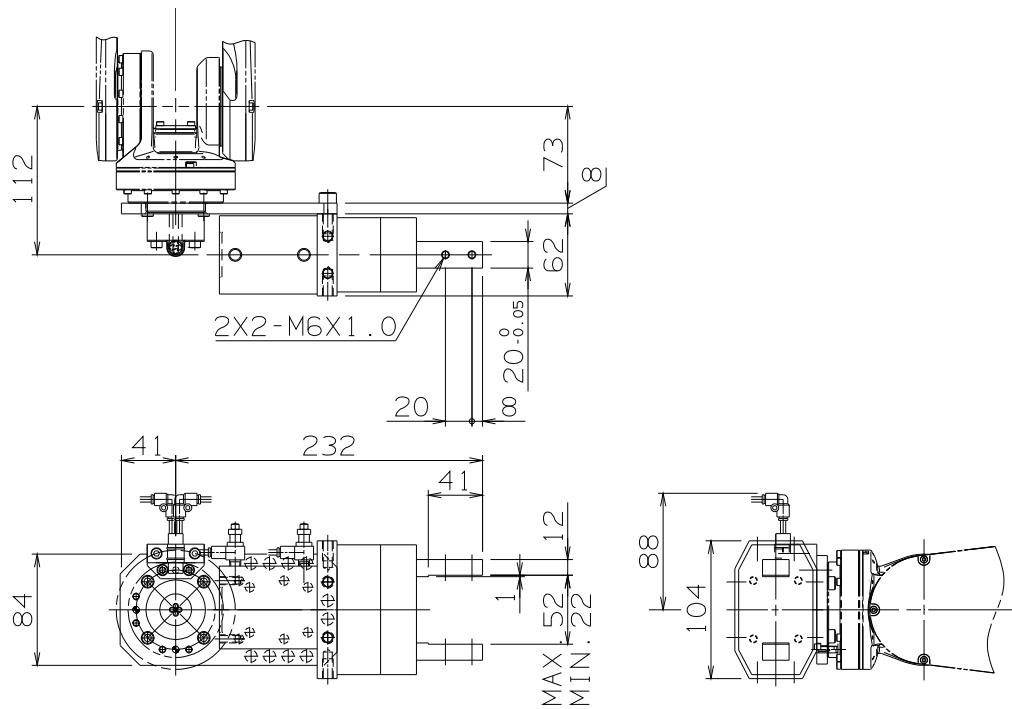
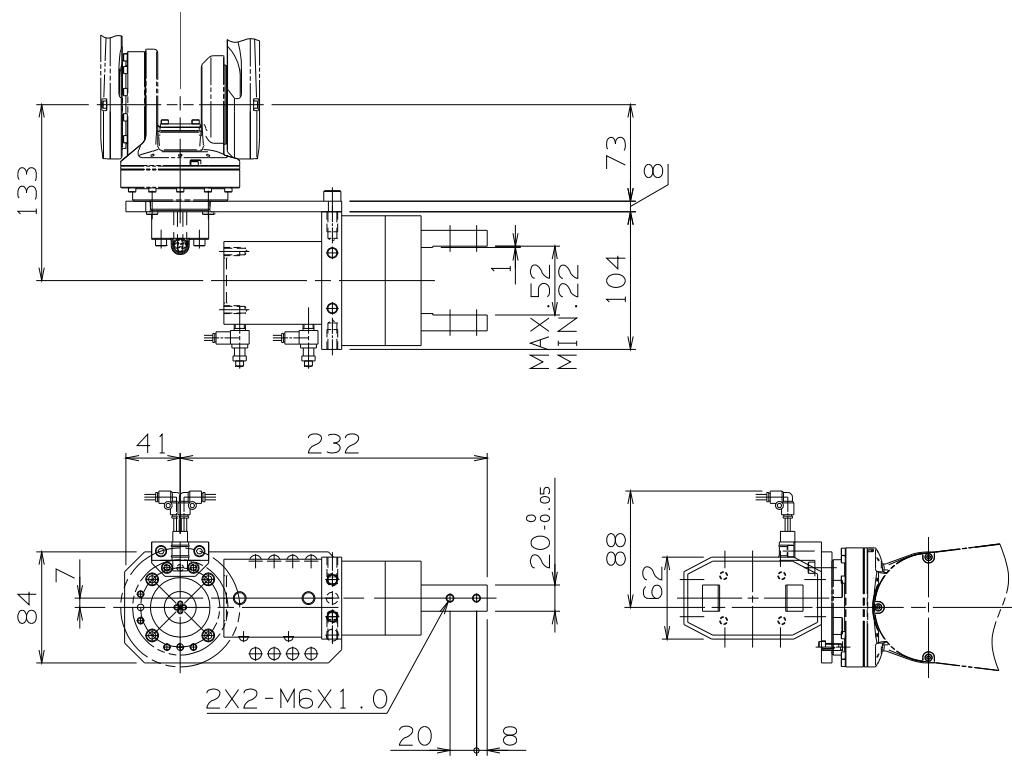


8.1.19 Parallel gripper double S (7)

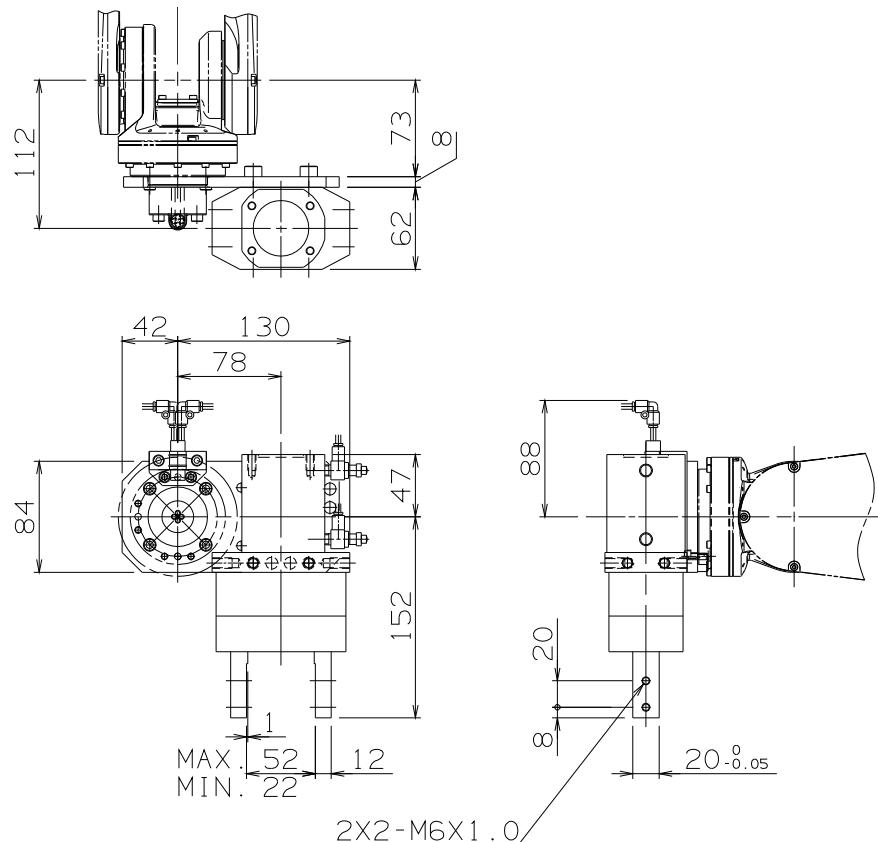


8.1.20 Parallel gripper double S (8)

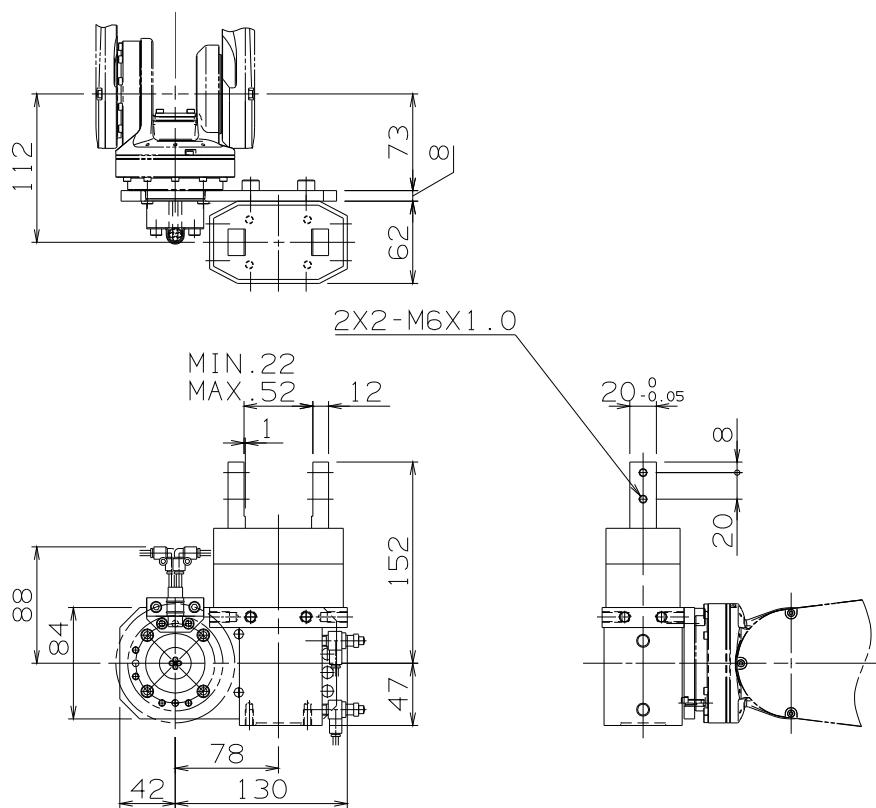


8.1.21 Parallel gripper single M (1)**8.1.22 Parallel gripper single M (2)**

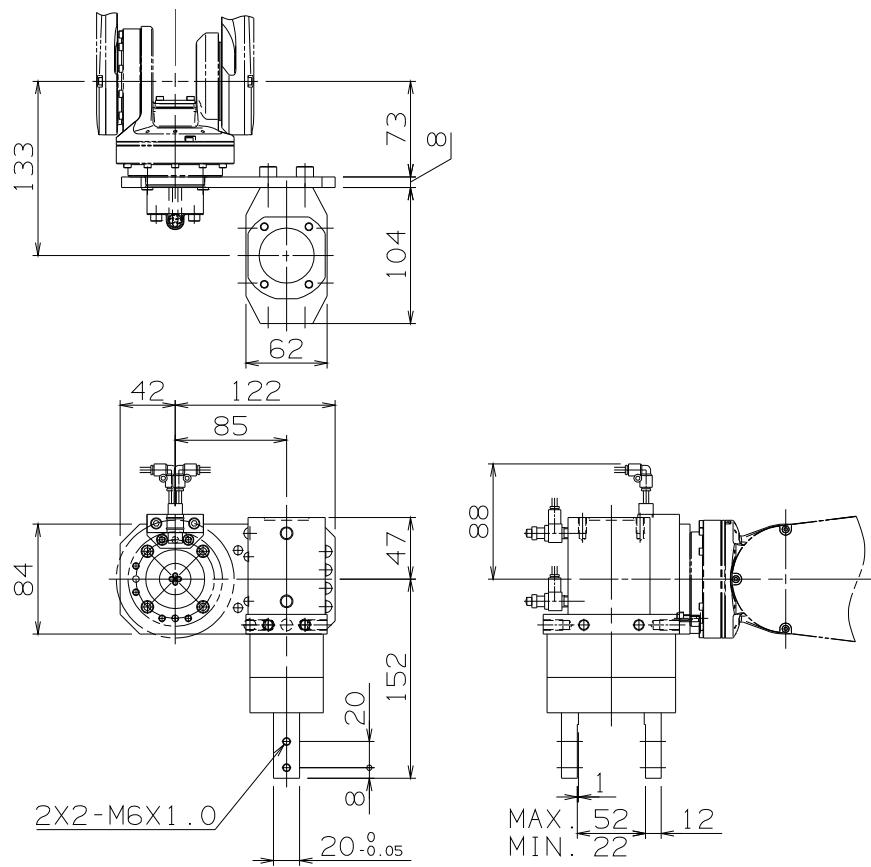
8.1.23 Parallel gripper single M (3)



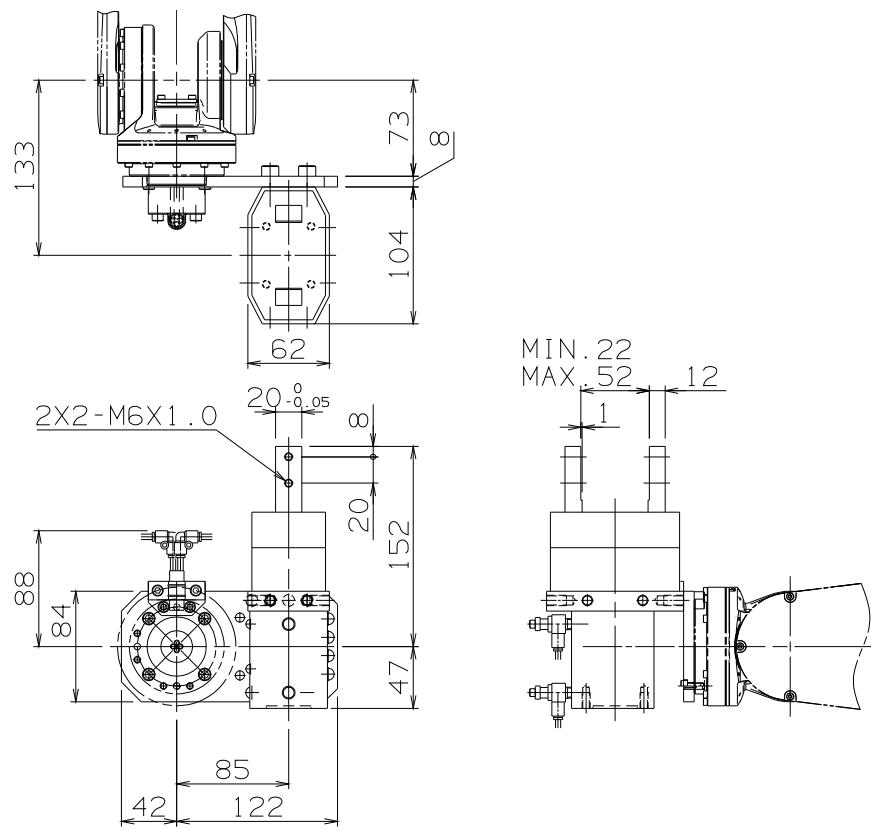
8.1.24 Parallel gripper single M (4)



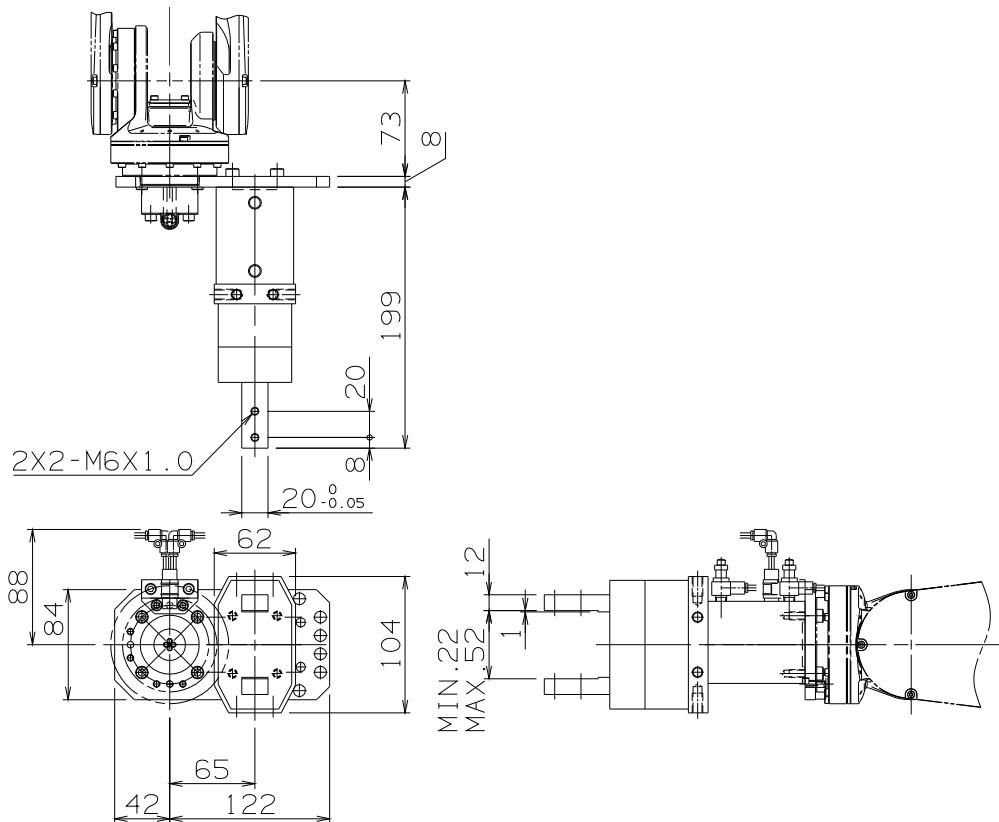
8.1.25 Parallel gripper single M (5)



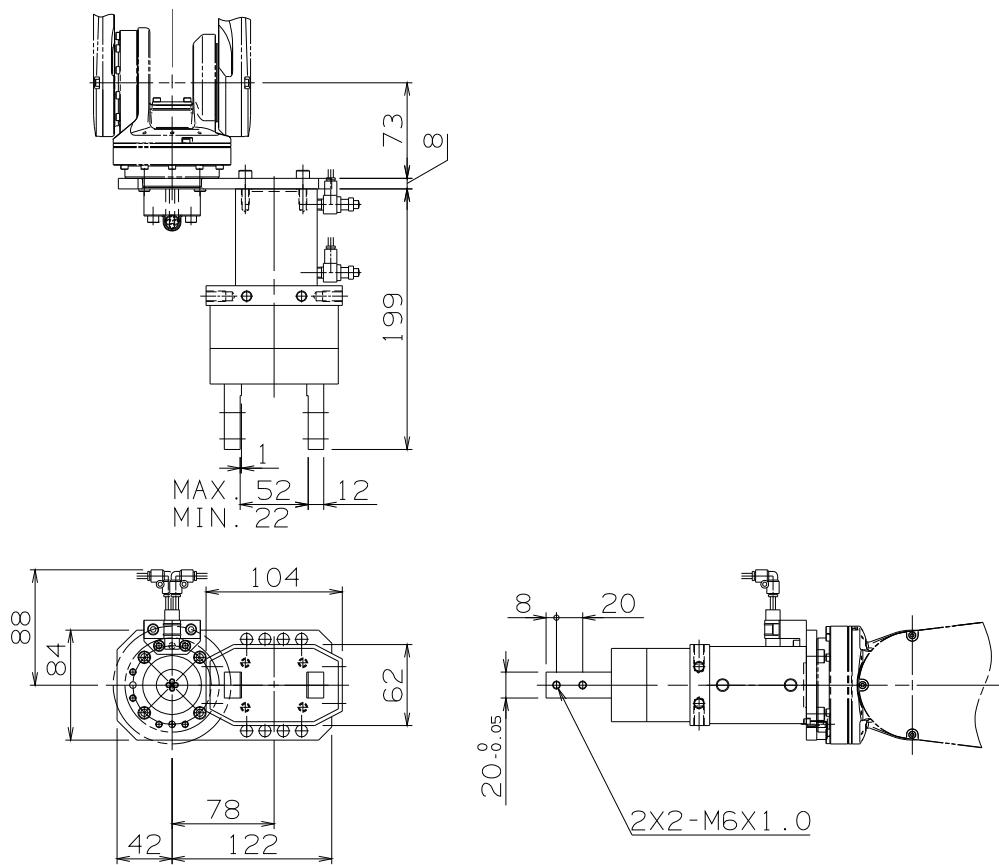
8.1.26 Parallel gripper single M (6)



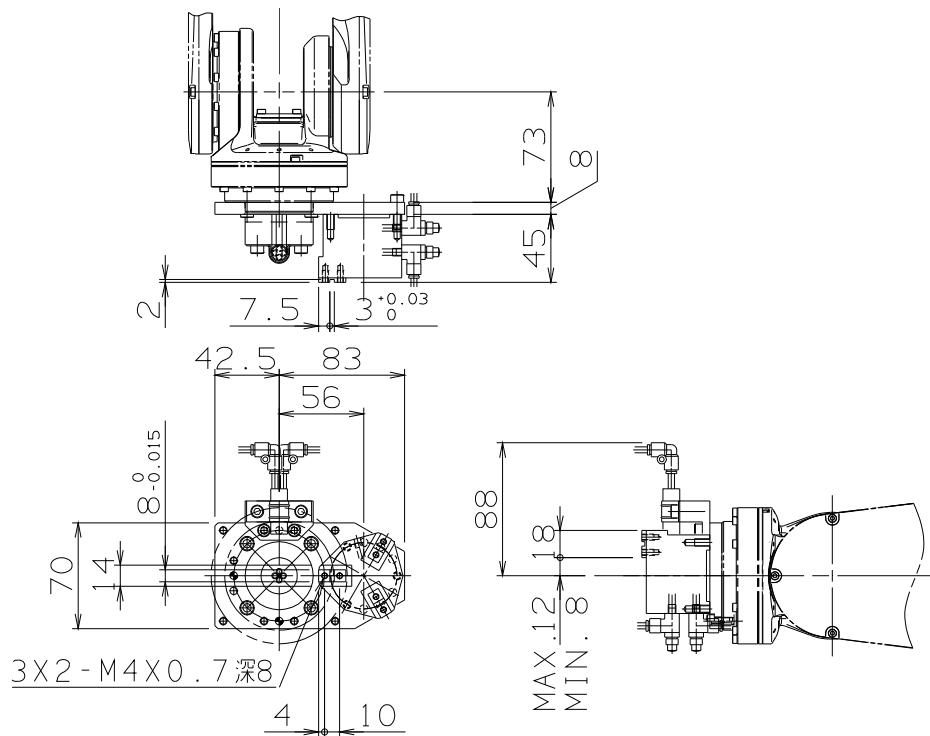
8.1.27 Parallel gripper single M (7)



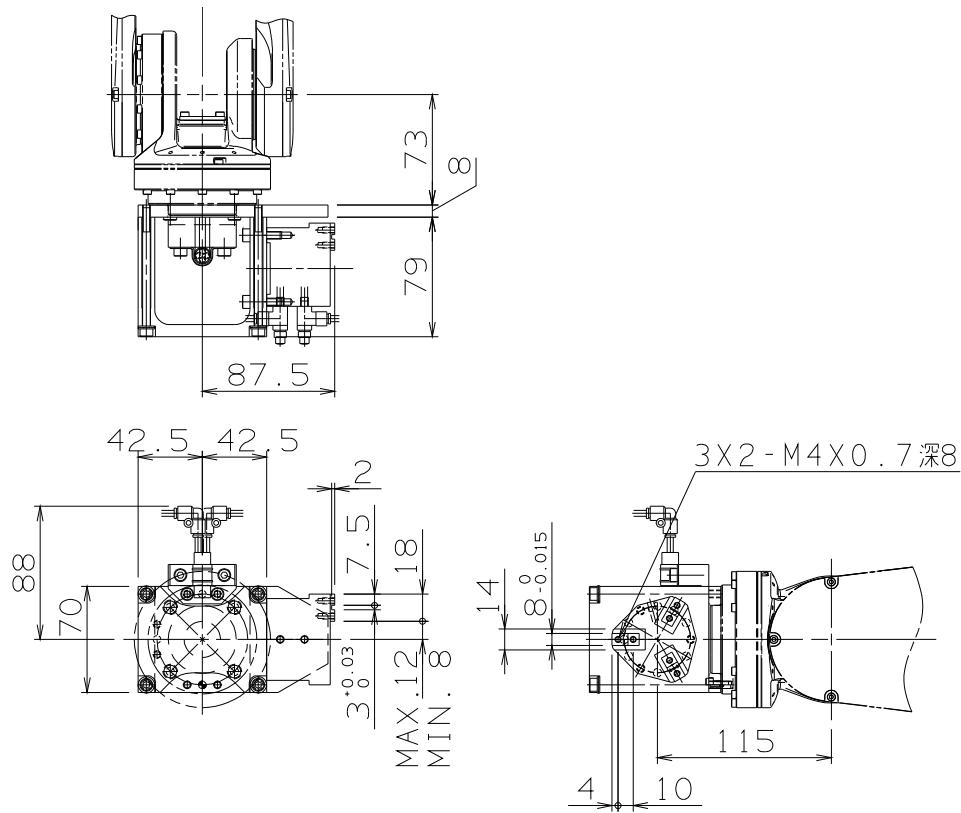
8.1.28 Parallel gripper single M (8)



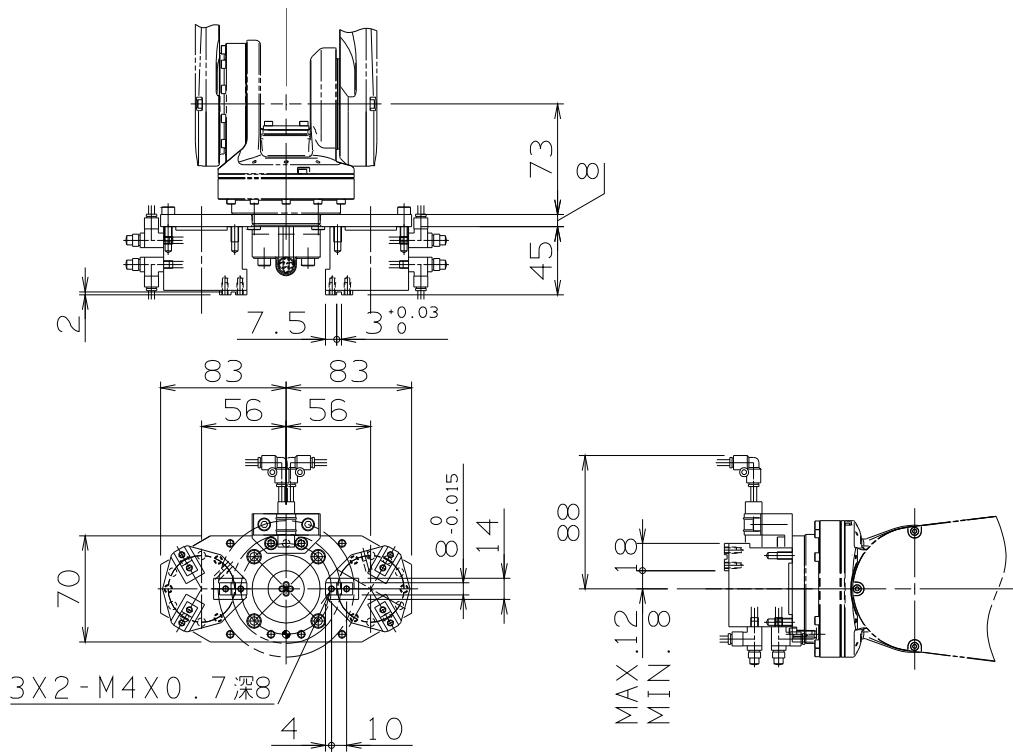
8.1.29 Three fingers chuck single S (Straight type)



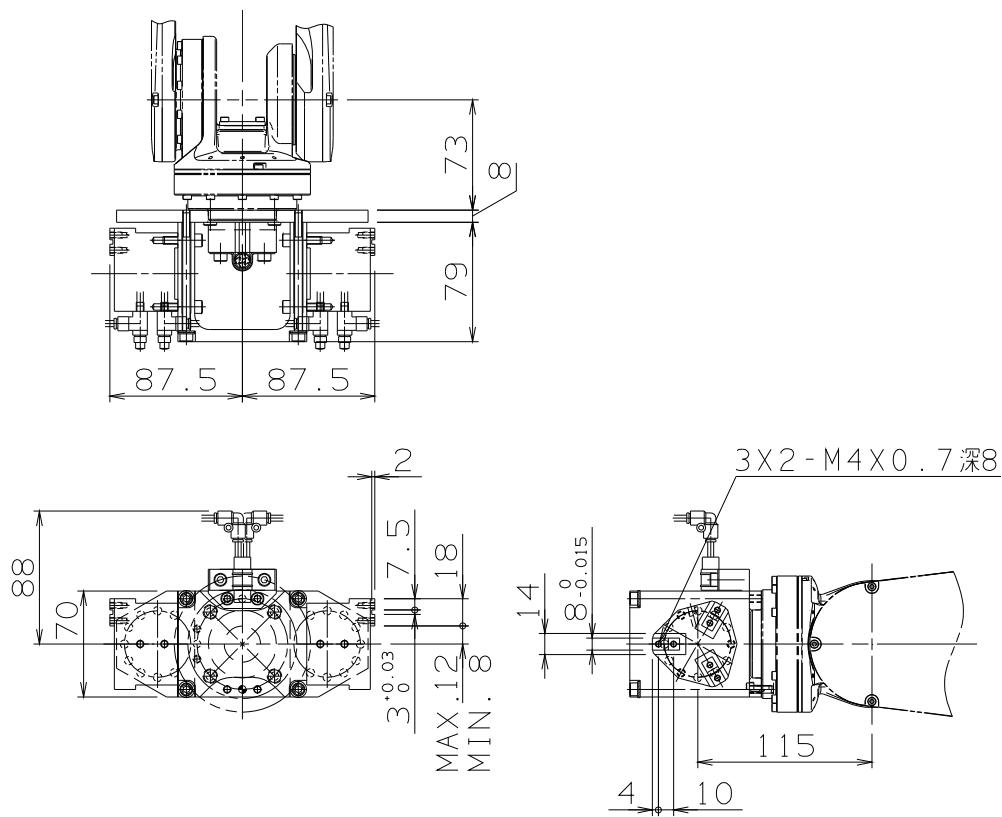
8.1.30 Three fingers chuck single S (Elbow type)



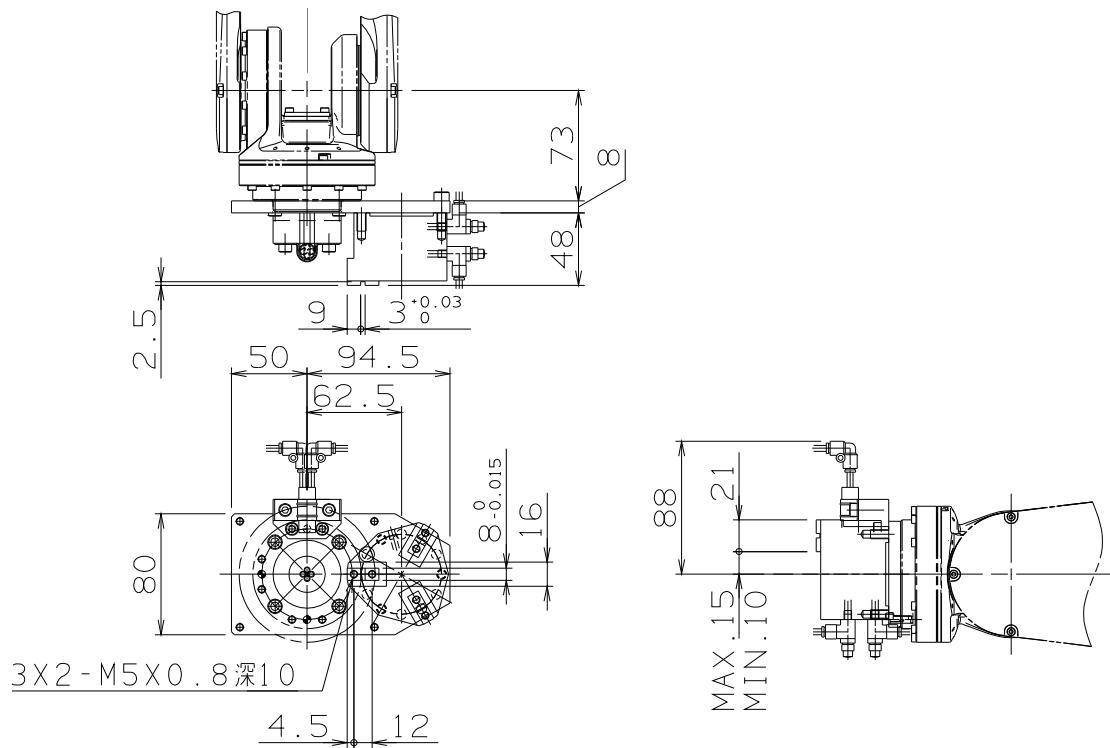
8.1.31 Three fingers chuck double S (Straight type)



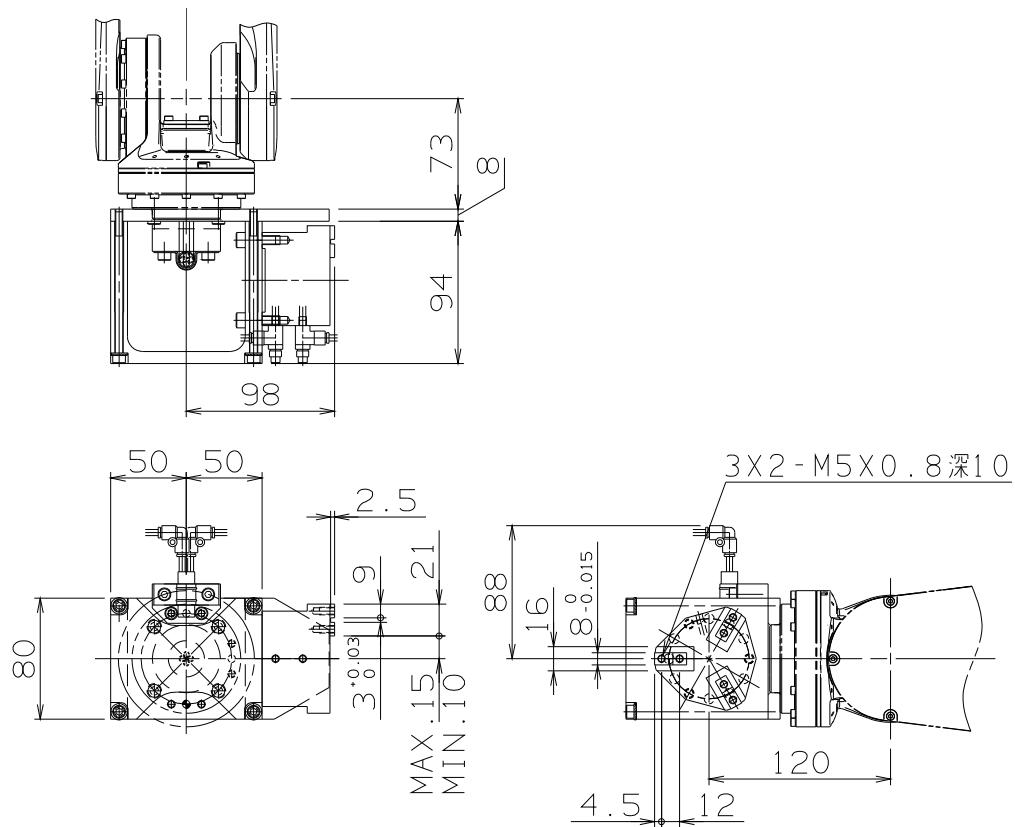
8.1.32 Three fingers chuck double S (Elbow type)



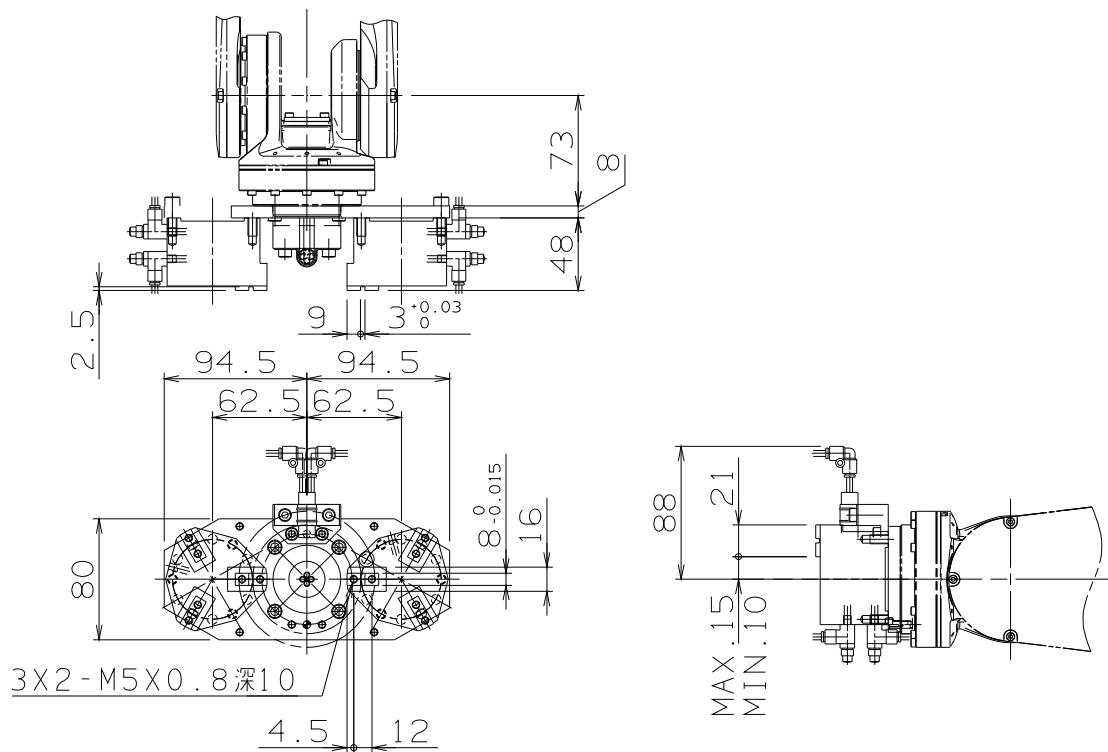
8.1.33 Three fingers chuck single M (Straight type)



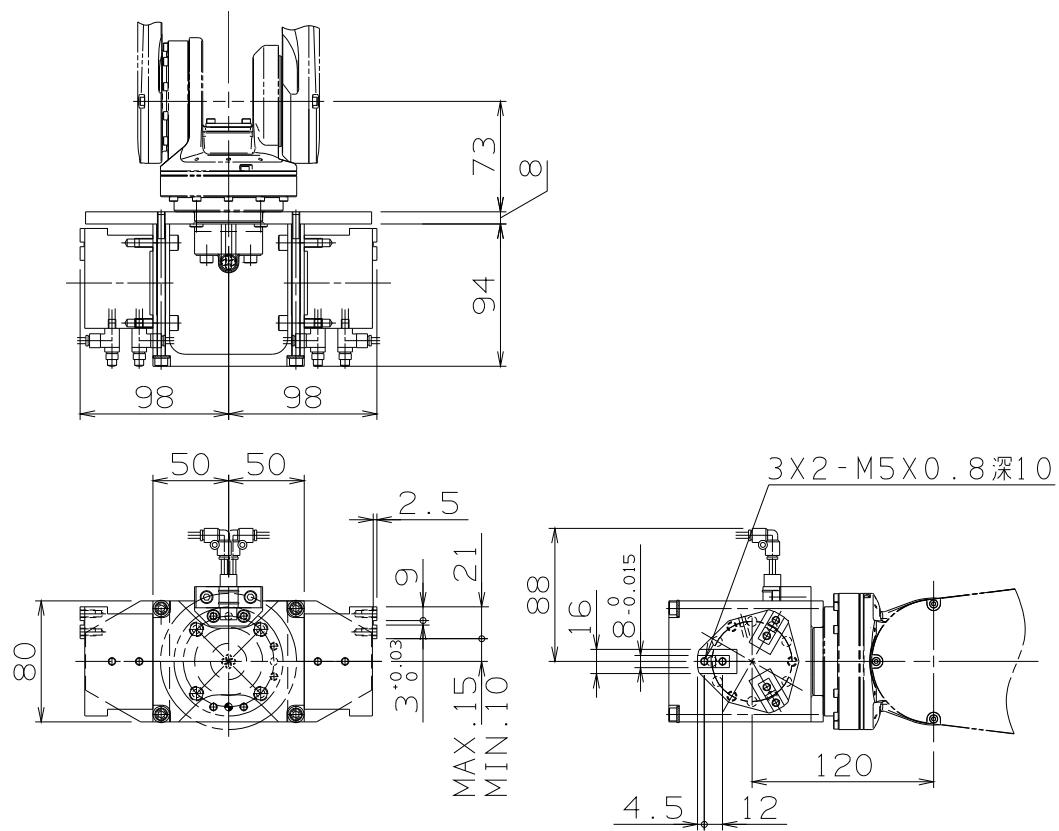
8.1.34 Three fingers chuck single M (Elbow type)



8.1.35 Three fingers chuck double M (Straight type)



8.1.36 Three fingers chuck double M (Elbow type)



8.2 MZ04 series

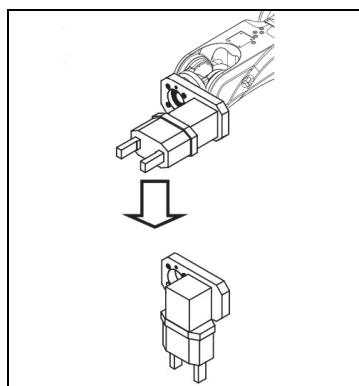
8.2.1 Outline

The following grippers are available for MZ04 series.

Name	Specification	Parts No.
Standard Gripper	Parallel gripper single S	OP-F10-009
	Parallel gripper single M	OP-F10-010
	Three fingers single S	OP-F10-011
	Three fingers single M	OP-F10-012



Parallel gripper and 3 fingers gripper



Flexible mounting of gripper

8.2.2 Specifications

Parallel gripper / Three fingers chuck specification table

	Parallel gripper S	Parallel gripper M	Threes fingers chuck S	Threes fingers chuck S
Actuator	Air (From 0.3 to 0.7Mpa)			
Environment temperature (°C)	5 to 60			
Movement stroke (mm)	24	30	8	10
Cylinder diameter (mm)	φ32	φ40	φ32	φ40
Holding power (N) *When 0.5MPa	300	600	170	310
Rod diameter (mm)	φ16	φ20	φ10	φ12
Internal capacity [back and forward] (cm ³ /1 time)	25.3	49.5	7.7	15.6
Repeatability (mm)	±0.01			
Mass (kg)	1.36	1.95	0.24	0.36

(NOTE)

- The holding power in this table is close direction.
- If the environmental temperature is 45°C or more, the actuator air pressure must be 0.5MPa or less.
- The air must be dry air.

Main contained parts

Specification	Name	Manufacture	Type	Q'ty	Notes
Parallel gripper single S	Parallel gripper	--	HK-32MS	1	
	Attachment plate	Fujikoshi		1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Parallel gripper single M	Parallel gripper	--	HK-40MS	1	
	Attachment plate	Fujikoshi		1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Three fingers single S	Three fingers gripper	--	CKL-32AS	1	
	Attachment plate	Fujikoshi		1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m
Three fingers single M	Three fingers gripper	--	CKL-40AS	1	
	Attachment plate	Fujikoshi		1	
	Air tube and joint	SMC, etc	—	1 set	φ 4、1.5m

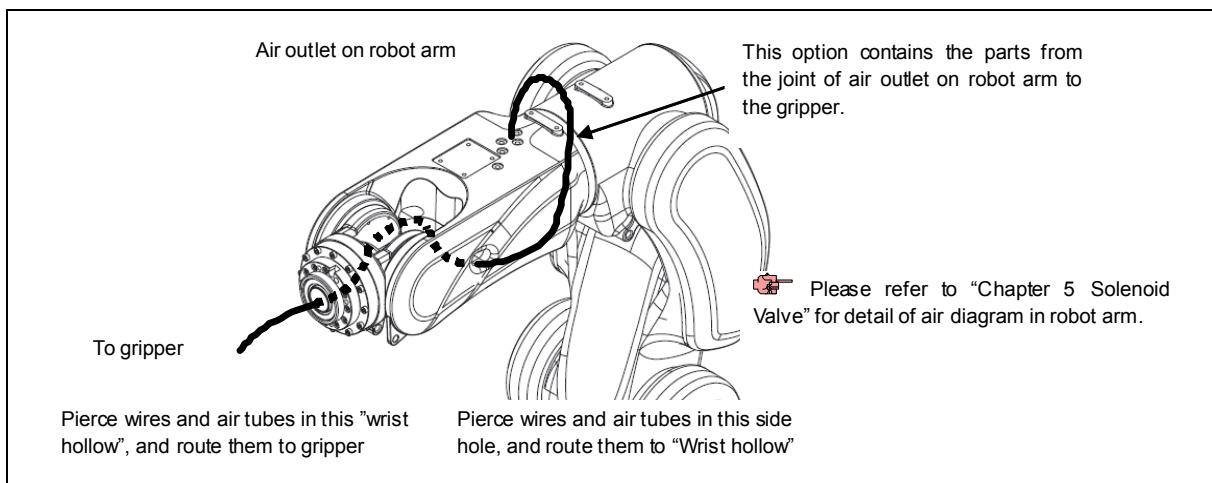
8.2.3 How to install

Mount grippers by following to the procedure written below.
This is recommended procedure that utilizes the wrist hollow.

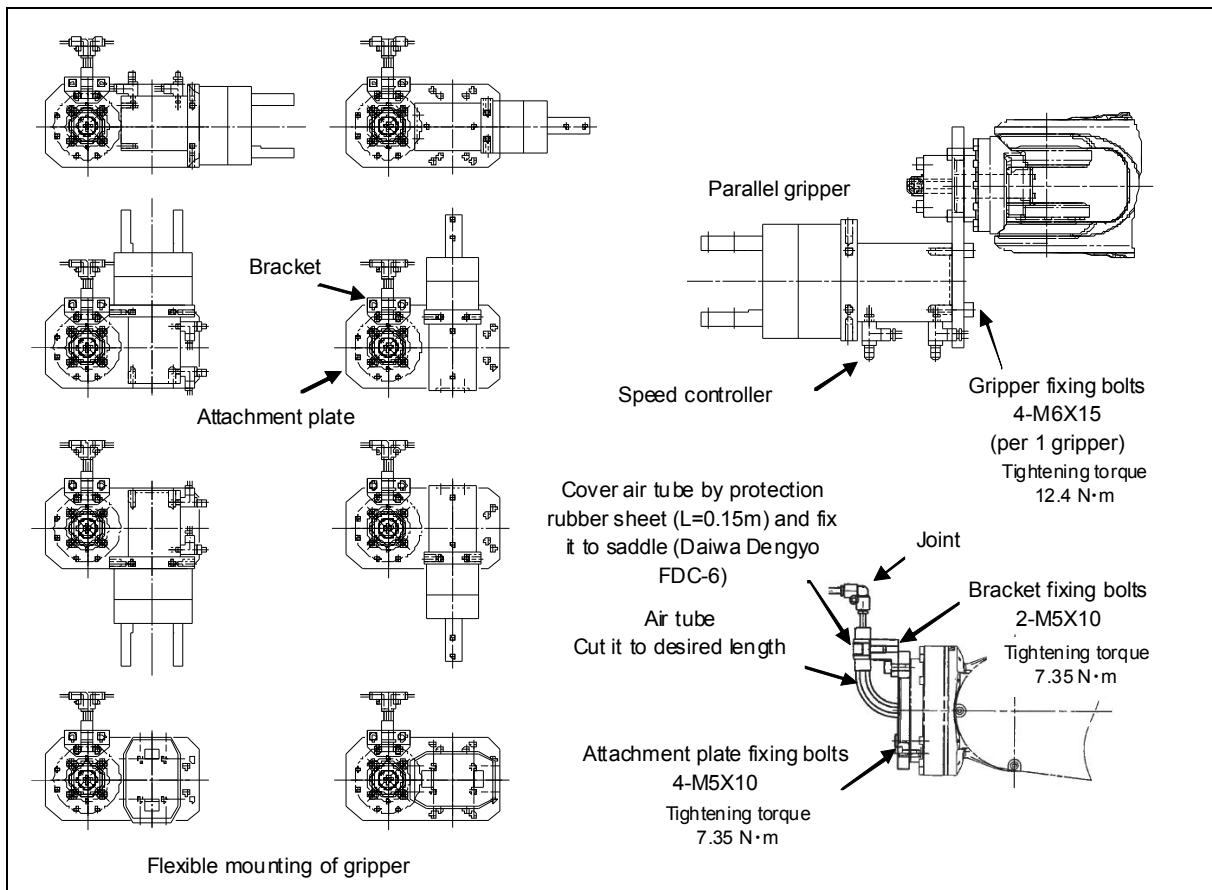
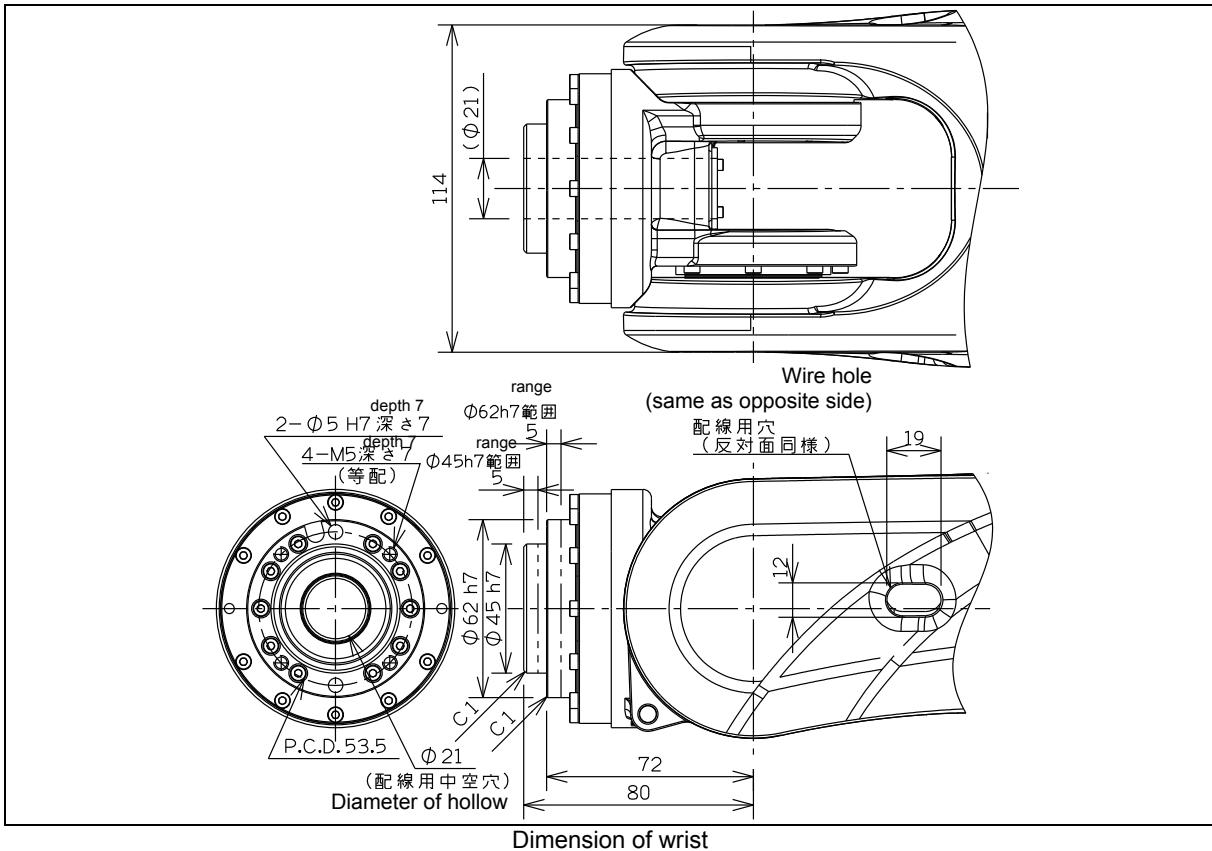
Step	Work performed
1	Move robot by manual operation to the posture where the tool can be mounted in safe.
2	Push emergency stop button.
3	Mount "Attachment plate" on the wrist top.
4	Mount "Gripper" on "Attachment plate".
5	Connect air tubes from outlet on robot arm to "Gripper". Robot wrist has hollow in it, wires and air tubes can be routed very smartly. Please refer to the figures below.
6	Wrist may move widely. By considering the real movement, keep the spare length of wires and air tubes and bind and fix them with cable band.
7	Operate the robot actually, and adjust the length.



- Be sure to screw M5 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.
- It is recommended to set the mass and the center of gravity using the "Automatic CoG measurement function". For details, refer to the following document.
"FD CONTROLLER INSTRUCTION MANUAL : SETUP MANUAL"(TFDEN-001)
"Chapter 4 Setup"

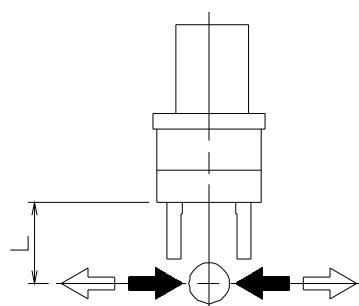
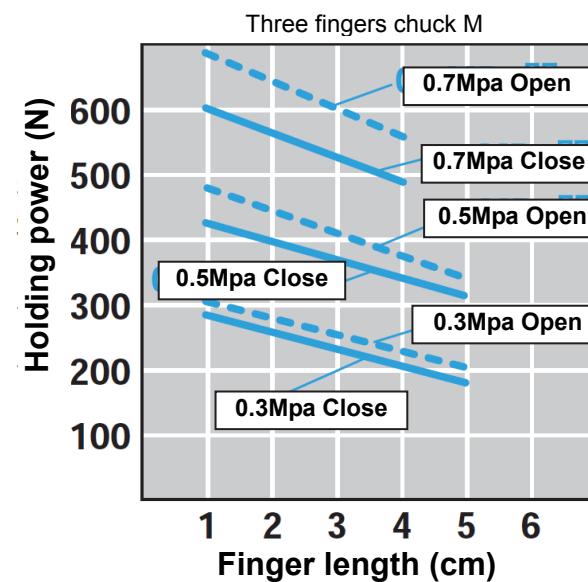
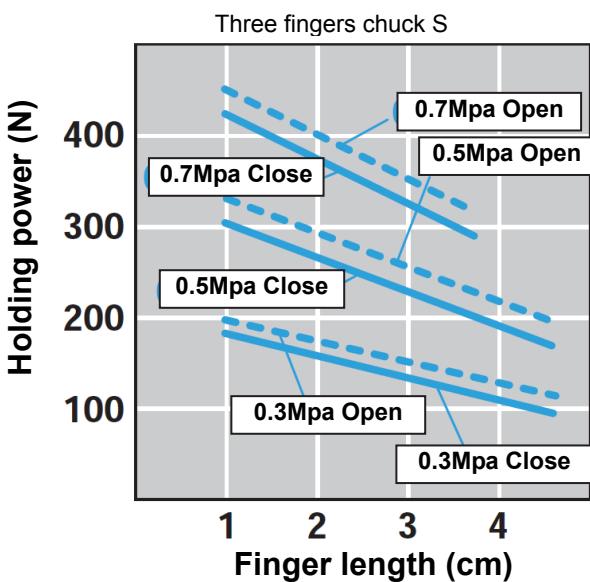
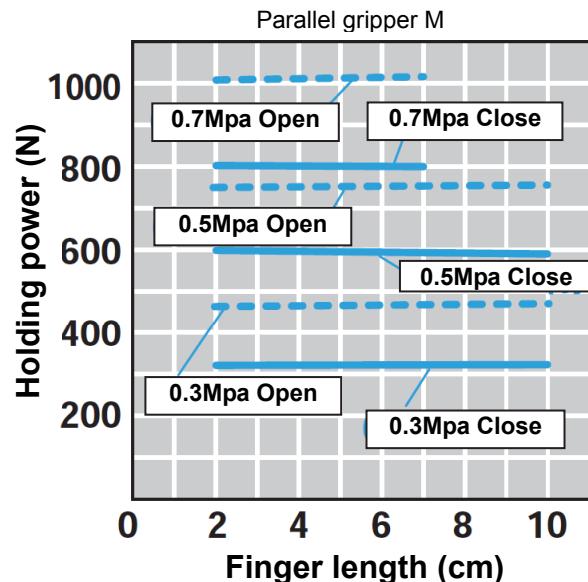
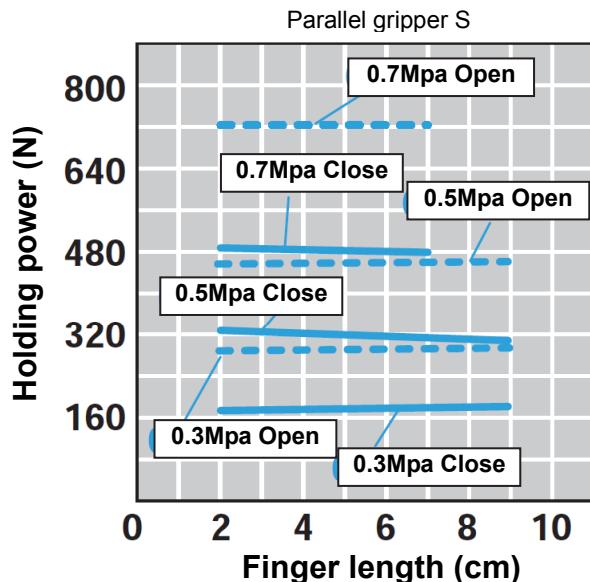


Routing example of wires and air tubes from robot arm to wrist top (Recommended)



8.2.4 Holding power

These graphs show the total holding power of the all fingers of the gripper.

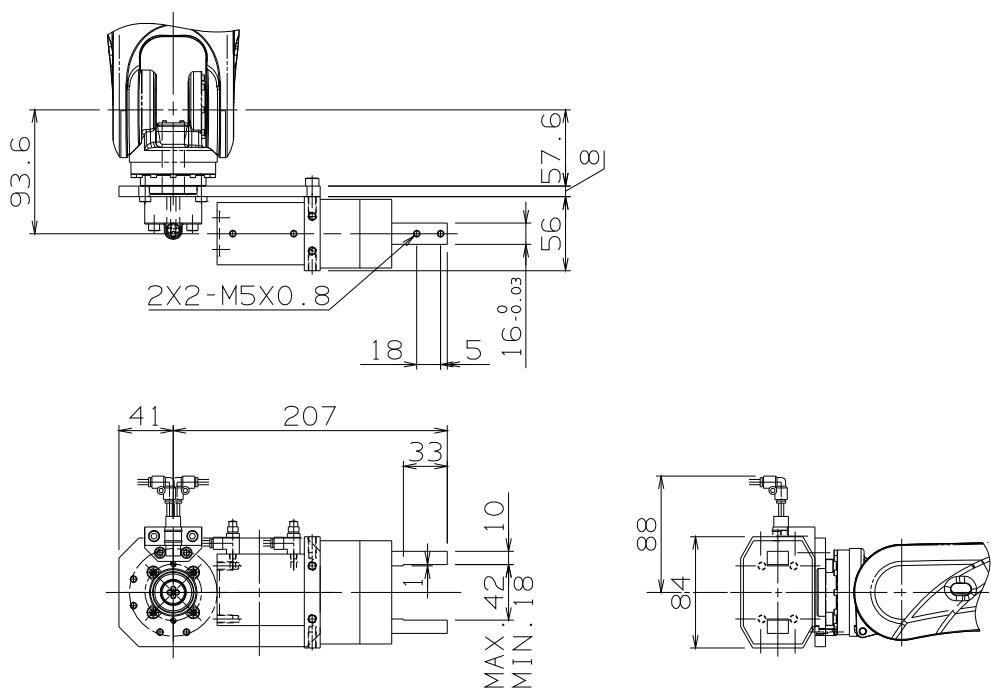


(NOTE)

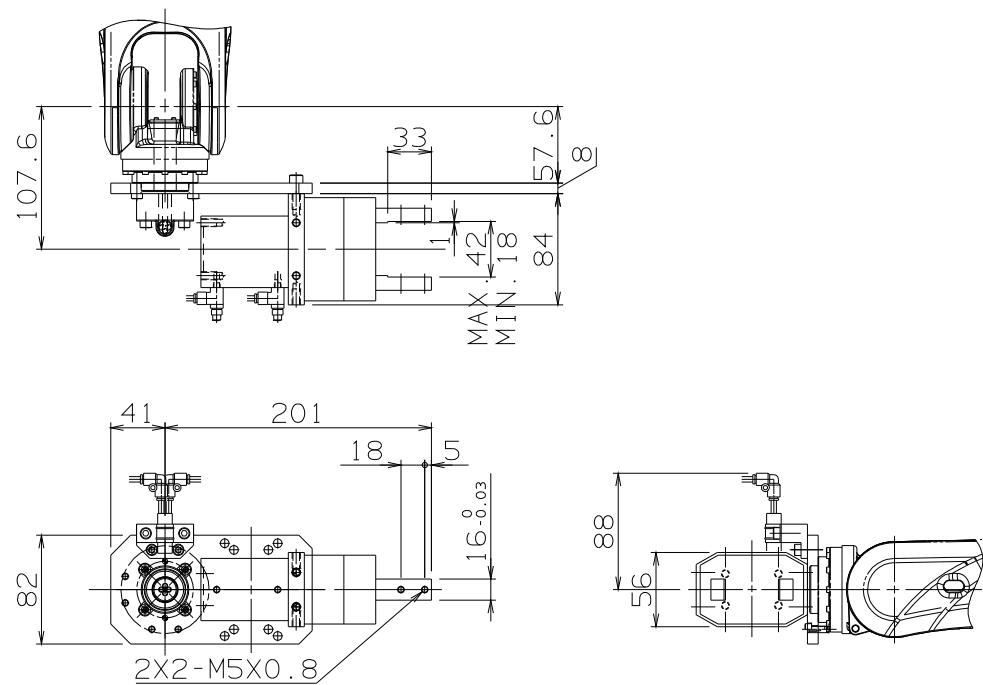
The length of the fingers "L" must be within the area shown by the lines in the graphs. (Solid lines or dotted lines)

Open direction (←)
Close direction (→)

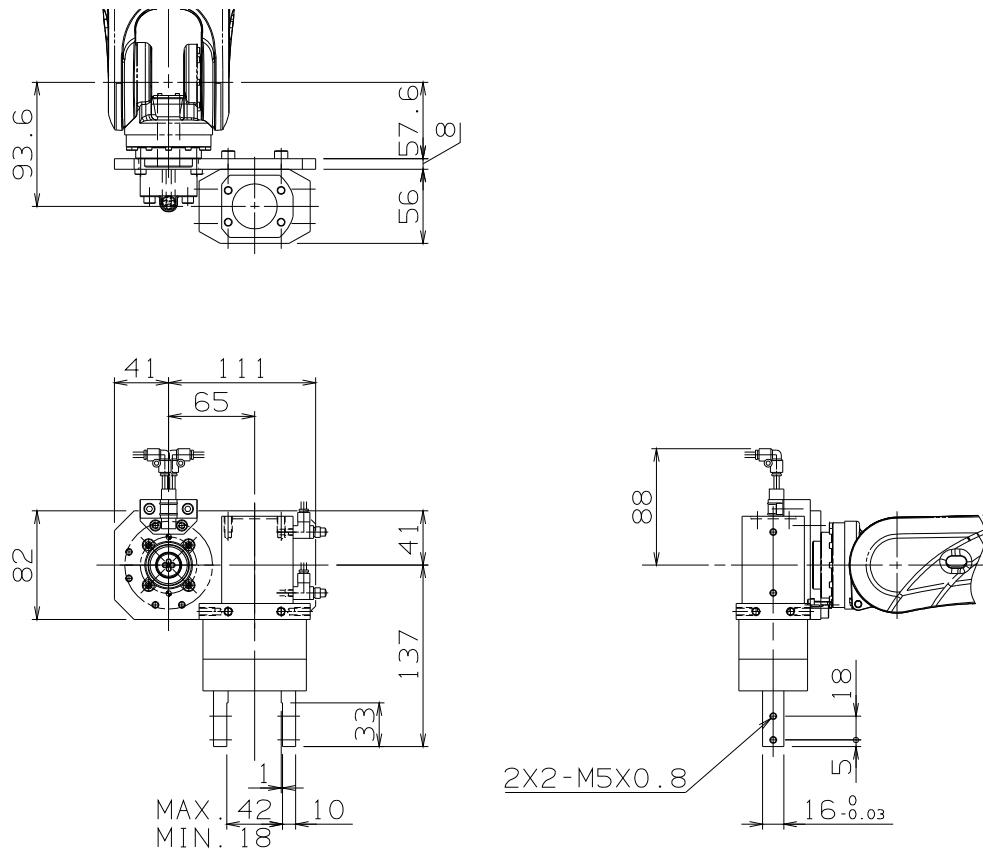
8.2.5 Parallel gripper single S (1)



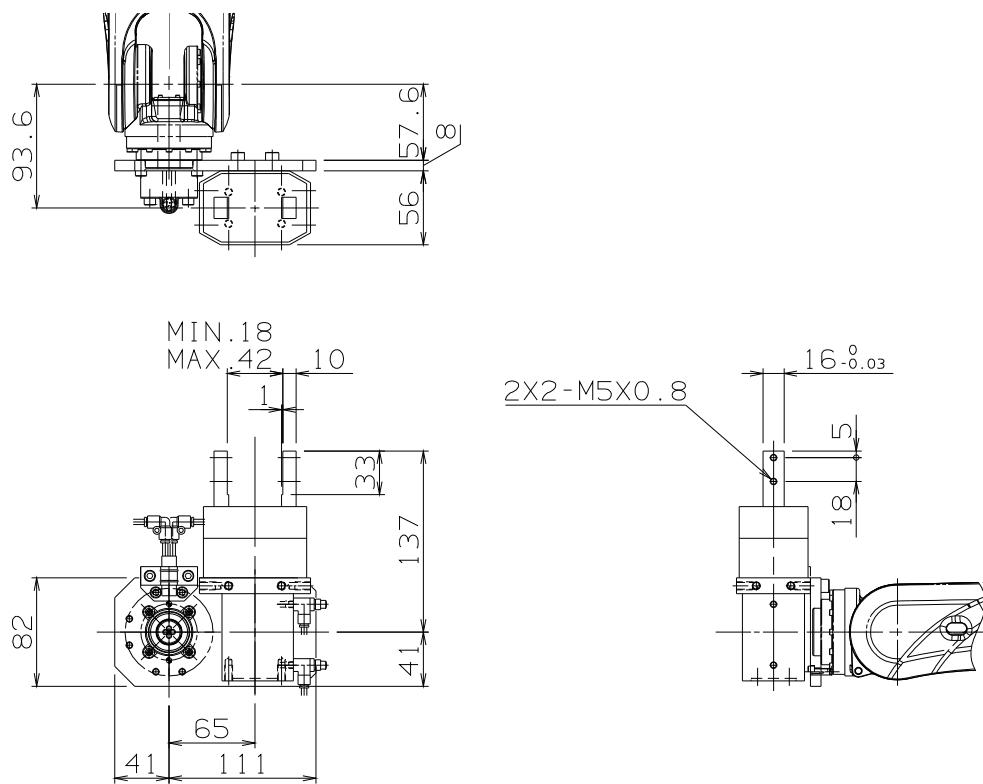
8.2.6 Parallel gripper single S (2)



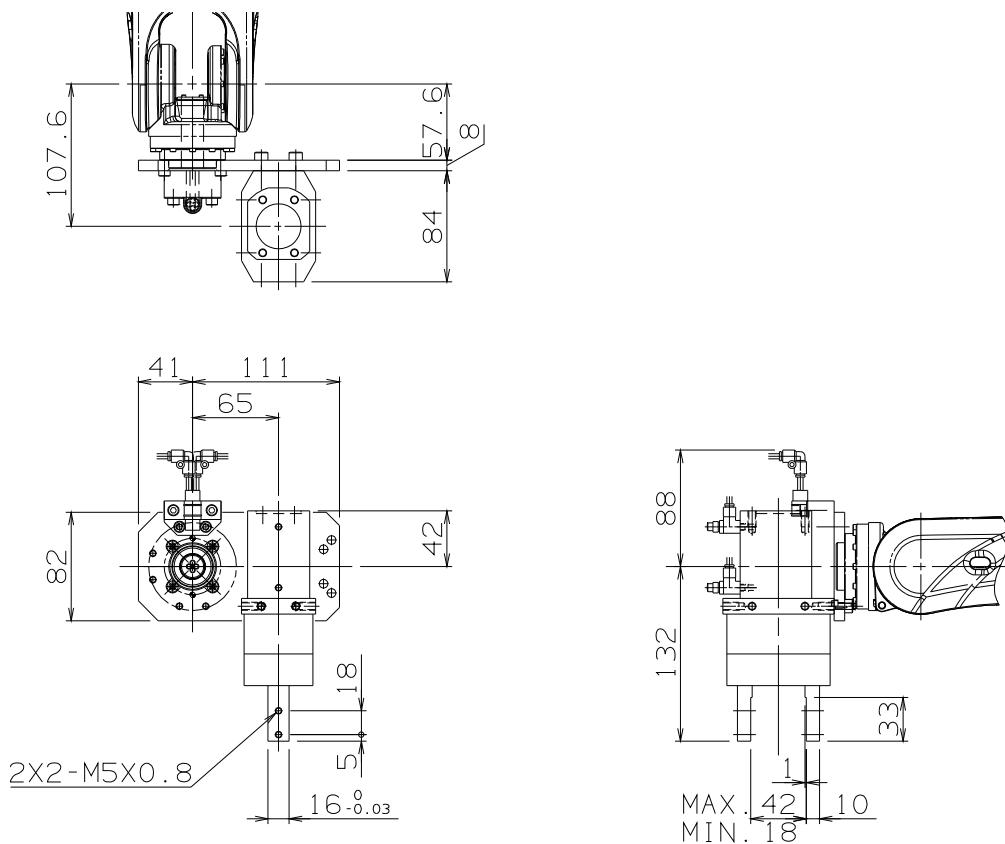
8.2.7 Parallel gripper single S (3)



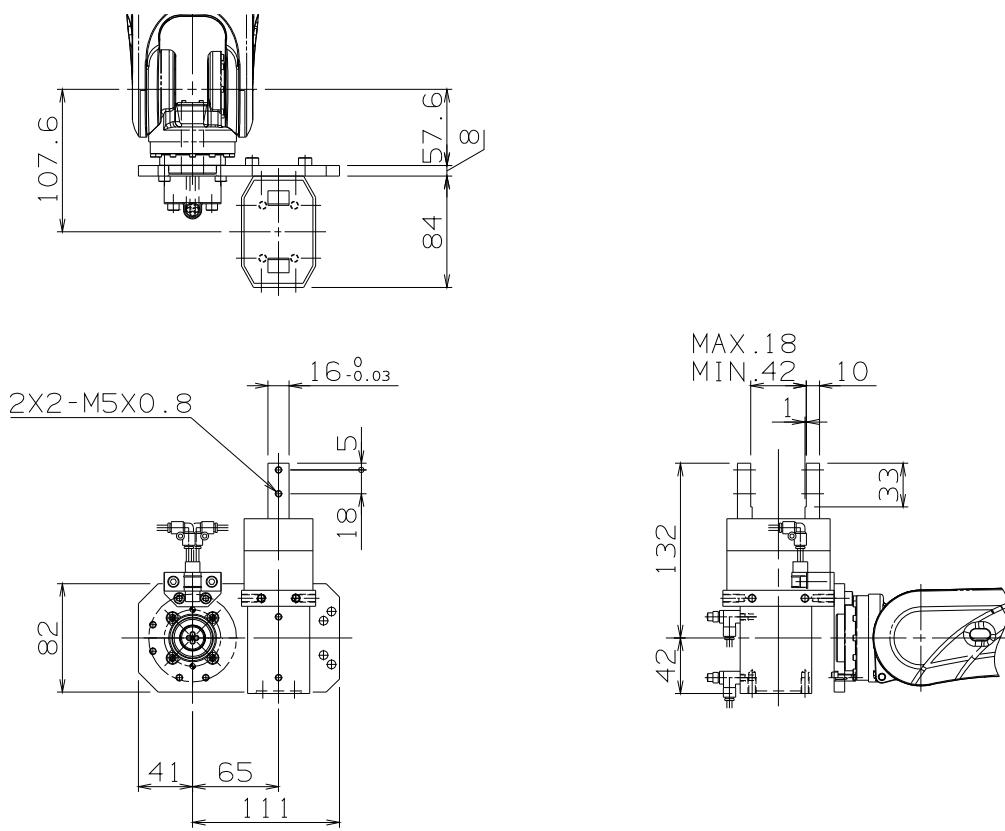
8.2.8 Parallel gripper single S (4)



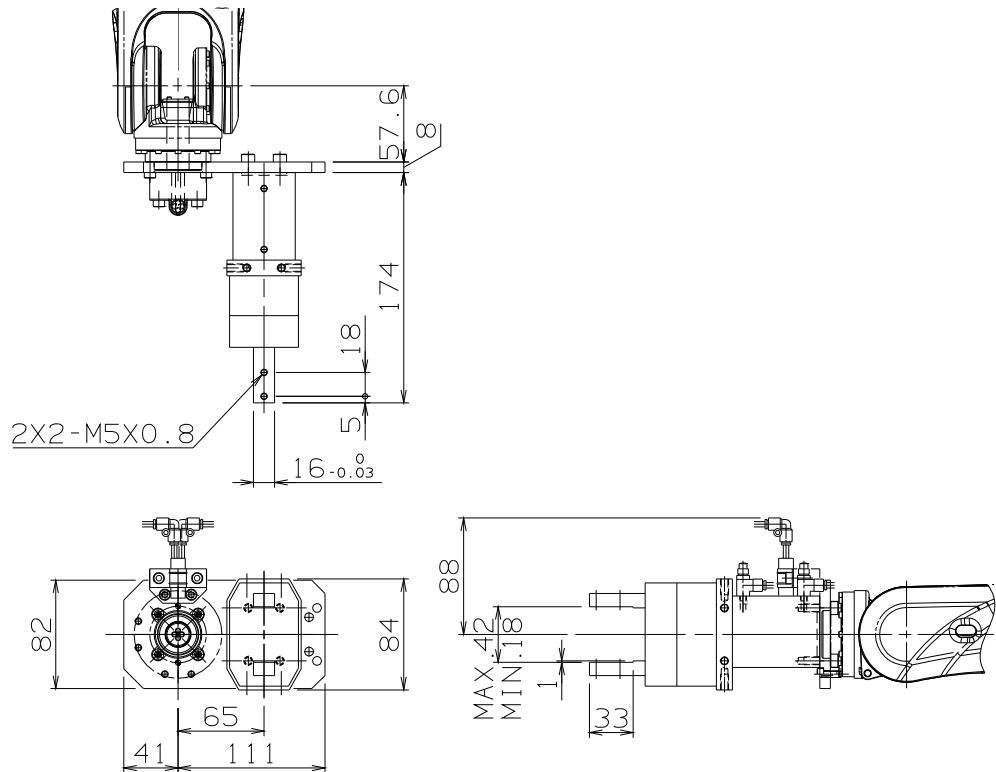
8.2.9 Parallel gripper single S (5)



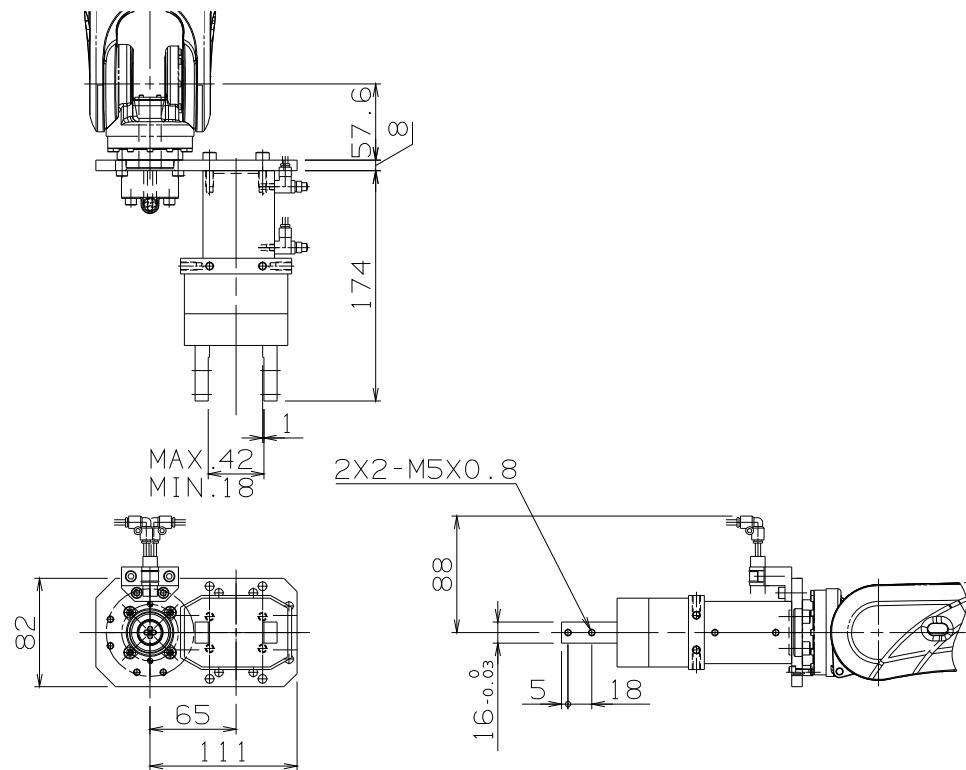
8.2.10 Parallel gripper single S (6)

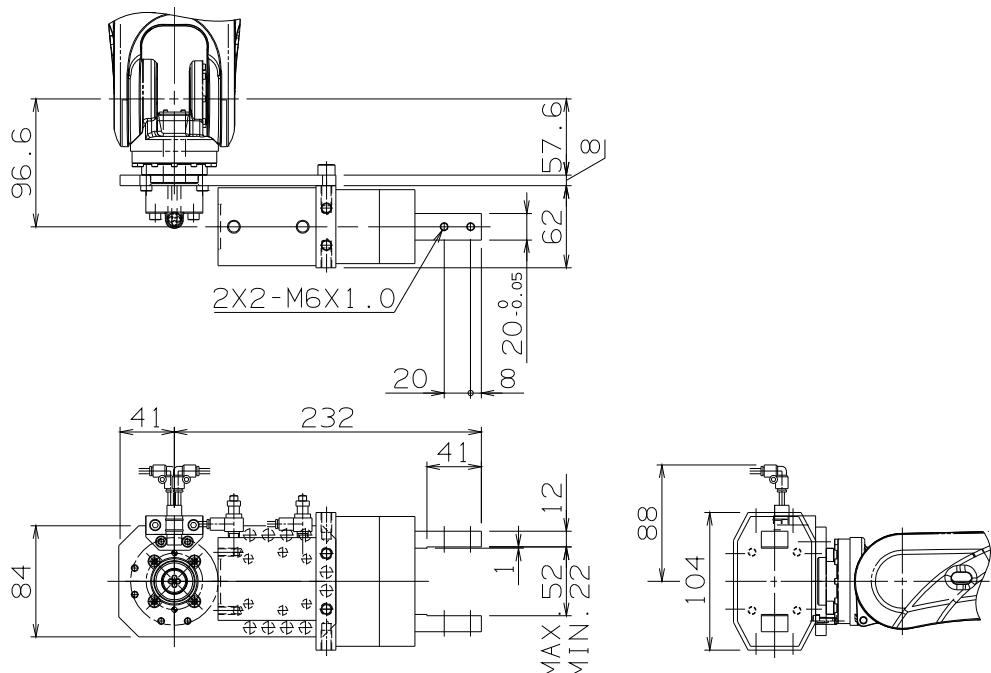
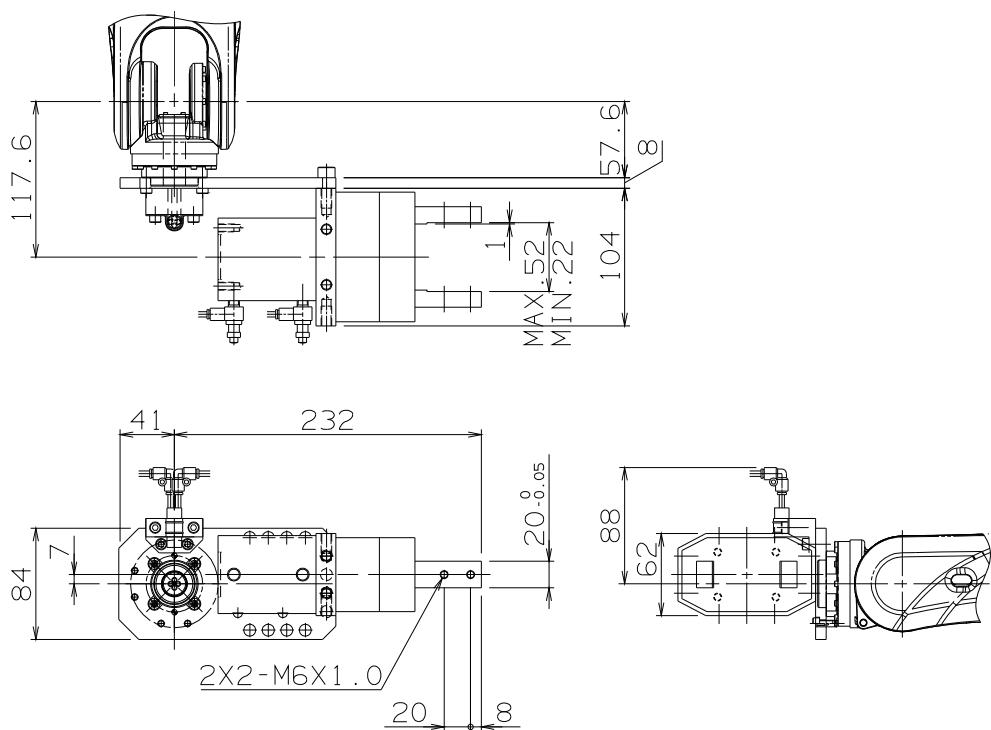


8.2.11 Parallel gripper single S (7)

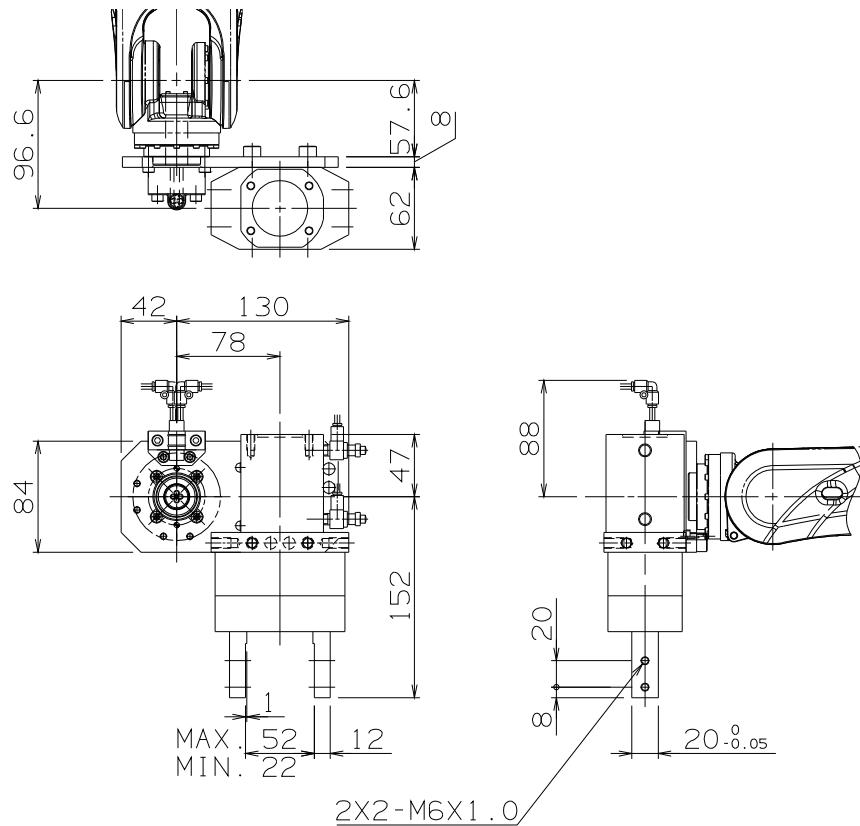


8.2.12 Parallel gripper single S (8)

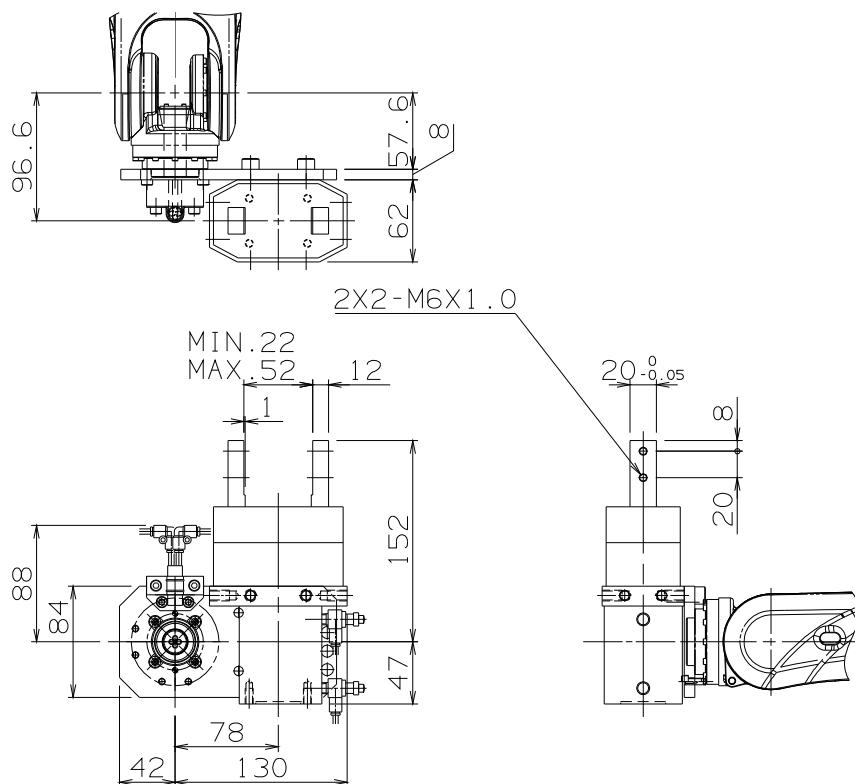


8.2.13 Parallel gripper single M (1)**8.2.14 Parallel gripper single M (2)**

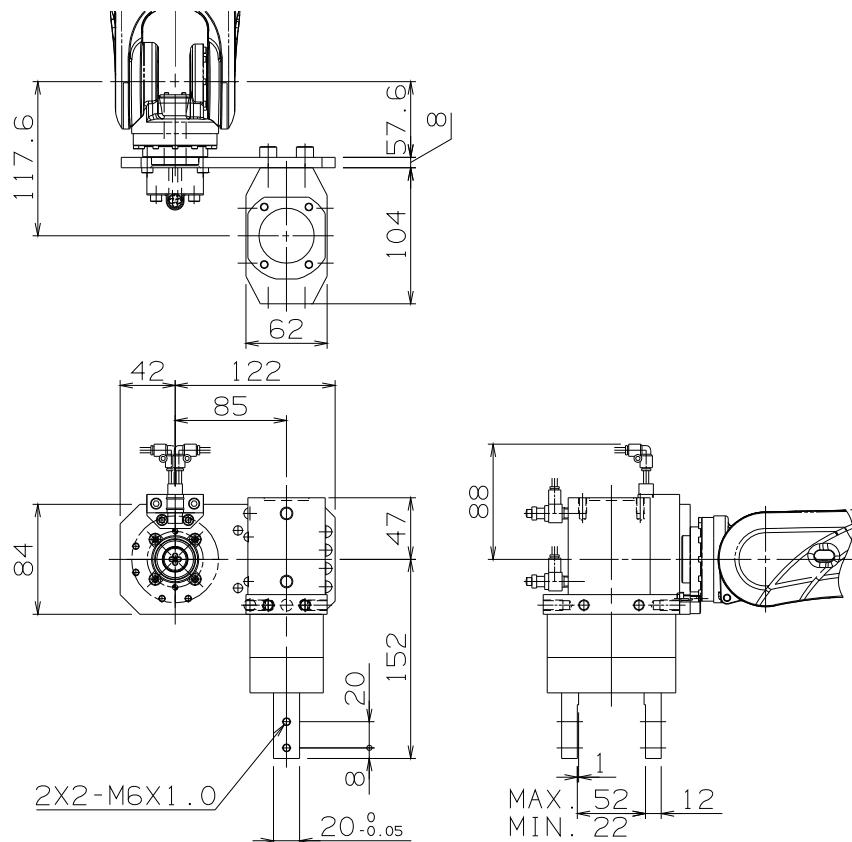
8.2.15 Parallel gripper single M (3)



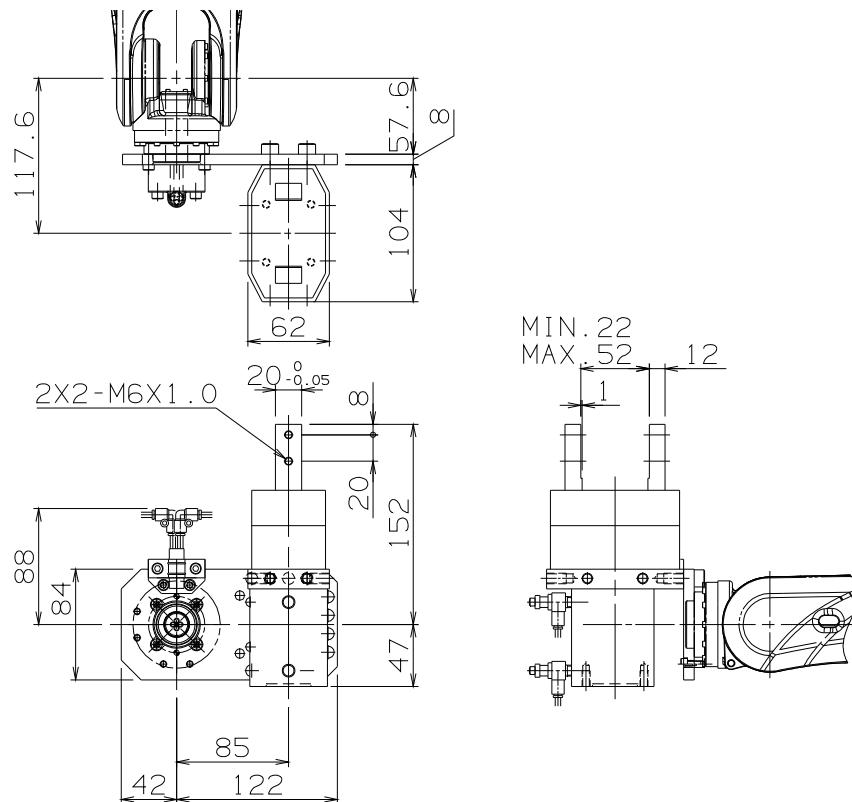
8.2.16 Parallel gripper single M (4)



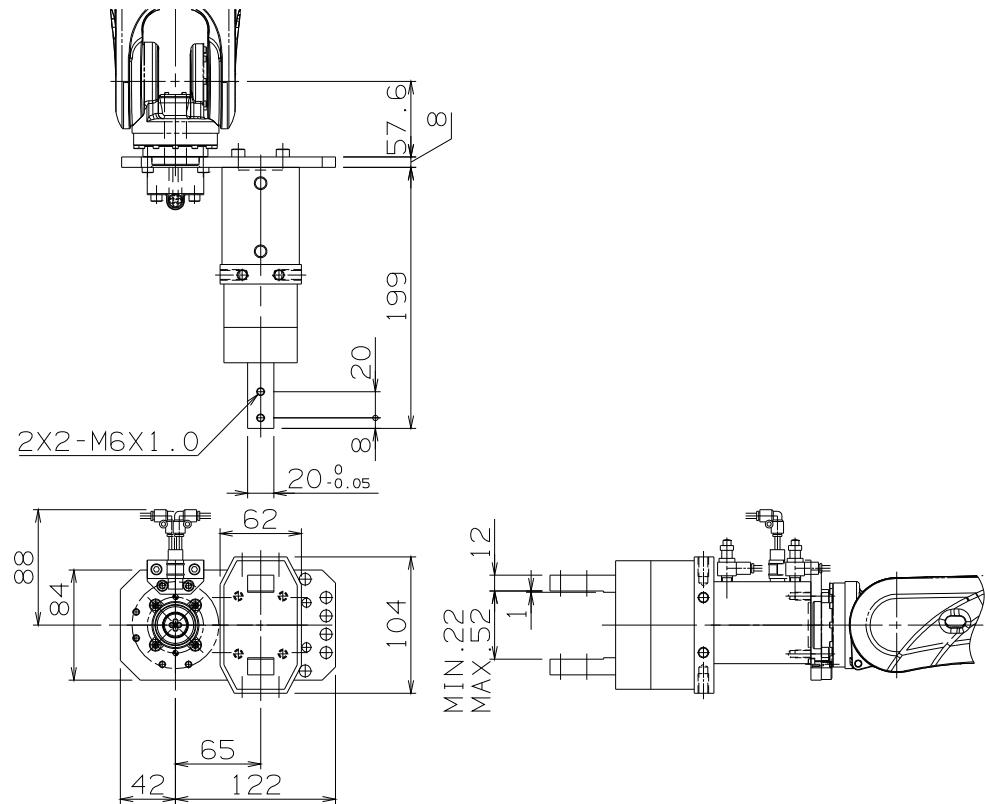
8.2.17 Parallel gripper single M (5)



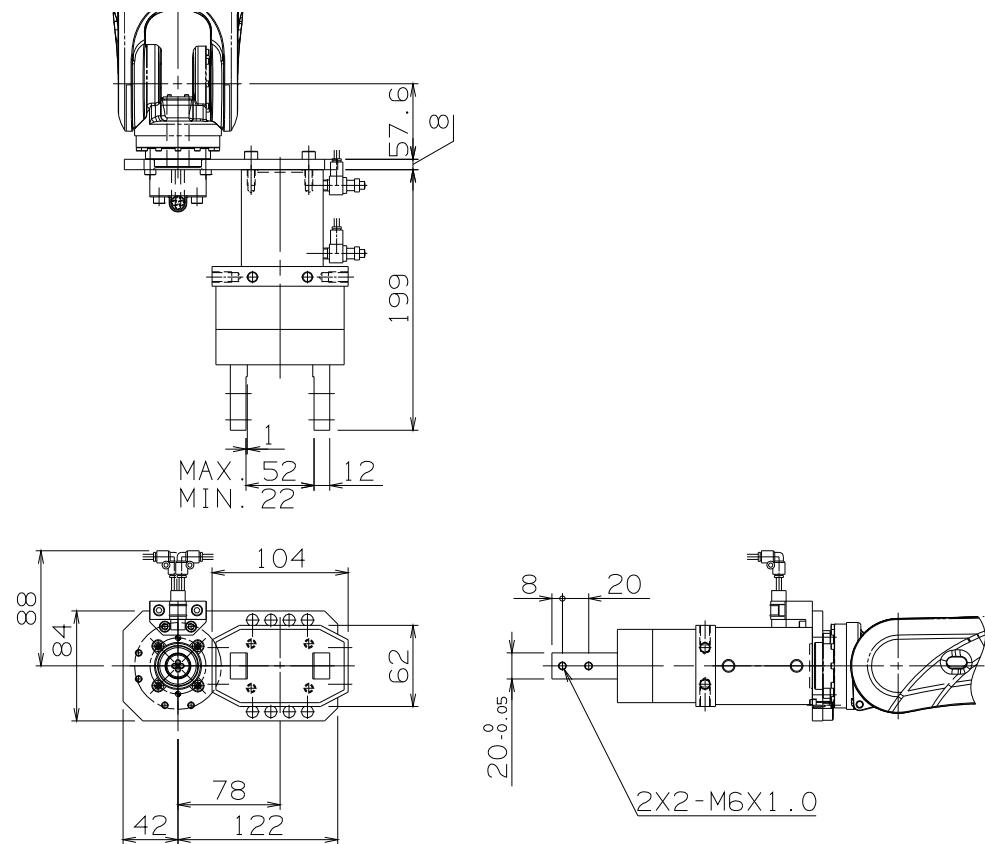
8.2.18 Parallel gripper single M (6)



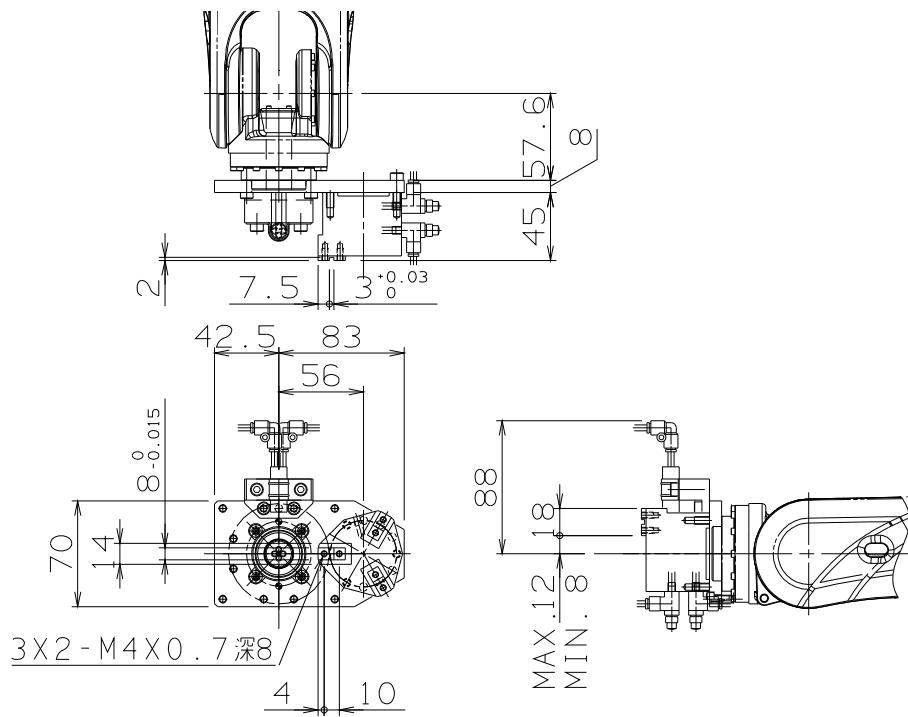
8.2.19 Parallel gripper single M (7)



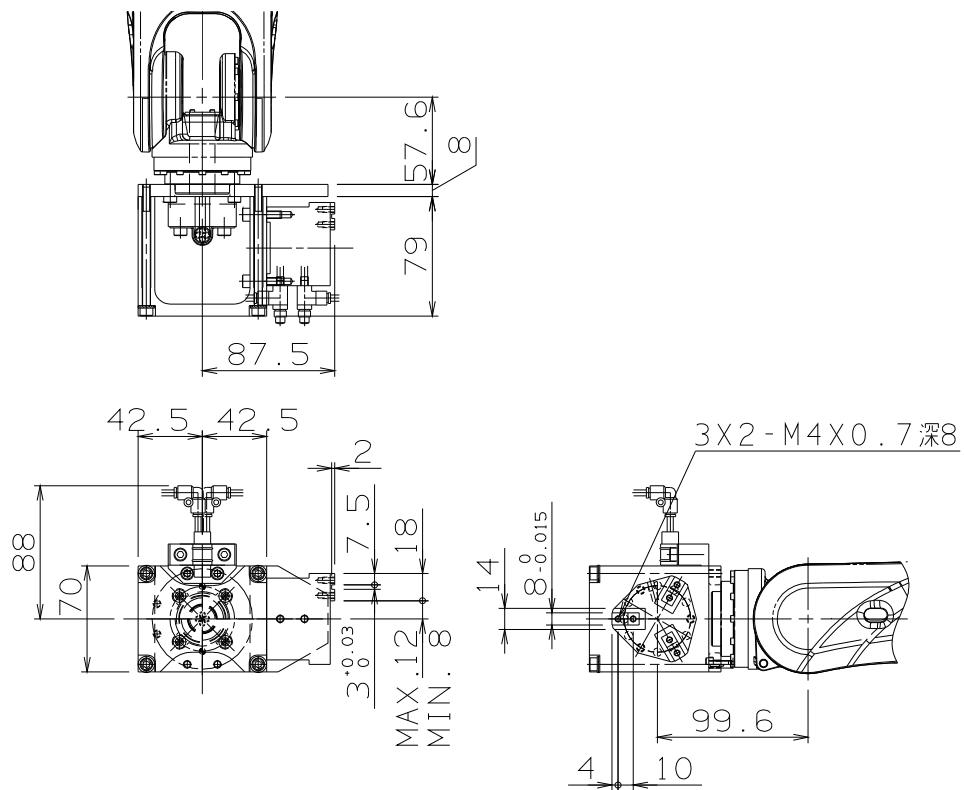
8.2.20 Parallel gripper single M (8)



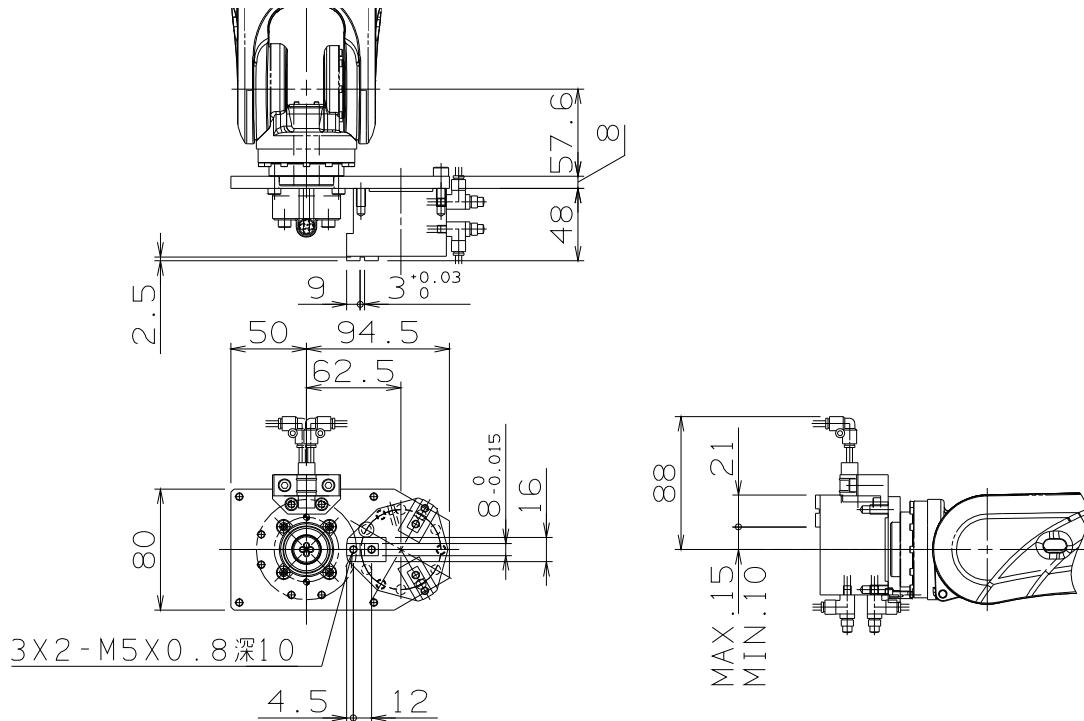
8.2.21 Three fingers chuck single S (Straight type)



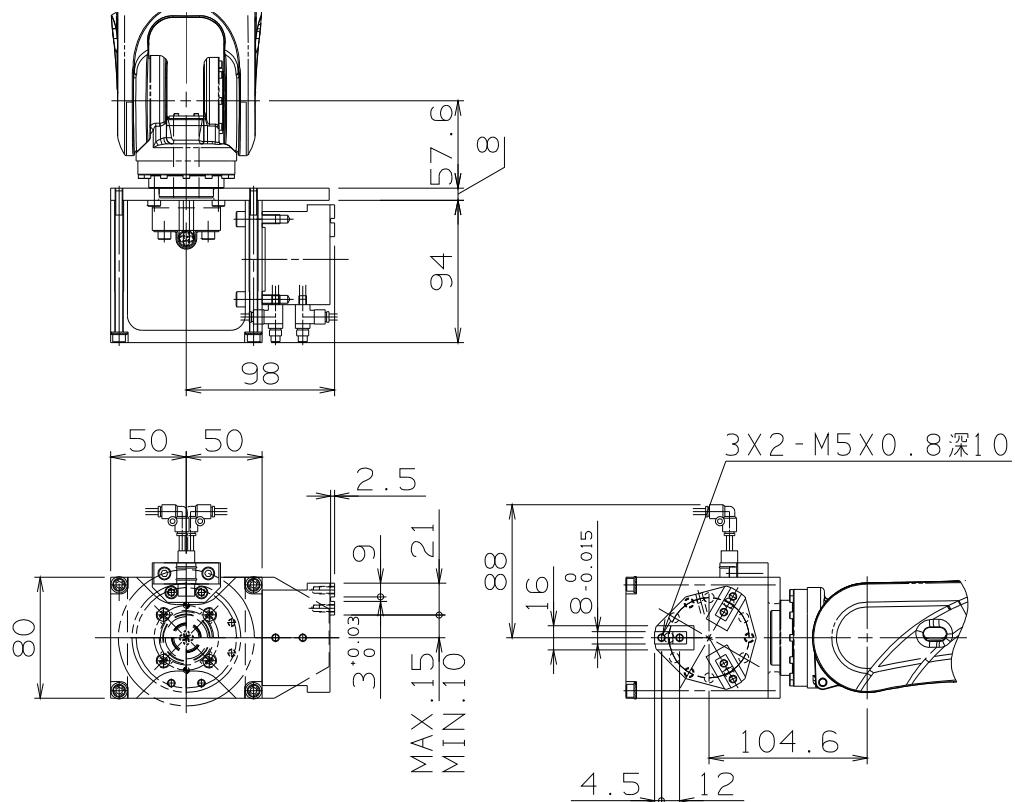
8.2.22 Three fingers chuck single S (Elbow type)



8.2.23 Three fingers chuck single M (Straight type)



8.2.24 Three fingers chuck single M (Elbow type)



NOTE

Chapter9 Brake Release Switch

This option is used to release the brake in one motor.

This is useful for the situation such as that motor power cannot be turned ON because of servo error, or operator is pinched by robot arm.

Name	Specification	Parts No.	Notes
Brake Release Switch	Forcible releasing of brake in one motor	FD11-OP90-E	

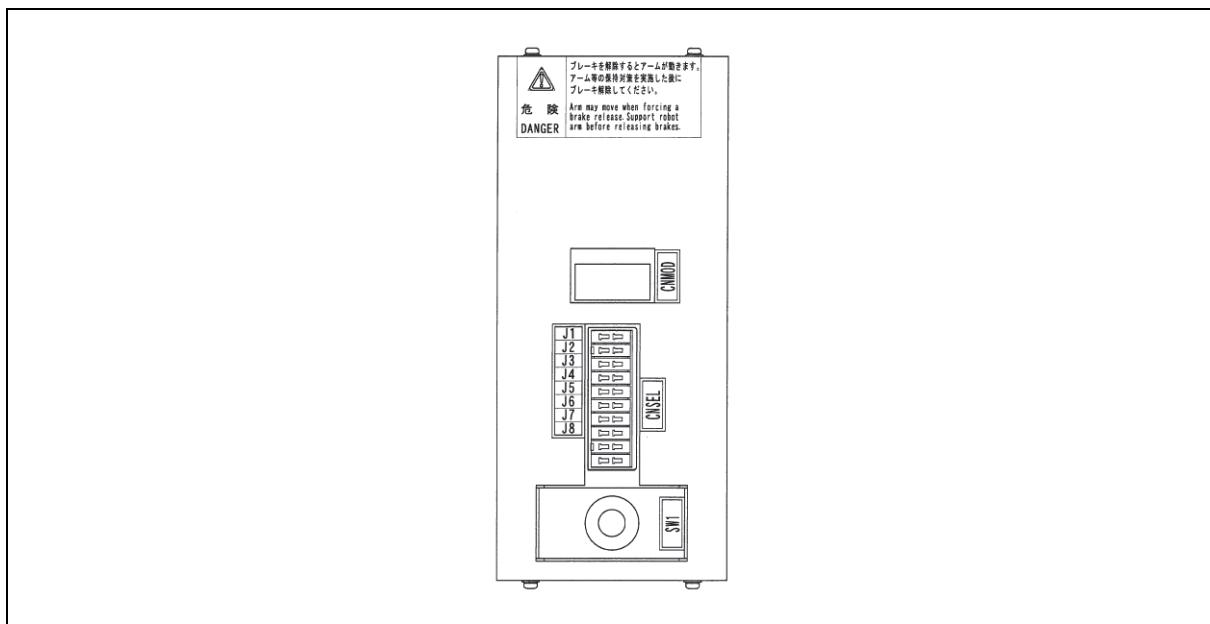
For detail, please refer to the instruction manual “MANIPULATOR”

MZ07 series / MZ03 EL

“MANIULATOR MZ07-01[CFD]”, “3.5 Forcible brake release (option)”.

MZ04 series

“MANIULATOR MZ04-01[CFD]”, “3.5 Forcible brake release (option)”.



Brake Release Switch

NOTE

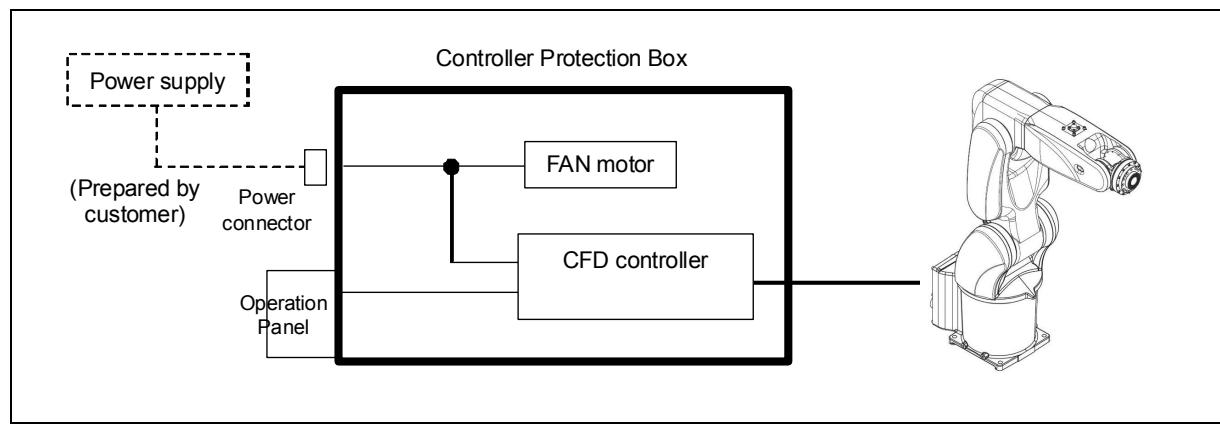
Chapter10 Controller Protection Box

This option is used for upgrading to IP54 equivalent CFD controller by preparing dust-proof and drip-proof box. This is suitable for using in harsh environments. (Ex: Machining line)
 CFD controller is installed inside this box.

Name	Specification	Parts No.	Notes
Controller Protection Box	Upgraded to IP54 equivalent by preparing dust-proof and drip-proof box	CFD-OP133-A	

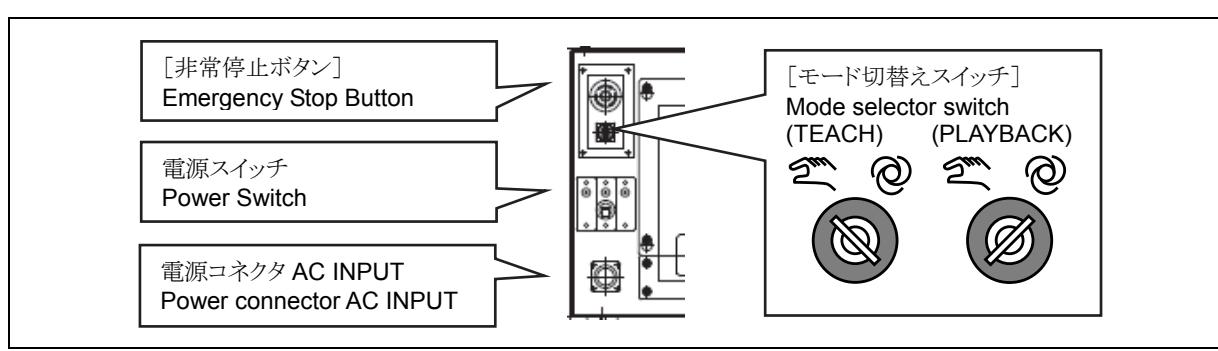
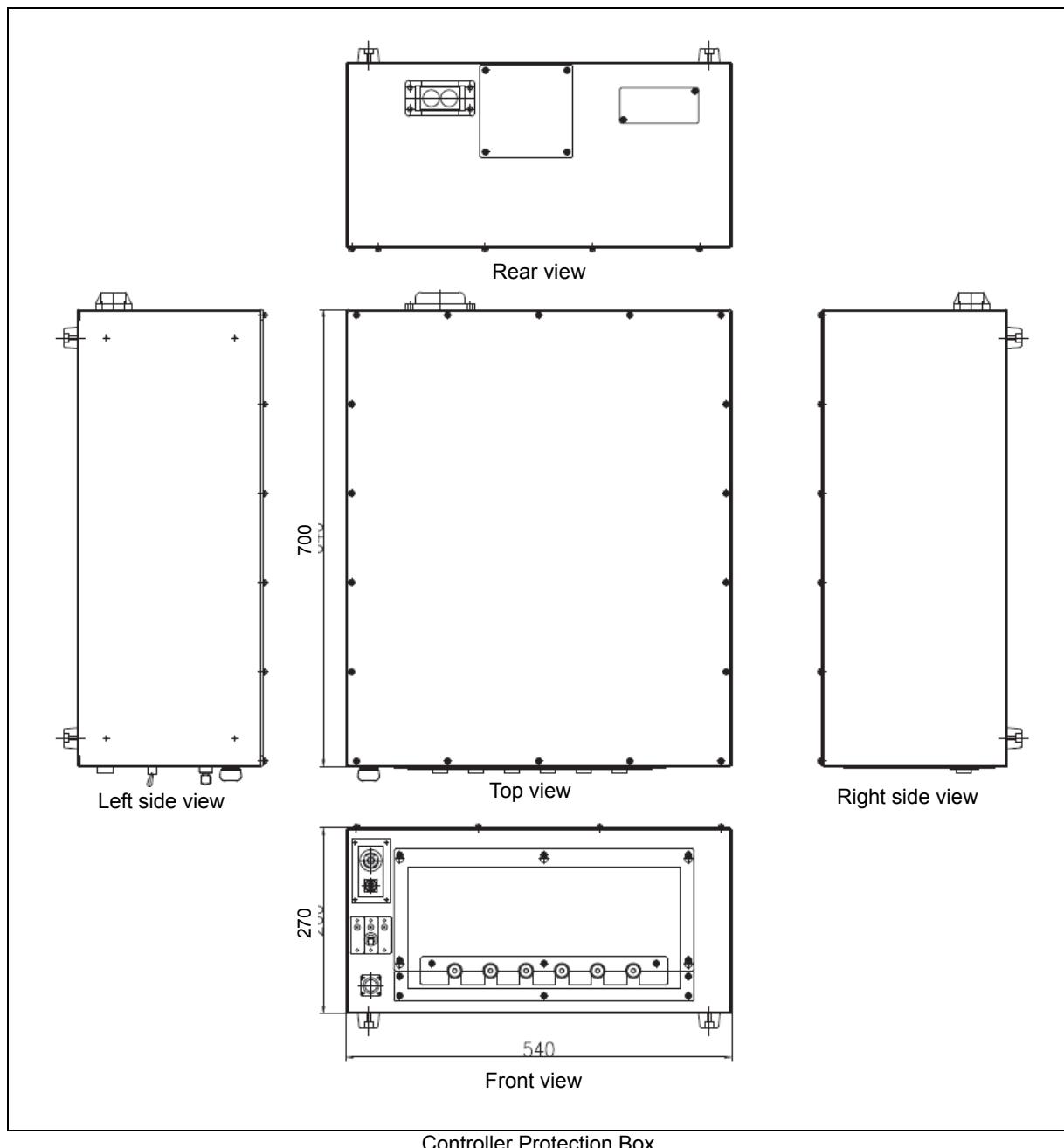
Basic Specification of Controller Protection Box

Item	Description
Size	W540 × D700 × H270
Mass	Approx. 19 Kg
Installing environment	Not needed to keep distance from the wall. Height from floor to the power switch should be between 0.6 m and 1.9 m.



Connection of Controller Protection Box

10.1 External View of Controller Protection Box

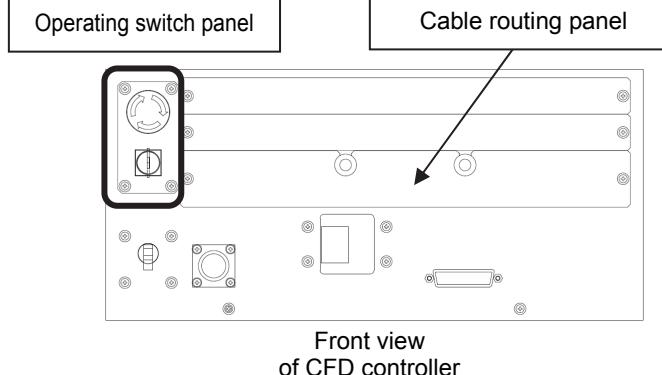
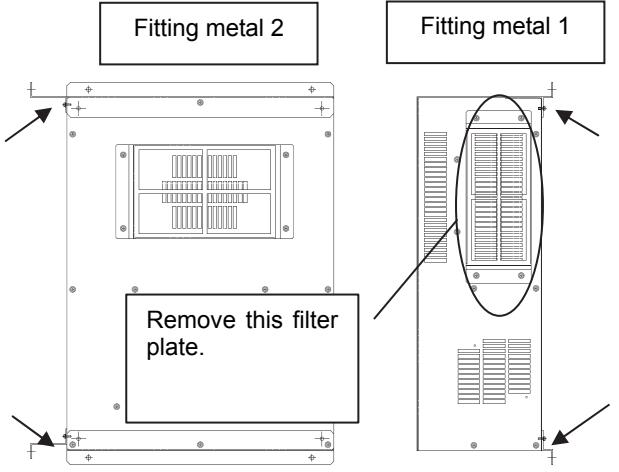


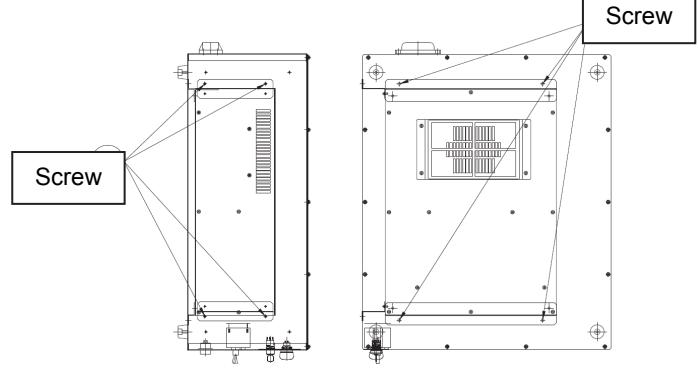
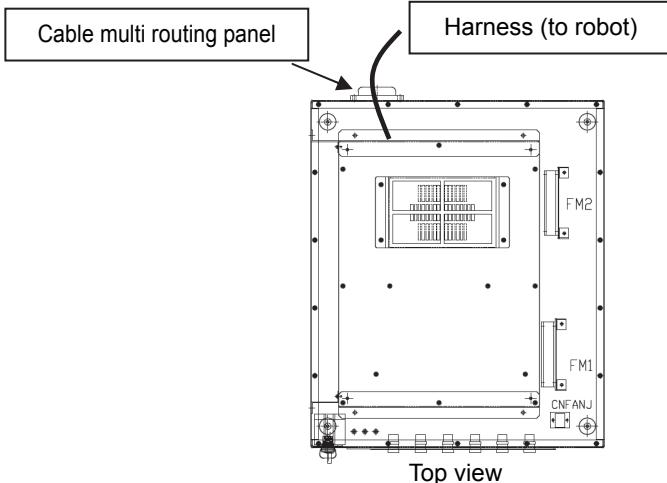
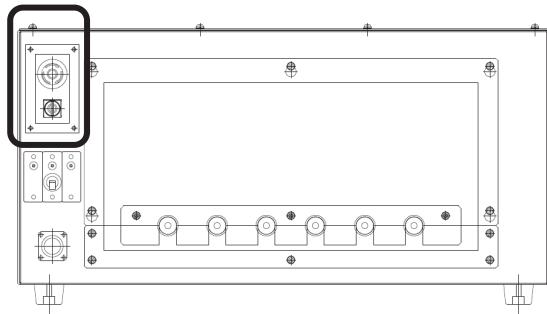
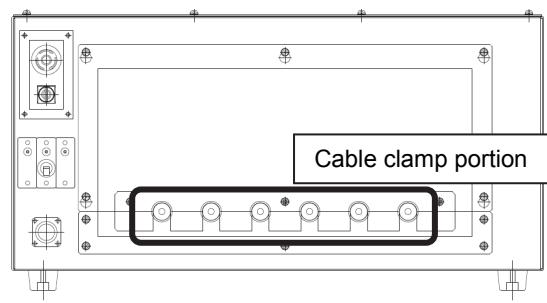
Operating panel of Controller Protection Box

10.2 Assembling Controller Protection Box

Main contained parts			
No.	Name	Type (Parts No.)	Notes
1	Controller Protection Box	KDTZ-07	
2	Rubber bush	KDT-10 KDT-13	
3	Fitting metal 1		To fix bottom of controller
4	Fitting metal 2		To fix left side of controller
5	Operating switch relay panel		
6	Operating switch extending cable		
7	Plug	NJW-204-PF12	
8	Cable tie	SG-100	
9	Screw	M3×8mm	
10	Screw	M4×8mm	

Assemble controller protection box by following to the procedure written below.

Step	Work performed
1	<p>Remove “Operating switch panel” of CFD controller.</p> <p>Remove “Cable routing panel” and disconnect cables which are connected to “Operating switch panel”.</p>  <p>Front view of CFD controller</p>
2	<p>Connect “Operating switch extending cable” and “Operating switch relay panel” instead of “Operating switch panel”.</p>
3	<p>Attach “Fitting metal 1” and “Fitting metal 2” to CFD controller with screws (M3×8mm). (If rubber stand is fixed on controller, please remove it)</p> 

4	<p>Fix CFD controller to "Controller protection box" with screws (M4×8mm).</p> 
5	<p>Fix "Harness" with "Cable multi routing panel".</p> 
6	<p>Attach "Operating switch panel", which is removed in step 1, to "Controller protection box".</p> <p>Connect cables for operation switches to "Operating switch extending cable" which is connected in step 2.</p> 
7	<p>Fix I/O cables on "Cable clamp portion" with rubber bush.</p> 

10.3 Connection of Primary Power

■ Primary power supply

Power to CFD controller is supplied from Controller Protection Box.

Customer is responsible for providing the primary power supply to Controller Protection Box.

Power connector is shipped with Controller Protection Box.

Rating of primary power		
Manipulator used in combination	Rated voltage	Power-handling capacity ^(Note)
MZ series	3-phase AC200V-230V Single-phase AC200V-230V (+10%, -10%) 50/60 Hz	0.4 kVA

(Note) Varies according to the application and operation pattern.

Connector pin layout Seeing from the soldering side		
PIN No.	Connection	
	3 - phase AC200V	Single - phase AC200V
1	AC200V R-phase (Red)	AC200V R-phase (Red)
2	AC200V S-phase (White)	-
3	AC200V T-phase (Black)	AC200V T-phase (Black)
4	Ground (Green/Yellow)	Ground (Green/Yellow)

Applicable cable diameter:
10~12.5 [mm]
Connector type
Nanaboshi Electric Mfg.Co.,Ltd.
NJW-204-PF12

Primary power supply cable connection

Primary power supply cable specification

Manipulator used in combination	Cross-section of power cable	Cross-section of grounding cable
MZ series	1.25mm ² AWG16	1.25mm ² AWG16

■ Grounding

To ensure safety, use the grounding method (type D ground)
(Customer is responsible for providing the grounding wires.)

- Ensure that the robot controller power cable is larger than 1.25 mm², and ground cable is larger than 1.25 mm².
- Set the ground resistance to less than 100 ohms.

■ Leakage breaker

Please use a leakage breaker that satisfies the following specification.

Rated current: 10A or more / For inverter / Middle sensitivity type (100mA or more)

NOTE

Chapter11 Teach Pendant Additional Cable

This option is used to extend the cable between teach pendant and controller.
Both sides have connector. This is added on the standard cable.
Only one additional cable can be used.

Name	Specification	Parts No.	Notes
Teach Pendant Additional Cable	5m	CFDTP-RC05M	
	10m	CFDTP-RC10M	

Please refer to the picture written on the back sheet of cover.

NOTE

Chapter12 MZ series Additional Harness

This option is used to extend the harness between robot and controller.
Both sides have connector. This is added on the standard harness.
Only one additional harness can be used. Total length must not be longer than 25m.

Name	Specification	Parts No.	Notes
Motor / Encoder Additional Harness	5m	Z102C-00-05-A	
	10m	Z102C-00-10-A	
	15m	Z102C-00-15-A	
Motor / Encoder Additional Harness (Flexible type)	5m	Z102C-01-05-A	
	10m	Z102C-01-10-A	
	15m	Z102C-01-15-A	

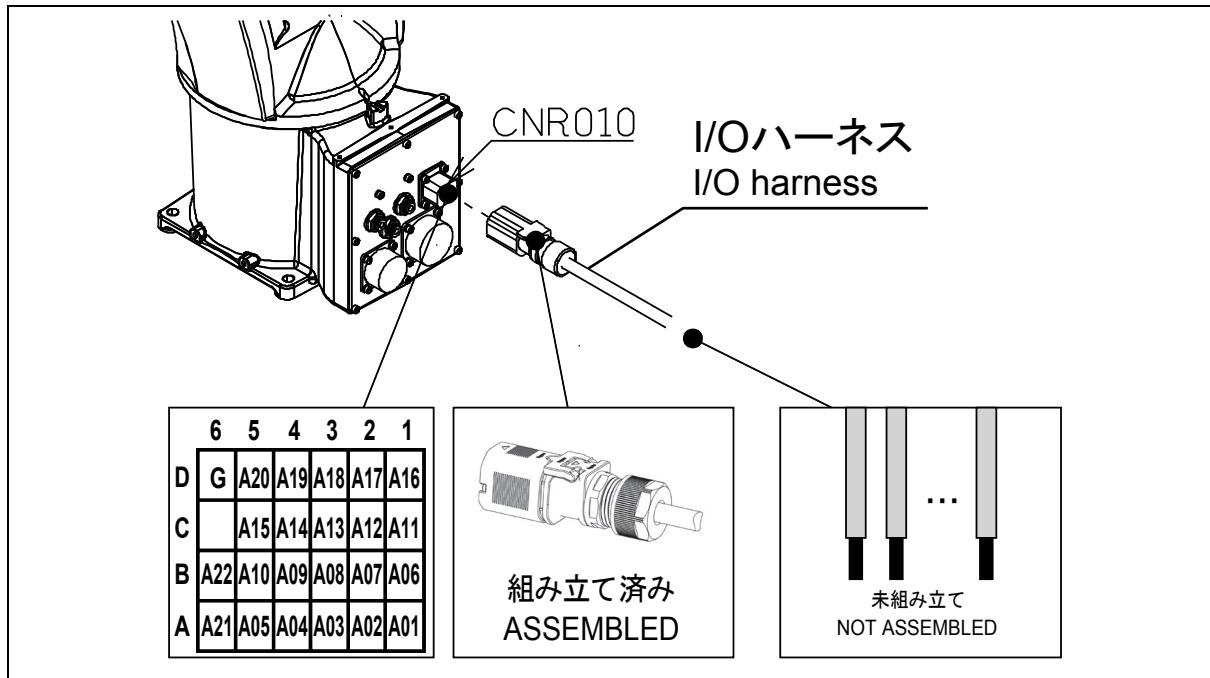
Please refer to the picture written on the back sheet of cover.

NOTE

Chapter13 MZ series I/O Harness

This option is used to connect signals (for control of gripper and or so) to robot from peripheral equipment. Robot side has connector. Select length among following list when purchasing.
This option does not include cables inside robot arm.

Name	Specification	Parts No.	Notes
I/O Harness	MZ series I/O Harness (CNR10 side is pre-assembled)	IOCABLE-10-02M IOCABLE-10-05M IOCABLE-10-10M IOCABLE-10-15M IOCABLE-10-20M IOCABLE-10-25M	02M : 2.5m 05M : 5.5m 10M : 10.5m 15M : 15.5m 20M : 20.5m 25M : 25.5m



I/O Harness

Robot side connector

Already assembled before shipment.

Revision of the I/O harness

There are 2 versions for the I/O harness (A01 and A02). The number of the included wires are different each other.

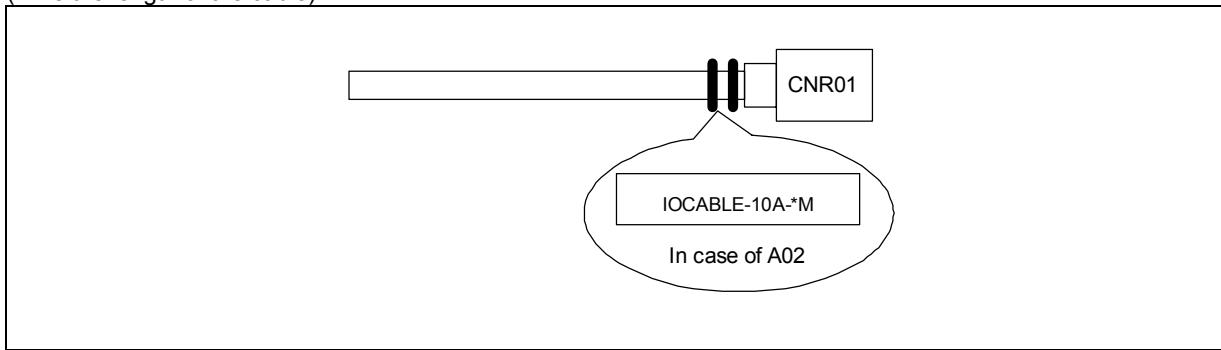
To use the force sensor function or the vision sensor function, Revision A02 is required.

The revision A02 has upper compatibility against the A01.

For the A01, a mark tube of "IOCABLE-10-*M" is attached.

For the A02, a mark tube of "IOCABLE-10A-*M" is attached.

("**" is the length of the cable)



I/O harness revision A02

Controller side wiring

Not assembled. Customer needs to assemble them conforming to the system design.
There are revision A01 and revision A02.

Revision A01

No.	Signal	Color
1	A01 / A02	Black / White
2	A03 / A04	Green / White
3	A05 / A06	Yellow / White
4	A07 / A08	Brown / White
5	A09 / A10	Red / White
6	A11 / A12	Blue / Pink

No.	Signal	Color
7	A13 / A14	Gray / Pink
8	A15 / A16	Orange / Pink
9	A17 / A18	Purple / Pink
10	A19 / A20	Light blue / Pink
11	G	Shield

Revision A02

No.	Signal	Color
1	A01 / A02	Blue / White
2	A03 / A04	Yellow / White
3	A05 / A06	Green / White
4	A07 / A08	Red / White
5	A09 / A10	Purple / White
6	A11 / A12	Blue / Brown
7	A13 / A14	Yellow / Brown

No.	Signal	Color
8	A15 / A16	Green / Brown
9	A17 / A18	Red / Brown
10	A19 / A20	Purple / Brown
11	A21 / A22	Blue / Black
12	Not used	Yellow / Black
13	G	Shield

Main contained parts (Revision A01)

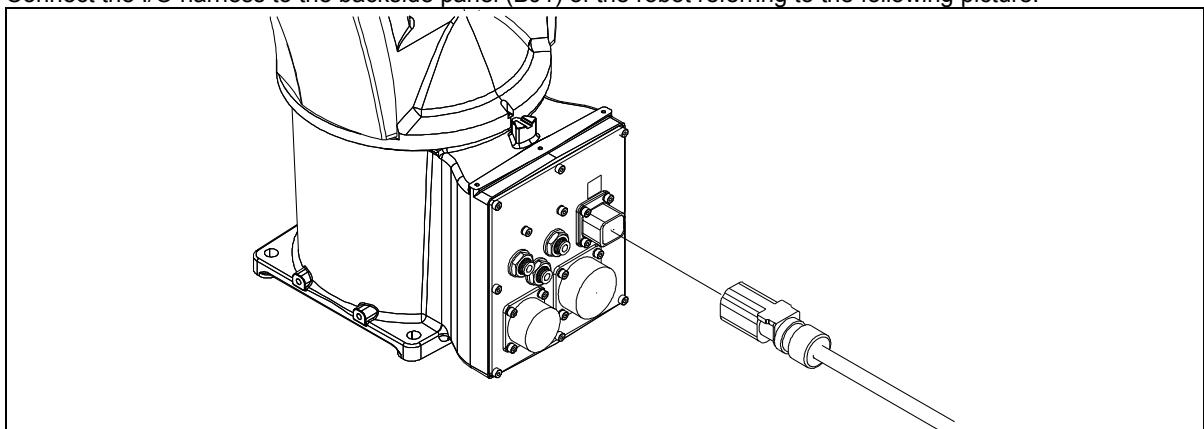
Name	Type	Manufacture	Q'ty	Notes
Plug case	1939847-1	Tyco	x 1	
Housing	1939850-1	Tyco	x 1	
Contact	1827570-2	Tyco	x 21	#28～#22 φ1.08～1.6
Cable ground	E20M1220	Sankei	x 1	
Jack case	1939840-1	Tyco	x 1	Mounted on robot rear panel BJ1
Cable	RMCV-SB-A(2464)0.3X10P	DAIDEN	x 1	AWG#23 φ1.29 Outer diameter φ10.5

Main contained parts (Revision A02)

Name	Type	Manufacture	Q'ty	Notes
Plug case	1939847-1	Tyco	x 1	
Housing	1939850-1	Tyco	x 1	
Contact	1827570-2	Tyco	x 23	#28～#22 φ1.08～1.6
Cable ground	E20M1420	Sankei	x 1	
Cable	RMCV-SB-A(2464)0.3X12P	DAIDEN	x 1	AWG#23 φ1.29 Outer diameter φ13

How to connect the I/O harness

Connect the I/O harness to the backside panel (BJ1) of the robot referring to the following picture.



(Supplement)

When using the CFD controller option part "Mini I/O board", the following cable can be used for it.
Because both sides of this cable are pre-assembled, it is easy to use.

IOCABLE-40-**M
(** : L = 02, 05, 10, 15, 20, 25 (cable length))

For details, see the following instruction manual.

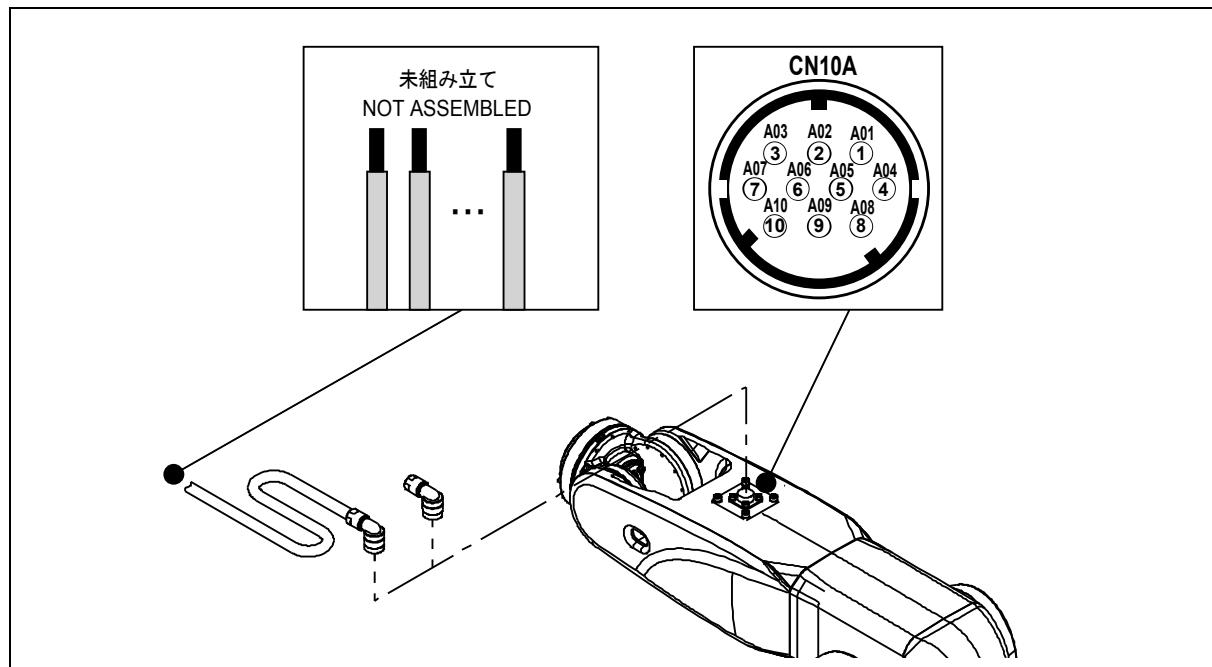
"CFD CONTROLLER TECHNICAL DOCUMENT 2" (TCFEN-156)
Chapter 2 "2.4 I/O cable for the mini I/O board (option)"

NOTE

Chapter14 MZ series I/O Cable on Arm

This option is cables and connector on robot arm, used to connect signals to gripper mounted on robot wrist.
It is convenient to utilize this option with I/O harness (another option).
This option can be used for the all MZ series robots.

Name	Specification	Parts No.	Notes
I/O cable on arm	MZ series I/O cable (robot side is pre-assembled)	IOCABLE-20-01M	Connector + Cable 1.5m Tool side cable is not assembled
I/O connector on arm	MZ series I/O connector	IOCABLE-20-00	Only connector (soldering type)



I/O cable and connector on robot arm

I/O cable on robot arm

Robot side connector

Already assembled before shipment.

Tool side

Not assembled. Customer needs to assemble them conforming to the system design.

No.	Signal	Color	Remarks
1	A01 / A02	Yellow / White	Analogue signals must be connected to A01 - A06 (See p14-3)
2	A03 / A04	Red / Blue	
3	A05 / A06	Green / Orange	
4	A07 / A08	Gray / Black	
5	A09 / A10	Light Blue / Brown	

Main contained parts

Name	Type	Manufacture	Notes
Plug	JN1FS10SL2	JAE	
Socket contact	JN1-22-22S-PKG100	JAE	
Cable	RMFES-SB-A(2464) #25X5P	DAIDEN	AWG#25 φ0.98 Outer diameter φ7.5

I/O connector on robot arm

Only connector can be ordered. In such case, customer needs to assemble it.

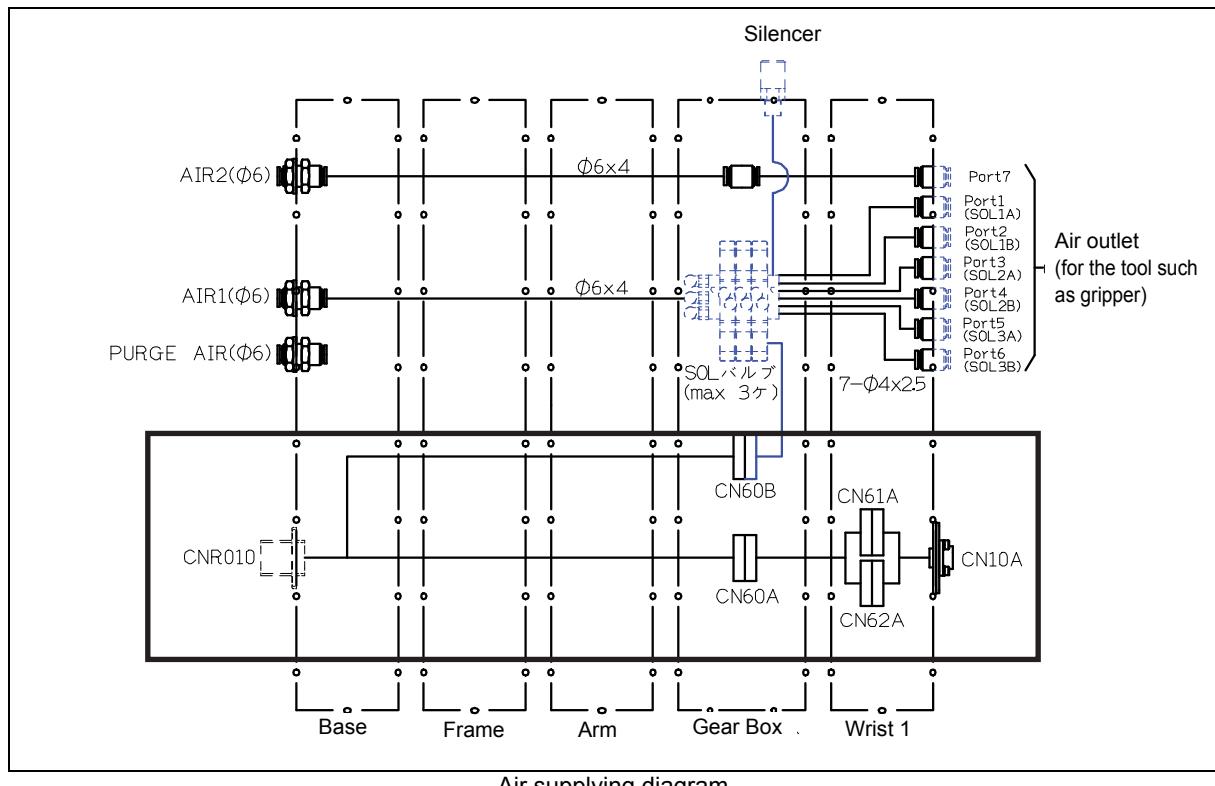
Main contained parts			
Name	Type	Manufacture	Notes
Plug	JN1FS10SL2	JAE	
Socket contact	JN1-22-22F-PKG10	JAE	Smaller than #20 ~φ1.5 soldering type

(Supplements) MZ07 series / MZ03EL

Lines A01 to A10 are connected to CN10A via CN60A, CN61A and CN62A connectors.

Lines A11 to A22 are connected to CN60A inside gear box.

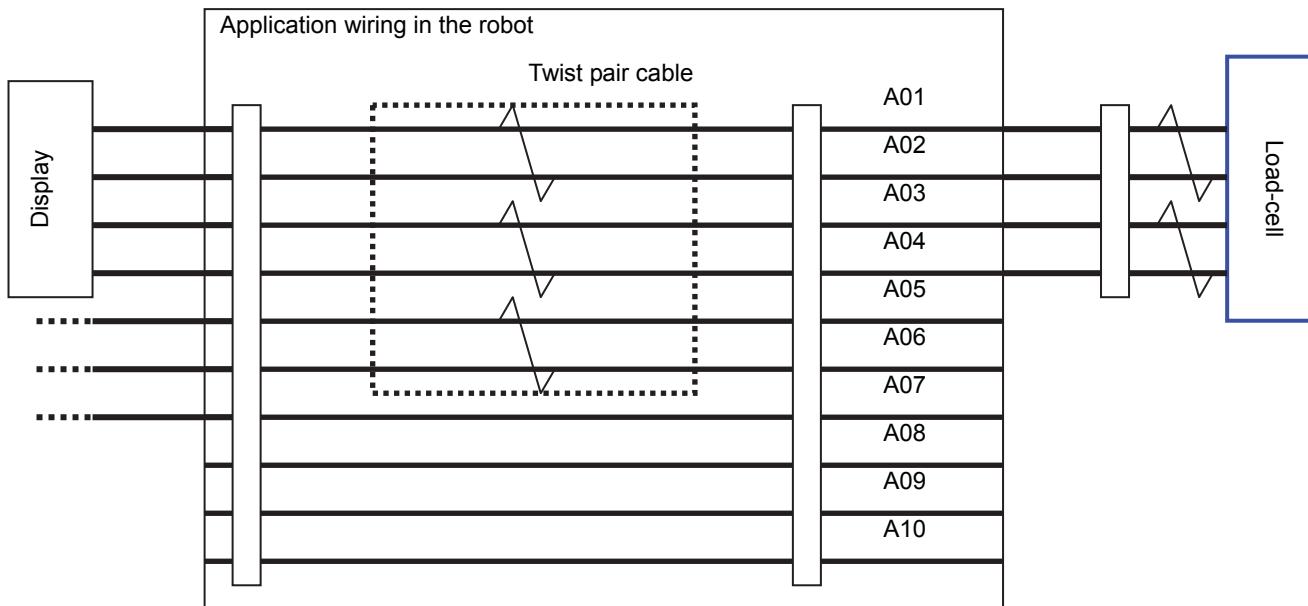
(These wires may be used for controlling solenoid valves.)



Air supplying diagram

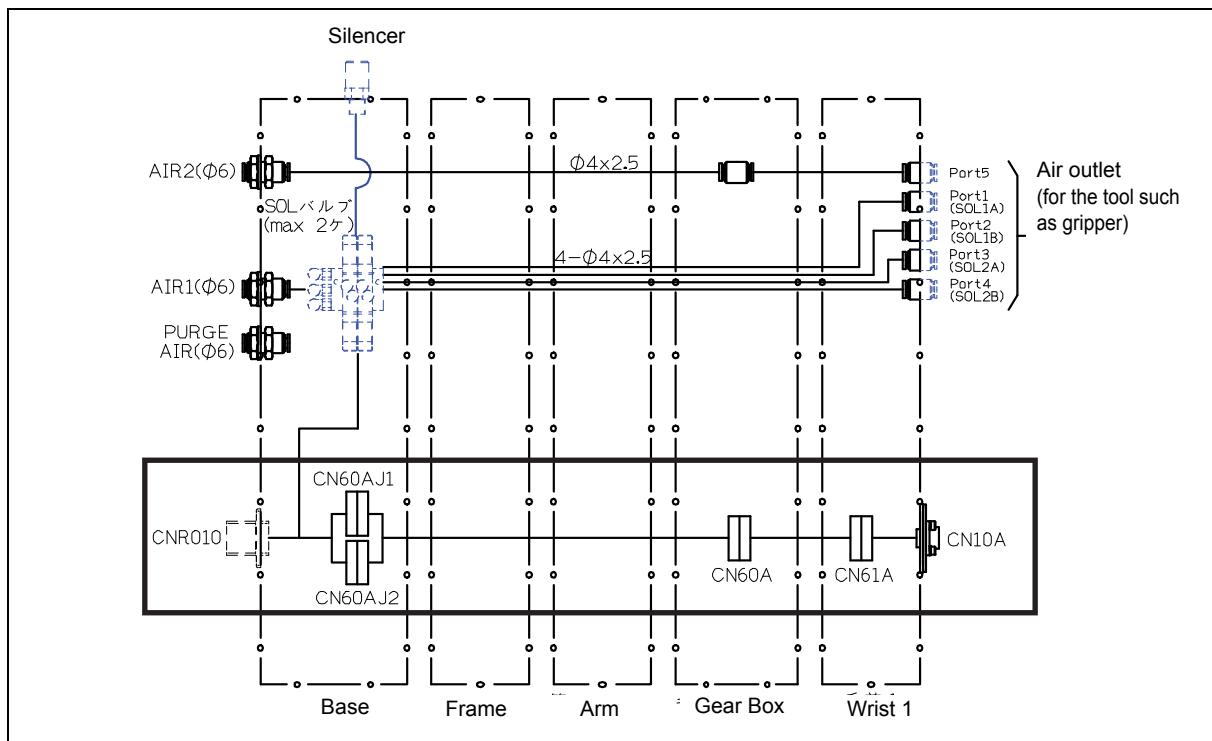
A connection example for analog signals : Load-cell connection

In case of a device that uses analog signal (e.g. a load-cell etc.), please connect it to A01 - A06 that use twist pair cable.



(Supplements) MZ04 series

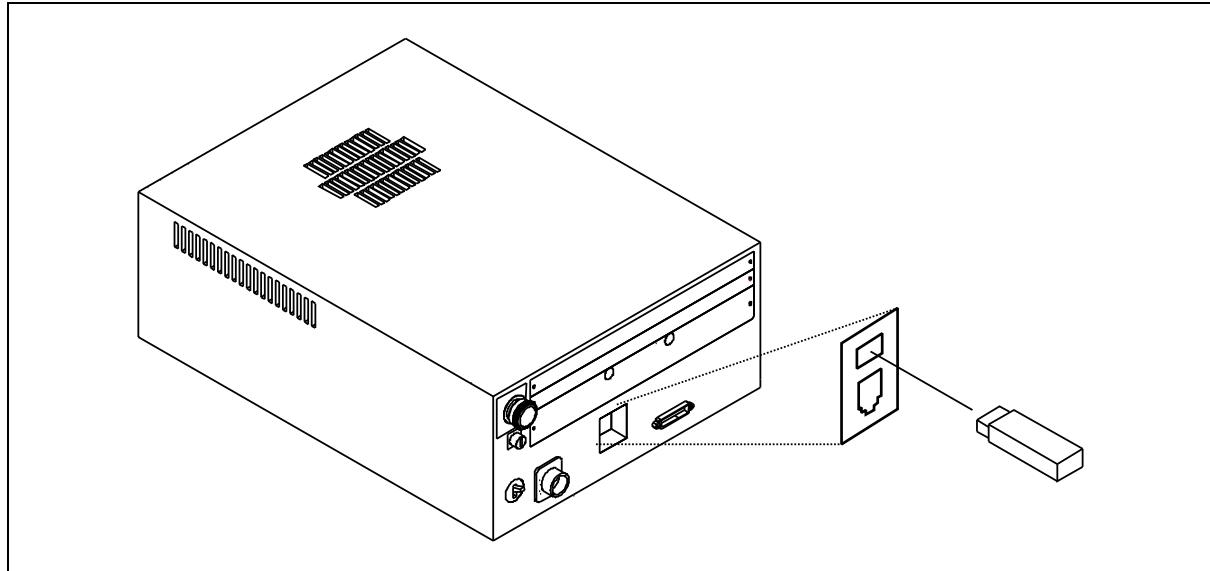
Lines A01 to A10 are connected to CN10A via CN60AJ1, CN60AJ2, CN60A and CN61A connectors.
 Lines A11 to A15 may be used for controlling solenoid valves (option).



Chapter15 USB Memory

This option is used for storage of data such as program files.

Name	Specification	Parts No.	Notes
USB memory	Used for storage of parameters and program files	FD11-OP93-A	1G Bytes



Location to insert USB memory

Please refer to the following manuals for using it.

In case of "Compact TP"

TCFJP-153 CFD controller instruction manual "START UP"
"Chapter 5.1 File operation"

In case of "Smart TP" or using "FD on DESK" PC software

TFDJP-002 FD controller instruction manual "BASIC OPERATION"
"Chapter 6 File operation"

NOTE

Chapter 16 Vision Sensor

Its function is to take pictures of objects such as work-pieces with a camera, and to measure positions of the objects based on the images that are taken in.

Registration of positions of objects during teaching enables measurement of amounts of displacement of the objects and corrects movement of the robot. The function is indispensable for intelligentification of robots. This is beneficial for taking out unpositioned work-pieces and for positioning work-pieces to be set.



To use this option, the "**Smart TP**" is necessary.

In case of "Compact TP" or combination of "Compact TP" and "FD on Desk Light", this option cannot be used.

This document includes the information only for setup of this option such as assembling and wiring. Please refer to another manual "FD controller instruction manual Vision Sensor NV-Pro", Revision 3 or after (TFDEN-133-###) for detail of operation.

16.1 Basic Style

Basic style of vision sensing system

Style	Characteristics
2D measurement	Work-piece position (feature point) is measured using vision sensor. Displacement of work-piece position is calculated by comparing the original teach position and the actual position measured by vision sensor to correct robot position. One big work-piece can be measured from plural direction. (complex measurement) One or two cameras are used according to application.
3D measurement	3-dimensional positions of feature points on work-piece are measured using a stereo camera. Posture of work-piece is calculated using measured data to correct robot position. Holes, marks (whose contrast is high enough after the monochrome image conversion), etc. can be used for feature points.
	A crisscrossed 2 laser slit lights irradiate work-piece. By measuring the reflected light, work-piece's position and angle are calculated to correct robot position. This is effective to the work-pieces on a plane. 2D measurement camera can be added according to application.

Camera position

Camera position	Characteristics
Gripper camera	Camera is mounted on the end effector such as gripper. This method is used when view area changes due to robot movement.
Fixed camera	Camera is mounted on the jig fixed to the ground. This method is used when view area is fixed irrelevant to robot movement.

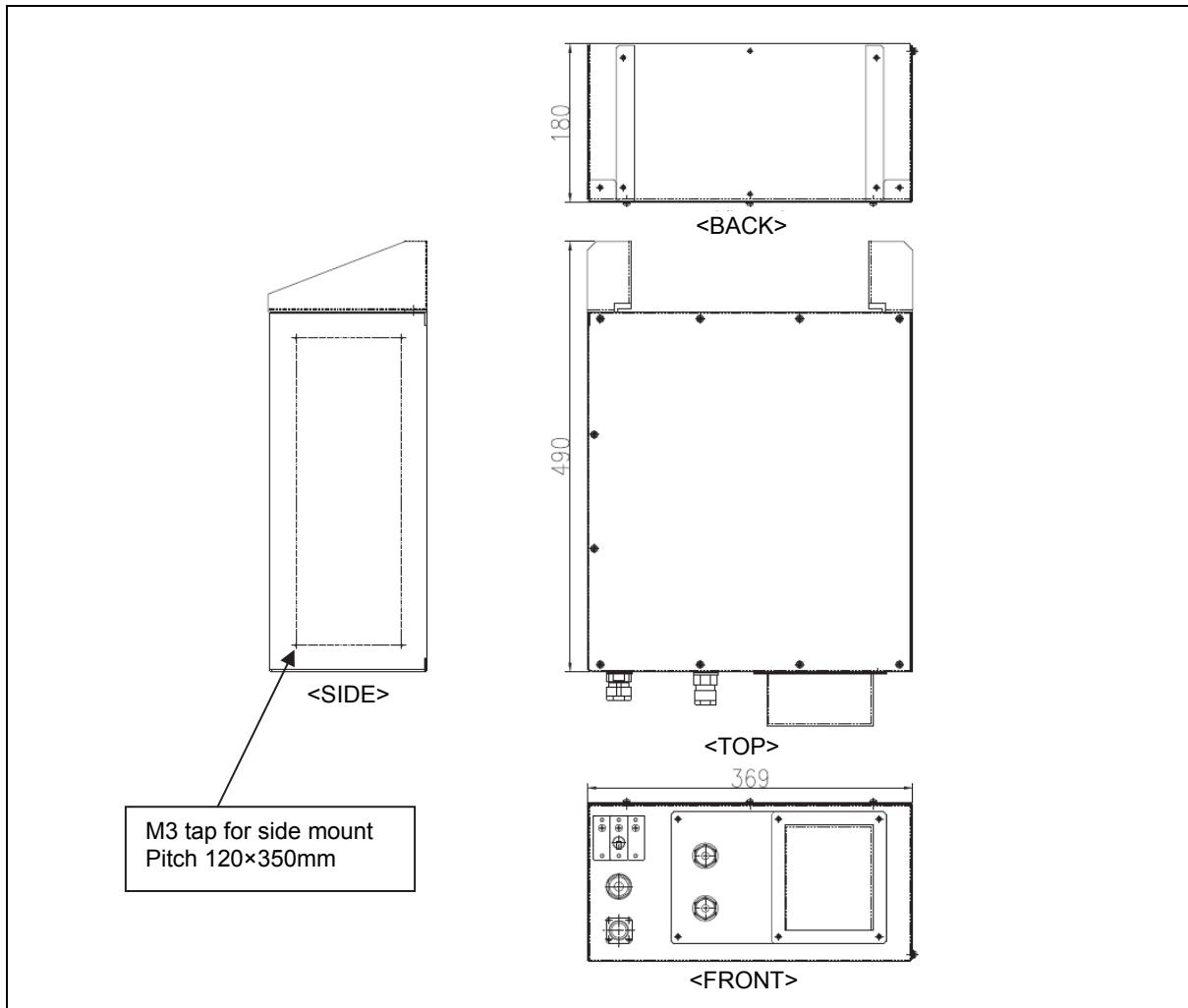
16.2 Vision Unit

Specification of vision unit (common for CFD-OP139-A/B/C)

Item	Description
External dimension	W369 × D490 × H180
Mass	Approx.10 Kg
Primary power source	3-phases, AC200 - 230V±10%, 50/60Hz, Type D grounding Single phase AC200~230V±10%, 50/60Hz, Type D grounding (The power is sent to the CFD controller from this unit)
Installation environment	No distance required surrounding vision unit. Height of power switch should be 0.6m to 1.9m from floor. If vision unit and CFD controller is installed one upon another, vision unit must be installed under CFD controller because of its ventilation.

Style	Combination of camera and light	Vision unit type			Remarks
		CFD-OP139-A	CFD-OP139-B	CFD-OP139-C	
2D measurement	1 Gripper camera + 1 Light		<input type="radio"/>		
	1 Fixed camera + 1 Light		<input type="radio"/>		
	1 Gripper camera + 1 Fixed camera + 1 Light		<input type="radio"/>		Fixed camera light is prepared by customer
	1 Gripper camera + 1 Fixed camera + 2 Lights			<input type="radio"/>	
3D measurement (Stereo camera)	2 Fixed cameras + 1 Light		<input type="radio"/>		
	2 Fixed cameras + 2 Lights			<input type="radio"/>	Can be used as "2D camera" x 2
	2 Gripper cameras + 1 Light		<input type="radio"/>		
	2 Gripper cameras + 2 Lights			<input type="radio"/>	
3D measurement (Cross-laser)	Cross-laser (1 Gripper camera + Laser unit + 1 Light)	<input type="radio"/>			
	Cross-laser (1 Gripper camera + Laser unit + 1 Light) + 1 Fixed camera	<input type="radio"/>			

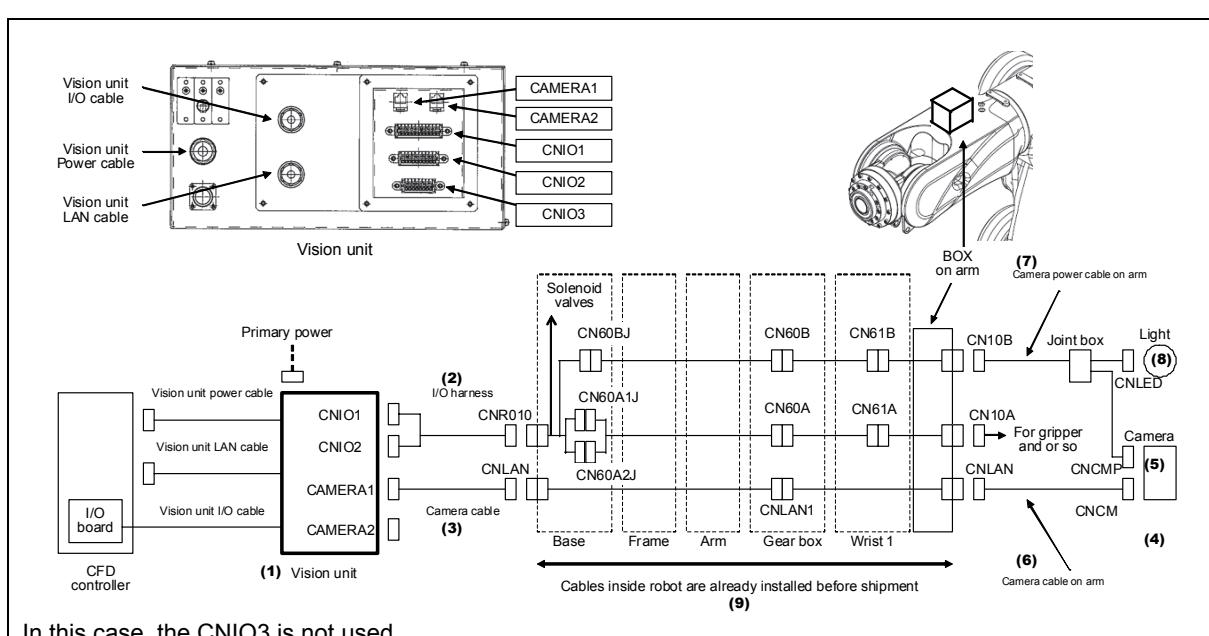
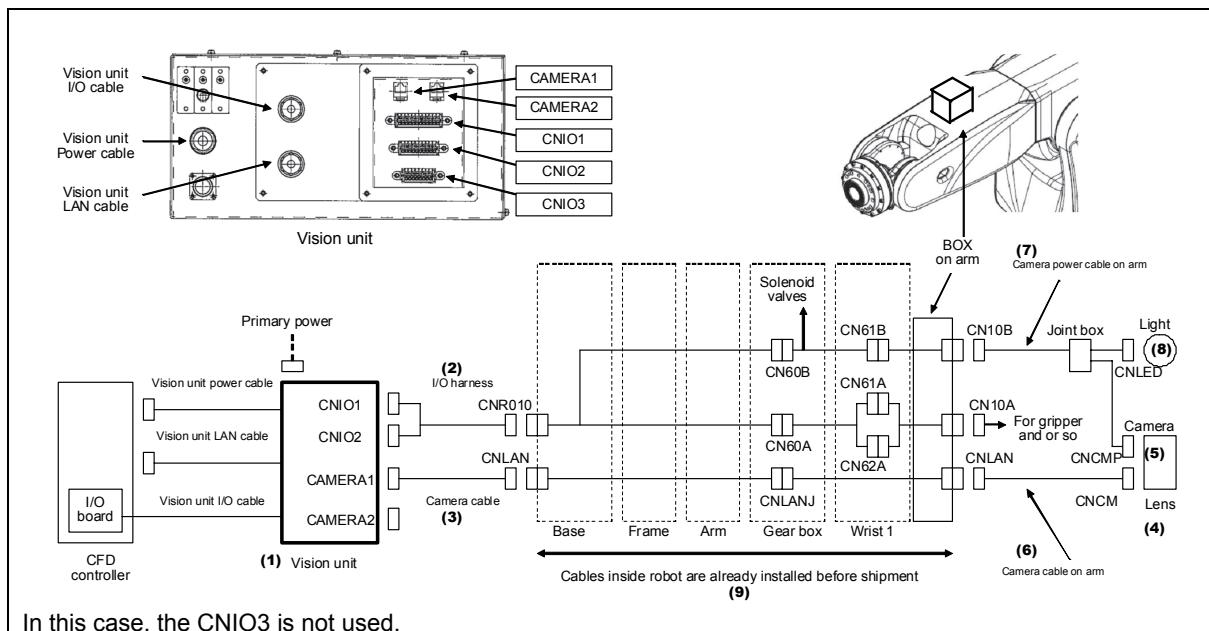
The "3D measurement (Cross-laser)" cannot be used for MZ03EL.

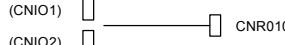
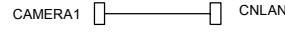
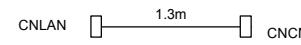
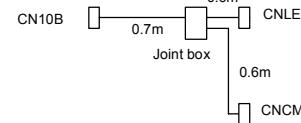


External view of vision unit (common for CFD-OP139-A/B/C)

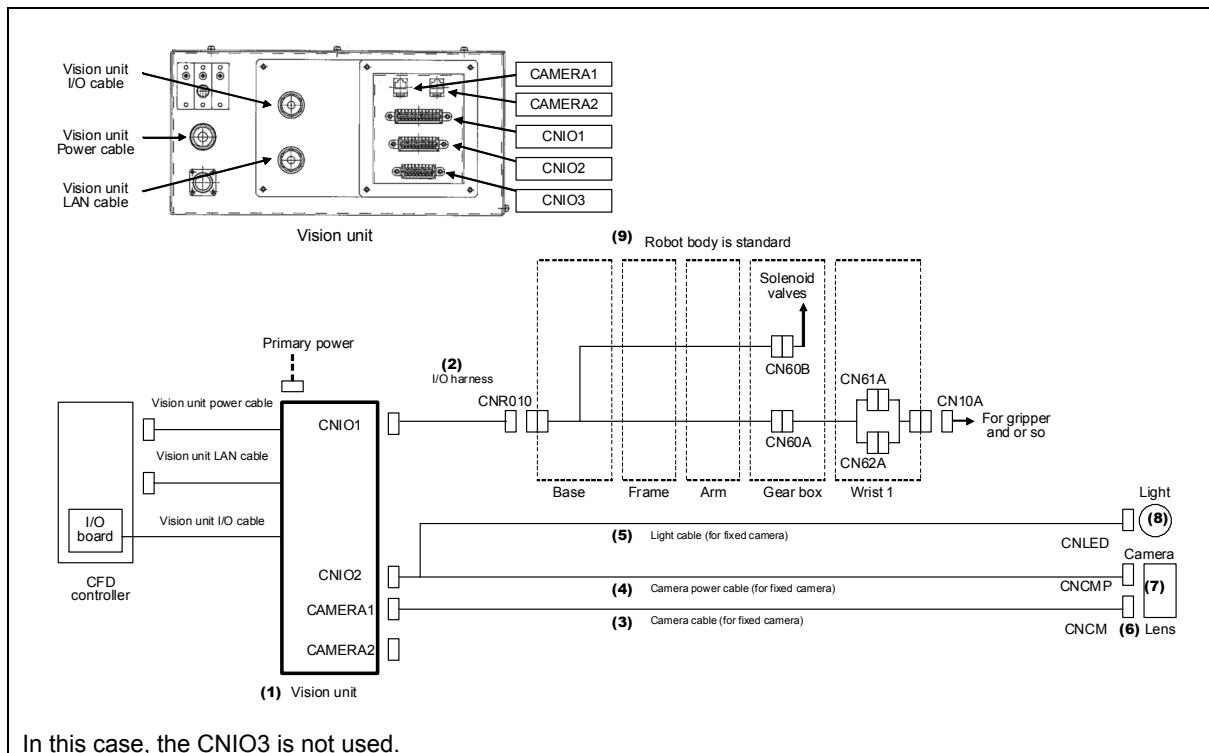
16.3 Construction

■ 1 Gripper camera + 1 Light



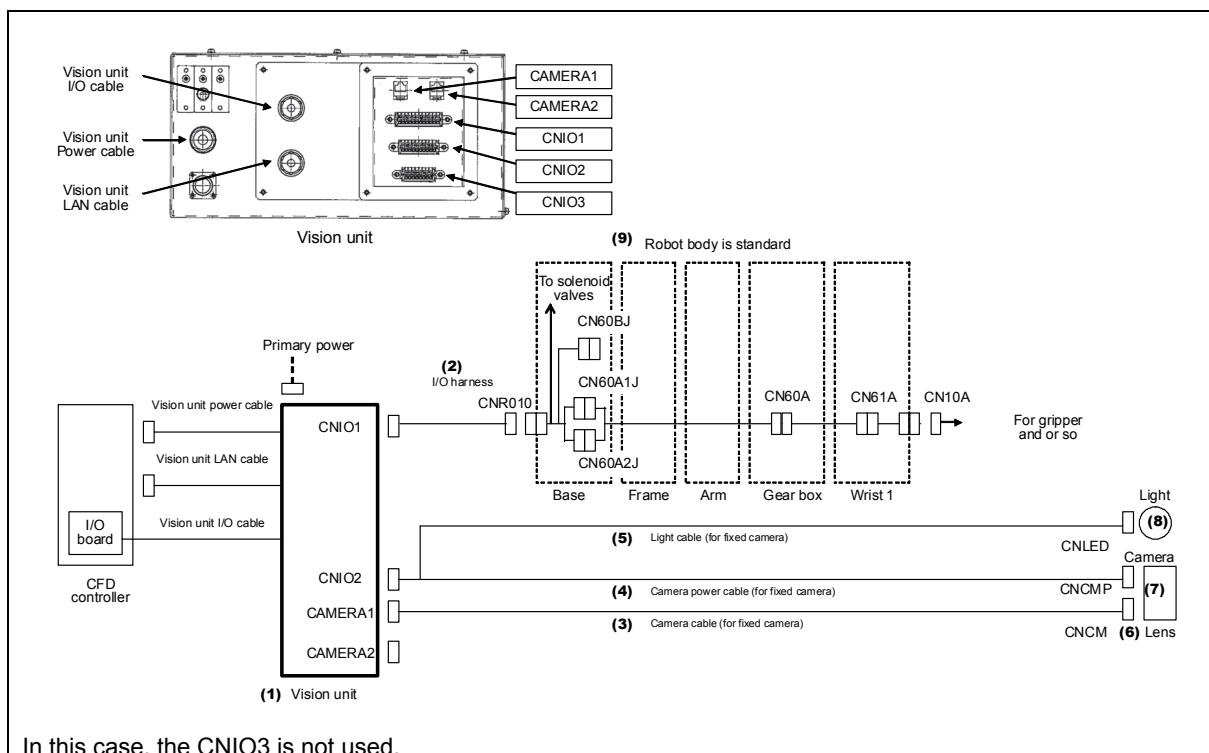
No.	Part name	Part No.	Remarks
(1)	Vision unit	CFD-OP139-B	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m  CNIO1/2 side needs to be manufactured by customer
(3)	Camera cable	NVCABLE-50-※M	※ : Cable length 5,10,15,20,25m 
(4)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(5)	Camera	CFD-OP139-C01	Effective pixels 320,000
(6)	Camera cable on arm	CFD-OP139-CC002	
(7)	Camera power cable on arm	CFD-OP139-LD01	
(8)	LED	CFD-OP139-LED01	Light for single camera (Ring type)
(9)	MZ07 MZ03EL MZ04	MZ07※-01-V※※ MZ03EL-01-V※※ MZ04※-01-V※※	Vision specification

■ 1 Fixed camera + 1 Light



In this case, the CNIO3 is not used.

Connection of vision system (MZ07, MZ03EL)

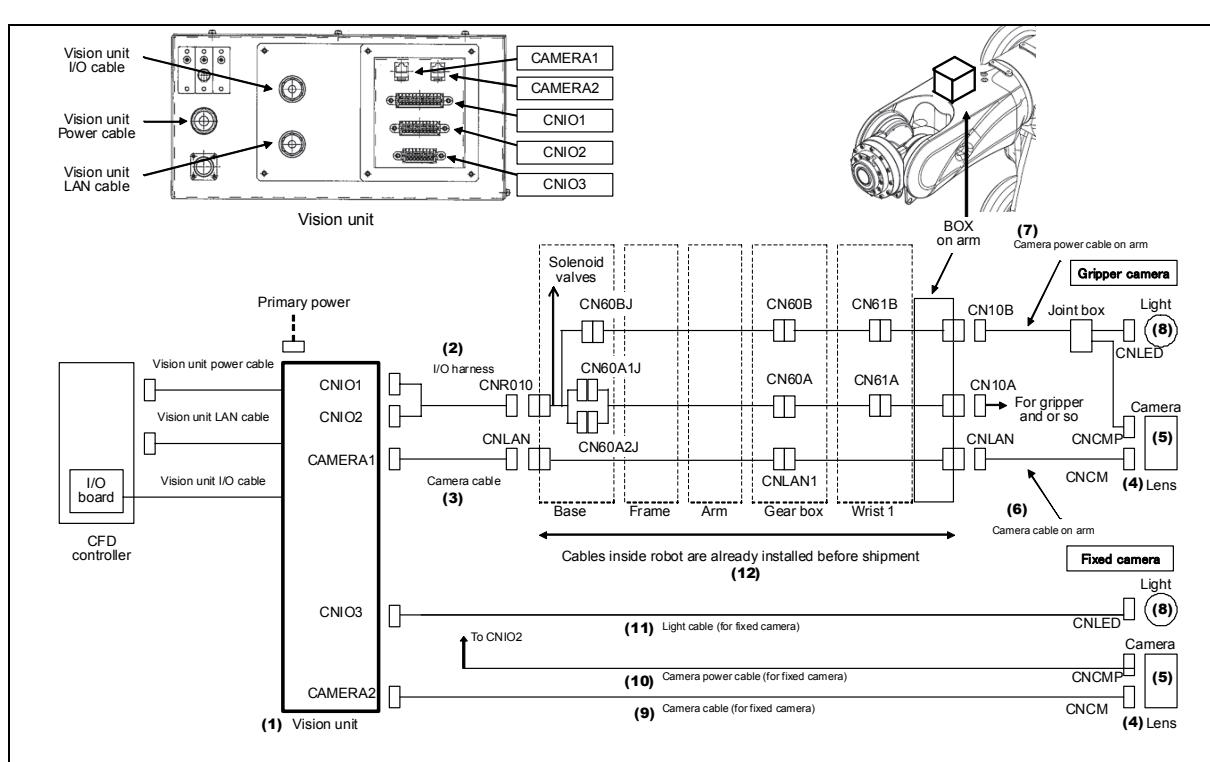
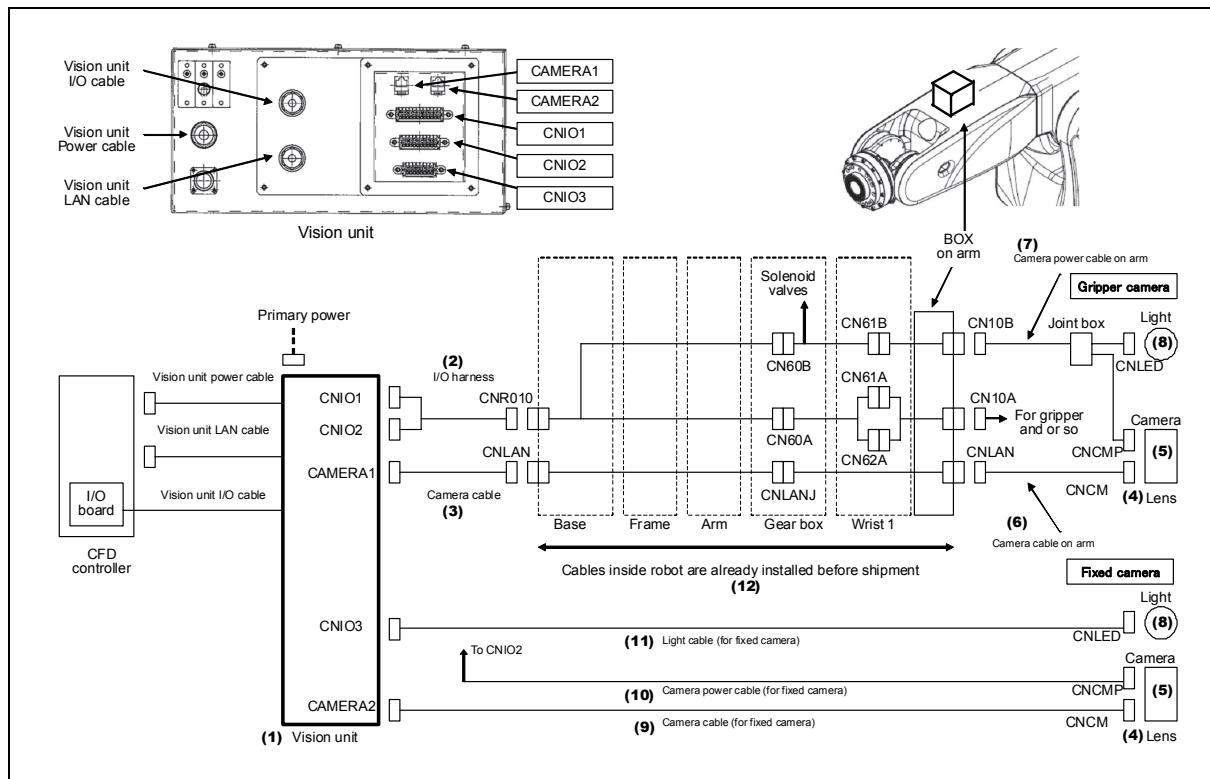


In this case, the CNIO3 is not used.

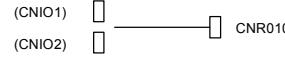
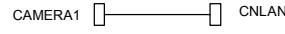
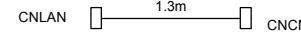
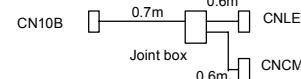
Connection of vision system (MZ04)

No.	Part name	Part No.	Remarks
(1)	Vision unit	CFD-OP139-B	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m (CNI01) ┌─────────┐ CNR010
(3)	Camera cable (for fixed camera)	NVCABLE-20-※M	※ : Cable length 5,10,15,20,25m CAMERA1 ┌─────────┐ CNCM
(4)	Camera power cable (for fixed camera)	NVCABLE-10-※M	※ : Cable length 5,10,15,20,25m (CNI02) ┌─────────┐ CNLED CNI02 side needs to be manufactured by customer
(5)	Light cable (for fixed camera)	NVCABLE-30-※M	※ : Cable length 5,10,15,20,25m (CNI02) ┌─────────┐ CNCMP CNI02 side needs to be manufactured by customer
(6)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(7)	Camera	CFD-OP139-C01	Effective pixels 320,000
(8)	LED	CFD-OP139-LED01	Light for single camera (Ring type)
(9)	MZ07 MZ03EL MZ04	MZ07※-01-V※※ MZ03EL-01-V※※ MZ04※-01-V※※	Vision specification

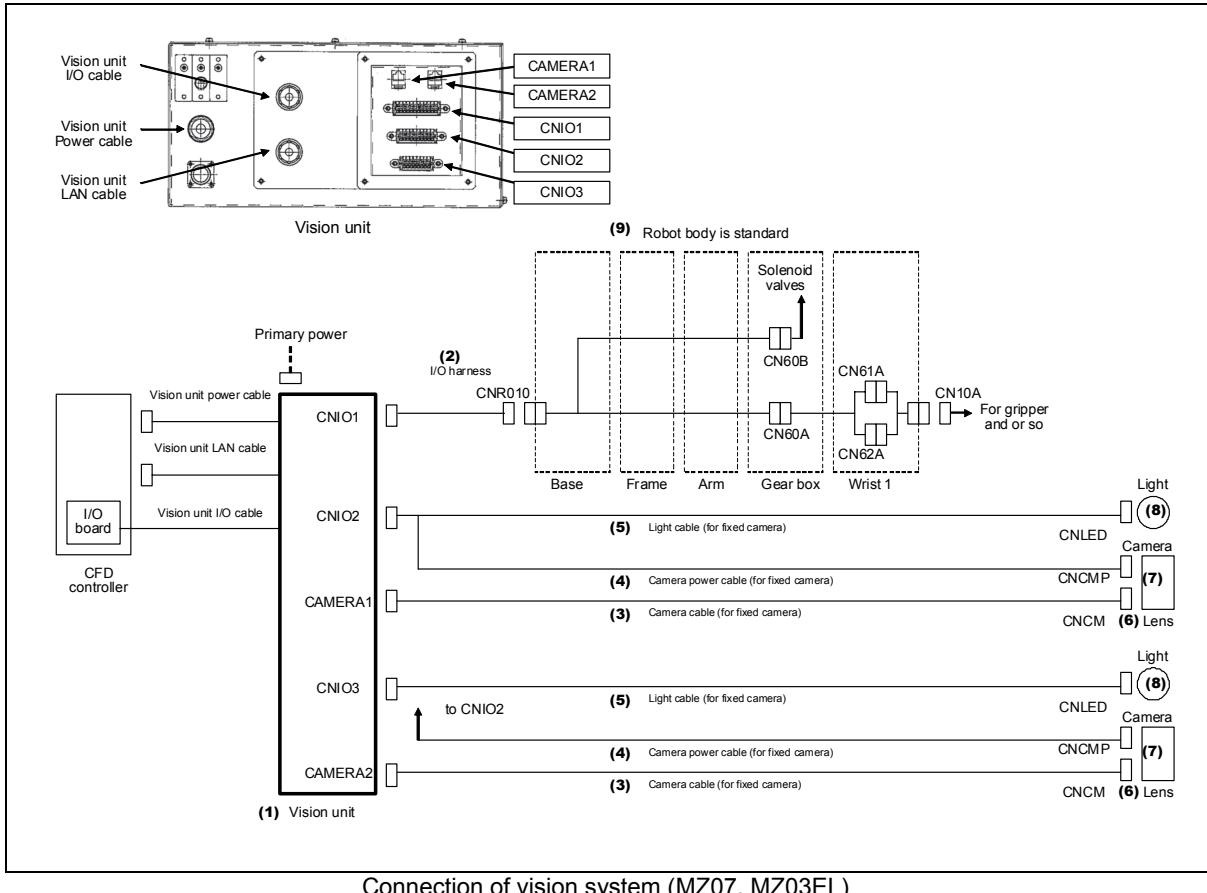
- 1 Gripper camera + 1 Fixed camera + 1 Light
- 1 Gripper camera + 1 Fixed camera + 2 Lights



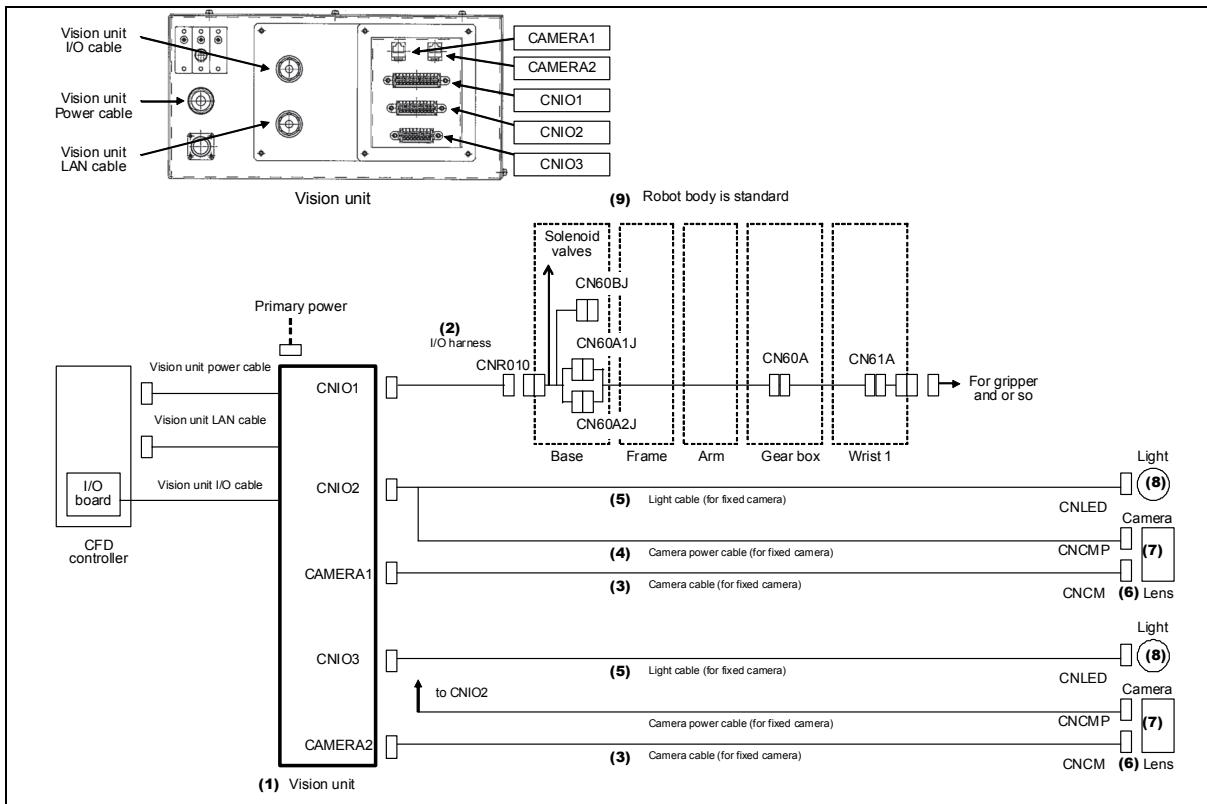
- Only 1 camera cable can be installed inside robot.
- Above figure shows the case of 2 lights. If only 1 light is used, either one light is connected.

No.	Part name	Part No.	Remarks
(1)	Vision unit	1 Light; CFD-OP139-B 2 Lights; CFD-OP139-C	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m  CNIO2 side needs to be manufactured by customer
(3)	Camera cable	NVCABLE-50-※M	※ : Cable length 5,10,15,20,25m 
(4)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(5)	Camera	CFD-OP139-C01	Effective pixels 320,000
(6)	Camera cable on arm	CFD-OP139-CC002	
(7)	Camera power cable on arm	CFD-OP139-LD01	 Joint box 0.6m
(8)	LED	1 Light; CFD-OP139-LED02 2 Lights; CFD-OP139-LED01	Light for stereo camera (Bar type) Light for single camera (Ring type) * 2
(9)	Camera cable (for fixed camera)	NVCABLE-20-※M	※ : Cable length 5,10,15,20,25m 
(10)	Camera power cable (for fixed camera)	NVCABLE-10-※M	※ : Cable length 5,10,15,20,25m  CNIO1/2 side needs to be manufactured by customer
(11)	Light cable (for fixed camera)	NVCABLE-30-※M	※ : Cable length 5,10,15,20,25m  CNIO3 side needs to be manufactured by customer
(12)	MZ07 MZ03EL MZ04	MZ07※-01-V※※ MZ03EL-01-V※※ MZ04※-01-V※※	Vision specification

- 2 Fixed cameras + 1 Light
 - 2 Fixed cameras + 2 Lights



Connection of vision system (MZ07, MZ03EL)



Connection of vision system (MZ04)

- Above figure shows the case of 2 lights. If only 1 light is used, either one light is connected.

No.	Part name	Part No.	Remarks
(1)	Vision unit	1 Light; CFD-OP139-B 2 Lights; CFD-OP139-C	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m (CNIO1) ┌─────────┐ CNR010
(3)	Camera cable (for fixed camera)	NVCABLE-20-※M	※ : Cable length 5,10,15,20,25m CAMERA1 ┌─────────┐ CNCM CAMERA2 ┌─────────┐ CNCM
(4)	Camera power cable (for fixed camera)	NVCABLE-10-※M	※ : Cable length 5,10,15,20,25m (CNIO2) ┌─────────┐ CNLED (CNIO3) ┌─────────┐ CNLED CNIO2/3 side needs to be manufactured by customer
(5)	Light cable (for fixed camera)	NVCABLE-30-※M	※ : Cable length 5,10,15,20,25m (CNIO2) ┌─────────┐ CNCMP (CNIO3) ┌─────────┐ CNCMP CNIO2/3 side needs to be manufactured by customer
(6)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(7)	Camera	CFD-OP139-C01	Effective pixels 320,000
(8)	LED	1 Light; CFD-OP139-LED02 2 Lights; CFD-OP139-LED01	Light for stereo camera (Bar type) Light for single camera (Ring type) * 2
(9)	MZ07 MZ03EL MZ04	MZ07※-01-V※※ MZ03EL-01-V※※ MZ04※-01-V※※	Vision specification

- 2 Gripper cameras + 1 Light

The camera cable installed inside the robot is only 1.

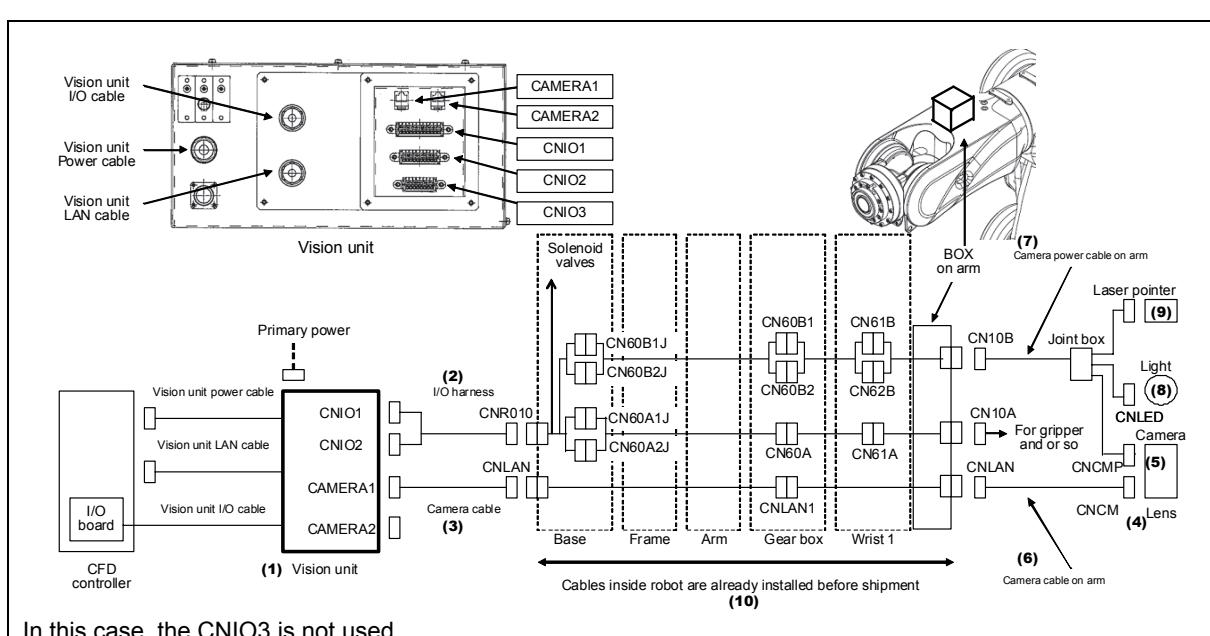
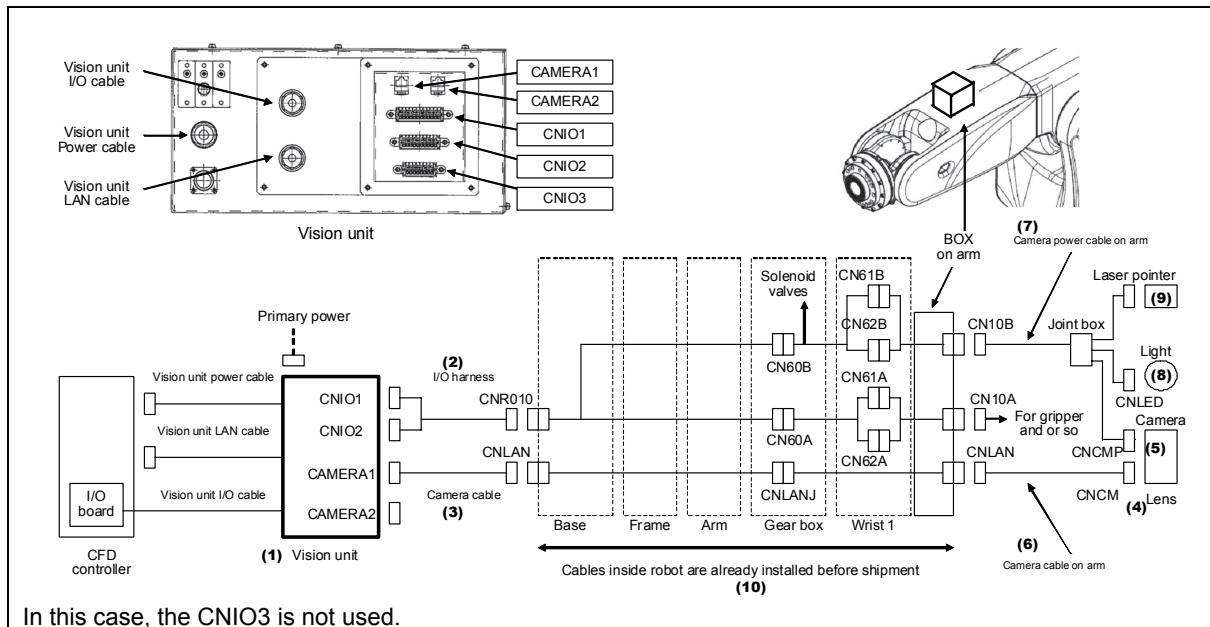
The second camera cable is installed outside of the robot in the same way with the fixed camera. So, the configuration is the same with that of the “**1 Gripper camera + 1 Fixed camera + 1 Light**” in this case. Or, if those 2 camera cables are installed outside of the robot, the configuration becomes the same with the “**2 Fixed cameras + 1 Light**”.

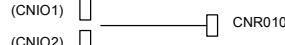
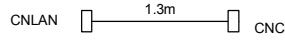
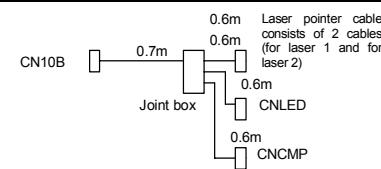
- 2 Gripper cameras + 2 Lights

The camera cable installed inside the robot is only 1.

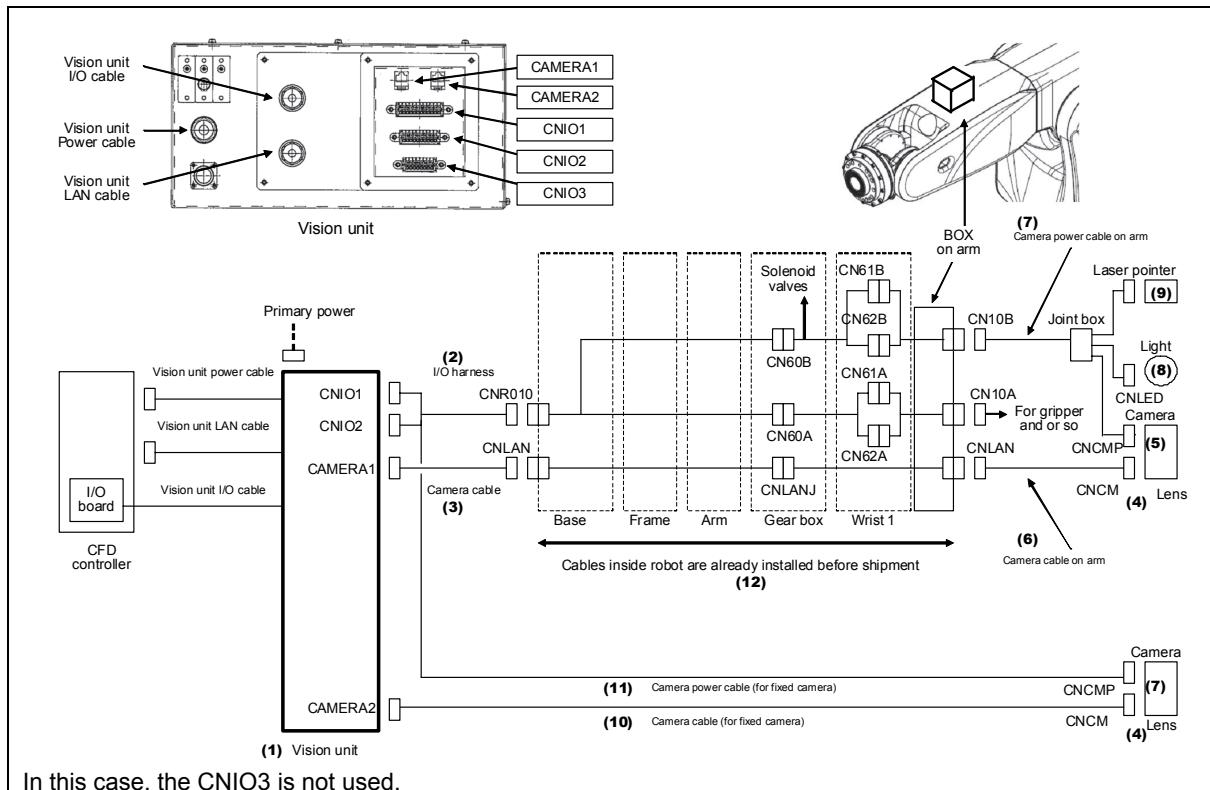
The second camera cable is installed outside of the robot in the same way with the fixed camera. So, the configuration is the same with that of the “**1 Gripper camera + 1 Fixed camera + 2 Lights**” in this case. Or, if those 2 camera cables are installed outside of the robot, the configuration becomes the same with the “**2 Fixed cameras + 2 Light**”.

■ Cross-laser (1 Gripper camera + Laser unit + 1 Light)

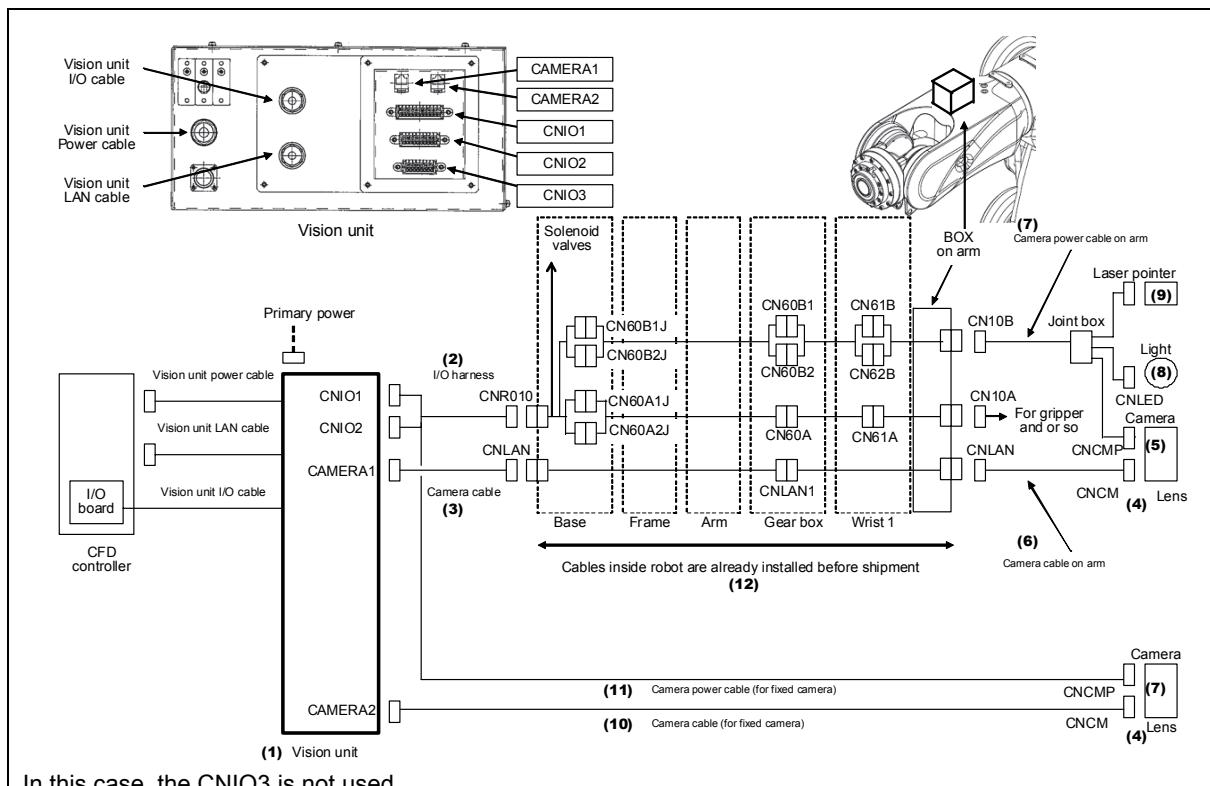


No.	Part name	Part No.	Remarks
(1)	Vision unit	CFD-OP139-A	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m  CNIO1/2 side needs to be manufactured by customer
(3)	Camera cable	NVCABLE-50-※M	※ : Cable length 5,10,15,20,25m 
(4)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(5)	Camera	CFD-OP139-C01	Effective pixels 320,000
(6)	Camera cable on arm	CFD-OP139-CC002	
(7)	Camera power cable on arm	CFD-OP139-LD03	
(8)	LED	CFD-OP139-LED01	Light for single camera (Ring type)
(9)	Laser pointer	CFD-OP139-LP01	
(10)	MZ07 MZ04	MZ07※-01-U※※ MZ04※-01-U※※	Cross-laser specification

■ Cross-laser (1 Gripper camera + Laser unit + 1 Light) + 1 Fixed camera

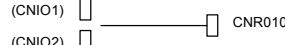
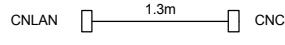
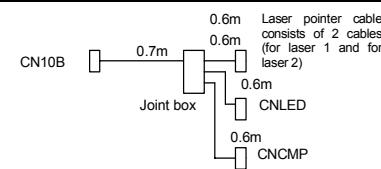
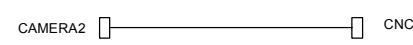


Connection of vision system (MZ07)



Connection of vision system (MZ04)

- Only 1 camera cable can be installed inside robot.

No.	Part name	Part No.	Remarks
(1)	Vision unit	CFD-OP139-A	With vision unit power cable, vision unit I/O cable and vision unit LAN cable (all connected)
(2)	I/O harness	IOCABLE-10-※M (Revision A02)	※ : Cable length 5,10,15,20,25m  CNIO1/2 side needs to be manufactured by customer
(3)	Camera cable	NVCABLE-50-※M	※ : Cable length 5,10,15,20,25m 
(4)	Lens	CFD-OP139-L08 CFD-OP139-L12 CFD-OP139-L16	Focus distance 8mm Focus distance 12mm select one among these Focus distance 16mm
(5)	Camera	CFD-OP139-C01	Effective pixels 320,000
(6)	Camera cable on arm	CFD-OP139-CC002	
(7)	Camera power cable on arm	CFD-OP139-LD03	 CN10B — 0.7m — Joint box — 0.6m (laser 1) — 0.6m (laser 2) — 0.6m — CNLED — 0.6m — CNCMP
(8)	LED	CFD-OP139-LED01	Light for single camera (Ring type)
(9)	Laser pointer	CFD-OP139-LP01	
(10)	Camera cable (for fixed camera)	NVCABLE-20-※M	※ : Cable length 5,10,15,20,25m 
(11)	Camera power cable (for fixed camera)	NVCABLE-10-※M	※ : Cable length 5,10,15,20,25m  CNIO2 side needs to be manufactured by customer
(12)	MZ07 MZ04	MZ07※-01-U※※ MZ04※-01-U※※	Cross-laser specification

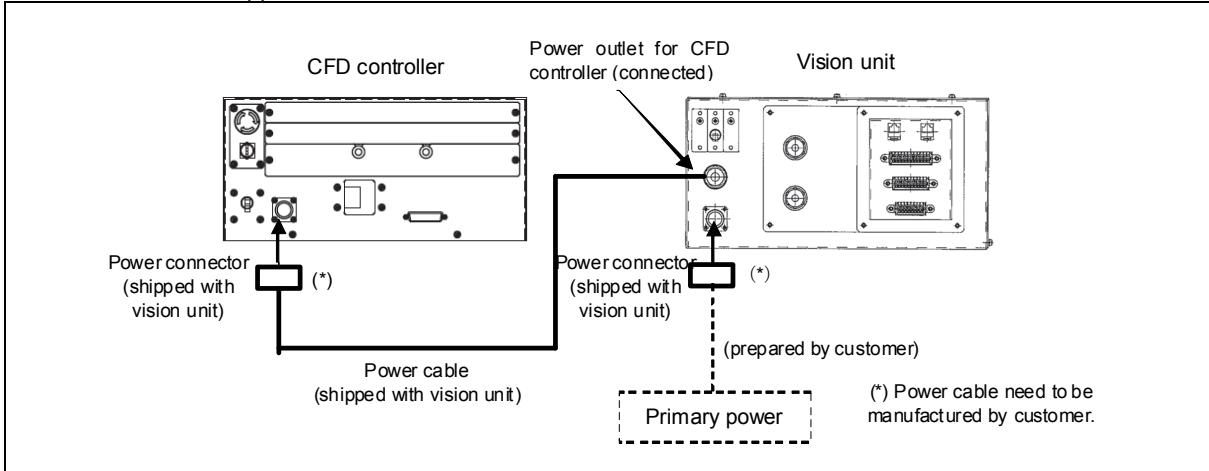
16.4 Connection of Primary Power

■ Connection of primary power

Power to CFD controller is supplied from vision unit.

Primary power supply to vision unit needs to be prepared by customer.

Power connector is shipped with vision unit.



Primary power supply connection

Rating of primary power

Manipulator used in combination	Rated voltage	Power-handling capacity ^(Note)
MZ series	3-phase AC200V-230V Single-phase AC200V-230V (+10%, -10%) 50/60 Hz	0.4 kVA

(Note) Varies according to the application and operation pattern.

Connector pin layout Seeing from the soldering side		Connection	
PIN No.		3 - phase AC200V	Single - phase AC200V
1	AC200V R-phase (Red)	AC200V R-phase (Red)	
2	AC200V S-phase (White)		-
3	AC200V T-phase (Black)	AC200V T-phase (Black)	
4	Ground (Green/Yellow)	Ground (Green/Yellow)	

Applicable cable diameter:
10~12.5 [mm]
Connector type:
Nanaboshi Electric Mfg.Co.,Ltd.
NJW-204-PF12

Primary power supply cable connection

Primary power supply cable specification

Manipulator used in combination	Cross-section of power cable	Cross-section of grounding cable
MZ series	1.25mm ² AWG16	1.25mm ² AWG16

■ Grounding

To ensure safety, use the grounding method type D. (Customer is responsible for providing grounding wires.)

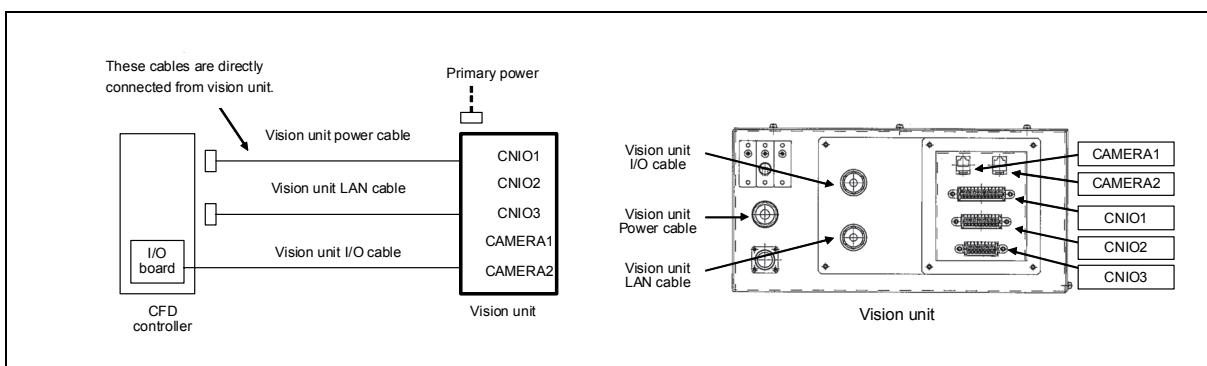
- Ensure that power cable is larger than 1.25 mm², and ground cable is larger than 1.25 mm².
- Ground resistance should be less than 100 ohms.

■ Leakage breaker

Please use a leakage breaker that satisfies the following specification.

Rated current: 10A or more / For inverter / Middle sensitivity type (100mA or more)

16.5 Connection of CFD controller



Connection of vision unit and CFD controller

■ Connection of “Vision unit I/O cable”

In case of using wires inside robot arm, connect “Vision unit I/O cable” to I/O board inside of CFD controller.



I/O signals from CFD controller (signal A01 to A17, but A01 to A13 for cross-laser specification) to vision unit is through out to connector CNIO1/CNIO2.
Please refer to “CFD controller Technical Document 2” (TCFDEN-156-###), “Chapter 2 Mini I/O” and “Chapter 3 Digital I/O” for detail of I/O specification and connection.

Colors of “Vision unit I/O cable”

No.	Wire No.	Color
1	A01 / A02	Green / White
2	A03 / A04	Yellow / White
3	A05 / A06	Brown / White
4	A07 / A08	Blue / Pink
5	A09 / A10	Gray / Pink
6	A11 / A12	Orange / Pink

No.	Wire No.	Color
7	A13 / A14	Purple / Pink
8	A15 / A16	Light blue / Pink
9	A17 / A22	Black / White
10	Not used	Red / White
11	G	Shield

■ Connection of “Vision unit LAN cable”

Connect “Vision unit LAN cable” to LAN connector on CFD controller front panel.

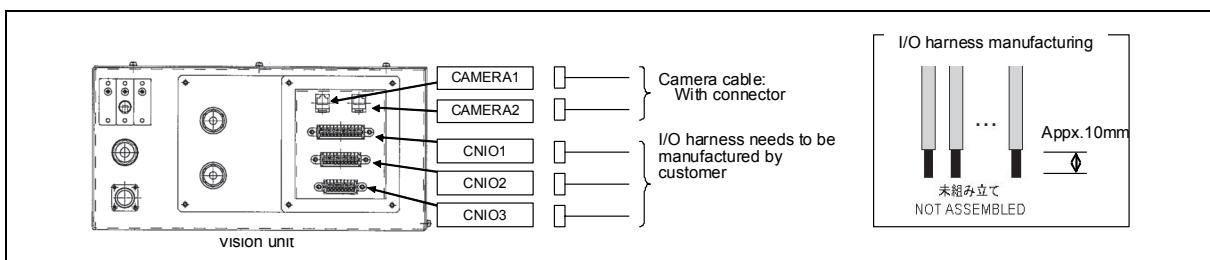
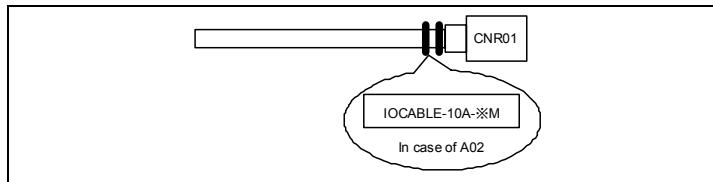
16.6 Connection of peripheral equipments

■ Connection of “I/O harness”

Cut “I/O harness” to the adequate length and manufacture all end of wires. Then connect them to CNIO1 and CNIO2 connectors on vision unit front panel. Please refer to “Chapter 13 MZ series I/O Harness” for detail.

(*) I/O harness

There are 2 types for the I/O harness.
(Revision A01 and A02) For the force sensor, please use A02 or more.



Vision unit connectors on front panel: CNIO1,2 and CAMERA1,2

Connector CNIO1 Pin allocation

Pin No.	I/O harness Connection Signal name	Except Cross-laser specification	Cross-laser specification
1	A01		Vision unit I/O harness A01
2	A02		Vision unit I/O harness A02
3	A03		Vision unit I/O harness A03
4	A04		Vision unit I/O harness A04
5	A05		Vision unit I/O harness A05
6	A06		Vision unit I/O harness A06
7	A07		Vision unit I/O harness A07
8	A08		Vision unit I/O harness A08
9	A09		Vision unit I/O harness A09
10	A10		Vision unit I/O harness A10
11	A11		Vision unit I/O harness A11
12	A12		Vision unit I/O harness A12

Connector CNIO2 Pin allocation

Pin No.	I/O harness Connection Signal name	Except Cross-laser specification	Cross-laser specification
1	A13		Vision unit I/O harness A13
2	A14	Vision unit I/O harness A14	Cross-laser power 1
3	A15	Vision unit I/O harness A15	Cross-laser power 2
4	A16	Vision unit I/O harness A16	Cross-laser power 3
5	A17	Vision unit I/O harness A17	Cross-laser power 4
6	A20	LED Light power +	
7	A21	LED Light power -	
8	-	DC24V+	
9	A19	GND (Ground of DC12V/24V)	
10	A18	DC12V+ (camera power)	

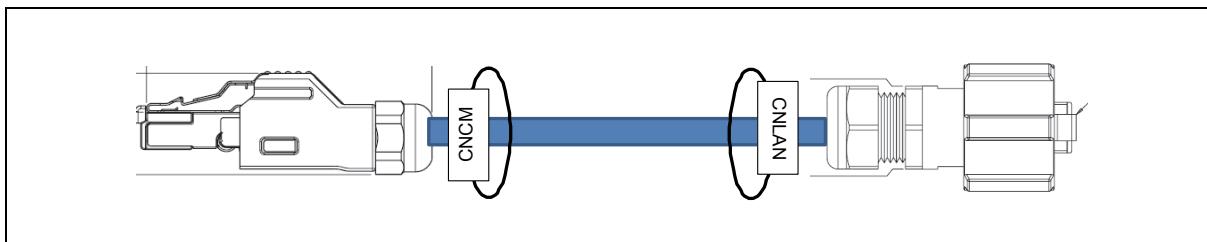
■ Connection of “Camera cable”

Connect “Camera cable” to CAMERA1 and CAMERA2 connectors of vision unit front panel.

■ Connection of peripheral equipments

Construction differs according to each application. Please connect needed equipments by referring to "16.3 Construction".

As written in the figure below, each cable has mark on both end which means connector name to be connected. If not, please confirm it by wire No.

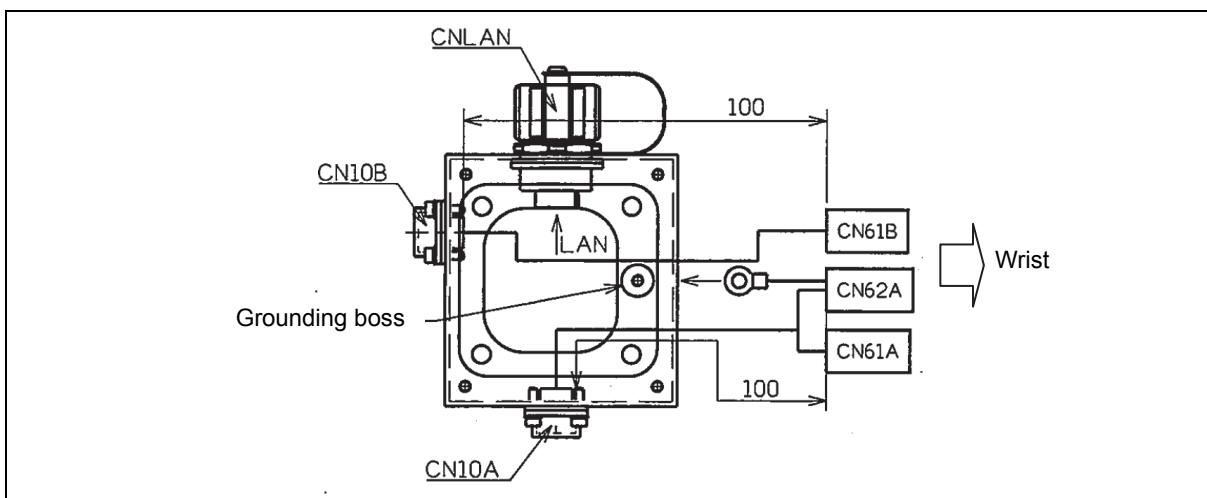


Cable appearance (Example of camera cable on arm)

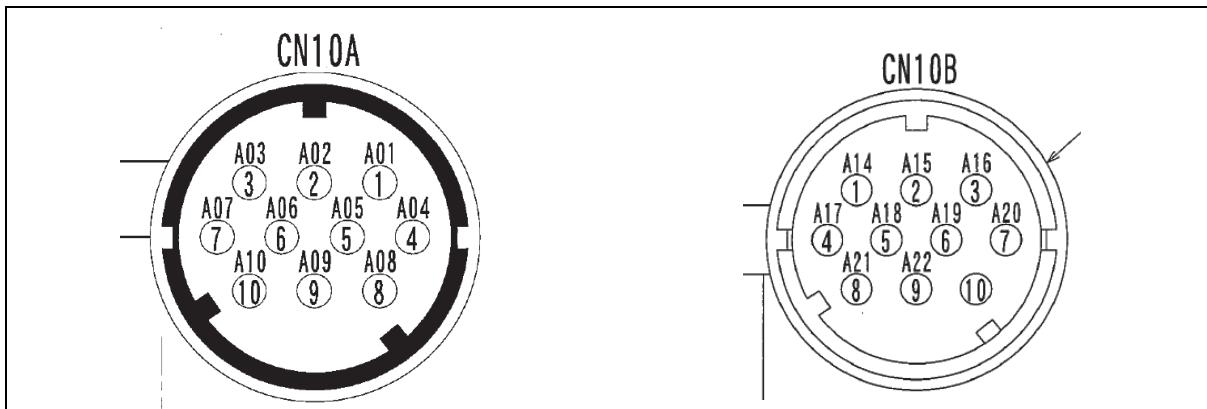
■ Connection of "Cable on arm" and "Box on arm"

Please refer to "Chapter 14 MZ series I/O Cable on Arm" for detail of "Cable on arm".

"Box on arm" is already mounted on robot arm before shipment.



Box on arm



Connector pin layout of Box on arm (seen from solder side inside box)

Connector CN10A Pin allocation (for all specification)

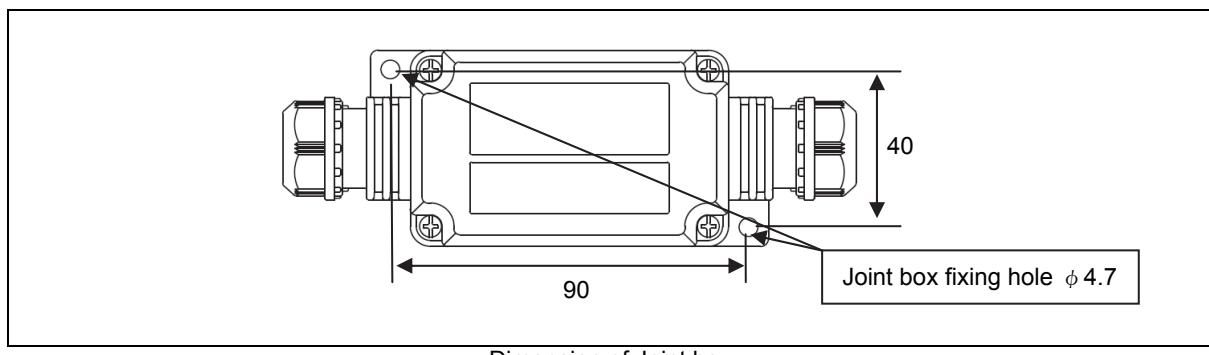
Pin No.	Signal name	Name	Remarks
1	A01	I/O signal A01	
2	A02	I/O signal A02	
3	A03	I/O signal A03	
4	A04	I/O signal A04	
5	A05	I/O signal A05	
6	A06	I/O signal A06	
7	A07	I/O signal A07	
8	A08	I/O signal A08	
9	A09	I/O signal A09	
10	A10	I/O signal A10	

Connector CN10B Pin allocation

Pin No.	Signal name	Except Cross-laser specification	Cross-laser specification
1	A14	-	Cross-laser power 1
2	A15	-	Cross-laser power 2
3	A16	-	Cross-laser power 3
4	A17	-	Cross-laser power 4
5	A20	LED Light power +	
6	A21	LED Light power -	
7		DC24V+	
8	A19	GND (Ground of DC12V/24V)	
9	A18	DC12V+ (camera power)	
10	—		

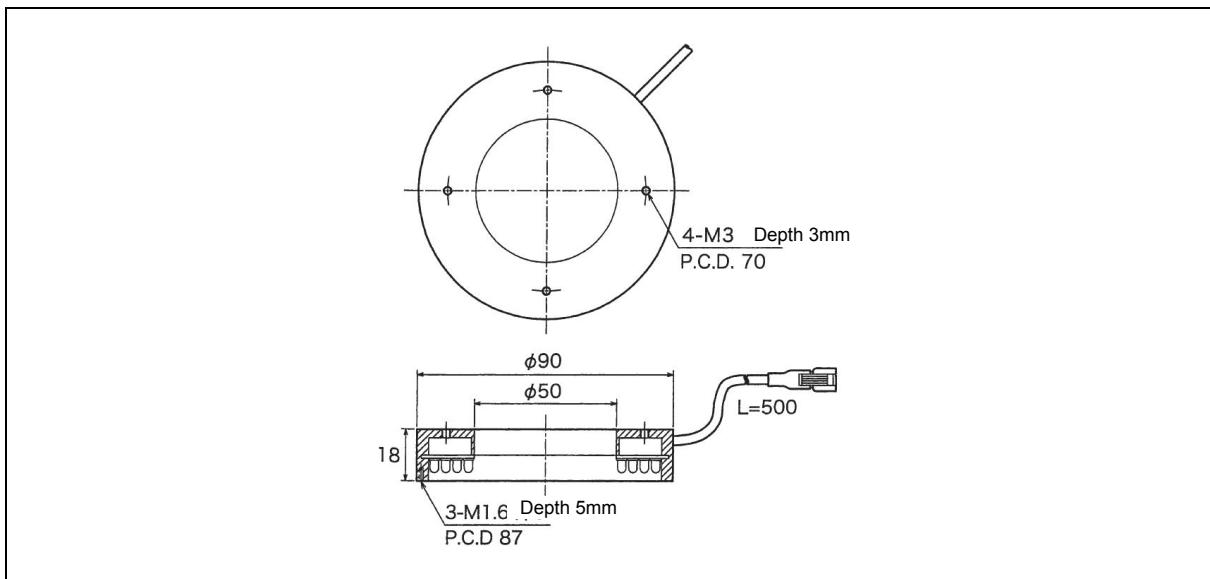
■ Connection of "Joint box" of camera power cable on arm

This is used for the branch of camera power cable and LED light cable. Cables are connected before shipment. Mount this box on adequate place.

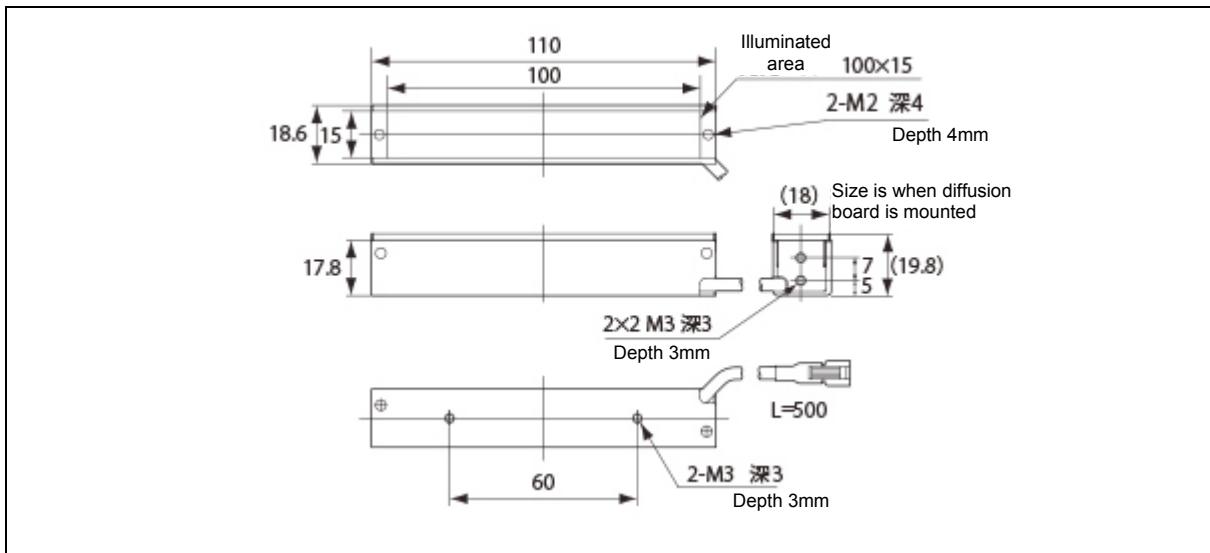


Dimension of Joint box

■ Light

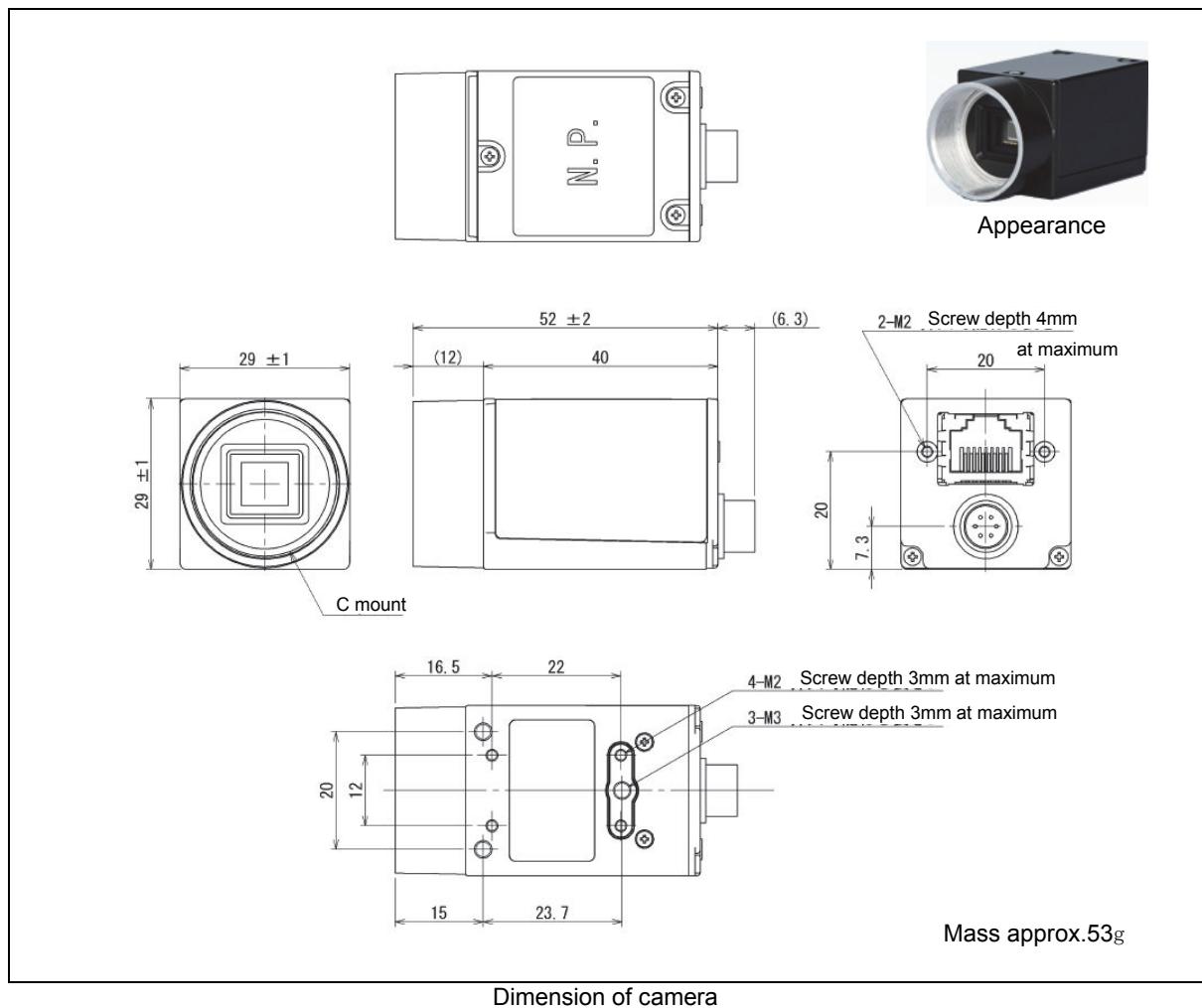


Dimension of light for single camera (Ring type) (Part No. CFD-OP139-LED01)



Dimension of light for stereo camera (Bar type) (Part No. CFD-OP139-LED02)

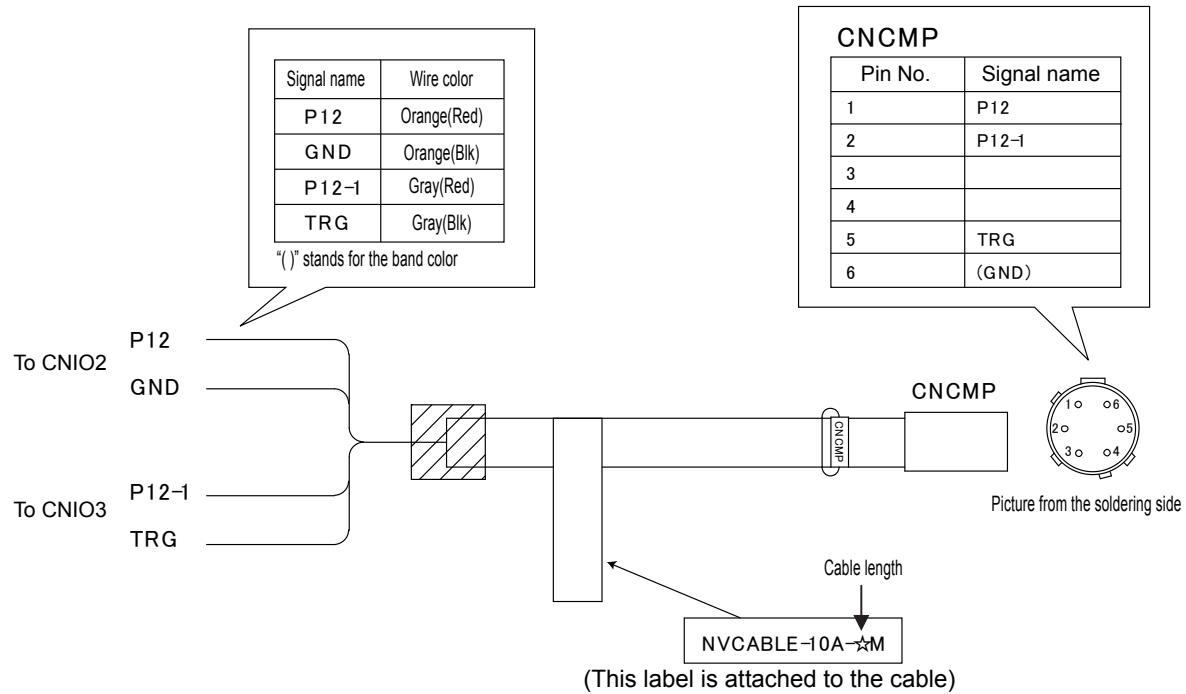
■ Camera

**16.7 Operating**

Please refer to another manual “FD controller instruction manual Vision Sensor NV-Pro revision 3 or after (TFDEN-133-###)”.

16.8 About the Vision conveyor tracking function

To use the Vision conveyor tracking function, a camera cable that has a label shown in the following picture is necessary.



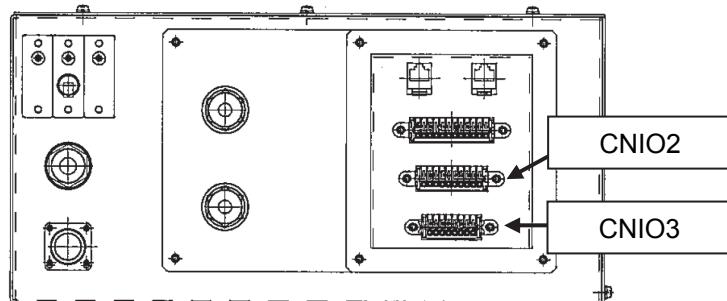
A cable that has not the label cannot be used for the Vision conveyor tracking function.
And, because this cable has upper compatibility, this cable can be used for other vision sensor applications.

Connection to the CNIO2 and CNIO3

Connect "P12-1" and "TRG" to the CNIO3.

Connector CNIO3 pin layout

Pin No.	Wire No.	Color
1	P12-1	Gray(Red)
2	TRG	Gray(Black)
3		
4		
5		
6		
7		
8		
9		
10		



Connect "P12" and "GND" to the CNIO2.
Concerning the pin layout of the CNIO2, refer to p16-8.

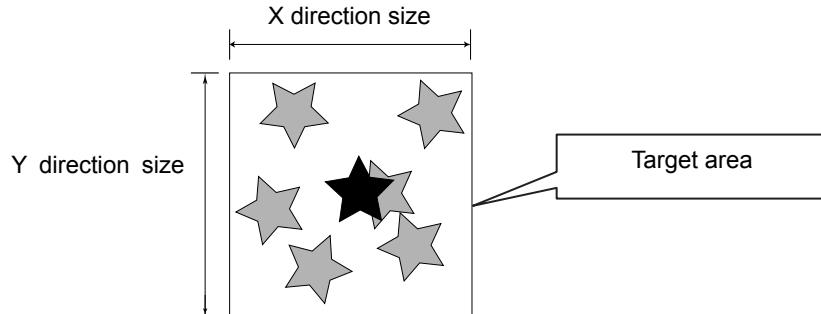
GND: to the 9th pin of the CNIO2
P12: to the 10th pin of the CNIO2

16.9 How to choose the lens and the calibration board

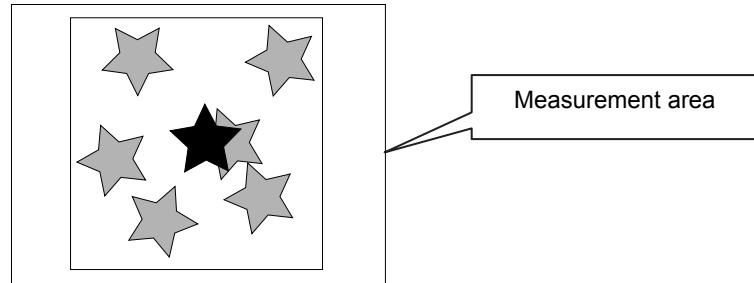
Choose the lens and the calibration board by following this procedure.

How to choose the lens and the calibration board

- (1) Calculate the size of the “**Target area**” considering the target object and its predicted range of position deviation.



- (2) Find a “**Measurement area**” that has larger size than the calculated “**Target area**” from the table in the next page. Select an area that has the most similar size.



(Example)

If the Target area size is “250mm x 250mm”, the measurement areas that can satisfy the conditions are shown as below.

- (a) Z=575, f=8, measurement area = 354.6 x 265.9
- (b) Z=925, f=12, measurement area = 351.8 x 263.8
- (c) Z=1500, f=16, measurement area = 351.8 x 263.8

- (3) Choose 1 among these 3 considering the distance Z[mm] between the camera and the measurement target object.

(Example)

To make the distance between the camera and the measurement target 575[mm], choose (a).

As a result, the lens is “f=8”.

- (4) Then choose the type of the calibration board from the following list. In this example, because the pitch is 30, the necessary calibration board type is **NV-EZ0-300-30-15**.

Calibration board list

Product number	Plate size	φ [mm]	Pitch [mm]
NV-EZ0-100-6-3	100x100mm	3	6
NV-EZ0-100-10-5	100x100mm	5	10
NV-EZ0-150-10-5	150x150mm	5	10
NV-EZ0-150-15-7.5	150x150mm	7.5	15
NV-EZ0-150-20-10	300x300mm	10	20
NV-EZ0-300-30-15	300x300mm	15	30
NV-EZ0-400-40-20	400x400mm	20	40

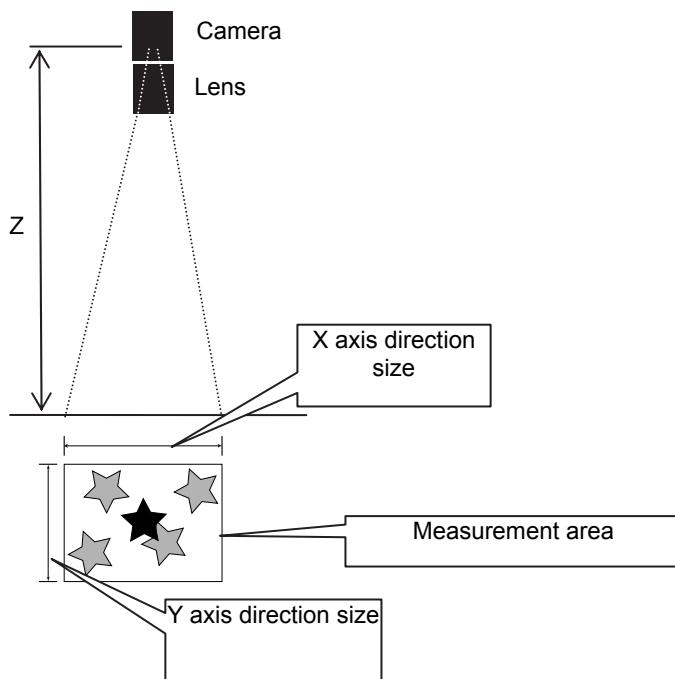
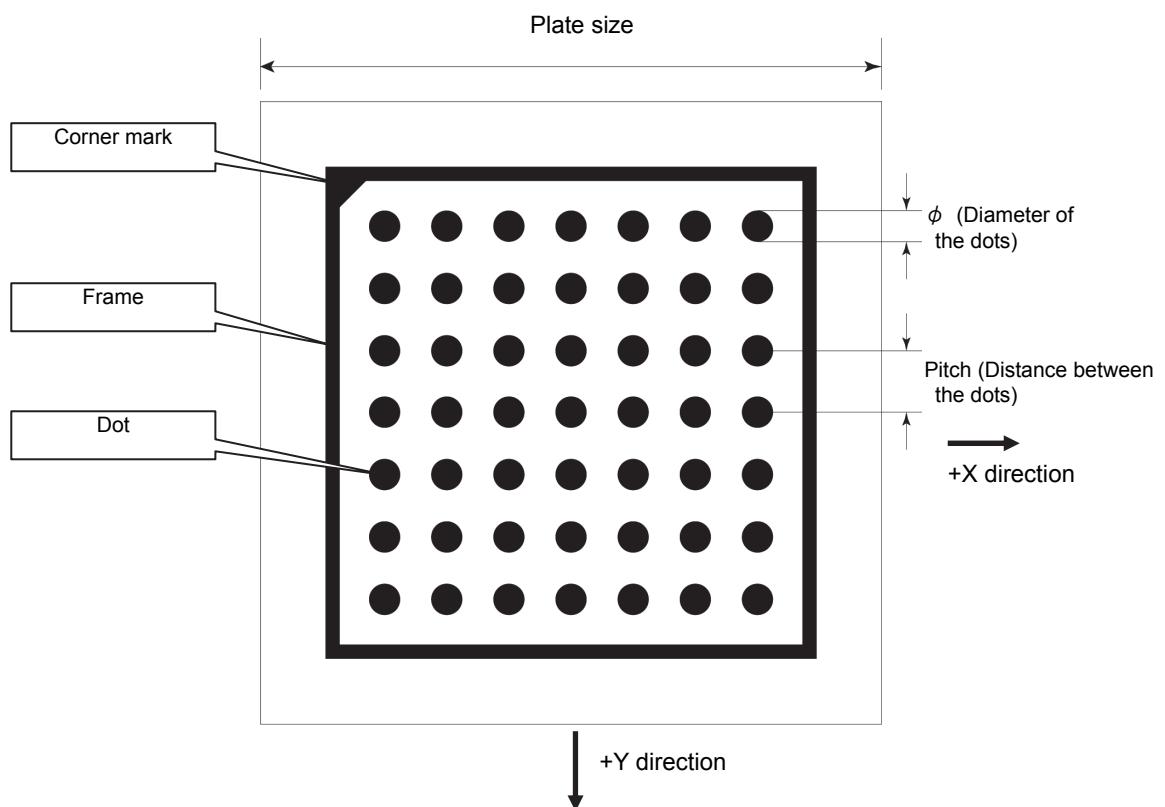
Distance	Measurement area for the respective lens types										Pitch of the calibration board				
	f=8mm		f=12mm		f=16mm		f=25mm		f=50mm		f=				
Z(mm)	X	Y	X	Y	X	Y	X	Y	X	Y	8	12	16	25	50
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	/	/	/	/	/
25	15.4	11.6	9.5	7.1	5.9	4.4	3.6	2.7	2.2	1.7	/	/	/	/	/
50	30.8	23.1	19.0	14.3	11.7	8.8	7.2	5.4	4.5	3.3	/	/	/	/	/
75	46.3	34.7	28.5	21.4	17.6	13.2	10.8	8.1	6.7	5.0	/	/	/	/	/
100	61.7	46.3	38.0	28.5	23.5	17.6	14.5	10.8	8.9	6.7	/	/	/	/	/
125	77.1	57.8	47.5	35.7	29.3	22.0	18.1	13.6	11.1	8.4	/	/	/	/	/
150	92.5	69.4	57.0	42.8	35.2	26.4	21.7	16.3	13.4	10.0	6	/	/	/	/
175	107.9	80.9	66.6	49.9	41.0	30.8	25.3	19.0	15.6	11.7		/	/	/	/
200	123.3	92.5	76.1	57.0	46.9	35.2	28.9	21.7	17.8	13.4	10	6	/	/	/
225	138.8	104.1	85.6	64.2	52.8	39.6	32.5	24.4	20.1	15.1			/	/	/
250	154.2	115.6	95.1	71.3	58.6	44.0	36.2	27.1	22.3	16.7			/	/	/
275	169.6	127.2	104.6	78.4	64.5	48.4	39.8	29.8	24.5	18.4	15		/	/	/
300	185.0	138.8	114.1	85.6	70.4	52.8	43.4	32.5	26.8	20.1		10	/	/	/
325	200.4	150.3	123.6	92.7	76.2	57.2	47.0	35.3	29.0	21.7			6	/	/
350	215.8	161.9	133.1	99.8	82.1	61.6	50.6	38.0	31.2	23.4				/	/
375	231.3	173.4	142.6	107.0	87.9	66.0	54.2	40.7	33.4	25.1	20			/	/
400	246.7	185.0	152.1	114.1	93.8	70.4	57.8	43.4	35.7	26.8				/	/
425	262.1	196.6	161.6	121.2	99.7	74.8	61.5	46.1	37.9	28.4				/	/
450	277.5	208.1	171.1	128.3	105.5	79.2	65.1	48.8	40.1	30.1		15		/	/
475	292.9	219.7	180.6	135.5	111.4	83.5	68.7	51.5	42.4	31.8				/	/
500	308.3	231.3	190.1	142.6	117.3	87.9	72.3	54.2	44.6	33.4			10	/	/
525	323.8	242.8	199.7	149.7	123.1	92.3	75.9	56.9	46.8	35.1				6	/
550	339.2	254.4	209.2	156.9	129.0	96.7	79.5	59.7	49.1	36.8					/
575	354.6	265.9	218.7	164.0	134.8	101.1	83.2	62.4	51.3	38.5	30				/
600	370.0	277.5	228.2	171.1	140.7	105.5	86.8	65.1	53.5	40.1		20			/
625	385.4	289.1	237.7	178.3	146.6	109.9	90.4	67.8	55.7	41.8					/
650	400.8	300.6	247.2	185.4	152.4	114.3	94.0	70.5	58.0	43.5					/
675	416.3	312.2	256.7	192.5	158.3	118.7	97.6	73.2	60.2	45.2					/
700	431.7	323.8	266.2	199.7	164.2	123.1	101.2	75.9	62.4	46.8					/
725	447.1	335.3	275.7	206.8	170.0	127.5	104.9	78.6	64.7	48.5			15		/
750	462.5	346.9	285.2	213.9	175.9	131.9	108.5	81.4	66.9	50.2	40				/
775	477.9	358.4	294.7	221.0	181.8	136.3	112.1	84.1	69.1	51.8					/
800	493.3	370.0	304.2	228.2	187.6	140.7	115.7	86.8	71.3	53.5				10	/
825	508.8	381.6	313.7	235.3	193.5	145.1	119.3	89.5	73.6	55.2					6
850	524.2	393.1	323.3	242.4	199.3	149.5	122.9	92.2	75.8	56.9					
875	539.6	404.7	332.8	249.6	205.2	153.9	126.5	94.9	78.0	58.5					
900	555.0	416.3	342.3	256.7	211.1	158.3	130.2	97.6	80.3	60.2					
925	570.4	427.8	351.8	263.8	216.9	162.7	133.8	100.3	82.5	61.9		30			
950	585.8	439.4	361.3	271.0	222.8	167.1	137.4	103.0	84.7	63.5					
975	601.3	450.9	370.8	278.1	228.7	171.5	141.0	105.8	87.0	65.2			20		
1000	616.7	462.5	380.3	285.2	234.5	175.9	144.6	108.5	89.2	66.9					

(NOTE) The lenses of "f=25" and "f=50" are not available.

Distance Z(mm)	Measurement area for the respective lens types										Pitch of the calibration board				
	f=8mm		f=12mm		f=16mm		f=25mm		f=50mm		f=				
	X	Y	X	Y	X	Y	X	Y	X	Y	8	12	16	25	50
1025	632.1	474.1	389.8	292.4	240.4	180.3	148.2	111.2	91.4	68.6	40	30	20	10	6
1050	647.5	485.6	399.3	299.5	246.2	184.7	151.9	113.9	93.6	70.2					
1075	662.9	497.2	408.8	306.6	252.1	189.1	155.5	116.6	95.9	71.9					
1100	678.3	508.8	418.3	313.7	258.0	193.5	159.1	119.3	98.1	73.6					
1125	693.8	520.3	427.8	320.9	263.8	197.9	162.7	122.0	100.3	75.3					
1150	709.2	531.9	437.3	328.0	269.7	202.3	166.3	124.7	102.6	76.9			15		
1175	724.6	543.4	446.8	335.1	275.6	206.7	169.9	127.4	104.8	78.6					
1200	740.0	555.0	456.4	342.3	281.4	211.1	173.5	130.2	107.0	80.3	40				
1225	755.4	566.6	465.9	349.4	287.3	215.5	177.2	132.9	109.3	81.9					
1250	770.9	578.1	475.4	356.5	293.2	219.9	180.8	135.6	111.5	83.6					
1275	786.3	589.7	484.9	363.7	299.0	224.3	184.4	138.3	113.7	85.3					10
1300	801.7	601.3	494.4	370.8	304.9	228.7	188.0	141.0	115.9	87.0					
1325	817.1	612.8	503.9	377.9	310.7	233.1	191.6	143.7	118.2	88.6					
1350	832.5	624.4	513.4	385.0	316.6	237.5	195.2	146.4	120.4	90.3					
1375	847.9	636.0	522.9	392.2	322.5	241.8	198.9	149.1	122.6	92.0					
1400	863.4	647.5	532.4	399.3	328.3	246.2	202.5	151.9	124.9	93.6					
1425	878.8	659.1	541.9	406.4	334.2	250.6	206.1	154.6	127.1	95.3					
1450	894.2	670.6	551.4	413.6	340.1	255.0	209.7	157.3	129.3	97.0					
1475	909.6	682.2	560.9	420.7	345.9	259.4	213.3	160.0	131.6	98.7					
1500	925.0	693.8	570.4	427.8	351.8	263.8	216.9	162.7	133.8	100.3		30			
1525	940.4	705.3	579.9	435.0	357.6	268.2	220.6	165.4	136.0	102.0					
1550	955.9	716.9	589.5	442.1	363.5	272.6	224.2	168.1	138.2	103.7					
1575	971.3	728.5	599.0	449.2	369.4	277.0	227.8	170.8	140.5	105.4			20		
1600	986.7	740.0	608.5	456.4	375.2	281.4	231.4	173.5	142.7	107.0					
1625	1002.1	751.6	618.0	463.5	381.1	285.8	235.0	176.3	144.9	108.7					
1650	1017.5	763.1	627.5	470.6	387.0	290.2	238.6	179.0	147.2	110.4					
1675	1032.9	774.7	637.0	477.7	392.8	294.6	242.2	181.7	149.4	112.0					
1700	1048.4	786.3	646.5	484.9	398.7	299.0	245.9	184.4	151.6	113.7					
1725	1063.8	797.8	656.0	492.0	404.5	303.4	249.5	187.1	153.8	115.4					
1750	1079.2	809.4	665.5	499.1	410.4	307.8	253.1	189.8	156.1	117.1					
1775	1094.6	821.0	675.0	506.3	416.3	312.2	256.7	192.5	158.3	118.7					
1800	1110.0	832.5	684.5	513.4	422.1	316.6	260.3	195.2	160.5	120.4					
1825	1125.4	844.1	694.0	520.5	428.0	321.0	263.9	198.0	162.8	122.1					
1850	1140.9	855.6	703.5	527.7	433.9	325.4	267.6	200.7	165.0	123.7					
1875	1156.3	867.2	713.1	534.8	439.7	329.8	271.2	203.4	167.2	125.4			15		
1900	1171.7	878.8	722.6	541.9	445.6	334.2	274.8	206.1	169.5	127.1					
1925	1187.1	890.3	732.1	549.1	451.5	338.6	278.4	208.8	171.7	128.8					
1950	1202.5	901.9	741.6	556.2	457.3	343.0	282.0	211.5	173.9	130.4					
1975	1217.9	913.5	751.1	563.3	463.2	347.4	285.6	214.2	176.1	132.1					
2000	1233.4	925.0	760.6	570.4	469.0	351.8	289.2	216.9	178.4	133.8					

(NOTE) The lenses of "f=25" and "f=50" are not available.

- This table is based on the nominal calculation. The real value includes some small errors.
- The "Distance Z[mm]" shows the distance between the measurement target object and the camera CCD (See the next page)
- This table shows the data for the "1/3 inch camera" (3 hundred thousand pixels / 1.3 million pixels) (Sony HR50)

(Reference) The distance Z[mm] between the camera and the measurement target object**(Reference) The overview of a calibration board**

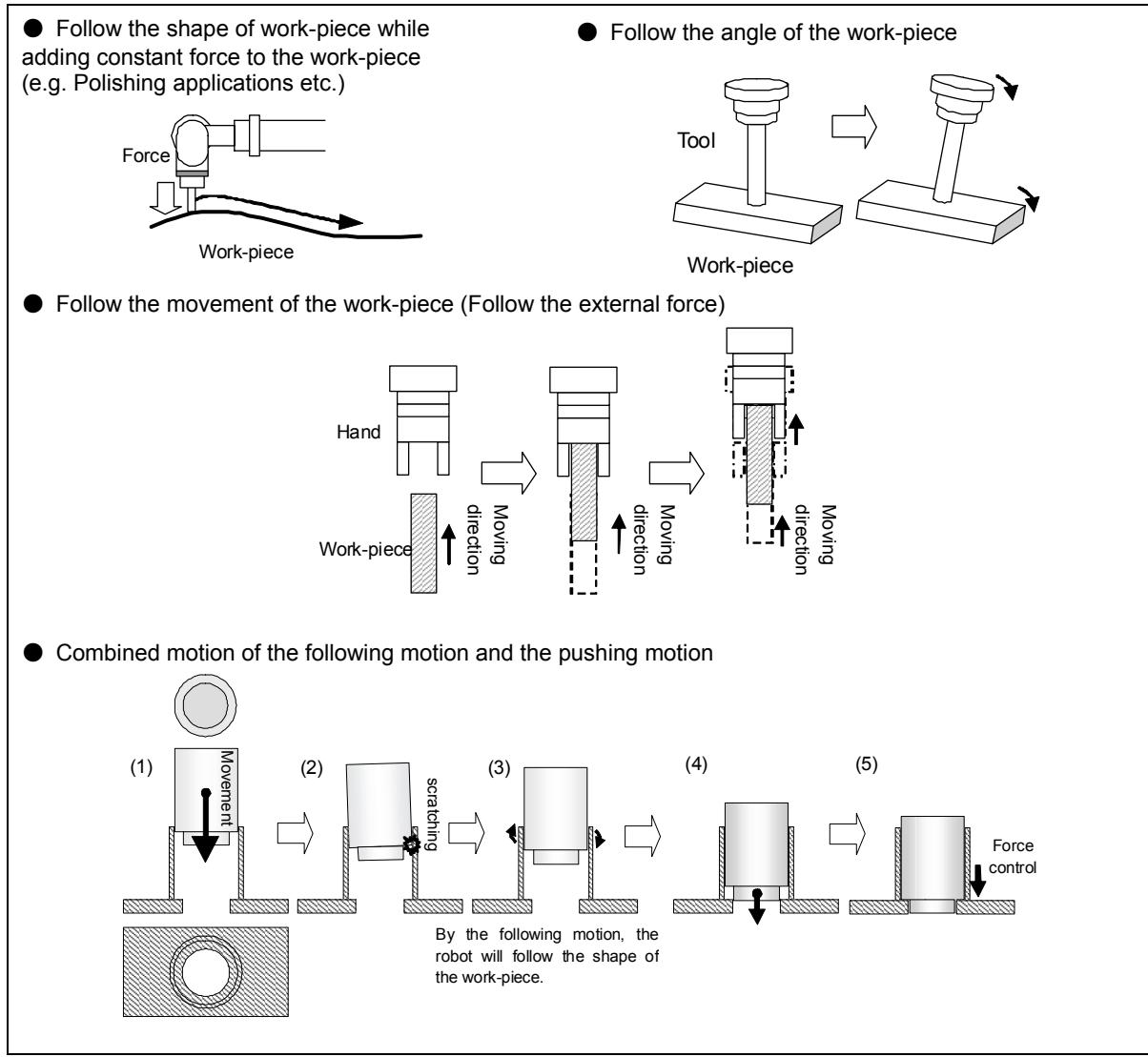
NOTE

Chapter 17 Force Sensor

The force control function provides the interface for customers to utilize the force/torque data obtained from force sensor and provides the force control performance of robot.

By utilizing this interface, it's possible to select the robot movement due to the occurring force and to output signals corresponding to the occurring force to external device. Also by utilizing force control, it's possible to push the work piece with the constant force, and to touch the work piece with the specified condition.

See the figures below for detail of these movements.



To utilize this option, Smart TP or combination of Compact TP and PC tool "FD on Desk Light" is necessary. Compact TP (without PC tool) is not enough to utilize this option.

This document includes the information only for setup of this option such as assembling and wiring. Please refer to another manual "FD controller instruction manual Force Sensor", (TFDEN-106-###) for detail of operation.

17.1 Force Sensor

Specification of force sensor

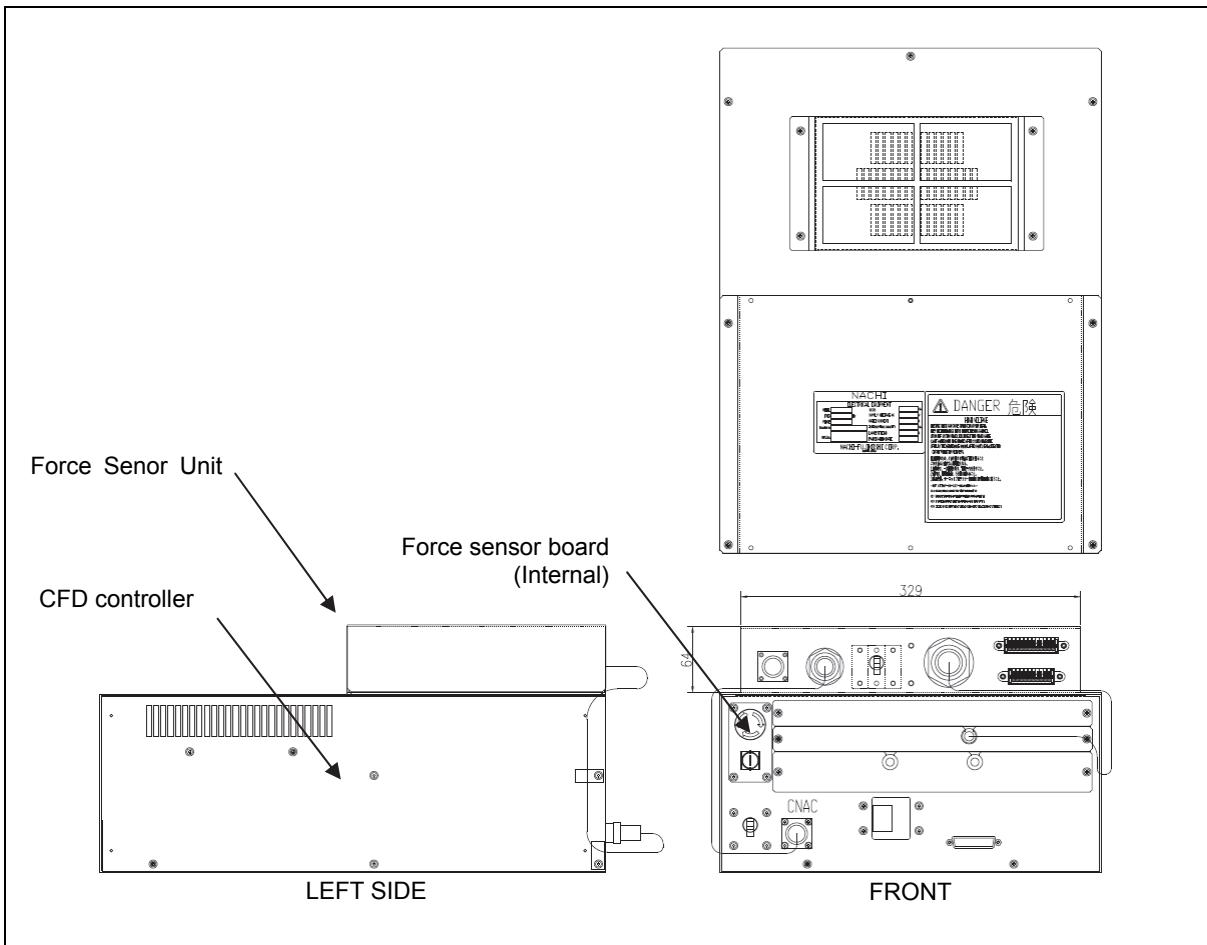
Item	Description
Type	WACOH WEF-6A series
Dimension	$\phi 50 \times H32.5\text{mm}$
Rated load	200 N (Moment load 4 Nm)
Resolution	0.122 N/pulse (Moment load 0.0024 Nm/pulse)
Mass	For MZ07 series : Approx. 1.3 kg (Sensor + fixing flange set)

17.2 Force Sensor Unit

Specification of Force Sensor Unit

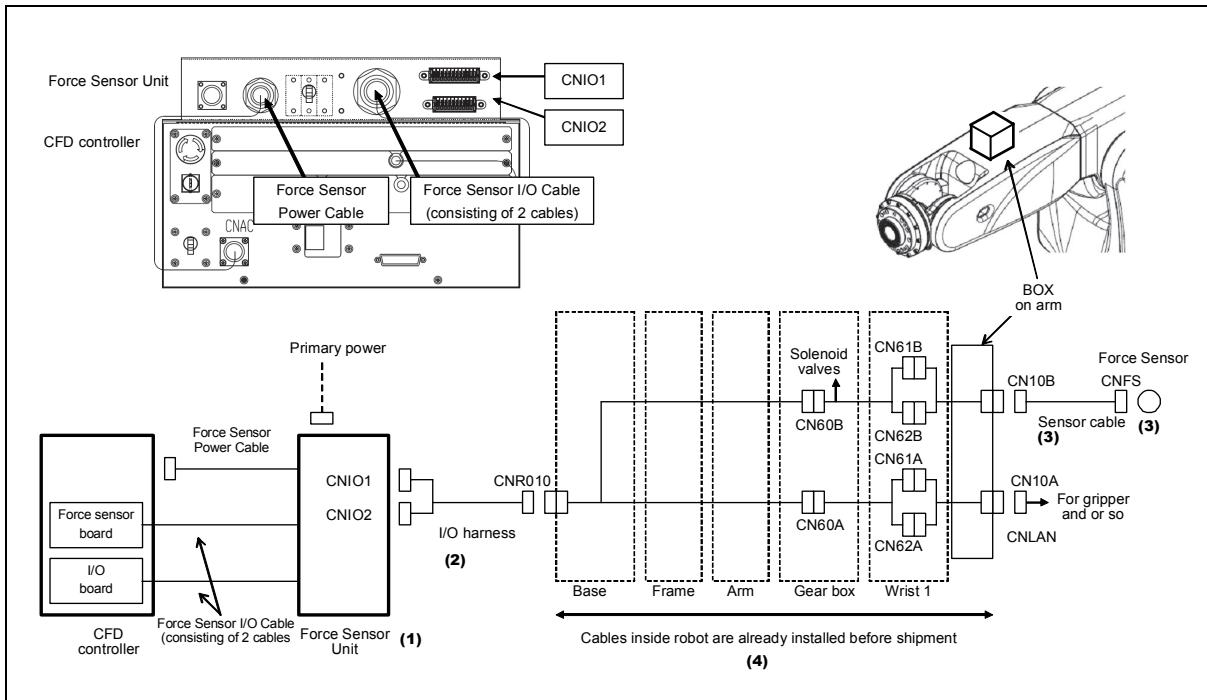
Item	Description
Dimension	W369 × D250 × H69
Mass	Approx. 3 Kg
Primary power	AC200V – 230V +/- 10% (3 phase, 50/60Hz) D grounding AC200V – 230V +/- 10% (2 phase, 50/60Hz) D grounding (power for CFD controller is supplied from this unit)
Installation environment	(same as CFD controller)

Force Sensor Unit is fixed on CFD controller.



External view of Force Sensor Control Unit

17.3 Construction

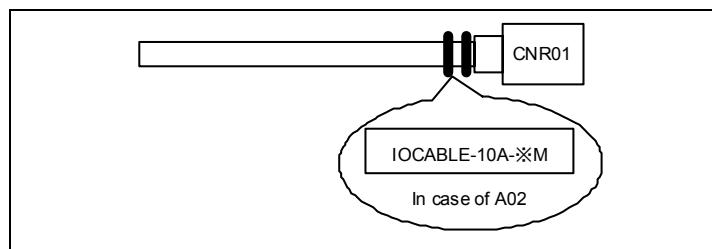


Connection of Force Sensor system (MZ07)

No.	Part name	Part No.	Remarks
(1)	Force Sensor Unit	CFD-OP152-A CFD-OP152-B	-A: Standard specification -B: CE Specification With Force Sensor Power Cable and Force Sensor I/O Cable (consisting of 2 cables) (all connected)
(2)	I/O harness (*)	IOCABLE-10-※M (Revision A02)	※: Cable length 5,10,15,20,25m (CNIO1) □ —————□ CNR010 (CNIO2) □ —————□ CNIO1/2 side needs to be manufactured by customer
(3)	Force Sensor	CFD-OP152-F01	Force Sensor WACOH WEF-6A series Sensor Cable CFD-152F-C08-001 Attachment bracket CN10B □ —————□ CNFS ○
(4)	MZ07	MZ07※-01-F※※	Force Sensor specification

(*) I/O harness

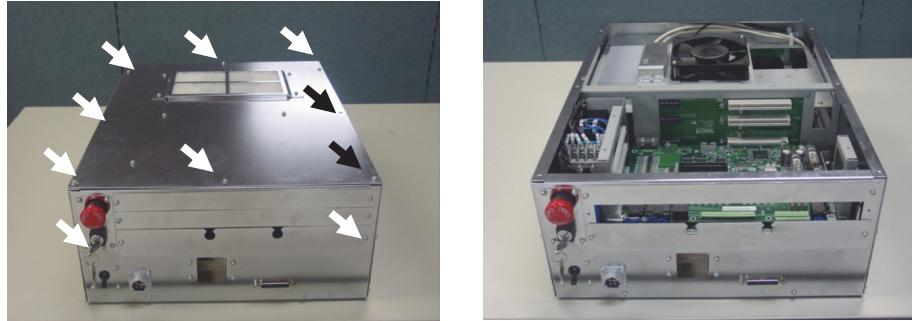
There are 2 types for the I/O harness.
(Revision A01 and A02) For the force sensor, please use A02 or more.



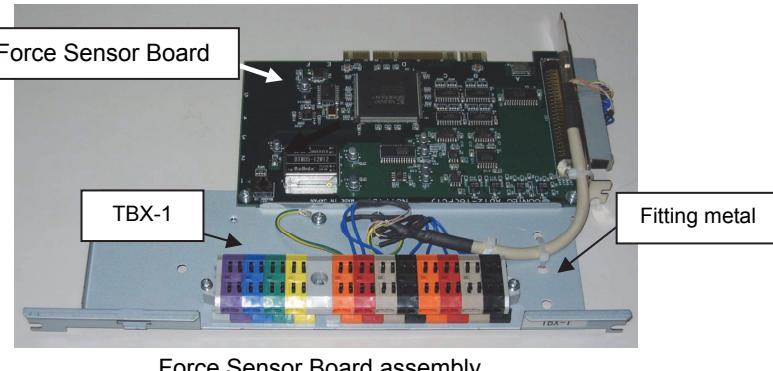
17.4 Installing Force Sensor Board

Please install Force Sensor Board assembly in CFD controller.

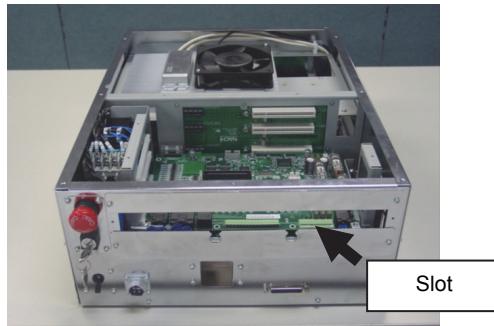
- 1 Turn off the controller power and disconnect the primary power source connector.
- 2 Loosen the screws on the top panel and the front side cable drawing panel.



- 3 Fix Force Sensor Board assembly to the slot.



Force Sensor Board assembly



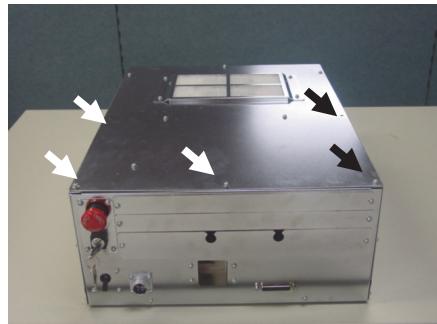
- 4 Install the new front panel.

(Please use the new "front side cable drawing panel" which is shipped with this option. Old one can not be used. But old "top panel" can be used again.)

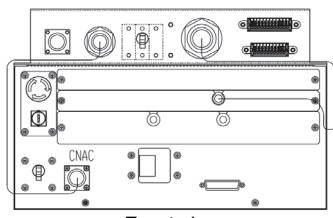
17.5 Assembling Force Sensor Unit

Please install Force Sensor Unit on CFD controller.

- 1 Loosen and remove the screws of CFD controller top panel.



- 2 Put Force Sensor Unit on CFD controller.



- 3 Fix Force Sensor Unit with top panel together on CFD controller.

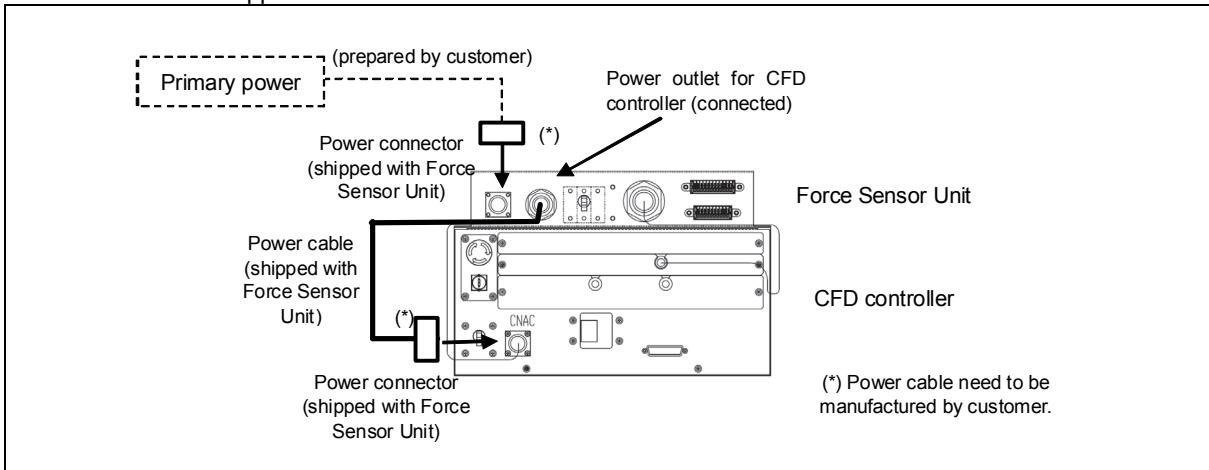
17.6 Connection of Primary Power

■ Connection of primary power

Power to CFD controller is supplied from Force Sensor Unit.

Primary power supply to Force Sensor Unit needs to be prepared by customer.

Power connector is shipped with Force Sensor Unit.



Primary power supply connection

Rating of primary power

Manipulator used in combination	Rated voltage	Power-handling capacity ^(Note)
MZ series	3-phase AC200V-230V Single-phase AC200V-230V (+10%, -10%) 50/60 Hz	0.4 kVA

(Note) Varies according to the application and operation pattern.

Connector pin layout Seeing from the soldering side		Connection		
PIN No.		3 - phase AC200V	Single - phase AC200V	
1	AC200V R-phase (Red)	AC200V R-phase (Red)		
2	AC200V S-phase (White)		-	
3	AC200V T-phase (Black)	AC200V T-phase (Black)		
4	Ground (Green/Yellow)	Ground (Green/Yellow)		

Applicable cable diameter:
10~12.5 [mm]
Connector type:
Nanaboshi Electric Mfg.Co.,Ltd.
NJW-204-PF12

Primary power supply cable connection

Primary power supply cable specification

Manipulator used in combination	Cross-section of power cable	Cross-section of grounding cable
MZ series	1.25mm ² AWG16	1.25mm ² AWG16

■ Grounding

To ensure safety, use the grounding method type D. (Customer is responsible for providing grounding wires.)

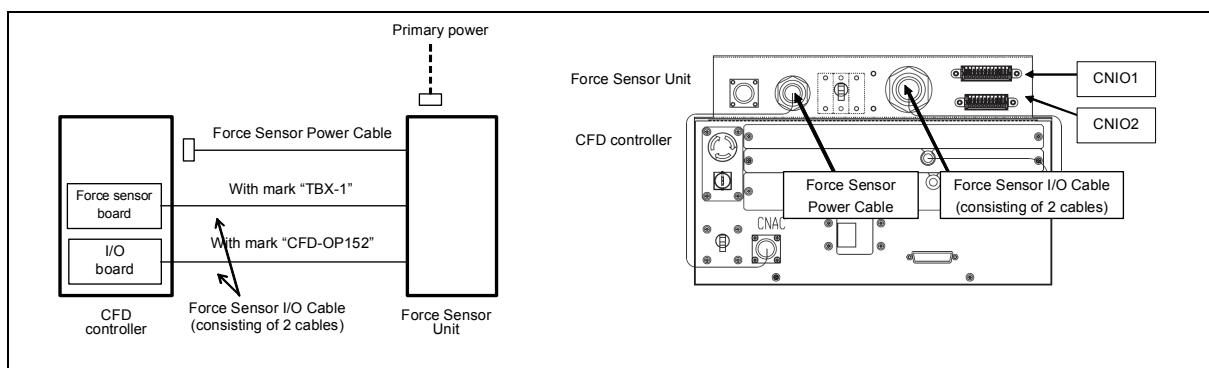
- Ensure that power cable is larger than 1.25 mm², and ground cable is larger than 1.25 mm².
- Ground resistance should be less than 100 ohms.

■ Leakage breaker

Please use a leakage breaker that satisfies the following specification.

Rated current: 10A or more / For inverter / Middle sensitivity type (100mA or more)

17.7 Connection of CFD controller



Connection of vision unit and CFD controller

■ Connection of Cable with mark “CFD-OP152” of “Force Sensor I/O Cable”

In case of using wires inside robot arm, connect this cable to I/O board inside of CFD controller.



I/O signals from CFD controller (signal A01 to A3) to Force Sensor Unit is through out to connector CNIO1/CNIO2.
Please refer to “CFD controller Technical Document 2” (TCFDEN-156-###), “Chapter 2 Mini I/O” and “Chapter 3 Digital I/O” for detail of I/O specification and connection.

Wire color of Cable with mark “CFD-OP152” of “Force Sensor I/O Cable”

No.	Wire No.	Color
1	Not used	Black / White
2	Not used	Red / White
3	A01 / A02	Green / White
4	A03 / A04	Yellow / White
5	A05 / A06	Brown / White
6	A07 / A08	Blue / Pink

No.	Wire No.	Color
7	A09 / A10	Gray / Pink
8	A11 / A12	Orange / Pink
9	A13 / ---	Purple / Pink
10	Not used	Light Blue / Pink
11	G	shield

■ Connection of Cable with mark “TBX-1” of “Force Sensor I/O Cable”

Connect this cable to Force Sensor board inside of CFD controller.

Terminal board (TBX-1) Pin allocation on Force Sensor Board

No.	Wire No.	Color
1	Fx	Black Right
2	—	Black Left
3	Fy	Beige Right
4	—	Beige Left
5	Fz	Red Right
6	—	Red Left
7	Mx	Orange Right
8	—	Orange Left
9	My	Black Right
10	—	Black Left
11	Mz	Beige Right
12	—	Beige Left

No.	Wire No.	Color
13	GND	Red Right
14	—	Ref Left
15	—	Orange Right
16	—	Orange Left
17	—	Yellow Right
18	—	Yellow Left
19	—	Green Right
20	—	Green Left
21	—	Blue Right
22	—	Blue 左 Left
23	—	Purple Right
24	—	Purple Left

Wire color of Cable with mark “TBX-1” of “Force Sensor I/O Cable”

No.	Wire No.	Color
1	Fx	Pink / Black dot
2	Fy	Pink / Red dot
3	Fz	Orange / Black dot
4	Mx	Orange / Red dot
5	My	White / Black dot

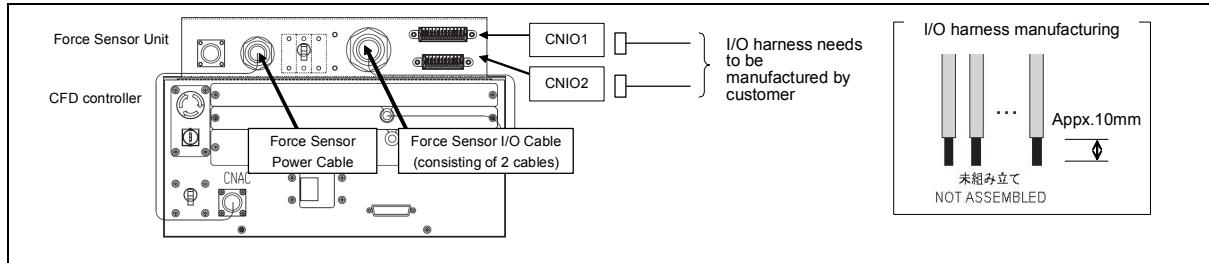
No.	Wire No.	Color
6	Mz	White / Red dot
7	GND	Yellow / Black dot
8	Not used	Yellow / Red dot
9	Not used	Gray / Black dot
10	Not used	Gray / Red dot

17.8 Connection of peripheral equipments

■ Connection of “I/O harness”

Cut “I/O harness” to the adequate length and manufacture all end of wires. Then connect them to CNIO1 and CNIO2 connectors on Force Sensor Unit front panel. Please refer to “Chapter 13 MZ07 series I/O Harness” for detail.

Please use the I/O harness whose revision is A02 or more.



Force Sensor Unit connectors on front panel: CNIO1,2

Connector CNIO1 Pin allocation

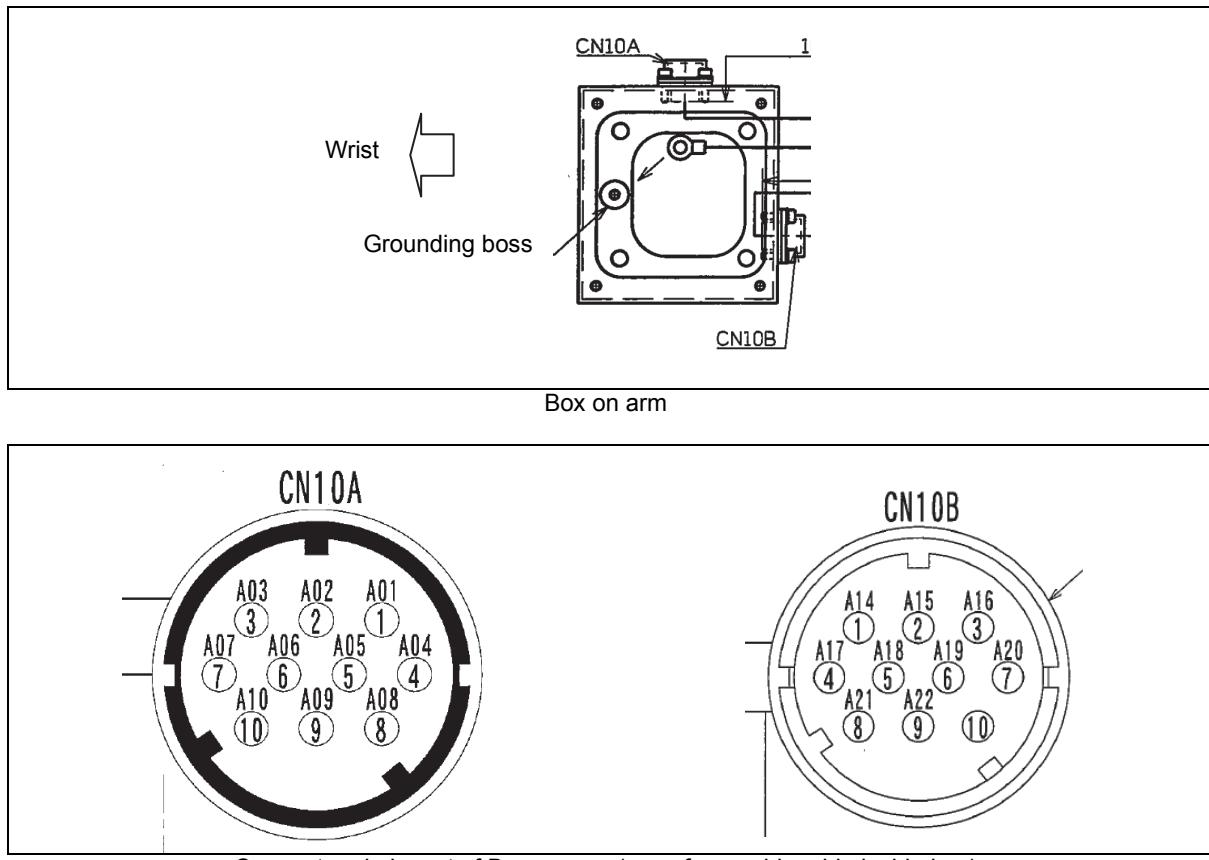
Pin No.	Wire No.	Name	Remarks
1	A01	Force Sensor I/O harness A01	
2	A02	Force Sensor I/O harness A02	
3	A03	Force Sensor I/O harness A03	
4	A04	Force Sensor I/O harness A04	
5	A05	Force Sensor I/O harness A05	
6	A06	Force Sensor I/O harness A06	
7	A07	Force Sensor I/O harness A07	
8	A08	Force Sensor I/O harness A08	
9	A09	Force Sensor I/O harness A09	
10	A10	Force Sensor I/O harness A10	
11	A11	Force Sensor I/O harness A11	
12	A12	Force Sensor I/O harness A12	

Connector CNIO2 Pin allocation

Pin No.	Wire No.	Name	Remarks
1	A13	Force Sensor I/O harness A13	
2	A14	Force Sensor Signal VCC	
3	A15	Force Sensor Signal TXD+	
4	A16	Force Sensor Signal RXD+	
5	A17	Force Sensor Signal GND	Ground of VCC
6	A18	Force Sensor Signal TXD-	
7	A19	Force Sensor Signal RXD-	
8	A20	Force Sensor Signal FG	
9	A21	Force Sensor Signal SG	
10	A22	—	

■ Connection of “Cable on arm” and “Box on arm”

Please refer to “Chapter 14 MZ series I/O Cable on Arm” for detail of “Cable on arm”.
“Box on arm” is already mounted on robot arm before shipment.



Connector pin layout of Box on arm (seen from solder side inside box)

Connector CN10A Pin allocation (for all specification)

Pin No.	Wire No.	Name	Remarks
1	A01	I/O signal A01	
2	A02	I/O signal A02	
3	A03	I/O signal A03	
4	A04	I/O signal A04	
5	A05	I/O signal A05	
6	A06	I/O signal A06	
7	A07	I/O signal A07	
8	A08	I/O signal A08	
9	A09	I/O signal A09	
10	A10	I/O signal A10	

Connector CN10B Pin allocation

Pin No.	Wire No.	Name	Remarks
1	A14	Force Sensor Signal VCC	
2	A15	Force Sensor Signal TXD+	
3	A16	Force Sensor Signal RXD+	
4	A17	Force Sensor Signal GND	
5	A18	Force Sensor Signal TXD-	
6	A19	Force Sensor Signal RXD-	
7	A20	Force Sensor Signal FG	
8	A21	Force Sensor Signal SG	
9	A22	—	
10	—	—	

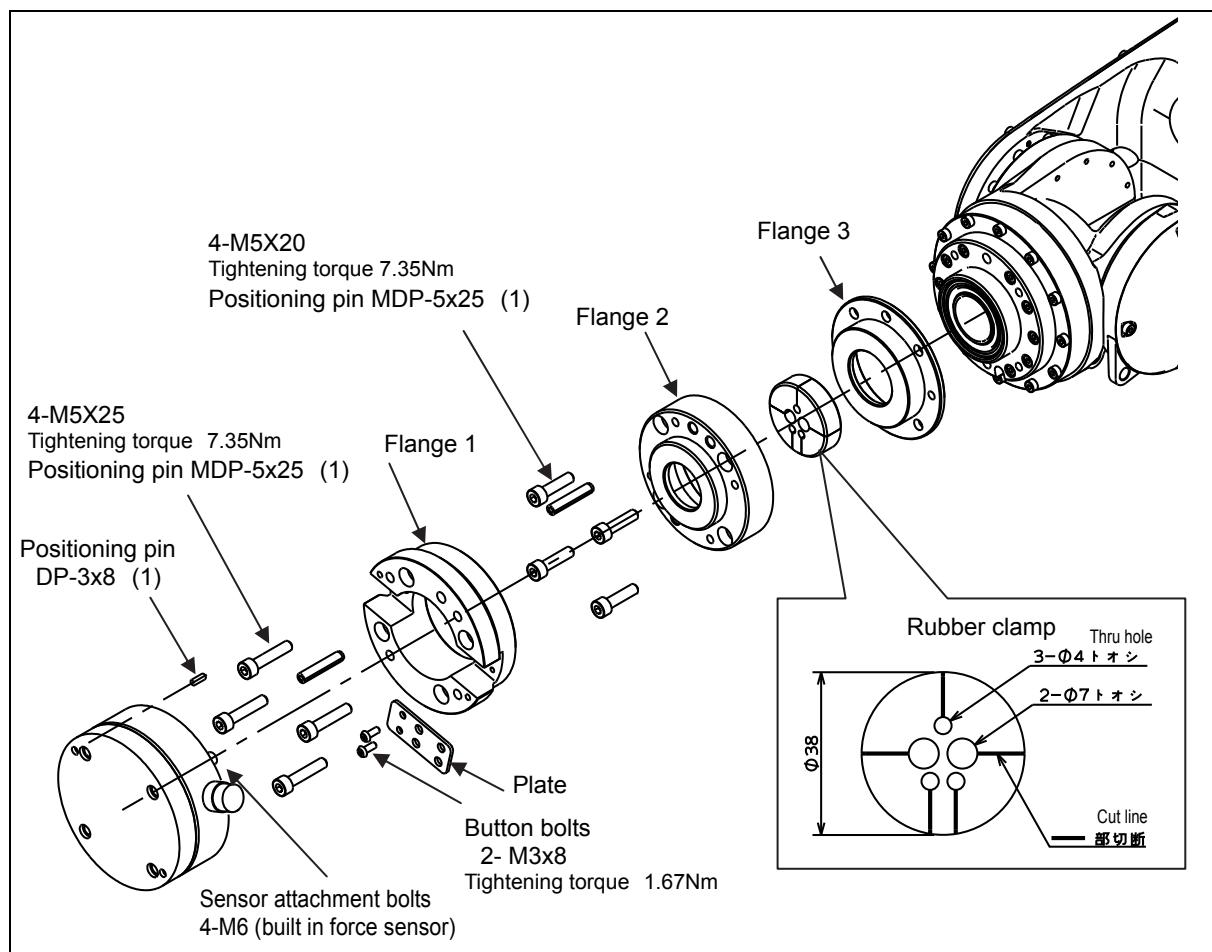
17.9 Mounting Force Sensor

Force Sensor is inserted between the robot's tool installation flange and end-effector.

17.9.1 MZ07 series

Main contained parts

Name	Manufacture	Parts No.	Q'ty	Specification
Flange 1	Fujikoshi	UMMZ07-01W6-013	1	$\phi 80$ H=24.5
Flange 2	Fujikoshi	UMMZ07-01W3-011	1	$\phi 72$ H=21
Flange 3	Fujikoshi	UMMZ07-01W3-012	1	$\phi 72$ H=13.5
Plate	Fujikoshi	UMMZ07-01W6-014	1	
Rubber clamp	Fujikoshi	UMMZ07-01W6-141	1	$\phi 38$ Chloroprene rubber



Mounting Force Sensor

How to install

Step	Work performed
1	Pierce all wires (including sensor cable) and air tubes in hollow of wrist.
2	Pierce all wires and air tubes to "Flange 3".
3	Pierce all wires and tubes to "Rubber clamp". This work is very easy because "Rubber clamp" has cut line as shown in the figure.
4	Pierce all wires and air tubes to "Flange 2" and place it on "Rubber clamp". At last fix them with bolts.
5	Pierce all wires and air tubes to "Flange 1" and fix them with bolts.
6	Fix "Plate" with bolts.
7	Fix all wires and air tubes on "Plate" with cable band (2 positions).
8	Mount Force Sensor.

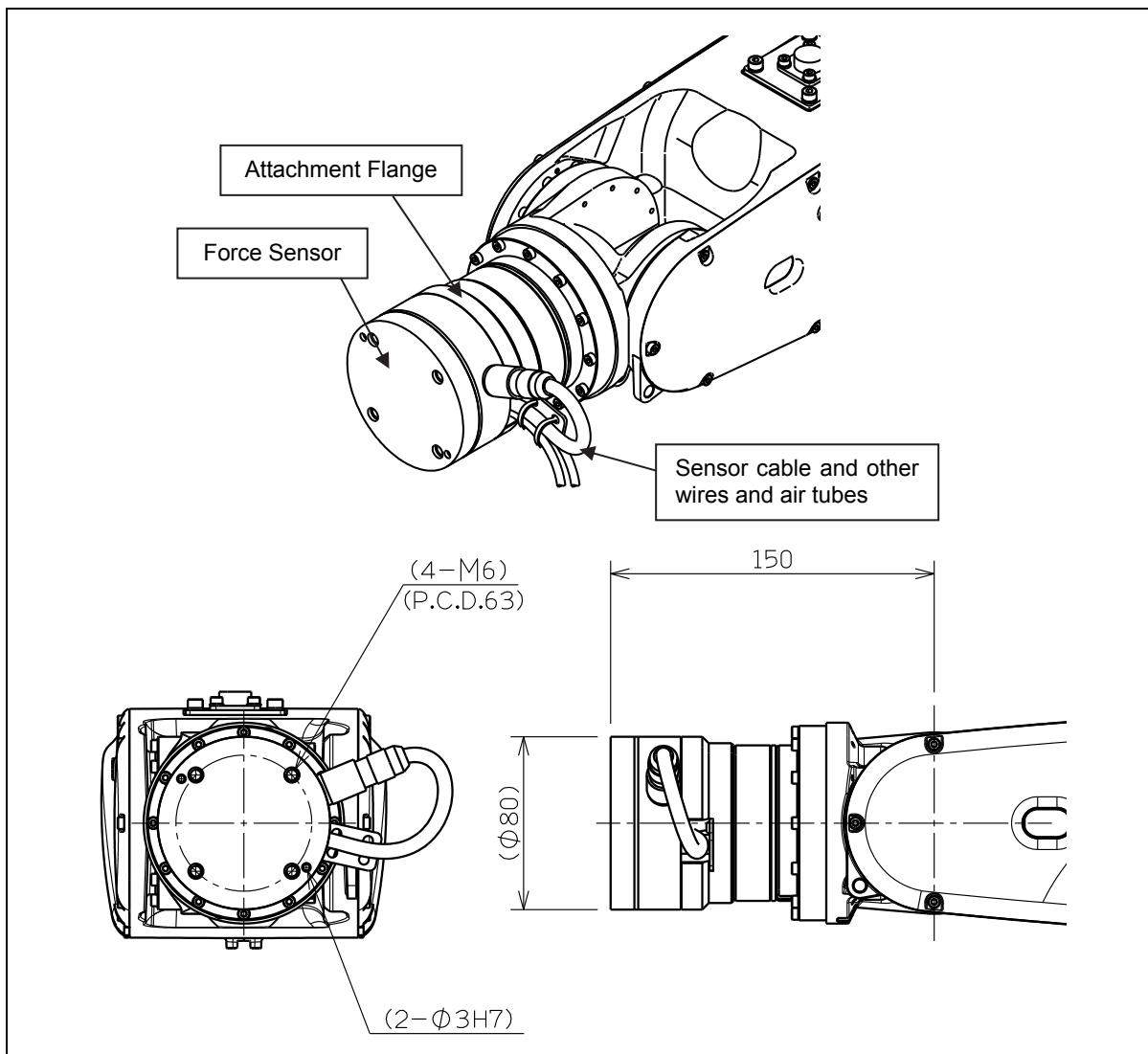


Be sure to screw M5 fixing bolts in the wrist not deeper than the screw depth in the mounting face.
Screwing the bolts deeper than the screw depth may damage the wrist.



This line shows the
detection axis X

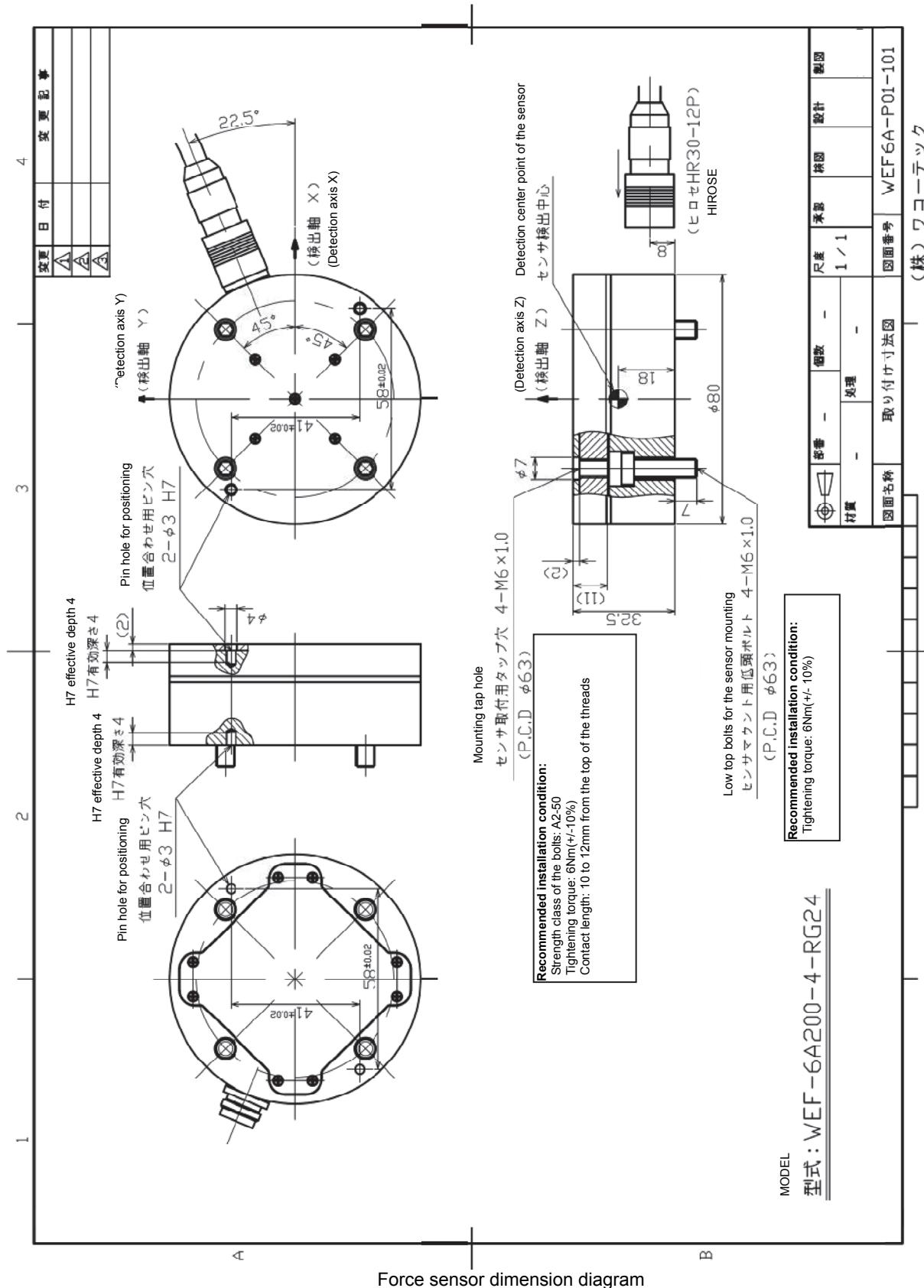
External view of Force Sensor



Final appearance of mounted Force Sensor



- Mass of Force Sensor + Attachment Flange is approximately 1.3kg.
This mass is included in tool weight. So mass of gripper + work-piece which can be mounted on robot tool is approximately 5.7kg.
- Concerning the detection axis, see the next page.



17.10 Operating

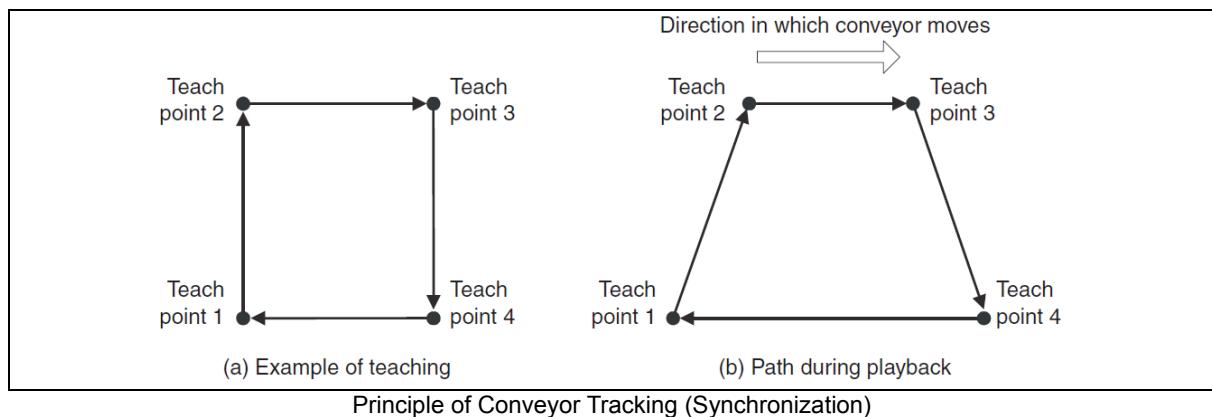
Please refer to another manual “FD controller instruction manual Force Sensor”, (TFDEN-106-###) for detail of operation.

NOTE

Chapter 18 Conveyor Tracking

This option ensures that robot tracks the conveyor in synchronization with conveyor's movement. It enables the correlation between the tool positions and postures and the work position which was established at the teaching stage to be maintained. The teaching is done when conveyor is stopping. During playback, robot calculates the position of conveyor using the signals from the pulse generator to track conveyor.

It is now assumed that the teaching shown in figure (a) below has been performed when the conveyor is at a standstill. If what has been taught is played back while the conveyor is moving, the robot will move along the path shown in figure (b) below. When viewed from the perspective of the work personnel, the movements appear as shown in figure (b) below, but when viewed from a point on the conveyor, they appear as shown in figure (a).



To utilize this option, Smart TP or combination of Compact TP and PC tool "FD on Desk Light" is necessary. Compact TP (without PC tool) is not enough to utilize this option.

This document includes the information only for setup of this option such as assembling and wiring. Please refer to another manual "FD controller instruction manual Conveyor Tracking", (TFDEN-050-###) for detail of operation.

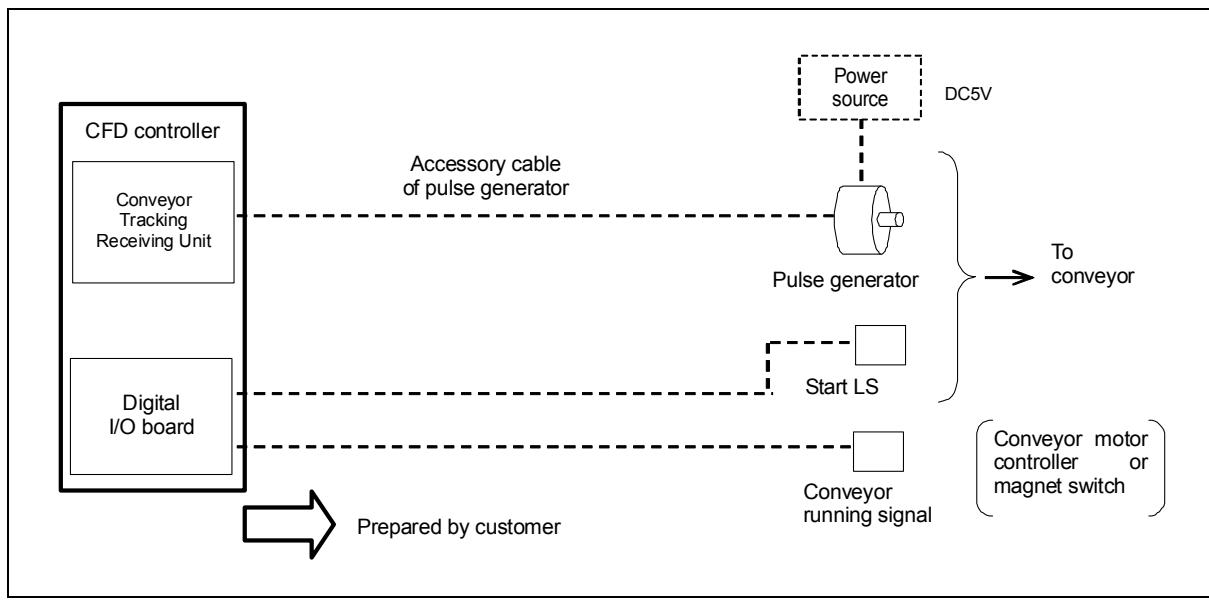
18.1 Construction

Contained parts of this option : CFD-OP47-A

Equipment	Manufacturer	Type or so
Digital I/O	NACHI	This is DC24V I/O board to connect Start LS and or so. This is installed inside robot controller cabinet. Type; CFD-OP125-A or CFD-OP125-B (☞ "CFD controller Technical Document 2" "Chapter 3 Digital I/O")
Conveyor Tracking Receiving Unit	NACHI	This is a unit to read conveyor pulse sent from Pulse Generator (prepared by customer). This is installed inside robot controller cabinet.

Other equipments and works needed for conveyor tracking system (Prepared by customer)

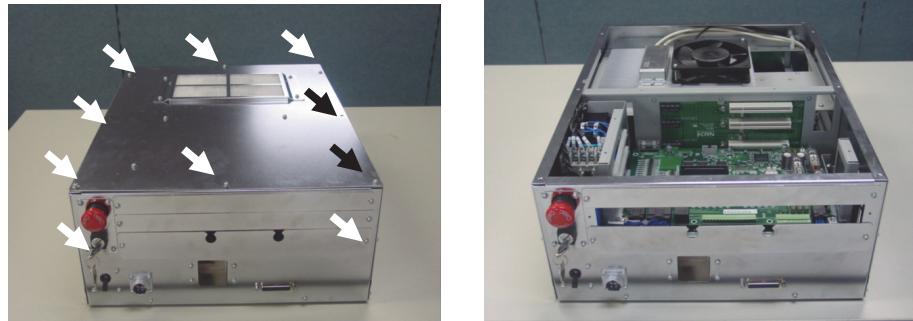
Equipment pr Work	Manufacturer	Type or so
Pulse Generator	(any)	Recommended; OMRON E6C2-CWZ1X
Start LS	(any)	When this limit switch is activated, robot starts counting of conveyor pulse and initiates conveyor tracking motion.
Connecting cables between equipments and those work	(any)	Connecting cables between all above equipments and those work



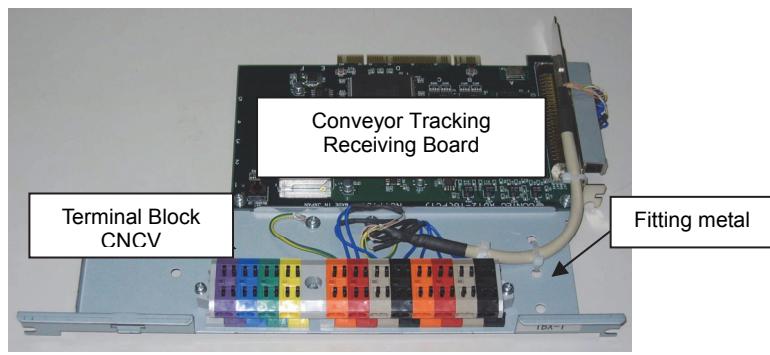
18.2 Installing Conveyor Tracking Receiving Unit

Please install Conveyor Tracking Receiving Unit in CFD controller.

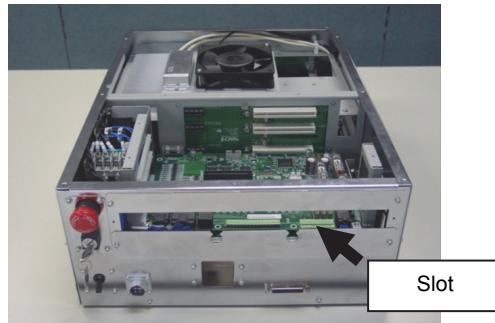
- 1 Turn off the controller power and disconnect the primary power source connector.
- 2 Loosen the screws on the top panel and the front side cable drawing panel.



- 3 Fix Force Sensor Board assembly to the slot.



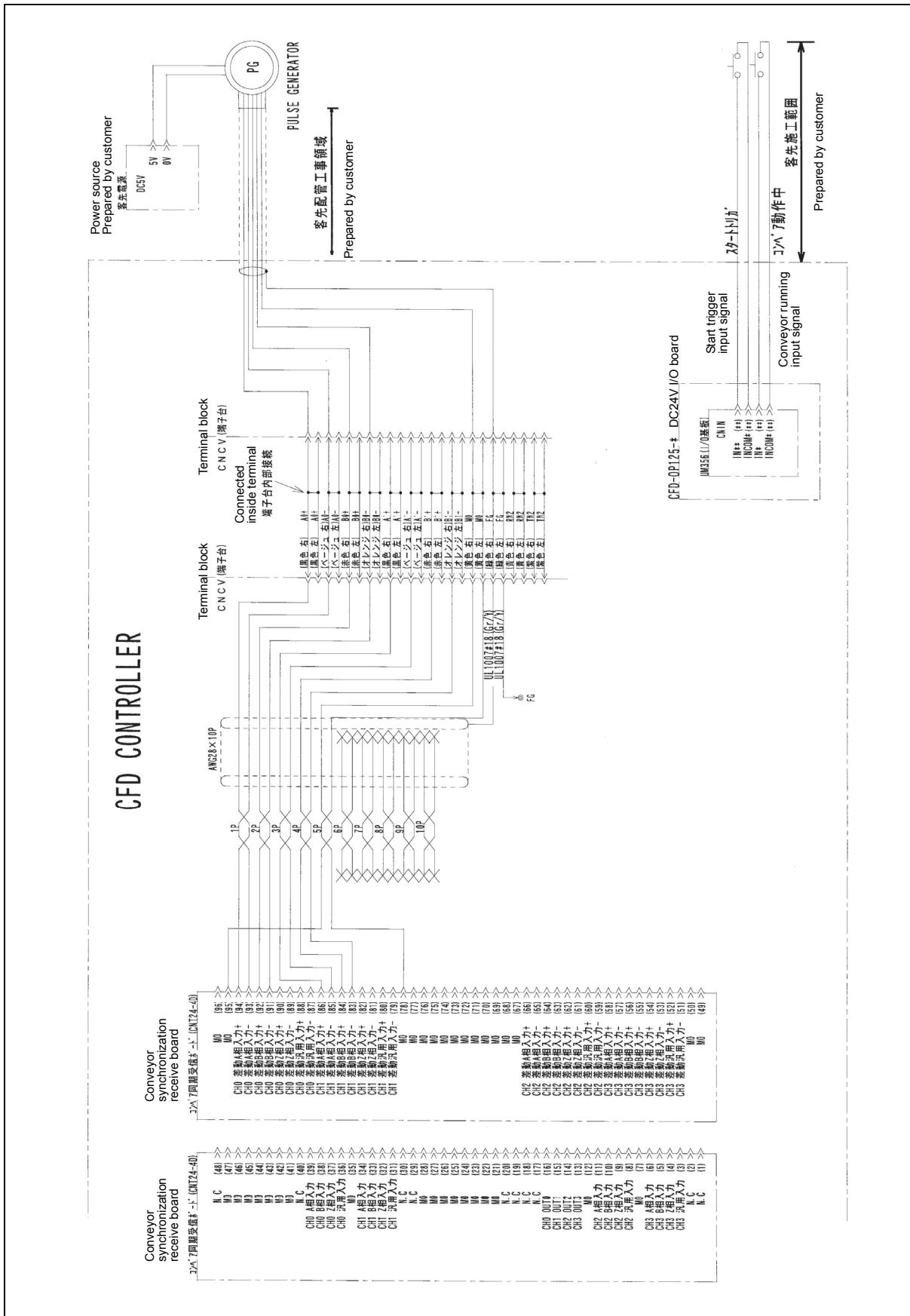
Conveyor Tracking Receiving Unit



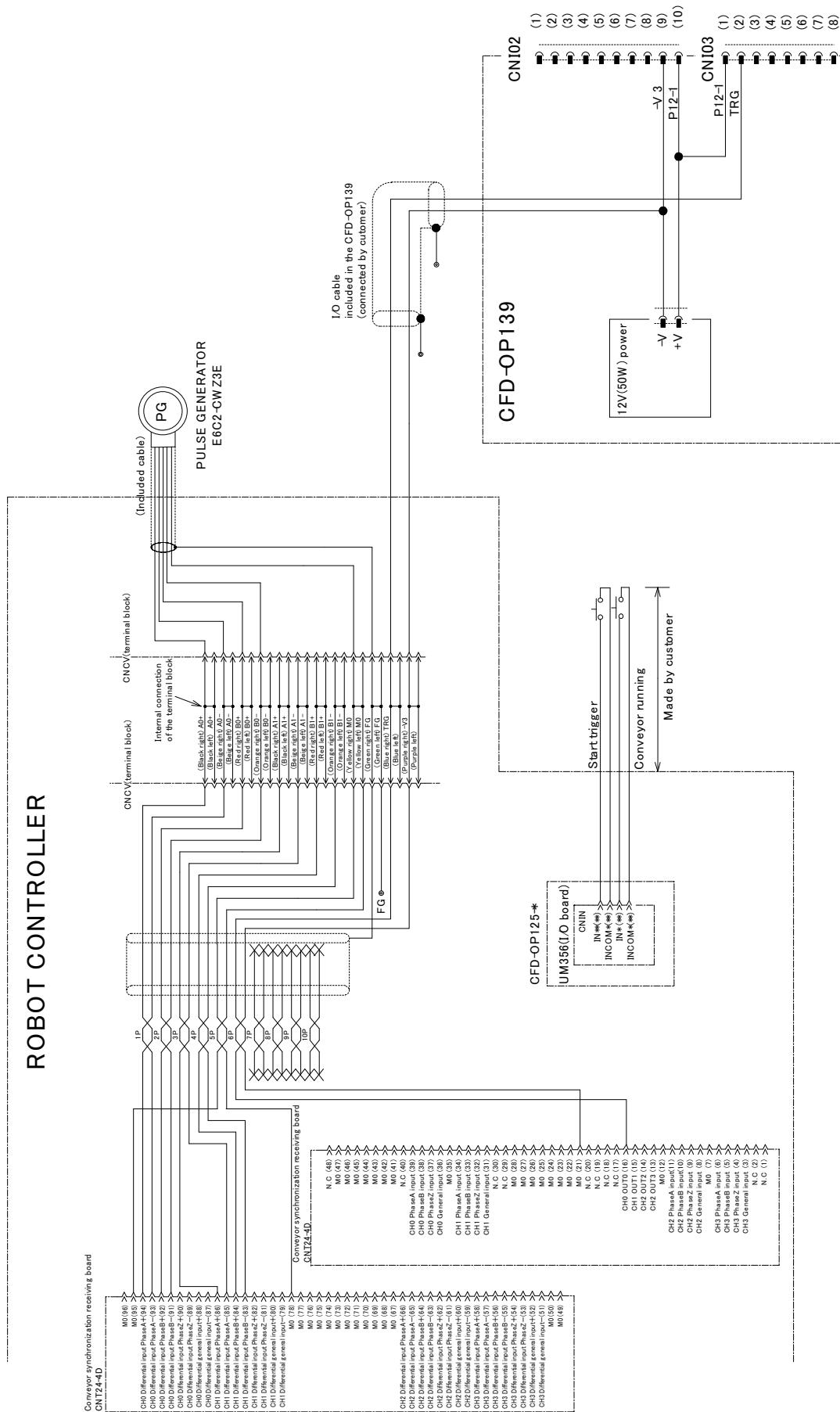
- 4 Install the new front panel.

(Please use the new "front side cable drawing panel" which is shipped with this option. Old one can not be used. But old "top panel" can be used again.)

18.3 Connection of Peripheral Equipments



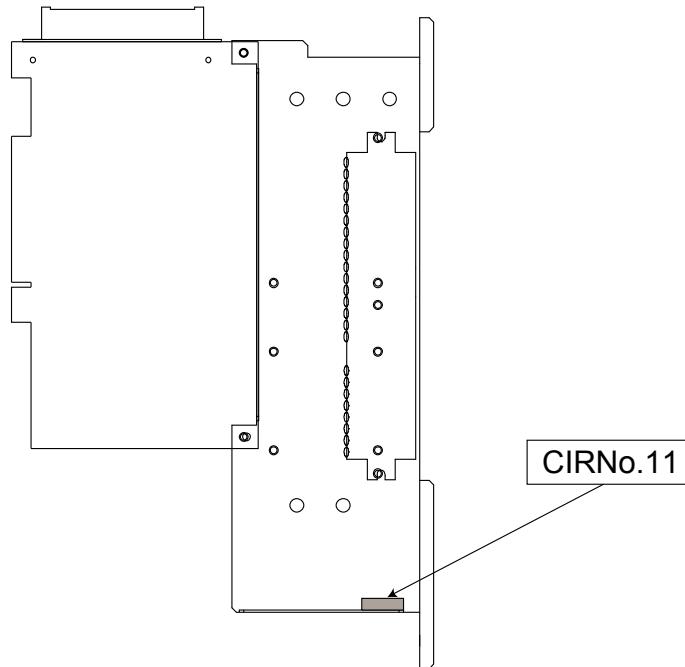
Connection of peripheral equipments



Connection of peripheral equipments (In case of Vision conveyor tracking)

The conveyor tracking board for the Vision conveyor tracking

A board that has a label of **CIRNo.11** can be used for the Vision conveyor tracking application.
If the conveyor tracking board does not have this label, **it cannot be used for the Vision conveyor tracking application.**



■ Pulse generator -> CFD controller Receiving Unit (Terminal block CNCV)

Wires (Accessory cable of pulse generator) from pulse generator mounted on conveyor must be connected to terminals block CNCV of Receiving Unit in CFD controller.
Please refer to the diagram of previous page for detail.



Do not bind the power and signal cables together, and run through separate tubes (such as steel or flexible tubes).

■ “Start LS” and “Conveyor running” signal -> CFD controller Digital I/O board

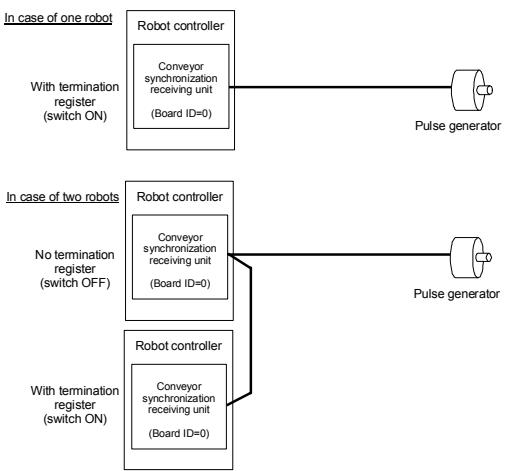
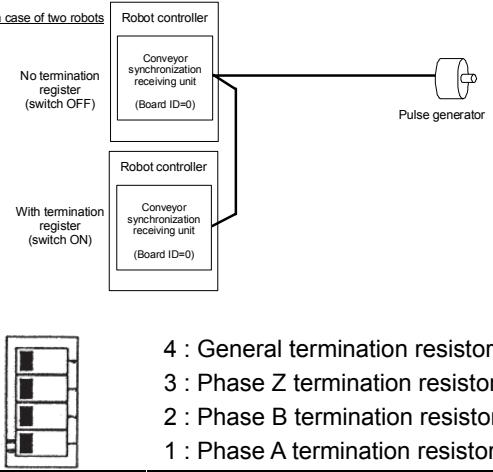
Connect the signal from Start LS mounted on conveyor to the pin allocated to “Start LS” on Digital I/O board input connector in robot controller.

Connect the signal from the conveyor motor control panel or electromagnetic switch to the pin allocated to “conveyor running” on Digital I/O board input signal connector in robot controller.

Please refer to “Instruction Manual “CFD controller Technical Document 2” “Chapter 3 Digital I/O” for the electric specification of DC24V input circuit.

■ Jumper setting of Print Circuit Board in Receiving Unit

	Purpose	Explanation	Factory setting
SW1	Board ID	<p>In case that one robot synchronizes with two conveyors, this setting is necessary to identify the receiving unit in robot controller.</p> <p>First conveyor : Board ID = 0 Second conveyor : Board ID = 1</p>	 Board ID=0
SW2	One shot pulse output	Not used	 All ON (fixed)
SW3	Channel 3 Termination resistor	Not used	 All ON (fixed)
SW4	Channel 2 Termination resistor	Not used	 All ON (fixed)

	Purpose	Explanation	Factory setting
SW5	Channel 1 Termination resistor	<p>This is used to select existence / no-existence of termination resistor in conveyor pulse line. Pay attention to this setting when one conveyor is connected with plural robot.</p> <p>With termination resistor ; In case that only one robot is used or in case that this robot is at the last of chain connection in plural robot, turn all of 4 switches to ON.</p> <p>No termination resistor ; In case that this robot is not at the last of chain connection in plural robot, turn all of 4 switches to OFF.</p> 	 All ON (with Termination register)
SW6	Channel 0 Termination resistor		 All ON (with Termination register)

18.4 Operating

Please refer to another manual "FD controller instruction manual Conveyor Tracking", (TFDEN-050-###) for detail of operation.

Chapter 19 Additional 1 Servo Axis

1 servo axis is added on CFD controller (Standard: 6-axes) to make it possible to drive 7 axes.



To utilize this option, Smart TP or combination of Compact TP and PC tool "FD on Desk Light" is necessary. Compact TP (without PC tool) is not enough to utilize this option.

This document includes the information only for setup of this option such as assembling and wiring. Please refer to another manual written in "19.9 Setup Operation" for detail operation such as format and servo adjustment procedure.

Basic specifications of "Additional Axis Drive Unit"

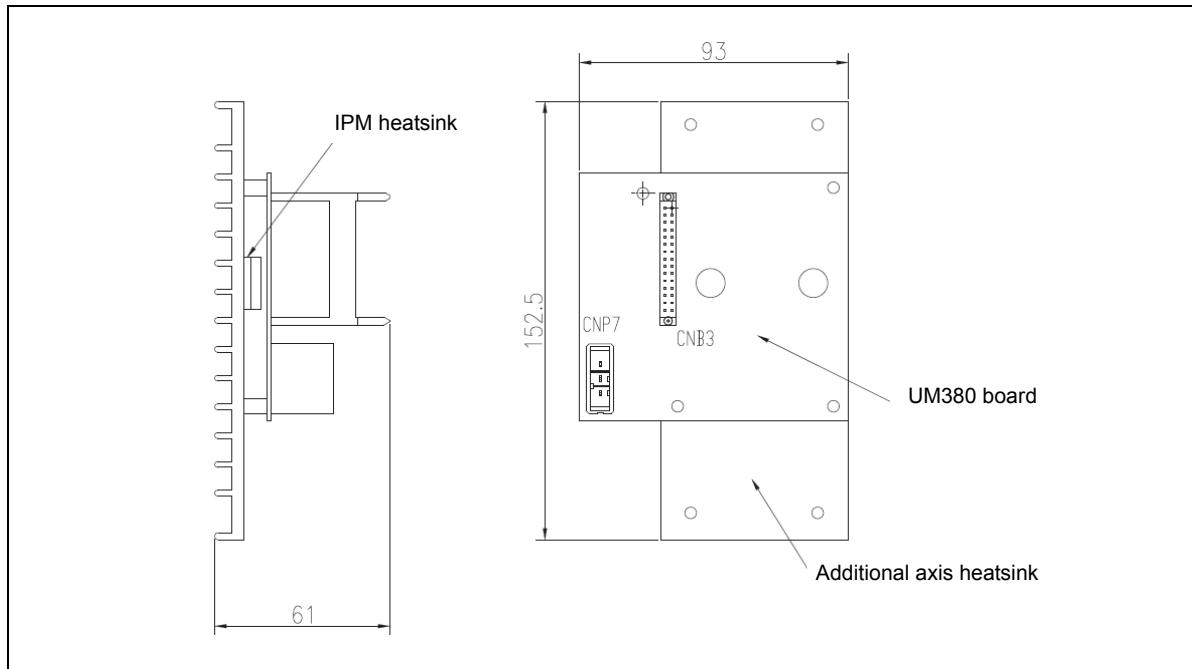
Item	Description
External dimension	W93 × D152.5 × H61
Mass	Approx. 1 Kg
Control target Number of axis	1 axis servo gripper or 1 axis servo traverse unit (slider)
Control motor	AC Servo motor 17bit absolute encoder
Motor capacity	600W(12Ap) (is equivalent to maximum torque 4.44 Nm) Adjust accel/decel time so that maximum torque is to be above value.

Basic specifications of "Additional Axis Servo Motor"

Item	Specification			
	CFD-OP79-MC01	CFD-OP79-MC02	CFD-OP79-MC04	CFD-OP79-MC06
Rated power[W]	100	200	400	600
No. of Poles	8	8	8	8
Rated rotation speed [rpm]	3000	3000	3000	3000
Max. rotation speed[rpm]	6000	5000	5000	5000
Rated torque[N·m]	0.32	0.64	1.3	1.91
Max. torque[N·m]	0.95	1.91	3.8	5.73
Rated current [Arms]	(1.1)	(1.6)	(2.6)	(3.8)
Rotor inertia [$\times 10^{-4}\text{kg}\cdot\text{m}^2$]	0.10	0.16	0.28	0.40
Max. current [Ap]	(4.7)	(6.9)	(11.0)	(16.1)
Brake inertia [$\times 10^{-4}\text{kg}\cdot\text{m}^2$]	0.02	0.018	0.018	0.018
Demagnetizing current [Ap]	7.1	10.4	16.5	24.2
Torque constant [N·m/Arms] [N·m/Ap]	0.31±10% 0.22±10%	0.41±10% 0.29±10%	0.51±10% 0.36±10%	0.52±10% 0.37±10%
Phase resistance [Ω]	4.5±7%	3.0±7%	1.78±7%	1.13±7%
Phase inductance[mH]	(9.3)	(7.6)	(5.4)	(3.5)
Mass [kg]	0.79	1.3	1.7	2.0
Brake torque [N·m]	0.3 or more	1.27~2.54	1.27 or more	1.27 or more

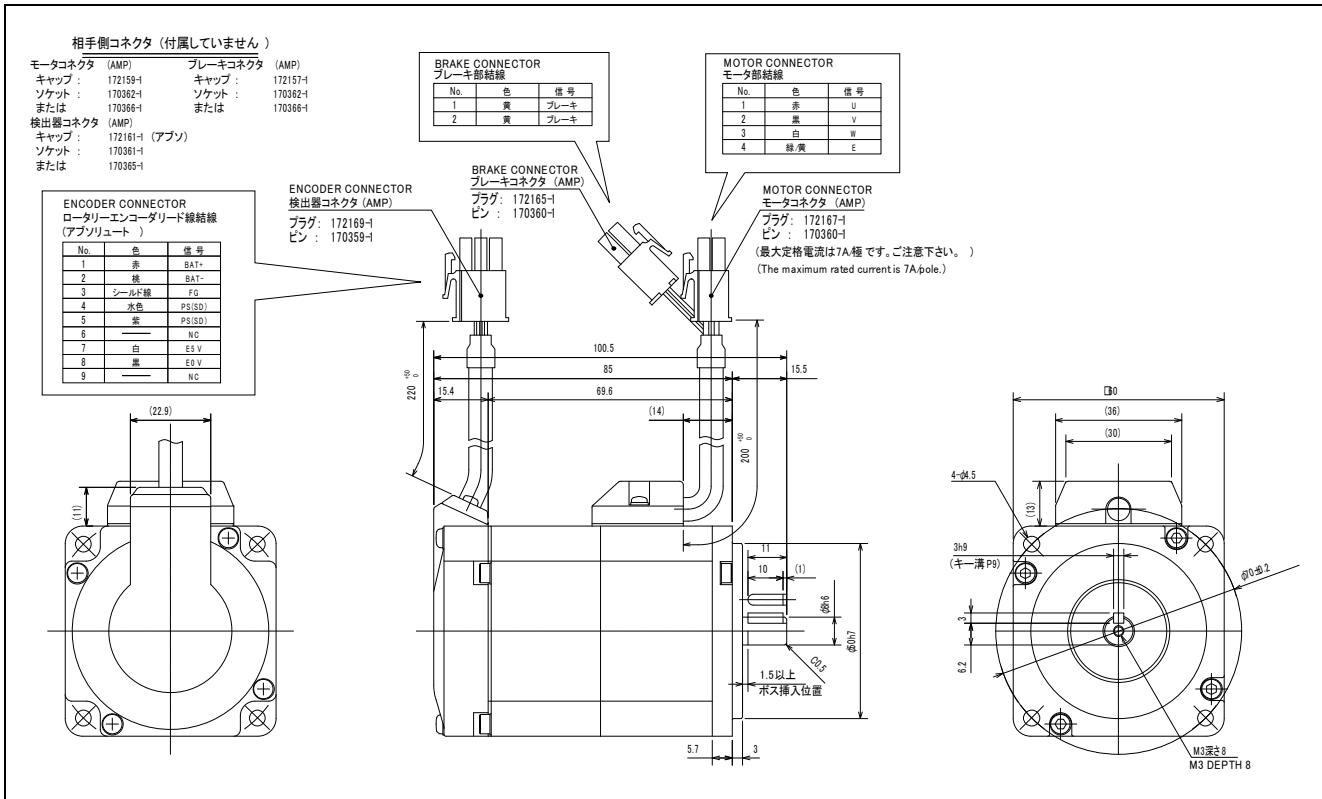
19.1 Additional Axis Drive Unit

This "Additional Axis Drive Unit" is installed in CFD controller.

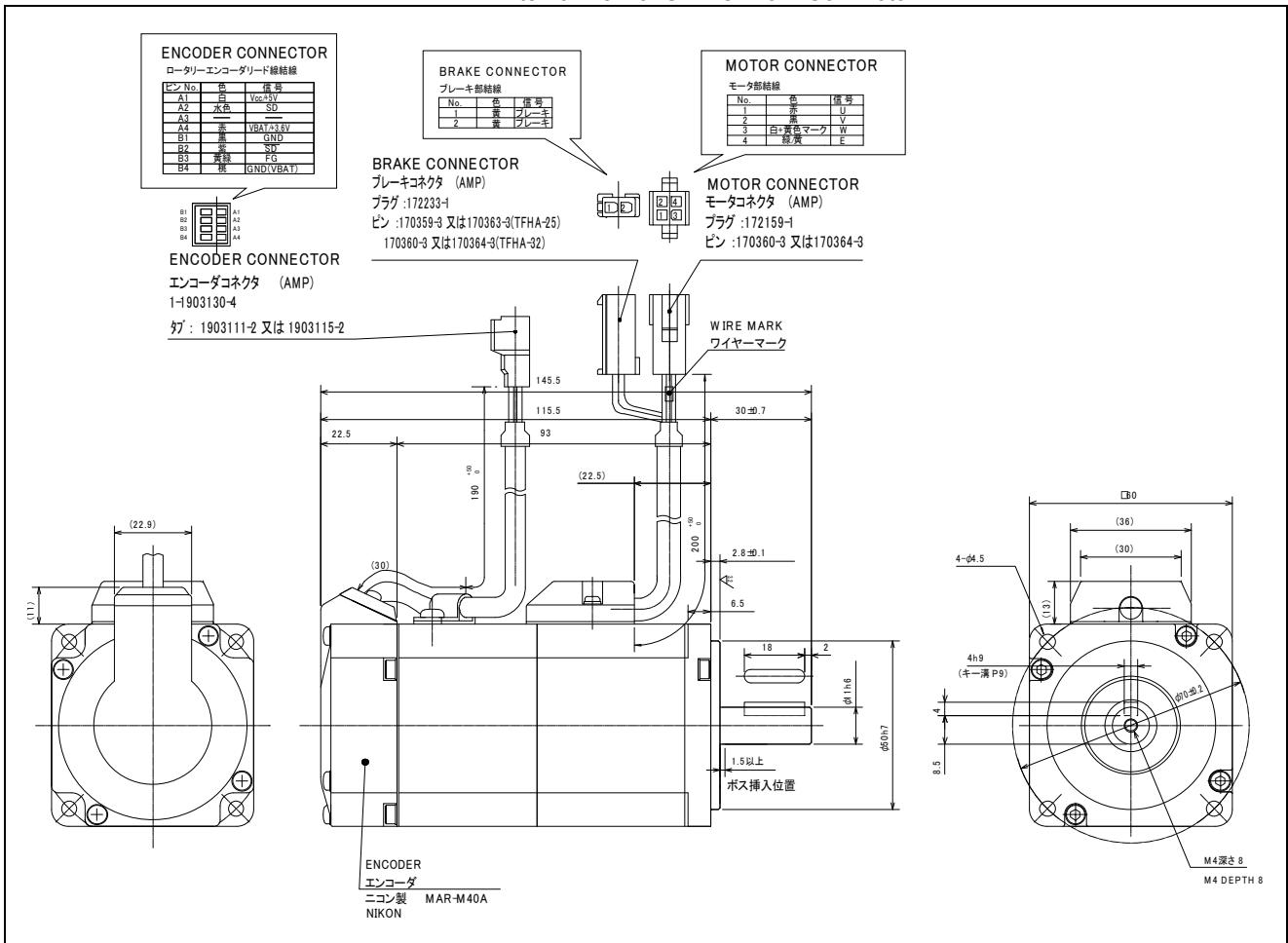


External view of "Additional Axis Drive Unit"

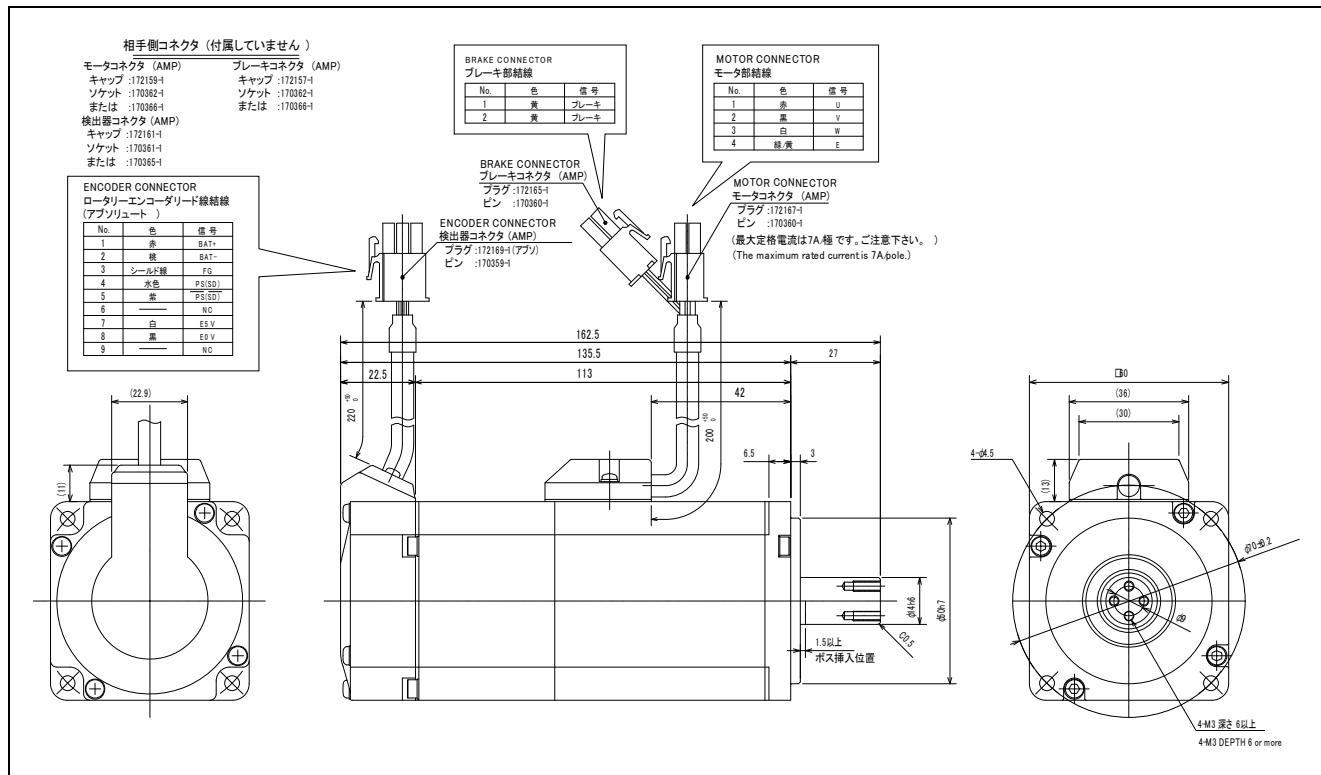
19.2 Additional Axis Servo Motor



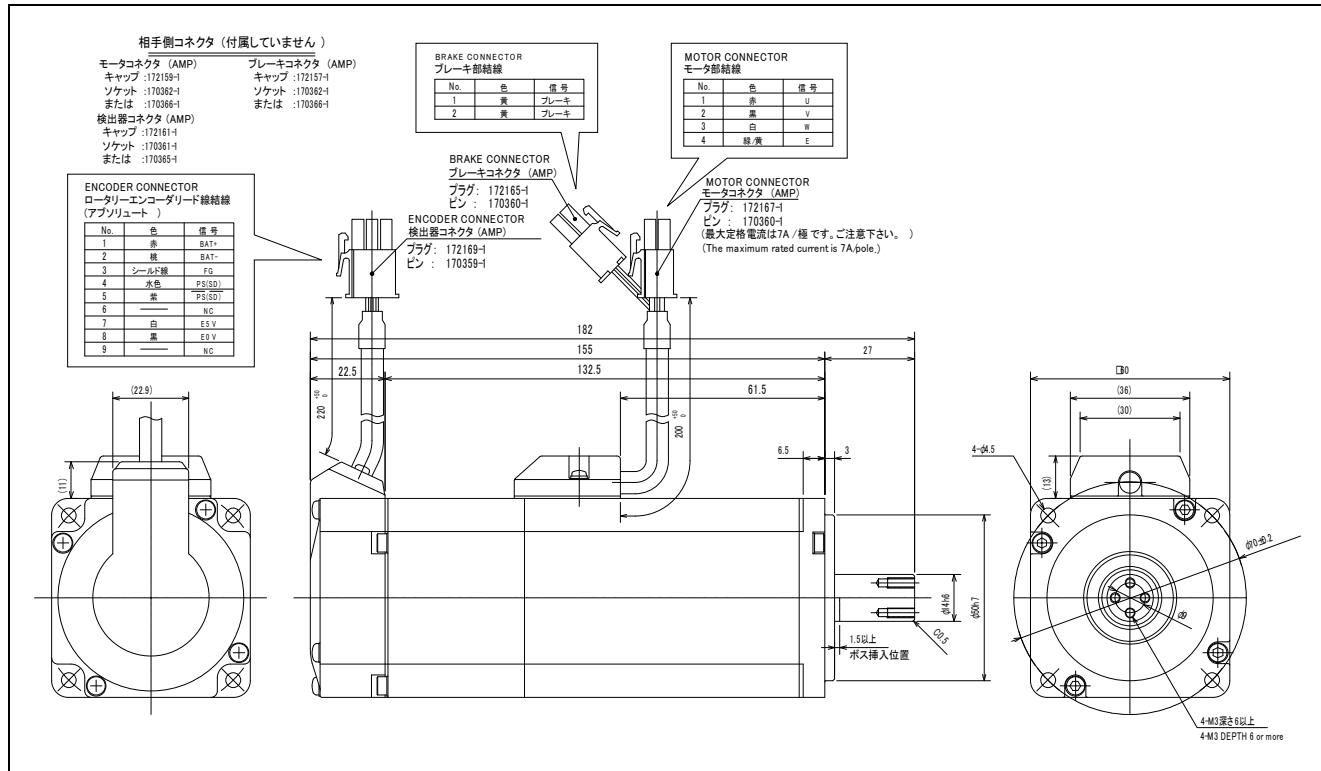
External view of CFD-OP79-MC01 motor



External view of CFD-OP79-MC02 motor

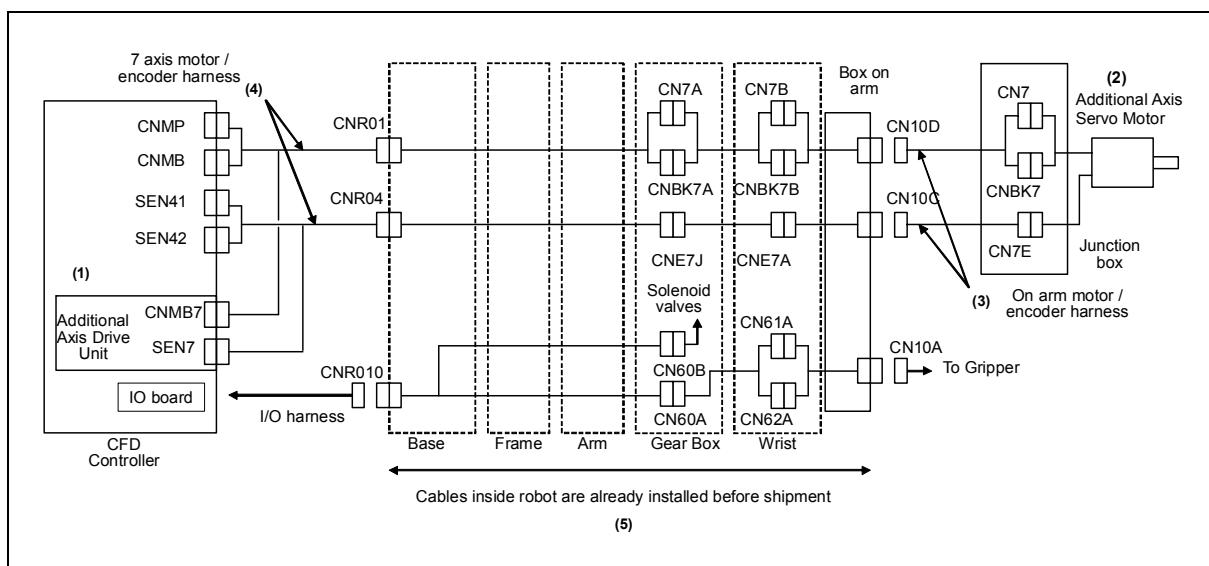


External view of CFD-OP79-MC04 motor

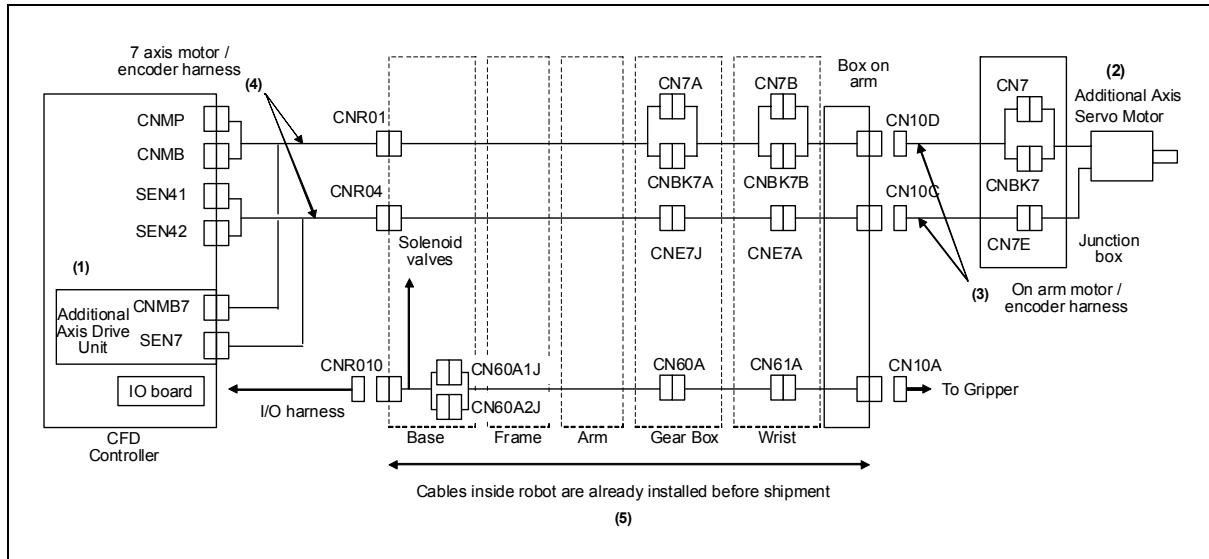


External view of CFD-OP79-MC06 motor

19.3 Construction (Servo Gripper)



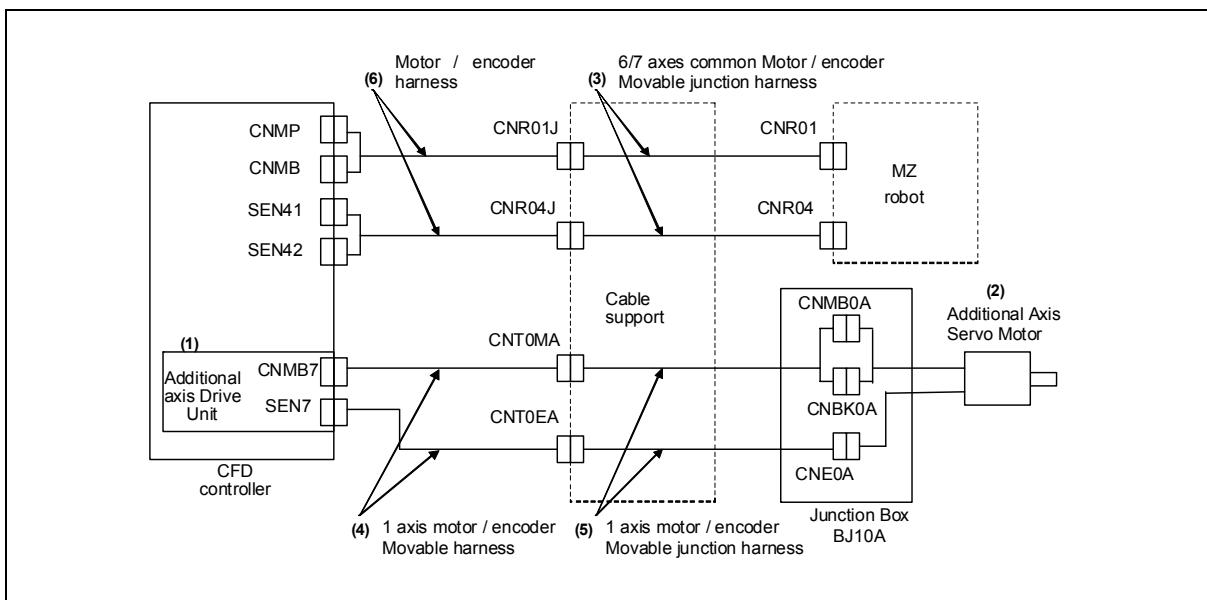
System construction of Servo Hand (MZ07)



System construction of Servo Hand (MZ04)

No.	Part name	Part No.	Remarks
(1)	Additional Axis Drive Unit	CFD-OP79-A	
(2)	Additional Axis Servo Motor	CFD-OP79-MC01 CFD-OP79-MC02 CFD-OP79-MC04 CFD-OP79-MC06	100W 200W 400W 600W
(3)	On arm motor / encoder harness	CFD-OP79-C01 CFD-OP79-C02	For 100,400,600W Cable length is fixed to 1.5m For 200W Cable length is fixed to 1.5m
(4)	7 axis motor / encoder harness	Z101C-J7-**-A	**: Cable length 2,5,10,15,20,25m
(5)	MZ07 robot MZ04 robot	MZ07*-01-S** MZ04*-01-S**	Servo hand available

19.4 Construction (Traverse Unit)



System construction of Traverse Unit

No.	Part name	Part No.	Remarks
(1)	Additional Axis Drive Unit	CFD-OP79-A	
(2)	Additional Axis Servo Motor	CFD-OP79-MC01 CFD-OP79-MC02 CFD-OP79-MC04 CFD-OP79-MC06	100W 200W 400W 600W
(3)	6/7 axes common Motor / encoder Movable junction harness	Z102C-01-**-A	**: Cable length 2,5,10,15,20,25m
(4)	1 axis motor / encoder Movable harness	CFD-OP17A-A-**	**: Cable length 2,5,10,15,20,25m
(5)	1 axis motor / encoder Movable junction harness	CFD-OP17-A-**	**: Cable length 2,5,10,15,20,25m With junction box BJ10A
(6)	Motor / encoder harness	Z101C-J1-**-A	**: Cable length 2,5,10,15,20,25m

(NOTE) For details of (3)(4)(5)(6), see "19.8 Connection of Peripheral Equipments (Traverse Unit)". (e.g. bending R, etc.)

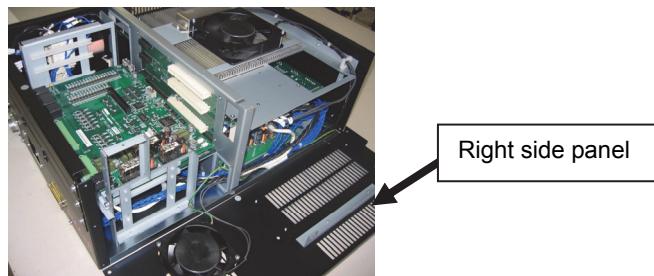
19.5 Installing Additional Axis Drive Unit

Please install Additional Axis Drive Unit in CFD controller.

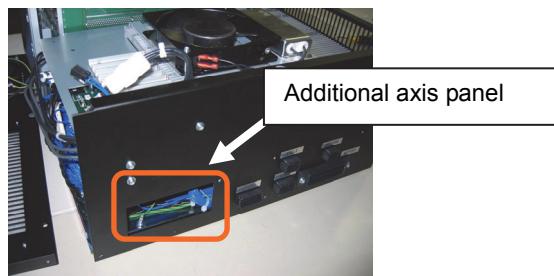
- 1 Turn off the controller power and disconnect the primary power source connector.
- 2 Remove the top panel of controller.



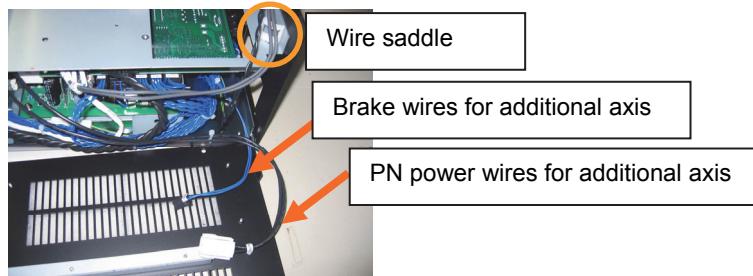
- 3 Remove the right side panel of controller.



- 4 Remove the additional axis panel on controller rear panel.

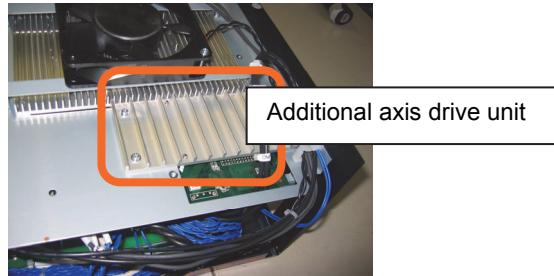


- 5 Extract the PN power wires and brake wires for additional axis.



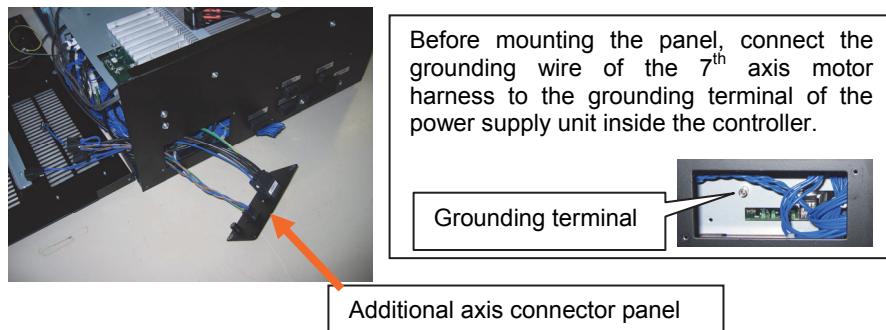
(PN power wires and brake wires for additional axis are fixed by wire saddle)

- 6 Mount the additional axis drive unit.



Pay enough attention not to bend the UM351 (Servo CPU board).

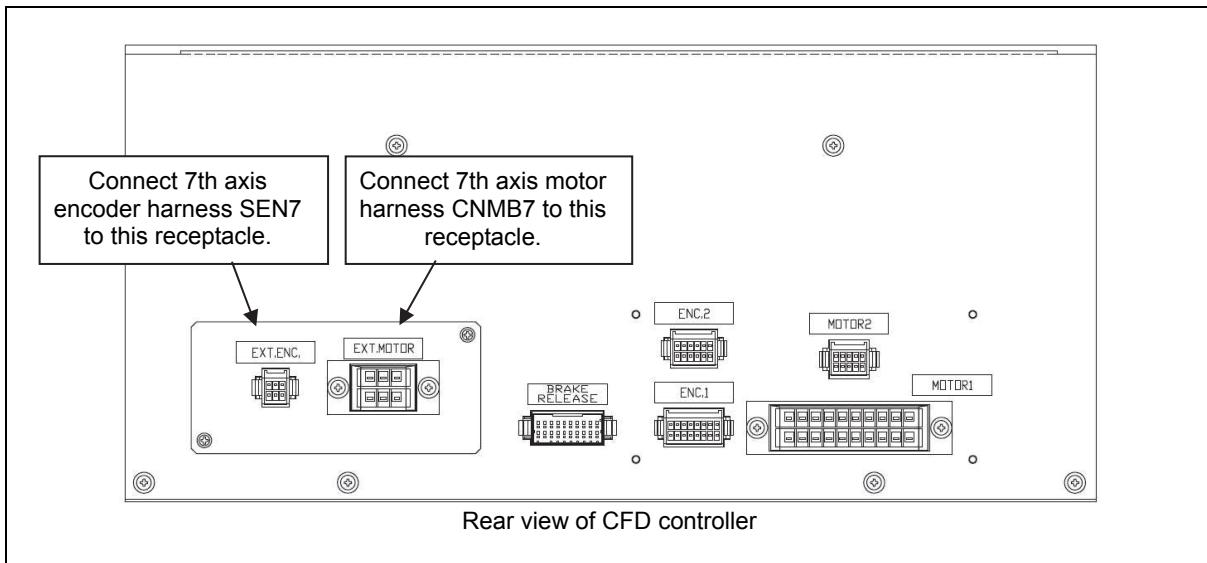
- 7 Mount the additional axis connector panel on the additional axis panel.



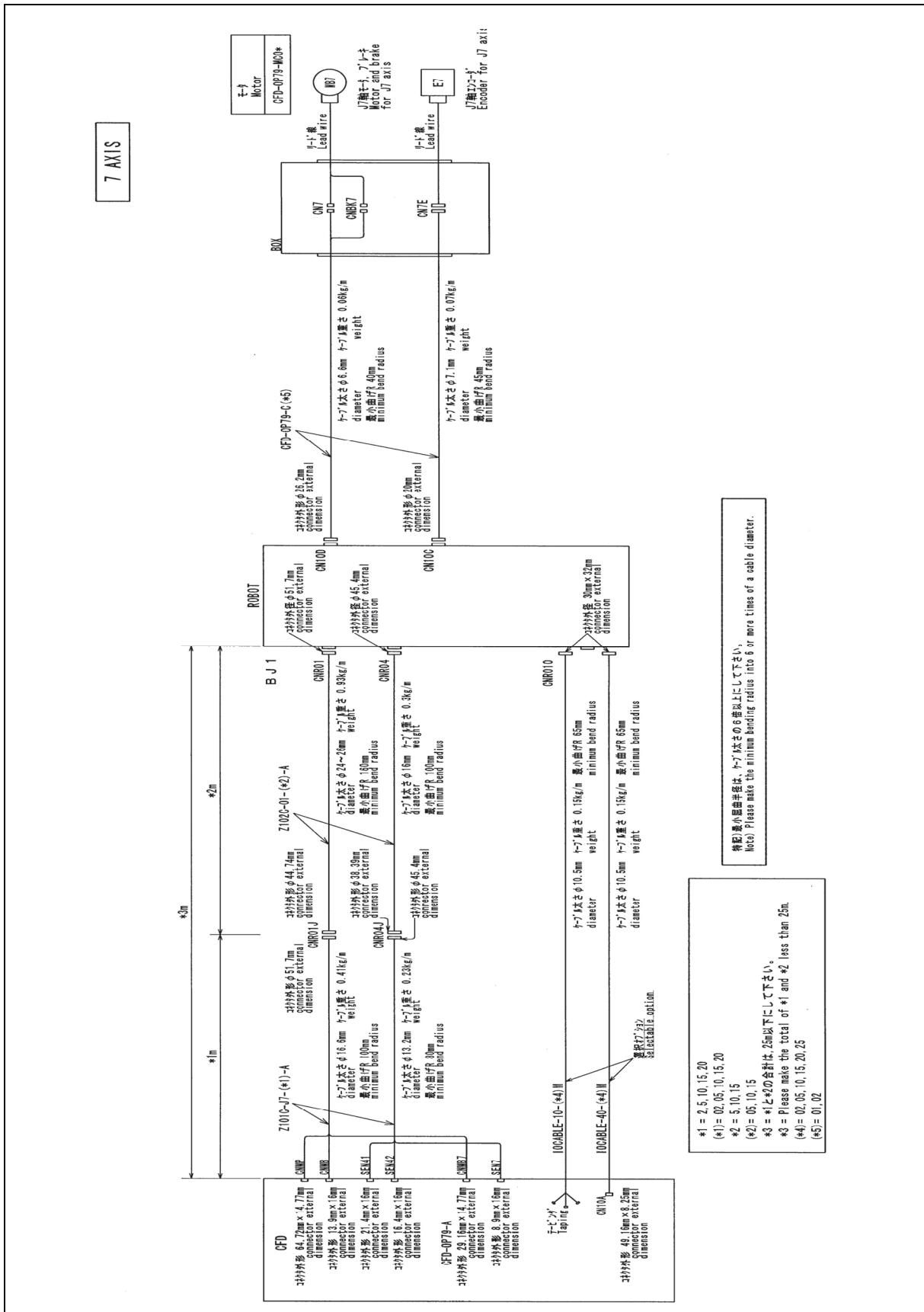
Connected cables
Additional axis brake wires (CN78BKJ)
Additional axis PN power wires (CNPNJ)

- 8 Restore the panel to the original position.

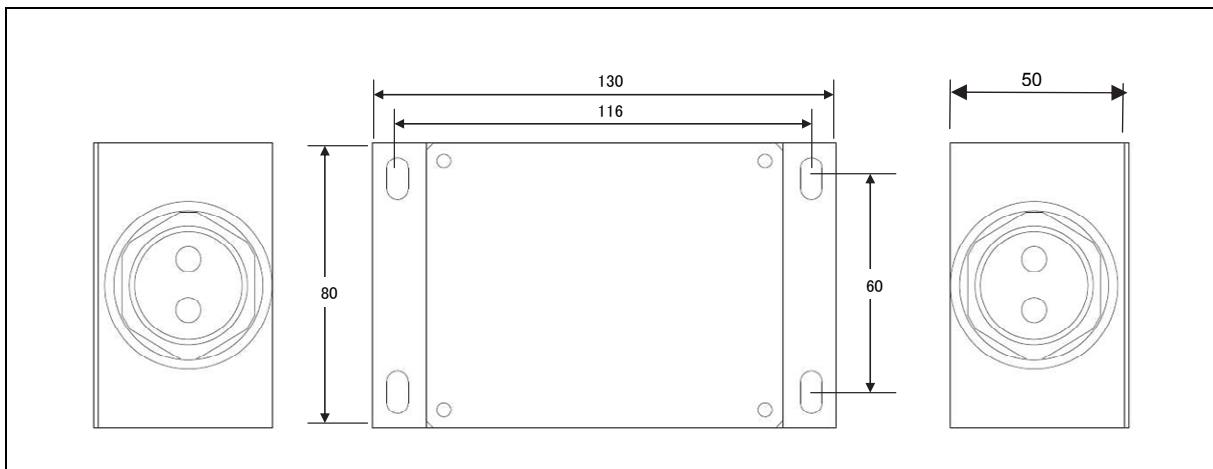
19.6 Connection of CFD controller



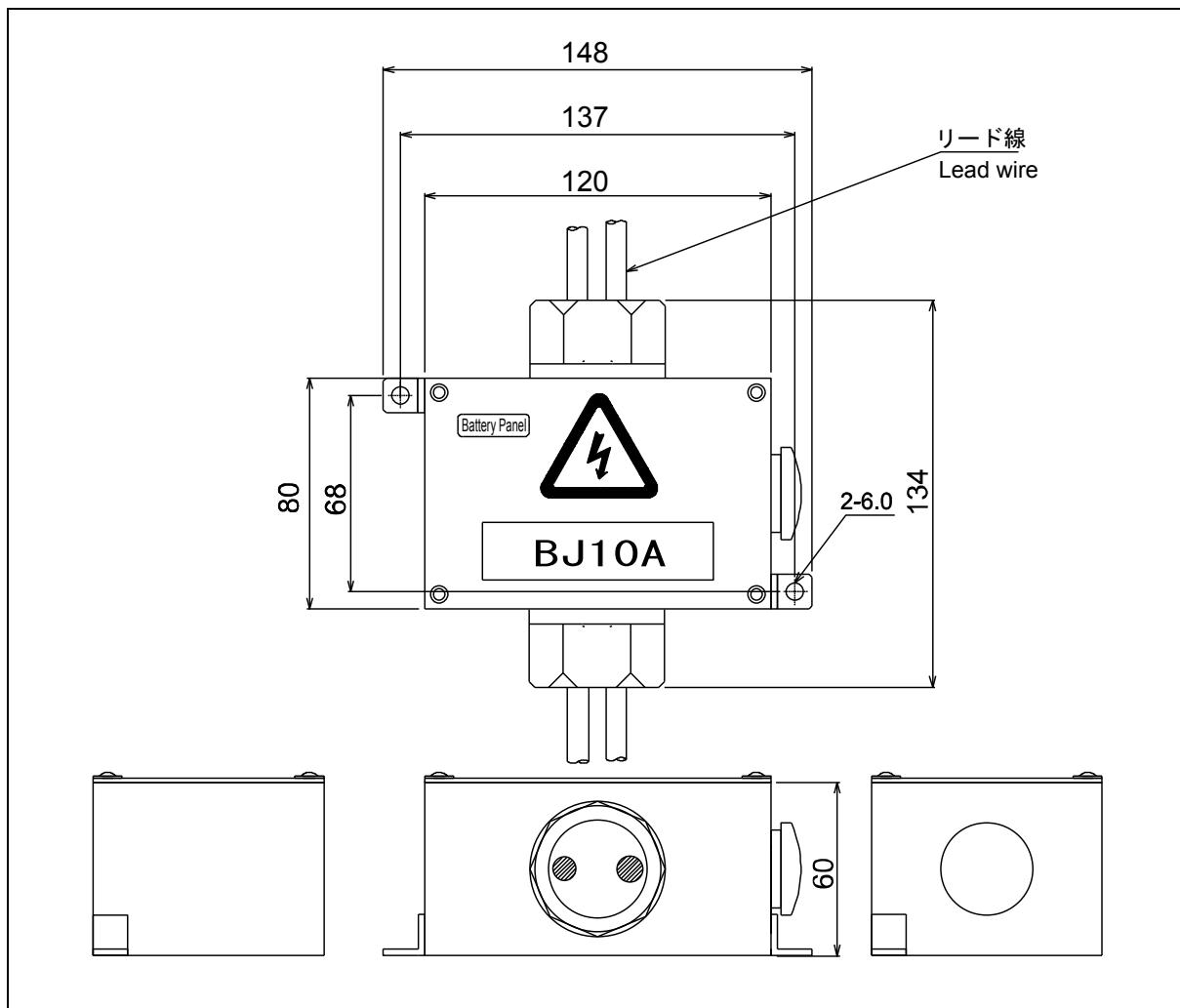
19.7 Connection of Peripheral Equipments (Servo Gripper)



Wiring connection diagram of additional axis (1 axis servo gripper)



Appearance of "Junction Box" for servo gripper



Appearance of "Junction box BJ10A" for traverse unit

19.9 Setup Operation

Please perform setup operation in order to utilize the additional 1 servo axis.



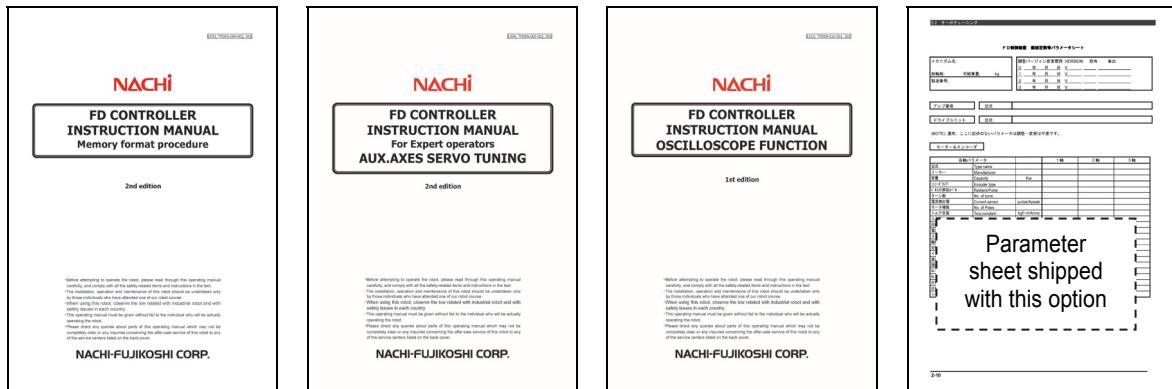
To utilize this option, Smart TP or combination of Compact TP and PC tool "FD on Desk Light" is necessary. Compact TP (without PC tool) is not enough to utilize this option.



Not only deep understanding of robot operation but also basic acknowledgement of servo control is necessary for "Registering mechanism parameters" procedure and "Servo tuning" procedure. (**EXPERT** or higher operator class is necessary.)

If robot is treated with insufficient acknowledgement of robot operation and maintenance, mis-operation is likely to cause the danger of property damage or of minor injuries of operator or neighbor personnel. Furthermore, this may result in death or serious injury of operator or neighbor personnel.

Please prepare following three instruction manuals and parameter sheet which is shipped with this option.



1 Registration of new mechanism

- ☞ Parameter sheet shipped with this option
- ☞ FD controller instruction manual "Aux. axes Servo Tuning for Expert operators" (TFDJP-065)"
- ☞ FD controller instruction manual "Memory Format Procedure" (TFDJP-094)"

Added 7th axis is one independent mechanism that is "Servo Gripper" or "Traverse Unit". This is different from "Manipulator". At first, it is necessary to register new mechanism.

Please refer to parameter sheet shipped with this option for detail of new mechanism name.

Please refer to instruction manual "Aux. axes Servo Tuning for Expert operators" and "Memory Format Procedure" for detail operation.

2 Registering mechanism parameters

- ☞ Parameter sheet shipped with this option ↴
- ☞ FD controller instruction manual "Aux. axes Servo Tuning for Expert operators" (TFDJP-065)"

Various mechanism parameters need to be registered in order to drive the mechanism precisely. Please refer to parameter sheet shipped with this option for detail of mechanism parameters.

Please refer to instruction manual "Aux. axes Servo Tuning for Expert operators" for detail operation.

3 Servo tuning

- ☞ FD controller instruction manual "Aux. axes Servo Tuning for Expert operators" (TFDJP-065)"
- ☞ FD controller instruction manual "Oscilloscope Function" (TFDJP-016)"

Servo parameters need to be adjusted in order to drive the mechanism precisely. This procedure is performed with motor power on and with actually operating the mechanism.

Please refer to instruction manual "Aux. axes Servo Tuning for Expert operators" for detail operation.

For this procedure, measurement instrument is necessary to monitor velocity, motor current and so on. "Oscilloscope Function" which is standard function of CFD controller is convenient for this work. Please refer to instruction manual "Oscilloscope Function" for detail operation.

19.10 Daily Operation

Please perform manual operation of additional 1 servo axis.

Added 7th axis is one independent mechanism that is "Servo Gripper" or "Traverse Unit". This is different from "Manipulator". This system is called "multi-mechanism" because plural mechanisms are contained in one controller. It is necessary to select mechanism before starting manual operation.

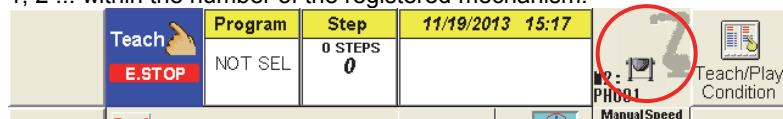
When using "SMART TP"

- 1 Current selected mechanism of manual operation is displayed on TP.**

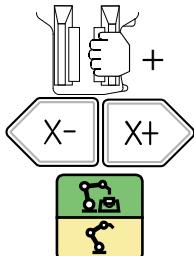


- 2 Press [Unit/Mechanism] key to change mechanism. Mechanism display is renewed.**

» Every time this key is pressed, current mechanism number will be changed like 1, 2 ... within the number of the registered mechanism.



This picture shows the case that 7th axis mechanism name is "PH001".



- 3 Now selected mechanism can be operated manually.
When operating Servo Gripper (or Traverse Unit), please press [X+] or [X-] key with grasping enable switch.**

This mechanism has only one axis. So keys except X+/X- are not to be used.

- 4 Press [Unit/Mechanism] key again. Mechanism display is renewed and selected mechanism is changed back to "Manipulator".**

When using "COMPACT TP"

- 1 Current selected mechanism of manual operation is displayed on TP.**

P 0 0 0 1	U 1 M 1 J	S 1 L N
S 0 0 0 0	S T A R T	
>		

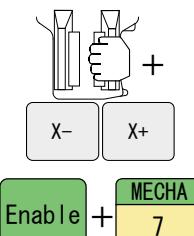
M1 : Manipulator

M2 : Servo Gripper (or Traverse Unit)



- 2 To select MECHANISM, press [Enable] + [MECHA / 7] key. Display will change to "M2".**

» Every time this key is pressed, current mechanism number will be changed like 1, 2 ... within the number of the registered mechanism.



- 3 Now selected mechanism can be operated manually.
When operating Servo Gripper (or Traverse Unit), please press [X+] or [X-] key with grasping enable switch.**

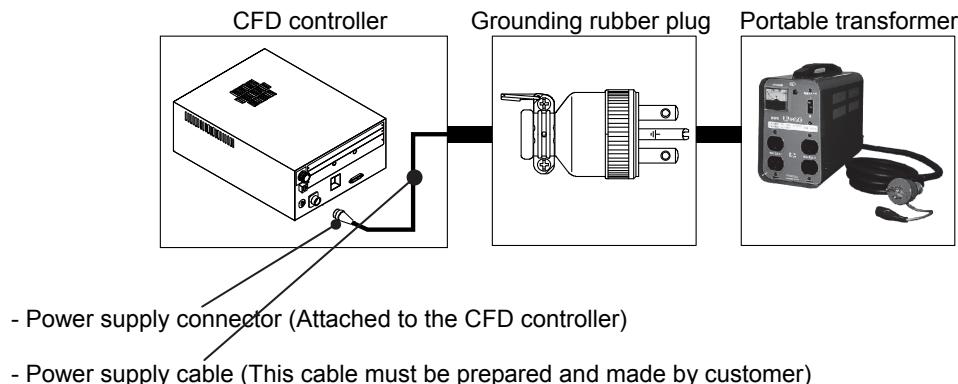
This mechanism has only one axis. So keys except X+/X- are not to be used.

- 4 Press [Enable] + [MECHA / 7] key again. Mechanism display is renewed and selected mechanism is changed back to "Manipulator".**

Chapter 20 100VAC Power Source Voltage

By using this option, it is possible to change the power source voltage of CFD controller from AC200V to AC100V. This option consists of the following parts.

Main contained parts				
Name	Type	Manufacture	Q'ty	Notes
Grounding rubber plug	ME2547-N	MEIKOSHA CO., LTD.	x 1	
Portable transformer	UP-300	SWALLOW	x 1	Input 100V±10V - Output 200V For details, refer to the following specification table.



CFD controller side power supply connector (This part is attached in the CFD controller)

By referring to the following figure, solder the power supply cable to the power supply connector.

Connector pin layout Seeing from the soldering side		Connection
PIN No.	Connection	
	Single phase AC200V	
1	AC200V R-phase (Red)	
2	—	
3	AC200V T-phase (Black)	
4	Ground (Green/Yellow)	

Applicable cable diameter:
10~12.5 [mm]
Connector type
Nanaboshi Electric Mfg.Co.,Ltd.
NJC-204-PF or NJW-204-PF

Primary power supply cable connection

Primary power supply cable specification

Manipulators	Cross-section of power cable	Cross-section of grounding cable
MZ series	1.25mm ² AWG16	1.25mm ² AWG16

UP-300 specification

Input voltage	Output voltage	Rated Capacity	Rated Current	Wire Thickness x Number of wires x length	Outlet	Plug	Dimension W,D,H(mm)	Insulating type	Mass
100V±10V	200V	3KVA	15A	3.5 x 3 x 2m	(-) x4	(+) 15A	135,280,230	B	Approx. 12.8kg

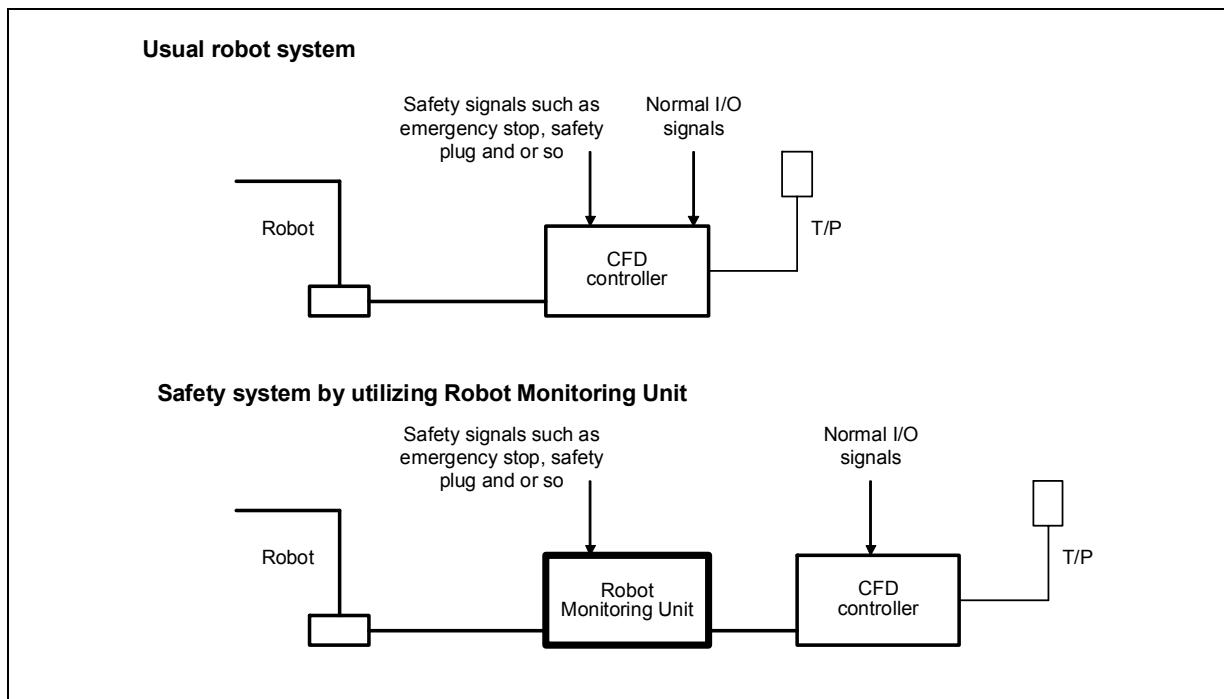
ME2547 specification

Chapter21 RMU (Robot Monitoring Unit)

RMU (Robot Monitoring Unit) is a Category 4 and PLe compliant system which monitors the robot position and speed so as to shut off the power to the robot when its position or speed are deemed to be irregular.

RMU consists of safety circuits using microcomputers and semiconductors, and input/output signals, redundant safety signals and other signals from the process control panel are connected as the input/output signals except robot controller. Control signals of emergency stop button, operation switches, and magnetic switch of the robot controller are connected as internal I/O signals, and RMU has functions for monitoring the sequence and status.

RMU is connected by a cable to the encoder of drive motor so that RMU can monitor the robot operations, and the system ensures that the robot will stop safely when the robot has operated irregularly.



Safety system with Robot Monitoring Unit

Furthermore, by utilizing “Virtual Safety Fence” utility, software can observe the robot so that defined object does not go out from the restricted area.



To utilize this option, Smart TP or combination of Compact TP and PC tool “FD on Desk Light” is necessary. Compact TP (without PC tool) is not enough to utilize this option.

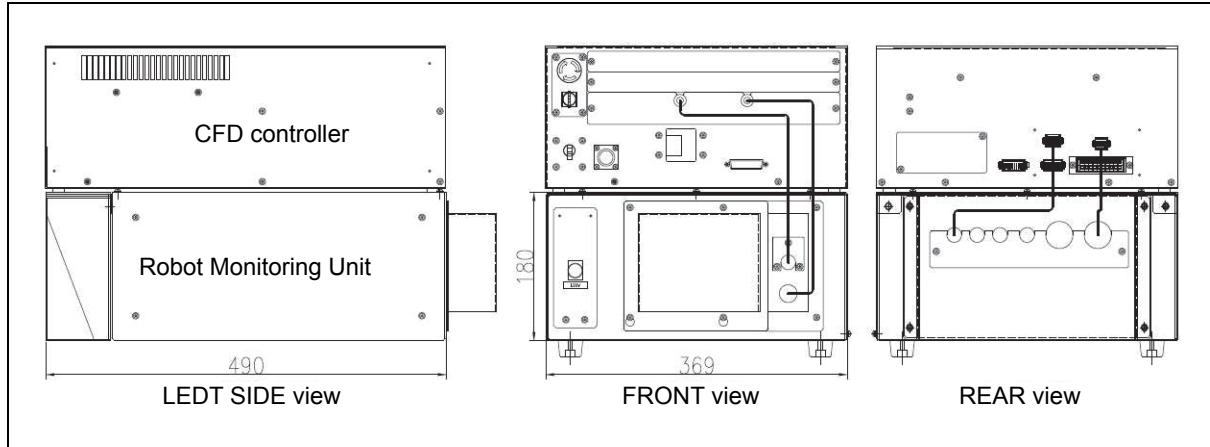
This document includes the information only for setup of this option such as assembling and wiring. Please refer to another manual “FD/CFD controller instruction manual Robot Monitoring Unit RMU20-20 / RMU20-30”, (TFDEN-143-###) for details such as input/output signal connection, setting procedure for RMU, utilizing Virtual Safety Fence and or so.

21.1 Robot Monitoring Unit

Specification of Robot Monitoring Unit

Item	Description
Dimension	W369 ×D490 ×H180
Weight	Approx. 10Kg
Primary power	Unnecessary (supplied from CFD controller)
Installation environment	(same as CFD controller)

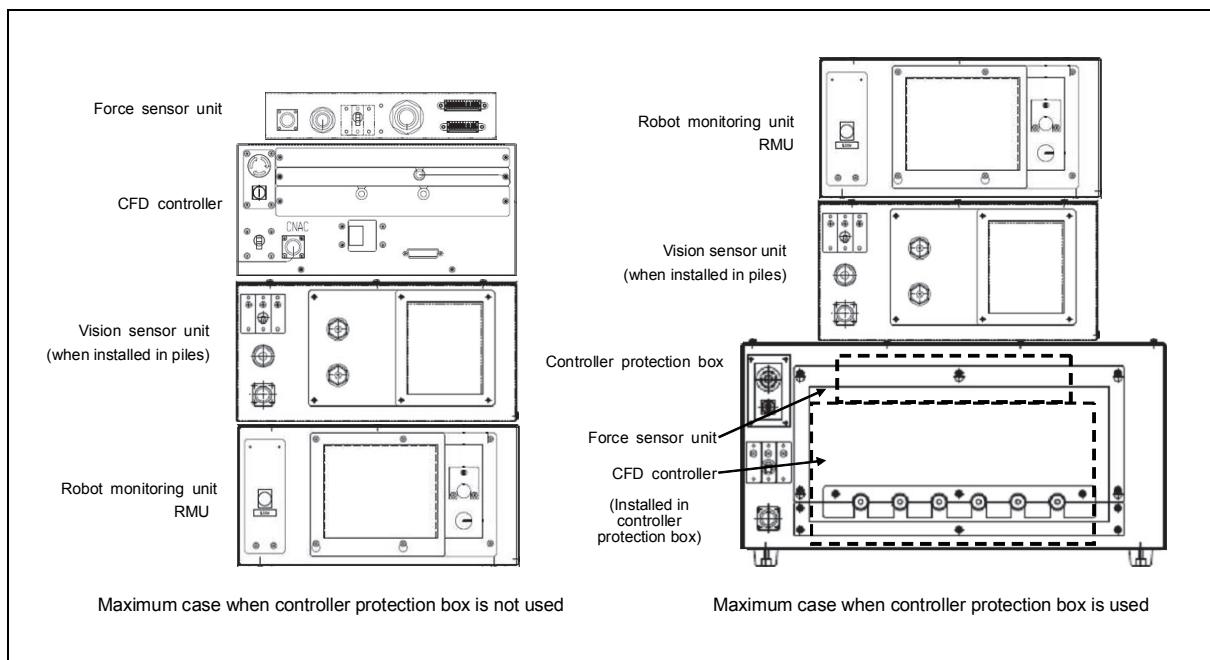
CFD controller is fixed on Robot Monitoring Unit.
CFD controller must be installed in horizontal direction (not vertical direction).



External view of Robot Monitoring Unit

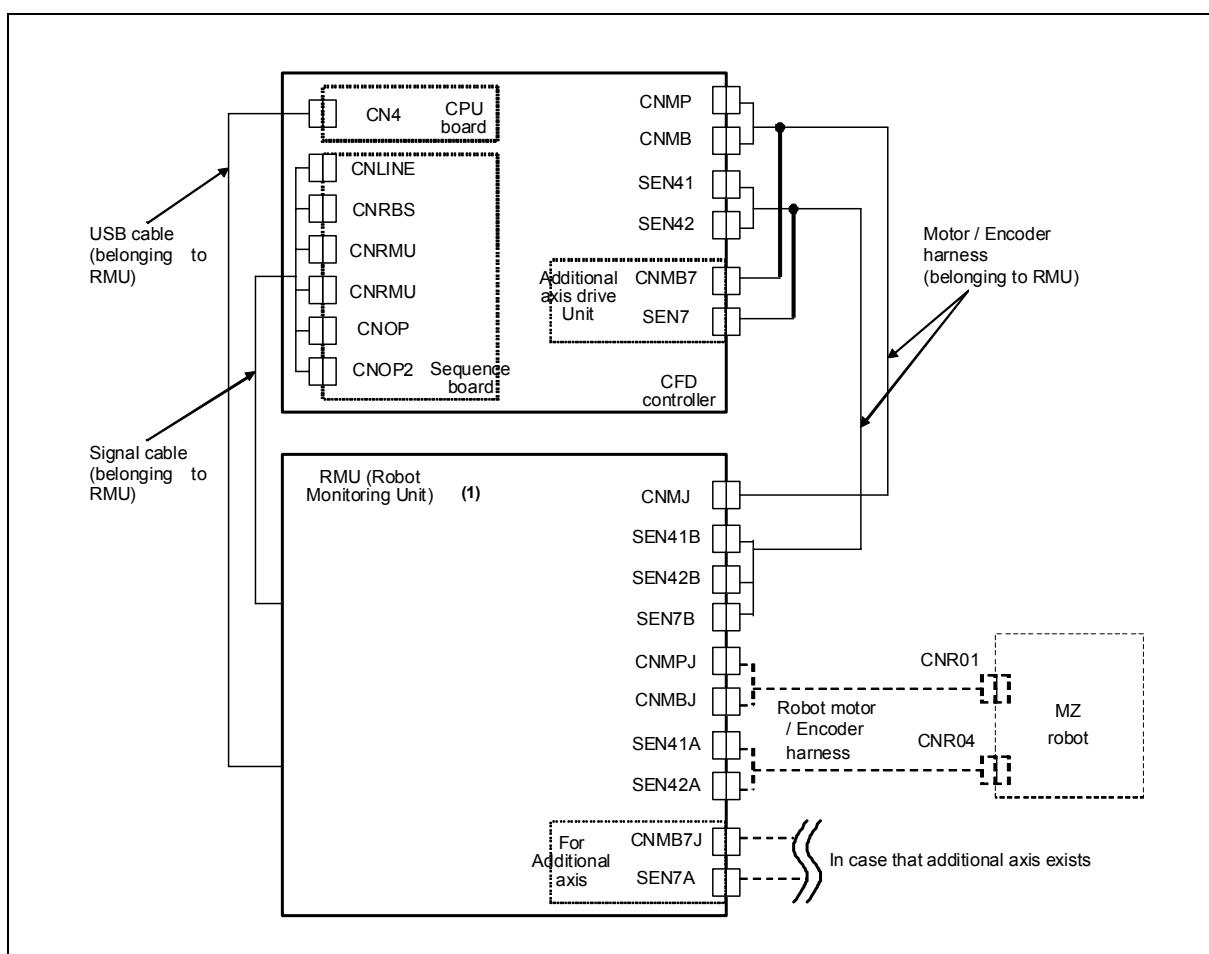
Please refer to the figure below when utilizing RMU with other options.

This figure shows the appearance of maximum case (All of CFD controller options which need separate box are used at the same time.)



External view when all of CFD controller options which need separate box are used at the same time

21.2 Construction



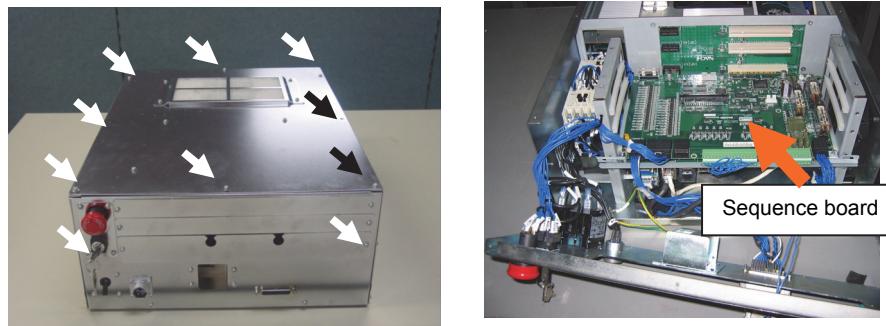
Connection of Robot Monitoring Unit

No.	Part name	Part No.	Remarks
(1)	Robot Monitoring Unit	CFD-OP145-A	With following cables motor/encoder harness 0.7m USB cable 0.7m signal cable 0.7m With sequence board (UM67-20) in CFD controller

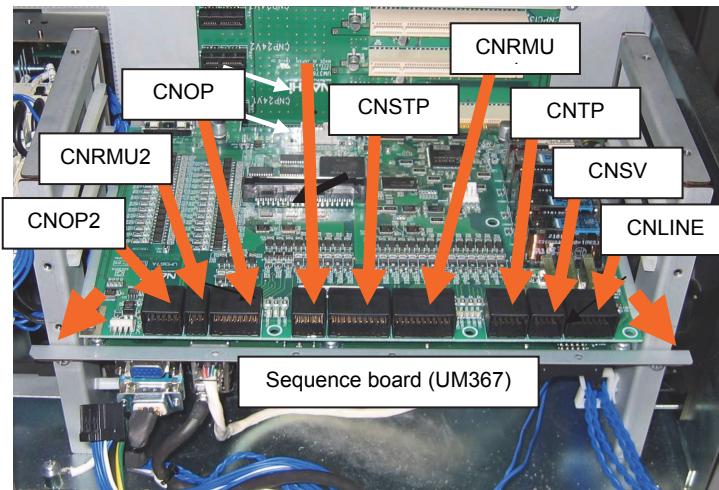
21.3 Installing and Connection of Robot Monitoring Unit

CFD controller is fixed on Robot Monitoring Unit.
CFD controller must be installed in horizontal direction (not vertical direction).

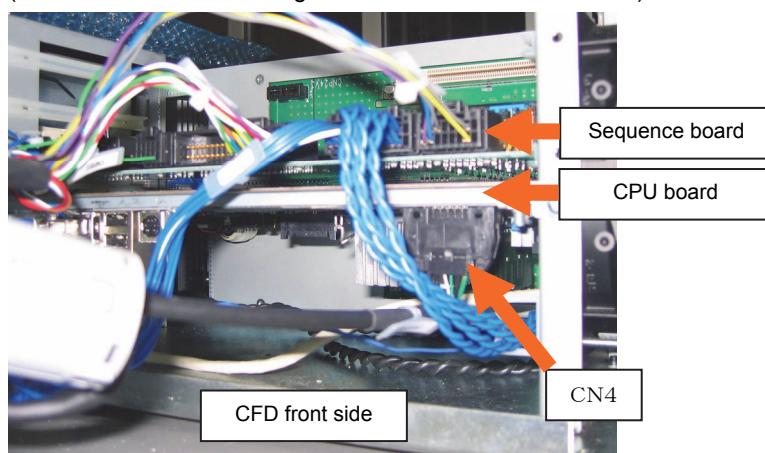
- 1 Turn off the controller power and disconnect the primary power source connector.
- 2 Loosen the screws on the top panel and the front side cable drawing panel.
Then pull out the sequence board.

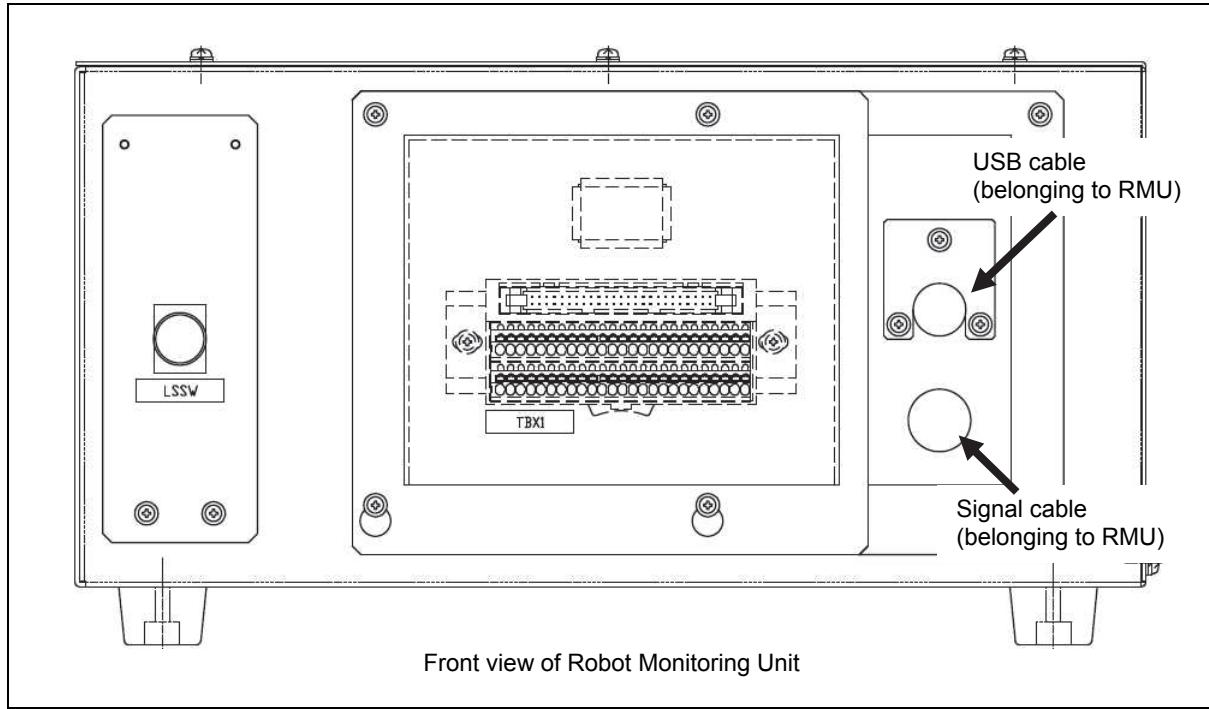


- 3 Fix the sequence board (UM367-20) to the slot.



- 4 Connect the USB cable and signal cable (belonging to RMU) connectors (CNLINE, CNRBS, CNRMU1, CNRMU2, CNOP, CNOP2, CNOPJ, CNSV, CNTP, CNSTP, CNOPJ and CN4) to the CPU board and I/O board.
(CN4 connector is on the right side beneath the CPU board)





Front view of Robot Monitoring Unit

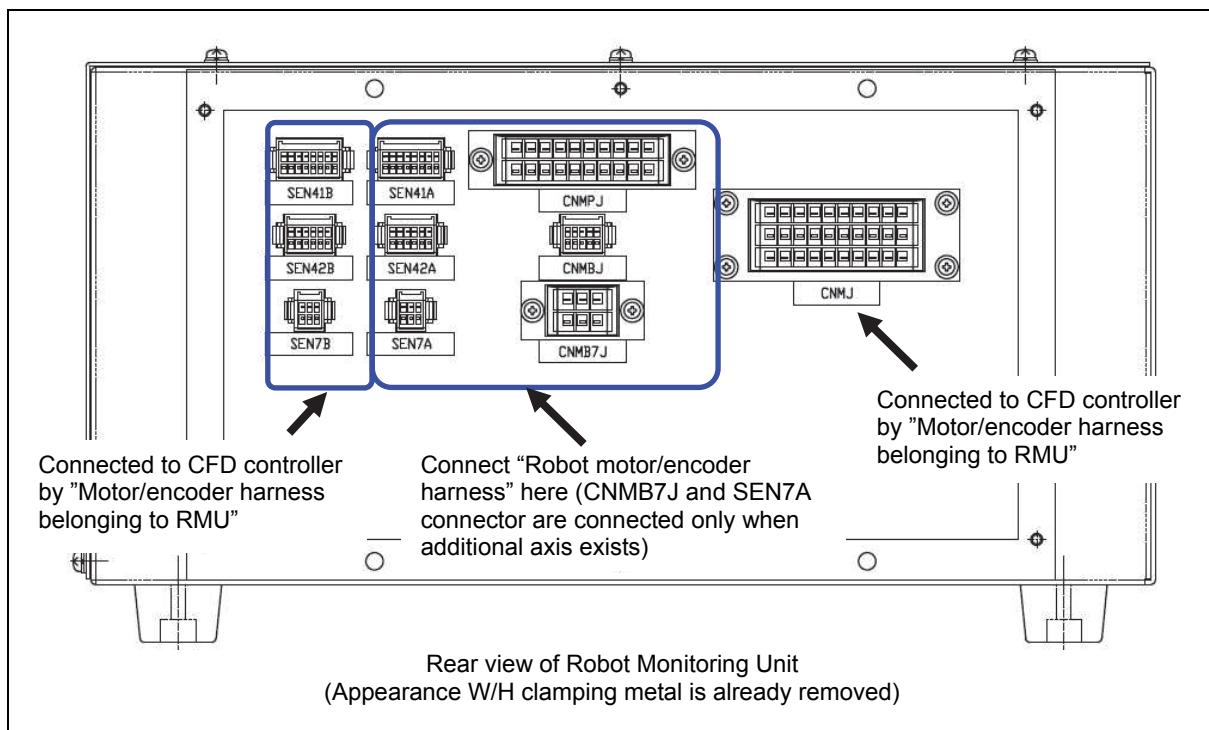
Outlet of USB cable and signal cable (belonging to RMU)

- 5** Disconnect "Robot motor/encoder harness" which connects CFD controller and robot at CFD controller side. Then connect them to Robot Monitoring Unit.

(Notes) Before connecting, pierce them to the hole of "W/H harness clamping metal".

- 6** Connect "Motor/encoder harness belonging to RMU" to CFD controller.

(Notes) Before connecting, pierce them to the hole of "W/H harness clamping metal".

Rear view of Robot Monitoring Unit
(Appearance W/H clamping metal is already removed)

Connection with robot

7 Fix harness with “W/H clamping metal”.

Attach cable bush (belonging to harness) and then fix harness with “W/H clamping metal”.

Following figure shows the position of each wire.

(1) Encoder harness belonging to RMU

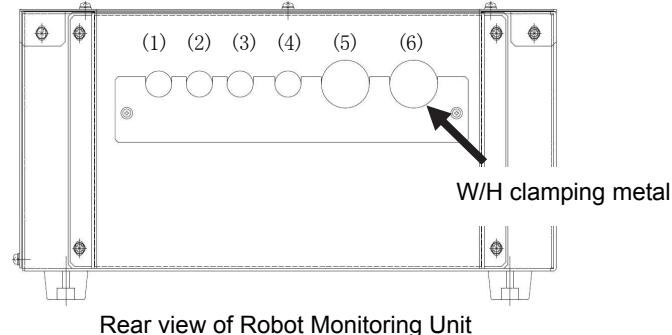
(2) Aditinal axis encoder harness

(3) Robot encoder harness

(4) Aditinal axis motor harness

(5) Robot Motor harness

(6) Motor harness belonging to RMU



8 Mount the front panel and top panel.

Install CFD controller on RMU. CFD controller is not fixed by screws, so install RMU on flat and horizontal floor.

21.4 Operating

See the following instruction manual for details of operation.

“FD/CFD CONTROLLER INSTRUCTION MANUAL: Robot Monitoring Unit RMU20-20 / RMU20-30”
(TFDEN-143-###)

21.5 Terminal block TBX-1

Please make connections of the signals for the terminal block TBX-1 in accordance with the customer's environment in advance.

PCX-1H50 (Manufacture: Toyo) (for CFD controller)

92.5mm

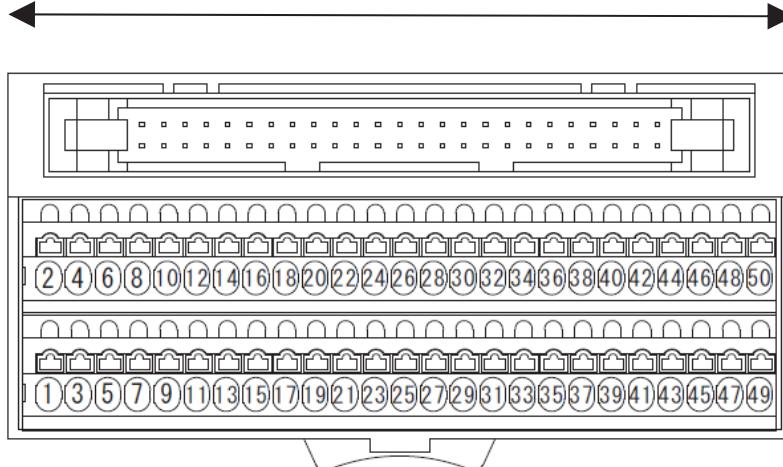


Table 21-1 Terminal block TBX-1 pin layout

Pin No.	Marking	I/O	Signal name	Pin No.	Marking	I/O	Signal name
A1	IN5A+	SI	External emergency stop 1+	B1	IN5A-	SI	External emergency stop 1-
A2	IN5B+	SI	External emergency stop 2+	B2	IN5B-	SI	External emergency stop 2-
A3	IN6A+	SI	Safety plug 1+	B3	IN6A-	SI	Safety plug 1-
A4	IN6B+	SI	Safety plug 2+	B4	IN6B-	SI	Safety plug 2-
A5	IN7A+	SI	Protective stop 1+	B5	IN7A-	SI	Protective stop 1-
A6	IN7B+	SI	Protective stop 2+	B6	IN7B-	SI	Protective stop 2-
A7	IN8A+	SI	External enable SW 1+	B7	IN8A-	SI	External enable SW 1-
A8	IN8B+	SI	External enable SW 2+	B8	IN8B-	SI	External enable SW 2-
A9	IN9A+	SI	General safety input 11+	B9	IN9A-	SI	General safety input 11
A10	IN9B+	SI	General safety input 12+	B10	IN9B-	SI	General safety input 12
A11	IN10A+	SI	General safety input 21+	B11	IN10A-	SI	General safety input 21
A12	IN10B+	SI	General safety input 22+	B12	IN10B-	SI	General safety input 22
A13	IN11A+	SI	General safety input 31+	B13	IN11A-	SI	General safety input 31
A14	IN11B+	SI	General safety input 32+	B14	IN11B-	SI	General safety input 32
A15	IN12A+	SI	General safety input 41+	B15	IN12A-	SI	General safety input 41
A16	IN12B+	SI	General safety input 42+	B16	IN12B-	SI	General safety input 42
A17	IN13A+	SI	General safety input 51+	B17	IN13A-	SI	General safety input 51
A18	IN13B+	SI	General safety input 52+	B18	IN13B-	SI	General safety input 52
A19	GPIN13	I	Tool number 1	B19	GPIN14	I	Tool number 2
A20	GPIN15	I	Tool number 3	B20	GPIN16	I	Tool number 4
A21	P1	P	24V	B21	P1	P	24V
A22	INCOM	I	Tool No. input COM	B22	M1	G	24V system GND
A23	EX_EMG1+	SO	Ext.I EMG stop out 1+	B23	EX_EMG1-	SO	Ext.I EMG stop out 1-
A24	EX_EMG2+	SO	Ext.I EMG stop out 2+	B24	EX_EMG2-	SO	Ext.I EMG stop out 2-
A25	X24V	P	Ext. DC24V power	B25	X0V	P	Ext. DC24V GND

SI:Safety Input, I:Monitor input, SO:Safety output, P:Power, G:Ground

About the “Normal Close” type terminals

The following terminals are “NC (Normal Close)” type terminals. So if these connections are not established, the robot motor power cannot be turned ON. If these signals are not used in your environment, please jumper these connections.

Terminals to be connected	Function	Remarks
A1 - B1	External emergency stop 1+/1-	When not using the “External emergency stop”, jumper these terminals.
A2 - B2	External emergency stop 2+/2-	
A7 - B7	External enable SW 1+/1-	When not using the “External enable SW” (e.g. mat switch etc.), jumper these terminals.
A8 - B8	External enable SW 2+/2-	

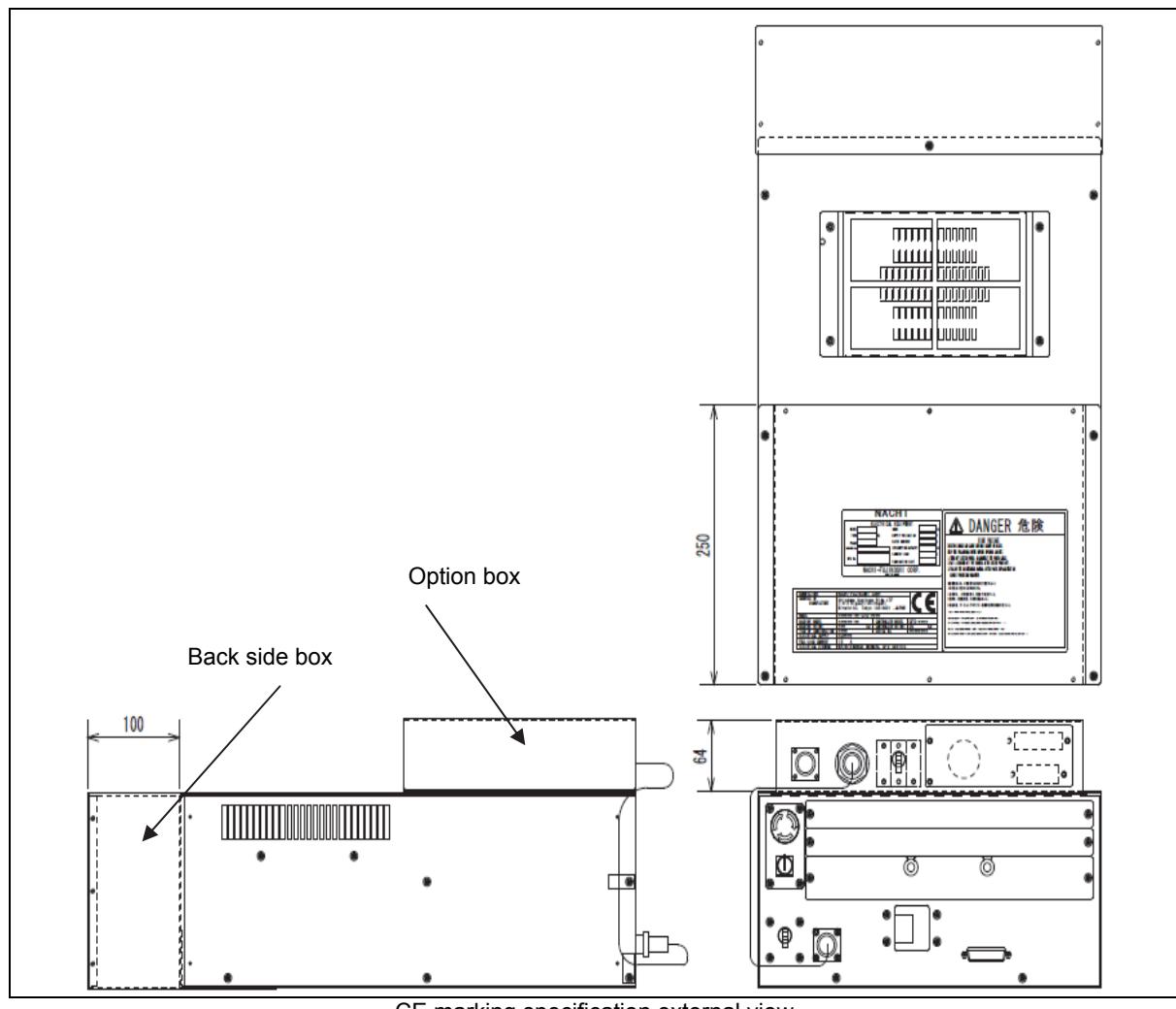
See the following instruction manual also.

“FD/CFD CONTROLLER INSTRUCTION MANUAL: Robot Monitoring Unit RMU20-20 / RMU20-30”
(TFDEN-143-###)

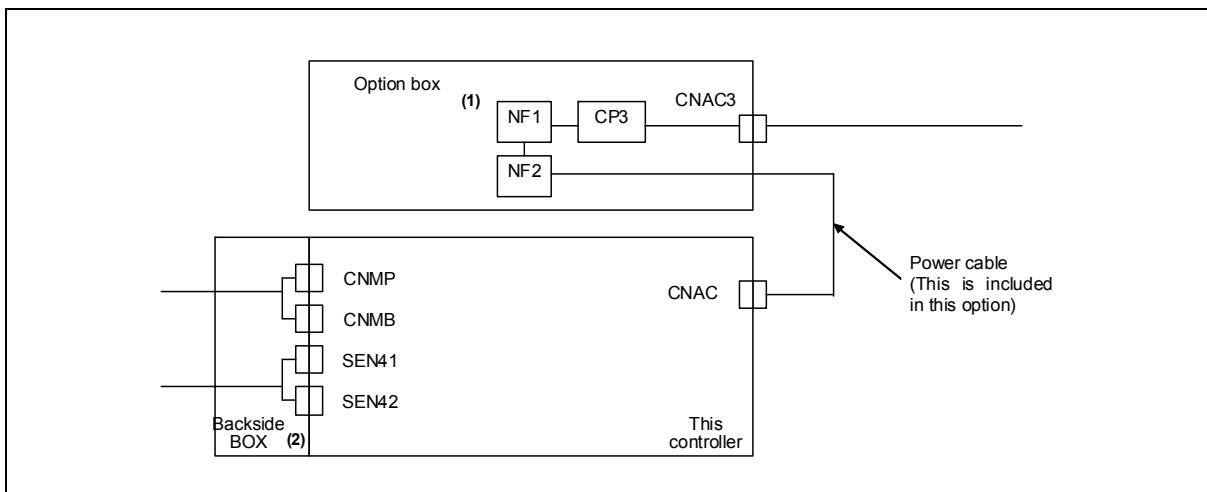
Chapter 22 CE marking specification

This chapter describes how to install option parts to change this robot controller to CE specification.

22.1 External view



22.2 Configuration

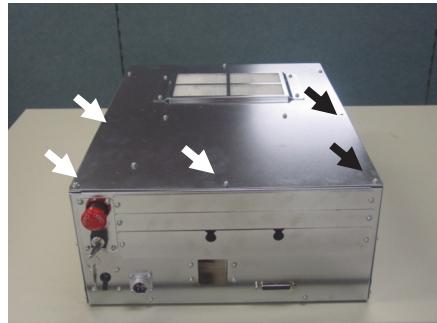


No.	Part name	Part No.	Remarks
(1)	Option BOX	CFD-OPBOX	
(2)	Backside box	CFD-05-C06-001	
(3)	Cover of the backside box	CFD-05-C06-002	
(4)	Harness fixing panel	CFD-05-C06-003	
(5)	Ferrite core	ZCAT3035-1330 or ZCAT3035-1330-BK	
(6)	Cable bush	•KDT-13 •KDT-Z16	

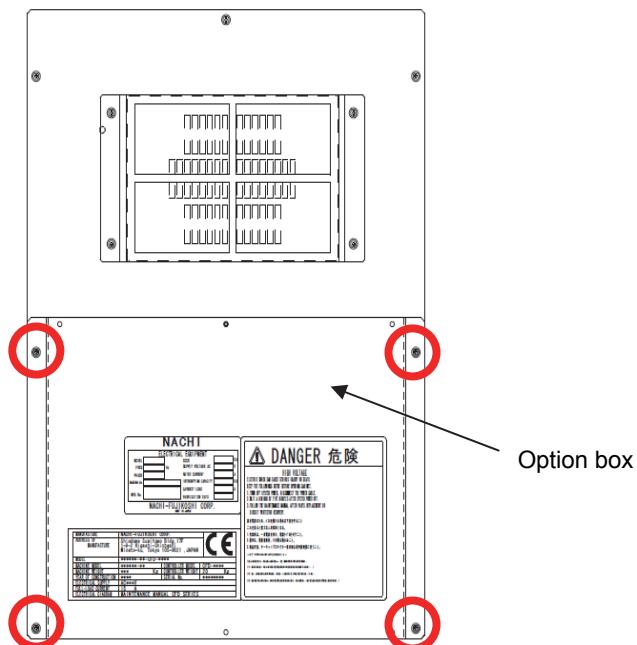
22.3 How to install

1 Turn off the controller power and disconnect the primary power source connector.

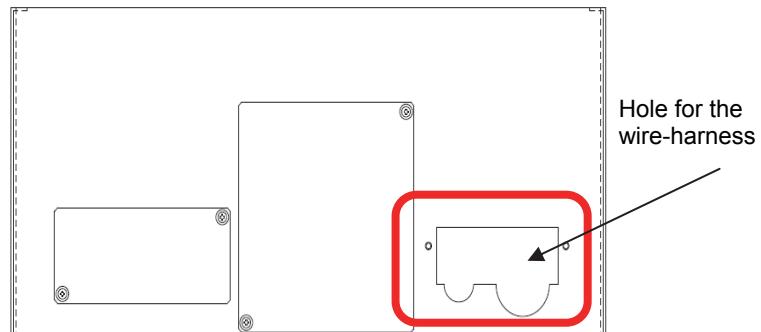
2 Loosen the 5 screws on the top panel



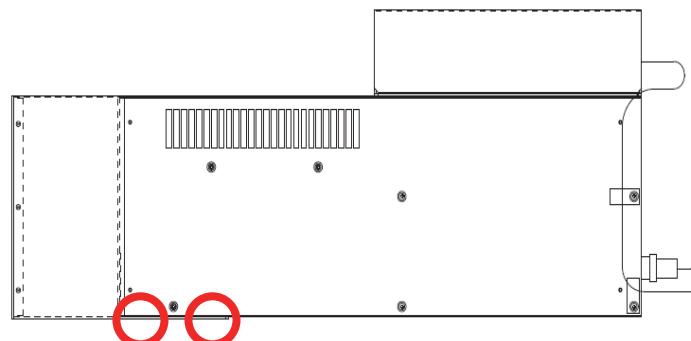
3 Place the option box on this robot controller and fix it with screws.



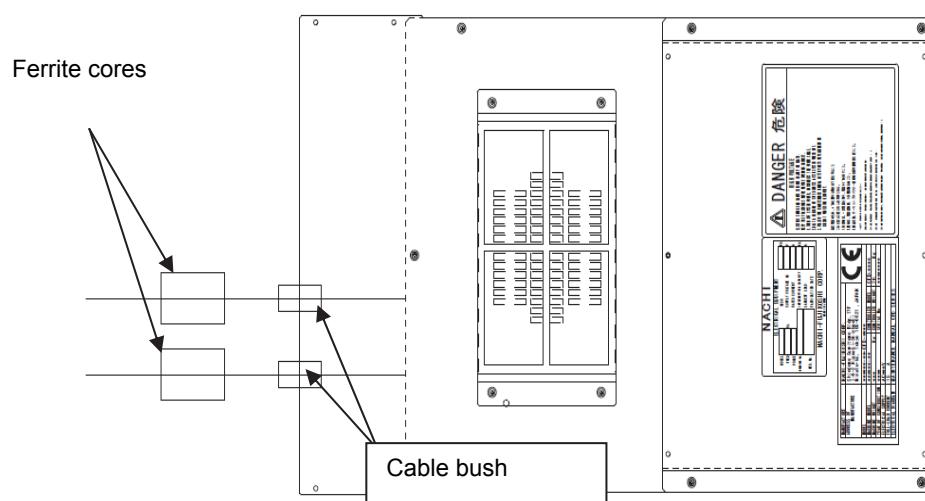
4 Let the wire-harness (connection cables) into the hole shown in the picture. Then connect the cables to this controller.



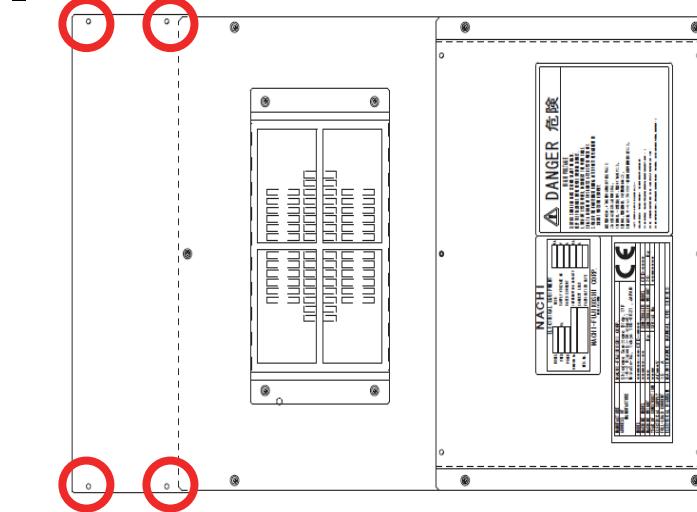
- 5** Install the backside box to the backside of this controller.
 First, dismount the rubber foot parts and then fix the backside box with 4 screws.
 (After that, mount the rubber foot parts again)

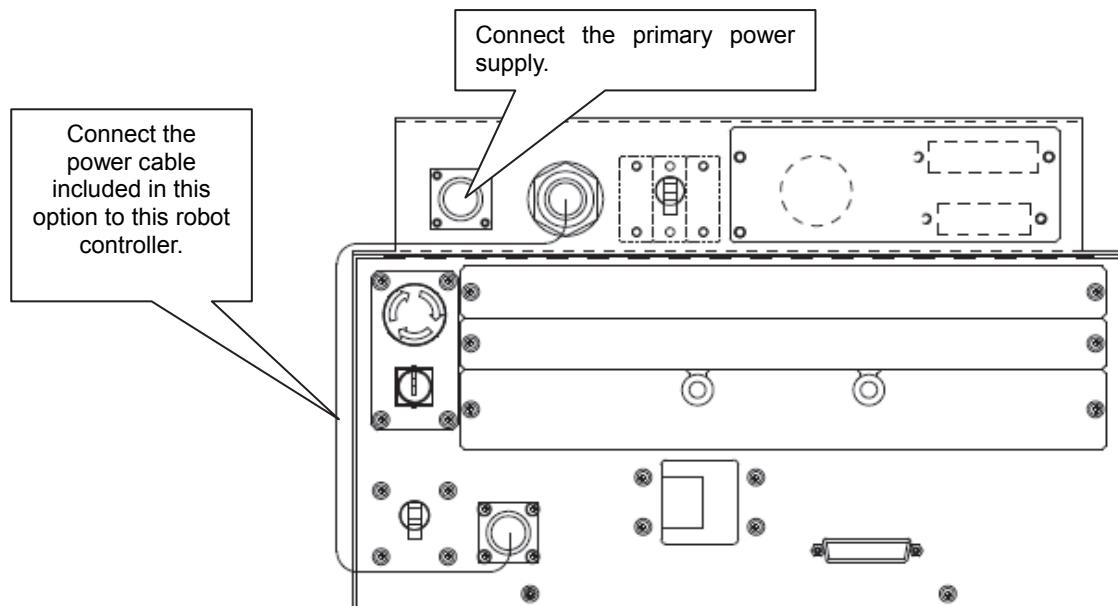


- 6** Attach the cable bush to the wire-harness (connection cables) then fix the wire-harness using the harness fixing panel. Then attach the ferrite cores to the wire-harness.



- 7** Fix the backside box cover with screws.



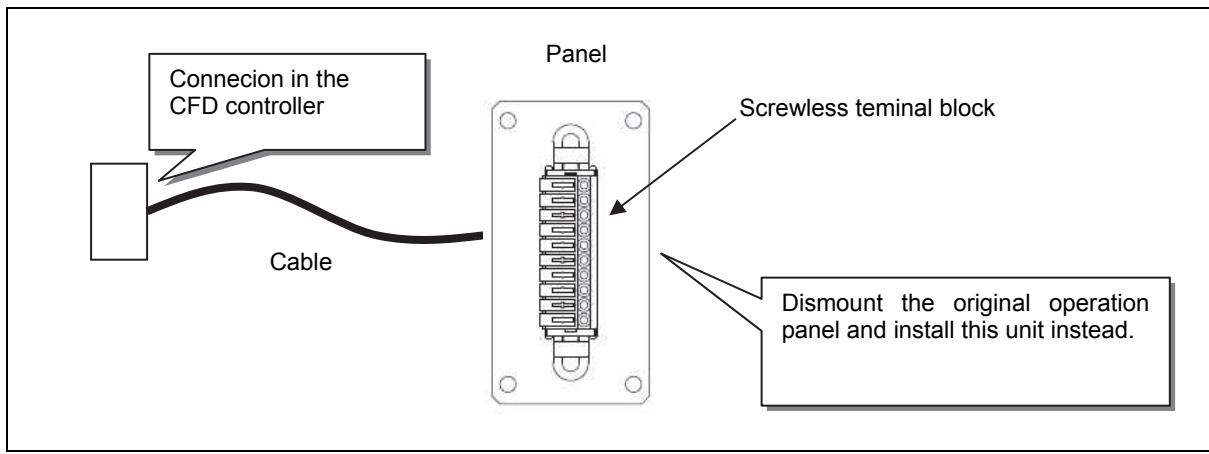
8 Make connection by referring to this picture.

NOTE

Chapter 23 External operation panel connection terminal block

This chapter describes how to install the “External operation panel connection terminal block” to the CFD controller. By using this optional part, it becomes possible to mount an operation panel in a place where is far from the CFD controller. (The operation panel should be prepared by customer) Then, it becomes possible to select the Teach mode / Playback mode or execute an emergency stop operation from a place that is far from the CFD controller.

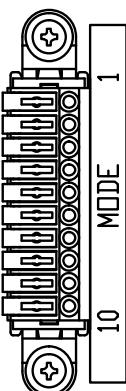
23.1 External view



External view

23.2 Specification of the terminal block

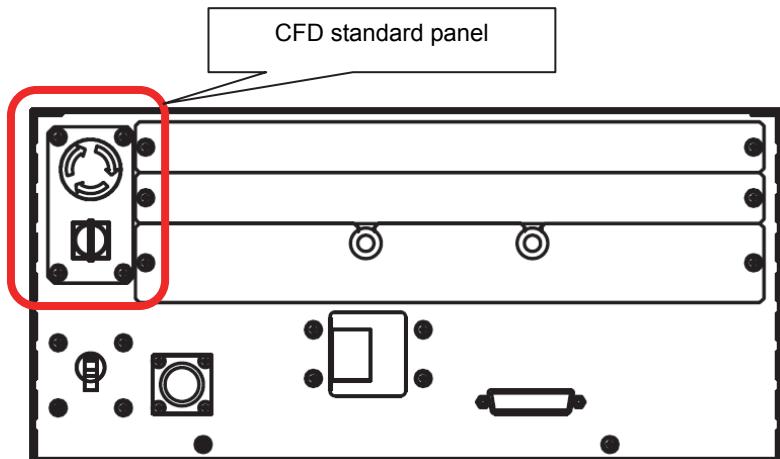
Screwless terminal block model number : ML-4000-ASV-10PGY (SATO PARTS CO., LTD)



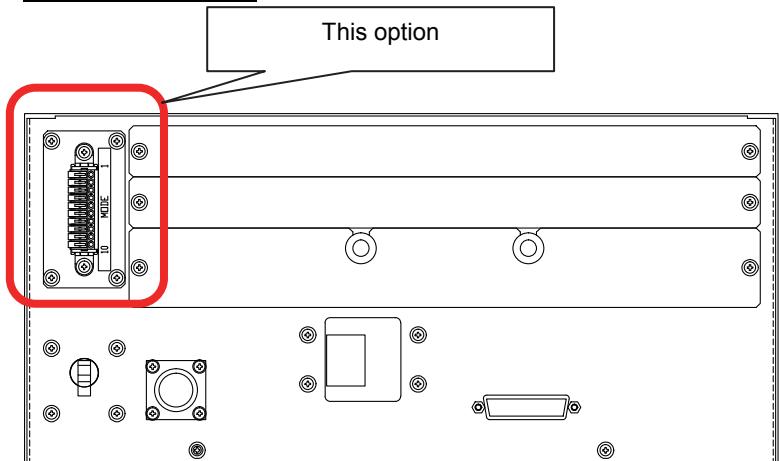
No.	Signal name	Description	No.	Signal name	Description
1	TP_EMG1	TP EMG STOP INPUT 1	2	P_EMG1	EMG STOP INPUT 1
3	TP_EMG2	TP EMG STOP INPUT 2	4	P_EMG2	EMG STOP INPUT 2
5	A_MODE1	Playback mode 1 (Connect this to the M1 in case of the Playback mode)	6	A_MODE2	Playback mode 2 (Connect this to the EX24V in case of the Playback mode)
7	T_MODE1	Teach mode 2 (Connect this to the M1 in case of the Teach mode)	8	T_MODE2	Teach mode 2 (Connect this to the EX24V in case of the Teach mode)
9	M1	24V GND	10	EX24V	For mode selection 24V

23.3 How to install

Before the installation



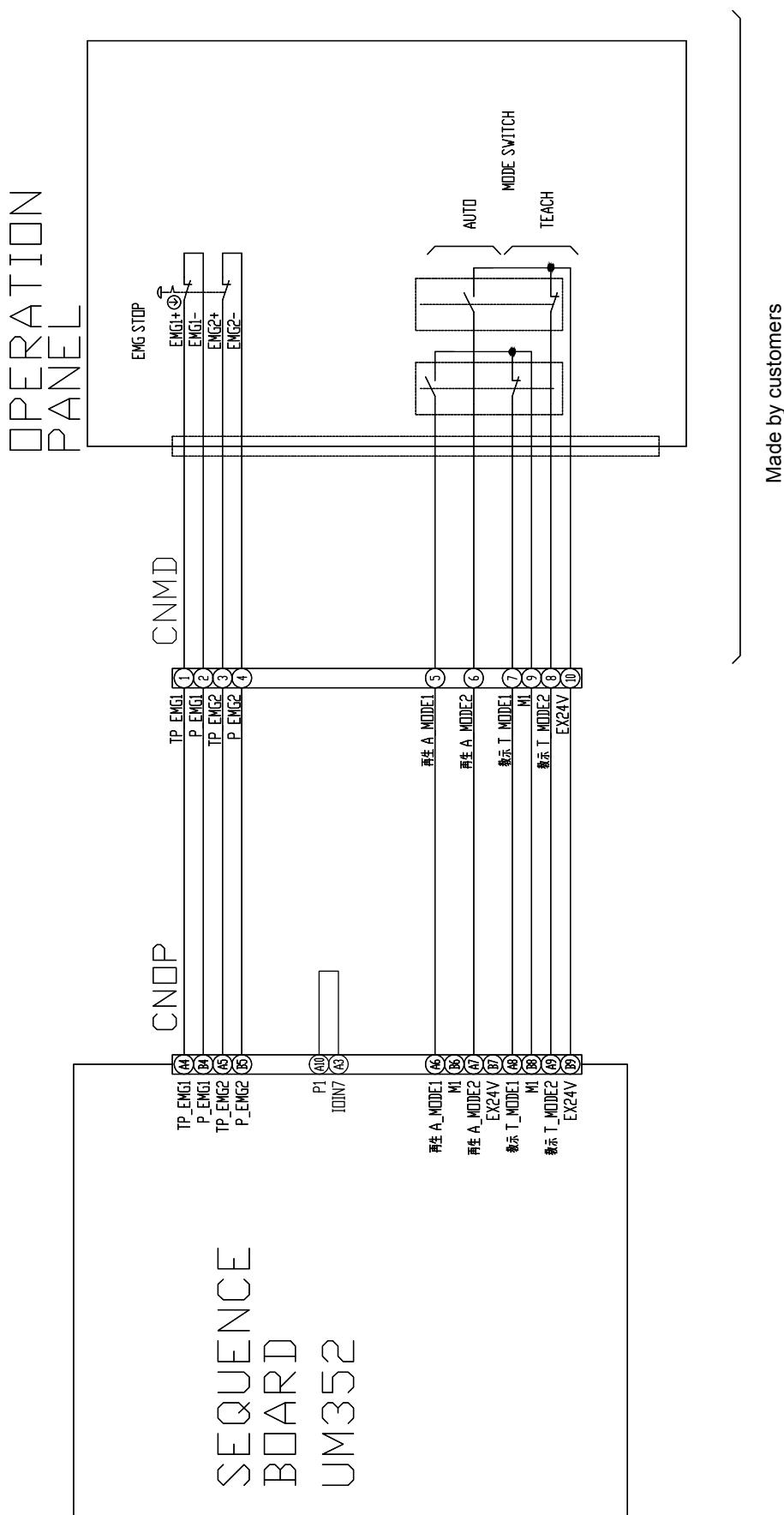
After the installation



- (1) Dismount the CFD standard operation panel an the install this option instead.
(Make a connection with the internal connector in the controller)
- (2) Connect the signals from the operation (prepared by customer) panel to the screwless terminal block.

See the connection diagram in the next page for reference.

23.4 Electric circuit diagram



NOTE



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