



# **CFD CONTROLLER INSTRUCTION MANUAL CONTROLLER MAINTENANCE**

**2nd 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.**

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## For safe use of the robot

Read this manual carefully prior to installation, operation, maintenance, or inspection and use equipment correctly. Use the robot only after fully understanding the equipment, all safety points, and comments/suggestions.






Instruction manual “Precautions for handling industrial robots”



Instruction manual “SETUP” (for FD controller) “Chapter 1 Point on safety”

The following table shows the importance of the following tags/marks in this Operation manual:

 DANGER	Case where a mistake made in handling is likely to cause the user to be exposed to the danger of death or serious injury and where the degree of the urgency (imminence) of the warning given for the danger to occur is at the high end of the scales (including high-level danger).
 WARNING	Cases where a mistake made in handling is likely to cause the user to be exposed to the danger of death or serious injury.
 CAUTION	Cases where a mistake made in handling is likely to cause the user to be exposed to the danger of minor injuries or of property damage only.

And, the other notes use a mark like the one shown as below.

 IMPORTANT	This indicates the other special notes.
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NOTE

# Chapter 1 Periodic inspection / Parts replacement














## 1.1 Regular inspection schedule





Perform the daily and periodic inspection to prevent troubles, ensure the safety and maintain the performance. This section describes the notes and details on periodic inspection operation.

### 1.1.1 Safety Measures in Inspection, Maintenance, Adjustment and Repair

To perform the inspection, maintenance, adjustment and repair of robot controller, you may be required to enter the robot work area or to operate with the primary/ servo power ON.

Be sure to follow the notes below in all cases.

 <b>DANGER</b>	Do not alter or remodel our products. You may get injured or have your equipment damaged because of fire, failure or malfunction caused by altering or remodeling the product. The warranty does not cover any altered or remodeled products.
 <b>WARNING</b>	Do not enter the robot work area while the power is ON. Do not approach the robot while it is moving. Approaching the moving robot may cause a fatal accident resulting in a serious injury or death.
 <b>WARNING</b>	Do not touch any live electrical parts. If you touch them, you may receive a fatal electric shock hazard or a burn.
 <b>WARNING</b>	Keep your hands, fingers, hair, clothes and other belongings away from the revolving part. If you bring them to the parts such as the feed roll of wire feeder or the revolving part of the fan, you may be caught in a revolving part and get injured
 <b>CAUTION</b>	To ensure your safety, perform the inspection, maintenance, adjustment and repair with wearing proper clothes specified by laws and regulations such as a protective hard hat, a pair of safety shoes, a pair of gloves and so on.
 <b>CAUTION</b>	Before operation, be sure to check that the robot can certainly stop when needed by testing the emergency stop or temporary stop. Also, check that the fail-safe devices such as the safety plug or enable SW, if equipped, properly work. If errors occur, stop the operation and immediately shut off the power supply. Then, inspect the cause of trouble to take remedies appropriate to the situation.
 <b>CAUTION</b>	Inexpert operators must not approach the robot safety fence.
 <b>CAUTION</b>	Before operation, hang out a noticeable sign "INSPECTION IN PROGRESS" as shown on the right to notify the operators of that the inspection is going on.
	<div style="border: 1px solid black; padding: 5px; text-align: center;"><b>INSPECTION IN PROGRESS</b></div>
 <b>CAUTION</b>	Do not use any devices to possibly cause electromagnetic noises in and around the area where the inspection is going on.
 <b>CAUTION</b>	Operations including the inspection must be performed by 2 or more persons; one for the practical operation and the other as a monitor.
 <b>CAUTION</b>	Only the operators who have been trained for the function, operation and maintenance of robots can perform the work such as inspection, maintenance, adjustment, repairs and so on. Also, if the special equipment is provided, be fully acquainted with the equipment in details.
 <b>CAUTION</b>	Operators, even if qualified, must not perform the operation of the particular equipment without thorough knowledge.
 <b>CAUTION</b>	The signals and gestures used for the inspection operator, monitor and other operators of related devices must be carried out based on the safety management standards of each user.

 <b>CAUTION</b>	<p>Monitors must follow the notes below.</p> <p>(A) Be in a position to overlook the entire robot work area to pay full attention for monitoring.</p> <p>(B) Always carry the emergency stop button with you so that you can immediately press it when the error occurs.</p> <p>(C) Do not allow anybody else to approach the robot work area unless they are engaged in the operation such as inspection.</p>
 <b>CAUTION</b>	<p>Operators to perform the inspection and other works must follow the notes below.</p> <p>(A) Be sure to check if it is possible to perform some operations outside the robot work area. If it is the case, perform all the operations outside that area.</p> <p>(B) Normally, turn off the robot before performing the inspection etc. If you have no choice but to operate while the robot is working, be sure to report to the safety manager to ask for permission. After you obtain permission, then perform the operation outside the robot work area.</p> <p>(C) If you are required to perform the operation with the robot stand-by, check the procedures beforehand to safely carry them out. If not specially required, shut off the input power supply of robot controller, welding power supply etc. before operation. Besides, shut off the input power supply of jigs and peripheral equipment, or make it invalid unless the special procedure is needed.</p> <p>(D) When entering the robot work area, prepare for the malfunction of robot so that you can immediately press the emergency stop button.</p> <p>(E) Be sure to check the safety around your feet before operation. Do not work in an insecure or elevated (2m or higher) scaffold.</p> <p>(F) When working in the robot work area, be sure that you could see the entire robot motion. Never turn your back to the robot.</p> <p>(G) When replacing the print board inside the robot controller or the teach pendant, take the antistatic measures such as using a static protective sheet and so on.</p>
 <b>CAUTION</b>	<p>Follow the notes below when an error occurs during the operation.</p> <p>(A) If you find any abnormal motions of robot, press the emergency stop button immediately.</p> <p>(B) Inform a monitor of the abnormality and turn off the robot controller. Then, hang out the sign "Do not turn ON." as shown on the left.</p> <div data-bbox="1082 1032 1437 1081" style="border: 1px solid black; padding: 2px; text-align: center;"> <b>DO NOT TURN ON</b> </div> <p>(C) Check that the peripheral equipment has also been turned off.</p> <p>(D) If you are required to enter the safety fence, be sure to remove the safety plug and keep it by yourself during operation.</p> <p>(E) Even if the robot automatically stops by the abnormalities in such as the voltage supply to robot, oil pressure in the peripheral equipment, air pressure or other factors, be sure to make it completely stop. Then, inspect the cause of trouble to take the measures against it.</p> <p>(F) If the fail-safe function of the emergency stop button does not work, shut off the main power immediately and inspect the cause of trouble to take the measures against it.</p> <p>(G) When restarting after the emergency stop, inspect the cause of trouble and take the remedies first. Then, insert the safety plug again and restart from the outside the fence.</p>
 <b>CAUTION</b>	<p>When you finish the work, be sure to always check that the required connectors, covers and panel are properly fixed and connected. And then, be sure to close the door and lock the door key.</p>

### 1.1.2 Inspection items

When you implement the maintenance and inspection, implement the following items

Inspection items ( ●: Replace ○: Inspect)

ID number	Frequency of periodical inspection			Maintenance			Inspected point	Content of inspection	Inspection / treatment method
	Daily	Every 3 months	Every 1 year	4 years	5 years	8 years			
1	○						External surface of controller	<ul style="list-style-type: none"> <li>Adhesion of spatter and dust etc.</li> </ul>	Visual check and cleaning
2	○						Indicating plate	<ul style="list-style-type: none"> <li>Peeling, damage</li> </ul>	Visual check and cleaning If the dust is remarkably attached or the indicating plate is removed, affix it again.
3	○						Filter	<ul style="list-style-type: none"> <li>Existence or nonexistence of dust and dirt</li> </ul>	Visual check and cleaning or replacement
4	○						Teach pendant Operation panel Other operation switch	<ul style="list-style-type: none"> <li>Indicating lamp and operation switch</li> <li>Operation of push-button switch etc.</li> </ul>	Visual check
5	○						Teach pendant Operation panel	<ul style="list-style-type: none"> <li>Operation of emergency stop button</li> <li>Operation of enable switch</li> </ul>	Check the servo power supply is surely turned off at the operation of every emergency stop button and enable switch.
6		○		●		●	Wire-harness Teach pendant cable Other external wiring	<ul style="list-style-type: none"> <li>Check of damage, crashing</li> <li>Looseness of connector</li> </ul>	Visual check Additional tightening If the cable is remarkably damaged, replace it with new one
7			○			●	Teach pendant	<ul style="list-style-type: none"> <li>Check damage</li> <li>Cleaning of seat key</li> <li>Check liquid-crystal display</li> </ul>	Visual check and cleaning If the display of liquid-crystal module is remarkably deteriorated, replace the teach pendant with new one.
8						●	Overhaul		

(Note 1) In cleaning, wipe the dusts and the particles with the soft cloth. Don't use air blow for the cleaning of the fan. The dust and particles invade in the fan. Failure and life of the fan may be had a bad influence, because the wing of the fan turns with rotational speed over capacity. If you use a vacuum cleaner, use it only wing. Be careful absorbing between the rotation part and the body.

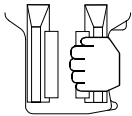
### 1.1.3 Inspection before the long vacation

If the long vacation continues, be sure to check the following items before turning OFF the power supply of robot controller.

- Check whether "A1016 encoder battery voltage reduction" is displayed on the error history and replace it with new one if an error is displayed. For details of the replacement procedures, refer to the instruction manual "Manipulator".

### 1.1.4 Inspection of enable switch

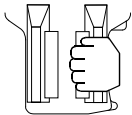
Teach pendant has the three-positional enable switch.  
According to the operation as follow, confirm to work enable switch.



- 1 Select teach mode.
- 2 Turn the MOTORS ON.
- 3 Grasp the enable switch.  
>> While the enable switch is being grasped, the servo power will be kept turned ON.
- 4 You grasp the enable switch more, or release enable switch.  
>> The servo power will be turned OFF.

### 1.1.5 Inspection of Emergency stop button

A teach pendant, operation box and starting box have an emergency stop button respectively.  
According to operation as follow, confirm to work each emergency stop button.












- 1 Select teach mode.
- 2 Turn the MOTORS ON.
- 3 Grasp the enable switch.  
>> While the enable switch is being grasped, the servo power will be kept turned ON.
- 4 Push the emergency stop button on the Teach pendant.  
>> Servo power is turned OFF. Please check the [EMERGENCY STOP BUTTON] on the operation panel in the same way.



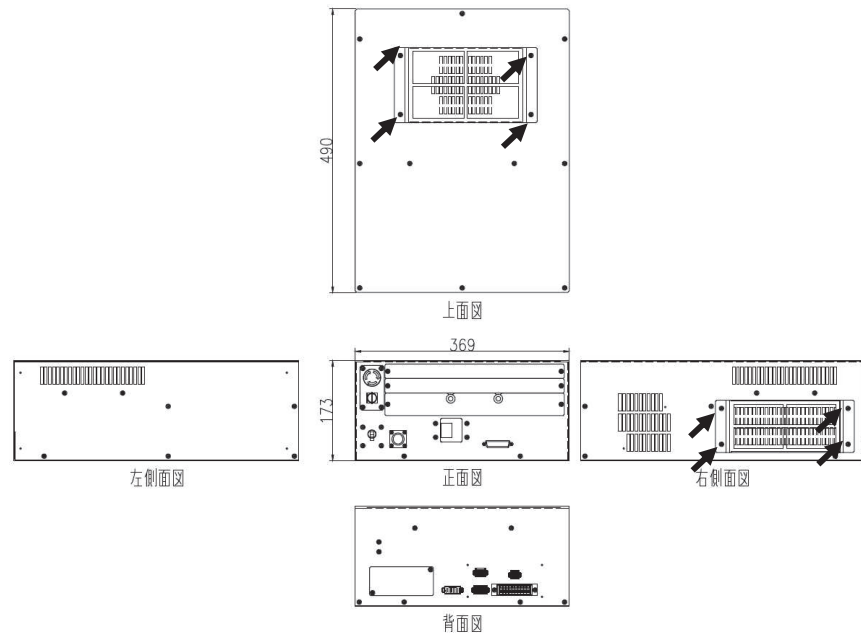
## 1.2 Part replacement

When you replace the parts of robot controller, implement the operation safely observing the precautions shown below.

 <b>DANGER</b>	Do not alter or remodel our products. You may get injured or have your equipment damaged because of fire, failure or malfunction caused by altering or remodeling the product. The warranty does not cover any altered or remodeled products.
 <b>WARNING</b>	Electric shock may cause serious injury or death. Wiring work should be done after turning off the primary power supply and the circuit breaker on the robot controller.
 <b>WARNING</b>	When you replace the parts, be sure to implement the operation in 5 minutes after turning OFF the power supply on primary side. Otherwise, you may get electric shock due to the remaining electric charge of board and electrolysis capacitor. Do not implement the operation with wet hands. If you get electric shock, it will cause heavy injury or fatal accident.
 <b>WARNING</b>	The replacement work should not be implemented by person other than the person who attended the class of robot school (maintenance course) implemented by our company. Otherwise, you may get electric shock or may be clipped by unexpectedly operated robot and it may cause heavy injury or fatal accident.
 <b>WARNING</b>	A lot of connectors are connected to each printed circuit board. Promote the replacement carefully not to cause mistake or omission. The heavy injury or fatal accident may be caused by electric shock or flare.
 <b>WARNING</b>	Do not damage the wiring at the replacement. Do not touch the electronic parts or pattern of printed circuit board or the contact part of connector at the replacement. Always hold the periphery of printed circuit board. If you touch it, the heavy injury or fatal accident may be caused.
 <b>WARNING</b>	Be absolutely sure NOT to expose the controller inside to direct sunlight, a searchlight or other strong lights before turning on the primary power supply while the controller door is left open to enable maintenance or other work to be performed. Failure to adhere to the precautions may cause the robot and/or controller to fail or operate in error.
 <b>CAUTION</b>	Prior to work, discharge static electricity charged on a worker. Antistatic wrist band is effective. To touch electric parts without countermeasures may cause breakdown.
 <b>CAUTION</b>	After finishing the parts replacement work, re-mount the cover panels carefully after checking that there are no wires etc. that are being pinched. If the cover is not completely closed, dirt, dust and other foreign matter may enter inside the controller, possibly causing malfunctions.

### 1.2.1 How to clean/replace the filter

- 1 Turn OFF the controller power.
- 2 Remove the screws of the filter cover.



- 3 Clean the dusts on the filter using air blow spray etc. The air blow should be applied from the inside of the filter. If the filter is remarkably dirty, wash it using tepid water or neutrality detergent. If the dirt does not run, replace the filter.
- 4 Re-install the filter.  
If the filter is still wet, dry it well before the installation.

## 1.3 Maintenance parts

### 1.3.1 List of maintenance parts

Recommended spare parts are broadly divided into two categories A and B according to the service life and frequency in use of the parts.

<b>Maintenance parts A</b>	Major maintenance parts to be provided for daily maintenance and inspection
<b>A-1</b>	<b>Important backup parts</b>
<b>A-2</b>	<b>Periodical replacement parts</b>

<b>Maintenance parts B</b>	Maintenance parts to be provided if two or more robots are purchased
<b>B-1</b>	<b>Parts recommended purchasing from NACHI</b>

Parts including in A-1 and A-2 categories are essential to maintain the normal operation of the robot. Therefore, it is recommended to provide a complete set of these parts. Furthermore, printed circuit boards have high-reliability parts. Pay careful attention to the following points for the maintenance of the boards.

- **Storage temperature: -10 to +50°C**  
If the parts are needed to store for an extended period of time, it is recommended to store them at a temperature of  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  in order to maintain reliability. Furthermore, do not store them in places with sharp changes in temperature (e.g.  $10^{\circ}\text{C}/\text{hour}$ ).
- **Storage humidity: 20 to 85%RH**  
If the parts are needed to store for an extended period of time, it is recommended to store them at humidity of 45 to 65% in order to maintain reliability. Furthermore, do not store them under conditions that tend to cause dew condensation or molds.
- **Antistatic measures**  
If the parts are stored under extremely dry conditions, they will be apt to take charge. Consequently, shocks caused by discharge may result in the destruction of semiconductors. To avoid that, put the parts in antistatic bags for storage.
- **Other ambient conditions**  
Store the parts in atmosphere with no toxic gas generation and minimal dirt and dust. Furthermore, do not store the parts under conditions causing loads to be applied.

## A-1 Important backup parts

No.	Part name	Type	Manufacture	Recommended quantity	Remark
1	CFD controller	CFD-0000 or CFD-3000	NACHI	1	Controller itself CFD-0000 ; All axes15A CFD-3000 ; Main 30A, Wrist 15A
2	Teach pendant	CFDTP-10-04M	NACHI	1	Smart TP
		MINITP-10-04M			Compact TP

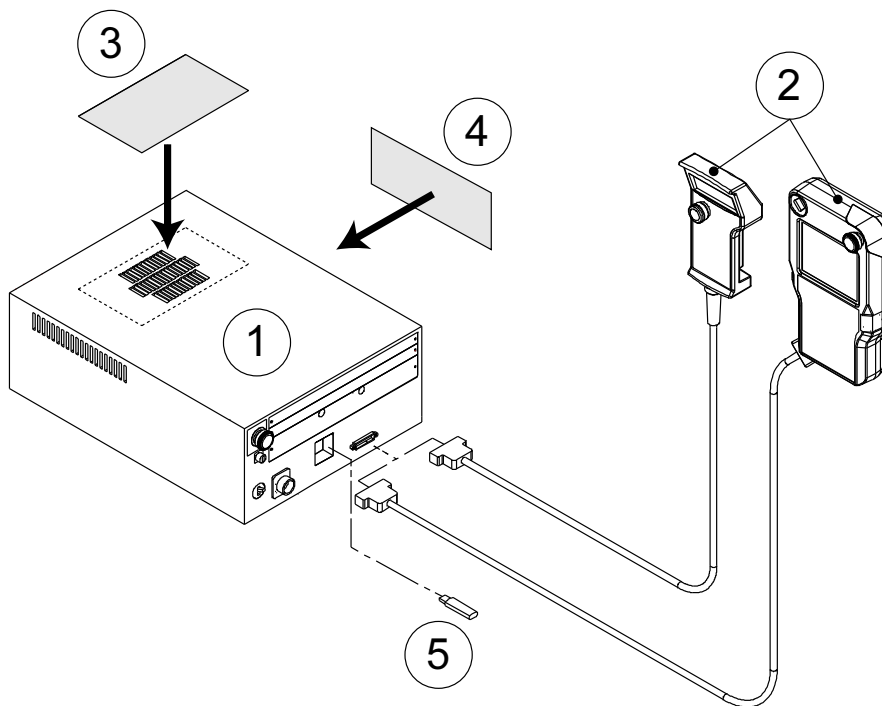
## A-2 Periodical replacement parts

No.	Part name	Type	Manufacturer	Recommended quantity	Remark
3	Filter (Note 1)	CFD-FILTER-01	NACHI	1	For top panel
4	Filter (Note 1)	CFD-FILTER-02	NACHI	1	For side panel

(Note1) Clean these filters at the timing of daily inspection. If the dust is remarkably attached, replace it.

## B-1 Parts recommended purchasing from NACHI

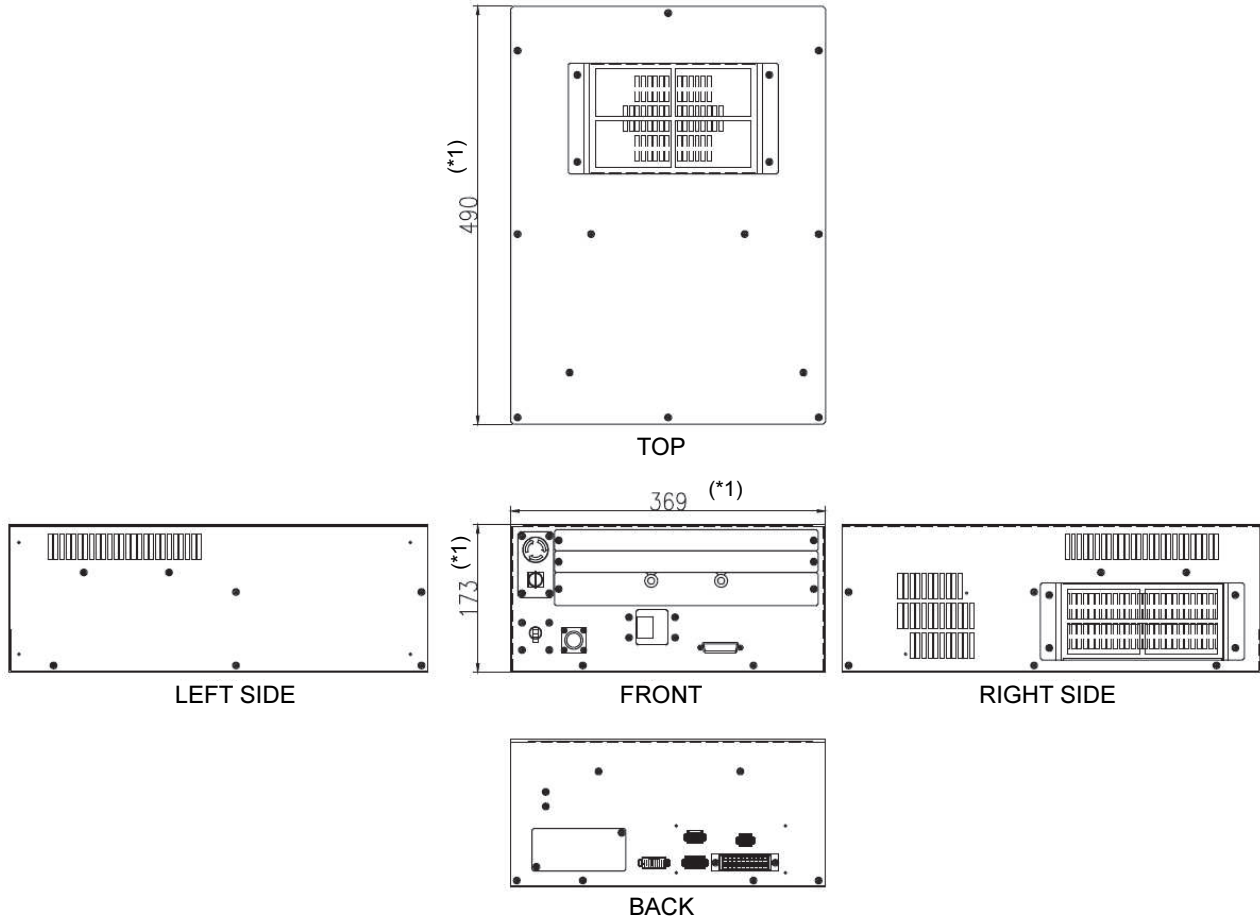
No.	Part name	Type	Manufacturer	Recommended quantity	Remark
5	USB memory	FD11-OP93-A	NACHI	1	1GB



# Chapter 2 Dimensions

## 2.1 External view

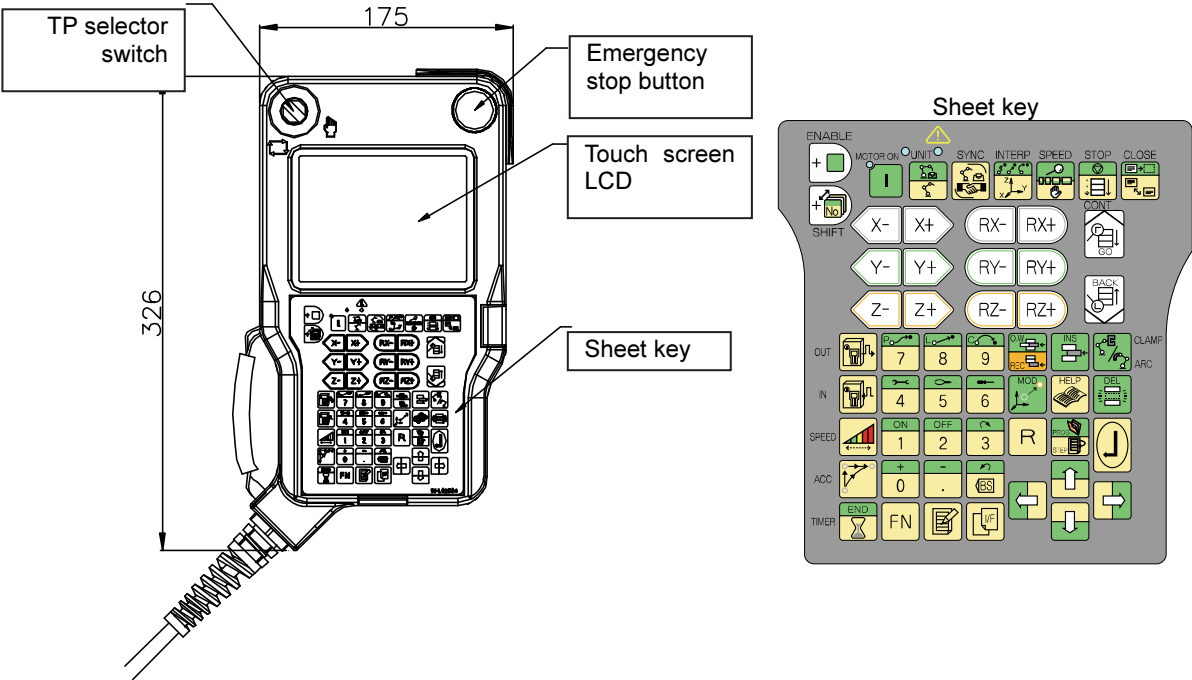
### ■ CFD Controller



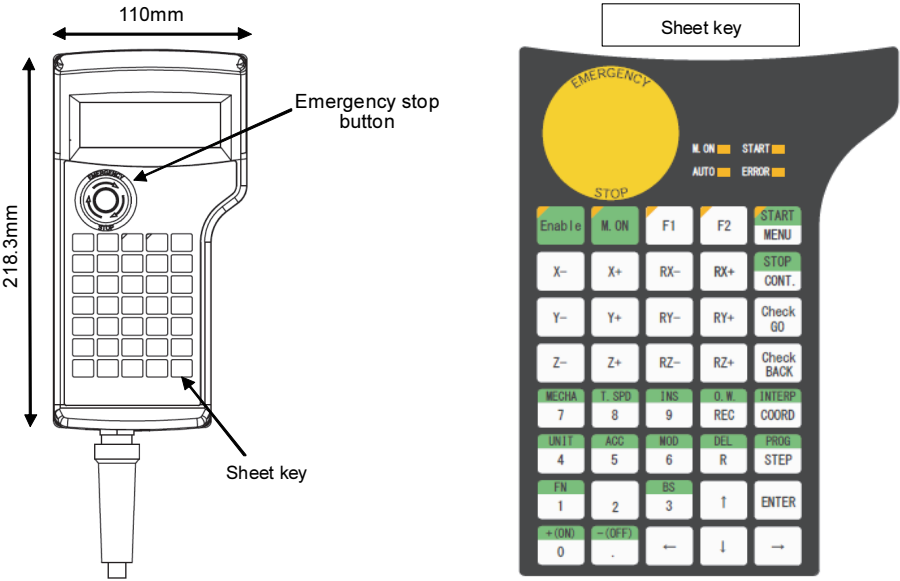
(\*1) This figure shows the box dimension. Final dimension including all of projections are  
 Height 184.5mm ; including rubber foot 5.5mm + Roof filter cover 6mm  
 Width 378.5mm ; including left side screw head 3.5mm + Right side filter cover 6mm  
 Depth 575.0mm ; including front panel key switch 35mm (with key) + Connector on rear panel 50mm

## 2.2 Teach Pendant


### ■ Smart TP



### ■ Compact TP





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